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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Railway Telecommunications (RT).

Introduction

While the legacy architecture for a GSM-R network relies on the Rel-99 versions of the 3GPP/ETSI Technical Specifications, the technical evolutions in the area of Core Network architecture led some railways operators to deploy equipments based on the network architecture as described optionally in Rel-4 versions of the 3GPP/ETSI Technical Specifications. This Technical Specification addresses the description of Rel-4 Core Network Architecture and interface requirements for application on railway networks.

1 Scope

The present document describes the Rel-4 Core Network architecture as depicted in the Rel-4 version of the 3GPP/ETSI Technical Specifications for application on railway networks in order to provide the ability for railway operators to deploy a Rel-4 CN architecture, also known as Bearer Independent Core Network.

It then specifies the requirements on interfaces and procedures to operate such a Rel-4 Core Network architecture for railway usage.

The present document does not mandate Rel-4 CN architecture to become the reference architecture for railways, baseline for railway telecommunications remaining the Rel-99 version of the 3GPP/ETSI Technical Specifications.

Also the present document focuses on the changes from a Rel-99 to a Rel-4 CN architecture for the CS domain, as PS domain equipments and interfaces are not affected by the deployment of BICN.

The present document is focussing on the requirements concerning the architecture and the interfaces only. It does not take into consideration any other features or applications inserted into 3GPP/ETSI versions later than Rel-99.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are necessary for the application of the present document.

- [1] ETSI TS 123 002 (V3.6.0): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Network Architecture (3GPP TS 23.002 version 3.6.0 Release 1999)".
- [2] ETSI TS 123 002 (V4.8.0): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Network architecture (3GPP TS 23.002 version 4.8.0 Release 4)".
- [3] ETSI TS 123 205 (V4.11.0): "Universal Mobile Telecommunications System (UMTS); Bearer-independent circuit-switched core network; Stage 2 (3GPP TS 23.205 version 4.11.0 Release 4)".
- [4] European Integrated Railway Radio Enhanced Network: "UIC Project EIRENE System Requirements Specification" P0011D010 Version: 15.1 dated 1st June 2010.
- [5] ETSI EN 300 925 (V7.0.2): "Digital cellular telecommunications system (Phase 2+) (GSM); Voice Group Call Service (VGCS) - Stage 1 (GSM 02.68 version 7.0.2 Release 1998)".
- [6] ETSI TS 100 933 (V8.2.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Voice Group Call Service (VGCS); Stage 2 (GSM 03.68 version 8.2.0 Release 1999)".
- [7] ETSI TS 100 948 (V8.1.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Group Call Control (GCC) protocol (GSM 04.68 version 8.1.0 Release 1999)".
- [8] ETSI EN 300 926 (V8.0.1): "Digital cellular telecommunications system (Phase 2+) (GSM); Voice Broadcast Service (VBS) - Stage 1 (GSM 02.69 version 8.0.1 Release 1999)".

- [9] ETSI TS 100 934 (V8.2.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Voice Broadcast Service (VBS); Stage 2 (GSM 03.69 version 8.2.0 Release 1999)".
- [10] ETSI TS 100 949 (V8.1.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Broadcast Call Control (BCC) protocol (GSM 04.69 version 8.1.0 Release 1999)".
- [11] ETSI TS 124 008 (V3.20.0): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Mobile radio interface Layer 3 specification; Core network protocols; Stage 3 (3GPP TS 24.008 version 3.20.0 Release 1999)".
- [12] ETSI TS 100 590 (V8.5.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Mobile-services Switching Centre - Base Station System (MSC - BSS) interface; Layer 3 specification (GSM 08.08 version 8.5.0 Release 1999)".
- [13] ETSI TS 129 002 (V3.20.0): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Mobile Application Part (MAP) specification (3GPP TS 29.002 version 3.20.0 Release 1999)".
- [14] ETSI TS 122 002 (V3.6.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); Circuit Bearer Services (BS) supported by a Public Land Mobile Network (PLMN) (3GPP TS 22.002 version 3.6.0 Release 1999)".
- [15] ETSI TS 122 003 (V3.3.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); Circuit Teleservices supported by a Public Land Mobile Network (PLMN) (3GPP TS 22.003 version 3.3.0 Release 1999)".
- [16] ETSI TS 122 067 (V3.0.1): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); enhanced Multi-Level Precedence and Pre-emption service (eMLPP) - Stage 1 (3G TS 22.067 version 3.0.1 Release 1999)".
- [17] ETSI TS 100 932 (V7.2.0): "Digital cellular telecommunications system (Phase 2+) (GSM); enhanced Multi-Level Precedence and Pre-emption service (eMLPP); Stage 2 (3GPP TS 03.67 version 7.2.0 Release 1998)".
- [18] ETSI TS 124 067 (V3.2.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); Enhanced Multi-Level Precedence and Pre-emption service (eMLPP); Stage 3 (3GPP TS 24.067 version 3.2.0 Release 1999)".
- [19] ETSI TS 124 082 (V3.0.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); Call Forwarding (CF) supplementary services - Stage 3 (3G TS 24.082 version 3.0.0 Release 1999)".
- [20] ETSI EN 301 702 (V7.1.2): "Digital cellular telecommunications system (Phase 2+) (GSM); User-to-User Signalling (UUS); Service description, Stage 1 (GSM 02.87 version 7.1.2 Release 98)".
- [21] ETSI EN 301 710 (V7.0.2): "Digital cellular telecommunications system (Phase 2+) (GSM); User-to-User Signalling (UUS); Stage 2 (GSM 03.87 version 7.0.2 Release 1998)".
- [22] ETSI EN 301 711 (V7.0.2): "Digital cellular telecommunications system (Phase 2+) (GSM); User-to-User Signalling (UUS); Stage 3 (GSM 04.87 version 7.0.2 Release 1998)".
- [23] ETSI TS 122 090 (V3.1.0): " Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); Unstructured Supplementary Service Data (USSD) - Stage 1 (3G TS 22.090 version 3.1.0 Release 1999)".
- [24] ETSI TS 123 090 (V3.2.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); Unstructured Supplementary Service Data (USSD) - Stage 2 (3GPP TS 23.090 version 3.2.0 Release 1999)".
- [25] ETSI TS 124 090 (V3.0.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); Unstructured Supplementary Service Data (USSD) - Stage 3 (3G TS 24.090 version 3.0.0 Release 1999)".

