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Technical Specification

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GLOBAL SYSTEM FOR MOBILE COMMUNICATIONS

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Foreword

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Contents

Foreword

This Technical Specification (TS) has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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1   Scope

The present document describes the Service Aspects of charging and billing of the 3GPP System.

The present document is not intended to duplicate existing standards or standards being developed by other groups on these topics, and will reference these where appropriate. The present document will elaborate on the charging requirements described in the Charging Principles in 3GPP TS 22.101 Service Principles. It will allow the generation of accurate charging information to be used in the commercial and contractual relationships between the parties concerned.

2   References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1]   3GPP TS 22.101: "Service aspects; Service Principles".

[2]   3GPP TS 22.066: "Support of Mobile Number Portability (MNP)".

[3]   3GPP TS 22.234: "Requirements for 3GPP system to wireless local area network (WLAN) interworking".

[4]   3GPP TR 21.905: "Vocabulary for 3GPP Specifications"

3   Definitions and abbreviations

3.1   Definitions

For the purposes of the present document, the definitions in [4] are supplemented by the following definitions:

Prepay service: A prepay service allows a subscriber to pay in advance for the use of specific services, the prepay account may be updated each time the subscriber uses the services related to that account.

Real time: Time, typically in number of seconds, to perform the on-line mechanism used for fraud control and cost control.

Session: logical connection between parties involved in a packet switched based communication This term is used for IP connections rather than the term 'call' that is normally used for a connection over conventional (circuit switched) systems.

   Note: Information about charging is typically collected in Charging Data Records (CDR).

Local Charging Zone (LCZ): A logical grouping of a number of cells, where a special tariff applies for a select group of users. A network may have a number of LCZs. A LCZ does not necessarily need to be aligned with an LA or RA, i.e. the border of LCZ may not be the border of an LA or RA.

3.2   Abbreviations

   For the purposes of the present document the definition of abbreviations in [4] apply.

4   Main Requirements and High Level Principles

The main new requirements for 3GPP system charging and accounting are:

- to provide charging information for all charges incurred and requiring settlement between the different commercial roles;

- to allow fraud control by the Home Environment and the Serving network;

- to allow cost control by the charged party;

- to provide at the beginning of a chargeable event an indication to the charged party (if involved in the chargeable event) of the charges to be levied for this event;

- to allow itemised billing for all services charged to each subscription, including voice and data calls, and services offered by home environments;

- to enable the Home environment to provide a Prepay Service and to enable the serving network to support that Prepay Service for the Home environment"s subscribers;

- to allow interconnect (inter-operator) charging including mobile/fixed operator to mobile/fixed operator (circuit switched & IP), and mobile/fixed operator to IP network provider; and mobile/fixed operator to I-WLAN operator;

- to allow Network operator to 3rd party supplier (e.g. Value Added Service Provider) charging;

- to provide details required for Customer Care purposes;

- to support the shared network architecture so that end users can be appropriately charged for their usage of the shared network, and network sharing partners can be allocated their share of the costs of the shared network resources.

The high level principles that will guide the charging requirements are summarised as follows:

- It shall be possible to charge separately for each type of medium used (e.g. voice, video, data) in a session and for each service used (e.g. voice call, streaming video, file download);

- It shall be possible to charge for different levels of QoS applied for and/or allocated during a session for each type of medium or service used;

- It shall be possible to charge each 'leg' of a session separately. This includes the incoming and outgoing legs and any forwarded/redirected legs. (Note: The legs mentioned here are logical legs, i.e. not necessarily identical to actual signal and traffic flow. Even though tromboning may be avoided by optimal routing, the operator should still be able to charge for the "virtual legs" of the call);

- It shall be possible to charge unsuccessful calls and sessions (e.g. for billing purposes, to provide the user a full documentation of his call attempts);

- The user can be charged according to the service used irrespective of the technology used to deliver it. (That is, the charge is not derived from whether 2G or 3G is used);

- The user can be charged according to the technology used to deliver a service. (That is, different charges can be applied on 2G and 3G);

- It shall be possible to charge a user according to the network resources used. For example, if a large bandwidth is required to use high quality video, the user could be charged accordingly. This is related to charging by QoS;

- It shall be possible to charge users flexibly for the use of extra resources (in at least the same network) for all legs of the call. For example, if a video component is added to a voice call the use of extra radio resource at both ends of the call could be paid for by each user in the call or totally by the initiating user;

- It shall be possible to suppress charging for certain types of connection e.g. when a customer receives tones or network announcements or during sessions such as automated pre-pay top-up;

- It shall be possible to apply different charging based on tariff information provided by a 3rd party. This tariff information may change during the use of the service (e.g. based on menu selection in a voice response menu). In this case the requirement applies both for customer-charging and interconnect-charging;

- It shall be possible for the home network to charge its customers while roaming in the same ways as when they are at home. For example, if duration based charging is used for charging for streaming music in the home network, then it shall be possible to apply the same principle when the user is roaming;

- It shall be possible for operators to have the option to apply charging mechanisms that are used in GSM/GPRS. For example for duration of a voice call, for the amount of data transmitted (eg for streaming, file download, browsing) and for an event (one-off charge);

- It shall be possible for a network operator to charge its users for activities while roaming so that the home network will get the capability to raise service charges depending on the roamed to network, e.g. because of inter operator charges for the use of service capabilities within the visited network which will in general depend on the serving network. The ability to supply all the necessary information for all the charging options will depend on the capability of the visited network. For service capabilities which are provided by the home network, however, it is required that the charging information is collected to allow to identify the serving network of the served subscriber;

- It shall be possible for charging to be applied based on location, presence, push services etc.;

- The network may provide information to the UE so that the UE is able to notify and indicate to the user the LCZs it is in. This allows the user to decide whether to accept/originate the service depending on the LCZs they are in;

- It shall be possible to charge using pre-pay, post-pay, advice of charge, 3rd party charging techniques;

- It shall be possible for the home network to apply different tariffs to national calls and short messages established/sent by their subscribers while roaming in their Home PLMN depending on whether or not the called subscriber"s Home PLMN equals the calling subscriber"s Home PLMN, rather than on the called subscriber"s MSISDN;

Note: This distinction is necessary only in the case, where the called subscriber's MSISDN may have been ported by Mobile Number Portability.

