Towards a Middleware for Mobile Grids

Fabio Navarro, Alexandre Schultet, Fernando Koch, Marcos Assunção, Carlos B. Westphall
Networks and Management Laboratory
Federal University of Santa Catarina
Florianópolis, Brazil
{fnnav, schultet, koch, assuncao, westphall}@inf.ufsc.br

Abstract— In this paper we present a proposal of a middleware to integrate mobile computing with grid computing. We describe the support to be provided by the combination of the two technologies, propose a middleware to support the development and management of mobile grids, and discuss how this scenario contributes to the development of a new age of mobile service applications.

Grid applications; mobile computing; grid management

I. INTRODUCTION

The development of mobile services involves two problem domains: (i) the problem of the computational infrastructure for the implementation of services, which regards the hardware and software structure that facilitates the connection of mobile devices (devices, data transport system, and others) and service base intrinsic to this scenario (location identification service, fault tolerance services, and others) [5] and; (ii) the problem of service implementation itself, in which the developer challenge is to integrate the available computational infrastructure and create a solution to the problem of the scenario in question. Furthermore, as described in [7], mobile computing imposes a degree of complexity inherent to the environment, such as dynamic environments, mobility, computational resource limitations, latency and instabilities in data transfer, energy supply limitations, and input/output interface limitations.

Several studies are being conducted and approaches are being proposed to circumvent these problems. Amongst these, we can cite advances in the areas of (a) data communication, such as faster and more reliable networks [8]; (b) distributed computing, through processing distribution among client and server [2]; and (c) software engineering, with the creation of applications that adapt their behavior according to the resource limitations [4]. However, to date the proposed methodologies don’t offer a complete solution, and in this way they lead to ad hoc solutions, specific to the problem scenario being dealt. The lack of re-usability and homogenization causes incidental costs in the development of these applications.

Therefore, the question we try to answer in our work is:

How to provide an integrated and homogeneous solution to a mobile computing environment that allows communication, integration, and management of the applications running in this environment?

To answer this question, we believe in the integration of grid computing and mobile computing technology through a middleware for the development of mobile service applications. This middleware integrates the tools of grid computing – e.g., data communication, directory and service distribution, security, resource discovery, and resource allocation – providing the developer a set of reusable and homogeneous resources.

This paper is organized as follows: Section II provides the background of the problem. Section III proposes a system architecture and shows how it solves the problem. The paper concludes with section IV.

II. BACKGROUND

A. Motivation

Let’s consider the problem scenario proposed below:

A hospital institution wants to make available a decision support system to its medical body in which the interned patients vital data be available to the doctors in real time anywhere and anytime. There exist in the hospital sensors of vital data connected to devices that collect data from the patients in real time. These sensors transmit the data to a central through a local wireless network (e.g., Wi-Fi technology). There also exists actuator equipment, such as bed inclination controllers and others, which are connected in the same system. The hospital’s internal system is responsible for classifying and storing the data received from the sensors and managing the nodes (sensors and actuators). One of the requirements in this environment is a rigid standard of security, avoiding loss of data and unauthorized access. On the other side, there exists the hospital’s medical body, which will be equipped with Personal Digital Assistants (PDA) loaded with software that allows the access of the data being collected in real-time from the patients. The doctors can visualize the data from one or several patients at the same time and also program their personal assistants to monitor the data e raise alarms when certain conditions are reached. The PDA must also allow the access of other data from the institution and the communication between doctors, nurses, and systems making up a decision support system.

B. Analysis

Based on the above example, on the characteristics of the necessary computational infrastructure, and on the implementation of the application for this environment, we present the requirements for this problem scenario: