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This report outlines the requirements and proposed new mechanisms to be used for billing and charging in UMTS.

CR (1) has been agreed by SMG1 and not yet approved by SMG#28 has already been applied to this specification in order to provide an accurate view of its status at SMG1. Its purpose is to align this report with the new terminology used in other specifications.

This CR is pending approval by SMG#28.

TR 22.24 V3.10.0 (1999-0401)

Technical Report

**Universal Mobile Telecommunications System (UMTS);
Charging and Accounting Mechanisms
(UMTS 22.24 version 3.10.0)**

Version agreed by SMG 1 only

UMTS

Universal Mobile
Telecommunications System



European Telecommunications Standards Institute

Reference

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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>

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Foreword

This Technical Report (TR) has been produced by ETSI Special Mobile Group (SMG).

1 Scope

This document outlines the requirements and proposed new mechanisms to be used for billing and charging in UMTS. This document is a basis for discussion during the standardisation work within ETSI SMG for UMTS.

2 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] ETS 22.01: "Universal Mobile Telecommunications System (UMTS); UMTS Service Principles".

3 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): 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.

4 Introduction

One of the major differentiators between GSM and UMTS will be the mechanisms used for charging and accounting for services. This report outlines why these mechanisms are required, and how they could work.

5 Background

GSM was designed using many of the principles and systems design from existing fixed networks. This included itemised billing for voice calls, which is implemented by logging one or more CDRs (Call Detail Records) for each individual call made or received. Offline billing systems can then process these records to produce an itemised bill for each customer, applying one of a wide range of specific tariffs. CDRs have been enhanced to contain additional information about the call, such as the location (cell id) of the originator and destination of the call. Ancillary platforms performing value-added services can also output CDR's, which can be processed or matched with ordinary CDR's to charge for value-added services. Immediate post-processing of CDR's is used to provide near real-time

charging information for services such as subscriptionless pre-paid SIM cards. Offline processing can also be used for fraud analysis and data-mining for churn reduction activities.

The major limitation of this method is that charges are calculated offline, sometimes many days after being incurred. This has led to some concerns about fraud, especially when roaming where the home network has no visibility of the charges being accumulated in the foreign network until some days later. The provision of additional services which can be charged in real-time up to a known credit-limit, or the use of the GSM network to pay for non-communications services, is not yet feasible.

The introduction of packet-based services into GSM, in the form of GPRS, has led to a requirement to bill for factors such as duration of an SVC "Switched Virtual Call", quantity of data actually transferred, and quality of service actually obtained. The billing for these factors is being added to the standard CDR records, but the potential for very long virtual calls will require some additional safeguards.

6 Requirements

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

- to allow on-line control of charges between the Home Environment and Serving Network ~~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 above ~~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~~ invoked.

~~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.~~

7 Proposed solution

7.1 Overview

Two independent mechanisms are proposed to fulfil the identified requirements:

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

It is not proposed to standardise cost control mechanisms between the Home Environment and Serving Network, ~~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 Home Environment ~~SP~~ can deduce from its commercial agreement with the Serving Network ~~NO~~ what charges will be due to the Serving Network ~~NO~~. The Serving Network ~~NO~~ is free to make whatever interconnections and commercial agreements ~~it~~ it chooses with other networks. If intermediate networks are used

during a call, it is transparent to the Home Environment^{SP} which only makes accounting with the Serving Network^{NO}. Accounting with other networks is done by the Serving Network^{NO}.

7.2 Online Cost Control Mechanism

Two options are proposed below for the Home Environment^{SP} to control the subscriber charges incurred by the user.

