

CONSIDERING THE NEW USER REQUIREMENTS FOR APT MOBILE INTERNET SERVICES DELIVERY

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ABSTRACT

The explosive growth in the size and use of the World Wide Web as a communication medium has been enthusiastically adopted by the mass market. New developments in ICT along with the growth of mobile and wireless communication allowed service providers to meet these challenges developing new ways of interactions through a variety of channels enabling users to become accustomed to new means of service consumption in an anytime, anywhere and anyhow manner. However, all these radical changes in the Internet services environment have driven service designers and providers to reconsider service delivery processes and interfaces since users' requirements and demands have been significantly proliferated. This paper will investigate the emergence of the mobile and wireless technology and the new multi-channel constraints and opportunities created. A further examination of the new mobile Internet user needs and requirements will take place in order to ensure proper services Internet design for a sustainable, direct and effective delivery.

KEYWORDS

New User Requirements, Mobility, Wireless, Internet, eServices

1. INTRODUCTION

The Information Communication Technologies (ICT) development in Europe and the rest of the world suggests a potential for more efficient and user-centered ways to deliver eServices. Thus, awareness by users of these services, their willingness to use them, ease of use and delivery of benefits with the services are important factors in the further development of the Information Society. "The mobile internet will allow users to access Information Society services without having to be tethered to a PC or digital TV. Apart from straight internet access, it will also provide a range of new services to help organizations run more efficiently and to entertain and educate people" (IST, 2004).

Relevant channel and distribution strategies are critical for the future improvement of accessible, citizen-focused and responsive eServices. Following the growing user demands and requirements as well as the rapid development of the technological advancements and infrastructure capabilities the development of eServices should not only focus on making the service available on the desktop Internet, but also examine the different mobile Internet delivery platforms. A multi-channel (WAP, MMS, SMS, Web, Satellite etc.) and a multi-device (PC, mobile phones, PDA, tablet PC, Satellite handset etc.) access mix will improve the access of the services offered, since will be available anytime, anywhere and anyhow through a single point of access entry. Indisputably, this is the vision of an interoperable, transparent and secure Internet environment whereby multi-channel service delivery integration is considered fundamental.

New communication platforms beyond PC-based Internet access are now becoming available allowing the involved sectors (public and private) to meet these challenges by re-engineering their front and back office and business processes, implementing new ways of interaction through a variety of channels (i.e.

interactive digital television and third generation (3G) mobile systems driven by common standards open up possibilities for multiple platforms access to services), and restructuring services that accommodate their users' needs. "Two new developments will have a major impact on the further development of the Internet: multi-platform access / convergence and broadband" (Communication from the Commission, 2002). Broadband stimulates the use of the Internet and enables the usage of rich applications and services. Its benefits emphasize in the areas of e-business, e-learning, e-health, and e-government, improving the functionality and performance of those services, and further extending the use of the Internet. "What we are seeing is the emergence of services that combine the benefits of broadband with mobility. While these services will have a major social impact, they will also produce significant economic effects by potentially transforming the way business is done" (Reding, 2005).

Mobile Internet aims to deliver better quality of services that are accessible for all. It aims to increase the productivity in the public and private sector, so that services can be provided by various channels, at a lower cost and time and in a personalized style. Mobile telephony could be considered one of the most challenging channels. It becomes more relevant considering the much faster growth of mobile penetration rate compared to desktop based Internet access, a factor which can play a considerable role in bridging the digital divide. From a user (citizen) perspective, mobile Internet stands for a new kind of front-end access to public and private services that have been made available specifically for mobile devices or adapted from existing applications (Europe's Information Society, 2004).

The aim of this paper is to investigate the concepts and arguments that will have to work in a coherent and cohesive way towards the sustainable provision of mobile Internet services without losing their integrity or quality of their content. These are mainly emphasized on the emergence of the broadband and mobile advancements, which are considered vital elements to the successful implementation of the "anytime, anywhere and anyhow" notion, and consequently to the various opportunities and constraints of the multi-channels for services delivery created. The aforementioned two could be characterized as the major enablers of the new user requirements that will have to be mainly incorporated in the design and development process for the apt delivery of mobile Internet services.

The paper is structured in 6 sections. Section 2 describes the need for mobile Internet services delivery with the emergence of the mobility and wireless communication sector. Section 3 gives an overview of the multi-channel services delivery aspects. Section 4 presents the new user service requirements to be considered. In Section 5 challenges and limitations considerations for a more proper adaptive mobile Internet design, leading to the provision of sustainable Internet services, are presented and section 6 concludes this paper.

