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TTC brings two documents for 3GPP TSG-S Architecture WG#1's information to introduce the current status of work in TTC. Attached draft document, "GSM evolved network requirements" (current version 0.3.5), is one of them, and it has been drafted in TTC since Fall 1998.

TTC wants to include the contents of this document into relevant 3GPP documents.

GSM evolved network requirements

Version 0.3.5

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1. GENERAL REQUIREMENTS

1.1 Global roaming

1.2 Multimedia

1.3 Service portability

Service portability is one of the important aspects of global roaming in 3G Mobile System.

Service portability is the capability of the network to provide a particular set of services/features from any user access point within an 3G Mobile System environment and according to the user's requests. From the subscriber's perspective, the service mobility is the ability of users to have transparent access to a set of their subscribed services when roaming.

Basic services (e.g. Mobile call origination, Mobile call termination , location registration) should be inherently supported in each 3G Mobile System.

Supplementary services can be classified into two categories:

- Standardized supplementary services (existing in GSM); These services are specified through the detailing of each of the operations involved in service provision and service usage (the provision/withdrawal, registration/erasure, activation/deactivation, invocation and interrogation operations.) These services are realized by implementing service-specific standardized capabilities in switches.

- Service provider/network operator specific supplementary services; To make this possible, standardized building blocks referred to as service features needs to be specified. The combination and parametarisation of these service features allow the creation of supplementary services. These services require VHE mechanisms.

In 3G Mobile System, it is desirable to follow the second approach to cope with future market needs to support flexible and quick service provisioning, and only service capabilities shall be standardized.

However, for the first phase, it is also expected to follow the first approach to utilize the existing resources and to avoid more signalling load. To which extent existing GSM supplementary services should be applied should be decided considering existing PDC supplementary services, VHE capabilities, user demand, and in order not to prevent service competition among operators.

1.4 Diversification and quick provision of services

Diversification and quick service provisioning is a one of the general requirement for 3G mobile system. Each operator can provide basic services and supplementary services to the user, and the services newly created by an operator should be provided to the user quickly.

1) Each operator can provide the operator specific supplementary services in 3G mobile system and the user can choose those services.

2) Each operator can create and provide various new supplementary services, which will be operator specific, by their own manner and the 3G mobile system should have a capability for creation and provisioning of those services.

3) Those newly created services should be provided to the users as soon as possible when operator wants to do so. 3G mobile system should have a flexibility or capability to implement those new services.

4) Services provided in the home network, which includes not only basic services and standardized supplementary services but also operator specific services, will be supported by VHE even a user is in the visited network.

1.5 Network efficiency

IMT-2000 provides new services such as multimedia services as well as services supported by 2G systems. In order for those services to be accepted widely, it is required to provide them at a reasonable rate. Network efficiency is one of important requirements for it.

Multimedia services generate high and non-constant bit rate traffic. Also, for IMT-2000, speech service is supported with non-constant bit rate traffic because speech compression technique is applied to radio interface (e.g. silence removal voice). Therefore, transport techniques which can utilize bandwidth efficiently are required.

ATM is to be used as the transport technique at radio access network. Dynamic set-up and tear-down of ATM VCs with SVCs or AAL2 channels with AAL2 signaling may be applied. By applying them, resource optimization at the radio access network may be achieved.

ATM is also expected to be applied to core network as an option by the similar reason.

1.6 Improvement of communication quality (e.g. TFO)

2. REQUIREMENTS ON DATA SERVICES

2.1 Quality of Service

- End to end QoS should be supported in IMT-2000.
- End to end QoS is required by user's applications.
- For the satisfaction of end to end QoS , QoS for RAN,CN and IP domain in IMT-2000 should be provided as high as possible.
- QoS may be Classified.
- Transport technology should be decided by the requirements of QoS.
- There are two QoS categories. These categories are further study. Purpose of this item is only clarified the two QoS categories, especially whether QoS in network should be standardized or not is not mentioned here.
  (1) QoS in service: Quality of communication
  (2) QoS in NW: Quality of connection
- Connection time
  - Connection time 1 : in the IP network
  - Connection time 2 : in the ATM-SVC network
- RA update time
- Resource block during a connection procedure
  Only the part relate to H.O.. The other part will be out of scope of standardization since it is operator's matter.)
- Packet QoS parameters in IMT-2000 are as follows.(although under studying)
  (1) Precedence Class
  (2) Maximum Through put Class
  (3) Minimum Through put Class

(4) Mean Through put Class
(5) Delay Class
(6) Reliability Class
(7) Priority Class

2.2 Point-to-multipoint

2.3 Access point selection (FFS)

2.4 Various bearer capabilities

2.5 Interworking with data networks

3. CALL/CONNECTION CONTROL REQUIREMENTS

3.1 Multicall

3.1.1 Relation between circuit switched call and packet session

Circuit switched call and packet session can be held in a MT simultaneously and independently. In addition, multiple CS calls and multiple packet sessions can also be held in a MT.

Following sections describe circuit-switched multicall.

3.1.2 Definition of multicall

Multicall service is a service that more than one active call are simultaneously held in a MT. A bearer (channel) need in order to makes a call active. Therefore, multicall service can be called multiple bearer (channel) service.

3.1.3 Service type of multicall

The number of simultaneous active call that is offered to the user shall be limited. However, both home and serving network operators should be able to freely set the number of simultaneous active calls. In other words, the number of maximum bearer can be set by the operators' choice. When an operator wish to offer a single call service, they just set the limit of the maximum number of bearer (call) is one. If the home operator sets the limit smaller than the serving network does, or vice vesa, the smaller number is the actual limit.

3.1.4 Relation with Supplementary Services

With the multicall service, CW, CALL HOLD and MPTY services can be offered simultaneously.

