3GPP TS 32.406 V11.3.0 (2012-03)

Technical Specification

**3rd Generation Partnership Project;
Technical Specification Group Services and System Aspects;
Telecommunication management;
Performance Management (PM);
Performance measurements;
Core Network (CN) Packet Switched (PS) domain
(Release 11)**

Keywords
GSM, UMTS, management, performance

3GPP

Postal address

3GPP support office address
650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet
http://www.3gpp.org

Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

Introduction

The present document is part of a TS-family covering the 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Telecommunication management; as identified below:

32.401 Performance Management (PM); Concept and requirements

52.402 Performance Management (PM); Performance measurements – GSM

32.404 Performance Management (PM); Performance measurements - Definitions and template

32.405 Performance Management (PM); Performance measurements Universal Terrestrial Radio Access Network (UTRAN)

32.406 Performance Management (PM); Performance measurements Core Network (CN) Packet Switched (PS) domain

32.407 Performance Management (PM); Performance measurements Core Network (CN) Circuit Switched (CS) domain

32.408 Performance Management (PM); Performance measurements Teleservice

32.409 Performance Management (PM); Performance measurements IP Multimedia Subsystem (IMS)

The present document is part of a set of specifications, which describe the requirements and information model necessary for the standardised Operation, Administration and Maintenance (OA&M) of a multi-vendor 3G-system.

During the lifetime of a 3G network, its logical and physical configuration will undergo changes of varying degrees and frequencies in order to optimise the utilisation of the network resources. These changes will be executed through network configuration management activities and/or network engineering, see TS 32.600 [3].

Many of the activities involved in the daily operation and future network planning of a 3G network require data on which to base decisions. This data refers to the load carried by the network and the grade of service offered. In order to produce this data performance measurements are executed in the NEs, which comprise the network. The data can then be transferred to an external system, e.g. an Operations System (OS) in TMN terminology, for further evaluation. The purpose of the present document is to describe the mechanisms involved in the collection of the data and the definition of the data itself.

Annex B of TS 32.404 helps in the definition of new performance measurements that can be submitted to 3GPP for potential adoption and inclusion in the present document. Annex B of TS 32.404 discusses a top-down performance measurement definition methodology that focuses on how the end-user of performance measurements can use the measurements.

1 Scope

The present document describes the measurements for UMTS and combined UMTS/GSM.

TS 32.401 [1] describes Performance Management concepts and requirements.

The present document is valid for all measurement types provided by an implementation of a UMTS network and combined UMTS/GSM network.

Only measurement types that are specific to UMTS or combined UMTS/GSM networks are defined within the present documents. Vendor specific measurement types used in UMTS and combined UMTS/GSM networks are not covered. Instead, these could be applied according to manufacturer's documentation.

Measurements related to "external" technologies (such as ATM or IP) as described by "external" standards bodies (e.g. ITU-T or IETF) shall only be referenced within this specification, wherever there is a need identified for the existence of such a reference.

The definition of the standard measurements is intended to result in comparability of measurement data produced in a multi-vendor network, for those measurement types that can be standardised across all vendors' implementations.

The structure of the present document is as follows:

- Header 1: Network Element (e.g. RNC related measurements);

- Header 2: Measurement function (e.g. soft handover measurements);

- Header 3: Measurements.

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 and/or edition number or version number) 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 TS 32.401: "Telecommunication management; Performance Management (PM); Concept and requirements".

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

[3]   3GPP TS 32.600: "Telecommunication management; Configuration Management (CM); Concept and high-level requirements".

[4]   3GPP TS 29.002: "Mobile Application Part (MAP) specification".

[5]   3GPP TS 25.413: "UTRAN Iu Interface RANAP signalling".

[6]   3GPP TS 29.060: "General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp interface".

[7]   Void.

[8]   3GPP TS 23.107: "Quality of Service (QoS) concept and architecture".

[9]   3GPP TS 23.003: "Numbering, Addressing and Identification".

[10]   3GPP TS 29.061: "Interworking between the Public Land Mobile Network (PLMN) supporting packet based services and Packet Data Networks (PDN)".

[11]   3GPP TS 44.064: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station - Serving GPRS Support Node (MS-SGSN) Logical Link Control (LLC) layer specification".

[12]   3GPP TS 44.065: "Digital cellular telecommunications system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) - Serving GPRS Support Node (SGSN); Subnetwork Dependent Convergence Protocol (SNDCP)".

[13]   IETF RFC 1034: "DOMAIN NAMES - CONCEPTS AND FACILITIES".

[14]   IETF RFC 1035: "DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION".

[15]   3GPP TS 24.008: "Mobile Radio Interface Layer 3 specification; Core Network Protocols; Stage 3".

[16]   GSM 08.18: "Digital cellular telecommunication system (Phase 2); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN); BSS GPRS Protocol (BSSGP)".

[17]   IETF RFC 2903: "Generic AAA Architecture".

[18]   IETF RFC 2138: "Remote Authentication Dial In User Service (RADIUS) ".

3   Measurement family and abbreviations

3.1   Measurement family

The measurement names defined in the present document are all beginning with a prefix containing the measurement family name (e.g. MM.AttGprsAttach). This family name identifies all measurements which relate to a given functionality and it may be used for measurement administration (see TS 32.401 [1]).

The list of families currently used in the present document is as follows:

- AAA (measurements related to AAA)

- CAM (measurements related to CAMEL)

- DNS (measurements related to DNS)

- GTP (measurements related to GTP)

- IMEI (measurements related to IMEI verification)

- ISYSC (measurements related to GSM/UMTS Intersystem changes)

- LLC (measurements related to Logical Link Control)

- MM (measurements related to Mobility Management)

- RELOC (measurements related to SRNS Relocation)

- RRC (measurements related to Radio Resource Control)

- SEC (measurements related to Security)

- SIG (measurements related to Signalling)

- SM (measurements related to Session Management)

- SNDCP (measurements related to Sub-Network Dependent Convergence Protocol)

- SUB (measurements related to Subscriber Management)

- UBS (measurements related to UMTS Bearer Service)

3.2 Abbreviations

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

3G	3rd Generation
3GPP	3G Partnership Project
ASN.1	Abstract Syntax Notation 1
BER	Basic Encoding Rules
CN	Core Network
DTD	Document Type Definition
DTI	Direct Tunnel Indicator
EGQM	Enhanced Goal, Question, Metric
EM	(Network) Element Manager
FTAM	File Transfer Access and Management
FTP	File Transfer Protocol
GQM	Goal, Question, Metric
IEEE	Institute of Electrical and Electronics Engineers
Itf	Interface
ITU-T	International Telecommunication Union - Telecommunications Standardisation Sector
MSC	Mobile services Switching Centre
NE	Network Element
NM	Network Manager
OA&M	Operation, Administration and Maintenance
OS	Operations System (EM, NM)
OSI	Open Systems Interconnection
PM	Performance Management
QoS	Quality of Service
RNC	Radio Network Controller
TFTP	Trivial FTP
UMTS	Universal Mobile Telecommunications System
UTRAN	Universal Terrestrial Radio Access Network

You can find below a list of abbreviations used within the measurement types for field E of the measurement template (see subclause 3.3).

