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SERIES Q: SWITCHING AND SIGNALLING

Technical report TRQ.2141.0: Signalling requirements for the support of narrowband services over broadband transport technologies – Capability set 2 (CS-2)

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ITU-T Q-SERIES RECOMMENDATIONS

SWITCHING AND SIGNALLING

SIGNALLING IN THE INTERNATIONAL MANUAL SERVICE	Q.1–Q.3
INTERNATIONAL AUTOMATIC AND SEMI-AUTOMATIC WORKING	Q.4–Q.59
FUNCTIONS AND INFORMATION FLOWS FOR SERVICES IN THE ISDN	Q.60–Q.99
CLAUSES APPLICABLE TO ITU-T STANDARD SYSTEMS	Q.100–Q.119
SPECIFICATIONS OF SIGNALLING SYSTEMS No. 4 AND No. 5	Q.120–Q.249
SPECIFICATIONS OF SIGNALLING SYSTEM No. 6	Q.250–Q.309
SPECIFICATIONS OF SIGNALLING SYSTEM R1	Q.310–Q.399
SPECIFICATIONS OF SIGNALLING SYSTEM R2	Q.400–Q.499
DIGITAL EXCHANGES	Q.500–Q.599
INTERWORKING OF SIGNALLING SYSTEMS	Q.600–Q.699
SPECIFICATIONS OF SIGNALLING SYSTEM No. 7	Q.700–Q.799
Q3 INTERFACE	Q.800–Q.849
DIGITAL SUBSCRIBER SIGNALLING SYSTEM No. 1	Q.850–Q.999
PUBLIC LAND MOBILE NETWORK	Q.1000–Q.1099
INTERWORKING WITH SATELLITE MOBILE SYSTEMS	Q.1100–Q.1199
INTELLIGENT NETWORK	Q.1200–Q.1699
SIGNALLING REQUIREMENTS AND PROTOCOLS FOR IMT-2000	Q.1700–Q.1799
BROADBAND ISDN	Q.2000–Q.2999
General aspects	**Q.2000–Q.2099**
Signalling ATM adaptation layer (SAAL)	Q.2100–Q.2199
Signalling network protocols	Q.2200–Q.2299
Common aspects of B-ISDN application protocols for access signalling and network signalling and interworking	Q.2600–Q.2699
B-ISDN application protocols for the network signalling	Q.2700–Q.2899
B-ISDN application protocols for access signalling	Q.2900–Q.2999

For further details, please refer to the list of ITU-T Recommendations.

Supplement 31 to ITU-T Q-series Recommendations

Technical report TRQ.2141.0: Signalling requirements for the support of narrowband services over broadband transport technologies – Capability set 2 (CS-2)

Summary

This Supplement to ITU-T Q-series Recommendations is a technical report on the requirements for Capability Set 2 of the Support of Narrowband Services using Broadband Bearer Technologies. Its scope is limited to overall functionality of the Serving Node (SN) and the requirements common to associated protocols at the call control level, the bearer control level, the call-bearer interactions and the signalling transport needed to provide this capability across a variety of broadband backbone networks for Capability Set 2 (CS-2).

Source

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FOREWORD

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CONTENTS

Supplement 31 to ITU-T Q-series Recommendations

Technical report TRQ.2141.0: Signalling requirements for the support of narrowband services over broadband transport technologies – Capability set 2 (CS-2)

1 Scope

This Supplement provides requirements for the support of narrowband services via broadband transport technologies. Its scope is limited to overall functionality of the Serving Node (SN) and the requirements common to associated protocols at the call control level, the bearer control level, the call-bearer interactions and the signalling transport needed to provide this capability across a variety of broadband backbone networks for Capability Set 2 (CS-2).

2 References

[1] ITU-T Q.761 (1999), *Signalling System No. 7 – ISDN user part functional description*.

[2] ITU-T H.248 (2000), *Gateway control protocol*.

[3] ITU-T Q-series Supplement 16 (1999), *Technical report TRQ.2140: Signalling requirements for the support of narrowband services via broadband transport technologies.*

[4] ITU-T Q-series Supplement 32 (2000), *Technical report TRQ.2141.1: Signalling requirements for the Support of Narrowband Services via Broadband Transport Technologies, CS-2 – Signalling Flows*.

[5] ITU-T Q-series Supplement 35 (2000), *TRQ. 2500: Signalling requirements for call bearer interface (CS-1)*.

[6] ITU-T Q-series Supplement 36 (2000), *Technical report TRQ.3030*: *Operation of the bearer independent call control (BICC) protocol with IP bearer control protocol (IPBCP)*.

[7] ITU-T Q-series Supplement 34 (2000), *Technical report TRQ.2410: Signalling requirements CS-1 for the support of IP bearer control in BICC networks.*

[8] ITU-T H.245 (2000), *Control protocol for multimedia communication.*

[9] IETF RFC 2543 (1999), *SIP: Session Initiation Protocol*.

[10] IETF RFC 2327 (1998), *SDP: Session Description Protocol*.

[11] ITU-T Q-series Supplement 24 (1999), *Technical report TRQ.3020: Operation of the bearer independent call control (BICC) protocol with broadband integrated services digital network user part (B-ISUP) for AAL Type 1 adaptation*.

[12] ITU-T Q-series Supplement 23 (1999), Supplement to the ITU-T Q.1901 Recommendation *– Technical report TRQ.3010: Operation of the bearer independent call control (BICC) protocol with AAL type 2 signalling protocol (CS-1)*.

[13] ITU-T Q-series Supplement 22 (1999), *Technical report TRQ.3000: Operation of the bearer independent call control (BICC) protocol with digital subscriber signalling system No. 2 (DSS2)*.

[14] ITU-T H.323 (1999), *Packet-based multimedia communications systems.*

[15] ITU-T Q-series Supplement 7 (1999), *Technical report TRQ.2001: General aspects for the development of unified signalling requirements.*

3 Abbreviations

This Supplement uses the following abbreviations:

AAL1 ATM Adaptation Layer 1

AAL2 ATM Adaptation Layer 2

BCF Bearer Control Function

BCF-G Bearer Control Gateway Function

BCF-J Bearer Control Joint Function

BCF-N Bearer Control Nodal Function

BCF-R Bearer Control Relay Function

BCF-T Bearer Control Transit Function

BCS Bearer Control Segment

BCU Bearer Control Unit

BICC Bearer Independent Call Control

BIWF Bearer Interworking Function

BIWN Bearer Interworking Node

BMC Bearer and Media Control

BNC Backbone Network Connection

BNCL Backbone Network Connection Link

CBC Call and Bearer Control

CCA Call Control Association

CMN Call Mediation Node

CS Capability Set

CSF Call Service Function

CSF-C Call Service Co-ordination Function

CSF-G Call Service Gateway Function

CSF-N Call Service Nodal Function

CSF-T Call Service Transit Function

DSS1 Digital Subscriber Signalling System No.1

DTMF Dual Tone Multi-Frequency

GSMN Gateway Serving Mediation Node

GSN Gateway Serving Node

IN Intelligent Networks

IP Internetworking Protocol

ISDN Integrated Services Digital Network

ISN Interface Serving Node

ISUP Integrated Services User Part

MCF Media Control Function

MG	Media Gateway
MGC	Media Gateway Controller
MMSF	Media Mapping/Switching Function
NBC	Network Bearer Connection
PDU	Protocol Data Unit
SCTP	Stream Control Transport Protocol
SIP	Session Initiation Protocol
SN	Serving Node
SRN	Service Resource Node
SWN	Switching Node
TDM	Time Division Multiplex
TE	Terminal Equipment
TMR	Transmission Medium Requirement
TSN	Transit Serving Node
USI	User Service Information

4 Definitions

Definitions of the items contained in the composite functional model are as follows:

4.1 Backbone Network Connection (BNC): Represents the edge to edge transport connection within the backbone network, consisting of one or more Backbone Network Connection Links (BNCL). The Backbone Network Connection represents a segment of the end to end Network Bearer Connection (NBC).

4.2 Backbone Network Connection Link (BNCL): Represents the transport facility between two adjacent backbone network entities containing a bearer control function.

