TSG-SA meeting #4
21 - 23 June 1999
Miami

TSGSP#4(99)304

Title: **3G TR 23.927 version 0.1.0**

Source: **TSG SA WG2**

Purpose: **Information**

TR 23.927 V0.1.0 (1999-02)

<long doctype>

Evolution of Virtual Home Environment; UMTS 23.927 version 0.1.0

UMTS

Universal Mobile Telecommunications System

Reference
<Workitem> (<Shortfilename>.PDF)

Keywords
VHE, UMTS

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Contents

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Foreword

This Technical Report (TR) has been produced by {ETSI Technical Committee|ETSI Project|<other>} <long techbody> (<short techbody>){|, and is now submitted for the {ETSI standards {Membership Approval Procedure|One-step Approval Procedure|<approval phase> phase of the ETSI standards Two-step Approval Procedure}}}.

1 Scope

This document is examining issues related to the evolution of the GSM platform towards UMTS with the overall goal of fulfilling the UMTS service requirements, the support of the UMTS role model, support of roaming and support of new functionality, signalling systems and interfaces.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[x] GSM 01.04 (ETR 350): ”Digital cellular telecommunication system (Phase 2+); Abbreviations and acronyms”

[x] UMTS 22.01: ”Universal Mobile Telecommunications System (UMTS): Service Aspects; Service Principles”.

[x] UMTS 22.05: “Universal Mobile Telecommunications System (UMTS); Services and Service Capabilities”.

[x] UMTS 22.xx: “Universal Mobile Telecommunications System (UMTS); Virtual Home Environment”.

[x] Other UMTS specs ??

[x] GSM 02.57: ”Digital cellular telecommunication system (Phase 2+); Mobile Station Application Execution Environment (MExE); Service description”

[x] GSM 02.78 Release 1999: ”Digital cellular telecommunication system (Phase 2+); Customised Applications for Mobile network Enhanced Logic (CAMEL); Service definition - Stage 1”

[x] GSM 11.14: ”Digital cellular telecommunication system (Phase 2+); Specification of the SIM Application Toolkit for the Subscriber Identity Module - Mobile Equipment; (SIM - ME) interface”

[x] GSM 02.60: "Digital cellular telecommunication system (Phase 2+); General Packet Radio Service (GPRS); Service Description Stage 1".

[x] GSM 02.90 Release 1997: "Digital cellular telecommunication system (Phase 2+); "Stage 1 Decision of Unstructured Supplementary Service Data (USSD)".

[x] GSM 02.03 (ETS 300 905): "Digital cellular telecommunication system (Phase 2+); Teleservices supported by a GSM Public Land Mobile Network (PLMN)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the [following] terms and definitions [given in ... and the following] apply.

<defined term>: <definition>.

example: text used to clarify abstract rules by applying them literally.

3.2 Abbreviations

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

<ACRONYM> <Explanation>

4 Support of the Virtual Home Environment concept

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.

Users VHE capability will be supported from both UMTS and GSM access, subject to the relevant limitations of the GSM/GPRS core networks. This means that mechanisms are required to support the delivery of VHE capability when handover between GSM/GPRS and UMTS occurs. The impact of the handover between GSM and UMTS on VHE should be minimised.

The design of the UMTS architecture has a strong impact on the efficient realisation of the Virtual Home Environment (VHE). In UMTS phase 1 VHE consists of: GSM services & roaming principles and service capabilities. UMTS phase 1 service capabilities are:

Bearers:

- GSM CS data,
- UMTS bearers for circuit and packet,
- GSM GPRS data and,
- SMS & USSD[1].

Mechanisms:

- CAMEL,
- MExE and,
- SIM Toolkit.

In the following, different mechanisms for the distribution of software, service logic and service data, are shown. Typically service may be formed from a combination of these mechanism.

[1] Note : SMS is originally defined as a Teleservice and USSD as part of the GSM Supplementary Service operations. This means that they were originally intended for both presentation of- and carrier of end-user information (e.g. the SMS-alphabet for SMS), but has over time evolved into bearers of encoded application information (e.g. carrying WAP information).

4.1 Modelling of VHE Implementation Approaches

This section presents a model which can be used as a basis for a comparison of VHE technical implementation options.

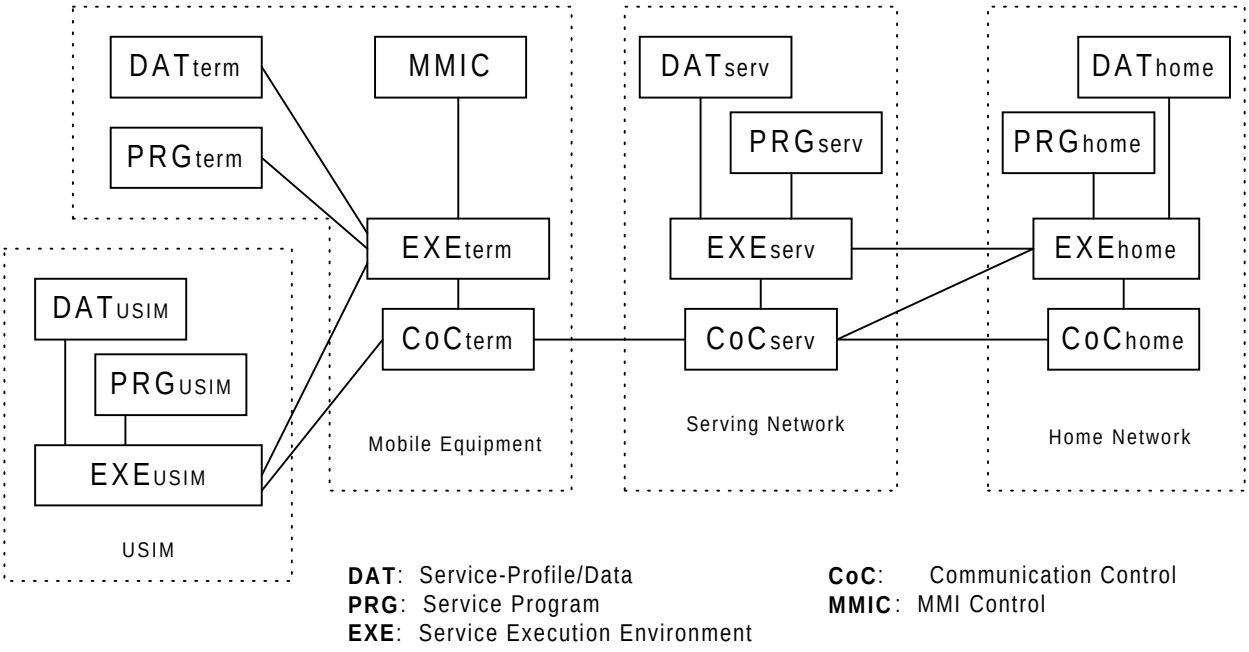

Figure 1 Basic VHE architecture model

The following **functional components** are introduced:

