ETSI TECHNICAL COMMITTEE REFERENCE TECHNICAL REPORT

TCR-TR 013

October 1993

Source: ETSI TC-NA

Reference: DTR/NA-01001

ICS: 33.060.50

Key words: Terminal, mobility

Network Aspects (NA);
Network Support of cordless terminal mobility

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Document History

The following summary shows amendments introduced during the final NA/TG/MOB meeting 29/30 March 1993.

Chapter 2 Service Aspects - Changes

2.1.2: It has been clarified that only handover within CTN (intra-cell and intra-cluster) may be provided in phase 1 depending on CT technology used.

2.1.9: Option of keeping the same number while changing a service (from fixed terminal to CT or vice versa) has been added.

2.2.3: A paragraph has been updated with mobility of public users to the PTN. This option is valuable but with the addition that this option may not be supported by all PTN.

2.2.6: It has been clarified that base for defining network standards should be always the CT radio access with a broader functionality.

However the proposed standards should also support the capability other CT radio access where possible.

2.3: A new paragraph dealing with aspects of Bearer services has been added.

2.3.3: The definition of the common set of supplementary services available in all environments (home, office and public) should be done during the phase 1.

2.4.1: Identification of PP and the identification of private of public network is essential.

In addition it has been recognised that a CTM service provider may, by using a combination of access rights identities and location area level indicators, limit the CTM roaming to a subset of the network.

2.4.1: Change related to the bullets related to the roaming between public and private networks.

Roaming between public and private networks should be under responsibility of PTN authorities.

Roaming between networks which are under the responsibility of different authorities should be under the control of these authorities.

The mechanism through which this control are performed should take in account the already available standards and on-going standardisation of all involved parties.

2.4.2: It has been added that calling user may get information of expected charge but calling user should at least get indication that a special charge can be related with such call.

It has been clarified that mechanism for split charge should be defined.

It has been clarified that called CT user could be charged for signalling cost in the case of refusing to accept offered call.

2.4.3: Handover in CTM phase 1 has been clarified.

2.7.2: Aspects of TMN should be applied on CT2 as well on DECT. In addition alarm registration should concentrate on relevant alarms in radio part as well in these networks parts related to support of CTM (including data bases).

2.8: It has been added that option of supporting CTM in PSTN by means of UPT could be extended during the phase 1 also on public ISDN networks.

2.9: Already existing text has changed clarifying PAP and GAP relations.

2.10: A paragraph on IC card for CTM services has been added.

Executive summary

Recommendation 37 from the Strategic Review Committee on Public Networks called for "An ETR be prepared analysing the feasibility of supporting terminal mobility on the fixed public PSTN/ISDN using cordless and access standards combined with mobility management standards. Priority should be on private/public business networks". The task group NA/TG/MOB was initiated by TC NA to perform this task and the delivery type was changed to TCR-TR. The inclusion of support of cordless terminal mobility also on GSM-networks was decided at a later TC NA meeting.

NA/TG/MOB has held 4 meetings in the October 92 - March 93 period. Some 50 delegates in total have participated in the work, representing 7 public operators of fixed and mobile networks, 14 manufacturers and 2 administrations. Liaison with TCs BT, RES and SMG and with SRC5 has been achieved by direct participation by members of these committees in the task group. The draft report has also been forwarded to TC/STCs concerned (NA1, NA2, NA4, NA6, NA7, BT, RES, SMG, SPS and ECMA/TC32) for comments, which have been taken into account.

The conclusion of the task group is that network support of cordless terminal mobility (CTM) within and between PSTN/ISDN, GSM and private telecom networks (PTNs), giving the user the possibility to roam with his cordless terminal between home, public areas and at work, is feasible and that standardisation- and study activities should be initiated. The conclusion by SRC in Rec 37 that "there is a market for mobility in and between different environments" motivating standardisation work is shared by the task group. An outline of technical solutions requiring standards to support this mobility has been developed.

A first phase of standardisation should be confined to telephony (incoming and outgoing calls), while other tele- and supplementary services should be defined and standardised in later phases. Roaming should be possible between home, work and public areas. Access should be standardised on ISDN, PTN (based on ISDN) and GSM (based on ISDN). Handover (switching a call in progress between different radio channels) on intra-exchange and intra-network level is not required during the first phase. (Handover on intra-cell and intra-cluster level may be performed, depending on CT technology used). Access on PSTN based on UPT should be studied. Efforts should be made to secure cost-effective solutions.

A standardised radio interface, to be supported at all access points, is essential. Access profiles should be developed for DECT and CT2 based on existing standards. A network architecture including reference configurations has been developed. In order to manage CTM, mobility management protocols have to be provided both on the network access reference points and on the inter exchange and inter network reference points Proposals on how this can be achieved, (by enhancement of existing protocols with mobility management) are shown.

An action programme covering the following activities and areas is proposed (responsible ETSI body in brackets):

1) standards should be developed in the following areas: Roaming (identification, authentication, location handling and authorisation, technical aspects of charging and accounting (stage 1 service descriptions by NA1/SMG1/BT1), numbering and routing - changes to be identified (NA2/SMG3/ECMA), security (to be defined), access profiles (RES3), access- and network mobility management protocols and bearers (SPS/ECMA).
   The optional use of IC cards for CTM should be studied (RES3);

2) work definition for phase two should be performed in the following areas: Bearer services, other teleservices than telephony, supplementary services, feasibility of handover (NA1/SMG1/BT1), and TMN (to be defined);

3) it is also proposed that UPT in combination with CTM should be included in the work programme of NA7/BT1. UPT is defined as mobility of users between different terminals, while CTM is defined as mobility of terminals between different cordless access points. UPT should consequently be supported transparently also on a cordless terminal.

The main part of the work in the task group has been devoted to CTM based on digital signalling. It has however been acknowledged that CTM offerings based on PSTN should substantially increase service coverage in the short and medium term. It is therefore proposed that:

4) a basic CTM-service (user controlled, using DTMF signalling) based on UPT should be studied, possibly as part of a project oriented activity (see below) together with NA1;

5) as the CTM standardisation activities cross the boundaries of responsibility of a number of ETSI TC/STCs, there is no obvious home for the overall responsibility and co-ordination of component standardisation. It is therefore proposed that a project oriented activity with representatives from the different TC/STCs concerned is established;

6) a first set of standards is according to SRC Rec 37 required by the end of 1993. A final decision on target date will have to be confirmed after agreement with TC/STCs concerned.

1 Introduction

1.1 Terms of reference

Recommendation 37 from The Strategic Review Committee on Public Networks called for "An ETR be prepared analysing the feasibility of supporting terminal mobility on the fixed public PSTN/ISDN using cordless and access standards combined with mobility management standards. Priority should be on private/public business networks". (The complete recommendation is included as Annex C, section C.1).

At the TC NA-meeting 5-8 May 1992, NA/TG/MOB was initiated to perform this task, and terms of reference were developed (Annex C, section 2). A first meeting of NA/TG/MOB was held 1/2 Oct 1992. At this meeting it was proposed by some ETSI members that also support of cordless terminal mobility on GSM networks should be treated. It was pointed out that 1) also GSM is a public network, 2) a CT/GSM interface could be implemented in volume even before a CT/ISDN interface and 3) that different interfaces or extra co-ordination work should be avoided. This was brought up at the TC NA meeting 20-23 Oct 1992, where this extension of the ToR was agreed. The final ToR of NA/TG/MOB is included in Annex C section 3.

1.2 Members

A list of members can be found in Annex D.

1.3 Working Method

NA/TG/MOB has held 4 meetings, all of them at the ETSI Secretariat in Sophia Antipolis. The final meeting took place 29/30 March 1993. During the first three meetings the group was divided in two WPs; Service and Network Aspects.

A first issue of the complete report was distributed in the beginning of January to members of the task group and to TC- and STC chairmen concerned. The comments received were taken into account, the report amended and a second version of the draft final report was distributed to TC NA members, to the chairman of STCs NA1, NA2, NA4, NA6, NA7, to the chairmen of TCs BT, SMG, RES, SPS, ECMA TC 32 and to members of the task group in the middle of February.

Comments received motivated a final meeting, 29/30 March. At this meeting the comments were discussed, the draft final report amended and agreed within the task group.

2 Service aspects

2.1 End user requirements (short term; standards 1993)

2.1.0 Cordless telephony applications

Three primary application environments for Cordless Telephony have been identified; business, residential and public.

User groups have been identified for each of these environments; however market research shows that users in each group also have requirements to use Cordless Telephony services in the other environments. In the long term up to 80% of users are expected to make use of Cordless Telephony in multiple environments. The market research indicates that without multiple environment mobility, Cordless Telephony would only achieve 70% of its market potential with the availability of multiple environment mobility (see Annex B).

2.1.1 Roaming between various places

Cordless terminals at home are proven to be very attractive for end users and have already a high and rapidly growing penetration in many countries. New requirements are the possibility to use one cordless terminals both for incoming and outgoing calls at the following places:

- home;

- work (PBX or Centrex);

- private commercial areas (Shops, petrol stations, airports etc.);

- public areas.

User procedures should be simple.

2.1.2 Handover within a cordless telecommunications network

Handover within a CTN (intra-cell and intra-cluster) may be provided in phase 1, dependent on the CT technology used. Intra-exchange and intra-network handover will be considered for later phases.

2.1.3 Attractive and competitive price level

The price level of cordless terminal mobility offering (the features described with 2.1.1) must be accepted by the target end users. Factors of importance are cost/benefit relations as well as comparison with other competing products.

- simple cordless or wired apparatus at home; or

- cellular technology at other places.

2.1.4 Access to different networks

A consequence of 2.1.1 is the requirement to access different networks. All cases: Public PSTN/ISDN (incl. Centrex) networks, private and GSM networks as well as interworking between them have to be considered.

2.1.5 Roaming between various network operators

It is an end user requirement to roam between different network operators. Selection of a network operator could be based on factors like coverage, tariffs, quality and performance.

2.1.6 Supplementary services requirements at home or at work

Supplementary services already in frequent use at home or at the work place will be required at these locations also when cordless access is used. Exceptions could be accepted in the first market phase if necessary.

