sysmocom

sysmocom - s.f.m.c. GmbH



OsmoPCU Gb Protocol Specification

by Max Suraev and Harald Welte

DRAFT

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.3 or any later version published by the Free Software Foundation; with no Invariant Sections, no Front-Cover Texts, and no Back-Cover Texts. A copy of the license is included in the section entitled "GNU Free Documentation License".

The Asciidoc source code of this manual can be found at http://git.osmocom.org/osmo-gsm-manuals/

HISTORY			
NUMBER	DATE	DESCRIPTION	NAME
DRAFT 1.5.3-1-g379d7	2026-Jul-30		HW

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

Contents

1 Introduction **1**

2 Overview **1**

2.1 Identities . . . 2

3 Network Service (NS) **3**

3.1 List of Messages . . . 3

3.1.1 Messages Compliant With 3GPP TS 48.016 . . . 3

3.1.2 Messages Specific to OsmoPCU . . . 3

3.1.3 Messages Not Implemented by OsmoPCU . . . 3

3.2 Details on Compliant NS Messages . . . 3

3.2.1 NS-UNITDATA . . . 3

3.2.2 NS-RESET . . . 4

3.2.3 NS-RESET-ACK . . . 4

3.2.4 NS-BLOCK . . . 4

3.2.5 NS-BLOCK-ACK . . . 4

3.2.6 NS-UNBLOCK . . . 4

3.2.7 NS-UNBLOCK-ACK . . . 4

3.2.8 NS-STATUS . . . 4

3.2.9 NS-ALIVE . . . 5

3.2.10 NS-ALIVE-ACK . . . 5

3.2.11 SNS-ACK . . . 5

3.2.12 SNS-ADD . . . 5

3.2.13 SNS-CHANGEWEIGHT . . . 5

3.2.14 SNS-CONFIG . . . 5

3.2.15 SNS-CONFIG-ACK . . . 5

3.2.16 SNS-DELETE . . . 5

3.2.17 SNS-SIZE . . . 5

3.2.18 SNS-SIZE-ACK . . . 5

3.3 Information Elements Overview . . . 5

3.3.1 IEs Conforming to 3GPP TS 48.016 . . . 5

3.3.2 IEs Not Conforming to 3GPP TS 48.016 . . . 6

3.3.3 Additional Attributes and Parameters . . . 6

3.4 Details on IEs . . . 6

3.4.1 Cause . . . 6

3.4.2 NSVCI . . . 6

3.4.3 NS PDU . . . 6

3.4.4 NS SDU . . . 6

3.4.5 BVCI . . . 6

3.4.6 NSEI . . . 7

3.5 Gb NS Initialization / PCU bring-up . . . 7

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

4 BSS GPRS Protocol (BSSGP) 7
4.1 List of Messages . . . 7
4.1.1 Messages Compliant With TS 48.018 . . . 7
4.1.2 Messages Specific to OsmoPCU . . . 7
4.1.3 Messages Not Implemented by OsmoPCU . . . 8
4.2 Details on Compliant BSSGP Messages . . . 8
4.2.1 DL-UNITDATA . . . 8
4.2.2 UL-UNITDATA . . . 9
4.2.3 RA-CAPABILITY . . . 9
4.2.4 PAGING PS . . . 9
4.2.5 PAGING CS . . . 9
4.2.6 SUSPEND-ACK . . . 9
4.2.7 SUSPEND-NACK . . . 9
4.2.8 RESUME-ACK . . . 9
4.2.9 RESUME-NACK . . . 10
4.2.10 BVC-BLOCK-ACK . . . 10
4.2.11 BVC-RESET . . . 10
4.2.12 BVC-RESET-ACK . . . 10
4.2.13 BVC-UNBLOCK-ACK . . . 10
4.2.14 BVC-UNBLOCK . . . 10
4.2.15 FLOW-CONTROL-MS-ACK . . . 10
4.2.16 FLOW-CONTROL-BVC-ACK . . . 10
4.2.17 FLOW-CONTROL-BVC . . . 10
4.2.18 FLUSH-LL . . . 10
4.2.19 SGSN-INVOKE-TRACE . . . 10
4.2.20 STATUS . . . 11
4.3 Information Elements Overview . . . 11
4.3.1 IEs Conforming to 3GPP TS 48.018 . . . 11
4.3.2 IEs Not Conforming to 3GPP TS 48.018 . . . 12
4.3.3 Additional Attributes and Parameters . . . 12
4.4 Details on IEs . . . 12
4.4.1 BSS Area Indication . . . 12
4.4.2 Bucket Leak Rate . . . 12
4.4.3 BVC Bucket Size . . . 12
4.4.4 Channel needed . . . 12
4.4.5 DRX Parameters . . . 12
4.4.6 eMLPP-Priority . . . 13
4.4.7 Flush Action . . . 13
4.4.8 LLC Frames Discarded . . . 13

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

4.4.9 Location Area . . . 13
4.4.10 Mobile Id . . . 13
4.4.11 MS Bucket Size . . . 13
4.4.12 MS Radio Access Capability . . . 13
4.4.13 OMC Id . . . 13
4.4.14 Priority . . . 13
4.4.15 QoS Profile . . . 13
4.4.16 Radio Cause . . . 13
4.4.17 RA-Cap-UPD-Cause . . . 13
4.4.18 Routeing Area . . . 14
4.4.19 Suspend Reference Number . . . 14
4.4.20 Tag . . . 14
4.4.21 Trace Reference . . . 14
4.4.22 Trace Type . . . 14
4.4.23 TransactionId . . . 14
4.4.24 Trigger Id . . . 14
4.4.25 Number of octets affected . . . 14
4.4.26 LSA Information . . . 14
4.4.27 LSA Identifier List . . . 14
4.4.28 Packet Flow Identifier . . . 14
4.4.29 Aggregate BSS QoS Profile (ABQP) . . . 15
4.4.30 Feature Bitmap . . . 15
4.4.31 Bucket_Full Ratio . . . 15
4.4.32 Service UTRAN CCO (Cell Change Order) . . . 15
4.5 Gb BSSGP Initialization / PCU bring-up . . . 15

5 Glossary **15**

A Osmocom TCP/UDP Port Numbers **24**

B GNU Free Documentation License **25**
B.1 PREAMBLE . . . 25
B.2 APPLICABILITY AND DEFINITIONS . . . 25
B.3 VERBATIM COPYING . . . 26
B.4 COPYING IN QUANTITY . . . 26
B.5 MODIFICATIONS . . . 27
B.6 COMBINING DOCUMENTS . . . 28
B.7 COLLECTIONS OF DOCUMENTS . . . 28
B.8 AGGREGATION WITH INDEPENDENT WORKS . . . 28
B.9 TRANSLATION . . . 29
B.10 TERMINATION . . . 29
B.11 FUTURE REVISIONS OF THIS LICENSE . . . 29
B.12 RELICENSING . . . 29
B.13 ADDENDUM: How to use this License for your documents . . . 30

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

1 Introduction

This document describes the Gb interface of **OsmoPCU**. Based on 3GPP TS 48.016 and 48.018, this document indicates which of the 3GPP specified Gb messages and IEs are implemented according to 3GPP specifications, which of these are not or not fully implemented, as well as OsmoPCU-specific extensions to the Gb interface not specified by 3GPP.

Extensions to the Gb interface specific to OsmoPCU are detailed in this document. For details on the messages and IEs that comply with above-mentioned 3GPP specifications, please refer to those documents.

Table 2: 3GPP document versions referred to by this document

3GPP TS 08.56	version 8.0.1 Release 1999
3GPP TS 08.58	version 8.6.0 Release 1999
3GPP TS 08.60	version 8.2.1 Release 1999
3GPP TS 12.21	version 8.0.0 Release 1999
3GPP TS 48.016	version 15.0.0 Release 15
3GPP TS 48.018	version 15.0.0 Release 15

Table 3: IETF documents referred to by his document

IETF RFC 768	User Datagram Protocol
IETF RFC 791	Internet Protocol

2 Overview

The OsmoPCU Gb interface consists of the NS (Network Services) and BSSGP (Base Station Subsystem Gateway Protocol), encapsulated in UDP (User Datagram Protocol) and IP (Internet Protocol) version 4. Use of other underlying protocols (e. g. Frame Relay) is not supported.

Table 4: UDP port numbers used by OsmoPCU Gb/IP

TCP Port Number	**Usage**
23000	NS over UDP (default port)

The NS-over-UDP link is established in the PCU → SGSN direction, i.e. the PCU is running as client while the SGSN is running as server.

Establishment of the NS-over-UDP link is only possible after OsmoPCU has been configured via the **PCU socket** interface from OsmoBTS.

OsmoBTS in turn receives relevant configuration parameters from OsmoBSC or the BSC component inside OsmoNITB.

