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WHITE PAPER

How To Make A Web Site Mobile

Extending Web Services With A Successful Mobile Service

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Preface

This document is a practical guide on how to extend a web service with a successful mobile service using color WML and WAP technologies.

A mobile web service, or application, differs in several ways from a regular web service. It is always at hand when and where the user wants it, but offers a reduced functionality compared to a regular Internet experience. Perhaps the most obvious differences for the application designer are the smaller display sizes, the limited bandwidth and processing power. Some attractive additional functions are added; secure unique user identification (based on the user's phone number), positioning (based on which cell the phone is communicating with), and direct service billing to the user's phone bill.

This document contains experience-based information on how to manage the technical limitations for a mobile web service, and how to best make use of the unique opportunities.

More information about formatting content for specific devices can be obtained from the WAP device manufacturers.

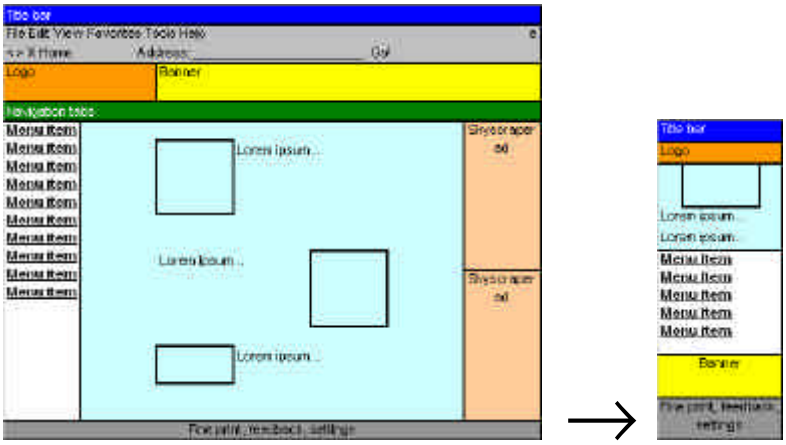
Contents

1 User Interface

1.1 Layout Mapping
Web Service -> Mobile Service

A typical computer has a display resolution setting of 1024x768 pixels. The display of a typical mobile phone measures approximately 100x80 pixels, or approximately 1% of that of a computer. In addition, a mobile phone only supports one browser window. Due to the above and other technical limitations, the layout of a web site needs to be different, and the designer must keep in mind that there is no room for white space, such as blank lines.

Below is an example of a typical web site and an illustration of how it can be mapped to a corresponding mobile service.



1.1.1 Title Bar

The function of the title bar maps almost one to one, but is much more visible than on a regular web browser. Most importantly, there is nothing between the title bar and the content, where in a normal web browser the browser's own buttons and menus would be. Since the title bar is always highly visible, does not scroll away, and takes up some 15% of a typical phone display, it is too valuable for simply displaying the name or brand of the service. In addition to or instead of displaying the name of the service, a description of the current page's function should be included.

1.1.2 Logo

As for any web service, it is important to display the brand on each page, where it is highly visible, yet does not intrude too much. Therefore, the logo should not be taller than 20% of the display height, which means approximately 15 pixels.

1.1.3 Banners

Regular web banners are too large to display on a mobile phone, and frequently contain animations etc. that are not supported. Put the banners far down on the page where it does not get in the way. You might want to consider visibility for sponsors etc.

1.1.4 Content Category Tabs

The mobile displays are too narrow for this graphical form of navigation, and in addition, many phones do not support having multiple links next to each other on the same line.

If you were planning to use tabs to indicate where in the site the user is, you could try to fit that information into the title bar instead, since it is much more visible on a mobile device than in a normal web browser.

1.1.5 Main Content Categories Menu

A main menu will take up the entire display width, and should therefore normally be placed below the sites main content and/or content teasers. Keep the number of main categories short, no more than 7 categories, or the user will lose overview. The order of menu items is important, since scrolling should be kept at a minimum, especially for time-critical services. Services which the end-user likely wants to access fast (such as news, timetables, etc.), should be placed on top.

1.1.6 Content And Content Teasers

Pages load slowly on mobile devices, since the round-trip time is much higher in proportion to the download time compared to a regular web service. It is therefore highly recommended to attempt to dynamically anticipate what content the user is looking for and display it before it is being asked for, for example in form of a content teaser, so that the user won't feel that he is wasting time only on navigating.