2.1.7 Supplementary services at other places

The initial requirements at other locations is more limited. Support of incoming and outgoing calls are the minimum functionality.

2.1.8 Privacy and protection against non authorised use

The risk for infringement in privacy and non authorised use should be very low regardless of location and network.

2.1.9 The same number when changing service or operator

The option to keep the same number when changing service is important.

The option to keep the CTM number when changing operator is very useful for the end user, at least within a country.

2.1.10 Unbundled services and tariffs

Value added services and related tariffs should be optional for the user.

2.2 Network operator requirements

2.2.1 Ensure PSTN and ISDN CTM offerings that are attractive for public network operators

The public ISDN/PSTN operators have normally a very good geographical coverage of the network and it is therefore well suited as a base for general public CTM offerings. This offering will be further enhanced with roaming capabilities to private networks.

2.2.2 Include CTM offerings from public GSM network operators as complement to present cellular offering

The GSM standard and technology may not support the high density of radio terminals that is needed in some cases. Cordless telephony standards could therefore be used by the GSM operator in order to offer a complete radio terminal solution.

2.2.3 Extension of mobility for PP between PTNs and public networks

Business PP users will get an increased services level with the ability to roam to the public network. This will increase the penetration of cordless business phones and give revenue to public network operators.

Public PP users will get an increased service level with the ability to roam to some private networks. This roaming will depend upon the control of private network operators.

2.2.4 Extension of mobility for PP between PTNs

A significant number of business PP users within one PTN will frequently visit another PTN. Such mobility could be supported by public network increasing the service level for business users and the revenue for the operator.

2.2.5 Establishment of generic access profiles for cordless terminals and fixed parts

A minimum level of functionality for the speech application is recommended with a corresponding access profile for cordless terminals and fixed parts. This is essential for the ability to use the same PP at different places and networks.

2.2.6 Broad functionality based on DECT radio access

The functionality offered on the radio access should be open for future service offerings based mainly on capabilities of DECT radio access. The proposed standards should also support the capabilities of CT2 radio access, where possible.

2.2.7 Coexistence with UPT

CT Mobility should not be in conflict with UPT services as defined by ETSI. However, phase 1 CTM standards should not be delayed due to harmonisation work.

2.2.8 Reusing of existing components in the network

It is essential for lead times as well as profitability to find solutions that reuse existing network components in an optimal way.

2.3 Applications

2.3.1 Bearer services

The influence of CTM on the bearer services as well as support of bearer services should be studied in phase 1.

2.3.2 Teleservices

Ideally all teleservices that are available on standardised PAP or proposed GAP and that are also available on specific networks should be supported.

2.3.2.1 Telephony

Telephony teleservice, for incoming and outgoing call, shall be updated (defined) in any case. It is the main teleservice that must be supported in phase 1.

2.3.2.2 Other teleservices

Technical report on what changes should be done on existing standards for other teleservices in order to use them on CT cordless terminals should be done during the phase 1.

2.3.3 Supplementary services

CTM is concerned with providing access to a set of services at home, at work and in public places. Supplementary services suitable for use in all places should be defined during phase 1, to be later standardised. It may not be possible to use all supplementary services in all places. However, those that are provided should be subsets of a common set. Therefore, standardisation is required as is stated in section 4.2.5.

2.4 Network features and capabilities

2.4.1 Roaming

The following standards related to roaming must be defined:

- PP/public & private network identification (see NOTE 1);
- PP/public & private network authentication (see NOTE 1);
- Cordless terminal location handling;
- Cordless terminal authorisation;
- Cordless terminal subscriber data handling;
- roaming between public (PSTN/ISDN/GSM) and private networks should be supported (see NOTE 2);
- roaming between private networks should be supported.

NOTE 1: A CTM service provided may, by using a combination of access rights, identities and location area level indications, limit the CTM roaming service to a subset of the network. The procedures to achieve this are a management issue.

NOTE 2: Roaming between networks which are under the responsibility of different authorities should be under the control of these authorities. The mechanisms through which these controls are performed should take into account the already available standards and the on-going standardisation work of all the involved parties.

2.4.2 Requirements for charging, billing and accounting mechanism

Charging, billing and accounting principles developed for:

- GSM networks;
- UPT services;
- existing mechanism for PSTN;
- existing PTN;
- ISDN,

should be used as basics for study. Charging functions must be defined and these functions should allow various charging cases, related to movement between the various areas.

The standardisation work in this paragraph concentrates on the principles and solutions for incoming and outgoing telephony calls. Calling user should have an indication that a special charge may apply to this call and the expected charge may be indicated. The principles for split of charging should be defined. It should be possible that the called CT can be charged for the part of call that has been established in order to support his mobility. Called CT would like to have CLIP supl. service in order to decide if it likes to take offered call.

If users are asking for:

- indications what the expected charge should be;
- CLIP supplementary services in order to decide whether of not they will accept an offered call,

this might cause high signalling costs. If these users, based on the anticipated costs for the call, finally decide not to establish/take the call, it should be possible for the related signalling costs to be charged for.

Transfer of charging information between Cordless terminal Service Providers should be investigated, in real time or transfer within a certain time interval. It should be investigated if it is possible to define such standard before the end of 1993.

2.4.3 Handover

Handover within a CTN (intra-cell and intra-cluster) may be provided in phase 1, dependent upon the CT technology used. Intra-exchange and intra-network handover will be considered for later phases.

2.5 Numbering, addressing and routing

2.5.1 Numbering and addressing

2.5.1.1 General aspects

One aspect of mobility between different networks is the different numbering plans that have to be considered. Public network numbering plans are described in CCITT Recommendations. The numbering plan for the International Telephone Service is described in E.163. The numbering plan for public ISDN networks is described in CCITT Recommendation E.164. The numbering plan for the terminal identities in PLMNs (e.g. GSM) is described in E.212. Other aspects are covered in E.164, E.213 and E.214. In private networks there is a greater variety of number plans. The general principles of these are described in ETS 300 189. According to this standard the native numbering plan of a private network may be according to E.164 but other plans are possible, including implicit numbering plans.

It is possible for a private network user to have a private network number and a public network number. This is required for the DDI supplementary service. The users private network number would be used within the private network, but the public network number would be used by callers outside the private network.

A cordless terminal is identified by a number which can be used to make calls to that terminal. A cordless terminal may have several numbers, either belonging to the same numbering plan or to different numbering plans.

It may be desirable in the future to allocate a personal number for the CTM service. This aspect is for further study.

2.5.1.2 Aspects related to CT terminated calls

The dialled number to be used to call a cordless terminal user should not depend on whether the called user is in the home network or in a visited network. However the number may be different for different callers. In particular, a private network user making a call to another private user of the same network will use the private network number, whereas a public user will use the DDI number. In order to maintain confidentiality of location the called line identity should be the number assigned to the CT, regardless of its location.

2.5.1.3 Aspects related to CT originated calls

It is desirable that the CTM service allows a user to be able to use the home network numbering plan when visiting other networks. In particular the home network might allow shortened numbers to be used and the user should be able to use these in the visited network.

It is clearly not practical for each network to know each visitors home network numbering plan. Therefore this service aspect would require the visited network to request a number translation from the home network. The request for number translation will require support by the inter-network signalling. This requires further study and might not be included in the initial standards.

In order to maintain confidentiality of location the calling line identity should be the number assigned to the CT, regardless of its location.

2.5.1.4 Operator aspects

When a cordless terminal is registered, the network operator will assign a number to that terminal. The assignment of numbers to cordless terminals should be independent of any radio specific identities contained within the cordless terminal.

The standards for CTM should not require a particular number series or prefix to be used when assigning numbers to cordless terminals. However a network operator should have the possibility of using a particular number series or prefix when assigning numbers to cordless terminals.

2.5.2 Routing

Calls between users of wired terminals usually only involve the calling party's network and the called party's network and possibly one or more transit networks. If the called party has a cordless terminal and is visiting another network, the called party's home network will also be involved. Similarly if the calling party is visiting another network the calling party's home network could also be involved in the call. Thus four networks could be involved in the call plus one or more transit networks.

There is clearly scope for optimising the routing of calls in such cases but the extent to which this might be realised depends on networks being able to interrogate databases in other networks. In the ideal case the home networks only have to deal with database enquiries and the actual routing is done by the calling and called party's networks.

2.5.2.1 Aspects related to CT originated calls

For further study.

2.5.2.2 Aspects related to CT terminated calls

The routing of calls to cordless terminal users could be influenced by the charging mechanisms used by the networks. Depending on the charging mechanisms adopted the call charges incurred by the calling user could depend on the routing of a call.

2.5.2.3 Operator aspects

The use of route optimisation, the benefits, costs and tariff implications, are for further study. In particular, The extent to which public network databases can be interrogated by other networks, and vice versa, is for further study.

2.6 Privacy and security

The security in the mobile networks/accesses is of a great interest for ETSI standardisation. Radio Paths, Terminals and Network infrastructures are to be protected.

Security in the fixed networks (ISDN, PSTN) is only an end-to-end security and the networks are totally transparent, so that there is no need up to now to manage any security mechanism / service provided by any CTN. The philosophy is different when there will be an interconnection between the GSM network and the CT Systems.

There are more commonalities in the philosophy to manage security in GSM and in DECT(encryption, authentication, confidentiality) than in CT2 (only Authentication), but it doesn't mean that the algorithms or the security procedures must be the same or must be really compatible.

Those aspect of security dealing with data confidentiality or privacy may need to be considered with any future mandate to ETSI initiated by the Commission.

Unfortunately DECT authentication algorithms are only provided on a restricted basis by ETSI, so the only way to provide security between networks is to ask the SAGE Group to work for enhancing/improving the DECT security protocols and the GSM security protocols, to interconnect present and future CT Systems with ISDN, PSTN, GSM. The problem of the interconnection between networks and accesses with their own security and privacy guaranteed, seems to be the most important issue for the future mobile networks.

Actions on encryption also need, to manage different encryption systems (e.g. GSM, DECT) preserving their own privacy. This is also work for SAGE.

