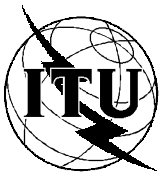

INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

I.373

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

(03/93)

INTEGRATED SERVICES DIGITAL NETWORK (ISDN)

OVERALL NETWORK ASPECTS AND FUNCTIONS

NETWORK CAPABILITIES TO SUPPORT UNIVERSAL PERSONAL TELECOMMUNICATION (UPT)

ITU-T Recommendation I.373

(Previously “CCITT Recommendation”)

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation I.373 was prepared by the ITU-T Study Group XVIII (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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Recommendation I.373

NETWORK CAPABILITIES TO SUPPORT UNIVERSAL PERSONAL TELECOMMUNICATION (UPT)

(Helsinki, 1993)

0 Scope

This Recommendation identifies the functional requirements and network architectures, and specifies the network capabilities to support universal personal telecommunication (UPT), specifically for the provision of a wide range of services to the UPT users in a multi-network communication environment.

This Recommendation should be read in conjunction with the following draft Recommendations:

a) I.114 (Vocabulary for UPT);

b) I.312 (Principles of intelligent network architecture);

c) I.328 (Service plane architecture / IN);

d) I.329 (Global functional plane architecture / IN);

e) F.850 (Principles of universal personal telecommunication / UPT);

f) E.168 (Application of E.164 numbering plan for UPT).

1 Introduction

Leading edge technology and network developments are providing new dimensions to users' telecommunication capabilities as ISDN, intelligent networks (IN) and digital mobile networks are introduced. This is expected to provide increased service flexibility together with a complementary level of customer control capability to support network services. Despite these advances each of these developments independently still use the line or the terminal identification as a means of identifying the customer.

By pursuing the inherent synergy among ISDN, digital mobile and intelligent network developments, the historical link between the line or terminal and user identification can be broken. Universal personal telecommunication is anticipated to bring personal identification to reality by transparently replacing the static relationship between terminal identity and user identity in existing networks with a dynamic association and thus provide complete personal mobility within networks and across multiple networks.

2 Terms and definitions (provisional)

A complete set of definitions for UPT terms is contained in Recommendation I.114; a subset is provided for ready reference in Appendix I together with a list of abbreviations and acronyms.

3 Objectives of UPT service

UPT enables access to telecommunication services by providing personal mobility. It enables each UPT user to participate in a user-defined set of subscribed services and to initiate and receive calls on the basis of a personal network transparent[1)] UPT number across multiple networks, at any terminal, fixed or mobile, irrespective of the geographical location, limited only by terminal and network capabilities and restrictions imposed by the network operator.

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1) A user identification is said to be network transparent when the user does not actually need to know where the UPT data base is located. Transparency includes the case where network independent user identification is used.

The aim of UPT is to provide user-to-user telecommunication services with:

a) user identification which is terminal- and network-transparent and is based on a UPT number where a UPT number is assigned to every user. Ideally, a UPT user will have one UPT number with multiple codes (e.g. passwords, priority codes) for different applications. (For further study);

b) personal call management which enables UPT users to control the destination address for all incoming calls based on the identity of the caller, the basic telecommunication service type, the call urgency, time of day; etc.

c) charging on the basis of the UPT number instead of the terminal identity;

d) service availability/accessibility across multiple networks (e.g. ISDN/PSTN, PSPDN, PLMN) and at different terminal types (fixed or mobile);

e) user and customer control of the user's service profile and personalization of terminal configuration;

f) network and access security, confidentiality of user information through UPT user authentication.

4 Functional requirements

The following network functionalities required for UPT were identified using Recommendation F.850 ("Principles of universal personal telecommunication - UPT") as a general guideline:

a) UPT number recognition and translation;

b) user registration/deregistration;

c) user authentication;

d) charging;

e) personalization of terminal access configuration;

f) service profile management;

g) recognition of user request to access to UPT service;

h) functionalities for operation and maintenance (OAM).

5 Functional architecture

5.1 UPT functional grouping

Whereas the concept of terminal mobility is currently evolving through miniaturization of personal communicators and advances in wireless technologies, the UPT represents a more fundamental and wider concept of personal mobility. However, the wireless component of the access and transport arrangements will be an important and integral part of the evolving networks, so that a reference architecture model for UPT that can provide an integrated view is required. The UPT functional grouping, shown in Figure 1, provides a logical partitioning of the major functionalities to support UPT while ensuring that the different access and transport arrangements implicit within the UPT concept can be properly reflected.

5.1.1 General

Generic access functions

Access functions include both wireline as well as wireless access types (e.g. mobile and personal stations and associated terminal functions in FPLMTS and PLMN). Thus, the continuous mobility available through the evolving wireless systems is fully reflected in this functional grouping.

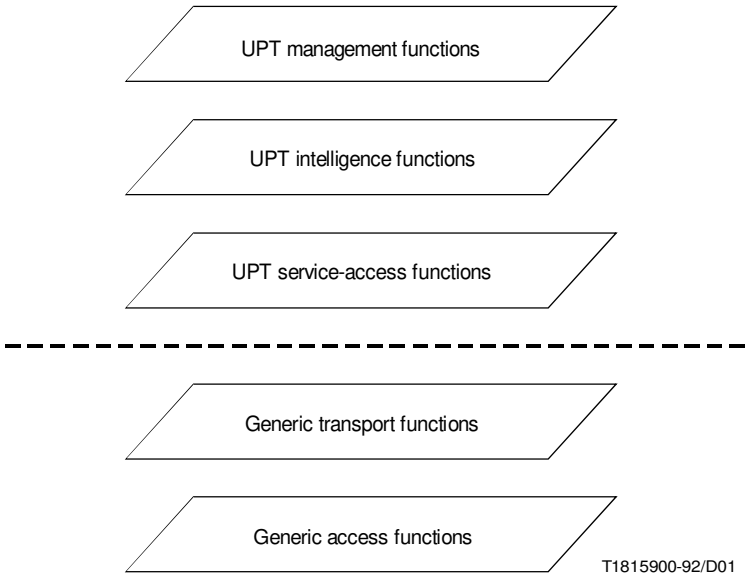


FIGURE 1/I.373

UPT functional grouping

Generic transport[2] functions

Transport functions include transmission and local and transit switching functionalities (including wireless network components).

