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A Study of Mobile Internet Capability Trends to Assess the Effectiveness of the W3C Default Delivery Context (DDC)

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Abstract

The mobile Internet is becoming increasingly popular, but the usability of many Web applications provides a negative mobile Internet experience. This paper researched the Internet capabilities of Web-enabled mobile phones through statistics generated using the R programming environment with data sourced from MobileAware's Device Description Repository (DDR). Time series analysis and measures of location were applied to the data set. Hands-on testing using selected mobile browsers were carried out to backup and prove findings. The data set contained 1384 device descriptions from LG, Nokia, Motorola, Samsung and Sony Ericsson mobile phones that have a browser capable rendering XHTML Basic 1.0 or better. The results of the research were used to evaluate the effectiveness of the W3C Default Delivery Context (DDC) and recommendations were proposed to adjust parts of the specification to improve end user experience and give developers more flexibility when designing mobile Internet applications. Five of the eight DDC recommendations were adjusted and presented as an Enhanced Delivery Context (EDC).

Keywords: mobile Internet, mobile browsers, DDC, EDC

1 INTRODUCTION

The mobile Internet is a connection to a Web page using a mobile phone; any mobile phone with a browser is capable of accessing the Internet. A research report by Nielsen Mobile (Covey 2008) believes that mobile Internet adoption reached a critical mass in 2008 through a confluence of device availability, network speeds, content availability and, most importantly, consumer interest.

The guidelines that make up the DDC were assessed by applying research, statistical analysis to the data set, and hands-on testing with selected mobile browsers to verify that the guidelines are representative of the population of mobile devices that can access the Internet. In assessing the DDC it was found that some guidelines conflicted with the majority of mobile devices; this paper will present adjusted guidelines as an Enhanced Delivery Context (EDC) to better represent the population of mobile devices that can access the Internet.

During the experiment selected mobile devices were used to connect to test XHTML documents to prove and backup findings. In order to be most efficient at this task, devices with browser types that did not get implemented into a device in 2008 were not considered as they have more than likely been superseded or dropped as a product. The browser types identified from the data set that were implemented in 2008 include Netfront, Obigo, Openwave, Opera, Nokia and Mozilla (Symbian) browsers.

2 Default Delivery Context

The W3C group, Mobile Web Initiative (MWI) (W3C 2009*b*), consists of four active working groups with a common goal of making Web access from a mobile device as simple as Web access from a desktop

device. The Best Practices Working Group (BPWG) (W3C 2009*a*) has defined a best practices document that consists of the Default Delivery Context (DDC); this specification provides a set of guidelines to assist in mobile Web development. Rabin & McCathieNevile (2008) explain that the specification will provide a default mobile experience in the absence of adaptation with the intention to improve the Web experience on mobile devices. The DDC is considered a baseline experience in which the Web can be viewed on a wide range of mobile devices, the editors stress that many devices exceed the capabilities of this specification but it is not a least common denominator approach. The DDC specification, shown in table 1, consists of nine attributes that are expected to represent the population of mobile devices with Internet capability.

Table 1: Default Delivery Context (Rabin & McCathieNevile 2008)

Delivery Context	Default Value
Usable Screen Width	120 pixels, minimum
Markup Language Support	XHTML Basic 1.1
Character Encoding	UTF-8
Image Format Support	JPEG and GIF89a
Maximum Total Page Weight	20 kilobytes
Colors Weight	256 Colors, minimum
Style Sheet Support	CSS Level 1 and CSS 2 Media Types
HTTP	HTTP/1.0 or HTTP/1.1
Script	No support for client side scripting

3 Evaluating the DDC

3.1 Statistics on Usable Screen Width

The time series graph in Figure 1 plots the new mobile devices introduced onto the market on a quarterly time scale that have a usable screen width of less than 128 pixels. There are four data points per year starting in 2002Q1 and ending in 2008Q4. Each data point represents the actual number of devices from the data set that have a usable screen width of less than 128 pixels per quarter. There is a clear downward trend indicating that the once dominant 128 division screen is becoming less popular. The last data point in 2008Q4 indicates that less than 20% of the 19 new mobile devices have a screen width less than 128 pixels.

Table 2, shows the summary statistics for all the usable screen widths in the data set. Overall there are 507 from 1384 devices in the data set that fall into the 128 division category. The median and the mean values are 168 and 170 respectively, and 395 devices fall into the 176 division category. In 2008 the minimum usable screen width is 108 and the total devices with a usable screen width of less than or equal to 128 pixels are 22 from 87 devices, only 9 devices fall into the 176 division category, and 49 devices fall into the 240 division category indicating that these Quarter VGA (QVGA) devices could become the dominant screen width in the future.

