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Foreword

This Technical Report (TR) has been produced by the User Group, a Special Committee of the European Telecommunications Standards Institute (ETSI).

Introduction

It is clear that mobility arouses major expectations from users, manufacturers and operators; it includes multiple aspects for which a variety of solutions are proposed. Unfortunately, every solution does not cover all the requirements.

The aim of this report is to describe the user expectations in the radio-communication field and particularly, to outline how operators and suppliers offerings could better meet the user needs.

Concerning the corporate needs with regard to mobility, the companies' general expectations for corporate communications apply:

The main issue for corporate communications in the next few years, will be to find the right balance between private networks and public networks and to achieve mobile connectivity between private and public networks. On one hand, private networks are generally better fitted to the corporate users' needs and sometimes cheaper than public ones but burdensome to operate. On the other hand, public networks are more flexible and more widely interconnected, without up-grading constraints for the users.

In radio-communication field, due to the trend to mobility within and outside a company, it is of the utmost importance to implement inter-working between the private wireless networks, which allow for communications within the company sites, and public mobile networks, which enlarge the communication everywhere else, in the streets, cars, airport, etc. …

Since this need for people and companies to communicate at every time and everywhere is continuously growing, at the same time, the need for a better ability to protect the individual privacy is also increasing. This raises several issues:

- to screen efficiently between private and business communications;

- is a single number for business and private communications the best solution to allow this universal communication, provided that call deflection or call diversion services are possible for one or another call category when desirable;

- or are separate numbers more suitable to ensure privacy if there are appropriate functions to identify or to reroute independently incoming calls from or to the other category when necessary.

Therefore, aiming to draw up high level user requirements for mobile communications, the guidelines in our thoughts were:

- a highest possible level of data exchange capability between the private and public systems of registration and management;

- a small number of inter-working interface types between the different networks (fixed/mobile and private mobile/public mobile). This means that other than the most current networks (e.g. GSM, DECT, TETRA) should align their interfaces on the previous ones;

- a common terminology and set of processes to deliver the major services (e.g. call transfer, attendant call…).

Data transmission aspects were also considered although there are few experiences yet.

Since it was not possible to study in detail all the combinations of the above parameters, it was decided, at the first step of the work to analyse what are the use and user typologies, then in a second stage to check the matrix of the needs, and particularly which services and applications are requested in the different situations.

In addition some indications on a philosophy of design for all users, including disabled and elderly people, are given.

1   Scope

The **purpose** of this report is to provide ETSI with user requirements for mobile communications, focusing in particular on issues related to inter-networking between public and private, fixed and mobile networks. Issues related to Radio LAN, Hiperlan and similar radio data networks were not considered.

The **aim** is to help ETSI to develop relevant standards. The report is intended for use by ETSI.

The users' requirement section covers the following usage categories:

- **business needs in the different environments**, although specific requirements related to some particular but nevertheless relatively widespread needs, like those of nomadic teams in maintenance or operating duties (e.g. group calls, broadcasting, emergency calls, etc.), were not considered in detail;

- **personal needs in the different environments,** in particular for business users, mobile workers and teleworkers.

The report comprises the following sections:

- clause 4 describes Users and Typology of Use;

- clause 5 describes Systems;

- clause 6 describes Standardization Models;

- clause 7 provides Users Expectations;

- clause 8 provides recommendations to ETSI for developing standards.

2   References

References may be made to either:

a) specific versions of publications: (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or

b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as EN with the same number.

[1]   ETR 029: "Human Factors; Access to telecommunications for people with special needs - Recommendations for improving and adapting telecommunication terminals for people".

[2]   ETR 116 (1994): "Human Factors Guidelines for ISDN Terminal Equipment".

[3]   ETR 345: "Characteristics of telephone keypads and keyboards; Requirements of elderly and disabled people".

[4]   ETS 300 056 (1991): "Integrated Services Digital Network (ISDN); Call Waiting (CW) supplementary service - Service description".

[5]   ETS 300 090: "Integrated Services Digital Network (ISDN); Calling Line Identification Restriction (CLIR) supplementary service - Service description".

[6]   ETS 300 128 (1992): "Integrated Services Digital Network (ISDN); Malicious Call Identification (MCID) supplementary service Service description".

[7]   ETS 300 136 (1992): "Integrated Services Digital Network (ISDN); Closed User Group (CUG) supplementary service Service description".

[8]   ETS 300 139 (1992): "Integrated Services Digital Network (ISDN); Call Hold (HOLD) supplementary service Service description".

[9]   ETS 300 173 (1992): "Private Integrated Services Network (PISN); Specification, functional models and information flows; Identification supplementary services".

[10]   ETS 300 178 (1992): "Integrated Services Digital Network (ISDN); Advice Of Charge: charging information at call set-up time (AOC-S) supplementary service Service description".

[11]   ETS 300 179 (1992): "Integrated Services Digital Network (ISDN); Advice Of Charge: charging information during the call (AOC-D) supplementary service Service description".

[12]   ETS 300 180 (1992): "Integrated Services Digital Network (ISDN); Advice Of Charge: charging information at the end of the call (AOC-E) supplementary service Service description".

[13]   ETS 300 183 (1992): "Integrated Services Digital Network (ISDN); Conference call, add-on (CONF) supplementary service Service description".

[14]   ETS 300 199 (1994): "Integrated Services Digital Network (ISDN); Call Forwarding Busy (CFB) supplementary service Service description".

[15]   ETS 300 200 (1994): "Integrated Services Digital Network (ISDN); Call Forwarding Unconditional (CFU) supplementary service Service description".

[16]   ETS 300 201 (1994): "Integrated Services Digital Network (ISDN); Call Forwarding No Reply (CFNR) supplementary service Service description".

[17]   ETS 300 202 (1994): "Integrated Services Digital Network (ISDN); Call Deflection (CD) supplementary service Service description".

[18]   ETS 300 237 (1993): "Private Integrated Services Network (PISN); Specification, functional models and information flows; Name identification supplementary services".

[19]   ETS 300 256 (1993): "Private Integrated Services Network (PISN); Specification, functional models and information flows; Diversion supplementary services".

[20]   ETS 300 260 (1993): "Private Integrated Services Network (PISN); Specification, functional models and information flows; Call transfer supplementary service".

[21]   ETS 300 284 (1993): "Integrated Services Digital Network (ISDN); User-to-User Signalling (UUS) supplementary service Service description".

[22]   ETS 300 365 (1994): "Private Integrated Services Network (PISN); Specification, functional models and information flows; Call completion supplementary services".

[23]   ETS 300 367 (1995): "Integrated Services Digital Network (ISDN); Explicit Call Transfer (ECT) supplementary service Service description".

[24]   TCR-TR 023: "Telephone key size and spacing for people with special needs".

[25]   TS GSM 03.41: "Digital cellular telecommunications system (Phase 2+); Technical realization of Short Message Service Cell Broadcast (SMSCB)".

[26]   ITU-T Recommendation X.25: "Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".

[27]   ISO 3461: "General principles for the creation of graphical symbols Part 1: Graphical symbols for use on equipment".

[28]   ISO 9186: "Procedures for the development and testing of public information symbols".

[29]   ISO 9241: "Ergonomic requirements for office work with visual display terminals".

[30]   ISO/IEC 9995: "Information technology".

[31]   EN 1332: "Identification Card Systems: Man-Machine Interface".

[32]   EN 29241-4: "Ergonomic requirements for office work with visual display terminals (VDTs) -
                Part 4: Keyboard requirements".

[33]   CEN TC 224 WG 6 N 183: "Design Principles & Symbols for the User Interface".

3   Definitions and abbreviations

Hereafter are given, in alphabetical order, the definitions of some features used in this ETR and among them the descriptions of the Supplementary Services as it stands either in the clause 5 of stage 1 description for service defined in ETSI or in ECMA related documents. Some minor changes to the original text (e.g. removal of references to other clauses) have been made for clarification. For ETSI services, ETS Number, where they come from, are given in bracket for referencing. Further details can be found in these ETSs.

3.1   Definitions

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

3.1.1   General

handover: The process of switching a call-in-progress from one physical channel to another physical channel. These processes can be internal or external.

interoperability: Ability of equipment from different manufacturers (or different systems) to communicate together on the same infrastructure (same system). This capability relies on the specification of the air interface, line interface and terminal interface.

interworking: Ability of equipment from the same system to communicate together from different systems. This capability relies on specification of the inter-system interface.

roaming: The movement of a portable part from one fixed part coverage area to another fixed part coverage area, where the capabilities of fixed parts enable the portable part to make or receive calls in both areas.

3.1.2   Impairments, disability, etc.

impairments: Any loss or abnormality of psychological physiological or anatomical structure of function.

disability: Any restriction or lack (possibly resulting from an impairment) of ability to perform an activity in the manner or with the range considered normal for a human being. Temporary disability can occur due to environmental factors which cannot be instantly mastered.

handicap: A disadvantage for a given individual, resulting from an impairment or disability that limits or prevents the fulfilment of a role that is normal, depending on age, sex, social and cultural factors.

disabled person: Person with one or more impairments, one or more disabilities, one or more handicaps or a combination of impairments, disability and/or handicap.

3.1.3   Environments

residential environment: Hotel, private dwelling.

business environment: Business building (own company or another company (e.g. customer's building)).

public environment: Street, airport, railway station, department store, etc.

3.1.4   Type of needs

business needs: Communications made related to company business with the corresponding costs paid by the company whatever the environment of the calling person.

personal needs: Communications made for personal purpose with the corresponding costs paid by the calling person whatever the environment of the calling person.

3.1.5   Service definitions

telecommunication service: A telecommunication service is defined as that which is offered by an administration/operator to its customers in order to satisfy a specific telecommunication requirement. Such service has generally to comply with a legal regulation.

bearer service: A bearer service is a telecommunication service providing the capability for information transfer between access points (called user-network interfaces in ISDN) and only involves the OSI lower layer functions (layers 1-3).

teleservice: A teleservice is a telecommunication service providing the complete capability, including terminal equipment functions, for communication between users according to protocols established by agreement between network operators (and equipment suppliers).

In other words a teleservice provides the user with the possibility of gaining access to various forms of applications via the terminal equipment, (and it is carried through the network by the bearer service). Telephony is an example of teleservice. More generally, teleservices may include:

   - speech;

   - short message;

   - data;

   - videotex;

   - text (teletex or data);

   - facsimile.

supplementary service: A supplementary service modifies or supplements a basic telecommunication service. Consequently, it cannot be offered to a customer as a stand alone service. It should be offered together with or in association with a telecommunication service (bearer service or teleservice). The same supplementary service may be common to a number of telecommunication services.

Supplementary Services may optionally be divided in 3 groups:

1) network transparent supplementary services;

2) standard supplementary services;

3) network specific supplementary services.

Such services may be call-independent or not.

facilities: The ITU-T has considered the need to standardize data transmission services and optional user facilities in data networks which would be made available on an international basis.

These facilities, and the ability of the networks to offer certain pre-defined user-determinable functions, would be determined and accessed by use of an inherent protocol, e.g. ITU-T Recommendation X.25 [26], etc.

3.1.6   Supplementary Services

ACC Accounting Code: The ACC service allows a calling user to assign a given code to a call for cost charging identification purpose.

AOC-D (ETS 300 179 [11]) Advice of Charge - during the call: The AOC-D supplementary service provides the served user with cumulative charging information during the call. The charge information can be provided for all calls, or on a per call basis. The information given relates to the charges incurred on the network to which the served user is attached.

AOC-E (ETS 300 180 [12]) Advice Of Charge - at the End of the call: The AOC-E supplementary service provides the served user with charging information for a call when the call is completed. The charge information can be provided for all calls, or on a per call basis. The information given relates to the charges incurred on the network to which the served user is attached.

AOC-S (ETS 300 178 [10]) Advice Of Charge - at time of call Set Up: The AOC-S supplementary service provides the served user with information about the charging rates at call establishment. In addition, the served user is informed if a change in charging rates takes place during the call. The charge information can be sent for all calls, or on a per call basis. The information given relates to the charges incurred on the network to which the served user is attached.

NOTE 1: In some cases, e.g. due to off-line processing of charges, or timing considerations, the charge calculated by the user or the user's equipment may not precisely reflect the actual cost incurred.

CCBS Completion of Calls to Busy Subscriber / Call Back When Free:

ETSI (ETS 300 357 [34]): The CCBS supplementary service enables User A, encountering a busy destination B, to have the call set up again without having to make a new call attempt when the destination B becomes Not Busy.

When User A requests the CCBS supplementary service, the network will monitor for destination B becoming Not Busy.

When destination B becomes Not Busy (i.e. access resources, for example at least one B-channel, being Not Busy) then the network will wait a short time in order to allow the possibility of the resources being re-used for originating a call. If the resources are not re-used by destination B within this period, then the network will automatically recall User A.

If User A accepts the CCBS test call, then the network will automatically generate a CCBS call to destination B. Otherwise, the call is cancelled.

ECMA (ETS 300 365 [22]): Completion of Call to Busy Subscriber (CCBS) is a supplementary service which is offered to a calling User A. On encountering a busy called User B, it allows User A to request that the Private Telecommunication Network (PTN) monitors User B and notifies User A when User B becomes Not Busy. On response by User A to that notification, the PTN will attempt to complete the call to User B.

CCNR, Completion of Calls on No Reply / Call Back When Next Used: The CCNR supplementary service enables User A, encountering a non-answering destination B, to have the call completed without having to make a new call attempt after destination B becomes Busy.

When User A requests the CCNR supplementary service, the network will monitor for destination B becoming Busy.

When destination B becomes Busy (i.e. at least one B-channel is Busy) then the network will wait a short time in order to allow either the Call Waiting to be used at the destination B or, if the resources are not re-used by destination B within this time, to recall automatically User A.

When User A accepts the CCNR recall, then the network will automatically generate a CCNR call to destination B.

CD (ETS 300 202 [17]) Call Deflection: The CD supplementary service enables the served user to respond to an incoming call by requesting redirection of that call to another user. The CD supplementary service can only be invoked before the connection is established by the served user, i.e. in response to the offered call, or during the period that the served user is being informed of the call. The served user's ability to originate calls is unaffected by the CD supplementary service.

The maximum number of diversions permitted for each call is a service provider option, with an upper limit of five diversions. All types of call diversion are included when counting the number of diversions.

NOTE 2: The answering party should be able, as a feature, to see the original number dialled, unless specifically withheld.

CFB Call Forwarding Busy:

ETSI (ETS 300 199 [14]**):** The CFB supplementary service enables a served user to have the network redirect calls which are addressed to the served user's ISDN number and meet the Busy condition to another user. The CFB supplementary service may operate on all calls, or just those associated with specified basic services. The served user's ability to originate calls is unaffected by the CFB supplementary service.

As a service provider option, a subscription option can be provided to enable the served user to receive an indication that the CFB supplementary service has been activated. This indication is provided when the served user originates a call if the CFB supplementary service has been activated for the served user's ISDN number and for the basic service requested for the call.

The maximum number of diversions permitted for each call is a service provider option with an upper limit of five diversions. All types of diversion are included when counting the number of diversions.

ECMA (ETS 300 256 [19]**):** CFB enables a served user to have the PTN redirect to another user calls which are addressed to the served user's PTN number and meet busy. CFB may operate on all calls, or just those associated with specified basic services. The served user's ability to originate calls is unaffected by CFB.

CFB is provided on a per PTN number basis.

