Mobile Multimedia: Reflecting on Dynamic Service Provision

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ABSTRACT

Delivering multimedia services to roaming subscribers raises significant challenges for content providers. There are a number of reasons for this; however, the principal difficulties arise from the inherent differences between the nature of mobile computing usage, and that of its static counterpart. The harnessing of appropriate contextual elements pertaining to a mobile subscriber at any given time offers significant opportunities for enhancing and customising service delivery. Dynamic content provision is a case in point. The versatile nature of the mobile subscriber offers opportunities for the delivery of content that is most appropriate to the subscriber’s prevailing context, and hence is most likely to be welcomed. To succeed in this endeavour requires an innate understanding of the technologies, the mobile usage paradigm and the application domain in question, such that conflicting demands may be reconciled to the subscriber’s benefit. In this paper, multimedia-augmented service provision for mobile subscribers is considered in light of the availability of contextual information. In particular, context-aware pre-caching is advocated as a means of maximising the possibilities for delivering context-aware services to mobile subscribers in scenarios of dynamic contexts.

Keywords: Context-Aware Pre-Caching, Mobile Computing, Mobile Multimedia, Service Provision

INTRODUCTION

Mobile computing has fundamentally challenged many aspects and tenets of what was perceived, and experienced, by most people in traditional computing scenarios. Though a radical paradigm shift in itself, nevertheless, it was only over time that the nature of mobile computing began to crystallise. Indeed, it must be observed that this is an ongoing process. When the historical development of modern computing is considered, it can be seen why this is the case. If the 1960s are regarded as the beginning of the modern computing era, then conventional computing had been in existence almost 30 years before the use of computing in mobile scenarios became feasible. In this time, various techniques for engineering software solutions were developed and a consensus was growing about what constituted good practice principles. By introducing a mobile element into computing infrastructures, a further level of complexity was introduced into practically all elements of the software engineering lifecycle. In particular, data management and dissemina-
tion for mobile service delivery are interesting cases in point.

Data management for mobile users raises a number of difficulties. The ubiquitous issues of security and privacy are to the forefront of concerns for many. In particular, the issue of cache consistency, that is, ensuring that the data on the mobile device is consistent with that maintained on other devices, especially networked servers, is of particular importance. Data dissemination is dominated by the classic Push/Pull model, but its effectiveness is compromised by the inherent limitations of mobile computing. However, a more holistic view of data management and dissemination is emerging for mobile subscribers. In this view, the management and dissemination of data should be governed by prevailing contexts, particularly as these pertain to mobile subscribers.

**Motivation**

Consumers of electronic content are a diverse group. Thus meeting their needs and expectations can provide significant challenges for content providers. A brief look at the development of the internet is illuminating. Some organisations have a significant presence on the WWW, as they view this as a significant revenue generator. One critical objective is to increase the number of visitors to their site. This is true for the major international companies as well as for individuals who may maintain a blog for their own amusement. One technique that is being increasingly adopted is that of personalisation (Kobsa, Koenenmann, & Pohl, 2001). In essence, selective attributes of WWW site visitors are captured and used to filter, customise and prioritise the content presented to the visitor. Even though the nature of mobile computing usage differs significantly from its static counterpart, this principle can also be applied to great effect with mobile users, particularly when salient contextual elements unique to mobile subscribers are included. In addition, when mobile user behaviour is analysed, it can be seen that opportunities to deliver content pertinent to the prevailing context may arise. However, there are two key challenges that must be addressed if content providers are to take advantage of these opportunities.

- models of subscriber behaviour that enables correlation between their environment and their immediate and likely future behaviour must be constructed, such that potential contextual situations may be anticipated, and taken advantage of.
- Content must be pre-cached, either on the subscriber’s host device or on a fixed network node such that it may be made available in that short period of time in which a select combination of contextual cues are valid.

As the mobile computing paradigm crystallized, the issue of mobile data management (Imielinski & Badrinath, 1994) became critically important. In particular, caching strategies in all their facets were widely investigated. A detailed description of these developments is beyond the scope of this discussion; however, the interested reader is referred to Barbará (1999) for a general discussion of some of the pertinent issues, and to Lee et al. (1999) for a discussion on semantic caching. From a historical perspective, it should be observed that much of this research took place in parallel with the WWW (Barish & Obrazcke, 2000). More recent research considers the implications for caching in peer-to-peer (P2P) scenarios (Cao et al., 2007; Chow, Leong, & Chan, 2004). Elements of context have been frequently harnessed implicitly for the refinement of caching strategies. Not surprisingly, location is the predominant element (Lee et al., 2002; Zheng, Xu, & Lee, 2002; Ren & Dunham, 2000). However, a number of researchers have considered the implications of their caching and pre-fetching algorithms from an energy and power perspective (Shen et al., 2005; Yin & Cao, 2004). Given the limited power resources of mobile devices, and the relatively power-intensive nature of wireless transmission, effectively harnessing these elements of
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