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INTERACTIVE DESIGN AND DELIVERY CHALLENGES FOR WIRELESS HANDHELD MULTIMEDIA SYSTEMS

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Abstract

The mobile media market is a new communication channel with its own characteristics and opportunities. Streaming on your mobile phone is not watching TV or going to the movies. Instead, the mobile channel provides personalization, interactivity and anytime, anywhere services. Content delivery in mobile multimedia is an application area that offers big business potential, as the users of mobile devices want to access multimedia content from their devices. People want to use it anytime, anywhere and in whatever way they choose. Mobile applications should therefore present adaptable multimedia content to different end-user devices. And with content presented in a dynamic environment, this presents new challenges. Hence, multimedia content has to be adapted to fit the constraints of the device. Handheld devices with increasing multimedia enabling features and diverse capabilities are undergoing considerable progress because of portability and mobility. This paper looks at the design and security challenges facing multimedia content and context delivery.

Key words: *Mobile Multimedia, Context and Content delivery, Mobile design, Security, Multimedia Streaming.*

1.0 Introduction

Multimedia in the mobile environment is growing. It is already a reality through the introduction of SMS, MMS and several commercially deployed streaming solutions around the world. The user actively requests multimedia content for streaming or downloading to the mobile device. As the market for multimedia and content is growing rapidly, it is important for operators to plan and prepare for these emerging services in order to stay competitive, as well as to assure generation of new revenues [18]. However, mobile handheld devices have limited bandwidth, small screen size and low computational power. The problem arising for institutions attempting to capitalise on these new channels for service delivery is the capability to deploy many multimedia services rapidly and cost effectively. Mobility and context-awareness introduce further challenges in that, the applications have to adapt themselves to the changing environment. Therefore designing interactive mobile handheld systems requires many of these aspects and some expertise in the process. In this paper we will explore some of the challenges and discuss the implications.

2.0. Is Content King?

Despite the considerable value of information systems already in place, one aspect in which they can be improved is a better method of adding and managing context specific content. In designing and developing multimedia content for mobile systems, there are certainly very important issues to be considered for the application [18]. Some of these, amongst others are: type of Content (for example photos, text, music video, games etc), Context and Format (for example, personalisation of information and real-time casting for conferencing etc), Compression technique, and Transport algorithms etc. It could be argued therefore that, without a simple effective way for content providers to properly

maintain and manage content, information in these systems will quickly become stale [7, 18]. Context is defined as “any information that can be used to characterise the situation of an entity. An entity is a person, place or object that is considered relevant to the interaction between a user and an application, including the user application themselves” [16] .Consequently, Context would be king in such very dynamic, highly demanding and very competitive mobile environment.

Providers must innovate contextually to keep users updatedly interested and tailor content to individual needs. Otherwise interest in the service would be lost and the trust factor together will loyalty will very easily thin out [18]. A value chain that defines all the major functions and combines all the major requirements from both the providers and end-users of content must be established. A more individual selection and personalised presentation would provide added value for users since this would take the users needs, interests and preferences into account [6]. This is where users profiling plays an important part. In addition and to avoid stale content, numerous content providers are needed and these content providers should be able to quickly and easily generate new content using existing infrastructures but which could be adapted to meet the new demands.

2.1 Context Awareness

According to [18], a context aware system uses context to provide relevant information to the user - personalisation. Therefore context must be relevant to performing certain tasks, this gives users choice, flexibility or dynamism and interest, together with loyalty to service. There is much information that can be gathered with fitting sensors and used within an existing network. For example, one can gather information about the location, the time, about the user, temperature or weather situation etc. [15] to provide adequate timely information for decision making.

Some analysts [17] argue that, a context aware system has to provide applications with the following context oriented functionality:

- Support of a variety of sensor devices,
- Support of the distributed nature of context because the data comes from different sources
- Providing for transparent interpretation and abstraction of context data,
- Maintenance of context storage, and
- Control of the context data flow.

All the above must function within an environment that is not only crowded but mobile as well as highly demanding.

3.0 Operating Environment

When coming to an activity and beginning to use a technology, people already have expectations and opinions of the technology in question. It also has to be noted that the norms developed when interacting with a particular technology are not meant to be static. They change as people change their way of working with technology and talking about technology. [11] In a dynamic distributed environment, the availability of services and hosts changes in continuous fashion due to the network disconnections and poor coverage in some locations. Hence service lookup becomes an important issue. [8] Additional requirements are presented by the needs of the existing business processes in multimedia service delivery. The fluidity of such an environment makes it difficult for service providers to maintain a particular approach in content delivery because they have come to realise that the “one size fits all” adage does not work here. There are sometimes legislative and regulatory bottlenecks or system limitations which service providers have to hustle against to satisfy users.