CW (Fig.4.1) and CALL HOLD (Fig.4.2) shall be offered by using bearers. Both of the services result in the same state; there are two calls related to one bearer and another call, and one of first two calls is active and another is held. MPTY (Fig.4.3) shall be offered from a state whose one call is active and another call is held.

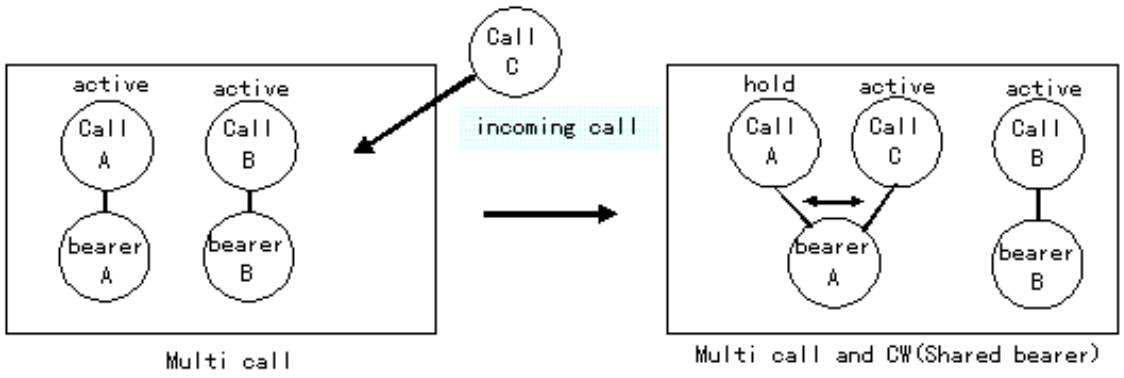


Fig.4.1: Call Waiting

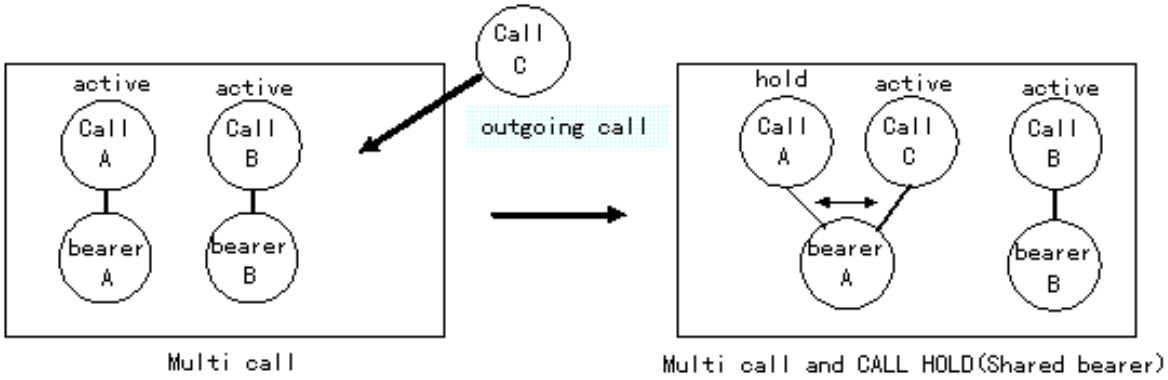


Fig.4.2: Call Hold

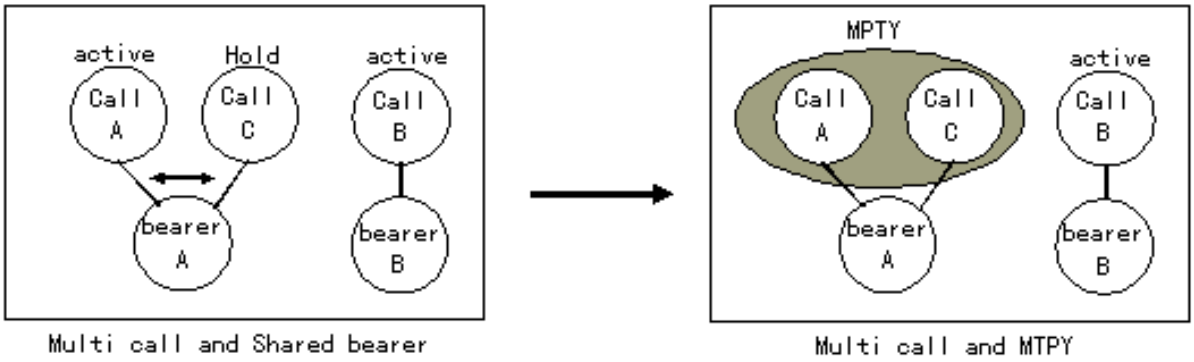


Fig.4.3: Multi Party

When an additional incoming or outgoing call is initiated, the user can select to form a multicall (multiple bearers) or a shared bearer (Fig 4.4). If there are multiple bearers, the user can select which bearer to be formed a shared bearer (Fig 4.5).

