

TS 22.15 V1.2.2 (1997-12)

Technical Specification

Universal Mobile Telecommunications System (UMTS); Service aspects; Charging and Billing (UMTS 22.15 version 1.2.2)

The logo for UMTS, consisting of the letters 'UMTS' in a bold, blue, sans-serif font. The background of the cover features a large graphic of concentric, light blue curved lines that resemble a signal or a stylized 'S' shape, with a grey rectangular area on the right side.

UMTS

Universal Mobile
Telecommunications System



European Telecommunications Standards Institute

Reference

DTS/SMG-012215U (kic00ior.PDF)

Keywords

<keyword[, keyword]>

ETSI Secretariat

Postal address

F-06921 Sophia Antipolis Cedex - FRANCE

Office address

650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16
Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

X.400

c= fr; a=atlas; p=etsi; s=secretariat

Internet

secretariat@etsi.fr
<http://www.etsi.fr>

Copyright Notification

No part may be reproduced except as authorized by written permission.
The copyright and the foregoing restriction extend to reproduction in all media.

Contents

Intellectual Property Rights.....	4
Foreword.....	4
1 Scope.....	5
2 Normative references.....	5
3 Definitions and abbreviations.....	5
3.1 Definitions.....	5
3.2 Abbreviations.....	5
4 Requirements.....	6
5 Charging System Operation.....	6
5.1 Overview.....	6
5.2 Online Cost Control Mechanism.....	6
5.2.1 Charging Delegation.....	8
5.2.2 On-line forwarding of call records.....	8
5.2.3 VASP Charge Control.....	8
5.3 Offline Settlement.....	9
5.4 Views from perspective of each role.....	9
5.4.1 Service Provider Role.....	10
5.4.2 Network Operator Role.....	10
5.4.3 Subscriber Role.....	10
5.4.4 User Role.....	11
5.4.5 Value Added Service Provider Role.....	11
6 Special Cases.....	11
6.1 Long calls.....	11
6.2 Multimedia calls.....	11
6.3 Low-cost Chargeable Events.....	11
7 Automatic Roaming Agreements.....	12
7.1 Routing the Registration Request.....	12
7.2 Settlement of charges.....	12
8 Settlement.....	13
8.1 Bulk Settlement.....	13
8.2 Itemised Settlement.....	13
8.2.1 Transfer of Charging Information.....	13
8.2.2 Incontestable Charging.....	13
8.2.3 Information provided by the user.....	13
8.2.4 Information provided by the network operator.....	14
8.2.5 Validation of Content and Receipt of Charging Information.....	14
9 Other Issues.....	15
9.1 Delegation of charging authority.....	15
9.2 Authorisation.....	15
9.3 Secrecy.....	15
9.4 Direct Charging.....	15
History.....	16

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETR 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available **free of charge** from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<http://www.etsi.fr/ipr>).

Pursuant to the ETSI Interim IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETR 314 (or the updates on <http://www.etsi.fr/ipr>) which are, or may be, or may become, essential to the present document.

Foreword

This Technical Specification (TS) has been produced by ETSI Special Mobile Group (SMG).

1 Scope

This ETSI Technical Specification describes the Service Aspects of charging and billing of the Universal Mobile Telecommunications System (UMTS).

This standard is not intended to duplicate existing standards or standards being developed by other groups on these topics, and will reference these where appropriate. This standard will address those aspects of

charging between the roles identified in the role model shown in UMTS 22.01 Service Principles. This will allow the generation of accurate and incontestable charging information to be used in the commercial and contractual relationships between the parties concerned.

2 Normative references

References may be made to:

- a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or
- b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or
- c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or
- d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

- [1] DTS/SMG-012201U, 1996: "Service Aspects; Service Principles (UMTS)";

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this TS, the definitions in [1] are supplemented by the following definitions:

Charging: A function whereby call information is formatted and transferred in order to make it possible to determine usage for which the subscriber may be billed.

Call Detail Record (CDR): A formatted collection of information about a single call or datacommunication session, (e.g. time of call set-up, duration of the call, amount of data transferred, etc) for use in billing and accounting.

Billing: A function whereby CDRs generated by the charging function are transformed into bills requiring payment.

Accounting: The process of apportioning charges between the roles in the UMTS role model.