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

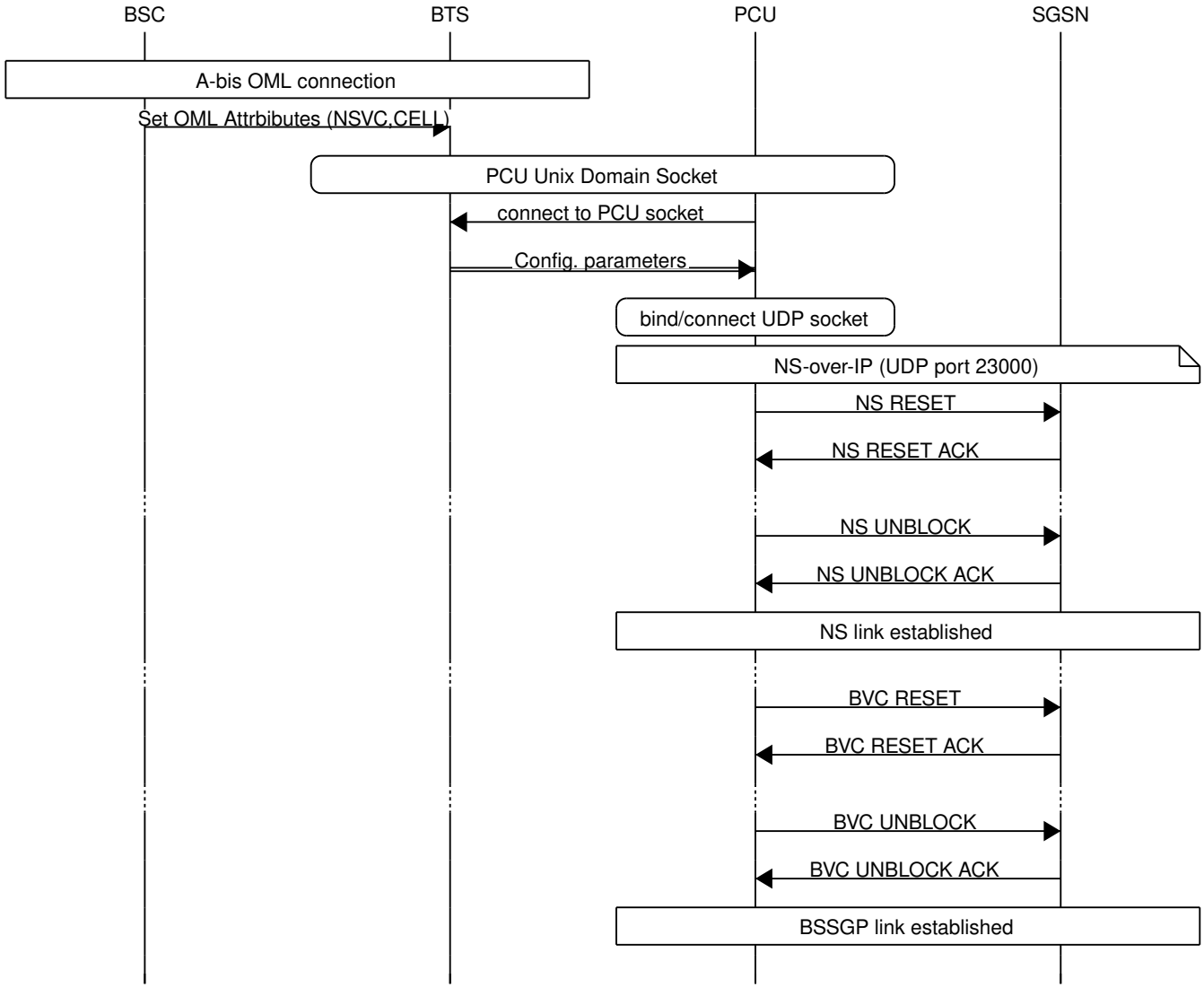


Figure 1: Overview of Gb link establishment

2.1 Identities

The Gb interface identities of the PCU are configured via BSC → OsmoBTS → PCU Socket. They consist of

NSEI
NS Equipment Identifier

NSVCI
NS Virtual Connection Identifier

BVCI
BSSGP Virtual Connection Identifier

For an explanation of those identifiers and their use in the NS and BSSGP protocols, please see the relevant 3GPP specifications for NS (TS 48.016) and BSSGP (TS 48.018).

In most cases, all above identities belong to different namespaces and must be unique within their respective namespace and within the SGSN they connect to.

This means that typically each OsmoPCU has one unique set of NSEI, NSVCI and BVCI in your network.

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

3 Network Service (NS)

3.1 List of Messages

The following tables list the NS messages used by osmo-pcu and osmo-gbproxy, grouped by their level of compliance with 3GPP TS 48.016.

3.1.1 Messages Compliant With 3GPP TS 48.016

The NS protocol is implemented inside libosmogb so none of the messages below are sent by OsmoPCU explicitly. Instead corresponding functions from libosmogb are called which send and receive messages as necessary. See Section 3.5 for details on establishing NS connection.

Table 5: Messages compliant with 3GPP TS 48.016

TS 48.016 §	type code (hex)	This document §	Message	←/→	Received/Sent by OsmoPCU
9.2.1	0x0a	Section 3.2.9	NS-ALIVE	←/→	Received/Sent
9.2.2	0x0b	Section 3.2.10	NS-ALIVE-ACK	←/→	Received/Sent
9.2.3	0x04	Section 3.2.4	NS-BLOCK	←/→	Received/Sent
9.2.4	0x05	Section 3.2.5	NS-BLOCK-ACK	←/→	Received/Sent
9.2.5	0x02	Section 3.2.2	NS-RESET	←/→	Received/Sent
9.2.6	0x03	Section 3.2.3	NS-RESET-ACK	←/→	Received/Sent
9.2.7	0x08	Section 3.2.8	NS-STATUS	←/→	Received/Sent
9.2.8	0x06	Section 3.2.6	NS-UNBLOCK	←/→	Received/Sent
9.2.9	0x07	Section 3.2.7	NS-UNBLOCK-ACK	←/→	Received/Sent
9.2.10	0x00	Section 3.2.1	NS-UNITDATA	←/→	Received/Sent
9.3.1	0x0c	Section 3.2.11	SNS-ACK	←/→	Received/Sent
9.3.2	0x0d	Section 3.2.12	SNS-ADD	←/→	Received/Sent
9.3.3	0x0e	Section 3.2.13	SNS-CHANGEWEIGHT	←/→	Received/Sent
9.3.4	0x0f	Section 3.2.14	SNS-CONFIG	←/→	Received/Sent
9.3.5	0x10	Section 3.2.15	SNS-CONFIG	←/→	Received/Sent
9.3.6	0x11	Section 3.2.16	SNS-DELETE	←/→	Received/Sent
9.3.7	0x12	[?]	SNS-SIZE	←/→	Received/Sent
9.3.8	0x13	Section 3.2.18	SNS-SIZE-ACK	←/→	Received/Sent

3.1.2 Messages Specific to OsmoPCU

There are no OsmoPCU specific NS messages.

3.1.3 Messages Not Implemented by OsmoPCU

All the NS protocol messages from 3GPP TS 48.016 are implemented in OsmoPCU.

3.2 Details on Compliant NS Messages

3.2.1 NS-UNITDATA

This PDU transfers one NS SDU (specified in 3GPP TS 08.18) between OsmoPCU and SGSN. Upon receiving it OsmoPCU passes it to BSSGP implementation to handle. It is also sent by BSSGP as necessary - see Section 4 for details.

It contains BVCI (Section 3.4.5) and NS SDU (Section 3.4.4) IEs.

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

3.2.2 NS-RESET

This message is send by OsmoPCU in order to initiate reset procedure described in 3GPP TS 48.016 § 7.3. The expected reply is NS-RESET-ACK (Section 3.2.3) message. If no expected reply is received in 3 seconds than the sending is retried up to 3 times. When this message is received it is replied with NS-RESET-ACK (Section 3.2.3). It might be ignored under conditions described in 3GPP TS 48.016 § 7.3.1.

The message conforms to 3GPP TS 48.016 § 9.2.5 specification.

It contains Cause (Section 3.4.1), NSVCI (Section 3.4.2) and NSEI (Section 3.4.6) IEs.

3.2.3 NS-RESET-ACK

This message is sent as a response to proper NS-RESET (Section 3.2.2) message initiating reset procedure.

The message conforms to 3GPP TS 48.016 § 9.2.6 specification.

It contains NSVCI (Section 3.4.2) and NSEI (Section 3.4.6) IEs.

3.2.4 NS-BLOCK

Upon receiving this message corresponding NS-VC is marked as blocked by OsmoPCU and NS-BLOCK-ACK (Section 3.2.5) reply is transmitted. When this message is sent by OsmoPCU corresponding NS-BLOCK-ACK (Section 3.2.5) reply is expected before NS-VC is actually marked as blocked. This behavior follows the blocking procedure described in 3GPP TS 48.016 § 7.2.

The message conforms to 3GPP TS 48.016 § 9.2.3 specification.

It contains Cause (Section 3.4.1) and NSVCI (Section 3.4.2) IEs.

3.2.5 NS-BLOCK-ACK

This message is sent by OsmoPCU automatically upon reception of correct NS-BLOCK (Section 3.2.4) message. It is expected as a reply for NS-BLOCK (Section 3.2.4) message sent by OsmoPCU.

The message conforms to 3GPP TS 48.016 § 9.2.4 specification.

It contains NSVCI (Section 3.4.2) IE.

3.2.6 NS-UNBLOCK

Upon receiving this message corresponding NS-VC is unblocked by OsmoPCU and NS-UNBLOCK-ACK (Section 3.2.7) reply is sent. When this message is sent by OsmoPCU corresponding NS-UNBLOCK-ACK (Section 3.2.7) reply is expected before NS-VC is actually marked as unblocked. This behavior follows the blocking procedure described in 3GPP TS 48.016 § 7.2.

The message conforms to 3GPP TS 48.016 § 9.2.8 specification.

3.2.7 NS-UNBLOCK-ACK

Receiving this message notifies OsmoPCU that NS-VC unblocking request is confirmed and thus NS-VC is marked as unblocked. This message is also sent as a reply to NS-UNBLOCK (Section 3.2.6) message.

The message conforms to 3GPP TS 48.016 § 9.2.9 specification.