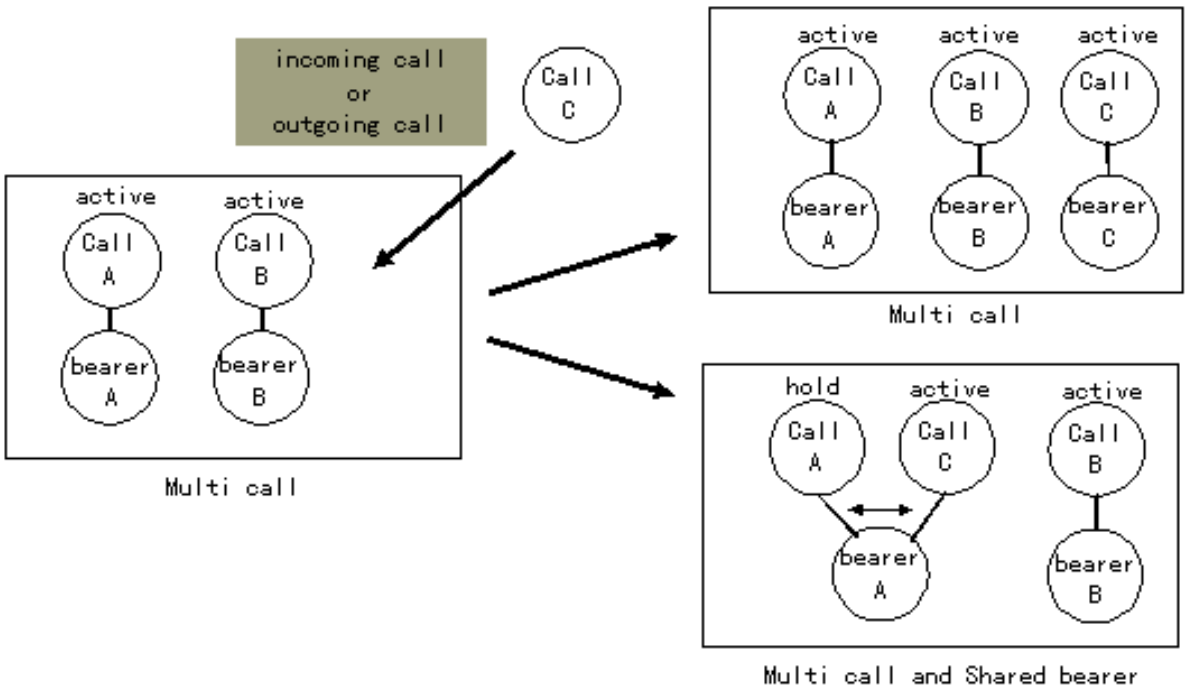


Fig.4.4: Selection of Multicall or Shared Bearer

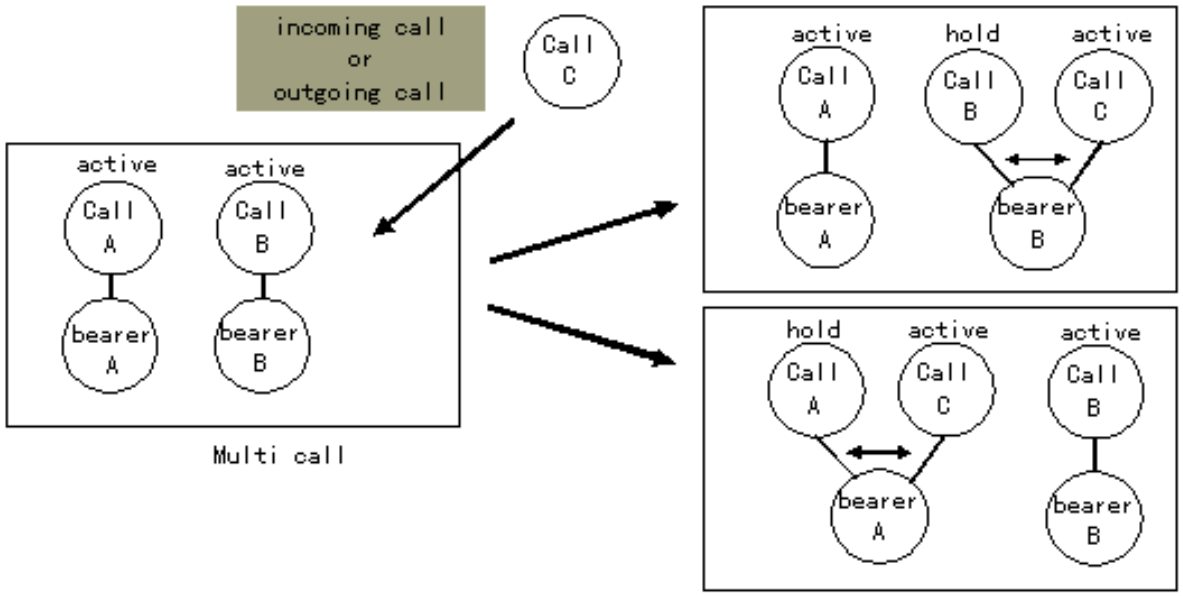


Fig.4.5: Selection of Shared Bearer

3.2 Interworking with ISDN/PSTN

3.2.1 Support of PSTN services

It is required to support PSTN services by connecting to PSTN.

3.2.2 Support of ISDN services

It is required to support ISDN services without major impact to the radio efficiency.

3.3 Negotiation/Modification of bearer

It is required to support a variety of bearer capabilities for circuit switched mode.

It is required to support the capability to negotiate the bearer capabilities between user and user or between user and networks.

It is required to support to modify the bearer capabilities.

3.4 Support of asymmetric communication

It is required to support asymmetric communication in both directions between MT and network for circuit switched mode and packet mode.

3.5 Emergency call

It should be possible to connect emergency call to the appropriate destination (i.e. police station or fire brigade).

The dial number is different for each call in Japan (i.e. *110* for police and *119* for fire brigade). It is required to support the capability to identify of emergency call for police or fire brigade in call/connection control.

4. MOBILITY CONTROL REQUIREMENTS

4.1 CS/PS mobility control

To support “Global Roaming” is one of the basic capabilities for IMT-2000. It is expected that the number of international (inter network) roaming will increase, then the control of inter network traffic will be important. The optimization of inter-network signaling is considered to be optional for each operator to be implemented. The following requirements are related to this optimization:

Case 1: Inter-network signaling optimization by the visited network

The home network does not contain any information if the visited network uses inter-network signaling optimization. Therefore, it is required that the inter-network signaling optimization concept is transparent to the home network.

