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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 defines the functional architecture and network interconnections for Universal Personal Telecommunication (UPT) Phase 1.

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1 Scope

This ETSI Technical Report (ETR) defines the functional architecture and network interconnections for Universal Personal Telecommunication (UPT) Phase 1. It gives a high-level description of the network functions required to support UPT, categorising them into several classes (see clause 4). It describes the architecture and the interconnection scenario chosen for UPT Phase 1 and allocates the network functions described above to the functional entities of the architecture (see clause 5). The requirements of UPT on the functional entities of the Intelligent Network (IN) model are assessed (see clause 6). The UPT Phase 1 architecture is then applied to several example cases of call handling and service management (see clause 7).

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] ETS 300 391-1: "Universal Personal Telecommunication (UPT); Specification of the security architecture for UPT Phase 1; Part 1: Specification".
- [2] ETR 223: "Universal Personal Telecommunication (UPT); Phase 1: Network functionalities for charging, billing and accounting".
- [3] ETR 179: "Universal Personal Telecommunication (UPT); UPT management aspects".
- [4] ETR 121: "Universal Personal Telecommunication (UPT); Architecture and functionalities for interworking".
- [5] ETR 067: "Universal Personal Telecommunication (UPT); Network considerations and requirements on dialling, routing and numbering".

3 Abbreviations

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

API	Access Point Identity
CCAF	Call Control Agent Function
CCF	Call Control Function
CS1	Capability Set 1
CSS7	Common Channel Signalling system No.7
DTMF	Dual Tone Multi-Frequency
GSM	Global System for Mobile communication
IN	Intelligent Network
ISDN	Integrated Services Digital Network
O&M	Operations and Maintenance
PSTN	Public Switched Telephone Network
PUI	Personal User Identity
SCEF	Service Creation Environment Function
SDF	Service Data Function
SI	Service Identity
SMAF	Service Management Access Function
SMF	Service Management Function
SRF	Specialised Resources Function
SSF	Service Switching Function
SSP	Service Switching Point
UPT	Universal Personal Telecommunication
UPTN	UPT Number

4 UPT network functions

4.1 Introduction

This subclause identifies UPT specific network functions, that is, network functions required to support UPT which are not provided by current networks. These functions have been grouped into a number of classes, based on the aspect of UPT they are related to:

- functions related to the access point;
- functions related to the Personal User Identity (PUI);
- functions related to service provider agreement;
- functions related to authentication;
- functions related to UPT call control;
- functions related to registration/deregistration;
- functions related to service profile management;
- functions related to services;
- functions related to charging;
- Operations and Maintenance (O&M) functions.

Each of these classes is described in a separate subclause. Within a given class the functions are individually described, and, for most of them, an example of a situation where it may be used is given, in order to illustrate the general description. It is to be noted that the level of detail may vary greatly from one description to the other: this fact simply reflects that some functions are easier to detail at this stage, while others will require further study before they can be more precisely described.

The definition of network functions required for UPT relies on some important facts about UPT, which are briefly summarised below:

- a unique UPT Number (UPTN) is assigned to every UPT user, who may render it public. This is the number dialled by other users when they wish to call the UPT user. It can also be used by network entities when they need to send a request to the UPT user's home Service Data Function (SDF);
- every UPT user is also identified by a unique PUI, for security and management purposes. This identity is not public. If no UPT device is used, this identity is known to the UPT user, who will have to supply it every time he accesses the UPT service. If a UPT device is used, it may store the PUI, in which case the UPT user does not have to memorise it;
- there is a one-to-one relationship between the UPTN and the PUI of a given user;
- a UPT user can register for specific services on specific access points. These access points are identified by Access Point Identities (APIs). The correspondence between Service Identity (SI) and API may vary according to time of the day and other parameters;

it should be noted that a routing address can be derived from an API;

- the characteristics of an access point have an impact on the services which may be supplied on it. It might, therefore, be useful to store the characteristics of access points (i.e. their terminal/network capabilities);
- some services may have specific requirements on the capabilities of the access point on which they are supplied. It may, therefore, also be useful to store the relationship between services and the capabilities required to supply them.

4.2 Class "access point"

The functions listed in this subclause are related to the access points used for access to the UPT service. These functions allow the input/output of an API from/to the user; they allow the verification of an API input from the user and the conversion of an API to a routeing address; they allow the storage of an association between an API and a service and the storage of an association between an API and a set of capabilities:

- **request API:** function to request and input an API from the UPT user. For example, this function can be used during registration procedures (InCall registration, OutCall registration or AllCall registration) to request the identity of the access point on which the user wishes to register;
- **determine API:** function to determine the API of the access point currently used;
- **provide API:** function to provide an API to the user. This function may be used by interrogation procedures to output to the user the identity of the access point(s) he has associated to a given service;
- **verify API:** function to verify an API specified explicitly by the user. This verification mainly asserts that the format of the API given by the user is acceptable from the point of view of the network where the verification takes place. It is not in general a complete verification, as the API may belong to an other network, in which case sufficient information may be not be available to perform a complete verification;
- **determine routeing address:** function to derive a routeing address from an API;
- **store API/routeing address:** function to store an API/routeing address in connection with a PUI and a specific service. For example, this function may be used at the time when a service is activated by the user, to store the identity of the access point on which the service is to be provided;
- **retrieve API/routeing address:** function to retrieve a stored API/routeing address. This function may be used by service logic when the service is actually in action, to retrieve the identity of the access point on which the user requested the service to be provided. It may also be used by interrogation procedures if the user wishes to be reminded of the API he has associated with a given service;
- **store access point capabilities:** function to store relevant capability information on an access point of the visited network. This function may be used in conjunction with **store API/routeing address** to store additional information about the access which is to be used for a given service. This is subject to the ability of the network to supply such information, and is for further study;
- **retrieve access point capabilities:** function to retrieve stored capability information for an access point. This function may be used by service logic to find out the capabilities of the access point on which the service is to be supplied, before attempting to match them against the capabilities required by the service;
- **store network capabilities:** function to store capability information for the access points of a given network;
- **retrieve network capabilities:** function to retrieve capability information for the access points of a network. This function is used when the capabilities of a particular access point must be determined. This happens when a UPT user registers to an access point: the UPT service needs to know about the capabilities of the access point to adapt the services it supplies.