3.2.8 NS-STATUS

This message is sent to inform other party about error conditions as a response to various unexpected PDUs or PDUs with unexpected/missing data. If this message is received for unknown NS-VC it is ignored in accordance with 3GPP TS 48.016 § 7.5.1, otherwise the error cause is logged if present in NS-STATUS.

The message conforms to 3GPP TS 48.016 § 9.2.7 specification.

It contains Cause (Section 3.4.1) and might (depending on actual error) contain NSVCI (Section 3.4.2), NS PDU (Section 3.4.3) and BVCI (Section 3.4.5) IEs.

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

3.2.9 NS-ALIVE

This message is sent periodically to test connectivity according to 3GPP TS 48.016 § 4.5.3. The expected response is NS-ALIVE-ACK (Section 3.2.10). If no such response arrives within given amount of time (3 seconds) than another NS-ALIVE message is sent and failed test attempt is recorded. After 10 failed attempts NS connection is considered dead and OsmoPCU tries to reconnect.

The message conforms to 3GPP TS 48.016 § 9.2.1 specification.

3.2.10 NS-ALIVE-ACK

This message is sent automatically in reply to NS-ALIVE (Section 3.2.9) message.

The message conforms to 3GPP TS 48.016 § 9.2.2 specification.

3.2.11 SNS-ACK

3.2.12 SNS-ADD

3.2.13 SNS-CHANGEWEIGHT

3.2.14 SNS-CONFIG

3.2.15 SNS-CONFIG-ACK

3.2.16 SNS-DELETE

3.2.17 SNS-SIZE

3.2.18 SNS-SIZE-ACK

3.3 Information Elements Overview

All of the IEs handled by OsmoPCU are listed below, with limitations and additions to 3GPP TS 48.016 specified in more detail.

3.3.1 IEs Conforming to 3GPP TS 48.016

The following Information Elements are accepted by OsmoPCU.

Table 6: IEs conforming to 3GPP TS 48.016

tag (hex)	TS 48.016 §	IE name	←/→	Received/Sent by OsmoPCU
0x03	10.3.1	BVCI	←/→	Received/Sent
0x00	10.3.2	Cause	←/→	Received/Sent
-	10.3.2a	End Flag	←/→	Received/Sent
0x0b	10.3.2b	IP Address	←/→	Received/Sent
0x05	10.3.2c	List of IP4 Elements	←/→	Received/Sent
0x06	10.3.2d	List of IP6 Elements	←/→	Received/Sent
0x07	10.3.2e	Maximum Number of NS-VCs	←/→	Received/Sent
0x08	10.3.2f	Number of IP4 Endpoints	←/→	Received/Sent
0x09	10.3.2g	Number of IP6 Endpoints	←/→	Received/Sent
0x02	10.3.3	NS PDU	←/→	Received/Sent
0x01	10.3.5	NSVCI	←/→	Received/Sent

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

Table 6: (continued)

tag (hex)	TS 48.016 §	IE name	←/→	Received/Sent by OsmoPCU
0x04	10.3.6	NSEI	←/→	Received/Sent
-	10.3.7	PDU Type	←/→	Received/Sent
0x0a	10.3.7a	Reset Flag	←/→	Received/Sent
-	10.3.8	Spare Octet	←/→	Received/Sent
-	10.3.10	Transaction ID	←/→	Received/Sent

3.3.2 IEs Not Conforming to 3GPP TS 48.016

Table 7: IEs conforming to 3GPP TS 48.016

tag (hex)	TS 48.016 §	IE name	←/→	Notice
-	10.3.9	NS-SDU Control Bits	←/→	Not implemented yet

All other IEs defined in 3GPP TS 48.016 § 10.3 are supported by OsmoPCU.

3.3.3 Additional Attributes and Parameters

There are no OsmoPCU specific additional Attributes and Parameters.

3.4 Details on IEs

3.4.1 Cause

This IE contains reason for a procedure or error as described in 3GPP TS 48.016 § 10.3.2.

3.4.2 NSVCI

This IE represents NSVCI identity described in Section 2.1 and 3GPP TS 48.016 § 10.3.5.

3.4.3 NS PDU

This IE contains PDU (possibly truncated) which cause error described in NS-STATUS message (Section 3.2.8) as described in 3GPP TS 48.016 § 10.3.3.

3.4.4 NS SDU

This IE contains BSSGP data - see Section 4 for details.

3.4.5 BVCI

This IE represents BSSGP identity described in Section 2.1 and 3GPP TS 48.016 § 10.3.1.

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

3.4.6 NSEI

This IE represents NSEI identity described in Section 2.1 and 3GPP TS 48.016 § 10.3.6.

3.5 Gb NS Initialization / PCU bring-up

OsmoPCU binds and connects an UDP socket for NS using port numbers and IP information given by OsmoBTS via the PCU socket. OsmoBTS in turn receives this information from the BSC vi A-bis OML.

Following successful initialization of the UDP socket, the reset procedure is initiated as described in Section 3.2.2.

4 BSS GPRS Protocol (BSSGP)

4.1 List of Messages

The following tables list the BSSGP messages used by OsmoPCU, grouped by their level of compliance with 3GPP TS 48.018.

4.1.1 Messages Compliant With TS 48.018

Table 8: Messages compliant with TS 48.018

TS 48.018 §	type code (hex)	This document §	Message	←/→	Received/Sent by OsmoPCU
RL and BSSGP SAP Messages:					
10.2.1	0x00	Section 4.2.1	DL-UNITDATA	←	Received
10.2.2	0x01	Section 4.2.2	UL-UNITDATA	→	Sent
10.2.3	0x02	Section 4.2.3	RA-CAPABILITY	←	Received
GMM SAP Messages:					
10.3.1	0x06	Section 4.2.4	PAGING PS	←	Received
10.3.2	0x07	Section 4.2.5	PAGING CS	←	Received
10.3.7	0x0c	Section 4.2.6	SUSPEND-ACK	←	Received
10.3.8	0x0d	Section 4.2.7	SUSPEND-NACK	←	Received
10.3.10	0x0f	Section 4.2.8	RESUME-ACK	←	Received
10.3.11	0x10	Section 4.2.9	RESUME-NACK	←	Received
NM SAP Messages:					
10.4.9	0x21	Section 4.2.10	BVC-BLOCK-ACK	←	Received
10.4.12	0x22	Section 4.2.11	BVC-RESET	←/→	Received/Sent
10.4.13	0x23	Section 4.2.12	BVC-RESET-ACK	←	Received
10.4.10	0x24	Section 4.2.14	BVC-UNBLOCK	→	Sent
10.4.11	0x25	Section 4.2.13	BVC-UNBLOCK-ACK	←	Received
10.4.4	0x26	Section 4.2.17	FLOW-CONTROL-BVC	→	Sent
10.4.5	0x27	Section 4.2.16	FLOW-CONTROL-BVC-ACK	←	Received
10.4.7	0x29	Section 4.2.15	FLOW-CONTROL-MS-ACK	←	Received
10.4.1	0x2a	Section 4.2.18	FLUSH-LL	←	Received
10.4.15	0x40	Section 4.2.19	SGSN-INVOKE-TRACE	←	Received
10.4.14	0x41	Section 4.2.20	STATUS	←/→	Received/Sent

4.1.2 Messages Specific to OsmoPCU

There are no OsmoPCU specific BSSGP messages.

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

4.1.3 Messages Not Implemented by OsmoPCU

Table 9: 3GPP TS 48.018 messages not implemented by OsmoPCU

TS 48.018 §	type code (hex)	Message
RL (relay) and BSSGP SAP Messages:		
10.2.4	0x03	PTM-UNITDATA
GMM (GPRS mobility management) SAP Messages:		
10.3.3	0x08	RA-CAPABILITY-UPDATE
10.3.4	0x09	RA-CAPABILITY-UPDATE-ACK
10.3.5	0x0a	RADIO-STATUS
10.3.6	0x0b	SUSPEND
10.3.9	0x0e	RESUME
NM (network management) SAP Messages:		
10.4.8	0x20	BVC-BLOCK
10.4.6	0x28	FLOW-CONTROL-MS
10.4.2	0x2b	FLUSH-LL-ACK
10.4.3	0x2c	LLC-DISCARDED
PFM (packet flow management) SAP Messages:		
10.4.16	0x50	DOWNLOAD-BSS-PFC
10.4.17	0x51	CREATE-BSS-PFC
10.4.18	0x52	CREATE-BSS-PFC-ACK
10.4.19	0x53	CREATE-BSS-PFC-NACK
10.4.20	0x54	MODIFY-BSS-PFC
10.4.21	0x55	MODIFY-BSS-PFC-ACK
10.4.22	0x56	DELETE-BSS-PFC
10.4.23	0x57	DELETE-BSS-PFC-ACK

4.2 Details on Compliant BSSGP Messages

4.2.1 DL-UNITDATA

This message conforms to 3GPP TS 48.018 § 10.2.1, with the following limitations:

- OsmoPCU does not support QoS
- all optional IEs except for IMSI and old TLLI are ignored.

Table 10: *DL-UNITDATA* IE limitations

TS 48.018 §	IE Name	Handling
11.3.28	QoS Profile	*ignored*
11.3.22	MS Radio Access Capability	*ignored*
11.3.27	Priority	*ignored*
11.3.11	DRX Parameters	*ignored*
1.3.42	PFI	*ignored*
11.3.19	LSA Information	*ignored*
11.3.47	Service UTRAN CCO	*ignored*

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

4.2.2 UL-UNITDATA

This message conforms to 3GPP TS 48.018 § 10.2.2, with the following limitations:

- OsmoPCU does not send optional IEs - PFI (§ 12.3.42) and LSA Identifier List (§ 11.3.18).
- QoS Profile (§ 11.3.28) IE is always set to 0x04.