- For circuit switched interconnection only a capability is required to collect information regarding user rate and user protocol at the interconnection point so that e.g. the identification of CS video telephony at the interconnection point for inter-network accounting purposes becomes possible.

These new requirements and principles will allow users more freedom to obtain service when roaming, whilst providing effective cost and credit control for the Home Environment and User.

4.1   Cross Phase Compatibility

Where possible (e.g. services already defined within earlier releases), the charging information collected shall be consistent with the information already provided

It is envisaged that 3GPP system will evolve beyond this Release with the addition of a number of new requirements for charging and billing, for example with the addition of a number of new requirements for charging and billing; these are noted in the appropriate sections below. The technical standards for each release should be developed in such a way that it is possible and practical to introduce these requirements, ideally in a backward compatible manner.

NOTE: When a change is introduced which affects the 3GPP technical standards, it is said to be 'backward compatible' if existing equipment can continue to operate and perform correctly with equipment that conforms to the new implementation.

4.2   Charging Entity Relationships

In the process of introduction of the all-IP technology there will be a mixture of different types of entities using different types of technology.

The diagram below shows the different entities involved in charging and their relationships.
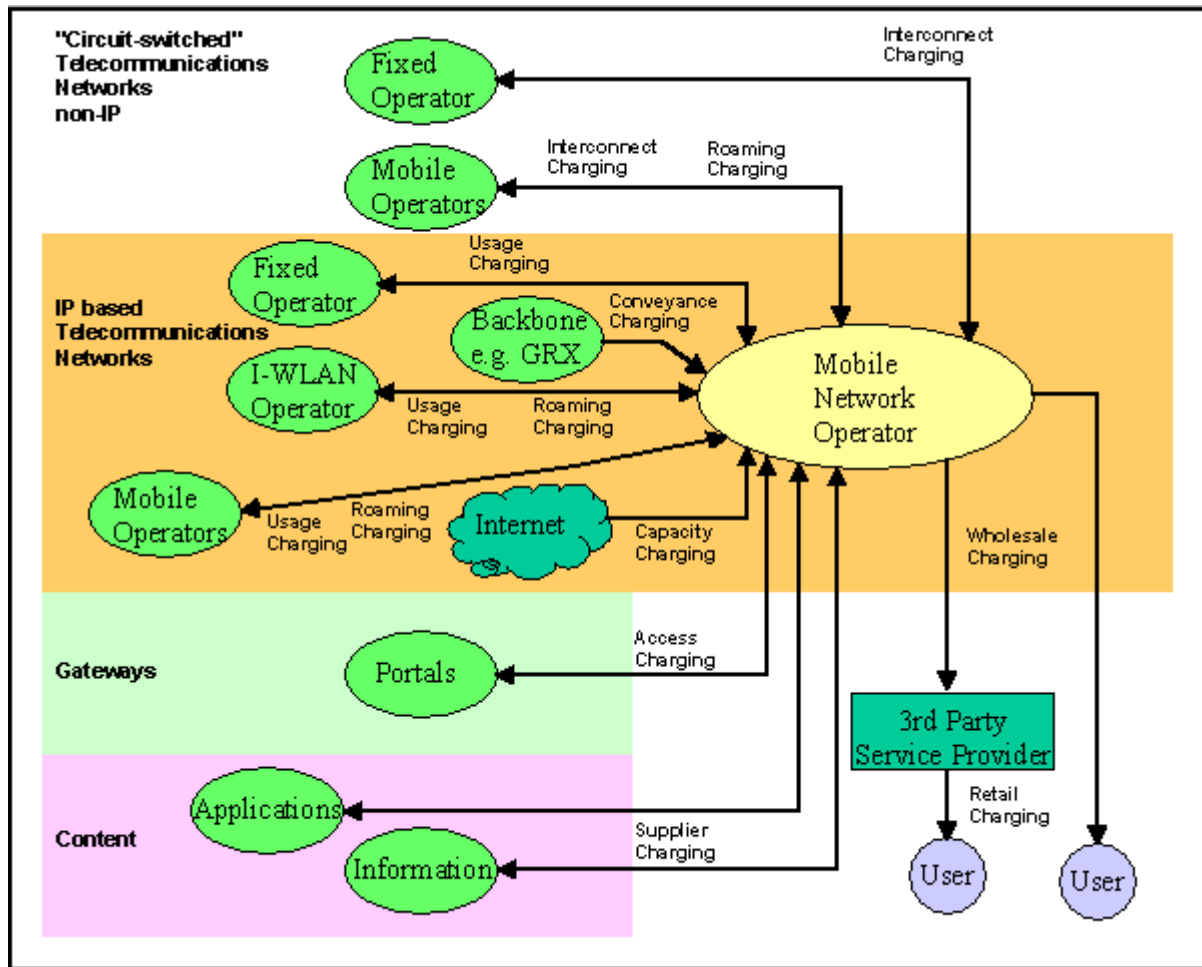
The types of entities and the relevant type of charging as shown on the diagram are as follows:

- **Users:** retail charged by Mobile Network Operator or 3rd Party Service Provider.

- **3rd Party Service Providers:** wholesale charged by Mobile Network Operator.

- **Other telecommunications operators:** interconnect charging between Mobile Network Operator and non-IP 'circuit-switched' Network Operators for call traffic carried; usage charging between Mobile Network Operator and IP-based Network Operators for session traffic carried.