Assn	Assign(ment,ed)
Att	Attempt(s,ed)
Auth	Authentication
Bgrd	Background
Call	Call
Chg	Change
Conn	Connection
Combi	Combined
CS	Circuit switched
Ctrl	Controlled
Conv	Conversational
Del	Deletion
Drop	Drop(ped)
Estab	Establish (ed,ment)
Fail	Fail(ed, ure)
FDD	Frequency Division Duplex
HO	Handover
Inc	Incoming
Intact	Interactive
Inter	Inter
Intra	Intra
Invol	Involve(d)
Max	Maximum
MM	Mobility Management
Nat	National

Netw	Network
NodeB	NodeB
Oct	Octet(s)
Out	Outgoing
Pkt	Packet(s)
Prep	Preparation
Proc	Procedure
PS	Packet switched
RAT	Radio Access Technology
ReEstab	Re-establish (ed,ment)
Rel	Released
Reloc	Relocation
Req	Request(s,ed)
Res	Resource
RL	Radio Link
RNC	RNC
RRC	Radio Resource Control
RTWP	Received Total Wideband Power
Setup	Setup
SGSN	SGSN
Sig	Signalling
Strm	Streaming
Sub	Subscriber
Succ	Success(es,ful)
TCP	Transmitted Carrier Power
UE	User Equipment
UTRAN	UTRAN

4 Measurements related to the SGSN

4.1 Mobility Management

4.1.1 GPRS attach procedures

The four measurements defined in the clause 4.1.1 are subject to the "3 out of 4 approach".

NOTE: Number of Attempted GPRS attach procedures = Number of Successful GPRS attach procedures + Total Number of Failed GPRS attach procedures + Aborted GPRS attach procedures.

4.1.1.1 Attempted GPRS attach procedures

a) This measurement provides the number of attempted GPRS attach procedures initiated within this SGSN area. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of "ATTACH REQUEST" message with "Attach type" information element indicating "GPRS attach" from the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.AttGprsAttach:

- MM.AttGprsAttach   Combined (don't care);

- MM.AttGprsAttach.G   GSM;

- MM.AttGprsAttach.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.1.2 Successful GPRS attach procedures

a) This measurement provides the number of successfully performed GPRS attach procedures within this SGSN area.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of a "ATTACH ACCEPT" message to the MS, in response to a "ATTACH REQUEST" message with the "Attach type" information element indicating "GPRS attach". If the "ATTACH ACCEPT" message is caused by a retransmission, this will not cause the counter to be increased. (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.SuccGprsAttach:

- MM.SuccGprsAttach   Combined (don't care);

- MM.SuccGprsAttach.G   GSM;

- MM.SuccGprsAttach.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.1.3 Failed GPRS attach procedures

a) This measurement provides the number of failed GPRS attach procedures. The measurement is split into subcounters per the reject cause. The three measurements defined in e) are subject to the "2 out of 3 approach".

b) CC

c) Transmission by the SGSN of the ATTACH REJECT message to the MS, in response to a "ATTACH REQUEST" message with the "Attach type" information element indicating "GPRS attach", the relevant measurement is incremented according to the reject cause. Possible reject causes are defined within TS 24.008 [15].
The sum of all supported per cause measurements shall be equal to the total number of failed GPRS attach procedures. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

d) Each measurement (as defined in e) is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the *.sum* suffix.

e) MM.FailedGprsAttach.*Cause*:

- MM.FailedGprsAttach.*Cause*   Combined (don't care);

- MM.FailedGprsAttach.*Cause*.G   GSM;

- MM.FailedGprsAttach.*Cause*.U   UMTS;

    where *Cause* identifies the reject cause.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching

h) GSM/UMTS

4.1.1.4 Aborted GPRS attach procedures

a) This measurement provides the number of aborted GPRS attach procedures. The three measurements defined in e) are subject to the "2 out of 3 approach".

b) CC

c) Abortion of a GPRS attach procedure, or a "ATTACH REQUEST" message with "Attach type" information element indicating "GPRS attach" would not be treated (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.AbortedGprsAttach:

- MM.AbortedGprsAttach   Combined (don't care);

- MM.AbortedGprsAttach.G   GSM;

- MM.AbortedGprsAttach.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching

h) GSM/UMTS

4.1.2 Intra-SGSN Routing Area update procedures

4.1.2.1 Attempted intra-SGSN Routing Area update procedures

a) This measurement provides the number of attempted intra-SGSN Routing Area Update procedures initiated within this SGSN area.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "ROUTING AREA UPDATE REQUEST" message from the MS, where the old RA and the new RA are served by this SGSN (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.AttIntraSgsnRaUpdate:

- MM.AttIntraSgsnRaUpdate   Combined (don't care);

- MM.AttIntraSgsnRaUpdate.G   GSM;

- MM.AttIntraSgsnRaUpdate.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.2.2 Successful intra-SGSN Routing Area update procedures

a) This measurement provides the number of successfully performed intra-SGSN Routing Area Update procedures initiated in this SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of "ROUTING AREA UPDATE ACCEPT" message to the MS (TS 24.008 [15]).

d) A single integer value.

e) MM.SuccIntraSgsnRaUpdate:

- MM.SuccIntraSgsnRaUpdate   Combined (don't care);

- MM.SuccIntraSgsnRaUpdate.G   GSM;

- MM.SuccIntraSgsnRaUpdate.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.2.3 Failed intra-SGSN Routing Area update procedures

a) This measurement provides the number of failed GPRS intra-SGSN Routing Area Update procedures initiated in this SGSN. The measurement is split into subcounters per the reject cause. The three measurements defined in e) are subject to the "2 out of 3 approach".

b) CC

c) Transmission by the SGSN of the ROUTING AREA UPDATE REJECT message to the MS, in response to a "ROUTING AREA UPDATE REQUEST" (Intra-Sgsn) message, the relevant measurement is incremented according to the reject cause. Possible reject causes are defined within TS 24.008 [15].
The sum of all supported per cause measurements shall be equal to the total number of failed GPRS routing area update procedures. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

d) Each measurement (as defined in e) is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the .*sum* suffix.

e) MM. FailIntraSgsnRaUpdate.*Cause*:

f) - MM. FailIntraSgsnRaUpdate.*Cause*   Combined (don't care);

g) - MM. FailIntraSgsnRaUpdate.*Cause*.G GSM;

h) - MM. FailIntraSgsnRaUpdate.*Cause*.U UMTS;

i) where *Cause* identifies the reject cause.

j) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

k) Valid for packet switching.

l) GSM/UMTS.

