INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Series Q
Supplement 38
(05/2001)

SERIES Q: SWITCHING AND SIGNALLING

Technical Report TRQ.2600: BICC signalling transport requirements – Capability set 1

ITU-T Q-series Recommendations – Supplement 38

(Formerly CCITT Recommendations)

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Supplement 38 to ITU-T Q-series Recommendations

Technical Report TRQ.2600: BICC signalling transport requirements – Capability set 1

Summary

This Supplement to ITU-T Q-series Recommendations is a technical report on the signalling transport requirements needed for support narrowband services via broadband transport technologies. Its scope is limited to the signalling transport of the associated protocols at the call control, bearer control and call bearer control needed to provide this capability across an ATM/IP backbone network for Capability Set 2.

Source

Supplement 38 to ITU-T Q-series Recommendations was prepared by ITU-T Study Group 11 (2001-2004) and approved under the WTSA Resolution 5 procedure on 25 May 2001.

FOREWORD

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Supplement 38 to ITU-T Q-series Recommendations

Technical Report TRQ.2600: BICC signalling transport requirements – Capability set 1

1 Scope

This Supplement provides requirements for the transport of signalling protocols supported by the BICC CS-2 functional model. For interfaces within the BICC functional model, the known requirements are identified to aid in the design of appropriate new transport protocol options.

2 References

[1] IETF RFC 2960 (2000), *Stream Control Transmission Protocol*.

[2] ITU-T Q.711 (2001), *Functional description of the signalling connection control part*.

[3] ITU-T Q.701 (1993), *Functional description of the message transfer part (MTP) of Signalling System No. 7.*

[4] ITU-T Q.2110 (1994), *B-ISDN ATM Adaptation Layer – Service specific connection oriented protocol (SSCOP)*.

[5] ITU-T Q.1902.1 (2001), *Bearer independent call control protocol (CS-2) functional description*.

[6] ITU-T Q.2150.0 (2001), *Generic signalling transport service*.

[7] ITU-T Q.2150.1 (2001), *Signalling transport converter on MTP3 and MTP3b*.

[8] ITU-T Q.2150.2 (2001), *Signalling transport converter on SSCOP and SSCOPMCE*.

[9] ITU-T Q.2150.3 (2001), (Draft) *Signalling transport converter on SCTP*.

[10] ITU-T Q.2210 (1996), *Message transfer part level 3 functions and messages using the services of ITU-T Recommendation Q.2140.*

[11] ITU-T Q.2630.1 (1999), *AAL type 2 signalling protocol – Capability Set 1*.

[12] ITU-T Q.2630.2 (2000), *AAL type 2 signalling protocol – Capability Set 2*.

2.1 Bibliography

[13] IETF RFC 791 (1981), Internet Protocol (IP v4).

[14] IETF RFC 2460, (1998), Internet Protocol (IP v6).

[15] ITU-T Q.733.3 (1997), *Stage 3 description for call completion supplementary services using Signalling System No. 7: Completion of calls to busy subscriber (CCBS)*.

[16] ITU-T Q.733.5 (1992), *Stage 3 description for call completion supplementary services using Signalling System No. 7: Completion of Calls on No Reply* .

[17] ITU-T Q.735.1 (1993), *Stage 3 description for community of interest supplementary services using Signalling System No. 7: Closed user group (CUG)*.

[18] ITU-T Q.736.1 (1995), *Stage 3 description for charging supplementary services using Signalling System No. 7: Clause 1 – International Telecommunication Charge Card (ITCC)*.

[19] ITU-T Q.2931 (1995), *Digital Subscriber Signalling System No. 2 – User-Network Interface (UNI) layer 3 specification for basic call/connection control*.

[20] ITU-T Q.2761 (1999), *Functional description of the B-ISDN user part (B-ISUP) of signalling system No. 7*.

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

[22] ITU-T Q.2130 (1994), *B-ISDN signalling ATM adaptation layer – Service specific coordination function for support of signalling at the user-network interface (SSFC at UNI)*.

[23] ITU-T Q.1950 (2001), *Bearer independent call bearer control protocol*.

[24] ITU-T Q.1990 (2001), *BICC Bearer Control Tunneling Protocol*.

[25] ITU-T Q.1970 (2001), *BICC IP Bearer control protocol*.

[26] IETF draft-ietf-sigtran-m3ua-06.

[27] IETF draft-ietf-sigtran-sua-05.

[28} IETF draft-ietf-sigtran-m2pa.-02.

[29] IETF draft-ietf-sigtran-m2ua-07.

3 Abbreviations

This Supplement uses the following abbreviations:

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

BICC Bearer Independent Call Control

BISUP Broadband Integrated Service User Part

BIWF Bearer Interworking Function

CS Capability Set

CSF Call Service Function

CSF-C Call Service Coordination Function

CSF-G Call Service Gateway Function

CSF-N Call Service Nodal Function

CSF-T Call Service Transit Function

DSS2 Digital Signalling System No. 2

GSN Gateway Serving Node

IN Intelligent Network

INAP Intelligent Network Application Protocol

IP Internet Protocol

ISDN Integrated Services Digital Network

ISN Interface Serving Node

M2PA SS7 MTP-2-Peer-to-peer Adaptation Layer

M2UA SS7 MTP2-User Adaptation Layer

M3UA SS7 MTP3-User Adaptation Layer

SCCP Signalling Connection Control Part

SCF Service Control Function

SCTP Stream Control Transport Protocol

SN Service Node

SRF Service Resource Function

SUA SS7 SCCP-User Adaptation Layer

TC Transaction Capability

TI/SCCP Transport Independent SCCP

TSN Transit Serving Node.

4 Definitions

NOTE – Refer to [5] for BICC CS-2 definitions

4.1 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.

4.2 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.

4.3 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 interworking 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 and/or BCF-J) 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 and/or BCF-J) 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.

4.4 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 interworking 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.

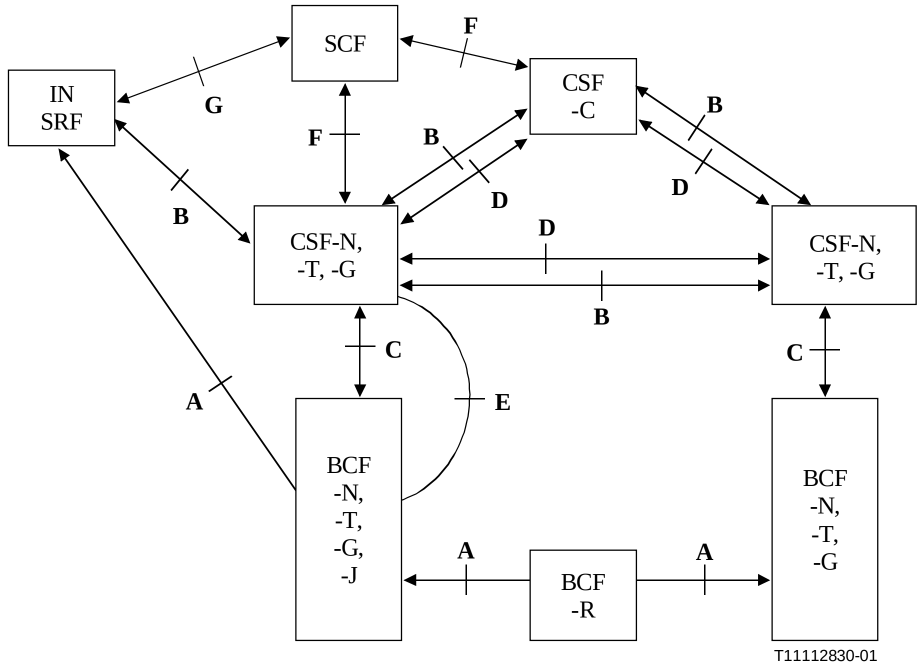
4.5 Interface Serving Node (ISN): A functional entity which provides the interface with non-BICC networks and terminal equipment. This functional entity contains one or more call service nodal functions (CSF-N), and one or more interworking functions (BIWF) which interact with the non-BICC networks and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

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

4.7 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

The signalling transport interfaces that are expected to be visible within a BICC CS-2 functional model are shown in Figure 1. Figure 1 is derived from the Signalling Requirements TRQ document. For the purposes of this Supplement there is not a one-to-one relationship with the functional entities in the Signalling Requirements TRQ. It is not necessary to separate out the various network CSFs (-N , -T, –G and -C) in Figure 1 for the purposes of examining the transport requirements between them as the signalling protocol between any two is expected to be the same.



