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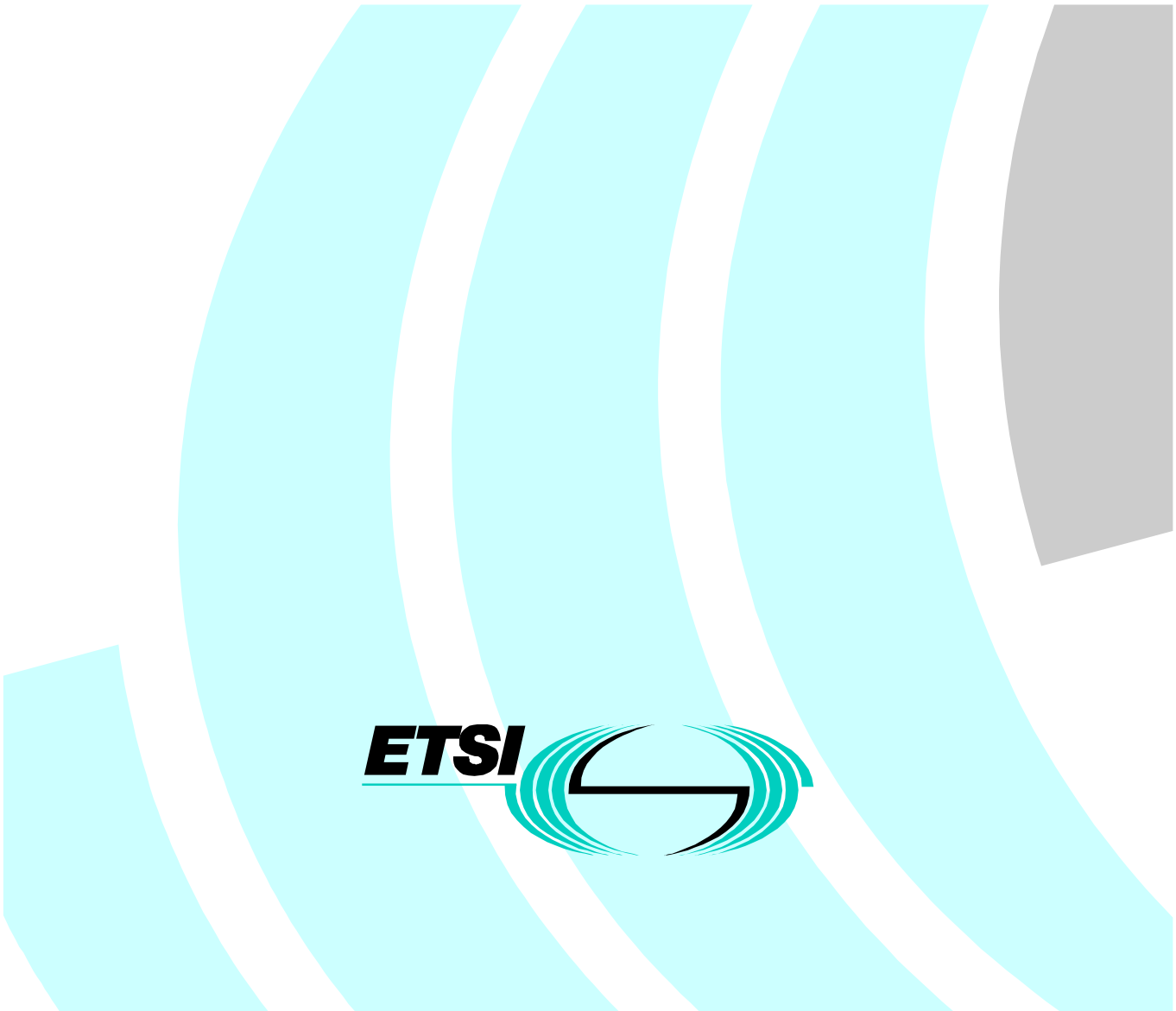
Technical Report

Network Aspects (NA); Considerations on network mechanisms for charging and revenue accounting



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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Network Aspects (NA).

Introduction

The present document shows general guidelines for determination of charging and revenue accounting parameters. The present document furthermore shows the general guidelines for technical mechanisms to register any event or parameter in relation to users transfer of messages via telecommunication networks, events or parameters which may be used for charging.

Guidelines are also given concerning mechanisms for revenue accounting between providers of network support and of telecommunication services, contributed to the same call and jointly charged and billed.

1 Scope

Whether the present document is applicable to a national environment and/or can be used for inter-network purposes, depends on regulatory demands and/or bilateral agreements. It should be noted that there are network requirements and signalling limitations that are not covered because they are outside the scope of the present document. Examples of these are as follows:

a) capabilities that require for translation function of currencies or for the translation of currencies into metering pulses;

b) with an analogue access with pulse metering no distinction can be made between pulses resulting from charges imposed by different operators;

c) the on-line provided advice of charge information may not accurately reflect the correct charging rate due to discount rates, special charging arrangements, etc.;

d) in association with these charging procedures also changes of the ISDN AOC supplementary services may be required for the identification of the network operator;

e) new services like B-ISDN and new IN concepts are not fully considered in the present document;

f) no interworking is covered with existing implementations making use of implicit information elements pointing to local available charging data;

g) complaint handling between operators in case of incorrect advice of charge information;

h) explicit encryption or special security mechanisms are outside the scope of the present document;

i) which currency is used is outside the scope of the present document.

Due to an increasing need for tools for flexible and efficient charging in a deregulated European telecommunications market with many telecommunication services available, it has been decided to study charging, billing and revenue accounting mechanisms in ETSI. The scope and background includes the reasons and intentions for the task.

It should be stated that guidelines given in the present document by no means would be mandatory for ETSI members. These are common guidelines for solutions within the domain of the present document, and do not exclude alternatives.

During the studies it has been decided that Billing is not relevant for this ETSI study. The billing process in this context is the task to organize the payment information for the user in a prepared billing layout and transfer this information to the user. Billing is regarded as an administrative procedure only, not fitted for ETSI recommendations and standardization. Nevertheless the activities providing the inputs for the billing process are included in the study.

The present document considers general matters and gives an overview of the total domain of charging and revenue accounting. The present document aims to cover the aspects of the domain for all networks within ETSI's responsibility. The present document is intended to be the main document of a family dealing with charging and revenue accounting.

It is important to state that the subjects of setting prices, tariffs, harmonization of tariffs or charging levels and administrative principles for revenue accounting between network operators/service providers (NO/SP), are outside the scope of the task. These matters are purely within the responsibility of the network operators and service providers and may be subject to national regulation.

1.1 Background

A main reason for the ongoing deregulation in the field of telecommunication is to open for competition between market suppliers within telecommunication: i.e. network operators and service providers. An important telecommunication development is the increasing variety of services and applications. A consequences of this development is a growing demand for flexible and differentiated methods for charging/billing and suitable systems, able quickly to establish any type of charging scheme for the use of the services. It should be possible to set up charging schemes as flexible as required concerning chargeable service elements. This could also influence systems for revenue accounting. In competitive environments such systems may be very important tools in managing the market.

The deregulation and competition within telecommunication will put focus on how the telecommunication providers could relate to their competitors within the domain of charging and revenue accounting. In international traffic network operators have a long tradition of interworking on charging, billing and revenue accounting. The gained experience may be usable in the deregulated telecommunication in general. The competition could be in a clean separation of all business between competitors, or the competition could include some collaboration. If joint activities are used discretion will be needed on competitive information balanced by the interest in efficient procedures. This requires precautions on confidentiality in the mechanisms for charging and revenue accounting. The mechanisms shall offer the participants guarantees against not allowed insight to sensitive information. The mechanisms for charging and revenue accounting should aim for handling of all relevant relationship between the providers.

During the latest years some manufacturers and network operators have started their own development of record-and-transfer-systems for call related data to charging-centres, and this has led to a growing demand for common methods and for standardization.

Due to the advantage of a common understanding of the subject, ETSI/NA has seen the importance of thorough studies and possible standardization of interfaces within the field of charging and revenue accounting. The interest covers all types of networks within ETSI's responsibility. By the means of carrier selection feature the user may select the network operator and the related network to connect his call. The user can see the carrier, but not the routing. The networks can belong to operators in competition. A call can include a number of network types. The involved networks could belong to different operators. Services from network operators and/or service providers could be added either somewhere on the traffic route and/or at any time during the call. The emerging multi-provider environment in domestic conditions will raise complex problems in the domain of charging and revenue accounting. The domestic scenario will in some respects approach the established conditions in international telecommunication.

1.2 Terms of references and the domain

ETSI/NA2 is, after decision at the ETSI/NA meeting in Vienna spring 1993, asked to play the guiding and co-ordinating role in all matters concerning charging and revenue accounting mechanisms for telecommunication networks within ETSI's responsibility. National and international networks are included as well as inter-provider revenue accounting between such networks.

The task includes an overall identification and description of the total domain of charging and revenue accounting. Detailed studies of appointed items should in agreement with NA be proposed allocated to relevant ETSI bodies for further work.

As mentioned in the introduction the document form retained is a TR showing general guidelines relating to the domain.

Furthermore NA2 shall identify interfaces suitable for standardization. NA2 shall identify the ETSI body adequate for elaboration of the standards. NA2 shall propose the activity from that body, when NA has accepted the work item.

NOTE: Since charging of the service usage is an issue different from the issue of revenue accounting between network operators and service providers, it is intended to consider the charging and the revenue accounting issue in separate clauses, although the issues are related.

For the revenue accounting issue it is important for the individual network operator or service provider to monitor and register the usage of services provided to his customers.

For telecommunication networks within the scope of the present document it is intended to set up reference configurations for the charging and revenue accounting activity and if possible to detect the interfaces which are candidates for standardization.

2 References

The following documents contain provisions, that 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, subsequent revisions do apply.
- 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] EN 301 175: "Cordless Terminal Mobility (CTM); Phase 1; Service description".

[2] I-ETS 300 819: "Telecommunications Management Network (TMN); Functional specification of usage metering information management on the Operations System/Network Element (OS/NE) interface".

[3] ETR 123: "Broadband Integrated Services Digital Network (B-ISDN); Parameters and mechanisms provided by the network relevant for charging in B-ISDN".

