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Universal Multiservice Networks

Third European Conference, ECUMN 2004
Porto, Portugal, October 2004
Proceedings

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Preface

On behalf of the Organizing and Program Committees of the 3rd European Conference on Universal Multiservice Networks (ECUMN 2004), it is our great pleasure to introduce the proceedings of ECUMN 2004, which was held during October 25–27, 2004, in Porto, Portugal.

In response to the Call for Papers, a total of 131 papers were submitted from 29 countries. Each paper was reviewed by several members of the Technical Program Committee or by external peer reviewers. After careful assessment of the reviews, 53 papers were accepted for presentation in 13 technical sessions; half of them originated from countries outside Europe (mainly Asia). This illustrates the strong interest of this conference beyond its original geographical area.

The conference program covered a variety of leading-edge research topics which are of current interest, such as wireless networks, mobile ad hoc networks, sensor networks, mobility management, optical networks, quality of service and traffic, transport protocols, real-time and multimedia, Internet technologies and applications, overlay and virtual private networks, security and privacy, and network operations and management. Together with three plenary sessions from France Télécom, Siemens, and Cisco Systems, these technical presentations addressed the latest research results from the international industry and academia and reported on findings on present and future multiservice networks.

We thank all the authors who submitted valuable papers to the conference. We are grateful to the members of the Technical Program Committee and to the numerous reviewers. Without their support, the organization of such a high-quality conference program would not have been possible. We are also indebted to many individuals and organizations that made this event happen, namely IEEE, EUREL, SEE, Order of Engineers, Institute of Telecommunications, France Télécom and Springer. Last but not least, we are grateful to the Organizing Committee for its help in all aspects of the organization of this conference.

We hope that you will find the proceedings of the 3rd European Conference on Universal Multiservice Networks in Porto, Portugal a useful and timely document that presents new ideas, results and recent findings.

October 2004

Mário Freire, Prosper Chemouil, Pascal Lorenz and Annie Gravey

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The 4GPLUS Project, Overview and Main Results

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Abstract. A 4G-environment is based on the integration of 3G mobile and other wired and wireless technologies into an all-IP network environment. Central to such an environment is a 4G-service platform, which offers services such as AAA, mobility management and session control, and also mediates between the users and providers of these services. Each service platform and its associated users, service providers and access networks constitute a service platform domain. Extension of offered functionality and expansion of coverage is obtained by federation between multiple service platform domains. In the 4GPLUS project a conceptual framework is developed for 4G-environments, which specifies the functionality and structure of the 4G-service platform and the concept of federation. Several key aspects of this framework have been refined, implemented and prototyped within this project. This paper provides an overview of the 4G-concepts developed within the project and the main results achieved.

1 Introduction

Current communication infrastructures comprise fixed networks (e.g. Ethernet and ADSL), mobile Wide Area Networks (e.g. GPRS and UMTS), Wireless Local Area Networks (WLAN) and their associated terminals. Services supporting all kinds of media, such as voice, video and data, are offered over these infrastructures by an increasing number of providers. Examples are voice over IP provided by telephony providers, conferencing services and multimedia streaming. Though these communication infrastructures have capable functionality, they fail to meet obvious upcoming user requirements: users are *technology agnostic*, they want to have *universal access* to their services, and their *services should be adapted* according to the context and/or their personal preferences [16]. In order to meet these user requirements, the following system requirements must at least be imposed on a supporting infrastructure. The first is *seamless mobility,* which includes hand-overs to other terminals, to other access networks as well as to other administrative domains. The second is *generic access* including authentication and authorization for both network access and service

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access. The third is *session control* including session negotiation as well as session adaptation.

The design of a supporting infrastructure meeting these requirements is the topic of the 4GPLUS project [1,4]. Such an infrastructure is generally denoted a 4G-environment. The design includes a framework that integrates network and service architecture. Central to the service architecture in 4GPLUS is the service platform, whose (distributed) generic software components provide feasible technological solutions for meeting the user requirements mentioned above. To implement our architectural framework, we combine and extend existing technologies. Also, we introduce new business opportunities without taking away assets from current operators and a new enterprise model that supports our solution.

In this paper we will explain our vision and solutions on facilitating software infrastructures for the 4G-environment and highlight results that we achieved within the 4GPLUS project. The remainder of this paper is structured as follows. A concise overview is given of the 4G-environment and the impact that the introduction of this 4G environment has on the current enterprise model. An end-user scenario illustrates the issues that have been addressed by the 4GPLUS project. These issues, i.e. mobility management, session control, federation and service provisioning, are described with references to papers, presentations and reports [20-25] published earlier. Our conclusions are given in the final section.

2 4G-Environment

A 4G-environment in the context of the 4GPLUS project consists of: (a) access networks of different technology types including wired (e.g. xDSL) and wireless networks (e.g. UMTS and Wi-Fi™); (b) next generation mobile terminals with a wide range of communication, computing and storage capabilities; (c) a rich set of (3rd party) services that offer value added services to mobile end users across these heterogeneous networks and terminals, and; (d) service platforms for development and provisioning of services.

