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ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

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Foreword

This ETSI Technical Report (ETR) has been produced by the Network Aspects (NA) Technical Committee of the European Telecommunications Standards Institute (ETSI).

ETRs are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or the application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or an I-ETS.

This ETR gives requirements on the capabilities needed in the network for providing charging, billing and accounting in Universal Personal Telecommunication (UPT) Phase 1 provision.

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1 Scope

This ETSI Technical Report (ETR) gives requirements on the capabilities needed in the network for providing charging, billing and accounting in Universal Personal Telecommunication (UPT) Phase 1 provision.

2 References

This ETR incorporates by dated and undated reference, provisions from other publications. These references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETR only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ETR 215: "Universal Personal Telecommunication (UPT); Phase 1 (restricted UPT service scenario); Service aspects of charging, billing and accounting".

[2] CCITT Recommendation Q.1218: "Interface Recommendation for intelligent network CS-1".

[3] CCITT Recommendation E.164: "Numbering plan for the ISDN era".

3 Abbreviations

For the purposes of this ETR, the following abbreviations apply:

CLI	Calling Line Identifier
CS1	Capability Set 1
IN	Intelligent Network
INAP	IN Application Protocol
IP	Intelligent Peripheral
PSTN	Public Switched Telephone Network
SCF	Service Control Function
SCP	Service Control Point
SDF	Service Data Function
SMAF	Service Management Access Function
SMF	Service Management Function
SP	Service Provider
SSF	Service Switching Function
SSP	Service Switching Point
UPT	Universal Personal Telecommunication
UPTAN	UPT Access Number

4 Charging issues considered in this ETR

As outlined in ETR 215 [1], there are three types of charges applicable to UPT users/subscribers, as well as to non-UPT users making calls to UPT users; these are:

- subscription related charges;
- subscription management related charges;
- connection related charges.

This ETR gives requirements on the network capabilities required to support these charging principles. With respect to the charges mentioned UPT users may be subject to credit limits. For example, there may be a threshold on accumulated charges. Network capabilities required for the application of such credit limits are also considered in this ETR.

This ETR considers the case that the originating network has IN/UPT functionalities: this case implies optimised routeing, preventing internetwork tromboning, as discussed in other documents. The case that the originating network does not have IN/UPT functionalities while the UPT calls are routed via the home network, is not subject to standardisation.

5 Charging procedures for UPT

5.1 Connection related charges

This subclause considers connection related charges for UPT. The following categories of connection related charges are identified:

- charging of incoming UPT calls;
- charging of outgoing UPT calls;
- charging of follow-on calls;
- charging of combined incoming/outgoing UPT calls.

5.1.1 General

For all cases, it should be observed that in case a UPT user uses a network access the normal charging of this network access should be inhibited in such a way that the use of UPT does not result in charges being assigned to the line subscriber. Charging of the UPT user is always performed by means of call event recording capabilities, irrespective of the method of charging normally used in the supporting network.

5.1.2 Charging of incoming UPT calls

The principles for splitting the call-related charges between the calling party and the called party (UPT user) are outlined in ETR 215 [1]. In this ETR such a default splitting is examined from a network point of view.

5.1.2.1 Description of incoming UPT call

A description of an incoming UPT call is shown in figure 1. It is a simplified view of the architecture and information flows defined in other documents for UPT Phase 1. It is assumed that the Service Switching Function (SSF) and Service Control Function (SCF) are in the originating network and that the Service Data Function (SDF) is in the home network of the called UPT user; "incoming" implies that the called user is a UPT user. The calling user can either be a UPT user or a non-UPT user. For the purpose of analysis we first only consider the case that the calling user is a non-UPT user. The case that both calling and called user are UPT users is treated in subclause 5.1.5.

The following phases of the call are considered:

- the UPT incoming call reaches the SSF, the latter recognises it and sends a query ("query" should not be confused with the IN Application Protocol (INAP) query operation) to the SCF (phase A);
- the SCF processes the query and as a result it in turn sends another query to the SDF, for translation of the UPT number into a routeing number. The SDF responds with the routeing number (phase B);
- the SCF processes the response and then instructs the SSF on how to route and how to bill the call (phase C);
- the call is routed to the destination, following normal network procedures as any other call (phase D).

