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# Charging mechanisms for mobile services

**Solution for GPRS and 3G mobile networks**

## Introduction

In order to get revenue from the use of mobile services, mobile operators need to have suitable charging mechanisms in place. Traditional CDR output from core network elements and IN or CAMEL based charging do not solve all the needs. This whitepaper describes a solution for how mobile operators can implement new mechanisms in their networks for charging of mobile services.

## Contents

## *Charging components in a GPRS/3G network*

A general idea is that a mobile service should be charged based on the value of the service, often referred to as the content of the service. The charging solutions for mobile services to date have not been flexible enough and as a consequence, very few mobile data services have been offered. Most of these services have been carried on SMS using the existing SMS charging model.

In order to charge for mobile data services, there is a need for charging mechanisms in the GPRS/3G network to identify and differentiate between the services. As illustrated in figure 1, a number of new network components can be introduced in the network to solve this. These new network components are described below.

To date, in GSM networks as well as other telephony networks, CDR (Charge Data Record) output from network elements have been used as the means to charge end-users. A CDR is a record including the details of a call or a session to be used for charging the end-user.

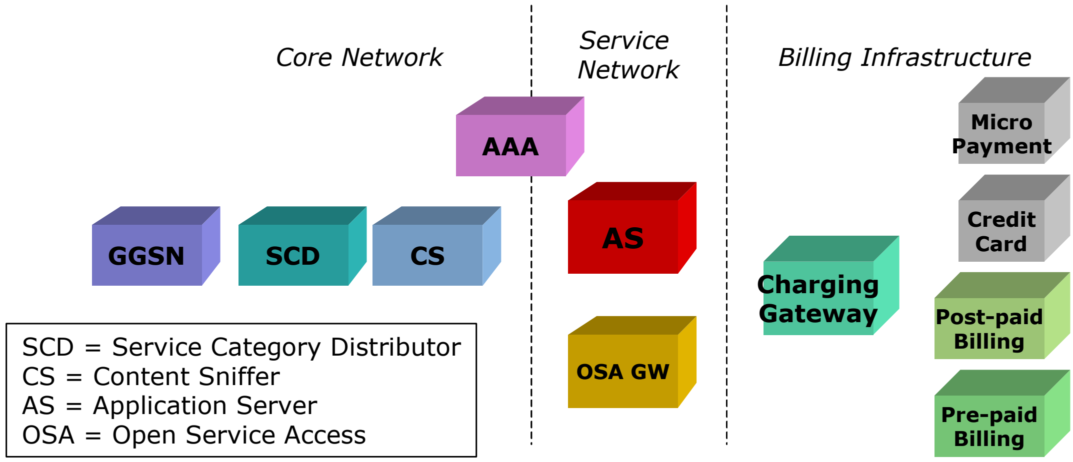


*Figure 1: Charging components in a mobile network*

### *GGSN*

The first component in the picture is the standard GGSN node. The CDRs generated by the GGSN include information about the sessions such as APN (Access Point Name), IP addresses, number of bytes, session duration and more. These CDRs can be used to charge for "raw" traffic without knowing the details of the service behind the traffic. However, the information provided by the CDRs is not sufficient to differentiate between and charge for services.

In the GPRS standard, the APN allows differentiating between service domains. A major obstacle today is that mobile terminals currently available do not support more than one simultaneous APN. In order to change between APNs, the terminal has to disconnect and reconnect to the network. This is not feasible and consequently using different APNs is an inconvenient way to differentiate between services.

Provided that there is support for multiple simultaneous APNs in the terminals, there is another issue with how to configure the APNs in the terminals. Given that you define services in different categories, the terminals have to configure each service with corresponding APN depending on service category. Operators and terminal manufacturers therefore have to agree on Over The Air (OTA) solutions to be used to configure services and APNs in the terminals.

### *Service Category Distributor (SCD)*

The SCD (Service Category Distributor) component has the ability to divide the sessions in service categories depending on IP address domain. The traffic to application servers hosting a specific service is uniquely identified with the IP address of the application server. Any service controlled by the operator will be hosted by a server inside the service network or by a server hosted by a third party. In both cases, the IP address domain of the application server is well known and can be used to differentiate between service categories. Services that should be charged in a similar manner are grouped in the same service category. In this way, the same APN can be used to differentiate between services.

The SCD can communicate with an AAA server to receive user and service profile information and create a context of each ongoing session. As an example, such context could result in an automatic login to the user's Intranet via a VPN tunnel.