Definition of Signalling Interfaces

A Bearer Control Signaling interface
B Call Control Signalling interface
C Call and Bearer Control (CBC) signalling interface
D ISDN supplementary service signaling interface
E Access Call Control Signalling interface
F Intelligent Networks signalling interface (SSF-SCF)
G Special resource control signaling interface (SCF-SRF)

Figure 1 – Signalling Interfaces

6 Identification of Existing and Candidate Protocols for the BICC Interfaces

The example upper layer signalling protocols currently identified to be transported over the above signalling interfaces are:

A ATM VC control, AAL2 Type 2 signalling (ITU-T Q.2630.2)

B Bearer Independent ICallControl CS-2 (ITU-T Q.1902.x)

C CBC protocol (based on ITU-T H.248)

D BICC Supplementary Services application protocol carried over TC

E Message based access protocol such as DSS1, DSS2, ISUP, H323

F Application protocol carried over TC

G Application protocol carried over TC

6.1 Signalling Interfaces and Signalling Transport Requirements

For the signalling interfaces identified in Figure 1, the upper-layer signalling protocols used may already have defined signalling transport requirements and indeed may already have one or more transport protocol stack options defined that meet those requirements. In ITU-T H.248 [21], both ATM or IP signalling transports are defined. Some signaling protocols such as BICC have transport protocol stack options already defined, such as BICC/STC_{mtp3}/MTP3, but have added new options for transport over emerging transport protocols such as SCTP/IP SCTP and MTP3 are also defined as a signalling transport for H.248.

This Supplement will consider only the transport of the protocols defined in BICC CS-2. These are BICC, ISUP Supplementary services and IN application protocol over TC, Bearer Control Protocols, ISUP Access Signalling Control and CallBearer Control. This supplement defines the signalling transport requirements and transport protocol stack options for these.

7 Backward Compatibility Considerations

Given that the call control protocol (BICC) is independent of the underlying signaling transport protocols, each network may be using different signalling transport protocols to transport the call control protocol (BICC) between peer entities. Given the number of possible network configurations and signalling transport options, appropriate signalling transport protocol selection and network design would be required to ensure end-to-end compatibility of the call control protocol. For example, there may be cases where a CS-1 and CS-2, two CS-1, or two CS-2 Service Nodes (SNs) are using different signalling transport protocols and therefore require proper network design for end-to-end compatibility of the call control protocol. Three generic network configurations for signalling transport compatibility considerations are identified in the following subclauses.

7.1 Configuration 1

Configuration 1 is illustrated in Figure 2. This is the case where two SNs (SN1 and SN3) communicate via a common signalling transport network. Since the underlying signalling transport protocols is common, there is no incompatibility between the two SNs and call control messages could be exchanged directly between the two SNs.

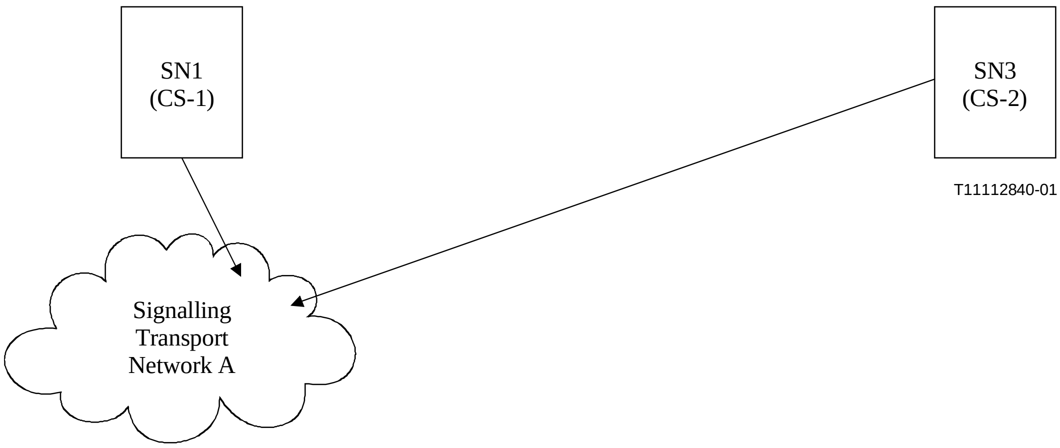


Figure 2 – Configuration 1

7.2 Configuration 2

Configuration 2 is illustrated in Figure 3. This is the case where two SNs (SN1 and SN3) are using two different signalling transport protocol options for the call control protocol. Since the signalling transport protocol options are incompatible, the two SNs (SN1 and SN3) cannot communicate directly with each other.