The maximum number of diversions to a single call is an implementation option. When counting the number of diversions, all types of diversions shall be included.

CFNR Call Forwarding No Reply:

ETSI (ETS 300 201 [16]**):** The CFNR supplementary service enables a served user to have the network redirect to another user calls which are addressed to the served user's number, and for which the connection is not established within a defined period of time. The CFNR supplementary service may operate on all calls, or just those associated with specified basic services. The served user's ability to originate calls is unaffected by the CFNR supplementary service.

The CFNR supplementary service can only be invoked by the network after the call has been offered to the served user and an indication that the called user is being informed of the call has been received.

As a service provider option, a subscription option can be provided to enable the served user to receive an indication that the CFNR supplementary service has been activated. This indication is provided when the served user originates a call if the CFNR supplementary service has been activated for the served user's number and for the basic service requested for the call.

The maximum number of diversions permitted for each call is a service provider option with an upper limit of five diversions. All types of diversion are included when counting the number of diversions.

ECMA (ETS 300 256 [19]**):** CFNR enables a served user to have the PTN redirect to another user calls which are addressed to the served user's PTN number and for which the connection is not established within a defined period of time. CFNR may operate on all calls, or just those associated with specified basic services. The served user's ability to originate calls is unaffected by CFNR.

CFNR is provided on a per PTN basis.

The maximum number of diversions to a single call is an implementation option. When counting the number of diversions, all types of diversions shall be included.

CFU Call Forwarding Unconditional:

ETSI (ETS 300 200 [15]**):** The CFU supplementary service enables a served user to have the network redirect to another user calls which are addressed to the served user's number. The CFU supplementary service may operate on all calls, or just those associated with specified basic services. The served user's ability to originate calls is unaffected by the CFU supplementary service. After the CFU supplementary service has been activated, calls are forwarded independently of the status of the served user.

As a service provider option, a subscription option can be provided to enable the served user to receive an indication that the CFU supplementary service has been activated. This indication is provided when the served user originates a call if the CFU supplementary service has been activated for the served user's number and for the basic service requested for the call.

The maximum number of diversions permitted for each call is a service provider option with an upper limit of five diversions. When counting the number of diversions, all types of diversion are included.

ECMA (ETS 300 256 [19]**):** CFU enables a served user to have the PTN redirect to another user calls which are addressed to the served user's PTN number. CFU may operate on all calls, or just those associated with specified basic services. The served user's ability to originate calls is unaffected by CFU. After CFU has been activated, calls are forwarded independently of the status of the served user.

CFU is provided on a per PTN number basis.

The maximum number of diversions to a single call is an implementation option. When counting the number of diversions, all types of diversions shall be included.

CLIP Calling Line Identification Presentation:

ETSI (ETS 300 089 [35]**):** The CLIP supplementary service provides the called party with the possibility of receiving identification of the calling party.

In addition to the telephone number, the calling line identity may include a sub-address generated by the calling user and transparently transported by the network. The network provider is not responsible for the content of this sub-address.

The network delivers the calling line identity to the called party during call establishment, regardless of the terminal capability to handle the information.

The network delivers the connected line identity to the calling party on call acceptance regardless of the terminal capability to handle the information.

> NOTE 3: In some situations, e.g. when a default number is used, the information delivered may not precisely identify the connected party.

ECMA (ETS 300 173) [9]**:** The PTN provides the called party with the number of the calling party whenever an incoming call is presented. The number provided should be sufficient to enable the called party to return the call.

The calling party number may be accompanied by a sub-address.

CLIR (ETS 300 090 [5]**) Calling Line Identity Restriction:** The Calling Line Identity Restriction (CLIR) supplementary service is a supplementary service offered to the calling party to prevent the presentation of the calling party's number, and sub-address information (if any), to the called party.

CNIP (ETS 300 237 [18]**) Calling Name Identity Presentation:** The Calling Name Identification Presentation (CNIP) is a supplementary service which is offered to the called user and which provides the name of the calling user (calling party name) to the called user.

The PTN provides the calling party name to the called user when an incoming call is presented.

The possible provision of the calling party name by the calling user to the PTN is outside the scope of this Standard.

CNIR (ETS 300 237 [18]**) Calling Name Identity Restriction:** The Calling Name Identity Restriction (CNIR) supplementary service is a supplementary service offered to the calling party to prevent presentation of the name of the calling party to the called party.

CO, Call Offer: The CO service allows a calling user to request that the call be offered to the user at a busy destination and that the called user be given the choice of accepting, rejecting or ignoring the waiting call. This service can be used in conjunction with ECT to transfer another user into a state of waiting at the busy destination.

CONF (ETS 300 183 [13]**) Conference call, Add On:** The CONF supplementary service enables a user to participate in and control a simultaneous voice-communication involving a number of users.

The CONF supplementary service can be invoked from the idle state. As a network option, the CONF supplementary service can be invoked from an existing active call.

When the CONF supplementary service is invoked, conference resources are allocated to the served user. In the case of invocation from an active call, this call will be connected to the conference resources.

CW (ETS 300 056 [4]) Call Waiting: The CW supplementary service permits a user to be informed of an incoming call (as per basic call procedures) with an indication that no interface information channel is available. The user has then the choice of accepting, rejecting or ignoring the waiting call (as per basic call procedures).

The CW supplementary service operates when all appropriate B channels of the access to the terminal(s) of subscriber B are busy.

Moreover, when at least one B-channel is free, any compatible busy terminal of subscriber B can react positively to an incoming call.

When a third party (calling user C) attempts to connect to that termination, subscriber B is given an appropriate indication of the waiting call.

The maximum number of calls that can be handled (e.g. active, held, alerting, waiting) for each ISDN number on a given interface shall be a network option.

> NOTE 4: It is recognized that a small call-connect system or an active bus may be present at customers' premises and that an internal call may be in progress when the call waiting indication is applied. It is assumed that it is the responsibility of the customer's equipment to determine what action should take place in these circumstances.

CUG (ETS 300 136 [7]) Closed User Group: The CUG supplementary service enables users to form groups to and from which access is restricted. A specific user may be a member of one or more closed user groups. Members of specific closed user group can communicate among each other.

A closed user group consists of a number of users. A closed user group can have members from one or more public networks. In a digital environment, each member of a closed user group is identified by their ISDN number (see also subclause 8.9 and subclause 8.13 in ETS 300 136 [7]).

Subscription to a closed user group shall be defined for all basic services, or in relation to one, or to a list of basic services.

Closed user group members can have additional capabilities that allow them to originate calls outside the group, and/or to receive calls from outside the group. Closed user group members can have additional restrictions that prevent them from originating calls to other members of the closed user group, or from receiving calls from other members of the closed user group.

DND, Do Not Disturb: The DND supplementary service determines whether all incoming calls to the served user, or just those relating to a specific basic service, are rejected by the PTN. The calling user is given an appropriate indication.

Users may be provided different levels of protection against override of DND service by DNDO.

Activation, deactivation and interrogation of this service can be performed by the served user or by another authorized user.

ECT, Explicit Call Transfer:

ETSI (ETS 300 367 [23]): The ECT supplementary service enables a user (user A) to transform two of that user's calls (for example an active call to user A and a held call to user B) into a new call between user B and user C. The users call can be an incoming call or an outgoing call.

Prior to transfer, the connection has been established on the call between user A and user B. On the call between user A and user C, either the connection has been established prior to transfer, or, as a service provider option, transfer can occur while user C is being informed of the call (i.e. the connection has not yet been established).

> NOTE 5: Service providers may reject a request for the ECT supplementary service depending on criteria (e.g. for operational reasons under certain circumstances).

ECMA (ETS 300 260 [20]): ECT is a supplementary service which enables a served user (user A) to transform two of that users calls into a new call between the other two users of the two calls (user B and user C). Each call can be either an incoming call to user A or an outgoing call from user A. After successful invocation of ECT user B and user C will be able to communicate with each other and user A will no longer be able to communicate with user B or user C.

One of the calls may be an outgoing call that has not been answered by the other user (user C). After successful invocation of ECT user A will no longer be able to communicate with user B. User B and user C will be in a position to communicate with each other as soon as user C has answered.

NOTE 6: The establishment of either call as part of a request for transfer is outside the scope of the present document. The present document assumes that both calls have already been established when the request for call transfer is made. This does not preclude an implementation whereby a single user request causes the establishment of a call and its subsequent transfer.

HOLD (ETS 300 139 [8]**) Call Hold:** The HOLD supplementary service allows a user to interrupt communications on an existing call and then subsequently, if desired, re-establish communications.

When the HOLD supplementary service is invoked, communication on a B-channel is interrupted and the B-channel is released from use by the existing call. A B-channel is reserved for use by the terminal used to invoke the HOLD supplementary service.

A B-channel on that user's interface is always available to the terminal used to hold the call to enable the user to:

- retrieve that call from hold;

- originate a new call;

- retrieve another call; or

- establish connection to an incoming call, e.g. a waiting call.

One B-channel is kept available for the user as long as the user has:

1) one or more calls on hold; and

2) is not currently connected to any other call.

The network only reserves one B-channel for the terminal used to invoke the HOLD supplementary service.

When the user wishes to reconnect to a held call, the retrieve operation is requested.

MCID (ETS 300 128 [6]**) Malicious Call Identification:** The MCID supplementary service enables an incoming call to be identified and registered. The following call information is registered:

- called party number;

- calling party number;

- local time and date of the invocation in the network serving the called user; and

- as a service provider option: calling party sub-address (if provided by the calling user).

The information is not available to the terminal equipment under the control of the called user, nor the calling user. The information is stored at a location(s) under the control of the network operator.

The MCID supplementary service can either be invoked during the active phase of the call, or after the active phase for a limited period but never after call termination by the served user.

MSS Manager/Secretary Switch: This MSS service allows a calling user to call an associated user by using a pre-set function key instead of dialling the complete number.

MWI Message Waiting Indication: This MWI service allows a called user, already engaged in a call, to be informed that there is another waiting call by flashing an indicator or ringing a special tone. It can also be used in conjunction with voice mail systems to indicate that a message has been left for that telephone number.

UUS (ETS 300 284 [21]**) User-to-User Signalling:** The UUS supplementary service allows the user to send/receive a limited amount of user generated information to/from another user-network interface. This information is passed transparently (i.e. without modification of contents) through the network. The network does not interpret or act upon this information.

Services 1, 2 and 3 allow the transmission of 128 octets per message as a maximum.

NOTE 7: During an interim period of time, some networks may support 32 octets on one or more of the services; 32 octets will always be supported. Restrictions may apply to calls requesting User to User Information (UUI) of more than 32 octets.

Limitations are also placed on the number of messages per time unit for service 3. The flow control of each direction is operated independently.

3.1.7   Specific Mobile Services

AL, Ambience Listening: AL is defined as the facility whereby a control point may place a terminal into a special type of individual voice call teleservice whereby the called terminal is transmitting without any action from, or indication to, the called user. AL is only set-up if the called unit is not already engaged in a call. The standard does not preclude that during AL the called mobile terminal may make and receive calls as normal.

BM, Broadcast Message: A broadcast message is a one way point-to-multipoint communication between a calling party and several called parties.

Normally the members of the group have one common number which is called their broadcast group number.

The broadcast message can only be cleared by the originator of the call.

BIC, Barring of Incoming Call: BIC enables the setting of barring restrictions for incoming calls. The authorized served user is able to change the activation/deactivation of the categories as shown below:

- all incoming calls (presumes all basic services);

- all incoming calls when outside home network;

- all incoming calls from certain identified users;

- all incoming calls from certain identified networks;

- to group numbers;

- call types.

BOC, Barring of Outgoing Call: BOC enables barring restrictions for outgoing calls to be set. The authorized served user is able to change the activation/deactivation of the categories as shown below:

- all calls;

- international calls;

- calls through certain gateways;

- calls to subscribers outside the closed user group;

- calls outside the authorized geographical area; etc.

CFNRc Call Forwarding on Not Reachable: This service permits a called user (the served user) to have the network send all incoming calls, or only those with a specific basic service, addressed to the called number, but which is not reachable, to another number. The ability of the served user to originate calls is in principle unaffected, but practically it is affected if the subscriber is deregistered, if there is a network congestion or if the mobile subscriber is, for example, out of coverage. If this service is activated, a call is forwarded only if the mobile subscriber is not reachable.

NOTE 1: An announcement of the the call being forwarded should be given to the caller.

CLMS, ConnectionLess Message Service: the ConnectionLess Message Service (CLMS) offers a connectionless point-to-point or point-to-multipoint service. The CLMS may offer either or both of the following service types:

- fixed length message service;

- variable length message service.

NOTE 2: Such message is, in principle, a sequence of characters.

COMS, Connection Oriented Message Service: the Connection Oriented Message Service (COMS) offers a point-to-point connection oriented packet service. This service only supports packet mode calls, and offers a faster and simpler call establishment than normal calls. The COMS includes the ability for rapid suspension (and resumption) of the connection, this capability is provided to allow the lower layer resources to be released during periods of inactivity (this provides a function similar to the virtual connection mode of packet connection).

DL, Discreet Listening: DL is defined as the facility whereby an authorized user may listen to one or more communications between subscribers without any indication to any subscriber that the communication is being monitored. Identification of the talking parties should be given to the monitoring party. As an implementation option the monitoring party may further be allowed to enter into the conversation and/or may clear the call if required.

GC, Group Call: A group call is a two way, point-to-multipoint communication between the calling party and one or more called parties.

The members of a group have one common pre-defined number which is called their group number and by which they are addressed. The group call can only be cleared by the call owner. The call initiator is by default the call owner.

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

PC, Priority Call: PC is a supplementary service that allows the infrastructure to give priority access to the network resources to a call which has been sent with priority status. The priority level should not apply to the initial up-link access but should apply to the resources across the infrastructure in preference to a call attempt with lower priority.

PPC, Pre-emptive Priority Call: PPC is a supplementary service that enables the user to have resources allocated, even if this means that other calls with lower priority will be disconnected. PPC normally means the highest access priority level at up-link access and the highest priority level across the networks.

SDS, Short Data Service: The Short Data Service (SDS) is available on TETRA networks. It is intended to be a quick service enabling the user to exchange a short user defined message or a short pre-defined message, e.g. emergency message. The message can be sent or received in parallel with an ongoing speech call.

SMS, Short Message Service: The purpose of the Short Message Service (SMS) is to provide the means to transfer messages between a GSM Public Land Mobile Network (PLMN) Mobile Station and a Short Message Entity via a Service Centre, as described in TS GSM 03.40 [36].

SMSCB, Short Message Service Cell Broadcast: SMSCB is a service in which short messages may be broadcast from a PLMN to Mobile Stations (MSs). SMSCB messages come from different sources (e.g. traffic reports, weather reports). The source and subject of the SMSCB message is identified by a message identifier in the SMSCB message header. A sequence number in the SMSCB message header enables the MS to determine when a new message from a given source is available.

SMSCB messages are not acknowledged by the MS. Reception of SMSCB messages by the MS is only possible in idle mode. The geographical area over which each SMSCB message is transmitted is selected by the PLMN operator, by agreement with the provider of the information.

A SMSCB message is an end-to-end message that is formatted by/for the SMSCB application, and which is intended for customer viewing. Its format is described in detail in Technical Specification GSM 03.41 [37]. A Cell Broadcast (CB) message is any message sent on the Cell Broadcast CHannel (CBCH). It can be an occurrence of a SMSCB message, or a schedule message.

