

## **Web Architecture and Codec Considerations for Audio-Visual Services**

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### **Summary**

The W3C is considering working towards "Video over the Web". We assume that this involves creating a suite of W3C Recommendations, or modifications/additions to existing Recommendations, that

- a) from a user experience viewpoint implement and build on what's available today as proprietary solutions (e.g. Flash, QuickTime, perhaps interactive video as available in many chat clients),
- b) target the emerging IP-TV/Internet-TV/Web-TV market,
- c) enable new services no one has dreamt of before.

We believe that W3C can play a significant role in this field, especially when it comes to the tight integration of video into the current technologies used on the Web (mainly (X)HTML, CSS, DOM, JavaScript). Proposed technologies like the video element in HTML5 are certainly only a first step to tighter integration.

We advocate caution when setting the scope of W3C's activities on video over the web. In particular, we recommend that W3C does not focus on media transmission protocol design (and let that handle by the IETF, ITU-T, and similar bodies), and does not attempt to design media codecs (and leave that to ITU-T, ISO/IEC, and similar bodies). Influencing those bodies, and the companies working therein, towards commercial terms that are in-line with W3C's commercial concepts (i.e. W3C's RF patent policy) is fair, but should not hinder the adoption (by reference) of technologies of another ecosystem that follows radically different commercial constraints. Finally, we recommend that, if W3C chooses to recommend codecs and transport infrastructure, they do so only after a careful investigation of the technical and commercial viability of the technology in question, and recommend future-proof concepts over those which may appear, at this very point in time, to be commercially more advantageous.

### **Commercial Constraints of the Web and Video ecosystems**

Today, there are more than a billion PCs in use in the world, and some expect that number to grow to two billion by 2015 [1]. Already, the number of web-capable mobile devices surpasses that number. While, at present, the use of web technologies on mobile devices is not that well developed, it is safe to assume that progress in user interface technologies, initiatives like dot-mobi, etc. etc., will increase the number of mobile devices actively used to access the web significantly in the foreseeable future. Both the standard implementations and the content distributed over the web are, from a consumer perspective, predominantly "free". For the sake of brevity we are discounting here all the implementation of "optional" parts of the W3C Recommendations (for which there is no RF commitment required), niche content, and cost for network access.

While these market numbers are impressive, they are believed to be actually lower than what is commonly viewed as the number of devices employing digital video.

Every DVD player, every digital camcorder, most web-connected PCs (after download of free software), most modern TVs, and most camera-equipped mobile device include digital video decoders. Some of these devices also include digital video encoders. In their vast majority, neither the digital video standard implementations nor the encoded content are “free”. The forms of payment vary greatly: patent royalties are folded into the device/software prices; content fees (both for patent use and copyright royalties) are part of the subscription fees a consumer pays (i.e. for cable TV), absorbed through advertising, by governments (e.g. public radio/TV stations), and so on. As one example, we refer to the licensing terms required for MPEG-2 devices and content [2]. To sum it up, in the field of digital video the rightholders get royalties from virtually all major players in the field. Very little professional content is available for free, and some of what is made available for free is relying on the tolerance of rightholders, or sometimes plainly pirated. The content available for free, at present, in its vast majority, is not of a quality level appropriate for widespread consumer-level distribution. The perhaps astonishing part of the story is that all these royalties have, however reluctantly, be accepted by the market, and have not significantly hindered the adoption of digital video. Marrying the two ecosystems, the predominantly free “web” with the predominately money bearing “digital video” is going to be a difficult task.

### ***Possible Requirements for codecs for video over the Web***

In this paragraph we list some of the evaluation criteria and requirements we are interested in evaluating for the adoption of new technologies in general, and codec technologies in particular. They are listed in a rough order of relevance.

