

Subscription Management and Charging for Value Added Services in UMTS Networks

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Abstract

In this paper¹ we propose a novel architecture for value added services provision in UMTS networks. The key idea is to introduce a model, which is capable of handling efficiently subscription management, as well as charging, billing and accounting for value added services that are provided either by the network provider or third trusted parties. We propose a flexible business model inline with the arising requirements for openness and dynamic subscription and introduce an integrated system that employs a flexible charging scheme for each type of service usage (transport and value added), so that the user will receive only one itemised bill for all services. As a result, the user is able to access a large number of services provided by independent providers, without the need for any additional contracts.

1. Introduction

Until recently, the range of services offered to mobile subscribers was rather limited, with the majority of revenue coming from voice telephony and a small proportion from short message services (SMS) and circuit-switched data. However, the evolution of UMTS, which combines the IP world with the telecommunication services, is leading to innovative new products and services, such as multimedia message services (MMS) and value added services (VAS).

The introduction of IP based services will enable the creation of an open market, with a large number of independent Value Added Service Providers (VASPs), who will deploy their services through a limited number of UMTS network providers. This is also a challenge for the mobile operators to increase their revenue.

However, in modern societies, a growing number of citizens become members of various organisations, groups, clubs, societies and associations, in order to receive special treatment arranged for them, such as credit, pass-permit, etc.

The entities involved in the area of telecommunications are the user, the mobile operator, the VASP and optionally the membership organisation.

Openness and unobtrusive regulations will attract business players as well as foster joint ventures. This evolution leads to the necessity of new business models that will enable the automation of the relevant procedures and the introduction of flexible models for the charging of these new services.

In this paper, we propose a flexible business model that fulfils the arising requirements for openness and dynamic subscription. As a result, the user will be able to access a large number of services provided by independent VASPs, without any additional contracts. In addition, we propose that the mobile operator could play the role of the third trusted party between the users and the VASPs, ensuring that the user will receive only one itemised bill for all services. In case the user is subscribed to a membership organisation, additional benefits could be provided to him/her. We also introduce an integrated system that employs a flexible charging model for each type of service usage (transport and value added).

The rest of this paper is organized as follows. In section 2 we describe the proposed business model, while in section 3 we briefly present the required

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enhancements to the UMTS network. In section 4, we present the details of our proposed model for VAS provision and in section 5, we illustrate the introduced system that has been developed for charging, billing and accounting. Section 5 concludes the paper.

2. Business Model

According to the proposed business model the user comes to an agreement with a mobile operator that covers issues such as pricing models and tariffs for the usage of transport services, provided by the UMTS network provider and rights of access to additional services, provided either by the mobile operator or independent VASPs. In addition, a user may have subscribed to a membership organisation and therefore be eligible to the benefits offered to him/her due to his/her membership status.

The mobile operator may have business level agreements with service and content providers so that services and contents with additional value are delivered on top of the UMTS network infrastructure.

The VASPs produce applications that employ services and contents as well. Since these are information services, a VASP should use transport services offered by the UMTS network provider as a delivery mechanism. Therefore, the existence of a commercial agreement between VASPs and mobile operators is necessary for the VAS provision. A VASP may delegate management services such as billing and security to the mobile operator. Furthermore, a VASP could have a commercial agreement with a number of membership organisations.

The membership organisation is an entity that offers benefits to its subscribers/members. To this end, it comes to agreements with several VASPs for preferential treatment of their subscribers/members.

Figure 1 illustrates the proposed business model, according to which the service provision must be dynamic, flexible and transparent to the user. The user does not have to be subscribed to a VASP before using its services, in contrast to the current models, where the service provision is more or less restricted by the static bond between subscription and service access.

In addition, a VASP is able to add new services, to remove others and to change the tariffs according to which the users are charged for its services, dynamically. The user is informed by the mobile operator for all the available services and the respective tariffs for each one. In case a user is subscribed to a membership organisation, the list of services and the tariffs may be different for such a user (special offers). If the information about such memberships is included in the profile kept for the specific user at the operator's

side, user membership status is taken into account during inquiry of the available services and the respective tariffs.