Functionally, the 4G-environment adheres to a 3-layered model consisting of an application layer, a service control layer and a transport layer [24]. The transport layer consists of heterogeneous access networks and core networks. The application layer contains all application logic needed to provide services from 3rd Party Service Providers (3PSPs) to end-users. The service control layer is logically located between the application and transport layers and shields the network heterogeneity for the different parties. The service control layer is made up of service platforms interoperating through federation [2,5,9,24].

Fig. 1 shows a schematic structure of the 4G-environment, including the three layers mentioned above. There is global IP-connectivity between all networks and all end-to-end communication is IP-based. The IP packets exchanged between access networks and the core network are assumed to have globally routable IP addresses. End users, 3PSPs and service platform operators are the end points connected to these access networks. The services provided in the application layer range from user-to-user services, such as telephony, to user-provider services, such as content retrieval services.

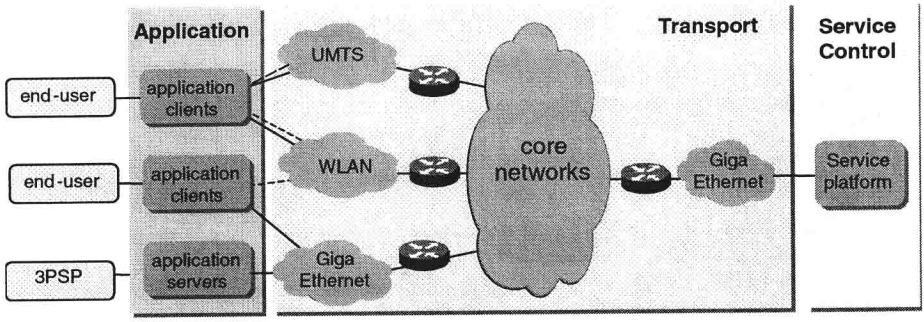

Fig. 1. The physical structure of a 4G-environment

The service platform(s) in the control layer offer(s) service control functions that enable end users to easily gain and maintain access to (new) services, while roaming between different access networks and terminals. For 3PSPs, a service platform acts as a one-stop-shop for providing their services to end-users and hides the changes of access networks and terminals due to roaming of end-users. For access networks, a service platform provides control functions for transport outsourcing services. Ref. [5] describes how service platforms and the envisioned federation among them realize the service control functionality.

3 4G-Enterprise Model

The current enterprise model for Internet access business is inadequate for 4G-environments, and therefore needs a revision. We first analyze in what respects the 4G-environment differs from the environment of current Internet access business. Based on these observations, an enterprise model for 4G-environments (4G-EM) is proposed. Finally we elaborate on the central role in this new enterprise model, i.e. the Service Platform Provider (SPP).

The current enterprise model for Internet access is shown in Fig. 2.a. The role of the Internet Service Provider (ISP) needs some explanation. The currently known ISP is not an atomic role. Rather it is a functional composition of three roles [18]. By offering services such as e-mail, web hosting, virus scanning and the like, the ISP performs the role of an Application Service Provider (ASP). Since the ISP has, in most cases, contact with the customer and sends the bills, it also performs the role of the packager. Finally, the ISP takes care of naming and addressing and thus of IP-address allocation. Therefore, it also plays the role of Internet Communication Provider (IP-CP). It is assumed that each ISP has its own range of public IP-addresses.

Opposed to the current Internet access business, the 4G-environment is in many cases an open service environment. By exporting interfaces to 3PSPs in a standardized way, the SPP introduces a new kind of functionality. Notice that the 3PSP role is similar to the ASP role. The difference is just a matter of parlance. Also, both personal and terminal mobility are supported by a 4G-environment. This means that the association between a customer and an access network, and thus the IP-edge, is a dynamic one rather than a permanent one.

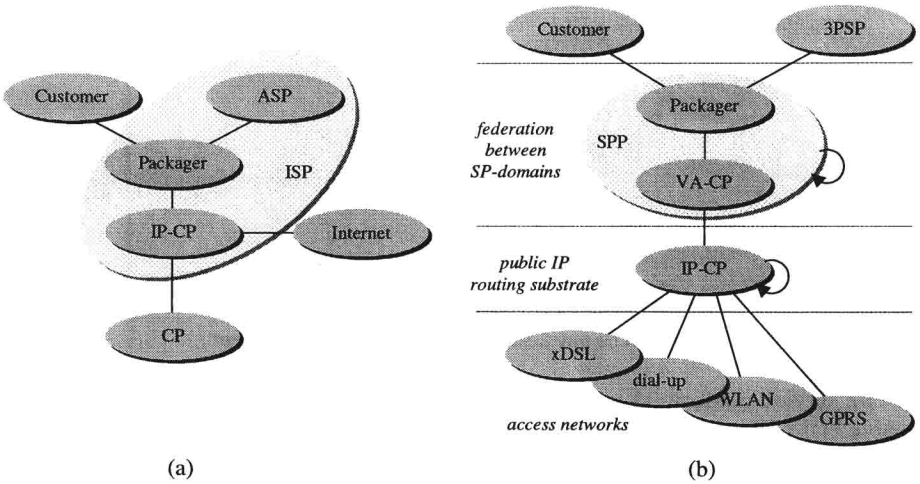

Fig. 2. Enterprise models for (a) the current Internet access business, and for (b) the 4G-environment