- [26] ETSI TS 122 094 (V3.1.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); Follow Me Service description - Stage 1 (3G TS 22.094 version 3.1.0 Release 1999)".
- [27] ETSI TS 123 094 (V3.2.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); Follow-Me (FM); Stage 2 (3GPP TS 23.094 version 3.2.0 Release 1999)".
- [28] ETSI TS 122 004 (V3.3.0): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); General on Supplementary Services (3GPP TS 22.004 version 3.3.0 Release 1999)".
- [29] ETSI TS 129 232 (V4.17.0): "Universal Mobile Telecommunications System (UMTS); Media Gateway Controller (MGC) - Media Gateway (MGW) interface; Stage 3 (3GPP TS 29.232 version 4.17.0 Release 4)".
- [30] European Integrated Railway Radio Enhanced Network: "UIC Project EIRENE Functional Requirements Specification" P0011D009 Version: 7.1 dated 1st June 2010.

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ETSI RT(10)0056: "R4 NSS "black box" replacement type".

NOTE: Available at: http://www.uic.org/IMG/pdf/rt_10_0056.pdf.

3 Definitions and abbreviations

3.1 Definitions

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

core network: architectural term relating to the part of 3GPP System which is independent of the connection technology of the terminal (e.g. radio, wired)

3.2 Abbreviations

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

AAL2	ATM Adaptation Layer type 2
ATM	Asynchronous Transfer Mode
AuC	Authentication Center
BICC	Bearer Independent Call Control
BICN	Bearer Independent Core Network
BSC	Base Station Controller
BSS	Base Station System
BTS	Base Transceiver Station
CAP	CAMEL Application Part
CC	Call Control
CCBS	Call Completion Busy Subscriber
CFB	Call Forwarding Busy
CFU	Call Forwarding Unconditional
CH	Call Hold
CN	Core Network
CS	Circuit Switched
CS-MGW	Circuit Switched - Media Gateway
CW	Call Waiting

ECT	Explicit Call Transfer
EIR	Equipment Identification Register
GCR	Group Call Register
GERAN	GSM / EDGE Radio Access Network
GMSC	Gateway MSC
GMSC-S	Gateway MSC Server
GSM	Global System for Mobile communication
GSM-R	Global System for Mobile communication for Railways applications
HLR	Home Location Register
IMEI	International Mobile Equipment Identification
IMSI	International Mobile Station Identifier
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISUP	Integrated Service Digital Network User Part
IWF	Interworking Function
MAP	Mobile Application Part
ME	Mobile Equipment
MEGACO	MEdia GAteway COntrol
MGW	Media Gateway
MPTY	MultiParty
MS	Mobile Station
MSC	Mobile-services Switching Centre
MSC-S	MSC Server
PLMN	Public Land Mobile Network
PS	Packet Switched
PSTN	Public Switch Telephone Network
QoS	Quality of Service
RTP	Real-Time Transport Protocol
SMS	Short Message Service
TC RT	Technical Committee Railway telecommunications
TDM	Time Division Multiplex
UDP	User Datagram Protocol
VBS	Voice Broadcast Service
VGCS	Voice Group Call Service
VLR	Visitor Location Register

4 Reference System Architecture for CS domain

This clause presents in a first part, for the sake of reminder, the legacy reference architecture of a Core Network built upon Rel-99 version of 3GPP/ETSI Technical Specifications. It then presents in a later part the reference architecture of Core Network built upon Rel-4 version of 3GPP/ETSI Technical Specifications.

The replacement of legacy CN architecture (Rel-99 CN architecture) by BICN (Rel-4 CN architecture) represents no difference with regards to functions and QoS referenced in [4] and [30] (backward compatibility: please refer to [i.1]). According to [2] a MSC/GMSC Server and a CS-MGW make up the full functionality of a MSC/GMSC.