Instead, they are forced to communicate via an intermediate node (SN2) that supports both signalling transport protocol options as illustrated in Figure 3.

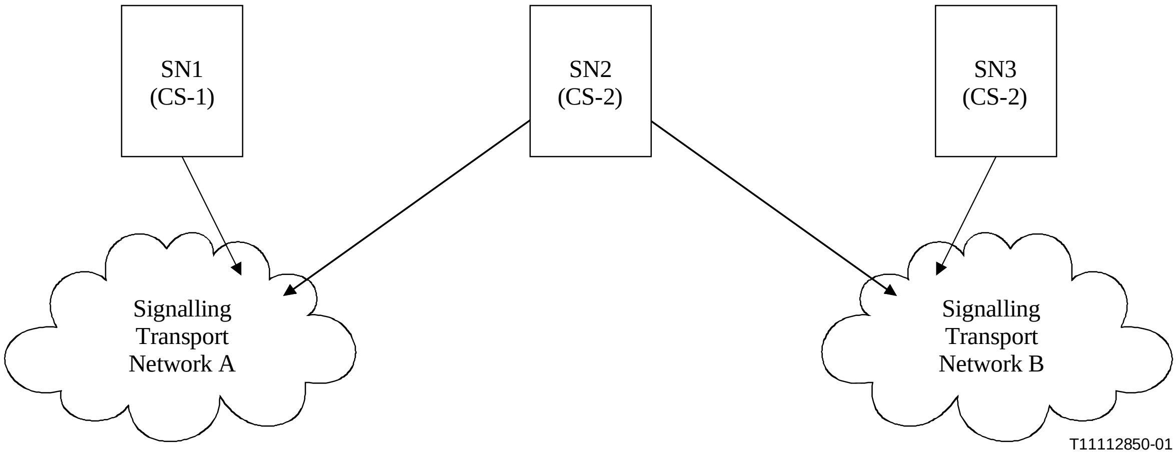


Figure 3 – Configuration 2

7.3 Configuration 3

Configuration 3 is illustrated in Figure 4. As in Configuration 2, the two SNs (SN1 and SN3) in this case are also using two signalling transport protocol options that are incompatible. However, in this case, there is no intermediate SN supporting both signalling transport protocols options to allow communication between the two SNs. To allow the two SNs to communicate in this case, interworking between the two signaling transport protocol options would be required. For example, some means must be provided to interwork signalling transport technology A to signalling transport technology B at some intermediate point in the transport network between the two SNs.

