Accounting in Next Generation Mobile Networks

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Abstract

In this paper we present the main differences in charging terminology between the Internet and mobile telecommunications world, than we discuss the principle requirements about accounting in mobile networks. After presenting some business charging models, we discuss our real-time charging model and give some future plans about testing and its implementation facilities.

1. Introduction

Nowadays we are witnesses of a rapid development of the mobile technology. With the appearance of 3rd generation mobile networks (UMTS) and up-to-date devices on the market it will be possible to introduce those services which have only been used through wired environment, like the IP-based video-conference, the real-time or on demand sound and video broadcasting. These new services need new charging and billing methods, which are familiar with packet-based approach. And it is very important that in the future there will be a large number of independent network operators and service providers.

Introducing these new multimedia services may enlarge the network traffic and will increase the number of QoS-sensible connections. The used charging method has to take in account the size and the QoS parameter of data streams arriving to the users. Counting, processing and transmitting all these additional informations may cause overhead in the network. Therefore it is a better way to estimate the size of real-time data stream and to be capable monitoring instantaneous the QoS parameters. The large number of pre-paid cards make necessary that the charging methods have to be capable to process these algorithms in real-time and to keep track online the account of each user.

2. Charging difference between Internet and Mobile Networks

The charging, billing and accounting schemes used in the Internet have been quite simple until now. Users have been mainly billed with a flat rate, based on their subscription and/or the duration of their connection for accessing the Internet. In mobile telecommunication networks, users have been mainly billed on their subscription and the call duration, as well as a number of other parameters (e.g. type of communication, location and destination, etc.). In the near future these schemes are expected to receive modifications as a consequence

of recent technological advances combined with the emerging dominance of the Internet Protocol. [3]

Although IP is the glue that will tie together the Internet and mobile networks, the business model and the related charging frameworks considered by the two communities are diverse in view of the placement and management of the charging functionality. Thus, the Internet community considers a business model that requires direct agreement between the user and independent provider, while the telecommunications world insists on the operator-centric model. These communities have been working separately for many years and therefore there are many differences even in the respective terminology. [3]

The Internet research community has focused more on the protocols used for accounting data exchange, while the mobile world paid more attention to the specification of the network entities that should generate, process and collect charging information. Since both worlds are converging and new dynamic links are now possible with the application/service providers, it is crucial that a minimum compatibility is achieved between these systems. Thus, effort should be made in order to align the accounting protocols and even new advanced functionalities such as content and location-based charging. [3]

3. Billing requirements in Mobile Networks

To bypass a complicated charging architecture, a multi-level charging architectural approach structured in several levels is proposed in 3GPP. The management and processing of the relevant information should be made separately for each level. Furthermore, different charging models should be applicable on each charging level. [3]

In such a charging architecture, subscribers require the provision of "one-stop billing". Users would like to receive a single itemized bill for using voice and data services offered by network operators and independent application or service providers. This requirement implies that the network operator would be responsible for collecting charging data from all players and billing the users. Another requirement is that the charging information should be in a form easily understood by the average user. Also the users should be constantly aware of the charges to be levied for each chargeable event. [2],[3],[5]

On the other side, the mobile operators require a flexible charging architecture, that accommodates various pricing models (e.g. time-based, volume-based, QoS-based, etc.) in order to fulfill not only the traditional business models but also innovative ones. In addition, the selection of a specific pricing model could be possibly based on the user and the service profile parameters. Another important requirement, imposed by the mobile operator is the support of both pre-paid and post-paid charging mechanisms. [4]

From the independent application or service providers' perspective, the evolving requirement is that each authorized player should be able to dynamically apply the desired pricing policy for its services' usage. The independent providers should be able to add or modify tariffs for the service and content portion. This dynamic modification should be made in a standardized

way in order to update whichever entity will handle the charging, accounting and billing functionality. [3]

4. 3G Business Models

4.1 Network Operator Centric Business Model

In the network operator centric business model (Figure 4.1) the customer has a direct relationship with the network operator. The network operator sets the prices of the services and handles the payments.