PRG The Service Program describes behaviour of a service and its corresponding service elements by means of (standardised) commands. The behaviour described by the PRG may be standardised, network- or even user-specific.

EXE The Service Execution Environment provides (standardised) platform to execute a service program and provides access to the communication resources. The service execution environment is accessed via (standardised) Application Programmers Interfaces (API), e.g. Java-based. The execution environment also protects the communication control from unauthorised access.

DAT The Service Profile/Data provides user- or network-specific input data to run a service program

CoC The Communication Control handles actual communication (i.e. allocates bearers, handling of SMS, etc.)

MMIC The MMI Control provides network/user-specific control of MMI (triggered by Execution Environment)

The corresponding **network components** are:

ME The Mobile Equipment which provides CoC, EXE, DAT, PRG, MMIC

USIM The User Service Identity Module, which may provide user-specific and probably also home network specific DAT and PRG as well as an EXE

Home Network The Home Network, which holds CoC, DAT, PRG as well as EXE

Visited Network The Serving or visited Network, which holds similar to the home network CoC, EXE, PRG, DAT

The implementation of VHE raises questions such as:

- Which party provides service data DAT?
- Which party provides service program PRG?
- Which execution environment EXE controls the service?
- When do the parties interact (at registration time/during call set-up)?
- Which 'service elements' are essential to create a certain 'home service experience'?
- Which parts of the service program has to be download (complete or only parts) ?
- Which kind of communication and/or synchronisation between different service programs has to be defined?

A key characteristic of the architecture model is that service data and service programs may be stored in a distributed way in the UMTS network (e.g. home network, serving network, ME, USIM). The data and program codes may be transferred in a flexible way in the network (either 'downloaded' or 'pushed', indicated by doted arrows in the following figures) as required by the service provider and/or user. A flexible co-ordination and administration (e.g. validity, update procedures, location, etc) of the transferred programs and data has to be defined to maintain the network.

4.2 Possible mechanisms to realise VHE

The following possible solutions for the realisation of VHE were identified, which differ in the "place" where the service execution (service control) is located:

- Service Execution in the Home Network
- Service Execution in the USIM
- Service Execution in the Mobile Equipment
- Service Execution in the Serving Network

The following sections will demonstrate how these identified possibilities could be fulfilled by existing GSM toolkits (e.g. CAMEL, SIM-Toolkit, MExE) and new techniques. They also show how the architecture model is used for the different scenarios and which components are involved.

4.2.1 Service Execution within the Home Network

The service execution within the home network gives the subscriber the possibility to use his own VHE services ('service tunnelling') although 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.

Possible Realisation: Evolved CAMEL/IN supports this mechanism by the use of remote procedure calls (RPC).

Requirements: The integration of packet and circuit switched service is one aspect of UMTS. Therefore also in GPRS a CAMEL control is needed. This integrates GPRS into the VHE concept.

Uses: Support of VHE in non UMTS networks, of GSM CAMEL services in UMTS, of simple Terminals and of supplementary services.

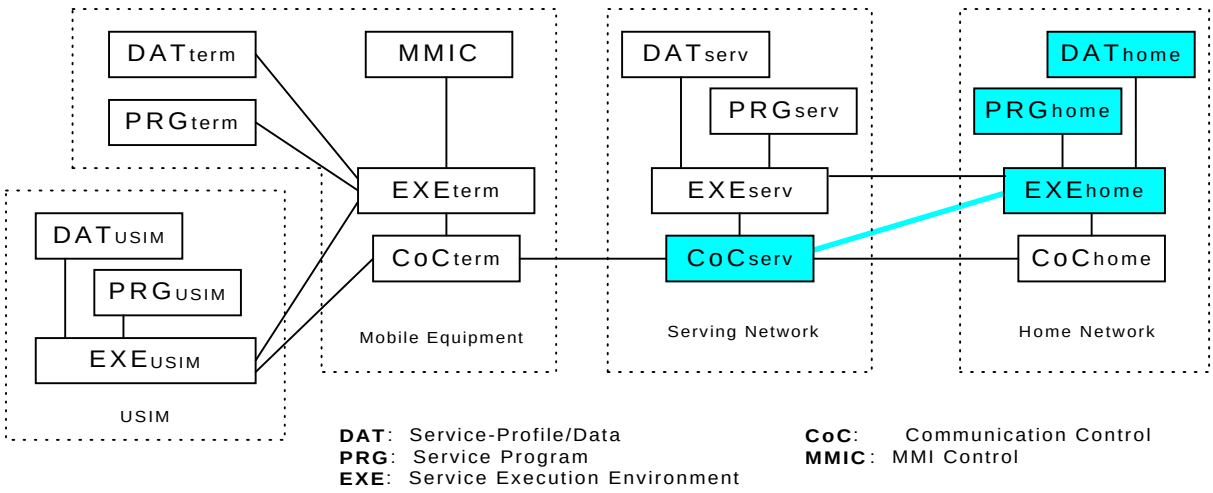

Figure 2 Involved entities (shaded) for service execution in the home network

The service control as specified in CAMEL would be described in terms of the architecture model in the following way: The execution environment of the home network directly interacts with the communication control in the serving network. The corresponding interface (API) of the communication control is either standardised (e.g. to one of the CAMEL phases) or bilaterally agreed between home and serving network. No service program and service data needs to be transferred between home and visited network.