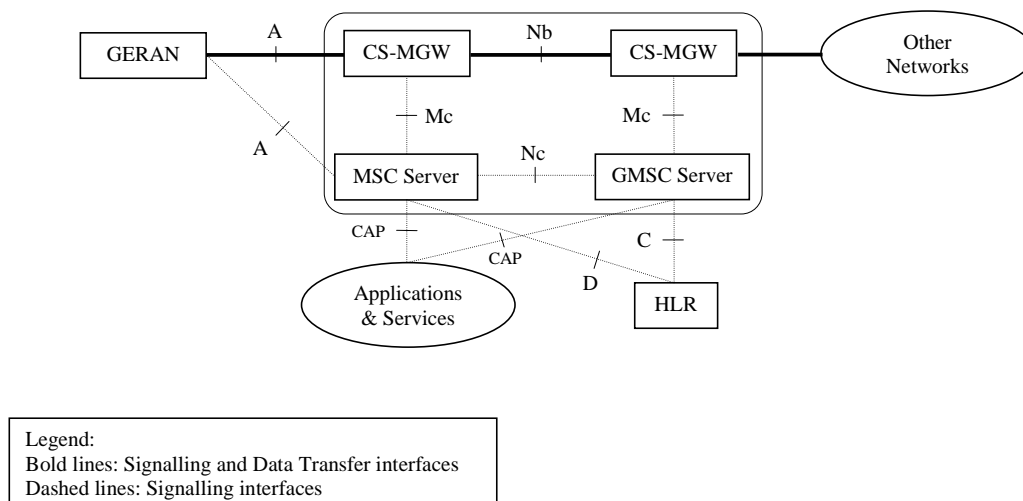


Figure 1: CS core network logical architecture using BICN

The Bearer Independent Core Network concept, introduced in 3GPP Rel-4, relies mainly on the replacement of the MSC entity by the couple MSC-Server + Media Gateway. The entities common to the PS and CS domain, such as HLR, VLR, AuC or EIR, or the entities out of the Core Network are not affected by this difference. However, the requirements on the interfaces to MSC-S or CS-MGW are described in clause 5.

As the interface between the Group Call Register function and other functions is not specified in the GSM technical specifications, and different functional splits between MSC and GCR can be implemented (see [6]), the interface between the GCR and the MSC-S is left unchanged. GCR functions in BICN shall remain as specified for a Rel-99 CN architecture.

4.1 Rel-99 Core Network architecture

In [1], the Mobile-services Switching Centre (MSC) constitutes the interface between the radio system and the fixed networks. The MSC performs all necessary functions in order to handle the circuit switched services to and from the mobile stations.