The SMS Cell Broadcast service is designed to minimize the battery usage requirements of a mobile station. A mobile station can read the first part of a CB message and then decide whether or not to read the rest of the message. In addition, the network may broadcast schedule messages, providing information in advance about the CB messages that will be sent immediately afterwards. The mobile station may use this scheduling information to restrict reception to those messages the customer is interested in receiving. This SMSCB Discontinuous Reception (DRX) feature is optional in the network and the mobile station.

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 or the associated user.

3.1.8   Applications

RAD, Remotely Available Directory: Today such a service is not standardized. It should be accessible by calling a server and giving, through for instance vocal information and decoded via a voice recognition system, relevant information about the wanted subscriber, e.g. name, town or company in order to get the wanted number.

LDS, Location Determination Services: This service enables authorized people to use the integrated features of the network to determine the position of a calling terminal, for example to supply assistance or to find the right person to whom an information or an instruction be delivered, taking into account his geographical position.

This could be achieved either by the identification of the calling cell or by using additional enhancement via GPS or GPS-like devices.

In addition, a user equipment could be enabled to use any external source to determine his position or to evaluate his position in relation to other fixed or mobile terminals and to transmit messages in support of emergency operations and/or hazard warnings.

3.2   Abbreviations

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

ACC	ACcounting Code
AFUTT	Association Française des Utilisateurs du Téléphone et des Télécommunications
AL	Ambience Listening
ANEC	European Association for the Co-ordination of Consumer Representation in Standardization
AOC-D	Advice Of Charge (During call)
AOC-E	Advice Of Charge (End of call)
AOC-S	Advice Of Charge (call Set-up)
API	Application Programming Interface
ATM	Asynchronous Transfer Mode
	Advanced Testing Methods
	Automated Teller Machine
BC	Broadcast Call
BIC	Barring of Incoming Call
BOC	Barring of Outgoing Call
BS	Base Station
BSI	British Standards Institute
CB	Cell Broadcast
CBCH	Cell Broadcast CHannel
CCBS	Completion of Calls to Busy Subscriber
CCITT	Comité Consultatif International pour la Télégraphie et la Téléphonie
CCNR	Completion of Calls on No-Reply
CD	Call Deflection
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardization
CENTREX	CENTRal EXchange
CFB	Call Forwarding Busy
CFNR	Call Forwarding No-Reply
CFNRc	Call Forwarding on Not Reachable
CFU	Call Forwarding Unconditional
CIGREF	Club Informatique des GRandes Entreprises Françaises
CLIP	Calling Line Identity Presentation
CNIP	Calling Name Identity Presentation
CO	Call Offer
CONF	Conference Call Add On
CPE	Customer Premise Equipment
CT2	Second generation cordless telephone, UK
CTM	Cordless Terminal Mobility
CUG	Closed User Group
CW	Call Waiting

DCE	Data Circuit-terminating Equipment
DTE	Data Terminal Equipment
DCS 1 800	Digital Cellular Systems at 1 800 MHz
DECT	Digital European Cordless Terminal
DL	Discreet Listening
DND	Do Not Disturb
DNDO	Do Not Disturb Override
DRX	Discontinuous Reception
ECMA	European Association for Standardizing Information and Communication Systems
ECT	Explicit Call Transfer
EDI	Electronic Data Interchange
ERMES	European RadioMEssaging System
EMC	ElectroMagnetic Compatibility
ETSI	European Telecommunications Standards Institute
GC	Group Call
GPS	Global Positioning System
GSM	Group Special Mobile
HiPERLAN	High Performance European Radio LAN
HLR	Home Location Register
HOLD	Call Hold
IC	Identification Card
IN	Intelligent Network
ISDN	Integrated Services Digital Network
ISO	International Standard Organization
IT&T	Information Technology and Telecommunications
ITU-T	International Telecommunication Union Telecommunication Standardization Sector (former CCITT)
LAN	Local Area Network
LDS	Location Determination Service
MCID	Malicious Call Identification
MMI	Man-Machine Interface
MS	Mobile Station
MSS	Manager/Secretary Switch
MWI	Message Waiting Indication
N-ISDN	Narrowband ISDN
NIMT	Network Interception
NNI	Nederlands Normalisatie Instisuut
OSITOP	European User group for Open Systems
PABX	Private Automatic Branch eXchange
PAC EG5	Programme Advisory Committee Expert Group 5
PC	Personal Computer
PC	Priority Call
PIN	Personal Identification Number
PISN	Private Integrated Services Network
PLMN	Public Land Mobile Network
PPC	Pre-emptive Priority Call
PSTN	Public Switched Telephone Network
PTN	Private Telecommunications Network
RAD	Remotely Available Directory
RE	Recall
RLAN	Radio LAN
SCF	Service Control Function
SCP	Service Control Point
SDS	Short Data Service
SIM	Subscriber Identification Module
SM	Short Message
SMS	Short Message Service
SMSCB	Short Message Service Cell Broadcast
SRC6	Strategic Review Committee 6
TETRA	Trans-European Trunked RAdio

TFIG   Task Force Implementation Group
UMTS   Universal Mobile Telecommunications Systems
UNI   User to Network Interface
UNICODE   UNIversal CODE (multilingual character set)
UUI   User to User Information
UUS   User-to-User Signalling
VPN   Virtual Private Network

4   Typologies of Users and Uses

Users have various functions and professions that require diverse telephone services and a more or less extensive degree of mobility, limited to the corporate site, a region, a country, or even world-wide. Their needs are thus highly heterogeneous.

Firstly, the profiles of some users was described and a glimpse on existing practices in the area of corporate cordless telephony was given.

The main expectations of users are then classified into two categories: the expectations of end-users and the expectations of telecommunications buyers and managers. These needs are quite different and sometimes opposing since end-users have less cost responsibility than the corporate or telecom managers.

These needs have been assessed in the following companies and associations: Régie Autonome des Transports Parisiens, Laboratories ROCHE, RITME International, American Express, CIGREF, AFUTT, ETDE, ANEC.

There are four main parameters to define the users' needs:

1) the type of mobility (full or limited to a geographical area);

2) the type of activity (operational or administrative, businesses or leasure);

3) the type of services needed (common or specific). In particular, is it a one-to-one or one-to-many communication;

4) users' capabilities. Individuals may have specific needs coming from either language issue or impairments. It should be kept in mind that more and more people with impairments are working in companies. As a consequence of that, their specific needs have to be considered.

Disability is a result of a task placing greater demands on an individual than he or she can master. For example, a native English speaker in Japan would become "disabled" because environmental factors (language/culture) cannot instantly be mastered. This disability disappears when the English speaker returns to an English speaking country; i.e. the disability was temporary. Technology can actually solve this disability. In the case above this could be solved by the individual having his/her language preferences stored on a smart card which gets a system to communicate in the preferred language (Note: this, and the Coding of Special User requirements on Cards is the subject matter of CEN TC 224 WG 6 [33] in prEN 1332-4 [31], and of the EU funded TIDE project 1040 "SATURN").

Other key impairments in relation to mobile communications that should be considered apart from language are, motor impairment (ranging from large motor impairment to fine movement/feel), visual, speech, hearing and cognitive impairment. ETSI TC HF ETR 029 [1] provides a description of these impairments and gives an indication of the functional requirements for telecommunications systems.

4.1   User Typology

Below are listed the profiles of a few end-users according to their degree of mobility and their function.

- **Technical staff:**
  This concerns on-site maintenance and security teams. They need to be reached quickly, should be able to note the call and possibly call back or answer immediately with respect to the security nature of the user's function.

- **Security staff:**
  They have about the same needs than the above staff but some additional ones (e.g. open group communications).

- **Administrative and supervisory staff:**
  They should move around to attend on-site meetings, meetings on other sites or outside the company, including in foreign countries. Above all, they want an extension of the company fixed telephone.

- **Technical production staff on industrial sites:**
  When they work in difficult conditions, they need to communicate among themselves and need to be able to make emergency calls.
  When their function requires numerous contacts with other services or divisions of the company, it should be possible to contact them at any time, preferably, as an extension of the site telephone system.

- **Pre-sales staff:**
  They usually travel away from their company. They need to make calls and need to be contacted by their company or clients, to whom they want to offer quality telephoneservice. Also, as they move around a great deal, they need to communicate for professional as well as for individual needs.

- **After-sales staff:**
  This concerns, for example, maintenance and delivery services outside the company. These users need to be reached rapidly by their company, and in some cases, their company would like to locate them for greater efficiency of deliveries and repairs. In addition, their calls may need to be restricted.
  The analysis has demonstrated that such staff have about the same needs than those of technical staff but with the difference that they operate outside their own company, e.g. in a customer company or in a public area.

- **Professional people:**
  This are for example doctors, lawyers, architects who need for their business to move around, sometimes in areas of poor public radiocommunication coverage in the towns or country, while keeping in connection with their office.

- **People on the Move (PoM):**
  This means people who are using private transportation. In addition to the Technical or Security staff needs, they are interested to have or give specific information on their location and environment.

- **Private users:**
  This is a heterogeneous group, since they vary considerably in terms of experience with communications technology in general; specific level of communications use (naive users - very experienced users), resources, etc. In general, they are not professional users.

This list is not exhaustive, and other users can have needs that do not correspond to the profiles described above. Nevertheless, as many as possible professional needs have been taken into account when information was available.

4.2   Typology of Uses

Most of the situations in the current life correspond to one of the following cases:

		Residential environment	Business environment	Public environment
Private Expectations		EXAMPLE: A private user in home, car or in holiday location. A business user in an hotel during a business trip.	EXAMPLE: A visitor in a company.	EXAMPLE: A private user in the street or on public transportation. An individual in business trip.
Business	End User Expectations	EXAMPLE: Teleworking, mobile worker.	EXAMPLE: An employee in his company or in another company.	EXAMPLE: An employee in business trip.
Expectations	Telecom Manager Expectations			

Each of the above cases are considered in the following of the document with some reservation in the case of home users for which the Topic Group members have little precise information available.

5   Typology of Systems

Mobile communications are not just about mobile handsets, but include personal and terminal mobility as well as interworking between networks.

5.1   Cordless Systems Currently in Use

Existing systems can be separated into two categories with respect to the extent of the wireless communication area.

-   **User Needs limited to one or several sites:**

    Today, private radio paging connected to a PBX are the most widely used systems. This product, when it displays the caller's number, is generally appreciated by users who have been using it. Although, it appears insufficient to some of them, especially those who needs to call back the caller quickly, it presents, nevertheless, the advantage to leave to the called person the choice of giving a priority to calls or to pursue his task.
    Some extended sites are equipped with analogue radio networks like trunk systems.
    New combinations between a paging system and a wireless phone are expected in the near future to provide extended battery autonomy.

-   **User Needs for communication outside the company:**

    So far, the users being away from their place of work, have the possibility to use cellular radio networks that offer good nation-wide radio coverage which has been extended with various cellular systems such as GSM, PCN, etc. Public radio paging networks are also widely used.

5.2   Future Wireless Communications Systems

Since Virtual Private Networks are nowadays more and more popular for business communications, some companies are expecting that the same concept would apply in radiocommunication services. For instance, the same supplier would provide the mobile communication service for a closed user group (see details in paragraph 7.3.2   Closed User Group (CUG)") within the private company sites or outside the company. The communication costs would be charged to the subscribing company. It is expected that nobody other than those authorized are able to access any equipment or interfere in any communication.

Future mobile telecommunication systems like Universal Mobile Telecommunications Systems (UMTS) are expected to be an evolution of the present systems and their interworking rather than a brand new third generation. Cordless Terminal Mobility (CTM) standards are being developed to allow users of CT2 and DECT cordless terminals to roam within and between the radio coverage of public, residential and business cordless base stations connected to public and/or private networks. These standards are based on public and private N-ISDN and the use of Intelligent Network (IN) facilities to provide the mobility management and service control in the public networks.

The availability of the CTM standards is expected to harmonize the interworking of a broad range of cordless products and related public and private N-ISDN to provide what is expected to be a very attractive end-user service.

CTM with cordless access is optimized for indoor and limited outdoor environments, whereas GSM is optimized for outdoor, mobile and limited indoor environments. CTM and GSM should, therefore, be seen as complementary systems. Consequently, one of the evolutionary steps towards future mobile telecommunications systems, is expected to be dual mode CTM and GSM terminals and services. These may be based on the use of dual mode cordless and cellular terminals and dual mode IN SCPs supporting the CTM mobility management and service control functions and the GSM HLR functionality. This dual mode CTM and GSM service is expected to provide a user friendly personal communication service, i.e. a single terminal, service registration, directory number and subscription, suitable for use in different environments.

In the longer term, UMTS is expected to provide a similar service on a wider coverage (indoor-outdoor) but there are still many uncertainties on what will actually be UMTS and how long setting up will take. In addition to the extended mobility, the significant improvement from UMTS is likely to be enhanced data capability.

6   Evolution of Standardization Models

There is now a trend in ETSI standardization to adopt the Enterprise model based on Information Value Chain and described by SRC6 then enhanced by several other committees, EPIISG, TFIG, PAC EG5, etc.

6.1   The Enterprise Model

This model therefore reflects both the wide range of activity as well as the competitive nature:
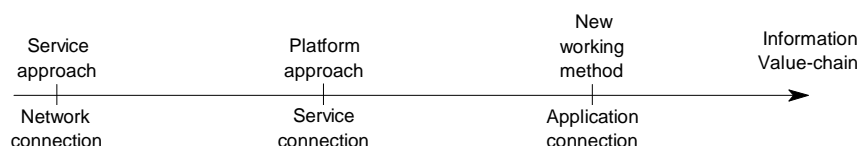
Evolution of the telecommunications industry along the Information Value-chain

An interface in the Enterprise model represents the boundary between entities within an overall structure: the term has a specific meaning for each of the different structures under consideration. In the context of information and telecommunication networks, the entities which should be interfaced are defined with reference to one or more domains to which the entity belongs.

Amongst the different categories of interfaces needed between the different domains, technical interfaces represent a key means to realize the information industry and the relationships between roles and domains within it. Standards describing technical interfaces represent the principal end product of the standards-making process, and form the basis upon which manufacturers, operators and service providers realize technical solutions.

The following categories of technical interfaces can be identified:

- *telecommunications* - the interfaces supporting telecommunications services which are required between systems (e.g. transmission systems, switching systems and network management systems) belonging to different Network Operation Domains or different Equipment Provisioning Domains;

- *management* - the interfaces supporting the administrative interfaces between domains;

- *computing* - the interfaces required for distributed processing included access;

- *software* - the interfaces between software modules and computer operating systems. Application Programming Interfaces (APIs) are in this category. Progress in the industry overall depends to a large extent on players being able to use proprietary extensions to standard APIs.

This categorization is not intended to be definitive and some overlap will occur - for example, the use of computing interfaces to realize management interfaces.

The requirement for standards for technical interfaces and the role of ETSI in their production and establishment are key issues that need to be addressed. The main motivations for establishing technical standards are:

- to ensure interoperability between enterprises and domains through interoperability between systems;

- to satisfy technical regulatory requirements for open interfaces - for example between a network and Customer Premises Equipment (CPE) where the CPE is not owned or controlled by the network operator;

- to reduce equipment development costs and support the specification and procurement of equipment;

- to ensure that information service providers can roll out their networks Europe-wide, or better world-wide, without having to concern themselves with issues of interoperability between telecommunications networks.