4.3 Class "PUI"

The functions described in this subclause are related to the PUI of a UPT user. They allow the retrieval of a user's PUI (from his UPTN or by querying it) as well as its verification. These functions are mostly used when access to the UPT service is requested by the user:

- **determine PUI:** function to derive a PUI from a UPTN. This function may, for example, be used when an incoming UPT call is to be handled by the UPT logic. The calling party dials the UPTN, whereas the service logic needs the user's PUI. This function provides the required mapping between the two;
- **request PUI:** function to request and input a PUI from the UPT user or from his UPT device. For example, all requests for UPT service from an unregistered terminal will start with this function, as the user cannot be identified until his PUI is known;
- **verify PUI:** function to check if a PUI is still valid, if it is blacklisted etc. This function can be used immediately after the Request PUI function, to check whether the UPT user is allowed access to the service or not.

4.4 Class "Agreements"

The functions listed in this subclause are related to agreements between service providers and network operators. They allow the determination of a given UPT user's home service provider, of the originating network of an incoming call and the interrogation of agreements passed between operators and service providers:

- **determine service provider identity:** function to derive the identity of a user's home service provider from his UPTN or his PUI. This identity is required when checking for an agreement between the visited network operator and the home service provider (see **check service provider agreement** next function);
- **check service provider agreement:** function to verify if there is an agreement between the UPT user's currently visited network operator (where this function is used) and his home service provider. This function may be used when a UPT user attempts to place an outgoing call, to assess whether he should be allowed to do so or not;
- **determine calling network identity:** function to derive a network operator identity from a calling party address. This identity is required when checking for an agreement between the operator of the network where the request for UPT service originates and the corresponding UPT service provider (see **check network operator agreement** function);
- **check network operator agreement:** function to verify if there is an agreement between the UPT user's home service provider (which uses this function) and the network from which a request for UPT service has been received.

The two functions **determine service provider identity** and **check service provider agreement** work in tandem, as do the two functions **determine calling network identity** and **check network operator agreement**. The two couples of functions are dual from each other, the first one operating from the point of view of the visited network operator, and the second one operating from the point of view of the home service provider.

4.5 Class "Authentication"

The functions described in this subclause are related to the authentication of the UPT user, when requesting service. They allow storage, retrieval, input and validation of authentication information:

- **store authentication information:** function to store authentication information related to a UPT user;
- **retrieve authentication information:** function to retrieve authentication information related to a UPT user;
- **request authentication information:** function to request and input authentication information from the UPT user and/or the UPT user's UPT device. For example, all requests for UPT service from an unregistered terminal will use this function together with the **request PUI** function, as UPT service will not be provided to a user until the user is both identified and authenticated.

The general principles and methods used for authentication in UPT Phase 1 are specified in ETS 300 391-1 [1];

- **authenticate:** function to validate the authentication information supplied by the UPT user. This information can be obtained by means of the **request authentication information** previous function.

4.6 Class "Call control"

The functions listed in this subclause are related to UPT call handling. They allow the recognition, processing and routing of UPT calls. They have been divided into two categories: the functions dealing with incoming UPT calls and the functions dealing with outgoing UPT calls.

4.6.1 UPT incoming calls

- **recognise UPT incoming call:** function to recognise that a call is directed to a UPT user. This function must be provided by low-level network call handling mechanisms. Its role is to trigger the following high-level function:
 - **process UPT incoming call:** function to provide service logic for handling a UPT incoming call: locate the UPT user, retrieve service profile information; check services to be supplied against the capabilities available, supply available services; etc. This function uses the functions related to services described in subclause 4.9. When it is done, it triggers the following low-level function:
 - **route UPT incoming call:** function to route a call to a UPT user. This function uses the routing address supplied by the **process UPT incoming call** function to route the call to the UPT user. Another UPT specific aspect of this routing function is that it may add an indication that the call to be routed is a UPT call in the signalling messages it sends.

4.6.2 UPT outgoing calls

- **recognise UPT outgoing call:** function to recognise a UPT outgoing call request. This function may have to be provided by low-level network call handling mechanisms, in the case where a specific dialling prefix or number is defined for UPT outgoing calls. Its role is to trigger the following high-level function:
 - **process UPT outgoing call:** function to provide service logic for handling a UPT outgoing call: retrieve service profile information, check services to be supplied against the capabilities available, supply actual services, etc. This function uses the functions related to services described in subclause 4.9.

NOTE: There is no need for a function to route a UPT outgoing call, as the normal network mechanism is used.

4.7 Class "Registration"

The functions listed in this subclause are related to UPT registration and deregistration. They allow the recognition and handling of registration and deregistration requests:

- **recognise registration/deregistration:** function to recognise a UPT registration or deregistration. This function may have to be provided by low-level network call handling mechanisms, in the case where a specific dialling prefix is defined for UPT registration or deregistration. Its role is to trigger the following high-level function:
 - **process registration/deregistration:** function to provide service logic for handling UPT registrations and deregistrations: retrieve service profile information; perform housekeeping (time of day dependant routeing, etc.); activate default registration upon deregistration; etc. This function uses the functions related to services described in subclause 4.9.

4.8 Class "Service profile"

The functions listed in this subclause are related to service profile management by the user. They allow the recognition and handling of service profile management requests, including functions to retrieve, modify and store the service profile:

- **recognise service profile management:** function to recognise a service profile management request from the user. This function may have to be provided by low-level network call handling mechanisms, in the case where a specific dialling prefix or number is defined for UPT service profile management. Its role is to trigger the following high-level function:
 - **process service profile management:** function to provide service logic for handling service profile management requests from the user: retrieve service profile information, check that user is authorised to edit it, edit it and store it back. This function uses the following functions:
 - **store service profile:** function to store the whole service profile of a given UPT user;
 - **retrieve service profile:** function to retrieve the whole service profile of a given UPT user;
 - **edit service profile:** function to interact with the user, for editing his service profile.