Due to the nature of wireless connections with mobile devices, consideration must be given to the possibility that the user losses connectivity due to travel outside coverage areas or other reasons [7]. Such inactivity can very easily reduce confidence and increase unreliability to the service and service providers.

4.0 Interactive browsing

The multimedia content should be able to adapt to the different end user devices and make it easier for the user to adequately manipulate the system with some ease. Most wireless mobile device systems do not allow for scrolling side ways. And in case of reading a text or viewing a wide image, scrolling is permitted only downwards and this is very limiting indeed. Its is reasonable to allow the user to stop the automated process at any time and, choose where to look at interactively – progressive delivery, and resume the automatic browsing process afterwards.[4] Manual browsing can avoid information loss but it is often time consuming for users to catch the most crucial information of an image. Therefore progressive delivery is what is required for such systems. The limitations of mobile devices also affect the layout of the mobile presentation. Consequently, not only media elements - lower resolution and size are selected, but also the layout of the multimedia presentation changed, e.g. the heading line of a presentation is removed in mobile devices. [6] Users therefore need to understand how the information will be presented to avoid misunderstandings and user frustration. By use of the navigation methods provided, users should be able to navigate, sign on and off the system, be able to handle withdrawal and inattention and be able to handle privately tailored information. [11]

5.0 Media Alerts

Media alerts are events associated with media content. They are generated when some media related content occurs e.g. a camera detects movement or a microphone detects speech. Every application can invoke its own kind of alerts. This allows creating a flexible infrastructure for delivering media messages. The media messages are delivered in a synchronous way. If the client is not available to receive the media alert, it will be queued and delivered later, when the client is available. [8] This is closely related to issues of session managing the delivery system.

5.1 Session management

In dealing with session management, a content delivery application takes a user's context - location, time, device and request – and access a content database and returns relevant information in a structured easy to use format [7]. The application platform must be able to handle a large number of service requests concurrently from various wireless and landline networks. The platform must also be able to reconfigure itself dynamically when certain machines fail or become overloaded; and continue to deliver services of satisfying guarantee [12]. The operation process is as illustrated below in figure 1.

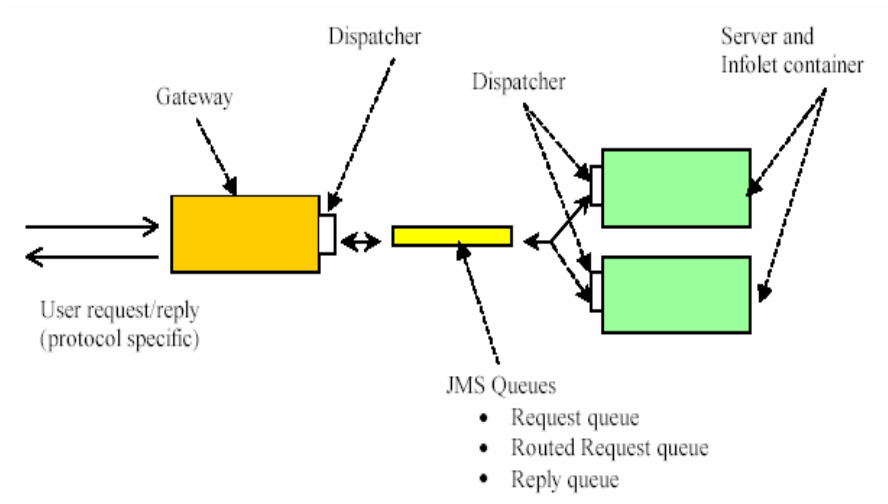

Figure 1. A Session Management system [12]

The entities involved are gateways, front- and back-end sessions, JMS-based transport entities, and front- and back-end dispatchers. Upon successful completion of user authentication, the gateway creates a new front-end session with a unique identification tag; this session is valid during the lifetime

of the user interaction with the device through this gateway. Each protocol specific request is transformed into a standard device request that carries the front-end session identification tag. If a particular service requires session management for subsequent requests, then a back-end session is created and is identified by the same identification tag used in the front-end session. The back-end session is valid for the server in which it was created and it is not available for use by other servers in the iMobile server cluster. For this reason, we have to guarantee that subsequent service requests of the same type from the same user are sent to the same server. This is achieved by enabling the request routing feature during the first reply, following the creation of a back-end session. [12]

6.0 Technology & Design

Critical design issues play a major role in the characteristics of a mobile device. This also has significant impact on the viability of a service. Most of the existing technologies were built for systems with fixed infrastructures and require the device to have a lot of resources. The central issue in the technology domain is functionality. Functionality can be perceived as the things a system or mobile device can do for its end users. For example 3G mobile services have always on capabilities and higher data rates, which are assumed to carry video and sound clips [1, 18], and perform better than its predecessors.