Keep the content teaser section of a page shorter than 20% of the display height, especially when the main navigation menu is below the content teasers.

Plain-text articles should be kept under 500 characters for technical, navigation and user experience reasons.

1.1.7 Skyscraper Ads

The displays are too narrow to display content side by side. Skyscraper ads are not suitable for mobile devices.

1.1.8 Feedback And Settings

Links to the fine print such as copyright notices etc., feedback entry forms and settings panels are best kept small and at the bottom of the page, just like for a regular web service.

1.2 Navigation

Display size (and the end-user's short-term memory) effectively limits the number of links that make sense to have on one single page to approximately 7-10.

Many devices have softkeys below the display. Frequently used navigation links can (and should) be mapped to the soft keys using the "do" tag in WML.

By using the "timer" function in WML, pages can be loaded automatically after a preset delay, which is useful for real-time news tickers, chat applications etc., and for briefly displaying interstitial advertisements.

Image maps are not supported, but normal image links are. As with all links on mobile phones, they must first be selected, and then activated. A selected image link, or button, is normally indicated by a black frame around the image.

For images that have dark edges it can be difficult to see the highlighting frame. Such images should therefore be drawn with a one-pixel outline in a contrasting color, so that the selection frame can be seen.

1.3 User Input

1.3.1 Reduce Input To A Minimum

Since user input in any form is comparably slow and cumbersome, all user interaction, be it text entry, a selection from a list, or even basic navigation such as scrolling and clicking, should be reduced to a minimum. Count the clicks!

1.3.2 Supply Good Default Values

When possible, supply server-sided – provided default values for example for time, location, most frequently used input etc.

For free text input fields, always specify "emptyok=true" to allow the user to leave a page without entering something into all fields.

1.3.3 Avoid Multiple Entry Fields On One Page

When more than one input or selection is required, experience shows that a sequence of pages is preferred before multiple fields on one page, followed by a "Submit"-button. Having multiple input fields on one page would theoretically improve the user's overview, but user tests reveal that end users simply don't manage to get an overview on such small displays anyway. They simply enter

information when prompted and expect to see the target content with the smallest possible number of inputs. By gradually refining the result, rather than taking an all-or-nothing approach, the user is more likely to click through until the desired content is reached.

Example: You wish to provide the end user with a local map. Required input is city, street name and street number.

Solution: Rather than having three fields and one submit button, a three-page sequence is recommended. The first page could list the five largest cities as clickable links, followed by a free text input field for other cities. The second page would show an intermediate result; an overview map of the city, followed by links for the five main streets, and a free text input field. The third page would show the next intermediate result; a map of the street, and, if relevant, a free text input or selection list for the street number.

Using the above proposed method, the users who want the most frequently used content will not have to manually enter any information. All users will receive "something" after each input; in the example above a gradually zoomed-in map, which helps avoid frustration over the potentially cumbersome input and slow communication.

1.4 Feedback

Attempt to provide the user relevant content as feedback after each input or selection, rather than asking for multiple inputs and selections before displaying any content.

The most efficient way to give the user feedback on which page he currently is or which part of the site, is to use the title bar. Due to the limited graphics and scripting capabilities, more elegant solutions such as tabbed navigation menus etc. are not possible to implement.

When the time needed for the server to compile a response to a request exceeds 10 seconds, the user should be provided with some form of feedback meanwhile, such as "Loading…".

2 Content Selection

2.1 Content Relevant In A Mobile Context

As already mentioned, the size of the display of a mobile phone is around 1% of a computer display. Hence, it is normally necessary at least for more entertainment/infotainment-oriented services (but not necessarily for database-lookup services) to select a subset of a web service's total content for the mobile edition. Experience shows that the content evaluation criteria "Here", "Now", "Fun" and "Cool" can be successfully applied to assist in the content selection process. Using personalized content, all criteria can get way more acceptance than generally distributed content only.

2.1.1 Here

Successful mobile data services meet a human need or desire that occurs in a mobile context at the exact location where the user is - where no other viable alternatives exist.