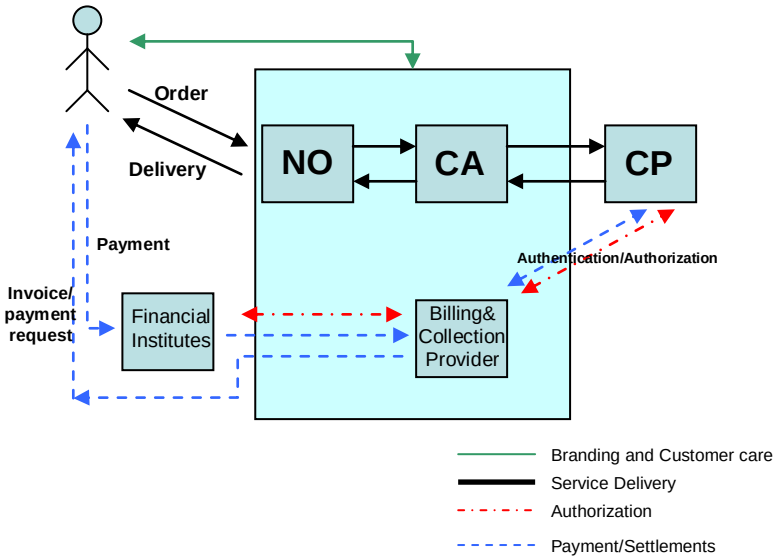

Figure 4.1: Network Operator Centric Business Model

The content is normally acquired wholesale from content providers or home-made by the network operator itself. The network operator therefore manages its own content aggregator role. Services are in many cases offered as bundled packages as part of subscriptions. Besides "traditional" event charges, new charging techniques may develop that handle the same basic process but in real time. Network operators will use this model to increase ARPU and retain their customers. External parties involved may be content providers and financial institutions. [1]

4.2 Content Aggregator Centric Business Model

The content aggregator ("m-portal") model is not limited to providing physical access to services through a mobile portal, but rather includes a range of value added services. Added value that might be offered on top of access and transport services could include authentication, security, simplicity, and payment aggregation. [1]

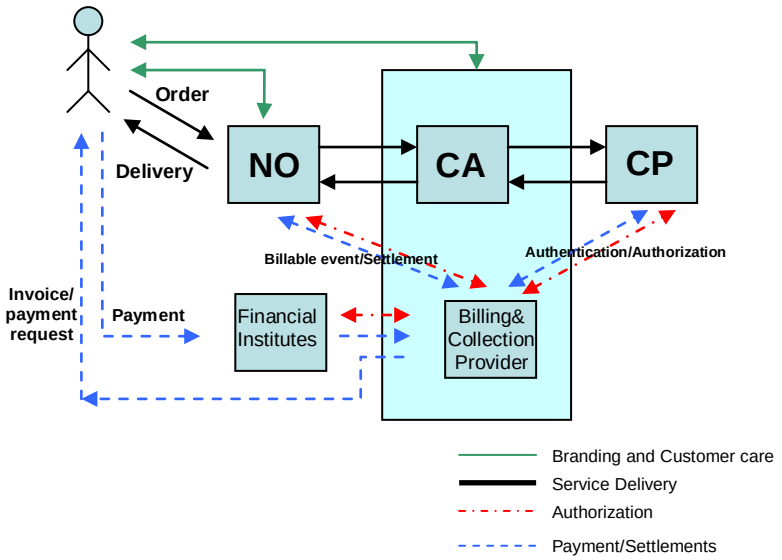

Figure 4.2: Content Aggregator Centric Business Model

In the content aggregator centric business model (Figure 4.2) the customer has an agreement with the content aggregator, but may still also have a relationship with the network operator. The content aggregator determines the price of its content, while the customer may pay access charges to the network operator separately – this can be arranged in different ways depending on agreements made between the parties. It is also indicated the possibility that the content aggregator settles access and transport charges with the network operator.

4.3 Content Provider Centric Business Model

At first glance, the content provider centric business model is similar to the content aggregator centric model. The main difference is that the content provider has a considerable content portfolio and wants to align itself with a network operator and also take up the content aggregator role. In the previous case the content aggregator will most probably sign up agreements with a number of content providers. The customer may have relationship with many content providers in this model. The network operator will only gain access and airtime charges.