Taking into account also the necessity to manage security in the nodes (exchanges, clusters, databases), the co-ordination with EEC. Normative activity and STAG is necessary, taking into account also the activity in ISO/IEC JTC1 SC6 WG2/WG4 (lower layer security), SC 27 and SC 21.

Security in ISDN and PSTN networks is partly independent of the attached mobile access networks, but if any security management appears inside this networks (interworking between databases and exchanges) special considerations must be investigated.

IN security (INAP) should be for further studies in the subsequent phases.

2.7 TMN aspects

2.7.1 Introduction

The general scope of a TMN (Telecommunications Management Network - ETR 037, February 1992, "Network Aspects (NA); Telecommunications Management Network (TMN) Objectives, principles, concepts and reference configurations") is to provide management functions for telecommunication networks and services, offering communications between itself and the telecommunication networks and services in a centralised, integrated and automated way. This requires a physical management architecture made of OSs (Operations Systems) interworking to each other to reach the objective briefly mentioned above.

This section is not intended to describe the TMN architecture and the TMN management services for the management of CTM (Cordless Terminal Mobility). First information required for CTM service are provided.

2.7.2 First information required for CTM service

In order to:

- control and monitor a CTM service;
- obtain knowledge of the actual quality of service;
- be responsible for the alarm registration and signalling initiated by network elements, related to support of the CTM services (including databases);
- change the software or information in data-bases within and between networks in a hybrid-system (GSM-NSS, ISDN, PTN),

TMN will have to transfer information between network management system and CTM related network elements. This information includes:

- identities;
- software update;
- black-white list;
- changes of black-white list;
- free of charge telephone numbers;
- barred telephone numbers;
- emergency call numbers;
- value added services (e.g. "star numbers" as, for example, *7=taxi, *3= service hotline, *x= travel information, ...);
- voice prompts;
- display prompts;
- data being needed for the authentication procedure;
- subscriber data;
- billing data (source, destination, time, length of call, ...);
- network state;
- other (to be identified).

2.8 Relation to Personal Mobility

Personal mobility is defined as the (discrete) mobility of users between different terminals. A personal mobility service offers the user the ability to make and receive calls at any terminal and be charged on a personal account. One personal mobility service being specified by ETSI, as well as CCITT, is the Universal Personal Telecommunications (UPT) service.

The Cordless Terminal Mobility (CTM) service offers Cordless Terminals (CTs) the ability to be mobile within and between cordless access systems (CT networks, CTNs), using these systems for making and receiving calls and being charged on one account. Consequently, from a principal point-of-view, the two concepts (UPT and CTM) are strictly separate. However, from a network functional point-of-view, they are

closely related. They do both require network functionalities for location management, call management, charging etc., that are very similar.

The relation between UPT and CTM can be summarised as:

* the CTM architecture and cordless terminals should be developed and constructed such that they allow transparent access from CTM terminals to UPT services;

* CTM should be specified in such a way, that services are harmonised as far as possible in order to gain network optimisation;

* CTM in PSTN can be built on standard UPT, offering a customer controlled terminal mobility service, using a cordless terminal with a personal number. This solution could be valid also for ISDN, in a first phase based on UPT phase 1 (DTMF) and in a second phase on digital signalling (see 3.5).

2.9 Generic Access Profile (GAP)

Some of the optional DECT features of the existing PAP are required to be mandatory in the GAP. This set of features includes incoming call and the associated mobility management procedures, in addition to the minimum PAP. This modified profile could be considered as the Generic Access Profile (GAP).

The development of a Generic Access Profile for the proposed phase 1 CTM standardisation programme should take account of work currently undertaken by ETSI RES3 in respect to the DECT-GSM profile, which has been based on an extension of PAP (this profile is expected to interwork in different environments in terms of mobility using GSM-MAP). The phase 1 programme also needs to take account of the work currently being undertaken by BT1 and RES3.

Interworking of all DECT equipments offering basic speech telephony is essential to the multiple environments use of DECT speech telephony terminals and hence to ensuring the wider spread of CTM services and the attainments of full market potential for DECT.

Interworking of all CT2 equipments offering basic speech telephony is essential to the multiple environments use of CT2 speech telephony terminals and hence to ensuring the wider spread of CTM services and the attainments of full market potential for CT2.

2.10 IC card for CTM

A concept for the use of/no use of an IC card for CTM needs to be considered. Serving as a basis for an appropriate reflection, the DECT DAM should be taken into account.

Therefore, the DAM in DECT is used to store authentication information and perform the necessary calculations for authentication.

As well as the ID procedures for the module, the physical characteristics for roaming terminals in multiple environments are quite important. So far three formats and layouts are common, the ID-1 card, the mini ID card (ID-00) and the plug-in card (ID-000). The choice of which card format to use should depend on market acceptance and suitability to the type of terminals being produced. Additionally, in order to allow low cost terminals and services, it should be possible to offer CTM without an IC card.

Consequence from the above is that two alternatives are resulting in using/not using an ID card for a CTM service:

1) CTM without an ID card (ID fixed to the terminal EE PROM), or

2) CTM with a DAM.

3 Network aspects

3.1 Introduction

This chapter of the report deals with the network aspects of cordless terminal mobility within and between private and public networks. The main issues addressed are the radio interfaces, the network architecture, the mobility management protocols and the interfaces and protocol architecture. Sections 3.2 - 3.4 deal with ISDN access to ISDN and GSM PLMN networks, which has been the basis for the main part of the work. Where it isn't necessary to refer specifically to ISDN or PLMN the general term Public Network is used. In section 3.5 some aspects of the PSTN access are treated.

3.2 Radio interfaces

This section describes the radio interfaces applicable to cordless terminal mobility.

3.2.1 Generic access profiles

In order to support cordless terminal mobility between different network access points on different networks a standardised radio interface is essential. As far as possible the network architecture should support a number of access standards (CT2, DECT, etc.). Obviously, cordless terminal mobility will only be possible where the appropriate cordless access standard is supported at the appropriate network access points. However, cordless access standards include many options. It is, therefore, necessary to standardise access profiles for the different services: mobility services, network services, supplementary services, etc., for each supported access standard. These standard access profiles for CTM are referred to as Generic Access Profiles.

Some key features of cordless access profiles, including the tasks required to define a profile are:

- identification of the functions (services) covered by the profile;

- identification of the base standards on which the profile is based;

- identification of the subsets, options and parameters required from the base standards to provide the identified functions.

The generic access profiles need to be specified with respect to both the Portable Part and the Fixed Part, as the mandatory and optional features may be different for the two parts.

It is expected that the generic access profiles for Cordless Terminal Mobility will be common for public, business and residential access.

The generic access profiles will be used in conjunction with a service registration to a CTM service provider to allow the CTM service to be used in business, public and residential environments.

The CTM service provider would normally be a network operator. The network on which a user has their service registration is referred to as the home network.

It is anticipated that a portable part may have access to additional functions in its home network.

A portable part may have additional non CTM registration(s) providing access to non CTM functions. However, this is outside of the scope of CTM.

3.2.2 Radio interface standards

Initially the two main cordless access standards that will be considered for CTM are CT2 and DECT. However, it should be noted that to support both access standards, and to allow new access technologies to be introduced in the future, the network architecture and services will be designed to be as independent of the access technology as possible.

3.2.3 CT2 Generic Access Profile

Initial investigations indicate that a suitable CT2 Generic Access Profile could be developed based on the existing Telepoint Access Profile.

RES3-CT2 is responsible for standardisation of the CT2 radio interface and should be responsible for defining the Generic Access Profile for CT2.

3.2.4 DECT Generic Access Profile

Initial investigations indicate that a suitable Generic Access Profile for DECT could be developed based on the standard minimum PAP with incoming call feature, and with additional procedures to support the use of unique CTM identities and with additional mobility management procedures.

RES3 is responsible for standardisation of the DECT radio interface and should be responsible for defining the Generic Access Profile for DECT.

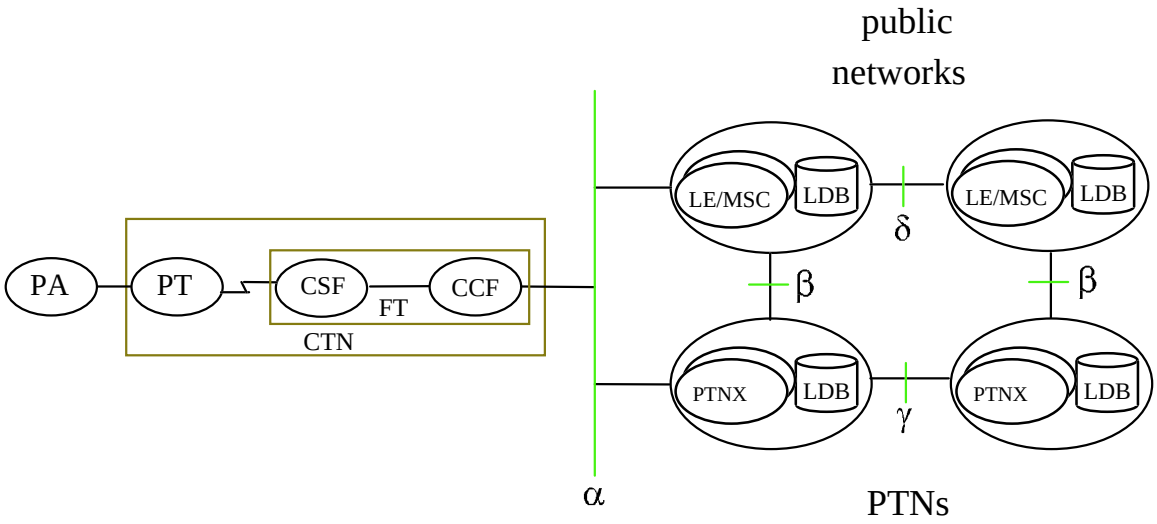
3.3 Network architecture

3.3.1 Introduction

In this section the functional network architecture for Cordless Terminal Mobility is described. The architecture is based on the terminology proposed in Annex A.