4.9 Class "Service"

The functions listed in this subclause are related to the provision of UPT services. They allow the recognition of a request for UPT service, the recognition of the particular UPT service requested, and the verification of the user's profile and access point capabilities, with respect to that service:

- **recognise UPT request:** function to recognise a request for UPT service. This function must be provided by low-level network call handling mechanisms. Its role is to trigger the following high-level function:
 - **recognise UPT service:** function to interact with the UPT user, to identify the type of service requested (outgoing call, registration, service management, etc.) and to run its service logic;
- **retrieve service information:** function to retrieve information on a specific service for a given UPT user;
- **check service against profile:** function to check the service requested against the corresponding information in the UPT user's service profile: if the user has not subscribed to the service, it cannot be provided;
- **check service against capabilities:** function to check the capabilities needed by the requested service against the capabilities of the user's current access point(s).

4.10 Class "Charging"

The functions listed in this subclause are related to the charging process for the UPT service. They allow the collection of charging information, the transfer of this information between operators and service providers, and the provision of charging information to the UPT user:

- **charge:** this function covers the whole charging process, which includes the recording of charging information during the call, and the storage of this information after the end of the call. This complex function may need to be split into simpler functions (for example: **charge determination; charge generation; charge registration**), but this has no impact on UPT architecture. More information can be found in ETR 223 [2];
- **check credit against limits:** function to check if the credit used by the user exceeds the amount authorised by the service provider. If the authorised credit has been exceeded, access to the UPT service is forbidden until some administrative action takes place. This credit checking may take place off-line, at regular time intervals, or in real-time, after each UPT call;
- **transfer charging information:** function to transfer collected charging information between network operators and service providers;
- **provide charging information to user:** function to indicate to the UPT user the cost of a call, either in real-time (i.e. during the call), or off-line (i.e. after the call is completed).

4.11 Class "O&M"

Functions related to operations and management aspects of the UPT service are described in ETR 179 [3].

5 UPT Architecture and Interworking

5.1 General UPT functional architecture

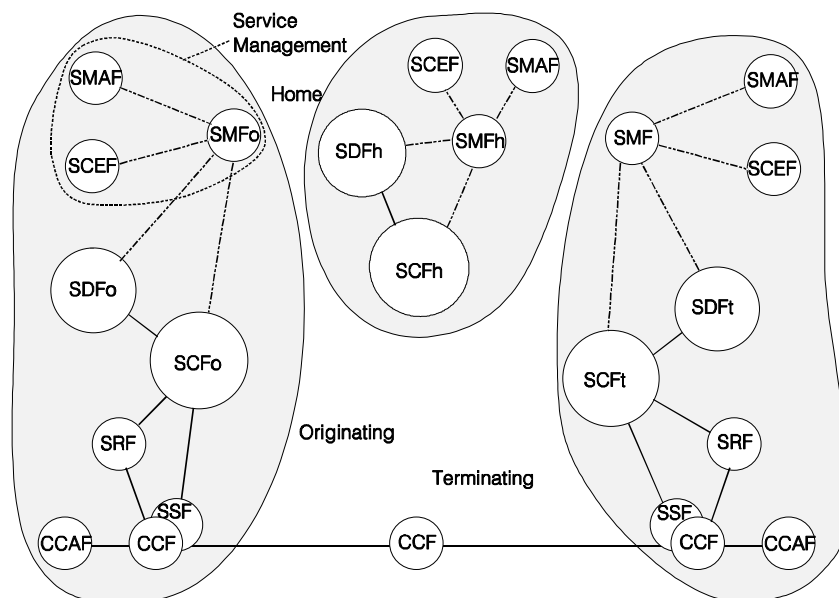


Figure 1: General UPT functional architecture

The general functional architecture for UPT, regardless of implementation phases, is described in ETR 121 [4], where several scenarios are envisaged for interaction between UPT entities. Figure 1 is adapted from ETR 121 [4] (interactions between UPT entities have been omitted for the sake of clarity) and gives an overview of the general UPT functional architecture. Apart from standard IN terminology, the following notation is used in figure 1:

- **SCFh** home Service Control Function (SCF);
- **SDFh** home SDF;
- **SMFh** home Service Management Function (SMF);
- **SCFo** local ("visited") SCF, originating side;
- **SDFo** local ("visited") SDF, originating side;
- **SMFo** local ("visited") SMF, originating side;
- **SCFt** local ("visited") SCF, terminating side;
- **SDFt** local ("visited") SDF, terminating side.

The three interconnection scenarios described in ETR 121 [4] are the following:

- direct SDF - SDF dialogue;
- direct access of SDFs from SCF;
- SCF - SCF dialogue.

Only the second scenario is used in UPT Phase 1. Subclause 5.2 describes it in more detail.

5.2 Phase 1 UPT functional architecture

The functional architecture for UPT Phase 1 is described in figure 2, which is extracted from ETR 121 [4]. The differences with the general UPT functional architecture are:

- the interconnection of networks takes place between the SCFo and SDFh functional entities, as indicated by the arrow on the figure. The interface between SCF and SDF is specified in Intelligent Network Capability Set 1 (IN CS1);
- SDFh stores all data related to the UPT user (i.e. the database in UPT Phase 1 is centralised).

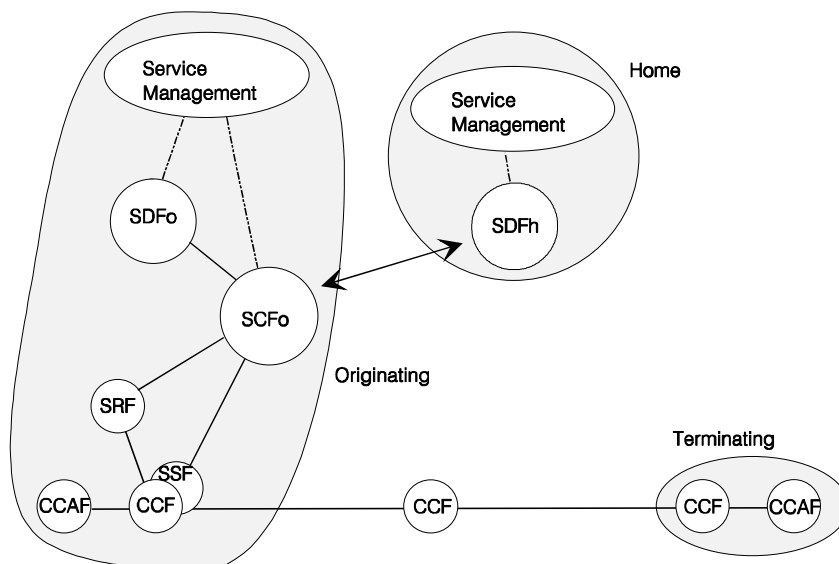


Figure 2: Phase 1 UPT functional architecture

- SDFh must as a consequence provide access control functions to check whether or not requests received from remote entities are authorised requests or not;
- SDFh performs the authentication of the UPT user;
- SDFo stores a list of agreements, which indicates the identity of all the service providers whose subscribers are allowed to access UPT service in SDFo's network;
- SDFo stores a list of service limitations resulting from agreements with service providers or network limitations;
- SDFo also stores information related to the management of the UPT service in its network, e.g. charging records which will be used later on for accounting.