4.2.3 RA-CAPABILITY

This message is received and logged but ignored by OsmoPCU at the moment.

4.2.4 PAGING PS

This message conforms to 3GPP TS 48.018 § 10.3.1, with the following limitations:

- only IMSI and P-TMSI are parsed by OsmoPCU.

Table 11: *DL-UNITDATA* IE limitations

TS 48.018 §	**IE Name**	**Handling**
11.3.11	DRX Parameters	*ignored*
11.3.6	BVCI	*ignored*
11.3.17	Location Are	*ignored*
11.3.31	Routeing Area	*ignored*
11.3.3	BSS Area Indication	*ignored*
11.3.42	PFI	*ignored*
11.3.43	ABQP	*ignored*
11.3.28	QoS Profile	*ignored*
11.3.36	P-TMSI	treated as mandatory (in case of absence paging with 0-length P-TMSI will be sent)

4.2.5 PAGING CS

This message is received and logged but ignored by OsmoPCU at the moment.

4.2.6 SUSPEND-ACK

This message is received and logged but ignored by OsmoPCU at the moment.

4.2.7 SUSPEND-NACK

This message is received and logged but ignored by OsmoPCU at the moment.

4.2.8 RESUME-ACK

This message is received and logged but ignored by OsmoPCU at the moment.

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

4.2.9 RESUME-NACK

This message is received and logged but ignored by OsmoPCU at the moment.

4.2.10 BVC-BLOCK-ACK

This message is received and logged but ignored by OsmoPCU at the moment.

4.2.11 BVC-RESET

OsmoPCU never transmits optional Feature bitmap (3GPP TS 48.018 § 11.3.40) IE.

Receiving BVC RESET will cause OsmoPCU to respond with "Unknown BVCI" status message.

4.2.12 BVC-RESET-ACK

This message conforms to 3GPP TS 48.018 § 10.4.13.

After receiving it OsmoPCU completes the RESET procedure for BVC according to 3GPP TS 48.018 § 8.4.

4.2.13 BVC-UNBLOCK-ACK

This message conforms to 3GPP TS 48.018 § 10.4.11.

After receiving it OsmoPCU completes the RESET procedure for BVC according to 3GPP TS 48.018 § 8.3.

4.2.14 BVC-UNBLOCK

This message conforms to 3GPP TS 48.018 § 10.4.10 and is send by OsmoPCU as part of UNBLOCK procedure described in 3GPP TS 48.018 § 8.3.

4.2.15 FLOW-CONTROL-MS-ACK

This message is received and logged but ignored by OsmoPCU at the moment.

4.2.16 FLOW-CONTROL-BVC-ACK

This message is received and logged but ignored by OsmoPCU at the moment.

4.2.17 FLOW-CONTROL-BVC

This message conforms to 3GPP TS 48.018 § 10.4.4, with the following limitations:

- OsmoPCU does not support Current Bucket Level (CBL) feature so Bucket_Full Ratio (TS 48.018 § 11.3.46) IE is not transmitted as part of this message.

4.2.18 FLUSH-LL

This message is received and logged but ignored by OsmoPCU at the moment.

4.2.19 SGSN-INVOKE-TRACE

This message is received and logged but ignored by OsmoPCU at the moment.

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

4.2.20 STATUS

This message conforms to 3GPP TS 48.018 § 10.4.14.

4.3 Information Elements Overview

All of the IEs handled by OsmoPCU are listed below, with limitations and additions to 3GPP TS 48.018 specified in more detail.

4.3.1 IEs Conforming to 3GPP TS 48.018

The following Information Elements are accepted by OsmoPCU. Not all IEs are actually evaluated.

Table 12: IEs conforming to 3GPP TS 48.018

tag (hex)	TS 48.018 §	IE name	←/→	Received/Sent by OsmoPCU
0x00	11.3.1	Alignment Octets	←/→	Received/Sent
0x01	11.3.2	Bmax default MS	→	Sent
0x02	11.3.3	BSS Area Indication	←	Received
0x03	11.3.4	Bucket Leak Rate	→	Sent
0x04	11.3.6	BVCI	←/→	Received/Sent
0x05	11.3.5	BVC Bucket Size	→	Sent
0x06	11.3.7	BVC Measurement	→	Sent
0x07	11.3.8	Cause	←/→	Received/Sent
0x08	11.3.9	Cell Identifier	→	Sent
0x09	11.3.10	Channel needed	←	Received
0x0a	11.3.11	DRX Parameters	←	Received
0x0b	11.3.12	eMLPP-Priority	←	Received
0x0c	11.3.13	Flush Action	←	Received
0x0d	11.3.14	IMSI	←/→	Received/Sent
0x0e	11.3.15	LLC-PDU	←/→	Received/Sent
0x0f	11.3.16	LLC Frames Discarded	→	Sent
0x10	11.3.17	Location Area	←	Received
0x11	11.3.20	Mobile Id	←	Received
0x12	11.3.21	MS Bucket Size	→	Sent
0x13	11.3.22	MS Radio Access Capability	←	Received
0x14	11.3.23	OMC Id	←	Received
0x15	11.3.24	PDU In Error	←/→	Received/Sent
0x16	11.3.25	PDU Lifetime	←	Received
0x17	11.3.27	Priority	←	Received
0x19	11.3.29	Radio Cause	→	Sent
0x1a	11.3.30	RA-Cap-UPD-Cause	→	Sent
0x1b	11.3.31	Routeing Area	←/→	Received/Sent
0x1c	11.3.32	R_default_MS	→	Sent
0x1d	11.3.33	Suspend Reference Number	←/→	Received/Sent
0x1e	11.3.34	Tag	←/→	Received/Sent
0x1f	11.3.35	TLLI	←/→	Received/Sent
0x20	11.3.36	TMSI	←/→	Received/Sent
0x21	11.3.37	Trace Reference	←	Received
0x22	11.3.38	Trace Type	←	Received
0x23	11.3.39	TransactionId	←	Received
0x24	11.3.40	Trigger Id	←	Received
0x25	11.3.41	Number of octets affected	→	Sent
0x26	11.3.18	LSA Identifier List	→	Sent

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

Table 12: (continued)

tag (hex)	TS 48.018 §	IE name	←/→	Received/Sent by OsmoPCU
0x27	11.3.19	LSA Information	←	Received
0x28	11.3.42	Packet Flow Identifier	←/→	Received/Sent
0x3a	11.3.43	Aggregate BSS QoS Profile (ABQP)	←/→	Received/Sent
0x3b	11.3.45	Feature Bitmap	←/→	Received/Sent
0x3c	11.3.46	Bucket_Full Ratio	→	Sent
0x3d	11.3.47	Service UTRAN CCO (Cell Change Order)	←	Received

4.3.2 IEs Not Conforming to 3GPP TS 48.018

Table 13: IEs not conforming to 3GPP TS 48.018

tag (hex)	TS 48.018 §	IE name	Description
0x18	11.3.28	QoS Profile	Received value is ignored. Sent value is hard-coded to 0x4 (3 octets).

4.3.3 Additional Attributes and Parameters

There are no OsmoPCU specific additional Attributes and Parameters.

4.4 Details on IEs

4.4.1 BSS Area Indication

This IE is ignored by OsmoPCU.

4.4.2 Bucket Leak Rate

The value used by OsmoPCU for this IE can be set through configuration file or vty via "flow-control force-ms-leak-rate <1-6553500>" command.

4.4.3 BVC Bucket Size

The value used by OsmoPCU for this IE can be set through configuration file or vty via "flow-control force-bvc-bucket-size <1-6553500>" command.

4.4.4 Channel needed

This IE is ignored because entire message which contains it is ignored by OsmoPCU - see Section 4.2.5 for details.

4.4.5 DRX Parameters

This IE is ignored by OsmoPCU.

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

4.4.6 eMLPP-Priority

This IE is ignored because entire message which contains it is ignored by OsmoPCU - see Section 4.2.5 for details.

4.4.7 Flush Action

This IE is ignored because entire message which contains it is ignored by OsmoPCU - see Section 4.2.18 for details.

4.4.8 LLC Frames Discarded

This IE is not available because entire message which contains it (LLC-DISCARDED) is not implemented by OsmoPCU - see for Section 4.1.3 details.

4.4.9 Location Area

This IE is ignored by OsmoPCU.

4.4.10 Mobile Id

This IE is ignored because entire message which contains it is ignored by OsmoPCU - see Section 4.2.19 for details.

4.4.11 MS Bucket Size

The value used by OsmoPCU for this IE can be set through configuration file or vty via "flow-control force-ms-bucket-size <1-6553500>" command.

4.4.12 MS Radio Access Capability

This IE is ignored by OsmoPCU.

4.4.13 OMC Id

This IE is ignored because entire message which contains it is ignored by OsmoPCU - see Section 4.2.19 for details.

4.4.14 Priority

This IE is ignored by OsmoPCU.

4.4.15 QoS Profile

No QoS is supported by OsmoPCU so this IE is ignored or safe default used when mandatory.

4.4.16 Radio Cause

This IE is not available because entire message which contains it (RADIO-STATUS) is not implemented by OsmoPCU - see for Section 4.1.3 details.

4.4.17 RA-Cap-UPD-Cause

This IE is not available because entire message which contains it (RA-CAPABILITY-UPDATE-ACK) is not implemented by OsmoPCU - see for Section 4.1.3 details.

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

4.4.18 Routeing Area

This IE is ignored by OsmoPCU upon receiving.

The messages which might require this IE to be send are not implemented by OsmoPCU - see for Section 4.1.3 details.