4.3 Bearer Control Function (BCF): Note that five types of BCFs are illustrated in the composite functional model; BCF-G, BCF-J, BCF-N, BCF-R and BCF-T.

– The Bearer Control Joint Function (BCF-J) provides the control of the bearer switching function, the communication capability with two associated call service functions (CSF), and the signalling capability necessary to establish and release the backbone network connection.

– The Bearer Control Gateway Function (BCF-G) provides the control of the bearer switching function, the communication capability with its associated call service function (CSF-G), and the signalling capability necessary to establish and release of the backbone network connection.

– The Bearer Control Nodal Function (BCF-N) provides the control of the bearer switching function, the communication capability with its associated call service function (CSF), and the signalling capability necessary to establish and release of the backbone network connection to its peer (BCF-N).

– The Bearer Control Relay Function (BCF-R) provides the control of the bearer switching function and relays the bearer control signalling requests to next BCF in order to complete the edge to edge backbone network connection.

– The Bearer Control Transit Function (BCF-T) provides the control of the bearer switching function, the communication capability with its associated call service function (CSF-T),

and the signalling capability necessary to establish and release of the backbone network connection.

4.4 Bearer Control Segment (BCS): Represents the signalling relationship between two adjacent Bearer Control Functional entities (BCF).

4.5 Bearer Interworking Function (BIWF): A functional entity which provides bearer control and media mapping/switching functions within the scope of a Serving Node (ISN, TSN or GSN). A BIWF contains one Bearer Control Nodal Function (BCF-N, BCF-T or BCF-G) and one or more MCF and MMSF, and is functionally equivalent to a Media Gateway that incorporates bearer control.

4.6 Bearer Interworking Node (BIWN): A physical unit incorporating functionality similar to a BIWF.

4.7 Bearer and Media Control Interface: The interface between the BCF and the MCF. The precise functionality of this interface is outside the scope of BICC.

4.8 Call and Bearer Control Interface: The interface between the CSF and the BCF.

4.9 Call Control Association (CCA): Defines the peer to peer signalling association between Call, and Call & Bearer state machines located in different physical entities.

4.10 Call Service Function (CSF): Note that four types of CSFs are illustrated in the composite functional model, CSF-N, CSF-T, CSF-G, and CSF-C.

– The Call Service Nodal Function (CSF-N) provides the service control nodal actions associated with the narrowband service by inter-working with narrowband and Bearer Independent Call Control (BICC) signalling, signalling to its peer (CSF-N) the characteristics of the call, and invoking the Bearer Control Nodal Functions (BCF-N) necessary to transport the narrowband bearer service across the broadband backbone network.

– The Call Service Transit Function (CSF-T) provides the service transit actions necessary to establish and maintain a backbone network call and its associated bearer by relaying signalling between CSF-N peers and invoking the Bearer Control Nodal Functions (BCF-T) necessary to transport the narrowband bearer service across the broadband backbone network.

– The Call Service Gateway Function (CSF-G) provides the service gateway actions necessary to establish and maintain a backbone network call and its associated bearer by relaying signalling between CSF-N peers and invoking the Bearer Control Nodal Functions (BCF-N) necessary to transport the narrowband bearer service between broadband backbone networks.

– The Call Service Coordination Function (CSF-C) provides the call coordination and mediation actions necessary to establish and maintain a backbone network call by relaying signalling between CSF-N peers. The CSF-C has no association with any BCF. It is only a call control function.

4.11 Call Mediation Node (CMN): A functional entity that provides CSF-C functions without an associated BCF entity.

4.12 Gateway Serving Node (GSN): A functional entity which provides gateway functionality between two network domains. This functional entity contains one or more call service gateway functions (CSF-G), and one or more bearer inter-working functions (BIWF). GSNs interact with other GSNs, in other broadband backbone network domains and other ISNs and TSNs within its own broadband backbone network domain. The network signalling flows for a GSN are equivalent as those for a TSN.

4.13 Interface Serving Node (ISN): A functional entity which provides the interface with non-BICC networks and terminal equipment. This functional entity contains one or more call service nodal functions (CSF-N), and one or more inter-working functions (BIWF) which interact with the non-BICC networks and terminal equipment and its peers within the broadband backbone network.

4.14 media control function: A functional entity that interacts with the BCF to provide the control of the bearer and MMSF. The precise functionality is outside the scope of BICC.

4.15 Media Gateway (MG): The media gateway is a physical unit, as defined in [2].

4.16 Media Gateway Controller (MGC): The media gateway controller is a physical unit, as defined in [2].

4.17 Media Mapping/Switching Function (MMSF): An entity providing the function of controlled interconnection of two bearers and optionally the conversion of the bearer from one technology and adaptation/encoding technique to another.

4.18 Network Bearer Connection (NBC): Is used to transport a user selected bearer service between two or more Terminal Equipment (TE).

4.19 Serving Node (SN): A generic term referring to ISN, GSN or TSN nodes.

4.20 Service Resource Node (SRN): the physical function that contains the IN SRF.

4.21 Switching Node (SWN): A functional entity which provides the switching functions within the broadband backbone network. This functional entity contains a bearer control state machine (BCF-R). SWNs interact with other SWNs, within their own broadband backbone network domain. The SWNs BCF-R also interact with the BCF-N functions contained in BIWF entities.

4.22 Terminal Equipment (TE): Represents the customer's access equipment used to request and terminate network associated connectivity services.

4.23 Transit Serving Node (TSN): A functional entity which provides transit functionality between ISNs and GSNs. This functional entity contains one or more call service transit functions (CSF-T), and one or more bearer inter-working functions (BIWF). TSNs interact with other TSNs, GSNs and ISNs within their own broadband backbone network domain.

