Charging and Accounting

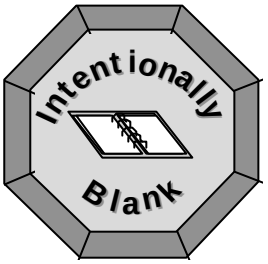
Chapter 13

This chapter is designed to provide the student with an overview of charging and accounting. It addresses charging and accounting components, their functions, features, and required specifications.

OBJECTIVES:

Upon completion of this chapter the student will be able to:

- Understand the charging principles
- List three call components
- Explain the future of billing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13 Charging and Accounting

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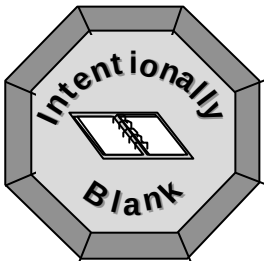
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PRINCIPLES OF CHARGING

The basic principles for charging in a GSM network are the same as for charging in a PSTN-network. There is one major difference. In a mobile network, the only thing known by the calling subscriber (A-subscriber) about the called subscriber (B-subscriber) is the country in which B's subscription is located. The calling subscriber (A-subscriber) pays for the call to the homecountry of the mobile subscription.

B-subscriber usually pays for those parts of the call associated with international roaming in another network.

In GSM 1900, charging is done differently than in other GSM versions. Traditionally in North America the mobile user pays for both incoming and outgoing calls. The reason for this is that the A-subscriber can not tell if the B-subscriber is a mobile subscriber because of the American integrated numbering plan.

It should be noted that the GSM specifications do not govern charging tariffs or packages. Each operator decides this. It does however deal with the charging mechanisms related to GSM mobile originated calls and with the "forwarded-to" element (when the mobile subscriber is roaming) of a call to a GSM subscriber (mobile terminated calls).

STRUCTURES FOR TARIFFS AND CHARGING

NETWORK TARIFF COMPONENTS

The network tariff structure is based on two main components:

- The network access component
- The network utilization component

Network Access Component

Network access charges for each subscription consist of:

- An once-off initial fee
- A subscription charge (paid monthly or quarterly, e.g. until the subscription is terminated)

The access charges vary according to subscription privileges and the number of basic and supplementary services subscribed to.

The network access charges are based on data registered in the subscription handling procedures and are collected by the home PLMN operator from subscribers.

Network Utilization Component

The network utilization component is registered on a per call basis. The basic principle is to start charging the moment the B-subscriber (or the C-subscriber if call forwarding is activated) answers, or on connection to an answering machine internally in the network. The main issues involved in the calculation of charging are:

- Use of GSM PLMNs
- Use of national/international PSTNs
- Use of connection between different networks
- Use of Signaling System no.7 (SS7)

Network utilization charges vary according to, e.g. which country/regional area the call is originated, its destination, day and time, use of supplementary services, if the calling party is roaming internationally and the service used.

CALL COMPONENTS

Each call is divided into a number of components that are used in determining charges. This facilitates the charging of the A-subscriber and B-subscriber separately for different parts of a call. The main call components are described below.

Originating Call Component

The originating call component is the part of a mobile originated call from the MSC/VLR to the network entity pointed to by the MSISDN. The A-subscriber pays for this component.

Roaming Call Forwarding Component

The roaming call forwarding component charges for the part of a call to a mobile subscriber from the home PLMN to the MSC/VLR pointed to by the MSRN. Depending on the operator, the A-subscriber or the B-subscriber can be charged for this.

