Standards for Web Applications on Mobile:
current state and roadmap

June 2013

Web technologies have become powerful enough that they are used to build full-featured applications; this has been true for many years in the desktop and laptop computer realm, but is increasingly so on mobile devices as well.

This document summarizes the various technologies developed in W3C that increase the capabilities of Web applications, and how they apply more specifically to the mobile context. A good subset of these technologies are described and explained in the W3C on-line training on programming Web applications.

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Status and changes

This document is the tenth edition of this overview of mobile Web applications technologies. The previous edition was released in February 2013. A live version of this document accepts contributions in the W3C Wiki.

Feedback on every aspect of this document should be sent to the author (dom@w3.org) and will serve as input for the next iteration of the document.

This edition adds a printer-friendly PDF version of the document, and, where appropriate, links to the Github repository of W3C test suites.

It documents the following changes in the Web platform since February 2013:

- **HTML 5.1** incorporates additions to HTML5 that helps Web apps on mobile, in particular the ability to run image processing in separate thread (via Canvas proxy), and improved form completion features;

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1. http://www.w3devcampus.com/writing-great-web-applications-for-mobile/
2. http://www.w3.org/2013/02/mobile-web-app-state/
3. http://www.w3.org/wiki/Standards_for_Web_Applications_on_Mobile
5. http://www.w3.org/TR/html51/
• Web Animations\(^6\), Encrypted Media Extensions\(^7\), Contacts Manager API\(^8\), Messaging API\(^9\), Runtime and Security Model for Web Applications\(^10\) were published as a First Public Working Draft;
• HTML Media Capture\(^11\), Pointer Events\(^12\), Resource Timing\(^13\) have reached the Candidate Recommendation status;
• the Vibration API\(^14\) went back to Last Call (from Candidate Recommendation) to cater for some changes based on implementation feedback;
• Touch Events\(^15\), Web Storage\(^16\) are now a Proposed Recommendation;
• Progress on Web Intents\(^17\) and associated specifications has stalled due to unresolved concerns on its integration in user interactions;
• A Patent Advisory Group\(^18\) is being convened on the Push API\(^19\) following a patent disclosure and exclusion;
• the document now tracks Media Source Extensions\(^20\) that provides an API to generate media content via JavaScript;
• this document now tracks NavigationController\(^21\), the likely replacement for ApplicationCache to manage off-line Web apps;
• Level 4 of Media Queries\(^22\), available as an Editors Draft, proposes the addition of CSS Media Queries to detect the type of pointing device, or the ambient luminosity;
• An editors draft of the NFC API\(^23\) was made available.

Document structure

The features that these technologies add to the Web platform are organized under the following categories: graphics (page 4), multimedia (page 11), device adaptation (page 15), forms (page 18), user interactions (page 21), data storage (page 24), personal information management (page 27), sensors and hardware integration (page 29), network (page 32), communication and discovery (page 36), packaging (page 39), performance & optimization (page 41).

7. http://www.w3.org/TR/encrypted-media/
8. http://www.w3.org/TR/contacts-manager-api/
10. http://www.w3.org/TR/runtime/
11. http://www.w3.org/TR/html-media-capture/
12. http://www.w3.org/TR/pointerevents/
15. http://www.w3.org/TR/touch-events/
17. http://www.w3.org/TR/web-intents/
18. http://www.w3.org/2013/03/push-pag-charter
19. http://www.w3.org/TR/push-api/
20. http://www.w3.org/TR/media-source/
22. http://dev.w3.org/csswg/mediaqueries4/
In each category, a table summarizes for each feature:

- which W3C specification defines the feature,
- which W3C group is responsible of the said specification,
- the stage of the specification in the W3C Recommendation track (see below),
- the estimated stability of the document, i.e. how widely the document is expected to change, as estimated by the author of this report, with three levels: low (the document is mostly stable), medium (some parts are stable, others are expected to change significantly), high (the document is expected to evolve significantly),
- some qualitative indication on availability of implementations on mobile devices, based on data collected primarily from Can I Use...24 and mobile HTML525, completed with data from Mozilla developer network26, QuirksMode27, as well as the author’s understanding of the mobile devices market (see also the code used to generate the support icons28)
- a link to the latest editors draft of the document,
- When available, a link to a relevant tutorial on WebPlatform Docs29, and to relevant on-line training courses on W3DevCampus30
- a link to the test suite for the said feature.

As a reminder, W3C creates Web standards by progressing documents through its Recommendation track31, with the following stages:

- “Editors drafts” represent the current view of the editors of the specification but have no standing in terms of standardization.
- “Working Drafts” are early milestones of the Working Group progress.
- “Last Call Working Drafts” signal that the Working Group has determined that the specification fulfills its requirements and all the known issues have been resolved, and thus requests feedback from the larger community.
- “Candidate Recommendations” trigger a call for implementations where implementers are invited to implement the specification and send feedback; Working Groups are expected to show the specification gets implemented by running test suites they have developed.
- “Proposed Recommendations” manifests that the group has gathered sufficient implementation experience, and triggers the final review by W3C Members
- “W3C Recommendations” are stable and completed Web standards; these documents only get updated rarely, through the “Edited Recommendation” process, as a results from errata collected by Working Groups.

