

Self-Configuration and Administration of Wireless Grids

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ABSTRACT

A Wireless Grid is an augmentation of a wired grid that facilitates the exchange of information and the interaction between heterogeneous wireless devices. While similar to the wired grid in terms of its distributed nature, the requirement for standards and protocols, and the need for adequate Quality of Service; a Wireless Grid has to deal with the added complexities of the limited power of the mobile devices, the limited bandwidth, and the increased dynamic nature of the interactions involved. This complexity becomes important in designing the services for mobile computing. A grid topology and naming service is proposed which can allow self-configuration and self-administration of various possible wireless grid layouts. [Article copies are available for purchase from InfoSci-on-Demand.com]

Keywords: Grid Computing; Grid Services; Mobile Computing; Wireless Network

INTRODUCTION

Foster (2002) offers a checklist for recognizing a “grid”. A grid allows

- Coordination of resources that are not subject to centralized control;
- Use of standard, open, general-purpose protocols and interfaces; and
- Delivery of nontrivial qualities of service.

The emergence of the Wireless Grid meets all these criteria and is fueled by technological advances in grid computing and wireless technology. The ultimate vision of the grid is that of an adaptive network offering secure, inexpensive, and coordinated real-time access to dynamic, heterogeneous resources, potentially traversing geographic boundaries but still able to maintain the desirable characteristics of a simple distributed system, such as stabil-

ity, transparency, scalability and flexibility. The technologies originally developed for use in a wired environment are now being augmented to operate in wireless situations. The development of the wireless technologies such as 802.11, GPRS, and 3G has extended the reach of wireless services to all the individuals. With the ubiquity and indispensability of wireless technologies established, these technologies are now making inroads into grids.

A wireless grid has to face added complexity due to the limited power of the mobile devices, the limited bandwidth, and the increased dynamic nature of the interactions involved. This added complexity has to be considered while designing service oriented architecture for mobile devices (Oliveira et al, 2006). This article highlights the key characteristics of the wireless grids and suggests various possible grid layouts. A grid topology and a naming protocol have been proposed to address the self-configuration and self-administration requirements of these grid layouts. This article is organized as follows. Section 2 describes the key characteristics of the wireless grids. Section 3 describes various possible grid layouts. Section 4 mentions the technical challenges associated with these layouts. Section 5 introduces a grid topology and a naming protocol to address the self configuration and self administration challenges. Section 6 concludes the article.

KEY CHARACTERISTICS

The development of the wireless grid technologies is governed by three driving forces:

- **New User Interaction Modalities and Form Factors:** Traditional applica-
- tions that can exist on the Wired Grid need to expand their scope by extending the interactions to mobile devices through adapting the user interface to small screens, small keyboards, and other I/O modalities such as speech. The mobile access interface needs to address the issue of connectivity of mobile devices.
- **Limited Computing Resources:** Wireless applications need to share the resources and to provide access to additional computational resources to mitigate the constraints imposed by limited storage, computational capability, and power of mobile devices.
- **Additional New Supporting Infrastructure Elements:** New applications, especially ones involving dynamic and unforeseen events, need to be addressed through the rapid provisioning of major amounts of computational and communications bandwidths. For example, the occurrence of an urban catastrophe could trigger a dynamic adaptive wireless network to alert people to organize remedial actions in a coordinated fashion, and to provide better control of available resources and personnel.

Grid Resources

A Wireless Grid must provide a virtual pool of computational and communications resources to consumers at attractive prices. Various grid resources are described below:

- **Computing Power:** Wireless devices possess limited computation power. Wireless grids can overcome this limitation by distributing the computational tasks across multiple power-

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