5.3 Allocation of network functions to functional entities

Based on the functional architecture for UPT Phase 1 this subclause attempts to allocate the UPT network functions described in clause 4 to the functional entities: Call Control Function (CCF), Service Switching Function (SSF), SCFo, SDFo, SDFh and SMF. Some functions require the co-operation of several entities or may be provided by different entities. This situation is always explicitly described in a note which states more precisely what is meant by this multiple allocation.

5.3.1 CCF

Table 1

Class	Function	Functional Entity
Call control	Route UPT incoming call	CCF
Charging	Charge	CCF (note 2)
	Provide charging information to user	CCF / SCFo / SMFh (note 1)
<p>NOTE 1: This function may be implemented by any three functional entities, depending on the type of information provided to the user. Real-time charging information can be provided by the CCF (by emitting a pulse every time a charging unit is spent) or by the SCFo (by emitting voice messages to indicate specific charging conditions). Off-line charging information can be provided by the SMFh (by listing the costs incurred so far since the last bill, etc.).</p> <p>NOTE 2: The charging information produced by the CCF entity may be transferred to SMFo and/or SMFh if no credit limit checking is to be performed or if only off-line credit limit checking is required. If real-time credit limit checking is required, this information must also be transferred to SDFh. Note that as indicated in subclause 4.10, this function may be split further to refine the description of the charging process. Several allocation scenarios are then possible, but they have no impact on the allocation of UPT functions. See ETR 223 [2] for more information.</p>		

5.3.2 SSF

Table 2

Class	Function	Functional Entity
Access point	Determine API	SSF
Call control	Recognise UPT incoming call	SSF + SCFo (note 1)
	Recognise UPT outgoing call	SSF + SCFo (note 1)
Registration	Recognise registration/deregistration	SSF + SCFo (note 1)
Service profile	Recognise service profile management	SSF + SCFo (note 1)
Services	Recognise UPT request	SSF (note 2)

NOTE 1: These functions are implemented by the two functional entities, working in collaboration: the SSF triggers on a specific prefix or number and sends a **provide instruction** request to the SCFo, which then determines which service to activate (incoming call, outgoing call, etc.), depending on the prefix or number used.

NOTE 2: This function only recognises the fact that a request for UPT service exists. The exact nature of the request is determined later by the SCFo, using the **recognise UPT service** function, which interacts with the user to determine which service is requested. Only the SSF is therefore involved.

5.3.3 SCFo

Table 3

Class	Function	Functional Entity
Access point	Request API	SCFo
	Provide API	SCFo
	Verify API	SCFo
PUI	Determine routing address	SCFo
	Request PUI	SCFo
Authentication	Request authentication information	SCFo
	Authenticate	SCFo + SDFh (note 1)
Call control	Recognise UPT incoming call	SSF + SCFo (note 2)
	Process UPT incoming call	SCFo
	Recognise UPT outgoing call	SSF + SCFo (note 2)
	Process UPT outgoing call	SCFo
Registration	Recognise registration/deregistration	SSF + SCFo (note 2)
	Process registration/deregistration	SCFo
Service profile	Recognise service profile management	SSF + SCFo (note 2)
	Process service profile management	SCFo / SMFh (note 3)
	Edit service profile	SCFo / SMFh (note 3)
Services	Recognise UPT service	SCFo
Charging	Provide charging information to user	CCF / SCFo / SMFh (note 4)

NOTE 1: The authentication of the UPT user is performed by SDFh, upon request from SCFo.

NOTE 2: See note 1 of table 2 on the SSF, above.

NOTE 3: As discussed later in this ETR (in subclause 6.7 on UPT requirements on Service Management Access Function (SMAF)), the user has two methods to perform service profile management: either through call handling entities or through management entities. Both will have to have the corresponding functions.

NOTE 4: See note 1 of table 1 on the CCF, above.

5.3.4 SDFo

Table 4

Class	Function	Functional Entity
Access point	Store network capabilities	SDFo
	Retrieve network capabilities	SDFo
Agreements	Determine service provider identity	SDFo
	Check service provider agreement	SDFo

5.3.5 SDFh

Table 5

Class	Function	Functional Entity
Access point	Store API/routeing address	SDFh
	Retrieve API/routeing address	SDFh
	Store access point capabilities	SDFh
	Retrieve access point capabilities	SDFh
PUI	Determine PUI	SDFh
	Verify PUI	SDFh
Agreements	Determine calling network identity	SDFh
	Check network operator agreement	SDFh
Authentication	Store authentication information	SDFh
	Retrieve authentication information	SDFh
	Authenticate	SCFo + SDFh (note 1)
Service profile	Store service profile	SDFh
	Retrieve service profile	SDFh
Services	Retrieve service information	SDFh
	Check service against profile	SDFh
	Check service against capabilities	SDFh
Charging	Check credit against limits	SDFh / SMFh (note 2)

NOTE 1: See note 1 of table 3 on the SCFo, above.

NOTE 2: This function may be implemented by two functional entities, depending on the type of credit limit checking required. If real-time checking is needed, SDFh does it. If off-line credit checking is needed, SMFh does it.