27. http://quirksmode.org/
29. http://docs.webplatform.org/wiki/Main_Page
30. http://www.w3devcampus.com/
31. http://www.w3.org/2005/10/Process-20051014/tr.html#Reports
Prior to starting standardization, a Working Group needs to be chartered, based on input from W3C Members, often through the organization of a workshop\textsuperscript{32}, or after the reception of a W3C Member Submission\textsuperscript{33}.

W3C has set up Community Groups\textsuperscript{34}, a mechanism that allows anyone to do experimental work within the W3C infrastructure, under IPR rules that are compatible to transition the work to the W3C standardization process.

1. Graphics

\textbf{SVG}\textsuperscript{35}, Scalable Vector Graphics, provides an XML-based markup language to describe two-dimensions vector graphics. Since these graphics are described as a set of geometric shapes, they can be zoomed at the user request, which makes them well-suited to create graphics on mobile devices where screen space is limited. They can also be easily animated, enabling the creation of very advanced and slick user interfaces.

The integration of SVG in HTML5 opens up new possibilities, for instance applying advanced graphic filters (through SVG filters) to multimedia content, including videos. SVG 2.0 is set to facilitate that integration and complete the set of features in SVG.

In complement to the declarative approach provided by SVG, the \texttt{<canvas>} element added in HTML5 enables a 2D \textit{programmatic API}\textsuperscript{36} that is well-suited for processing graphics in a less memory intensive way. That API not only allows rendering graphics, but can also be used to do image processing and analysis — \textit{HTML 5.1}\textsuperscript{37} adds the ability to do that processing in a separate Web Worker\textsuperscript{38}.

Both SVG and HTML can be styled using \textit{CSS}\textsuperscript{39} (Cascading Style Sheets); in particular, CSS3 (the third level of the specification) is built as a collection of specifications set to offer a large number of new features that make it simple to create graphical effects, such as rounded corners, complex background images, shadow effects (\textit{CSS Backgrounds and Borders}\textsuperscript{40}), rotated content (\textit{CSS Transforms}\textsuperscript{41}, including with 3D effects), animations (\textit{CSS Animations}\textsuperscript{42}, and \textit{CSS Transitions}\textsuperscript{43}).

Animations, which can also be managed via scripting through the API exposed in \textit{Web Animations}\textsuperscript{44}, can be resource intensive — the possibility offered by the \textit{Timing control for script-based animations API}\textsuperscript{45} to manage the rate of updates to animations can help keep them under control.

Fonts play also an important role in building appealing graphical interfaces, but mobile devices are in general distributed with only a limited set of fonts. \textit{WOFF}\textsuperscript{46} (Web Open Font Format) addresses that limitation by making it easy to use fonts that are automatically downloaded through style sheets, while keeping the size of the downloaded fonts limited to what is actually needed to render the interface.

Another important aspect in graphics-intensive applications (e.g. games) is the possibility to use the entire screen to display the said graphics; the \textit{Fullscreen API}\textsuperscript{47} lets a Web application requests and detects full screen display.

Likewise, in these scenarios, it is often useful to be able to \textbf{lock the orientation of the screen}; the \textit{Screen Orientation API}\textsuperscript{48} allows not only to detect orientation change, but also to lock the orientation in a specific state.

32. http://www.w3.org/2003/08/Workshops/
33. http://www.w3.org/Submission/
34. http://www.w3.org/community/
35. http://www.w3.org/standards/techs/svg
36. http://dev.w3.org/html5/2dcontext/
37. http://www.w3.org/TR/html51/
39. http://www.w3.org/standards/techs/css
40. http://www.w3.org/TR/css3-background/
41. http://www.w3.org/TR/css3-transforms
42. http://www.w3.org/TR/css3-animations
43. http://www.w3.org/TR/css3-transitions/
44. http://www.w3.org/TR/web-animations/
45. http://www.w3.org/TR/wa/
46. http://www.w3.org/TR/woff/
NB: a 3D graphic API for HTML5 canvas, called WebGL\textsuperscript{49}, has been developed outside of W3C, as part of the Khronos Group\textsuperscript{50}; this API has been built to be compatible with OpenGL ES\textsuperscript{51}, i.e. for embedded systems, and is intended to work on mobile devices.