2. THE DEVELOPMENT OF THE MOBILE COMMUNICATION SECTOR – THE MOBILE INTERNET EMERGENCE

With the rapid development of the wireless and mobile advancements and infrastructures is quite evident the reason of the mobile Internet "birth". It would be considered fundamental to emphasize on its imperative existence, since in the future statistically the related channels will take over as the most sustainable mediums of services provision.

Mobile Internet could be considered as a new kind of front-end access to public and private services with specific capabilities of delivering on demand real time information. Nowadays, many sectors (governmental, private, educational etc.) start to offer services and information via a variety of service delivery channels apart from the Web (Synodinos, and Avgeriou, 2003). Two of these mobile service delivery channels are mobile telephony and PDAs. These channels become more relevant considering the much faster growth of mobile penetration rate compared to desktop based Internet access. More broadly, the growth of mobile communications has had a profound economic and social impact in Europe and beyond. The mobile phone is now pervasive and is used in every human activity. While penetration levels are likely to continue to increase, the most significant future development will be the growth of mobile broadband services, as the potential provided by third generation mobile (3G) and its enhancements, as well by other wireless technologies, including W4, RLAN, satellite and others, is realized. The dissemination of these technologies represents a paradigm shift that will enable the emergence of new data services, combining the benefits of broadband with mobility (Communication from the Commission, 2004). Looking forward, the convergence

of telecommunications, broadcasting and internet will result in the proliferation of high speed multimedia services delivered over mobile networks. The 2.5G / 3G / 4G and R-LANs will co-exist and provide complementary services. Users can benefit from the high-speed wireless access when near a hot-spot, and receive 3G services over a wider area. Continued technological innovation will also affect other platforms which, in turn, may affect the development of 3G by giving a broader technology base from which new innovative services could develop to the benefit of all. The convergence of fixed and mobile services, for example, through unified fixed / mobile offerings, will also bring additional opportunities for innovation.

Eventually, the research environment has changed dramatically, since 1998, when ETSI adopted the UMTS standard for 3G. Global competitiveness is based on innovative capability as well as cost-efficiency. Research in the mobile and wireless communications sector must necessarily address the entire value chain, from technology development up to the development of services and applications as well as content, taking into consideration the fact that the associated cycles of innovation, although interrelated and inter-dependent, are subject to different time constraints. Global standards and platforms for the development of innovative and high-speed mobile broadband accessibility will be essential for creating an integrated global multi-channel environment.

3. MULTI-CHANNEL SERVICE DELIVERY

“To struggle against the amplification of the digital divide and therefore to think ‘user interaction’ whatever the age, income, education, experience, and the social condition of the citizen” (Europe’s Information Society, 2004).

The specific theme above reveals exactly the need for user centered service development and delivery. In many ways, the new technology, as mentioned in the introduction, provides greater opportunities for access, for example by people in remote locations, those who work unsocial hours, or those who are immobile and thus cannot attend offices in person. However, there are important problems in determining precisely what citizens want and need, and how to provide Internet services in user-friendly and effective way. User needs are always conditioned by what they already get, or imagine they can get. The most prominent approach to collect this type of information is focused upon the users’ level segmentation and providing them consequently personalized and adaptive services depending on their preferences. This methodology has an extensive application on the services delivery via mobile channels whereby the presentation and nature of information are restricted from the capabilities of the devices.

A channel can change the users’ perception of a service, when a user have a free choice between different channels to access a service, he will choose the channel that realizes the highest relative value for him. Furthermore, to increase the service value a provider should have its service processes more integrated, i.e. by re-organizing its organizational structure or by a more intensive cooperation between its internal and external departments, while to increase its service provision, it should increase the level of integration of its delivery channels. If channels are integrated, the introduction of a new channel is not merely an additional channel but a new opportunity to improve service delivery, i.e. by offering the user more flexibility. To the user, the integration of channels means more accessible and more flexible service delivery (which leads to better services). When services processes as well as delivery channels are integrated, full service integration becomes possible by means of a high quality, accessible, flexible, cost-efficient and effective one-stop approach.

Separate development of different channels for a single service (multi-channel delivery) can lead to inconsistencies such as different data formats or interfaces. To overcome the drawbacks of multiple-channel service delivery, the different channels should be integrated and coordinated (Caldow, 2001). To enable this, the common data that are used by the *front office* applications should be stored centrally so that they can be shared by the applications. Storing data centrally means that they need to be collected only once and that they can be accessed by back office applications. When data are stored centrally, users can also access the services they want from the location(s) they want, as all the relevant information retrieval is taking place from the same databases. When only the channels are integrated, there will eventually be an improvement in service delivery: services will be available over more channels, especially electronic and mobile ones enabling providers to offer fully automated services that can be provided on a 24x7 basis. When *back office* processes

are also integrated, full service integration becomes possible, which raises the quality and number of services significantly.

