Chapter 15

QoS–Predictions Service: 
QoS Support for Proactive Mobile Services

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ABSTRACT
The success of emerging mobile services depends on the serviceability of the underlying wireless networks, expressed in terms of Quality of Service (QoS) provided by a network available to service user at a given geographical location and time. In general, this serviceability is a priori unknown. As a solution the authors propose a QoS-predictions service, providing predictions of QoS of networks available at a given user’s geographical location and time. In a case study they prove the feasibility of deriving predictions from historical data collected by a mobile service user. They have chosen this mobile user to be a patient, who uses a personalized health telemonitoring service in his daily environments for a period of one month. They consider the QoS-predictions service as a novel support for mobile services operational in 4G heterogeneous network environments.

INTRODUCTION
The emergence of new wireless broadband networks and diverse miniaturized and personalized networked multimedia devices has given rise to a variety of new interactive mobile applications and mobile services (Hansmann et al., 2003). These new applications allow the mobile users to not only access information anywhere-anytime-anyhow, but are also able to adapt their functionality based on different context information. This information can range
from user-related context, like user profile, role and activity and geographical location and time, to device-related context, like available network interfaces or screen size and resolution, and up to the network-related context, like network signal strength and its current load. By having access to rich context information, mobile applications are able to adapt themselves and increase the quality of the user’s experience (defined as QoE by (ITU-T, 2007b). Although user and device related context information are to a great extend available to the applications, network related context information (i.e. Quality of Service (QoS by (ITU-T, 1993, 2008)) provisions) is only roughly and approximately available (Chalmers & Sloman, 1999a).

Current trends are that mobile applications become highly interactive, and users become highly mobile, using different underlying networks as available in his environment (Ortiz, 2007). Hence, the success of application service delivery depends upon QoS provided by these underlying networks, which tend to be highly heterogeneous (Chalmers & Sloman, 1999b). In this situation, we consider that one of the most critical elements contributing to an improvement of mobile applications and services functionality is precise information about the QoS provided by these underlying networks. This information can be used for the application’s QoS management and assurance of user satisfaction.

Today’s wireless network providers (for example Mobile Network Operators (MNOs)), provide coarse-grained, marketing-based, static QoS information about their networks (e.g. network nominal capacity), refusing to give any detailed information to mobile users, mainly due to marketing reasons (Gomez & Sanchez, 2005). As a result, mobile applications base their QoS management and adaptation on best case scenarios for networks’ QoS, as derived from the network’s nominal capacity. Moreover, some mobile applications are using the signal strength to estimate the networks QoS; still this does not provide any information on, e.g. actual network congestion. Taking into consideration that the mobile users are by definition moving in space and time, the task of managing QoS by figuring out and trying to anticipate QoS of the underlying wireless network(s) on a continuous basis becomes impossible, leading to worst case scenario assumptions and lowering the QoE of the user provided applications and services.

On the other hand, mobile users are no longer passive information and content consumers but are now able (and willing) to create themselves new geo-referenced information and content and make it available to other (mobile) users. Many mobile collaborative applications (i.e. so-called Mobile Web 2.0 applications (Lin, 2007; O’Reilly, 2005)) are available on the market today allowing mobile users to exchange geo-information like points of interest, virtual geo-tags or geographical locations of traffic radars and so on (Want et al., 1999). Based on the need of the emerging mobile applications to have access to high quality fine-grained QoS information, and the ability of users to create and share geo-referenced information, we conclude that nowadays it is possible for mobile users to create and share any QoS information in a fully collaborative way. In particular, sharing information regarding fine-grained QoS provided by wireless networks at given geographical locations and times, as observed when using a particular application. This information can be further used for predicting the QoS, which in turn could be used by demanding mobile applications to choose the most suitable network and adapt themselves to provide services to the users on a higher QoE level. As for precise geographical location-determination techniques, many of them are currently available, and even more are emerging (Hightower & Borriello, 2001).

Towards this direction, we propose a platform for a QoS-predictions service. It is based on the Mobile Web 2.0 paradigm and supports collection of reliable, user- and application-transparent information about network provided QoS. Based on this information set, the service provides...
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