4.2.2 Service Execution within the UMTS Subscriber Identity Module (USIM)

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

Possible Solutions: Remote Programming, (enhanced) SIM-toolkit, JavaCard

Requirements: A secure and standardised execution environment and API within the USIM is needed. This requirement lead to an open USIM operating system. An electronic certification process by using hash algorithms or encryption techniques can be used to guarantee the source and the quality of the downloaded software. Also the copyright question has to be solved.

Uses: This mechanism can be used for personalised MMI for operator specific services, banking application or update of subscriber data.

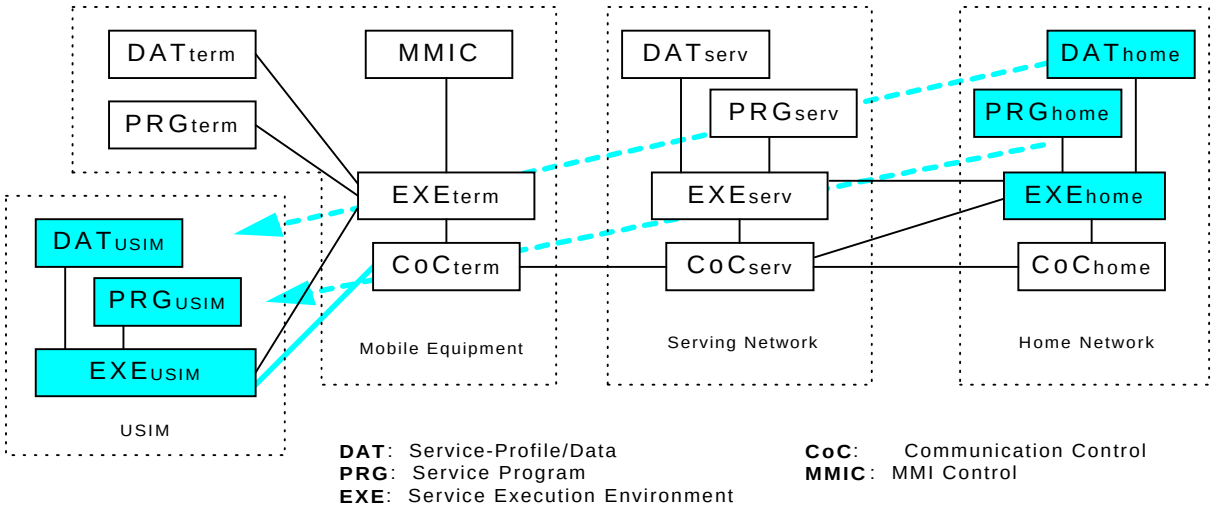

Figure 3 Involved entities (shaded) for the service execution in the USIM

The case of the SIM-toolkit is covered by the capability of the USIM to store service data and programs as well as to provide an execution environment, which interacts with the mobile terminal.

4.4.3 Service Execution within the Mobile Equipment

Similar to the mechanism for the USIM also a download of software into the mobile equipment (ME) 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 one 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.

Possible Solutions: Remote Programming, Mobile Station Execution Environment (MExE), Wireless Application Protocol (WAP), Suns Java-Technology

Requirements: Similar to the USIM a secure and standardised execution environment and API within the terminal is needed. This requirement lead to an open terminal operating system. Also similar to the USIM requirements an electronic certification process by using hash algorithms or encryption techniques can be used to guarantee the source and the quality of the downloaded software. Also the copyright question has to be solved.

In addition one new aspect has to be considered. ME software could exist which is only operating with a specific USIM enabling adaptation and personalisation of ME functions which are related to a specific subscription and should not be available for another one. In contrast is the Non-USIM related software e.g. codec updates.

Uses: Codec update, firmware update, download of announcements, enhancements of applications in general.

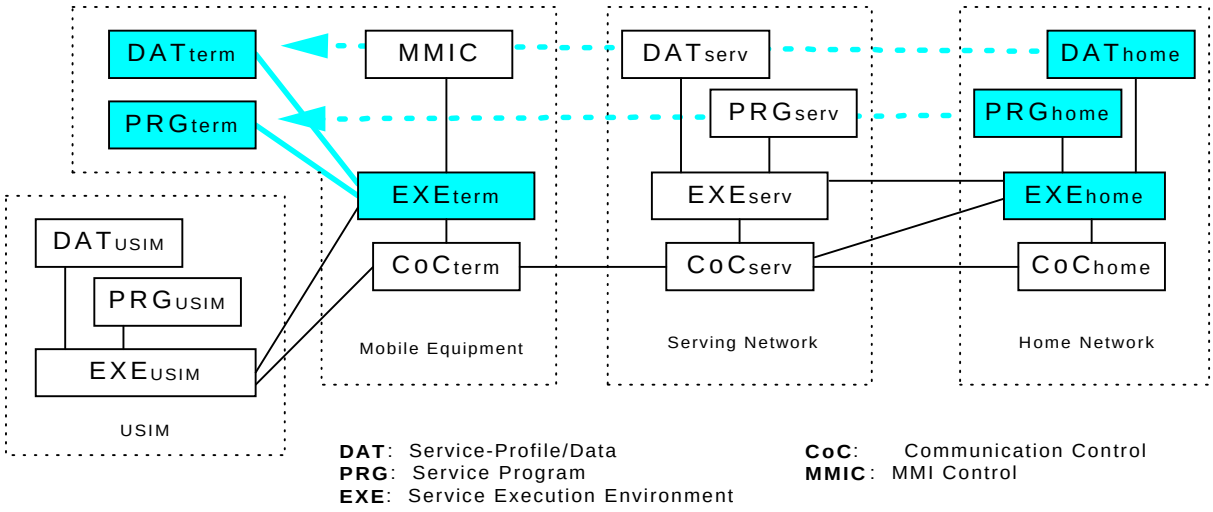

Figure 4 Involved entities (shaded) for the service execution in the Mobile Equipment

The case of a **mobile station execution environment** is covered in the following way: the execution environment in the terminal would use service programs and user specific data provided by the ME or the USIM to interact with the communication control and MMI control. The service program and data may have been downloaded from the home or even serving network.