Some reference configurations indicating possible access arrangements of Cordless Telecommunication Networks attached to public and private telecommunication networks are provided. These reference configurations show the relationships between the functional "CTM entities", ISDN access entities and possible implementations. This identifies different possible CTM network access arrangements to public and private telecommunications networks. Thereby the relation between the CTM reference points and the ISDN reference points are identified.

3.3.2 Functional CTM architecture



3.3.2.1 Functional entities

The following entities (defined in Annex A "Cordless terminal mobility - terminology") are included in the functional CTM architecture:

- Cell Site Function (CSF);
- Cluster Control Function (CCF);
- Cordless Telecommunications Network (CTN);

- Fixed Radio Termination (FT);
- Home Data Base (HDB);
- LE/MSC indicates a LE or MSC;
- Local Exchange (LE);
- Location Data Base (LDB), including HDB and VDB functionality;
- Mobile services Switching Centre (MSC);
- Portable Application (PA);
- Portable Radio Termination (PT);
- Private Telecommunications Network Exchange (PTNX);
- Private Telecommunications Network (PTN); and
- Visitor Data Base (VDB).

The cordless telecommunications network consists of one fixed radio termination, and its associated portable radio terminations.

Two important functional entities within the FT are the Cluster Control Function and the Cell Site Function. The CCF is responsible for the overall control of the cluster, i.e. the cells of the FT, and the CSFs control one cell each.

The Portable Radio Termination (PT) contains all CT specific processes and procedures on the portable side of the air interface. All other functions are located in the Portable Application(s) (PA), associated with the PT. Collectively the PT and its associated PAs is referred to as a Portable Part (PP).

The Fixed Radio Termination may be connected to a public network or a Private Telecommunications Network (PTN). In the public network the FT will be connected to a Local Exchange or Mobile services Switching centre, and in the PTN to a PTN Exchange (PTNX). The public networks and/or PTNs may also contain Home Data Bases and/or Visitor Data Bases. These are used to hold the parameters associated with the PPs, permanently and temporarily, respectively.

3.3.2.2 Reference points

Reference points are the conceptual points between two functional entities. In the functional architecture four reference points are defined; α, β, δ and γ.

The α reference point divides the FT and the LE/MSC, as well as the FT and the PTNX. It is important to notice that a reference point may correspond to one, many or no physical interface between different equipment, and may also correspond to different interfaces in different configurations. The α reference point, e.g., is likely to correspond to different interfaces when the implementation of the FT is connected to an LE/MSC in a public network, and when it is connected to a PTNX in a PTN.

The β reference point divides public networks from PTNs. It is thereby also dividing Location Data Bases in the public and private networks. This identifies an important difference between the α and the β reference points: no Location Data Base to Location Data Base information will be transferred over the α reference point.

This implies that if a cordless access system (CCF and CSFs) is implemented with location Data Base functionality, it does by definition include (at least parts of the) PTN functionality. The interface between the cordless access system and the service providing switching node will then correspond to the β reference point.

The γ and δ reference points divide private and public networks respectively. Inter-network mobility will involve Location Data Base to Location Data Base information transfer over these reference points.

3.3.2.3 Interfaces

The interface at the α reference point, hereafter referred to as the α interface, is proposed to be either an ISDN Basic Access (2B+D) or a Primary Rate Access (30B+D) with a Mobility Management protocol. The traffic capacity of the CTN will determine which interface to use in a particular implementation.

Also in a PTN, the α interface is proposed to be an ISDN BA or PRA. However, this interface may be different from the public interfaces as it may include additional functionality.

The interface at the β reference point, hereafter referred to as the β interface, will be an ISDN Primary Rate Access or a Basic Access with an additional Mobility Management protocol.

3.3.3 CTM reference configurations

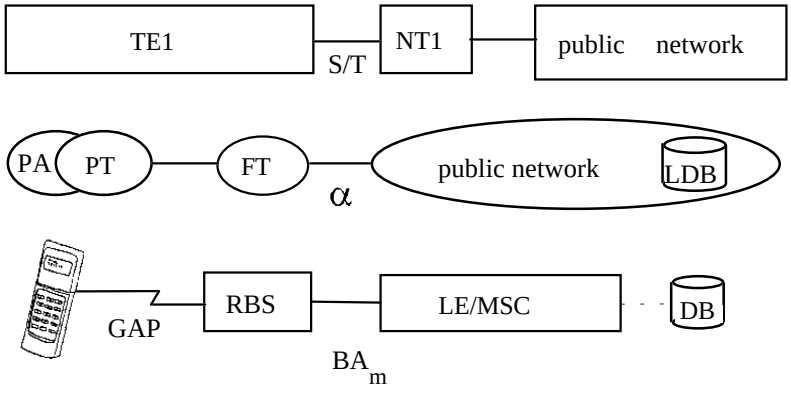
In this section possible reference configurations showing the attachment of Cordless Telecommunication Networks to public networks and PTNs are described. These reference configurations show the relationships between the functional "CTM entities", the ISDN access configuration entities and possible implementations, in order to identify different possible CT Network access arrangements to public networks. Each configuration consists of three "box chains"; the first represents the ISDN access entities, and the second the related CTM entities. The last is an example of how these entities may be implemented.

It should be noted that it has proved to be impossible to map all of the CTM reference configurations onto the ISDN access reference model in a manner that can satisfy all opinions. However, it is felt that the mappings shown are self consistent and provide the best relationships between the CTM functional architecture and the ISDN access reference model.

3.3.3.1 Possible residential configuration

The FT is directly connected to the public network at the α reference point. The FT, PT and PA corresponds to the ISDN TE1, and the α reference point coincides with the S/T reference point of ISDN.

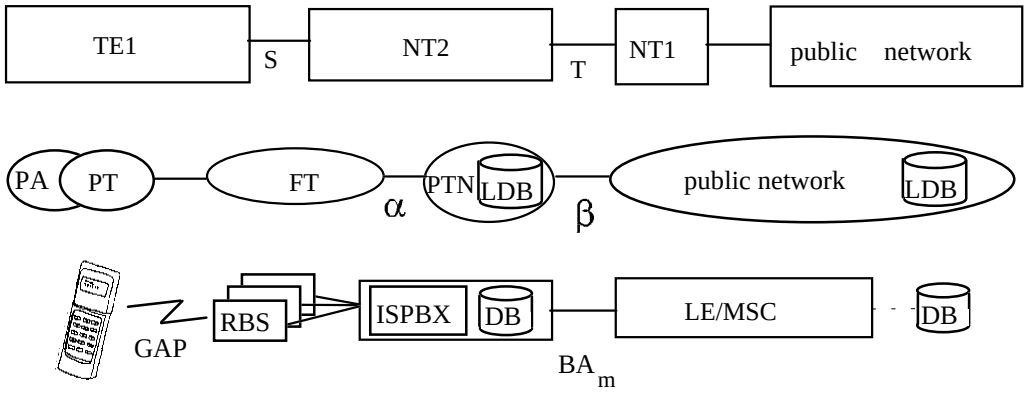
The FT is implemented as a simple single cell Radio Base Station (RBS), and the interface to the network is an ISDN Basic Access with mobility functions. The LE or MSC communicates with the HDBs and VDBs associated with appropriate registered Portable Parts.



3.3.3.2 Possible small business configuration

The FT is connected to the public network via PTNX functionality to provide greater functionality in the access configuration. This would correspond to an NT2 entity in ISDN, and the β- and T-reference points coincide.

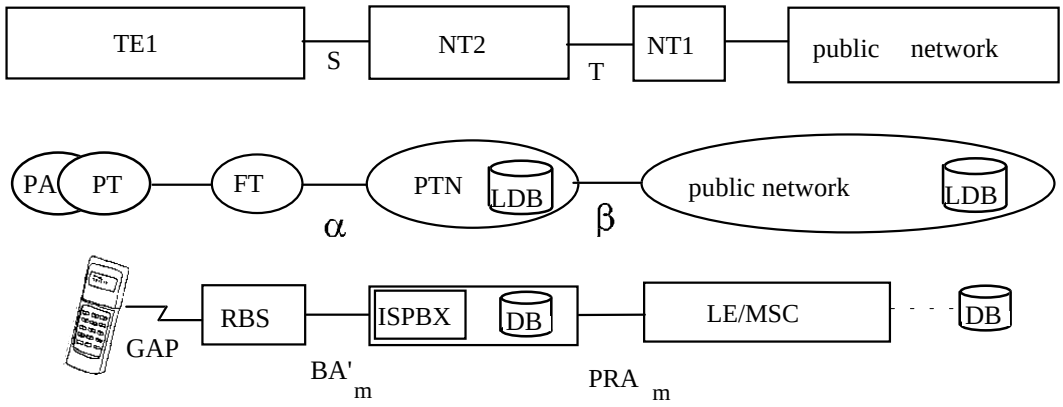
A possible implementation is an ISPBX with integral Cluster Control Functionality and a number of connected RBSs forming a multi-cell cluster. The interface between ISPBX and the LE or MSC is an ISDN Basic Access with mobility functions. The ISPBX Location Data Bases can communicate with the Public network Location Data Bases associated with appropriate registered Portable Parts.



3.3.3.3 Possible large business configuration

The FT is connected to a PTN, which in turn is connected to the public network. The PTN contains both switching and Location Data Base functionality. The FT, PT and PA corresponds to the ISDN TE1, and the α reference point coincides with the S reference point of the PTN, whereas the β reference point is equal to the T reference point.

