Chapter 8

Mobile Grids: An Enabling Technology for Next Generation M-Learning Applications

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ABSTRACT

The grid brings a new era to the Internet, by introducing new mechanisms, resources, and concepts which allow it to advance from a passive information medium into an active tool for creating, exploring, and sharing knowledge. In the meanwhile, the realisation of this trend is further spurred by the emergence of next generation grids (NGG) and the far more efficient, cost-effective, and broadly applicable infrastructure they introduce to cover a broader spectrum of business needs. Towards this direction and taking into account that mobility has become a central aspect in business, education, and entertainment, mobile grid has been recently developed as a full inheritor of grid covering the mobility aspects of applications, such as m-learning. In this context, this book chapter focuses on providing a business-technical presentation of mobile grid, as an enabling technology for next generation m-learning applications. We present a general mobile grid architecture able to serve the strict requirements such an m-learning application poses, and analyse the main trends and challenges in the mentioned sector.

DOI: 10.4018/978-1-60566-882-6.ch008
INTRODUCTION

The constantly increasing complexity and volume of interactions among parties, the continuous growth of industrial and business competition and the increased distances between communicating entities, due to globalisation, impose the absolute need for effective and timely communication between all interested parties. In fact, one of the main business-technical challenges is posed by the development of a wide range of continuously evolving services with complex workflows and distributed resources aiming to serve a rapidly increasing number of individuals in varying contexts and with different requirements. In meanwhile, mobility has become a central aspect in the individual’s daily life and the business operations through enabling anywhere-anytime connectivity. These challenges combined with the advanced Quality of Service (QoS) requirements narrow the compromise margin for dynamicity, mobility, scalability, performance, security and privacy requirements.

M-learning, as the next generation in e-learning, comprises an exciting new trend in learning techniques allowing for the learner to have an active role in the learning process and enabling continuous education through anytime-anywhere access to and construction of knowledge and expertise as well as collaboration among learners. Following the latest advances in mobile computing and communications and coming to meet the need for advanced knowledge management and undisruptive but still affordable access to learning content, this enhanced learning process brings a new educational era in the academic and business sectors. This revolution in the learning domain, however, is followed by strict accessibility, availability, security, performance non-functional technical requirements that existing infrastructures can address only in small-scale and quite often not sufficiently or resulting in high costs.

These advanced infrastructural needs in combination with the innate business goal for lower cost and higher profit are driving key business sectors such as multimedia, engineering, e-health, gaming, m-learning, among others towards adopting new efficient and scalable solutions into their business. Although initially designed to cover the needs of computationally intensive applications (Foster, Kesselman, & Tuecke, 2001; Leinberger & Kumar, 1999) through facilitating the combination of distributed computational resources, Grid technology of nowadays aims at providing such an infrastructure that can also serve the rising needs of the business and educational domain. As a full inheritor of Grid, Mobile Grid (Litke et al, 2004) with its additional trait being its ability to support mobile resources (serving either as a service provider or a service consumer) in a seamless, transparent, secure and efficient way comes to serve the additional infrastructural needs posed by mobile applications, such as m-learning.

This chapter focuses on presenting and analyzing both from a technical and a business perspective a general Mobile Grid architecture able to serve the strict infrastructural requirements m-learning applications pose based on work performed during the FP6 European project Akogrimo (AKOGRIMO project, 2007). More specifically, work in this chapter presents a Mobile Grid Architecture including the main components and their interconnections as well as the main challenges in such architecture. The driving business needs are presented and a scenario describing the main roles in an advanced m-learning system and their participation in this collaborative environment as well as a set of technical requirements related to this system form the basis for the technical analysis. Finally, the main concerns and challenges are briefly discussed and future research opportunities are suggested, whereas the business future trends are presented.