4.4.4 Service Execution within the Serving Network

Execution of standardised GSM services or download of software into the serving network.

Possible Solutions: Remote Programming

Requirements: Secure and standardised execution environment within the serving network, open system, certification of software, copyrights, secure API. But also a standardised protocol is required for the secure and efficient transfer of the relevant service data across network boundaries.

Uses: Download of announcements, Upload of user data (e.g. from the USIM) into the visited network e.g. the VLR.

4.4.4.1 Downloading of user-specific service data from the home network to the serving network, Service Execution of Standardised Services

One mechanism relies on interaction between execution environments of home and serving network, which also may imply the download of user-specific service data from the home network to the serving network. The actual interaction with the communication control of the serving network will be carried out by the serving network. No program code is exchanged, as the behaviour and input parameters of the services are either standardised or bilaterally agreed between home and serving network.

For execution of standardised 2nd generation GSM services the existing GSM roaming principles shall be used, which means MSC/VLR services are executed by the serving network.

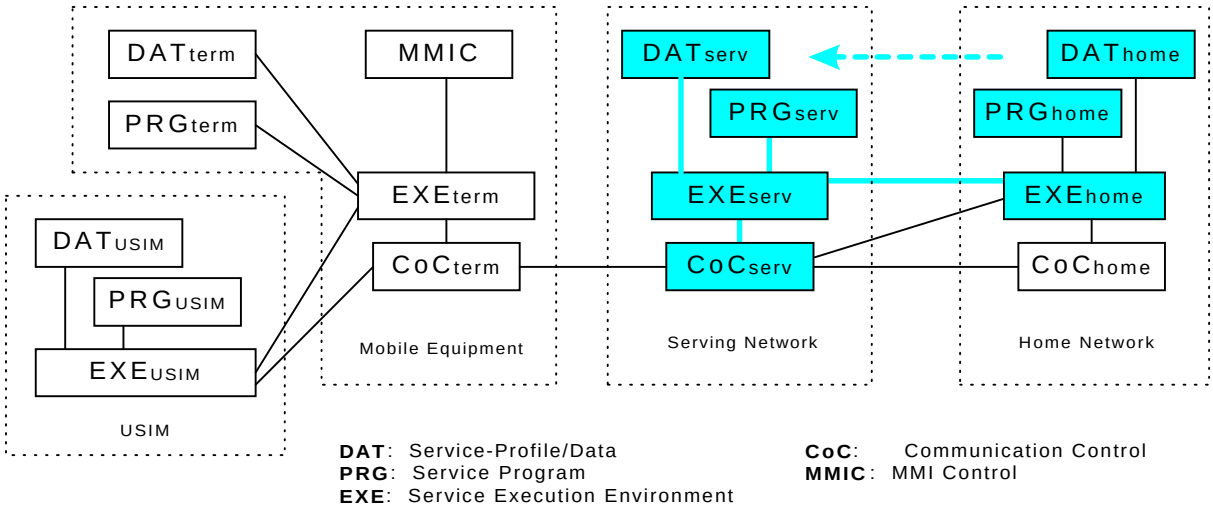

Figure 5 Involved entities (shaded) for the service execution in the serving network by downloading of only data from the home network

4.4.4.2 Downloading from the home network to the serving network

This scenario is included for completeness only and is not considered for the first phase of UMTS.

The approach of **downloading of service programs** (e.g. Java programs) between networks would be described by a transfer of service programs and associated service data or only the service programs from the home to the serving network. The execution environment in the serving network uses these downloaded program and data to interact with the communication control. The execution environment needs to be standardised

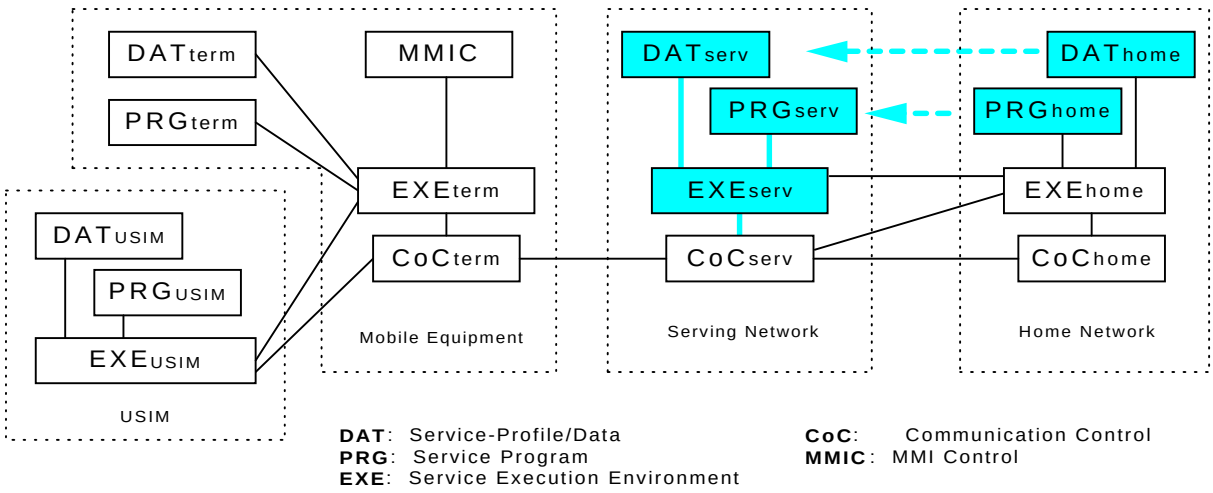

Figure 6 Involved entities (shaded) for the service execution in the serving network by downloading of service program and data from the home network

4.4.4.3 Uploading from the USIM to the serving network

This scenario is included for completeness only and is not considered for the first phase of UMTS.

As an extension of example above, the service data and programs to be run on a the execution environment in the serving network may be stored also in the USIM and **uploaded from the USIM to the serving network**. By doing so, the user may modify the service data and program according to his current needs without needing interaction with his home network.