\textsuperscript{49} http://www.khronos.org/webgl/
\textsuperscript{50} http://www.khronos.org/
\textsuperscript{51} http://www.khronos.org/opengles/
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<td>HTML Working Group(^{59})</td>
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<td>HTML 5.1 Canvas Proxy(^{63})</td>
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52. http://www.w3.org/TR/SVG11/
53. http://www.w3.org/Graphics/SVG/WG
54. http://docs.webplatform.org/wiki/svg/tutorials
55. http://www.w3.org/Graphics/SVG/Test/
56. http://www.w3.org/TR/SVG2/
57. http://dev.w3.org/SVG/profiles/2.0/publish/index.html
58. http://www.w3.org/TR/2dcontext/
60. http://docs.webplatform.org/wiki/tutorials/canvas/canvas_tutorial
63. http://www.w3.org/TR/html51/embedded-content-0.html#proxying-canvases-to-workers
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<td>CSS Transform&lt;sup&gt;71&lt;/sup&gt;</td>
<td>CoreMob 2012</td>
<td>Working Draft</td>
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<td>Latest update Feb 2013&lt;sup&gt;72&lt;/sup&gt;</td>
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<sup>64</sup> http://www.w3.org/TR/css3-flexbox/
<sup>65</sup> http://www.w3.org/Style/CSS/members
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<td>Web Performance Working Draft</td>
<td>Last Call Working Draft</td>
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<td>Regularly updated</td>
<td>Well deployed</td>
<td></td>
<td>Well started</td>
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66. http://dev.w3.org/csswg/css-flexbox/
68. http://dev.w3.org/csswg/css-background/
70. http://docs.webplatform.org/wiki/tutorials/CSS_background_images
71. http://www.w3.org/TR/css3-transforms/
72. http://dev.w3.org/csswg/css-transforms/
73. http://docs.webplatform.org/wiki/tutorials/css_transforms
75. http://dev.w3.org/csswg/css-animations/
76. http://docs.webplatform.org/wiki/tutorials/css_animations
77. http://dev.w3.org/csswg/css-transitions/
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<td>Regularly updated</td>
<td>Limited</td>
<td>WebPlatform.org</td>
<td>None</td>
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78. http://docs.webplatform.org/wiki/tutorials/css_transitions
79. http://dev.w3.org/fxtf/web-animations/
81. http://w3c-test.org/webperf/specs/RequestAnimationFrame/
82. https://dvcs.w3.org/hg/webperf/file/tip/tests
83. http://www.w3.org/Fonts/WG/
84. http://dev.w3.org/webfonts/WOFF/spec/
85. http://docs.webplatform.org/wiki/tutorials/webfonts_font-face
86. http://dev.w3.org/webfonts/WOFF/tests/Format/Tests/xhtml1/testcaseindex.xht
87. http://www.w3.org/TR/fullscreen/
88. http://www.w3.org/2008/webapps/
89. http://docs.webplatform.org/wiki/tutorials/using_the_full-screen_api
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<td>Regularly updated</td>
<td>Very limited</td>
<td>None</td>
<td>None</td>
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90. [http://www.w3.org/TR/screen-orientation/](http://www.w3.org/TR/screen-orientation/)
2. Multimedia

HTML5 adds two tags that dramatically improve the integration of multimedia content on the Web: the `<video>` and `<audio>` tags. Respectively, these tags allow embedding video and audio content, and make it possible for Web developers to interact much more freely with that content than they would through plug-ins. They make multimedia content first-class citizens of the Web, the same way images have been for the past 20 years.

The playback content can be augmented and completed via Media Source Extensions that lets developers generate media content in JavaScript.

To cater for the needs of some content providers, a proposal to enable playback of protected content, Encrypted Media Extensions is an API that is under consideration in the HTML Working Group.

The Pick Media Intent offers a Web-intent based approach to search and retrieve locally or remotely stored media content, while the Networked Service Discovery API opens the door for integrating DLNA-hosted content into Web applications.

While the new HTML5 tags allow to play multimedia content, the HTML Media Capture defines a markup-based mechanism to access captured multimedia content using attached camera and microphones, a very common feature on mobile devices. The Web Real-Time Communications Working Group and the Device APIs Working Group are building together an API (getUserMedia) to directly manipulate streams from camera and microphones, as well as an API to record these streams into files.

Beyond capturing and recording, two additional APIs add multimedia manipulation capabilities to the Web platform. We have already mentioned the Canvas 2D Context API: it enables modifying images, which in turn opens up the possibility of video editing.

In a similar vein, the Audio Working Group is working on an API that that makes it possible to modify audio content, as well as analyze, modify and synthesize sounds, the Web Audio API.

The combination of all these features marks the starting point of the Web as a comprehensive platform for multimedia, both for consuming and producing. The rising interest around bridging the Web and TV worlds (manifested through the W3C Web and TV Interest Group) should strengthen that trend in the coming months. Mobile devices are expected to take a growing role in many users TV experience, providing a "second screen" experience, where users can find more information on or interact with a TV program they're watching via their mobile devices.

93. http://www.w3.org/TR/media-source/
95. http://w3c-test.org/dap/gallery/
96. http://w3c-test.org/dap/discovery-api/
98. http://www.w3.org/2011/04/webrtc/
100. http://dev.w3.org/2011/webrtc/editor/getusermedia.html
102. http://www.w3.org/TR/webaudio/
103. http://www.w3.org/2011/webltv/
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<td>Latest update May 2013</td>
<td>Very limited</td>
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104. http://www.w3.org/TR/html5/embedded-content-0.html#the-video-element
107. http://www.w3.org/TR/html5/embedded-content-0.html#the-audio-element
110. http://www.w3.org/TR/encrypted-media/
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111. http://www.w3.org/TR/gallery/
113. http://www.w3.org/TR/discovery-api/
114. http://www.w3.org/TR/html-media-capture/
115. http://www.w3.org/TR/mediacapture-streams/
117. http://www.w3.org/TR/mediastream-recording/
118. https://dvcs.w3.org/hg/dap/raw-file/default/media-stream-capture/MediaRecorder.html
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3. Device Adaptation

Mobile devices not only differ widely from traditional computers, but they also have a lot of variations among themselves, in terms of screen size, resolution, type of keyboard, media recording capabilities, etc.