3.1 Channel selection

A channel could be defined as “a means for users to contact public administrations (inbound) or for public administrations to contact their users (outbound) with the aim of acquiring or delivering public services. This includes the use of web-based technologies, telephony, paper media or face-to-face contacts; applications of these technologies such as the internet, e-mail, SMS, call centers or the counter; and devices to access the applications such as a personal computer, mobile phone, kiosk or digital TV” (IDA, 2004).

A closer look at the term “channel” and an examination of the relevant documents reveals that the exact meaning of the term “channel” (or “access channel”) cannot clearly be defined. The term is often used as a concept that includes “channel type”, “technology”, “platform”, “media”, “device” and “touch point”, although none of these terms are used consistently. What is more important is the meaning conveyed on how services delivered.

Services can be delivered through a wide variety of channels. As in previous sentences have briefly been mentioned certain channels are more suitable than others for meeting particular user requirements. Factors such as cost and management make it impractical for an organization to implement all channels. A realistic set of channels must, therefore, be selected from the available range of potential channels. Since success in service delivery depends on a vast range of parameters, there is no single formula or solution that fits all situations. Nevertheless, there have been reported particular steps (IDA, 2004) that could guide a provider throughout the channel selection process. These include:

1. Rate the features of the available channels.
2. Rate the service provision requirements for each service type.
3. Match the channel features and the service provision requirements.
4. Investigate the channel preferences of potential users and use the results to fine-tune the selection of channels that meets the general user requirements.
5. Determine whether the remaining channels are technically and organizationally appropriate to deliver the services.
6. Determine which channels will realize the best public value, based on (expected) costs and benefits.

Ultimately, it should be mentioned that the suitability and usefulness of channels depends on a range of factors, out of which technology is only one element. Additional features that could affect the service channels assessment could be: *directness, accessibility and inclusion, speed, security and privacy and availability*. To realize though their potential value, channels also need to be properly implemented and operated.

3.2 Channel limitations

The Internet is today one of the most important information retrieval resources affecting directly the on going people’s quality of life. The demand for service consumption anytime, anywhere and anyhow has emerged the evolvement of the wireless networks (wireless Internet) and mobile devices adding not only even more value to the specific medium but increasing at the same time the number of channels liable to convey the requested information. Since the number and variety of these channels (networks and devices) is really huge, with different capabilities and limitations, the design and implementation complexity is rising significantly. With regards to the networks some of the added issues and concerns are the low bandwidth, the unreliable connectivity, the lack of processing power, the limited interface of wireless devices and the user mobility.

The mobile devices have nowadays been proliferated dramatically and they are usually used to keep the users to a continuous interaction with the rest of the “world”. In parallel to the wireless networks evolvement, they are also used to provide users with information and services on demand. Nevertheless, many restrictions and limitations characterize them not only because of their restricted computational power but of their small size as well. More specifically, one mobile device could be distinguished from a desktop one because of it’s:

- *Size*. One mobile device must be small enough so to move easily and ideally.

- *Processor*. Usually mobile devices processors have less computational power and different architectural design.
- *Memory and Storage space*. The memory is significantly restricted due to the small size of a mobile device.
- *Screen*. The screen is of very small sizes with low resolution capabilities, that is why in many cases there are only monochrome panels.
- *Data entry*. Most of the mobile devices either they do not have keyboard at all or they have one of restricted size. Therefore, the data entry for processing becomes even harder. Additionally, in these devices could be inserted data via voice or image recognition techniques.

4. COMPREHENSIVE REQUIREMENTS OF THE MOBILE INTERNET USER

To get the right information at the right time and the right place is not so easy for the users. The involved sectors, both private and public, working at their front or back office, they have encountered in several times and occasions the particular problem. Users' interaction with the services has to be improved, and a serious analysis of user requirements in the area of mobile Internet for services provision has to be undertaken and documented and furthermore examined taking into consideration their multi-application to the various delivery channels and devices.