4.4.19 Suspend Reference Number

This IE is ignored by OsmoPCU upon receiving.

The messages which might require this IE to be send are not implemented by OsmoPCU - see for Section 4.1.3 details.

4.4.20 Tag

This IE currently only used by OsmoPCU for Flow Control procedure (TS 48.018 § 8.2). In other cases it's either ignored or unavailable.

4.4.21 Trace Reference

This IE is ignored because entire message which contains it is ignored by OsmoPCU - see Section 4.2.19 for details.

4.4.22 Trace Type

This IE is ignored because entire message which contains it is ignored by OsmoPCU - see Section 4.2.19 for details.

4.4.23 TransactionId

This IE is ignored because entire message which contains it is ignored by OsmoPCU - see Section 4.2.19 for details.

4.4.24 Trigger Id

This IE is ignored because entire message which contains it is ignored by OsmoPCU - see Section 4.2.19 for details.

4.4.25 Number of octets affected

This IE is not available because the messages which contains it (FLUSH-LL-ACK and LLC-DISCARDE) are not implemented by OsmoPCU - see for Section 4.1.3 details.

4.4.26 LSA Information

This IE is ignored by OsmoPCU.

4.4.27 LSA Identifier List

This IE is not implemented by OsmoPCU.

4.4.28 Packet Flow Identifier

This IE is ignored by OsmoPCU upon receiving.

The messages which might require this IE to be send are not implemented by OsmoPCU - see for Section 4.1.3 details.

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

4.4.29 Aggregate BSS QoS Profile (ABQP)

This IE is ignored by OsmoPCU upon receiving.

The messages which might require this IE to be send are not implemented by OsmoPCU - see for Section 4.1.3 details.

4.4.30 Feature Bitmap

This IE is not implemented by OsmoPCU.

This IE is ignored by OsmoPCU when received.

Absence of Feature Bitmap automatically disables optional features for Network Service Entity (NSE) communicating with OsmoPCU.

4.4.31 Bucket_Full Ratio

This IE is not implemented by OsmoPCU.

4.4.32 Service UTRAN CCO (Cell Change Order)

This IE is ignored by OsmoPCU.

4.5 Gb BSSGP Initialization / PCU bring-up

The BSSGP initialization directly follows NS connection establishment described in Section 3.5.

OsmoPCU allocates a BVC context for the BVCI given by OsmoBTS, which in turn receives it from OsmoBSC or OsmoNITB via OML procedures.

In addition to the BVCI identifying the OsmoPCU side of BSSGP connection, there is also special BVCI which is accepted by OsmoPCU in accordance with 3GPP TS 48.018 § 5.4.1: BVCI = 0 represents signaling data between SGSN and PCU in contrast to PTP (Peer-To-Peer) user's data.

The mapping between BSSGP PDUs and signaling or PTP BVCIs is available in 3GPP TS 48.018 Table 5.4.

5 Glossary

2FF
: 2nd Generation Form Factor; the so-called plug-in SIM form factor

3FF
: 3rd Generation Form Factor; the so-called microSIM form factor

3GPP
: 3rd Generation Partnership Project

4FF
: 4th Generation Form Factor; the so-called nanoSIM form factor

A Interface
: Interface between BTS and BSC, traditionally over E1 (*3GPP TS 48.008* [?])

A3/A8
: Algorithm 3 and 8; Authentication and key generation algorithm in GSM and GPRS, typically COMP128v1/v2/v3 or MILENAGE are typically used

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

A5
Algorithm 5; Air-interface encryption of GSM; currently only A5/0 (no encryption), A5/1 and A5/3 are in use

Abis Interface
Interface between BTS and BSC, traditionally over E1 (*3GPP TS 48.058* [?] and *3GPP TS 52.021* [?])

ACC
Access Control Class; every BTS broadcasts a bit-mask of permitted ACC, and only subscribers with a SIM of matching ACC are permitted to use that BTS

AGCH
Access Grant Channel on Um interface; used to assign a dedicated channel in response to RACH request

AGPL
GNU Affero General Public License, a copyleft-style Free Software License

AQPSK
Adaptive QPSK, a modulation scheme used by VAMOS channels on Downlink

ARFCN
Absolute Radio Frequency Channel Number; specifies a tuple of uplink and downlink frequencies

AUC
Authentication Center; central database of authentication key material for each subscriber

BCCH
Broadcast Control Channel on Um interface; used to broadcast information about Cell and its neighbors

BCC
Base Station Color Code; short identifier of BTS, lower part of BSIC

BTS
Base Transceiver Station

BSC
Base Station Controller

BSIC
Base Station Identity Code; 16bit identifier of BTS within location area

BSSGP
Base Station Subsystem Gateway Protocol (*3GPP TS 48.018* [?])

BVCI
BSSGP Virtual Circuit Identifier

CBC
Cell Broadcast Centre; central entity of Cell Broadcast service

CBCH
Cell Broadcast Channel; used to transmit Cell Broadcast SMS (SMS-CB)

CBS
Cell Broadcast Service

CBSP
Cell Broadcast Service Protocol (*3GPP TS 48.049* [?])

CC
Call Control; Part of the GSM Layer 3 Protocol

CCCH
Common Control Channel on Um interface; consists of RACH (uplink), BCCH, PCH, AGCH (all downlink)

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

Cell
A cell in a cellular network, served by a BTS

CEPT
Conférence européenne des administrations des postes et des télécommunications; European Conference of Postal and Telecommunications Administrations.

CGI
Cell Global Identifier comprised of MCC, MNC, LAC and BSIC

CSFB
Circiut-Switched Fall Back; Mechanism for switching from LTE/EUTRAN to UTRAN/GERAN when circuit-switched services such as voice telephony are required.

dB
deci-Bel; relative logarithmic unit

dBm
deci-Bel (milliwatt); unit of measurement for signal strength of radio signals

DHCP
Dynamic Host Configuration Protocol (*IETF RFC 2131* [?])

downlink
Direction of messages / signals from the network core towards the mobile phone

DSCP
Differentiated Services Code Point (*IETF RFC 2474* [?])

DSP
Digital Signal Processor

dvnixload
Tool to program UBL and the Bootloader on a sysmoBTS

EDGE
Enhanced Data rates for GPRS Evolution; Higher-speed improvement of GPRS; introduces 8PSK

EGPRS
Enhanced GPRS; the part of EDGE relating to GPRS services

EIR
Equipment Identity Register; core network element that stores and manages IMEI numbers

ESME
External SMS Entity; an external application interfacing with a SMSC over SMPP

ETSI
European Telecommunications Standardization Institute

FPGA
Field Programmable Gate Array; programmable digital logic hardware

Gb
Interface between PCU and SGSN in GPRS/EDGE network; uses NS, BSSGP, LLC

GERAN
GPRS/EDGE Radio Access Network

GFDL
GNU Free Documentation License; a copyleft-style Documentation License

GGSN
GPRS Gateway Support Node; gateway between GPRS and external (IP) network

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

GMSK
Gaussian Minimum Shift Keying; modulation used for GSM and GPRS

GPL
GNU General Public License, a copyleft-style Free Software License

Gp
Gp interface between SGSN and GGSN; uses GTP protocol

GPRS
General Packet Radio Service; the packet switched 2G technology

GPS
Global Positioning System; provides a highly accurate clock reference besides the global position

GSM
Global System for Mobile Communications. ETSI/3GPP Standard of a 2G digital cellular network

GSMTAP
GSM tap; pseudo standard for encapsulating GSM protocol layers over UDP/IP for analysis

GSUP
Generic Subscriber Update Protocol. Osmocom-specific alternative to TCAP/MAP

GT
Global Title; an address in SCCP

GTP
GPRS Tunnel Protocol; used between SGSN and GGSN

HLR
Home Location Register; central subscriber database of a GSM network

HNB-GW
Home NodeB Gateway. Entity between femtocells (Home NodeB) and CN in 3G/UMTS.

HPLMN
Home PLMN; the network that has issued the subscriber SIM and has his record in HLR

IE
Information Element

IMEI
International Mobile Equipment Identity; unique 14-digit decimal number to globally identify a mobile device, optionally with a 15th checksum digit

IMEISV
IMEI software version; unique 14-digit decimal number to globally identify a mobile device (same as IMEI) plus two software version digits (total digits: 16)

IMSI
International Mobile Subscriber Identity; 15-digit unique identifier for the subscriber/SIM; starts with MCC/MNC of issuing operator

IP
Internet Protocol (*IETF RFC 791* [?])

IPA
ip.access GSM over IP protocol; used to multiplex a single TCP connection

Iu
Interface in 3G/UMTS between RAN and CN

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

IuCS
Iu interface for circuit-switched domain. Used in 3G/UMTS between RAN and MSC

IuPS
Iu interface for packet-switched domain. Used in 3G/UMTS between RAN and SGSN

LAC
Location Area Code; 16bit identifier of Location Area within network

LAPD
Link Access Protocol, D-Channel (*ITU-T Q.921* [?])

LAPDm
Link Access Protocol Mobile (*3GPP TS 44.006* [?])

LLC
Logical Link Control; GPRS protocol between MS and SGSN (*3GPP TS 44.064* [?])

Location Area
Location Area; a geographic area containing multiple BTS

LU
Location Updating; can be of type IMSI-Attach or Periodic. Procedure that indicates a subscriber's physical presence in a given radio cell.

M2PA
MTP2 Peer-to-Peer Adaptation; a SIGTRAN Variant (*RFC 4165* [?])

M2UA
MTP2 User Adaptation; a SIGTRAN Variant (*RFC 3331* [?])