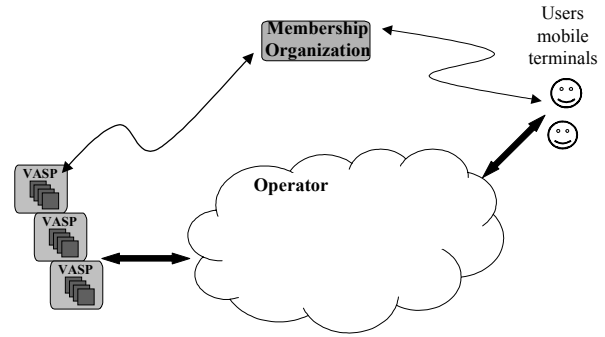


Figure 1

Although the tariffs and the pricing model, according to which a user is going to be charged, are defined by the VASP, it is the mobile operator that provides the necessary infrastructure and network components.

3. Enhanced UMTS Network

As already stated, in addition to transport services, the mobile operator will also provide users with access to various services and applications. In order to fulfill the provision of such services the network provider should enhance the standard UMTS network infrastructure [1] [2] with 3 basic schemes, the Users and Services Manager (USM), the Metering Device (MD) and the Charging Accounting and Billing system (CAB), as shown in Figure 2.

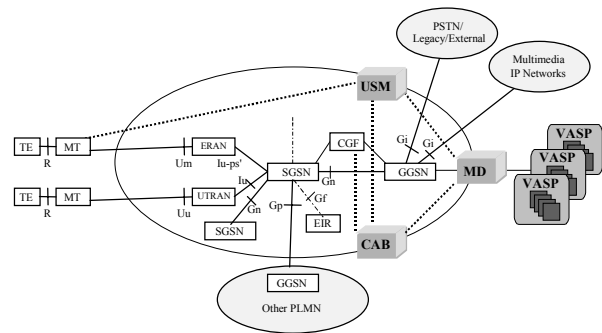


Figure 2

The introduced entities are IP nodes that do not affect the underlying infrastructure, but they should be within the mobile operator administrative domain. These nodes implement the mechanisms that realise innovative management services, such as dynamic

introduction of new VASs, service discovery and flexible charging and billing.

The USM is an entity that coordinates the provision of the VASs [3] [4]. The VASP should communicate with USM in order to add, update or remove a VAS. Therefore, it contains all the necessary information (description, tariffs, pricing model and resource requirements) for a VAS and has the responsibility for formulating the list of available VASs in order to inform the users.

The MD is an entity that monitors IP flows, sending reports that contain the required details for the services' usage (session protocol, application port, transport protocol, DSCP etc.). It should be placed in the edge of the core network in order to monitor all transit traffic, as shown in Figure 2. The MD could actually be a Layer 4 SmartSwitch-Router [5] [6] that examines data over the IP layer and provides the required information to the CAB.

The CAB is an entity that collects all the necessary charging information in order to charge the users for the consumption of transport services provided by the network operator, as well as for VAS provided by independent VASPs. In addition the CAB calculates the portion of revenue that is due to the VASPs of their VASs usage.

4. The proposed model for VAS provision

Figure 3 illustrates the proposed model as is applied to the enhanced UMTS network.

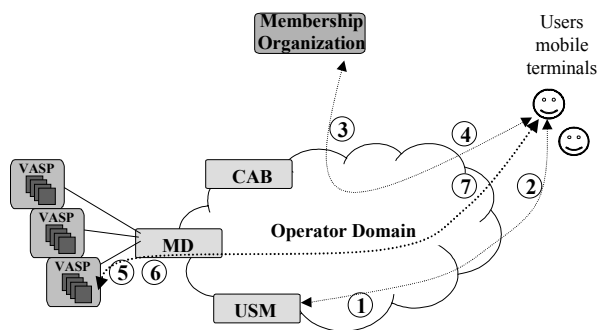


Figure 3

1. The user requests a list of the available VASs from the USM, which is constructed after taking into account the user profile and the membership status of the specific user.
2. This list is sent to the user along with information about the respective charges, which in case of membership may be different.
3. If the user selects a VAS that offers him/her preferential treatment due to his/her membership

status, the USM automatically imposes the user/member to connect to the membership organisation. This will lead to user authentication against the membership organisation information system and instrument (ticket) acquisition that will prove his/her membership [7].