5 Functional Reference Model

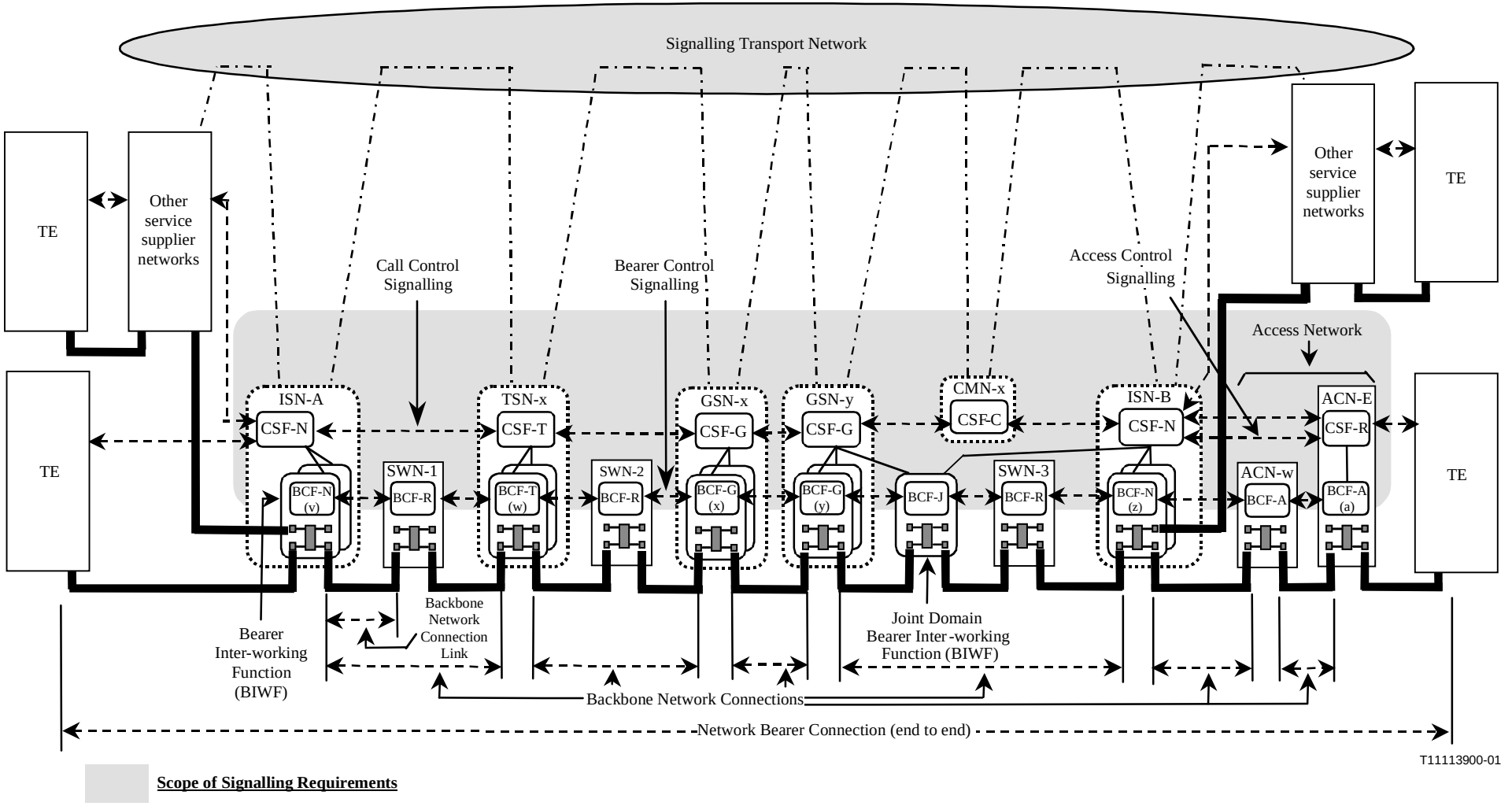
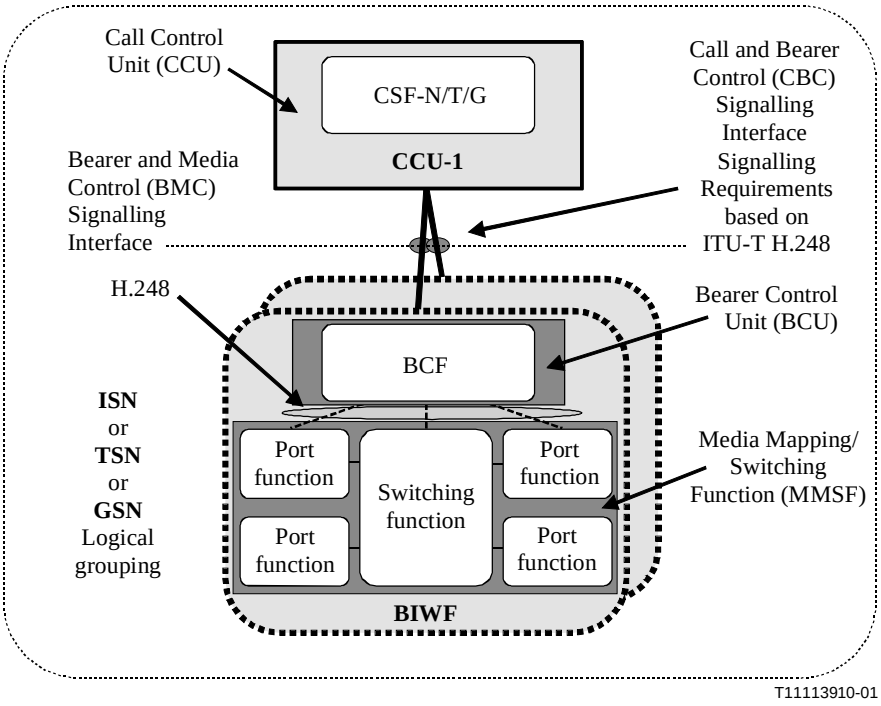


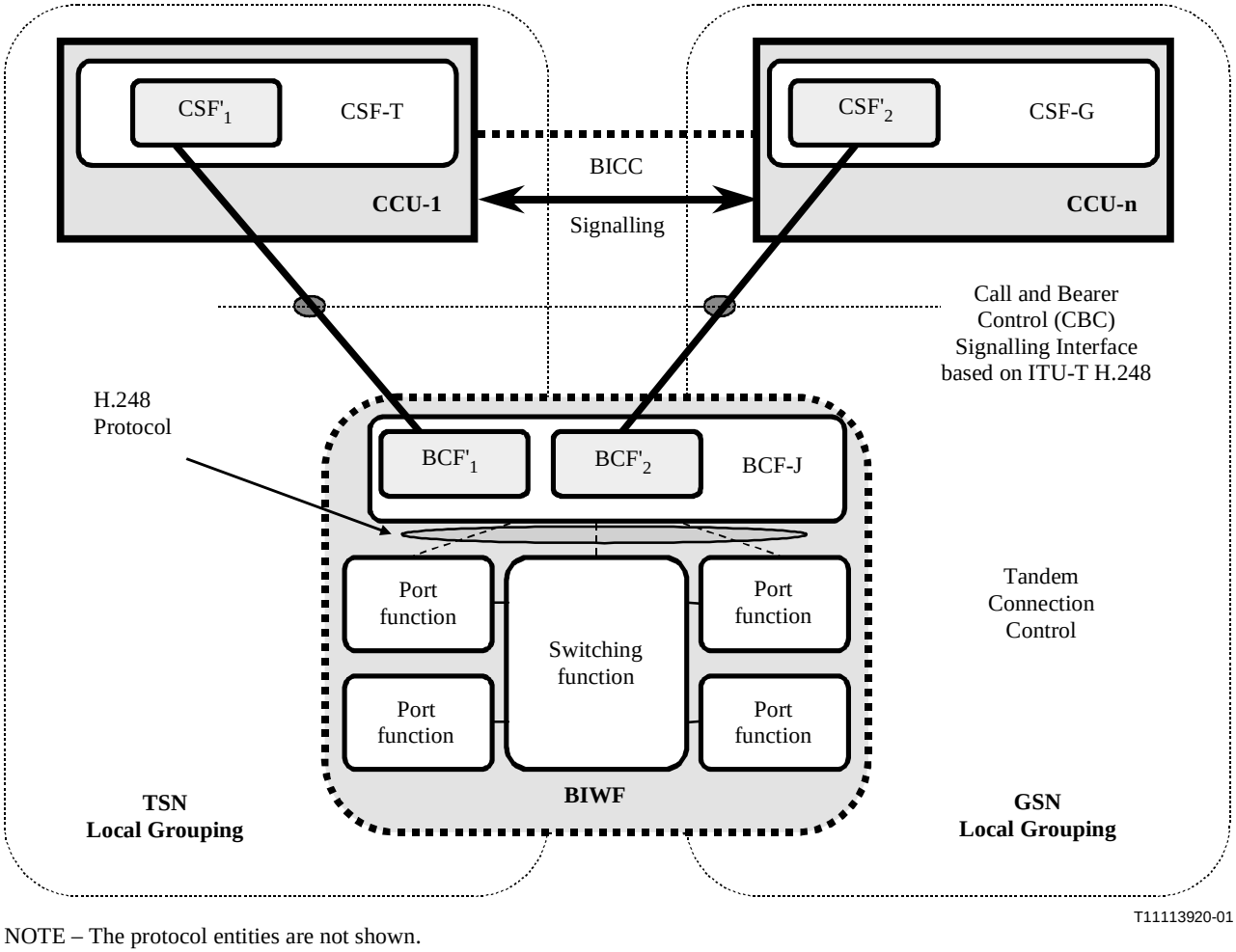
Figure 5-1 – Composite Functional Reference



NOTE – The protocol entities are not shown.

Figure 5-2 – Service Node Logical Grouping of Functional Entities.

Figure 5-2 represents the capability of a CSF to select a BIWF, based on call routing, bearer capabilities etc. At the point in time of a call establishment (e.g. reception of an IAM), a CSF instance may have a choice of BIWF. The first interaction with the selected BIWF will result in a signalling association between the CSF and BCF. This figure does not imply support for multi-connection.



NOTE – The protocol entities are not shown.

Figure 5-3 – Logical representation of control configurations.