3.1.1 Delivering Content

The time series graph in figure 1 indicates that the small screen of 128 pixels or less is decreasing, but table 2 showed that the once dominant 128 pixel screen division should not be neglected. Six devices were selected to test how mobile browsers deal with content that exceed the width of the device screen. Further study of the target browser types indicated that Mozilla and Opera browsers were not implemented in any devices with a screen width less than 176 pixels whereas the others were implemented into 128 pixel wide devices and upwards; therefore, the selected devices represent small screen devices that implement small screen browsers. Each device was connected to an XHTML-MP Web page containing three images with an absolute width of 232 pixels, 168 pixels and 120 pixels, with a paragraph of text.

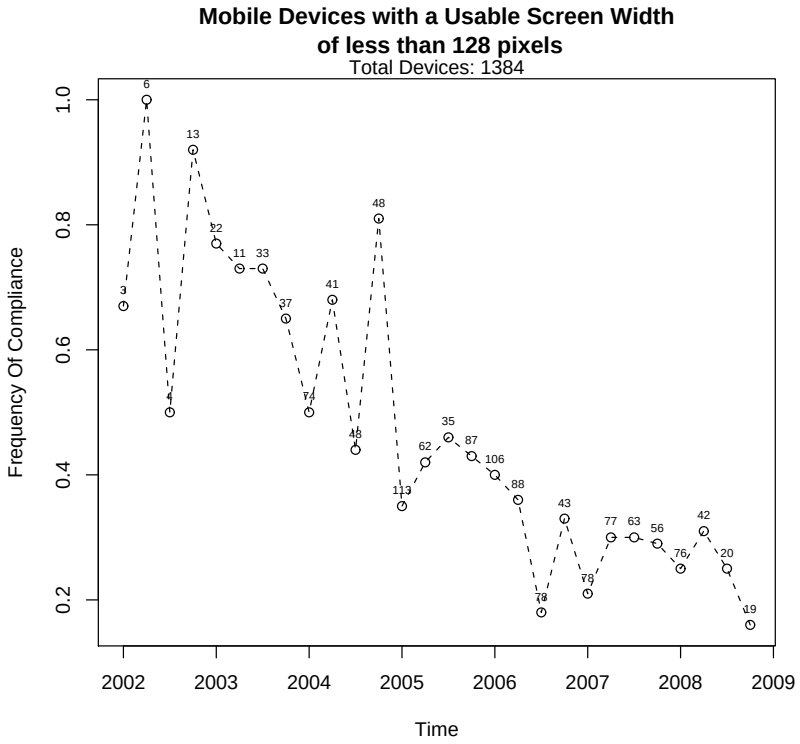

Figure 1: Small Screen Support

Table 2: Usable Screen Width Statistics (2002 - 2008)

Usable Screen Width Statistics for 1384 Devices	
Min.	82
Total 128 Division	507
Total 176 Division	395
Total 240 Division	347
Median	168
Mean	170
Max.	620

Each device handled the content sufficiently. The SamsungSGH-T539 with the Netfront browser had an option of desktop view or smartfit view and text was wrapped automatically to fit the screen. In desktop view images were not distorted and a horizontal scroll bar was introduced to view the full image. In smartfit view the images were rescaled to fit the 120 pixel screen without the need of horizontal scrolling. The Nokia 2630 with the Nokia browser had similar modes called screen size full and screen size small, the SamsungSGH-A227 with the Openwave browser was capable of rescaling content to fit the screen and the LG-KP235 with the Obigo browser had both screen modes. Hands-on testing with these four devices indicates that client side adaptation in the mobile browser is efficient at rendering larger-than-screen content.

3.2 Support for XHTML Basic 1.1

The time series graph in Figure 2 shows the growing support towards full HTML 4.01, a device that claims support for full HTML 4.01 should in theory support both its XHTML Basic and XHTML-MP

subsets. There is a clear upward trend in the graph indicating that the browser companies pay little heed to adherence of the W3C recommendations and strive to develop their product to support the full features of HTML 4.01.