4. If the authentication process completes successfully, the membership instrument, which is an attribute certificate that proves his/her membership status, is sent to the user/member.
5. The membership instrument, which is valid for a certain short period of time, is then forwarded to the VASP's information system along with the request for the VAS. Once the ticket is accepted by the VASP, the user exercises his/her special rights.
6. The user is able to communicate with the VASP in order to execute the selected service and get the requested contents.
7. As soon as the data transfer starts, the MD meters the VAS IP related traffic and creates the appropriate records that are sent to the CAB. In addition, the UMTS network nodes (i.e., SGSN, GGSN) [8], [9] collect the charging information that concerns the transport service usage provided by the mobile operator. This information should also be delivered to the CAB in order to calculate both transport and service usage.

The 3, 4 and 5 steps could be omitted in case the user selects a VAS to which he/she has no special rights, either he/she is member to a membership organisation or not.

5. Charging, Billing and Accounting

The CAB is an integrated system that has the overall control of Charging, Billing and Accounting. It aims to fulfil the arising requirements for flexible charging, fair billing and generation of one itemised bill for all services. It consists of 3 major components that execute the respective processes [10], as shown in Figure 4.

Charging is the function whereby call information is examined and processed in order to determine the usage for which the user will be billed.

Billing is the function whereby the records generated by the charging function are transformed into bills requiring payment. Tariffing information, as well as pricing policies are necessary information during the billing process.

Accounting is the process of the calculating the sharing of revenue amongst operators (in case of roaming) and VAS providers for the usage of their services.

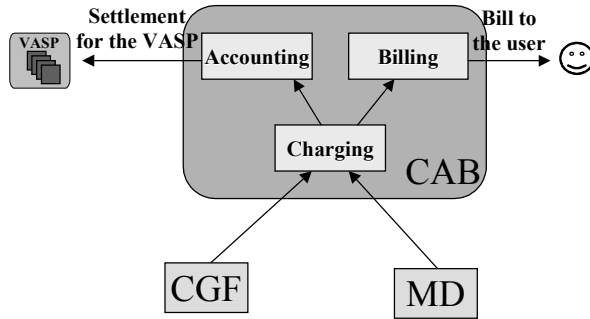


Figure 4

The charging component receives Value Added Service Detail Records (VASDRs) produced by the additional network component, MD; these records are related to the VAS usage. It also communicates with the CGF² [10] [11], from which it receives Call Detail Records (CDRs) related to the core and access network chargeable events, in order to re-use existing functionality and to minimize modifications in the other network components (i.e., SGSN, GGSN).

The Charging component receives these records from the MD and the CGF, correlates the related information for each user and queries the USM for the tariffs related to the services a mobile user is executing.

The Billing component proceeds with the calculation of charges for the user, based on the respective tariffs and the appropriate pricing model, while the accounting component completes the process by calculating the portion of revenue that is due to the VASP.

The proposed charging model is an innovative layered one that enables the separation of charges to Access and Transport ones (for the access and the use of the operator's network) and to Service and Content charges (for the usage of the specific VAS and the exchange of the contents) [12]. The existing charging schemes [13] can calculate only the first category, since the operator's CGF creates CDRs that are forwarded to the CAB in order to calculate the charges that are due to the operator for the VASs usage.

Currently, there is no scheme that can provide differentiated charging records for each VAS. This is achieved with the introduction of the MD that meters the flow and generates different records for each VAS usage that contain the charging information needed by the CAB in order to implement a "fair usage" layered charging model for the VAS usage.

As we have already mentioned, a user can be eligible to special rights (e.g. lower prices) if he/she has subscribed to a membership organisation, which has such an agreement with a VASP. If the user selects a VAS using his/her membership status, this will be

taken into account during the billing process. In such a case the USM provides the lower prices, when the CAB queries it for the tariffs related to the service the mobile user/member is executing.

6. Conclusions

In this paper we have introduced a model, which is capable of handling subscription management efficiently, as well as charging, billing and accounting for value added services that are provided either by the network provider or independent VASPs.

We proposed a flexible business model inline with the arising requirements for openness and dynamic subscription and introduced an integrated system that implements a flexible charging model for each type of service usage (transport and value added), so that the user receives only one itemised bill for all services.

As a result, the user is able to access a large number of services provided by independent providers, without any additional contracts.

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² Charging Gateway functionality

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