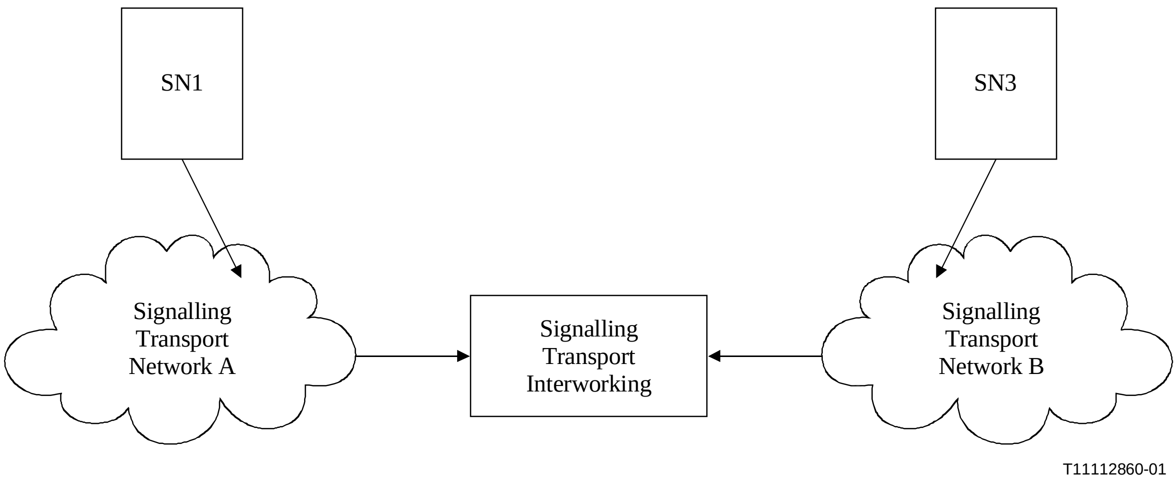


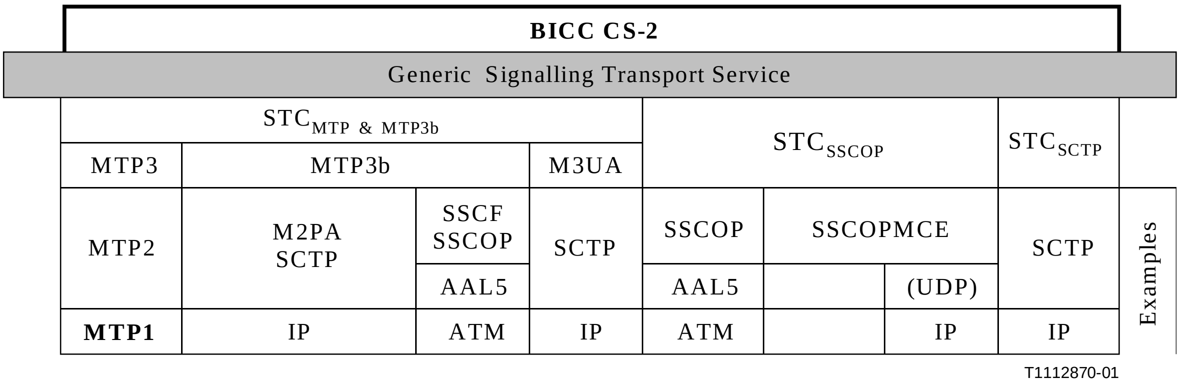
Figure 4 – Configuration 3

8 Signalling Transport Protocol Architecture

This clause describes the protocol architecture for the signalling interfaces applicable for signaling transport.

8.1 BICC Signalling Transport Options (Interface "B")

BICC CS-2 (ITU-T Q.1902.x series) are independent of the underlying transport protocols by specifying Signalling Transport Converters (STCs) for the specific underlying transport protocol type. Protocol type in this context refers to the underlying protocol directly interfacing with the STC (e.g. MTP) and does not include the protocol options below that protocol. Using the STC for MTP, BICC CS-2 could be deployed over MTP3, MTP3b or M3UA. Using the STC for SSCOP, BICC CS-2 could be deployed over SSCOP or SSCOPMCE. A STC for BICC deployment directly over SCTP is specified. Figure 5 illustrates the STCs for BICC CS-2 deployment and also provides examples of some complete transport protocol options.



NOTE – M2PA and M3UA adaptation layers under development by the IETF Signalling Transport (SIGTRAN) Working Group.

Figure 5 – Signaling Transport Options for BICC CS-2

NOTE – All protocol stacks shown below the various STCs are examples: other stacks are possible beneath the MTP3, MTP3B, M3UA, SSCOP, SSCOPMCE and SCTP protocol layers. The set of examples shown is not intended to be exhaustive. Which lower layer protocols to be used depends on the Network Operator's application. Figure 5 does not preclude use of CS-2 example lower layers in CS-1 implementations where this would be transparent to the STCs defined in CS-1.

Figure 5 does not imply an implementation of a node.

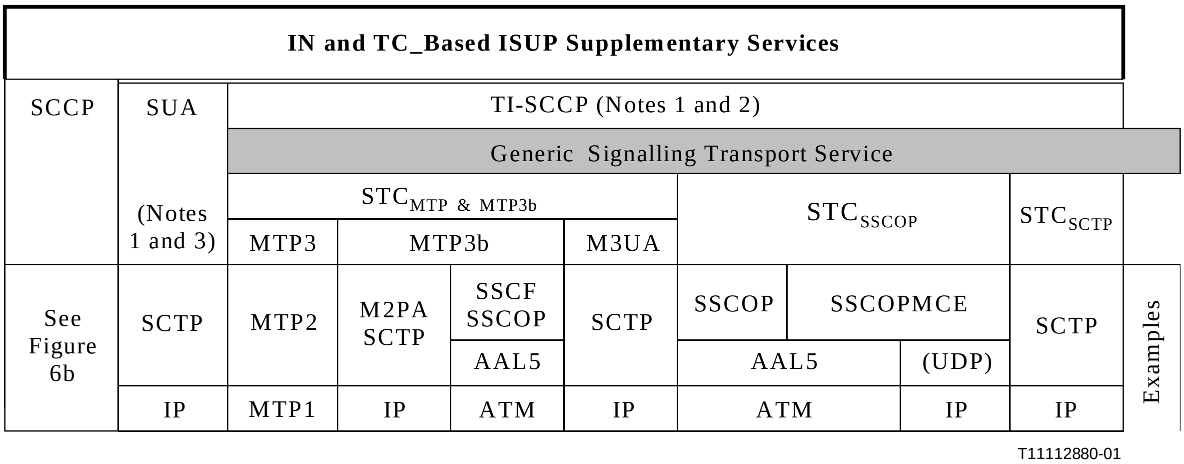
The STC_{mtp} for adapting BICC CS-2 to signalling transport layers providing an MTP3 upper layer interface is described in ITU-T Q.2150.0 and Q.2150.1.

