

Adopting HTML5 for Television: Next Steps

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Abstract: Driven by business opportunities that take advantage of devices connected to the home network as well as users preferences and social interactions to enhance the overall experience of watching TV, TV has started to connect to the Web. Similarly, the possibility to attract premium video content to the Web has led Web technologies to evolve and consider TV requirements. Standardization aspects of the convergence between Web and TV are presented, together with a list of technical priorities under discussion at the World Wide Web Consortium (W3C), where core Web technologies are developed.

Keywords: Web, TV, HTML5, video, standardization, broadcasting, home networks

1 INTRODUCTION

HTML5 [1] is the core specification that shapes the next open Web platform. Among other new functionalities, HTML5 brings video to the Web through the `<video>` tag. This tag opens the possibility to fully integrate video directly in Web pages and Web applications without having to resort to dedicated plug-ins.

The `<video>` tag is the first step towards the convergence between two separate worlds: Web and TV. This paper looks at this convergence from a Web standardization perspective and presents key elements under discussion at the World Wide Web Consortium (W3C), the organization that develops the open standards that compose the core fabric of the Web as we know it (HTML5, CSS, SVG, device APIs, etc.).

Convergence here is taken to mean both « Web on TV », whereby Web content and applications are rendered on a TV device, and « TV on the Web », whereby TV content and experience moves to a regular Web browser environment on various types of devices.

This paper is structured as follows: In Section 2, we give more background on the *raison d'être* of the convergence between Web and TV worlds. Section 3 highlights main problems to address for that convergence to be a success. Section 4 presents technical priorities for standardization derived from first workshops and discussions on Web and TV.

2 CONTEXT

2.1 Evolution of Web Technologies

The explosion of the mobile device market demonstrates how consumers have come to expect and rely on access to the network from anywhere, at any time, including from

mobile computers, phones, tablets, and more. Though consumers do not yet have the same expectations about their televisions, the situation is to change in the near future given the emergence of « connected TVs », the importance of television in people's lives, ongoing display and feature improvements, better interaction between TV and other devices, and the opportunity for new services created by increased connectivity, such as:

- use of the TV as central hub to control other home devices
- support for VoD (Video on Demand) delivered through a broadband connection
- support for video conference, chat and social applications
- the ability to purchase through the Internet items advertised during a commercial

Driven by the development of HTML5, published as a Last Call Working Draft on 25 May 2011, Web technologies are quickly evolving to embrace these new opportunities.

2.2 Possible Benefits of Web Technologies to Broadcasting

Indeed, the convergence of Web technology and broadcasting has already begun. For instance, IP-based television is growing more popular, many countries have begun to recognize the importance of broadband access to their citizens, and many televisions run applications that are partially based on Web or Web-like technologies. Many in the IT industry view these as important transitional steps that can enable a wide new range of interactive services, well-integrated with the Web. The time is thus ripe for the television industry to help ensure this integration can be accomplished in a way that meets the needs of the industry. W3C has shown that people value « One Web » — available to anyone, anywhere, on any device — and the value of open and global Web standards, which lower implementation costs and simplify deployment of new applications.

In many homes, the television is a family centrepiece. Connecting television with the Web offers tremendous opportunities for commerce, games, entertainment, and social interaction. Video on the Web, DTV, IPTV, Hybrid TV and other trends show that the convergence is well under way.

2.3 Towards TV as a Service

As television evolves further into a service, people will expect the service to be available on a variety of devices,

and to connect smoothly with other favourite services, including social networks and shopping Web sites. As the number and diversity of devices grows (across multiple industries), interoperability challenges will also grow.

This is where W3C's Open Web Platform for application development comes in: it gives designers cross-platform interoperability. Open Web Platform applications will combine specific device strengths with private and networked sources of data, such as broadcast content and social networks feeds. Those applications will run on mobile devices, tablets, and on the family television.

3 PROBLEMS TO SOLVE

The Web is global and open by design. Web standards (HTML, CSS, JavaScript, APIs, etc.) are clearly identified, available to anyone and free to use and implement. In contrast, the TV space operates in a much more controlled environment that involves many organizations with various patent policies for the re-use of the technical specifications they develop.

This section presents high-level problems that need to be addressed for the convergence between Web and TV to be a success.

3.1 TV-Specific Aspects

Some aspects of TV are unique to the TV platform, for instance over-the-air television, i.e. content broadcasted over national terrestrial networks, has no equivalent on the Web.

Television is based on a push architecture with different sources of inputs. Four main reception modes compose the classic TV picture: over the air, satellite, cable, ADSL.