4.1.3 GPRS detach procedures initiated by MS

4.1.3.1 Attempted GPRS detach procedures initiated by MS

a) This measurement provides the number of MS initiated GPRS detach procedures within this SGSN area. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "DETACH REQUEST" message from the MS indicating a GPRS detach (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.AttGprsDetachMs:

-   MM.AttGprsDetachMs   Combined (don't care);

-   MM.AttGprsDetachMs.G   GSM;

-   MM.AttGprsDetachMs.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.4 GPRS detach procedures initiated by SGSN

4.1.4.1 Attempted GPRS detach procedures initiated by SGSN

a) This measurement provides the number of attempted GPRS detach procedures initiated by SGSN. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of a "DETACH REQUEST" message to the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.AttGprsDetachSgsn:

-   MM.AttGprsDetachSgsn   Combined (don't care);

-   MM.AttGprsDetachSgsn.G   GSM;

-   MM.AttGprsDetachSgsn.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.4.2 Successful GPRS detach procedures initiated by SGSN

a) This measurement provides the number of successfully completed GPRS detach procedures SGSN-initiated within this SGSN area.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of "DETACH ACCEPT" message from the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.SuccGprsDetachSgsn:

- MM.SuccGprsDetachSgsn   Combined (don't care);

- MM.SuccGprsDetachSgsn.G   GSM;

- MM.SuccGprsDetachSgsn.U   UMTS.

f)   RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g)   Valid for packet switching.

h)   GSM/UMTS

4.1.5 Inter-SGSN Routing Area update procedures

4.1.5.1 Attempted inter-SGSN Routing Area update procedures

a) This measurement provides the number of attempted inter-SGSN Routing Area Update procedures initiated in this SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of an "ROUTING AREA UPDATE REQUEST" message from the MS where the old RA is served by another SGSNs (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.AttInterSgsnRaUpdate:

- MM.AttInterSgsnRaUpdate   Combined (don't care);

- MM.AttInterSgsnRaUpdate.G   GSM;

- MM.AttInterSgsnRaUpdate.U   UMTS.

f)   RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g)   Valid for packet switching.

h)   GSM/UMTS.

4.1.5.2 Successful inter-SGSN Routing Area update procedures

a) This measurement provides the number of successfully completed inter-SGSN Routing Area Update procedures in this SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of a "ROUTING AREA UPDATE ACCEPT" message to the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.SuccInterSgsnRaUpdate:

- MM.SuccInterSgsnRaUpdate Combined (don't care);

- MM.SuccInterSgsnRaUpdate.G GSM;

- MM.SuccInterSgsnRaUpdate.U UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.5.3 Failed inter-SGSN Routing Area update procedures

a) This measurement provides the number of failed GPRS inter-SGSN Routing Area Update procedures initiated in this SGSN. The measurement is split into subcounters per the reject cause. The three measurements defined in e) are subject to the "2 out of 3 approach".

b) CC

c) Transmission by the SGSN of the ROUTING AREA UPDATE REJECT message to the MS, in response to a " ROUTING AREA UPDATE REQUEST" (Inter-Sgsn) message, the relevant measurement is incremented according to the reject cause. Possible reject causes are defined within TS 24.008 [15].
The sum of all supported per cause measurements shall be equal to the total number of failed GPRS routing area update procedures. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

d) Each measurement (as defined in e) is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the *.sum* suffix.

e) MM. FailInterSgsnRaUpdate.*Cause*:

f) - MM. FailInterSgsnRaUpdate.*Cause* Combined (don't care);

g) - MM. FailInterSgsnRaUpdate.*Cause*.G GSM;

h) - MM. FailInterSgsnRaUpdate.*Cause*.U UMTS;

i) where *Cause* identifies the reject cause.

j) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

k) Valid for packet switching

l) GSM/UMTS

4.1.6 GPRS attach procedures with IMSI already attached

The four measurements defined in the clause 5.1.6 are subject to the "3 out of 4 approach".

NOTE: Number of Attempted GPRS attach procedures with IMSI already attached = Number of Successful GPRS attach procedures with IMSI already attached + Total Number of Failed GPRS attach procedures with IMSI already attached + Aborted GPRS attach procedures with IMSI already attached.

4.1.6.1 Attempted GPRS attach procedures with IMSI already attached

a) This measurement provides the number of attempted GPRS attach procedures, while IMSI is already attached. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of "ATTACH REQUEST" Message with "Attach type" information element indicating "GPRS attach while IMSI attached" from the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.AttGprsAttachImsiAttached:

- MM.AttGprsAttachImsiAttached Combined (don't care);

- MM.AttGprsAttachImsiAttached.G GSM;

- MM.AttGprsAttachImsiAttached.U UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.6.2 Successful GPRS attach procedures with IMSI already attached

a) This measurement provides the number of successfully performed GPRS attach procedures with IMSI already attached within this SGSN area.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of a "ATTACH ACCEPT" message to the MS, in response to a "ATTACH REQUEST" message with the "Attach type" information element indicating "GPRS attach while IMSI attached". If the "ATTACH ACCEPT" message is caused by a retransmission, this will not cause the counter to be increased. (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.SuccGprsAttachImsiAttached:

- MM.SuccGprsAttachImsiAttached Combined (don't care);

- MM.SuccGprsAttachImsiAttached.G GSM;

- MM.SuccGprsAttachImsiAttached.U UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.6.3 Failed GPRS attach procedures with IMSI already attached

a) This measurement provides the number of failed GPRS attach procedures with IMSI already attached. The measurement is split into subcounters per the reject cause. The three measurements defined in e) are subject to the "2 out of 3 approach".

b) CC

c) Transmission by the SGSN of the ATTACH REJECT message to the MS, in response to a "ATTACH REQUEST" message with the "Attach type" information element indicating "GPRS attach while IMSI attached", the relevant measurement is incremented according to the reject cause. Possible reject causes are defined within TS 24.008 [15].
The sum of all supported per cause measurements shall be equal to the total number of failed GPRS attach procedures with IMSI already attached. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

d) Each measurement (as defined in e) is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the .sum suffix.

e) MM.FailedGprsAttachImsiAttached.Cause:

- MM.FailedGprsAttachImsiAttached.*Cause* Combined (don't care);

- MM.FailedGprsAttachImsiAttached.*Cause*.G GSM;

- MM.FailedGprsAttachImsiAttached.*Cause*.U   UMTS;

where *Cause* identifies the reject cause.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.6.4 Aborted GPRS attach procedures with IMSI already attached

a) This measurement provides the number of aborted GPRS attach procedures with IMSI already attached. The three measurements defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Abortion of a GPRS attach procedure with IMSI already attached, or a "ATTACH REQUEST" message with "Attach type" information element indicating "GPRS attach while IMSI attached" would not be treated (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.AbortedGprsAttachImsiAttached:

- MM.AbortedGprsAttachImsiAttached   Combined (don't care);

- MM.AbortedGprsAttachImsiAttached.G   GSM;

- MM.AbortedGprsAttachImsiAttached.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.7 IMSI detach procedures initiated by MS

4.1.7.1 Attempted IMSI detach procedures initiated by MS

a) This measurement provides the number of attempted IMSI detach procedures MS-initiated within this SGSN area.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "DETACH REQUEST" message from the MS, indicating a IMSI detach (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.AttImsiDetachMs:

- MM.AttImsiDetachMs   Combined (don't care);

- MM.AttImsiDetachMs.G   GSM;

- MM.AttImsiDetachMs.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.8 Combined GPRS/IMSI attach procedures

The four measurements defined in the clause 4.1.8 are subject to the "3 out of 4 approach".

NOTE: Number of Attempted combined GPRS/IMSI attach procedures = Number of Successful combined GPRS/IMSI attach procedures + Total Number of Failed combined GPRS/IMSI attach procedures + Aborted combined GPRS/IMSI attach procedures.