The STC_{SSCOP} for adapting BICC CS-2 to signalling transports providing an SSCOP upper layer interface is described in ITU-T Q.2150.0 and Q.2150.2**.**

The STC_{SCTP} for adapting BICC CS-2 to the SCTP upper layer interface is described in ITU-T Q.2150.0 and Q.2150.3.

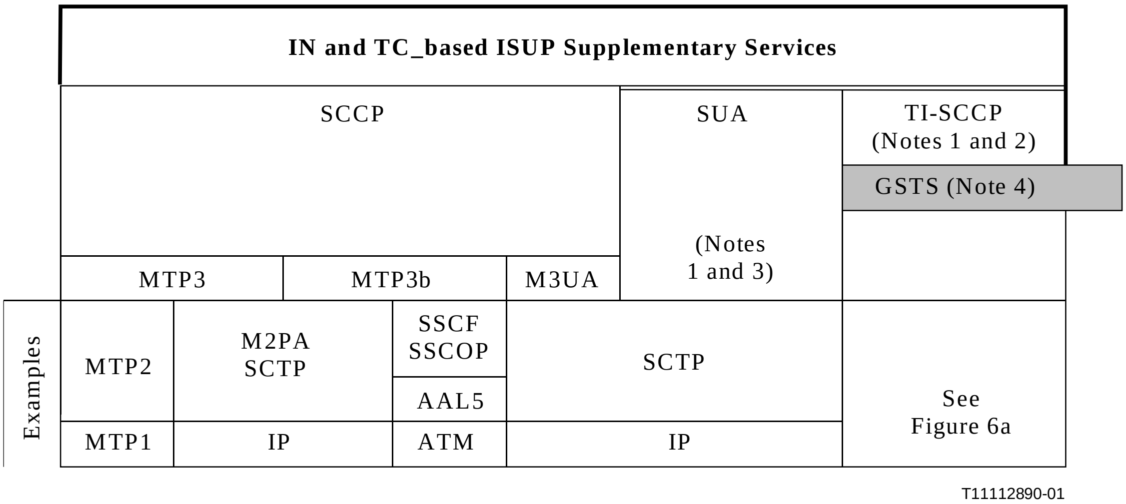
8.2 TC-based service signalling transport options (Interface "D", "F", and "G")

Figures 6a and 6b show the signalling transport stack options for the transport of the TC-based ISUP Supplementary Services. Various Signalling Transport Converters are utilized to adapt the SCCP and TC lower layer interface to the upper layer interfaces of the various network and transport layer protocol options.



NOTE 1 – These SCCP Services permit extended Global Title Translation.
NOTE 2 – TI-SCCP is being developed.
NOTE 3 – M2PA, M3UA, and SUA are under development by the IETF SIGTRAN Working Group.

Figure 6a – BICC Signalling Transport Options for TC-based Services



NOTE 1 – These SCCP Services permit extended Global Title Translation.
NOTE 2 – TI-SCCP is being developed.
NOTE 3 – M2UA, M3UA, and SUA are under development by the IETF SIGTRAN Working Group.
NOTE 4 – Generic Signalling Transport Service

Figure 6b – BICC Signalling Transport Options for TC-based Services

NOTE – All protocol stacks the various STCs are examples: other stacks are possible beneath the MTP3, MTP3B, M3UA, SSCOP, SSCOPMCE and SCTP protocol layers. The set of examples shown is not intended to be exhaustive. Which lower layer protocols to be used depends on the Network Operator's application. Figure 6 does not preclude use of CS-2 example lower layers in CS-1 implementations where this would be transparent to the STCs defined in CS-1. Figure 6 does not imply an implementation of a node.