This paper will present, based on studies conducted (IDA, 2004; Top of the web, 2003; PRISMA, 2002; CAP Gemini Ernst & Young, 2004), some of the user requirements and arguments anticipated. They could be clearly distinguished into:

- General user service requirements.
 - *Flexibility: anyhow, anytime, anywhere*. (a) Technological developments have introduced a wide variety of new channels over which different forms of contact can take place (i.e. web technology, has introduced e-mail, which in many situations has replaced regular mail, or has opened the possibility of consuming services by means of self-service on a 24x7 basis; moreover, mobile technology makes it possible to consume services irrespective of location). (b) Many service delivery processes consist of two more interaction sessions between the user and the involved sectors (i.e. if the administration is flexible in terms of its service delivery, it will allow the user to choose the channel or location for the interaction processes, and allow him to switch between channels at any preferable time).
 - *Accessibility*. (a) Users should be able to locate the required services (awareness). (b) Users should be able to identify the channels that they can use to access the service they need (i.e. provide help to the users regarding the channel most suitable for them to use). (c) Once a service is located and accessed, users should be able to consume the information provided by the service and it should be usable to all members of the intended user community. (d) The legal basis of public services stipulates that they must be accessible for all potential users. (e) A pricing policy for services should guarantee that the intended target groups can afford the services.
 - *Quality*. (a) There are many situations in which a user needs more than just one service to deal with a particular situation. In a one-stop shop approach (Herbert and Hagen, 2000), a single interaction would be able to address all requirements, thus saving the user considerable amount of time. (b) Public services are usually regulated by means of strictly defined specifications. Quality can be described as satisfactory if the service is provided in conformance with the relevant specifications. (c) In user-centric approach, services must be offered pro-actively. A timely service is a service that is offered at the moment a user may need it, even though he may not yet be aware of it. (d) Quality comes at a price (i.e. faster delivery of a service may involve more costs than delivery at a regular speed).
 - *Security*. (a) A trusted exchange of information depends on an assured security level. If a channel is not secure, or if users do not trust its security, the channel will not be used for services that involve sensitive information. (b) Security is not only a technical matter, it is also one of perception. Due to a lack of trust in security matters, relatively large segments of the user population are less inclined to use channels that they do not fully trust, especially when payment is involved.

- Requirements for a friendly and effective user interaction.
 - *Information Acquisition*. Support active involvement.
 - *System Controllability*. Give the users the control.
 - *Navigation*. Provide easy means for navigation and orientation.
 - *Versatility*. Support alternate interaction techniques.
 - *Errors*. Tolerate user's errors and support error system-based and context-oriented correction of user's errors.
 - *Personalization*. Enable customization of multi-media and multi-modal user interfaces to particular user's needs.

The convergent perception of many studies seems to be that users are different in their perceptions, reactions, and demands. In addition, it is almost universally accepted that, "where misunderstandings in a human-machine interaction are possible, then misunderstandings will occur" (Europe's Information Society, 2004). Therefore, a consistent optimized approach incorporating all the positive and negative outcome viewpoints is considered vital for the most optimum fulfillment of user needs.

5. FURTHER MOBILITY IMPLICATIONS FOR ADAPTIVE INTERNET SERVICES DESIGN

It is an indisputable fact, that when creating Internet applications and interfaces there must be taken into consideration the target audience requirements presented previously, especially when an application has both a desktop and a mobile presence. Generic guidelines as the ones below could be easily identified:

- Determine what makes sense for a mobile user. What provides the best value?
- Ensure that the user can easily enter and retrieve information.
- Ensure that the application is customized for the target device and for the desktop.
- Where possible, pre-select the most common items and use them as default values. Default values increase user convenience, to reduce or eliminate the need for data entry based on key scenarios.
- Consider navigation and operational characteristics of the target device.
- Decide on the user design interface and begin by creating a storyboard for the application.

The user population is not homogeneous, nor should be treated as such. To be able to deliver quality mobile Internet services, they should be tailored to the needs of individual users providing them personalized and adaptive information at the requested moment. Although one-to-one service provision may be a functionality of the distant future, user segmentation is a very valuable step in the right direction. User segmentation means that the user population is subdivided, into more or less homogeneous, mutually exclusive subsets of users who share common user profile characteristics. The subdivisions could be based on: *Demographic characteristics* (i.e. age, gender, urban or rural based, region); *socio-economic characteristics* (i.e. income, class, sector, number of employees, volume of business, channel access); *psychographic characteristics* (i.e. life style, values, sensitivity to new trends); *individual physical and psychological characteristics* (i.e. disabilities, attitude, loyalty).

The issue of personalization is a complex one with many aspects and viewpoints that need to be analyzed and resolved. Some of these issues become even more complicated once viewed from a moving user's perspective, in other words when constraints of mobile channels and devices are involved. Such issues include, but are not limited to: *What content to present to the user, how to show the content to the user, how to ensure the user's privacy, how to create a global personalization scheme*. As clearly viewed, user characteristics and needs, determining user segmentation and thus provision of the adjustable information delivery, differ according to the circumstances and they change over time (Panayiotou and Samaras, 2004). This is one of the reasons why users should be offered a choice of channels when they access services. By user needs we mean both, the *thematic preferences* (i.e., the traditional notion of profile) as well as the characteristics of his *personal device* on which any requested info will be displayed. By focusing on wireless Internet the capabilities of the user's device become crucial as these wireless devices are quite restrictive on the form and length of the received content.