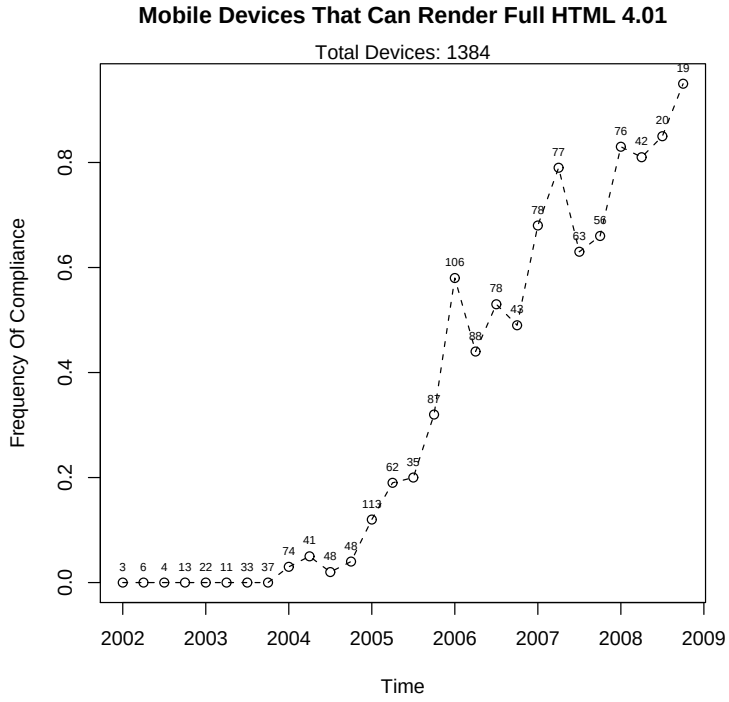

Figure 2: Markup Support

Six devices that implement a different target browser type was used to test support of the additional elements and attributes XHTML Basic 1.1 introduced over XHTML-MP 1.2; each device was connected to an XHTML Web page that contained the target attribute to open a new browser window: target=”_blank” and the three additional presentation elements. Only the Mozilla and Opera browsers dealt with the target attribute successfully. The Opera browser opened new tabs within the browser window and the Mozilla browser had the ability to switch between windows. The remaining browsers could not open a second browser window. There was good support for the sub and sup elements, but no browser supported the tt element.

3.3 Browser Support for UTF-8

An XHTML-MP 1.2 Web page specifying UTF-8 encoding was created to display Latin, Arabic and a set of special characters; each of the target browser types were connected to this page to understand the level of conformity to UTF-8 encoding. Six mobile devices were selected to test conformance to UTF-8; both the Nokia5500d and the NokiaN95 allowed the user to choose a character encoding on the device, if set to automatic the character encoding declared in the Web document was used otherwise the selected encoding was given the highest priority. Both the SonyEricssonTM506 and SonyEricssonW960i relied on the character encoding that was declared in the Web document. These four devices were able to display Latin, Arabic and the set of special characters. A second test was carried out using the same devices on the Web document after the character encoding was changed from UTF-8 to ISO-8859-1. If the browser used the ISO-8859-1 encoding the Arabic or special characters did not display correctly.

Neither the SamsungSGH-A227 or the LG-VX9700 were able to display the Arabic characters even though their HTTP header: accept-charset, indicated support for UTF-8. Further research showed that

depending on the level of Unicode support in the browser being used and whether or not the necessary fonts are installed, there may be display problems for some of the translations, particularly with complex scripts such as Arabic (unicode.org 2009). The data set showed that UTF-8 followed by ISO-8859-1 and US-ASCII are the most supported character encoding in the data set, a device can support more than one character encoding scheme.

3.4 Support for PNG

The data set shows a wide support for all three image types with 100% of devices supporting both JPEG and GIF, with 97% supporting PNG since 2002. A closer look at the devices that do not support PNG reveal that they are Motorola devices that have implemented the Openwave browser and predominantly belong to the devices released by the American telecom company, Verizon. Openwave browsers are capable of rendering PNG images but a bug in Motorola's implementation of the Openwave browser has resulted in PNGs not being supported.

3.5 Colour Weight Support

The time series graph in Figure 3 shows that nearly every device from 2004 onwards is capable of displaying more than 256 colours on its main screen display.