It can be argued that the destination IP address is already identified in the SGSN/GGSN CDRs, and therefore there is no need for a new SCD element. It is true that the IP address is the key identifier of a service category, however other attributes of the service categories are needed to fulfil the needs of charging. It is not sufficient with only IP addresses in the CDRs to differentiate between and manage sessions. Additional attributes are needed. Such other attributes of the services categories include service details such as quota, allowance and restrictions. In addition, the less post processing and reconciliation are needed, the earlier the traffic can be divided in the right categories. The extra SCD functionality, which is not standard functionality of a GGSN, could however be added as a module to the GGSN, thereby avoiding the need for a new physical SCD element.

One example when the SCD brings additional functionality is automatic login via VPN to the user's Intranet. The SCD will identify the session through destination IP domain, authorize the user through the AAA server and establish a VPN connection to the Intranet. The VPN connection is accomplished with service encryption keys received form the AAA server.

### *CS (Content Sniffer)*

The CS (Content Sniffer) is a component that "sniffs" and interprets the sessions on a higher protocol layer (higher than IP) to identify the type of service hidden inside the traffic. As an example, messaging traffic could be interpreted to count the messages sent to and from users. This ability to identify services by sniffing traffic is very theoretical. Upper layer protocols can be used in theory, but it is questionable how reliable a CS component would be for charging purposes.

### *Application Servers and OSA/Parlay*

The best place to control the use of a mobile service is at the server hosting the application. In this paper, this server is referred to as the Application Server (AS). The application server interconnects with a charging gateway to perform charging of the mobile service. A standard for integrating application servers with mobile operators' networks (thereby using functionality in the mobile network for the application) is OSA/Parlay. Charging of services with OSA/Parlay is described in detail in the section "Charging in the service network with OSA/Parlay" below.

### *Interconnection with billing systems*

Common for all charging components (GGSN, SCD, CS) and application servers is that they have to interconnect with a billing system, regardless of pre-paid, post-paid, credit card or micro payment method. This interconnect would preferably be through a charging gateway acting as an abstraction layer to the billing system. Through the charging gateway, the same interface is used by all charging components regardless of payment method. The charging gateway is therefore the only component that needs to implement the interfaces to the billing systems, which often are vendor proprietary.

### *Pre-paid reservation*

In a prepaid scenario, the charging initiator (GGSN, CSC, CS or the application server) needs to interrogate the pre-paid billing system via the charging gateway. A possible implementation is to request a quota from the billing system. Depending on the balance on the user's account on the billing system, the quota determines how much the user is allowed to utilise the service. Depending on the charging model, this quota can be a volume quota or a duration quota. If the user exceeds the received quota, the charging initiator can ask for another quota. To give a simple example, the user gets a quota of 100 kByte at a time.

Each time a quota is requested by the charging initiator, the billing system will reserve the corresponding amount on the user's balance account. In this way, the pre-paid users are controlled to avoid exceeding their accounts.

### *Charging in the service network with OSA/Parlay*

As mentioned above, the application server hosting a mobile service is the best place to control the use of the mobile service. Consequently, the application server is the most suited component to implement charging of the service. A standard technology that can be used for this is OSA/Parlay.

The OSA/Parlay standard is a merged standard derived from OSA and Parlay. OSA is developed by the 3GPP organization and Parlay is developed by the Parlay Industry Consortium. The objective of OSA and Parlay was to simplify application development for fixed and mobile networks and open up to a larger development community than what traditionally existed for telecom networks. Via standardized OSA/Parlay interfaces, the Application Server interconnects with the operator's network to use functionality in the network. For charging the application server interfaces the billing system via a charging gateway. Figure 2 illustrates a combined OSA/Parlay and charging gateway.