The Device Description Repository API\(^{123}\) is a unified server-side API that allows Web developers to retrieve data on the devices that are accessing their pages on a variety of device information database.

The Media Capture Streams API exposes some specific information on capabilities of camera and microphones to make it possible to take advantage of the large variety of media capturing devices provided on mobile phones.

CSS Media Queries\(^{124}\) offer a mechanism that allows adapting the layout and behavior of a Web page based on some of the characteristics of the device, including the screen resolution — to which Media Queries Level 4\(^{125}\) proposes to add the availability and type of a pointing device, the ability to hover over elements, and the ambient luminosity. CSS Device Adaptation\(^{126}\) defines a set of CSS directives to define the size on which this layout should be based, relatively to the size of the underlying device — specifying what has been implemented using the <meta name="viewport"> element so far.

The proposal for a new picture element\(^{127}\), initially developed by the Responsive Images Community Group\(^{128}\), has been taken up by the HTML Working Group as one of the proposed extensions to HTML. It lets authors define what image to show depending on the rendering context as determined through media queries.

As a complementary approach, the srcset attribute\(^{129}\), developed in the WHATWG\(^{130}\) and also published an extension to HTML, let Web developers define the various existing resolutions of an image, letting the browser pick the best choice for the resolution of the screen.

\(^{123}\) http://www.w3.org/TR/DDR-Simple-API/
\(^{124}\) http://www.w3.org/TR/css3-mediaqueries/
\(^{125}\) http://dev.w3.org/csswg/mediaqueries4/
\(^{126}\) http://dev.w3.org/csswg/css-device-adapt/
\(^{127}\) http://www.w3.org/TR/html-picture-element/
\(^{128}\) http://www.w3.org/community/respimg/
\(^{129}\) http://www.w3.org/html/wg/drafts/srcset/w3c-srcset/Overview.html
\(^{130}\) http://www.w3.org/community/whatwg/
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132. [http://w3c-test.org/csswg/mediaqueries3/](http://w3c-test.org/csswg/mediaqueries3/)
133. [http://docs.webplatform.org/wiki/css/mediaqueries](http://docs.webplatform.org/wiki/css/mediaqueries)
134. [http://www.w3.org/Style/CSS/Test/MediaQueries/20100726/](http://www.w3.org/Style/CSS/Test/MediaQueries/20100726/)
135. [http://www.w3.org/TR/css-device-adapt/](http://www.w3.org/TR/css-device-adapt/)
137. [http://docs.webplatform.org/wiki/tutorials/mobile_viewport](http://docs.webplatform.org/wiki/tutorials/mobile_viewport)
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<td>None</td>
<td>None</td>
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140. http://dev.w3.org/html5/srcset/
The ability to build rich forms with HTML is the basis for user input in most Web-based applications. Due to their limited keyboards, text input on mobile devices remains a difficult task for most users; HTML 5\(^{141}\) address parts of this problem by offering new type of form controls that optimize the way users will enter data:

- **date and time entries**\(^{142}\) can take advantage of a number of dedicated form controls (e.g. `<input type="date">`) where the user can use a native calendar control;
- the `<input type="email">`\(^{143}\), `<input type="tel">`\(^{144}\) and `<input type="url">`\(^{145}\) can be used to optimize the ways user enter these often-difficult to type data, e.g. through dedicated virtual keyboards, or by accessing on-device records for these data (from the address book, bookmarks, etc.);
- the **inputmode**\(^{146}\) attribute (proposed in HTML 5.1) defines the type of textual input expected in a text entry;
- the **pattern**\(^{147}\) attribute allows both to guide user input as well as to avoid server-side validation (which requires a network round-trip) or JavaScript-based validation (which takes up more resources);
- the **placeholder**\(^{148}\) attribute allows to guide user input by inserting hints as to what type of content is expected in a text-entry control;
- the `<datalist>`\(^{149}\) element allows creating free-text input controls coming with **pre-defined values** the user can select from;
- **HTML 5.1**\(^{150}\) defines a mechanism for the **autocomplete** attribute to automatically fill input fields based on well-known data for the user.

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<td>Early draft</td>
<td>Regularly updated</td>
<td>None</td>
<td>None</td>
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155. [http://www.w3.org/TR/html5/forms.html#telephone-state-(type=tel)](http://www.w3.org/TR/html5/forms.html#telephone-state-(type=tel))  
157. [http://www.w3.org/TR/html51/forms.html#input-modalities:-the-inputmode-attribute](http://www.w3.org/TR/html51/forms.html#input-modalities:-the-inputmode-attribute)  
158. [http://www.w3.org/TR/html5/forms.html#the-pattern-attribute](http://www.w3.org/TR/html5/forms.html#the-pattern-attribute)  
160. [http://www.w3.org/TR/html5/forms.html#the-placeholder-attribute](http://www.w3.org/TR/html5/forms.html#the-placeholder-attribute)  
161. [http://www.w3.org/TR/html51/forms.html#the-datalist-element](http://www.w3.org/TR/html51/forms.html#the-datalist-element)  
163. [http://www.w3.org/TR/html51/forms.html#autofilling-form-controls:-the-autocomplete-attribute](http://www.w3.org/TR/html51/forms.html#autofilling-form-controls:-the-autocomplete-attribute)
5. User interactions

An increasing share of mobile devices relies on touch-based interactions. While the traditional interactions recognized in the Web platform (keyboard, mouse input) can still be applied in this context, a more specific handling of touch-based input is a critical aspect of creating well-adapted user experiences, which Touch Events in the DOM (DOM) enable. The work on that specification is now nearly finished.