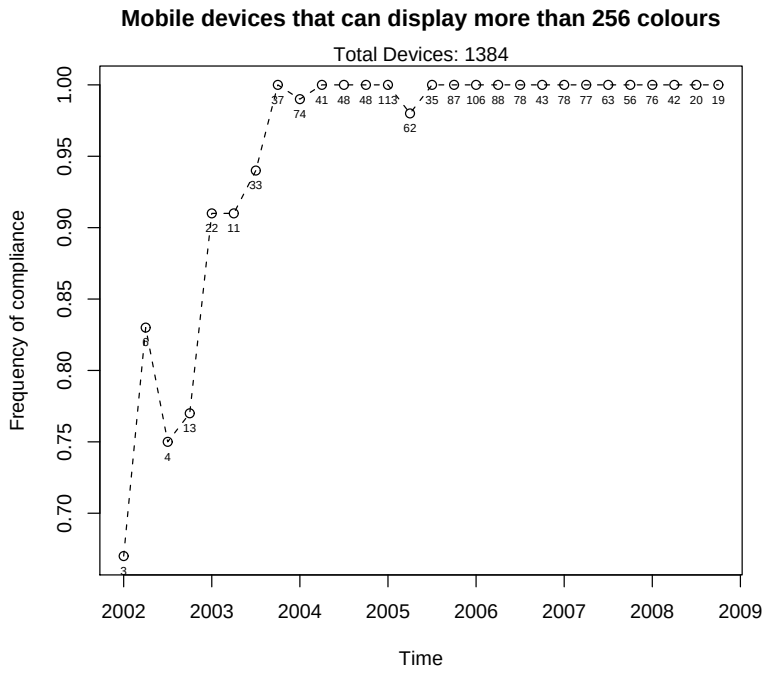

Figure 3: Colour Support

Table 3 shows the summary statistics for the total colours supported in the data set. The table shows that black-and-white devices exist in the data set, but the actual number is two devices and that mobile device screens are capable of supporting a vast array of colours well above the DDC recommendation.

Table 3: Colour Weight Statistics (2002 - 2008)

Colour Weight Statistics for 1384 Devices	
Min.	2
Total 8-bit screens	11
Total 16-bit screens	837
Total 18-bit screens	393
Total 24-bit screens	55
Median	65540
Mean	781600
Max.	16780000

3.6 Optimum Page Weight

The time series graph in figure 4 shows, as expected, that with time devices can handle larger Web pages; this is due to an improvement in the underlying network, faster browser rendering and an increase of memory available in menu-driven devices. MobileAware explained that an optimum page weight value is established through heuristics: if the device could download a test page of 20kb size within an acceptable time period of 4 seconds it was assigned that value. If the download exceeded 4 seconds a smaller page size was tested. Each data point in Figure 4 is an average page size from all the values in the same quarter. Every year from 2005 onwards, devices on average, have been able to render an extra 2000 bytes while keeping within the acceptable download period. In 2008 devices are successfully dealing with 20 kilobyte Web pages.

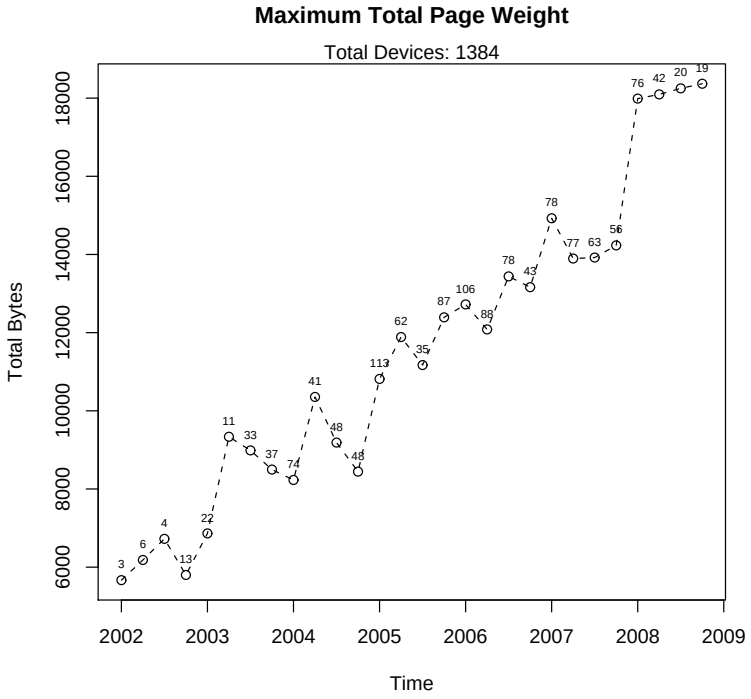

Figure 4: Average Page Weight

3.7 CSS Media Rule

Testing on six different browser types showed that three of the target browser types do not support the handheld media type: Both the Mozilla and Opera browsers explicitly choose the screen media over handheld, and the Obigo browser did not support media types at all.

3.8 Javascript Conformance

Testing found that Openwave 6.x browsers did not support Javascript and submitted the form without email validation. The remaining target browsers supported Javascript and provided an error message if the email field was wrongly formed or left blank. However, the mobile browsers that support Javascript allowed the user to configure the browser to enable/disable Javascript. Powers (2008) explains that for those who prefer not to use Javascript, and those who have no choice, it's important to provide alternatives when no script is present. One alternative is the noscript element introduced in XHTML-MP 1.2. Content contained within the opening and closing noscript element will be processed if Javascript is not supported or disabled. This could be particularly useful to inform a user to enable Javascript. The time series graph in Figure 5 shows the growing support for Javascript. From 2005 Javascript has been widely implemented into mobile browsers and in 2008 very few mobile devices did not support the technology.