In order to clearly separate the roles of transport network operations, information network operations and service provision, a number of essential interfaces are needed. At present, the User Network Interface (UNI) and the Network Node Interface (NNI) are the general transport and signalling interfaces to and between the transport network roles. An Application Programming Interface (API) is needed by the information industry structural roles to support the building of their applications and through which the application can access the various storage, processing and transport facilities provided by the information network operators and the transport network operators. These three interfaces are essential for the successful development of the information network operations role.

6.2   Service Provision Evolution

The introduction of Intelligent Network techniques into PSTN and ISDN networks enables to separate the service control functions from the underlying switching and transmission functions. This will allow the network control systems to evolve separately from the switching and transmission systems and will also allow greater flexibility in the development and deployment of telecommunications services. Nevertheless, the two additional functions included in IN CS-2 are required: firstly a non call related signalling mechanism to avoid using circuit switched connections for location registration, authentication, etc., and secondly a Service Control Function (SCF) Interworking facility to allow different SCFs in different Service Control Points (SCP) to co-operate in the provision of the mobility management and service control.

Different strategies may be envisaged for the convergence of the services through the different networks:

-    all users in all networks get the same services; or

-    all users get their home network services in all networks.

The second option seems more flexible but requires that the visited network co-operates in a service independent manner with the home network.

7   User Expectations

The following of the document has been designed by consolidation of the 6 different following situations:

-    business expectations in a residential environment;

     "the user is located in a residential environment (hotel, home, customer home) and wants to establish or receive calls by means of a wireless set for business needs with the corresponding costs paid by his company";

-    business expectations in a business environment;

     "the user is located in his company and wants to establish or receive calls by means of a wireless PBX or a CENTREX for business needs";

     or

     "the user is located in another company (e.g. a customer) and may wish to establish or receive calls via a wireless host equipment but with the corresponding costs paid by his own company";

-    business expectations in a public environment;

     "the user is located in a public environment (street, airport) and wants to establish or receive calls by means of a wireless set for business needs";

-    private expectations in a residential environment;

     "the user is located in a residential environment (hotel, home) and wants to establish or receive calls by means of a wireless set for private needs";

-    private expectations in a business environment;

     "the user is located in a company and wants to establish or receive calls by means of a wireless PBX or a CENTREX for private needs (or for another company business needs)";

-    private expectations in a public environment;

"the user is located in a public environment (street, airport) and wants to establish or receive calls by means of a wireless set for private needs".

Each of the aspects considered in these different subclauses have been considered by both the end-user's and the telecom manager's points of view. In addition, the end-user's point of view has been studied under the different perspectives given in 4.1   User Typology", e.g. technical staff, security staff, administrative and supervisory staff, technical production staff on industrial sites, pre-sales staff, after-sales staff, professional people …

7.1   General

Key consumer issues are:

-    ease of use;

-    accessibility on equal terms;

-    interoperable;

-    uniform user interface for the user;

-    adaptable;

-    transparency of the system;

-    privacy and confidentiality;

-    manned alternatives;

-    consumer participation;

-    forgiving system;

-    reliability of product;

-    anonymity;

-    reliability of service (especially in relation with emergency numbers);

-    availability of the various communications means (fixed or radio) to provide for mobility;

-    limited responsibility for misuse;

-    security.

Since mobile communications are provided for the public, they should be easy to use for all intended user groups. Ease of use can be measured in terms of performance (e.g. the time taken by users to complete a predetermined task, and/or number of errors, and/or satisfaction with a service), and goals for ease of use (known as usability statements) can be developed.

The system should be easily accessible to all users on equal terms. This includes being accessible to those who encounter for example problems in reading messages on displays (visually impaired, dyslexic, etc.) or to those with hearing difficulties.

The systems should be interoperable so that in principle any service can be accessed on any network on any terminal, thus avoiding the acquisition of access to several different networks and terminals.

The systems should have uniform user interface. It is especially important that the method of entering, navigating in and exiting the systems is consistent for the user.

A uniform user interface for the user can be achieved by two means:

    a) all components of the user interface are uniform;

    b) the user interface adapts to the user, so that the user always meets a personalized uniform interface. This principle is the subject of the TIDE project 1040 "SATURN", where the feasibility of using a smart card to trigger a personalized user interface is being evaluated.

The system should be adaptable to meet a users' specific requirements, for example provide output (on screen or sound) in a required language.

The system should be transparent, with regards to both costs involved for the user and in terms of operating the system.

The system should ensure privacy and confidentiality of the individual. This in turn requires a security system that can be relied upon, with no confidential information being shown on screens or on paper output such as receipts, and that electronic footprints are avoided.

Manned alternatives (i.e. friendly attendant) should always be available to those who have difficulty using a (new) system.

Active consumer participation throughout the design process is required to ensure "consumer friendly" systems.

The system should anticipate human errors of operation and be forgiving. Informative error messages should lead the consumer forward.

7.1.1   Speech Quality

Users familiar to the high vocal quality of the fixed telephone network are expecting the same quality with mobile communication. They often complain of the poor quality of current radio transmission, limited radio coverage (notably in tunnels), untimely carrier interruption in public networks and call drops.

7.1.2   Flexibility of Utilization

The advantage of a mobile telephone come from the ability of being contactable at any place and at any time at the users discretion. This advantage may become an inconvenience if the user loses the possibility of delaying the answer to telephone calls.

Users should have the freedom of choice to answer a call or reroute it elsewhere, yet being in control. In particular, this is very important for Technical Staff busy on a special assignment they cannot leave. A doctor visiting a patient at home is in the same situation: he should have the possibility to forward his calls to a voice mail or a secretary.

It is therefore important, for the user friendliness, to have the following functions available:

-   calling line identification from all networks, public and private;

-   call forwarding to a mail box or to a fixed terminal;

-   the possibility of filtering calls by defining authorized calling numbers that are allowed to ring the terminal;

-   given certain circumstances.

7.1.3   Coverage

Once the user has a cordless terminal available, he experiences an increasing need to communicate and expand the cordless communication area: when he can be reached, he wants to be reached in the greatest possible number of places.

It is that much more true in the case where users are in the process of renewing their cordless communication tools: they not only want more functions but, above all, they want radio coverage that is at least equivalent to what they had in the previous system. This is the case for example:

-   of users who go from an analogue cellular network to a digital cellular network (GSM) and whose coverage a the opening of the service was not extensive;

- of users of paging systems that move to cordless telephony or cordless PABX (CT2 or DECT) whose radio range is narrower than that of paging systems.

From the end-user perspective, the only appropriate coverage is when the terminal operates satisfactorily when he wants to use it, wherever the location.

A telecom managers is, more than the business end-user, attracted by a good price/quality of service ratio. Therefore, a private network coverage can be improved step by step from a first level to a more perfect one as this is now the case with the public networks.

In many cases, users, when in areas of poor coverage, would like to have the possibility to switch between different systems/services to enhance the quality of service. They need to be at least informed of unsuccessful incoming calls. This is for example the case of doctors in the countryside or the case of technical staffs in large industrial sites. In such situations, a combination of paging and wireless telephony may helpfully palliate a poor radiotelephone coverage. Such solution would be all the more user friendly if it is provided with a multifunction terminal or as a combined service. For instance, it could be useful to have information interchange between the paging system and the radiotelephone handset, e.g. calling number identification, etc.

In any case, the user need to have an indication of his current network availability.

It is clear that current mobile networks do not enable to cover all user needs as they need to set up communications within a short range (cordless) and also long range (cellular) networks. This binds the users to subscribe to different networks and leads them to acquire several different terminals.

However, most users do not want multiple mobile terminals. Therefore, CTM and the appropriate registrations allowing the user to roam, with a single terminal, between different public and private networks, should help to solve at least one part of the problem.

Another more general solution could be to develop terminals allowing access to several different networks, for example:

- access to a cordless corporate network and a public cellular network: for example, DECT/GSM, DECT/DCS1800;

- access to different public cellular networks: for example DCS1800 and GSM, to take advantage from;

- extended GSM radio coverage outside urban areas and from the DCS1800 greater traffic capacity within the urban areas.

Taking into consideration the considered types of users, different terminal combinations might be envisaged taking ETSI standards as examples:

Type of User	Common Needs	Specific Needs
Technical staff:	DECT/GSM, DECT/DCS1800,	TETRA, TETRA/GSM
Security staff:	DECT/GSM/ERMES,	TETRA, TETRA/GSM
Administrative and supervisory staff:	DECT/GSM, DECT/DCS1800, DECT/GSM/ERMES,	
Technical production staff on industrial sites:	DECT/ERMES, DECT/private pager	TETRA
Pre-sales staff:	DECT/GSM, DECT/DCS1800, DECT/GSM/ERMES,	
After-sales staff:	DECT/GSM/ERMES, DCS1800/GSM/ERMES,	TETRA, TETRA/GSM, TETRA/ERMES, TETRA/private paging
Professional people:	DCS1800/GSM/ERMES,	

With the availability of the CTM mobility management function, such multi-mode terminals would provide for a quasi universal mobile communication.

Where there are several solutions available, users want to have the choice to decide which solution to take in any given condition.

7.1.4   Handover

From the end-user point of view, the terminal should continue to operate satisfactorily until one part decides to end the communication wherever he is going.

In a private network environment and from the telecom managers' point of view, an information to the user that he is about to loose network service, could be sufficient if that allows to save money.

The handover feature should allow for low speed motions.

7.1.5   Numbering

Preferably, the calling number of cordless subscribers will be integrated into the company numbering scheme in order to facilitate remembering and dialling of the cordless subscriber's number by the callers. This should not have any constraint on the existing numbering scheme.

When users were interviewed, the request was made for the called party to have a single telephone number which would allow him to be reached via the private cordless system when he is in the company and via the public network when he is outside the company.

Moreover, if a subscriber is allowed to have both a fixed and a mobile terminal within the corporate network, he should be reached by the same number, whatever terminal he is using.

If the mobile terminal is registered within the corporate and the public networks, the subscriber should have the possibility to have his incoming calls re-routed to the network which is able to set up the communication either automatically or by dialling a code to inform these networks where he is located. This raises the issue of the personal mobility in addition to the terminal mobility which standardization is under development.

The general development of business mobility lead to a growing need for mobile communications for business but also private needs. This raises difficult questions on how to handle properly private and business communications. Whether people needs a single or different call numbers for private and business communications, is an important issue. Each solution has advantages and drawbacks:

- Separate numbers are more suitable to ensure privacy, but transferring incoming calls on one line to the other one may be necessary in some circumstances and should be possible. Nevertheless both types of call should be set up and received with the same terminal but with different identification.

- A single number is the simplest solution to allow a universal communication but call deflection or call diversion services should be available, when desirable, for private or business communications.

Since different circumstances and individuals may lead to different conclusions, both solutions should be available.

7.1.6   Ergonomics of Terminals and Services

Users have very different knowledge of a mobile communication use: above all, the user seeks simplicity of utilization: ergonomics of the terminal, duration and ease in changing the battery, weight and size.

7.1.6.1   Input devices

This section notes the requirements for some input devices including keypads, card readers and alphanumeric keyboards.

Keypad

The principle input device on (nearly) all terminals is the keypad. A keypad consists of the numerical keys "0-9" and function keys "#" and "*".

It should be noted that many of the requirements below are based on ISO 9995 [30] , ISO 9241-4 [29] (see bibliography) and prEN 1332 [31], Identification Card Systems: Man-Machine Interface (MMI): Part 3: Keypads.

Requirement

Given the number of different applications and different uses of a keypad, it is not practical to provide a standard allocation for all functions. This is because the ergonomically correct allocation of function is dependent upon a number of factors such as:

> - intended use of system (task to be performed);
>
> - sequence of use (way task is to be performed);
>
> - intended user groups and their different characteristics.

Allocation of function should be based on the following principles:

> - sequence of use;
>
> - functional grouping;
>
> - importance.

Function keys should be positioned distant from numeric keys in order to prevent an unintentional selection.

The different sections of the keypad should be separated vertically and horizontally by at least half a key pitch.

To assist blind and visually impaired people, the "5" key should be identified by a dimple or other suitable tactile marker. More detailed requirements are given in annex B.1.1.

Alphanumeric keyboards

Due to the increasing number and complexity of services, combined with a fall in hardware prices, the number of alphanumeric keyboards in the public domain is increasing. Whilst these input devices may be suitable for trained office workers, they are not necessarily suited to naive or occasional users. Keyboards for use in office environments are well defined by ISO 9995 [30] and ISO 9241-4 [29] (see bibliography). Detailed requirements are given in annex B.1.1.

Touch screens

A touch screen is an input device that allows the user to give commands to a system by physically touching part of the screen. Touch screens are becoming increasingly used on self service terminals and in office systems. For visually impaired persons these may cause problems. The corresponding requirements are given in annex B.1.1.

7.1.6.2   Interaction With The System

The requirements in this section cover the process of the interaction between the user and the system.

Dialogue design - general principles

The interaction with the system should conform to the following features:

- suitable for the task;

- self descriptive;

- controllable;

- conforms to users expectations;

- easy to learn;

- consistent;

- flexible.

Detailed requirements in this field are given in annex B.1.2.

Operating the system

Most human factors "bibles" argue that **consistency** at the user interface is a key to ease of use. When using different terminals, one of the key attributes that will facilitate successful operation is that the sequence of operation is similar. This includes especially entering the system and exiting the system.

Key issues for operating a system are Navigation, Undo, Transparency, Error messages, Confirmation of choice, Feedback, Time between steps, Status messages, Abandoning the system, Exiting the service engaged, Single-handed operation, Summary screen pictures, Change in operational procedure and Help.

An important improvement should be made in order to harmonize the key feature and basic function access through the different networks and services offered. For example, a menu with icons displayed on a screen with standardized shapes and features would be highly appreciated.

Detailed requirements related to these issues are detailed in annex B.1.2.

Interaction Styles

The term applies to the overall character of the interaction between the user and the system. Some commonly used interaction styles (often call dialogue styles), in order of increasing difficulty are:

- question and answer;

- form filling;

- menu selection;

- numerical entry;

- alphanumeric entry.

Requirement

Selection of dialogue style should be based on assessing the relative advantages and disadvantages of each dialogue in relation to the requirements of the users and from the task.

The most preferred and used dialogue style for the public is currently "menu". This choice should be used as a "default" style unless another dialogue style would appear to be more advantageous.

Detailed requirements related to these issues are given in annex B.1.2.

Error messages

"To err is human". Therefore the system designer should design for error, making sure that it is possible to recover from error without too much damage. Ideally it should be impossible to make errors.

Requirement

All possible error situations should be identified and attempted eliminated during the design of the system.

For error situations that cannot be eliminated in the design process, recovery procedures should be developed. These procedures should be tested with end-users.

More detailed requirements related to these issues are given in annex B.1.2.

Adapting interaction with the system

The possibility of increased storage space on cards through the introduction of smart and optical card technology gives the possibility of adapting the system software to the users needs. Information stored on the card (data elements) can tell the terminal what input or output mode is required (e.g. speech instead of screen information, or vice versa) and define detailed requirements (e.g. size of text on screens). It should be noted that this work has just started in CEN TC 224 WG 6 [33] and ETSI TC HF. The concepts presented below are being tested in the EU TIDE project 1040 "SATURN".

Requirement

Inclusion of a users profile on a machine readable card is to be voluntary and at the discretion of the card holder.