[4] EN 301 007-1: "Integrated Services Digital Network (ISDN); Signalling System No.7; Operations, Maintenance and Administration Part (OMAP); Part 1: Protocol specification".

[5] ETR 055-3: "Universal Personal Telecommunication (UPT); The service concept; Part 3: Service aspects of charging, billing and accounting".

[6] ITU-T Recommendation M.3010: "Principles for a Telecommunications Management Network".

[7] ETS 300 178: "Integrated Services Digital Network (ISDN); Advice of Charge: charging information at call set-up time (AOC-S) supplementary service; Service description".

[7a] ETS 300 179: "Integrated Services Digital Network (ISDN); Advice of Charge: charging information during the call (AOC-D) supplementary service; Service description".

[7b] ETS 300 180: "Integrated Services Digital Network (ISDN); Advice of Charge: charging information at the end of the call (AOC-E) supplementary service; Service description".

[8] ETS 300 374-1: "Intelligent Network (IN); Intelligent Network Capability Set 1 (CS1); Core Intelligent Network Application Protocol (INAP); Part 1: Protocol specification".

[9] ES 201 296: "Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP); Signalling aspects of charging".

[10] EN 301 140-1 (V1.1): "Intelligent Network (IN); Intelligent Network Application Protocol (INAP); Capability Set 2 (CS2); Part 1: Protocol specification".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

access network operator: The network operator to which the customer is physically connected.

accounting: The term "Accounting" is not used separately in the present document, because the term in literature on telecommunication has a number of interpretations. See "Revenue Accounting".

Administrative (Number Portability) Interface: An interface/information base in which information on ported numbers is available for NOs.

Advice Of Charge (AOC): Advice Of Charge (AOC) supplementary service appears in three versions:

AOC-S provides the served user with information about the charging rates at call establishment. In addition, the served user shall be informed if a change in charging rates takes place during the call.

AOC-D provides the served user with cumulative charging information during the call.

AOC-E provides the served user with charging information for a call when the call is terminated.

bill: A document from the billing entity to a served user in a decided format informing of the price for the usage of the concerned telecommunication services and resources. It shows the price for a single usage or the accumulated price for a certain period of usage. The information can be specified. It should be noted that the subscription fee and the periodic fee are normally included in the bill.

billing entity: Entity responsible for the joint billing activities for one or more providers to the served users.

billing process: The process of transferring the stored charging information for a user into a bill.

billing system: The technical entity performing the billing process.

call contractor: The network operator responsible for establishment of a call, which may contain contributions from a number of network operators and/or service providers.

NOTE: In case of carrier selection, the call contractor is either the access network operator or the selected carrier. The arrangement is depending of national regulation and agreements between operators concerned. If the selected carrier is the Call Contractor the access from the calling party to the Access NO is outside the Call Contractor's responsibility.

call reference: Parameters in Usage Metering Records (UMR) and e.g. in ISUP/INAP signalling messages on charging indicating a specific call, globally or within certain limits.

carrier selection: User selection of a NO different from the access NO. The carrier selection is made either on call-by-call basis or based on preselection of a certain NO. Carrier selection on call by call basis can be managed by access code overriding the default NO access and a preselection.

centralized charging method: Centralized charging method means charging outside the switch points in charging centres common to a number of switch points.

charging: Charging means by help of needed functions to determine the charge units (tariffs) to be assigned to the service utilization (i.e. the usage related elements applicable for charging).

clearing centre: Technical entity to handle the clearing activity for the revenue accounting between a number of interworking and co-operating telecommunication providers. NOs transfer general accounts for clearing and receive cleared invoices.

cordless terminal: A physical entity that provides access to the telecommunication services of a network via a radio interface.

Cordless Terminal Mobility (CTM): The scenario of cordless terminals moving within the limits of a certain radio based network or within the limits of co-ordinated radio based networks.

degressive charging: Charging which decreases stepwise or continuously during the call. See also Increasing charging.

direct debit service: Direct Debit Service means that the jobs to bill the users, to receive the billed income and to account the revenue are performed by an entity entitled to manage that for a co-operating group of network and service providers.

directory number: The catalogue number for a telecommunication subscriber.

discount: A reduction of the charging for a certain service compared to the generally applicable charging for that service.

instant discount: Discount triggered at the call execution.

delayed discount: Discount triggered by actions/events occurring after the call execution.

distributed charging method: It means that charging is distributed partly or completely to the switch points in the network.

geographical and non geographical numbering plan: A geographical numbering plan will use the first digits in the access number for a telecommunication subscription to indicate the geographical area in which the switch point access is located. The non-geographical numbering does not indicate the geographical location of the subscription's switch point access.

Hot Billing (HB): The process to produce a bill immediately after a call release. The input for this is the UMRs produced for the call or similar information.

increasing charging: Charging which increases stepwise or continuously during the call. See Degressive Charging.

interval billing: Billing process in telecommunication performed periodically e.g. in intervals of three months.

location portability: (Related to Number Portability) It means a service that allows the customer to retain his Directory Number when his premises location is moved within a certain area.

logical channel: A data path access from the user to a packet network.

mediation device: A TMN term indicating a device situated between NE and OS managing information to be transferred between NE and OS.

multi-operator/multi-provider environments: A telecommunication area in which a number of network and service providers are serving the users.

Network Operator (NO): An entity which is operating a public telecommunication network. If local networks are operated the Network Operator can provide access for subscribers and users.

network portability: (Related to Number Portability). A service that allows the customer to retain the Directory Number when he from the same location is shifting to another network access. The Recipient Network type can be different from the Donor Network type and/or the Recipient Network and the Donor Network can belong to different Network Operators.

Network Provider (NP): A term with the same significance as the term "Network operator".

number portability: The possibility for a telecommunication customer to retain the directory number when his access is moved to another network type, to another Network Operator, or if he moves his geographical location within the switchpoint area, within the numbering area, within the charging area or anywhere.

Operations System (OS): A TMN term indicating a management system.

Permanent Virtual Circuit (PVC): A permanent virtual circuit is a permanent "connection" for an undefined period of time or a permanent "connection" only set up according to calendar statements, periodically or non-periodically. A permanent virtual circuit relates to packet oriented traffic.

Price Information unit: Technical entity handling requests for charging information to the served users e.g. Advice Of Charge.

Q3-interface: A TMN term indicating the interface between an OS-device and a Mediation Device or an OS-device and a NE-device.

recipient network: The network where the ported number is located after being ported.

revenue accounting: The technical process of accounting the collected revenue for jointly service provision to a group of users and distribute it to the interworking and/or co-operating service/network providers.

Service Provider (SP) (or value added service provider): An entity that can provide a network service or a value added telecommunication service to a user having established a call by a network operator.

split charging: Charging of the call types to be paid partly by the calling party and partly by the called party.

tariff: Charged price per usage element or per group of usage elements.

tariffing: Determination of the prices, to be applied for services and service elements.

Virtual Circuit (VC): A virtual circuit includes a call request, call set up, current call and call release. A virtual circuit is managed by the user and lasts for a certain time i.e. seconds, minutes or hours. A virtual circuit relates to packet oriented traffic.

usage element: A feature, service or function associated with a telecommunication usage and suitable for payment.

usage metering: Registration of the telecommunication resources or services used by a served user.

usage metering data: Data, which represents usage of telecommunication resources or services by a served user.

usage metering record: A data item for a specific user containing information of resource or service usage.

X-interface: A TMN term indicating the interface between OS-devices.

3.2 Abbreviations

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

AOC	Advice Of Charge
BA	Basic rate Access (ISDN)
B-ISDN	Broadband ISDN
CC	Charging Centre
CS1	Capability Set 1 (IN)
CTM	Cordless Terminal Mobility
DSS1	Digital subscriber Signalling System No. 1
GSM	Global System for Mobile Communications
HB	Hot Billing
HLR	Home Location Register (GSM)
IN	Intelligent Network
INAP	Intelligent Network Application Protocol (IN)
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part
LE	Local Exchange
MRVT	MTP Routing Verification Test
MSC	Mobile-services Switching Centre (GSM)
MTP	Message Transfer Part
NE	Network Element
NEF	Network Element Function
N-ISDN	Narrowband ISDN
NO	Network Operator
NP	Network Provider
OMAP	Operations and Maintenance Application Part
OS	Operations System
OSF	Operations System Function
PI	Price Information
PRA	Primary Rate Access (ISDN)
PSTN	Public Switched Telephone Network
PVC	Permanent Virtual Circuit
QoS	Quality of Service
R2	Regional Signalling System No.2
SCCP	Signalling Connection Control Part
SCP	Service Control Point (IN)
SDR	Service Detailed Record (Internet)
SP	Service Provider
SPT	Switch Point
SS7	Signalling System No.7
SSP	Service Switch Point (IN)

STC	Sub Technical Committee
TR	Technical Report
TMN	Telecommunications Management Network
TUP	Telephone User Part
UMR	Usage Metering Record
UMTS	Universal Mobile Telecommunications System
UPT	Universal Personal Telecommunication
VC	Virtual Circuit
VLR	Visited Location Register (GSM)

4 The charging and revenue accounting issues

4.1 Approach to the issues

The present document will only consider charging for the utilization of telecommunication services. The fee for establishment or for subscription of telecommunication services is outside the scope of the present document.

The present document describes usage-related elements for charging and mechanisms and methods for charging and revenue accounting related to network types. It includes basic requirements for the network types and reference configurations. Charging and revenue accounting of signalling traffic is considered. Charging and revenue accounting are considered separately.

Additional services in specific calls may be by customer or by network operator/service provider choice. Care is needed to charge the customer correctly and only once and to determine the correct automatic procedures for revenue accounting.

Charging information is very important. Handling of the information has to be very careful, due to the provider's responsibility for the correctness of the customer's charging, and due to the provider's revenue. Reliable means have to be used to prevent loss or distortion.

4.2 Carrier selection

Single calls may use services from a number of NOs/SPs, and calls might be routed by the user's carrier selection via alternative competitive networks, i.e. calls can be provided in multi-operator/multi-provider environments.