Access from user's current location to

- Information
- Communication
- Transactions

No other attractive alternatives exist because:

- There is nobody around to ask
- There is no information on site
- The user is unable to leave his current location to search for information
- There is a lack of other means of communication or transaction
- The service requires current location as input - automatic with WAP device

Examples:

- Yellow pages, White pages
- News
- Local maps (to nearest ATM, restaurant, bus stop etc.)
- Movie and entertainment information and reservation
- Bus and train schedules
- Messaging

2.1.2 Now

Successful mobile data services meet a human need or desire for near real-time services or services related to the precise current time of day.

Immediate access to near real-time…

- Information
- Communication
- Transactions

No other attractive alternatives exist because:

- Other services are too far away to be reached quickly
- Other services are not on-line and do not get updated fast enough
- Service requires current time as input - automatic with WAP device

Examples:

- Bus and train schedules
- News
- Ticket reservations

2.1.3 Fun

Successful mobile data services entertain the user when he has a few minutes to spare while waiting. For this selection criterion, all the regular stickiness principles for web services apply.

Fun services allow users to:

- Enjoy Internet anonymity
- Stay up-to-date on topics of general or special interest
- Mentally escape from current context

No other attractive alternatives exist because:

- There is no entertainment available on site
- There is nobody around to speak to
- The user is unable to leave current location to search for other entertainment

Examples:

- News
- Interactive games
- Quizzes
- Tests
- Entertaining media content; celebrities, sports, erotics, comics
- Anonymous communication: chats, blind dating

2.1.4 Cool

The mobile phone has become an image-related accessory, and experience shows that users are prepared to pay a premium for services that are perceived as "cool" within the user's peer group.

Successful mobile data services boost user's ego by signalling:

- Wealth or success in general
- Membership of prestigious peer or social group
- Access to "the latest"

Cool services are:

- Egocentric
- Easy to communicate to friends and surroundings
- Visually or audibly attractive and identifiable
- New
- Expensive, extravagant or exclusive

Examples:

- Upload and sending of pictures to others
- Downloadable ringtones, logos, pictures, screensavers
- Multimedia clips

2.2 Brand

Mobile services currently enjoy a smaller user base than regular web services. It is therefore wise to leverage from existing on-line and off-line brands to bring new users into using mobile services. Expose your brand with logos, colors, patterns, slogans, writing style etc., just like for a regular web service.

Tips for exposing your brand in your mobile service:

- "Anchor" pages by inserting a logo on top. Make it small.
- Use your identity colors for separator bars, image frames, etc.
- Formatting text (fonts, colors, etc.) is not supported: Use graphic text where special fonts and colors are required
- Insert slogans as "alt-texts" for images, logos, etc.: The "alt-texts" are displayed during image loading (typically 1-4 seconds/image)
- Allow the user to download/purchase branded merchandise: logos, screensavers, themes…

2.3 Core

For your mobile service to remain credible, you should provide access to information or services from your core business portfolio.

Examples of strategically interesting opportunities:

- Extend the reach of your core business
- Offer product info, reservation or even sales
- Schedule/map of activities (timetable, event listing, ATM maps...)
- Boost your brand
- Offer cool services such as branded games, logos and ringtones
- Invite customer contacts
- Provide phone numbers, email addresses etc. to main corporate functions

2.4 Mass Market

Just like web services, mobile services are expensive to develop and maintain. In addition, there are fewer users, and sessions are shorter (but more frequent). Ensure you reach a wide audience!

Examples of measures to reach a wide user base:

- Prioritise device / network compatibility!
- Provide services of general interest
- Avoid niche services
- Prioritise areas with high population density

2.5 Freshness

It's both difficult and slow to type a URL or even browse to find a good service within a portal, so users do return once they find something that works. In addition, users often turn to mobile services because they search for "now"-information. It is therefore even more important than for a regular web service that content is fresh.

Examples of measures to ensure content is perceived as fresh:

- Minimum content update rate: weekly
- Ideal content update rate: every 5 minutes
- If no new content is available, re-format the old and present it again...
- Use dynamic, even random, deep links to interesting content or services from the main page and other frequently visited pages

3 Content Preparation

Again due to limitations in display size, communication bandwidth and processing power in the mobile devices, the raw content itself needs to be accordingly formatted. Although the basic content formats are theoretically the same as for regular web services (ASCII text, gif images, MPEG-4 video), only by fine-tuning these formats can a good end-user experience be guaranteed.