The cardholder should be able to select which requirements are to be included on a card.

Confidential information about a user should not be recorded anywhere, either in a form or in a register (e.g. central data file) or at the terminal. It should not be possible to capture user sensitive data at the terminal.

The card holder should be able to enter confidential information himself or with the assistance of persons chosen by the cardholder.

A "user profile" on a card is to show requirements (e.g. large letters) - not the users characteristics (e.g. short sighted).

It should be possible for the user to select which terminals the card can and cannot be used on, in relation to different services and in relation to different values/time periods. For example, programme the card so it can be used in a public phone to ring inside your own country for a given value per day, with a maximum value per week.

Output from the System

Indications on users' requirements for the output from the terminal: Screen, Icons and Symbols and User instructions are given in annex B.1.3.

7.1.6.3   Weight, Size

Needs in terms of ergonomics and size are very different according to function:

-    Administrative or pre-sales staff want a lightweight terminal small enough to go into a pocket or to be attached to a belt.

-    Technical staff prefer a sturdy terminal with keys that are accessible (even with gloves) with an emergency button if required by the work environment. In addition, the terminal should have some necessary accessories (for example, head phones that can be necessary in a noisy environment).

7.1.6.4   Battery aspects

As for the battery, users are nearly unanimous: battery capacity should be sufficient for daily use and should be able to be recharged during a very short lapse of time. In addition, a charge indicator should be provided to prevent an unexpected loss of power.

Standards should be developed to determine the handset autonomy, the battery lifetime and recharge time.

It should be impossible to insert or install a battery in a way that might damage the battery, the handset or the user.

7.1.6.5   IC card

An IC card could be used to manage the personal mobility between mobile and fixed networks to identify where the owner is located in order to route the incoming calls to the right place (fixed or mobile terminal). This may also be useful to give different teams the same terminal when there is a round the clock service to operate and the identification of the people handling the terminal is needed (e.g. on-board terminal).

The providers should declare what information is recorded in the IC Card.

7.1.6.6   PIN Code

A PIN Code should be used to secure the use of the handset and the subscription as well. The procedures for producing and distributing such codes should conform to standards developed by CEN TC224 [33]. Given that a SIM card could be used in a public terminal, this terminal should be designed to keep PIN dialling away from inquisitive eyes, including security cameras.

7.2   Interworking between Networks

7.2.1   Private Wired Telephone Network / Private Wireless Telephone Network

A minimum level of interworking is necessary:

- to offer some inter-activity of services between fixed terminals and cordless terminals (calling line identification, automatic call-back, call forwarding);

- to have tools for management and charging that can inter-work with existing tools.

Hereafter are given some examples which illustrate corresponding needs for interconnection standards and supplementary services:

A - Case of several radio controllers connected to the same PABX:

Mobile communication area
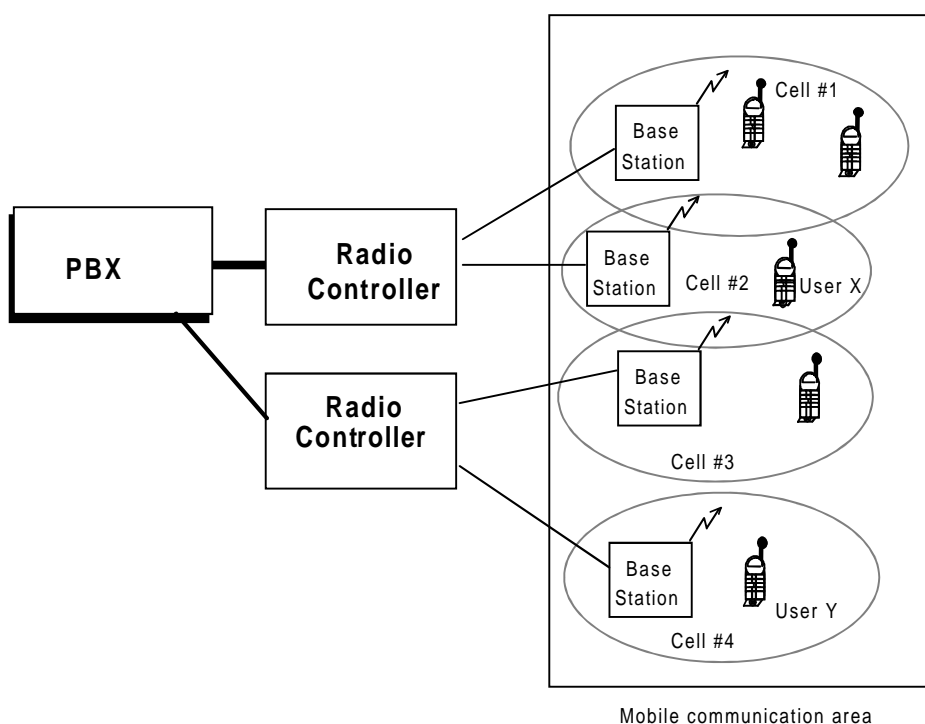
In the case of a single area of communication and several radio controllers plugged into the same PABX, this technical constraint should be transparent for the subscriber. All the cordless communication areas served by different radio controllers should be perceived a single link by the user. Handover and roaming functions should be available throughout the area.

B - Corporate Network with several mobile communication areas:
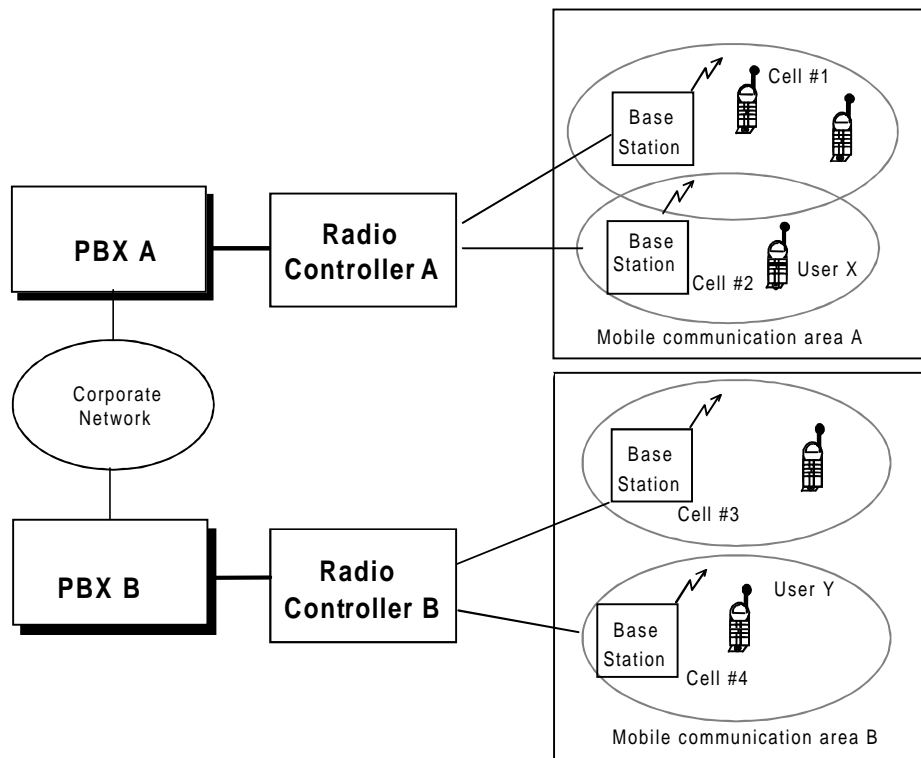
In this case, each mobile user should have a users' service profile which contains the list of the subscriber rights and restrictions:

-   incoming call barring and outgoing call barring from his home area;

-   incoming and outgoing call barring from another site of the company.

For example, the home location of mobile user Y is site A and he is visiting site B. When Y comes into area B, his terminal should be automatically detected by the PBX B and the controller B. Then, the PBX B should check his service profile and allow him or not for using his terminal according to his service profile.

7.2.2   Corporate Telephony Network / Public Cellular Telephony Network
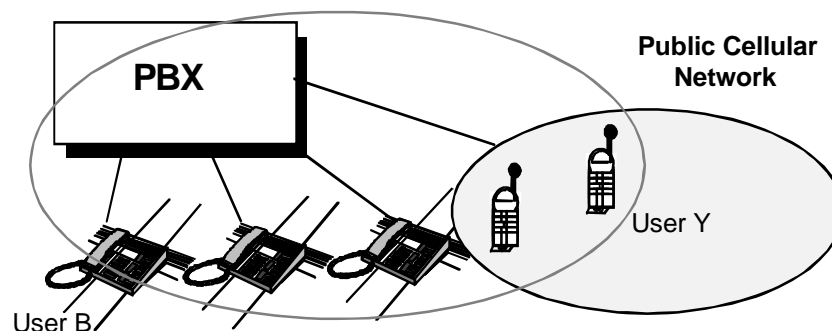
In this example, users B and Y belong to the same company.

They should have the same call number (Universal Personal Number or dedicated solution), and they should, at least, access to the following supplementary services:

1   Call forwarding on busy, no response, unconditional for both ways, i.e.:

-   if a third person calls B, the call should be forwarded to Y;

-   if a third person calls Y, the call should be forwarded to B.

2   Calling Line Identification especially for Y: if he receives a call from B, the number of B should be displayed on his mobile terminal.

3   Call Completion on Busy.

7.2.3   Wireless Corporate Telephony Network / Public Cellular Telephony Network
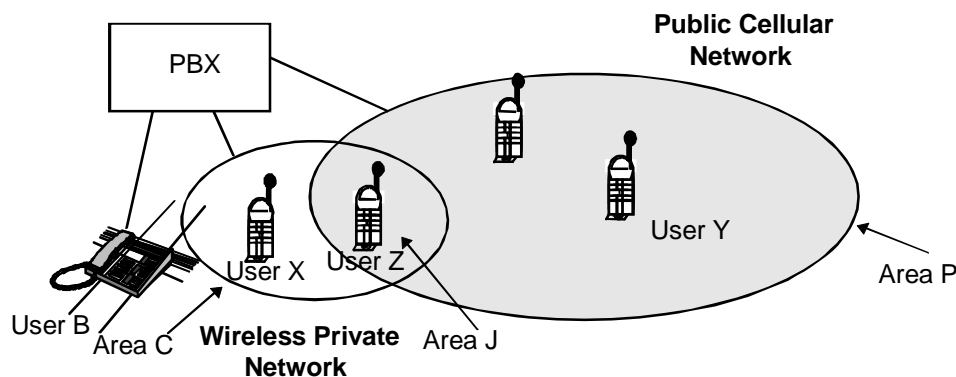
Subscribers B, Y, Z and X belong to the same company.

Definition of the different areas:

-   Area C = Area covered by the wireless corporate network.

-   Area P = Area covered by the public cellular Network.

-   Area J = Area both covered by the public and the private mobile networks.

Subscriber Z has a mobile terminal allowing him to use both mobile networks: the cellular and the wireless corporate Network.

Subscribers X, Y and Z should have the same numbering plan, and the following functions should be offered to them:

-   Call forwarding on busy, no response, Unconditional and inaccessibility for both ways, i.e.:

    -   if a third person calls X the call should be forwarded to Y;

    -   if a -third person calls Y the call should be forwarded to X.

-   Calling line identification for both ways.

-   Calling completion on busy for both ways.

-   When Z is located in area C and J the equipment should manage automatically his outgoing calls via the private network.

-   When Z is located in area P (but not in J) the equipment should manage automatically his outgoing calls via the public cellular network.

-   When Z moves from area C to P, location information should be sent from the database of the corporate network to the database of the public network in order to route automatically his incoming calls.

-   When Z moves from area P to C, location information should be sent from the database of the corporate network to the database of the public network in order to correctly route automatically his incoming calls.

Finally, the telecom manager should be able to define a single service profile for each subscriber that have access to several mobile networks. This could help to ensure the consistence of the service profiles used by the wireless corporate network and the public cellular network.

The introduction of multi-network terminals implies some level of interworking between the different public and private mobile networks, that is, the transmission of administrative and mobility information (handover, roaming) from one to another network.

The choice of a default public network should be easily defined by the user.

7.2.4 Interworking Between Networks For Automatic Location Determination Purposes

The aeronautical user obligation to communicate with aeronautical services in accordance with recognized international standards limit their availability. The use of GSM/TETRA type terminals for aeronautical applications meets with certain reservations from the aeronautical standards setting bodies. There appears to be a need for regional standard setting in order to enable early benefits from available technology and standards.

Present aeronautical cellular communication applications focus on airport movement, low-altitude VFR (View Flight Road) and mountain flight operations.

The transmission of position determined between airborne mobile terminals and ground-based stations enables the implementation of situation display on-board any aircraft. In combination with on-board data base facilities, it enables to raise situational awareness of pilots of air traffic situations, regulations and collision hazards independent from the ground infrastructure. Thus, it allows to evaluate new concepts of air traffic management within a given cell range. Supplemented by two-way data transmission capabilities for remote monitoring and control of flight operations this operational concept is termed FREE FLIGHT in the United States. It applies to low altitude situation.

7.3 Supplementary Services

Standards are developed in each public, private, fixed and mobile network area by different committees within different network capabilities and service control platforms, so it is not surprising that there are some difficulties to making services harmonized between the different networks. The lack of coherence between public and private fixed networks was raised many times. Unfortunately the issue is still more complex for mobile networks due to there being more variables.

7.3.1 Connection Related Services

These services are directly related to the connection, and mainly designed to improve the call completion. Therefore there is no reason why these services should be very different from those generally offered in PISN or PSTN. The issue is rather how to ensure inter-operation between these services provided in the different networks. In addition, some services very specific to the mobility area are detailed in paragraph 7.5 Other Services and Applications".

Annex A.1 shows a list of services selected by the users and IT&T managers as the most interesting ones among those generally offered in PISN or PSTN. Annex A.3 gives indications on how these services should inter-operate between the different fixed and mobile networks.

Hereafter, are given explanations on how some of these services can be used, why they are needed and how they should be delivered to fulfil the users' expectations.

7.3.2 Closed User Group (CUG)

A closed user group may be understood as the ability for an operator to provide to one customer (a company) a Virtual Private Network (VPN) on the infrastructure used for the public service with all confidentiality features linked to that mode of provision. That means that a user of such network has the same features as if he was using a traditional private network and that nobody who is not acknowledged as an authorized user, has no means to entering this network.

7.3.3 Open User Group

This function is rather a feature of the user situation. That means that a user has the feature to be in the same situation as a set of other users. This situation is generally related to a geographical location (segment of an highway, vicinity of a dangerous location, etc.). This concept is mainly linked to the capability to receive dedicated information related to the user's situation.

A similar function is also needed by technical staff or security staff who needs to keep in permanent connection for work effectiveness (continuous listening). The Group Call function is needed to fulfil this requirement.

7.3.4   Call Barring

Barring of Incoming Call (BIC) is the ability for an empowered user to decide, for a given period of time, to not receive calls other than pre-defined ones. This feature is designed to allow someone, for example while he is performing a task during which he wants not to be disturbed, to receive only urgent calls. The other calls may receive the busy indication or, preferably, should be routed to a voice mail.

Barring of Outgoing Call (BOC) is a function mainly needed by IT&T managers to prevent abuses of communications.

Ability should be given to manage in a very flexible manner incoming and outgoing call barring to provide for call barring from and to every interface with public and private areas.