Settlement: Payment of amounts resulting from the accounting process.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

- CDR Call Detail Record

4 Requirements

The main new requirements for UMTS charging and accounting mechanisms are:

- to allow on-line control of charges between the different roles linked by commercial relationships. These relationships are:
 - the SP (Service Provider)-NO (Network Operator);
 - the SP-Subscriber;
 - the SP-VASP (Value Added Service Provider).
- to provide an accounting record for all charges incurred and requiring settlement between the different roles above;
- to allow the distinction between subscriber and user roles. Where a subscriber is financially responsible for several users, the subscriber shall be able to control (and limit) the charges incurred by all its users;
- to allow itemised billing for all services charged to each subscription, including voice and data calls, services offered by service providers and services offered by Value Added Service Providers.

These new requirements will allow users more freedom to obtain service when roaming, and services from new and innovative value added service providers, whilst providing effective cost and credit control for the service provider and subscriber.

5 Charging System Operation

5.1 Overview

Two independent mechanisms are proposed to fulfil the identified requirements:

- an online cost control mechanism to limit charges incurred for each subscription;
- an offline accounting mechanism which acts as the basis for inter-role settlement.

It is not proposed to standardise cost control mechanisms for SP-NO or User-Subscriber charges. However, charges incurred through use of a VASP service on the subscribers account with her SP would use the cost control mechanism.

This is because the SP can deduce from its commercial agreement with the NO what charges will be due to the NO. The NO is free to make whatever interconnections and commercial agreements he chooses with other networks. If intermediate networks are used during a call, it is transparent to the SP which only makes accounting with the NO. Accounting with other networks is done by the NO.

5.2 Online Cost Control Mechanism

Two options are proposed below for the SP to control the subscriber charges.