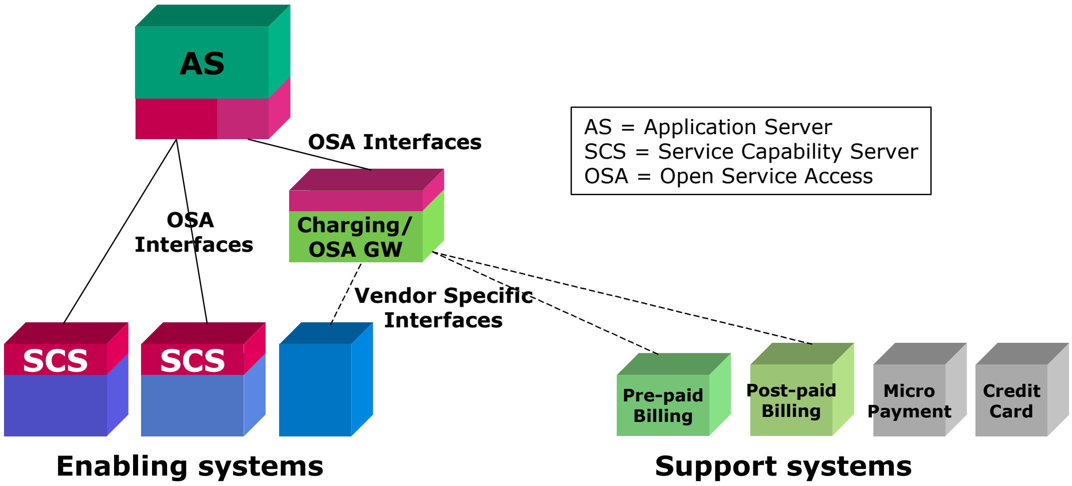


*Figure 2: A combined OSA/Parlay and charging gateway in a service network*

Billing related service capability features in OSA/Parlay are Charging and Account Management. The OSA charging functionality allows an application to do the following

- Reserve amount
- Debit units
- Credit units
- Immediately charge without first reserving the amount

The charging service can be used to charge pre-paid, post-paid, micro-payment and credit card accounts.

The OSA account management service allows an application to check a user's account and set notification criteria for events of importance to the application and end-user.

- Transaction history
- Query balance
- Set/change notification criteria
- Receive notifications

### *An example with mobile service categories*

An operator first has to define how to charge for the offered services. In this example, it is assumed that a mobile operator divides mobile services in service categories depending on how they should be charged for. The following service categories are defined

- Service category 1 - Default "Internet" web traffic charged on a volume basis. Charging controlled either by GGSN, SCD or CS
- Service category 2 - Internal services traffic. Charging controlled in the service network by the application server with OSA/Parlay
- Service category 3 - Streaming services using a "premium" QoS class in the network to prioritise the traffic, e.g. video clips. Charging controlled by the (streaming) application server
- Service category 4 – VPN connection to the user's Intranet, charged on a volume and subscription fee basis. Charging controlled by SCD

The application server controls the use of mobile services and is in charge for triggering chargeable events. Preferably depending on the implementation, the application server can be responsible for pricing (the cost) of the service. By doing this, less work is needed in the billing system for each new application. The alternative is to control all pricing in the billing system. A problem that may arise with an external (third party) application server controlling pricing is dependency on business rules inside the operator's network. This problem could be solved by allowing access from external application servers to business components inside the operator's network that implement the business rules.

The charging gateway and the billing system are in charge of debiting the right amount to the correct account with the right payment method (pre-paid, post-paid, credit card or micro payment). A charging gateway should preferably be based on OSA/Parlay technology.

### *There are no good alternatives to OSA/Parlay*

The alternatives to OSA/Parlay are solutions based on vendor proprietary interfaces between the application server and the billing systems. The disadvantage with proprietary solutions is the scalability, i.e. proprietary solutions are more expensive to maintain since each new application server needs to implement the proprietary interface.

## *Managing user and service profiles*

There are situations when the charging initiator (GGSN, SCD, CS or application server) needs to know details of the end user, e.g. payment method, what services are allowed and other rules on service usage. This information will be stored in user and service profiles in the network. User and service profiles can be part of an AAA server, for example a RADIUS server. (An AAA server's main task is also to authenticate and authorize users' access to the network resources and to services.)

Assuming that an SCD is used to divide between service categories, the SCD retrieves user and service profiles from the AAA server that are used when a user accesses a service category. The user profile may prevent or allow the user from accessing the service category. The service profile may provide with details how to get access to the service.

## *Conclusions*

- Current charging mechanisms with CDR output and IN based pre-paid solutions are not sufficient for new emerging mobile data services
- Alternative solutions exist for how to implement the additional charging mechanisms necessary in the core networks to enable charging for mobile data services
- OSA/Parlay is a standard technology that is developed to simplify application development on fixed and mobile networks for operators and third party application developers
- OSA/Parlay includes charging procedures for application servers to implement billing of mobile data services by integrating with the mobile operators' billing environment

**Contact:**

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