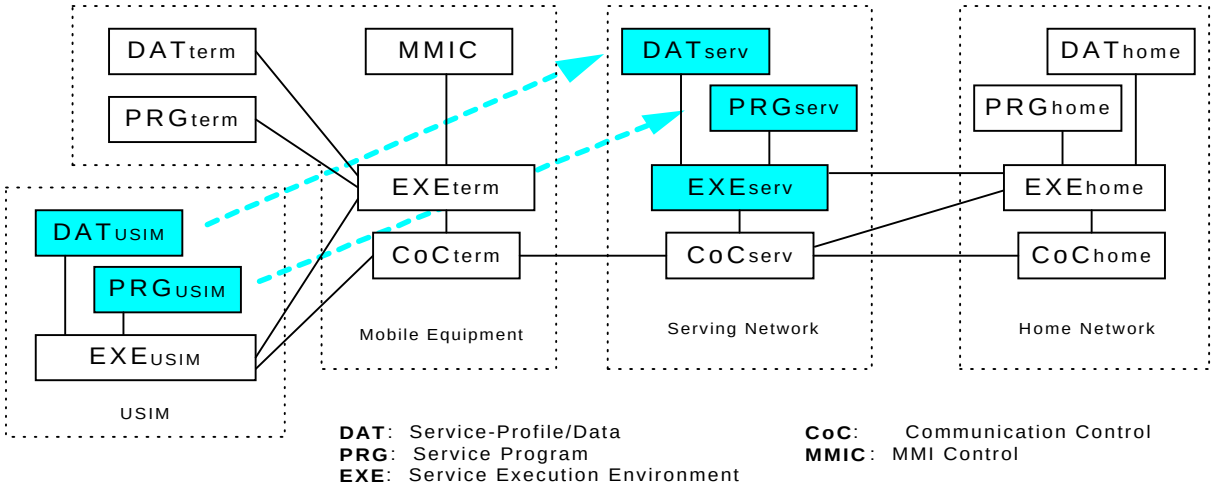

Figure 7 Involved entities (shaded) for the service execution in the serving network by downloading of service program and data from USIM

4.5 Service Differentiation

4.5.1 Flexible Teleservices

<< Comments are needed on the extent to which such a network could address the concepts of flexible teleservices defined in the requirements for UMTS. One question raised by this is whether the teleservices would be entirely implemented end-to-end and would therefore be transparent to the UMTS network, or whether they would be implemented in a different way over the radio interface requiring an interworking unit in the UMTS network.>>

4.5.2 Flexible Value Added Services and Supplementary Services

By the time of deployment of UMTS phase 1 all the existing phase 2+ GSM service capabilities (SIM toolkit, CAMEL and MS API) will have evolved considerably from today's versions. To meet the ambitious objectives of UMTS for flexible service creation a range of techniques will need to be made available. For example, any service requiring handling of the not-reachable condition will need a network-based component. Any service requiring MMI interaction with the user will require an MS-based component.

The environment for value-added and supplementary services in the phase 1 UMTS network will therefore consist of evolved versions of the existing GSM tools. These tools can be used individually, but will be most effective if they are used co-operatively (e.g. if a service implemented using CAMEL is provided with an MMI implemented using the MExE).

The range of applicability of the various techniques is suggested below:

- SIM Toolkit: The SIM Toolkit could be extended to manipulate the call handling functions internally within the terminal, communicating with the Home Network only to update the information/service logic within the terminal. By allowing the Service Provider (who owns the Home Network and USIM card) to update the Home Network and the USIM card, more flexibility in the creation of services can be obtained. This functionality could be introduced to augment the existing GSM features, thus allowing a smooth migration of services over to the new architecture while continuing to provide existing services for older mobiles.

This requires a robust, efficient core network on which to build. The functions provided by the network include security (authentication, encryption), charging and billing, and addressing.

- MExE: The MExE provides similar capabilities to those that may be available from an enhanced SIM toolkit, and the synergy between these features should be exploited. MExE may applied in cases where the capabilities of the SIM on its own, or limitations of the SIM-ME interface mean it is not feasible to implement the service by relying on the SIM.

- CAMEL: CAMEL primarily provides support for call routing and call handling services. The CAMEL approach is required if services are to operate when a mobile station is switched-off or out of coverage. CAMEL is also beneficial when a service requires access to a large, frequently updated database (e.g. for VPN or freephone services), or if it is required to optimise the use of bandwidth on the radio interface (e.g. to avoid having to present two calls over the access interface to implement a call waiting service).

4.5.3 Standardised Supplementary Services

The extent to which standardised supplementary services continue to exist in a phase 1 UMTS network is an important issue. The UMTS requirements for flexible service support suggest the objective should be to eliminate standardised supplementary services. However, this would force GSM operators to migrate many existing features (e.g. voice mail) from simple standardised services to implementations based on CAMEL, SIM toolkit or MExE. It also has impacts on the efficiency of the network.

One approach is to:

- Minimise the extent to which new standardised GSM services are created, and instead prefer solutions in GSM that implement new services though “toolkits”

- Minimise linkage between standardised services and the toolkits so that features implemented using the toolkits are self-contained and will remain useful when standardised services are removed.

5 The Evolution of the Virtual Home Environment Concept

5.1 VHE phase 1

The first phase of the VHE concept is realised within the UMTS phase 1 timeframe (release 99). VHE phase 1 consists of: GSM services & roaming principles and, service capabilities.

5.2 VHE phase 2

The VHE phase 2 is realised within the UMTS phase 1 and Camel phase 4 timeframe (release 00). VHE phase 2 consists of GSM services & roaming principles and, service capabilities.

VHE phase 2 service capabilities are:

Bearers:

- UMTS bearers for circuit and packet

- GSM CS data

- GSM GPRS data

- SMS & USSD

Mechanisms:

- CAMEL phase 4
- MExE (release 00)
- SIM Toolkit (release 00)

The VHE phase 2 should be based on the VHE mechanisms the Service Execution within the Home Network, the Service Execution within the Mobile Equipment, the Service Execution within the UMTS Subscriber Identity Module. VHE phase 2 is realised by extending the GSM toolkits Camel, MExE and SIM application toolkits further from VHE phase 1. However, VHE phase 2 still maintains the existing GSM supplementary services, roaming principles and the bearers from the VHE phase 1.