A number of customer possibilities exist for NO choice, also named carrier selection:

- Preselection, i.e. predetermined NO choice. The preselection can be (1) for all calls or (2) for certain call types e.g. local calls, long distance calls and international calls.
- Carrier selection on call-by -call basis by an access code defined for each NO. Carrier selection can override the preselection.

4.3 Number Portability

4.3.1 Directory Number and the impact of Number Portability

The classical reason for a telephone number, also called a Directory Number is to define an address for a customer in the topographical telecommunication landscape. Directory numbers serves two main aims:

1) the network routing issue; and
2) the charging issue since the location of the calling and the called party are basic charging parameters.

Liberalization of telecommunication makes it possible for customers to change subscription between NOs. Simultaneously changing of directory number would be an obstacle for customer's NO interchanging. A change of directory number is generally seen as a disadvantage for the customer.

Intending to minimize the obstacles for competition, public regulators require number portability, so that a customer can retain his directory number. Two scenarios for Number Portability are seen.

Scenario 1: Network Portability. It means a service that allows the customer to retain the Directory Number when he from the same location is shifting to another network access. The Recipient Network type can be different from the Donor Network type and/or the Recipient Network and the Donor Network can belong to different Network Operators.

This scenario is or will be generally mandatory in a considerable number of states.

Scenario 2: Location Portability. It means Number Portability in connection with the customer's change of address.

This scenario may or may not be implemented due to regulator's decision or local conditions. NOs might see an advantage in offering the service.

Introduction of number portability will undermine the classical directory number principles. The number portability issue has raised a number of technical problems for the charging process. The aim is to establish alternative conditions for the routing and for the charging purpose.

4.3.2 Procedures for ported numbers

In case of a ported number, different possibilities exist on making the information available for other NOs. The Donor Network, the network in which the number was created, or the Recipient Network, the network to which the number is moved, may in a mailing procedure inform an Administrative Interface, open for other NOs. The information can be transferred to a common database or stored in the NO's own databases. Before routing a call the call-originating network can check in the relevant database whether the called directory number is ported or not.

In case a number is ported within an area, which makes no differences in the charging, it is not necessary to announce the number porting. Calls will be routed to the Donor Network and forwarded to the destination.

The procedure for calls set up to customers having ported number may include one or more number enquiries.

4.3.3 Charging aspects in number portability

In case of scenario 1 "Network Portability" charging is supposed to be unaffected. I.e. the charging should be handled according to the NO access and to the real geographical location of the parties involved in the usage of the network services. The routing may be influenced by the number portability.

It means that charging for calls to customers having numbers ported to a certain NO shall be as for calls to non ported numbers for that NO.

Calls from customers with ported numbers shall not be charged additionally due to the number porting.

Since the charging is determined (mostly) at the call origination point, information of the (geographical) call destination is required at the call origination. Different technical solutions are under establishment to handle the number portability. Data for the location of the called party may be included in the records for ported numbers.

In case of scenario 2 "Location Portability" the charging may be according to the normal principles based on the new geographical location for the user.

The number portability features shall be taken into account in the following Clauses.

4.4 Real time processing and postponed processing, Hot Billing/Interval Billing

The charging process and the following billing process may be performed either in real time or postponed.

1) Real time processing supports immediate information to the user of charging (Advice of Charge) and/or an immediate billing (Hot Billing).

2) Postponed processing relates to Interval Billing.

This is a repeated billing in intervals. After accumulation e.g. during three months of the records of the usage events the postponed billing process is performed.

The users may need both the methods.

5 Narrowband and Broadband Networks

Basically narrowband and broadband networks have the same requirements for charging and revenue accounting. Technical and the market conditions are similar. This clause covers both network types.

5.1 PSTN, N-ISDN and B-ISDN in Single- or Multi-provider networks

The interworking conditions in present international traffic have features, which now appears in the national deregulated area. Experience from international telecommunication may therefore be valid in handling of the reorganized national telecommunication markets.

Deregulation allows many NOs and SPs to operate in the same market. A Single-provider network can be seen as a special Multi-provider network. In a Multi-provider network different sorts of interrelationship between the providers could be established. The interrelationship will depend on the commercial conditions, which may change during time. Independent parties in fierce competition, parties in gentle competition as well as parties in alliance may exist. This could lead to all from only necessary interworking to a close interrelationship and common efforts to efficient procedures. The charging issue may constitute a sector in which efficient technical procedures might lead to considerable savings.

The NOs have to co-operate to meet end-users requirements on services and functionality not obtainable from one provider or required by choice by the end-user from different providers. This might offer users the best conditions. SPs might offer services to the end-users via a single NO or via several.

An example of the charging aspects in multi-provider networks is seen in Figure 1. Charging (and billing) of end-users is managed by the NO at the call origination, the call contractor. A common scenario for regulated telecommunication markets when no competition exists between local loop providers and long distance companies. NOs have exclusive agreements with their customers including the charging and billing, also for services provided by other NOs/SPs.

NO x in Figure 1 manages charging of accessing users. Usage metering data for a user accessing x is transferred to the charging centre for NO x. Call reference (see definitions) shall be added to usage metering data in the Usage Metering Record (UMR).

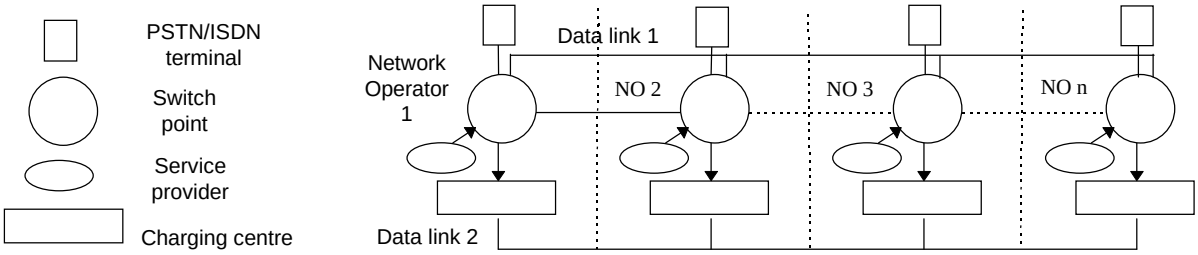


Figure 1: Reference configuration for multi-provider networks with charging centres for each NO

In Figure 1, usage metering data is transferred in alt. 1 by Data link 1 (e.g. a SS7 link) from the service originating switch points to the NO managing the joint charging/billing (call contractor), normally the NO at the call access or the selected carrier. Other NOs could be call contractors. In alt. 2 usage metering data is transferred in Data link 2 connecting the charging centres.

A second example of the charging aspects of a multi-provider network is shown in Figure 2. It shows a network in which the charging (and billing) of end-users is managed by a joint charging centre for all network operators and service providers in the shown network. It could be a scenario for the deregulated telecommunication market.

The usage metering data shall be transferred to the common charging centre by data links from the network operators and service providers. The interface for transfer of related information to the charging centre could be the Q3 or X interface, see [6]. If the ISUP (ITU-T Signalling System No. 7) is used, extension of the ISUP for transfer of charging related data is required.

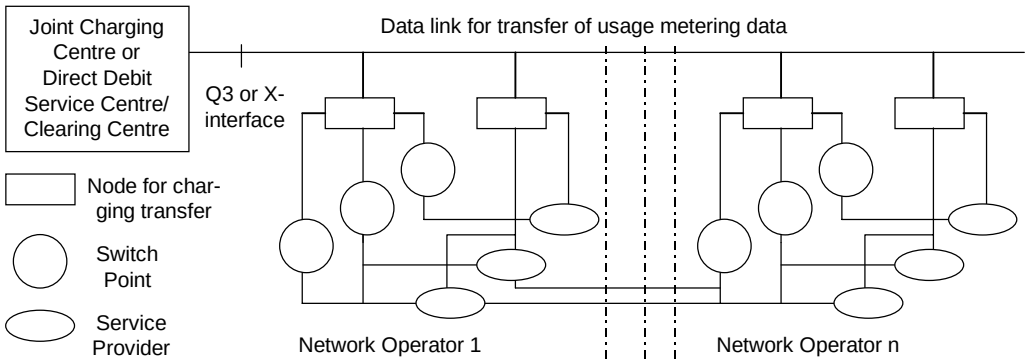


Figure 2: Reference configuration for multi-provider networks with a joint charging centre for the network operators and service providers

Figure 2 shows the reference configuration for multi-provider networks with a joint charging centre for the network operators and service providers. The data link transfers the user information via a Q3 or X-interface to the charging centre. ISUP from ITU-T signalling system 7 could also be applicable if extended for the purpose. Service providers can support a multiple of switch points and network operators. If the Joint Charging Centre is managed by an independent entity, the billing service is a Direct Debit Service, see 5.1.1.2.3. The Direct Debit Centre can also manage Revenue Accounting.

5.1.1 Charging, billing and revenue accounting in multi-provider environment

The functional mechanisms to serve the charging, billing and revenue accounting depends on the interrelationship between the providers in the telecommunication market. Requirements for Information on charge to the users and split charging has also to be taken into account. Possible provider interrelationships and the consequences for the charging, split charging, information on charge and revenue accounting mechanisms are set up below.

5.1.1.1 Individual provider charging

Individual provider charging means that providers who separately or jointly serve the users will charge and bill them individually for the provisions.

The possibility continues to exist, also for calls including services provided by a number of separate providers. Individual provider charging will introduce a set of requirements for the charging systems.

Consequences:

The charging equipment for each provider shall store/handle the charging data for billing purposes for his contributions to the users.

Network providers' and service providers' charging equipment shall be able to handle split charging.

Information on charge to the user shall be handled by the individual provider's equipment. Automatic transfer of information between the users' and the providers' equipment may be needed.

Revenue accounting between providers is not needed.

5.1.1.2 Joint provider charging

If more network operators and/or service providers are involved in a specific call, every provider should be paid for his service. The providers can agree on combined provider charging of the user per call. Joint provider charging means mechanisms for joint charging of the users for joint provisions. A combined charging could be more efficient for the

providers and might be simpler from the user's point of view than individual charging. One of the network operators, either the Access NO or the carrier selected NO, can act as the call contractor, who combines the charging of all the services in use. Other providers or external entities could also handle the activity. Combined provider charging will introduce a set of requirements for the charging systems.