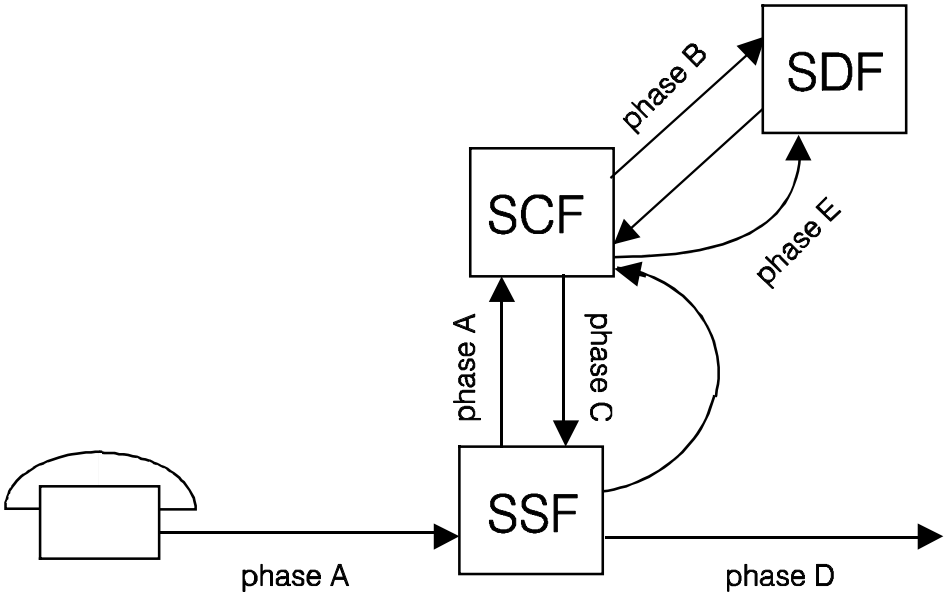

Figure 1: Simplified description of incoming UPT call

Other functional entities (e.g. Service Management Function (SMF), Service Management Access Function (SMAF)) are not considered in this analysis.

5.1.2.2 Default charging (split charging)

The information the network must know, in order to be able to calculate the charges to be applied to each party are the origin of the call (provided in phase A, as a Calling Line Identifier (CLI) or as a less detailed indication such as originating area code ID), and the destination of the call as provided in phase B, i.e. the routeing number. It also knows, either from analysis of dialled digits provided in phase A or from the SDF response in phase B, the default charging reference location of the called UPT subscriber.

From this data, the following information can be derived:

- the charging Rate applicable to a connection from the Origin to the default charging reference location (also referred to as Home location) (ROH);

- the charging Rate applicable to a connection from the Origin to the actual Current location of the called user (ROC).

Charges to the calling party

If ROC ≤ ROH then all connection related charges must be applied to the calling user.

If ROC > ROH then the connection related charges to be applied to the calling user are based on the rate ROH.

Charges to the called party (i.e. the UPT user).

If ROC ≤ ROH then connection related charges to the called party (UPT user) are null. It is very likely, however, that the called UPT user will want to keep track of incoming calls, even if the called UPT user does not pay them, so a call event record must likely be created in the SSF, to be sent later to the home UPT service provider (see clause 6).

If ROC > ROH, then connection related charges to the called user are based on the balance ROC ROH between the total charges ROC and the charges to the calling party ROH.

5.1.3 Charging of outgoing UPT calls

In this case the only rate to be calculated and applied is ROC. Since the charges must be applied to the UPT subscriber and not to the calling line/terminal, the normal charging procedures for non-UPT outgoing calls must be inhibited (e.g. via the recognition of the UPT access code or the SCF should instruct the SSF to stop the normal charging of the network access). The originating network (SCF_O) will calculate the total charge for the call (using the rate ROC) and, if required, will send it to SDF_h, for real-time credit limit checking.

5.1.4 Charging of follow-on calls

Follow-on calls should be charged as separate calls, i.e. a separate call record should be created for each call within the series of follow-on calls.

5.1.5 Charging of combined outgoing/incoming UPT calls

The network functionalities needed for charging of combined outgoing/incoming UPT calls (i.e. a UPT outgoing call which is directed to a UPT user) are a combination of those described in the sections on "charging of incoming UPT calls" and "charging of outgoing UPT calls".

5.2 Subscription management related charges

In UPT phase 1 subscription management is performed by setting up a call towards a Service Switching Point (SSP), which will ask the Service Control Point (SCP) for instructions. Interaction between user and network is performed by establishing a connection from a user terminal to an Intelligent Peripheral (IP). Since, from a network point of view a normal call/connection is established, charging could be achieved similar to the outgoing UPT call, e.g. the SCF instructs the SSF to suppress the charging of the access, and to maintain a record for the call, applying a certain charging rate.

Alternatively to this mechanism, the SCF could also determine the charge itself.

5.3 Subscription related charges

These charges are related to the UPT subscription alone, and are not related to any UPT procedures. These charges are of an administrative nature and do not require any additional network functionality, hence are not considered any further in this ETR.

6 Billing

6.1 General

Billing involves collecting the charging data for each user and transforming it into a bill (by assigning the appropriate tariff for each call) to be presented to the responsible subscriber. All charges to be applied to the calling non-UPT user will be entirely treated (and billed) in the originating network and should follow normal billing procedures in that network.

Charges or call records related to the UPT user (who is the called party in the case of incoming calls, and the calling party in the case of outgoing calls), must be sent from the originating network to the home UPT service provider, for two reasons:

- settlements between UPT service providers;

- the service feature "Account credit limit".

There are different ways of transferring such data, however they may be classified into 2 main types:

- off-line transfer via data-links or even paper work;

- interactive on-line transfer, meaning that at the end of the call a record or an equivalent indication is sent from the SCF to the SDF. There is a need, in this case, for a message from SCF to SDF at the end of the call for such information transfer. In general, there is also a need for a previous message from SSF to SCF. This is shown as phase E in figure 1.

The service feature "Account credit limit" requires that after each call a call record is send to the home service provider of each UPT user that was involved in the call.