Call Forwarding Component

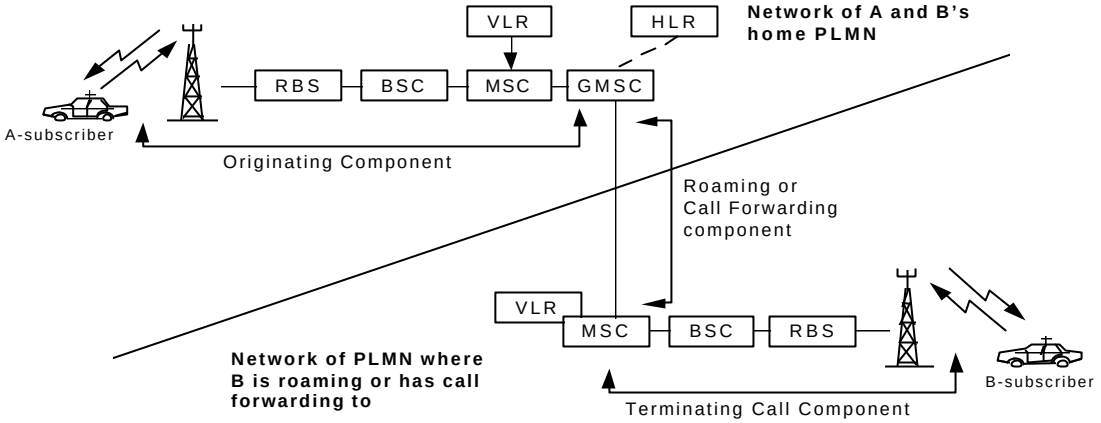
The call forwarding component is the part of a call from the GMSC or MSC/VLR to the Network Entity (NE) pointed to by a "forwarded-to" number. The A- or B-subscriber pays for this, depending on the operator.

Terminating Call Component

This is the part of the call from the serving MSC/VLR to the mobile subscriber. Depending on the operator, either the A-subscriber or the B-subscriber pays for this component.

Transiting Call Component

The originating, roaming and/or call forwarding call component may include a transiting component using the PSTN. This depends on the network structure between the serving MSC/VLR and GMSC for the A-subscriber and the B-subscriber respectively.



BSC = Base Station Controller
GMSC = Gateway Mobile services Switching Center
HLR = Home Location Register
MSC = Mobile services Switching Center
RBS = Radio Base Station
VLR = Visitor Location Register

Figure 13-1 Originating, Roaming, Call Forwarding and Terminating Components

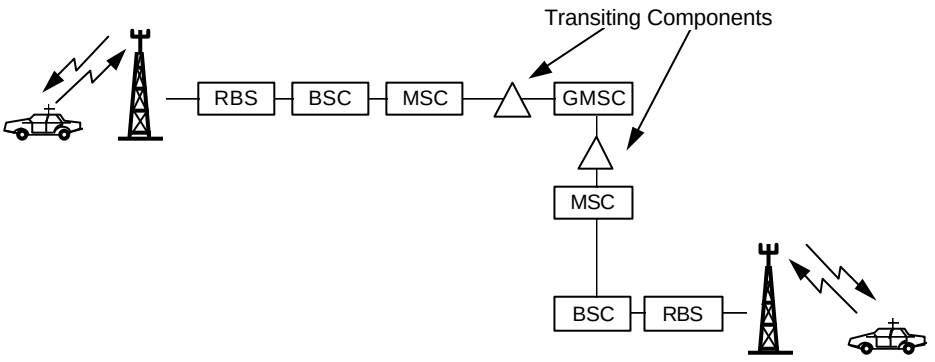


Figure 13-2 Transiting Call Component

RECEPTION AND PROCESSING OF CHARGING DATA

To charge a subscriber, the system requests the necessary data from the relevant network components. In Ericsson's GSM systems the subsystems CHS and CHSS in the MSC/VLR or GMSC handle charging functions. The AM Formatting and Ouput AM (FOAM) also processes the output of charging functions in an MSC/VLR for use by, for example, a billing center.

TOLL TICKETING

All charging within a PLMN is performed by means of Toll Ticketing (TT). TT is a charging method that provides detailed output information for all, or certain types of calls, as defined by the charging analysis function. When a call is charged using TT, the data which is needed to calculate the charge and bill the customer is collected, formatted into a Call Data Record (CDR) and transferred to an output medium.

