

## MOBILE WEB FOR DEVELOPMENT

S. BOYERA

*W3C, 2004 ROUTE DES LUCIOLES 06902 Sophia-Antipolis France  
boyer@w3.org*

**Abstract.** The availability of mobile phones and the wide coverage of GSM networks in Developing Countries are a huge opportunity to provide services, based on Information and Communication Technologies (ICT), that would trigger development and improve people lives in rural areas. Numerous success stories have shown the potential of that direction. However, there is still a gap between the development of few services that demonstrate the proof of concept, and the availability of thousands of services all over the Developing World. This paper explores this gap, and the potential solution through the enabling of the Mobile Web.

### 1. Introduction

The emergence of new Information and communication technologies (ICT), the Web and Internet in particular, in late 80s, has changed the World, offering a new paradigm in communication, exchange and commerce. However, while the new Information Society is still developing today, a new gap has also appeared with those without regular, effective access and ability to use these digital technologies. This is known as the Digital Divide, which is particularly affecting Developing Countries.

On another hand, ICTs are also a great opportunity for the Developing World. Providing minimal services (Health, Education, Business, Government...) to rural communities and under-privileged populations is of major importance to improve people lives, and to sustain development. Using ICTs would be the easiest and possibly only way to develop and deploy those services. It is therefore critical to work towards bridging this Digital Divide.

In this context, the recent explosion of mobile telephony in the Developing World is a great opportunity. At the end of last year, according to the GSMA and ITU, the total number of people having access to a mobile phone was around 2.7 billions, and 80% of the World population was currently covered by a GSM network (source [GSMA06], [ITU07]). These numbers illustrate the potential of the mobile platform to be the right solution

to deploy services now, compared to other options, which are still in development phase (e.g. low-cost laptops).

This paper will review, in a first part, the strengths and the weaknesses of the approach used today to deploy eServices on mobile phones in Developing Countries, and will emphasize, in the second part, on the Mobile Web option, its potential, and the challenges that have to be tackled.

## **2. First generation of ICT-based services on mobile phones: SMS**

For about two years, the use of mobile phones as a platform to deliver services to underprivileged populations and rural communities has been successfully experimented all over the Developing World. Many stories have demonstrated the ability for ICT-based applications to improve people lives and increase their incomes with simple services (read e.g. [RJ2007]).

The type and domain of deployed services are very broad, and spanning the whole society. There are lots of examples in the banking area (e.g. [VODEE07]), business (e.g. [SAF411]), health and government / public services. Usually, each service has been the result of a specific project directed by a local or an international NGO, or through a governmental experiment.

Most of these projects are using SMS technology to provide their services. People, knowing the phone number associated with the service, send an SMS to this number with appropriate keywords, and get back the answer by SMS. Sometimes, when there is no interaction needed (e.g. sending weather forecast), it is just a broadcast of SMS messages to people subscribed to the service.

The reasons of the success this technology are numerous:

- Ease of use for users: using SMS capability of a mobile phone is very easy and natural for users. People are used to use text-messaging for people-to-people communications, and so using the same mechanism to reach a service is easy.
- Availability on all phones
- Low network requirements: GSM networks are sufficient to run services based on this technology.
- Low and predictable cost: one always knows how much the sending of SMS costs, and it is usually inexpensive.
- Free push mechanism: The reception of SMS is free. So receiving data, even if it is split over multiple messages, is free to users.

However, there are also some weaknesses associated with this way of providing eServices:

- Discoverability of services: People who are not aware of existing services have no way to find them, to find the right phone number to call and the right keywords to enter, and so on.
- Interoperability between operators: While sending person-to-person SMS is not a problem between operators, sending SMS-data across operators is a clear limitation of this technology (Read [TAL06]). For example, banking systems based on SMS are working between users of the same operator only.
- Lack of standardization for application development: there are no standardized platforms or programming languages and libraries to develop SMS applications. There are a few free/open-source environments and a few commercial ones, but the knowledge required to develop those applications is very specific to each platform.
- Infrastructure requirements for hosting and deployment of SMS services: Each SMS-service needs its own specific infrastructure. Due to the above-mentioned interoperability problem, and also due to the lack of widely available and affordable hosting services, the setup and deployment of a new service requires a quite heavy infrastructure (a computer to host the application, a GSM modem, a GSM subscription...) not particularly appropriate with the conditions available locally (PC are expensive, electricity problem, ...).
- Limited User Interaction: SMS applications are a perfect fit for simple query-based services. People are entering one or two keywords and get the answer. But given there is no direct interaction, no online-help of any kind, people have to remember the keywords and the format to enter them, and so the list of these keywords has to be limited. Complex multi-cycles interactions are almost impossible to implement.