UPT service-access functions

UPT service-access functions provide the service recognition and the connectivity into the UPT service through the existing (and evolving) PSTN/ISDN infrastructure including the infrastructure associated with a specific type of access (e.g. the base stations and mobile services switching centres in FPLMTS and PLMN).

UPT intelligence functions

UPT intelligence functions contain the information (data bases) and functionalities to manage the mobility and call management requirements of UPT and to support the registration, authentication, security, call routing and establishment functions.

UPT management functions

UPT management functions maintain the network and service related data (maintenance, operations, charging) and provide full operations support system (OSS) functionalities for UPT.

5.1.2 UPT specific functionalities

5.1.2.1 UPT service-access functions

a) Service access recognition

Service access recognition is initiated by a UPT specific procedure or a UPT number (depending on a dialling plan), a UPT procedure request (including registration procedure) or an outgoing call request recognition.

---

[2] Transport is defined as the functional process of transferring information between points at different locations.

b) User interaction

Collect information (e.g. information for UPT user authentication) from a UPT user, and send information to a UPT user, through in-channel signalling or out-channel signalling (e.g. D-channel signalling), and pass it to the UPT intelligence functions, if required.

c) Authorization of user access

Authorize user access without accessing user service profile (e.g. use of an intelligent card).

d) Personalization of terminal access configuration

Allow a UPT user to use specific terminal access configuration, such as abbreviated dialling, feature key assignment, but it may depend on the situation, for example, request of the UPT user.

e) Routing information handling

In a registration procedure, this function passes appropriate routing information, such as a routing address, to UPT intelligence functions. To complete an incoming call, it receives appropriate routing information from UPT intelligence functions.

5.1.2.2 UPT intelligence functions

a) Authentication and validation of user

Authenticate and validate user on the basis of information exchange, accessing user service profile data.

b) Service request validation

Verify that the requested services are available in relation to the service profile and the capabilities of the network and terminal.

c) User and service information request

Obtain user and service information from service profile.

d) Determination of call charging

Determine charging according to service condition such as the terminating UPT users current location.

e) UPT number translation

Translate a UPT number to a routing address (in accordance with call management defined by a UPT user).

f) Call handling

Send instructions to the UPT service-access functions and receive information from them for further instructions to maintain a UPT call.

g) Registration information storage

Store registration information in the service profile such as terminal address, a duration of call registration and number of calls.

h) User/Subscriber review and modification of service profile

Offer service profile review and modification to a UPT user, through telecommunication terminals utilizing “user interaction” in UPT service-access functions.

5.1.2.3 UPT management functions

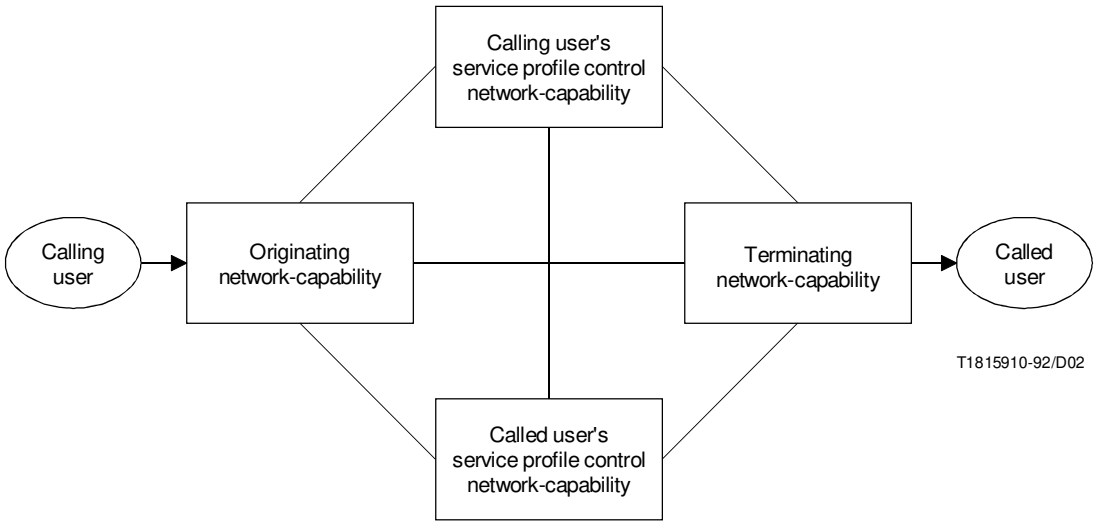
a) service profile management by the service provider;

b) operation and maintenance (OAM) functions for UPT;

c) processing of charging information.

5.2 UPT call reference model

A UPT call reference model is shown in Figure 2. This generic model illustrates the various network capabilities required for the completion of UPT calls. However, for a specific call, not all these connections are applicable. The specific network functions associated with each of the capabilities in the model are identified in Table 1. An illustrative example is provided in Figure 3. Additional call flow examples are provided in Appendix II.



NOTE – The specific network-capabilities are not intended to be linked to any part of the physical network. The network-capabilities may be provided within one network or across multiple networks.