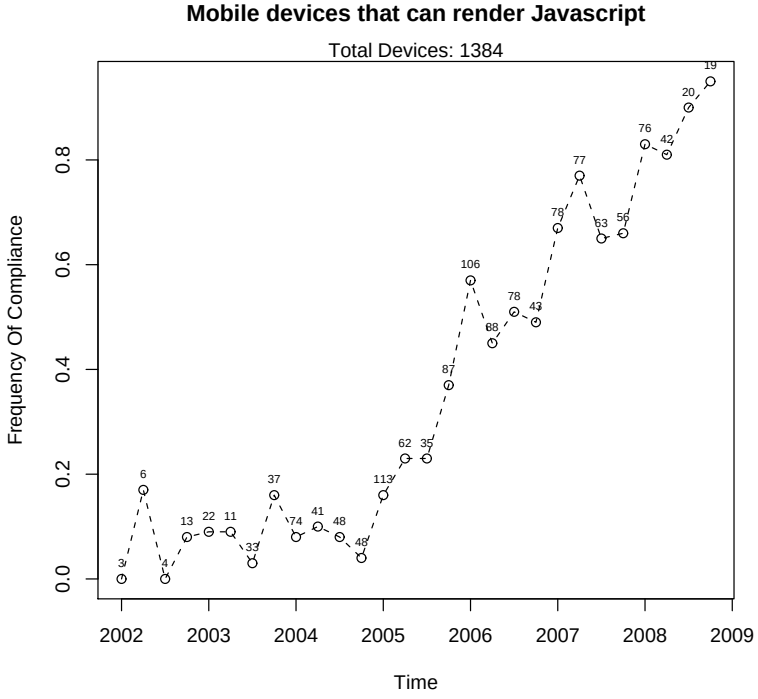

Figure 5: JavaScript Support

4 Enhanced Delivery Context

Five of the eight DDC attribute values assessed have been adjusted to form the new EDC specification to better represent the population of mobile Internet devices. Table 4 compares the original DDC specification with the adjusted Enhanced Delivery Context (EDC) specification and the capabilities of devices in 2008.

A mobile application can now be developed for a larger screen, a more stable mark-up language, additional colour range, Javascript support and the use of an additional image type, PNG, without the

Table 4: Comparing the DDC, EDC and 2008 Devices

Attribute	DDC	EDC	2008
Usable Screen Width	120 pixels, minimum	168 pixels	232 pixels
Markup Language	XHTML Basic 1.1	XHTML-MP 1.2	HTML 4.01
Character Encoding	UTF-8	UTF-8	Same
Image Format Support	JPEG and GIF89a	JPEG, GIF89a and PNG	Same
Max Total Page Weight	20 kilobytes	10kb optimum	20kb
Colors Weight	256 colors, minimum	65,540 colors	262,100
Style Sheet Support	CSS1 + CSS2 media types	Accepted with caution	Same
HTTP	HTTP/1.0 or HTTP/1.1	Not assessed	Same
Script	No client-side scripting	Support for Javascript	Same

concern of effecting the usability on entry-level devices while providing a more positive experience on high-end devices. An optimum page weight has been introduced but the maximum page weight was not adjusted. Both the DDC and EDC agree that UTF-8 is the most appropriate character encoding standard.

5 Conclusion

Connecting to the mobile Internet is becoming a popular activity and its adoption will continue to grow as more consumers have a positive experience. The main goals of this paper was to assess the effectiveness of the DDC and if possible, enhance the guidelines to provide a better mobile Internet experience for the population of Web-enabled mobile devices. Eight of the nine DDC attributes were assessed using statistics, resulting in 5 attributes being adjusted to form the Enhanced Delivery Context.

The DDC guidelines contain important attributes to help achieve a positive mobile Internet experience; when assessing these core attributes for devices in 2008 it was found that competing mobile Internet browsers are converging and moving a step closer to competing with the traditional desktop Internet experience. Devices in 2008 have moved towards a dominant QVGA wide screen, and support for HTML 4.01 and Javascript have become standard. The bandwidth for the mobile Internet has seen an increase of 2000 bytes per year while remaining within an acceptable download time; on average devices in 2008 were capable of rendering 20kb Web pages relatively easily. If the trend of improving the core capabilities continues, the future of a positive Internet experience on any device, whether mobile or desktop will be expected.

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