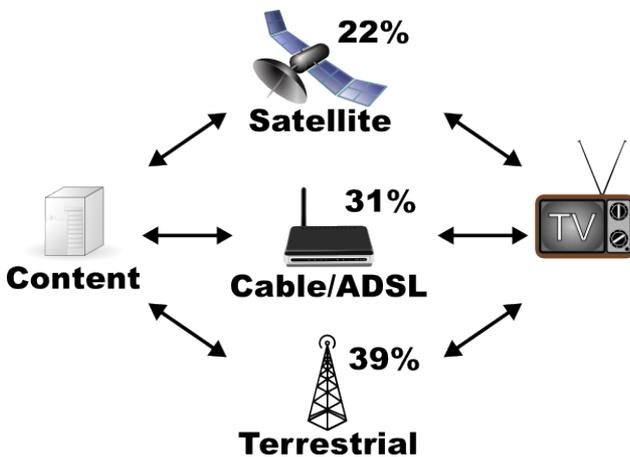


Figure 1: Repartition in Worldwide reception modes in 2009 (source IDATE, according to World Television Markets January 2010)

Figure 1 shows the repartition between the different TV reception modes in 2009 [2]. Even though one may expect significant changes to these figures as TV content moves to the Web, terrestrial networks will continue to play a significant role in the years to come and needs to be accounted for in convergence scenarios.

TV sets are constrained devices: the screen is wide but seen from a distance, the TV remote is usually the only

means of interaction with the user and memory and processing power are very limited. Performance considerations are not to be dismissed but the Web platform has been designed to be independent of the device it runs on. Readers familiar with mobile devices will recognize very similar constraints to those of the mobile Web. From a standardization perspective, the answer is not so much technical as educational. The W3C Mobile Web Best Practices [3] [4], initially targeted to mobile devices, provide a very good starting point to develop TV-friendly Web content.

Certifying and deploying firmware upgrades throughout the life of a given product is costly. In a vertical model where an operator leases set-top boxes to its customers, subscription fees could in theory fund these updates. In a more horizontal model where TV sets are sold once and are not linked to any operator in particular, firmware updates would affect the price of the device, which is hardly possible in a mass market where margins are already low. While mobile users switch to a new mobile device after 18 months on average [5], TV users keep their TV device for about 7 years [6]. This means that the TV world evolves at a lower pace than the rest of the Web and requires stable specifications that can be used for certification purpose. On the Web, HTML5 is under development and there is no official test suite for the time being that could be used to ensure device interoperability.

3.2 Regionalisms

Various organizations define TV standards, often on a regional or product basis (governments, EBU, HbbTV, YouView, UK DTG, IPTV Forum Japan, CableLabs, etc.). Looking at TV from a pure Web perspective, TV is a closed and fragmented world. As business needs push for more interaction between devices and content and for a migration towards a global market, TV needs to open up and meet Web requirements.

Of course, the point is not to suggest that a major switch to an open model is required, rather that Web and TV actors should discuss and prioritize topics of interest in a global forum to agree a common view as to what precise gaps need to be integrated within the core set of Web standards so that TV technologies can be used.

3.3 Business Models

A whole chain of actors take an active role in the TV world, from traditional industries such as content producers, content providers, TV and set-top box manufacturers, or TV broadcasters to relatively new entrants such as network operators and over-the-top providers (e.g. Hulu, Netflix). A few conglomerates (e.g. Walt Disney, Time Warner) make business over the whole chain. These actors interact with each other through customers/providers contracts, agreements and involvement in standardization organizations.

Convergence between Web and TV shakes existing business models as companies consider new possible sources of revenues. Competition between solutions that overlap and different priorities for everyone will undoubtedly affect the convergence schedule.

3.4 Access to Premium Content

All TV business models eventually revolve around selling access to premium content, be it through subscriptions, pay-per-view, advertisements or public license fees. Content protection is key to protect investments and reduce piracy. Content protection may take different forms, from making it difficult for users to save video streams on the Web to full-fledged Digital Rights Managements (DRM) systems. HTML5 brings video to the Web but there is no standard way to serve protected content across devices and browsers. As of today, there is no premium video content on the Web.

Web and TV come to content protection from opposite sides, and discussions on content protection have often led to misunderstandings. Technical solutions that could serve as starting point for standardization do not attempt to standardize DRM systems since they always involve some proprietary aspect, but propose to use a common encryption algorithm (e.g. AES) and to add hooks to the HTML5 video mechanism for the integration of key exchange technologies.

4 TECHNICAL PRIORITIES

To address high-level problems mentioned above, the W3C organized a series of workshops on Web and TV, in Tokyo in September 2010 [7], in Berlin in February 2011 [8], and a third workshop is under discussion for September this year. These workshops kicked off discussions between Web and TV actors and raised several technical topics of interests. Prioritization now continues in the W3C Web and TV Interest Group [9]. That group identifies requirements and potential solutions to ensure that the Web will function well with TV.