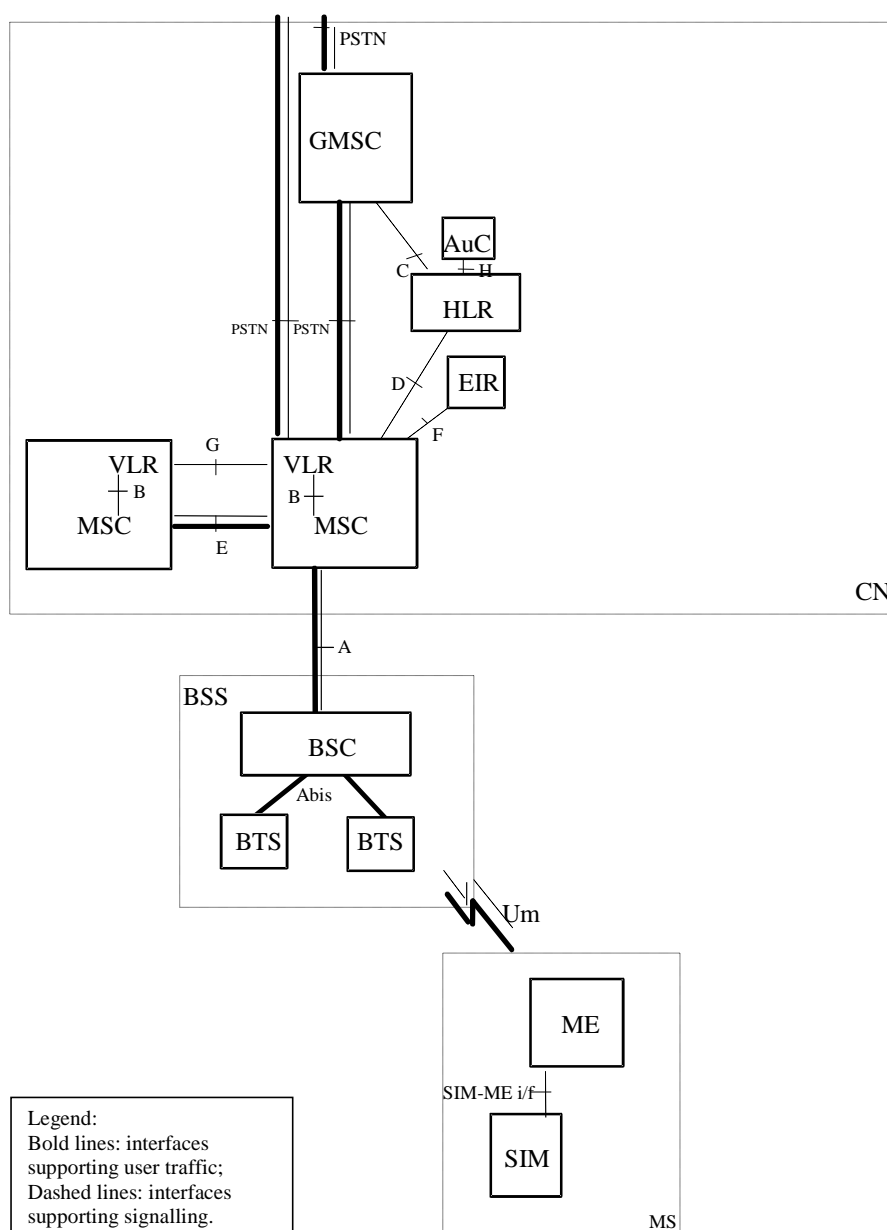


Figure 2: Basic Configuration of a PLMN using MSC entity

NOTE: The interface PSTN is used as synonym for interfaces to 'Other Networks' shown in figure 1.

The Mobile-services Switching Centre is an exchange which performs all the switching and signalling functions for mobile stations located in a geographical area designated as the MSC area. The main difference between a MSC and an exchange in a fixed network is that the MSC has to take into account the impact of the allocation of radio resources and the mobile nature of the subscribers and has to perform in addition procedures required for the location registration; and procedures required for handover.

If a network delivering a call to the PLMN cannot interrogate the HLR, the call is routed to an MSC. This MSC will interrogate the appropriate HLR and then route the call to the MSC where the mobile station is located. The MSC which performs the routing function to the actual location of the MS is called the Gateway MSC (GMSC).

If the call is a voice group/broadcast call, it is routed directly from the GMSC to the VBS/VGCS Anchor MSC, based on information (VBS/VGCS call reference) contained in the dialled number. See also [6] and [9].

4.2 Rel-4 Core Network architecture

In [2], with the BICN concept introduction, the reference system architecture for the Core Network remain the same, with the exception that the MSC is implemented in two different entities: the MSC Server, handling only signalling, and the CS-MGW, handling user's data.

This is also applicable to the GMSC: GMSC is implemented in two different entities: the GMSC Server, handling only signalling, and the CS-MGW. GMSC server and associated CS-MGW can however be implemented as a single node.