7.3.5   Abbreviated dialling

This function is defined as follows: A range of numbers that are commonly called, from throughout an organization, is stored within the network to be used by an identified group of people. These numbers are dialled when the short access code is entered.

It should be possible to have abbreviated dialling numbers retained for a specific time period such that when this period has elapsed, the use of the short code no longer has any effect.

7.3.6   Cost Information and Cost Control

Because the cost of a communication being greater on a mobile network than on a fixed network, the callers want to be informed of the tariffs of the communication before the call is set up.

Generally, the operators should provide the callers, and the called people when there is a charge being made to him, with a transparent information on tariffs and costs.

Cost control of communications is often necessary in particular in a public network context. The following functions are esteemed useful by IT&T managers and should be applied individually:

-    limitation of the duration of the communication;

-    call restriction for the cordless subscriber: on a list of numbers and for a defined time span.

In addition, it is a fundamental consumer right to know how much a product or service will cost before engaging in the purchase of that product or service.

Requirement

If the user is to be charged for the use of a service, all the costs of that service should be displayed before the user engages that service.

If the charge for a service is based on units of time (e.g. use of telephone line), the on-line charges are to be displayed whilst the service is engaged.

The possibility to stop the transaction at any time should be provided.

When all prices are shown, the customer should be given sufficient time to read and understand the costs before proceeding. The information shall be displayed at a pace and in a format that allows the user sufficient time to read and make appropriate decisions.

The default after the price screen shall be "not continue".

7.3.7   Short Message Service (SMS)

Such a service is available today with different names and some variations on digital fixed and mobile networks like ISDN, GSM, TETRA networks. It can be seen as a complementary tool to improve call efficiency or as a mini data service as well.

Such a service might also as well be delivered via a paging system which may be seen as complementary to mobile phones with a lower cost, attracting from the Telecom manager point of view. Pagers are in fact often more efficient than handsets for technical staff who are often working in a noisy environment; the coverage is also often more extensive than mobile phone networks and ensures then a more reliable connection.

In order to provide for interworking of this type of message services between the different kinds of terminals and networks, it is proposed that a common specification be adopted as a common messaging standard compatible with all type of networks (fixed and mobile, public and private, phone terminals and pagers). This specification should obviously include the number of digits and the standard to be used for the content of the message, for instance the UNICODE ISO standard.

In addition alarm monitoring systems are often linked to a paging system in order to alert directly the technical staff in case of problems.

7.4   Data Services

Today, data transmission service may be seen as a service that improves the communication effectiveness. In such a context, the purpose is mainly related to facsimile transmission and paging function (reception of alpha-numerical messages on the cordless terminal). Current network capabilities are sufficient in that aspect, provided that interoperability through the different networks is improved.

In the next few years, wireless data transmission is expected to take an important position in operational services.

Real time technical data consultation and on-the-field-reporting are the most expected benefits. Document transfers, information server consultation and updating of databases in portable PCs for nomadic people should develop in a teleworking perspective as well as multimedia communications, Video-conferencing and interactive video-services. Nevertheless, if the extended data capabilities of new networks like DECT or new technologies like GSM phase 2 and UMTS are expected to foster the later ones' development, the cost of these broadband communications should be managed efficiently, using appropriate facilities like Bandwidth on Demand (BoD) for example.

Connection Oriented Data Services and Connectionless Data Services may both meet the users' needs depending on the type of application to use. These data services should both take into account that mobile terminals may be out of coverage or switched off, in order to provide the corresponding information to the calling party.

Obviously, whatever terminals and networks involved, full interoperability should be provided in a transparent way.

7.5   Other Services and Applications

Standardization of applications is outside the scope of standardization bodies like ETSI. Nevertheless, applications which have been developed to use fixed telecommunications bearer services should be able to use mobile networks. Some of the applications may require additional software and hardware in the terminals and hosts.

Example of such possible applications are given hereafter:

- secure speech;

- secure data;

- road transport informatics;

- interactive groupware;

- file transfer;

- fixed or slow moving images;

- access to databases;

- approximate vehicle location using by examination of the location register;

- automatic vehicle location using auxiliary position location equipment in the vehicle;

- facsimile transmission;

- message handling systems;

- videoconferencing;

- etc.

As examples, in addition to more usual services, some requirements are hereafter detailed on a few of these applications.

7.5.1   Voice mail

For administrative and pre-sales staff, the cordless terminal should be part of the reception function as this is the case for voice mail and call forwarding facilities. It should allow improvement of reception of the company's external or internal correspondents.

The multiplication of voice mail systems (one per system of cord or cordless communication) is to be avoided. The user should be able to access all his messages within one call from a wired or wireless terminal (and with a single password). In addition, if there are messages in the voice mail, an indication should be given to the user when he switches the terminal on or when he comes back in the coverage area.

Also, unavailability due to a terminal outside the sector or the zone of radio coverage should be handled for incoming calls:

- either by a greeting message;

- or by automatic call forwarding to a fixed telephone.

7.5.2   Broadcasting

The purpose of this function is to distribute the same information to a group of terminals. This could be achieved either via the message service or via a real phone call. This could be performed either by the operator on request of one user or by a local service provider on an event occurrence (e.g. road traffic congestion, hazardous weather conditions, etc.).

In the first case, the sender may have to dial a code to identify a pre-defined group of receivers. In the last case, the broadcast may be done when the event occurs or periodically or even to a terminal entering the area.

7.5.3   Location Determination Service

This function enables authorized people to use the integrated features of the network to determine the position of a calling terminal, for example to supply assistance or to find the right person to whom an information or an instruction can be delivered, taking into account his geographical position.

This could be achieved either by the identification of the calling cell or by using additional enhancement via GPS or GPS-like devices.

In addition, a user shall be enabled to use any external source to determine his position or to evaluate his position in relation to other fixed or mobile terminals and to transmit messages in support of emergency operations and/or hazard warnings.

Regulation should be developed to avoid misuse of this service.

7.5.4   Emergency Call

This function provides the user with the possibility to call for assistance when he is in a difficult situation. It may be invoked by dialling a short code or by a keystroke. Such a call should be routed to a station identified for example by the group within which the terminal is registered.

To provide assistance, the people receiving the call need to have information on the location of the caller. The simple identification of the cell where the call comes from may not be sufficient to provide the requested assistance if the caller is no longer able to supply additional information by himself. Therefore, an additional improvement of the location determination may be necessary e.g. for mobile people working in a dangerous environment or for elderly people.

For staff working in a dangerous area, emergency call capability associated with an automatic location determination system is a major requirement. This may require a full dedicated terminal with a built in dead man system using secured protocol.

A more simple system (e.g. by dialling or keystroke) could suit the needs of elderly people staying at home.

7.5.5   Remotely Available Directory

As a mobile user has rarely an extensive directory information in hand, a directory service accessible via the mobile terminal would be of great interest. Therefore a common interface with public and private electronic directories should be defined and provided by operators and private systems suppliers with a common access process.

Today, such a service is not standardized. Nevertheless, it would considerably improve the user-friendliness of the mobile communications, since users have often to ask a secretary to get the calling number of a person they want to call. It should be accessible by calling a server that can provide the wanted number through, for instance, vocal information given to that server and decoded via a voice recognition system. The process to access such servers should be standardized world-wide in order to improve the user-friendliness.

7.5.6   Videoconferencing

Today videoconferencing standardization is well developed, using data compression algorithm enabling the use of radiocommunications data channels for slow rate moving pictures. Mobile networks should allow terminals, conforming to standards, to inter-work with other terminals conforming to the same standards by providing a transparent channel for the signals between the two terminals. Evolution of technology is expected to provide broader channels at a convenient cost. Such channels would fit more sophisticated video-terminals which obviously can inter-work at full speed only with similar terminals. Nevertheless, to provide optimal costs for every kind of terminal using different bit rates, the channel bandwidth should align to the needs (Bandwidth on Demand).

7.6   Management Information

Management is a strategic issue for users, whatever solution is adopted for the provision of their telecommunication services. This issue is related to both private tools for the management of corporate network management systems and to information exchanges between public and existing private management tools.

7.6.1   Configuration Management

Taking into account the private users' requirements, configuration management tools should enable:

-    to define subscriber service profiles;

-    to avoid double registration of the subscriber in the PBX and wireless system configuration.

In private networks, the infrastructure should have functions allowing to find alternate routings in case of link unavailability or congestion.

In addition, interchange with public network is needed to allow roaming between public and private networks.

Moreover, in the case of closed user group services, interchange of configuration information between the service provider systems and the company's own management systems is needed to avoid double work and to speed up the tasks.

In general, means should be provided to allow business customers to choose to manage user features themselves (e.g. services subscription, etc.) in a given range, rather than to leave this function to the supplier.

7.6.2   Accounting Management

Charging management should take the following requirements into account:

in private network context:

- integration into the existing charging system in the case of a private cordless network in order to avoid the multiplication of charging systems in the company;

in both private and public network contexts:

- breakdown of communication costs following several levels, for example, by extension/service/direction;

- distinction between private and professional communications (notably for pre-sales staff).
  In addition, to facilitate management of public network subscriptions, some administrators want to be able to easily consolidate contracts taken out individually or one by one into a single contract;

- in order to ease the cost monitoring by the telecom manager, public operators should provide charging information on files transmitted either by their network management systems or on easily to handle supports (diskettes, CD ROM, etc.) or better by EDI.

These features should allow for provision of a detailed charging account for every end-user, if requested. This should detail number called, time and costs of call. Such information is confidential and must comply to the national and international regulations.

7.6.3   Fault Management

Preferably, in a private network context, the alarm management system of a private cordless system should be integrated into the alarm management system of the private network or at least should interwork with it.

7.6.4   Security Management

Cordless networks must offer protection from undesired listeners. Some sensitive professions require the ciphering of communications.

Access to a private cordless system must not allow fraudulent utilization of the fixed corporate network: a non-authorized individual shall not be able to have access to public networks via the cordless system and shall not then be able to access the fixed corporate network.

The terminal should be capable of being protected from theft:

- it should be equipped with an access code;

- rights to access should be easily and quickly modified.

Moreover, the management tools should be protected against fraudulent access and include adjustable access levels to enable different geographical or management level zones, in particular between public and private networks. For example a person may be allowed to manage charging parameters without being allowed to manage the network structure and vice versa. Another example is a person allowed to access any information but does not have the right to change anything.

7.6.5   Performance Management

It is necessary to have facilities allowing the Telecom Manager to monitor the overall quality of service in terms of traffic adequacy and radio coverage of its private system, both in real time and delayed time and including connections with or via the public networks.

In addition, usual information on the quality of service in call handling, such as:

-   call completion rate;

-   duration of call set-up;

-   number of dropped calls;

-   number of handover completed;

-   number of failed handover;

-   number of call attempts;

-   etc.

should be provided by the operators and the private network systems.

These network management tools should be able to inter-work with other usual private network management systems, as well.

7.7   Other items

7.7.1   Level of price

Concerning the private network and cordless PBX, the participants considered that the key to the widespread usage of wireless in the corporate market was a price close to that of the existing offer of wired connections.

They estimated that twice the initial cost of the wired extension is the upper limit giving a 20 % penetration.

When purchasing terminals, the manager wants the possibility of choice, whatever the private cordless system in place is, while preserving most of the service facilities.

7.7.2   New / Existing Systems

As in other areas, new systems should provide some level of interworking with existing fixed and mobile ones.

As usual, managers and purchasers wish that the system may evolve with the advancing technology and can be maintained and extended for many years in order to maximize the benefit of their investments.

8   Recommendations

8.1   General recommendations

Recommendation 1: The design philosophy when developing mobile communications, should be "design for all" as opposed to "design for non-impaired people versus impaired people".

Mass use of mobile communications is relatively new, and side effects on health are still poorly known. Therefore:

Recommendation 2: The User Group encourages EC to foster research to identify side effects related to health in order that ETSI takes into account the development of the corresponding standards to prevent from any hazard in using mobile handsets. These researches should include the installations in vehicles (see note).

   NOTE: Consideration should be given in particular to changes in the ground plane effect to new materials and assembling techniques in vehicle manufacturing.

Recommendation 3: In addition, EMC standards should be developed to prevent interference with technical aids and other sensitive electronic devices, including from fixed and semi-mobile installations.

End-users and their representatives should not just be consulted at the end of the standard development. Therefore:

Recommendation 4: The ETSI User Group should be consulted to define the end-users functional requirements for new standards. Some form of on-going dialogue and liaison should be elaborated to allow further follow up of the standardization process.

8.2   Recommendations related to service provision

Users are concerned with the lack of interworking between the different types of networks and with the lack of coherence of services, such as those detailed in subclauses 7.3, 7.4 and 7.5, between cellular, cordless, private and public networks. Therefore:

Recommendation 5: the ETSI User Group strongly encourages ETSI to work on the harmonization of the services with respect to existing and future, fixed and mobile networks.

Recommendation 6: taking into account the standardization evolution considered in subclause 6.1 and the service and application needs described in subclauses 7.3, 7.4 and 7.5, ETSI should work to harmonize new and evolving interfaces (UNI, NNI and API) in the different public and private, fixed and mobile networks. Such a standardization is expected to provide:

-    a minimum set of services available on any network, irrespective of the user terminal;

-    the same service invocation for the minimum set of services;

-    interworking of networks and customer equipment;

-    interoperability of services (bearer services, teleservices and supplementary services) and applications.

Recommendation 7: Standards should be developed to enable fixed and mobile networks to interwork in a service independent manner, in order to ensure that users may get their home network services for private and business use in all networks.

Recommendation 8: the User Group supports the concept of separation of service control functions (SCF) from switching and transport functions.

Recommendation 9: All international, national and local emergency services should be accessible in any situation and in accordance with standard emergency call numbers, even without any subscriber registration.

8.3   Recommendation related to the Quality of Service

According to subclause 7.1. and to enable users to compare different operator offerings on the same basis:

Recommendation 10: ETSI MTS should define a standard method to describe the technical characteristics of the service provision such as coverage with respect to the terminal performance, speech quality, load rate, etc… for mobile networks and services.

According to subclause 7.1.3:

Recommendation 11: ETSI should develop standards that allow the user of the terminal, which is capable of access more than one network (multimode terminal) to have an indication of the network availability.
Users should have the possibility to enforce the use of any accessible network.

8.4   Recommendations related to numbering

Users consider that being reached by a single number within private and public networks is a key issue for the communication effectiveness.

Therefore, following the indications from subclauses 7.1.5, 7.2.2 and 7.2.3:

Recommendation 12: the User Group encourages the development of the standards to allow subscribers to keep the same call number, independent of the network they subscribe to. In other words, Personal Mobility should be provided in addition to Terminal Mobility.

Because the needs for a single or different called number for personal and business communications is an important issue, considering each solution has advantages and drawbacks and that different circumstances and individuals may lead to different conclusions, both solutions should be available. Therefore:

Recommendation 13: the ETSI User Group encourages ETSI to develop standards allowing to receive calls to different called numbers and subscriptions on the same terminal and provide flexibility to give either a single number or separate numbers for private and business use. In addition, provision for handling (transfer, forwarding, etc.) independently the calls from the two categories should be provided.

8.5   Recommendations related to the Ergonomics of Terminals and Services

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Recommendation 14: The ETSI User Group encourages to continue developing standards to improve ergonomics of the systemsaccording to the recommendations detailed in subclause 7.1.6, in annex B.1.1, and B.1.3 in co-operation with CEN and ISO. In particular, 7.1.6.4. is a very important issue.