VHE phase 2 should implement a relevant subset of the ETR 22.70 requirements. Additionally, VHE phase 2 should provide a sufficient set of service creation capabilities. The set should include the capabilities derived from the functionalities of the present commonly used GSM supplementary services. A comprehensive toolkit based implementation of the most common GSM supplementary services should be achieved within VHE phase 2.

An extensive service creation capability set from VHE phase 2 would be the solid basis for a toolkit-based evolution of VHE and UMTS. The existing GSM supplementary services continue to exist in parallel with the toolkit based services at least during a transition period beyond the VHE phase 2.

5.2.1 The Functional Entity Model for VHE phase 2

The modelling used herein is strongly based on IN, because in the network side it is the primary mechanism in VHE phase 1 and phase 2. The functional entities in the network side are derived from the CS-1, CS-2 and CS-3 distributed functional plane specifications. However, the functionality of the functional entities and their interfaces are not necessarily in compliance with CS-1, CS-2 or CS-3, rather they should be as much as possible in compliance with already existing Camel phases. The functional entities within the terminal and the USIM are based on the modelling in subclause ‘Modelling of VHE Implementation Approaches’. A more precise modelling is for further study.

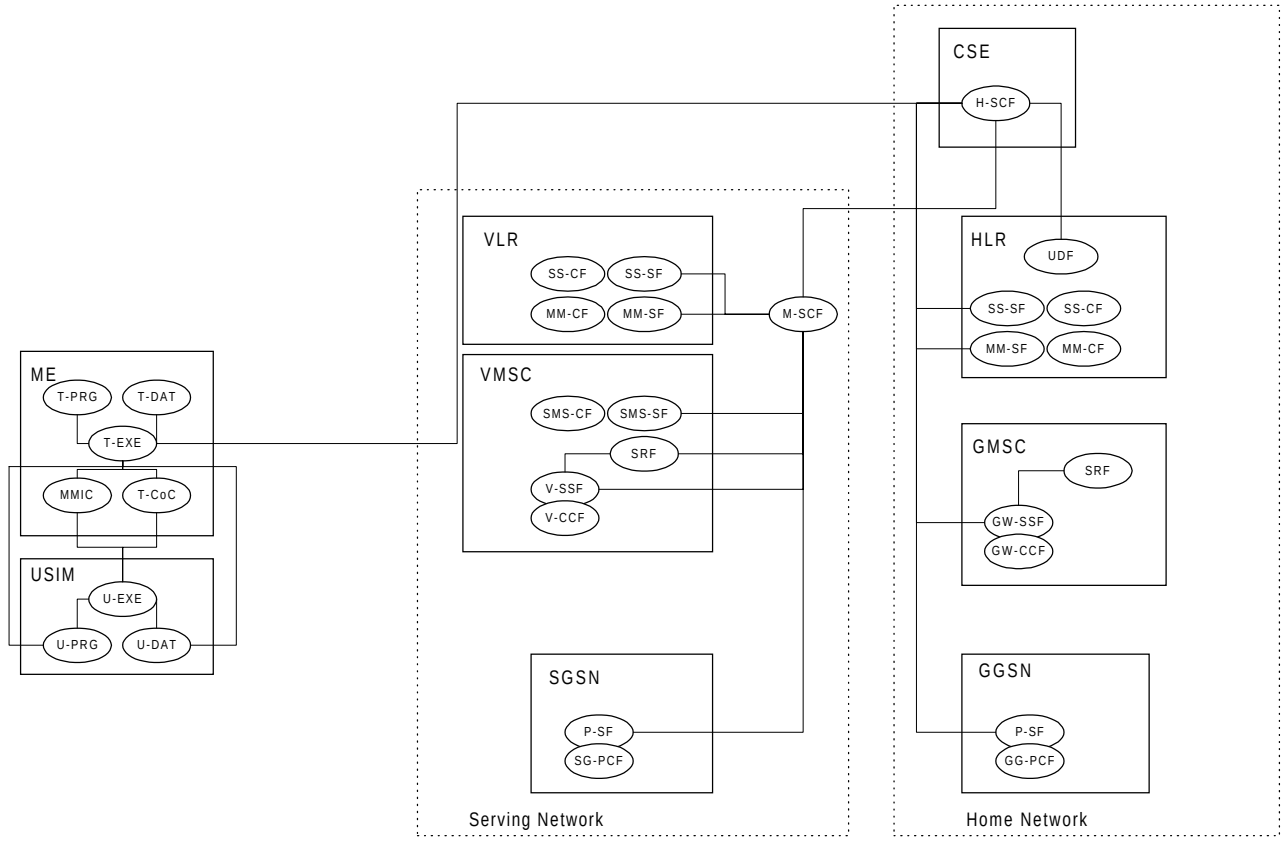

Figure 8 The VHE functional entity interfaces

5.2.1.1 The Functional Entities of the VHE Concept

The functional entities in the network side can be mapped to the more coarse level functional entities of subclause 'Modelling of VHE Implementation Approaches'. The EXE represents the SCFs, the CoC represents CCFs, CFs and PCF, while the DAT represents data in the SDFs and PRG the service logic program instances executing in the SCFs.

The Functional Entities within the Terminal

T-CoC Terminal Communication Control
The T-CoC interacts with the signalling protocol layers. It is responsible for establishing, maintaining and releasing transactions like calls, packet data sessions and short message handling between the terminal and the network. It is responsible for controlling mobility management procedures and supplementary service handling. Additionally, it provides the T-EXE and U-EXE with a standardised API that enables the EXEs to request methods and to receive exceptions associated with CoC functions. Generally, the API should enable a sufficient control over each of the types of communication transactions that CoC supports (e.g. call control, packet data, mobility management and supplementary service management).

MMIC Man-Machine Interface Control
The MMIC interacts with the terminal specific user interface functions. Additionally, it provides the T-EXE and U-EXE with a standardised API that covers the terminal specific differences as far as possible. However, manufacturer specific extensions to this API must be allowed.

