

Requirements for Intelligent Mobile Notification Services

Work-in-progress paper

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Abstract—Many pervasive computing architectures are based on obtaining information using mobile devices. Another method is to use a subscribe/publish architecture and to notify subscribers, using push technology, when certain conditions are met. In this paper, we discuss the requirements that a model for subscribe/publish mobile notification services should satisfy as well as the benefits that context awareness and multimodality can provide.

Index Terms—Mobile devices, mobile notification services, location aware computing, context awareness, push technology, multimodal interfaces.

I. INTRODUCTION

Mobile notification is an important component in ubiquitous computing. Having knowledge of events happening around you whilst being on the move empowers you with the ability to make decisions based on information that you would otherwise not have [11]. The problem lies in the fact that most information sources (e.g. the Internet, databases, etc) are all pull-based sources [1]. There are many limitations to this type of approach [3]:

- The user is never sure of updates in information and has to constantly check for these.
- Since the user has to request information first, the interaction contains more steps and can become more complicated.
- If the information has to come from several different sources, the user has to monitor and request information from all the sources.

This clearly is not an ideal solution and initial inspection suggests push-based technology as a solution [2].

In this paper, the requirements for intelligent mobile notification services are discussed together with the benefits that context awareness and multimodality could provide.

II. MOBILE TECHNOLOGY

The increased interest in mobile computing and applications has led to the rapid advancement of mobile technology. This has created a large pool of mobile devices which can be used [4]. Examples of mobile devices include cell phones, laptops, personal digital assistants (PDA's) and tablet pocket computers (tablet PC's). Cell phones are by far the most popular mobile device in use these days [12].

III. MOBILE NOTIFICATION SERVICES

Mobile notification can be defined as sending a text or multimedia message to a group of wireless subscribers. Notification is a form of push technology where information is transferred as a result of an event [2]. A wireless subscriber is a consumer that subscribes to events that he or she is interested in (the subscriber lets the system know that they want to be informed whenever certain events occur based on location or some other factors). Once those events occur, the event is published to all consumers who have subscribed to that particular event. An event is published by notifying all subscribed consumers using the most appropriate device and mobile technology.

A. Characteristics

Communication in mobile notification systems follows a User-to-Information approach [5]. Due to the nature of mobile devices, it is impossible to know the number of devices that will subscribe to events beforehand or to predict whether or not a device will be present when an event occurs. The number of repeated queries for a client without push technology in order to check for updates would place excess strain on servers and network traffic. Also, the nature of mobile devices limits the resources, processing power and information available for use [2].

B. Requirements

A solution to the above concerns can be found using a push-based approach [6]. Push technology consists of a set of consumers, who subscribe to events, and information providers; which listen for the events and then publish them to the subscribed consumers.

A number of issues arise when using push-based mobile applications. Mobile applications are, by their very nature, mobile, and users must be allowed the freedom of moving around without having to worry about whether or not the system caters for this mobility [7].

Due to the number of mobile users worldwide, millions of subscriptions must be catered for as well as many event sources [7]. Also, the large variety of mobile devices implies a need for multiple content formats and mediums [8]. The security and privacy of the consumers is obviously very important [9]. Allowing users access to other users' information represents privacy invasion, and not all subscribers should be allowed to receive all events that occur (a user should not be able to receive events pertaining to another user without prior consent).

From the above discussion, several requirements for a

push-based system for mobile users were identified. These requirements are:

- Take the mobility of users into account;
- process multiple content formats;
- support large amounts of subscribers and publishers; and
- support security and privacy of information.

IV. MULTIMODALITY AND CONTEXT AWARENESS

Multimodality and context awareness enable a system for mobile notification to provide information in a more suitable mode depending on the context of use. This allows for a more subtle integration into the users' lifestyle and users may want to be notified using different modes of communication, e.g. text, voice, image, SMS, etc. Hard-copy notifications may also be required for book-keeping purposes [10]. To support this set of diverse requirements, a large number of device gateways must be supported and on-the-fly transcoding of the notification data to a format suitable for the specified device must be provided.

Context awareness implies knowledge of the user's context, which may result in privacy issues [9]. Knowing the location of someone else can infringe on the users' right to privacy and some criteria must be defined for who has access to this information. In order for a mobile notification service to be intelligent, it must therefore satisfy the following additional requirements:

- Support multiple notification channels;
- use context awareness to select the appropriate mode of communication; and
- ensure the privacy of the users' context.

V. MOBILE NOTIFICATION MODELS

The model in Figure 1 is an example of a model for push-based services. When mail arrives on the mail server, the system reads it and sends a notice to the user. The notice can be sent either using an SMS, a FAX message, or the message can be converted to voice and transmitted with a traditional voice phone call (Figure 1).

Evaluating this model according to the requirements defined above shows that whilst it supports mobility, varying amounts of subscribers and multiple notification channels, it does not support security and privacy. This model supports multiple notification channels, but no context awareness is used to decide which mode to use when notifying the user.

VI. CONCLUSION

The requirements for intelligent mobile notification services were outlined, presenting a set of criteria against which existing mobile notification models can be compared and evaluated. Multimodal interfaces coupled with context awareness can be used to provide a better service using mobile technology [11]. Future work will involve using the criteria defined in this paper to evaluate existing models and create a new model which addresses the weaknesses of these.

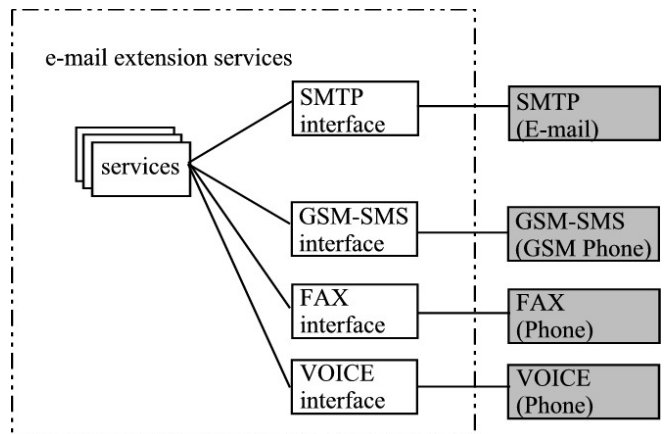


Figure 1: E-mail to Short Message Service (SMS) [5]

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