While all the existing success stories demonstrate the potential of mobile phones to be the most promising platform to deliver services to rural and under-privileged populations of Developing Countries, we doubt that the current SMS technology would allow a large scale development and deployment of applications. Moving from “islands” of successes as it is today, to a World where thousands of services are available, usable and useful for under-privileged populations is a huge challenge which could hardly be tackled by SMS applications. We believe that only the switch to Web technologies will allow this transition, and we will present, in the next section, the roots and rationale of this view.

### **3. The next generation of mobile applications: the Mobile Web**

The Web is clearly an incredible space of communications and exchange as well as an endless source of information. For that reason, W3C, the standardization organisation for all Web core technologies ([W3C]), has a

mission to work toward Universal Web Access (the Web for Everyone, at Anytime, from Everything). Enabling Web access from mobile phones is part of this mission, and is the specific work item of the W3C Mobile Web Initiative ([MWT]).

However, providing access to the Web may not be a goal by itself for rural communities. The aim is to provide services to populations using the power of the Web as the support for facilitating the development and deployment. Among its numerous features, the Web has indeed some specific strengths in this context:

- Discoverabilities of services: Search engines and portals are the natural existing ways to discover existing and new services.
- Operator Independence: As far as the operator is providing a data service plan with full Web access, there is no interoperability problem.
- Easy development of services: Using e.g. standardized interoperable markup languages like HTML, Forms, CSS to create content is very easy due to free availability and a huge amount of resources. This is probably one of the strongest arguments that explain the growth speed of the Web. Allowing anybody with minimal knowledge to create Web resources ensure the availability of a huge number of information. Where SMS applications require heavy and expensive platforms, specific knowledge and skills, developing Web content is far more accessible, and the effort required to empower people is far smaller.
- Easy hosting and deployment: Once the Web content or application is developed, there are thousands of very inexpensive / free hosting services over the Web. Here again, where SMS platforms requires investment at a global level, it is very easy for anybody to host his applications and content.
- Good user interface: It is very easy to create simple-to-use but complex interaction between the user and the application thanks to e.g. HTML forms. As previously presented, limited capabilities of SMS do not allow multi-cycle interactions.

These specific strengths let us think that Web Technologies are the most appropriate way for future large scale, low-cost development, deployment and availabilities of ICT-based services on mobile phones.

We will explore in the next section of the paper what are the challenges associated with the enabling of Mobile Web for rural communities, and how to tackle them.

#### **4. Challenges of the Mobile Web for Development**

The strengths of the Web are obvious, and its incredible success in the last ten or twelve years illustrate them. The recent take-off of Mobile Web access in the Developed World is also an evidence of the importance of Web access

on mobile phones. As underlined in the section 2 of this paper, the potential of the mobile platform in development is also clear. The question is to know if these two aspects fit together, and if the Mobile Web is a promising opportunity for Developing Countries.

Lots of people are indeed doubtful on the potential of the Mobile Web to be a solution to improve people lives, and leverage development of rural communities (read [NE07], [KB07]).

We will review in the following the usual problems people are underlining.

#### 4.1 COST OF DATA ACCESS

Lots of people think that data service and web-capable handsets are very expensive, and rural communities would never be able to afford them for Web browsing. This is true, if we consider only the cost of the access. The critical aspect is the return on investment. It is very unlikely that a crop producer in rural India would spend the required money to surf the Web for entertainment, because he would consider the money wasted, and not invested in his basic needs. At the opposite, if accessing a service to declare his new children costs him a day of salary, but the travel to the nearest office would require more than a day, then he would surely go for the online version. This specific aspect has been very well studied in the literature (see [RJ2007] and [IQ2005]). Moreover, all the models which worked for the voice service (community shared access, phone ladies model [BBC05]...) can work for data access too. So the cost of data access should not be a problem if valuable content and services are available.

The critical problem is to make useful content for rural communities, content that would help people in their daily lives, and allow them to get more income and afford the service.