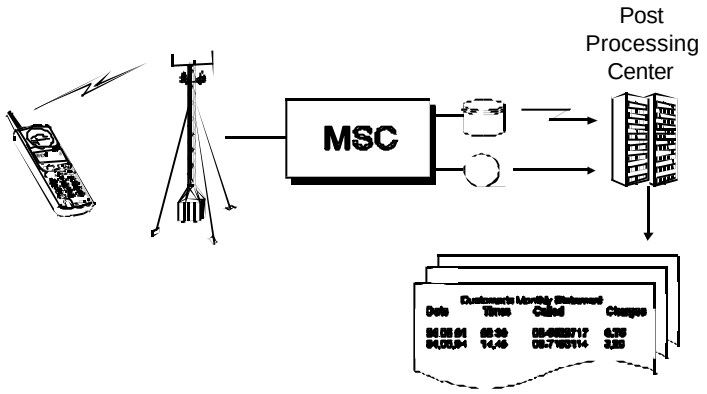


Figure 13-3 Billing procedure

The CDRs are transferred to a hard disk in the MSC/VLR or GMSC. From the hard disk, the TT records can be sent to a data link for transfer directly to a billing center or to magnetic tapes, which can then be sent to the billing center. When a data link is used, data can either be sent automatically when a pre-defined amount has been registered or can be polled from the billing center.

The types of call records that can be output correspond to the types of call components such as the originating call component etc.

WHEN IS DATA TRANSFORMED INTO A RECORD?

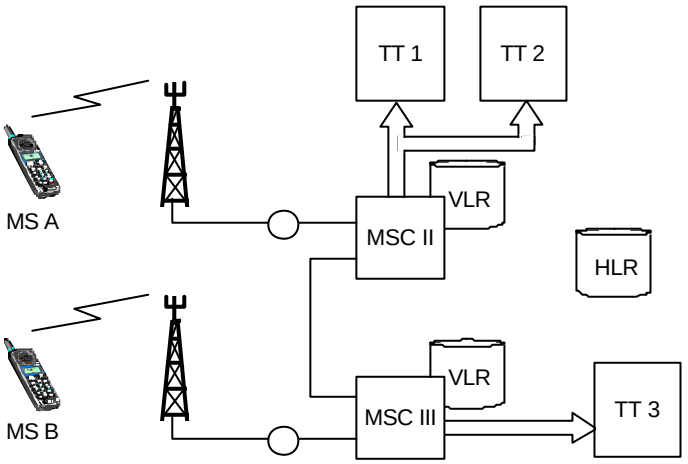
Data from a call is generated when one of the following conditions is fulfilled:

- The call is disconnected
- The time limit for partial generation is reached
- The limit for call related events has been reached

The charging analysis function is the basis of toll ticketing. This analysis is performed by the exchange to determine whether or not TT is to be used. It is possible to charge using TT for outgoing, incoming, internal and transit calls.

The TT function collects output data into a detailed output record. Thus, the subscriber is provided with a detailed bill. A detailed bill decreases the number of subscriber inquiries by providing clear, itemized billing information.

An example of toll ticketing is shown in the following figure:



First TT-record:	MS A - MSC II	(output in MSC II)
Second TT-record:	MSC II - MSC III	(output in MSC II)
Third TT-record:	MSC III - MS B	(output in MSC III)

Figure 13-4 MS A calls MS B

BILLING GATEWAY (BGW)

The Billing GateWay (BGW) collects CDRs in files from the network elements and immediately forwards these to post-processing systems that use CDR files as input. The Billing Gateway (BGW) acts as a billing interface to all network elements in a GSM network.

The functions of the BGW include:

- Collection of billing information from network elements of different types and releases
- Processing of billing information
- Distribution of billing information to post-processing systems of different types
- Graphical configuration and supervision of the gateway
- Alarm handling