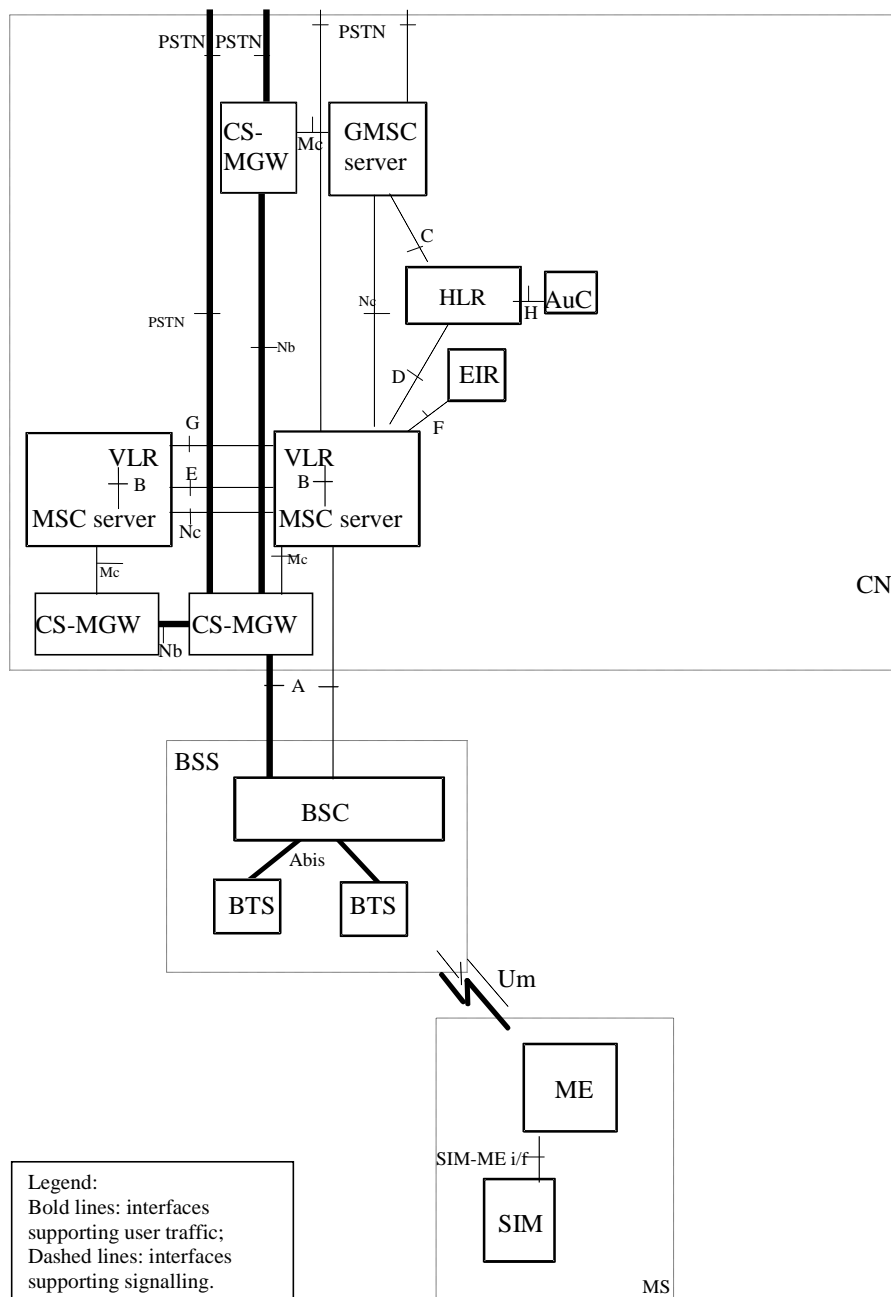


Figure 3: Basic Configuration of a PLMN using MSC-S and CS-MGW entities

4.2.1 Main concept

The circuit switched core network enables the support of different transports (e.g. ATM or IP) in a bearer-independent fashion. However this is only applicable within the BICN, external interfaces (e.g. an interface or external interfaces to other networks) shall be supported as in Rel-99 Core Network architecture.

For the ATM and IP transport, there is a strict separation between the call control level and the bearer control level. In the case of ATM or IP transport, the passage of compressed speech at variable bit rates is possible through the CS core network.

The CS core network shall employ the MSC server, GMSC server and media gateways. The GMSC server and MSC server shall provide the call control and mobility management functions, and the media gateway shall provide the bearer control and transmission resource functions. The media gateway shall contain the stream manipulating functions.

The GMSC server and MSC servers are connected to the media gateway via the Mc reference point. The MSC servers and GMSC servers are connected with the Nc reference point. There may be a number of call control transit nodes between the MSC server and GMSC server in the Nc reference point. The MGWs are connected with the Nb reference point. Also, it has to be noted that according to [3] a Rel-4 (or later) node is backward compatible with a Rel-99 (or earlier) node.

The users connected to the CS core network shall not be aware whether a MSC-S + CS-MGW combination is used, or a monolithic MSC is used.

4.2.2 MSC Server

The MSC-S mainly comprises the call control and mobility control parts of a MSC.

It is responsible for the control of mobile originated and mobile terminated CC CS Domain calls. It terminates the user-network signalling (see [11]) and translates it into the signalling over the Nc interface. It also terminates the signalling over the Mc interface with the media gateway.

The MSC-S controls the parts of the call state model that pertain to connection control for media channels in an MGW. It also contains the 'Call Control Function' in the BICC model.

The MSC-S is also integrated with a VLR to hold the mobile subscriber's service data.

4.2.3 GMSC Server

The GMSC-S mainly comprises the call control and mobility control parts of a GMSC.

The GMSC-S terminates the signalling over the Nc interface and the call control interfaces to the external networks. It also terminates the signalling over the Mc interface towards the media gateway.

The GMSC server controls the parts of the call state model that pertain to connection control for media channels in an MGW. It also contains the 'Call Control Function' in the BICC model.

4.2.4 Circuit Switched - Media Gateway Function (CS-MGW)

The CS-MGW terminates the signalling over the Mc interface from the (G)MSC-S. It also terminates the bearer part of the signalling over the A interface and the Nb interface.

A CS-MGW may terminate bearer channels from a switched circuit network and media streams from a packet network (e.g. RTP streams in an IP network). Over A, the CS-MGW may support media conversion, bearer control and payload processing (e.g. codec, echo canceller, conference bridge) for support of different A options for CS services (AAL2/ATM based as well as RTP/UDP/IP based).

The CS-MGW:

- Interacts with MSC-S and GMSC-S for resource control;
- Owns and handles resources such as echo cancellers, etc.;
- May need to have codecs.

The CS-MGW will be provisioned with the necessary resources for supporting GSM transport media. Further tailoring (i.e. packages) of the H.248 may be required to support additional codecs and framing protocols, etc.

The CS-MGW bearer control and payload processing capabilities will also need to support mobile specific functions such as handover and anchoring. H.248 standard mechanisms can be applied to enable this.

4.2.5 Identities

4.2.5.1 Bearer Address and Binding Reference

The Bearer Address is exchanged on the Nc and Mc interfaces to identify the termination point of the bearer control signalling within the peer CS-MGW.