The capability of two CSF to control a single BIWF is represented in Figure 5-3. CSF-T establishes a signalling association with BCF-J, and shares the information on the selected BIWF with the next CSF in the call routing (CSF-G). When the call is established in CSF-G, the same BIWF is selected, and a second Bearer Control Function instance is instantiated. This maintains the one to one relationship between CSF and BCF, whilst allowing the two call instances (CSF'_1 and CSF'_2) to control a single BIWF through the two bearer control function instances (BCF'_1 and BCF'_2) interacting together to provide the control of the physical equipment.

6 General Requirements

6.1 Service Requirements

It is required that signalling related features, functions, and services listed in Annex A shall be supported when using a backbone network utilising AAL1, Structured AAL1, AAL2 and IP technology.

ISDN User Part Capabilities, both national and international, as listed in Tables 1 and 2/Q.761, *Signalling System No.7 – ISDN User Part functional description*, are to be supported in capability set 2. Annex A contains a detailed list of the required narrowband services to be included into capability set 2.

The support of Codec modification includes the ability to modify the attributes of the connection, except for AAL1 and structured AAL1.

6.2 CS-1 Requirements Applicable to CS-2

All of the requirements of BICC CS-1, as defined in ITU-T Q-series Supplement 16 (TRQ.2140) [3], are applicable to BICC CS-2

6.3 Additional Requirements in CS-2

This clause lists the new requirements for CS-2 and are additional to the CS-1 requirements [3].

1) IP Backbone Networks shall be supported.
2) The call control protocol shall provide functional compatibility with ISUP 2000 [1].
3) The call control protocol shall provide peer-to-peer compatibility with ITU-T Q.1901, (2000).
4) New information objects in CS-2 (and beyond) must describe the intended interaction with both BICC CS-1 nodes and ISUP nodes.
5) Provide a means of supporting narrowband ISDN services across an IP backbone network without impacting the interfaces to the existing non-BICC network and end-to-end services.
6) CS-2 shall support physical separation of the CSF and BCF entities.
7) The interactions between a CSF and BCF shall be signalled using the services of ITU-T H.248 [2].
8) Binding information will be carried in the signalling protocols where it is needed to coordinate the independent establishment of protocol associations, between peer call control entities and peer bearer control entities, correlated at the end points of the backbone network.
9) The ISN functional grouping will have direct interaction with user terminals and with Access Networks for fixed and mobile applications.
10) The ISN shall support interworking between the core network signalling protocols and the following access signalling protocols: DSS1, H.323, V5.1, V5.2, DTMF and Decadic.
11) The ISN shall support interworking between the core network signalling protocols and the following NNI signalling protocols: ISUP, H.323.
12) The association between the CSF and BIWF functional groupings is not limited to a one-to-one relationship (it is possible to have both a one-to-many and a many-to-one relationship), however, on a per call basis, there will be a one-to-one relationship between a CSF instance and a BCF instance.
13) The call control signalling shall take into account that the bearer network may not be fully meshed.
14) The call control signalling protocol shall support the use of a CSF that does not interact with a bearer control functional entity (CMN support). Such a node may be used as a call control signalling gateway between network operator domains (GCMN).
15) In CS-2, the call control signalling protocol is based on N-ISUP signalling and the different bearer technology-based control signalling protocols supported shall include IPBCP, AAL2 signalling ITU-T Q.2630.2, DSS2, B-ISUP.
16) The information exchanged between the CSF and BCF that the CSF uses shall be independent of the bearer and the bearer control protocol.
17) The call control protocol shall support a general purpose capability for efficient (and reliable) transparent transport of tunnelled bearer control information between BCF's (e.g. addresses). The mechanism shall not support the transfer of information at normal call release.

18) The capabilities in CS-2 shall support the interactions with a functionally separate control entity that participates for a partial duration of a call (SRN).

19) Structured AAL1 shall be supported.

20) Bearer redirection is supported.

21) In addition to the CS-1 signalling transport protocols, CS-2 shall support signalling transports over SCTP.

22) In CS-2, before call control can attempt to establish calls, a peer application must be available.

23) The call control signalling protocol shall support the transfer of an identifier that uniquely identifies the call. The scope of this identifier is global**.**

24) The call control signalling protocol shall support the transfer of an identifier that uniquely identifies the originating TDM trunk.

25) The call control signalling protocol shall support the transfer of an identifier that uniquely identifies the destination TDM trunk.

26) The call control shall support the explicit signalling of TDM trunk group information.

27) The call control signalling protocol shall transparently transfer the Origination ISC Point Code (if provided) across the international interface, but shall discard it at the succeeding international gateway to prevent it being presented within a national or regional network.

6.4 Quality of Service provisioning with BICC

The required quality of service does not need to be signalled from the CSF to the BCF.

6.5 Guidelines for protocol development

Even though the scope of this Supplement is signalling requirements, this clause is provided as a guide to the protocol development.

The CS-2 services are the ITU-T – defined narrowband ISDN services as supported by the 2000 version of ISUP (see Table A.1). Additional capabilities are listed in Table A.2.

Point-to-point bi-directional bearer services will be considered in call control signalling and also conference type services provided by a server (i.e. type 6 connections defined in ITU-T Q-series Supplement 7 (TRQ.2001) [15]) controlled from the IN shall be supported as in capability set 1.

Maximum end-to-end setup delay should not be exceeded as defined for current narrowband networks.

The call control and bearer control protocols shall be designed to operate over multiple carrier network domains.

The protocols used for the support of CS-2 should not impact the interfaces to existing non-BICC networks, nor the services that may be provided by an intelligent network.

CS-2 shall support the transfer of signals such as DTMF as out of band information in the call control signalling.

The established bearer must support the bearer service requested in the TMR. The application using the bearer service cannot be determined from the TMR.

7 Detailed Requirements

7.1 General

A route between two ISN shall support one or more BNC type.

7.2 Addressing

7.2.1 Call Control

The CSF uses existing N-ISUP addressing procedures.

7.2.2 BNC Control

Each type of BNC will use the existing addressing mechanism identified for that BNC.

7.2.3 Call control and Bearer Control Interactions

The interactions between CSF and BCF shall use the existing mechanisms defined for ITU-T H.248.

7.3 Routing

7.3.1 Call Control

The CSF routes the call control signalling, as in CS-1, based on the called party number and TMR, plus optionally USI. For CS-2, the following additional information and services will place requirements on the call route:

- Information identifying traffic groups, when present, shall be used.

7.3.2 BIWF Selection Control

The CSF selects a BIWF, as in CS-1, based on bearer service characteristics, called party number and BNC characteristics. For CS-2 the following information shall also be used:

a) The services required by the call;

b) The list of BIWF's which can be used to interface the peer SN;

c) Interworking with Switched Circuit Networks;

d) Network Interconnect Scenarios;

e) Minimizing the number of BIWF's in the connection;

f) At the succeeding SN, the BCU-ID of the BCU selected at the preceding SN.

7.3.3 BNC Control

Each type of BNC will use existing route selection mechanisms supported for that BNC. The BCF routes the bearer control signalling based on TMR and possibly USI for connection oriented BNC types. For connectionless BNC types, the bearer control signalling is routed to the selected BIWF.

7.4 Symmetry of call and bearer control

7.4.1 Call Control

BICC shall support symmetric call control.

7.4.2 BNC Control

The BNC control signalling shall provide a symmetric BNC.

7.5 Connectionless BNC Types

For connectionless bearer types, more than one method of providing quality of service is supported. The call control signalling interacts with the bearer control supported on a BNC type and remains independent of the underlying QoS mechanism.

7.6 Bearer Control Tunnelling

7.6.1 General requirements

The BICC and CBC protocols shall provide a mechanism for the transport of Bearer Control PDUs between BIWFs. The mechanism shall provide a reliable, sequenced transport on a per backbone network connection basis when there is no requirement for intermediate BCF-Rs between the BCF-Ns to process the tunnelled information.

The Bearer Control Tunnelling mechanism may be used in place of the existing mechanism based on communication of the Bearer Interworking Function signalling endpoint address and Bearer Network Connection Identity.

The decision on use of the Bearer Control Tunnelling mechanism shall be made on a per call basis by the Bearer Interworking Function at the originating SN. The CSF shall inform the BIWF of the possibility of using the Bearer Control Tunnelling Mechanism and the BIWF shall respond with an indication of whether the Tunnel should be set up or not.

