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**Digital cellular telecommunications system (Phase 2+) (GSM);
General Packet Radio Service (GPRS);
Base Station System (BSS)
- Serving GPRS Support Node (SGSN) interface;
Network service
(3GPP TS 48.016 version 17.0.0 Release 17)**

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Contents

Foreword

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1 Scope

The present document specifies the Network Service used on the Base Station System (BSS) to Serving GPRS Support Node (SGSN) interface (Gb interface).

The protocol stack on the Gb interface is defined in the stage 2 Technical Specification 3GPP TS 43.060.

The Network Service entity provides network services to the BSSGP entity specified in 3GPP TS 48.018.

The layer 1 of the Gb interface is specified in 3GPP TS 48.014.

In the present document, the communication between adjacent layers and the services provided by the layers are distributed by use of abstract service primitives. But only externally observable behaviour resulting from the description is normatively prescribed by the present document.

The service primitive model used in the present document is based on the concepts developed in ITU-T Recommendation X.200.

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 22.060: "General Packet Radio Service (GPRS); Service description; Stage 1".

[3] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".

[4] 3GPP TS 48.014: "General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN) interface; Gb interface Layer 1".

[5] 3GPP TS 48.018: "General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN); BSS GPRS Protocol (BSSGP)".

[6] FRF 1.1 (1996): "User-to-Network Implementation Agreement (UNI)".

[7] (void).

[8] ITU-T Recommendation Q.921 (1997): "ISDN user-network interface - Data link layer specification".

[9] ITU-T Recommendation Q.922 (1992): "ISDN data link layer specification for frame mode bearer services".

[10] ITU-T Recommendation Q.931 (1998): "ISDN user-network interface layer 3 specification for Basic Call Control".

[11] ITU-T Recommendation Q.933 (1995): "Digital Subscriber Signalling System No. 1 (DSS 1) - Signalling specifications for frame mode switched and permanent virtual connection control and status monitoring".

[12] ITU-T Recommendation I.370 (1991): "Congestion management for the ISDN Frame Relaying Bearer Service".

[13] ITU-T Recommendation X.200 (White Book): "Information technology - Open Systems Interconnection - Basic Reference Model: The basic model".

[14] ANSI T1.602: "ISDN - Data Link Layer Signalling Specification for Application at the User-Network Interface".

[15] ANSI T1.606 (1990): "Frame Relaying Bearer Service Architectural Framework and Service description (R 1996)".

[16] ANSI T1.617 (1991): "Digital Subscriber System No. 1 (DSS1) Signaling Specification for Frame Relay Bearer Service (R1997)".

[17] ANSI T1.618 (1991): "Digital Subscriber System No. 1 (DSS1) Core Aspects of Frame Relay Protocol for Use with Frame Relay Bearer Service (R1997)".

[18] IETF RFC 768 (1980): "User Datagram Protocol" (STD 6).

[19] IETF RFC 791 (1981): "Internet Protocol" (STD 5).

[20] IETF RFC 2460 (1998): "Internet Protocol, Version 6 (IPv6) Specification".

[21] 3GPP TS 23.236: "Intra-domain connection of Radio Access Network (RAN) nodes to multiple Core Network (CN) nodes".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TS 22.060 and the following in apply:

BSSGP Virtual Connection (BVC): end-to-end virtual communication path between remote Network Service user entities

BSSGP Virtual Connection Identifier (BVCI): identifier of a BVC, having end-to-end significance across the Gb interface

IP endpoint: an endpoint defined by its IP address and UDP port. An IP endpoint can be a data endpoint and/or a signalling endpoint

Data IP endpoint: an IP endpoint used for Data traffic

Signalling IP endpoint: an IP endpoint used for Signalling traffic

Data traffic: data traffic for an IP Sub-Network is defined as NS SDUs for PTP and PTM functional entities (BVCI≥1)

Signalling traffic: signalling traffic for an IP Sub-Network is defined as NS SDUs for Signalling functional entities (BVCI=0) and all PDUs for IP Sub-Network Service Control