A Binding Reference is an identity, unique within the scope of one bearer control function, which identifies a bearer network connection. This information is exchanged on the Nc and Mc interfaces. The bearer control function is identified by the Bearer Address.

4.2.5.2 CS-MGW-Id

The CS-MGW Identity (CS-MGW-Id) is information sent on the Nc interface to aid CS-MGW selection by the succeeding/preceding node.

The CS-MGW-Id is bearer independent and it can be translated into a signalling address towards the appropriate CS-MGW.

4.2.5.3 (G)MSC server Address

The (G)MSC-S Address defines the signalling address associated with the (G)MSC-S that is used to interact with the CS-MGW over the Mc interface. This is a unique address in the network service supplier domain.

5 Interfaces requirement

In this clause the existing interfaces described in Rel-99 version of the 3GPP/ETSI Technical Specifications which are affected by the introduction of MSC-S/CS-MGW in replacement of MSC are detailed and requirements on those interfaces are given.

Additionally, new interfaces introduced by the BICN concept (Mc-, Nc-, Nb- reference point) are also detailed, and requirements on those interfaces are given.

In the basic configuration presented in figures 2 and 3, all the functions are considered implemented in different equipments. Therefore, all the interfaces within PLMN are external. From this configuration, all the possible PLMN organisations can be deduced. In the case when some functions are contained in the same equipment, the relevant interfaces become internal to that equipment.

5.1 Interfaces existing from Rel-99 onwards

5.1.1 Interface between the MSC/MSC-S and Base Station System (A-interface)

The BSS-MSC interface is used to carry information concerning:

- BSS management;
- call handling;
- mobility management.

When used in BICN, the A-interface signalling terminates in the MSC-S and the user plane terminates in the CS-MGW, but the requirements for the physical layer, signalling transport mechanism, interface protocols (see [12]), and rate adaptation are left unchanged.

5.1.1.1 Interworking with GERAN (A interface)

In the A-interface the only supported user plane up to Rel-8 is a TDM circuit. The MSC-S uses the Mc interface to remotely control the TDM circuits in the CS-MGW.

For each TDM circuit a physical termination is provisioned in the CS-MGW. The TDM circuit is identified by the termination Id in the Mc interface. Since TDM circuits are also grouped together, the physical termination Ids are structured in accordance with the grouping of TDM circuits. The MSC-S also knows the termination Ids and the grouping of termination Ids. The physical termination exists as long as the TDM circuit(s) exists in the CS-MGW. For n TDM circuits, the MSC-S has a mapping table between circuits CIC1-CICn and the terminations T1-Tn.

For call-independent transactions, the general (G)MSC-S - CS-MGW procedures, as described in clause 10 of [3], apply to the physical terminations in the same way as to any other terminations.

For call related transactions the handling as described in the clauses 6, 7 and 8 of [3] apply to physical terminations in the same way as any other terminations.

For intra-MSC handover, the target A-interface is handled as described in clause 8.4.1 of [3]. If the target A-interface user plane terminates in a different CS-MGW from the CS-MGW that terminates the serving A-interface user plane, a bearer has to be established between the two CS-MGWs. Because the same MSC-S controls both MGWs, no external call control signalling is involved.

5.1.2 Interface between the MSC/MSC-S and its associated VLR (B-interface)

The VLR is the location and management data base for the mobile subscribers roaming in the area controlled by the associated MSC(s). Whenever the MSC needs data related to a given mobile station currently located in its area, it interrogates the VLR. When a mobile station initiates a location updating procedure with an MSC, the MSC informs its VLR which stores the relevant information. This procedure occurs whenever an MS roams to another location area. Also, when a subscriber activates a specific supplementary service or modifies some data attached to a service, the MSC informs (via the VLR) the HLR which stores these modifications and updates the VLR if required.

This interface is internal to the MSC and MSC-S/VLR; signalling on it is not fully standardised. When used in BICN, the MSC-S is required to perform all the tasks previously done by the MSC. It is to be noted that according to [3], the MSC-S is integrated with a VLR to hold the mobile subscriber's service data.

5.1.3 Interface between the HLR and the GMSC/GMSC-S (C-interface)

The GMSC must interrogate the HLR of the required subscriber to obtain routing information for a call or a short message directed to that subscriber.

When used in BICN, this interface is set between the GMSC-S and the HLR, but the requirements for signalling via the Mobile Application Part (MAP) protocol (see [13]) are left unchanged.

5.1.4 Interface between the HLR and the VLR (D-interface)

This interface is used to exchange the data related to the location of the mobile station and to the management of the subscriber. The main service provided to the mobile subscriber is the capability to set up or to receive calls within the whole service area.

When used in BICN, this interface is set between the VLR and the HLR, but the requirements for signalling via the Mobile Application Part (MAP) protocol (see [13]) are left unchanged.

5.1.5 Interface between MSCs/MSC-Ss (E-interface)

When a mobile station moves from one MSC area to another during a call, a handover procedure has to be performed in order to continue the communication. For that purpose the MSCs have to exchange data to initiate and then to realise the operation. After the handover operation has been completed, the MSCs will exchange information to transfer A interface signalling.