The Bearer Control PDUs transported by this mechanism shall not be examined or modified by the CSF.

7.6.2 CBC protocol requirements

The CBC protocol shall be capable of:

- Indicating in the CSF to BIWF direction that Bearer Control Tunnelling is available.
- Requesting in the BIWF to CSF direction that Bearer Control Tunnelling shall be used for a particular termination.
- Passing from CSF to BIWF a Bearer Control PDU relating to a particular termination, which has been received from the peer termination
- Passing from BIWF to CSF a Bearer Control PDU relating to a particular termination for transport to the peer termination

7.6.3 BICC protocol requirements

The BICC protocol shall be capable of:

Transparently transporting Bearer Control PDUs.

Simultaneously supporting multiple signalling 'tunnels' to be used for the case where multiple Bearer Network Connections exist simultaneously.

Setting up a tunnel to a remote termination in the same end-to-end message flow which creates that termination.

7.7 Connection configuration

7.7.1 Connection Types supported

The backbone network shall support symmetric point-to-point BNC connections. In BICC CS-2, a call can support only one BNC. It should be noted that the support for multi-connection in later capability sets is not precluded.

7.7.2 Conference services

Conference services are supported by using a server (connection type 6), which may be controlled by IN.

7.7.3 Multi-Stream Support

Support for multiple streams in CS-2 is limited to a single BNC. Negotiation or modification of multiple codecs are not supported for multiple streams.

7.7.4 Connection Modification

CS-2 shall support only the modification of the bandwidth and profiles (codec) of a connection.

7.8 Essential features of the underlying signalling transport

The network signalling requirements provided in this Supplement are based upon a dependence that any underlying signalling transports for call signalling, bearer signalling, call and bearer signalling, and bearer control of a media gateway supports:

- assured data transfer,
- in sequence delivery of PDU's, and
- an indication of flow congestion.

The requirements for signalling transport are fully defined in ITU-T Q-series Supplement 8 (TRQ.2400).

7.9 Flow control

Flow control shall be supported on the call control level to enable a call control node to limit the number of new call requests that can be satisfied.

Flow control procedures at the bearer control level may affect the ability to successfully satisfy requests for new bearer connections. Bearer flow control indications are not explicitly communicated to or between ISN/CSFs.

7.10 Independence from underlying signalling transport

The network signalling protocol design shall be independent from the underlying signalling transport. As an example, it shall be possible to carry the call signalling messages over multiple or different signalling transport protocol stacks. For CS-2, a new signalling transport converter to support SCTP will be required.

7.11 Concatenation

All types of SN shall handle calls and bearer connections over a network of nodes, where each bearer connection may be a concatenation of backbone network connection links. The conversion of a BNC from one type of network/transport technology to another shall take place at an intermediate node supporting call and bearer interactions (TSN or GSN). Multiple types of BNC transport capabilities may be concatenated using a TSN or GSN (as an example, one BNC could be conveyed by AAL2 (ISN-A – TSN-1) and the other BNC be conveyed by IP (TSN-1 – ISN-B).

7.12 Contention resolution

The CSF shall be able to resolve all contentions with respect to resource allocation and collisions related to call establishment. Bearer control is responsible for contention resolution of bearer resource allocation and collisions during connection establishment.

7.13 Error reporting

All types of SN shall include mechanisms for detecting and reporting signalling procedural errors or other failures to network management. For CS-2, the CMN shall also include mechanisms for detecting and reporting signalling procedural errors or other failures to network management.

7.14 Unrecoverable failures

All types of SN shall include mechanisms for returning call instances and bearer network connection instances to a stable state after detection of unrecoverable failures. For CS-2, the CMN shall also include mechanisms for returning call instances to a stable state after detection of unrecoverable failures.

7.15 Forward and backward compatibility

The CSF shall include a forward compatibility mechanism and backward compatibility rules. ISUP nodes and BICC nodes utilise the same compatibility mechanism and share the same code-points. Parameters proposed for BICC that are to transit nodes using earlier versions of the protocol (i.e. indicator set to "pass-on") should, absent compelling reasons, also be permitted to transit ISUP nodes. Even if ISUP nodes will never process such a parameter, they can "pass them on" as unrecognised parameters. If there is a compelling reason to pass on a parameter only in BICC, then it should be performed such that BICC CS-1 can pass on the information, but it will be discarded by ISUP (e.g. placed in the BAT ASE Context, even though that context was originally specific to bearer-related information).

The tunnelling mechanism shall support the ability to add future capabilities and protocols.

7.16 Decomposition of Serving Nodes

In CS-2 the Serving Nodes may be split into two physical units. The signalling interactions occurring at the interface between CSF and BCF are defined in ITU-T Q-series Supplement 35 (TRQ.2500) [5].

7.17 Performance Requirements

The object is to meet existing narrowband performance requirements and objectives.

7.18 Codec Negotiation

The ability to select (negotiate) a suitable codec shall be supported, as in CS-1. Additionally, in CS-2, the capability to renegotiate the Codec list shall be supported. Codec selection requests and responses shall be supported by the call signalling protocol.

7.19 Codec Modification

The ability to modify a codec or codec list shall be supported, as in CS-1. Codec modification requests and responses shall be supported by the call control signalling protocol and may result in bearer modification.

7.20 Bearer Redirection

The call and bearer control protocols shall support the redirection of a bearer as a generic function, and shall include the following:

- An ISN should reliably be able to determine the new bearer destination for the call.
- An ISN should indicate forward which capabilities it is willing and able to support. This will provide for forward compatibility with future versions and will simplify negotiations

between the nodes, e.g. if ISN-B requests that a three-way bearer be established at BCF-N(X).

- The invoking ISN should be able to indicate when it expects the old bearer to be dropped. Options should include:
  1) on invocation of Bearer Redirection;
  2) on acceptance of the invocation by an ISN;
  3) on successful setup of a new (replacement) bearer;
  4) on answer along a new (replacement) bearer;
  5) on separate notification from invoking ISN;
  6) on call Release (i.e. to setup a three-way bearer connection at ISN-A).

These requirements are generic across a wide variety of services and apply whether an ISN whose bearer is effectively removed, remains in the call path for the duration of the call or is allowed to be removed.

7.21 Call Control support for Transfer of Out of Band Signals.

Signals, such as DTMF indications, can be passed by using either of two methods: by the established bearer or by the call control signalling protocol as out of band signals. It is required to be able to pass signals (in either direction) after through connection in the forward direction (with respect to the call). To reduce the possibility of unnecessary interworking scenarios, the call should be progressed using the method received at the originating ISN. To enable the BICC CS-2 to progress signals when interworking to BICC CS-1, conversion may be necessary.

Note that the ability to carry out of band signals in the call control will not be tied to the codec negotiation and modification procedures.

8 Signalling Procedures.

A list of the functions and services supported in CS-2 can be found in Annex A.

8.1 Successful Call Set up

8.1.1 Call Establishment

Both enbloc and overlap address signalling is to be supported.

8.1.2 Bearer establishment

The call control signalling interacts only with the backbone network signalling. The transport connection for CS-2 may be provided by any of the CS-1 connection technologies and also an IP bearer and structured AAL1.

8.1.2.1 Establishment of a new bearer

A bearer can be established in either direction. The signalling shall be able to support both forward and backward BNC on a per call basis.

NOTE – During BNC set up, no end-to-end bearer bandwidth negotiation is required in CS-2.

8.1.2.2 Use of idle connections

The use of an idle backbone connection may be supported, as in CS-1. Idle connections will only be supported with a single network domain.

NOTE – The reuse of idle bearers may not be applicable to all bearer technologies.

8.2 Unsuccessful Set up

Unsuccessful setup could be caused by either call control or bearer control.

8.3 Release of a Successful Call

Three cases of release shall be included in CS-2; Release of a Call and related bearer, Release of the call only, and Release of an idle bearer not associated with any call.

8.4 Error Handling

Separate error handling shall be the responsibility of the call and bearer protocols. Interactions between these protocols shall also be covered.