Full Mesh Connectivity: any IPv4 endpoint in an NSE is capable of communications with any IPv4 endpoint in its peer NSE. Also any IPv6 endpoint in an NSE is capable of communications with any IPv6 endpoint in its peer NSE

Network Service Entity Identifier (NSEI): identifier of an NS Entity having end-to-end significance across the Gb interface, i.e. the peer NSEs on the BSS side and the SGSN side are identified by the same NSEI value

Network Service Virtual Connection (NS-VC): end-to-end virtual communication path between Network Service peer entities

Network Service Virtual Connection Identifier (NS-VCI): identifier of an NS-VC having end-to-end significance across the Gb interface

Network Service Virtual Link (NS-VL): virtual communication path between the BSS or the SGSN and the intermediate network, or between the BSS and the SGSN in case of direct point-to-point configuration

Network Service Virtual Link Identifier (NS-VLI): identifier of an NS-VL, having local significance at the BSS or SGSN

Network Service Virtual Connection Group: groups all NS-VCs together which provide communication between the same peer NS entities. This grouping has local significance at the BSS or SGSN

Blocked / unblocked: when an NS-VC can not be used for NS user traffic, it is blocked. When an NS-VC can be used for NS user traffic, it is unblocked

Dead / alive: when an NS-VC is able to provide communication between remote NS entities, it is alive. When it is not able, it is dead. These states are supervised by means of a test procedure, as further described in the present document

Pool area: an area within which an MS may roam without need to change the serving SGSN. A pool area is served by one or more SGSNs in parallel. All the cells controlled by a BSC belong to the same one (or more) pool area(s).

3.2 Symbols

For the purposes of the present document, the symbols given in 3GPP TS 23.060 apply.

3.3 Abbreviations

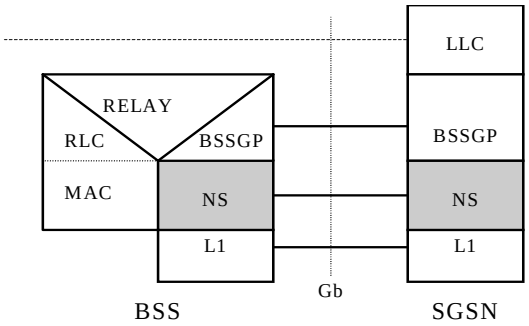
For the purposes of the present document, the abbreviations given in 3GPP TS 21.905 and the following apply:

BECN	Backward Explicit Congestion Notification
BSSGP	Base Station System GPRS Protocol
BVC	BSSGP Virtual Connection
BVCI	BSSGP Virtual Connection Identifier
CLLM	Consolidated Link Layer Management
DE	Discard Eligibility
FECN	Forward Explicit Congestion Notification
FR	Frame Relay
FRF	Frame Relay Forum
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
LLC	Logical Link Control
LSP	Link Selector Parameter
MAC	Medium Access Control
NS	Network Service
NSEI	Network Service Entity Identifier
NS-SAP	Network Service Service Access Point
NS-VC	Network Service Virtual Connection
NS-VCI	Network Service Virtual Connection Identifier
NS-VL	Network Service Virtual Link
NS-VLI	Network Service Virtual Link Identifier
PDU	Protocol Data Unit
PTM	Point-To-Multipoint
PTP	Point-To-Point
PVC	Permanent Virtual Connection
RLC	Radio Link Control
SGSN	Serving GPRS Support Node
SNS	Sub-Network Service
UDP	User Datagram Protocol
UNI	User-to-Network Interface

4 Network Service general description

4.1 Overview

The position of the Network Service within the protocol stack of the Gb interface is shown in figure 4.1.1.



NOTE: BSSGP, L1, LLC, MAC, RELAY, RLC are outside the scope of the present document, refer to 3GPP TS 43.060 for further details.