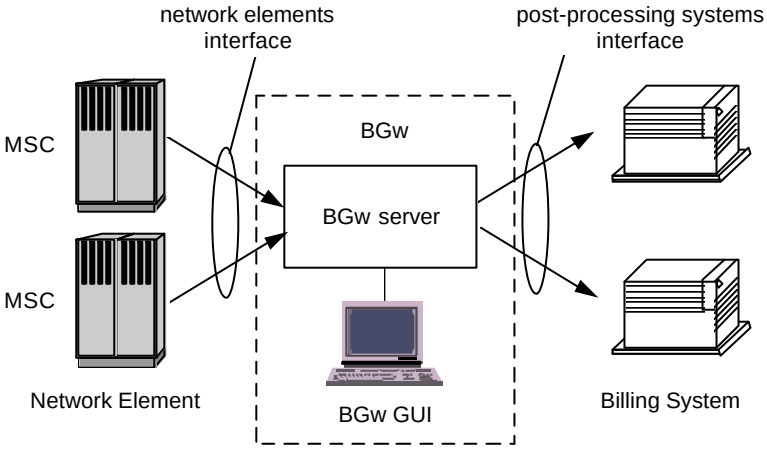


Figure 13-5 The interfaces in a Billing Gateway

A Graphical User Interface (GUI) is connected to each BGW. The GUI makes it possible to visualize the network structure through a directed graph, corresponding to the different data streams in the system.

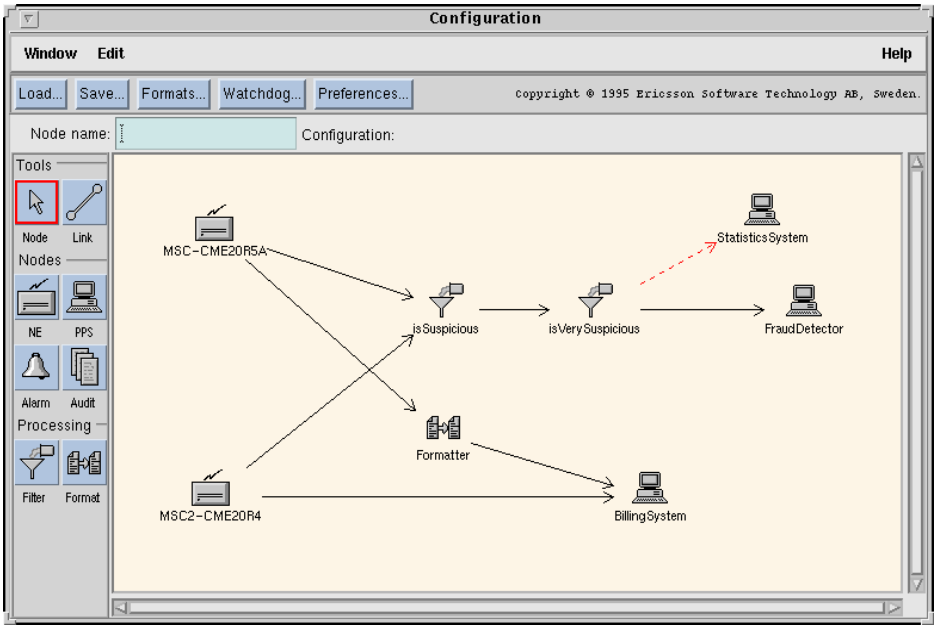


Figure 13-6 Graphical User Interface (GUI)

The BGW has an internal alarm system. Abnormal situations, such as unexpectedly high levels of hard disk usage (a shortage of disk space could interfere with charging calculations) are displayed on the GUI. Serious errors are also sent (with an alarm status) to the OSS and the application called Fault Management.

There is no system limit on the number of network element connections and post-processing systems that the BGW can handle.

A TRAFFIC CASE

This section describes an example of charging in which several subscribers are involved. Many of the subscribers are not in their home PLMNs and the networks must determine which subscriber is responsible for paying each call component.

Note: The MSCs and call case are fictitious.