1. The specifications, and supporting documentation and code (i.e. conformance test suites, example/reference code, ...) are obtainable by everyone, for free or against a reasonable fee (ISO/IEC fees are reasonable in this sense).
2. There is only a manageable risk in implementing the specification. In practice, we prefer specifications that have been developed in a collaborative manner under an IPR policy with disclosure requirements. Examples include specifications developed by the ITU-T, ISO/IEC, or the IETF.
3. Implementable on a wide range of target systems, from mobile devices to digital cinema applications.
4. Thought-out and standardized integration of the codecs into supporting infrastructure, for example file formats, real-time and download content transmission protocols, session setup mechanisms and the like.
5. Compatibility with DRM. We understand that this could be a sore point in W3C, but from our viewpoint, any DRM-incompatible video related mechanism is a non-starter with the content industry (Hollywood). There is in our opinion no need to make DRM support mandatory, though.
6. Wide industry support, critical mass of major players to enable fast market adoption.
7. Reasonable content fees, including provisions for royalty free content from non-professional sources.
8. Availability of content production tools from the very start of the adoption.

### ***Nokia's recommendation for Codec Choices for normative reference by W3C***

Considering our requirements, we believe the widespread use of technically competitive, but not necessarily “free” open standards, such as H.264 for video and AAC for audio, would serve the community best. This would be fully aligned with the business model dominant in the digital video ecosystem.

As a major device manufacturer, we obviously prefer cheaper solutions. Therefore, Nokia has, in the past, supported initiatives in committees such as MPEG towards royalty-free standards (which unfortunately were not fully successful). We are actively considering making more such attempts, and W3C's considerable evangelization power could be directed towards a similar use. Options for W3C include enhanced liaison activity towards bodies such as MPEG and the ITU-T in order to launch projects closer to W3C's view on IPR, suggesting tighter company-internal coordination in those companies which contribute to both "ecosystems", and so on.

Anything beyond that, including a W3C-lead standardization of a "free" codec, or the active endorsement of proprietary technology such as Ogg, ..., by W3C, is, in our opinion, not helpful for the co-existence of the two ecosystems (web and video), and therefore not our choice.

### ***Alternative ways forward***

Nokia is interested to see technologies being accepted that are technically competitive, have already gained wide market acceptance, and of which the commercial terms are reasonably well known. This is the case for video compression technologies such as H.264, and audio compression such as AAC. Recommending these codecs would be our choice. However, we understand that there are groups in W3C who will have difficulties to accept the business models associated with these codecs, and at this point in time.

We see a few alternatives, which Nokia could perhaps accept and support, although they are, from our viewpoint, not optimal solutions.

1. One possible alternative would be not to recommend any codec, and leave it up to the market forces to play out this game. Doing so may be perceived to lead to less interoperability; however, previous experience in this field has shown rather quick convergence to certain codecs. An example is the wide (close to exclusive) adoption of MPEG-2 for digital SDTV, and another is the momentum H.264 currently enjoys in other key market places. Closer to the Web world, dare we mentioned Flash :-). There is no reason to believe that the market forces at play in the past wouldn't work for the "video over the web" application.
2. A second alternative would be the reference, as a baseline, of older media compression standards, of which one can be reasonably sure that related patents are expired (or are close to expiration). One example for these codecs is ITU-T Rec. H.261, which (in its first version) was ratified in November 1988. While not competitive with today's state of the art codecs, it's in the author's personal experience not that far in its performance from Ogg Theora (this technology is what the current HTML5 draft suggests for the same purpose). Similarly, there are older audio codecs of which it is equally likely that they will be unencumbered. Examples here include the ADPCM codecs of the ITU-T; G.722 (1988) and G.726 (1990). MP3 has been ratified in 1991, and that also sets a certain target year (not too far in the future) from which on one can be reasonably certain to be able to use this technology without financial compensation. The disadvantage of this approach is clearly the use of technologies that are two decades old, but that may be at least partly offset by the commercial advantage. And, these codecs are very lightweight on the computational complexity aspect.
3. As a third option, we suggest that W3C could entertain an official codec selection, as it is common in many other committees. The hard part in these "shootouts" is usually the definition of the evaluation criteria. Once this is done, proponents submit codec codecs for performance testing. Commercial criteria can be taken into consideration either expressed (a path few other

committees are interested to venture on), or by the type of implicit consideration taking most organizations are well prepared to handle. All these alternatives are, in our opinion, preferable over the recommendation of the Ogg technologies, based almost exclusively on the current perception of them being free.

[1] <http://www.informationweek.com/software/showArticle.jhtml?articleID=199200360>

[2] <http://www.mpegla.com/m2/m2-agreement.cfm>