The provisioning of location dependent services (such as CAMEL, SOLSA, SMS) should be provisioned transparently if the inter-network signaling optimization approach is used or not by the visited network.

The visited network should have the opportunity to implement an optimized internetwork network signaling to improve their control of the internetwork traffic.

Case 2: Inter-network signaling optimization by the home network

The visited network dose not contain any information if the home network uses inter-network signaling optimization. Therefore, it is required that the inter-network signaling optimization concept is transparent to the visited network.

The home network should have the opportunity to implement an optimized inter-network signaling to improve their control of the inter-network traffic.

Case 3: Inter-network signaling optimization

The home network and the visited network can use the inter-network signaling optimization with cooperation between their networks.

A Gateway Location Register (GLR) can be considered as solution, however other solutions are not excluded.

4.2 Diversity handover

Handover is originated from Mobile Terminal as well as Network. Handover shall be supported within a cell (intra-cell handover) as well as between cells (inter-cell handover). The execution of each shall be designed to the greatest extent practicable such that the execution of handover is unnoticeable to the end users (seamless handover). The services and QoSs shall in principle be maintained or improved. The security and the privacy shall also be protected during Handover.

4.3 Routing

One of the most important requirements for 3G mobile system is the capability of making the most of the network resource, in order to realize the provision of efficient system and the multimedia services which will consume wide bandwidth. This requirement is also applied to routing mechanism.

It is a basic capability to support “Global Roaming” for 3G mobile system user, and then the number of inter network roaming user will increase. It means that the traffic between networks will be important factor for network operator, (especially in case of the long distance such as inter continents). This leads a requirement that 3G mobile system will optimize the route as much as possible and make efficient use of not only radio resource but also inter/intra network resource with the provision of suitable quality.

It is useful to make use of existing mechanism and provide new one in 3G mobile system in order to achieve the efficient routing.

If optimal routing and Pre-routing Paging are used, it could reduce the unnecessary use of resources within and between networks.

- Optimal Routing has been standardized in GSM specification. It enables the calls directed to a mobile subscriber to be routed directly to the mobile subscriber's actual location, or to her forwarded-to destination. The basic Optimal Routing enable the call to be directed to visited network from interrogating network without extending the call to home network. The Optimal Routing for conditional call forwarding can be specified into early call forwarding and late call forwarding. In the former case, the call is handled without being extended to the visited network of the forwarding subscriber. In the latter case, the control of the call is returned to interrogating network after the call has been extended to visited network of forwarding subscriber.

- Pre-routing Paging is the feature by which interrogating network will confirm whether the mobile terminal is able to respond to paging before routing to visited network. The visited network will need the ability to execute the terminal paging after routing information query is received.

5. VIRTUAL HOME ENVIRONMENT

5.1 VHE concept

VHE is a capability whereby a User is offered the same service capabilities in a visited network as in his Home network. The establishment of this concept realizes that service provision and network operation may be separated, allowing services to be offered by networks or service providers other than those providing the home or visited call processing capabilities.

Note: The degree to which the VHE can emulate the actual home environment may be subject to, for example, the degree of co-operation between the visited network and home or supporting networks, their relative technical capabilities and the compatibility of the user terminal.

VHE is a set of tools that enable a more flexible service creation environment, faster deployment of new services, and service differentiation. The VHE concept will ensure a uniform appearance, or presentation, of services, features and tools to a service user, or subscriber, in an identical manner independent of serving network or location.

The VHE services are realised based on a number of service features, which are realised based on service capabilities, teleservices or existing standardised (switch based) supplementary services. Figure 1 clarifies the relationship between services, features and realisation.

The VHE concept shall define the service features required to implement the VHE benchmark services. The realisation of each service feature may utilise service capabilities, existing supplementary services and/or teleservices according to the nature of the service feature.

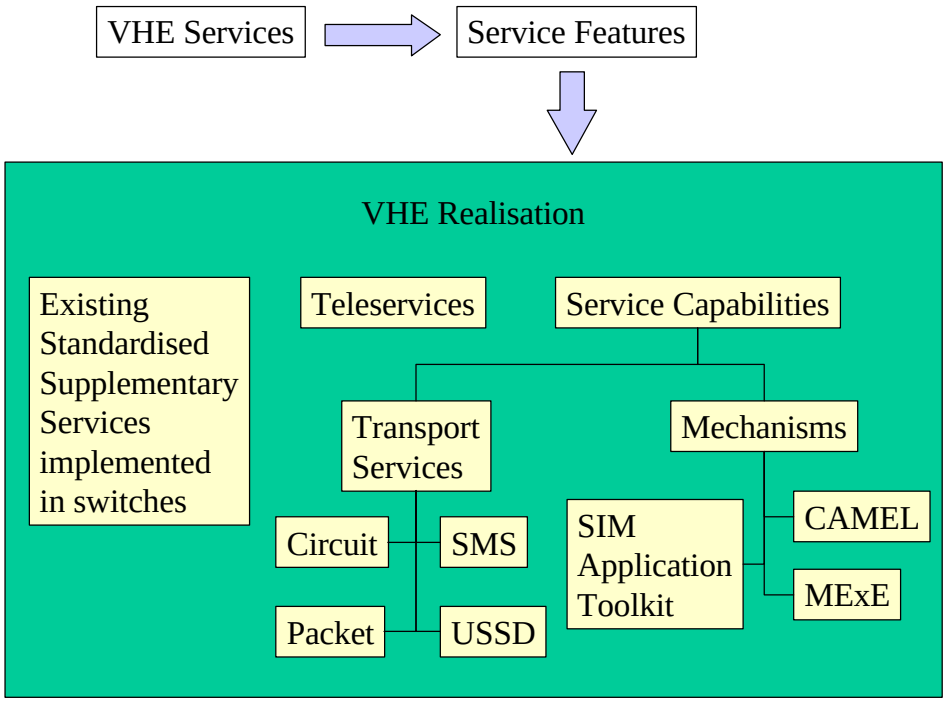


Figure 1: Relations between Services, Service Features and Realisation

5.2 Possible mechanisms to support VHE

Besides, implementing existing standardized supplementary services in switches, the following possible scenarios for the realization of VHE can be identified, which differ in the “place” where the service execution is located:

5.2.1 Service Execution in the Home Network

The service execution within the home network gives the subscriber the possibility to use his own VHE services (‘service tunneling’) even if the serving network might not be able to support the desired service or the storage and execution of the appropriate data. E.g. when using some of the 2nd Generation systems for access to 3G services.

Note – Service execution in the visited network is for further study since it requires the download of software into the serving network from the home network.

This scenario can be supported by evolved CAMEL/IN. CAMEL(Customized Applications for Mobile network Enhanced Logic) is a GSM concept of VHE which provides the mechanism to support services of operators not covered by standardized GSM services even when roaming outside the HPLMN. The CAMEL feature is a network feature and not a supplementary service. It is a tool to help the network operator to provide the subscribers with the operator specific services even when roaming outside the HPLMN.

The following network functions are identified to support this scenario:

- **Provisioning of VHE Specific service profiles**: This function is required to ensure that the visited network receives the appropriate information to invoke the VHE services. The VHE Service Profiles are part of the IMT-2000 Subscriber Profiles. It contains the trigger information that has to be exchanged between the home network and the visited (serving) network.

- **Dynamic arming of triggers within the switching network:** This function is required to activate the VHE triggers including the trigger profile (e.g. trigger conditions, information, etc.). The arming of these VHE triggers is requested to be activated by the home network or service provider.

- **Downloading VHE trigger profiles to the visited network:** This function is required to reduce the unnecessary signalling between the home and visited network. The VHE trigger profile is downloaded towards the visited network together with the IMT-2000 Subscriber Profile.

- **Service logic execution (home network capability):** This function requires an agreement between the home network or service providers and visited network for the home network to execute service logic from the home network to control the visited network resources. IN supported capabilities must be compatible between the two networks.

- **Service addressing (visited network capability):** This function is required to allow the visited network to address specific service control functions. This is used to request the initiation of a VHE context between the visited network and the home network.

- **Security and screening functions (visited to home network):** These functions are required to enable the networks to verify each other's identity and bind the context between the networks for the execution of the VHE services.

5.2.2 Service Execution within the UIM

The support of the VHE can be realised by exchange of service related data or service logic from the home network or service providers to the UIM. The software is then executed on the IC-Card.

This scenario can be supported by Remote Programming, (enhanced) SIM-toolkit, or JavaCard. The SIM toolkit allows the SIM to be used to intercept calls made from the mobile, and block or change the number dialled. The SIM can also directly manipulate the menu structure of the terminal's user interface, adding new menu options tailored dynamically to the service being used.

5.2.3 Service Execution within the MT

Similar to the mechanism for the UIM also a download of software into the mobile terminal (MT) can support the VHE. The distinction between two execution environments with different levels of security may be useful: One for the UMTS service provider with larger functionality range and the other for value added service providers (VASP) with less functionality but higher security. Functionality and security is meant mainly with respect to the UMTS network and should not limit the range services of the VASP.

This scenario can be supported by Remote Programming, Mobile Station Execution Environment (MExE), Wireless Application Protocol (WAP), or Suns Java-Technology. MEXE provides environmental support for operator-defined services in the MS, with the emphasis on functions in the ME. MEXE is still being defined, but it is likely to include standards for:

- A Java execution environment on the MS and mechanisms for downloading Java and other applications,
- Control of MMI aspects of the MS in real-time from the network to allow user friendly control of applications in the network and applications distributed between the MS and the network.
- Mobile station clients for common applications such as address books.

5.2.4 Functions

For scenario 2 (Service execution within UIM) and scenario 3 (Service execution within MT), following functions are identified:

Capability Profile Exchange: This function provides a mechanism for the MT, the UIM and the Core Network to exchange service capability information. For example, the following types of exchanges may occur:

- MT services capability may be provided to the UIM or Core Network;
- UIM services capability may be provided to the MT or Core Network;
- Core Network services capabilities may be provided to the UIM.

Application Data Transfer: This function provides a mechanism for the MT, the UIM and the Core Network to exchange applications and associated data. For example, the following types of exchanges may occur:

- MT data may be provided to the UIM or Core Network;
- UIM data and applications may be provided to the MT or Core Network;

- Core Network data and applications may be provided to the UIM or MT.

Proactive Applications: This function gives a mechanism whereby applications can initiate actions to be taken by the MT. These applications may reside in the UIM, MT or external device or may be downloaded from the Core Network. Examples of these actions include:

- display text from the UIM or Core Network to the MT;
- send a short message;
- set up a voice call to a number held by the UIM, MT or external device;
- set up a data call to a number and bearer capabilities held by the UIM, MT or external device;
- send a supplementary service control or service data;
- play tone in earpiece;
- initiate a dialogue with the user;
- provide local information from the MT to the UIM or to the Core Network;
- provide help information on each command involved in the dialogue with the user.

Screening service by UIM: This function allows that when this screening service is activated by the UIM, all dialed digit strings, supplementary service control service data are first passed to the UIM before the MT sets up the call, the supplementary service operation or the service data operation. The UIM has the ability to allow, bar or modify the call, the supplementary service operation or the service data operation. For example, a call request can be replaced by a supplementary service operation or a service data operation, and vice-versa.