5.3.6 SMFo & SMFh

Table 6

Class	Function	Functional Entity
Service profile	Process service profile management	SCFo / SMFh (note 1)
	Edit service profile	SCFo / SMFh (note 1)
Charging	Check credit against limits	SDFh / SMFh (note 3)
	Transfer charging information	SMFo + SMFh
	Provide charging information to user	CCF / SCFo / SMFh (note 2)

NOTE 1: See note 3 of table 3 on the SCFo, above.
 NOTE 2: See note 1 of table 1 on the CCF, above.
 NOTE 3: See note 2 of table 5 on the SDFh, above.

5.3.7 Others

No UPT-specific functions have been identified for Call Control Agent Function (CCAF), Specialised Resources Function (SRF), Service Creation Environment Function (SCEF) and SMAF, so far.

5.4 Interworking with non-UPT networks

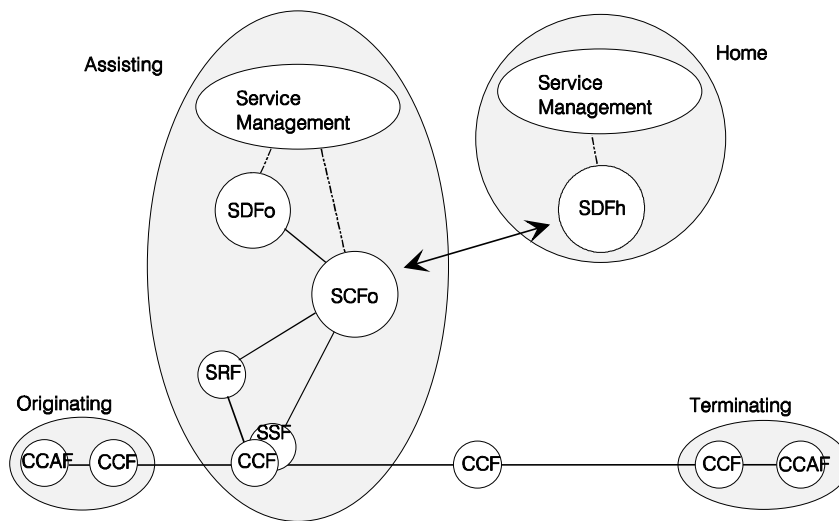


Figure 3: Interconnection with non-UPT networks

Although the ultimate aim is to provide UPT functionality in all networks, it must be recognised that this will not be feasible in the near future, and especially not for UPT Phase 1. UPT networks (that is, networks which provide UPT functionality) and non-UPT networks will, therefore, coexist for some time. On the other hand, even for UPT Phase 1, user mobility should not be restricted to a small set of countries (for example, those which have an IN-structured network) or to certain types of terminals (for example, Public Switched Telephone Network (PSTN) but not Global System for Mobile communication (GSM)).

Some networks will not, therefore, be able to offer full UPT support, but it may still be desirable that UPT users be able to use part of the functionality of UPT when they visit these networks. This is possible, if the aid of another network with UPT capabilities, the assisting network, is sought. The corresponding architecture is shown on figure 3. A UPT user visiting the non-UPT network could then use the UPT facilities of the assisting network to access the UPT service.

In order to achieve this, agreements between the operator of the non-UPT network and the home/assisting network are needed, as we have to consider a non-standardised environment: the lack of

standards should be compensated with bilateral agreements. As these considerations are out of the scope of this ETR, a more detailed description is given in annex A.

Also, numbering and routing aspects may have some implications on the way of interworking with non-UPT networks. See ETR 067 [5] for more information.

6 UPT requirements on IN functional entities

6.1 CCAF

A major service requirement for UPT is that there be as few requirements as possible on the CCAF: existing terminals should be used as far as possible with minor or no modifications. In the PSTN, which is likely to be considered for the first implementation of UPT, the majority of terminals are Dual Tone Multi-Frequency (DTMF) or decadic-pulse telephone sets. The interaction between the UPT user and the network will, therefore, be based on decadic characters with, possibly, the addition of '*' and '#'.

A distinction is made between the digits which are dialled in order to route the UPT call to an appropriate network point (i.e. a Service Switching Point (SSP)) and the digits/characters dialled after those, which are used to exchange information between the UPT user and the UPT service. These digits/characters must be passed by all the exchanges from the user up to the SSP (by transforming decadic pulses into DTMF tones if necessary) and must be recognised by the SSP. The SRF is expected to play a significant role in the user-to-network interaction (see subclause 6.5 on the SRF).

The UPT CCAF is a combination of the terminal, the subscription device and network functionalities.

6.2 CCF

Ideally, UPT should have no requirements on the CCF functional entity. However, it has already been discussed in the previous subclause that CCF's may be required to convert decadic pulses into DTMF tones in some cases. Also, UPT being a complex service, it may require that additional information be passed through the network by the signalling system. Some examples of possible requirements are: transmission of calling line identity to the SSP; transmission of UPT subscriber identity to the called terminal; etc.

Further study is required on this issue, which should be considered with a high priority for the following reasons:

- some of the information required by UPT may not be available in traditional trunk signalling systems. This could imply the availability of Common Channel Signalling system No.7 (CCS7) throughout the network;
- some of the information required by UPT may imply the modification of existing signalling protocols standards.

6.3 SSF

The capabilities currently under study for this functional entity may be sufficient for the provision of UPT. However, some UPT services (like the registration for outgoing calls) may require that the SSF be available in local exchanges or that additional functionalities be made available to local exchanges if the SSF is available in transit exchanges only. This issue requires further study.

6.4 SCF

The SCF functional entity will contain service logic for UPT. As defined in IN, the SCF is a versatile entity, which should be able to implement any kind of service. If such is the case, the requirements of UPT on this functional entity will be limited.

Some such requirements may be foreseen; UPT being an international service, the SCF should be able to query an SDF (SDFh) in another network.

6.5 SRF

In UPT Phase 1, the interaction between the user and the network will take place via in-band communication; DTMF tones will be used in one direction and voice prompts in the other direction. The SRF will be the interworking unit between the network and the SCFo: it will translate the dialling tones received from the user into messages to the SCFo and will transform SCFo requests into voice announcements sent to the user.

The definition of the appropriate announcements is left to the document on service aspects. However, some features already foreseen in that document (such as the availability of announcements in different languages) may have some impact on the complexity of the implementation of the SRF and, therefore, need to be studied from a network perspective as well.