4.1.8.1 Attempted combined GPRS/IMSI attach procedures

a) This measurement provides the number of attempts of combined GPRS/IMSI attach procedures initiated within this SGSN area.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "ATTACH REQUEST" message with "Attach type" information element indicating "Combined GPRS/IMSI attach" from the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.AttCombiAttach:

- MM.AttCombiAttach   Combined (don't care);

- MM.AttCombiAttach.G   GSM;

- MM.AttCombiAttach.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.8.2 Successful combined GPRS/IMSI attach procedures

a) This measurement provides the number of successfully performed combined GPRS/IMSI attach procedures within this SGSN area.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of a "ATTACH ACCEPT" message to the MS, in response to a "ATTACH REQUEST" message with the "Attach type" information element indicating "Combined GPRS/IMSI attach". If the "ATTACH ACCEPT" message is caused by a retransmission, this will not cause the counter to be increased. (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.SuccCombiAttach:

- MM.SuccCombiAttach   Combined (don't care);

- MM.SuccCombiAttach.G   GSM;

- MM.SuccCombiAttach.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.8.3 Failed combined GPRS/IMSI attach procedures

a) This measurement provides the number of failed combined GPRS/IMSI attach procedures. The measurement is split into subcounters per the reject cause. The three measurements defined in e) are subject to the "2 out of 3 approach".

b) CC

c) Transmission by the SGSN of the ATTACH REJECT message to the MS, in response to a "ATTACH REQUEST" message with the "Attach type" information element indicating "Combined GPRS/IMSI attach", the relevant measurement is incremented according to the reject cause. Possible reject causes are defined within TS 24.008 [15].
The sum of all supported per cause measurements shall be equal to the total number of failed combined GPRS/IMSI attach procedures. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

d) Each measurement (as defined in e) is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the .sum suffix.

e) MM.FailedCombiAttach.Cause:

   - MM.FailedCombiAttach.*Cause*   Combined (don't care);

   - MM.FailedCombiAttach.*Cause*.G   GSM;

   - MM.FailedCombiAttach.*Cause*.U   UMTS;

   where *Cause* identifies the reject cause.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.8.4 Aborted combined GPRS/IMSI attach procedures

a) This measurement provides the number of aborted combined GPRS/IMSI attach procedures. The three measurements defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Abortion of a combined GPRS/IMSI attach procedure, or a "ATTACH REQUEST" message with "Attach type" information element indicating "Combined GPRS/IMSI attach" would not be treated (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.AbortedCombiAttach:

   - MM.AbortedCombiAttach   Combined (don't care);

   - MM.AbortedCombiAttach.G   GSM;

   - MM.AbortedCombiAttach.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.9   Combined GPRS/IMSI detach procedures initiated by MS

4.1.9.1   Attempted combined GPRS/IMSI detach procedures initiated by MS

a) This measurement provides the number of attempted Combined GPRS/IMSI detach procedures MS-initiated within this SGSN area.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of "DETACH REQUEST" message from the MS, indicating a Combined GPRS/IMSI detach (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.AttCombiDetachMs:

- MM.AttCombiDetachMs   Combined (don't care);

- MM.AttCombiDetachMs.G   GSM;

- MM.AttCombiDetachMs.U   UMTS.

f)   RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g)   Valid for packet switching.

h)   GSM/UMTS.

4.1.10   Combined RA/LA intra-SGSN Routing Area update procedures

4.1.10.1   Attempted combined RA/LA intra-SGSN Routing Area update procedures

a) This measurement provides the number of combined RA/LA updates (intra-SGSN) procedures initiated in this SGSN. These are counted as attempts.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of "Routing Area Update REQUEST" message from the MS, indicating a combined RA/LA update (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.AttCombiIntraSgsnRaUpdate:

- MM.AttCombiIntraSgsnRaUpdate   Combined (don't care);

- MM.AttCombiIntraSgsnRaUpdate.G   GSM;

- MM.AttCombiIntraSgsnRaUpdate.U   UMTS.

f)   RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g)   Valid for packet switching.

h)   GSM/UMTS.

4.1.10.2   Successful combined RA/LA intra-SGSN Routing Area update procedures

a) This measurement provides the number of success-fully performed combined RA/LA updates (intra-SGSN) procedures initiated in this SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of "Routing Area Update ACCEPT" message to the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.SuccCombiIntraSgsnRaUpdate:

- MM.SuccCombiIntraSgsnRaUpdate   Combined (don't care);

- MM.SuccCombiIntraSgsnRaUpdate.G   GSM;

- MM.SuccCombiIntraSgsnRaUpdate.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.10.3 Failed combined RA/LA intra-SGSN Routing Area update procedures

a) This measurement provides the number of failed GPRS combined RA/LA intra-SGSN Routing Area Update procedures initiated in this SGSN. The measurement is split into subcounters per the reject cause. The three measurements defined in e) are subject to the "2 out of 3 approach".

b) CC

c) Transmission by the SGSN of the ROUTING AREA UPDATE REJECT message to the MS, in response to a "ROUTING AREA UPDATE REQUEST" (combined RA/LA Intra-Sgsn) message, the relevant measurement is incremented according to the reject cause. Possible reject causes are defined within TS 24.008 [15].
The sum of all supported per cause measurements shall be equal to the total number of failed GPRS routing area update procedures. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

d) Each measurement (as defined in e) is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the .*sum* suffix.

e) MM.FailCombiIntraSgsnRaUpdate.*Cause*:

f) - MM.FailedCombiIntraSgsnRaUpdate.*Cause* Combined (don't care);

g) - MM.FailedCombiIntraSgsnRaUpdate.*Cause*.G   GSM;

h) - MM.FailedCombiIntraSgsnRaUpdate.*Cause*.U   UMTS;

i) where *Cause* identifies the reject cause.

j) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

k) Valid for packet switching

l) GSM/UMTS

4.1.11 "Combined RA/LA with IMSI Attach" intra-SGSN Routing Area update procedures

4.1.11.1 Attempted "combined RA/LA with IMSI Attach" intra-SGSN Routing Area update procedures

a) This measurement provides the number of combined RA/LA updates with IMSI attach (intra-SGSN) procedures initiated in this SGSN. These are counted as attempts.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of "Routing Area Update REQUEST" message from the MS, indicating a combined RA/LA update with IMSI attach (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.AttImsiCombiIntraSgsnRAUpdate:

- MM.AttImsiCombiIntraSgsnRAUpdate   Combined (don't care);

- MM.AttImsiCombiIntraSgsnRAUpdate.G   GSM;

- MM.AttImsiCombiIntraSgsnRAUpdate.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.11.2   Failed "combined RA/LA with IMSI Attach" intra-SGSN Routing Area update procedures

a) This measurement provides the number of failed GPRS "combined RA/LA with IMSI Attach" intra-SGSN Routing Area Update procedures initiated in this SGSN. The measurement is split into subcounters per the reject cause. The three measurements defined in e) are subject to the "2 out of 3 approach".

b) CC

c) Transmission by the SGSN of the ROUTING AREA UPDATE REJECT message to the MS, in response to a "ROUTING AREA UPDATE REQUEST" ("combined RA/LA with IMSI Attach" Intra-Sgsn) message, the relevant measurement is incremented according to the reject cause. Possible reject causes are defined within TS 24.008 [15].
The sum of all supported per cause measurements shall be equal to the total number of failed GPRS routing area update procedures. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

d) Each measurement (as defined in e) is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the *.sum* suffix.