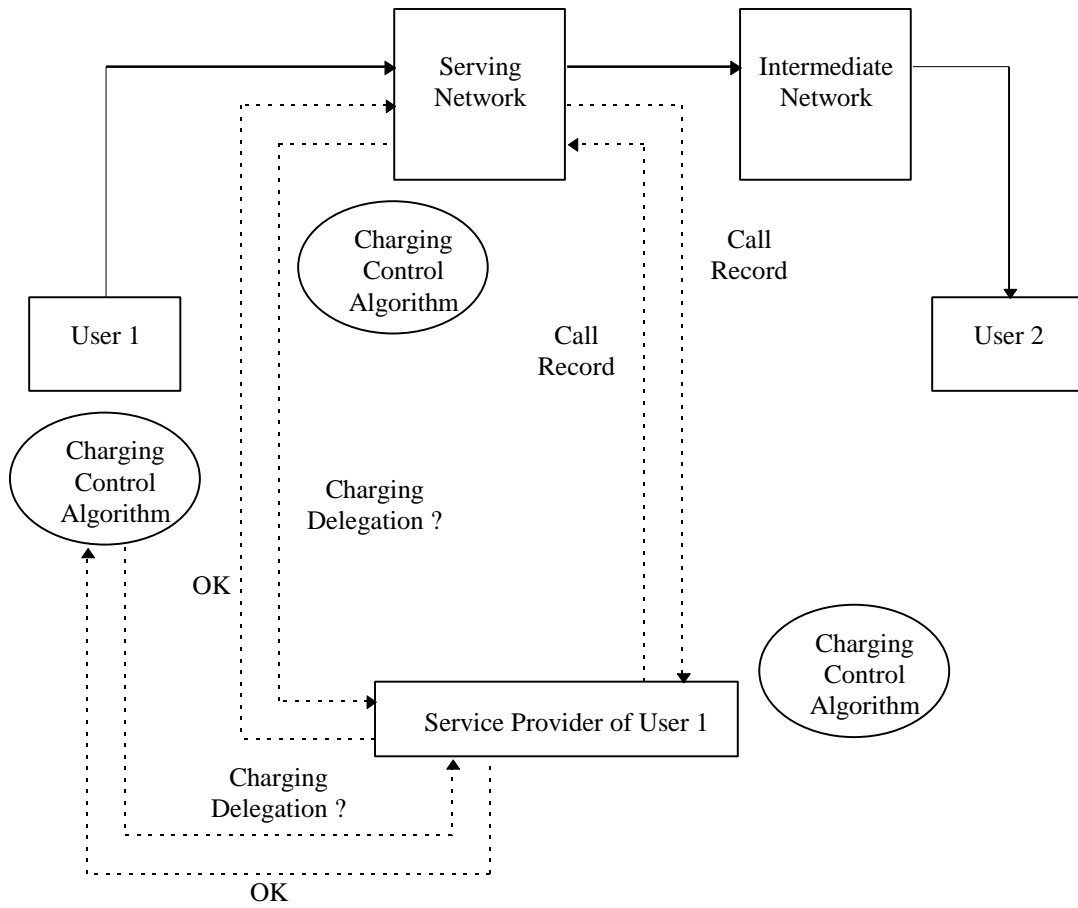


Figure 1: Charging Control Flow for Outgoing Calls

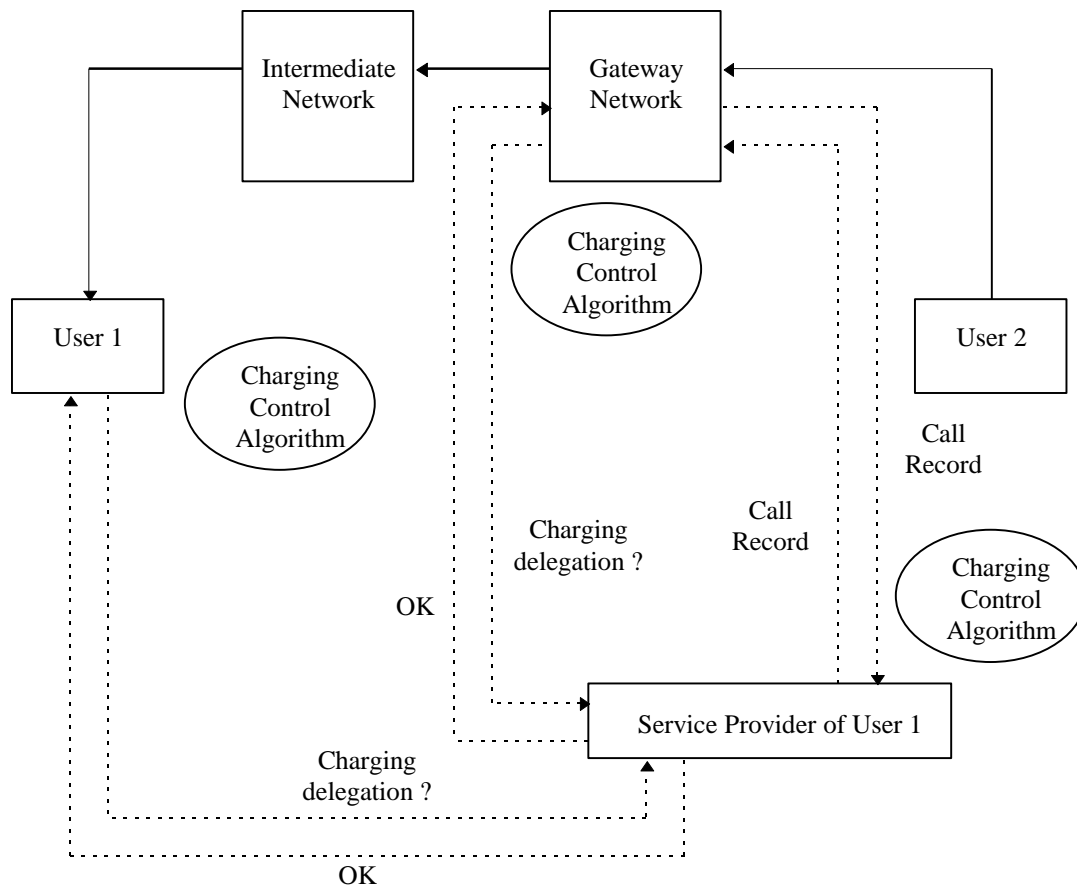


Figure 2: Charging Flow Control for Incoming Calls

5.2.1 Charging Delegation

The serving network (MO call) or the incoming gateway network (MT call) or the mobile station (both MO and MT) have the necessary capabilities to download a charging control algorithm from the SP. This algorithm is used during the calls to control Subscriber charges. The SP delegates authority to the serving network/ gateway network/ mobile station to incur Subscriber charges up to a limit. The period up to the charge limit is called a charging session. Once a charging session is finished, the SP has to authorise a new charging delegation for the next charging session. The system should be designed such that authorisation for new charges is obtained before the expiry of the previous charge limit.