Meanwhile, the Pointer Events Working Group has made good progress on an alternative approach to handle user input, Pointer Events, that allows to handle mouse, touch and pen events under a single model. This new approach is expected to replace the currently more widely deployed Touch Events.

Conversely, many mobile devices use haptic feedback (such as vibration) to create new form of interactions (e.g. in games); work on a vibration API in the Device APIs Working Group is making good progress.

But as the Web reaches new devices, and as devices gain new user interactions mechanisms, it also becomes important to allow Web developers to react to a more abstract set of user interactions: instead of having to work in terms of “click”, “key press”, or “touch event”, being able to react to an “undo” command, or a “next page” command independently of how the user instructed it to the device will prove beneficial to the development of device-independent Web applications. The IndieUI Events specification, developed by a joint task force between the Web Events Working Group and the Indie UI Working Group, aims at addressing this need.

Mobile devices follow their users everywhere, and many mobile users rely on them to remind them or notify them of events, such as messages: the Web Notifications specification proposes to add that feature to the Web environment.

Mobile devices, and mobile phones in particular, are also in many cases well-suited to be used through voice-interactions; the Speech API Community Group is exploring the opportunity of starting standardization work around a JavaScript API that would make it possible for users to interact with a Web page through spoken commands, and a W3C Working Group charter is currently under review by the Advisory Committee.

The hardware constraints of mobile devices, and their different usage context can make mobile users experience similar barriers to people with disabilities. These similarities in barriers mean that similar solutions can be used to cater for them, making a Web site accessible both for people with disabilities and mobile devices a natural goal.

How Web Content Accessibility Guidelines (WCAG) and User Agent Accessibility Guidelines (UAAG) provide guidance on mobile accessibility — that is, making websites and applications more accessible to people with disabilities when they are using mobile phones and a broad range of other devices — is discussed in Mobile Accessibility.

WAI-ARIA provides semantic information on widgets, structures and behaviors hooks to make Web applications more accessible, including on mobile devices.

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165. http://www.w3.org/2012/pointerevents/
166. http://www.w3.org/TR/pointerevents/
168. http://www.w3.org/TR/indie-ui-events/
170. http://www.w3.org/WAI/IndieUI/
172. http://www.w3.org/community/speech-api/
175. http://www.w3.org/WAI/mobile/experiences
176. http://www.w3.org/WAI/mobile/overlap
177. http://www.w3.org/WAI/mobile/
178. http://www.w3.org/TR/wai-aria/
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179. http://www.w3.org/TR/touch-events/
183. http://docs.webplatform.org/wiki/concepts/PointerEvents
185. http://www.w3.org/TR/vibration/
186. https://w3c-test.org/web-platform-tests/submissions/125/vibration/
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188. http://www.w3.org/TR/notifications/
191. http://www.w3.org/TR/mwbp-wcag/
192. http://www.w3.org/WAI/PF/
193. http://www.w3.org/WAI/PF/aria/
6. Data storage

A critical component of many applications is the ability to save state, export content, as well as integrate data from other files and services on the system.

For simple data storage, the Web Storage specification offers two basic mechanisms, localStorage and sessionStorage, that can preserve data respectively indefinitely, or on a browser-session basis.

For richer interactions, the Web platform has a growing number of APIs to interact with a device filesystem: the FileReader API makes it possible to load the content of a file, the FileWriter API allows saving or modifying a file, while the nascent FileSystems API give access to more general file operations, including directory management. Discussions have started on whether these two latter APIs would better be implemented on top of IndexedDB.

On top of this file-based access, the Indexed Database API (IndexedDB) defines a database of values and hierarchical objects that integrates naturally with JavaScript, and can be queried and updated very efficiently. Note that the work around a client-side SQL-based database, which had been started in 2009, has been abandoned in favor of this new system.

As more and more data need to be stored by the browser (e.g. for offline usage), it becomes critical for developers to get reliable storage space, which the proposed Quota Management API will offer to Web applications.

Likewise, as some of this data need to be encrypted, the emerging Web Cryptography API from the Web Cryptography Working Group exposes strong cryptography primitives to Web applications.

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195. http://dev.w3.org/2006/webapi/FileAPI/
200. http://www.w3.org/TR/WebCryptoAPI/
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^{201} http://www.w3.org/TR/webstorage/
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<td>Regularly updated</td>
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203. http://w3c-test.org/webapps/WebStorage/tests/
204. http://www.w3.org/TR/FileAPI/
206. http://www.w3.org/TR/file-writer-api/
207. http://www.w3.org/TR/file-system-api/
208. http://www.w3.org/TR/IndexedDB/
210. http://www.w3.org/TR/webdatabase/
211. http://www.w3.org/TR/quota-api/
212. http://www.w3.org/2012/webcrypto/
213. http://www.w3.org/2012/webcrypto/WebCryptoAPI/
Applications can benefit from integrating with existing data records; on mobile devices, the address book and calendar are particularly useful source of information, which the Contacts API\textsuperscript{215} and the Calendar API\textsuperscript{216} bring access to.