Most mobile devices are constrained by the environments they operate in and by the resources they possess. What makes sense from a technical point of view may not make sense from a financial and user perspective. Some of the design challenges facing the mobile multimedia devices in their content delivery include [3, 18] but not limited to the following:

Battery gap: The energy consumption for supporting battery constrained in mobile devices is high. Slow growth rates in battery capacities are easily out paced by the increasing energy requirements for processing data, leading to battery drain, a battery gap. Nowadays mobile batteries are getting better with improved energy retention capabilities [18]. But battery technology is not evolving as fast as modern applications and their hunger for more and more power – MIPS, which on the one hand shortens the time a device, can be used without being recharged [9]. The battery size has also reduced from the previous bulky state of earlier makes and models to small and slimmer size to fit with increasing demands for lighter pocket-sized devices.

Processing gap: The mobile multimedia enabled devices are not capable of keeping up with the computational demands of data processing demands that need to be achieved. These short comings are mostly felt in systems that process very high data rates or a large number of transactions e.g. network routers, firewalls and web servers. Users prefer to spend as little time as possible as long as certain percentage of information is presented to them. Users prefer to read as much information as possible within a limited period of time, [4, 18.] and may lose patience and concentration with any download delays etc. However, mobile systems nowadays are beginning to have extensive power in terms of processing mechanism, random access memory, and massive hard drives capacities. For example the Nokia N91 has a massive 4 Gigabytes capacity. The trends not only improve technology and vendors' competition, and in effect the human development in communication, but also raises some very critical security concerns.

Assurance gap: Truly reliable systems are much more difficult to build than those that merely work most of the time. Reliable systems must be able to handle the wide range of situations that may occur by chance. Increase in the complexity of the multimedia mobile devices systems are making it more difficult for designers to be sure that they have not overlooked serious weaknesses.

Cost: Device and operational costs are increasingly becoming an issue in the development and use of multimedia content for the systems. This is one of the fundamental factors that influence the design of multimedia enabled mobile device. It is the designers' responsibility to balance the design requirements against the cost. There is need to analyse the trade-offs in the value of information gained against the costs of performing activity in human computer interaction tasks.

Screen size: Visual attention can be seen as the ability of a portion of image to attract the users' attention and concentration. All mobiles have a maximum of 240x180 pixels and this is indeed very limiting. Rapid Serial Visual Presentation (RSVP), a presentation technique is used to support

electronic information browsing, and can be used to improve browsing in small devices [4]. When browsing large images on small devices, people often devoted considerable efforts in scrolling and zooming to view the content. This causes eye and finger strain with limited concentration. [18] Users prefer to read as much information as possible within a limited period of time. However, small screen size does not have to be and indeed is not a barrier to collaborative work. There are ways that a device can be designed so that users can move around a small device by paying attention to the detail of the interaction taking place [10]. Again, this is where progressive delivery of information that is tailored to the individual needs can achieve the balance.

Bandwidth: A key factor contributing to the increased network demand for bandwidth is the delivery of multimedia services such as videos, music, and peer-to-peer. Consumers are interested in downloading digital media content in order to subsequently use this content anywhere at a time of their choosing. [5, 18] Therefore faster download time is very necessary to maintain interest and increase service usage.

7.0 Security challenges

While security can have widely varying objectives in different contexts the most common include ensuring privacy and integrity of data, (stored or communicated) and the authenticity of an entity (electronic system or a human user), [2, 19] security may also refer to the way in which access is granted and how security of communication and information is realised [1]. The process of creating security requires eliminating undesired functionality. For example, a cellular telephone network should prevent unauthorised calls from being placed. It is important to define what security capabilities are required, such as which attacks must be prevented. The strength of a system is determined by the easiest attack. While security may be well addressed in computer based systems it still remains a major challenge in multi-media technology. According to [2, 19], the factors that elevate the security challenges are cited as:

- Software solutions are not sufficient to keep up with the computational demands of security processing due to increasing data rates and complexity of security protocols. These short comings are mostly felt in systems that need to process high data rates or a large number of transactions.