Indisputably as stated previously, the Internet is today one of the most important information retrieval resources affecting directly the on going people's quality of life. The demand for interactive access anytime, anywhere and anyhow has emerged the evolvement of the wireless networks (wireless Internet) and mobile

devices adding not only even more value to the specific medium but increasing at the same time the number of channels liable to convey the requested information. Since the number and variety of these channels (networks and devices) is really huge, with different capabilities and limitations, the design and implementation complexity is rising significantly. With regards to the networks some of the added issues and concerns are the low bandwidth, the unreliable connectivity, the lack of processing power, the limited interface of wireless devices and the user mobility. On the other hand, the mobile devices have nowadays been proliferated dramatically and they are usually used to keep the users to a continuous interaction with the rest of the “world”. In parallel to the wireless networks evolvement, they are also used to provide users with information and knowledge on demand. Nevertheless, many restrictions and limitations characterize them not only because of their restricted computational power but of their small size as well. More specifically, one mobile device could be distinguished from a desktop one because of it’s: *Small size* (of wireless information devices leads to inherently limited user interfaces), *bandwidth* constraints (impose limits on the amount of information to be transferred), *cost* constraints (under current conditions – wireless information transmission is expensive), *processor* (usually mobile devices processors have less computational power and different architectural design), *memory* and *storage space* (the memory is significantly restricted due to the small size of a mobile device), *screen* (the screen is of very small sizes with low resolution capabilities, that is why in many cases there are only monochrome panels), *high latency* (in critical real-time systems a response to environment changes is required in real time and latencies are tolerated), and *data entry* (most of the mobile devices either they do not have keyboard at all or they have one of restricted size. Therefore, the data entry for processing becomes even harder. Additionally, in these devices could be inserted data via voice or image recognition techniques)

Various attempts have been made so far to comply with the aforementioned demands. These emphasize on re-engineering existing Internet interfaces and services. However, creating and maintaining a Web site to support multi-channel access is proved to be quite costly and also require a significant amount of work.

Moreover, mobile applications can suffer from a handful of noteworthy problems. These could be summarized into: local mobility, limited mobility, closed mobility and interrupted mobility. Local mobility describes the situation when some mobile applications have been successfully delivered in a local environment, but are not cost-effective when applied at a trans-national mobility level. Limited mobility describes cases where an impressive coverage has been reached nevertheless encountering local problems, non-covered local areas or not enough capacity. Closed mobility describes situations where mobile services are restricted for example to GSM technology (both CSD and SMS), without any generalized use of complementary mobile technologies for local environments as well as non-terrestrial areas. And finally, interrupted mobility describes cases where there is a lack in the availability of frameworks that make possible business models in which complex interactions between different sectors are performed by means of mobile applications.

To overcome these problems intelligent techniques and thorough consideration of the new mobile Internet user requirements and demands have to be implemented to enable the development of an open Adaptive Mobile Web (Brusilovsky and Nejd, 2004) that will provide sustainable user-centric Internet services. Fundamental characteristics will be the directness, high connectivity speed, reliability, availability, context-awareness, broadband connection, interoperability, transparency and scalability, expandability, effectiveness, efficiency, personalization, security and privacy (Lankhorst et al., 2002; Volokh, 2000; Korkea-aho, 2000).

6. CONCLUSION

This paper seized the opportunity of the mobile and wireless communication sector emergence as well as the increasing demand for quality mobile Internet services provision, to present the various challenges and opportunities with regards to the multi-channel delivery, and the new user requirements and needs initiated. The demand for multi-channel eServices provision through a single point of access anywhere, anytime and anyhow, is nowadays the principle driver of users’ requests. More specifically, this paper presented the rapid development of the wireless and mobile platforms and devices. Special emphasis has been placed on the multi-channels’ capabilities and limitations indicating proper selection criteria. The proliferation of the various eServices delivery media imposed the generation of new user requirements focusing upon flexibility, accessibility, quality, and security. Furthermore, it has been identified the increasing demand for adapted user

friendly eServices interfaces that will enable information acquisition, system controllability, navigation, versatility, error handling and personalization. The last section presented some overall vital mobile implications that have to be considered during the design and development process in order to ensure effective, efficient and sustainable mobile Internet services delivery and consequently increasing citizens' quality of life.

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