The generation of call records is independent from the duration or cost of charging sessions.

5.2.2 On-line forwarding of call records

The charging algorithm runs in the SP premises. Call records are regularly forwarded on-line to the SP so that call continuation is authorised or not. This could be used by the SP as the fallback mechanism when the charging algorithm cannot be downloaded

When a user uses a value added service and wants the subscriber to pay for it (in addition to standard call charges), the VASP submits the charges to the charging control algorithm. This will require the user to accept the additional charges, and online authorisation from the SP, which may occur transparently to the user, especially for low value transactions.

5.2.3 VASP Charge Control

When a user uses a value added service and wants the subscriber to pay for it (in addition to standard call charges), the VASP submits the charges to the charging control algorithm. This will require the user to accept the additional charges, which may occur transparently to the user, especially for low value transactions.

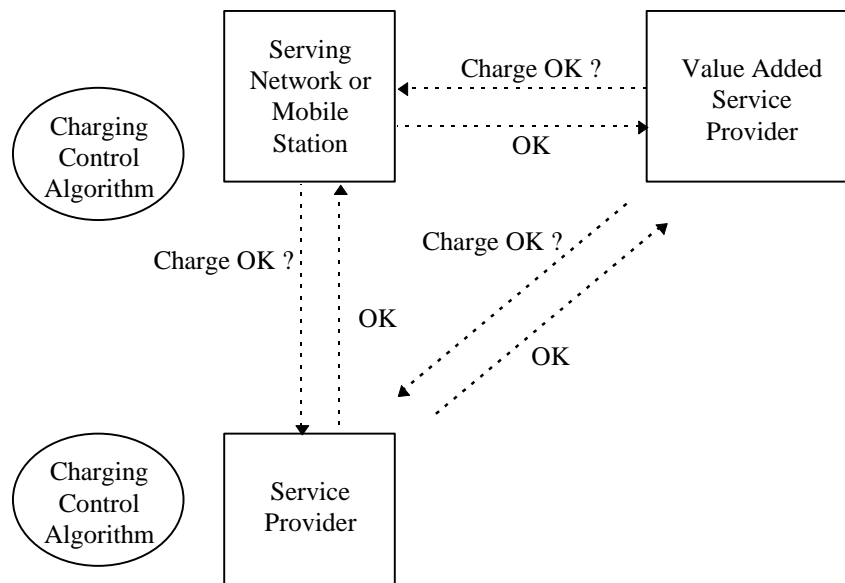


Figure 3: Value Added Service Provider Charging

5.3 Offline Settlement

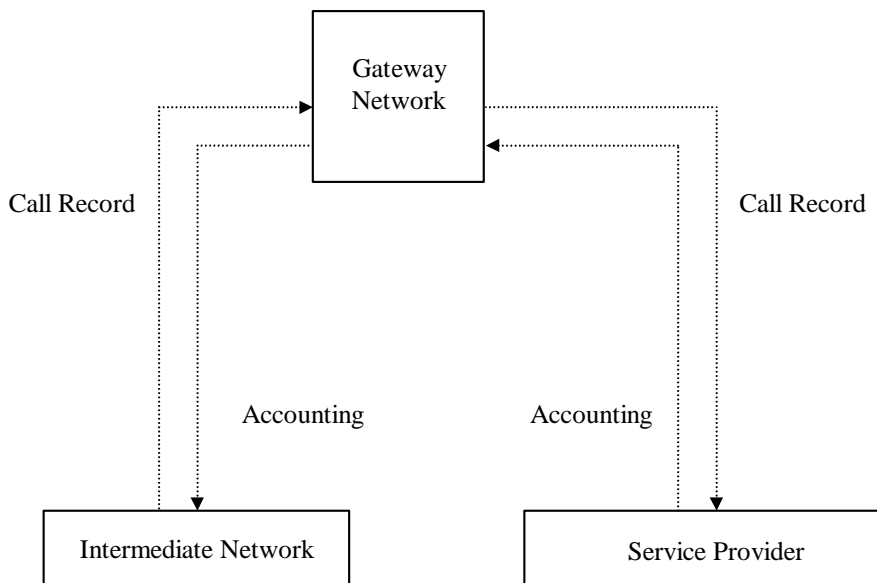


Figure 4: Accounting Data Flow

Off-line, the charging records are sent by the serving/gateway network to the SP. These records must itemise every chargeable event incurred. They are used to calculate the subscribers bill and provide itemised billing to the subscriber. They also act as the basis for inter-role settlement, between SP, NO and VASP.