5.1.1.2.1 Call contractor's charging and revenue accounting for joint providers

The call contractors are charging and billing the users for the joint contributions by the providers and are furthermore managing the internal revenue accounting.

Consequences:

The call contractor's charging equipment shall store/handle the charging data for billing purposes for the call-contributing providers. Automatic transfer of charging related data from providers to the call contractor is needed.

Network providers' charging equipment shall be able to handle split charging.

Information on charge to the user shall be handled by the call contractor's equipment or by the individual provider's equipment. Automatic transfer of information between the users' and the providers' equipment is needed.

The call contractor's equipment manages revenue accounting for the call-contributing providers. Automatic transfer of revenue accounting related data from providers to the call contractor is needed.

5.1.1.2.2 Call contractor's charging for joint providers. Revenue accounting by clearing centres

The call contractors, normally the operators accessed by the concerned users, could charge the users for the joint contributions from the providers. The charging could also be handled by other entities. Revenue accounting between the providers can be managed by systems in external clearing centres.

Consequences:

The call contractor's charging equipment shall store/handle the charging data for billing purposes for the call-contributing providers. Automatic transfer of charging related data from providers to the call contractor is needed.

Network providers' charging equipment shall be able to handle split charging.

Information on charge to the user shall be handled by the call contractor's equipment or by the individual provider's equipment. Automatic transfer of information between the users' and the providers' equipment is needed.

The clearing centre shall store/handle the data for the providers' provisions, and shall perform the technical clearing procedure between the providers. Automatic transfer of revenue accounting related data from providers to the Clearing Centres is needed.

5.1.1.2.3 Direct Debit Service

A special entity, the Direct Debit Service Centre, could manage the billing to the users for a co-operating group of providers. The providers will transfer the call-related data and/or the information on charge from the providers' equipment to the Direct Debit Service Centre. The configuration is shown in Figure 2.

Consequences:

The charging equipment for each provider shall store/handle the charging data for billing purposes for his contributions to the users. Automatic transfer of information from providers to the Direct Debit Service Centres is needed.

Network providers' and service providers' charging equipment shall be able to handle split charging.

Information on charge to the user shall be handled by the individual provider's equipment. Automatic transfer of information between the users' and the providers' equipment is needed.

Revenue accounting is made directly from the Direct Debit Service Centre to the providers' equipment. Automatic transfer of revenue accounting related data from providers to the Direct Debit Service Centre is needed.

5.1.2 Basic requirements for charging of telecommunication including signalling

Charging in telecommunication requires assignment of a paying party or parties. The candidates can be:

- the calling party (A);
- the called party (B); or
- a third party (C).

Depending on the assignment, a single party charging or multi-party charging (split charging) shall be provided.

5.1.2.1 Usage related elements for applicable charging

For utilization of telecommunication services the charging mechanisms shall be able to manage any type of charging and to charge all sorts of features, functions and services. Based on the provider's decision and according to legal regulations different sorts of bundling of charging elements might be offered. The charging mechanisms shall also handle bundling of charges by the provider's choice. For PSTN, N-ISDN and B-ISDN [3] examples of usage related elements for charging are mentioned in Table 1. The content of the table is also applicable for IN services.

Table 1: Usage related elements applicable for charging, examples

1) Calendar and time related charging	15) Multiple rate charge
2) Call attempt fee(1)	16) Operator assisted services
3) Call duration	17) Point to multi-point connections
4) Call set up fee	18) Priority
5) Called party category	19) PSTN related services
6) Calling party category	20) Quality of Service
7) Calls to other networks, (mobile etc.)	21) Reserved resources
8) Degressive charging	22) Routing between calling and called party
9) Distance to called party, national calls	23) Signalling resources (2)
10) Flat rate	24) Traffic contract parameters
11) Carrier selection access fee	25) Value-added services
12) IN related services	26) Volume of transferred packet traffic
13) International calls, area or country depending	27) Volume of transferred packet traffic/sec.
14) ISDN related service (bearer, tele-, suppl.)	28)

1) Call attempts might be charged if the call is through connected, even without reply, or in case of user failure in the call procedure. If the call is not through connected due to network failure or network congestion, the call attempt might not be charged.

2) The call set up signalling may include available space for transfer of information between the end-users. The charging of call set up or call attempt might take this into account. Alternatively charging for usage of signalling resources could be taken into account (see 5.1.2.3).

Call reference and provider identification should be included in the Usage Metering Record.

5.1.2.2 Split charging

For certain services both the calling and the called user could be charged (split charging). Split charging will introduce a set of requirements for the charging systems. The record for the calling user (A) shall be set up as usual. Furthermore a record for the called user (B) shall be set up and transferred from the registration points for the call related data to the entity responsible for charging of the called user. An indication of the paying A- and/or B-user shall be added to the call reference enclosed in the UMR (see definition in 3.1 and clause A.3). The originating switch point (A-access switch) may generally handle the B-part of split charging. For certain services the switch point for the B-access may handle the split charging. If the call contractor handles the charging a record will be set up and transferred from the call contractor's registration switch point to the registration entity for the B-user's account. The B-record might be of the same type as the A-record.

5.1.2.3 Charging for usage of signalling resources

Signalling was in the classical perception considered as a supporting activity for the call set up, for the current call and for the call release. As such the charging of calls included costs for the signalling traffic. Currently services have been introduced, requiring substantial signalling resources. Certain cases may even require signalling resources without a set up of a call connection, resulting in no charging for the usage. The needed signalling resource depends on the service profile. Due to these facts charging of signalling traffic could be appropriate. Charging of the usage of signalling resources require monitoring of the signalling traffic.

ETSI/STC/SPS2 has developed a standard on measuring possibilities for SS7 signalling traffic intending to create charging capabilities for such traffic [4].

Charging could be based on records for signalling traffic transferred to the charging entity and by the call reference added to the other charging related records for the same call.

NOTE: Studies and research may be performed to a mature status as a condition for substantial statements on charging for signalling traffic.

5.1.3 Reference configurations for charging

As an approach to a general model for the network capabilities related to charging and revenue accounting a solution based on the functional levels might be studied. The levels could have the following headlines:

- level for immediate information of customers;
- level for measurement of the service contributed;
- level of monitoring;
- level of initial calculation;
- level of final calculation;
- level of billing;
- level of further billing organization;
- level of revenue accounting.

5.1.3.1 The distributed charging method

The distributed charging method is the traditional charging system suitable for simple charging schemes in non-competitive environments. Charging is distributed partly or completely to the switch points in the network. The switch points are individually able to monitor the calls originated by their customers and to collect and store the call related data, which will be used in the charging process. In some cases price calculation is managed in the switching point itself, in other cases managed externally based on usage metering records transferred. The charging process is managed externally to the switch points. The originating switch point and the call contractor normally manages charging of the individual calls (see Figure 3), but also other switch-points could manage the charging. Bulk counters are normally used for charging registration. The scenario requires simple charging schemes possible to monitor from the charging switch point, i. e. the charging determination point and the charging registration point. If external service providers are involved in a call, as shown in Figure 3, the call contractor shall know the charging for the externally added services or service elements to be able to handle the complete charging.

A modified model of the distributed charging method is seen in networks having long-distance calls (e.g. international calls) and determination of the charge at a higher level in the network hierarchy. Traditional line signalling schemes (for R2, TUP and ISUP) are by some operators extended by proprietary solutions for sending of charging information from the charging determination point to the call originating switch point. A standardized extension of ISUP for transfer of charging related messages and parameters is in development.

The total charge can be added to a bulk counter allocated to the subscriber line, or to a number of counters allocated to individual call types or services. The total charging can also be registered from the usage metering records.

Complicated scenarios in multi-provider environments could require charging information, which is not detectable at the charging determination point. An example is a call getting service additions during the call from distant network/service providers, or the call can follow different routes with different charging. Complex scenarios will hardly be possible to manage in the distributed charging method. Individual service provider charging might be the only possible solution.

In multi-provider environments the distributed charging method would probably only be able to support the providers individually and not to support a charging system for joint use by a group of providers.

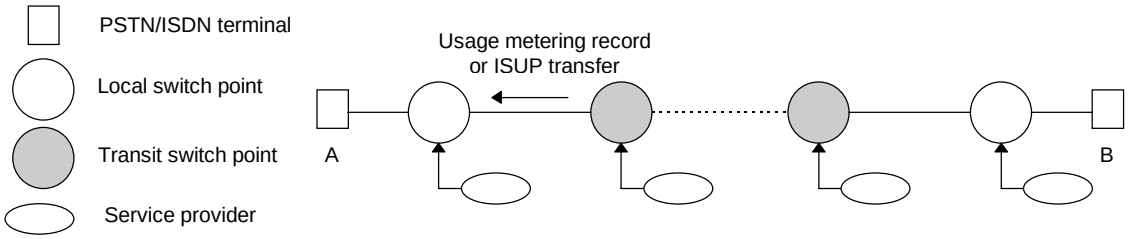


Figure 3: The distributed charging method

Figure 3 shows the distributed charging method. The call originating switch point 1 for an A -> B call can compute the complete charge of the call. The modified model determines charging for long distance calls/international calls at a higher level in the network hierarchy. By a proprietary solution of the line signalling system (R2, TUP or ISUP) charging information is sent back to the originating switch point, as indicated by the arrow. An extension of ISUP for transfer of charging related messages and parameters is in development. The charging can step a number of counters allocated to individual call types or a bulk counter associated to the subscriber line. Also an external handling of the charging can be applicable using usage metering records.

5.1.3.2 The centralized charging method

Centralized charging means charging outside the switch points in charging centres common to a number of switch points. The calls could be monitored at the originating switch point or by the service provider chosen by the customer to process the call. The call related data is stored and accumulated per subscriber line. Two scenarios can occur:

1) At certain intervals, normally some hours, the accumulated usage data from a switch point is inserted in a batch of records. By using a data transmission protocol the batches are transferred from the switch point to the charging centre. This is a computer system able to store the usage metering data per customer. At a later stage the accumulated data is transferred to a billing centre and calculated per customer to form individual customer bills. This is called the billing process.

