iMobile EE – An Enterprise Mobile Service Platform

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Abstract. iMobile1 is an enterprise mobile service platform that allows resource-limited mobile devices to communicate with each other and to securely access corporate contents and services. The original iMobile architecture consists of devlets that provide protocol interfaces to different mobile devices and infolets that access and transcode information based on device profiles. iMobile Enterprise Edition (iMobile EE) is a redesign of the original iMobile architecture to address the security, scalability, and availability requirements of a large enterprise such as AT&T. iMobile EE incorporates gateways that interact with corporate authentication services, replicated iMobile servers with backend connections to corporate services, a reliable message queue that connects iMobile gateways and servers, and a comprehensive service profile database that governs operations of the mobile service platform. The iMobile EE architecture was also extended to provide personalized multimedia services, allowing mobile users to remotely control, record, and request video contents. iMobile EE aims to provide a scalable, secure, and modular software platform that makes enterprise services easily accessible to a growing list of mobile devices roaming among various wireless networks.

Keywords: middleware, content transcoding, mobile enterprise, mobile devices, mobile multimedia services

1. Introduction

With the advances of wireless networking technologies and mobile devices, enterprises are looking for mobile solutions that empower their employees to work more productively while on the road. This paper describes iMobile Enterprise Edition (EE), a project that addresses research issues in building a mobile service platform that delivers end-to-end mobile solutions to large enterprises.

Several key issues arise in providing such an enterprise-level platform:

• **Scalable Services**: The platform must be able to handle a large number of service requests concurrently coming from various wireless and landline networks. Our initial aim is to handle up to 10,000 users and to ramp up to 200,000 users to accommodate the largest enterprises. The traffic mix may change dynamically and may include short messages from cell phones, instant messages, emails, and HTTP, WAP, and GSM short message service (SMS) requests.

• **Corporate Authentication**: Since mobile users frequently have access only to the public Internet or wireless networks, the platform must provide a gateway or tunneling solution to allow mobile employees to access corporate information on their intranet. This requires the platform to interact with corporate authentication services (such as Microsoft Windows domain authentication or RADIUS, Remote Authentication Dial-In User Service [26]).

• **Security Policy**: Since the platform will act on behalf of the mobile user to access corporate resources, the platform must obtain authorization based on the user identity, channel security, and corporate policy before accessing corporate databases, directories and email servers, etc. The platform should log resource accesses and operation details for accounting purposes.

• **Dependability**: The platform must be able to reconfigure itself dynamically when certain machines fail or become overloaded and continue to deliver services satisfying appropriate performance guarantees.

This paper is organized as follows. In section 2, we describe the logical view of the iMobile architecture, which reflects the actual implementation of the iMobile standard edition [25]. Section 3 describes how the original architecture was changed in iMobile EE to provide enterprise-level services, taking into account the issues described above. Selected issues in the design of iMobile EE are discussed in section 4, while section 5 provides concrete examples of complete applications implemented using iMobile EE as well as initial performance results. Section 6 discusses related work and section 7 concludes with summary and future work.

2. iMobile: Logical architectural view

As shown in figure 1, the original architecture of iMobile [25] implements three key abstractions: devlets, infolets, and applets. A devlet is a driver or a protocol adaptor attached to the proxy that receives and sends messages through a particular protocol (e.g., Instant Messaging, Short Message Service, WAP, HTTP, Email) running on a mobile device. An infolet is responsible for creating an abstract view of an “informa-
tion space” using an appropriate protocol (e.g., HTTP for the Web, JDBC for database access, X10 for home network control, and LDAP for directory services) to connect to a backend server. An applet implements the application logic by post-processing information obtained by the various infolets. The core of iMobile, the proxy engine, implements the basic framework for hosting devlets, infolets, and applets. It supports user and device profiles for personalization, performs appropriate content transcoding and adaptation, and invokes the proper applets and infolets to answer requests from a devlet. The iMobile architecture allows new mobile devices and protocols to be added to its framework without requiring any changes in the operational logic for information retrieval and delivery. iMobile effectively acts like a personal agent on the network that enables limited devices to access personalized mobile services. iMobile's modular architecture allows it to incorporate new devices and technologies as they become available. Unfortunately, the original iMobile architecture was not scalable or reliable, because the proxy acted as a middleman in every message transaction. Moreover, it was not integrated with corporate authentication services. In the next section, we describe how we designed the new iMobile Enterprise Edition to meet the challenges of scalability, reliability, and security.

3. iMobile enterprise edition

To address the needs of the mobile enterprise users, we redesigned the original architecture in several ways while keeping the original spirit of flexibility and modularity in iMobile. The new enterprise architecture is shown in figure 2. A mobile device always interacts with an iMobile gateway to access iMobile services. A gateway authenticates a mobile user and puts each service request on the message queue. Typically, a cluster of iMobile servers can then pick up messages from the message queue in a round-robin fashion. Each server hosts a set of infolets for backend connections to corporate services. Both iMobile gateways and servers interact with the service profile database, which governs the transcoding and content delivery processes. The iMobile architecture conforms to design specifications already popular in Java enterprise applications, such as JMS [30], JDBC [33], JNDI [31], Servlet [32], WebDAV [39], XSLT [41], and XML. This allows us to interface with a broad spectrum of products used in the enterprise world; ideally, iMobile EE would simply be an add-on to the existing infrastructure in an enterprise.

The following subsections describe each component of iMobile EE in greater detail.

3.1. Gateways

The original iMobile devlets are replaced by gateways, with each gateway hosting one or more devlets. Each devlet implements the corresponding protocol interfaces. The number of gateways can be dynamically adjusted depending on the traffic load. Each gateway implements a protocol and authenticates the mobile user against iMobile’s corporate authentication service. In the following, we will briefly describe some of the gateways in iMobile EE and demonstrate how the same AT&T Directory Service (Post) can be accessed from different gateways through the iMobile LDAP infolet.

HTTP/WAP gateway

The HTTP gateway handles HTTP service requests and associated user authentication (see section 4.4) from mobile devices. It also supports WAP\(^2\) [37], an open specification that offers a standard method to access Internet based content and services from wireless devices such as mobile phones and

\(^2\) The WAP forum has been renamed to Open Mobile Alliance. http://www.openmobilealliance.org/