Security: This function allows that applications designed using the features in this capability can use the methods to ensure data confidentiality, data integrity, and data sender validation, or any subset of these.

5.3 VHE capabilities

The Virtual Home Environment supports:

- **Service transparency** between different IMT-2000 networks
- **Transparent execution** of the "*Virtual Home Environment*" service features: the VHE service features are used by the mobile operators to provide more functionality to the mobile users than basic mobility. The services may be executed without necessary sharing of service and subscriber information to the visited mobile operator (except of roaming agreements).
- **Customised Services:** the means for network operators, service providers and users to define their own specific features/services
- **A personalised service set:** with user personalisation of features/services.
- **Service Level:** It is desirable that the roaming mobile end-users will experience the same service level as within their home networks (The Virtual Home Environment Concept). Therefore, it is desirable that the services are provided transparently by the visited networks.

- **Provisioning of subscriber specific services:** The mobile users may have custom demands for functionality from their home service providers. The Virtual Home Environment intends to make management access to customised services available to the mobile users when roaming.

- **Limited network load:** The current mobile networks already contains a considerable signalling load to handle a mobile call. These signalling is required to maintain the mobility information of the mobile subscriber up to date. Therefore, the signalling load of new features must be limited as much as possible to ensure that the mobile network will not be overloaded its signalling capacity.

- **Activation of mobile related call events:** This enables the operators to provide mobile specific services such as Call Forwarding Not Reachable, message delivery when terminal is activated, and registration restriction .

- **Perform charging activities:** The VHE may be able to exchange charging parameters between the Home Service Provider and Serving (Visited) Network. This exchange is required to have services, such as Advice of Charge.

- **Perform In-Band User Interaction:** The VHE shall provide the capabilities to order the playing of announcements and tones towards calling/called subscribers during the call-setup, call disconnection, unsuccessful call establishment, and incoming call procedures.

- **Allow for Subscriber Interaction:** The subscriber should have control capabilities to activate/register/invocation of supplementary services. The VHE should be able to add functionality to these supplementary service control mechanisms.

- Interaction with the Supplementary Services: **The mobile network already provides a number of standardized supplementary services. The interaction with these services needs to be considered.**

5.4 Service Capability Requirements

VHE should support following service capabilities:

- Support of standardized GSM supplementary services (switch based services)
    - To be provided
- Support of existing PDC operator specific services
    - Called user hunting
    - Barring of day time call
    - Barring of incoming/outgoing call except from/to some particular called parties
    - Barring of incoming call from some particular callers
    - Messages/data storage service
    - Message waiting indication
    - Support of standardized IN services

- UPT
- Freephone
- Calling Name Identification Presentation

- Support of Multimedia services
  - Point-to-point communication service control shall only be supported;
  - QoS control
  - Support of various addressing scheme (e.g. ISDN address string, packet, ATM, IP addressing)
- Support of operator specific MMI
  - triggered by specific dialling
  - service execution MT to control MMI
  - download mechanism of announcements and software logic for MMI
- Support of supplementary service control by the subscriber (e.g. Registration, Deregistration, Activation, Deactivation, and SS data modification)
  - from the subscriber with his own terminal
  - from the authorized user via PLMN/PSTN/ISDN

The following table shows the benchmark services to be considered in the VHE

TABLE Prioritization of benchmark services

Benchmark Services	Abb	GSM	Camel ph2	Priority
Abbreviated Dialling	ABD		X	A
Account Card Calling	ACC			B
Automatic Alternative Billing	AAB			A
Call Distribution	CD	X		A
Call Forwarding	CF	X		A
Call Hold	CH	X		A
Call Rerouting Distribution	CRD	X	X	A
Call Transfer	TRA	X		A
Call Waiting	CW	X		A
Completion of Call to Busy Subscriber	CCBS	X		A
Conference Calling	CON	X		A
Credit Card Calling	CCC			B
Destination Call Routing	DCR		X	A
Follow-Me Diversion	FMD		X	A
Freephone	FPH			A

Global Virtual Network Service	GVNS			A
Hot Line	HOT		X	A
International Telecommunication Charge Card	ITCC			B
Internetwork Freephone	IFPH			A
Internetwork Mass Calling	IMAS			A
Internetwork Premium Rate	IPRM			A
Internetwork Televoting	IVOT			A
Malicious Call Identification	MCID			A
Mass Calling	MAS	X		A
Message store and forward	MSF			A
Multimedia	MMD			B
Originating Call Screening	OCS		X	A
Premium Rate	PRM		X	A
Security Screening	SEC			A
Selective Call Forward on Busy / Dont' answer	SCF		X	A
Split Charging	SPL		X	A
Televoting	VOT			A
Terminating Call Screening	TCS		X	A
Terminating Key Code Protection	TCKP			B
Universal Access Number	UAN			B
Universal Personal Telecommunication	UPT			A
User-Defined Routing	UDR		X	B (FFS)
Virtual Private Network	VPN		X	A

Priority designation

A: Highly required, B: Required, C: Not required

Following service capabilities may be required to build services shown above:

- Service environment capabilities
    - address translation;
    - call origination;
    - call control;
    - answering calls;
    - call termination.
- MMI capabilities
    - Addition and cancellation of service subscription
    - Modification of user/subscriber data
    - The error messages and session progress signals in the same language format

- The various choices which can be selected in case of quality reduction
- Charging credit control and security checks
- List of services offered by service providers attached to the serving network

5.5 Core Network Requirements

5.5.1 Requirements in the serving network

- Find and bill the correct subscriber / Service Provider for provided services and associated signaling
- Interpret the addressing, the QoS negotiation and the service logic of services demanded
- Keep accurate account for services delivered
- Route incoming calls, service request and signals to the correct receiver
- Interpret the MMI received from the user/subscriber's terminal into session control information or service provider dialogues
- Maintain distributed subscriber and user data consistent with data held by the service provider