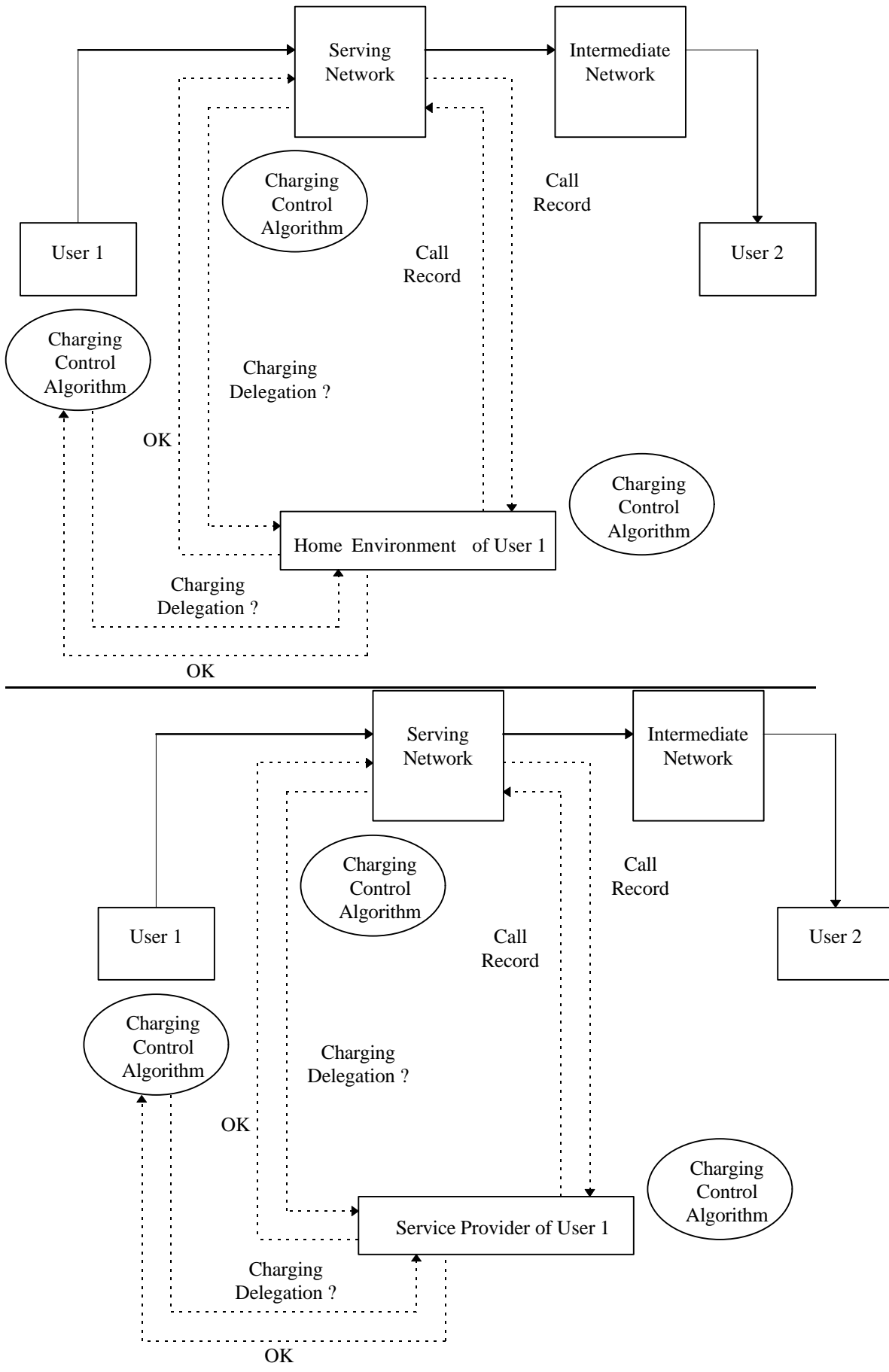


Figure 1: Charging Control Flow for Outgoing Calls

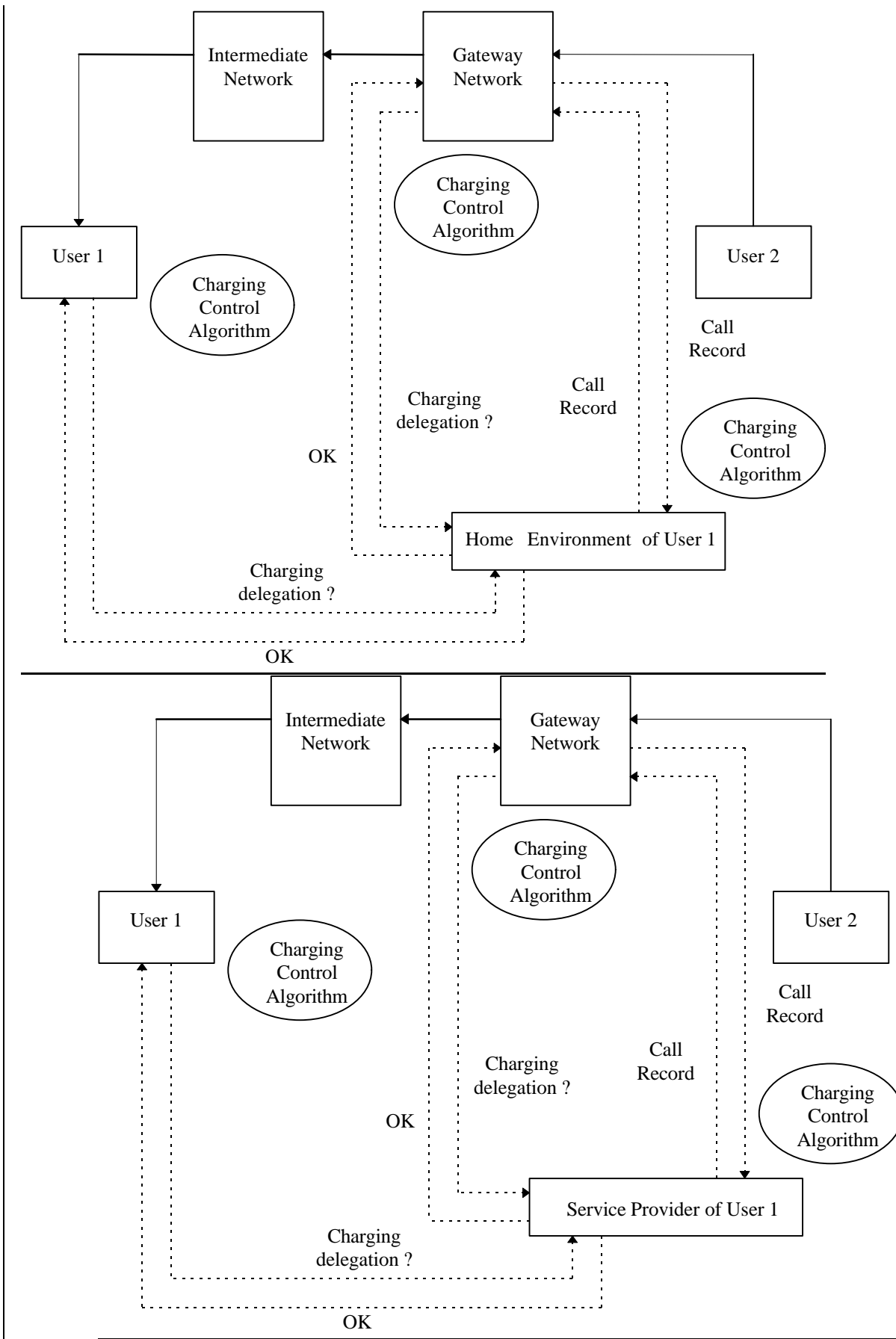


Figure 2: Charging Control Flow for Incoming Calls

7.2.1 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 Home EnvironmentSP. This algorithm is used during the calls to control the user'sSubscriber charges. The Home EnvironmentSP 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 Home EnvironmentSP 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.

7.2.2 On-line forwarding of call records

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

7.2.3 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.