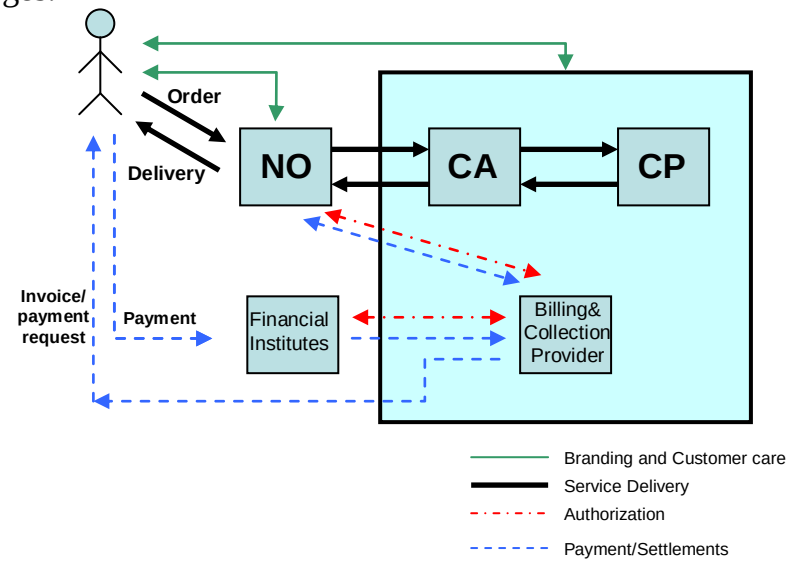

Figure 4.3: Content Provider Centric Business Model

Content providers may settle access and transport charges with the network operator to offer a complete price for delivering a service. The main disadvantage of this model is that content providers have to arrange billing and payment on their own. Also, the customer has to deal with each content provider individually – for example by paying with a credit card. In this model, the likelihood of one-time buyer-seller transactions is higher compared with the other models. The diversity of service offerings is likely to be very high, while the number of transactions per buyer-seller combination is probably rather low. [1]

5. The QoS-based, real-time charging model

Before researching and modeling the QoS-based real-time charging mechanisms, we had to choose a real-time service offered by a vendor. Our choice was the RTP-based video broadcasting because the RTP describes very well the most attributes of real time services. It is also ubiquitously used and its implementation into a simulation environment is not difficult. The main reason for choosing RTP is that it has built-in QoS measurement mechanism.

A RTP service can be discussed in three parts: Content server, Content proxy, and Client (Figure 5.1).

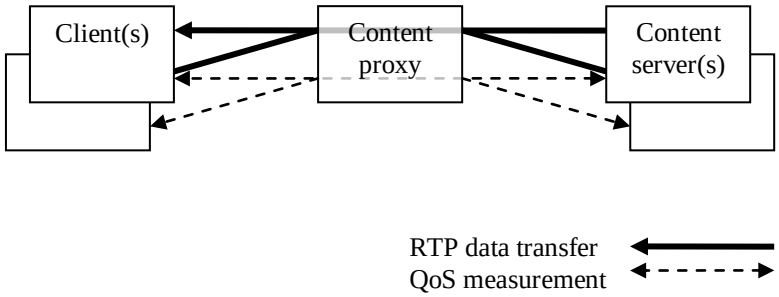

Figure 5.1: typical RTP service

The Client function is very simple, it uses the RTP data, and it measures the QoS parameters of the transport. The Content server(s) can be anywhere in the network, its function is only the data delivery. The Proxy is the only one access point for the clients to the outer network, and to the Content servers, it enabled/disabled the requests of the clients.

For the QoS based charging, we must measure the QoS of the data transfer. In this point, we recline upon to the QoS measurement of RTP in the application layer.

For the charging, our model contains a charging system (Figure 5.2):

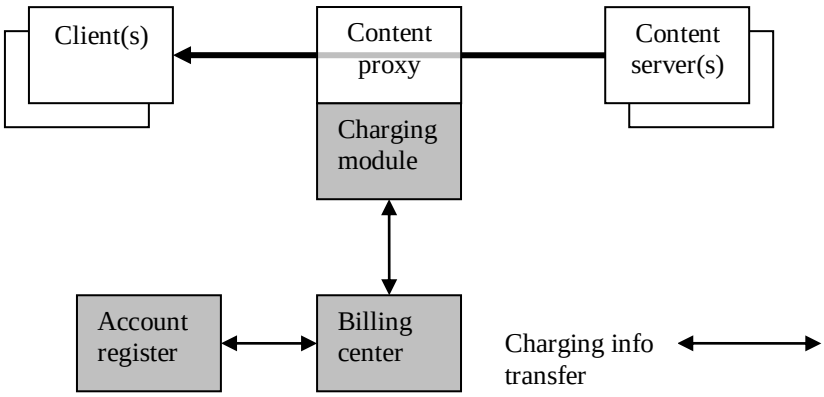

Figure 5.2: RTP model with charging function

The charging module is built in the Content proxy. Its function is the user access management, QoS measurement and charging record generation. The account register contain the user's accounts, and the billing center manage the system works.

6. Conclusion

This article starts from the main requirements of charging mechanisms in mobile environment. Because of this brief overview, we could give just a short description of charging models. During our research, we have focused on creating this real-time QoS-based charging model. This charging model first should be taken under several tests, and if the testing results will be corresponding to the real environments, we should start working on its implementation.

7. Future plans

In the future, we would like to implement our model in the OmNet++ simulation environment, than examine our charging model over wireless transport layer. After these we would like to improve our model to next phase, when the QoS measurements will be examined in the IP network layer.

8. References

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