There are four mobile subscribers:

- **Fowler:** a subscriber who's home network is in Australia and who is currently located in China
- **Lee:** a subscriber who's home network is in South Korea, but who is currently on business in the United States
- **Walker:** a subscriber to a South African network who is on vacation in Brazil
- **Rush:** a subscriber who's home network is in the United Kingdom, but who is on business in Saudi Arabia

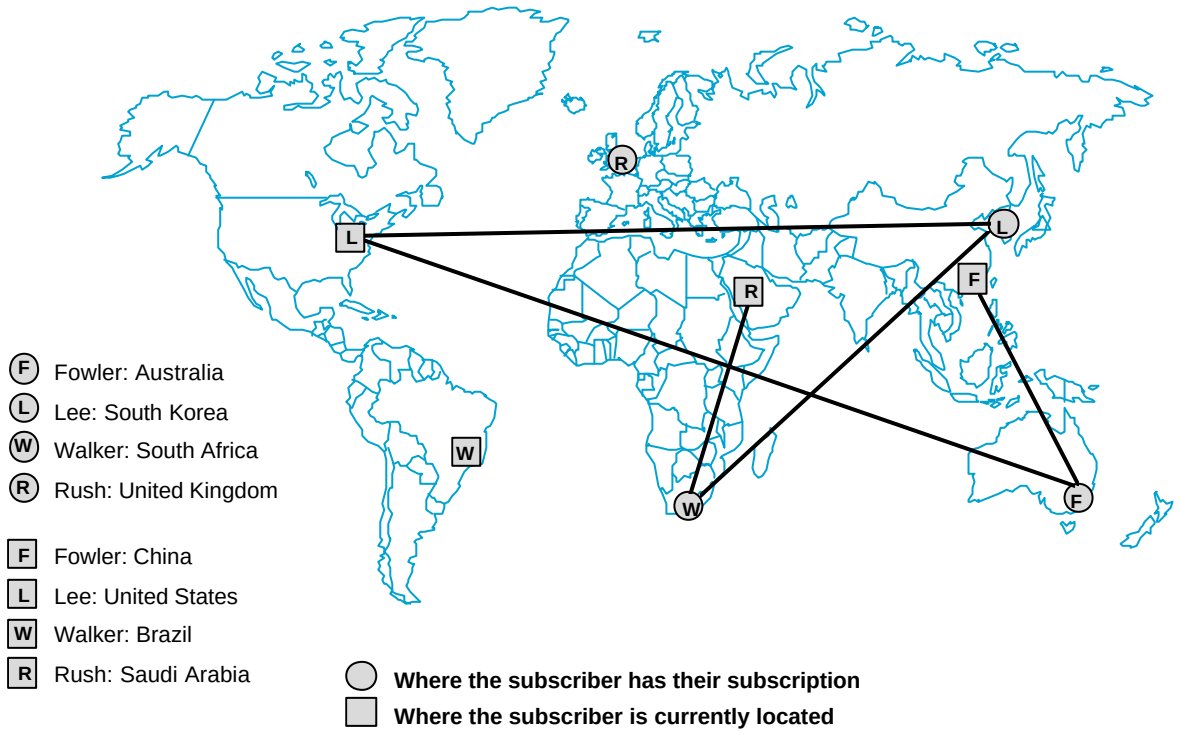


Figure 13-7 Charging case

1. Rush calls Walker. The Saudi Arabian network identifies from Walker's MSISDN that it must contact the South African network.
2. Walker has the service "Call Forwarding on no reply" activated, to Lee in South Korea. The South African network initiates contact with the South Korean network.
3. Lee is in the United States (roaming internationally) and is talking on the phone. Rush activates the service "Completion of calls to busy subscribers" (the network will automatically set up the call when Lee disconnects from the phone call).
4. Lee finally hangs up after his conversation. Rush's MS tries to place the call again, starting with the another attempt to connect to Walker.
5. The call is forwarded to South Korea.
6. The call is forwarded to the United States.
7. During the call Lee has to consult Fowler from Australia. He activates "Three-party-call" service.
8. Fowler is in China, so Australian network routes the call to China.

Fowler, Rush and Lee finish talking, and hang up.

Question: Who pays for which part of the call?