8.5 Echo Control Procedure

Only basic echo control procedures are required, as in CS-1. Enhanced echo control and dynamic echo control procedures are not required. Echo control procedures are defined in ITU-T Q.115. Enhanced/dynamic echo control parameters received at the non-BICC ISN interface must be passed unmodified by the call control protocol.

8.6 Blocking and unblocking

Blocking and unblocking of backbone network connections shall be supported. BNC resource blocking and unblocking shall be handled by BNC control.

8.7 Call Automatic Repeat attempts

The application of call automatic repeat attempt shall be supported, as in CS-1.

8.8 Dual Seizure

Dual seizure should be minimised and the recovery from dual seizure of signalling identifiers when they occur, shall be to be supported, as in CS-1.

8.9 Reset

The reset of call and bearer resources shall be handled by the respective control protocol.

8.10 Support of Codec Negotiation and Renegotiation

Functionality to convey codec information to all nodes supporting coding/transcoding functionality. Capability to negotiate among all SN with coding/transcoding functionality with common codec to be used for a specific call. Idle backbone network connection shall not be used when codec negotiation is requested.

8.11 Support of Codec Modification

Provide functionality to modify the codec selected. Provide functionality to request codec modification from either end of the BNC connection.

8.12 Support of Call Mediation Node

The call control procedures shall provide the functionality to access IN services from a node that does not have any direct communication with the bearer control protocol. The CMN shall also perform call routing and may provide gateway screening functionality. The call control procedures shall:

- Support of a mechanism of relaying CMN exchange data and/or IN data between the CMN (CSF-G) and the Originating SN using functionality already provided in SS7;
- Support of a mechanism for relaying recording, exchange, and/or IN data between an Originating SN and a CMN with the same network;
- Support of call routing;
- Support of screening functionality at the CMN (by the CSF-G).

9 General Signalling Transport Requirements

The transport of signalling information between peer protocol entities shall not be limited to a particular signalling transport protocol. The use of IP based signalling networks shall be supported in addition to CS-1 signalling transports. No specific requirements are identified in CS-2.

ANNEX A

Capability Set 2 Services and Functions

Table A.1 – N-ISUP Services and Functions Supported in BICC Capability Set 2

ITU-T ISUP 2000 Function/service	Applicability to BICC
Basic call	
Speech/3.1 kHz audio	Required
64 kbit/s unrestricted	Required
Multirate connection types	Required
N × 64 kbit/s connection types	Required
En bloc address signalling	Required
Overlap address signalling	Required
Transit network selection	National Option
Continuity check	Not Required
Forward transfer	Required
Simple segmentation	Required
Tones and announcements	Required
Access delivery information	Required
Transportation of User teleservice information	Required
Suspend and resume	Required
Signalling procedures for connection type allowing fallback capability	Required
Propagation delay determination procedure	Required
Enhanced echo control signalling procedures	Not Required
Simplified echo control signalling procedures	Required
Automatic repeat attempt	Required
Blocking and unblocking of circuits and circuit groups (in Q.BICC, circuits = CIC which is equal to the CCA-ID)	Required
CIC group query (in Q.BICC, CIC = CCA-ID)	National Option

Table A.1 – N-ISUP Services and Functions Supported in BICC Capability Set 2 (*continued*)

ITU-T ISUP 2000 Function/service	Applicability to BICC
Dual seizure (in Q.BICC, dual seizure applies to CIC = CCA-ID and does not refer to circuits)	Required
Transmission alarm handling for digital inter-exchange circuits	Not Required
Reset of circuits and circuit groups (in Q.BICC, circuits = CIC which is equal to the CCA-ID)	Required
Receipt of unreasonable signalling information	Required
Compatibility procedure	Required
Temporary trunk blocking	Not Required
ISDN User Part signalling congestion control	Required
Automatic congestion control	Required
Interaction between N-ISDN and INAP	Required
Unequipped circuit identification code (in Q.BICC, CIC = CCA-ID)	National Option
ISDN User Part availability control	Not Required
MTP pause and resume	Required
Overlength messages	Required
Temporary Alternative Routing (TAR)	Required
Hop counter procedure	Required
Collect call request procedure	Required
Hard-to-Reach	Required
Calling Geodetic location procedure	Required
Generic signalling procedures	
End-to-end signalling – Pass along method	Required
End-to-end signalling – SCCP Connection Orientated	Required
End-to-end signalling – SCCP Connectionless	Required
Generic number transfer	Required
Generic digit transfer	Required
Generic notification procedure	Required
Service activation	Required
Remote Operations Service (ROSE) capability	Required
Network specific facilities	Required
Pre-release information transport	Required
Application Transport Mechanism (APM)	Required
Redirection	Required
Pivot Routing	Required
Supplementary services	
Direct-Dialling-In (DDI)	Required
Multiple Subscriber Number (MSN)	Required
Calling Line Identification Presentation (CLIP)	Required
Calling Line Identification Restriction (CLIR)	Required
Connected Line Identification Presentation (COLP)	Required
Connected Line Identification Restriction (COLR)	Required

Table A.1 – N-ISUP Services and Functions Supported in BICC Capability Set 2 (*concluded*)

ITU-T ISUP 2000 Function/service	Applicability to BICC
Malicious Call Identification (MCID)	Required
Sub-addressing (SUB)	Required
Call Forwarding Busy (CFB)	Required
Call Forwarding No Reply (CFNR)	Required
Call Forwarding Unconditional (CFU)	Required
Call Deflection (CD)	Required
Explicit Call Transfer (ECT)	Required
Call Waiting (CW)	Required
Call HOLD (HOLD)	Required
Completion of Calls to Busy Subscriber (CCBS)	Required
Completion of Calls on No Reply (CCNR)	Required
Terminal Portability (TP)	Required
Conference calling (CONF)	Required
Three-Party Service (3PTY)	Required
Closed User Group (CUG)	Required
Multi-Level Precedence and Preemption (MLPP)	Note
Global Virtual Network Service (GVNS)	Required
International telecommunication charge card (ITCC)	Required
Reverse charging (REV)	Required
User-to-User Signalling (UUS)	Required
Additional functions/services	
Support of VPN applications with PSS1 Information Flows	Required
Support of Number Portability (NP)	Required
NOTE – MLPP functionality shall not be supported in CS-2, but the support for MLPP transparency is required.	

Table A.2– BICC Signalling Capabilities Listing

Composite Capabilities Listing
Architectural Requirements
ISN supports Local exchange basic and supplementary service features
ISN supports Mobile Switching Center Features basic and supplementary service
Physical separation of the CSF and BIWF (BCF) entities (open CBC interface)
A BIWF may have control associations to multiple CSF entities (terminates multiple CBCs)
A CSF can have control associations to multiple BIWF entities (source of Multiple CBCs)
Peer-to-peer interworking with CS-1 serving nodes.
Allow different transport technologies to be employed between an ISNs and TSNs. One BNC could be conveyed by AAL 2 (ISN-A – TSN-1) and the other BNC be conveyed by IP (TSN-1 – ISN-B).