For integration in browser-based Web Apps, Web Intents\textsuperscript{217} based approaches have been suggested, but are now stalled due to the lack of progress around that technology.

For Web apps outside of the browser, a purely programmatic approach is part of the System Applications Working Group\textsuperscript{218}, with work on a Contacts Manager API\textsuperscript{219} in progress.

\textsuperscript{215} http://w3c-test.org/dap/contacts/
\textsuperscript{216} http://dev.w3.org/2009/dap/calendar/
\textsuperscript{217} http://dvcs.w3.org/hg/web-intents/raw-file/tip/spec/Overview.html
\textsuperscript{218} http://www.w3.org/2012/05/sysapps-wg-charter.html
\textsuperscript{219} http://www.w3.org/TR/contacts-manager-api/
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220. http://www.w3.org/2012/sysapps/  
221. http://www.w3.org/2012/sysapps/contacts-manager-api/  
223. http://w3c-test.org/dap/contacts/tests/  
224. http://www.w3.org/TR/calendar-api/  
225. http://www.w3.org/TR/calendar-api/
8. Sensors and hardware integration

Mobile devices are packed with sensors, making them a great bridge between the real and virtual worlds: GPS, accelerometer, ambient light detector, microphone, camera, thermometer, etc.

To take full advantage of these sensors in mobile Web applications, Web developers need to be provided with hooks to interact with them.

The Geolocation API provides a common interface for locating the device, independently of the underlying technology (GPS, WIFI networks identification, triangulation in cellular networks, etc.)

Web applications can also now access orientation and acceleration data via the DeviceOrientation Event Specification.

The work on a generic Sensor API has been put on hold in favor to designing APIs for specific sensors, such as the Proximity Events API, the Ambient Light Events API or the proposed Ambient Humidity Events API.

As already mentioned in the section on multimedia (page 11), there is ongoing work on APIs to open up access to camera and microphone streams.

The opportunity for Web applications to use Near-Field Communications (NFC) mechanisms have led to the chartering of the NFC Working Group to develop a Web NFC API.

A more global access to sensors and hardware (including USB and bluetooth) is in scope for the System Applications Working Group.

226. http://dev.w3.org/geo/api/spec-source.html
232. http://www.w3.org/2012/nfc/
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<td>DeviceOrientation Event Specification&lt;sup&gt;238&lt;/sup&gt;</td>
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<td>Updated regularly&lt;sup&gt;242&lt;/sup&gt;</td>
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234. http://www.w3.org/TR/geolocation-API/
235. http://www.w3.org/2008/geolocation/
237. http://dev.w3.org/geo/api/test-suite/Overview.html
238. http://www.w3.org/TR/orientation-event/
239. http://docs.webplatform.org/wiki/tutorials/device_orientation
240. https://dvcs.w3.org/hg/geo/file/tip
241. http://www.w3.org/TR/battery-status/
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244. [http://www.w3.org/TR/proximity/](http://www.w3.org/TR/proximity/)
245. [https://w3c-test.org/web-platform-tests/submissions/127/proximity/](https://w3c-test.org/web-platform-tests/submissions/127/proximity/)
246. [http://www.w3.org/TR/ambient-light/](http://www.w3.org/TR/ambient-light/)
9. Network

Network connectivity represents a major asset for mobile devices: the Web is an immense store of content, as well as an almost endless source of processing power, overcoming two of the limitations of mobile devices.

The Web platform is growing a number of APIs that facilitate establishing network connectivity in different contexts.

**XMLHttpRequest**\(^{248}\) (the “X” in AJAX) is a widely deployed API to load content from Web servers using the HTTP and HTTPs protocol: the W3C specification (formerly known as XMLHttpRequest Level 2) completes the existing deployed API with the ability to make requests on servers in a different domain, programmatic feedback on the progress of the network operations, and more efficient handling of binary content. The work on documenting the currently deployed API (XMLHttpRequest Level 1) has been abandoned in favor of getting the new API developed more quickly.

By default, browsers do not allow to make request across different domains (or more specifically, across different *origins*, a combination of the protocol, domain and port) from a single Web page; this rule protects the user from having a Web site abusing their credentials and stealing their data on another Web site. Sites can opt-out of that rule by making use of the *Cross-Origin Resource Sharing*\(^{249}\) mechanism, opening up much wider cooperation across Web applications and services.

XMLHttpRequest is useful for client-initiated network requests, but mobile devices with their limited network capabilities and the cost that network requests induce on their battery (and sometimes on their users bill) can often make better use of server-initiated requests. The *Server-Sent Events*\(^{250}\) API allows triggering DOM events based on push notifications (via HTTP and other protocols.)

Early work on a *Push API*\(^{251}\) would allow Web applications to receive server-sent messages whether or not the said Web app is active in a browser window. As patents have been disclosed on that API, a *Patent Advisory Group*\(^{252}\) is being formed to assess how to make further progress possible on this work item.