2) For some purposes e.g. Advice of Charge it is essential to transfer the call-related data immediately. The technical solutions shall take both the scenarios into account.

It might be a practical advantage for customers to pay all the services related to a specific call in a single bill. The customer bill could be specified in degrees of details according to the decided requirements.

The providers could decide to join their efforts to meet the customer's wishes. A solution could be the centralized charging method.

To meet the requirement, information of services added during the call or along the route by network operators or service providers, could be transferred to the charging centre related to the originating switch point, in accordance with the traditional call monitoring mentioned above. Usage metering data for a certain call will be combined and stored in the charging centre related to the originating call switch point. In relation to a specific call it is necessary to link together the different or the different originated call related records. For this purpose a call reference has to be inserted into the records. The call reference in the UMR has to be unique in order to identify unambiguously the records belonging to the same call. (For UMR see definition in 3.1 and clause A.3).

Two reference configurations are seen in Figures 4 and 5. In Figure 4 the switch points have individual data links to the charging centre. In order to join the usage metering data coming to the charging centre via different data links from network and service providers contributing to the same call a call reference to any transfer of UMR is needed. The reference configuration in Figure 5 has a common data link for transfer of usage metering data. The TMN Q3 interface could be used for the transfer.

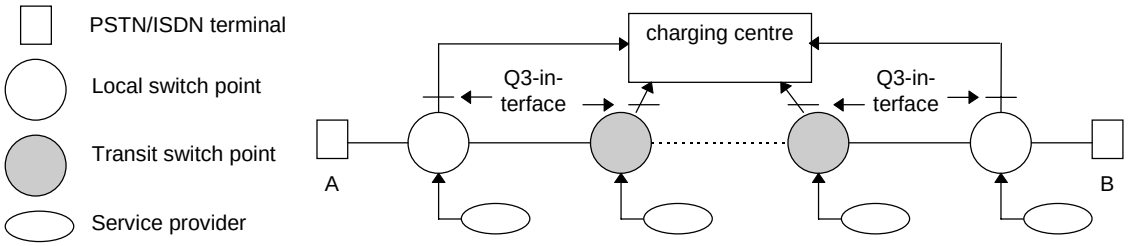


Figure 4: Reference configuration 1 for a centralized charging system

Referring to Figure 4: for services added at switch points along the route, the usage related data for charging are transferred to the charging centre by data links from the originating switch points for the services to the charging centre. The Q3 interface could be used. Call related data for service elements of different origin but related to the same call should be interlinked by the call reference in the UMR.

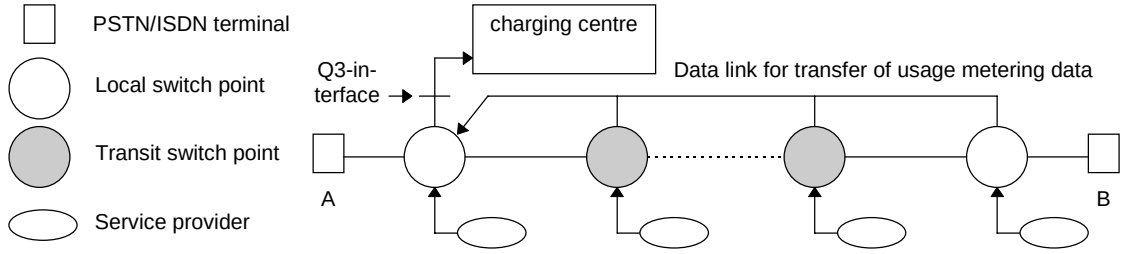


Figure 5: Reference configuration 2 for a centralized charging system

Referring to Figure 5: for services added at switch points along the route, the additional usage related data for charging is transferred via data links from the service originating switch points to the switch point for the call access. The data links could be signalling links if extensions to ISUP (ITU-T Signalling System No.7) are developed. The Q3 interface could be used for transfer from the switch point to the charging centre.

5.1.4 Revenue accounting mechanisms

Network operators and service providers that regularly provides services in common to the same customers could either charge and bill them individually or arrange a common activity. For joint provider charging/billing, the providers need revenue accounting in accordance with the provision from each provider.

The present document considers mechanisms and technical configurations to handle both the individual providers' charging of users and the joint charging activity for providers serving the users in common. For joint provider charging of users it becomes necessary to transfer call related data for charging from the providers to the charging entity (e.g. the call contractor). Mechanisms for revenue accounting are needed. Technical configurations for revenue accounting leads to transfer of related data from the service providers to the revenue accounting entity. ETSI standardization of interfaces for data transfer related to revenue accounting is considered.

Although based on the same elements charging and revenue accounting are of different nature. Tools to manage the two items reflect this difference. The remarks in the scope on handling of sensitive information in the competitive environments shall be taken into account within the item of revenue accounting. Guidelines on revenue accounting mechanisms in the present document do not exclude alternatives.

As shown in Figure 6: a network with two sets of network operator/service providers: A/a and B/b - revenue accounting could be managed automatically by a bilateral arrangement over the X interface between A and B.

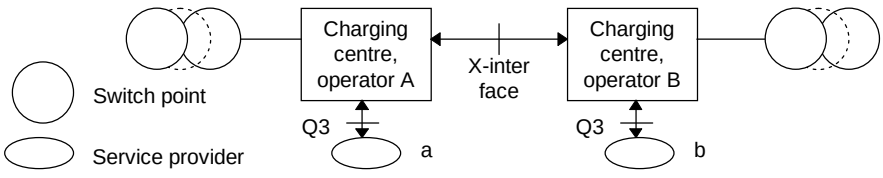


Figure 6: Bilateral revenue accounting between two sets of NO/SP: A/a and B/b. The interfaces Q3 and X are related to TMN [6]. Other interfaces than TMN's might be applicable

In the deregulated scenario a number of operators and service providers could contribute to a single call. A call could transit several networks with different owners, networks of the same or of different types (e.g. ISDN, GSM, and PSTN). A call between two customers could follow different routes e.g. due to the price or to the quality of transmission. This could lead to complicated revenue accounting scenarios even for simple calls. Since the clearing between the involved parties normally would be based on accumulation through a certain period (e.g. three months) an automatic clearing mechanism would be helpful or even a necessity. A number of service providers could jointly manage the revenue accounting by help of a clearing centre. An independent body could also manage the clearing centre. The clearing centre could arrange the clearing in a domestic region, a state or within a number of states and could cover all or only some of the operators and providers within that area.

As mentioned earlier a main principle is one bill for one call also if more providers contribute to that call. It is mostly the network operator of the calling party who is the charging and billing entity collecting the money from the end-user. The service contributors will per call store the delivering information i.e. address of the receiving network operator plus the date and time, the type of service and any (network specific) features used e.g. supplementary ISDN services. Furthermore the service contributors will transfer the same information to the clearing centre via data links, and add the call reference information if necessary.

The clearing centre will for an agreed period store and accumulate the information coming from the service contributors, and at certain intervals compute the collected material and arrange the clearing between the parties. From the storing of information of call contributions sent by the individual providers it is possible to check the results coming from the clearing centre.

Figure 7 shows the revenue accounting managed by a clearing centre. The clearing centre scenario may cover some or all network operators and service providers in a certain district (a domestic region, a state or a number of states). See also Figure 2. The Clearing Centre can also managed the Charging and Billing activity to the end users. (See under Direct Debit Service).

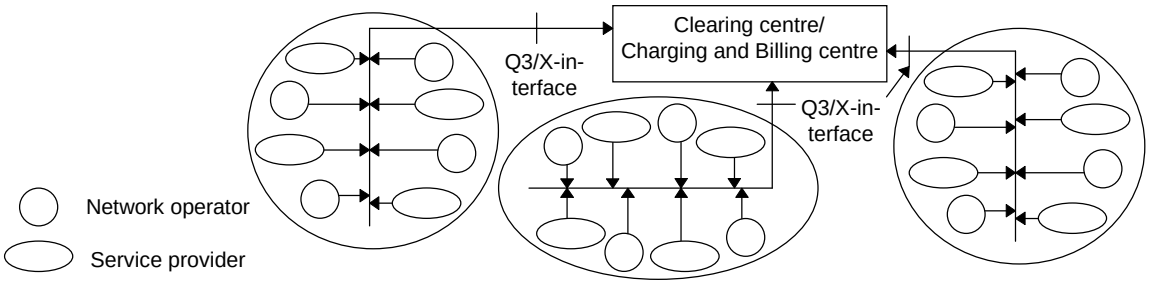


Figure 7: Revenue Accounting managed by a clearing centre for a number of network operators and service providers

The interfaces Q3/X are related to TMN [6]. Other interfaces than TMN's could be used. The usage metering data is transferred by data links to the clearing centre. The physical establishment of data links between the providers and the clearing centre is open for individual solutions e.g. direct links or shared multiple-links. The Clearing Centre can also managed the charging and billing activity for the end users.

Another possibility could be a number of clearing centres within the same district, each serving a multiple of providers.

The clearing centres could be a public or a private enterprise according to the current domestic or international conditions.

5.1.5 Revenue accounting for usage of signalling networks

Charging of signalling traffic will be followed by a need for considerations on related revenue accounting. In certain cases signalling resources are used are connectionless, i.e. without a call set up. For certain services a provider, without relationship to the user may handle the signalling. I.e. a sort of "transit signalling traffic". The emerging need for revenue accounting may lead to activity within the field, calling for standard methods.

NOTE: Studies and research may be performed as a condition for substantial statements on revenue accounting for signalling traffic.

5.2 Intelligent Networks

Two charging aspects are related to Intelligent Networks: (1) Structure and functionality for IN networks as a tool to support the charging and revenue accounting activity. (2) General charging principles for the use of IN services. The INAP protocol will be extended in line with the ISUP protocol for transfer of charging related data.

5.2.1 IN structure and functionality as a tool for charging

The elements in the IN structure might be used as building blocks for charging mechanisms for telecommunication services in general. However this general scenario seems not to be mature for considerations at present. But the charging of IN services performed by elements in the IN structure will be considered. The [8] shows in a number of scenarios a detailed discussion on charging of IN services. The discussion can be studied in [8], and will not be repeated here. But some features are reflected.