- **Other mobile operators:** roaming charging between these entities, this may require different mechanisms for IP-based types from the traditional 'circuit-switched' types. Also, where mobile operators need to pass traffic to one another, there will be interconnect charging for non-IP 'circuit switched' types; usage charging for IP-based types.

- **I-WLAN operators:** where I-WLAN operators need to pass traffic to mobile operators or mobile operators to I-WLAN operators, there may be roaming and usage charging, .

- **IP backbone carriers:** conveyance charging Mobile Network Operators for traffic carried.

- **3rd Party content & application suppliers:** supplier charging between Mobile Network Operators and Value Added Service Providers for information exchanged.

- **3rd Party Portals:** access charging between Mobile Network Operators and this entity.

- **Internet:** charge for capacity of connection between Mobile Network Operator and Internet. An Operator pays a provider for a connection based on capacity, e.g. annual charge for a 2Mbit/s 'pipe'.

4.3 Charging guidelines for IP-Multimedia services

4.3.1 User Charging Requirements

This section describes the options required for the charging of end users. The network operator could charge users directly (retail charging) or charge a 3rd party service provider (wholesale charging). These requirements can therefore apply to retail and wholesale charging. Note that the word 'session' is used to describe the connection between a user and either another user or a service. This term is used for IP connections rather than the term 'call' that is normally used for a connection over conventional (circuit switched) systems.

The various ways that users can establish sessions and the main components are described. Also, the required charging options are specified.

4.3.1.1 Session End Point Configurations

A variety of different connection configurations are possible for IP multi-media independently of the components of the session being used. It should be possible to charge for the following types of sessions with the options identified. These charging options should be applicable to each medium separately. Note that not all the charging options need to be used and that some of the options can be used only if the particular party is using the resources of IMS:

The table below lists some example session scenarios and describes some of the possible charging options for each scenario. The table does not list all possible session scenarios nor does it list all possible charging options for the scenarios. Rather, the intent of the table is to emphasize the numerous charging options that shall be supported by an IP Multimedia System due to the complexity of sessions possible. The charging options shall adequately account for all session resources used in order to enable the operators to apply flexible billing policies and to satisfy regional and/or national regulatory policies.

In general, any session shall allow for the following charging options:

- To apply the 'Calling Party Pays' charging principle;

- A 3rd party to be charged for all or part of the session;

- Split charging between any of the parties, including 3rd parties;

- Session setup and session resources to have different charging rules. Different rules would be applied for example, in a scenario where **A** calls an advertising number, say **B**. **B** could be a web-based toy advertisement number, for example. In this scenario, **A** could pay for the initiation fee (session setup), and **B** could pay for the session resource.

- Any party can add another media to the current session in progress and any of the parties (not necessarily the one(s) being charged for the current session) can be charged for the additional media. For example, **A** calls **B** and **A** is paying for the audio; **B** adds a wireless video image to the call and pays for that portion. The individual resource set-up and usage should be separately identified. This supports the 'Calling Party Pays' model;

- During an active session, media types can change (e.g. audio changed to data) and shall be charged for appropriately. It is thus necessary to be able to detect a change of media during a session so that different rating may be applied.

It should also be noted that during a multi-party session, normally if the charged party drops off the session, all components being charged to that party should drop. But it is foreseeable to support a service option that allows the charged party to continue to be charged even if they drop off the session. The charging rules should support this option.

No	CONNECTION	DESCRIPTION	CHARGING OPTIONS REQUIRED
1	**A** sets up a session to **B**	**A** simple connection between 2 subscribers or a subscriber and a service (eg voicemail)	**A** pays for the session set-up to **B** **A** pays for the session resource to **B** **B** pays for the session resource to **A**
2	**A** sets up a session to **B**	**A** simple connection where **B** is a 'toll free' (800) type service	**B** pays for the session set-up **B** pays for the session resource **A** pays for part of the session resource (i.e. allowing split charging between **A** & **B**)
3	**A** requests session with **B**, **B** redirects to **C**	This is redirection. The connection path is not set up to **B** from **A**, instead **A** is told to set up a connection direct to **C**	**A** pays for the session set-up to **B** **A** pays for the session resource to **C** **C** pays for the session resource to **A** **A** pays for the session resource as though it were to **B** and **B** pays for the session resource to **C** as though it came from **B**
4	**A** requests session with **B**, **B** forwards to **C**	This is normal forwarding as in GSM. The connection path is **A** to **B**"s home network and **B**"s home network to **C**	**A** pays for the session set-up to **B** **A** pays for the session resource as though it were to **B** and **B** pays for the session resource to **C**.
5	**A** sets up sessions with multiple parties (Multi-party)	**C**onnections to multiple parties are initiated by **A**	**A** pays for the set-up of each session **A** pays for each of the sessions resource to each of the called parties Each of the called parties pays for the session resource to **A**
6	**A** has a multi-party session where the individual parties set up the session to **A**	The multiple parties in the session initiate the session to **A**	Each party pays for the session set-up to **A** **A** pays for the session resource to the multiple parties The individual parties in the session each pay for the session resource to **A**
7	**A** is in a session with **B**, then puts **B** on hold to set up a session with **C**, then returns to **B** after dropping **C**	**A** still has a connection to **B** while also in a session with **C**. The session with **B** continues after the session with **C** is terminated	**A** pays for each of session set-ups to **B** and **C** **A** pays for the session resource to **B** & **C** **B** & **C** pay for the session resource to **A**
8	**A** is in a session with **B** then answers a session request from **C** while keeping **B** on hold	**A** still has a connection to **B** while also in a session with **C**. The session with **B** continues after the session with **C** is terminated	**A** pays for the session set-up to **B** **C** pays for the session set-up to **A** **A** pays for the session resource to **B** and **C** **B** & **C** pay for the session resource to **A**
9	**A** sets up a session with **B** who is roaming in another network	The connection is made from **A** to **B**"s home network and then forwarded to **B** in the visited network. (Normal GSM mechanism) **A**lternatively, **A** is redirected directly to **B** in the visited network	**A** pays for the session set-up to **B** **A** pays for the session resource as though it were to **B** in his home network and **B** pays for the session resource from his home network to the visited network **A** pays for the session resource to **B** in the visited network **B** pays for the session resource to **A**

4.3.1.2   Charging Principles For User Session Components

A number of different components can comprise a session. These components may be added or dropped from an ongoing session by any participating party. These components should be individually identifiable for charging purposes.