How the UPT service provider bills its subscribers, does not impact the standardisation of network functionalities.

6.2 Transfer of information between UPT service providers for settlement and billing purposes

This subclause presents the information that should be transferred between different UPT service providers for each service provider to be able to bill the UPT subscriber for the services used within the domain of an other service provider. Note that the network may impose restrictions as to the information that can be transferred. For example, some networks may not be able to record the calling party's identity, hence in such a case it will not be able to transfer any information on the calling party. This subclause also indicates the network functionalities needed for the collection of billing information, and gives possibilities and restrictions of IN Capability Set 1 (CS1) (based on CCITT Recommendation Q.1218 [2]) with respect to the information transfer, as well as possible other network restrictions (non-exhaustive).

NOTE: This ETR does not prescribe the method used for exchanging the information between service providers.

UPT users can register in networks served by another UPT Service Provider (SP) (i.e. a visited service provider) than their home UPT SP. This has the following consequences:

- inter-operator settlements are needed for reimbursements between service providers for the use by their respective subscribers of the facilities of the other service provider;

- the visited service provider should provide the home service provider with data from which the home UPT SP can bill its subscribers for calls made via visited UPT SPs.

Because of the split-charging mechanism applied for UPT possibly three UPT SPs can be involved in the reimbursements required for one call. When both the calling and called user are UPT users, reimbursement is needed between the visited UPT SP and the home UPT SP of the calling user and between the visited UPT SP and the home UPT SP of the called user.

The subclauses 6.2.1 to 6.2.3 present the information that needs to be transferred between UPT service providers to allow reimbursement of UPT calls.

6.2.1 Start information

Information to be transferred

The start information contains at least the following items:

- name of the visited UPT SP;

- name of the home UPT SP;

- transfer cut off date and time;

- transfer number (separate consecutive sequence for each home UPT SP);

- file creation date.

Network functionalities needed

This information is of an administrative nature, and has no implications to the network functionalities.

6.2.2 Per call information

For each call made in the period covered by the account detailed information shall be provided. This "per call information" can be subdivided into three categories:

- general: information generated for each call;
- UPT originated: information generated in case the calling subscriber is a UPT subscriber;
- UPT terminated: information generated in case the called subscriber is a UPT subscriber.

6.2.2.1 General

Information to be transferred

The general information consists of:

- origination; calling address (e.g. point of attachment from which the call was made);

  NOTE: The transfer of this information is optional; it is subject to network capabilities and possible legal restrictions.

- destination; called address;
- date and time when the charging started;
- chargeable time.

The origination and destination together with the date and time of the call are needed for the determination of the appropriate tariff. There may be some extra charges for the use of supplementary services, etc.

Network functionalities needed

Though CCITT Recommendation Q.1218 [2] provides the possibility to record the origination, it depends on the capability of the network whether this can actually be supported. Alternatively, it may be possible to give an indication of the area from which the call was made. Note that other restrictions may apply, e.g. when calling number identification restriction is invoked.

It should normally not present any problems to register the other items of information (i.e. these are used for UPT calls within the network of concern anyway and, therefore, are available for accounting as well).

6.2.2.2 UPT originated

Information to be transferred

The extra information required in case of a UPT originated call consists of:

- identity of the calling UPT-user;
- charge to be paid for the originating part of the call.

The identity of the calling user is needed to enable the home UPT SP of the calling user to bill the right subscriber for the call.

The home UPT SP bills the subscriber on the basis of the charge the home service provider pays to the visited service provider. In case the called user is not a UPT user there is no split charging. Consequently the specified "charge for the originating part of the call" is the charge for the complete call.

Network functionalities needed

The identity of the calling UPT user is always known in case of UPT originated calls, hence requires no new network functionalities. The same applies to the charge to be paid.

6.2.2.3 UPT terminated

Information to be transferred

The extra information required in case of a UPT terminated call consists of:

- identity of the called UPT-user;

- charge for the terminating part of the call.

The identity of the called user is required to enable the home UPT SP of the called user to bill the right subscriber for the call.

The "charge" specifies the amount that should be paid for the terminating part of the call.

Network functionalities needed

The identity of the called UPT user is always known in the case of UPT terminated calls, and hence requires no network functionalities. It is assumed that from this information the default charging reference location and consequently the charging rate ROH can be derived by the service providers receiving this information.

6.2.3 End information

Information to be transferred

The per call information is followed by the end information, consisting of:

- total number of calls included in this transfer;

- first and last call date and time included;

- total amount of this transferred account.

Network functionalities needed

This information is of an administrative nature (it is based on the other information) and has no network implications.