T-EXE Terminal service Execution Environment
The T-EXE executes a customised service logic (e.g. Java), which enables the creation of user and service provider specific services that alter the behaviour of the terminal itself. It receives method invocations and notifications from the MMIC and T-CoC when different procedures and events are handled in the terminal. The services may alter the behaviour of terminal in the course of call and packet data session handling, SMS handling, location management procedures, supplementary service handling and user interface dialogues. The T-EXE may provide the entire user interface logic, leaving only low-level user interface control for the terminal platform functions.

The implementation of T-EXE relies on MExE at least within VHE phase 1 and 2.

U-EXE USIM service Execution Environment
The U-EXE is very much similar to T-EXE except that it resides in the USIM. However, U-EXE is subject to the limitations of the SIM card environment.

The implementation of the relies on enhanced SIM application toolkit within VHE phase 1 and 2.

The Functional Entities within the Network

Call Control Functions (CCFs)

The CCFs are mapped to CoCserv or CoChome as specified in the subclause ‘Modelling of VHE Implementation Approaches’..

The CCFs represent all the high-level call control application functions within a GSM/UMTS switch. They are responsible for the establishing, maintaining and releasing calls between switches and terminals. The CCFs contain the call state models. They interact with the signalling protocol stacks i.e. ISUP, RANAP and MAP, execute the functions according to signalling messages.

GW-CCF Gateway MSC Call Control Function
The GW-CCF is responsible for establishing, maintaining and releasing calls towards the VMSC. The GW-CCF routes incoming calls towards the VMSC by means of the HLR.

V-CCF Visitor MSC Call Control Function
The V-CCF is responsible for establishing, maintaining and releasing calls to and from the Iu-interface or A-interface.

Packet data Control Function (PCFs)

The PCFs are mapped to CoCserv or CoChome as specified in the subclause ‘Modelling of VHE Implementation Approaches’..

The PCFs represent all the high-level packet data session control functions within a GPRS/UMTS node. They interact with the signalling plane (i.e. GMM/SM and GTP) and execute the functions according to the signalling messages. They also may participate in packet handling and collect charging information.

GG-PCF GGSN Packet data Control Function
The PG-PCF it is responsible for PDP context creation, modification and deletion. It also routes packets between the SGSN tunnels and the external packet networks connected to the GGSN. It maintains a combined statemodel containing both the PDP context handling and packet handling aspects.

SG-PCF SGSN Packet data Control Function
The SG-PCF it is responsible for GPRS attach, GPRS detach, PDP context activation and PDP context deactivation. It maintains a combined statemodel including the GPRS mobility management, PDP context handling and packet handling aspects. It may affect packet routing between the Iu-interface or Gb-interface and the Gn-interface.

Control Functions (CFs)

The CFs are mapped to CoCserv or CoChome as specified in the subclause ‘Modelling of VHE Implementation Approaches’. However, in this context they also may represent signalling communication instead of user plane communication.

The CFs represent the different high level call unrelated (i.e. mobility management, supplementary service handling control, SMS control related) application functions within a GSM/UMTS switch or node. Herein only the CFs of interest in VHE are listed. The CFs of interest currently are the CFs for mobility management, supplementary service handling and short message handling. As in the case of IN modelling generally, the equivalents for the CFs listed do exist irrespective of Camel involvement i.e. they are only a modelling of the native GSM/GPRS functionality. Besides, there doesn't have to be a one-to-one mapping to an actual implementation.

MM-CF Mobility Management Control Function
A MM-CF is responsible for controlling the mobility management procedures within a register. It maintains the state models for location updating, IMSI attach and detach. In the VLR it interacts with the RIL layer 3 MM protocol, the MAP protocol and the VLR database when controlling a mobility management procedure. In the HLR it interacts with the MAP protocol and the HLR database.

SS-CF Supplementary Service Control Function
A SS-CF is responsible for controlling supplementary service handling within a register. It maintains the state models for supplementary service activation, deactivation, registration and interrogation procedures. In the VLR it interacts with the RIL layer 3 SS protocol, MAP protocol, and the VLR database in the course of an SS procedure. In the HLR it interacts with the MAP protocol and the HLR database.

SMS-CF Short Message Service Control Function
The SMS-CF is responsible for controlling short message handling. It maintains the statemodel for SMS MO and SMS MT within the WMSC and IWMSC. It interacts with the MAP protocol and the RIL 3 layer SMS protocol.

Service Control Functions (SCFs)

The SCFs are mapped to EXEserv or EXEhome as specified in the subclause ‘Modelling of VHE Implementation Approaches’. However, when executing a service the SCF includes also the PRG aspects i.e. the service logic program instance.

The SCFs are responsible for executing the service logic for customised services. An SCF receives triggering and notifications from different types of SSFs. It issues instructions to the SSFs according to its service logic.

H-SCF Home PLMN Service Control Function
The H-SCF is responsible for controlling and monitoring CCFs and CFs within the network to be controlled via the M-SCF. It can be notified of and it can affect various events in the network, for instance, call, packet session, mobility management and supplementary service handling within different UMTS nodes.

M-SCF Mediator Service Control Function
The M-SCF is a relay function between the H-SCF and SSFs or SFs. It provides authentication and screening for SSFs. It restricts the H-SCFs capability to affect functionalities within the visited PLMN or inquiring PLMN. It does this by performing operation and operation parameter value screenings and authorisation checks. The authority of the H-SCF to affect visited or inquiring PLMN depends on bilateral agreements between the service provider and the PLMN in question. E.g. Camel operations could be grouped into allowed and restricted operations according to these agreements. The M-SCF may also assist H-SCF by indicating resources available in the PLMN to be controlled.

The M-SCF is suggested by the ITU-T Q.FNA document. The need for an M-SCF may emerge as numerous limited trust value added service providers define services for UMTS. The M-SCF may not be needed in the cases, where the network element to be controlled and the H-SCF are under the same administration. The overall necessity of M-SCFs is for further study in the VHE standardisation. Its existence paves road for the service execution within the visited network mechanism.