When used in BICN, this interface is set between two MSC-S, but the requirements for handover procedure, and signalling via the Mobile Application Part (MAP) protocol (see [13]) still apply. Additional requirements are described in clause 6.3.

5.1.6 Interface between MSC/MSC-S and EIR (F-interface)

This interface is used between MSC and EIR to exchange data, in order that the EIR can verify the status of the IMEI retrieved from the Mobile Station.

When used in BICN, this interface is set between the MSC-S and the EIR, but the requirements for signalling via the Mobile Application Part (MAP) protocol (see [13]) are left unchanged.

5.1.7 Interface between VLRs (G-interface)

When a mobile subscriber moves from one VLR area to another Location Registration procedure will happen. This procedure may include the retrieval of the IMSI and authentication parameters from the old VLR.

When used in BICN, this interface is set between two MSC-S, but the requirements for signalling via the Mobile Application Part (MAP) protocol (see [13]) are left unchanged.

NOTE: A configuration interfacing a MSC with a MSC-S within the same PLMN is not applicable in railway environment

5.1.8 External interface to fixed networks

The Interworking Function (IWF) is a functional entity associated with the MSC. The IWF provides the functionality necessary to allow interworking between a PLMN and the fixed networks (ISDN, PSTN and PDNs). The functions of the IWF depend on the services and the type of fixed network. The IWF is required to convert the protocols used in the PLMN to those used in the appropriate fixed network. The IWF may have no functionality where the service implementation in the PLMN is directly compatible with that at the fixed network.

When used in BICN, this functional entity is associated with the MSC-S, and the requirements to support interworking between PLMN and the fixed networks for circuit switched services in the PLMN are left unchanged.

5.2 Interfaces introduced by Rel-4 distributed architecture

5.2.1 Reference point (G)MSC server - CS-MGW (Mc Reference Point)

The Mc reference point describes the interfaces between the MSC-S and CS-MGW, and between the GMSC-S and CS-MGW. It has the following properties:

- full compliance with the H.248 standard, baseline work of which is currently carried out in ITU-T Study Group 16, in conjunction with IETF MEGACO WG.
- flexible connection handling which allows support of different call models and different media processing purposes not restricted to H.323 usage.
- open architecture where extensions/Packages definition work on the interface may be carried out.
- dynamic sharing of MGW physical node resources. A physical MGW can be partitioned into logically separate virtual MGWs/domains consisting of a set of statically allocated terminations.
- dynamic sharing of transmission resources between the domains as the MGW controls bearers and manage resources according to the H.248 protocols.

H.248/MEGACO has been jointly developed within the ITU-T and the IETF, and supports a separation of call control entities from bearer control entities, and a separation of bearer control entities from transport entities. H.248 is used on the Mc interface between the (G)MSC servers and the media gateway (see [29]).

All the general (G)MSC-S - CS-MGW procedures are further detailed in [3] clause 10.

5.2.2 Reference Point MSC Server - GMSC Server (Nc Reference Point)

The Nc reference point describes the Network-Network based call control. Any suitable call control protocol may be used over the Nc interface allowing the physical separation of the call control entities from the bearer control entities. Examples of this are ISUP or an evolution of ISUP for bearer independent call control (BICC). In the Rel-4 architecture different options for signalling transport on Nc shall be possible including IP.

The specification of the interworking between the Nc reference point, call control protocols and ISUP is outside the scope of the present document.

All the messages exchanged between (G)MSC-S are further detailed in [3], clause 16.

5.2.3 Reference Point CS-MGW - CS-MGW (Nb Reference Point)

The Nb reference point describes the interface between CS-MGWs. The bearer control signalling and transport are carried over the Nb interface. The transport may be RTP/UDP/IP or AAL2 for transport of user data. In the Rel-4 architecture different options for user data transport and bearer control shall be possible on Nb, for example:

AAL2/Q.AAL2, STM/none, RTP/H.245.

The specification of the interworking on the Nb reference point is outside the scope of the present document.

6 Additional requirements for legacy procedures in BICN

Legacy procedures handled by the MSC include call establishment / call clearing, and handover/relocation. This clause identifies the additional requirements needed for those procedures for the bearer independent CS Core Network.

6.1 Call Establishment

All the additional requirements for call establishment are described in [3]:

- Basic Mobile Originating Call (see clause 6.1).
- Basic Mobile Terminating Call (see clause 6.2).

6.2 Call Clearing

All the additional requirements for call clearing are described in [3]:

- Network Initiated (see clause 7.1).
- User Initiated (see clause 7.2).
- (G)MSC-S Initiated (see clause 7.3).
- CS-MGW Initiated (see clause 7.4).

6.3 Handover

All the additional requirements for handover are described in [3]:

- Intra-MSC GSM to GSM Handover (see clause 8.4.1).
- Basic Inter-MSC GSM to GSM Handover (see clause 8.4.2).
- Subsequent Inter-MSC GSM to GSM Handover back to the Anchor MSC (see clause 8.4.3).
- Subsequent GSM to GSM Handover to a third MSC (see clause 8.4.5).