e) MM. FailImsiCombiIntraSgsnRAUpdate.*Cause*:

f) - MM. FailImsiCombiIntraSgsnRAUpdate.*Cause* Combined (don't care);

g) - MM. FailImsiCombiIntraSgsnRAUpdate.*Cause*.G   GSM;

h) - MM. FailImsiCombiIntraSgsnRAUpdate.*Cause*.U   UMTS;

i) where *Cause* identifies the reject cause.

j) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

k) Valid for packet switching

l) GSM/UMTS

4.1.12   Combined RA/LA inter-SGSN Routing Area update procedures

4.1.12.1   Attempted combined RA/LA inter-SGSN Routing Area update procedures

a) This measurement provides the number of combined RA/LA updates (inter-SGSN) procedures initiated in this SGSN. These are counted as attempts.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of "Routing Area Update REQUEST" message from the MS, indicating a combined RA/LA update (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.AttCombiInterSgsnRaUpdate:

- MM.AttCombiInterSgsnRaUpdate   Combined (don't care);

- MM.AttCombiInterSgsnRaUpdate.G   GSM;

- MM.AttCombiInterSgsnRaUpdate.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.12.2 Successful combined RA/LA inter-SGSN Routing Area update procedures

a) This measurement provides the number of success-fully performed combined RA/LA updates (inter-SGSN) procedures initiated in this SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of "Routing Area Update ACCEPT" message to the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.SuccCombiInterSgsnRaUpdate:

- MM.SuccCombiInterSgsnRaUpdate   Combined (don't care);

- MM.SuccCombiInterSgsnRaUpdate.G   GSM;

- MM.SuccCombiInterSgsnRaUpdate.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.12.3 Failed combined RA/LA inter-SGSN Routing Area update procedures

a) This measurement provides the number of failed GPRS combined RA/LA inter-SGSN Routing Area Update procedures initiated in this SGSN. The measurement is split into subcounters per the reject cause. The three measurements defined in e) are subject to the "2 out of 3 approach".

b) CC

c) Transmission by the SGSN of the ROUTING AREA UPDATE REJECT message to the MS, in response to a " ROUTING AREA UPDATE REQUEST" (combined RA/LA Inter-Sgsn) message, the relevant measurement is incremented according to the reject cause. Possible reject causes are defined within TS 24.008 [15].
The sum of all supported per cause measurements shall be equal to the total number of failed GPRS routing area update procedures. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

d) Each measurement (as defined in e) is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the .*sum* suffix.

e) MM.FailCombiInterSgsnRaUpdate.*Cause*:

f) - MM.FailedCombiInterSgsnRaUpdate.*Cause* Combined (don't care);

g) - MM.FailedCombiInterSgsnRaUpdate.*Cause*.G   GSM;

h) - MM.FailedCombiInterSgsnRaUpdate.*Cause*.U   UMTS;

i) where *Cause* identifies the reject cause.

j) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

k) Valid for packet switching

l) GSM/UMTS

4.1.13 "Combined RA/LA with IMSI Attach" inter-SGSN Routing Area update procedures

4.1.13.1 Attempted "combined RA/LA with IMSI Attach" inter-SGSN Routing Area update procedures

a) This measurement provides the number of combined RA/LA updates with IMSI attach (inter-SGSN) procedures initiated in this SGSN. These are counted as attempts:
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of "Routing Area Update REQUEST" message from the MS, indicating a combined RA/LA update with IMSI attach.E52.

d) A single integer value per measurement type defined in e).

e) MM.AttImsiCombiInterSgsnRAUpdate:

- MM.AttImsiCombiInterSgsnRAUpdate   Combined (don't care);

- MM.AttImsiCombiInterSgsnRAUpdate.G   GSM;

- MM.AttImsiCombiInterSgsnRAUpdate.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.13.2 Failed "combined RA/LA with IMSI Attach" inter-SGSN Routing Area update procedures

a) This measurement provides the number of failed GPRS "combined RA/LA with IMSI Attach" inter-SGSN Routing Area Update procedures initiated in this SGSN. The measurement is split into subcounters per the reject cause. The three measurements defined in e) are subject to the "2 out of 3 approach".

b) CC

c) Transmission by the SGSN of the ROUTING AREA UPDATE REJECT message to the MS, in response to a "ROUTING AREA UPDATE REQUEST" ("combined RA/LA with IMSI Attach" Intra-Sgsn) message, the relevant measurement is incremented according to the reject cause. Possible reject causes are defined within TS 24.008 [15].
The sum of all supported per cause measurements shall be equal to the total number of failed GPRS routing area update procedures. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

d) Each measurement (as defined in e) is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the *.sum* suffix.

e) MM. FailImsiCombiInterSgsnRAUpdate.*Cause*:

- MM. FailImsiCombiInterSgsnRAUpdate.*Cause* Combined (don't care);

- MM. FailImsiCombiInterSgsnRAUpdate.*Cause*.G   GSM;

- MM. FailImsiCombiInterSgsnRAUpdate.*Cause*.U   UMTS;

where *Cause* identifies the reject cause.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching

h) GSM/UMTS

4.1.14 Number of received invalid P-TMSI's during detach

a) This measurement provides the number of received invalid P-TMSI's during detach.
   The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of an "DETACH_REQUEST" with invalid P-TMSI (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.NbrPTMSIDetachFail:

   - MM.NbrPTMSIDetachFail   Combined (don't care);

   - MM.NbrPTMSIDetachFail.G   GSM;

   - MM.NbrPTMSIDetachFail.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.15 GSM PS paging procedures

The three measurement types defined in clauses 4.1.15.n are subject to the "2 out of 3 approach".

4.1.15.1 Attempted GSM PS paging procedures

a) This measurement provides the number of attempted PS paging procedures initiated at the SGSN over the Gb
   interface. The initial paging procedures as well as the repeated paging procedures are counted.

b) CC.

c) Incremented when a GSM PS paging procedure is started, i.e. at the transmission of the first BSSGP Paging
   Request (GSM 08.18 [16]) from the SGSN to the MS.

d) A single integer value.

e) MM.AttPsPagingProcGb.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM.

4.1.15.2 Successful GSM PS paging procedures

a) This measurement provides the number of successful PS paging procedures initiated at the SGSN over the Gb
   interface. The initial paging procedures as well as the repeated paging procedures are counted.

b) CC.

c) Incremented when an uplink_trigger (any LLC frame) is received by the SGSN from the MS (over the Gb
   interface) as response to a GSM PS paging procedure (TS 23.060 [2]) or during intersystem change UMTS ->
   GSM.

d) A single integer value.

e) MM.SuccPsPagingProcGb.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM.

4.1.15.3 Failed GSM PS paging procedures

a) This measurement provides the number of failed PS paging procedures initiated at the SGSN over the Gb interface, i.e. PS paging procedures that time out. The initial paging procedures as well as the repeated paging procedures are counted.

b) CC.

c) Incremented when a GSM PS paging procedure times out.

d) A single integer value.

e) MM.FailPsPagingProcGb.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM.

4.1.16 UMTS PS paging procedures

The three measurement types defined in clauses 4.1.16.n are subject to the "2 out of 3 approach".

4.1.16.1 Attempted UMTS PS paging procedures

a) This measurement provides the number of attempted PS paging procedures initiated at the SGSN over the Iu interface. The initial paging procedures as well as the repeated paging procedures are counted.

b) CC.

c) Incremented when a UMTS PS paging procedure is started i.e. at the transmission of the first "Paging" message (TS 25.413 [5]) from the SGSN to the MS.

d) A single integer value.

e) MM.AttPsPagingProcIu.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) UMTS.