Service Switching Functions (SSFs)

The SSFs are mapped to the CoCserv or CoChome as specified in the subclause ‘Modelling of VHE Implementation Approaches’.

The SSF represents the interface between the CCF and the SCF. The CCF can notify the SCF or give control to the SCF via the SSF. The SSF maintains the statemodel for the connection between the CCF and SCF.

V-SSF Visitor MSC Service Switching Function

GW-SSF Gateway MSC Service Switching Function

Service Functions (SFs)

The SFs are mapped to the CoCserv or CoChome as specified in the subclause 'Modelling of VHE Implementation Approaches'. The mentioned SFs represent the interfaces between the identified CFs and the SCF. Their purpose is analogous to the SSF which is the interface between the CCF and the SCF. A CFs can notify the SCF or give control to the SCF via its SF. A SF maintains the statemodel for the connection between the SCF and the CF in question. The SCF – SF interface operations and CF state models are SF type specific, for instance, MM-CF has its own statemodel and operations.

P-SF Packet Service Function

MM-SF MM Service Function

SMS-SF SMS Service Function

SS-SF SS Service Function

Miscellaneous Functions

SRF Specialised Resource Function
The SRF provides interface for the in-band user interface functions within an UMTS switch or an external intelligent peripheral. For instance, SRFs interface voice announcement devices, tone generator, DTMF collection and speech recognition. The SRF performs user interaction according to SCF instructions. There is no direct equivalent for SRF in the subclause 'Modelling of VHE Implementation Approaches'., however, its functions can be included inside CoCserv or CoC home.

SDFs Service Data Functions
There is no direct equivalent for SDF in the subclause 'Modelling of VHE Implementation Approaches'. The SDF can be mapped to the EXEserv or EXEhome - DAT interface. EXE models the SCF communication aspects and DAT the actual data stored in the SDF.

The SDF is the data storage function containing information about services and subscribers. It may contain both service logic programs to be executed in the SCFs and information accessed by the service logic during execution. The SDF provides an interface to the SCFs for data access. The existence of SDFs is not visible directly to the visited or the home PLMN. The existence of an SDF separable from the SCFs is manufacturer and operator option.

UDF User Data Function
There is no direct equivalent for UDF in the subclause 'Modelling of VHE Implementation Approaches'. The UDF can be mapped to the EXEserv or EXEhome - DAT interface. EXE models the SCF communication aspects in HLR side and DAT the actual data stored in the HLR.

The UDF (user data function) represents the subscriber, user and user profile data within the HLR. It is a passive data function that can be enquired and updated with user data manipulation operations. The UDF is separate from MM-CF and SS-CF, which are active functions for which events and triggers can be set.

5.2.1.2 The Functional Entity Interfaces

For each interface listed, the protocol is mentioned together with the extensions explicitly required to the existing version (e.g. Camel CAP phase 2), or to the release 99 version (e.g. Camel CAP phase 3), if they are still not included in release 99 version. Some of the mentioned extensions are required purely to implement the 22.70 requirements and some of the mentioned extensions are needed to bring the level of VHE service creation capabilities up to the level of most common existing GSM supplementary services (i.e. that these services could be implemented using toolkits. However, the existing GSM supplementary services are not abandoned in the VHE phase 2).

Even though the H-SCF – M-SCF interface exists, the intra PLMN interfaces should be standardised in order to enable compatibility between manufacturers and to provide a consistent set of PLMN capabilities for the H-SCF – M-SCF interface.

M-SCF – SSF interface

CAMEL CAP, extended at least with the original SMG1 Consolidated CAMEL Phase 3 feature list, the VMSC T-BCSM (which enables the capability to support VMSC controlled Camel based supplementary services for terminating calls e.g. of type call transfer, call hold, conditional call forwarding and the sending of AoC parameters to MS) and prepaid charging capabilities. Prepaid charging may not be applicable in all the networks, but the option for it should be enabled by the standards.

M-SCF – SS-SF

CAMEL CAP, extended with SS activation, deactivation and registration state models. It provides the capability for the SCF to be notified of and intercept GSM supplementary service activation, deactivation, registration and interrogation procedures between the MS, VLR and HLR.

M-SCF – SMS-SF

CAMEL CAP, extended with state models and detection points for MO and MT SMS.

M-SCF – MM-SF

CAMEL CAP, extended with location updating, IMSI attach and detach state models, capability for SCF to be notified of these procedures. Capability for the SCF to prohibit location updating.

M-SCF – P-SF

CAMEL CAP, extended with packet data session state models and at least the support for prepaid services and SoLSA.

M-SCF – UDF

MAP, extended with subscriber, user and user profile data enquiry and modification operations for SCF.

M-SCF/H-SCF – SRF

CAMEL CAP.

M-SCF/H-SCF – SDF

CS-2 compliant SCF – SDF interface.

M-SCF – H-SCF

Partially CS-2 compliant SCF – SCF interface, extended with transparent relay for CAMEL CAP operations. The mapping of SCF – SCF interface operations to CAMEL CAP CSE – network element operations should be as straightforward as possible and one to one. Therefore, the existence of M-SCF does not violate the Direct Home Command principle.

Non transparent relay is also applicable where enabled with bilateral agreements between the H-SCF and M-SCF.

T-EXE/U-EXE – T-CoC

Standard, extendible Java API for GSM/UMTS terminal functions including at least call, packet data, MM, SS, SMS and USSD, EXE initiated operations and CoC raised exceptions. The interface must be subject to manufacturer specific extensions.

T-EXE/U-EXE – MMIC

Standard, extendible Java API for GSM/UMTS terminal user interface, including API for different user interface objects and exceptions. The interface must be subject to manufacturer specific extensions.

T-EXE/U-EXE – PRGs/DATs

Standard, extendible Java API for a service data storage function.

T-EXE/U-EXE – network application interface

WTP (wireless transport protocol) compliant. Application protocol is operator specific according to mutual agreement between T-EXE/U-EXE service logic provider and the network application administrator. The SCFs and SDFs are treated as arbitrary network applications.

History

Document history		
0.0.0	1999-02-04	Initial draft of document (copied from chapter 7.6 of 23.20 V1.4.0)