The TC-based ISUP Supplementary Services considered are:

- CCBS as defined in ITU-T Q.733.3
- CCNR as defined in ITU-T Q.733.3
- CUG as defined in ITU-T Q.735.1 (only CUG version with centralized administration of CUG data)

• ITCC as defined in ITU-T Q.736.1.

For these TC-based supplementary services, signalling information is traditionally transferred between end nodes via the SS7 SCCP as defined in ITU-T Q.711.

The same options may also be used for IN-based services signalling transports.

8.3 Signalling Transport Option for the Call Bearer Control Protocol (Interface "C")

The CBC protocol is based on ITU-T H.248. For ITU-T H.248, a number of signalling transport protocols are defined to cover the wide use of applications foreseen for ITU-T H.248. These options are defined in Annex D, H and I/H.248. For applications like the CBC protocol, and taking into account the signalling transport requirements outlined in clause 9, the most reliable signalling transports are SCTP and MTP3B, which are defined in Annex H and I/H.248.

No additional requirement is identified beyond those already covered by the defined signalling transports.

8.4 Signalling Transports for the Bearer Control Protocol (Interface "A")

Currently four different protocols are identified as bearer control protocols:

1 DSS2, as defined in ITU-T Q.2930 series and other alike protocols, where the signalling transport is defined in ITU-T Q.2140 and Q.2130.

2 B-ISUP as defined in ITU-T Q.2960 series, where the signalling transport is defined in ITU-T Q.2210 (Message transfer part level 3 functions and messages using the services of ITU-T Q.2140).

3 AAL type 2 signalling protocol where the signalling transport is defined in ITU-T Q.2630.1 and Q.2630.2.

4 IPBCP as defined in ITU-T Q.1990 where the signalling transport is defined in the ITU-T Q.1950 and Q.1902 series Recommendations.

No additional requirement is identified beyond those already covered by the defined signalling transports.

8.5 ISUP Access Signalling Transport Options (Interface "E")

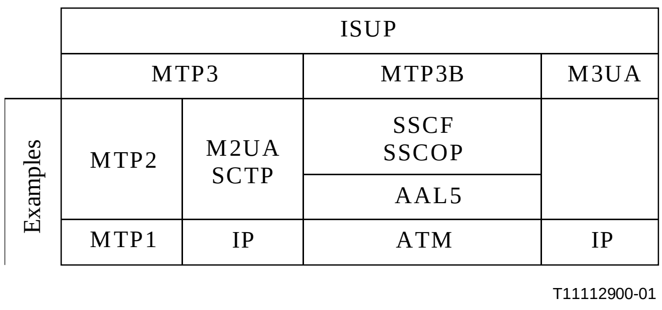


Figure 7 – Signalling transport options for ISUP access signalling.

NOTE – All protocol stacks shown are examples: other stacks are possible beneath the MTP3, MTP3B, M3UA, SSCOP, SSCOPMCE and SCTP protocol layers. The set of examples shown is not intended to be exhaustive. Which lower layer protocols to be used depends on the Network Operator's application. Figure 7 does not preclude use of CS-2 example lower layers in CS-1 implementations where this would be transparent to the STCs defined in CS-1. Figure 7 does not imply an implementation of a node.

Interface "E" is used where the signalling links are terminated in the BCF and the relevant ISUP signalling information is transported to the CSF with different protocol stacks. It is assumed that the BCF includes a signalling gateway.

9 Signalling Transport Requirements

The following subclauses present the proposed set of signalling requirements for transport of BICC CS-2, TC-based ISUP Supplementary Services Call Bearer control protocol and Bearer Control protocols. These have been divided into a number of categories for classification.

Within the definition of requirements specified in the subclauses below, the following terms are used:

– Signalling route: A specific path across the signaling transport network between two nodes.

– Signalling route set: A collection of one or more signalling routes.

9.1 Basic Services

The introduction of a new signalling transport will provide the following **minimum** basic services:

- assured data transfer;
- in-sequence delivery of PDUs.

9.2 Signalling Transport Interface

– The introduction of a new signalling transport shall not impact the existing application primitive interface.

– It shall be possible for a BICC-related node to support multiple signalling transports at the same time.

– A signalling transport shall allow multiple signalling interfaces terminating on a node to use a common physical interface.

– The signalling transport shall provide an indication to the users of the signalling transport when they can start/stop exchanging signalling information.

9.3 Addressing

– A signalling transport shall provide a means of uniquely identifying the originating and terminating signalling entities.