4.1.16.2 Successful UMTS PS paging procedures

a) This measurement provides the number of successful PS paging procedures initiated at the SGSN over the Iu interface. The initial paging procedures as well as the repeated paging procedures are counted.

b) CC.

c) Incremented when a paging_response is received by the SGSN from the MS (over the Iu interface) as response to a UMTS PS paging procedure (Receipt of "Service Request" message with Service Type = Paging Response from the MS (TS 24.008 [15])) or during intersystem change GSM -> UMTS.

d) A single integer value.

e) MM.SuccPsPagingProcIu.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) UMTS.

4.1.16.3   Failed UMTS PS paging procedures

a) This measurement provides the number of failed PS paging procedures initiated at the SGSN over the Iu interface, i.e. PS paging procedures that time out. The initial paging procedures as well as the repeated paging procedures are counted.

b) CC.

c) Incremented when a UMTS PS paging procedure times out.

d) A single integer value.

e) MM.FailPsPagingProcIu.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) UMTS.

4.1.17   PS paging procedures with unknown access type

4.1.17.1   Attempted PS paging procedures with unknown access type

a) This measurement provides the number of attempted PS paging procedures initiated at the SGSN with access type unknown. In this case the paging will be done both over the Gb and the Iu interface. The initial paging procedures as well as the repeated paging procedures are counted.

b) CC.

c) Incremented when a paging procedure is started for which MM doesn't know the access type i.e. at the transmission of the first BSSGP Paging Request (GSM 08.18 [16]) and/or "Paging" message (TS 25.413 [5]) from the SGSN to the MS.

d) A single integer value.

e) MM.AttPsPagingProcGbIu.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) Combined.

4.1.18   Number of PS paging message sends from 2G-SGSN to the MS

a) This measurement provides the Number of PS paging message sends from 2G-SGSN to the MS.

b) CC.

c) Transmission of "GMM-PAGING.req" (GSM 08.18 [16]) from the SGSN to the MS. Each paging message will be counted separately, addressed to all BSS in this certain RA.

d) A single integer value.

e) MM.NbrPsPagingMesGb.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM.

4.1.19 Number of PS paging message sends from 3G-SGSN to the MS

a) This measurement provides the Number of PS paging message sends from 3G-SGSN to the MS.

b) CC.

c) Transmission of "Paging" message (CN Domain Indicator = PS Domain) from the SGSN to the MS (TS 25.413 [5]). Each paging message will be counted separately, addressed to all RNC in this certain RA.

d) A single integer value.

e) MM.NbrPsPagingMesIu.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) UMTS.

4.1.20 GSM subscribers state

4.1.20.1 Subscribers in STANDBY state

4.1.20.1.1 Number of subscribers in STANDBY state

a) This measurement provides the number of subscribers in STANDBY state.

b) GAUGE.

c) Incremented at transition of a subscriber registered in the SGSN into STANDBY state, decremented at transition of a subscriber registered in the SGSN out from STANDBY state.

d) A single integer value.

e) MM.NbrSubStandby.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM.

4.1.20.1.2 Mean number of subscribers in STANDBY state

a) This measurement provides the mean number of subscribers in STANDBY state.

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of subscribers in STANDBY state and then taking the arithmetic mean.

d) A single integer value.

e) MM.MeanNbrSubStandby.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM.

4.1.20.1.3 Max number of subscribers in STANDBY state

a) This measurement provides the maximum number of subscribers in STANDBY state.

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of subscribers in STANDBY state and then taking the maximum.

d) A single integer value.

e) MM.MaxNbrSubStandby.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM.

4.1.20.2 Subscribers in READY state

4.1.20.2.1 Number of subscribers in READY state

a) This measurement provides the number of subscribers in READY state.

b) GAUGE.

c) Incremented at transition of a subscriber registered in the SGSN into READY state, decremented at transition of a subscriber registered in the SGSN out from READY state.

d) A single integer value.

e) MM.NbrSubReady

f) SgsnFunction.

g) Valid for packet switching.

h) GSM.

4.1.20.2.2 Mean number of subscribers in READY state

a) This measurement provides the mean number of subscribers in READY state.

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of subscribers in READY state and then taking the arithmetic mean.

d) A single integer value.

e) MM.MeanNbrSubReady.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM.

4.1.20.2.3 Max number of subscribers in READY state

a) This measurement provides the maximum number of subscribers in READY state.

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of subscribers in READY state and then taking the maximum.

d) A single integer value.

e) MM.MaxNbrSubReady.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM.

4.1.21 UMTS subscribers state

4.1.21.1 Subscribers in PMM-IDLE state

4.1.21.1.1 Number of subscribers in PMM-IDLE state

a) This measurement provides the number of subscribers in PMM-IDLE state.

b) GAUGE.

c) Incremented at PS Signalling Connection Release (Iu Release), decremented at PS Detach or PS Signalling Connection Establish (Service Request).

d) A single integer value.

e) MM.NbrSubPmmIdle.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.1.21.1.2 Mean number of subscribers in PMM-IDLE state

a) This measurement provides the mean number of subscribers in PMM-IDLE state.

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of subscribers in PMM-IDLE state and then taking the arithmetic mean.

d) A single integer value.

e) MM.MeanNbrSubPmmIdle.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.1.21.1.3 Max number of subscribers in PMM-IDLE state

a) This measurement provides the maximum number of subscribers in PMM-IDLE state.

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of subscribers in PMM-IDLE state and then taking the maximum.

d) A single integer value.

e) MM.MaxNbrSubPmmIdle.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.1.21.2 Subscribers in PMM-CONNECTED state

4.1.21.2.1 Number of subscribers in PMM-CONNECTED state

a) This measurement provides the number of subscribers in PMM-CONNECTED state.

b) GAUGE.

c) Decremented at PS Signalling Connection Release (Iu Release), Detach, PS Attach Reject or RAU Reject, incremented at PS Attach or PS Signalling Connection Establish (Service Request).

d) A single integer value.

e) MM.NbrSubPmmConnected

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.1.21.2.2 Mean number of subscribers in PMM-CONNECTED state

a) This measurement provides the mean number of subscribers in PMM-CONNECTED state.

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of subscribers in PMM-CONNECTED state and then taking the arithmetic mean.

d) A single integer value.

e) MM.MeanNbrSubPmmConnected.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.1.21.2.3 Max number of subscribers in PMM-CONNECTED state

a) This measurement provides the maximum number of subscribers in PMM-CONNECTED state.

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of subscribers in PMM-CONNECTED state and then taking the maximum.

d) A single integer value.

e) MM.MaxNbrSubPmmConnected.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.1.22 Attached subscribers

4.1.22.1 Number of attached subscribers

a) This measurement provides the number of attached subscribers within this SGSN area.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) GAUGE.

c) Incremented when a subscriber enters the GMM_REGISTERED state in the SGSN Location Register, and decremented when a subscriber leaves the GMM_REGISTERED state.