Rush
- Saudi Arabia to South Africa (originating component)
- Activation of the service "Call completion to busy subscriber"

Walker
- South Africa to South Korea (call forwarding component)
- Activation of the service "Call forwarding" (if not included in the subscription)

Lee
- South Korea to the United States (roaming component)
- United States to Australia (originating component)
- Activation of the service "Three-party call"

Fowler
- Australia to China (roaming component)

ACCOUNTING BETWEEN OPERATORS

Agreements for international charging are drawn up between network operators. Operator A bills operator B when a visiting subscriber from B uses operator A's PLMN. Subscribers are only billed for their own operator's administration costs.

Every operator who has a roaming agreement with other PLMNs must be able to support the "transferred account" procedures which allow the visited PLMN to be paid by the subscriber's home PLMN.

When calculating international charges, the accounting analysis covers:

- Destination information
- Outgoing route
- Incoming route
- Calling subscriber number

If the result of the analysis indicates that accounting between operators is to be performed, a suitable accounting class is selected which will be used for the call.

Accounting data collection starts when a call is connected. Examples of collected data include:

- Number of calls
- Call duration
- Number of sent meter pulses, if used

All these are stored in counters per accounting class.

The time of the day and the interval between output of all, or part of the accounting classes, may also be ordered and performed directly as an answer to a command.

TARIFFING SCHEMES

Due to the deregulation of telecommunications markets around the world, mobile cellular markets in particular have become increasingly competitive. This competition has led to a reduction in the charging rates for mobile telephony and to the introduction of attractive subscription deals, which include free or greatly subsidized MSs.

Many network operators also offer subscriptions that include a certain amount of free calls per month. Many of these schemes are aimed at business users and other people who typically make a high number of calls. When a subscriber exceeds the quota of free calls, any extra calls are charged at rates, which vary, depending on the subscription and the times set for peak rates.

A common practice for operators is to market one subscription type for business users and another for personal users. For example, a business package may have reduced charges for calls during business hours but expensive charges outside of those hours.

PRE-PAID SIM

The concept of a pre-paid SIM card is an idea that has become a success. With a pre-paid SIM the subscriber does not enter into a standard contract and pay a monthly or quarterly fee, instead the subscriber gets a special subscription which is already connected to the network. The pre-paid SIM-card allows the user to make calls until the pre-paid fee has been used. Then the subscriber will have to buy a refill-card and enter a code from the refill-card to make more calls.

☞ Did you know?

A version of pre-paid SIM was released in Italy in 1997. Within 3 months, 600,000 extra subscribers had joined the operator's network.

People without income and people who only need to use a mobile phone occasionally often use this method of payment and those who do not want to pay monthly rates for a phone they rarely use. It could also be used to assign an individual limit of call credit with the knowledge that the limit cannot be exceeded.

THE FUTURE OF BILLING

Traditional voice services are billed according to time, duration and destination of the calls. If the user makes a phone call and talks for two minutes, the information goes into a Call Data Record (CDR) that is sent to the operator's billing system.

This workflow becomes more complex with the introduction of new technologies. A greater number and wider variety of services offered will need to be charged in a way that the end user can understand.

For operators introducing GPRS into their mobile network, time to market is, as always, extremely important. It is crucial that adaptations that are needed in the administrative and billing systems do not delay the introduction.

The charging criteria used for packet switching services such as GPRS, are fundamentally different from the principles used in circuited switched services; they are volume based instead of time based.

The BGW will make it possible to charge for datacom service usage with the minimal effect on the existing billing system. The BGW can either transform the CDRs produced by the GPRS network into GSM similar CDRs, or it can be used for building new billing applications, specifically adapted to volume based charging.

Rating in GPRS can be used to put a price tag on the CDR. For example, it is possible to change a volume based data produced, such as megabytes sent, into time based data that the billing system can handle. For example, an operator may decide that one megabyte of data equals ten minutes of speech time, which corresponds to a known cost in the used currency of that operator. The BGW can do all these calculations, which are, completely user configurable to the operators needs.

BILLING IN 3G NETWORKS

The introduction of 3G systems will have major impact on charging. Key areas effected are:

- The off-line charging flow will still be the main flow, but also the backup for the on-line charging flow.
- CDRs for roaming subscribers will be available in their home network within minutes after call completion or service usage.
- There will be new and evolved charging mechanisms, e.g. volumes, service usage and content.
- There will be many new service platforms in the network. This means many different new nodes with many different charging interfaces.
- The number of receivers of charging data will increase, both internally and externally.