#### 4.2 USABLE CONTENT

Before being useful, a service or content has to be usable. The usability aspect, heavily explored in the application design literature (see e.g. [GBL91]), is particularly critical when developing services towards users without technological background. Indeed, the users targeted by our work are clearly people of rural communities in Developing Countries. Those people usually present two specificities: no previous computer experience, and no technical background (in computer science, and computer-based application in general).

In the specific context of Web applications, the user interacts with both the browser, and the Web content loaded. Therefore mobile browsers and

Web applications have to be accessible and natural for those without previous desktop experience, and without technological background.

Concerning browsers, there are different issues to consider. Usually, the configuration is the first problem. While placing a phone call or sending/reading an SMS is almost obvious on all handsets for almost anybody in the World, configuring a terminal to access the Web is very far from being natural and easy. Only expert users can do that configuration themselves directly. So given that this already a problem for most of users in Europe or US, it is hard to believe that this would not be also a problem of a higher degree of magnitude in Developing Countries.

Then, the interaction with the browser is also a problem. All the usual menus and interface have been defined by reproducing what exists on usual desktop applications. The notion of URI is also less than natural. It is not possible to believe that people would enter a meaningless string of characters by hand, through the keypad.

To end, the way of rendering Web content has also to be redefined. As said earlier, the current trend in the Developed World is to focus on providing the same experience as on desktop. For instance, towards reaching this goal, browser makers are developing zooming interface ([WPZUI]). These kinds of interfaces are very successful to allow anyone to access on a small screen content which is defined for big desktop screen. But are such zooming interfaces natural for those who never been on the Web before? This is questionable. A new way of interactions with the browser should probably be defined, and there are ongoing researches in that direction (read [JA07]).

Concerning Web content itself, the problem is identical. There are some challenges that are related to the specificities of the mobile platform. These challenges are currently addressed by the W3C Mobile Web Initiative ([MWI]) and are not specific to context of this paper. There are also specific challenges inherent to the targeted users. It is essential to understand what is natural, in terms of interaction between the user and the content for those who never used ICT-based applications (read [MMT06]). Here again there are few ongoing researches in that area, but not related to the specificity of Web content. It is therefore critical to revisit these researches and their applicability.

#### 4.3 USEFUL APPLICATION

While offering usable content and browsers is a mandatory step to make the Mobile Web relevant, the major goal is still to provide useful applications which would really improve people lives. The question is to understand which services or content would be considered useful by targeted populations.

It is very unlikely that we could define a list of applications that could be considered useful by all, all over the World, from Kenya to India, or from Bolivia to Sudan. Of course, there might be some particular examples. M-banking is surely one, because it is a common process worldwide (exchanging money). For other services, there are probably big domains to tackle (education, health, public/government, business...), but trying to define a list of services to provide to communities would surely not work (see e.g. [GM06]).

At the opposite, if we analyze the success stories we mentioned before, we can see that they are sharing the characteristic of enhancing an existing behavior or a way of working or living. Attempts to radically change the habits are usually not working. All the successful projects are usually the result of in-depth analysis of a community, with the involvement of local NGOs working with the community for a long time.

That said, there is probably a place for general guidance. Each project has developed its own expertise, but there are surely commonalities, and a way to define some guides that would help the identification of the areas where a service will be useful. It should be possible to gather expertise which has been developed through the realization of existing projects, plus theoretical knowledge from e.g. the ethnology field, to develop guidelines on identifying areas where ICT-based services could help and leverage development of specific communities.

Web technologies on mobile phones are a great opportunity to deploy a big numbers of application at large scale and low-cost, enabling anybody to start and run new services. In order to make this potential a reality in a near future, specific work has to be engaged, particularly in the area of Human-Computer Interaction (HCI) applied to the targeted users, and in the area ICT for development (where and how ICT can leverage development).

## 5. Conclusion

As underlined in the previous section, to make the Mobile Web relevant, usable and useful for rural communities of the Developing World, it is essential to engage work in different directions:

- Making usable mobile Web browsers.
- Defining guidelines on how to make usable Web content and applications for people without previous computer experience, and without technological background.
- Defining guidelines on how to identify needs and requirements of communities in terms of ICT-based services.

Obviously, those broad directions have to be refined to establish detailed and achievable goals and deliverables in a short timeframe.

In order to work towards the objectives described in this paper, W3C will propose the creation of a specific Interest Group ([W3CIG]) to build the right community and work on the definition of this roadmap.

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