FIGURE 2/I.373

UPT call reference model

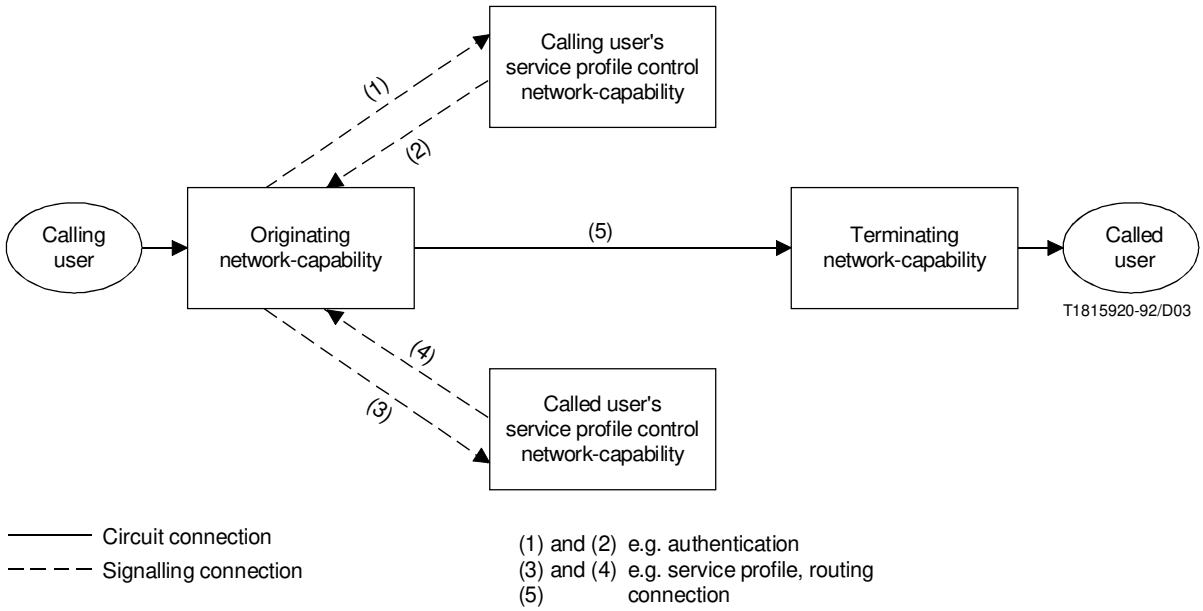
The originating network-capability supports the UPT service-access interface for a user originating a call. This capability recognizes the type of action requested by the calling user (e.g. dialled UPT number to call a UPT user, UPT access code to involve OutCall, etc.) and interacts with the other capabilities to carry out that action. This capability may also authorize a calling UPT user locally if an intelligent access device is used by the UPT user.

The calling UPT user's service profile control network-capability supports the UPT intelligence functions associated with a calling UPT user's service profile. This capability validates the UPT user's identity and requested action when a UPT user originates a call. This capability may be provided solely by the calling UPT user's service provider or, by agreement, jointly with the originating UPT serving network[3)].

The called UPT user's service profile control network-capability supports the UPT Intelligence functions associated with a called UPT user's service profile. This capability determines the appropriate destination for a call to a called UPT user based on user-specific call management information. This capability may be provided solely by the called UPT user's service provider or, by agreement, jointly with the originating UPT serving network.

---

3) A UPT serving network has UPT capabilities and provides physical access for a user either directly or via a non-UPT access network. The UPT serving network may be the UPT service provider associated with a calling UPT user or a called UPT user but need not be.



NOTES

1 The specific network-capabilities are not intended to be linked to any part of the physical network.The network-capabilities may be provided within one network or across multiple networks.

2 The numbers between brackets indicate the sequence of the events.

FIGURE 3/I.373

Example of UPT call flow – UPT user calls a UPT user

TABLE 1/I.373

Main functions for UPT call handling

Functions	Originating network capability	Calling UPT user's service profile control network-capability	Called UPT user's service profile control network-capability	Terminating network-capability
Recognition of UPT procedures	A			B
Interrogation for user authentication and service authorization	A	B	A	B
User authentication and service authorization	A[a)]	A	B	B[a)]
UPT number recognition[b)]	B	B	B	B
Interrogation for number translation and call management[b)]	B	B		
Call management and number translation			B	
Personalization of terminal access	A			B

A Calling user related

B Called user related

a) Only in the case where user information is available in the user's intelligent access device.

b) For a specific call, the function would be provided by only one of the network-capabilities identified.

The terminating network-capability supports the UPT service-access interface for a user receiving a call. This capability provides authentication of the called UPT user, if required, through interaction with the called UPT user's service profile control network-capability. This capability is provided by the terminating UPT serving network.

Information is exchanged between capabilities by signalling interaction alone or signalling associated with a circuit connection. The network-capabilities may be provided within one network or across multiple networks.

5.3 Interactions among UPT capabilities

When a service is provided to a UPT user some specific procedures should take place (e.g. identification, authentication) between the user access and the registration function. The diagram in Figure 4 is intended to address both call-related (calling/called users) and management-related (UPT users) functions. Both non-circuit-associated and circuit-associated signalling interactions are included. However, these are only logical distinctions; the same physical signalling interface may provide both capabilities.

5.4 Relationship between personal mobility management and terminal mobility management

UPT provides personal mobility. Systems such as those described by FPLMTS provide terminal mobility. These are separate mobility functions. The relationship between terminal and personal mobility is shown in Figure 5. The figure shows that the personal mobility management-terminal mobility management relationship is an association between a user identification and a terminal identification. The actual location of the terminal, e.g. network routing address, is determined by the terminal mobility management-terminal relationship. In the case of fixed, wired terminals, the terminal identification and the terminal location (i.e. line number) have one-to-one correspondence and the terminal mobility management is a "null" function. Logical separation of personal mobility management from terminal mobility management provides two major benefits. First, personal mobility management is relieved of any terminal tracking function. Second, personal mobility management can be "overlaid" on networks already providing terminal mobility management. However, the two must interwork; this interworking is for further study.