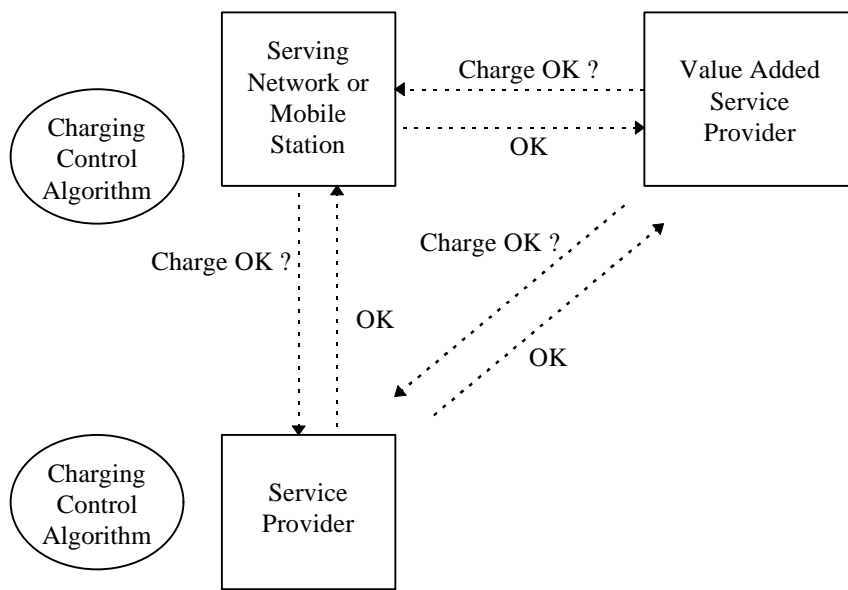


Figure 3: Value Added Service Provider Charging

7.3 Offline Settlement

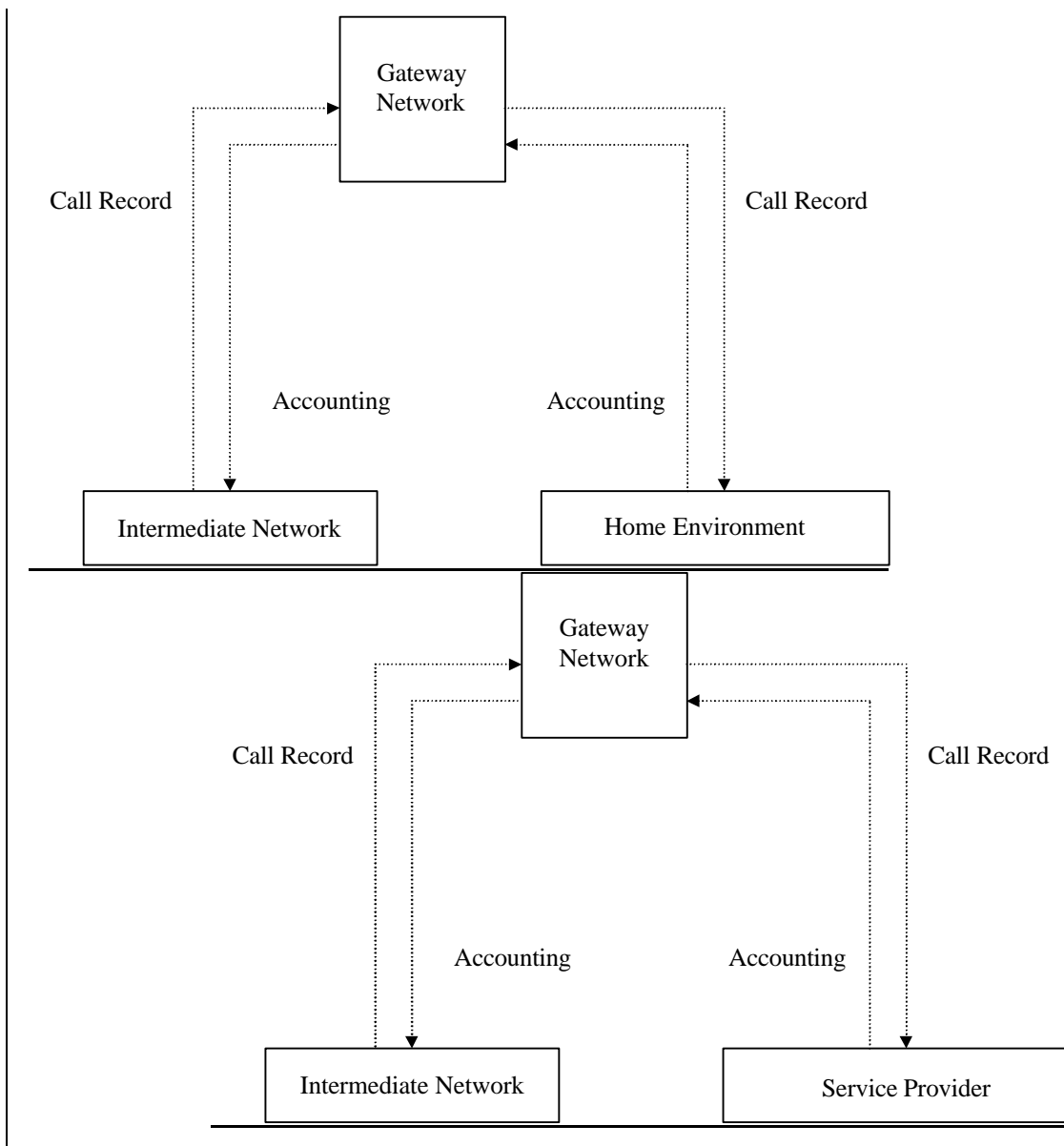


Figure 4: Accounting Data Flow

Off-line, the charging records are sent by the serving/gateway network to the Home Environment ~~SP~~. These records must itemise every chargeable event incurred. They are used to calculate the users' subscribers bill and provide itemised billing to the user-subscriber. They also act as the basis for inter-role settlement, between the Home Environment and Serving Network, ~~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.