6.2.4 Example

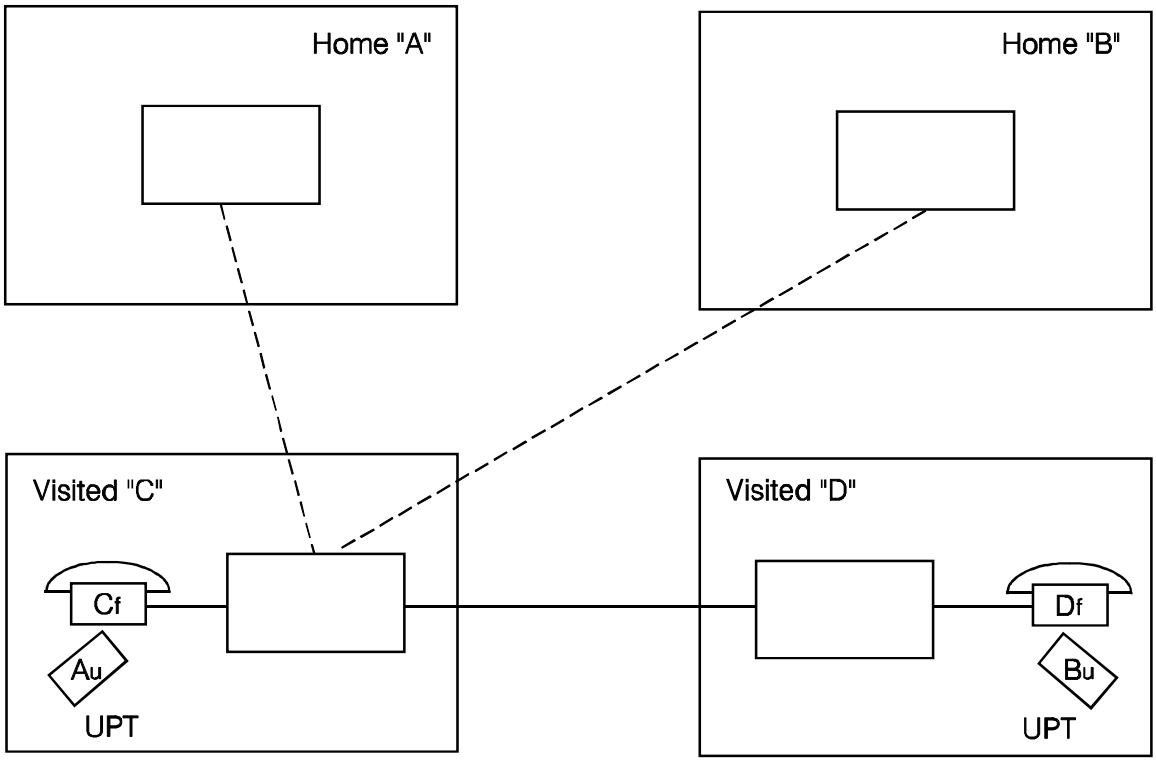

Figure 2

The most complex case for charging of UPT calls in fixed networks is shown in figure 2. In this case there exists a relation between the visited "C" service provider and both the calling and called users' home service providers (A and B).

At least the general information and the information concerning the originating part of the call should be transferred to the "A" service provider. Similarly the "B" service provider should at least receive the general information plus the information concerning the terminating part of the call. To enable the home service providers to provide a full detailed bill to their subscribers it will be useful to send the information about both the originating and terminating part of the call to both service providers.

7 International and inter-network accounting

Accounting is an action taking place between operators, i.e. it is invisible to users. The UPT service has no impact on the normal accounting process, i.e. accounting principles currently in use among networks should be used.

Annex A: Interworking with non-UPT networks

This annex provides some considerations on the use of UPT from within non-UPT networks. The issues addressed in this annex are outside the scope of standardisation and are purely intended for clarification.

A.1 Network functionalities needed

In case of incoming UPT calls, the (non-UPT) originating network does not recognise the UPT calls as such, and special arrangements need to be provided, for the routeing and charging of UPT calls, which are different from the ones outlined in clause 6.

Incoming calls

In case of incoming UPT calls, the situation may occur that the originating network does not have any provision for UPT calls, however, if it has internetwork (e.g. international) direct dial-out, the calling user, in order to make an incoming UPT call, may dial that network's outgoing (e.g. international) prefix and after that the UPT number.

It is clear that in this case a connection is always established, for all UPT incoming calls, between the originating network and the home network of the called UPT subscriber. There the UPT call is recognised and the UPT number is translated to the current routeing address of the UPT subscriber, and the call is finally routed on to destination. The call diagram is identical to the one in figure 1, except that in this case phase A involves an internetwork leg.

In this case the connection related charging should be as follows:

- the leg from origin to home is charged to the calling line or terminal, according to the normal charging procedures provided in the originating network;

- the leg from home to actual destination (current location of the called UPT subscriber) is charged to the UPT subscriber. The network functionalities for this second part of the charges are in principle identical to the ones described above for the (default) split charging when the originating network has UPT capabilities.

Outgoing UPT calls and service management procedures

In case of outgoing UPT calls, as well as for the case of service management procedures, a UPT Access Number (UPTAN) could be used to access UPT from a non-UPT network.

The following questions arise regarding the charging relating to the use of a UPTAN to register for service in a third network.

Scenario:

A UPT user dials a UPTAN to invoke a UPT procedure in a UPT service entity explicitly known to themselves. The UPTAN being a CCITT Recommendation E.164 [3] number is routed to the specific service entity in the usual manner, as for Public Switched Telephone Network (PSTN) calls.

Case A) The local network could by number analysis regard this as a "special freephone call", expecting the UPT subscriber to be charged by the service entity. Accounting arrangements may then allow the local originating network to recover revenue to offset against their costs.