- New techniques for breaking security, such as fault analysis require that the system implementation itself be secure even when it can physically be accessed by malicious entities. Resistance in such a case can only be ensured only if suitable tamper-proofing features are built in during design.

- New issues such as denial of service and security of systems that execute dynamically downloaded third party software need to be addressed.

- Embedded systems are assembled from redesigned components that originate from different organisations. The responsibility of secure implementation therefore needs to be distributed across a significant number of entities.

8.0 Elements of secure mobile appliance architecture

Security challenges are usually complex even when viewed from a limited handset perspective. The mobile handset nowadays is used for a variety of purposes such as distribution of internal E-Mail exchange, which also facilitates download and upload of data [18]. And issues like these brings about serious security needs on the devices and adequate architectures needs to be put in place to protect sensitive private and/or business data on the device, in the server, over the air, and in the system cell. Thus from a systems perspective, it is imperative to take a hierarchical approach where each layer of security provides a foundation for the one above it. A base platform architecture must be flexible and scalable to meet the needs of each stratum in the marketplace. Flexible and scalable base platform architectures simplify the development and deployment of new applications and services and the associated security requirements [9, 19]. A simplified design system could follow the structure as illustrated in figure 2 below, to implement some security features in the deployment, delivery and management of content services.

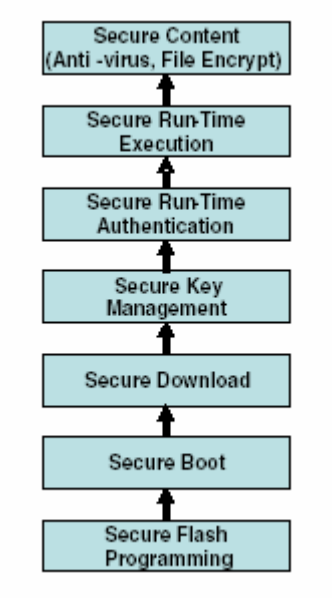

Figure 2. A security framework [9]

9.0 Business Implications

The business benefits of context based content delivery include faster time to market, lower costs overall, increase uptake and dramatic improvements to flexibility and responsiveness from users.

Publishers of information products need the ability to dynamically deliver content on demand, so that the customer always gets the most up-to-date content in a format customized for them.

Mobile multimedia technologies are nowadays so developed that they are becoming interesting for the entertainment industry. The broad/narrow casting of entertainment and multimedia contents to mobile terminals is technically feasible [18].

Flexible charging and business models - A new media channel has emerged and the behaviour in the mobile network is thereby changing. Consumers are moving the mobile phone from ear to eyes and ears. Most mobile devices are now able to support different business models.

Future Proof - Adherence to standards is key objective for future proof interoperability. The multimedia devices adhere to 3GPP standards organizations. This means they support most major formats and networks and meaning availability of most content to most users now and in the future.

Cost control - Most of the mobile devices have an integration toolbox, with already pre-configured core interfaces, as well as an open platform for adaptations. It is therefore easier for the operator to predict the total cost of operation and ownership.

Short time to market – packages could be developed and delivered at an unprecedented pace to meet market demands and in personalised fashion.

Ensured Quality of Service – This is one area that is improving and distinguishes performers in the market. Quality of Service (QoS) supports competitive advantage and provides users with better choice of network providers and content and context services deliveries.

10. Conclusion

Mobile computing is increasingly becoming par of our living. The devices widely usage is transforming the e-business world into a mobile m-business one. A world in which hand-held

computers are the user's front-ends to communicate and access enterprise data for informed mobile decision making. Mobile users need to count on reliable up-to-date, business-critical data for such on the spot decisions. Such easy accessed data are typically in the form of summarized information tailored to suit the user's analysis interests – context based. In this paper, we have addressed the issues of time and energy efficient delivery of context based services. And drawing from all the impending issues concerned with mobile-wireless system interactive design, it could be argued that, 'Context' and not 'Content' is King. Mobile Systems Design should be approach from the area and application of Context. We have presented the challenges facing the progressive delivery of wireless multimedia services. Progressive context based delivery enables users to get fast access to the most relevant parts of a personalised document. Also the paper has highlighted some of the issues, such as physical design and interactivity, system security and delivery of content services in relation to give better, flexible and effective uses to users.

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