NOTE: The GMM state machine in the SGSN Location Register is described in TS 24.008 [15], clause 4.1.3.3 (Figure 4.1c/3GPP TS 24.008 [15]: GMM main states on the network side).

d) A single integer value per measurement type defined in e).

e) MM.NbrActAttachedSub:

- MM.NbrActAttachedSub   Combined (don't care);

- MM.NbrActAttachedSub.G   GSM;

- MM.NbrActAttachedSub.U   UMTS.

f) SgsnFunction
RoutingArea.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.22.2 Mean number of attached subscribers

a) This measurement provides the mean number of attached subscribers within this SGSN area.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of attached subscribers and then taking the arithmetic mean.

d) A single integer value per measurement type defined in e).

e) MM.MeanNbrAttachedSub:

- MM.MeanNbrAttachedSub   Combined (don't care);

- MM.MeanNbrAttachedSub.G   GSM;

- MM.MeanNbrAttachedSub.U   UMTS.

f) SgsnFunction.
RoutingArea

g) Valid for packet switching.

h) GSM/UMTS.

4.1.22.3 Max number of attached subscribers

i) This measurement provides the maximum number of attached subscribers within this SGSN area.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

j) SI.

k) This measurement is obtained by sampling at a pre-defined interval the number of attached subscribers and then taking the maximum.

l) A single integer value per measurement type defined in e).

m) MM.MaxNbrAttachedSub:

- MM.MaxNbrAttachedSub   Combined (don't care);

- MM.MaxNbrAttachedSub.G   GSM;

- MM.MaxNbrAttachedSub.U   UMTS.

n) SgsnFunction.
   RoutingArea

o) Valid for packet switching.

p) GSM/UMTS.

4.1.23 Home subscribers

4.1.23.1 Number of home subscribers

a) This measurement provides the number of GPRS home subscribers located in the SGSN location register. The GPRS MM state of this subscriber is GMM_REGISTERED or GMM_DEREGISTERED. Only GPRS subscribers that are homed in the same GPRS network are considered.
   The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) GAUGE.

c) Incremented by one when GPRS home subscriber is successfully registered in the SGSN location registered and decremented by one when GPRS home subscriber is successfully deregistered out of the SGSN location register (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.NbrHomeSub:

   - MM.NbrHomeSub   Combined (don't care);

   - MM.NbrHomeSub.G   GSM;

   - MM.NbrHomeSub.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.23.2 Mean number of home subscribers

a) This measurement provides the mean number of GPRS home subscribers located in the SGSN location register.
   The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of GPRS home subscribers located in the SGSN location register and then taking the arithmetic mean.

d) A single integer value per measurement type defined in e).

e) MM.MeanNbrHomeSub:

   - MM.MeanNbrHomeSub   Combined (don't care);

   - MM.MeanNbrHomeSub.G   GSM;

   - MM.MeanNbrHomeSub.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.23.3　　Max number of home subscribers

a) This measurement provides the maximum number of GPRS home subscribers located in the SGSN location register.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of GPRS home subscribers located in the SGSN location register and then taking the maximum.

d) A single integer value per measurement type defined in e).

e) MM.MaxNbrHomeSub:

- MM.MaxNbrHomeSub　　　　　　Combined (don't care);

- MM.MaxNbrHomeSub.G　　　　GSM;

- MM.MaxNbrHomeSub.U　　　　UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.24　Visiting national subscribers

4.1.24.1　　Number of visiting national subscribers

a) This measurement provides the number of visiting national GPRS subscribers located in the SGSN location register. The GPRS MM state of this subscriber is GMM_REGISTERED or GMM_DEREGISTERED. Only GPRS subscribers that are homed in a partner GPRS network of the same country are considered.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) GAUGE.

c) This measurement provides the number of visiting national GPRS subscribers located in the SGSN location register. The GPRS MM state of this subscriber is GMM_REGISTERED or GMM_DEREGISTERED. Only GPRS subscribers that are homed in a partner GPRS network of the same country are considered.

d) A single integer value per measurement type defined in e).

e) MM.NbrVisitingNatSub:

- MM.NbrVisitingNatSub　　　　Combined (don't care);

- MM.NbrVisitingNatSub.G　　　GSM;

- MM.NbrVisitingNatSub.U　　　UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.24.2　　Mean number of visiting national subscribers

a) This measurement provides the mean number of visiting national GPRS subscribers located in the SGSN location register.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of visiting national GPRS subscribers located in the SGSN location register and then taking the arithmetic mean.

d) A single integer value per measurement type defined in e).

e) MM.MeanNbrVisitingNatSub:

- MM.MeanNbrVisitingNatSub   Combined (don't care);

- MM.MeanNbrVisitingNatSub.G   GSM;

- MM.MeanNbrVisitingNatSub.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.24.3 Max number of visiting national subscribers

a) This measurement provides the maximum number of visiting national GPRS subscribers located in the SGSN location register.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of visiting national GPRS subscribers located in the SGSN location register and then taking the maximum.

d) A single integer value per measurement type defined in e).

e) MM.MaxNbrVisitingNatSub:

- MM.MaxNbrVisitingNatSub   Combined (don't care);

- MM.MaxNbrVisitingNatSub.G   GSM;

- MM.MaxNbrVisitingNatSub.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.25 Visiting foreign subscribers

4.1.25.1 Number of visiting foreign subscribers

a) This measurement provides the number of visiting foreign GPRS located in the SGSN location register. The GPRS MM state of this subscriber is GMM_REGISTERED or MM_DEREGISTERED. Only GPRS subscribers that are homed in a GPRS network of a foreign country are considered.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) GAUGE.

c) Incremented by one when GPRS subscriber is successfully registered in the SGSN location registered and decremented by one when GPRS subscriber is successfully deregistered out of the SGSN location register (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.NbrVisitingForeign:

- MM.NbrVisitingForeign   Combined (don't care);

- MM.NbrVisitingForeign.G   GSM;

- MM.NbrVisitingForeign.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.25.2   Mean number of visiting foreign subscribers

a) This measurement provides the mean number of visiting foreign GPRS subscribers located in the SGSN location register.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of visiting foreign GPRS subscribers located in the SGSN location register and then taking the arithmetic mean.

d) A single integer value per measurement type defined in e).

e) MM.MeanNbrVisitingForeign:

- MM.MeanNbrVisitingForeign   Combined (don't care);

- MM.MeanNbrVisitingForeign.G   GSM;

- MM.MeanNbrVisitingForeign.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.25.3   Max number of visiting foreign subscribers

a) This measurement provides the maximum number of visiting foreign GPRS subscribers located in the SGSN location register.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of visiting foreign GPRS subscribers located in the SGSN location register and then taking the maximum.

d) A single integer value per measurement type defined in e).

e) MM.MaxNbrVisitingForeign:

- MM.MaxNbrVisitingForeign   Combined (don't care);

- MM.MaxNbrVisitingForeign.G   GSM;

- MM.MaxNbrVisitingForeign.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.26 Void

4.1.27 Void

4.1.28 Void

4.1.29 Void

4.1.30 CAMEL subscribers

4.1.30.1 Number of CAMEL subscribers

a) This measurement provides the number of attached subscriber within this SGSN area with CAMEL service. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) GAUGE.

c) Incremented when a CAMEL subscriber enters the GMM_REGISTERED state in the SGSN Location Register, and decremented when a subscriber leaves the GMM_REGISTERED state.
Note: the GMM state machine in the SGSN Location Register is described in 3GPP TS 24.008 [15], subclause 4.1.3.3 (Figure 4.1c/3GPP TS 24.008 [15]: GMM main states on the network side).