Case B) The originating network operator has no arrangements, or knowledge, of the specialised UPT procedures, and considers the call as a normal connection, charging it at the local exchange in the normal way. The service entity must recognise that the local network has charged the UPT user at the source, i.e. via a pay-phone, or a charge has been made to the line subscriber, and not charge the UPT subscriber.

Clearly, the options for network and service entity interworking, are acceptable to support either case A or case B.

If the local network does not charge for the call, recognising it as a request to use a UPT procedure, albeit in a remote network, and the service entity which handles the procedure assumes that it has been charged locally by the originating network, then, no charge is made for the call, in error.

In UPT Phase 1 this may clearly relate to the InCall registration procedure, though such calls will have a short duration and may by policy be uncharged. Also, it may relate to a UPT outgoing call with more significant consequences.

A.2 International and inter-network accounting

The following examples illustrate the accounting between UPT service providers in case of interworking with non-UPT networks.

Special charging arrangements may include bi-lateral agreements between network operators, e.g. the provision of a "free-of-charge" access number to give access, from the originating network to the home network, to the calling users for UPT calls.

Example A.1: incoming UPT call

In this case UPT user Bu is registered in visited network C, and is called by fixed station Af in non UPT network A. The call is routed via home-network B of UPT user Bu, see figure A.1.

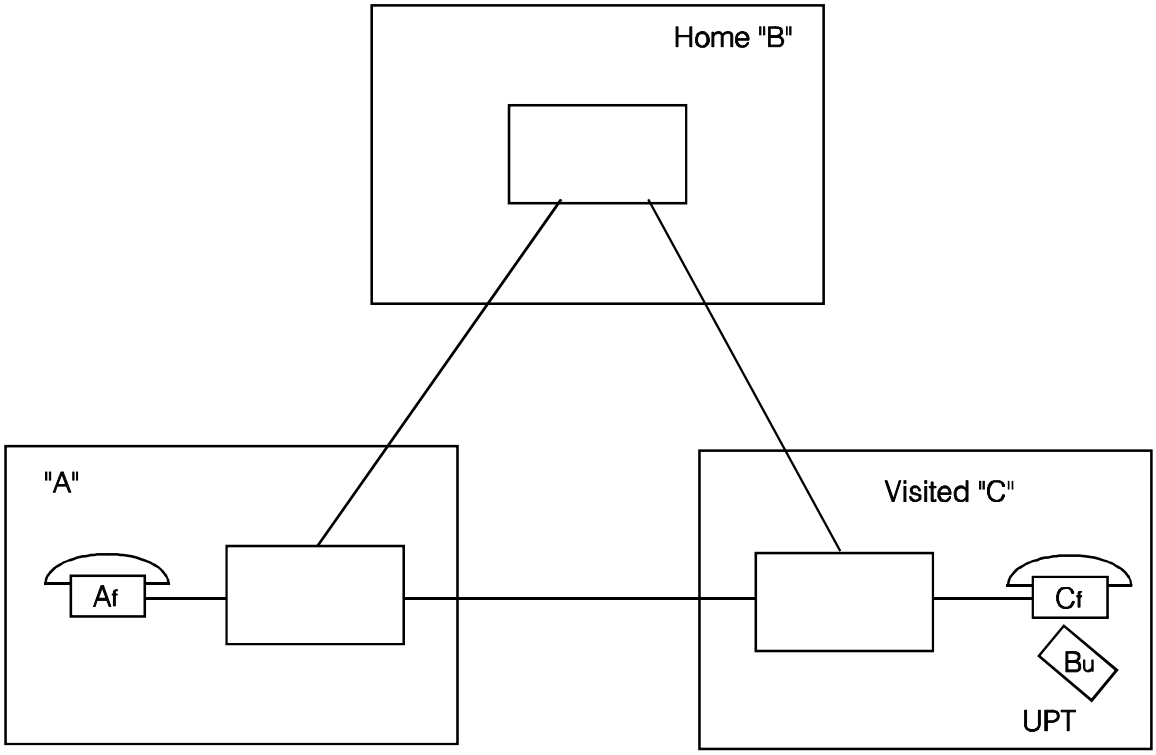

Figure A.1

Charging: UPT user Bu is charged/billed by its Home-operator for the leg between B and C.

Inter operator settlement: Not applicable.

Traffic accounting: The leg from A to B is included in the normal telephone traffic account of A. The leg from B to C is included in the normal telephone traffic account of B.

Example A.2: combined outgoing and incoming UPT call

In this case it is assumed that both incoming and outgoing calls are routed via the respective home networks. Note that establishment of outgoing calls via the home network requires a "freephone" service between the originating and home network: freephone in the sense that the calling station (used by the calling UPT user) is not charged for this freephone connection, but of course the UPT user is. Refer to figure A.2.