M3UA
MTP3 User Adaptation; a SIGTRAN Variant (*RFC 4666* [?])

MCC
Mobile Country Code; unique identifier of a country, e.g. 262 for Germany

MFF
Machine-to-Machine Form Factor; a SIM chip package that is soldered permanently onto M2M device circuit boards.

MGW
Media Gateway

MM
Mobility Management; part of the GSM Layer 3 Protocol

MNC
Mobile Network Code; identifies network within a country; assigned by national regulator

MNCC
Mobile Network Call Control; Unix domain socket based Interface between MSC and external call control entity like osmo-sip-connector

MNO
Mobile Network Operator; operator with physical radio network under his MCC/MNC

MO
Mobile Originated. Direction from Mobile (MS/UE) to Network

MS
Mobile Station; a mobile phone / GSM Modem

MSC
Mobile Switching Center; network element in the circuit-switched core network

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

MSC pool
A number of redundant MSCs serving the same core network, which a BSC / RNC distributes load across; see also the "MSC Pooling" chapter in OsmoBSC's user manual [?] and *3GPP TS 23.236* [?]

MSISDN
Mobile Subscriber ISDN Number; telephone number of the subscriber

MT
Mobile Terminated. Direction from Network to Mobile (MS/UE)

MTP
Message Transfer Part; SS7 signaling protocol (*ITU-T Q.701* [?])

MVNO
Mobile Virtual Network Operator; Operator without physical radio network

NCC
Network Color Code; assigned by national regulator

NITB
Network In The Box; combines functionality traditionally provided by BSC, MSC, VLR, HLR, SMSC functions; see OsmoNITB

NRI
Network Resource Indicator, typically 10 bits of a TMSI indicating which MSC of an MSC pool attached the subscriber; see also the "MSC Pooling" chapter in OsmoBSC's user manual [?] and *3GPP TS 23.236* [?]

NSEI
NS Entity Identifier

NVCI
NS Virtual Circuit Identifier

NWL
Network Listen; ability of some BTS to receive downlink from other BTSs

NS
Network Service; protocol on Gb interface (*3GPP TS 48.016* [?])

OCXO
Oven Controlled Crystal Oscillator; very high precision oscillator, superior to a VCTCXO

OML
Operation & Maintenance Link (ETSI/*3GPP TS 52.021* [?])

OpenBSC
Open Source implementation of GSM network elements, specifically OsmoBSC, OsmoNITB, OsmoSGSN

OpenGGSN
Open Source implementation of a GPRS Packet Control Unit

OpenVPN
Open-Source Virtual Private Network; software employed to establish encrypted private networks over untrusted public networks

Osmocom
Open Source MObile COMmunications; collaborative community for implementing communications protocols and systems, including GSM, GPRS, TETRA, DECT, GMR and others

OsmoBSC
Open Source implementation of a GSM Base Station Controller

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

OsmoNITB
Open Source implementation of a GSM Network In The Box, combines functionality traditionally provided by BSC, MSC, VLR, HLR, AUC, SMSC

OsmoSGSN
Open Source implementation of a Serving GPRS Support Node

OsmoPCU
Open Source implementation of a GPRS Packet Control Unit

OTA
Over-The-Air; Capability of operators to remotely reconfigure/reprogram ISM/USIM cards

PC
Point Code; an address in MTP

PCH
Paging Channel on downlink Um interface; used by network to page an MS

PCP
Priority Code Point (*IEEE 802.1Q* [?])

PCU
Packet Control Unit; used to manage Layer 2 of the GPRS radio interface

PDCH
Packet Data Channel on Um interface; used for GPRS/EDGE signalling + user data

PIN
Personal Identification Number; a number by which the user authenticates to a SIM/USIM or other smart card

PLMN
Public Land Mobile Network; specification language for a single GSM network

PUK
PIN Unblocking Code; used to unblock a blocked PIN (after too many wrong PIN attempts)

RAC
Routing Area Code; 16bit identifier for a Routing Area within a Location Area

RACH
Random Access Channel on uplink Um interface; used by MS to request establishment of a dedicated channel

RAM
Remote Application Management; Ability to remotely manage (install, remove) Java Applications on SIM/USIM Card

RF
Radio Frequency

RFM
Remote File Management; Ability to remotely manage (write, read) files on a SIM/USIM card

Roaming
Procedure in which a subscriber of one network is using the radio network of another network, often in different countries; in some countries national roaming exists

Routing Area
Routing Area; GPRS specific sub-division of Location Area

RR
Radio Resources; Part of the GSM Layer 3 Protocol

RSL
Radio Signalling Link (*3GPP TS 48.058* [?])

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

RTP
Real-Time Transport Protocol (*IETF RFC 3550* [?]); Used to transport audio/video streams over UDP/IP

SACCH
Slow Associate Control Channel on Um interface; bundled to a TCH or SDCCH, used for signalling in parallel to active dedicated channel

SCCP
Signaling Connection Control Part; SS7 signaling protocol (*ITU-T Q.711* [?])

SDCCH
Slow Dedicated Control Channel on Um interface; used for signalling and SMS transport in GSM

SDK
Software Development Kit

SGs
Interface between MSC (GSM/UMTS) and MME (LTE/EPC) to facilitate CSFB and SMS.

SGSN
Serving GPRS Support Node; Core network element for packet-switched services in GSM and UMTS.

SIGTRAN
Signaling Transport over IP (*IETF RFC 2719* [?])

SIM
Subscriber Identity Module; small chip card storing subscriber identity

Site
A site is a location where one or more BTSs are installed, typically three BTSs for three sectors

SMPP
Short Message Peer-to-Peer; TCP based protocol to interface external entities with an SMSC

SMSC
Short Message Service Center; store-and-forward relay for short messages

SS7
Signaling System No. 7; Classic digital telephony signaling system

SS
Supplementary Services; query and set various service parameters between subscriber and core network (e.g. USSD, 3rd-party calls, hold/retrieve, advice-of-charge, call deflection)

SSH
Secure Shell; *IETF RFC 4250* [?] to 4254

SSN
Sub-System Number; identifies a given SCCP Service such as MSC, HLR

STP
Signaling Transfer Point; A Router in SS7 Networks

SUA
SCCP User Adaptation; a SIGTRAN Variant (*RFC 3868* [?])

syslog
System logging service of UNIX-like operating systems

System Information
A set of downlink messages on the BCCH and SACCH of the Um interface describing properties of the cell and network

TCH
Traffic Channel; used for circuit-switched user traffic (mostly voice) in GSM

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

TCP
Transmission Control Protocol; (*IETF RFC 793* [?])

TFTP
Trivial File Transfer Protocol; (*IETF RFC 1350* [?])

TOS
Type Of Service; bit-field in IPv4 header, now re-used as DSCP (*IETF RFC 791* [?])

TRX
Transceiver; element of a BTS serving a single carrier

TS
Technical Specification

u-Boot
Boot loader used in various embedded systems

UBI
An MTD wear leveling system to deal with NAND flash in Linux

UBL
Initial bootloader loaded by the TI Davinci SoC

UDP
User Datagram Protocol (*IETF RFC 768* [?])

UICC
Universal Integrated Chip Card; A smart card according to *ETSI TR 102 216* [?]

Um interface
U mobile; Radio interface between MS and BTS

uplink
Direction of messages: Signals from the mobile phone towards the network

USIM
Universal Subscriber Identity Module; application running on a UICC to provide subscriber identity for UMTS and GSM networks

USSD
Unstructured Supplementary Service Data; textual dialog between subscriber and core network, e.g. **100 → Your extension is 1234*

VAMOS
Voice services over Adaptive Multi-user channels on One Slot; an optional extension for GSM specified in Release 9 of 3GPP GERAN specifications (*3GPP TS 48.018* [?]) allowing two independent UEs to transmit and receive simultaneously on traffic channels

VCTCXO
Voltage Controlled, Temperature Compensated Crystal Oscillator; a precision oscillator, superior to a classic crystal oscillator, but inferior to an OCXO

VLAN
Virtual LAN in the context of Ethernet (*IEEE 802.1Q* [?])

VLR
Visitor Location Register; volatile storage of attached subscribers in the MSC

VPLMN
Visited PLMN; the network in which the subscriber is currently registered; may differ from HPLMN when on roaming

VTY
Virtual TeletYpe; a textual command-line interface for configuration and introspection, e.g. the OsmoBSC configuration file as well as its telnet link on port 4242

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

A Osmocom TCP/UDP Port Numbers

The Osmocom GSM system utilizes a variety of TCP/IP based protocols. The table below provides a reference as to which port numbers are used by which protocol / interface.