Although this mechanism operates offline, ideally records would be sent electronically within a few minutes of their creation. It is likely that charging records will be processed within a few hours. This would allow the method of cost control using forwarded billing records to be applied.

5.4 Views from perspective of each role

The following section reviews the proposed methods of billing and charging from each of the commercial role model's roles.

5.4.1 Service Provider Role

When a user registers on a network, the Service Provider will delegate authority to incur charges up to a set limit on that network. The Service Provider will have great flexibility in the method of calculating charges, because her own charging algorithm is used, whether running the the Mobile Station (SIM or ME), serving network or gateway. The network will then offer services to the user until that limit is reached, when a request for additional authorisation will be made to the Service Provider to authorise further charges. This allows the Service Provider to exert control of limits to each user (and thus each subscriber) and/or network operator as appropriate, much in the same way as credit card authorisation at point of sale terminals operates today.

Charges which the Service Provider will pay the Network Operator will be based on commercial agreements between the these two roles, and there will not be a standardised procedure for calculating these online.

The Service Provider will receive billing records, usually online, and typically very shortly after they have been generated. These are used to calculate the settlement charges between the SP and NO. They may be passed via a third party (clearing house), which could provide currency conversion and credit control between an SP and different NO's. However, these latter functions are outside the scope of standardisation.

The standardised features of UMTS Charging and Billing will therefore allow the SP to limit his credit risk for each individual user (and thus subscriber), whilst retaining detailed accounting records for inter-role settlement and itemised billing. The latter could be based on an evolution of the current TAP2 format billing records used in GSM today.

5.4.2 Network Operator Role

The network operator needs to ensure that the users of his network services are authorised to do so, and that he will be paid for the services obtained through it. His concern is therefore primarily between the NO and SP, which is a commercial agreement outside the scope of standardisation. A separate report deals with how NO and SP can interwork when they have no prior knowledge of each other or commercial agreement in place (see ETSI report "Automatic Negotiation of Roaming Agreements").

The NO must therefore validate users of his network, and receive authorisation from the SP to incur charges for that user. This may involve downloading a charging algorithm which calculates SUBSCRIBER charges, and causes a revalidation when the charge limit has been reached.

The NO is responsible for generating on-line charging records and forwarding them to the SP for settlement.

The tariffing method with an NO uses, and the commercial basis on which charges for the services used are levied to the SP are outside the scope of the standard.

Where users invoke services from a Value-Added Service Provider, these can either be charged via the serving network operator (the default) or charged directly to the Service Provider. In the former case, the serving network shall have the capability to accept these charges, obtaining additional authorisation from the SP where required. This is likely to be the most common case, especially where VASP charges are low.

5.4.3 Subscriber Role

Commonly, the subscriber and user will be the same person. However, the roles have been created to allow for the case where several users share the same subscription, for example a small company account. In this case, the company would like to limit the charges incurred by each individual user, in addition to the total charges incurred.

It is therefore envisaged that the subscriber shall be able to limit the charges per user (say on a monthly basis), such that specific additional authorisation from the subscriber is required to exceed the limit.

These mechanisms are directly between the Subscriber and SP, and may involve a variety of mechanisms and procedures. It is not anticipated that any standardisation will be done in this aspect.

The subscriber should be aware that the granularity of the cost control mechanisms proposed for UMTS shall not allow precise real-time status of current charges for all users, but will provide a maximum charge exposure (the sum total of all outstanding charge delegation authorities plus all received charge records) together with a detailed and accurate itemised billing status based on all received charging records to date.

5.4.4 User Role

The user should ideally not be aware of the charging and billing procedures, unless her credit limit is exceeded. This should allow users to operate on any network, and access any value added service provider on demand. Where large charges for Value Added Services are being accepted, the standard shall allow for the user to be notified and accept them (either by a subscription default - say up to a certain value - or by explicit acceptance).