8.6   Recommendations related to Interworking and Interoperability

According to the indications given in subclause 7.2.1. A:

Recommendation 15: ETSI should develop standards to manage the mobility in order to provide for call handover and roaming within a single private area served by several controllers connected to one PABX.

According to the indications given in subclause 7.2.1. B:

Recommendation 16: ETSI should develop standards to manage the mobility in order to provide for roaming between several private areas served by different PABXs of the same corporate network, according to the user profile.

In order to take advantage of mobile infrastructure to enable cheap automatic location determination as described in subclause 7.2.4.:

Recommendation 17: ETSI should develop standards to enable the use of the US concept of FREE FLIGHT in EUROPE supported by public terminals and infrastructure. Data as to the movement of the mobile part should be considered as the user's property.

8.7 Recommendations related to Supplementary Service harmonization and prioritization

Regarding the Supplementary Services, the User Group recommends that:

> **Recommendation 18:** For Supplementary Services, in addition to the harmonization highlighted in recommendations **5** to **8**, in particular for the Message Service concept, the User Group recommends that ETSI adopts for its working programme the prioritization proposed in annex A. Such services should be designed to allow for the addition of specific service elements in order to customize these services to meet particular business needs.

8.8 Recommendations related to Data Services

Considering Data Services, the User Group recommends that:

> **Recommendation 19:** ETSI extends to the Data Services the harmonization highlighted in recommendations **5** to **8**, whether they are Connection Oriented Data Services or Connectionless Data Services.

> **Recommendation 20:** ETSI develops standards to provide for Bandwidth on Demand management (flexible data rate, transmission speed and charging) in the delivery of these Data Services.

8.9 Recommendations related to other Services and Applications

Although standardization of applications is outside the scope of ETSI, applications provided via fixed networks, and the corresponding services, should be provided via public and private mobile networks as well. Therefore:

> **Recommendation 21:** In addition to the previous recommendations (4 to 6) on service harmonization, ETSI should set-up expert groups to check which standards are available to deliver the applications and services mentioned in subclause 7.5, e.g.:
>
>   - Voice mail;
>
>   - Remotely Available Directory;
>
>   - Videoconferencing;
>
>   - Broadcasting;
>
>   - Location Determination Service;
>
>   - Emergency Call;
>
>   - One way and two ways paging.

8.10   Recommendations related to Management Tools

The User Group asks ETSI to pay attention to the importance of management tools in the telecommunication networks from a user point of view and therefore to take the following dispositions.

Recommendation 22: ETSI should develop the appropriate standards to interface properly private and public network management systems, including established industry standards, in order to provide for:

- Configuration management;

- Accounting management;

- Fault management;

- Security management;

- Performance management;

with the requirements detailed in subclause 7.6.

These standards should include adjustable access levels to allow fully flexible access rights to the management tools and systems.

8.11   Recommendation approval by the User Group

The recommendations were endorsed unanimously, with the exception of the three recommendations 1, 11 and 15. Recommendations 1 was rejected by one member and encountered some reservations from another member due to possible cost impact. Recommendations 11 and 15 were rejected by one member. Some members consider that recommendations 6, 9, 10, 14 and 18 should be given a high priority.

Annex A:
Priorities for Supplementary Services

A.1   Selected General Services

Acronym	Supplementary Service (note 1)	TS (note 2)	S	PoM	A-S	Tec-Pro	Pre-Sls	Aftr-Sls	Prof-Ppl	Pers Use
ABD	Abbreviated Dialling	***	***	***	***	***	***	***	***	**
ACC	ACcounting Code	***		***	***		***	***	***	
AOC-D	Advice Of Charge (During call)			***	***		***	***		***
AOC-E	Advice Of Charge (End of call)			***	***		***	***		***
AOC-S	Advice Of Charge (call Set-up)	***	***	***	***	***	***	***	***	***
BIC	Barring of Incoming Call	***	***	***	***	***	***	***	***	***
BOC	Barring of Outgoing Call	***	***	***	***	***	***	***		***
CCBS	Completion of Calls to Busy Subscriber	*	*	***	*	***	***	***	***	***
CCNR	Completion of Calls on No-Reply	***	***	***	***	***	***	***	***	***
CD	Call Deflection	*	*	***	*	*	***	*	***	***
CFB	Call Forwarding Busy	***	***	***	***	*	***	***	***	***
CFNR	Call Forwarding No-Reply	***	***	***	***	*	***	***	***	***
CFU	Call Forwarding Unconditional	***	***	***	***	*	***	***	***	***
CLIP	Calling Line Identity Presentation	***	***	***	***	***	***	***	***	***
CLIR	Calling Line Identity Restriction	**	**	**	**	**	**	**	**	**
CLMS	ConnectionLess Message Service									*
CNIP	Calling Name Identity Presentation	***	***	***	***	***	***	***	***	***
CNIR	Calling Name Identity Restriction	**	**	**	**	**	**	**	**	**
CO	Call Offer (on busy called party)	*	*	*	*	*	*	*	*	*
COMS	Connection Oriented Message Service									
CONF	Conference Call Add On	*	*	*	*	*	*	*	**	*
CUG	Closed User Group	***	***		***	***	***	***		
CW	Call Waiting	***	***	***	***		***	***	***	***
DISA	Direct Inward System Access	*	*	*	***	*	***	***	***	*
DND	Do Not Disturb	***	***		***		***	***	***	***
ECT	Explicit Call Transfer	*	*	*	*	*	*	*	*	*
HOLD	Call Hold	*	*	*	*	*	*	*	*	*
MCID	Malicious Call IDentification	***	***	***	***	***	***	***	***	***
MSS	Manager/Secretary Switch				***		***	***	***	
MWI	Message Waiting Indication (Light or Signal)	***	***	***	***		***	***	***	***
SCDI	Short Code Dialling Individual	***	***	***	***	***	***	***	***	***
SCDS	Short Code Dialling System based	***	***	***	***	***	***	***		
UUS	User-to-User Signalling	***	***	***	***	***	***	***	***	***
NOTE 1:	The indication that one service requested, means that the corresponding user category wishes to use it whether it be on his terminal or on the called terminal.									
NOTE 2:	TS = technical staff, S = security staff, A-S = administrative and supervisory staff, Tec-Pro = technical production staff on industrial sites, Pre-Sls = pre-sales, Aftr-SLs = after-sales staff, Prof-Ppl = professional people, Pers Use = Personal Use.									

***: services requested unanimously

**: services requested by several members

*: services requested by one part of the members

A.2   Services Specific to Mobility

Acronym	Supplementary Service (note 1)	TS (note 2)	S	PoM	A-S	Tec-Pro	Pre-Sls	Aftr-Sls	Prof-Ppl	Pers Use
DL	Discreet Listening			***	***					
BC	Broadcast Call	***	***	***						
CFNRc	Call Forwarding on Not Reachable	***	***	***	***	***	***	***	***	***
GC	Group Call	***	***			***				
LDS	Location Determination Service	***		***						***
PC	Priority Call	***	***	***		***			***	
PPC	Pre-emptive Priority Call	***	***	***		***			***	
RAD	Remotely Available Directory	***	***	***	***		***	***	***	***
SDS	Short Data Service	***	***	***	***		***	***	***	***
SMS	Short Message Service	***	***	***	***		***	***	***	***
SMSCB	Short Message Service Cell Broadcast	***	***	***	***		***	***	***	
NOTE 1:	The indication that one service is requested, means that the corresponding user category wishes to use whether it can be on his terminal or on the called terminal.									
NOTE 2:	TS = technical staff, S = security staff, A-S = administrative and supervisory staff, Tec-Pro = technical production staff on industrial sites, Pre-Sis = pre-sales staff, Aftr-Sls = after-sales staff, Prof-Plp = professional people, Pers Use = Personal Use.									

***: services requested unanimously

**: services requested by several members

*: services requested by one part of the members

A.3   Services Interoperability between Fixed and the Different Mobile Networks

Acronym	Supplementary Service (note)	Fixed to Cordless Network	Cordless to Fixed Network	Fixed to Cellular Network	Cellular to Fixed Network
ABD	Abbreviated Dialling	***	***		
ACC	Accounting Code	***	***		***
AOC-D	Advice Of Charge (During call)	***	***	***	***
AOC-E	Advice Of Charge (End of call)	***	***	***	***
AOC-S	Advice Of Charge (call Set-up)	***	***	***	***
CCBS	Completion of Calls to Busy Subscriber	***	***	***	***
CCNR	Completion of Calls on No-Reply	***	***		
CD	Call Deflection	***	***		
CFB	Call Forwarding Busy	***	***		
CFNR	Call Forwarding No-Reply	***	***		
CFU	Call Forwarding Unconditional	***	***		
CLIP	Calling Line Identity Presentation	***	***	***	***
CNIP	Calling Name Identity Presentation	***	***	***	***
CO	Call Offer (on busy called party)	***	***		
CONF	Conference Call Add On	***	***	**	*
CW	Call Waiting	***	***	*	*
DISA	Direct Inward System Access	*	***	*	*
DND	Do Not Disturb	***	***	***	***
ECT	Explicit Call Transfer	***	***	***	***
HOLD	Call Hold	***	***		
MCID	Malicious Call IDentification	***	***	***	***
MSS	Manager/Secretary Switch	***	***	***	***
MWI	Message Waiting Indication (Light, Message or Signal)	***	***	***	***
SCDI	Short code dialling individual				
SCDS	Short code dialling system based	***	***	***	***
UUS	User-to-User Signalling	***	***	***	***
CFUA	Call Forwarding Unavailable	***	***	***	***
DL	Discreet Listening	***	*	***	*
GC	Group Call	***	*	***	*
PC	Priority Call	***	***	***	***
RAD	Remotely Available Directory	***	***	***	***
SMS	Short Message Service	***	***	***	***
NOTE:	The indication that one service is requested, means that the corresponding user category wishes to use it be on his terminal or on the called terminal.				

***: services requested unanimously

**: services requested by several members

*: services requested by one part of the members

Annex B:
Supplementary Information

B.1   Detailed Requirements on User-System Interface

B.1.1   Requirements to the System Input

Detailed keyboard design requirements and recommendations

Keypad surfaces and material properties

The visible surfaces of the keypad housing and the key caps should be non reflecting. Specular reflections of surfaces should not exceed 45 gloss units (silky matt) measured according to ISO 2813. Diffuse reflectance shall be between 0,15 and 0,50. The material of the surfaces that the user comes in contact with should not have unfavourable heat conductivity characteristics.

There shall be no sharp edges and corners on the keyboard housing.

Key Displacement and Key Force

Key displacement should be between 1,0 mm and 6,0 mm. The force required for character generation should be between 0,25 N and 1,5 N (ideally between 0,5 N and 0,8 N). Keys shall be stable, (i.e. no excessive play, twist or wobble) and have an identical resistance for each key over the entire keypad.

Key positioning

The horizontal and vertical distances between two adjacent keys measured centre to centre shall be a minimum of 19 mm +/-1 mm. EN 29241-4 [32] (see bibliography). Certain keys may be double sized (e.g. function keys) and therefore the 19 mm centre to centre restriction may not apply.

Key top size

The strike surface of the key top (key cap) shall be at least 110 mm^2 in area, the width of the strike surface shall be between 12 mm and 15 mm for a single key. EN 29241-4 [32]. The minimum recommended key top size for elderly and disabled users is 150 mm^2 for numeric keys and 151-350 mm^2 for function keys (ETR 345 [3]: "Characteristics of telephone keypads and keyboards; Requirements of elderly and disabled people").

Character height

Character height should be a minimum of 7,5 mm for use on public terminals. (ETR 345 [3]: "Characteristics of telephone keypads and keyboards; Requirements of elderly and disabled people").

Key profiles

Sloped, stepped, dished, (concave) sculptured and flat key profiles are acceptable for users. Concave keys are recommended. Convex key profiles are not recommended (EN 29241-4 [32]).

Feedback

Tactile and/or audible ("click") and/or visual feedback (e.g. on screen) should be given when a key is depressed.

Rebound Action (Bounce)

In order to prevent unintended actuation the keypad shall be bounce free.

Keystrokes

Users should be not be required to press two or more keys simultaneously. Keystrokes should be sequential.

Dimensions of characters on keys

The character width of a capital letter (except I) shall be between 50-100 % of character height.

Stroke width. The ratio of character height to stroke width shall be between 7:1 and 14:1.

Character height should be a minimum of 4 mm.

Where several characters are included upon a key cap (e.g. numerals and alpha characters) character height should be a minimum 2,4 mm.

Type faces

Roman style fonts of medium weight are easier to read than their italic, light, bold, condensed or expanded variants. For labels (e.g. on function keys) capital letters alone are recommended. For isolated words or labels, sans-serif faces are the most legible. (Helvetica, Univers, GillSans, Futura are among the ones to be recommended)

Colour

Colour should be used to distinguish between different groups/functions of keys. Visually disabled people have no or little colour vision. Therefore colours should never be used alone to indicate vital functions, but always in addition to other modes of information such as location or shape of keys, etc. The contrast between luminance level of the background and characters shall be a minimum 3:1 for all keys. This includes keys which are colour coded. Characters should have a sharp outline.

If colour is to be used to identify different groups of keys (e.g. numeric keys versus function keys), clear, inverse colour contrasts can be acceptable, except to the blind or the most seriously visually impaired people. All colours used should transform into clearly discernible grey-tones on the monochrome grey-scale.

Contrast

The contrast between luminance level of the background and characters shall be a minimum 3:1 for all keys. This includes keys which are colour coded.

Characters should have a sharp outline. Dark characters on a light background are recommended.

Number and positioning of key legends.

The number of legends on each key top shall be kept to a minimum.

Where a key is used for a single function the legend should be centred on the key top.

Coding of command keys

In order to help visually impaired people, command keys should be coded by a combination of location, shape and or/colour.

Graphic symbols

Graphic symbols on key tops should be developed according to ISO 9186 [28] and drawn according to ISO 3461 [27].

Alphanumeric mapping

Alphanumeric mapping on the numeric pad should be avoided. Alpha mapping should not be used if the numeric pad is part of a larger combined keyboard.

Alphanumeric mapping should follow ISO 9995-8.2 [30] "Allocation of letters to a numeric pad". ETSI, in TCR-TR 023 [24]recommends this.

More information?

ISO/IEC 9995 parts 1-8, ISO 9564, EN 9241-4, IEC 73, prEN 614-1 and 2, prEN 1332, TCR-TR 023, ETR 116 and CCITT Recommendation E. 161 (1988), Iig 1987, Smith and Mossier 1986, Schneidermann 1987.

Alphanumeric Keyboard detailed recommendations

Other solutions than a full alphanumeric keyboard may be more suitable for the general public. Instead, it is recommended that the task the user will be required to perform be redesigned (e.g. instead of a job applicant having to type in name, address, etc. on a terminal, such information could be stored on a smart card and automatically entered for the applicant).

Where possible, use a keyboard with the minimum number of functions and function keys instead of a full alphanumeric keyboard.

If it is decided to implement an alphanumeric keyboard, it should be noted that there currently exists no accepted standard layout for use in the public domain. The layout should be based on iterative testing solutions with intended user groups and intended tasks. A test method should be adapted from the ISO 9241-4 [29] (see bibliography) Keyboard Standard.

If an alphanumeric keyboard is to be implemented, the letters "F" and "J" should have a tactile marker (dot) on them to aid visually disabled users.