5.5 Relationship to the intelligent network

While the initial implementation of UPT service can be provided using simple data base arrangements, the evolving intelligent network (IN) architecture is well suited for providing many of the signalling and data base features required for UPT. Some of these include:

a) user controllable and portable service profile;

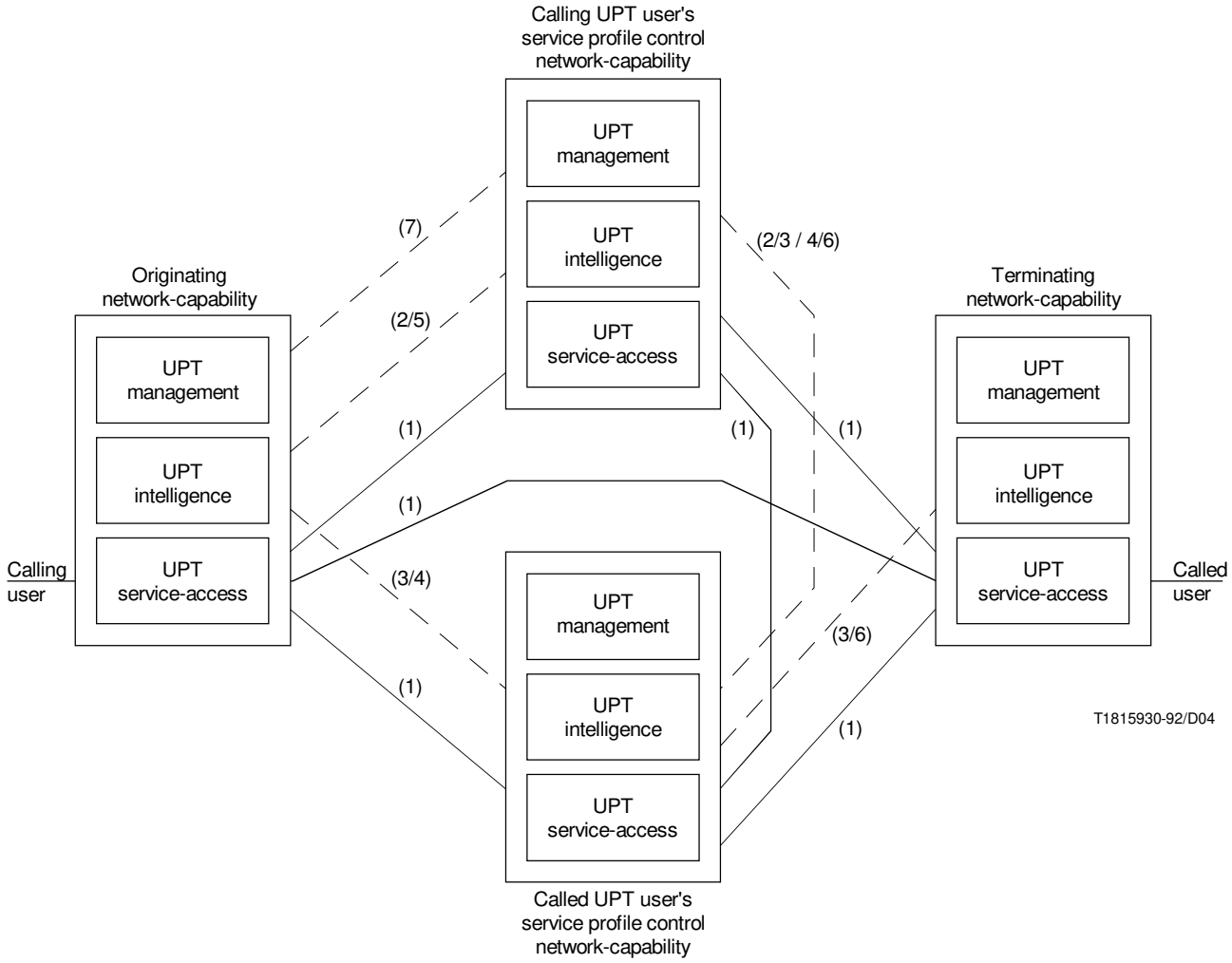
b) efficient and flexible number translation and routing;

c) personalized charging and single source billing;

d) rapid service provisioning and alteration;

e) interworking between service providers.

Therefore, as the IN capabilities are implemented at an increasing rate, many of the functionalities required to support UPT will be provided within the IN architectural framework. Figure 6 illustrates the broad relationship between the current IN functional architecture and the main functionalities required to support UPT. As the specifications for the UPT service and network aspects emerge and as the IN functional architecture evolves, further CCITT studies will be required on detailed functional mappings for the support of UPT within the broad IN architectural framework.



(1) UPT number and procedures information.
(2) Calling user authentication and service authorisation.
(3) Called user authentication and service authorisation.
(4) UPT number translation and call management.
(5) Calling user terminal access personalisation.
(6) Called user terminal access personalisation.
(7) Service profile review and modification.

NOTES

1 The specific capabilities are not intended to be linked to any part of the physical network.

2 Circuit connections and circuit associated signalling are established by the generic transport functions, and the user network interface is established by the generic access functions.