Generally, the party that adds a component should be responsible for the payment for the use of the component. However, it should also be possible to charge all users that need an increase in resource to handle the component. An example is 2 users in an audio session where one of the users upgrades the session to videophone session. Both users could be charged extra for the use of the video component as this requires extra resource at both ends.

Possible components are:

- Voice

- Audio (real time)

- Audio (streaming)

- Video (real-time)

- Video (streaming)

- Data (download/upload)

- Data interactive eg web browsing

- Messaging (SMS text type)

- E-mail

- Data stream (unspecified content) This is where the network operator acts as a 'bit-pipe'

It shall be possible to charge for each of these components separately in a session with the options shown in the table below.

It shall be possible for operators to be able to charge for individual components of sessions even if there is no identifiable service. For example a proprietary codec may be used to set up an 'end-to-end' speech session where the network operator acts as a 'bit-pipe'. In this case, it should be possible for the operator to charge for this differently. This type of component is called 'datastream' in the table below.

It might not be possible to apply some of the charging mechanism and type options described below depending on the capability of the networks used.

COMPONENT	CHARGING MECHANISM OPTIONS	CHARGING TYPE OPTIONS
Voice	Charging principles as described in section 4.3.1.1	Charging by duration of session Charging by QoS requested and/or delivered One-off set-up charge
Real time Audio and Video	Charging principles as described in section 4.3.1.1	Charging by duration of session Charging by QoS requested and/or delivered One-off set-up charge
Streaming Audio and Video	Charged to the initiator of the request Charged to the sender of the audio or video	Charging by duration of session Charging by volume of data, optionally QoS-differentiated One-off set-up charge
Data (upload or download)	Charged to the initiator of the request Charged to the sender of the data	Charging by duration of session Charging by volume of data, optionally QoS-differentiated One-off set-up charge
Interactive Data	Charged to the initiator of the session	Charging by duration of session Charging by volume of data, optionally QoS-differentiated One-off set-up charge
Messaging (SMS text type)	Charged to the initiator of the message Charged to the recipient of the message	Charging by event (eg like SMS) Charging by volume of data
Unspecified content (data stream)	Charged to the initiator of the session Charged to all parties involved	Charging by duration of session Charging by volume of data (sent & received), optionally QoS-differentiated One-off set-up charge

4.3.1.3 Other Charging Requirements

The user will also be charged for additional activities while in a session, for example downloaded applications or information. The table below shows some of these requirements and the priority. [This section will need to be further developed.]

CHARGING REQUIREMENT	DESCRIPTION
Downloaded items	User is charged for a specific item downloaded eg a music file, video clip, application
Location based services	User is charged for receiving information on his location (charging based on accuracy as an option). This could be a stand-alone location query or linked to another service
Content accessed or downloaded	User is charged according to the value of the information. Eg weather information, share price or other financial information
M-Commerce	Electronic transactions to 3rd party suppliers of goods & services
Use of portal or other site	User is charged for any access to a portal or any other site. This could be a one-off charge or based on duration or data volume of the portal or site use
APN and associated content	User is charged for access to a specific APN and for the content associated. Requirements are for further study.
Actual duration of rendered service	User is charged (e.g. for premium rate services or hotline) based on the actual duration of the rendered service (holding time is free of charge).

4.3.2 Roaming Charging Requirements

It shall be possible for a network operator to charge its users for activities while roaming. It shall be possible for a network operator to charge its users while roaming using the same principles used while on the home network. The ability to supply all the necessary information for all the charging options will depend on the capability of the visited network.

In addition, the network operators have to charge each other for the use of their networks by roaming users. The methods of charging between operators may be different from the methods used to charge the user. For example, a user may be charged by duration for voice sessions made while roaming but the home network may pay the visited network by volume of data used.

Mechanisms used in today"s networks may also be applied eg Inter-Operator Tariff (IOT).

The table below shows the types of charging principle that networks will require for roaming settlement and a priority for its provision.

ITEM	CHARGING METHOD DESCRIPTION
Charging for session use	Sessions made by users while roaming charged according to the principles described in section 4.3.1.1, above. This includes duration and volume charging
Downloaded items	Items downloaded by the user while roaming from providers associated with the visited network are charged back to the home network for onward charge to the user
Location based services	Location information provided by the visited network is charged back to the home network for possible onward charge to the user.
Content accessed or downloaded	Information that is accessed by the user while roaming from providers associated with the visited network is charged according to its value by the visited network back to the home network for onward charge to the user.
M-Commerce	Charging requirements between visited and home networks for M-Commerce transactions made by a roaming user are for further study.
Use of portal or other site	The visited network may charge the home network for any access by the roaming user to a local portal or any other local site. This could be a one-off charge and/or based on duration or data volume of the portal or site use
APN & associated content	Charge by visited network to home network for access to a specific APN and for the content associated. Requirements are for further study.

4.3.3 Interconnect Charging Requirements

This clause applies (but is not limited) to the following interconnection scenarios:

- Interworking between two IMS-based networks

- Interworking between IMS-based networks and PSTN/ISDN

- Interworking between IMS-based networks and TISPAN NGN supporting PES

- IMS transit scenario

The following charging requirements principles and guidelines shall apply for IMS when interconnected to other systems:

- Existing, legacy charging principles will need to be retained while there is a requirement to interwork with non-IP based 'circuit switched' type of networks

- All the charging and accounting information shall be collected as closest as possible to the interconnection point (subject to network element performance capabilities).