The 4G-EM shows some salient aspects of 4G-environments as defined within the 4GPLUS project, namely the incorporation of all kinds of access networks, the use of public IP as the common transport technology, the federation between SP-domains, and the various 3PSPs that take the role of ASPs. The SPP role entails three major aspects, as shown by the decomposition of this role in Fig. 2.b:

1. *value-added IP-connectivity provider (VA-CP)* – In addition to simply issue IP-addresses and process AAA, the SPP can provide mobility, session control, profile management, personalization and QoS-management.
2. *packager* – The SPP performs the packager role and thus offers the services of the 3PSPs and the access network providers within its domain to the customers. The relation of an SPP with multiple access networks and multiple 3PSPs makes it a one-stop-shop for customers.
3. *one-stop-shop for 3PSPs* – Due to federation with other service platform domains and its role as a packager, the SPP is a one-stop shop for 3PSPs. 3PSPs need to have a relation with only one SPP in order to get a much larger 'audience'.

4 End User Scenario

Following the descriptions of the 4G-environment and the 4G-enterprise model we now introduce an end-user scenario that provides links to the concepts that have been developed within the 4GPLUS project.

John is an end-user (customer), who has a subscription with a public SPP, and who (also) has IP-connectivity via his corporate domain in his employee-role. The public SPP domain and corporate domain, including the involved parties, are depicted in the scenario environment of Fig. 3. The SPPs provide John with access to a number of different access networks and services, offered by different CPs and 3PSPs. In the fol-

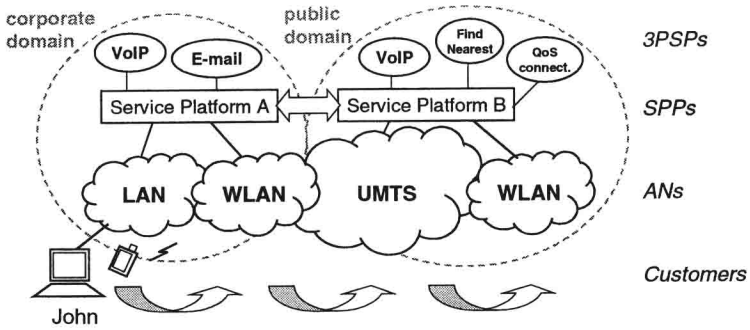

Fig. 3. Overview of the scenario environment

lowing scenario description this is elaborated upon. Further, with superscripts we refer to the sections that follow, where we describe the specific 4GPLUS concepts and results, being:

A. federation: enabling access to services across administrative domains;
B. mobility management: handling the mobility of the user (equipment);
C. session control: controlling sessions in a heterogeneous network environment; and
D. services: providing support for value added services.

John is planning to go home when he receives a video call from his wife[C.1, B.1]. He answers the call using his fixed videophone. Since he was just about to leave the office, he transfers the call[B.2] to his PDA that is connected to the corporate WLAN network[A.3,B.3]. According to company policy only audio calls are allowed[C.2] and the video is dropped[C.1]. Meanwhile, John can continue[B.2] the conversation with his wife; she reminds him on her mother's birthday coming up and asks John to buy a gift on his way home. While John leaves the office premises his call is seamlessly handed over to the UMTS network[A.1,A.2,A.3,B.2,B.3].

He walks over to the railway station where a Wi-Fi™ hotspot is available[A.1,A.3]. When he accesses the network[B.3] he is notified of the cost. A local service[D] provided by the railway operator informs him[A.3,D] on the delay of certain trains. This provides John with sufficient time for buying a present. He finds a nearby gift shop using the FindNearest service[A.3,D]. John's preferences indicate he likes to be notified about interesting offers while being in a shopping center and he receives a number of advertisements before arriving at the gift shop[A.3,D]. Once there, he cannot make up his mind on the best present. On the spot he sends three picture-messages[C] to his wife and she – knowing her mother best, selects the appropriate gift.

The railway service reminds him to get back to the railway station to catch his train. In the 45-minutes train trip John spends his time on reading the latest news and his private e-mail. He also views the video clips that were recorded by his personal video recorder during the day[C]. Suddenly he remembers he forgot to send an important e-mail message to his colleague Jan. Although he is not in his corporate domain, he has access[A.1,A.3] to all corporate services and is able to send the e-mail[A.2]. When he gets home, his PDA automatically obtains access to his private WLAN[A.3,B.2,B.3], which now is being used to receive all private telephone calls[B.1].