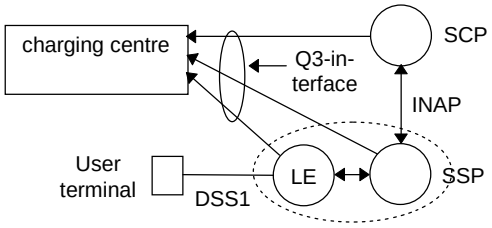


Figure 8: Basic IN elements, which might be applicable for charging of IN services

Figure 8 shows the basic IN elements, which might be used for charging of IN services. LE is the local exchange (switch point). The SSP could be software in LE or a separate unit. SSP or SCP could perform charging calculation for AOC-D and - E. Charging calculation means the process to combine tariffs for the call related elements with the present usage of them, to determine the price for the call. For the delayed charging case, UMRs could be transferred from LE to the charging centre for calculation, registration and storing as for charging of non-IN services.

Figure 8 shows the basic IN elements, which could be used for charging besides their usual functions.

When a call is triggered in an SSP, SCP will control the service. Charging can be performed in SSP or SCP or in both. If charging is performed in SSP, the SCP can influence the charging. If the charging calculation is performed in the SCP, it needs a transfer of call related data from the basic call control in the LE to the SCP over the INAP signalling link.

User required charging information (AOC) could be transmitted from SCP/SSP via the signalling link and the local loop signalling, DSS1 in case of ISDN. In this concept the SCP will serve as a Price Information Unit for the Advice Of Charge service.

The SCP will in general be common for a number of switch points and could consequently be rather busy. Taking this into account the charging process could be performed in SSP instead of SCP. The master program for charging could e.g. be located in the SCP, and the program could be loaded into the SSP and used for charging calculations according to the concept of the charging system.

In this concept the SSP will serve as a Price Information Unit for the Advice Of Charge service.

For delayed charging the calculation, registration and storing might be handled in a Charging centre as indicated in Figure 8. If the IN elements are not applied for charging, the LE will act as for normal PSTN/ISDN services and either charge the IN services by itself, or transfer UMRs to the charging centre for further handling.

In case of AOC-D and -E or Hot Billing performed by SSP or SCP, the result could be transferred to the charging centre for storing and postponed billing. This will eliminate the possibility for different calculation in the two concerned units.

Information between the SCP, SSP or LE and the charging centre might be transferred via Q3 interface.

5.2.2 Charging of IN services

IN services are similar to other telecommunication services, and might be charged on the same conditions and by the same parameters. For a list of usage related elements for charging see subclause 5.1.2.1, Table 1.

5.3 Cordless Terminal Mobility

5.3.1 Introduction

The charging of a CTM user is here analysed, taking into account the geographical and non geographical CTM numbering plan, and the centralized or distributed charging scenarios.

The CTM service description can be found in [1].

5.3.2 Basic requirements for Charging

The basic requirements described in subclause 5.1.2 for PSTN/ISDN are also valid for the CTM service, with some extensions due to the terminal mobility. The usage related elements for charging should include in this case mobility related information elements, according to the operator's requirements and tariffing criteria.

Both the individual provider billing and the single complete bill per call are accepted in the case of calls involving more than one service provider.

5.3.3 Reference Configuration

The reference configuration is based on the Intelligent Network platform, used by the CTM service for the mobility management. For this reason the charging functions are similar to those used for IN services.

The CTM customer has typically access to most of PSTN/ISDN services, provided by the same or different operators. Depending on the operator's choice a distributed and a centralized charging method may apply for charging in the CTM environment, see subclause 5.1.3. The scenarios should also include the possibility of split charging (e.g. the operator can choose to charge the called CTM party for the link from the home switch to the visitor switch he has roamed to - see Figures A.2 and A.3 in Annex A). Another possibility is the creation, by the destination switch, of a "mobility premium record" to charge the called CTM party for the provision of the mobility feature.

The reference configuration for CTM is drafted in Figure A.1, Annex A.

5.3.4 Distributed/centralized charging method

The network operator, depending on the switching point's functionality and the network architecture can adopt a distributed or centralized charging method. However the CTM calls should be charged by usage metering records only, since bulk counters are not able to register the charge of mobile subscribers. The switch should create a record with the appropriate usage metering data, used by a charging centre for off-line calculation, or used by a charging system in a distributed scheme.

Due to the mobility feature, the IN could be requested to provide charging information to some switches (typically one) involved in the call.

5.3.5 Charging in a geographical/non geographical numbering plan scenario

Charging considerations are independent of the numbering scenario.

NOTE: The reference numbering scenarios can be found in Annex A. Figure A.2 refers to the geographical numbering plan, Figure A.3 to the non geographical one.

The usage metering record shall be created by the originating switching point when the CTM subscriber is the calling party, or by the home/trigger switch (case of geographical or non geographical numbering plan) when the CTM subscriber is the called party and split charging is done. If foreseen, a "mobility premium record" for the CTM called party will be created by the visited exchange.

The cases of CTM calling party and CTM called party are considered in details below.

CTM: calling party

One switching point is involved in this scenario.

- Originating switch creates a record for the calling CTM party. If required the switch will calculate the amount of charge units and store these data in the call record.

The originating switch could be different from the home switch if the calling CTM terminal has roamed outside his home area.

CTM: called party

A call to a CTM terminal roaming to a visitor switch and originated by a fixed or CTM terminal is discussed.

Three switching points could be involved in this scenario, depending on the operator's decisions to foreseen a split charging between the calling and the called party and a "mobility premium record". In this case the following actions will be performed for the charging scope.

- Originating switch: updates a bulk counter or creates a record for the calling party.
- Home switch (geographical numbering plan) or trigger switch (non-geographical numbering plan): if split charging is foreseen it will create a record for the called CTM party. If required the switch will calculate the amount of charge units and store these data in the call record.
- Destination switch: if a "mobility premium record" is foreseen, a record for the called CTM party will be created.

5.3.6 Usage metering record

Here is considered the usage metering record, used for billing/charging, created when the CTM handset is used as mobile and not as homely cordless. The case in which the CTM handset is used as a fixed terminal (cordless) is not analysed in the present document.

The usage metering record shall be created by IN functionality (e.g. SSP/INAP or SCP), and will be used by a charging centre or by a centralized charging system. The usage metering record is composed by usage elements similar to those adapted to charge IN services, properly adapted to take into consideration the mobility related aspects. (For instance the record should store the CTM service identity, the CTM subscriber's telephone number, the charging originating point, and the translated number to the actual destination).

The switch point in accordance with the defined in [2] should generate the considered CTM record.

The considered network architecture (centralized or distributed charging method) and the numbering plan (geographical or not geographical into the PSTN network) have no impact on the record format.

The CTM usage-metering record might also be used for statistic or other purposes properly handled by the right management centres.

5.3.7 Supplementary Services

In case the CTM user (calling or called party) invokes supplementary services, the same record used to charge the connection, or a different one, has to store the relevant charging information for the services.

5.3.8 Usage metering records during the handover phase

The CTM standardization defines different handover capabilities for the CTM terminal. These capabilities are limited during the first phase of the implementation of the service (according to [1]) or by the operator's decision.

If the CTM handset will be given the possibility to perform a switch to switch handover or an internet work handover, the switching points involved shall provide the management with the usage information so that a complete set of data will be available to the billing/charging system.

5.3.9 Structure of the CTM usage metering record for Hot Billing purpose

The "hot billing" (HB) function, which allows the CTM subscriber to receive the bill in a short time (to be defined) could be realized through the creation (in the switch) of a short record (extracted from the CTM complete one). This could be sent in real time to a dedicated charging/billing centre. This one shall collect the complete records related to each CTM user who subscribed the HB service, no matter to whom he was roamed.

Each CTM user who subscribes the HB service shall be properly characterized.

The switch functionality for the "hot billing" service for storage and sending are defined in [2].

5.4 Mobile telecommunication systems

The issue of charging in this subclause will only be related to mobile systems specified by ETSI. In this context mobile systems are those, intended to cover large geographical areas by radio access for portable telecommunication terminals. Other systems like cordless telephones are considered in separate clauses.

Charging methods for mobile telecommunication are basically the same as for the fixed network, i.e. according to the distributed and to the centralized method. Usage related elements for applicable charging are also similar to the applicable elements in the fixed network. (See Table 1)

5.4.1 Different home and away charging for outgoing mobile calls

Due to occasionally considerable differences between charging in fixed and in mobile networks, a feature is available intending to equalize charging of mobile calls from the customer's home location to charging of calls from the fixed network. The feature makes it possible for people to be customer on the mobile service only, and avoid the fixed network subscription, which otherwise could be interesting due to the charging. The feature covers only outgoing calls from the mobile terminal in home location. In case incoming calls to the mobile terminal should be covered, the needed data should be transferred to the call originating point.

The home location of the terminal is defined, detected and stored once by a special procedure. The home location can be defined as the coverage area for the homebase station or for a few homebase station sectors. More sophisticated methods might be applied in order to define a closer and smaller home location area.

5.4.2 Split charging aspects in mobile telecommunication

Due to the differences between charging of calls in fixed networks and in mobile networks split charging is interesting for charging of calls from other networks to mobile customers. Cost of calls from fixed network customers to mobile could be higher than cost for calls to other fixed network customers. Split charging can afford equal charging for the fixed network customer either calling a fixed network customer or a mobile customer. The called mobile customer may be charged for the exceeding costs. The mobile customer might also be far from the home location without the calling party's knowledge. The mobile user is normally charged for the forwarded leg from the mobile home network to the visited network.

5.4.3 Charging aspects for mobile telecommunication signalling

Generally the signalling traffic is not charged. The tools are not yet available but might be needed. Mobile telecommunication creates considerable signalling traffic due to its nature. The following events requires signalling resources:

- During visits much of the signalling traffic utilize signalling resources from foreign NO's as well as the home NO's mobile networks. The mobile terminals present in the geographical area of a mobile switching centre (MSC) are depending on the status registered in the home location register (HLR) or the visited location register (VLR). The open mobile terminal is monitored continuously. Moving geographically outside the HLR district, the terminal location is registered in the VLR, and the information is transferred to the HLR. The MSC area can even be divided and the registration of the mobile terminals accordingly refined, intending to address the paging distinctly to the geography in question.