3.1 Texts

Generally, keeping texts short and concise will ensure a good result. For more detailed guidelines, refer to the experience-based information below.

3.1.1 General

- Always format in ISO-8859-1 for best compatibility.

3.1.2 Menus / Selection Lists

- Keep it short
- Max 15 characters / line, aim for 10
- Max 7 lines
- Typically the 3 most frequently used/relevant choices on top, then in logical/structured order

3.1.3 Headers

- Keep it short
- Avoid "gremlin" characters: ' " @ $ ...
- Max 15 characters, aim for 10
- Page title is normally centred and bold – no manual formatting available
- In-page headers can (should) be centred and/or bold and/or italicised

3.1.4 Body Text

- Keep it short
- Estimate 15-20 characters per line
- Maximum text length/article: 1000 characters
- Maximum text length/page: 500 characters
- When writing "gremlin" characters: ' " @ $, use the &#nnn; formatting where nnn is the ASCII code for the character in decimal format. See appendix.
- Avoid in-line hyperlinks in the body text
- Keep it short

3.1.5 Entry Fields

- Keep it short
- It is possible to have a default text entry

- It is possible to have a default character category (numerical, alphabetical, internet, etc.)
- Don't expect users to type in anything longer than their own names...
- Always specify emtyok=”true” (Workaround for bug in certain phones)

3.2 Pictures

Generally, keeping images small, high-contrast and sharp will ensure a good result. Due to the small number of colors (typically 256 or 4096), gradients will normally not display nicely, and should thus either be avoided or use the target device's palette and dithering. A picture size of 96x37 pixels is suitable for most purposes. The file size must be smaller than 2.7 kB due to restrictions in the WAP gateway of several network operators. For more detailed guidelines, refer to the experience-based information below.

3.2.1 General

It is possible to prepare macros that perform a decent transformation of good quality original photographs, but best results are achieved by hand. When using computer-generated graphics for graphs, maps and illustrations, keep in mind that the number of colors or greyscales is limited. Avoid using gradients, which will not display well. Avoid using similar colors for graphs, as they may not be possible to distinguish from each other on the mobile phones.

3.2.2 Picture Sizes

To ensure that pictures fit on the screen, yet use the most of the devices' capabilities, regardless of manufacturer, refer to the table below for suitable picture sizes.

Phone type (display type)	**Clickable image**	**Non-clickable image**	**Screensaver image**
Smartphone / PDA (SonyEricsson P800, Series 60 etc.)	Up to 150x120 pixels	Up to 160x120 pixels	240 x 320 pixels
Medium-sized color (SonyEricsson T68i, T300, Series 40 etc.)	97 x 7 97 x 17 97 x 27 **97 x 37 ←** 97 x 47	101 x 7 101 x 17 101 x 27 **101 x 37 ←** 101 x 47	101 x 80 pixels
Medium-sized greyscale (SonyEricsson T65, T200 etc.)	97 x 7 97 x 17 97 x 27 **97 x 37 ←**	101 x 7 101 x 17 101 x 27 **101 x 37 ←**	73 x 39
Medium-sized black&white (SonyEricsson T600, Series 30 etc.)	94x40	96x40	Not available
Small-sized black&white (Series 20)	82x30	84x30	72x28

From the above table, it is clear that you can get away with using pictures that are all the same size of 96 x 37 for color, greyscales and black & white, and they will work with almost all phones. To support the low-end "Series 20", models, an extra version at 84 x 30 in black & white could also be prepared. Black and white pictures should be in WBMP format. Greyscale and color pictures should use gif format.

To display a photograph or graphics nicely on a Smartphone/PDA; use the 160x120 picture size. Smartphones/PDA's support the JPEG format, which offers better compression of photographs. Smartphones/PDA's use a different method to load images compared to normal WAP phones, and hence the 2.7kB picture size limit usually does not apply (operator dependent – test on your target networks).

Caution: Certain "Series 60" Smartphones will rescale images to 95% of the original size when used as clickable buttons. This causes severe distortion of finer details in the images, and will for example render text on maps and graphs illegible. Workaround: specify width="105%", height="105%" in the image tag when detecting a "Series 60" browser. This will make the devices display the images in 100% scale.