5.5.2 Requirements in the originating network

- Interwork with other networks
- Route sessions and signals
- Maintain distributed data consistent

5.5.3 Requirements in the supporting network/ home network

- Locate the user and route incoming sessions to the user
- Authenticate the users and service providers in the network and allow access to services
- Add or cancel service subscription
- Cease subscription to a service when the subscriber departs
- Modify the user/subscriber profile
- Account for user traffic and signaling traffic
- Distribute user interface logic and service logic for new services
- Interpret addressing remotely in case of need
- Negotiate bearer / service capabilities and their attributes, such as throughput and QoS level. The QoS level of the service/level of the service capabilities will be negotiated between the network and the user based on what is necessary for the service and what capabilities are available in the network.

5.5.4 Internetworking Requirements

- NNI should have the capabilities to provide information for user charging and interconnection charge billing between serving network and supporting/home network;
- NNI should have the management capabilities to provide protection of the home network from overload;
- NNI should have the security capabilities such as authentication and screening

6. UIM

7. SUPPLEMENTARY SERVICES

Supplementary service is a service which modifies or supplements a basic telecommunication service. Consequently, it cannot be offered to a customer as a standalone service.

3G Mobile Systems are expected to support the switch based supplementary services specified in GSM. However, it is up to each operator's choice how these supplementary services are supported. The mechanism can be switch based implementation or based on CAMEL using IN approach.[Note] VHE capability will enable 2nd generation PDC operator-specific supplementary services to be provided globally in 3G Mobile Systems.

[Note] The services provided may be limited depending on the CAMEL capability.

8. INTERWORKING WITH PDC

8.1 PDC-3G roaming

9.1.1. Objective

PDC/3G roaming is a optional capabilities. The objective of PDC/3G roaming is to enable to access telecommunication services, especially call origination/termination, even when the 3G user is out of 3G area and visiting in PDC area. At the early stage of 3G service, service area of 3G may be small when it compared to PDC. In such situation, 3G service area can be complemented by PDC by applying this PDC/3G roaming.

9.1.2. Requirements

It should be possible for 3G mobile system subscriber to access telecommunication service via PDC network without extra subscription to the certain PDC network. Addition to that, it is desirable to use same number and user identities when roaming in PDC.

According to the objective above, it is not required for PDC subscriber to access telecommunication services via 3G network without extra subscription to the 3G NW.

Due to the difference of NW capability, some supplementary service may be impossible to initiate while 3G user roams into PDC network.

Impact on existing PDC system should be minimized. For instance, NW is not required to instructs UE the mode to be in(mobile station decide its mode to be in autonomously, or is instructed by user operation).

9.1.3. Possible solution for PDC/3G roaming

For the mobile station side, multi-application ICC consist of UIMs for PDC and 3G may be used by putting it into the single-mode PDC MS or 3G MS. Besides that, dual mode terminal (DMT) may be used. DMT may decide the mode (i.e. PDC or 3G mode) to be in autonomously or manually(user operation). This decision may be done by comparing PDC and 3G radio conditions.

For the network side, some possible solution can be considered. One possible short term solution is the approach using IWF(InterWorking Function) which functions as protocol converter between PDC-MAP and 3G-MAP (see ANNEX1).

9.1.4.Impacts on Standardization

Assuming the IWF approach above, no impacts on standardization (nor Air, UIM-MT and NNI interface) is foreseen.

8.2 PDC-3G handover

9.2.1. Objectives

PDC/3G handover is also optional capability. The objective of PDC/3G handover is to reduce the frequenct of abnormal call release by keeping the connection even when MS goes out from 3G area and step into PDC area. This capability can also be measures for the situation that 3G area is small compared to PDC.

9.2.2. Requirements

For this capability, it is prerequisite that MS support both PDC and 3G radio interface (DMT; dual mode terminal).

According to the objective above, single direction 3G -> PDC H.O. is minimum requirement.

Since PDC area have been extended enough actually and call can be continued without being released caused by going out from PDC area, the reverse direction handover(PDC -> 3G) may not be required.

If reverse direction(PDC->3G) handover is not supported, MS should initiate search for 3G radio channel in order to try going back to 3G mode when the call is finished, or in idle state mode (e.g. periodical serch of 3G radio channel).

Supplementary services may be limited after HO to PDC. It is not required to support full SS after H.O. to PDC.

Packet HO between PDC-P and GPRS is not required for the first phase.

9.2.3. Possible solutions for PDC/3G handover

Inter-system H.O. can be classified into following three types.

[NOTE:In order to select type of H.O., more detail study is needed.]

1) Seamless type

- It may be possible to re-use the study in ETSI SMG.

- Anchor point is not moved after inter-system H.O. is executed.

2) Call re-setup type(MS initiated)

- The MS automatically calls back from a PDC network.
- Anchor point is moved after inter-system H.O. is executed.

3) Call re-setup type(NW initiated)

- The 3G network automatically calls back to the (PDC) MS.
- Anchor point is moved after inter-system H.O. is executed.