7 Additional requirements for legacy services in BICN

Legacy services interact with the MSC in a Rel-99 CN architecture. Whenever a change for BICN architecture affects legacy services used for railways, this clause identifies the additional requirements needed for those procedures for the bearer independent CS Core Network.

7.1 GSM Basic Services

The list of the following GSM Basic services is taken from [14] and [15], VGCS/VBS taken from [5], [6], [7], [8], [9] and [10].

7.1.1 Circuit Bearer Services

Circuit Bearer Services supported by a Public Land Mobile Network are not impacted by BICN.

7.1.2 Circuit Teleservices

Circuit Teleservices (including telephony and SMS) supported by a Public Land Mobile Network are not impacted by BICN.

7.1.3 Facsimile Service

The technical Realization of Facsimile Group 3 Service - transparent and non transparent needs additional requirements in BICN, as described in [3]:

- Alternate Speech/Fax (see clause 13.17).
- GSM Fax (see clause 13.18).

7.1.4 Voice Group Call Service

The voice group call service is not impacted by BICN.

7.1.5 Voice Broadcast Service

The voice broadcast service is not impacted by BICN.

7.2 Supplementary Services

The list of the following supplementary services is taken from

- [16], [17] and [18] for eMLPP.
- [19] for Call Forwarding.
- [20], [21] and [22] for User to User signalling.
- [23], [24] and [25] for Unstructured Supplementary Service Data.
- [26] and [27] for Follow Me.
- [28] for all other supplementary services.

7.2.1 eMLPP

The enhanced Multi-Level Precedence and Pre-emption service is not impacted by BICN.

7.2.2 Call Deflection Service description

The call deflection service needs additional requirements in BICN, as described in [3]:

- Call Deflection Service (see clause 13.2).

7.2.3 Line identification Supplementary Services

The line identification supplementary services are not impacted by BICN.

7.2.4 Call Forwarding Supplementary Services

The call forwarding supplementary services need additional requirements in BICN, as described in [3]:

- Call Forwarding Unconditional (CFU) (see clause 13.4.1).
- Call Forwarding on mobile subscriber Busy (CFB) (see clause 13.4.2).
- Call Forwarding on No Reply (CFNRy) (see clause 13.4.3).
- Call Forwarding on mobile subscriber Not Reachable (CFNRc) (see clause 13.4.4).

7.2.5 Call Waiting and Call Hold Supplementary Services

The call waiting and call hold supplementary services need additional requirements in BICN, as described in [3]:

- Call Waiting (CW) (see clause 13.5).
- Call Hold (CH) (see clause 13.6).

7.2.6 MultiParty Supplementary Services

The MultiParty supplementary service needs additional requirements in BICN, as described in [3]:

- MultiParty (MPTY) (see clause 13.7).

7.2.7 Closed User Group Supplementary Service

The closed user group supplementary service is not impacted by BICN.

7.2.8 Advice of Charge Supplementary Services

The Advice of Charge supplementary service is not impacted by BICN.

7.2.9 User-to-User Signalling

The User-to-User Signalling service is not impacted by BICN.

7.2.10 Call Barring supplementary services

The Call Barring supplementary services are not impacted by BICN.

7.2.11 Unstructured Supplementary Service Data

The Unstructured Supplementary Service Data is not impacted by BICN.

7.2.12 Explicit Call Transfer Supplementary Service

The Explicit Call Transfer supplementary service needs additional requirements in BICN, as described in [3]:

- Explicit Call Transfer (ECT) (see clause 13.12).

7.2.13 Completion of Calls to Busy Subscriber Supplementary Service

The Completion of Calls to Busy Subscriber supplementary service needs additional requirements in BICN, as described in [3]:

- Completion of Calls to Busy Subscriber (CCBS) (see clause 13.13).

7.2.14 Follow Me Service description

The Completion of Follow Me service is not impacted by BICN.

7.3 Railway Specific Services and applications

The list of the following railway specific services and applications is taken from [4].

7.3.1 Confirmation of High Priority Call

The confirmation of high priority call service is not impacted by BICN.

7.3.2 Functional Addressing

The functional addressing service is not impacted by BICN.

7.3.3 Location Dependent Addressing

The location dependent addressing is not impacted by BICN.

7.3.4 Presentation of Functional Numbers to Called and Calling Parties

The presentation of functional numbers to called and calling parties is not impacted by BICN.

7.3.5 Railway Emergency Call

The railway emergency call is not impacted by BICN.

7.3.6 Railway Specific Applications

The railway specific applications (see clause 1.4.1.1 of [4]) are not impacted by BICN.

Annex A (informative): Bibliography

ETSI EN 301 515: "Global System for Mobile communication (GSM); Requirements for GSM operation on railways".

ETSI TS 102 281: "Railways Telecommunications (RT); Global System for Mobile communications (GSM); Detailed requirements for GSM operation on Railways".

ETSI TR 101 748 (V8.0.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Abbreviations and acronyms (GSM 01.04 version 8.0.0 Release 1999)".

History

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