Figure 4.1.1: Position of the NS within the Gb interface protocol stack

The Network Service performs the transport of NS SDUs between the SGSN and BSS. The services provided to the NS user shall be:

- Network Service SDU transfer. The Network Service entity shall provide network service primitives allowing for transmission and reception of upper layer protocol data units between the BSS and SGSN. The NS SDUs are transferred in order by the Network Service, but under exceptional circumstances order may not be maintained.
- Network congestion indication. Congestion recovery control actions may be performed by the Sub-Network Service (e.g. Frame Relay). Congestion reporting mechanisms available in the Sub-Network Service implementation shall be used by the Network Service to report congestion.
- Status indication. Status indication shall be used to inform the NS user of the NS affecting events e.g. change in the available transmission capabilities.

The Network Service entity is composed of an entity dependent on the intermediate transmission network used on the Gb interface, the Sub-Network Service, and of a control entity independent from that network, the Network Service Control. There is a hierarchical relationship between both entities. This is reflected in figure 4.1.2. The detailed communication mechanisms between both entities is an internal matter for the Network Service and is not further standardized.

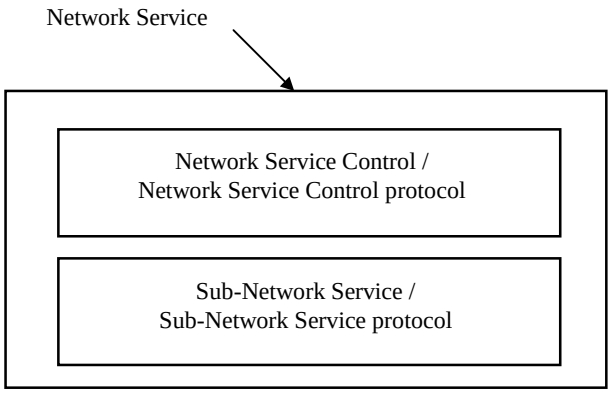


Figure 4.1.2: Internal architecture of the Network Service

The Sub-Network Service entity provides a communication service to Network Service Control peer entities. The Network Service Control peer entities use the Sub-Network Service for communication with each other. The peer-to-peer communication accross the Gb interface between remote Network Service Control entities is performed over Network Service Virtual Connections (NS-VCs). An NS-VC is a virtual communication path between Network Service Control peer entities.

The Network Service entity provides a communication service to NS user peer entities: the peer-to-peer communication between remote NS user entities is performed over BSSGP Virtual Connections (BVCs). A BVC is a virtual communication path between Network Service user peer entities. A Network Service Entity communicates with only one peer Network Service Entity.

Addressing across the Gb interface is further detailed in the rest of the present document.

The Network Service Control entity is responsible for the following functions:

- NS SDU transmission: The NS SDUs shall be transmitted on the NS-VCs. The NS SDUs are encapsulated into Network Service Control PDUs which in turn are encapsulated into Sub-Network Service PDUs.

- Load sharing: The load sharing function distributes the NS SDU traffic amongst the available (i.e. unblocked) NS-VCs of a group.

- NS-VC management: A blocking procedure is used by an NS entity to inform an NS peer entity when an NS-VC becomes unavailable for NS user traffic. An unblocking procedure is used for the reverse operation. A reset procedure is used between peer NS entities in order to set an NS-VC to a determined state, after events resulting in possibly inconsistent states of the NS-VC at both sides of the Gb interface. A test procedure is used to check that an NS-VC is operating properly between peer NS entities.

4.2 Addressing

The purpose of this sub-clause is to describe the addressing principles on the Gb interface in a generic way, i.e. irrespective of the exact configuration of the Gb interface and of the exact nature of the intermediate transmission network, when present. Therefore, this sub-clause provides an abstract description of the addressing principles. These principles are then applied to real networks in sub-clause "Sub-Network Service protocol".

In this sub-clause, addressing is considered in the general case where an SGSN is connected to several BSSs via an intermediate transmission network and in the specific case where a BSS is connected to several SGSNs within one or more pool areas, see 3GPP TS 23.236. Point-to-point physical connections may also be used, addressing in this special case can be derived from the general case.

4.2.1 Network Service Virtual Link (NS-VL)

An SGSN and a BSS may use different physical links for connecting to each other (e.g. because of intermediate equipment or transmission network). Each physical link is locally (i.e. at each side of the Gb interface) identified by means of a physical link identifier. The exact structure of the physical link identifier is implementation dependent.