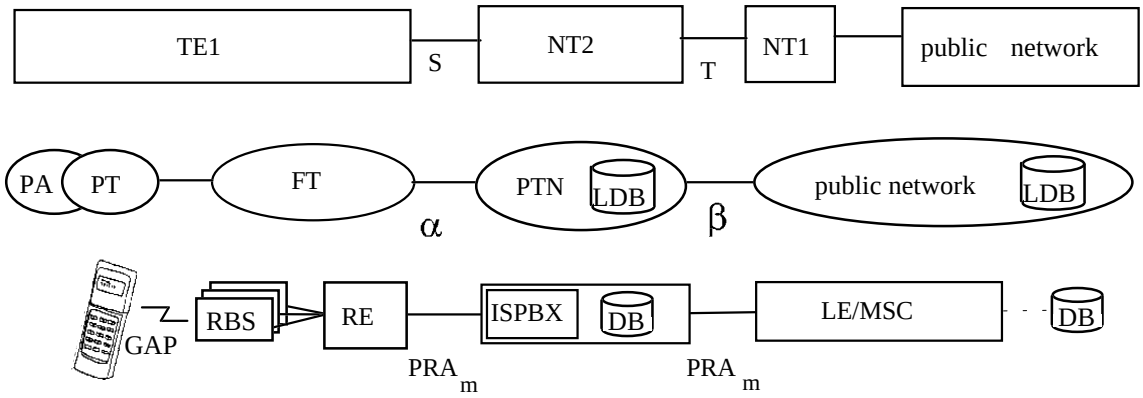
In the example, the FT is implemented as a single-cell radio base station attached to an ISPBX via an ISDN Basic Access with mobility functionality. This interface may be slightly different from the BAm of the public network, and is therefore denoted BA'm The ISPBX may have direct access to a Location Data Bases (HDB and/or VDB), or it may not. The ISPBX is connected to the LE or MSC via a Primary Rate Interface with mobility functionality.



3.3.3.4 Possible large business configuration with advanced CTN

This configuration is equal to the previous, with the exception that the CTN is more advanced with distributed functionality. The FT, PT and PA corresponds to the ISDN TE1, and the α reference point coincides with the S reference point of the PTN, whereas the β reference point is equal to the T reference point.

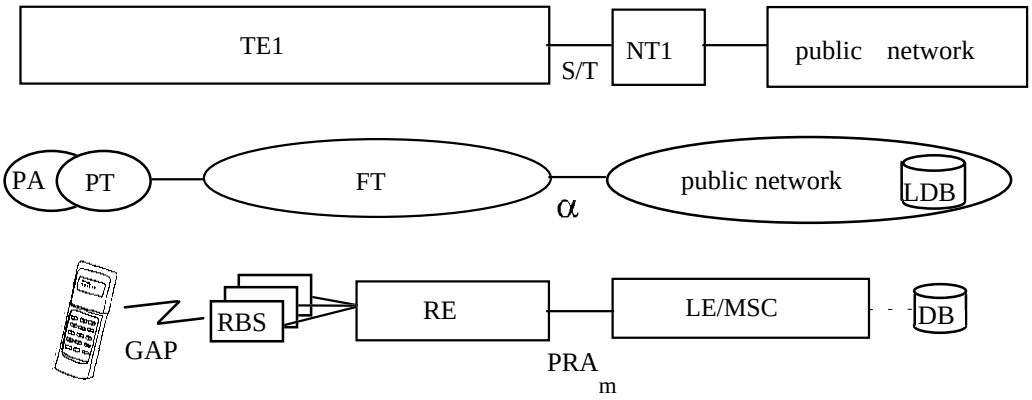
A typical implementation would be a Radio Exchange and a number of Radio Base Stations forming a cluster, and the RE connected to an ISPBX. The interface between RE and ISPBX could be an ISDN Primary Rate Interface or Basic Access.



3.3.3.5 Possible public access configuration with advanced CTN

The FT is directly connected to the public network at the α reference point. The FT, PT and PA corresponds to the ISDN TE1, and the α reference point coincides with the S/T reference point of ISDN.

The FT is more advanced than the residential configuration and is implemented as a cluster of Radio Base Stations (RBS) and a Radio Exchange. The interface from the RE to the public network is an ISDN Primary Rate Access with mobility functions. The Local Exchange can communicate with the HDBs and VDBs associated with appropriate registered Portable Parts.



3.4 Mobility Management protocols

In order to manage the cordless terminal mobility it is necessary to provide mobility management protocols on both the network access interfaces between the CT Network and the location Data Bases, and on the inter exchange and inter-network interfaces between the Home and Visitor Data Bases. This section describes the proposed protocols.

3.4.1 Network Mobility Management Protocols

The two main protocols considered for the mobility management protocols were the GSM Mobile Application Part (MAP) and Intelligent Network Application Part (INAP). Although there may be long term benefits of using an INAP based solution, the need to establish initial standards by the end of 1993 make this impractical. Initial investigations into the use of the MAP operations between HLRs and VLRs to support CTM suggest that they would form a suitable basis. The equivalent of the MAP operation for interrogating HLRs for call routing may also be required for use between networks. An additional operation for transferring charging information is also expected to be required. This mobility management protocol will need to be suitable for use over the β, δ, γ inter-network interfaces and the inter-exchange interfaces within the networks.

The group considered alternative schemes for the allocation and use of Roaming Numbers and recommends that the GSM scheme of allocation of MSRN at call establishment time should be adopted for CTM. It should be noted that this is at variance with the plans of TC-BT for CTM in PTNs. TC-BT should, therefore, consider adopting the GSM scheme for PTNs.

The use of TCAP or ROSE to support the Network Mobility Management Protocols on the different bearers requires consideration in TC SPS and ECMA.

3.4.1.1 SCCP Bearer

The inter-node interfaces within and between public networks (reference point δ) may use the CCS7 MTP and SCCP to support the Network Mobility Management Protocol described above.

3.4.1.2 DSS1 Bearer

The DSS1 protocols on this interface will be enhanced to support the Network Mobility Management Protocol described above. The Protocol will be carried over this interface independently of circuit switched calls, i.e. without associated traffic channels.

3.4.1.3 QSIG Bearer

It is anticipated that a QSIG Bearer similar to the DSS1 Bearer above will be used within and between PTNs (reference point γ) to support the Network Mobility Management Protocol.

3.4.1.4 X.25 Bearer

In cases where none of the above bearers are available between the appropriate Location Data Bases then the X.25 Connection Oriented Network Service may be used to support the Network Mobility Management Protocol.

3.4.2 Access Mobility Management Protocols between CTNs and public/private networks

The need for CT technology independent mobility management over the α interface was identified. The related access mobility management protocol will have to be compatible with the CT2 and DECT GAPs on the cordless access side and with the Network Mobility Management Protocol on the network side.

3.4.2.1 DSS1 Bearer

The DSS1 protocols on this interface will be enhanced to support the Access Mobility Management Protocol described above. The mobility management protocol on this interface will be supported independently of the call control protocol using either a separate SAPI, Protocol discriminator or other method.

3.4.2.2 SSIG Bearer

The SSIG protocols on this interface will be enhanced to support the Access Mobility Management Protocol described above. The mobility management protocol on this interface will be supported independently of the call control protocol using either a separate SAPI, Protocol discriminator or other method.

3.4.3 Coexistence of Network and Access Mobility Management Protocols on the same physical interface

Situations may exist where both the Access and Network Mobility Management Protocols need to be supported on a single DSS1 interface, this should not be precluded.

3.4.4 Use of V5 Interfaces

It was noted that an Access Network (AN), offering a V5 interface to a local exchange is functionally located within the public network. It is assumed that the V5 interface is transparent as far as the access signalling protocols are concerned. However, it was noted that an AN may be physically integrated in a radio exchange. Thereby, the interface between the radio exchange and the local exchange will be V5.

3.5 CTM on the PSTN

3.5.1 Introduction

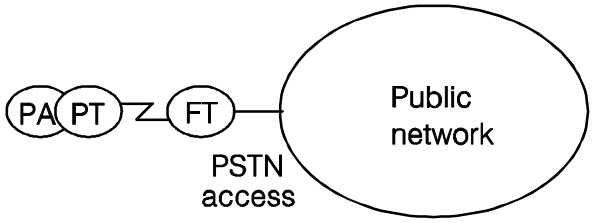
In paragraphs 3.1 - 3.4 requirements for a Cordless Terminal Mobility service have been described, that requires ISDN type access to an ISDN or GSM PLMN. However, it will be possible to provide a basic international CTM service at a PSTN access as well, using the mobility functions of UPT Phase 1, requiring basically only DTMF capabilities at the network interface.

3.5.2 Radio Interfaces

Both the CT2 and DECT cordless standards could be used to support this service. For CT2, the access profile can be the Telepoint Access Profile with an incoming call capability. In the case of DECT, the access profile can be basic PAP, enhanced with mandatory Incoming call establishment (only optional in basic PAP). Some new procedures in the FT and in the PT might be required, however.

3.5.3 Network architecture

The network architecture for this basic CTM service is depicted below. The CTN is attached to a public network (also supporting corporate network services) at the PSTN access. The functional architecture of this network will be that of UPT phase 1.



3.5.4 Mobility management protocols

The access mobility management protocol is the protocol of UPT Phase 1, which is DTMF based. The procedures for Registration, De registration, incoming call and outgoing call, as described for UPT Phase 1, are applicable without changes. However, if e.g. calling line identification, voice prompt overriding and/or DTMF signalling from an IN Special Resource Function (SRF) instead of voice prompts are possible, it would increase the efficiency of the procedures as well as the quality of the man-machine interface.

Registration of many cordless terminals on one single-line system (e.g. domestic base station) is possible in all cases, but for the base station to be able to alert a particular terminal at an incoming call, personal number information is required.

4 Proposed action plan

4.1 Introduction

This chapter summarises the standardisation activities required to enable cordless terminal mobility (CTM) within and between private and public networks. It proposes the groups that should be responsible for the component standards, and the possible phasing of the development of the standards. If not explicitly stated otherwise, proposals below refer to phase 1 (target date end 93).

It is assumed that in the case where CTM is based on a GSM-network, GSM appears as an ISDN in disguise and therefore GSM is not mentioned, unless there are explicit differences between ISDN and GSM, which require specific attention.

PSTN based CTM is referred to in 4.2.1 and 4.5.

4.2 Service aspects

4.2.1 Roaming

Intra- and inter network automatic roaming for ISDN, GSM as well as PTN should be standardised. Functions required are identification, authentication, authorisation, location registration and subscriber data handling (see paragraph 2.4).

Intra- and inter-network customer controlled roaming should be studied for PSTN. Functions required are identification, authentication, authorisation, location registration and subscriber data handling (see paragraph 2.4)

These service descriptions (stage 1) should be the responsibility of STC NA-1, STC NA-6, STC SMG-1, and STC BT-1 (For all activities, see also 4.6)

4.2.2 Handover

Intra-cell and intra-cluster handover is allowed, depending on the CT-technology used. Intra-exchange and intra-network handover need not to be specified during phase 1. In a future phase these latter two types of handover should be considered. See paragraph 2.4.