The *WebSocket API*\(^{253}\), built on top of the IETF *WebSocket protocol*\(^{254}\), offers a bidirectional, more flexible, and less resource intensive network connectivity than XMLHttpRequest.

The work on *Web Real-Time Communications*\(^{255}\) will also provide direct *peer-to-peer data connections* between browsers with real-time characteristics, opening the way to collaborative multi-devices Web applications.

Of course, an important part of using network connectivity relies on being able to determine if such connectivity exists, and the type of network available. The *HTML5 onLine DOM flag*\(^{256}\) (and its associated change event, `ononline`) signals when network connectivity is available to the Web environment.

The *network-information API*\(^{257}\) addresses discovery of the network characteristics, allowing to determine for instance the rough bandwidth of the current connection. The *Resource Timing*\(^{258}\) API offers to measure precisely the impact of the network on the time needed to load various resources, offering another approach to adapt a Web app to its network environment.

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248. [http://dev.w3.org/2006/webapi/XMLHttpRequest-2/](http://dev.w3.org/2006/webapi/XMLHttpRequest-2/)
249. [https://dvcs.w3.org/hg/cors/raw-file/tip/Overview.html](https://dvcs.w3.org/hg/cors/raw-file/tip/Overview.html)
250. [http://dev.w3.org/html5/eventsorce/](http://dev.w3.org/html5/eventsorce/)
252. [http://www.w3.org/2013/03/push-pag-charter](http://www.w3.org/2013/03/push-pag-charter)
253. [http://dev.w3.org/html5/websockets/](http://dev.w3.org/html5/websockets/)
255. [http://www.w3.org/TR/webrtc/](http://www.w3.org/TR/webrtc/)
258. [http://www.w3.org/TR/resource-timing/](http://www.w3.org/TR/resource-timing/)
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259. [http://www.w3.org/TR/XMLHttpRequest/](http://www.w3.org/TR/XMLHttpRequest/)
260. [https://dvcs.w3.org/hg/xhr/raw-file/tip/Overview.html](https://dvcs.w3.org/hg/xhr/raw-file/tip/Overview.html)
262. [http://www.w3.org/TR/cors/](http://www.w3.org/TR/cors/)
263. [http://docs.webplatform.org/wiki/tutorials/using_cors](http://docs.webplatform.org/wiki/tutorials/using_cors)
264. [http://w3c-test.org/webappsec/tests/cors/](http://w3c-test.org/webappsec/tests/cors/)
265. [http://www.w3.org/TR/eventsource/](http://www.w3.org/TR/eventsource/)
266. [http://docs.webplatform.org/wiki/tutorials/eventsource_basics](http://docs.webplatform.org/wiki/tutorials/eventsource_basics)
268. [http://www.w3.org/TR/push-api/](http://www.w3.org/TR/push-api/)
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269. [http://www.w3.org/TR/websockets/](http://www.w3.org/TR/websockets/)
270. [http://docs.webplatform.org/wiki/tutorials/websockets_basics](http://docs.webplatform.org/wiki/tutorials/websockets_basics)
274. [http://www.w3.org/TR/html5/browsers.html#browser-state](http://www.w3.org/TR/html5/browsers.html#browser-state)
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<td></td>
<td>Last updated Oct 2012</td>
<td>Very limited</td>
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<td>None</td>
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</tbody>
</table>

276. http://www.w3.org/TR/netinfo-api/

10. Communication and Discovery

Beyond connection to on-line services, allowing communications between users, but also between devices and between applications is an important aspect of a good mobile development platform. To communicate with unknown devices or pre-existing services, a discovery component is critical.

The **Messaging API** completes the existing ability to create and send message through links (with `sms:`, `mms:` and `mailto:` URI schemes) with more control on adding attachments and the success of the message sending. For browsers, this API would preferably be replaced by an approach based on **Web Intents**. For Web apps not in a browser, the **System Applications Working Group** is working on more complete **Messaging API**.

The **postMessage** API of **HTML5 Web Messaging** allows for Web Applications to communicate between each other.

A joint task force of the Device APIs and Web Apps Working Groups had been looking at a mechanism called **Web Intents**: it aimed at closer integration of Web applications, as well as of Web applications with native applications. Some of the initial use cases for Web Intents have proved hard to expose through the regular Web browser UI, and discussions on how to properly scope that technology are on-going. In the mean time, progress on Web Intents and derived APIs has **stalled**.

The **Networked Service Discovery API** offers to discover services on the local network (such as the ones offered via DLNA), enabling mobile Web applications to integrate seamlessly with these services. An **alternative approach based on Web Intents** has also been under exploration.

The **Web Real-Time Communications Working Group** is the host of specifications for a wider set of communication opportunities:

- **Peer-to-peer connection** across devices,
- **P2P Audio and video streams** allowing for real-time communications between users.