Table A.2– BICC Signalling Capabilities Listing (*continued*)

Call Level Signalling (Horizontal Interface) Capabilities
Support of BNC Bandwidth Modification
All BICC IAM information flows shall carry the BCU-ID associated with the requesting entity in order simplify BIWF selection at the receiving node in the cases where no "core network" exists between the two nodes
Add and drop of a BNC from a call. Only IN CS-2 may initiate this request
BNC rerouting requested by the terminating SN (bearer redirection).
Interwork the call control with the various ITU access signalling protocols, and the various legacy network-signalling protocols
Interwork the call control with IN entities in order to provide service control support to call control.
Support and define CMN procedures
The addition of information objects in the BICC call control signalling information flow.
The call control signalling protocol shall support the transport of DTMF outband information independent of the bearer transport technology used.
The call control signalling protocol shall support the transport of generic tones and announcements independent of the bearer transport technology used.
Support for the transparent carriage of bearer control information by the Call Control (Tunnel)
Bearer Level Transport (Horizontal Interface) Capabilities
Support of single IP bearer calls
Support of a structured AAL type 1 bearer transport technology
Support of Bandwidth Modification of the BNC
A separate bearer establishment protocol carried independent of BICC
A separated bearer establishment protocol carried by BICC (transparent tunnel)
Support of the IP-IP relay for IP-NAT.
Call-Bearer Control Signalling (CBC Vertical Interface) Capabilities
Technology independent bearer control used to establish, test, modify, and release of a bi-directional BNC – Access communication facility. This includes the provision of specifying the appropriate network resources.
Support of BICC capability set 2 call-bearer interactions including call-bearer interactions as indicated in CS-1
Support for DTMF outband information
Control of Tones (e.g. ring back tone, busy tone, idle tone, comfort tone, etc) and announcements applications
Addition/removal of parties associated with a type 6-communication bridge configuration.
Insertion of "bridge" devices into an existing internal BIWF connection
Connection hold and move internal control capabilities
Codec specific information exchange
Development of the CBC interface for the ISUP part of the half call.
Support of Q.931 (Q.2931) as an access signalling protocol
Non-call related updating of BIWF capabilities
Individual port control of forward and backward communication paths of the bi-directional BNC termination.
Support of V5.1 and V5.2

Table A.2– BICC Signalling Capabilities Listing (*concluded*)

Signalling Network Transport Capabilities
Use of IP for the carriage of network based signalling
Specification of the architectural requirements for a IP signalling network
Addressing arrangements in an all IP signalling network
Interworking with CS-1 signalling transport networks (STC)
Routing and sequencing of signalling messages through an IP network
Migration scenarios between MTP based signalling networks and IP based networks
Support of link by link and end to end type of signalling procedures within an IP based network
Specification of one or more STCs to interface BICC, CBC, and Bearer signalling with the IP signalling transport function
Interworking with CS-1 signalling transport networks (IP-MTP3)

ANNEX B

General Signalling Transport Requirements

Figure B.1 shows the signalling transport architecture that provides signalling transport independence by using signalling converters.

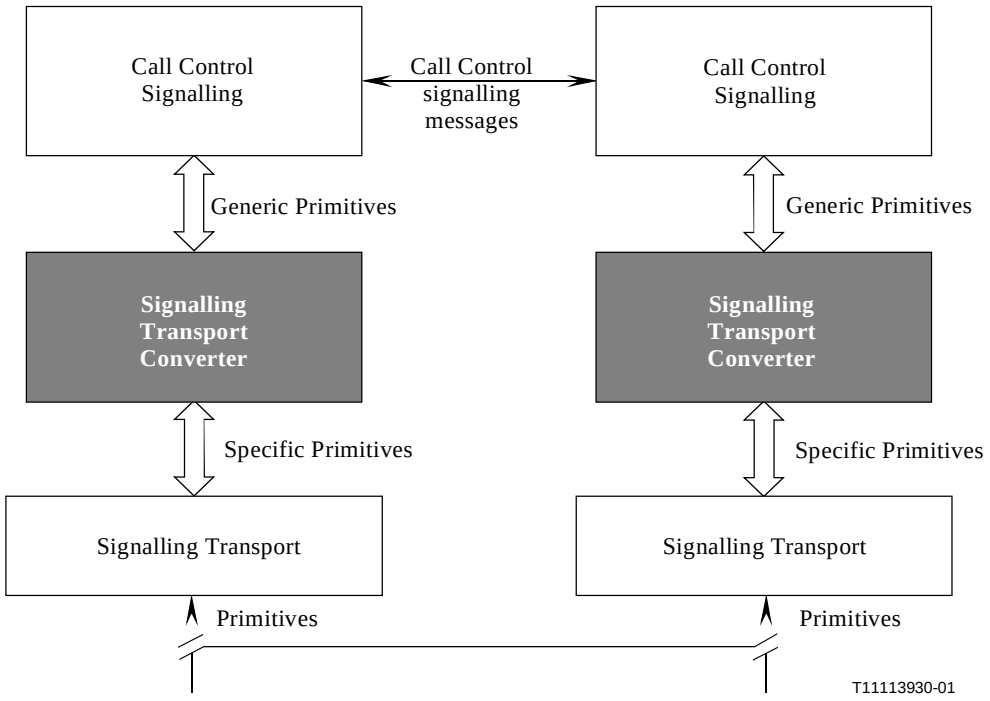


Figure B.1 – Signalling Transport Architecture

Signalling Transport Converter entity operations may include:

- Passing parameters from the generic primitives to the specific primitives and vice versa,
- Adding parameters to specific primitives issued and ignoring parameters from specific primitives received,

- Issuing specific primitives upon receiving specific primitives without any action on the generic interface, etc.

The call signalling protocol entity has BICC functionality. The signalling transport entity is the provider of the real signalling transport. The generic primitive interface includes signalling transport independent primitives. The specific primitives interface includes signalling transport dependent primitives.

The Signalling Transport protocols supported in CS-1 were MTP3, MTP3B and SSCOP (including multi-link). The signalling Transport protocols supported in CS-2 shall be all of those in CS-1 and additionally SCTP.

ANNEX C

Functional to Physical Mapping

This annex provides information on some of the possibilities for physical locations of the functional entities, functional and logical groupings. It should be noted that physical equipment cannot be equivalent to a functional entity or logical grouping, as physical equipment will always consist of additional functions not required to be shown in signalling requirements (power supply, cooling fans, physical terminations, etc).

C.1 Three Physical Location Scenarios

The functional groupings allow for the possibility of both the "CBC" and the "BMC" interfaces to be both open and to interface between geographically separated equipment. This is shown in Figure C.1. The CSF, BCF and MCF functional entities are realised within the physical equipment represented by the CCU, BCU and MG respectively. The requirements for the CBC interface are documented in ITU-T Q-series Supplement 35 (TRQ.2500) [5]. The BMC interface is an existing interface that BICC does not place any new requirements on, and is specified in ITU-T H.248 [2].

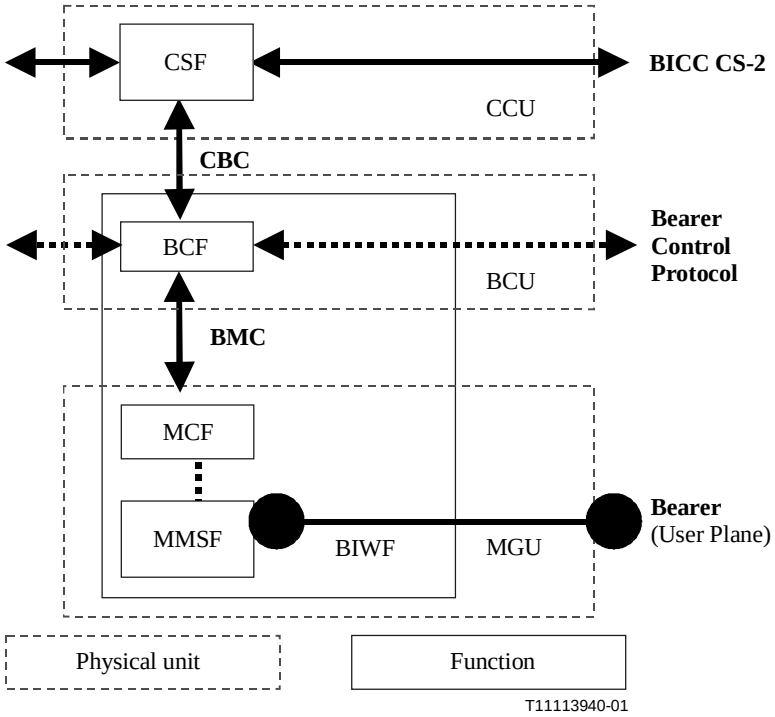


Figure C.1 – Three Separate Physical Units

C.2 Co-location of BCF MCF and MMSF.

The functional grouping "BIWF" allows the "BMC" interface to be a theoretically open interface between geographically co-located equipment. The CBC interface is still an open interface between geographically separated equipment. This is shown in Figure C.2. The CSF and BIWF logical groupings are realised within physical equipment CCU and BIWN respectively.