5.4.5 Value Added Service Provider Role

A VASP may have a direct relationship with the SP (and/or an NO), but it is not essential. The VASP will raise a charging record for the services delivered during a charging session, and these will be handled and processed in the normal way. The inter-role commercial handling in this case will be the same as between SP and NO, and can thus use the same billing record formats and clearing procedures.

Alternatively, a VASP may have a special arrangement with a NO. All communications with the VASP would be routed via a specific NO who would also handle the raising of charging records and settlement with external parties. This scheme would operate in a similar way to the current premium rate telephone services available on both fixed and cellular networks.

6 Special Cases

6.1 Long calls

The advent of packet data calls, which can extend for very long periods of time (days, weeks etc), although at low cost because charges are based on data throughput, may mean that billing records are only output at the end of very long periods. This may require call records to be generated mid-call, either when some charge value is reached or some duration or both, to allow for both charging settlement and cost control.

6.2 Multimedia calls

Where calls use bandwidth-on-demand to vary the quality and quantity of data sent during a call, the parameters used to calculate charges become considerable. The downloading of a charging algorithm which can access the relevant parameters may be implemented. The variable bandwidth etc. makes it difficult to calculate cost, and may result in very large numbers of billing records.

6.3 Low-cost Chargeable Events

Some services offered by networks may be at such a low cost per invocation that they become more expensive to charge and bill for than to provide the service itself. Three solutions are possible:

- offer the service for free (or included in the basic subscription). This can lead to significant additional traffic which requires additional infrastructure to support it. Example of this case are SMS in GSM, and Public Internet access through ISPs.
- Charge for the service anyway. The high profit margins on the service are seen to justify the limited use. This could be seen as the current market positioning of SMS in some GSM networks today.
- Use of a concept of "Postage Stamps", where a pack of electronic low-value units is purchased and used when such services are invoked. This could be done by attaching an electronic stamp to the message when invoking the service, or possibly using an electronic purse in the subscriber's USIM to pay directly at the time of invocation.

7 Automatic Roaming Agreements

It is a requirement that UMTS users shall be able to obtain service and use chargeable services with networks and value-added service providers with whom neither they nor their SP have any direct commercial agreement. This shall be enabled by interworking via trusted third parties. Each Service Provider or Value Added Service Provider shall interwork with one or more network operators, with whom they would negotiate a commercial roaming agreement and test the interworking. Any user wishing to use the services of a particular network would register with that network, who would either directly or indirectly interwork with the home Service Provider. Real-time online billing mechanisms would be used to ensure that charges incurred for UMTS services do not exceed the credit limits set. This would be applied both for the end user, the subscriber and the other roles involved in commercial dealings. In practice, any network operator shall be capable of operating as an intermediate network operator.

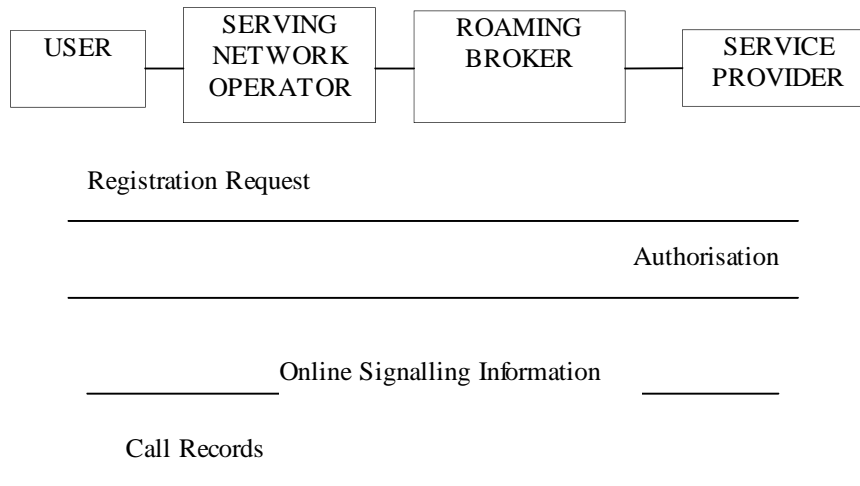


Figure 3: Registration and Roaming Process

There are two key aspects which are required to allow such a system to be deployed:

- How does the serving network operator know how to route the registration request?
- How does each party in the transaction charge for their services?