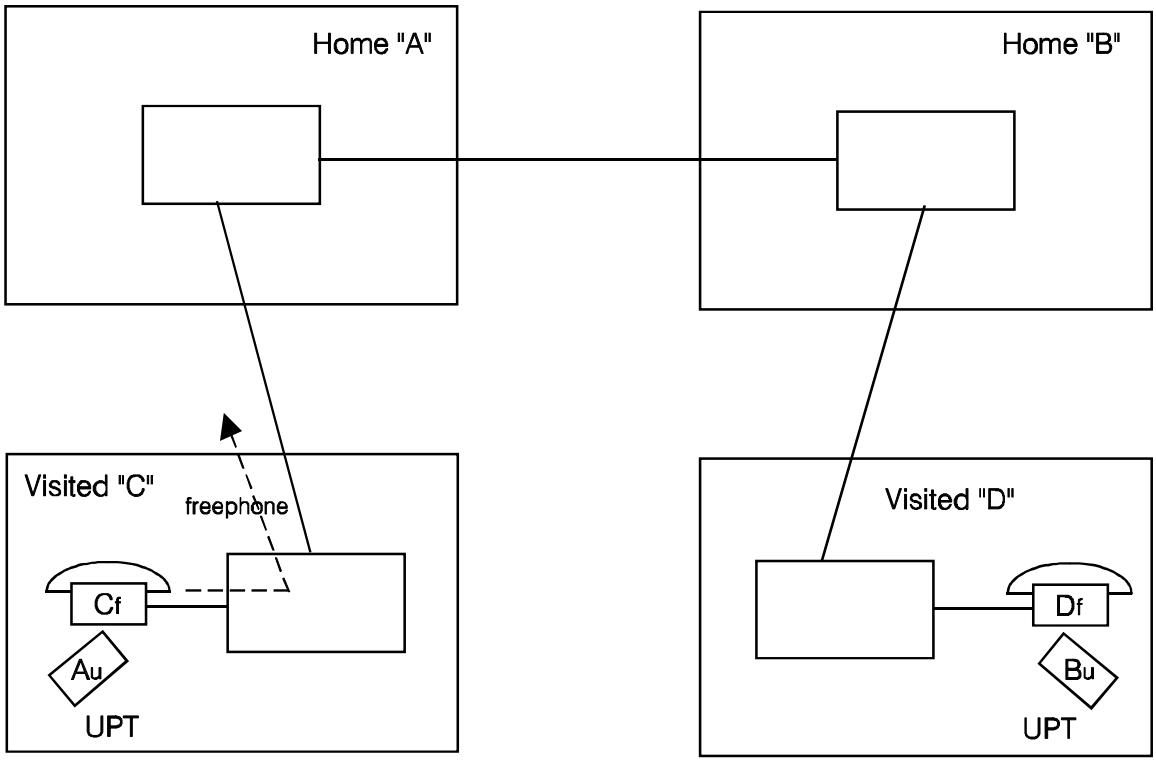

Figure A.2

Charging: UPT user Au is charged/billed by its Home-operator for the leg from C to A, and for the leg from A to B. UPT user Bu is charged for the leg from B to D.

Inter operator settlement: Operator A will reimburse operator C for the use of the freephone leg from Cf to A.

Traffic accounting: All international connections are included in normal outgoing traffic accounts.

Annex B: Inter-operator settlements

B.1 General

For UPT calls, the charges may be split among normal users (billed by the originating network operator/service provider) and UPT users (billed by UPT service provider).

For the purpose of clarification/illustration the clause B.2 gives some examples of charging, billing and accounting requirements for internetwork UPT calls.

B.2 Examples of settlements between UPT service providers

The assumption for all of the examples given is that existing accounting principles should not be affected by the introduction of UPT. This ETR concentrates on connection related charging, i.e. on the charging of calls made to and from UPT users. Charging for signalling is only addressed sideways.

A number of call cases are identified to illustrate charging, billing and accounting requirements.

Example B.1: Outgoing UPT call

In this case UPT user Au is present in visited network B, and makes a call to fixed station Bf2, also within network B, see figure B.1.

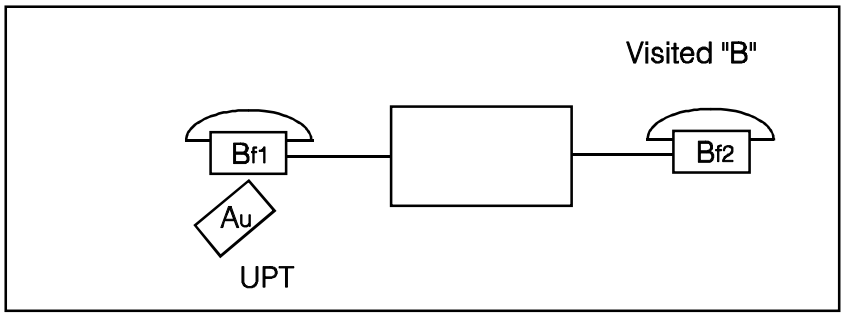

Figure B.1

Charging: UPT user Au will be billed by his home-operator based on data provided by the visited operator.

Inter operator settlement: The home-operator "A" will reimburse the visited-operator "B" for the charges incurred by UPT user Au.

Traffic accounting: Not applicable.

Example B.2: Outgoing UPT call

In this case UPT user Au is in a visited network B, and calls fixed station Cf in network C, as shown in figure B.2.