Each physical link supports one or more Network Service Virtual Links (NS-VLs). Each NS-VL is supported by one physical link if the Frame Relay Sub-Network is employed. For an IP sub-network, the NS-VL is mapped to an IP endpoint. The exact nature of the NS-VL depends on the intermediate network used on the Gb interface. In the general case of an intermediate transmission network, the NS-VL is used to access the intermediate network. Communication means internal to the intermediate network are outside the scope of the present document. The NS-VLs may alternatively be used end-to-end between the BSS and SGSN, in case of a point-to-point configuration on the Gb interface.

Each NS-VL may be identified by means of a Network Service Virtual Link Identifier (NS-VLI). The significance (i.e. local or end-to-end) and the exact structure of the NS-VLI depends on the configuration of the Gb interface and on the intermediate network used. For example, in the case of a Frame Relay network, the physical link is the FR bearer channel, the NS-VL is the local link (at UNI) of the FR permanent virtual connection (PVC) and the NS-VLI is the association of the FR DLCI and bearer channel identifier.

4.2.2 Network Service Virtual Connection (NS-VC)

In order to provide end-to-end communication between the BSS and SGSN irrespective of the exact configuration of the Gb interface, the concept of Network Service Virtual Connection (NS-VC) is used. The NS-VCs are end-to-end virtual connections between the BSS and SGSN. In the case of a FR sub-network, at each side of the Gb interface there is a one-to-one correspondence between NS-VCs and NS-VLs. When employing an IP-sub-network one NS-VL may serve several NS-VCs (see figure 4.2.2.1).

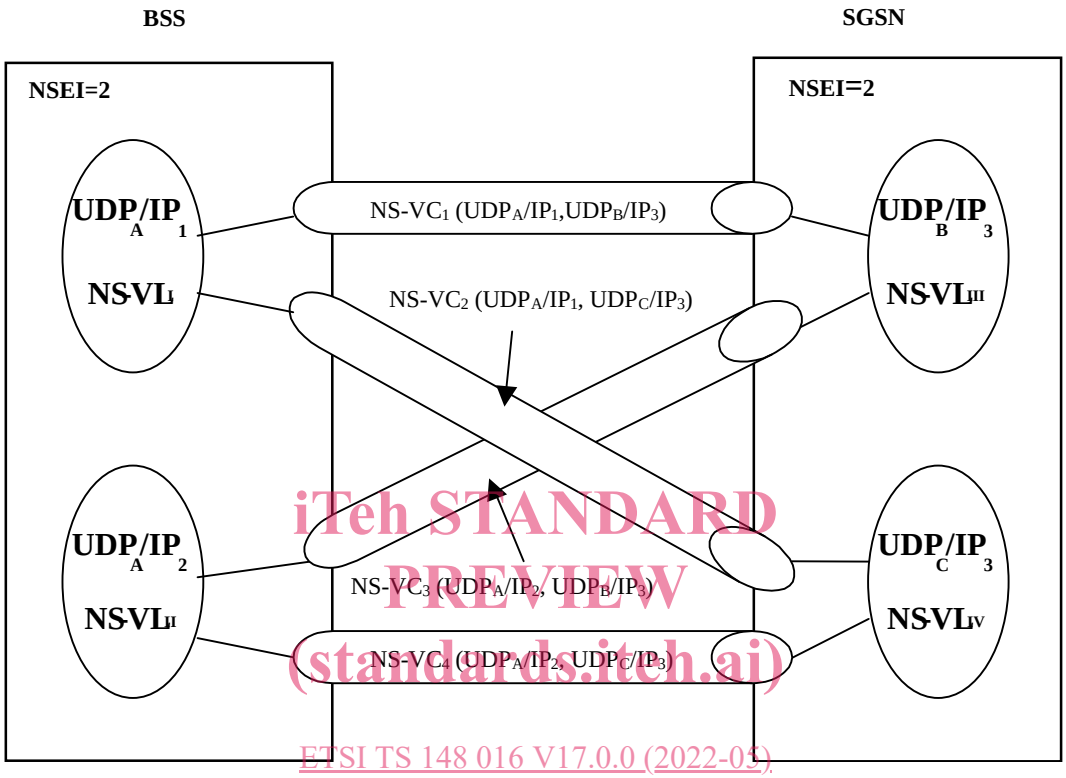


Figure 4.2.2.1: IP sub-network relationship between NS-VCs and NS-VLs

For example, in the case of a Frame Relay network, the NS-VC is the FR permanent virtual connection (PVC).