9.2.4. Impacts on standardization

Following impacts are foreseen,

Air interface: Measurement and report of PDC's radio condition (other impacts ars FFS at this time)

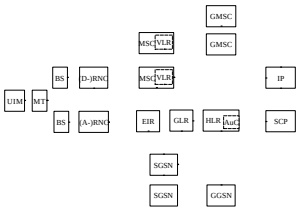
NNI: FFS(may be different for each HO scenario above)

9. REQUIREMENTS ON INTERFACES

9.1 Reference model

Figure 9.1 shows reference model for IMT-2000 as seen by TTC. Note that:

- UIM in the reference model is corresponding to USIM;
- MT in the reference model is corresponding to UE in UMTS ZZ.01 without USIM;
- BS in the reference model is corresponding to Node B in ZZ.01;
  Anchor RNC in the reference model is corresponding to RNC in anchor RNS in ZZ.01;
- Drift RNC in the reference model is corresponding to RNC in drift RNS in ZZ.01;
- MSC/GMSC/VLR/HLR/AuC/SGSN/GGSN/EIR/SMS-IWMSC/SMS-GMSC in the reference model are corresponding to the same entities in 09.02;
- MSC and GMSC in the reference model include gsmSSF;
- GLR in the reference model is corresponding to GLR in UMTS 23.20;
- SCP in the reference model includes gsmSCF;
- IP in the reference model includes gsmSRF.



Note: Selection of the actual protocols in the reference points is an operator matter.

AuC	Authentication Center
BS	Base Station
EIR	Equipment Identity Register
GGSN	Gateway GPRS Support Node
GLR	Gateway Location Register
GMSC	Gateway Mobile Switching Center
HLR	Home Location Register
IP	Intelligent Peripheral
MSC	Mobile Switching Center
MT	Mobile Terminal
(A/D-)RNC	(Anchor/Drift-)Radio Network Controller
SCP	Service Control Point
SGSN	Serving GPRS Support Node
VLR	Visitor Location Register
UIM	User Identity Module

Fig.9.1: Reference model for IMT-2000

9.2 **Interfaces to be standardized** (FFS: MPT's main responsibility)

9.3 Evolved GSM CN related interfaces (CC&MM, MAP, CAP, GPRS interfaces)

CN related interfaces for 3G mobile system is based on the GSM/GPRS specifications. It is likely that the capabilities are enhanced from the contemporary GSM/GPRS specifications in order to fulfill a variety of requirements in this document.

CC & MM

It is thought that fundamental concept of Call Control and Mobility Management will not be changed.

3G mobile system should support the capability of multimedia services according to existing and emerging multimedia standards. The capabilities to be realized can be for instance asymmetric up-link/down-link communication, simultaneous use of multiple services associated with separate calls, bearer negotiation. It also means the services from low bit rate to high bit rate. ATM is expected as transmission technique for network efficiency. If ATM is used, the signaling protocol for ATM will be needed for call control. However regarding associated signaling, it is not necessary to enhance ISUP.

As for mobility management, further co-ordination function can be thought of packet mode and circuit mode.

MAP

MAP is one of the most widely spread protocol for mobility handling. MAP for 3G mobile system will be based on the evolution of GSM MAP so as to use the common specification and realize global roaming.

CAP

3G mobile system supports VHE, which enable a user to be offered the same service capabilities in a visited network as in his home network. It is important capability for a more flexible service creation environment, faster deployment of new service, and service differentiation.

It is realized by utilizing CAMEL mechanism based on INAP protocol, which has been developed to provide IN service.

GPRS

Packet service is also supported in 3G mobile system in order to access Internet and provide data communications. To make a common specification, it will be based on GPRS being developed in ETSI.

The current GPRS specification defines mobility management function of packet mode independently from or in addition to ones for circuit mode. However further co-ordination can be thought, when it comes to the network model based on the equivalent of both modes or based on further integration. It is needed to take Applying ATM and further coordinate mobility management into consideration.

3G mobile system should also keep up with Packet related standards stream.

9.4 New UTRAN interfaces (Iu, Iur)

9.5 New radio interface

The radio interface is layered into three protocol layers; the physical layer (L1), the data link layer (L2) and network layer (L3).

The physical layer offers information transfer services to MAC and higher layers. A general classification of transport channels is into two groups:

- common channels (where there is a need for inband identification of the MSs when particular MSs are addressed) and
- dedicated channels (where the MSs are identified by the physical channel, i.e. code and frequency for FDD and code, time slot and frequency for TDD).

Layer 2 is split into two sublayers, Logical Access Control (LAC) and Medium Access Control (MAC). MAC offers Data transfer, Reallocation of radio resources and MAC parameters and Reporting of measurements. LAC offers LAC connection establishment/release, Transparent delivery , Unacknowledged delivery , Acknowledged delivery, Multicast delivery of layer 3 messages (only for U-plane), QoS setting(only for U-plane) and Notification of unrecoverable errors.

Layer 3 offers following requirements;

- It should be possible to broadcast non-access stratum information in a certain geographical area.
- The information is transferred on an unacknowledged mode link. Unacknowledged mode means that the delivery of the broadcast information can not be guaranteed (typically no retransmission scheme is used). It seems reasonable to use an unacknowledged mode link since the information is broadcast to a lot of UEs and since broadcast information often is repeated periodically.
- It should be possible to do repeated transmissions of the broadcast information (how it is repeated is controlled by the non-access stratum).
- The point where the UE received the broadcast information should be included, when the access stratum delivers broadcast information to the core network.
- It should be possible to broadcast paging information to a number of UEs in a certain geographical area.
- The information is transferred on an unacknowledged mode link. It is assumed that the protocol entities in core network handle any kind of retransmission of paging information.
- It should be possible to broadcast notification information in a certain geographical area.
- The information is transferred on an unacknowledged mode link.
- It should be possible to establish connections (both point and group connections).
- It should be possible to transfer an initial message during the connection establishment phase. This message transfer has the same requirements as the information transfer service.

- It should be possible to release connections.
- Acknowledged mode link for transfer of messages
- A connection between two DC SAPs using an acknowledged mode link is called *signalling connection*. This link should also guarantee that no messages are lost or duplicated during handover.
- Preserved message order
- Priority handling

9.6 Evolved UIM-UE interface