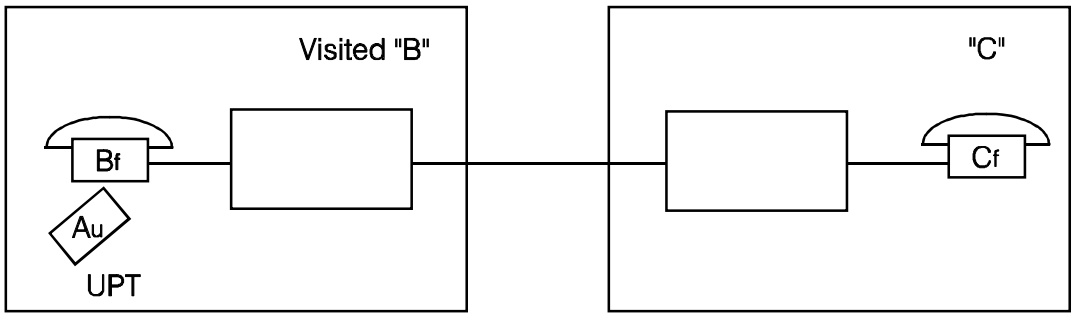

Figure B.2

Charging: Au will be billed by his home-operator based on data provided by visited-operator "B".

Inter operator settlement: Home-operator "A" will reimburse visited operator "B" for the charges incurred by user Au.

Traffic accounting: The call from B to C is included in the normal telephone traffic account of B.

Example B.3: Incoming UPT call

In this case UPT user Bu is in a visited network C, and is called by fixed station Af in network A). Note that the call is routed directly from A to C; only some signalling is needed between B and C.

NOTE: Charging of signalling is not applicable to UPT phase 1.

The situation is illustrated in figure B.3.

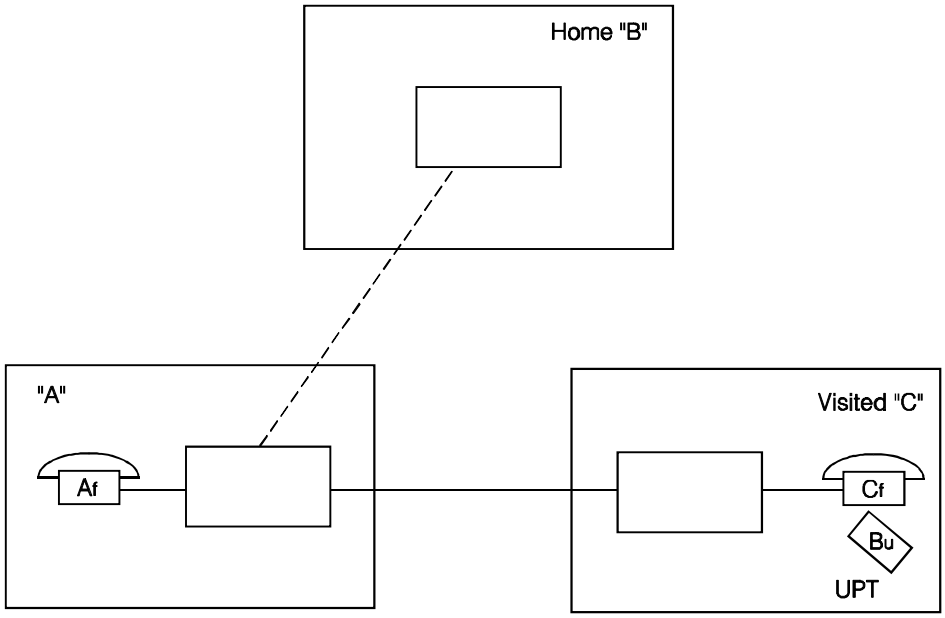

Figure B.3

Charging: UPT user Bu is billed by its home-operator for charges that exceed the normal charges for a call between A and B (i.e. ROC-ROH[1)]) based on data provided by operator A.

Inter operator settlement: Home operator B will reimburse network A for part of the charges incurred by UPT user Bu.

Traffic accounting: The call from A to C is included in A's outgoing traffic account.

Example B.4: Combined outgoing and incoming UPT call

Example B.4 is the most complex case for UPT calls in a fixed network. It concerns a UPT to UPT call, both UPT users being present in a (different) visited network, refer to figure B.4.