- Hand-over of calls between base stations.

- Roaming of traffic between MSCs.

Table 2: Usage related elements applicable for mobile charging, examples

Hand over of calls between base stations, charging for signalling traffic
Multi-channel calls, i.e. calls using a number of base channels
Operator assisted services
Home location charging
Roaming between MSCs
Short Message Service (SMS) transferred by the signalling system
Signalling traffic due to on/off switching of mobile handset

The interest in charging of signalling traffic within mobile telecommunication is increasing due to the market growth and the growing number of mobile NOs. Monitoring and detection of signalling traffic as basic tools for charging of signalling traffic requires further development.

5.5 Universal Personal Telecommunication (UPT)

ETSI/NA7 has produced an ETR 055-3 [5]. ETR 055-3 is Part 3 of a multi-part ETR 055.

The ETR details the service requirements on the charging and billing mechanisms involved with the Universal Personal Telecommunication (UPT) service, and the necessary information transfer required between UPT service providers and network operators. It also specifies the principles for international revenue accounting. Detailed realization of these mechanisms is not specified in ETR 055-3 [5].

Charging within UPT should be based on charging of the UPT subscriber and not the subscriber of the temporary access.

The ETR specifies the types of charging which in principle might be applied to UPT:

- subscription related charges;
- subscription management related charges;
- call related signalling charges;
- location related charges;
- supplementary/additional charges.

Call related signalling charges is a special feature related to UPT. It is based on the need for extensive signalling traffic for both incoming and outgoing traffic for UPT calls. The principles for charging of signalling traffic for UPT should be based on the general principles for charging of signalling traffic, studied by ETSI/SPS2, see [4].

Revenue accounting mechanisms for UPT might be based on the principles for Revenue Accounting for PSTN/ISDN described in 5.1.4.

5.6 Universal Mobile Telecommunication Systems (UMTS)

NOTE: Studies should be performed on charging in UMTS.

5.7 Packet oriented traffic

Packet oriented traffic can be provided by virtual circuit (VC) or by permanent virtual circuit (PVC). The access from the user to the packet network is called a logical channel.

Packet oriented traffic may be provided to the users in multi-operator/multi-provider environments on conditions similar to those for circuit oriented traffic. The same types of interrelationship may exist for operator to operator and for operator to service provider. It means the guidelines set up for transfer of call related data applicable for charging between the providers in connection oriented traffic might be valid for packet oriented traffic also.

5.7.1 Usage related elements for charging

The usage related elements for charging are basically the same as for circuit oriented traffic, see Table 1. Certain considerations for call set up and volume related charging should be mentioned.

The call set up signalling may include available space for transfer of information between the users. The charging of call set up or call attempt might take this into account.

Volume related charging means charging proportional to the sequentially transferred sections of bytes. The provider shall define the number of bytes in a section. The charging for a section is triggered when transfer of that section begins. Volume related discount is based on accumulation of the transferred volume over time. Volume related discount can either be based on transfer accumulation within the same call set up or related to transfer accumulation for a period e.g. three months. The last one will normally not be released before the billing process.

5.7.2 Reference configurations

The network mechanisms for charging and revenue accounting in packet oriented networks could be based on the same principles as for circuit oriented networks. It means the call related data for packet oriented calls should be monitored and registered by the network as for the circuit oriented traffic. If charging is managed external to the switch points, the traffic related data should be send as records to charging units or charging centres for storing and accumulation. At certain intervals the billing process is started transferring the call related data to a billing entity producing the bill to the user for a certain period.

6 ETSI co-ordination on charging and revenue accounting activities

In general ETSI WG NA2 shall co-ordinate the ETSI activities on charging and revenue accounting.

6.1 ETSI Technical Bodies involvement

The situation for deliverables is seen below. Other items may later be identified for studies.

TC-TMN document I-ETS 300 819 [2] specifies the usage information on the NE/OS Interface.

ETSI SPS1 has extended the ISUP protocol for transfer of charging related data [9].

ETSI SPS3 has extended the INAP protocol for transfer of charging related data [10].

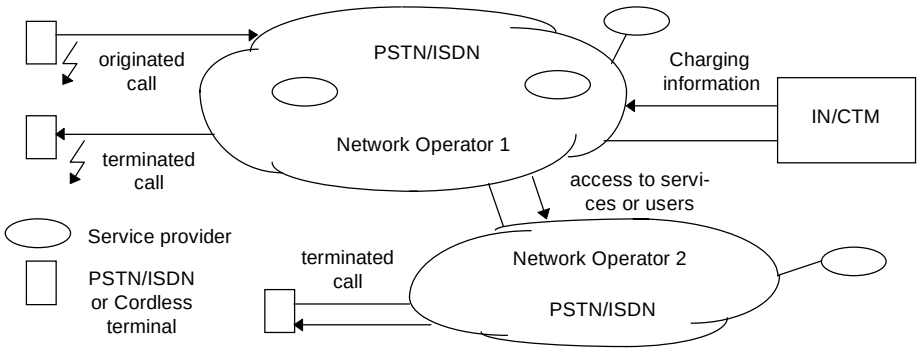
ETSI SPS2 has developed a standard EN 301 007-1 [4] on the possibilities to measure the signalling traffic on the SS7 network intending to create charging capabilities for such traffic.

The standard defines the requirements for monitoring and measuring in SS No.7 networks (including measurements for message traffic accounting), the requirements for MTP and SCCP managed objects, and the requirements for the MTP Routing Verification Test (MRVT) of ITU-T (previously known as CCITT) Signalling System No.7 management. It also lists the considerations applicable when inter-connecting ITU-T Signalling System No. 7 networks.

Annex A (informative): CTM scenarios

A.1 Call and charging handling

A call from/to a CTM customer can be originated and terminated inside one PSTN/ISDN network or it can reach a second operator's network (see Figure A.1). The call can also access a service provider through a PSTN/ISDN or the IN itself.



NOTE: The IN involved in the mobility management could be a third operator's IN.

Figure A.1: Reference configuration for charging in CTM

The IN could be required to provide charging information to the PSTN/ISDN network.

To provide a brief overview on the charging record creation, the following scenarios are presented.

A.1.1 Geographical numbering plan scenario

In this scenario (see Figure A.2) the CTM terminal is reachable using the geographical national destination code numbering plan. A call originated at a certain point in the network and having as a destination a CTM terminal will reach the home switch for that CTM customer. The terminal could be roaming to another switch, If it is not present in the home switch area. To reach the real destination the home switch makes an enquiry to a centralized database (SCP). As a final step the call is re-routed by the home switch to the switch where the CTM terminal has been registered. The records can be generated at the originating switch point, the home switch point (in case of split charging) or the destination switch point (in case of mobility premium).

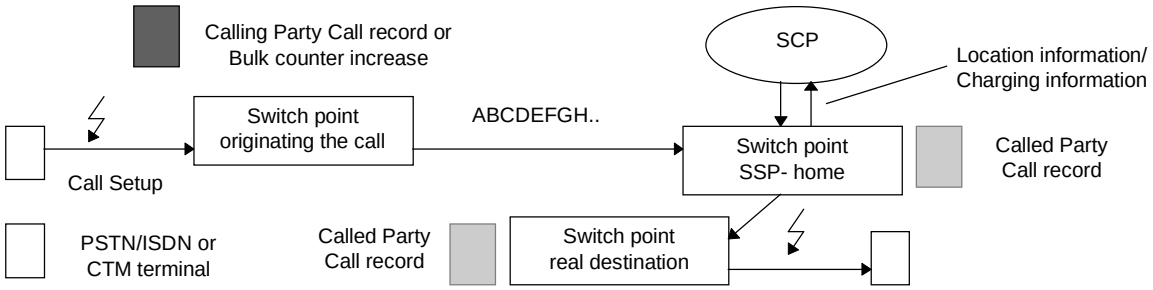


Figure A.2: Call scenario with CTM in a geographical numbering plan

A.1.2 Non geographical numbering plan scenario

In this case (see Figure A.3) the CTM terminal is reachable by dialling a non-geographic national destination code. The switch where the call is originated (or the first trigger switch) will then access the SCP in order to retrieve information on the real destination to be reached. It will then route the call to the destination switch where the CTM terminal has been registered. The records can be generated at the originating switch point, the home switch point (in case of split charging) or the destination switch point (in case of mobility premium).

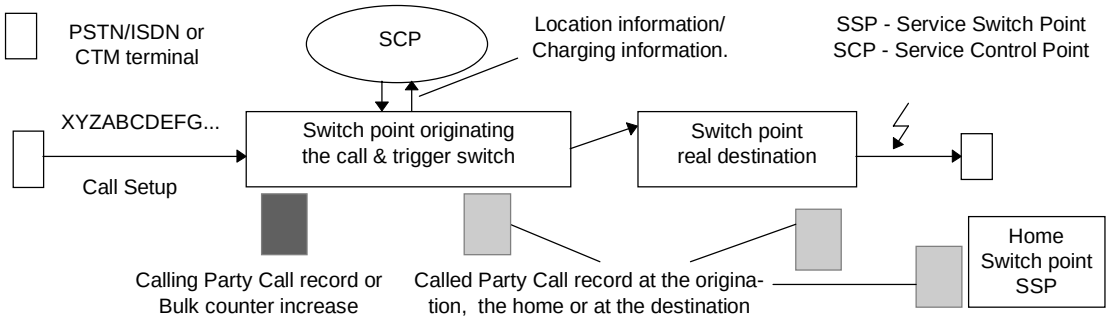


Figure A.3: Call scenario with CTM in a non-geographical numbering plan

A.2 Charging information to the user

Information to the user on charge can include any sort of information within the issue of charging. The information on charge can include:

- charging information of general nature;
- charging information on the user's account status;
- charging information related to call execution.

