

Network-centric Context-aware Service over Integrated WLAN and GPRS Networks

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Abstract: In order to bring together the higher speed of WLAN and the wider coverage of GPRS, solution from service's perspective is necessary. And this kind of integrated service should be context-aware in order to automatically adapt itself to the changing environment. This paper proposes to explore the applicability of using network-centric context-aware service to integrate WLAN and GPRS network environments. Starting from typical scenario description and requirement analysis, a policy-based context model is presented, which takes into account the real implementation of context-aware service in the underlying networks. A context-aware service scenario called *Modern Professor* is explored to exemplify this methodology based on the policy-based context-aware service system architecture. This paper presents part of the work ongoing in European Union IST project CONTEXT.

Keywords: Context, Context Modeling, Context-aware Service, Policy-based management

I. BACKGROUND AND RATIONALE

As the hardware and lower-level structures and protocols of wireless networks get mature, the demands from higher-level applications and services are rapidly growing, especially when WLAN technology becomes increasingly popular for providing IP connectivity and GPRS is undergoing large deployment stage. The integration of WLAN and GPRS technologies has attracted plenty of researches aiming to bring together the higher speed of WLAN and the wider coverage of GPRS. This paper tends to address this challenge from the service's perspective by providing context-awareness to the integrated services operating on WLAN and GPRS networks. We believe the essence of these wireless applications or services is the ability of being *context-aware*.

Having a wider scope than *location*, *context* refers to the physical and social situation in which computational devices are embedded [1]. *Context-aware service* (CAS) is more flexible and autonomous so as to respond accordingly to the highly changing computing environments such as location, terminal size, and network features etc without disturbing end user. For example, a cell phone will always vibrate rather than beep during a meeting, if the system can know the location of the cell phone and the meeting schedule. While most of the researches on context-aware computing focus mainly on the human-computer interface (HCI) [1, 2], this paper tends to tackle the context awareness from the perspective of networks, i.e., *network-centric* context-aware services. The networks include both wired IP networks and wireless networks.

To facilitate the provision of context-aware services, apart from an appropriate infrastructure to gather, manage, and disseminate context information to services, the design and development of a context model that takes into account the

service and network management is even more important. This context model serves as the basis for CAS system infrastructure. This paper explores the applicability of *policy* for the representing of context in context-aware service.

The reason why policies are employed for context modelling is partly because we want to take into consideration the implementation of context-aware services in the underlying networks where policy-based network management (PBNM) is widely regarded as a promising means. Policies are seen as a way to guide the behaviour of a network or distributed system through high-level declarative language in PBNM field, which has been the subject of extensive research as a new network management method over the last decade [3, 4]. As many research works have shown, PBNM technology can relieve network administrator from the burden of configuring every single device manually and it is more flexible since administrator can reconfigure network elements by just giving or changing policies.

On the other hand, in order to provide context aware services, contextual information need to be represented, stored, and maintained. Context information are usually complex, changing, layered and related to each other, which means the use of context information needs complex decision making. Policy-based method fits well to these features of context. Regarded as an extension of PBNM, policy-based context modelling can consist very well with the underlying PBNM thanks to the common policy-based schema.

The content of the paper is structured as follows. After the scenario description in Section 2, Section 3 discusses the requirement of context modelling and context-aware service system in term of context definition, context classification and policy specification. Then policy-based context modelling and CAS system architecture are presented in Section 4 and 5 respectively. Before conclusions and future work in Section 7, Section 6 presents the implementation of scenario mainly by means of workflow.

II. SCENARIO DESCRIPTION

A typical network-centric context-aware service called *TEANU* (Transparent Enterprise Access for Nomadic User) is described, which uses both WLAN and GPRS networks.

This service tends to provide a means for nomadic user to maintain the *secure* access to his enterprise network *transparently* after the user has registered for context-aware services from context-aware service provider.

Consider Thomas, a medical professor in a famous university always with a busy schedule for medical consultation around Europe. Thomas works from home