6.6 SDF

This functional entity will store all data related to the UPT service and to the UPT subscriber. **Urgent** study is required on this functional entity, for at least the following reasons:

- UPT will require a considerable amount of subscriber information to be stored in the network (location information, service profile, authentication information, etc.). It must be ensured that the structure and contents of this information can be reflected in the SDF;
- the information about the UPT service as a whole will be distributed across several SDF entities. Co-operation between these SDFs and integrity of the data they collectively maintain must be guaranteed;
- furthermore, the SDFs co-operating to maintain the UPT database will be spread across several networks and be under the supervision of different operators. Suitable interfaces and security mechanisms must be devised to ensure this;
- in UPT Phase 1 SDFh is not limited to data storage and management functions. It must also be able to:
 - perform the authentication of a UPT user upon request from an SCFo;
 - perform credit limit checks after UPT calls (i.e. in real-time) if required.

6.7 SMAF

There are 2 ways in which UPT procedures other than call handling procedures can be performed in an IN-structured network:

- the user interacts with the same terminal which is used for making and receiving calls, and the exchange of information related to the UPT procedure flows through the CCAF, CCF, SSF, SCF and SMF entities, in this order. Due to limitations imposed by the terminal, this method may not be used for the more complex management procedures;
- the user interacts with a terminal dedicated to service management (the SMAF). The exchange of information related to the UPT procedure then flows through the SMAF, SMF, SCF and SSF entities, in this order. For technological reasons, this method is in general more powerful, more flexible and more user-friendly than the previous one. It may not, however, be available to all users at all times, since it requires access to some specific equipment.

From a PSTN access, the first method will be used for those procedures which are simple in nature and need to be performed quite often and from different places (personal mobility procedures). The second method will be used for those procedures which are more complex but less frequent and can be performed from selected locations only (service management procedures).

From an Integrated Services Digital Network (ISDN) access, a more user-friendly terminal may be used, allowing the use of more complex procedures than with a PSTN access. The use of a SMAF may, however, still be required for the more complex procedures. The objective is to allow, in future phases at least, all service management procedures to be used from an ISDN terminal.

Most terminals in UPT Phase 1 will use a PSTN access. UPT users will, therefore, have the need for an SMAF in order to use the service management procedures. Thus, the SMAF should be flexible enough to allow the use of these procedures, which may be quite complex in some cases (e.g. a registration on multiple terminals combined with the creation of a decision pattern for incoming calls).

6.8 SMF

Beyond the requirements on SMF implied by the subclause on the SMAF above, the following are identified:

- requirements related to the editing of the user's service profile;
- requirements related to the checking of user credit limits.

6.9 SCEF

No requirements on the SCEF are identified at the moment.

7 Applications of the functional architecture

This clause applies the functional architecture and the interconnection scenario defined in clause 5 to several cases of use of the UPT service: UPT incoming and outgoing calls, UPT registration and service management. It also studies the situation where the UPT user is visiting a non-UPT network and requires the assistance of a UPT network (more information can be found in annex A).

7.1 Call handling

7.1.1 Outgoing UPT call originating in a UPT network

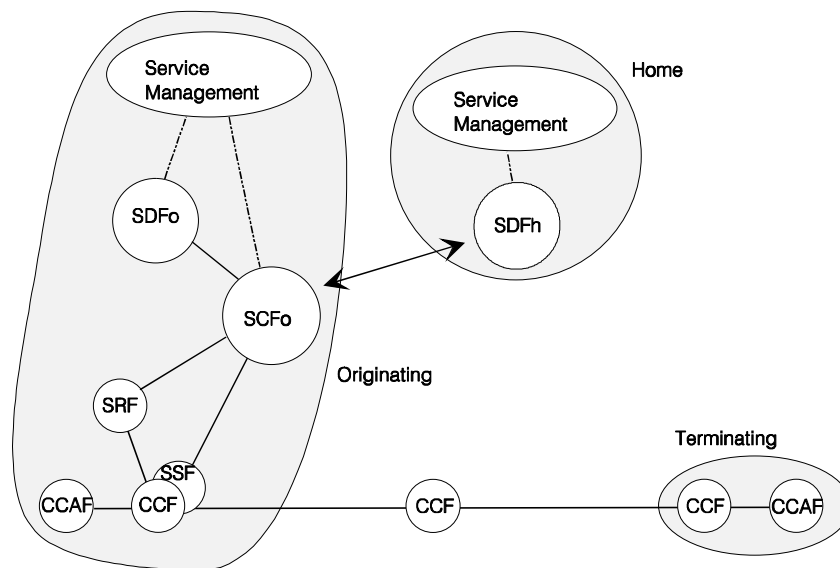


Figure 4: Outgoing UPT call originating in a UPT network

Since the originating network is a UPT network, the call can be handled locally (by SCFo) and optimal routing can be achieved.

7.1.2 Outgoing UPT call originating in a non-UPT network

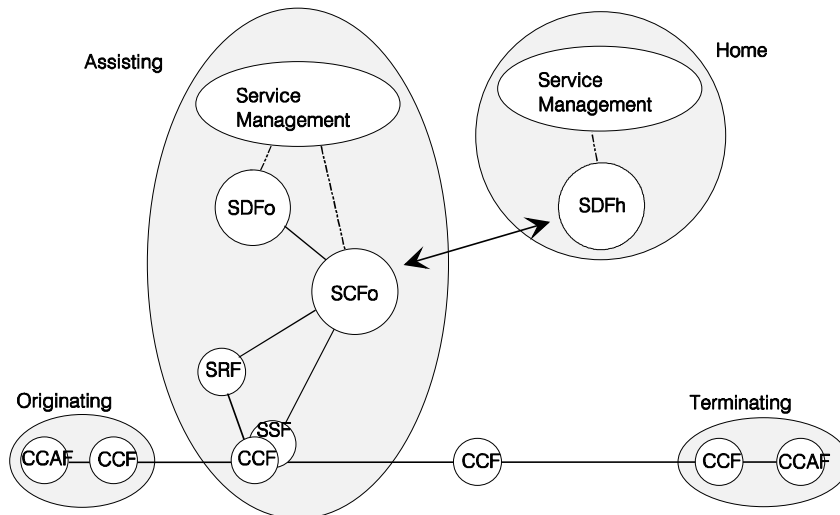


Figure 5: Outgoing UPT call originating in a non-UPT network

As discussed in subclause 5.5 on the interworking with non-UPT networks, this scenario requires some co-operation between the originating (non-UPT) and the assisting (UPT) networks. The difference with the call from a UPT network is that routing may not be optimal and that tromboning can take place if the UPT user is calling someone who is also in the originating network.