A.2.1 Charging information of general nature

Charging information of general nature could be found in databases (see table A.2.1):

Table A.2.1: Charging information of general nature, examples

Subscription fee, ISDN (BA or PRA), PSTN, Mobile	Charging tables for domestic calls relating to time, calendar, distance to or district of B subscriber (PSTN, ISDN, Mobile)
Periodically rates for current subscription, ISDN (BA or PRA) PSTN, Mobile	Charging Tables for international calls relating to time, calendar, distance to or internat. area for the B subscriber (PSTN, ISDN, Mobile)
Subscription fee rates for additional services ISDN, PSTN, Mobile	Charging table for usage of additional service (PSTN, ISDN, Mobile)
Quarterly rates for current subscription to additional services	Price list for purchase and rental of terminal equipment
Rates for call attempts and call set up	Rates for repair service

A.2.2 Information on the user's account status

Information of the user's personal account status should be given on user's request. The information could be specified according to the request and could be related to specific calls or to all calls within a defined period. Even for a single specific call. The information is stored in the charging buffer for the system.

Access should be established allowing the user to read the concerned sets of information in the buffer for his subscription only.

In multi-provider environments the type of co-operation between the providers/operators and the related configuration of the charging activities will lead to one or more registrations for a specific user's usage of provider resources. Access to the users account status should be arranged correspondingly.

Buffer type and access protocols should be defined taking the necessary safety requirements into account. The user request procedures could be menu oriented.

A.2.3 Charging information related to call execution. Advice Of Charge for ISDN

The need for immediate charging information related to call execution, e. g. for premium rate (kiosk-billing), coinboxes and hotels, is met by the Advice Of Charge supplementary service (AOC) for ISDN, [7], [7a] and [7b]. The Advice Of Charge supplementary service has three sub-services: Charging information of a call to be started, charging information during the call execution or charging information at the end of a call corresponding to the sub-services AOC-S, AOC-D and AOC-E, see Definitions.

The AOC service intends to give the users the exact information, if possible, on the charging, equal to the bill appearing later. Reductions in charging triggered at the call execution (Instant discount) should be included in the charging information. The charging information can not include reductions triggered by actions/events occurring after the call execution (Delayed discount). Delayed discount can be included in the billing.

If the exact charging information is not obtainable for logical, technical, economical or political reasons, the AOC service will only present an estimated charging information.

Charging information on the call execution should be approximate to the real charging, even if the exact charging can not be presented. In case the available charging information will be misleading for the end user due to considerable differences or lack of information on certain charging elements, the misleading information should be inhibited and the user informed.

A.2.3.1 Charging of call execution in multi-operator/multi-provider environments

Charging information on call execution in multi-provider environments could, depending on the provider co-operation, include information on the joint contributions from the providers. The information could be limited due to different reasons. The charging information to the user assumes the following conditions:

- provisions from the accessed network operator, including call executed reductions/additions;
- provisions from other network- or service-providers, including call executed reductions/additions;
- split charging information for the requesting user.

A.2.4 Technical reference configurations for charging information of PSTN/ISDN users

The AOC service is defined in the Stage 1 and 3 ETSs, [7], [7a] and [7b]. It only takes the transfer from the charging registration point in the access switch point to the user terminal into account. It can only transfer charging information available in the access switch point. It is therefore essential to create support functions for transfer of all relevant charging information to that switch point. Technical configurations for AOC will be considered in the present document. Different solutions could be used. A scenario is shown in Figure A.4. The unit to handle AOC is the Price Information Unit.

A.2.4.1 Price information unit for the distributed charging method

The following conditions are seen:

A.2.4.1.1 Price information unit for requests on the providers provisions

Location of the Price information unit:

- Integrated into or closely connected to the network switch point (Figure A.4, C and D).

Needed transfer facilities:

- User terminal to price information unit signalling should be defined and established.

A.2.4.1.2 Price information unit for requests on the multi-providers' provisions

The charging scheme for the co-operating providers shall be known in the price information unit. For networks including elements from several networks and service providers, only simple and static charging schemes will be possible to manage.

Location of the Price information unit:

- Integrated into or closely connected to the network switch point (Figure A.4, C and D).

Needed transfer facilities:

- Links and signalling protocols for transfer of charging information from the call contributors to the call contractor should be defined and set up. User terminal to price information unit signalling should be defined and established.

A.2.4.2 Price information unit for the centralized charging method

The following conditions are seen:

A.2.4.2.1 Price information unit for requests on the provider's provisions

Location of the Price information unit:

- Integrated into the provider's charging centre, (Figure A.4, B).
- Remote from the provider's charging centre covering a region of switch points (Figure A.4, A).
- Integrated into or closely connected to the network switch points (Figure A.4, C and D).

A.2.4.2.2 Price information unit for requests on the multi-providers' provisions

The following conditions are seen:

A.2.4.2.2.1 The providers in multi-provider environments with individual charging centres

Location of the Price information unit:

- Integrated into the NOs' individual charging centres (Figure A.4, B).
- Remote from the NOs' individual charging centres covering a region of switch points (Figure A.4, A).
- Integrated into or closely connected to the network switch points (Figure A.4, C and D).

A.2.4.2.2.2 The providers in multi-provider environments with joint charging centres

Location of the Price information unit:

- Integrated into the joint charging centre (Figure A.4, B).
- Remote from the joint charging centre covering a region of switch points (Figure A.4, A).
- Integrated into or closely connected to the network switch points (Figure A.4, C and D).

In all the presented cases, the supporting material for charging shall be created in the appropriate location and the information transferred to the PI unit. The transfer from the PI unit to the user's terminal requires available signalling facilities.

A.2.5 Configurations for Price Information entity

Charging information to the users shall be given instantly on request. The price information entity shall consequently include the updated charging table for the concerned services and providers and related charging calculation algorithms. The protocols for transfer of information for interface i1 shall offer real time conditions for the Charging Information service.

Figure A.4 shows the reference configurations for interfaces and locations of Price Information entity (PI) in centralized charging environments. The interfaces are:

i1: the interface between the switch point (SPT) and the PI;

i2: the interface between SPT and the charging centre (CC); and

i3: the interface between the PI and (CC).

The location of PI have basically three types:

A: a separate PI entity;

B: an integrated PI into CC; and

C: an integrated PI into SPT.

D: The PI as an independent entity set up per SPT. The configurations cover the scenarios for single provider and multi-provider environments. The price information entity shall be updated from the charging centre to be able to calculate the Charging Information according to the latest charging schemes.

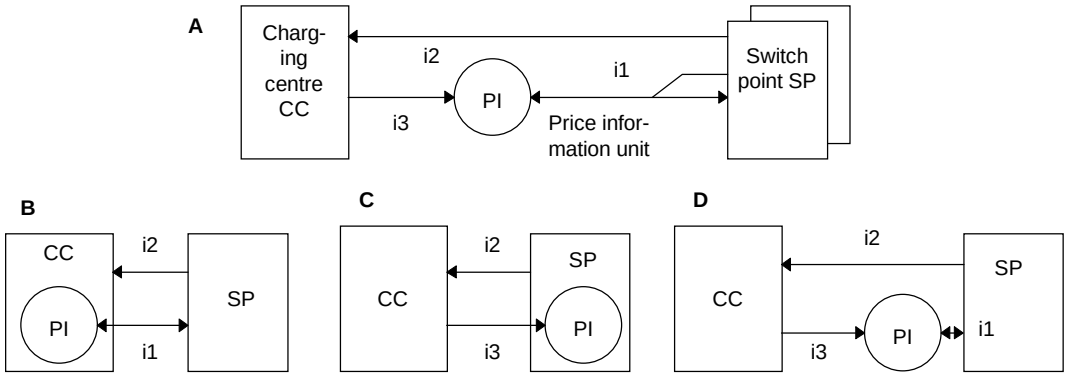


Figure A 4: Reference configurations for interfaces and locations of Price Information entity (PI) in centralized charging environments

A.3 Usage Metering Record

The UMR information is specified by the ETSI standard I-ETS 300 819 [2].

A UMR shall contain all usage data necessary to account for resource utilization at a specific instance by a specific user. Furthermore it shall contain identification of:

- the calling party;
- the called party;
- the call contractor for the basis call;

- the switch point for the basis call;
- the time window for the basis call;
- a call identification number for the basis call, given by the call contractor;
- a related call number. This number contains the call identification number of an associated call record. It is used to associate different call records generated in the same switch point. The prime purpose of the related call number is to combine different UMR's which belong to the same service transaction in the same itemized bill item; (The standard [2] specifies a 4-byte value for both the **Call identification number** and the **Related Call number**. This value is incremented for each call and will result in possible 4294967296 calls before restarting from zero.)
- the service provider, contributing a service to the basis call (Service provider identification);
- the originating switch point for the service, contributed to the basis call;
- the time window for the service, contributed to the basis call;
- information on the party to be charged for the call (calling party, called party or others). This includes information on the division in charging between the parties in case of split charging.

NOTE: A global **Call Reference** seems needed in order to interlink UMRs for the same call, but coming from different NEs.

Annex B (informative): Open Issues

General review of the charging and revenue accounting issue could lead to guidelines for more efficient and flexible tools. The charging and revenue accounting issue may need basic studies within some respects. Below is mentioned some fields.

B.1 Charging of signalling traffic

Studies and research might be performed on charging of signalling traffic.

B.2 Charging in UMTS

Studies might be performed on charging in UMTS.

B.3 Charging for Internet services

The ETSI Tiphon project has an open possibility to continue with studies on needed charging capabilities for Internet services. In case of studies the following requirements are seen:

1) The Tiphon system should have a mechanisms for providing Service Detailed Records (SDR) for each call, which can be used for charging and revenue accounting. Successful and unsuccessful calls should be taken into account.

2) The SDR should at least be able to support the following scenarios/services:

   a) basic call (calling party pays by subscription);

   b) free phone/toll free (800 call);

   c) operator assisted call/collect call;

   d) premium rate call;

   e) credit card call.

3) The SDR should contain information on the identity of the party to charge. It shall also be possible to configure the SDR to contain any of the following information:

   a) type of service;

   b) time of the day;

   c) the source and the destination of the call;

   d) the level of QoS;

   e) duration of the call;

   f) resource utilization.

B.4 Real time charging/billing and information to the user

In mono and multi-provider environments real time charging/billing and related information to the user is needed. Studies might be performed on requirements and technical solutions including scenarios, entities, transfer protocols etc.

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