4.1 More Control over the Video Pipeline

To ensure Quality of Service (QoS), TV video needs to be streamed using some HTTP adaptive streaming mechanism and MPEG DASH [10], under development at MPEG, has been singled out by workshops participants as a key enabler for video streaming on broadband connections. Integration of such adaptive streaming mechanisms in HTML may require exposing some programmatic control over playback parameters and over the selection of the current bit-rate.

Adding support to content splicing to the `<video>` element in HTML would also enable richer TV-like user experiences. This includes the possibility to insert advertisements at the beginning of a video playback.

Content protection, as mentioned in 3.4, fits in that category as well.

Similarly, there is no generic error feedback control to alert the user and suggest alternatives when a video

cannot be viewed because e.g. the Web browser does not support the video encryption model.

These use cases and requirements, once clarified and agreed upon, should result in a minimal set of extension proposals to the `<video>` element in HTML.

More extended APIs may be considered, for instance to allow Web applications to control and interact with the broadcasted channel on a TV set.

4.2 Home Networking Scenarios

Once connected, the television (or the set-top box) becomes a central device on the home network. This creates a number of home networking scenarios, from simple second-screen scenarios where a mobile device or a tablet is used to control the TV to more complete multi-devices scenarios where a device coordinate actions between other devices, for instance selecting a resource on a media server and controlling its playback on a third media player device.

Devices may implement different discovery and communication protocols (e.g. UPnP, ZeroConf). From a Web perspective, the goal is to enable device and service discovery directly from within the Web browser. Within the W3C Web and TV Interest Group, the Home Network Task Force reviews use cases and requirements for such scenarios.

Similarly, work has started in the Web Real-Time Communications Working Group [11] to enable Peer-to-Peer video/audio conferences between devices. Coupled with device discovery on the local network, ever more immersive user experiences that involve synchronization of multiple devices become possible.

4.3 Social Interactions

As watching TV moves away from a rather passive experience, personalization of the user interface becomes a key differentiator between services. Most needs here boil down to exposing the right metadata at the right time, e.g. to:

- augment the user experience with contextual information on the programme he is watching, taking his preferences into account
- enable social experiences e.g. where remote friends watch and exchange on a football match in real time.
- provide personalized recommendations

Coordination is needed between metadata development in W3C and in industrial and other television and radio standardization activities. For instance, the Ontology for Media Resources [12] maps existing media vocabularies.

4.4 Profiling and/or Testing

Two solutions come to mind to address the need for stable specifications and to cope with low-performance requirements of TV devices. The first solution involves sub-setting and profiling of existing specifications. On the Web, experience gained through the mobile platform tends to show that this solution is a short-term response that creates « compartments » on the Web. Most modern

mobile devices now support (and sometimes even drive the development of) the same stack of technologies as regular desktop devices. Profiling is a matter of striking the right balance between addressing needs at a given point in time (products need to ship) and avoiding the creation of silos in Web content (there is but One Web).

The second solution is to contribute to testing the Web technologies that are integrated in the targeted consumer electronic devices. It is a longer-term solution that will ensure the high level of interoperability that diverse industries demand. W3C has started a generic Testing activity to facilitate the development of test suites across technical specifications and that can be run across devices.

4.5 Accessibility

In many ways, accessibility in the TV industry has been much better than accessibility on the Web, partly thanks to regulations that companies must comply with to sell TV products.

Accessibility needs to be taken into account right at design time and not as an after thought. While sometimes considered by companies as a regulatory requirement, adaptive accessibility can often be leveraged in non-accessible contexts, be it only to watch a movie with subtitles in a sound-sensitive environment.

In particular, accessibility was shown as important for the design of multimodal applications that work on various kinds of devices. Works on Accessible Rich Internet Applications (WAI-ARIA) [13] and multimodal interactions [14] are candidate technologies to target heterogeneous environments.

The Web Content Accessibility Guidelines 2.0 [15], that serve as recommendations for making Web content more accessible, should probably be harmonized with the various existing regulations from the TV world.

5 CONCLUSION

The success of Web and TV depends on its capacity to integrate TV requirements within Web standards. The W3C organized Web and TV workshops to bring all the industries and organizations involved in Web and TV around the table and have them discuss their respective needs and priorities.

The Web and TV Interest Group in W3C was created as a consequence to provide a discussion forum so that discussions on use cases, requirements and possible solutions started during the workshops can lead to a precise identification of technical gaps that need to be addressed.

Standardization efforts have also started to enable Web Real-Time communications within browsers and work on a device discovery API is about to begin as this paper is written.

Standardization is not defined a priori. It relies heavily on contributions from relevant communities so that requirements get specified and properly integrated in the specifications. Members of the TV community have started to contribute to standardization efforts in relevant W3C groups. Support for multiple audio/video tracks in HTML5 has been recently added based on input from members of the TV community, for instance.

Today is the dawn of an intertwined Web and TV world. There are significant business opportunities in rising to the challenge of ensuring that people have access both to the Web from their televisions and to the television on the Web.

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