FIGURE 4/I.373

UPT interactions

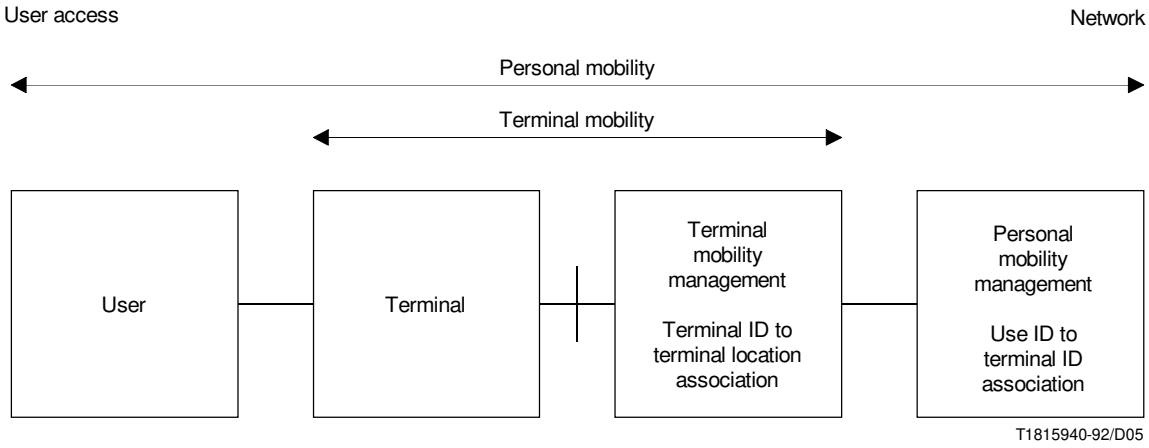


FIGURE 5/I.373

Relationship between personal mobility and terminal mobility

6 Network capabilities

It is expected that UPT will be implemented in phases over a period of time and it will follow an evolutionary path which will be determined by the evolving market needs and the increasing level of network intelligence. The network capabilities required for UPT will include capabilities that already exist in the network to support non-UPT calls/services, additional capabilities that are specific to UPT as per its service definition, and capabilities that may be required to harmonize the interactions between non-UPT and UPT related services and protocols.

6.1 Generic capabilities

The generic capabilities in the network that support call and service control for UPT user as well as non-UPT users include such functions as:

- terminal alerting;
- user alerting;
- service feature delivery;
- call and connection control and supervision.

Note that in the case of wireless access arrangements, "paging" may be one form of user/terminal alerting. Some of these may be further partitioned. For example, in case of PLMNs call control may also include automatic call handover and link transfer.

6.2 Specific network capabilities

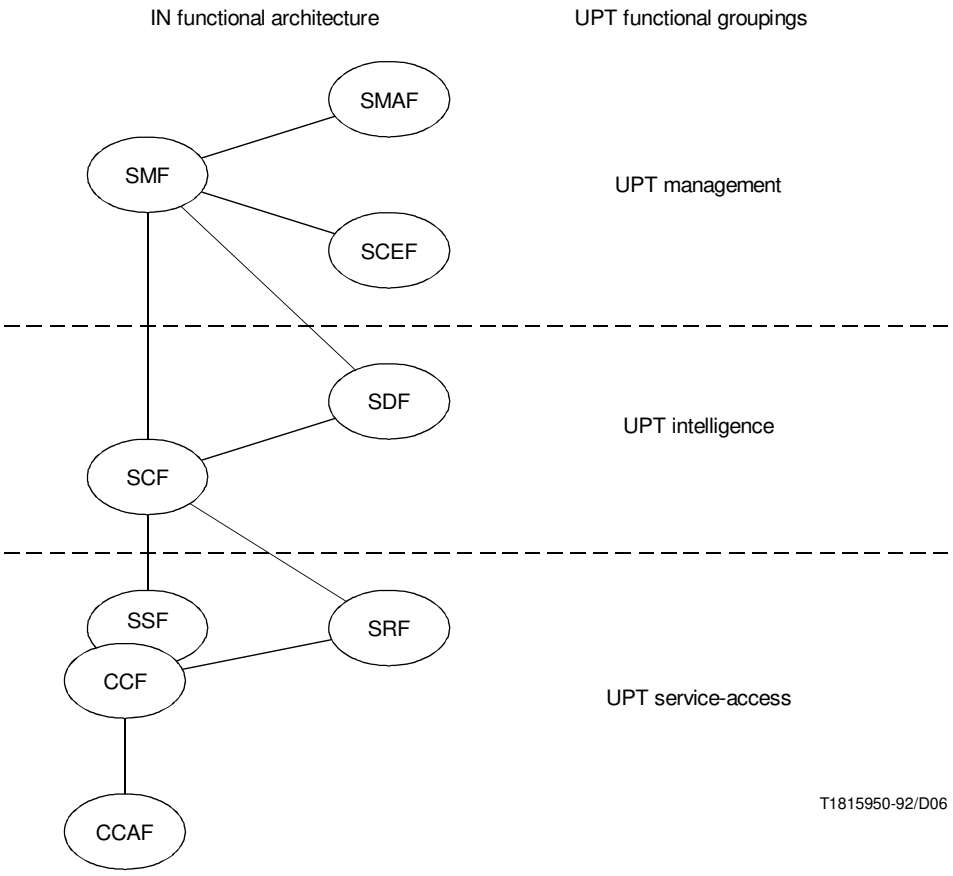
The UPT specific network capabilities that will support personal mobility with different terminal types (fixed and mobile) include:

- user authentication;
- user registration/deregistration based on UPTN;
- user location management;
- identification of different users on a terminal;
- user review and modification of user service profile;

– translation of UPTN into routing address;

– network/user data security and privacy management;

– charging and billing on the basis of UPTN.



IN functional entities

CCAF Call control access (agent) function
CCF Connection (call) control function
SSF Service switching function
SCF Service control function
SRF Specialized resource function
SDF Service data function
SMF Service management function
SCEF Service creation environment function
SMAF Service management access (agent) function

FIGURE 6/I.373

Relationship between IN functional architecture and UPT functional grouping

6.3 Network capabilities for services interaction

UPT allows the user of the UPT service to invoke a selected set of ISDN/PSTN/PLMN services at the user-designated terminal. It is possible that the features/protocols related to providing personal mobility to the user may need to interact with the features/protocols that already exist for supporting the telecommunications services in the network (e.g. Call forwarding service). Additional network capabilities may have to be provided to ensure that UPT implementations are well harmonized with existing and planned services/features.

Specific capabilities required for harmonization of services and service features are for further study.