4.2.3 Bearer services

The support of bearer services should be studied during phase 1 with a view to possible implementation in later phases. Responsibility STC NA1 (ISDN), STC SMG-1 and STC BT1/ECMA (PTN).

4.2.4 Teleservices

Only telephony, incoming and outgoing, need to be standardised. See paragraph 2.3.2

During the first phase a study should be performed on changes required on standards for other teleservices in order to use them for CTM. Responsibility as for 4.2.3.

4.2.5 Supplementary services

A list of supplementary services, common for ISDN, GSM and PTN, needs to be produced during phase 1, together with a study on amount of work required in order to update them for CTM during phase 2. See paragraph 2.3 Responsibility as for 4.2.3.

4.2.6 UPT

UPT as defined by STC NA7 should be supported transparently. This should be studied by STC NA-7. See paragraph 2.8.

4.2.7 Technical Aspects of Charging

Standards (or updating of existing standards) for incoming and outgoing calls should be developed. See paragraph 2.4. Responsibility STC NA-1 (ISDN), STC SMG-1 and ECMA (PTN).

4.2.8 Technical Aspects of Accounting

As for 4.2.7.

4.2.9 Security

Standards for security in connection with identification, authentication of CT, authorisation of user shall be developed. Responsibility to be defined.

STAG should be asked to align work on CTM security with other security aspects. See paragraph 2.6.

4.2.10 Numbering, addressing and routing

The need for changes or additions to the standards for numbering and addressing should be identified with a view to implementation during phase 1.

Responsibility STC NA-2, STC SMG-3 and STC BT1/ECMA. The PLMN numbering plan should be taken into account.

As a part of the project oriented activity (see 4.6) a technical report should be produced including the following items:

- identities;
- personal number;
- support of home network numbering plan;
- interrogation of data bases.

See paragraph 2.5.

4.2.11 TMN

No standards are foreseen for phase 1.

A technical report including proposed standardisation work should be produced. Responsibility to be defined.

4.2.12 IC card

The use of an optional IC card for CTM should be studied, primarily by RES3 (see 2.10).

4.3 Network Aspects

4.3.1 Generic Access Profiles for Cordless Terminal Mobility

4.3.1.1 CT2 Generic Access Profile

A new or modified standard for the CT2 Generic Access Profile for CTM should be developed (see paragraph 3.2.3). This activity should be the responsibility of ETSI STC RES3, which is responsible for CT2 standardisation.

4.3.1.2 DECT Generic Access Profile

A new or modified standard for the DECT Generic Access Profile for CTM should be developed (see paragraph 2.9 and 3.2.4). This activity should be the responsibility of ETSI STC RES3, which is responsible for DECT standardisation.

Consideration should be given to the use of this standard as a basis for approval testing at a later date.

4.3.2 Network mobility management to support CTM within and between public and private networks

A standard should be developed for network mobility management at the β-, γ- and δ-reference points. (see paragraph 3.4.1). This activity should be the responsibility of ETSI TC-SPS, which is responsible for public network signalling and TC-BT and ECMA which are responsible for private network signalling.

4.3.2.1 SCCP bearer

A standard should be developed for the use of SCCP to support the network mobility management protocol between (δ reference point) and within public networks (see paragraph 3.4.1.1). This activity should be the responsibility of ETSI TC-SPS, which is responsible for SCCP.

4.3.2.2 DSS1 Bearer

A standard should be developed for the use of DSS1 to support the network mobility management protocol between public and private networks (β reference point) (see paragraph 3.4.1.2). This activity should be the responsibility of ETSI TC-SPS, which is responsible for DSS1 standardisation for public networks.

4.3.2.3 QSIG Bearer

A standard should be developed for the use of QSIG to support the network mobility management protocol between (γ reference point) and within private networks (see paragraph 3.4.1.3).This activity should be the responsibility of ECMA, which is responsible for QSIG standardisation for private networks.

4.3.2.4 X.25 Bearer

A standard should be developed for the use of X.25 to support the network mobility management protocol when other bearers are not available (see paragraph 3.4.1.4) It is not clear which ETSI TC should be responsible for this activity.

4.3.3 Access Mobility Management between Cordless Telecommunications Network (CTN) and Public and Private Networks

A standard should be developed for access mobility management at the α-reference point (see paragraph 3.4.2). This activity should be the responsibility of ETSI TC-SPS and ETSI TC-BT/ECMA.

4.3.3.1 DSS1 Bearer

A standard should be developed for the use of DSS1 to support the access mobility management protocol between CTN and public networks (α reference point) (see paragraph 3.4.2.1). This activity should be the responsibility of ETSI TC-SPS which is responsible for DSS1 standardisation for public networks.

4.3.3.2 S-SIG bearer

A standard should be developed for the use of S-SIG to support the access mobility management protocol between CTN and private networks (α reference point) (see paragraph 3.4.2.2). This activity should be the responsibility of ECMA, which is responsible for S-SIG standardisation for private networks.

4.4 Relationship between standards and categories of mobility

The following table indicates the relationship between the standardisation activities and the various categories of cordless terminal mobility.

CTM Category	Intra PTN	Intra PN	Inter PTN	Inter PN	Inter PTN/PN
Standardisation Activity					
CT2 Generic Access Profile	Y	Y	Y	Y	Y
DECT Generic Access Profile	Y	Y	Y	Y	Y
Mobility Management	Y	Y	Y	Y	Y
SCCP Bearer	N	Y	N	Y	N
DSS1 Bearer	N	N	N	N	Y
Q-SIG Bearer	Y	N	Y	N	N
X.25 Bearer	Op	Op	Op	Op	Op
PN = Public Network, Y = affects, N = does not affect, Op = optionally affects.					

As can be seen from the table most of the standardisation activities affect most of the categories of CTM, therefore limiting the categories of mobility has little effect on the standardisation activities. It is, therefore, not a matter of which interfaces need standardising for the different phases but a matter of which services and functions need to be supported on those interfaces for the different phases.

4.5 PSTN Based CTM

A basic CTM service (user controlled) for PSTN access, should be studied (see paragraph 3.5). As a first phase, this could be done together with ETSI STC NA1, within the project based activity proposed in 4.6.

4.6 CTM co-ordination

As the CTM standardisation activities cross the boundaries of responsibility of a number of ETSI TCs, there is no obvious home for the overall responsibility for the Overall Network Aspects, Service Aspects, and co-ordination of the component standardisation activities. It is, therefore, expected that a project oriented activity with representatives from the different TCs will be required, this could be based on a continuation of The NA Task Group on Mobility. If this is decided, this project oriented activity could also produce input to the STCs responsible in areas agreed.

The need to split the work into phases has been noted. A number of items have been identified for phase 1, in addition some items have been identified for introduction in later phases. To ensure a smooth transition between the different phases, the study and introduction of forward compatibility mechanisms should be a high priority part of the work performed by the involved parties, co-ordinated by the proposed project oriented activity.

According to SRC Rec 37, a first set of standards is required by the end of 1993. A final decision on target date will have to be confirmed after agreements with TC/STCs concerned.

Annex A: Cordless terminal mobility - terminology

A.1 Introduction

This Annex proposes a terminology for the Cordless Terminal Mobility (CTM) work in ETSI/NA/TG/MOB. The aim is to base this terminology on, and make it as consistent as possible with, the terminology used in related work areas. It should be noted that the CTM terminology does not include service related definitions (e.g. user, service providers, etc.). This will be completed during phase 1.

A.2 CTM terminology

The related work areas, which are used as a platform for the CTM terminology are:

- DECT (ETSI/RES3);
- PTN internal mobility (ETSI/BT1/WG3);
- CT2 (ETSI/RES3).

Only those terms that at this stage are directly related to the work of NA/TG/MOB are described, with focus on logical and physical entities and mobility related terms. The aim of these descriptions is to create a platform, on which a NA/TG/MOB terminology can be based. It is proposed, that when definitions are used in different work areas with the same meaning, the definitions for DECT should be used.

Cell

The radio coverage area served by a single antenna(e) system (including a leaky feeder) of one Radio Base Station (RBS).

Cell Site Function (CSF)

This includes all the functions that are concerned with a single radio cell.

Cluster

A logical grouping of one or more cells that are controlled by a set of cluster control functions to provide the appearance of a single large cell to both the user and telecommunications network, i.e. intra-cluster tracking of PPs and intra-cluster handover would be implemented with no extra-cluster switching or signalling.

Cluster Control Function (CCF)

A Cluster Control Function (CCF) controls the CSFs associated with one cluster.

Cordless Telecommunications (CT)

Telecommunications involving the use of cordless technology. A generic term used to indicate cordless technology in general rather than, for example, CT2 or DECT.

Cordless Telecommunications Network (CTN)

A network that uses a CT air interface to offer a user access to a public or private network. A CTN is a logical grouping that contains one Fixed Radio Termination plus its associated Portable Radio Terminations.