9.4 Routing

– The signalling transport shall provide a signalling route set between the originating and terminating signalling entities consisting of a priority sorted list of one or more signalling routes. In this case, Only one signalling route may be in use at any given moment – the highest priority available route.

– It shall be possible to establish parallel signalling routes between two entities across multiple signalling transport technologies. This might be useful when migrating from one transport technology to another, for the period of a transport cutover. How the traffic is moved from one route to another is, in this case, implementation dependent.

– The signalling transport shall allow multiple signalling routes of equal priority over which signaling traffic will be evenly distributed.

NOTE – The ability to allow signalling routes of different signalling transports to be allocated between a pair of nodes is implementation dependent. If allowed, the ability to load share between those different routes is also implementation dependent.

9.5 Network management procedures

- *Alternate routing*
  - The signalling transport shall provide a means of moving signalling messages from a failed signalling route to another signalling route with an equal or lower priority within the same signalling route set.
  - The signalling transport shall provide a means of returning signalling messages to an available signalling route with an equal or higher priority after that signalling route's failure condition(s) have been corrected.
- *Route status indication*
  - The signalling transport shall provide an indication to the application when the availability status of a signalling entity changes.
  - The signalling transport shall provide an indication to the application when the currently used signalling route to a signalling entity has become congested.

9.6 Message length

– It shall be possible to transfer messages of up to 272 bytes for narrowband SS7, 4096 bytes for broadband SS7 and 65 534 bytes for IP signalling transport. The message length capacity of the signalling transport shall be indicated to the BICC. The value is provisioned by the Operator based on the capabilities of the underlying transport between the specific transport end-points.

9.7 Quality of Service

- *Error detection*
  - The signalling transport shall be able to identify signalling units received containing bit errors.
- *Error correction*
  - The signalling transport shall be able to correct signalling units received containing bit errors.
- *Error rate monitoring*
  - The signalling transport shall be able to monitor the error rate of the signalling connection. The signalling connection shall be removed from service if the error rate exceeds an acceptable threshold. The signalling connection shall not be made available until an acceptable error rate is achieved.
- *Congestion control*
  - The signalling transport shall provide a means to detect signalling congestion on the route. (It is the responsibility of the application to reduce traffic based on the congestion indication.)

9.8 Signaling network performance

- *Delay*
  - The signalling transport network shall not introduce more than a mean value of 500 ms delay on a particular signalling relation.
  - Conditions such as alternate routing and changeover/changeback shall not introduce significant delay such that existing network services are impacted.
- *Availability*
  - The unavailability of a signalling route shall not be greater than 10 minutes/year.

- Undetected errors
  - Not more than one in 10^{10} of all signalling unit errors may be undetected.
- *Message loss*
  - Not more than one in 10^7 of all signalling units may be lost due to a failure, that are undetected.
- *Messages out-of-sequence*
  - Not more than one in 10^{10} signalling units may be delivered out-of-sequence to the user part due to failure.

9.9 Operational Aspects

– To be able to change the signalling transport in a smooth way it shall be possible to add and delete signalling paths within a route without interruption of the service between two nodes.

9.10 Security

When the signalling is transported over an IP network, two possible ways to provide the network can be distinguished:

1) Signalling transported only within an intranet: security measures are applied at the discretion of the network owner.

2) Signalling transported, at least to some extent, in the public Internet: the public Internet should be regarded generally as an "unsecure" network and usage of security measures are required.

Generally security comprises several aspects:

- Authentication: It is required to ensure that the information is sent to/from a known and trusted partner.
- Integrity: It is required to ensure that the information hasn't been modified while in transit.
- Confidentiality: It might be sometimes required to ensure that the transported information is encrypted to avoid illegal use.
- Availability: It is required that the communicating endpoints remain in service for authorized use even if under attack.

10 Network Planning and Provisioning Guidelines

The main objective for network planning is to ensure that the signalling network fulfils the requirements for availability, capacity and delay that the operator has set up. All operators do not have the same requirements so it should therefore be possible to provision the network in accordance with the service objective for the operator. It should be possible to:

- provide the signalling transport network as an intranet or as a part of the public Internet;
- handle the signalling transport network independent from the bearer network;
- increase/decrease the number of signalling possibilities between two communications entities;
- provide the signalling paths in a redundant manner between the entities;
- arrange them as direct or routed path between the entities;
- ensure the required bandwidth for each signalling path.

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Printed in Switzerland
Geneva, 2001