6.4 Network capabilities for multi-network operation

Providing UPT service in a multi-network environment will require the cooperation between different networks in order to exchange the relevant data across networks for call set-up to a UPT user and for data base updating. This would also be the case of some other services offered to the UPT users (e.g. Calling Line or Calling Name ID). These data exchanges will be supported by the signalling protocols implemented in the networks. These protocols should be harmonized to simplify interworking.

An issue that needs consideration is that UPT 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 "UPT service areas" (e.g. countries) where users can subscribe to UPT services, and "non-UPT service areas", where there are no specific network functionalities for the provision of UPT service.

Two alternatives can be envisaged:

a) non UPT service areas cannot use UPT service;

b) non-UPT service areas can use UPT service, but possibly with some limitations. Users in these areas may have to use specific procedures to access UPT.

The first alternative is the simplest, but the second would be convenient in many cases.

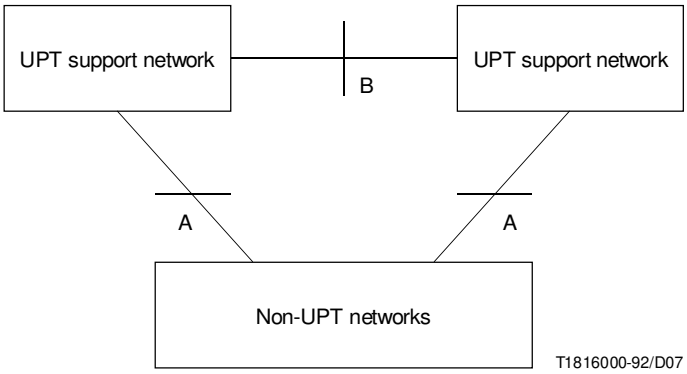
UPT services needs to be offered across multiple networks. The following network types may be considered:

– UPT support networks, which have the capabilities to control and manage UPT service; and

– non-UPT networks, which have only capability needed to connect UPT calls to UPT support networks.

In Figure 7 the interface points between these two network types are proposed. Type A is an interface point between "UPT support network" and "non-UPT network". Type B is an interface point between "UPT support network" and "UPT support network".

Appendix III illustrates some of the multi-network scenarios.



NOTE – Non-UPT networks can connect the call to the UPT support network with ordinary routing function.

FIGURE 7/I.373

Interface points in multiple networks for UPT service

Appendix I

(to Recommendation I.373)

Definition of UPT terms and list of abbreviations and acronyms

(This appendix does not form an integral part of this Recommendation)

terminal mobility: The ability of a terminal to access telecommunication services from different locations and while in motion, and the capability of the network to identify and locate that terminal.

personal mobility: The ability of a user to access telecommunication services at any terminal on the basis of a personal identifier, and the capability of the network to provide those services according to the user's service profile.

NOTE – Personal mobility involves the network capability to locate the terminal associated with the user for the purposes of aggressing, routing and charging of the user's calls.

universal personal telecommunication (UPT) service: A service which provides personal mobility and UPT service profile management.

NOTES

1 This involves the network capability of uniquely identifying a UPT user by means of a UPT Number.

2 The general principles of Universal Personal Telecommunications are given in Recommendation F.850 "Principles of Universal Personal Telecommunication".

UPT customer (UPT subscriber): A person who, or entity which, obtains UPT service from a UPT service provider on behalf of one or more UPT users and is responsible for payment of the charges due to that service provider.

UPT user: A person who, or entity which, has access to universal personal telecommunication services and has been assigned a UPT number.

universal personal telecommunication number (UPTN): A number that uniquely identifies a UPT user and is used to place, or forward a call to that user.

NOTE – A user may have more than one UPT number (for examples a business UPT number for business calls and a private UPT number for private calls). In that case, from a network point of view, each UPT number is considered to identify a distinct UPT user, even if they all happen to identify the same person or entity.

UPT service profile: A record containing all the information related to a UPT user in order to provide that user with the UPT service.

NOTE – Each UPT service profile is associated with a single UPT number.

Service profile management, UPT service profile management: The ability to access and manipulate the UPT service profile.

NOTE – UPT service profile management can be performed by the UPT User, UPT customer or UPT service provider.

call management: The ability of a user to indicate to the network how to handle incoming calls according to certain parameters such as the originator of the call, the time of day and the nature of the call.

NOTE – Call management is done through the user's service profile.

UPT routing address: A number used by the network to direct a call according to the user's UPT service profile.