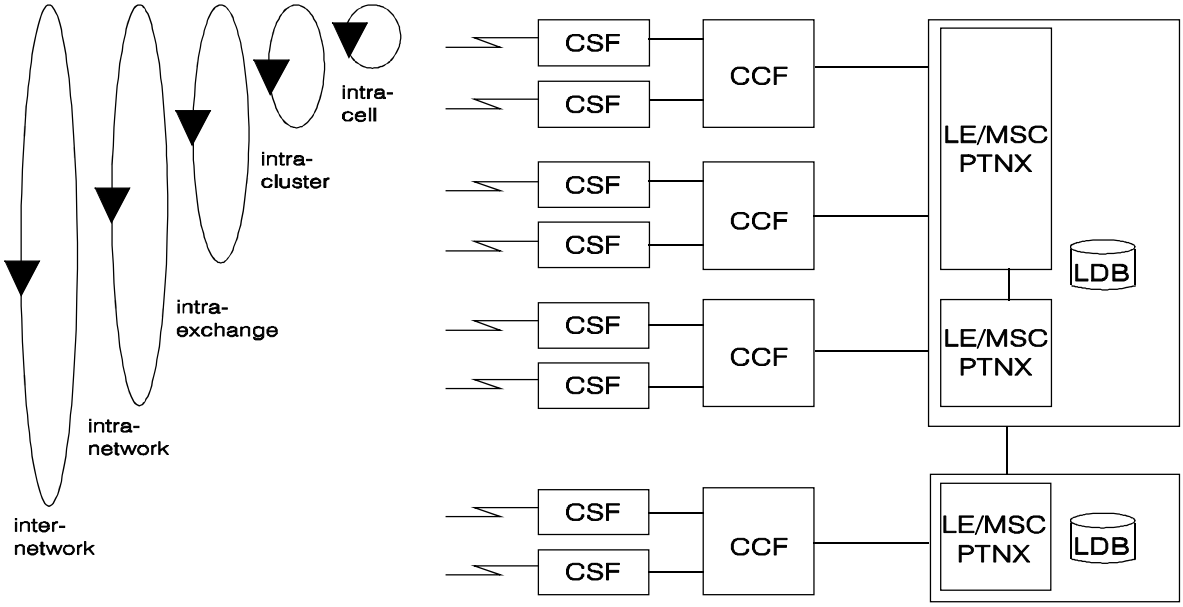
Cordless Terminal Mobility (CTM)

Cordless Terminal Mobility involves the ability of a cordless Portable Part to be mobile within and between CT Networks. The mobility may be continuous while the PP is accessing and using the telecommunication services offered by the public network or PTN, and it may include the capability of the networks to keep track of the Portable Part's location throughout the entire network.

NOTE: The continuity of the mobility or the automatic location registration functionality of the networks is not required to allow CTM. The former indicates continuous coverage as well as handover functionality between CT Networks, and the latter requires that the network has continuous information about the location of the terminal. Both these requirements may be desirable, but not possible in all implementations.

Cordless Terminal Mobility Levels

The relationship between the different mobility levels is indicated below.



Coverage Area

The area over which reliable communication can be established and maintained.

Fixed Part (FP)

A physical grouping that contains all of the CT processes and procedures on the fixed side of the CT air interface. A Fixed Part contains the logical elements of one Fixed Radio Termination, plus additional implementation specific elements.

Fixed Radio Termination (FT)

A logical group of functions that contain all of the CT Network specific processes and procedures on the fixed side of the air interface. A Fixed Radio Termination only includes elements that are defined in the relevant CT specification. This includes radio transmission elements (layer 1) together with a selection of layer 2 and layer 3 elements.

Generic Access Profile (GAP)

A cordless access profile that allows Cordless Terminal Mobility between Residential, Public and Business cordless access systems operated by a variety of organisations.

Handover

The process of switching a Portable Part's call in progress from one physical channel to another physical channel.

Home Data Base (HDB)

The Location Data Base where the current location and all associated parameters of a PP are stored.

Integrated Services Centrex (ISCTX)

An implementation of a PTNX that is not located on the premises of a private network operator. It may be collocated with or physically part of a public network local exchange.

Integrated Services Private Branch Exchange (ISPBX)

An implementation of a PTNX located on the premises of a private network operator.

Inter-network mobility

Cordless Terminal Mobility from one network to another network, i.e. between the coverage areas of different network operators, public or private.

The inter-network mobility requires not only technical functions in the different networks, but also commercial agreements (roaming agreements) between the operators, for terminal information retrieval, accounting, etc.

Inter-network roaming

Roaming between clusters controlled by exchanges of different networks.

Intra-cell handover

The process of switching a call in progress from one physical channel to another physical channel within the same cell.

Intra-cell mobility

Mobility within one cell. All CT systems can offer this basic level of terminal mobility. Due to this mobility, or due to traffic reasons, intra-cell handover may be required.

The intra-cell mobility does not put any extra requirements on the α- or β- reference points, or on the LE or PTNX.

Intra-cluster handover

The process of switching of a call in progress from one physical channel in one cell to another physical channel in a different cell within the same cluster.

Intra-cluster mobility

Mobility within one cluster, i.e. under the control of one CCF. The Portable Part can move within and between cells belonging to the same cluster. If intra-cluster handover is possible, then intra-cluster mobility is also possible during an active call.

The intra-cluster mobility does not, just as the intra-cell mobility, put any extra requirements on the α- or β- reference points, or on the public network- or PTN-entities. Even if the CCF is physically located in the LE or ISPBX, the inter-cell mobility does not logically affect the LE or PTNX. However, it does require mobility functions in the CT Network internal CSF and CCF entities and on the reference point between them, but since that is CTN internal functionality, it is proposed that it is outside the scope of the CTM work.

Intra-cluster roaming

Roaming between cells belonging to the same cluster.

Intra-exchange handover

The process of switching of a call in progress from one physical channel in one cluster to another physical channel in a different cluster controlled by the same exchange (LE/MSC or PTNX).

Intra-exchange mobility

Mobility between clusters controlled by the same LE or PTNX. The Portable Part can move within and between clusters which are controlled by the same exchange (LE/MSC or PTNX).

The intra-exchange mobility does require mobility management functionality in the LE or PTNX, as well as at the α reference point. This mobility management functionality includes e.g. the ability to: route calls to, identify, authenticate and charge the Portable Part. It may also include handover functions, i.e. switching a call in progress from one cluster to another cluster.

Note that the intra-cell and intra-cluster mobility are totally CT Network internal mobility levels, and do not concern the public network or PTN. It is the intra-exchange mobility and higher mobility levels, that affects the network functionality and reference points.

Intra-exchange roaming

Roaming between clusters controlled by the same exchange.

Intra-network handover

The process of switching of a call in progress from one physical channel in a cluster controlled by one exchange to another physical channel in a cluster controlled by a different exchange (LE/MSC or PTNX) within the same public or private network.

Intra-network mobility

The intra-network mobility allows a Portable Part to move from one cluster or cell under the control of one LE or PTNX to another cell or cluster under the control of another LE or PTNX, belonging to the same network, i.e. owned by the same network operator.

The lower mobility levels put requirements on the CT Network, on the LE or PTNX and on the α reference point. The intra-network mobility requires extra functionality also on the reference points between LE/MSCs and between PTNXs.

Intra-network roaming

Roaming between clusters controlled by different exchanges of the same network.

Local Exchange (LE)

A public network exchange to which access systems are connected.

Location Area (LA)

The coverage area in which a PP may receive (and/or make) calls as a result of a single location registration.

Location Data Base (LDB)

A functional entity used to hold the permanent and temporary data associated with cordless portable parts, see also Home and Visitor Data Bases.

Location registration

The process whereby the position of a Portable Part is determined to the level of one Location Area, and this position is updated in one or more Location Data Bases (HDB/VDB).

Mobile Station Roaming Number (MSRN)

Portable Application (PA)

A logical grouping that contains all the elements that lie beyond the CT Network boundary on the portable side.

NOTE: The functions contained in the Portable Application may be physically distributed, but any such distribution is invisible to the CT Network.

Portable Part (PP)

A physical grouping that contains all elements between the user and the CT air interface. Portable Part is a generic term that may describe one or several physical pieces of equipment.

NOTE: A Portable Part is logically divided into one Portable Radio Termination plus one or more portable applications.

Portable radio Termination (PT)

A logical group of functions that contains all of the CT processes and procedures on the portable side of the CT air interface. A Portable Radio Termination only includes elements that are defined in the relevant CT specification.

Private Telecommunications Network (PTN)

A network comprising of one or more interconnected PTNXs. The PTN provides PTN services to its users which are based on those provided by its PTNXs. The PTN may comprise more than one PTNX spread over more than one user premises. In this case, inter-PTNX connections between the PTNXs serving the individual premises are required. The inter-PTNX connections are considered part of the PTN.

In the context of the NA/TG/MOB work, as well as of [3], a PTN is considered a private ISDN.

NOTE: Local Location Data Base functionality will from a logical point-of-view always be located in the PTN.

Private Telecommunications Network Exchange (PTNX)

A nodal entity in a PTN which provides autonomous and automatic switching and call handling functions used for the provision of telecommunications services which are based on those specified for public ISDNs.

NOTE: If applicable, a PTNX provides:

- telecommunications services within its own area, and/or;
- telecommunications services from the public ISDN, and/or;
- telecommunications services from other public or private networks, and/or;
- within the context of a PTN, telecommunication services from other PTNXs to users of the same and/or other PTNXs.

A PTNX may be represented by an ISPBX, or by equipment which is physically part of the equipment of, for example, a public ISDN local exchange.

Radio Base Station (RBS)

A Physical grouping that contains the radio equipment associated with one cell.

Radio Exchange (RE)

A physical grouping that contains the CT-specific Cluster Control Functions (CCF) and other non-CT components and controls one or more RBSs. It supports an interface to the PTNX or public LE, and may contain concentrating-, multiplexing- or switching functionality.

NOTE: It should be noted that the RE does not contain any location register functionality. If a cordless access system is implemented with location register functionality, it does by definition include (at least parts of the) PTN functionality. The interface between the cordless access system and the service providing switching node will then correspond to the β reference point.

Roaming

The movement of a PP between calls from one Fixed Part coverage area to another Fixed Part coverage area, where the capabilities of the public network and/or PTN enable the Portable Part to make or receive calls in both coverage areas.

NOTE: Roaming requires the relevant FPs and PPs to be inter-operable.

Remote Operation Service Element (ROSE)

Service registration

The infrequent process whereby a user obtains access rights to one or more Fixed Parts.

NOTE: Service registration is usually required before a user can make or receive calls.

Transaction Capability Application Part (TCAP)

Visitor Data Base (VDB)

The Location Data Base where some, or all, of the relevant parameters concerning a PP are stored as long as the PP is in the area served by the VDB.

A.3 References

[1] ETR XXX
DECT System Description Document

[2] ETS 300 175-3
DECT CI Part 3: Medium Access Control Layer 3

[3] DTR/BT 1005, rev G, October 1992
PTN Internal Mobility; Private User Mobility and Cordless Terminal Mobility. General principles and service aspects.