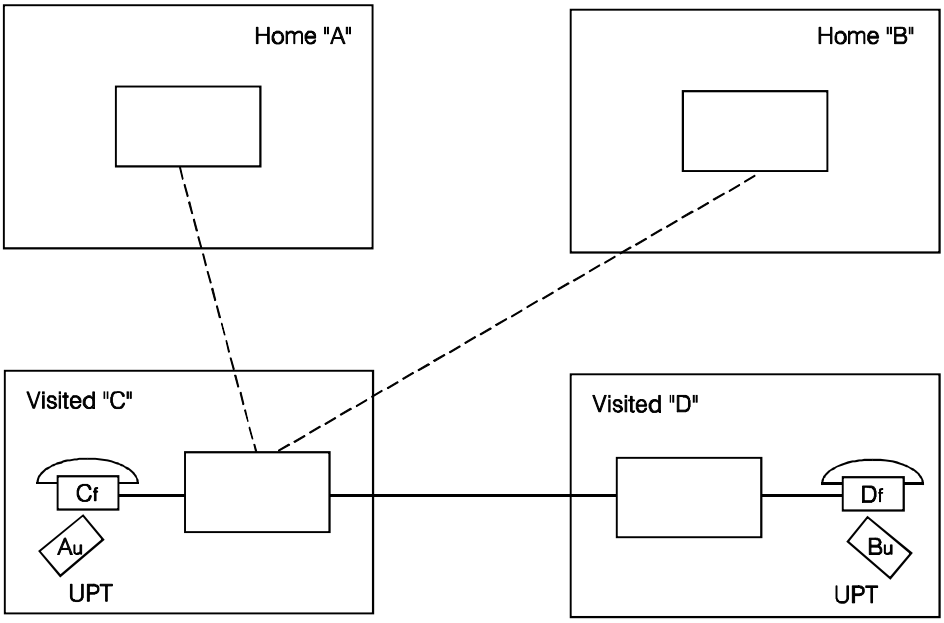

Figure B.4

Charging: UPT user Au is billed by its home-operator for charges equalling the normal charges for a UPT call between Cf and B (ROH), based on data provided by operator C. UPT user Bu is billed by its home-operator for charges that exceed the normal charges for a call between A and B (i.e. ROC-ROH), based on data provided by operator C.

Inter operator settlement: Home-operator A will reimburse network C for the part of the charges incurred by UPT user Au. Home operator B will reimburse network C for part of the charges incurred by UPT user Bu.

Traffic accounting: The call from C to D is included in C's outgoing traffic account.

Observe that in this example it is assumed that ROC > ROH. Otherwise only Au needs to be charged.

NOTE: All other cases can be derived from the case of example B.4 (i.e. are simplifications of it).

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1) ROH refers to the charging rate applicable to a connection from the origin to the default charging reference location (home). ROC refers to the charging Rate applicable to a connection from the origin to the actual current location of the called user. In this particular case ROH refers to the charging rate for a connection from A_f to the default charging reference location of B_u, whereas ROC refers to the charging rate for a connection from A_f to C_f.

Example B.5: **Use of an assisting network**

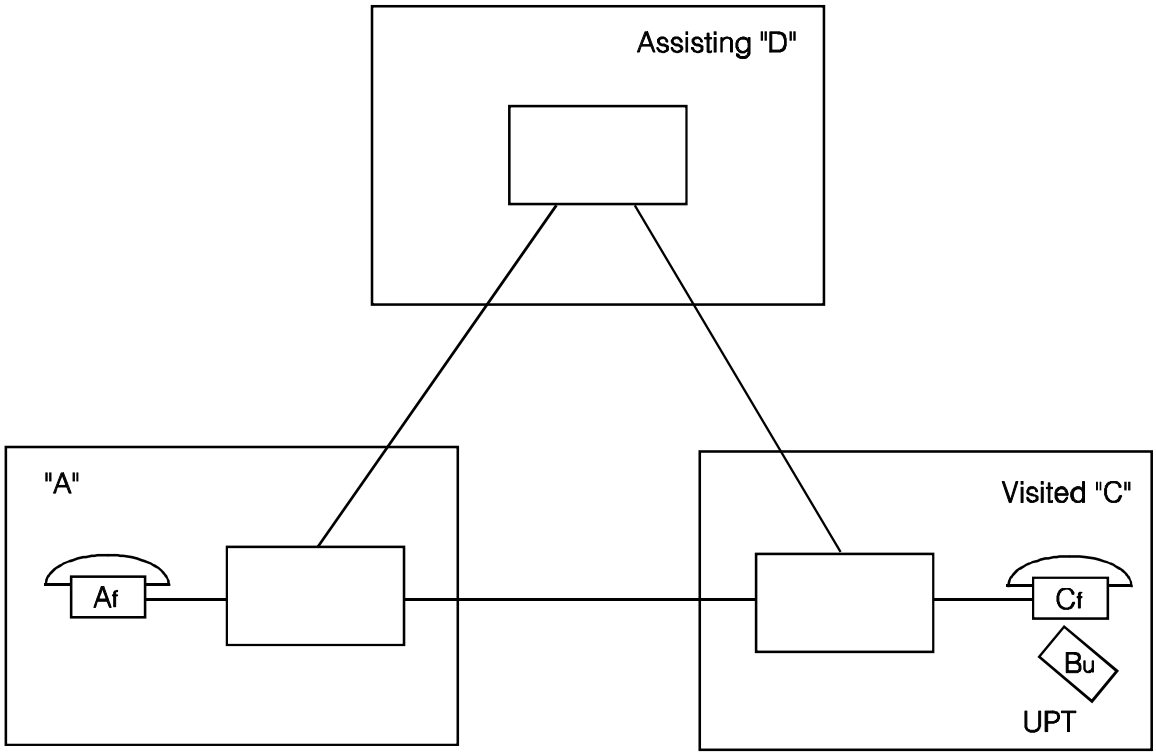

Figure B.5

Charging: UPT user Bu is billed by its home operator an amount (ROC-ROH).

Inter operator settlement: For further study.

Traffic accounting: The leg from A to D is included in the normal telephone traffic account of A. The leg from D to C is included in the normal telephone traffic account of D.

History

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