List of abbreviations and acronyms

CCAF Call control access (agent) function

CCF Connection (call) control function

FPLMTS Future public land mobile telecommunication systems

ISDN Integrated services digital network

MSC Mobile services switching centre

OAM Operation and maintenance

OSS Operation support system

PSPDN Packet switched public data network

PLMN Public land mobile network

PSTN Public switched telephone network

SCEF Service creation environment function

SCF Service control function

SDF Service data function

SMAF Service management access (agent) function

SMF Service management function

SRF Specialized resource function

SSF Service switching function

UPT Universal personal telecommunication

UPTN Universal personal telecommunication number

Appendix II

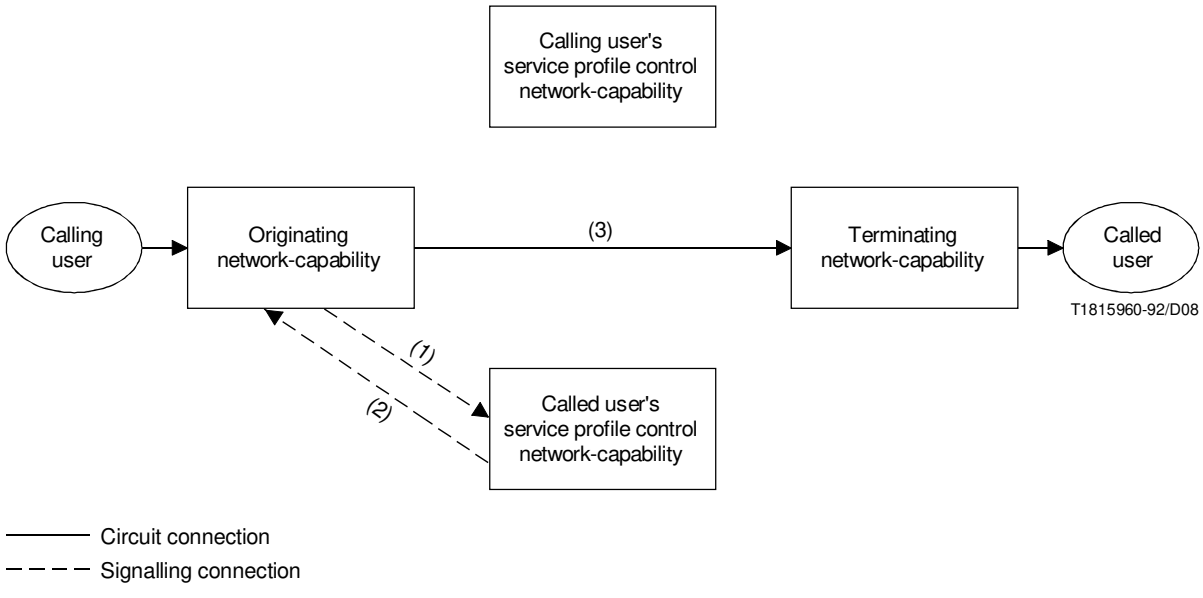
(to Recommendation I.373)

Additional UPT Call Flow examples

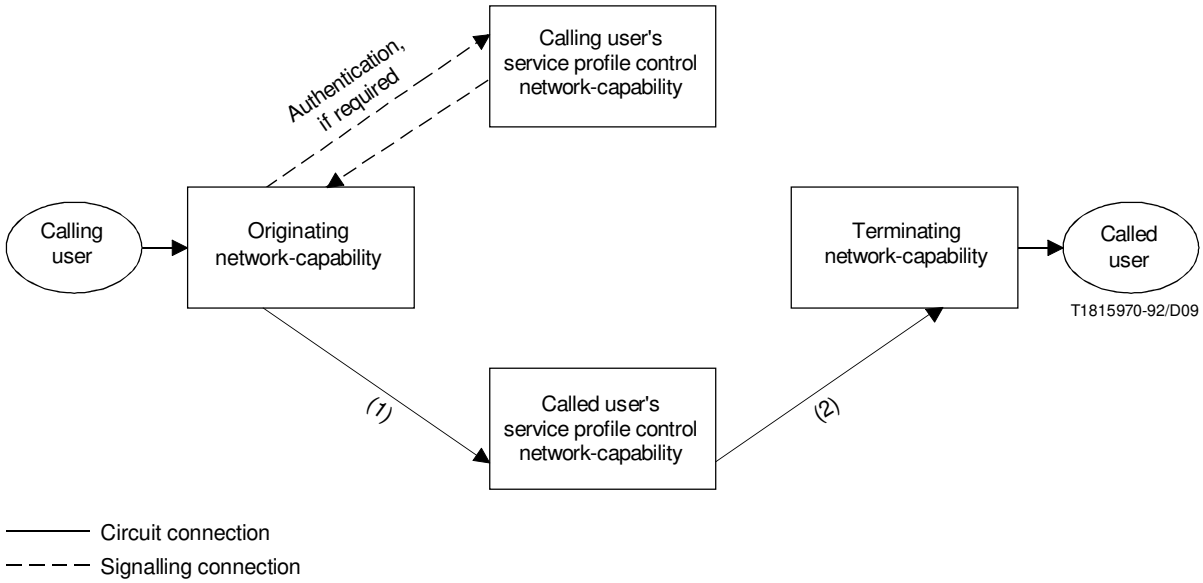
(This appendix does not form an integral part of this Recommendation)

Note that the numbers between brackets indicate the sequence of the events and that the specific capabilities are not intended to be linked to any part of the physical network.