7.1 Routing the Registration Request

The same mechanisms used for routing calls and resolving addresses shall be used to route the subscription identity back to its Service Provider. Clearly, some form of routing identification will be required to allow a serving network, which does not maintain its own list of all known service providers, to determine the appropriate route to reach a given Service Provider. A number of alternative routes may be possible, and ideally the system should be capable of determining the lowest cost to the end user.

Typically, smaller networks will only have a limited number of external connections to other networks or clearing houses, but may not know which one to use for an unknown (new) Service Provider. In this case, the serving network may make a number of inquiries for each route to determine the lowest cost route to handle the call.

7.2 Settlement of charges

Settlement of charges incurred by a user shall be on a wholesale basis between the different parties involved in the registration link. By authorising a user to register, or a roaming broker to pass that on, each party is in turn authorising charges up to a maximum credit limit with the adjacent party. Any charges levied can then be paid to the adjacent party on a wholesale basis at the end of a mutually agreed accounting period. Funds are thus passed between each party for the services supplied by the network operator in a serial fashion.

Charges incurred for use of value added services, by accessing 3rd party value added service providers, could be charged for in one of two ways. For small amounts, it is not worthwhile involving the service provider directly to

authorise the charge. These charges should be dealt with as for the costs of normal call handling (e.g. like premium rate calls). Higher value transactions, for example where direct purchase of travel tickets, theatre tickets or other services, can be processed via direct online request to the Service Provider, or by the user sending credit card details directly and bypassing the UMTS billing system altogether.

8 Settlement

8.1 Bulk Settlement

Mechanisms shall also be provided to allow inter-network settlement of charges on a bulk basis. The same mechanisms shall be used between service providers, network operators and value-added service providers. This will allow each of these roles to meter the total input and output of charges and thus determine the payments required on a periodic basis between each of the roles with which it directly interacts. For example, it would allow a Value Added Service Provider to determine the total charges to be invoiced to its serving network operator over a billing period. The mechanisms used shall allow each of the roles to meter charge flows independently, with the aim of matching the values recorded at both sides of the same interface. The imbalance in charge flow shall be accumulated in realtime, such that each entity can be informed when a threshold has been exceeded and determine whether to continue.

8.2 Itemised Settlement

The standard shall support the creation and transfer of charging records in order to facilitate:

- interworking with pre-UMTS systems;
- fraud management procedures;
- detailed itemised billing.

8.2.1 Transfer of Charging Information

The efficient transfer of charging information between network operators and from network operators to service providers shall require a standardised interface between these entities. Transfer of charging information between network operators and service providers shall be done at the following times:

- when a chargeable event occurs;
- when a chargeable event is initiated by the user;
- when a chargeable event terminates
- at regular intervals during a chargeable event.

The format of the charging information exchanged shall be standardised. It shall be possible for the relevant parties to agree minimum and maximum times between transfer of call records. It shall be possible for the relevant parties to agree to transfer only particular fields of charging information and to specify which fields of the charging information shall be transferred. [Ed Note: This will need further clarification because some fields will be mandatory, esp. to allow interworking with pre-UMTS systems].

8.2.2 Incontestable Charging

It is required that charges incurred by a user or subscriber shall be incontestable. This requirement necessitates that certain information about the chargeable event be collected and recorded.

8.2.3 Information provided by the user

The user incurring the charge shall provide the following information to the party acting as network operator:

- User identity used for authentication;
- Service provider identity; [Ed Note: Important because User can change SP and must route charges to “active” SP for each chargeable event]
- Service Identifier (if relevant); [Ed Note: Should this be standardised teleservice, where used]
- Supplementary Service Identifier (if relevant); [Ed Note: Is this possible, since supplementary services are not standardised, only service capabilities?]
- Terminal Identity (if required); [Ed Note: This will require all terminals to be numbered - where is this req specified - should this be included in Section 4?]
- Destination endpoint identifier for service requested e.g. B number; [Ed Note: Advanced addressing schemes may allow the B number in a variety of different formats. Which format would be used here?]
- Resource requested (e.g. bandwidth, connectionless); [Ed Note: Presumably initiate resource requested, not that negotiated at call setup nor that actually provided by network]
- QoS parameters (e.g. maximum delay). [Ed note: And delay variation...]

