Chapter 39
An Approach to Mobile Grid Platforms for the Development and Support of Complex Ubiquitous Applications

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ABSTRACT

Several complex and time-critical applications require the existence of novel distributed, heterogeneous and dynamic platforms composed of a variety of fixed and mobile processing nodes and networks. Such platforms, that can be called Pervasive Mobile Grids, aim to merge the features of Pervasive Computing and High-performance Grid Computing onto a new emerging paradigm. In this Chapter we study a methodology for the design and the development of high-performance, adaptive and context-aware applications. We describe a programming model approach, and we compare it with other existing research works in the field of Pervasive Mobile Computing, discussing the rationales of the requirements and the features of a novel programming model for the target platforms and applications. In order to exemplify the proposed methodology we introduce our programming framework ASSISTANT, and we provide some interesting future directions in this research field.

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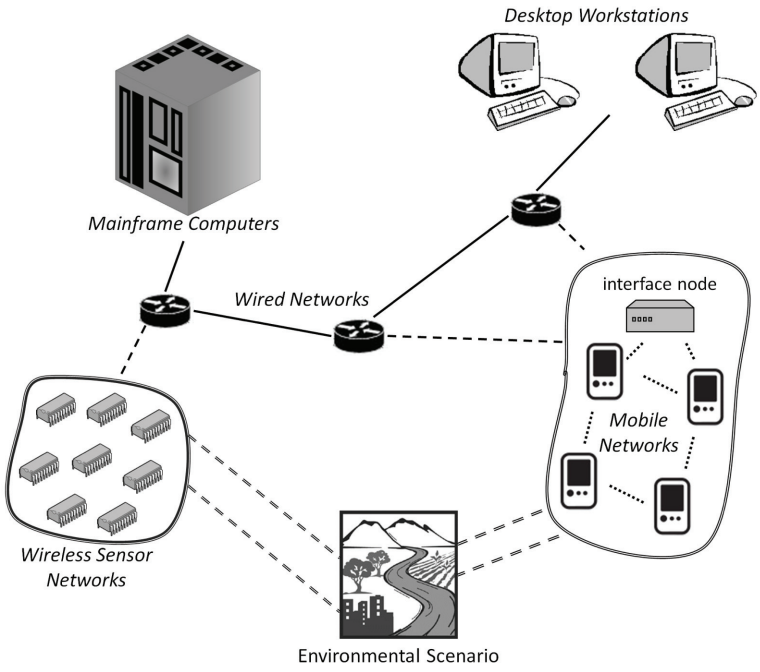
Figure 1. A schematic view of a Pervasive Grid infrastructure



INTRODUCTION

An increasing number of critical applications require the existence of novel distributed, heterogeneous and dynamic ICT platforms composed of a variety of fixed and mobile processing nodes and networks. Notable examples of such applications are (but not limited to) risk and emergency management, disaster prevention, homeland security and *i*-mobility. These platforms are characterized by full virtualization of ubiquitous computing resources, data and knowledge bases and services, embedded systems, PDA devices, wearable computers and sensors, interconnected through fixed, mobile and ad-hoc networks. Wireless-based platforms, enabling the robust, flexible and efficient cooperation of mobile components, including both software components and human operators, are of special interest. Users themselves are part of the distributed platform. These platforms, that aim to merge the features of *Pervasive Computing* and of *Grid Computing* onto a new emerging paradigm for heterogeneous distributed platforms, can be called *Pervasive Mobile Grids* (Hingne, Joshi, Finin, Kargupta, & Houstis, 2003; Priol & Vanneschi, 2008).

Figure 1 shows an abstract view of a Pervasive Grid platform, focusing on the heterogeneity of computing resources and on interconnection network technologies. The Pervasive Grid paradigm implies the development, deployment, execution and management of applications that, in general, are dynamic in nature. Dynamicity concerns the number and the specific identification of cooperating components, the deployment and composition of the most suitable versions of software components, processing and networking resources and services, i.e., both the quantity and the quality of the application components to achieve the needed *Quality of Service* (QoS). The specification and requirements of QoS itself are varying dynamically during the application, according to the *user intentions* and to the information produced by sensors and services, as well as according to