There will be both on-line and off-line charging flow:

- On-line is real-time charging for chargeable events or sessions.
- Off-line is non real-time charging done while or after a service has been rendered.

The complexity of handling charging data in UMTS will increase as well as the importance of being able to rapidly introduce and bill for new services. It will be crucial for operators to have the right solutions for handling this in an effective way.

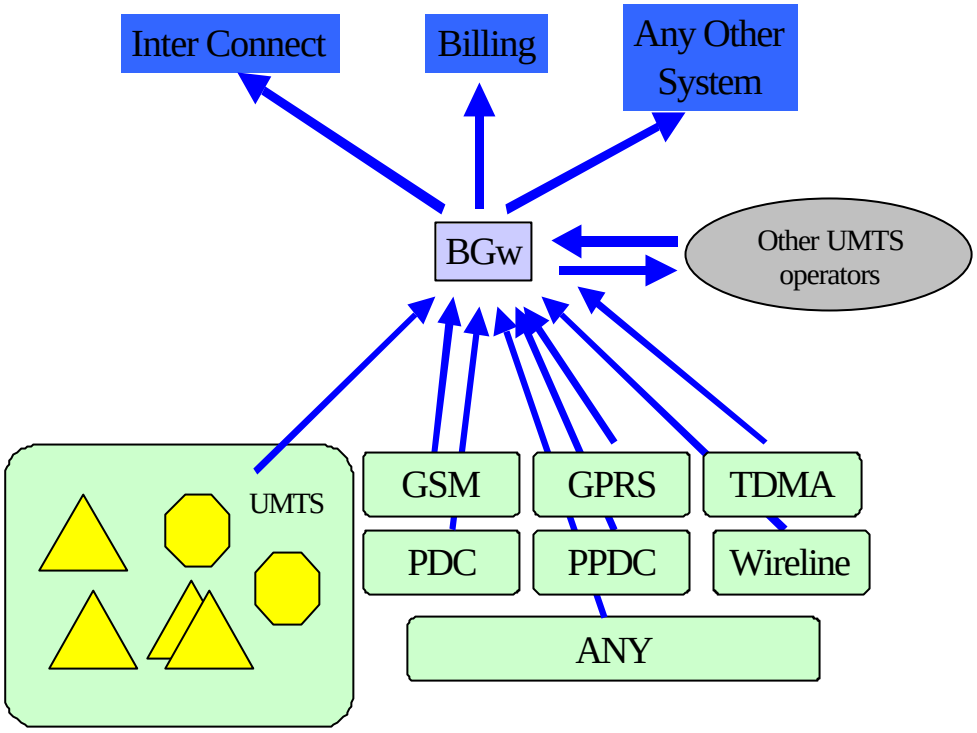


Figure 13-8 The Future of Billing

THE BILLING GATEWAY

The Billing Gateway(BGW) is a standard component in the Ericsson charging network. It enables smooth introduction of 3G charging with minimal impact on existing systems and provides a flexible environment for handling future requirements.

Key areas for BGw in the 3G charging network:

- Distribute CDRs for roaming subscribers to their home environment.
- Provides interface to the on-line node, for example, for nodes that do not provide an on-line signalling interface.
- Provides flexibility to process data in accordance with operator specific needs.
- Feed all applications needing charging information with relevant data in suitable format.

The BGw provides operators with the flexibility to configure the processing of the charging data in accordance with their specific requirements and business rules. Adding new network elements or services is easily done. The rules for collection, processing and distribution of charging data can be configured by the operator's own personnel.

BGw can be configured to collect the CDRs from the existing GSM and GPRS networks and at the same time also be connected to the new 3G network..

Backward compatibility for the charging flow is also secured when the BGw is used. The BGw is capable of providing the old charging interface when new releases of individual services or the complete 3G core network is introduced.