Table 14: TCP/UDP port numbers

L4 Protocol	Port Number	Purpose	Software
UDP	1984	Osmux	osmo-mgw, osmo-bts
UDP	2427	MGCP GW	osmo-bsc_mgcp, osmo-mgw
TCP	2775	SMPP (SMS interface for external programs)	osmo-nitb
TCP	3002	A-bis/IP OML	osmo-bts, osmo-bsc, osmo-nitb
TCP	3003	A-bis/IP RSL	osmo-bts, osmo-bsc, osmo-nitb
TCP	4227	telnet (VTY)	osmo-pcap-client
TCP	4228	telnet (VTY)	osmo-pcap-server
TCP	4236	Control Interface	osmo-trx
TCP	4237	telnet (VTY)	osmo-trx
TCP	4238	Control Interface	osmo-bts
TCP	4239	telnet (VTY)	osmo-stp
TCP	4240	telnet (VTY)	osmo-pcu
TCP	4241	telnet (VTY)	osmo-bts
TCP	4242	telnet (VTY)	osmo-nitb, osmo-bsc, cellmgr-ng
TCP	4243	telnet (VTY)	osmo-bsc_mgcp, osmo-mgw
TCP	4244	telnet (VTY)	osmo-bsc_nat
TCP	4245	telnet (VTY)	osmo-sgsn
TCP	4246	telnet (VTY)	osmo-gbproxy
TCP	4247	telnet (VTY)	OsmocomBB
TCP	4249	Control Interface	osmo-nitb, osmo-bsc
TCP	4250	Control Interface	osmo-bsc_nat
TCP	4251	Control Interface	osmo-sgsn
TCP	4252	telnet (VTY)	sysmobts-mgr
TCP	4253	telnet (VTY)	osmo-gtphub
TCP	4254	telnet (VTY)	osmo-msc
TCP	4255	Control Interface	osmo-msc
TCP	4256	telnet (VTY)	osmo-sip-connector
TCP	4257	Control Interface	osmo-ggsn, ggsn (OpenGGSN)
TCP	4258	telnet (VTY)	osmo-hlr
TCP	4259	Control Interface	osmo-hlr
TCP	4260	telnet (VTY)	osmo-ggsn
TCP	4261	telnet (VTY)	osmo-hnbgw
TCP	4262	Control Interface	osmo-hnbgw
TCP	4263	Control Interface	osmo-gbproxy
TCP	4264	telnet (VTY)	osmo-cbc
TCP	4265	Control Interface	osmo-cbc
TCP	4266	D-GSM MS Lookup: mDNS serve	osmo-hlr
TCP	4267	Control Interface	osmo-mgw
TCP	4268	telnet (VTY)	osmo-uecups
SCTP	4268	UECUPS	osmo-uecups
TCP	4269	telnet (VTY)	osmo-e1d
TCP	4270	telnet (VTY)	osmo-isdntap
TCP	4271	telnet (VTY)	osmo-smlc
TCP	4272	Control Interface	osmo-smlc
TCP	4273	telnet (VTY)	osmo-hnodeb
TCP	4274	Control Interface	osmo-hnodeb

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

Table 14: (continued)

L4 Protocol	Port Number	Purpose	Software
TCP	4275	telnet (VTY)	osmo-upf
TCP	4276	Control Interface	osmo-upf
TCP	4277	telnet (VTY)	osmo-pfcp-tool
TCP	4278	Control Interface	osmo-pfcp-tool
UDP	4729	GSMTAP	Almost every osmocom project
TCP	5000	A/IP	osmo-bsc, osmo-bsc_nat
UDP	23000	GPRS-NS over IP default port	osmo-pcu, osmo-sgsn, osmo-gbproxy
TCP	48049	BSC-CBC (CBSP) default port	osmo-bsc, osmo-cbc

B GNU Free Documentation License

Version 1.3, 3 November 2008

Copyright © 2000, 2001, 2002, 2007, 2008 Free Software Foundation, Inc. http://fsf.org/

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

B.1 PREAMBLE

The purpose of this License is to make a manual, textbook, or other functional and useful document "free" in the sense of freedom: to assure everyone the effective freedom to copy and redistribute it, with or without modifying it, either commercially or noncommercially. Secondarily, this License preserves for the author and publisher a way to get credit for their work, while not being considered responsible for modifications made by others.

This License is a kind of "copyleft", which means that derivative works of the document must themselves be free in the same sense. It complements the GNU General Public License, which is a copyleft license designed for free software.

We have designed this License in order to use it for manuals for free software, because free software needs free documentation: a free program should come with manuals providing the same freedoms that the software does. But this License is not limited to software manuals; it can be used for any textual work, regardless of subject matter or whether it is published as a printed book. We recommend this License principally for works whose purpose is instruction or reference.

B.2 APPLICABILITY AND DEFINITIONS

This License applies to any manual or other work, in any medium, that contains a notice placed by the copyright holder saying it can be distributed under the terms of this License. Such a notice grants a world-wide, royalty-free license, unlimited in duration, to use that work under the conditions stated herein. The "Document", below, refers to any such manual or work. Any member of the public is a licensee, and is addressed as "you". You accept the license if you copy, modify or distribute the work in a way requiring permission under copyright law.

A "Modified Version" of the Document means any work containing the Document or a portion of it, either copied verbatim, or with modifications and/or translated into another language.

A "Secondary Section" is a named appendix or a front-matter section of the Document that deals exclusively with the relationship of the publishers or authors of the Document to the Document's overall subject (or to related matters) and contains nothing that could fall directly within that overall subject. (Thus, if the Document is in part a textbook of mathematics, a Secondary Section may not explain any mathematics.) The relationship could be a matter of historical connection with the subject or with related matters, or of legal, commercial, philosophical, ethical or political position regarding them.

The "Invariant Sections" are certain Secondary Section whose titles are designated, as being those of Invariant Sections, in the notice that says that the Document is released under this License. If a section does not fit the above definition of Secondary then

it is not allowed to be designated as Invariant. The Document may contain zero Invariant Sections. If the Document does not identify any Invariant Sections then there are none.

The "Cover Texts" are certain short passages of text that are listed, as Front-Cover Texts or Back-Cover Texts, in the notice that says that the Document is released under this License. A Front-Cover Text may be at most 5 words, and a Back-Cover Text may be at most 25 words.

A "Transparent" copy of the Document means a machine-readable copy, represented in a format whose specification is available to the general public, that is suitable for revising the document straightforwardly with generic text editors or (for images composed of pixels) generic paint programs or (for drawings) some widely available drawing editor, and that is suitable for input to text formatters or for automatic translation to a variety of formats suitable for input to text formatters. A copy made in an otherwise Transparent file format whose markup, or absence of markup, has been arranged to thwart or discourage subsequent modification by readers is not Transparent. An image format is not Transparent if used for any substantial amount of text. A copy that is not Transparent is called "Opaque".

Examples of suitable formats for Transparent copies include plain ASCII without markup, Texinfo input format, LaTeX input format, SGML or XML using a publicly available DTD, and standard-conforming simple HTML, PostScript or PDF designed for human modification. Examples of transparent image formats include PNG, XCF and JPG. Opaque formats include proprietary formats that can be read and edited only by proprietary word processors, SGML or XML for which the DTD and/or processing tools are not generally available, and the machine-generated HTML, PostScript or PDF produced by some word processors for output purposes only.

The "Title Page" means, for a printed book, the title page itself, plus such following pages as are needed to hold, legibly, the material this License requires to appear in the title page. For works in formats which do not have any title page as such, Title Page means the text near the most prominent appearance of the work's title, preceding the beginning of the body of the text.

The "publisher" means any person or entity that distributes copies of the Document to the public.

A section "Entitled XYZ" means a named subunit of the Document whose title either is precisely XYZ or contains XYZ in parentheses following text that translates XYZ in another language. (Here XYZ stands for a specific section name mentioned below, such as "Acknowledgements", "Dedications", "Endorsements", or "History".) To "Preserve the Title" of such a section when you modify the Document means that it remains a section "Entitled XYZ" according to this definition.

The Document may include Warranty Disclaimers next to the notice which states that this License applies to the Document. These Warranty Disclaimers are considered to be included by reference in this License, but only as regards disclaiming warranties: any other implication that these Warranty Disclaimers may have is void and has no effect on the meaning of this License.

B.3 VERBATIM COPYING

You may copy and distribute the Document in any medium, either commercially or noncommercially, provided that this License, the copyright notices, and the license notice saying this License applies to the Document are reproduced in all copies, and that you add no other conditions whatsoever to those of this License. You may not use technical measures to obstruct or control the reading or further copying of the copies you make or distribute. However, you may accept compensation in exchange for copies. If you distribute a large enough number of copies you must also follow the conditions in section Section B.4.

You may also lend copies, under the same conditions stated above, and you may publicly display copies.

B.4 COPYING IN QUANTITY

If you publish printed copies (or copies in media that commonly have printed covers) of the Document, numbering more than 100, and the Document's license notice requires Cover Texts, you must enclose the copies in covers that carry, clearly and legibly, all these Cover Texts: Front-Cover Texts on the front cover, and Back-Cover Texts on the back cover. Both covers must also clearly and legibly identify you as the publisher of these copies. The front cover must present the full title with all words of the title equally prominent and visible. You may add other material on the covers in addition. Copying with changes limited to the covers, as long as they preserve the title of the Document and satisfy these conditions, can be treated as verbatim copying in other respects.

If the required texts for either cover are too voluminous to fit legibly, you should put the first ones listed (as many as fit reasonably) on the actual cover, and continue the rest onto adjacent pages.

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

If you publish or distribute Opaque copies of the Document numbering more than 100, you must either include a machine-readable Transparent copy along with each Opaque copy, or state in or with each Opaque copy a computer-network location from which the general network-using public has access to download using public-standard network protocols a complete Transparent copy of the Document, free of added material. If you use the latter option, you must take reasonably prudent steps, when you begin distribution of Opaque copies in quantity, to ensure that this Transparent copy will remain thus accessible at the stated location until at least one year after the last time you distribute an Opaque copy (directly or through your agents or retailers) of that edition to the public.

It is requested, but not required, that you contact the authors of the Document well before redistributing any large number of copies, to give them a chance to provide you with an updated version of the Document.