7.1.3 Incoming UPT call originating in a UPT network

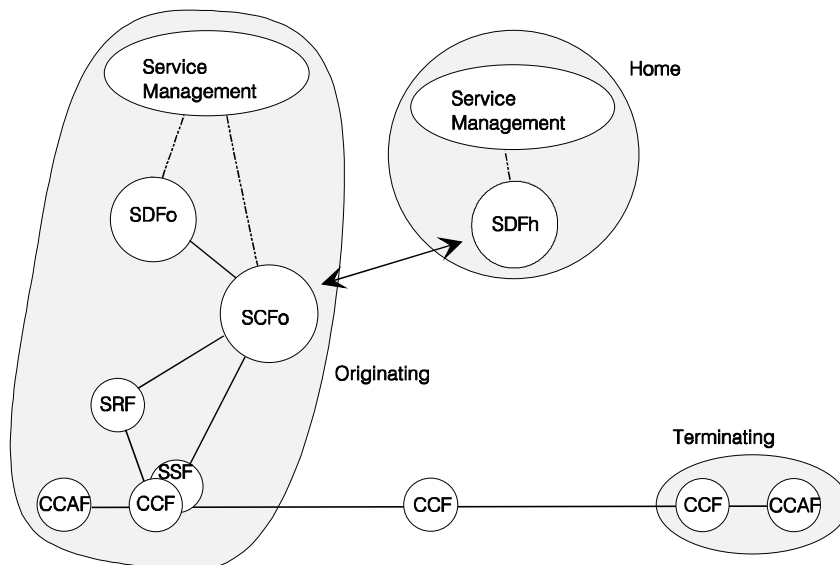


Figure 6: Incoming UPT call originating in a UPT network

Since the originating network is a UPT network, the call can be handled locally (by SCFo) and optimal routing can be achieved.

7.1.4 Incoming UPT call originating in a non-UPT network

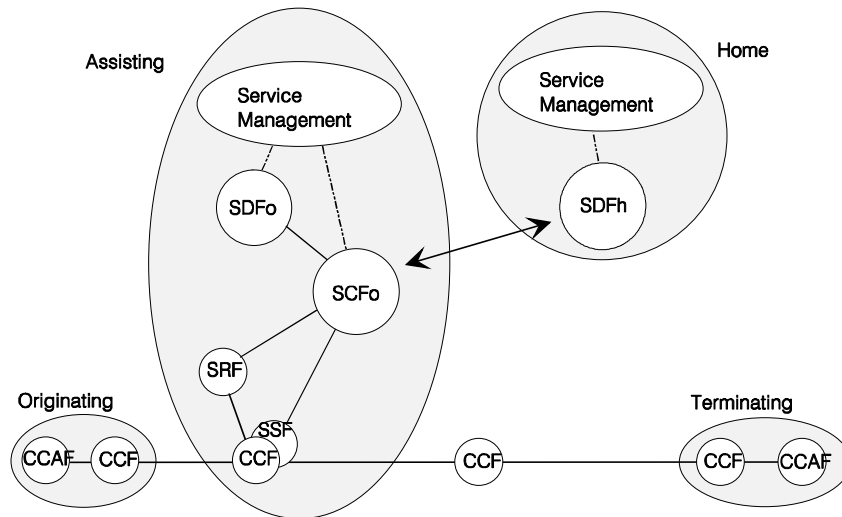


Figure 7: Incoming UPT call originating in a non-UPT network

7.1.5 UPT user to UPT user call

This case is simply a particular case of subclause 7.1.1 "Outgoing UPT call originating in a UPT network", since UPT Phase 1 does not supply any services on the terminating side of the call: it does not matter whether this side is a UPT user or not. Figure 4, therefore, also applies to this case.

7.2 Registration and service management

7.2.1 From a UPT network

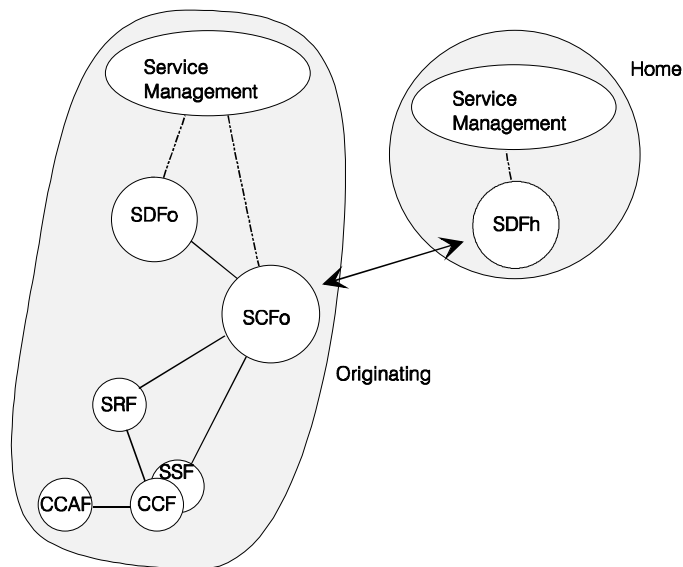


Figure 8: Registration and service management from a UPT network

Only two networks are involved in this scenario. Call handling is performed locally (by SCFo), but registrations and the service profile are modified in the home network (by SDFh).