8.2.4 Information provided by the network operator

The network operator serving the user shall provide the following information to the party acting as service provider:

- All of the information listed in section 5.8.2.3;
- Time at which the service request was initiated; [Ed Note: Need to specify if local time, UT..., and date]
- Time at which resources were provided for the service;
- Resource allocated to the user; [Ed Note: Could vary during charging period]
- Quantity of data transferred by the user;
- QoS provided to the user;
- Location of the user (definition of location is required) ;
- Was Optimal Routing Applied, if YES Destination Endpoint identifier actually used for service requested; [Ed Note: This is very specific to GSM. Surely an operator can charge what he likes for routing a call, but would obviously be in a better commercial position to apply OR where possible and charge less in a competitive environment. Also, OR may be the default mode of operation in UMTS. Therefore this option may not be relevant.]
- Current status of service instance e.g. ongoing, terminated; [Ed Note: Needs clarification]
- Time covered by this call record; [Ed Note: and if it is one of a series of records for a single chargeable event]
- Charge accumulated for this call. [Ed Note: is this monetary value and therefore does it require currency?]

8.2.5 Validation of Content and Receipt of Charging Information

A mechanism to validate the source and integrity of the information collected in 5.7.2 above shall be provided so that:

- The service provider shall be able to validate the source and integrity of the charging information supplied by the network operator;
- The service provider shall be able to validate the source and integrity of the charging information supplied by the network operator;
- The network operator shall be able to validate the source and integrity of the charging information supplied by the user;

- The network operator shall have proof that services were provided to a specified user.

9 Other Issues

9.1 Delegation of charging authority

The registration process allows the service provider to authenticate users before they incur any charges. Once authenticated, the service provider then delegates authority to the network operator with which he has a direct commercial relationship to incur charges for services supplied to that user. The direct commercial relationship may be with either the serving network operator if known directly by the service provider or a network operator known to the Service Provider. This procedure uses each network as trusted third parties in a chain of delegation between entities, thus allowing commercial transactions between entities who have no direct commercial dealings. There shall be an authentication procedure between all entities in the UMTS system which have a commercial relationship.

9.2 Authorisation

The basic mechanism used during authentication shall set a charge limit for which services shall be made available. Once reached, or prior to incurring a charge which would exceed the limit, further authorisation shall be obtained directly from the service provider. A threshold may be specified to allow authorisation to be obtained prior to reaching the credit limit and thus providing continuous service to the user.

9.3 Secrecy

The record of each individual transaction shall be reported to the service provider in order to provide itemised bills, and to deal with any disputes regarding charges both for users and for other UMTS networks and service providers. It shall therefore be necessary for each transaction to be recorded and passed

9.4 Direct Charging

It shall be possible for Value Added Service Providers to charge users directly for services provided. The mechanisms to perform this are available through other standards, and therefore are outside the scope of this specification. UMTS shall not prohibit the use of these mechanisms, and, where possible, shall provide the basic communications transport to allow them to be used effectively.

History

Document history		
Date	Status	Comment
27 August 1996	Version 0.0.1	SMG1 WPC output draft for editing purposes only
3 February 1997	Version 0.0.3	Presented to SMG1 WPC meeting, London Incorporated changes agreed at Dec 96 Meeting including charging model and charge enquiry
20 April 1997	Version 0.0.4	Presented to SMG1 WPC meeting in Sophia Antipolis Incorporated text submitted at Feb 97 meeting
4 June 1997	Version 1.0.0	Proposed Version 1 incorporating changes discussed at SMG1 WPC meeting in Antwerps, June 97
23 June 1997	Version 1.0.2	Incorporated remaining changes discussed at SMG1 WPC meeting in Antwerps, June 97
27 Nov 1997	Version 1.1.0	Preparation for SMG1 UMTS Helsinki meeting, incorporating text from reports 22.24 and 22.71
4 Dec 1997	Version 1.2.0	Incorporated comments from 22.24, 22.71 developed at SMG1 UMTS Meeting in Helsinki
8 Dec 1997	Version 1.2.2	Format and editorial changes by ETSI Sec for SMG#24