Keyboard layout should be based on the following principles:

- sequential operation;

- function;

- importance.

More information?

The reader is referred to ISO 9995, ISO 9241-4, ISO 9995 1-8, ETR 116, CCITT 1988-Recommendation E161, Potosnack 1988, Clatworthy 1988, Cushman 1991, Grenstein and Arnaut, 1988.

Touch Screen Detailed Requirements

If a touch screen is to be used, consideration as to how visually impaired users will be able to input data should be given. Alternative input devices (speech) should be made available.

The shape and form of the touch sensitive area should resemble a square button/key.

The size of a square button should be a minimum of 12 mm and a maximum of 22 mm.

The touch sensitive area should be slightly larger than the visual button. The touch sensitive area should extend under the button.

For buttons located on the left of the screen, the touch sensitive area should extend to the right.

Between buttons, there should be areas that are "dead", i.e. not touch sensitive.

Aural and/or visual feedback should be given whenever a button is selected.

Touch screens should be cleaned regularly to reduce parallax and damage (scratching).

More information?

The reader is referred to Bergmann 85, Benninger and Patterson 1983, Carroll 1987, Clatworthy 1989, Karat, McDonald & Anderson 1985, Martin 1988, MILSTD 1472 (8), Pfauth & Priest 1981 and Whitfield 1983.

B.1.2   Requirements for the interaction with the System

Dialogue design - general principles

These high level dialogue design principles have been identified as important for the design of a user friendly dialogue. They are application and technology independent. They have been developed by a consolidation of ISO 9241-10 [29] (see bibliography). (Dialogue Design Principles), ETR 116 (Human Factors Guidelines for ISDN Terminal Equipment) [2], and prEN 1332-1 [31] "Identification Card Systems - Man-Machine Interface Part 1: Design Principles & Symbols for the User Interface", Apple 1992 and IBM 1991 (both user interface guidelines).

It should be noted that when developing dialogue systems these principles can be applied, but only as general guidelines. The way in which these principles can be applied will depend upon which applications are to be demonstrated in what environments and in relation to which technology. Trade-offs may have to be made.

Dialogue should conform to the following principles:

Suitable for the task

A dialogue is suitable for a task to the extent that it supports the user in the effective and efficient completion of the task.

E.g. a dialogue should only present the user with those choices that are directly relevant at that particular stage.

Self descriptive

A dialogue should be self descriptive to the extent that each dialogue step is immediately comprehensible through feedback from the system or is explained to the user upon request.

E.g.: "Now enter your PIN" is presented on the screen and with an audible signal, whilst the backlighting on the keyboard also flashes.

Controllable

A dialogue is controllable to the extent that the user is able to maintain control over the sequence of interaction until the goal has been reached e.g.: the speed of interaction should not be dictated by the system -as in "time outs" - reported by many elderly using an Automated Teller Machine (ATM) in Norway (Bjørneby 1992).

Conforms to users expectations

A dialogue conforms with user expectations to the extent that that it corresponds to the users' task knowledge, education, experience and commonly accepted conventions.

An example of where this is not true are non standardized sequences of operation on ATM's and their menu layout for cash withdrawal.

Suitable for learning

A dialogue is suitable for learning to the extent that it provides support and guidance to the user during the learning phases.

Consistent

A dialogue should be consistent both within and between the way a system operates allowing the users to improve their skills and predict the effects of their actions. Control actions should have the same outcomes throughout the system, control sequences the same syntax, terms and labels remain the same and display items have a designated location.

Flexible

A dialogue should provide flexibility to allow for differences in the user population, such as short cuts, national variations, etc.

More information?

ISO 9241-10, ETR 116, CEN TC 224 WG 6 N 183, Apple 1992, IBM 1991, Bjørneby 1992, Schneidermann 1987, Smith & Mossier 1986, Norman 1994, etc.

Operating the system

Most human factors books of reference argue that consistency at the user interface is a key to ease of use. When using different terminals, one of the key attributes that will facilitate successful operation is that the sequence of operation is similar, especially when entering or exiting the system.

Requirements

Navigation

The method for user navigation between screen pictures or between different levels of information and services (forwards/backwards) should be consistent.

Undo

It should be possible to independently delete the last character entered, the last line of characters entered or last block of characters entered.

Transparency/self descriptive

Operation (and charges) of the system should be transparent.

Error messages

Informative error messages (see section on Error messages) should be given if the card holder attempts to do something incorrectly.

Confirmation of choice

The user should always be allowed to confirm his actions to the system, e.g. by selecting "Enter".

Feedback

Feedback should be provided to indicate that an action by the user is completed; to inform of the system status or to advise on an incorrect entry. Feedback should be presented in at least two complimentary modes (visual and/or audible and/or tactile signal).

Time between steps

Timeouts in the dialogue should be sufficient to allow all users (especially the elderly and first time users) to begin and complete each new step but not to compromise the security or incur excessive costs.

Status messages

The system's operational status should always be indicated to the user (e.g. out of order, PIN code is being checked, cash is being counted, etc.).

Abandoning the system

The user should, at any point in the transaction, be able to cancel the service engaged and exit the system.

Exiting the service engaged

Under normal operation, at any point in the transaction the user should be able to cancel the service engaged and return to the start without having to re-enter the system.

Single-handed operation

The system should not require two or more physical actions by the user to be completed simultaneously.

Summary screen pictures

Screen pictures which summarize all events should be presented before they are executed.

Change in operational procedure

Users should be professionally informed before changing established routines/sequences of operation.

Help

Specific user guidance information should be available for display at any point in an operational sequence.

Interaction style

The term applies to the overall character of the interaction between the user and the system. Some commonly used interaction styles (often call dialogue styles), in order of increasing difficulty are:

- question and answer;

- form filling;

- menu selection;

- numerical entry;

- alphanumeric entry.

Requirements

Selection of dialogue style should be based on assessing the relative advantages and disadvantages of each dialogue in relation to the requirements of the users and from the task.

The most preferred and used dialogue style for the public is currently "menu". This choice should be used as a "default" style unless another dialogue style would appear to be more advantageous.

"Menu" for the general public should be of the fixed step by step type and not interactive. The possibility of experienced users making "short cuts" should be allowed for.

"Menu" should require simple decisions, not compound decisions (e.g. when buying a ticket, select first destination, then select class. Not select both at the same time.

Alphanumeric and numeric input should be avoided where possible.

Numeric input involving decimal commas should be avoided.

The guidelines promoted in ISO 9241-14 [29] (see bibliography) "menu" should be reviewed for information that could be applied for a particular system.

More information?

The reader is referred to: ISO 9241-14 [], Allen 1993, Apple 1992, Felix, Graf and Kreuger 1991, IBM 1991, Smith and Mosier 1986, Microsoft 1992, OSF/Motif 1990, Schneidermann 1987, Siemens Nixdorf 1990, Verhoef 1988.

Error messages

"to err is human". Therefore the system designer should design for possible user error, making sure that it is possible to recover from error with minimum damage. Ideally it should be impossible for the system to accept an erroneous entry.

Requirements

All possible error situations should be identified and attempted to be eliminated during the design of the system.

For error situations that cannot be eliminated in the design process, recovery procedures should be developed. These procedures should be tested with end-users.

Informative error messages should be provided whenever the user attempts to use the system incorrectly.

Informative error messages should inform the user that:

- an error has occurred;

- what the error is;

- how to correct the error.

When an error has been corrected, the user should be automatically returned to where he was in the system before the error occurred.

Error messages should be distinctive from other types of messages.

Error messages should be as specific and helpful as possible.

Error messages should be neutral in tone and not "blame" the user.

If a user repeats an error, there should be some noticeable change in the displayed error message.

Error messages should be displayed 2 s-4 s after the user entry in which the error is detected.

When an error is detected, the user should only be required to change the incorrect data and not be required to re-enter all the information again.

Error messages should be tested to ensure that they are correct and that users comprehend the contents before being implemented.

Error messages should not be given in abbreviations or code.

Error messages should be located consistently on the screen.

Attention to the error message should be drawn by at least two channels of information, e.g. visual and/or audible and/or tactile signal.

Users should be given the possibility to correct errors at 3 different levels:

- whilst entering information;

- when entry of information is complete;

- when summarizing all the information in a transaction.

All systems should have a capability for recording errors. Additionally systems should be evaluated with regard to errors. These records should be used to rectify errors.

When changes are made to an established system which will in turn require a change in the way the system is used, the user should be actively informed of this.

More information?

The reader is referred to Apple 1992, Diaper 1989, Draper 1986, ETR 116, Helander 1988, IBM 1991, Maddix 1990, Nielsen 1989, Salvendy 1987, Smith and Mosier 1986, Schneidermann 1987 and 1992.

B.1.3   Requirements for the output from the system

Outputs from the system can be static and/or dynamic. Dynamic output is usually presented visually, either on screens, or by buttons/background lights flashing. Telephone systems primarily rely upon the auditory channel. Static output (e.g. user instructions, symbols, etc.) is primarily visual.

Screen requirements

Successful communication presupposes an ideal environment (no specular glare from sun), that the individual has normal eyesight, and that there is an optimum viewing distance. These three presumptions are rarely met either individually or collectively.

Requirements

Information should be supplied by a minimum of two channels (e.g. visual and auditory).

Allow for character size on screen to vary between 4 mm - 7 mm in size.

Screen backgrounds should be dark (black or blue) with light figures (white or yellow).

Avoid red and green colours due to colour blindness.

Information presented visually should be coded by several methods, e.g. shape, location, size. Information should not just be colour coded.

Information on the screen should be compatible with other information (brochures, user instructions, etc.).

Since environmental conditions vary considerably, the location of terminals should be determined individually with relevant expertise at hand.

More information?

See: Silver, Gill and Wolffsohn, 1994, Morris 1994, ISO 9241-3, ETR 116, Salvendy 1987, Smith and Mossier 1986.

Screen picture layout

Layout of information on a screen has major consequences for its perception and comprehension. It has been the subject of considerable ergonomics research, and there exists therefore many principles for the good design and layout of information. The key conclusions from this wealth of material is that there is no ergonomically correct "standard" layout and good screen design is a process.

Requirements

High level design process requirements.

Determine projects requirements and constraints in order to determine the role the screen pictures will play in the total system.

Define the target user populations characteristics and requirements.

Analyse the task to be performed (task analysis) to elicit the informational requirements at each screen. Estimates of frequency of use are important.

Develop task scenarios which can be used to evaluate prototypes.

Develop design rules/guidelines. This includes the definition of colours, typefaces, icons, etc. and their layout.

Screen design should occur independently of the application logic.

Early design, prototyping, evaluation

Designs in "paper and pencil" can be developed and rapidly evaluated to test major concepts based on the "Wizard of Oz" technique. More detailed designs to test specific details can be generated on screen.

Full scale prototyping and implementation.

Using "User Interface Management Systems" (UIMS) or "dialogue management implementation systems", implement prototypes and test with intended users on intended tasks in a relevant environment.

A team to design and test screen layouts should include graphics designers, ergonomists, software engineers, text editors as a minimum. The team should be expanded if video is included.

Generic requirements

The screen picture layout and all graphical elements should be consistent both within a product and between products offered on the same system.

When developing new systems, try and identify later phases of the product in order to identify implications for screen pictures.

Page layout should provide feedback on what has been done and what is to be done.

Information on the screen should be based on the principle of frequency of use or the principle of importance.

Sequential information should either be presented as:

A then B then C, or   A
                           B
                           C

Screen pictures should be divided into categories (e.g. error messages, wait messages, status messages, choices, help messages) as early as possible.

Information should be functionally grouped (e.g. as in a menu). Different groups of information should be clearly separated from each other.

Complete pages of information should be shown; "scrolling" should be avoided.

Each page of information should have a title.

The number of different colours on a screen page should never exceed five.

Use of colour should be consistent on both screen pictures, and in supportive paper based information (instructions, mail shots, etc.).

"De facto" standards for page layout should be built upon, since users are at least used to this. Red should be used for "error/cancel", green for "clear/OK".

Text should be left justified, numerical figures right justified. If several different lengths of figures are presented they should be centred round the decimal full stop.

Important information should be located in the middle of the screen, and be obvious.

"Help" should always be available on the screen.

Up to 10 choices for the next step of the programme can be presented on a screen. The optimum number is between 5 and 9.

More information?

The reader is referred to ISO 9241-12, ETR 116, Apple 1992, IBM 1991, Tullis 1988, Salvendy 1987, Smith & Mossier 1986, Schneidermann 1987, DTI 1988.

Icons and symbols

A symbol is a 2 dimensional graphical representation of a function. An icon is similar, but in addition it can have actions performed on it - you can open it, move it, empty it, etc. Symbols and icons can be advantageous where there are users from many different countries, or where there are people who cannot read (children, dyslexics, visually impaired).

Requirements

Graphical symbols, at and on a terminal, on the screen and on user instructions should be consistent and complimentary.

A key descriptive word should be placed under the symbol (e.g. Telephone, Tickets, etc.) as research indicates that this improves recognition.

Symbols should be developed according to ISO 9186 [28] and drawn up according to ISO 3461 [27].

More information?

The reader is referred to ISO 3461, ISO 9186, ETR 116, ETS 300 375, ETR 070:1993, BS 7649, 1993, CCITT E.121, IEC 417, CEN TC 224 WG 6 N 183, Zwaga 1987.

User instructions

The need for user instructions documents the mismatch between what the system requires of the user and what the users capabilities are. An easy to use product should not need user instructions - it should be natural to use. However, occasional or first time users are very dependent upon clear user instructions, although research indicates people tend not to notice them.

Requirements

Improving the products operational sequence is as important as producing "user friendly" user instructions.

The design of instructions should be based on the principles of importance of use, or frequency of use.

The contents of instructions should be based on the requirements for those that actually need them, including unusual or non-users, tourists (language), children (comprehension) and the elderly. Frequent users do not tend to read instructions.

All information, on automates, screen pictures and in supportive brochure material should be consistent and correct.

Visual coding should consist of at least colour and shape, not just colour alone.

Design of user instructions should take into account content, readability, conspicuity and competition in their environment for attention (adverts).

Diagrams, presented in a numbered sequence with explanatory words are the best method to provide proceduralized instructions. This is better than just words, just graphics or just photographs. Photographs do not focus upon the necessary detail, unlike diagrams.

When developing instructions the task to be performed should be broken into a logical sequence of steps, from which diagrams are conceived, explaining each step. Short statements to support each diagram should be produced -these focus the attention of the user on the action to be performed and help explain concepts that are difficult to illustrate.

Relevant text and diagrams should be well integrated, thus minimizing eye movements. Shape coding can be used by placing numbers in circles and text in rectangles, thus providing perceptual shapes and boundaries that prompt the reader to selectively attend to the relevant aspects of the instructions.

The numbers showing the sequential operation of the automate should be clearly visible from a distance.

Abbreviations should not be used.

User instruction should explain all functions on the automate.

All functions should be named (card insertion, receipt output, etc.).

The terminology should avoid technical words and expressions ("enter") and the functionality should be unambiguous ("Cancel").

User instructions should be located so that the target user groups can read them.

The number of language versions should be kept to a minimum (2).

More information?

The reader is referred to: DTI Publication-1988, BS 7649, ISO 9241-13, AN 1988, Balfour 1992, Gerad and Yvon 1993, Schmidt & Kysor 1987, Verhoef 1988.

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