B.5 MODIFICATIONS

You may copy and distribute a Modified Version of the Document under the conditions of sections 2 and 3 above, provided that you release the Modified Version under precisely this License, with the Modified Version filling the role of the Document, thus licensing distribution and modification of the Modified Version to whoever possesses a copy of it. In addition, you must do these things in the Modified Version:

a. Use in the Title Page (and on the covers, if any) a title distinct from that of the Document, and from those of previous versions (which should, if there were any, be listed in the History section of the Document). You may use the same title as a previous version if the original publisher of that version gives permission.

b. List on the Title Page, as authors, one or more persons or entities responsible for authorship of the modifications in the Modified Version, together with at least five of the principal authors of the Document (all of its principal authors, if it has fewer than five), unless they release you from this requirement.

c. State on the Title Page the name of the publisher of the Modified Version, as the publisher.

d. Preserve all the copyright notices of the Document.

e. Add an appropriate copyright notice for your modifications adjacent to the other copyright notices.

f. Include, immediately after the copyright notices, a license notice giving the public permission to use the Modified Version under the terms of this License, in the form shown in the Addendum below.

g. Preserve in that license notice the full lists of Invariant Sections and required Cover Texts given in the Document's license notice.

h. Include an unaltered copy of this License.

i. Preserve the section Entitled "History", Preserve its Title, and add to it an item stating at least the title, year, new authors, and publisher of the Modified Version as given on the Title Page. If there is no section Entitled "History" in the Document, create one stating the title, year, authors, and publisher of the Document as given on its Title Page, then add an item describing the Modified Version as stated in the previous sentence.

j. Preserve the network location, if any, given in the Document for public access to a Transparent copy of the Document, and likewise the network locations given in the Document for previous versions it was based on. These may be placed in the "History" section. You may omit a network location for a work that was published at least four years before the Document itself, or if the original publisher of the version it refers to gives permission.

k. For any section Entitled "Acknowledgements" or "Dedications", Preserve the Title of the section, and preserve in the section all the substance and tone of each of the contributor acknowledgements and/or dedications given therein.

l. Preserve all the Invariant Sections of the Document, unaltered in their text and in their titles. Section numbers or the equivalent are not considered part of the section titles.

m. Delete any section Entitled "Endorsements". Such a section may not be included in the Modified Version.

n. Do not retitle any existing section to be Entitled "Endorsements" or to conflict in title with any Invariant Sections.

o. Preserve any Warranty Disclaimers.

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

If the Modified Version includes new front-matter sections or appendices that qualify as Secondary Section and contain no material copied from the Document, you may at your option designate some or all of these sections as invariant. To do this, add their titles to the list of Invariant Sections in the Modified Version's license notice. These titles must be distinct from any other section titles.

You may add a section Entitled "Endorsements", provided it contains nothing but endorsements of your Modified Version by various parties—for example, statements of peer review or that the text has been approved by an organization as the authoritative definition of a standard.

You may add a passage of up to five words as a Front-Cover Text, and a passage of up to 25 words as a Back-Cover Text, to the end of the list of Cover Texts in the Modified Version. Only one passage of Front-Cover Text and one of Back-Cover Text may be added by (or through arrangements made by) any one entity. If the Document already includes a cover text for the same cover, previously added by you or by arrangement made by the same entity you are acting on behalf of, you may not add another; but you may replace the old one, on explicit permission from the previous publisher that added the old one.

The author(s) and publisher(s) of the Document do not by this License give permission to use their names for publicity for or to assert or imply endorsement of any Modified Version.

B.6 COMBINING DOCUMENTS

You may combine the Document with other documents released under this License, under the terms defined in section 4 above for modified versions, provided that you include in the combination all of the Invariant Sections of all of the original documents, unmodified, and list them all as Invariant Sections of your combined work in its license notice, and that you preserve all their Warranty Disclaimers.

The combined work need only contain one copy of this License, and multiple identical Invariant Sections may be replaced with a single copy. If there are multiple Invariant Sections with the same name but different contents, make the title of each such section unique by adding at the end of it, in parentheses, the name of the original author or publisher of that section if known, or else a unique number. Make the same adjustment to the section titles in the list of Invariant Sections in the license notice of the combined work.

In the combination, you must combine any sections Entitled "History" in the various original documents, forming one section Entitled "History"; likewise combine any sections Entitled "Acknowledgements", and any sections Entitled "Dedications". You must delete all sections Entitled "Endorsements".

B.7 COLLECTIONS OF DOCUMENTS

You may make a collection consisting of the Document and other documents released under this License, and replace the individual copies of this License in the various documents with a single copy that is included in the collection, provided that you follow the rules of this License for verbatim copying of each of the documents in all other respects.

You may extract a single document from such a collection, and distribute it individually under this License, provided you insert a copy of this License into the extracted document, and follow this License in all other respects regarding verbatim copying of that document.

B.8 AGGREGATION WITH INDEPENDENT WORKS

A compilation of the Document or its derivatives with other separate and independent documents or works, in or on a volume of a storage or distribution medium, is called an "aggregate" if the copyright resulting from the compilation is not used to limit the legal rights of the compilation's users beyond what the individual works permit. When the Document is included in an aggregate, this License does not apply to the other works in the aggregate which are not themselves derivative works of the Document.

If the Cover Text requirement of section 3 is applicable to these copies of the Document, then if the Document is less than one half of the entire aggregate, the Document's Cover Texts may be placed on covers that bracket the Document within the aggregate, or the electronic equivalent of covers if the Document is in electronic form. Otherwise they must appear on printed covers that bracket the whole aggregate.

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

B.9 TRANSLATION

Translation is considered a kind of modification, so you may distribute translations of the Document under the terms of section 4. Replacing Invariant Sections with translations requires special permission from their copyright holders, but you may include translations of some or all Invariant Sections in addition to the original versions of these Invariant Sections. You may include a translation of this License, and all the license notices in the Document, and any Warranty Disclaimers, provided that you also include the original English version of this License and the original versions of those notices and disclaimers. In case of a disagreement between the translation and the original version of this License or a notice or disclaimer, the original version will prevail.

If a section in the Document is Entitled "Acknowledgements", "Dedications", or "History", the requirement (section 4) to Preserve its Title (section 1) will typically require changing the actual title.

B.10 TERMINATION

You may not copy, modify, sublicense, or distribute the Document except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense, or distribute it is void, and will automatically terminate your rights under this License.

However, if you cease all violation of this License, then your license from a particular copyright holder is reinstated (a) provisionally, unless and until the copyright holder explicitly and finally terminates your license, and (b) permanently, if the copyright holder fails to notify you of the violation by some reasonable means prior to 60 days after the cessation.

Moreover, your license from a particular copyright holder is reinstated permanently if the copyright holder notifies you of the violation by some reasonable means, this is the first time you have received notice of violation of this License (for any work) from that copyright holder, and you cure the violation prior to 30 days after your receipt of the notice.

Termination of your rights under this section does not terminate the licenses of parties who have received copies or rights from you under this License. If your rights have been terminated and not permanently reinstated, receipt of a copy of some or all of the same material does not give you any rights to use it.

B.11 FUTURE REVISIONS OF THIS LICENSE

The Free Software Foundation may publish new, revised versions of the GNU Free Documentation License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns. See http://www.gnu.org/copyleft/.

Each version of the License is given a distinguishing version number. If the Document specifies that a particular numbered version of this License "or any later version" applies to it, you have the option of following the terms and conditions either of that specified version or of any later version that has been published (not as a draft) by the Free Software Foundation. If the Document does not specify a version number of this License, you may choose any version ever published (not as a draft) by the Free Software Foundation. If the Document specifies that a proxy can decide which future versions of this License can be used, that proxy's public statement of acceptance of a version permanently authorizes you to choose that version for the Document.

B.12 RELICENSING

"Massive Multiauthor Collaboration Site" (or "MMC Site") means any World Wide Web server that publishes copyrightable works and also provides prominent facilities for anybody to edit those works. A public wiki that anybody can edit is an example of such a server. A "Massive Multiauthor Collaboration" (or "MMC") contained in the site means any set of copyrightable works thus published on the MMC site.

"CC-BY-SA" means the Creative Commons Attribution-Share Alike 3.0 license published by Creative Commons Corporation, a not-for-profit corporation with a principal place of business in San Francisco, California, as well as future copyleft versions of that license published by that same organization.

"Incorporate" means to publish or republish a Document, in whole or in part, as part of another Document.

An MMC is "eligible for relicensing" if it is licensed under this License, and if all works that were first published under this License somewhere other than this MMC, and subsequently incorporated in whole or in part into the MMC, (1) had no cover texts or invariant sections, and (2) were thus incorporated prior to November 1, 2008.

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH

The operator of an MMC Site may republish an MMC contained in the site under CC-BY-SA on the same site at any time before August 1, 2009, provided the MMC is eligible for relicensing.

B.13 ADDENDUM: How to use this License for your documents

To use this License in a document you have written, include a copy of the License in the document and put the following copyright and license notices just after the title page:

```
Copyright (c)  YEAR  YOUR NAME.
Permission is granted to copy, distribute and/or modify this document
under the terms of the GNU Free Documentation License, Version 1.3
or any later version published by the Free Software Foundation;
with no Invariant Sections, no Front-Cover Texts, and no Back-Cover Texts.
A copy of the license is included in the section entitled ``GNU
Free Documentation License''.
```

If you have Invariant Sections, Front-Cover Texts and Back-Cover Texts, replace the "with…Texts." line with this:

```
with the Invariant Sections being LIST THEIR TITLES, with the
Front-Cover Texts being LIST, and with the Back-Cover Texts being LIST.
```

If you have Invariant Sections without Cover Texts, or some other combination of the three, merge those two alternatives to suit the situation.

If your document contains nontrivial examples of program code, we recommend releasing these examples in parallel under your choice of free software license, such as the GNU General Public License, to permit their use in free software.

Copyright © 2015-2021 sysmocom - s.f.m.c. GmbH