279. [http://www.w3.org/TR/messaging/](http://www.w3.org/TR/messaging/)
280. [http://dev.w3.org/html5/postmsg/](http://dev.w3.org/html5/postmsg/)
281. [http://www.w3.org/TR/webintents-local-services/](http://www.w3.org/TR/webintents-local-services/)
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<td>Last updated Feb 2013</td>
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[^282]: [http://www.w3.org/TR/messaging-api/](http://www.w3.org/TR/messaging-api/)
[^283]: [http://www.w3.org/2012/sysapps/messaging/](http://www.w3.org/2012/sysapps/messaging/)
[^284]: [http://www.w3.org/TR/webmessaging/](http://www.w3.org/TR/webmessaging/)
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<td>P2P connections</td>
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286. [http://www.w3.org/TR/web-intents/](http://www.w3.org/TR/web-intents/)
An important aspect of the user experience of applications is linked to how the user perceives the said application is available permanently (even when off-line, which is particularly important on mobile devices), as well as how it can be shared and distributed, typically through purchases via applications stores — this is adequately addressed by packaging the application.

The Web platform offers two complementary approaches to packaging Web applications:

- HTML5’s ApplicationCache\(^{288}\) enables access to Web applications off-line through the definition of a manifest of files that the browser is expected to keep in its cache; while relatively well deployed, the current approach has shown some strong limitations and the HTML and Web Applications Working Groups are considering a potentially major overhaul of the technology, likely based on NavigationController\(^{289}\)
- a JSON-based manifest format\(^{290}\) in development by the the Web Apps Working Group (as replacement for the W3C Widgets\(^{291}\) family of specifications). The System Applications Working Group is building a runtime and security model\(^{292}\) on top of that packaging.


\(^{290}\) [http://www.w3.org/2008/webapps/manifest/](http://www.w3.org/2008/webapps/manifest/)

\(^{291}\) [http://www.w3.org/standards/techs/widgets](http://www.w3.org/standards/techs/widgets)

\(^{292}\) [http://www.w3.org/TR/runtime/](http://www.w3.org/TR/runtime/)
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</table>

293. http://www.w3.org/TR/html5/browsers.html#appcache
297. http://www.w3.org/2012/sysapps/runtime/
12. Performance & Optimization

Due to their limited CPU, and more importantly to their limited battery, mobile devices require a lot of attention in terms of performance.

The work started by the Web Performance Working Group on Navigation Timing\textsuperscript{298}, Resource Timing, Performance Timeline\textsuperscript{299} and User Timing\textsuperscript{300}, gives tools to Web developers for optimizing their Web applications.

The proposed work on Efficient Script Yielding\textsuperscript{301} offers the opportunity to Web developers to use more efficiently asynchronous programming, but has so far gained very limited traction.

The API to determine whether a Web page is being displayed\textsuperscript{302} (Page Visibility API) can also be used to adapt the usage of resources to the need of the Web application, for instance by reducing network activity when the page is minimized. Likewise, the Timing control for script-based animations API can help reduce the usage of resources needed for playing animations.

The battery API\textsuperscript{303} allows adjusting the use of resources to the current level of power available in the battery of a mobile device.

Beyond optimization of resources, the perceived reactivity of an application is also a critical aspect of the mobile user experience. The thread-like mechanism made possible via Web Workers\textsuperscript{304} allows keeping the user interface responsive by offloading the most resource-intensive operations into a background process.

The Mobile Web Application Best Practices\textsuperscript{305} provide general advice on how to build Web applications that work well on mobile devices, taking into account in particular the needs for optimization.

\begin{itemize}
\item \textsuperscript{298} \url{http://w3c-test.org/webperf/specs/NavigationTiming/}
\item \textsuperscript{299} \url{http://dvcs.w3.org/hg/webperf/raw-file/tip/specs/PerformanceTimeline/Overview.html}
\item \textsuperscript{300} \url{https://dvcs.w3.org/hg/webperf/raw-file/tip/specs/UserTiming/Overview.html}
\item \textsuperscript{301} \url{http://w3c-test.org/webperf/specs/setImmediate/}
\item \textsuperscript{302} \url{http://www.w3.org/TR/page-visibility/}
\item \textsuperscript{303} \url{https://dvcs.w3.org/hg/dap/raw-file/tip/battery/Overview.html}
\item \textsuperscript{304} \url{http://dev.w3.org/html5/workers/}
\item \textsuperscript{305} \url{http://www.w3.org/TR/mwabp/}
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306. [http://www.w3.org/TR/navigation-timing/](http://www.w3.org/TR/navigation-timing/)
307. [http://w3c-test.org/webperf/tests/](http://w3c-test.org/webperf/tests/)
309. [http://www.w3.org/TR/performance-timeline/](http://www.w3.org/TR/performance-timeline/)
310. [http://www.w3c-test.org/webperf/specs/PerformanceTimeline/](http://www.w3c-test.org/webperf/specs/PerformanceTimeline/)
311. [http://www.w3.org/TR/user-timing/](http://www.w3.org/TR/user-timing/)
313. [https://dvcs.w3.org/hg/webperf/file/3a425fb1f142/tests/approved/UserTiming](https://dvcs.w3.org/hg/webperf/file/3a425fb1f142/tests/approved/UserTiming)
314. [http://www.w3c-test.org/webperf/specs/PageVisibility/](http://www.w3c-test.org/webperf/specs/PageVisibility/)
315. [http://www.w3.org/TR/workers/](http://www.w3.org/TR/workers/)
316. [http://docs.webplatform.org/wiki/tutorials/workers_basics](http://docs.webplatform.org/wiki/tutorials/workers_basics)