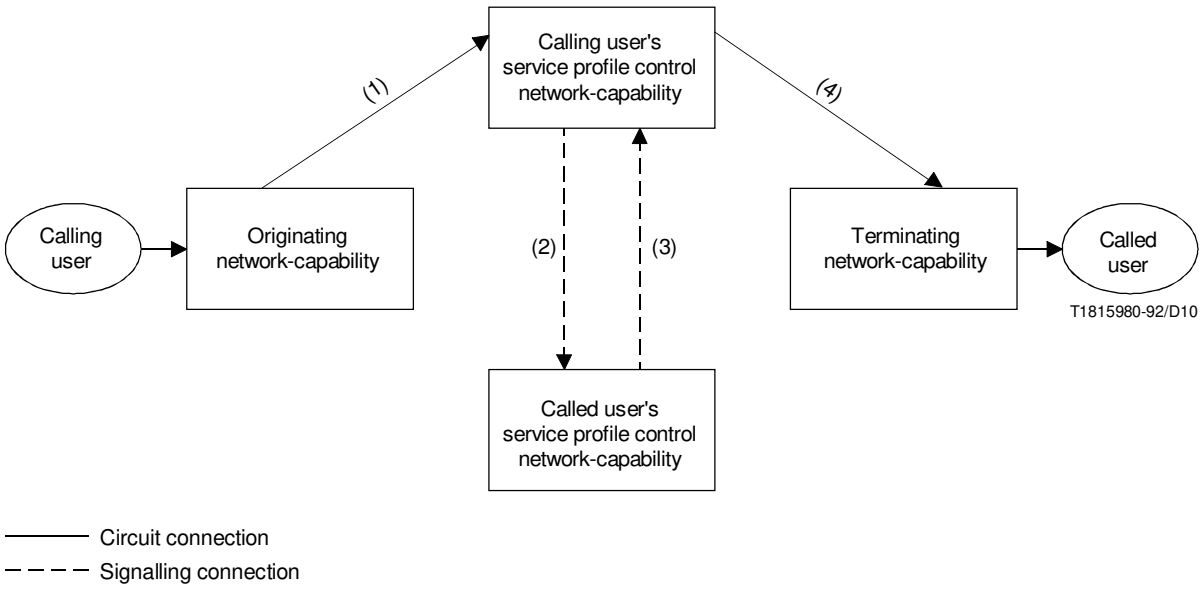
a) The calling user is not a UPT user



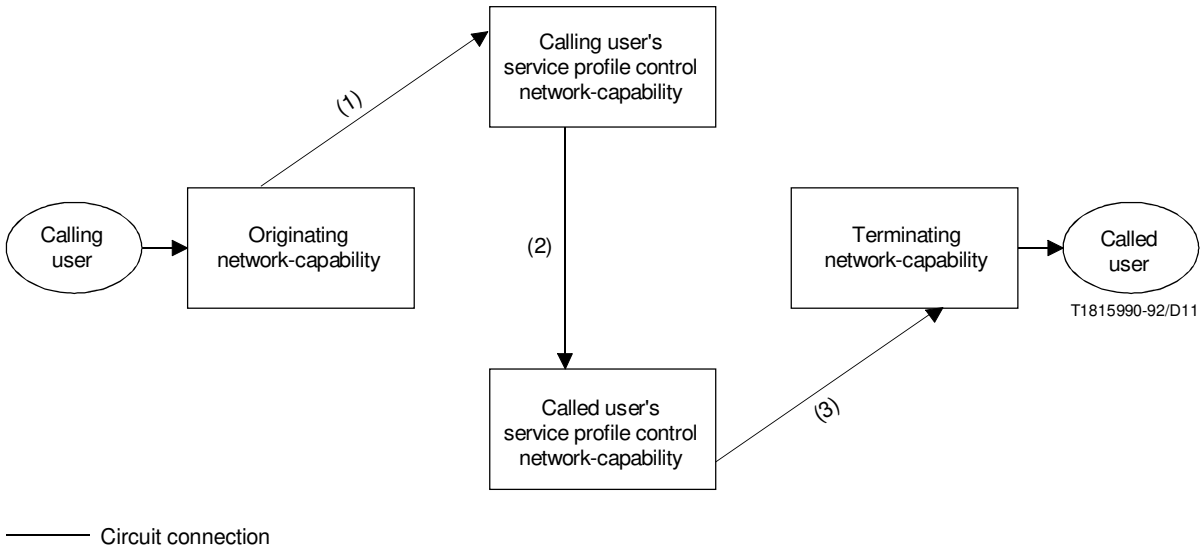
b) Call routed to called user service profile control network-capability (e.g. for interaction with calling user on charging options, service options, security features for called user)



c) Call routed to calling user service profile control network-capability (e.g. for authorizations, calling party preferences)



d) Call first routed to called user's service profile control network-capability than routed to called user's service profile control network-capability for routing to terminating network



Appendix III

(to Recommendation I.373)

Some multi-network scenarios for UPT

(This appendix does not form an integral part of this Recommendation)

III.1 Scenario 1 – Call handling within PSTN

When a call is made, using a UPT number, to a UPT User, the UPT serving network of the caller will recognize the UPT number and ascertain the routing address for that call from the UPT data base. The UPT serving exchange will then switch the call. (The UPT serving exchange is not necessarily the local exchange of the caller.)

The UPT data base provides to the interrogating node a routing address. This routing address has been determined by the UPT data base based on the UPT user's service profile, communication environment and location information. By doing the determination of the routing address in the UPT data base, a minimum amount of intelligence is required in the interrogating node (in the UPT serving network), and the UPT data base can take into account information stored regarding the UPT user's situation as well as the calling party's requested type of call. The UPT data base determines whether the call can be switched to the user's location or whether it should be switched to a voice messaging system, etc. It may also, if location information is missing, provide a routing address to a default terminal, specified by the customer (e.g. home or office terminal).

III.2 Scenario 2 – Call handling within ISDN

ISDN will support multiple service access from a single connection and may have "service dependent" sub-addressing. UPT can provide "service dependent" call diversion wherein the UPT customer will be able to specify the destination address for each of the combination of the basic and supplementary services. For specifying these diversions the UPT customer can access the network through D-channel signalling by providing his UPT number and a password. Thus, service dependent call diversion is achieved.

When a call is placed, using a UPT number, the UPT serving ISDN node will obtain a routing address from a UPT data base. The routing address is used by the UPT serving ISDN node to switch the call to the specified destination. The UPT data base has determined this routing address based on information regarding the type and nature of the service, destination address, terminal and terminating network capabilities.

III.3 Scenario 3 – Call handling across multiple networks

Within a UPT environment a user will be able to receive and initiate a call at any arbitrary point across multiple networks. The call delivery/reception may be limited by the capabilities of the network and the terminal equipment.

When a UPT number call is made from a PSTN, the UPT serving exchange will recognize it as a UPT call and interact with a UPT data base for obtaining routing information.

If the local switch is not able to interact with the data base it will pass on the call to the nearest suitable node for call handling. If the called party's physical call termination is on the PSTN itself the call will be switched to that terminal either by the UPT node or the originating exchange as a normal PSTN call. If, for example, information indicates that the call has to terminate on a mobile network, the routing of the call will have to be modified to suit the requirements of protocol, etc. If on the other hand the UPT data base detects limitations of the terminal or the terminating network, the call will be handled using a routing address to data bank/voice bank/video bank. Depending on the network implementation, this type of call could be either switched by the PSTN switch or a mobile services switching centre (MSC). UPT data base in the PSTN may have to interact with a data base in the mobile network both for routing information and switching purposes.

Similar procedures would apply for calls across ISDN, PSTN, PLMN and other networks, such as private networks.