3.2.3 Recommended Image Size Matrix

When generating graphics (logotypes, buttons, graphs, maps, decorative elements etc.), it is important that fine details (graphic text, lines, patterns, etc.) are well readable, and hence it makes sense to generate graphics for each display type more or less individually. The effort can be reduced by reducing the number of versions as illustrated in the table below.

Number of graphics versions afforded	Recommended graphics versions
1	84x30, black & white
2	84x30 b&w, 96x37 color
3	84x30 b&w, 96x37 b&w, color
4	84x30 b&w, 96x37 b&w, color, 160x120 color

When preparing photographs, fine details are less important. More important is that the photographs can be prepared fully automatically by scaling down a large original photograph with predicatable results. To ensure that no cropping errors occur, all display types must use photographs with the same proportions. This means that photographs will not fill the entire screen on devices with oddly proportioned displays. The effort to prepare photographs can be reduced by reducing the number of versions as illustrated in the table below.

Number of photograph versions afforded	Recommended photograph versions
1	77x30, black & white
2	77x30 b&w, 96x37 color
3	77x30 b&w, 96x37 b&w, color
4	77x30 b&w, 96x37 b&w, color, 160x62 color

3.3 Animations

Although currently not generally supported within WAP services, many phones are capable of downloading GIF animations to be used as screensavers.

3.4 Video

Recent high-end phones support video downloads and streaming. Video quality is limited by display size, communication bandwidth, processing power in mobile devices, and file sizes (not applicable for streaming).

Audio quality is also subject to the above limitations, but also to the limitation of the typically very small speaker, with relatively high distortion on low frequency sounds and loud sounds.

Best video results are achieved where the video content is "predictable", so that it can be well compressed; avoid short cuts, fast motion, blinking items, etc..

Best audio results are achieved with low background sound levels. Avoid background music to spoken text, for example. When suitable, remove low frequency sounds, and equalize the overall sound amplitude over the entire clip.

Please also consider available bandwidth at the operator network and adapt file size accordingly, to allow rich user experience.

Compression type	**Suitable settings**
MPEG-4 for download (SonyEricsson P800, iPaq, etc.)	Size: Up to 176x144 pixels Video bit rate: Up to 45kbit/s (Variable bit rate recommended) Video frame rate: 5-10 fps Audio bit rate (AAC): At least 16kbit/s for music, 8kbit/s for voice Recommended file size: 300 kB
MPEG-4 for GPRS streaming (SonyEricsson P800, iPaq, etc.)	Size: Up to 176x144 pixels Video bit rate: Up to 28kbit/s (Variable bit rate not allowed) Video frame rate: 3-7 fps Audio bit rate: 8kbit/s for voice
Realvideo for download (Series 60, Series 80, iPaq, etc.)	Size: Up to 176x144 pixels Video bit rate: Up to 45kbit/s, RealVideo 8 only (RealVideo 9 not supported) Video frame rate: 10-15 fps Audio bit rate: At least 16kbit/s for music, 8kbit/s for voice, RealAudio G2 Recommended file size: 300 kB
Realvideo for GPRS streaming (Series 60, Series 80, iPaq, etc.)	Size: Up to 176x144 pixels Video bit rate: Up to 28kbit/s, RealVideo 8 only (RealVideo 9 not supported) Video frame rate: 5-10 fps Audio bit rate: 8kbit/s for voice, RealAudio G2

4 References

Official WAP documentation:

http://www.wapforum.org/what/technical.htm

http://www.openmobilealliance.org/

Ericsson WAP documentation, see “Open Zone” at:

http://www.ericsson.com/mobilityworld/

Sony Ericsson product and service information:

http://www.sonyericsson.com/

Motorola WAP documentation

http://developers.motorola.com/developers/wireless/documentation/#wap

Nokia WAP documentation

http://www.forum.nokia.com/main/1,6668,21,00.html#1978

Colored WAP emulator

http://www.wapsilon.com/PDA/

UnWired WBMP Plug-In for Adobe Photoshop

http://www.rcp.co.uk/

Image Manipulation for Web Sites running PHP

http://www.php.net/manual/en/ref.image.php

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