- A session or a service instance shall be uniquely identified within a network domain to allow a correct accounting and charging.

- The identities of the originating network and of the destination network shall be unique and transported at signalling layer. This applies also to transit scenarios.

- The interconnecting provider(s) will be able to apply Inter Operator Tariff schemes both for offline and online charging.

- Charging information will be available for recording at both ends of interconnected parties. The charging information shall be sufficient to enable inter operator accounting correlation and inter operator dispute resolution.

- The real-time transfer of tariff information in interconnection scenarios shall be supported when the serving network supports it, in order to support value added services that are billed by the caller's operator (e.g. Premium rate services 0900 or hotlines).

NOTE: Such services often appear as 3rd party services where the tariff information resides in the called network and the caller"s operator does not have this information.

- This tariff information must be submitted by the external provider in realtime, so that the caller's operator is capable of

  - providing AoC (Advice of Charge) information to the caller.

  - capturing the imported tariff information into charging records.

The service-hosting network shall provide appropriate charging information to the caller"s operator in a secure way, independently from the realtime transfer of charging information for AoC purposes.

NOTE: Where required to support offline charging for third party services where the tariff information resides in the called network and the caller's operator needs to bill the end user for that service.

4.3.4   Conveyance & Usage charging requirements

It shall be possible for network operators (including mobile, fixed and IP backbone suppliers) to charge each other for the use of resources required to support user sessions. The items to be charged and the principles to be applied are described below.

The methods of charging between operators could be different from the methods used to charge the user. For example, a user may be charged by duration for voice sessions but the mobile network may pay the fixed network or 3rd party carrier by volume of data used.

ITEM	CHARGING METHOD DESCRIPTION
Session use	Charging according to the resources used by duration of session and/or by data volume
Quality of Service	Charging by QoS delivered to and from the other network

4.3.5   Charging 3rd parties

It shall be possible for network operators and 3rd parties to charge each other for the use of their resources. Third parties include content and application providers and portals.

The items that will be charged and the principles are described below:

ITEM	CHARGING METHOD DESCRIPTION
Content accessed	The 3rd party charges the end user (via the network operator) for content accessed/downloaded
Access to site	The 3rd party is charged by the network operator for each 'hit' by its users
Location information	The 3rd party is charged by the network operator for information on the location of the user. Amount charged could depend on accuracy of location information.
Presence information	The 3rd party is charged by the network operator for presence information about the user.
Pushed information	The 3rd party is charged by the network operator for each message pushed to the user, eg advertisements

4.4   Additional Charging requirements for prepay services

A prepay service allows a subscriber to pay in advance for the use of specific services, the prepay account will be decreased each time the subscriber uses the services related to that account.

In a multi-service environment like 3GPP system, a subscriber can have different prepay accounts for different kinds of services (e.g. internet access, m-commerce, infotainment, location based services etc.).

In order to guarantee the use of the prepay services, the following general requirements shall be fulfilled:

- The prepay service shall check a subscriber"s prepay account for coverage of the requested service charges prior to execution of that service.

- All charging information related to a specific prepay account shall be prevented to the user when the prepay credit of that account is exhausted or expired.

- All the ongoing charging information related to a specific prepay account shall be immediately (within a few seconds) interrupted as soon as the prepay credit of that account exhausts or expires.

- The prepay service shall decrease the prepay account each time the subscriber uses the services related to that account.

It should be possible to support more than one prepay account for a user if needed.

To guarantee a meaningful multi-prepay account concept, at least 2 different prepay accounts should be supported.

5 Collection of charging information

The standard shall support the collection and transfer of charging information in order to facilitate:

- interworking with Release 98 and earlier releases

- fraud management procedures;

- unsuccessful calls and sessions documentation (e.g. for billing purposes);

    Note: collection of charging information due to error in the signalling flows (e.g. incomplete or erroneus call setup) are not required;

- detailed itemised billing

- allow for prepay charging

    Generally, the charging information collected shall support the high level principles in section 4 (above) and the requirements identified for inter-operator charging as elaborated by the GSM Association. The information listed below is the minimum requirement.

5.1 Charging information Requirements

Charging information shall be collected in the Serving Network to record chargeable User or Mobile Station activity and inter-carrier connections. Some of the information is provided by the user, other information is only available in the network element of the serving network.

Depending on the type of charging information some of the data may not be available or might not be required.

5.1.1 Information provided by the user

The user"s user equipment that is incurring the charge shall provide the following information to the serving network:

- User identity used for authentication;

- Home environment identity;

- Terminal Identity and Terminal Class;

- Destination endpoint identifier for service requested (e.g. B number);

- Resource requested (e.g. bandwidth, connectionless);

- QoS parameters (e.g. maximum delay);

- IP Multimedia capability requested (e.g.media components).

5.1.2 Information provided by the serving network

The network serving the user shall provide the following information to the home environment:

- All of the information listed in section above (Information provided by the user);

- Serving network identity;

- Recording network element identity;

- Universal Time (UT) at which the service request was initiated;

- Universal Time (UT) at which resources were provided for the service;

- Universal Time (UT) at which the service execution was successfully completed;

- Universal Time (UT) at which the service execution was unsuccessfully completed;

- Cause for unsuccessful completion of the service execution. At least the following causes shall be included:

    -the terminating party does not respond;

    -communication rejected by the terminating party;

    -network determined terminating party busy;

    -network congestion;

    -terminating party non reachable (out of coverage, switched-off);

    -destination non reachable (non active address, non-existing address).