Figure 4.2.2.2 shows the relationship between NS-VCs and NS-VLs for a Frame Relay sub-network. In the case of an IP network, the NS-VC is given by a pair of IP endpoints at the BSS and SGSN. While Figure 4.2.2.1 illustrates a configuration with only one NSE, multiples NSE in either the BSS or SGSN are allowed.

At the BSS, the IP endpoints for each NSE shall not be shared among NSEs connected to the same SGSN. Howewer, an IP endpoint at the BSS may serve multiple NSEs when each of the NSEs is connected towards different SGSNs. At the SGSN, an IP endpoint may serve multiple NSEs; (i.e. IP endpoints may be shared among NSEs).

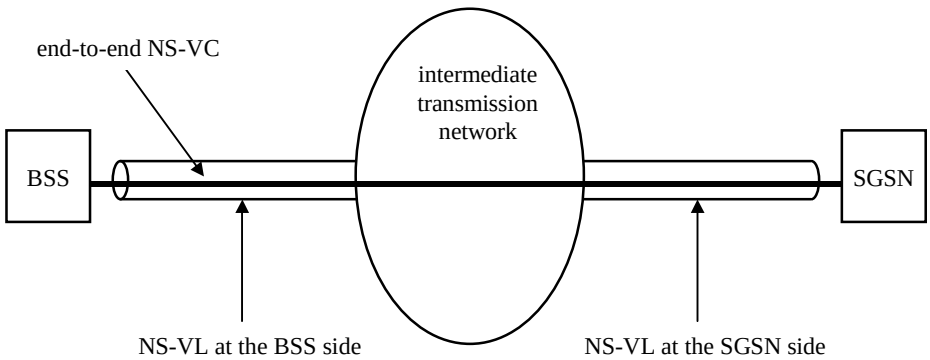


Figure 4.2.2.2: Frame relay sub-network relationship between NS-VCs and NS-VLs

Each NS-VC is identified by means of a Network Service Virtual Connection Identifier (NS-VCI) having end-to-end significance across the Gb interface. An NS-VCI uniquely identifies an NS-VC within an SGSN and within a BSS.

The establishment of an NS-VC includes the establishment of physical links, see 3GPP TS 48.014, and of NS-VLs.

In the case of an FR sub-network NS-VCs and NS-VLs are permanently established by means of administrative procedures, NS-VCIs are allocated by administrative means as well. The mapping of NS-VCIs on NS-VLIs and on physical link identifiers is held in non-volatile memory.

When employing an IP sub-network the NS-VCs and NS-VLs may be established by means of administrative means (static configuration) or by auto-configuration procedures (dynamic configuration).

4.2.3 Network Service Virtual Connection Group

The Network Service Virtual Connection Group groups together all NS-VCs providing communication between the same peer NS entities. One NS-VC group is configured between two peer NS entities. This grouping is performed by administrative means. At each side of the Gb interface, there is a one-to-one correspondence between a group of NS-VCs and an NSEI. The NSEI has an end-to-end significance across the Gb interface.

4.2.4 BSSGP Virtual Connection (BVC)

The Network Service provides communication paths between remote NS user entities. These communication paths are called BSSGP Virtual Connections (BVCs). Each BVC is used to transport NS SDUs between NS users.

A Network Service Entity provides one or more BVCs between peer NS user entities. Each BVC is supported by one group of NS-VCs. Each group of NS-VCs supports one or more BVCs. The NS entity maps between BVC and the related NS-VC group.