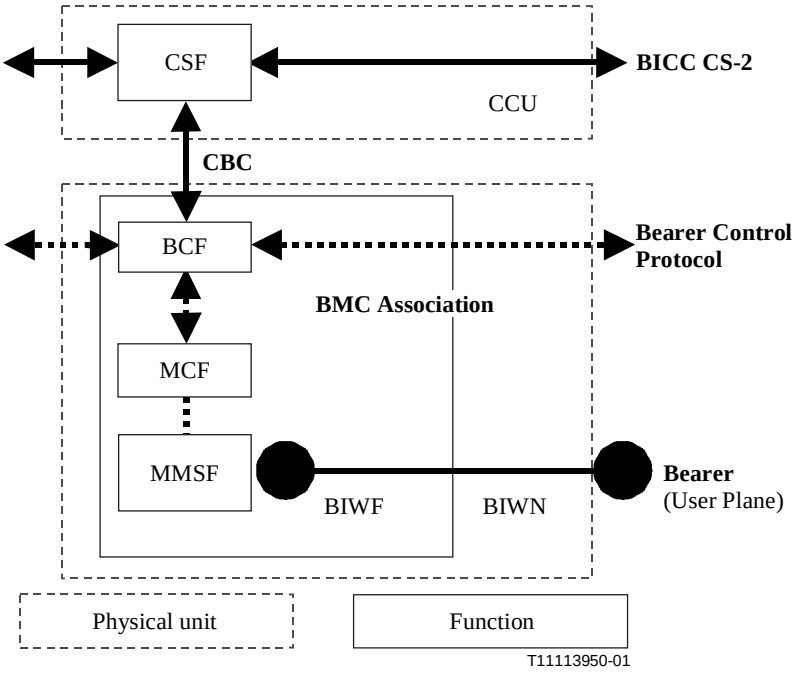


Figure C.2 – Two Physical Units, CCU and BIWN

C.3 Co-location of CSF and BCF

The "CBC" interface may similarly be a theoretically open interface between geographically co-located equipment. In this particular case, the BMC interface is still an open interface between geographically separated equipment, as shown in Figure C.3. The CSF and BCF functional entities are realised within physical equipment MGC, and the MCF and MMSF is geographically separated into a MGU. Note that the MGU is similar to a Media Gateway without bearer control (as defined in ITU-T H.248 [2]).

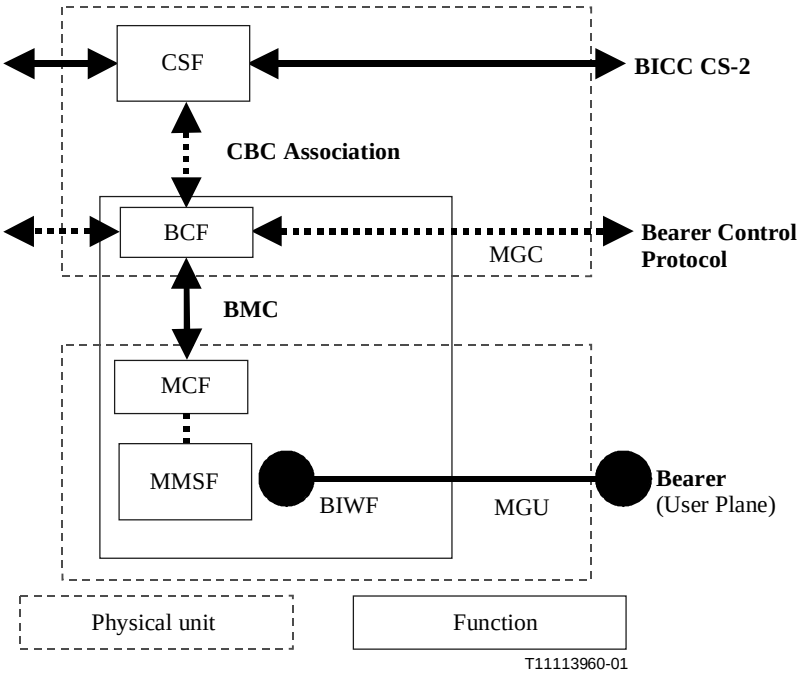


Figure C.3 – Two Physical Units, MGC and MGU

C.4 Co-location of CSF, BCF and MMSF

The logical groupings and physical locations do not preclude the BICC CS-1 requirements scenario of having all three functions co-located in a single physical location (similar to any of the SN logical groupings). While this is not precluded, this is not shown in CS-2, since it introduces no new functionality, and hence no new requirements on the protocols.

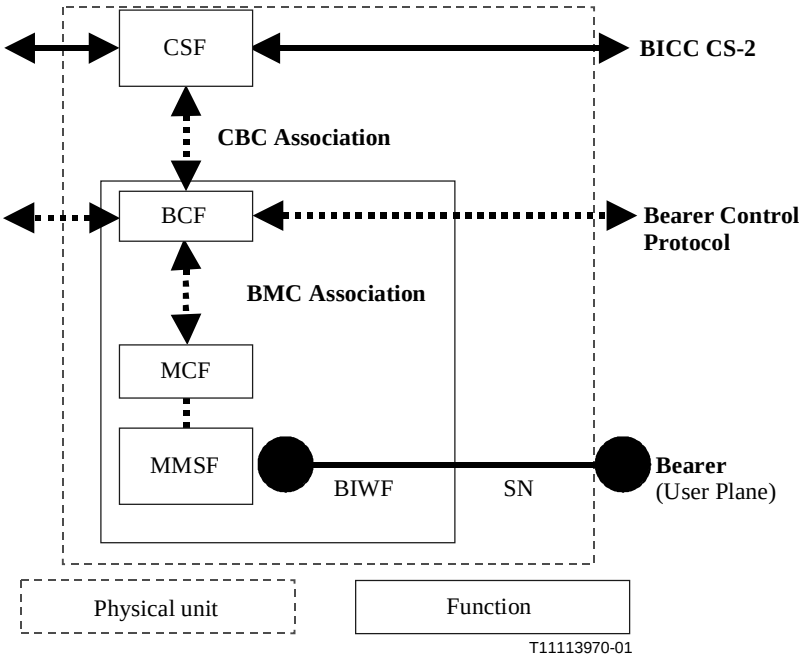


Figure C.4 – One Physical Unit

C.5 Functionality of the BCF and MCF

BICC CS-2 has restricted its scope to the CBC interface in order to support the delivery of narrowband services. The BMC interface is not within the scope of this requirements Supplement, and is therefore deliberately not defined. One of the major impacts of this scope statement is to leave the split of functionality between the BCF and the MCF also undefined. However, the BCF and MCF interacting together must provide, at the BCF side of the CBC interface, the same functionality regardless of the split of responsibilities between the BCF and the MCF.

ANNEX D

Roadmap to BICC CS-2 requirements documentation

This annex contains a list of Technical Reports appropriate to BICC CS-2 requirements.

D.1 BICC CS-1 ITU-T Q-series Supplements Applicable to CS-2

Technical report TRQ. 2140: Signalling requirements for the support of narrowband services over broadband transport technologies [3].

Technical report TRQ.3000: Operation of the bearer independent call control (BICC) protocol with digital subscriber signalling system No. 2 (DSS2) [13].

Technical report TRQ.3010: Operation of the bearer independent call control (BICC) protocol with AAL Type 2 signalling protocol (CS-1) [12].

Technical report TRQ.3020: Operation of the bearer independent call control (BICC) protocol with broadband integrated services digital network user part (B-ISUP) for AAL Type 1 adaptation [11].

D.2 BICC CS-2 Requirements ITU-T Q-series Supplements

Technical report TRQ.2141.0: Signalling requirements for the support of narrowband services over broadband transport technologies – Capability set 2 (CS-2) (this Supplement).

Technical report TRQ.2141.1: Signalling requirements for the support of narrowband services via broadband transport technologies, CS-2 –Signalling Flows [4].

Technical report TRQ.2500: Signalling requirements for call bearer interface (CS-1) [5].

Technical report TRQ.2410: Signalling requirements for the support of IP bearer control in BICC networks [7].

D.3 BICC CS-2 Mapping ITU-T Q-series Supplements

Technical report TRQ.3030: Operation of the bearer independent call control (BICC) protocol with IP bearer control protocol IPBCP [6].

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