- Resource allocated to the user;

- Quantity of data transferred both to and from the user;

- QoS provided to the user;

- Location of the user in the standard format used for 3GPP location based services (e.g. geographical co-ordinates, Cell ID);

- whether GSM Optimal Routing was applied;

- If IN or CAMEL services were applied, the service parameters and the actually used destination number and calling party number identification;

- Time duration covered by this charging information to an accuracy of at least 1 second;

- Unique identity of the chargeable event which allows the billing system to correlate all charging information belonging to the same chargeable event;

- Unique charging information identity (unique per network element in a period of about 100 days);

- IP Multimedia capability provided to the user;

- VAS information;

- Identifier of third party accessed by the user;

- Presence Information;

- Service Identification (eg voice call, video call, data download etc);

- Supplementary Services used;

- Prepay account identifier and related information.

5.1.3   Charged Party

For subscription related chargeable events the charging information shall indicate the charged party, i.e. normally the calling party. As alternative it should be possible to apply reverse charging or to charge the event to a party not involved in the event itself (e.g. a company as VPN subscriber). It should be possible for multiple leg calls (e.g. forwarded, conference or roamed) to be charged to each party as if each leg was separately initiated. However, in certain types of call, the originating party may wish/be obliged to pay for other legs (e.g. SMS MO may also pay for the MT leg.).

It shall be possible to change the chargeable party at the call set-up.

In case of inter-network chargeable events, the charging information usually does not contain the charged party, but it can be derived from network configuration information contained in the charging event data..

For each party to be charged for a chargeable event or parts of it charging information shall be collected.

5.1.4   Information provided by the third party accessed by the user

Supply of Value Added Services, especially in IP based environment, is often made with the aid of third parties typically represented by portals and content/application providers.

To execute an effective charging of these services, the following charging information should be provided by the third party:

- Third party identity;

- Type of service (information, entertainment, gaming, public utility);

- Change in the type of service provided to the user;

- Type of content (picture, videoclip, mp3 file, java file);

- Universal Time (UT) at which the service request was initiated;

- If a service change happens, Universal Time (UT) at which the service provision was initiated;

- Universal Time (UT) at which the service execution was successfully completed;

- Universal Time (UT) at which the service execution was unsuccessfully completed;

- Cause for unsuccessful completion of the service execution. At least the following causes shall be included:

    -the terminating party does not respond;

    -communication rejected by the terminating party;

    -network determined terminating party busy;

    -network congestion;

    -terminating party non reachable (out of coverage, switched-off);

    -destination non reachable (non active address, non-existing address).

- Cause for Abnormal reject of the service;

- Universal Time (UT) for abnormal reject of the service

5.2   Special Cases

5.2.1   Long calls and sessions

The advent of packet data services, 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 charging information are only output at the end of very long periods. For this reason the serving network shall support the transmission of charging information also

during the life of the packet data session, either when some charge value is reached or some duration or some data volume or all three, to allow for both charging settlement and cost control.

5.2.2 Multimedia calls

During one call the user may invoke different services like speech, data transmission, video and audio, which may lead to a separate collection of charging information for each service in different network components. In this case, the billing system shall be able to correlate these charging information and to indicate to the user that they belonged to one call.

5.2.3 Service Change

Sufficient information about a service change using SCUDIF changing a voice call to a CS multimedia call, or vice versa, shall be collected to enable operators to apply maximum flexibility in charging. This information is collected on top of the data that is already available for the underlying call now subject for the service change.

On a service change using SCUDIF the following information shall be collected on both sides of the call:

1) Initiator of the service change (A side or B side)

2) Type of the service change (To speech or to multimedia)

3) For a service change to multimedia: nature of the service change (User or network initiated service change)

5.2.4 E-Commerce

The 3GPP system may be used to trade soft goods (e.g. information, video, audio), or hard goods (e.g. books) of high or low value per item between the user and a merchant. It shall be possible for such merchants to charge users directly for services they provide. Electronic payment mechanisms are or shall be made available through other standards (micropayment, credit card payment, etc), and therefore are outside the scope of this specification 3GPP shall not prohibit the use of these mechanisms, and, where possible, shall provide the basic communications transport to allow them to be used effectively.

However, if the serving network acts as merchant of soft goods, it may charge the user directly, collecting the related charging information as described above or using micropayment mechanisms.

5.2.5 Volume Based Charging

It shall be possible to charge for the total volume of data/packets sent and received by the user.

5.2.6 VAS

It shall be possible to charge the user for Value Added Services offered by the network in terms of access, surfing, queries etc. irrespectively of the volume of data sent or received by the user.

5.2.7 Usage of IP Multimedia service

It shall be possible to charge the usage of IP multimedia service independently of the volume of data sent or received by the user. Information on the IP Multimedia capability provided to the user (e.g. voice, mixture of voice and video component, numbers of parties) should be available in the charging information.

5.2.8 I- WLAN

I-WLAN charging issues are captured in 3GPP TS 22.234 [3].

5.2.9   Charging for two(and multi)-phases services for IMS networks

It shall be possible to charge a service change in case of VAS that foresee different service phases at different tariffs. This applies both at the interconnection between IMS network operators and at the interconnection between IMS network operators and service providers.

This information is collected on top of the data that is already available for the underlying communication now subject for the service change.

6   Transfer of Charging Information

The efficient transfer of charging information between serving networks and from serving networks to home environments requires a standardised interface between these entities. It shall be possible to define different time intervals for the transfer of charging information between serving network and home environment (e.g. 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 (see 5.1) shall be standardised. It shall be possible for the relevant parties to agree minimum and maximum age of charging information transferred between themselves.

6.1   Integrity, Secrecy and Validation of Content and Receipt of Charging Information

The transmission mechanism for charging information collected in 5.1 above shall ensure its integrity and secrecy.

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

- the home environment shall be able to validate the source and integrity of the charging information supplied by the serving network;

- the serving network shall be able to validate the source and integrity of the charging information supplied by the user;

- the serving network shall have proof that services were provided to a specified user.