Each BVC is identified by means of a BSSGP Virtual Connection Identifier (BVCI) having an end-to-end significance across the Gb interface. The BVCI together with the NSEI uniquely identifies a BVC within an SGSN. The BVCI and NSEI are used on the Network Service-Service Access Point (NS-SAP) for layer-to-layer communication.

4.2.5 Use of Concepts on the Gb Interface when Intra Domain Connection of RAN Nodes to Multiple CN Nodes applies in the BSS

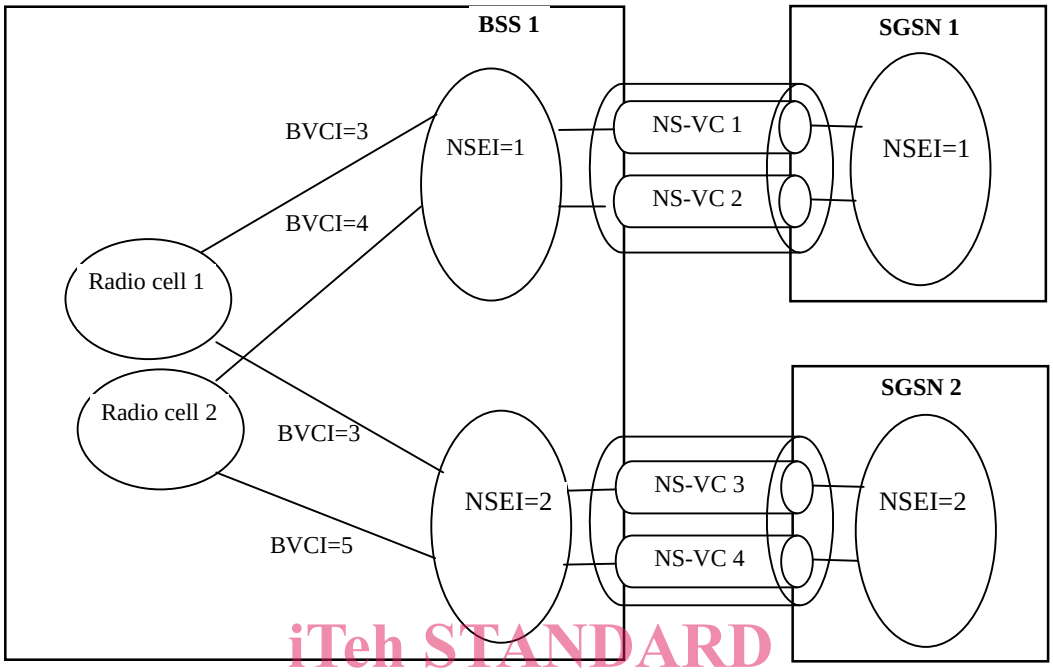


Figure 4.2.2.3: Use of Gb Concepts when Intra Domain Connection of RAN Nodes to Multiple CN Nodes applies in the BSS

For a pool area the BSS sets up several NSEs, and each of these NSEs goes towards different SGSNs. In this way the BSS have one NSE towards each of the connected SGSNs. Alternatively, several NSEs in the BSS are connected towards each of the SGSNs supporting the pool area.

One or more NS-VCs are set up between each of the NSEs in the BSS and the corresponding peer NSEs in the SGSNs. In an IP network, an NS-VC is identified by a pair of IP addresses and UDP ports at both the BSS and the SGSN. In a FR network, the identity of an NS-VC is unique within an NSEI.

4.3 Sub-Network Service functions

The Sub-Network Service functions of the Network Service shall provide access to the intermediate network (or to the peer entity in case of direct point-to-point configuration) by means of NS-VLs and shall provide NS-VCs between NS peer entities.

On each NS-VC, data are transferred in order by the Sub-Network Service.

When the Sub-Network Service entity detects that an NS-VC becomes unavailable (e.g. upon failure detection), or when the NS-VC becomes available again (e.g. after failure recovery), the Network Service Control entity shall be informed. Failures may occur due to protocol errors, intermediate transmission network failure, equipment or link failure or other reasons.