7.4 Views from perspective of each role

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

7.4.1 ~~Service Provider Role~~ Home Environment

When a user registers on a network, the ~~Service Provider~~ Home Environment will delegate authority to incur charges up to a set limit on that network. The Home Environment ~~Service Provider~~ will have great flexibility in the method of calculating charges, because its own charging algorithm is used, whether running the the Mobile Station (SIM or

ME), serving network or gateway. The serving network will then offer services to the user until that limit is reached, when a request for additional authorisation will be made to the Home Environment~~Service Provider~~ to authorise further charges. This allows the Home Environment~~Service Provider~~ to exert control of limits to each user (~~and thus each subscriber~~) and/or serving network operator as appropriate, much in the same way as credit card authorisation at point of sale terminals operates today.

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

The Home Environment~~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 Home Environment and Serving Network~~SP and NO~~. They may be passed via a third party (clearing house), which could provide currency conversion and credit control between the Home Environment and different Serving Networks~~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 Home Environment~~SP~~ to limit ~~its~~^{its} 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.

7.4.2 Serving Network Network Operator Role

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

The Serving Network~~NO~~ must therefore validate users of his network, and receive authorisation from the Home Environment~~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 Serving Network~~NO~~ is responsible for generating on-line charging records and forwarding them to the Home Environment~~SP~~ for settlement.

The tariffing method ~~which with a Serving Network~~^{NO} uses, and the commercial basis on which charges for the services used are levied to the Home Environment~~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.~~

7.4.3 UserSubscriber 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 user subscriber shall be able to limit the charges ~~per user~~ (say on a monthly basis), such that specific additional authorisation from the usersubscriber is required to exceed the limit. ~~This would allow an SP to calculate and control the total charges associated with all the users for a single subscriber.~~

~~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 usersubscriber 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.

7.4.4 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).~~

7.4.5 Value Added Service Provider Role

~~A VASP may or may not have a direct relationship with the SP (and/or an NO). 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.~~

8 Issues

8.1 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.

8.2 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.

8.3 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.

9 Conclusion

The proposed control mechanisms allow charging control in all situations (even when the terminal is not involved in the call) and offer the possibility to control the subscriber bill as a whole. VASP services are taken into account by the control mechanism). Only UMTS equipments shall require the deployment of the new charging mechanisms. Other equipments do not need any upgrade. Intermediate networks have a classical technical and commercial relationship with UMTS network operators.

10 Impact on Standardisation

The following items have been identified as requiring standardisation work to implement the schemes proposed in this report:

A charge control mechanism whereby a standardised form of service logic can be downloaded from the Home Environment Service Provider to serving network, terminal equipment/USIM, and Service Provider. The service logic execution environment (e.g. MExE) shall be standardised to allow the same charge control logic to operate identically in different networks. The charge control logic shall have access to all relevant parameters to allow it to determine charges in real time, including time of day, number dialled, bearer(s) used, data transferred and Quality of Service achieved. A procedure for online authorisation of charges is also required. This feature effectively supercedes the GSM Advice of Charge service, and would apply to both circuit switched and packet data traffic. The GSM Phase 2+ system shall be enhanced to provide support for this charging mechanism.

Accounting records shall be used as the basis of inter-role accounting and offline billing. The GSM billing record format (TAP3 format) shall be enhanced to accommodate charging parameters required for the more flexible data and multimedia traffic. A standardised procedure for transferring call records online between the serving network and the Service Provider is required.

~~Subscriber Billing shall be done by the Service Provider, who shall retain knowledge of the association between Subscriber and User roles. It is not anticipated that any standardisation work is required for this aspect.~~

It is therefore proposed that a new work item be started for GSM Phase 2+: "Online Charge Control Mechanism", to handle both GSM and GPRS traffic with a view to meeting the UMTS requirements.

Annex A (informative): Change history

Change history					
SMG No.	TDoc. No.	CR. No.	Section affected	New version	Subject/Comments
SMG#25				3.0.0	Approved at SMG#25 Version 3.0.0
<u>pre-SMG#28</u>	<u>SMG1</u> <u>Tdoc 98-</u> <u>0808</u>	<u>A001</u>	<u>Misc</u>	<u>3.1.0</u>	<u>Updated to reflect changes in UMTS Role</u> <u>Model terminology in 22.01</u>