7.2.2 From a non-UPT network

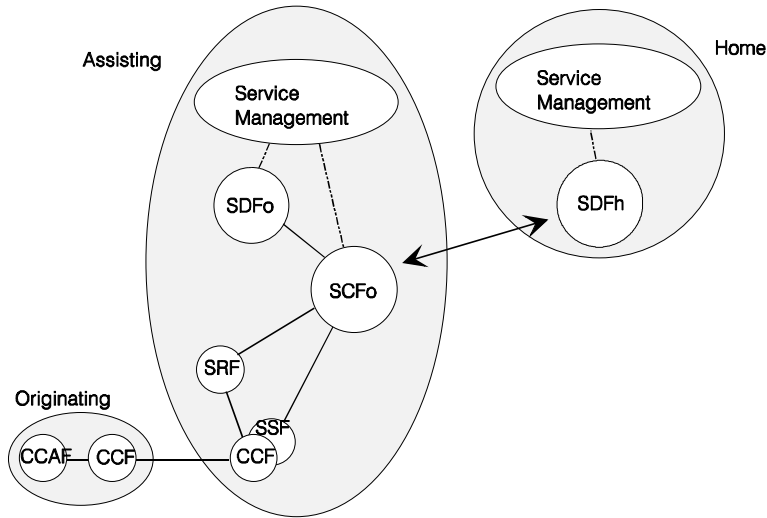


Figure 9: Registration and service management from a non-UPT network

Three networks are involved in this scenario. Registration handling is not local, as it is performed by the assisting network (where the SCFo is located). A normal (non-UPT) call therefore needs to be set up from the UPT user's access point in the non-UPT network, to the assisting network. The branch of the call going from the originating to the assisting network is not seen as a UPT call and is therefore subject to different charging principles (it may be free).

7.2.3 Using IN service management procedures

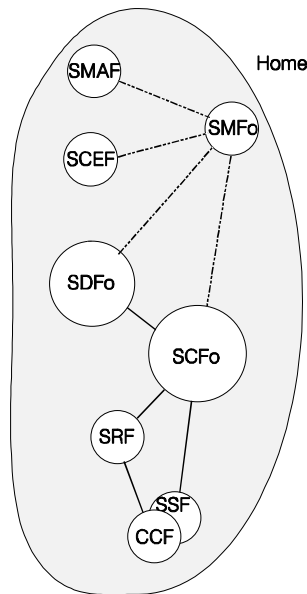


Figure 10: Registration and service management using IN service management procedures

Only one network is involved in this scenario. Moreover, not all entities in this network are used, as only SMAF, SMFh and SDFh are used to let the UPT user interact with the network in order to query and modify his service profile.

Annex A: Methods for interworking with non-UPT networks

As stated in subclause 5.4, an issue that needs consideration for the short term provision of the UPT service is the interworking with non-UPT networks, since the service will not be introduced all over the world at the same time. Therefore, at least for the initial phase, there is a need to consider both UPT areas (where users can subscribe to and access the UPT service), and non-UPT areas (where there are no specific network functionalities for the provision of the UPT service).

The simplest solution would be to rule that UPT users cannot access the service while in non-UPT areas. But this is not the only solution, if interworking with an assisting UPT network is possible. Such interworking will be based on bilateral agreements between the non-UPT network operator and the assisting UPT operator. Different levels of agreements between the operators are possible and they can impose some limitation to the UPT service provided or may require specific access procedures.

In the following, three methods are described, showing how different levels of agreement can influence the grade of service provided.

Method 1

The non-UPT network only accepts incoming calls to UPT users that have previously registered from another network, on an access point of the non-UPT network. No registration is possible from the non-UPT network. This grade of service is always available from any non-UPT network, since it does not require any extra effort from the network operators, either on the UPT or on the non-UPT side.

Nevertheless, a check on the number provided by the user should be performed by the originating network during a remote registration, in order to avoid that the number used for the registration be a special number (e.g. an emergency number). The originating network would then have to perform a check on a number of the non-UPT network, which would require a bilateral agreement between the two operators, as the format of these numbers differs from one network to another.

Method 2

The non-UPT network accepts incoming calls to UPT users. In addition, a UPT user can perform a registration for incoming calls and other simple service profile management operations by dialling a special "UPT access" number in the assisting network. From the point of view of the originating, non-UPT, network, this is an ordinary international call and will be charged as such (the non-UPT network cannot avoid charging this call). The assisting network may charge the call as appropriate.

If this simple solution is used, it is not possible to let the UPT user place outgoing UPT calls using the facilities of the assisting network, as part of the call (the call from the non-UPT network to the assisting UPT network) would be charged to the owner of the access used, which is not UPT service any longer. While this deviation from the UPT definition may be acceptable in the case of simple registration and service profile management operations (because of the small cost involved and the benefit derived from it), it is not acceptable for outgoing UPT calls, however, and an agreement between the two networks is required, in order to refuse requests for outgoing UPT calls.

Method 3

Full UPT Phase 1 service is available to the UPT user, by either:

- 1) dialling a special number supplied by the non-UPT network;
- 2) dialling a freephone "UPT access" number in the non-UPT network, which is supplied by the assisting network.

The call is then redirected to the UPT facilities of the assisting network, without the need for the UPT user to be aware of it (see NOTE 1). Appropriate charging may be applied by both networks. An agreement is required between the two operators in the first scenario, while none is required in the second one (the assisting network supplies a true UPT service by offering freephone access to its network ; the costs incurred may of course be charged back to the account of the UPT user).

NOTE 1: Registration for outgoing UPT calls explicitly requires UPT capabilities in the network where it takes place, since it puts some requirements on its local exchanges. The solution described here will, therefore, not give full access to UPT service in non-UPT networks beyond phase 1, since registration for outgoing calls will then be an integral part of UPT. It is, however, an appropriate solution for Phase 1, since registration for outgoing calls has been excluded from it.

NOTE 2: In the three methods, the fact of providing UPT service in a non-UPT network may result in inefficiencies and non-optimal use of network resources. This may be the case for the routing of UPT incoming calls: if the calling party is also in a non UPT network, tromboning can take place; the calling user will be charged according to the country code of the UPTN and the called UPT user will pay the rest of the call. The use of methods 2 or 3 may have other consequences:

- since the UPT user sets up a call to an other network in order to access all or part of the UPT service, the procedures and the dialogues involved may have to be different from the normal procedures;
- the UPT user is not recognised as such by the non-UPT network. Conflicts with the features attached to the access point he uses in the non-UPT network may therefore occur (e.g. for restrictions, call forwarding, etc.).

History

Document history	
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