Annex B: User groups

This Annex, which was kindly contributed by one ETSI member, discusses cordless mobility from a market point of view. It was judged by the Task Group to be of value in this feasibility study. It has however no direct impact on standardisation work proposed. Nor was the contents generally approved.

Overall definitions and characteristics of three User Groups are considered here: Two Mass Consumer Market Groups including Residential and Public/Outdoor Roaming; and the Business Segment.

The most fundamental aspect and unique characteristic that DECT offers as a digital cordless technology, which distinguishes all digital cordless systems from other wireless communications systems is the ability to provide low cost communications to users in multiple environments. Along with other digital cordless systems such as CT2, DECT will attain large volumes and low costs only by serving a wide market in all three User Group environments.

DECT systems will initially serve business users with on-site cordless PBX systems and both personal data and wireless LAN's. Assuming timely adoption of the PAP, those users will also want to roam on public systems. As volume builds and terminal costs decline, DECT systems will also be sold into residential environments.

The following table summarises basic User Group needs served by DECT, plus a separate column for those needs common across all three environments.

BASIC NEEDS

COMMON	BUSINESS	RESIDENTIAL	PUBLIC
- Integrated Pers. Telephony and Information	- Productivity via Communicating While Moving About	- Freedom to Talk in Any Location	- Be In Touch While Out-and-About
- Multiple Environment Use	- Avoid "Telephone Tag"		- Safety
	- Timely Information in Any Location		- Timely Information
- Convenience			
- Security			

In Business, DECT will provide full mobility with handover between multiple cells to workers as an adjunct to the wired telecommunications system initially, and progress to full desk phone replacement. In residential, essentially single cell systems, DECT will initially penetrate the high end market, and will replace other cordless systems based on the pace of terminal and base station price reduction. In public systems, public operators will initially provide roaming service to business DECT users with islands of coverage, progressing rapidly to ubiquitous coverage with full mobility in denser pedestrian locations. The vast majority of public users will not be for public use only, but will be cordless users from home or office for whom the public roaming is a key benefit of their cordless equipment.

The following highlights the near-term and long-term mix of User Groups forecasted, as a share of the total user universe. The percentages are based upon forecasted primary usage; and therefore add to 100%. Overlapping usage is indicated by the percentage of users with multiple environment usage. Initially the systems will serve business system users, accounting for 80% of primary usage volume, and penetrate the other applications as terminal costs decline.

This forecast assumes timely adoption of the PAP and interoperability of terminals between the three main environments. Should the PAP and interoperability/mobility aspects not materialise, DECT long term will not attain 70% of its potential market. Because of its Common Air Interface CT2 has been adopted both inside and outside of Europe. In addition to the impact on the European market, lack of interoperability/mobility via the PAP would severely limit adoption of DECT outside Europe, reducing the potential for equipment exports from Europe.

		NEAR TERM
-	Business	80 %
-	Residential	10 %
-	Public	10 %
-	Multiple Environment/Overlapping	25 %
		LONG-TERM
-	Business	30 %
-	Residential	40 %
-	Public	30 %
-	Multiple Environment/Overlapping	80 %

Mass consumer market

Residential user group

The residential user has a somewhat limited need for mobility, and is relatively more concerned about equipment cost. Cost is his primary decision criteria, and the user will compare cost against his wired residential phone and versus cordless alternatives including analogue cordless and CT2 digital cordless.

The residential user has need for two types of mobility- within his residence, and while "out and about"(the latter is covered under the Public User Group).

Within his residence, which can typically be served by single cell coverage, mobility to the user means:

- freedom to converse from any location;
- originate and receive calls.

Features and services needed do not have the same level of sophistication as in other applications. In addition to low cost, the user will demand very good audio quality and freedom from interference. Also in comparison to conventional cordless, a user will want to roam with the handset away from his residence.

Public user group

The public user group consists primarily of DECT cordless users who roam into the public environment from office or home, as opposed to usage primarily in the public environment only. To offer convenience, public services will be targeted to higher density and pedestrian applications. Also the public service will be designed to offer service to users with DECT handsets from multiple and varying manufacturers. Therefore, the mobility and interoperability aspects of such roaming in the public environment are key. Mobility can be characterised as both intra-network mobility and multi-network mobility.

Intra-network mobility includes:

- access to communications while roaming in convenient locations which have high use density;
- mobility with handover between cells to cover larger locations, such as shopping areas, dense on-the street- pedestrian corridors, etc.;
- levels of service including both call originate only and originate/receive calls.

Full wide area coverage is typically not required; the more limited mobility demanded by digital cordless users does include convenient pedestrian coverage, ubiquitous in the areas they spend the majority of time while "out and about". Users desire to have complete coverage within self-contained logical locations, with both voice and simple messaging/status information.

Multi-network mobility includes both roaming between public systems and between systems in different countries, and also interoperability between public and private applications. In these applications users have simpler information needs than in business, but will desire not only telephone communications but also basic personal information, status, and messaging. This mobility requires:

- ability to register to multiple systems;

- ability to transparently roam between systems.

Demand studies indicate that about 60% of users in public service applications will be new users to public/wireless roaming services, expanding the overall market for wireless communications. It is important to recognise that the overwhelming majority of these users will not subscribe to such service for public roaming only, but as an adjunct to their cordless use in home and office. In particular the mass market residential user while "out and about" does not have the same functionality/cost tradeoff as the business user. For a much lower cost he will accept:

- non-wide area limited geographic coverage in public systems, so long as it is convenient. Coverage is desired in the places the residential user will want to communicate- shopping locations, bus and train stations, near restaurants, etc.

- "Islands of Coverage", with areas of multiple cell coverage covering high traffic areas.

Business user group

As seen above, the fundamental need for DECT in business, as a wireless access technology, is to provide on- site mobility. In larger business applications, this mobility, in order to improve productivity and provide both timely completion of phone calls without telephone tag and real time information, must be multidimensional.

Mobility must provide:

- complete and full roaming capability within an office, not only a single office but in a complete building or campus with multiple buildings;

- handover;

- ability to accept handsets from multiple private system manufacturers and roaming from public systems to provide a basic call originate and receive capability within any private business system;

- allow use of the same handset when working in other offices of the same company, often in another country, which may have a DECT system offered by another manufacturer.

Also typically, the business user will want to use his terminal while attending a convention, a meeting at a hotel, having lunch with business associates, etc. These full levels of mobility require full interworking between competing manufacturers equipment, and between the private and public applications, to provide true user convenience. It is the full provision of truly convenient mobility which will provide real value for DECT against the use of wired communications systems now fully penetrated in businesses.

Also in comparison to the wired systems now in place, the business user will require several other characteristics. One of course is coverage, which must be ubiquitous in his office environment. Quality is essential, and must be at least as good as expected with wired service, measured in terms of grade of service, voice quality, freedom from interference, seamless handover, and particularly security of the conversation. Security deserves special mention. The typical business user will be very concerned about the security of the over the air portion of his conversation, and encryption will be a frequently demanded feature. Given high quality service in all these dimensions, system cost and cost per user will not be the primary decision factor, and DECT will be sold at a reasonable premium vs. wired systems, in the range of 20% to 50% over wired systems depending on applications, system size, and whether sold as a new or add-on system.

Annex C: Terms of reference

C.1 ETSI Strategic Review on Public Networks, Recommendation number 37

C.2.6 RADIO ACCESS

C.2.6.1 Support of Mobility in and between Public and Private Networks for Services via a common Radio Terminal

- There is a market of mobility in and between different environments as home, place of work and public access.

- There is a market for a common set of services accessible in these environments via a common radio terminal.

- The European standards, DECT, for the local access makes it possible to use terminals complying with DECT Public Access Profile (PAP) in both public and private environments.

- The European standardisation of a network protocol, MAP, for mobility in GSM networks makes handling of roaming in and between GSM networks possible.

- The European standardisation of a subscriber interface for services makes the provision of a common set of services in public and private networks possible.

- DECT is seen as the first priority for development in these areas, but the SRC recognises that there may be a market demand for similar work around other similar technologies (e.g. CT2), which some members will wish to resource.

RECOMMENDATION 37 Support of Mobility in and between Public and Private Networks for Services via a common Radio Terminal.

The SRC RECOMMENDS THAT:

- An ETR be prepared analysing the feasibility of supporting terminal mobility on the fixed public PSTN/ISDN using cordless and access standards combined with mobility management standards. Priority should be on private/public business networks.

- The preparation of such an ETR has to be given high priority and is by nature a multi-discipline exercise potentially performed by several TCs in co-operation.

- In the long term, IN standards should be further developed to support terminal mobility.

- If feasible, required standards should be produced by the end of 1993.

C.2 Terms of Reference as decided at the TC NA meeting in Stockholm 5-8 May 1992

1) Based on SRC4 Rec 37, assess the service characteristics and the capabilities of associated networks in order to identify the required features and prepare plans for the production of necessary standards/documents to introduce terminal mobility. (Report from TC NA-meeting in Stockholm (page 35)).

2) A TCR-TR should be delivered to TC NA by the end of March 1993.

C.3 Terms of Reference - revised after the TC NA meeting in Bristol 20-23 Oct 1992

1) Based on SRC4 Rec 37 assess the service characteristics and the capabilities of associated networks in order to identity the required features and prepare plans for the production of necessary standards/documents to introduce terminal mobility (Report from TC NA meeting in Stockholm (page 35)).

2) Consider also support of cordless terminal mobility on GSM-networks, in addition to the fixed PSTN/ISDN. (Decision at the TC NA-meeting in Bristol).

3) A TCR-TR should be delivered to TC NA after approval within NA/TG/MOB by the end of March 1993 (Decision at the TC NA meeting in Bristol).

Annex D: ETSI TC NA Task Group MOB - Member list

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M Creedy	Motorola Ltd	UK
G Crisp	GPT Ltd	UK
T D'Amico	Motorola Ltd	UK
J Davis	BT Laboratories	UK
A Dorgelo	AT & T - NSI	NL
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History

Document history	
October 1993	First Edition
March 1996	Converted into Adobe Acrobat Portable Document Format (PDF)