7   Accounting and Settlement

The serving network shall collect and process the charging data generated in its network elements. The record of each individual transaction shall be reported to the home environment at short time intervals in order to allow further processing by the billing system in the Home Environment, provide itemised bills, and to deal with any disputes regarding charges both for users and for other visited networks and home environment.

The standard shall support the transfer of charging data at different intervals as required by the Home Environment (e.g. short time intervals, real time, other regular intervals).

7.1   Delegation of charging authority

The registration process allows the home environment to authenticate users before they incur any charges. Once authenticated, the home environment then delegates authority to the serving 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 home environment or a network operator known to the home environment. 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 3GPP system which have a commercial relationship.

7.2 Fraud Control

A mechanism to control fraud shall be provided by the serving networks and the home environment.

7.2.1 Fraud Control by the Home Environment

Charging information shall be collected by the home environment in real time from all serving networks which its users are allowed to use. The billing system in the home environment shall process the information in real time and provide the means to set charge thresholds per time interval upon which some actions may be started, such as informing the customer care centre or even barring the user in the HLR.

It shall be possible for the Home Environment to define different time intervals for the collection and the processing of charging information (e.g. real time, short time, other regular intervals).

7.2.2 Fraud Control by the Serving Network

Charging information shall be collected from the network elements and processed in real time. This will allow the serving network to always be aware of the exposure to visitors. A limit for the accumulated charges for all visitors from one home environment or a limit per visitor may be agreed between the home environment and the serving network.

It shall be possible for the Serving Network to define different time intervals for the collection and the processing of charging information (e.g. real time, short time, other regular intervals).

7.3 Cost Control

A mechanism shall be standardised providing an indication to the user (if involved in the chargeable event) of the charges to be levied for a chargeable event. This mechanism shall be able to handle all possible charging scenarios, and all service and tariff variants that the home environment and the serving network may offer to the user.

The user shall be able to set in his home environment a limit for the accumulated charges per time interval. Upon exceeding this limit or prior to incurring a charge which would exceed the limit, certain actions may be desired by the user:

- notification to the user, requesting to extend the limit; or

- Home Environment barring allowing no further originating calls; or

- Home Environment barring cancelling the roaming permission.

7.3.1 Cross Phase Compatibility

For Release 99 the cost control mechanism may be based on Advice of Charge. However the Release 99 standards should not prevent the future implementation of the full Cost Control requirements.

The Release 99 standards should allow these new features to be introduced in a backward compatible manner; specifically terminals conforming to Release 99 standards should continue to support the Release 99 service requirements when operating with future implementations of Advice of Charge in the Home Environment.

7.4 Inter-network Settlement

Mechanisms shall also be provided to allow inter-network settlement of charges on a bulk basis. The same mechanisms shall be used between home environments and serving networks. This will allow each of these parties to meter the total input and output of charges and thus determine the payments required on a periodic basis between each of the parties with which they directly interact. The mechanisms used shall allow each of the parties 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 short time, such that each entity can be informed when a threshold has been exceeded and determine whether to continue.

8 Automatic Roaming Agreements

Support for the requirements in this section is not required in Release 99. However the Release 99 standards should not prevent the future implementation of this requirement in a backward compatible manner (eg a roaming broker enabled Home Environment should inter-operate with a R99 Serving Network).

It is a requirement that users shall be able to obtain service and use chargeable services with networks with whom neither they nor their home environment have any direct commercial agreement. This shall be enabled by interworking via trusted third parties. Each Home Environment shall interwork with one or more serving 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 serving network would register with that serving network, that would either directly or indirectly interwork with the home environment. Fraud and cost control mechanisms shall be used to ensure that charges incurred for 3GPP services do not exceed the credit limits set. This can be applied for the user and the other roles involved in commercial dealings. In practice, any serving network shall be capable of operating as a roaming broker.
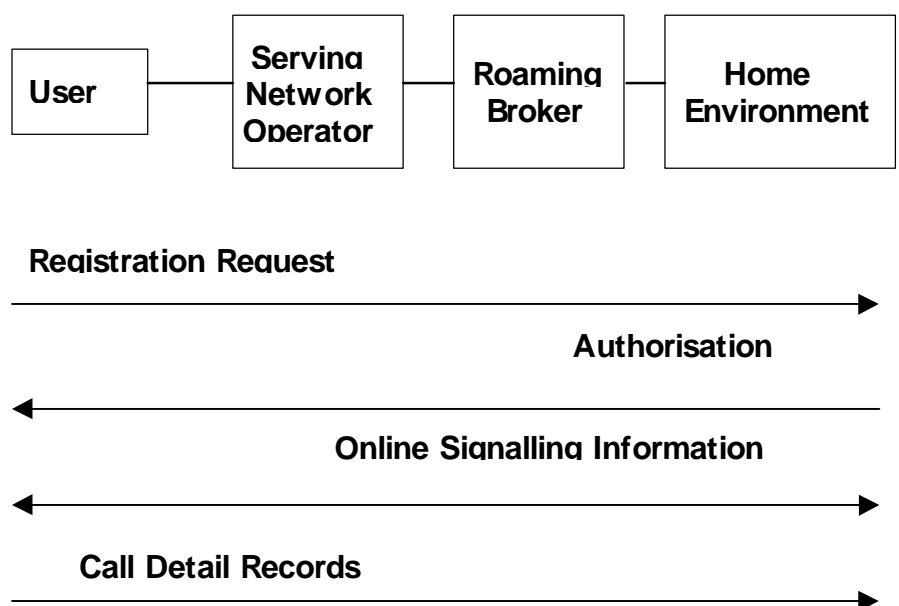

Figure 1: Registration and Roaming Process

8.1 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 Home Environment. The standard shall support a routing identification mechanism to allow a serving network, which does not maintain its own list of all known HE, to determine the appropriate route to reach a given HE. 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) HE. 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.

8.2 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.

Annex A (informative) :
Change history

Document information		
Date	**Status**	**Comment**
27 August 1996	Version 0.0.1	SMG 1 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
26 April 1999	Version 3.1.0	
8 Dec 1997	Version 1.2.2	Format and editorial changes by ETSI Sec for SMG#24
5 November 1998	Version 1.3.0	Incorporate changes discussed at SMG1 Rome, including reflecting changes to 22.01 role model.
12 January 1999	Version 1.3.1	Accept Changes and send to editing SMG1 Rome Tdoc 98-0859 Agreed by correspondence. Reviewed by Rapporteur Jan 13, 1999
27 January 1999	Version 2.0.0	To be presented at SMG#28 for Approval
February 1999	Version 3.0.0	Approved at SMG#28
March 1999	Version 3.0.1	Reformatted for TSG SA

TSG SA#	**SA Doc.**	**SA1 Doc**	**Spec**	**CR**	**Rev**	**Rel**	**Cat**	**Subject/Comment**	**Old**	**New**	**Work Item**
SMG#28			22.115					Version 3.0.0 Approved		3.0.0	
SP-03	SP-99106	S1-99234	22.115	A001	1	R99	F	Clarification of the Charging Service	3.0.0	3.1.0	
SP-05	SP-99454	S1-99817	22.115	002		R99	D	clarify the mandatory features supported by the standard	3.1.0	3.2.0	
SP-05	SP-99454	S1-99762	22.115	003		R99	B	Addition of Charging for Volume of Data and some edits	3.1.0	3.2.0	
SP-07	SP-000066	S1-000171	22.115	004		R99	D	Clarifications to 22.115	3.2.0	3.3.0	
SP-11	SP-010065	S1-010258	22.115			Rel-4		Creation of Release 4	3.3.0	4.0.0	
SP-11	SP-010058	S1-010192	22.115	005		Rel-5	B	Introduction of charging for IPMultimedia and Event Based Charging	3.3.0	5.0.0	IMS-OAM
SP-12	SP-010260	S1-010572	22.115	006		Rel-5	B	Introduction of online charging for prepaid services	5.0.0	5.1.0	PRPY
SP-15	SP-020053	S1-020643	22.115	007		Rel-5	B	CR 22.115 Charging and billing Some latitude was given by SA #15 to MCC to ensure that section numbering of original sections did not change.	5.1.0	5.2.0	OAM-CH
SP-19	SP-030023	S1-030184	22.115	008	-	Rel-6	B	CR to TS 22.115 - Clarification of the charging entity WLAN	5.2.0	6.0.0	WLAN-CR
SP-19	SP-030035	S1-030270	22.115	009	-	Rel-6	B	Requirements for Network Shairng in Rel-6	5.2.0	6.0.0	NTShar-CR
SP-20	SP-030263	N4-030449	22.115	013	1	Rel-6	A	Charging Requirements in an MNP environment	6.0.0	6.1.0	TEI
SP-21	SP-030467	S1-030764	22.115	014	-	Rel-6	D	Alignment of 22.115 with 21.801	6.1.0	6.2.0	TEI-6
SP-21	SP-030467	S1-030976	22.115	015	-	Rel-6	B	CS interconnection requirement for the identification of user data rate and user protocol at the interconnection point for charging purposes	6.1.0	6.2.0	TEI-6
SP-22	SP-030701	S1-031296	22.115	016	-	Rel-6	F	CR on 22.115: CS interconnection correction of an improper statement on the requirement for the identification of user data rate and user protocol at the interconnection point e.g. for inter-network	6.2.0	6.3.0	TEI-6
SP-23	SP-040101	S1-040259	22.115	020	-	Rel-6	D	Extraction of redundant WLAN charging information – now in WLAN TS22.234	6.3.0	6.4.0	WLAN
SP-29	SP-050621		22.115	0021	2	Rel-6	F	Clarification of Charging Implications of SCUDIF	6.4.0	6.5.0	CS video and voice improvements
SP-30	SP-050808	-	22.115	0022	2	Rel-6	F	Clarification of Charging Implications of SCUDIF	6.5.0	6.6.0	CS_VSS
SP-31	SP-060203	-	22.115	0023	3	Rel-6	F	Making charging principles also applicable to prepay services	6.6.0	6.7.0	TEI6
SP-33	-	-	22.115	-	-	Rel-7	-	Produced as a result of the implementation of Rel-8 CR 0024 and 0025 to Rel-6	6.7.0	7.0.0	-
SP-33	SP-060483	S1-060963	22.115	0024	-	Rel-8	B	Local Charging Zone Concept	7.0.0	8.0.0	LCZR
SP-33	SP-060483	S1-060962	22.115	0025	-	Rel-8	B	Local Charging Zone Requirements	7.0.0	8.0.0	LCZR
SP-37	SP-070567	S1071093	22.115	30	1	Rel-8	A	Correction for incomplete text on Universal Time (UT) at which resources were provided for the service	8.0.0	8.1.0	TEI8
SP-38	SP-070845	S1-071784	22.115	0036	1	Rel-8	C	Inclusion of fixed operator in interconnection charging requirements	8.1.0	8.2.0	CIMS8-TIS
SP-38	SP-070845	S1-071785	22.115	0034	2	Rel-8	B	TISPAN charging requirements	8.1.0	8.2.0	CIMS8-TIS
SP-38	SP-070857	S1-071933	22.115	0035	2	Rel-8	B	Charging Requirements for Unsuccessful sessions and calls	8.1.0	8.2.0	TEI8

ETSI

Change history											
TSG SA#	SA Doc.	SA1 Doc	Spec	CR	Rev	Rel	Cat	Subject/Comment	Old	New	Work Item
SP-38	SP-070863	S1-071929	22.115	0037	3	Rel-8	B	Charging for two-phases services	8.1.0	8.2.0	CHRG2PH

History

Document history		
V8.1.0	January 2008	Publication
V8.2.0	January 2008	Publication