d) A single integer value per measurement type defined in e).

e) MM.NbrCamelSub:

- MM.NbrCamelSub   Combined (don't care);

- MM.NbrCamelSub.G   GSM;

- MM.NbrCamelSub.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.30.2 Mean Number of CAMEL subscribers

a) This measurement provides the mean number of attached subscribers with CAMEL service. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of attached subscribers with CAMEL service and then taking the arithmetic mean.

d) A single integer value per measurement type defined in e).

e) MM.MeanNbrCamelSub:

- MM.MeanNbrCamelSub   Combined (don't care);

- MM.MeanNbrCamelSub.G   GSM;

- MM.MeanNbrCamelSub.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.30.3 Max number of CAMEL subscribers

a) This measurement provides the maximum number of attached subscribers with CAMEL service.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of attached subscribers with
CAMEL service and then taking the maximum.

d) A single integer value per measurement type defined in e).

e) MM.MaxNbrCamelSub:

- MM.MaxNbrCamelSub   Combined (don't care);

- MM.MaxNbrCamelSub.G   GSM;

- MM.MaxNbrCamelSub.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.31 Void

4.1.32 InsertSubscriberData requests received from a HLR during GPRS Update Location procedure

4.1.32.1 Attempted InsertSubscriberData requests received from a HLR during GPRS Update Location procedure

a) This measurement provides the number of InsertSubscriberData requests received from a HLR during GPRS
Update Location procedure.

b) CC.

c) Receipt of a "MAP-INSERT-SUBSCRIBER-DATA" service request (TS 29.002 [4]) during a GPRS Update
Location procedure.

d) A single integer value.

e) MM.AttInsertSubscrDataHlrUpdLoc.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.1.33 GPRS Update Locations sent to the HLR

4.1.33.1 Attempted GPRS Update Locations sent to the HLR

a) This measurement provides the number of GPRS Update Locations sent to the HLR.

b) CC.

c) Transmission of a 'MAP_UPDATE_LOCATION' service request (TS 29.002 [4]).

d) A single integer value.

e) MM.AttUpdateGprsLocationHlr.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.1.33.2 Successful GPRS Update Locations returned from the HLR

a) This measurement provides the number of successful GPRS Update Locations returned from the HLR.

b) CC.

c) Receipt of a 'MAP_UPDATE_LOCATION ack' service response/confirm indicating a successful GPRS Update location (TS 29.002 [4]).

d) A single integer value.

e) MM.SuccUpdateGprsLocationHlr.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.1.34 CancelLocation requests received from an HLR-operator, in case of a HLR-initiated Detach

4.1.34.1 Attempted CancelLocation requests received from an HLR-operator, in case of a HLR-initiated Detach

a) This measurement provides the number of CancelLocation requests received from an HLR-operator, in case of a HLR-initiated Detach.

b) CC.

c) Receipt of a 'MAP_CANCEL_LOCATION' service request (TS 29.002 [4]).

d) A single integer value.

e) MM.AttCancelLocHlrOp.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.1.35 CancelLocation requests received from a HLR due to a SGSN-change (previous SGSN)

4.1.35.1 Attempted CancelLocation requests received from a HLR due to a SGSN-change (previous SGSN)

a) This measurement provides the number of CancelLocation requests received from a HLR due to a SGSN-change(previous SGSN).

b) CC.

c) Receipt of a 'MAP_CANCEL_LOCATION' service request (TS 29.002 [4]) due to a SGSN-change (previous SGSN).

d) A single integer value.

e) MM.AttCancelLocHlrSgsnChg.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.1.36 Reset requests received from a HLR due to an HLR restart, indicating that a failure occurred

4.1.36.1 Attempted Reset requests received from a HLR due to an HLR restart, indicating that a failure occurred

a) This measurement provides the number of Reset requests received from a HLR due to an HLR restart, indicating that a failure occurred.

b) CC.

c) Receipt of a 'MAP_RESET' service request (TS 29.002 [4]) from a HLR.

d) A single integer value.

e) MM.AttResetHlr.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.1.37 Periodic Routing Area update procedures

4.1.37.1 Attempted periodic Routing Area update procedures

a) This measurement provides the number of periodic Routing Area updates procedures initiated in this SGSN. These are counted as attempts.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of "Routing Area Update REQUEST" message from the MS with the value of the update type IE in the ROUTING AREA UPDATE REQUEST message indicating "periodic updating" (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.AttPeriodRaUpdate:

- MM.AttPeriodRaUpdate   Combined (don't care);

- MM.AttPeriodRaUpdate.G   GSM;

- MM.AttPeriodRaUpdate.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.37.2 Successful periodic Routing Area update procedures

a) This measurement provides the number of successfully performed Routing Area periodic updates procedures initiated in this SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of "Routing Area Update ACCEPT" message to the MS in response to a Routing Area Update REQUEST message with the value of the update type IE in the ROUTING AREA UPDATE REQUEST message indicating "periodic updating" (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) MM.SuccPeriodRaUpdate:

   - MM.SuccPeriodRaUpdate   Combined (don't care);

   - MM.SuccPeriodRaUpdate.G   GSM;

   - MM.SuccPeriodRaUpdate.U   UMTS.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching.

h) GSM/UMTS.

4.1.37.3   Failed Periodic Routing Area update procedures

a) This measurement provides the number of failed GPRS Periodic Routing Area Update procedures initiated in this SGSN. The measurement is split into subcounters per the reject cause. The three measurements defined in e) are subject to the "2 out of 3 approach".

b) CC

c) Transmission by the SGSN of the ROUTING AREA UPDATE REJECT message to the MS, in response to a " ROUTING AREA UPDATE REQUEST" (Periodic) message, the relevant measurement is incremented according to the reject cause. Possible reject causes are defined within TS 24.008 [15].
The sum of all supported per cause measurements shall be equal to the total number of failed GPRS routing area update procedures. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

d) Each measurement (as defined in e) is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the *.sum* suffix.

e) MM. FailPeriodRaUpdate.*Cause*:

   - MM.FailPeriodRaUpdate.*Cause*   Combined (don't care);

   - MM.FailPeriodRaUpdate.*Cause*.G   GSM;

   - MM.FailPeriodRaUpdate.*Cause*.U   UMTS;

      where *Cause* identifies the reject cause.

f) RA, specified by a concatenation of the MCC, MNC, LAC and the RAC.

g) Valid for packet switching

h) GSM/UMTS

4.1.38   Number of implicit detach procedure

a) This measurement provides the number of implicit detach procedures initiated by SGSN. The measurement defined in e) is subject to 2 out of 3 approaches.

b) CC.

c) SGSN initiates "Implicit detach" in order to return the MM context to IDLE state. (TS 23.060).

d) A single integer value per measurement type defined in e).

e) MM.ImplicitDetach:

- MM. ImplicitDetachSgsn   Combined (don't care);

- MM. ImplicitDetachSgsn.U   UMTS;

- MM.ImplicitDetachSgsn.G   GSM.

f)   SgsnFunction.

g)   Valid for packet switching.

h)   GSM/UMTS

4.2 Subscriber Management

4.2.1 Insert Subscriber Data requests received from a HLR due to an HLR-operator intervention

4.2.1.1 Attempted Insert Subscriber Data requests received from a HLR due to an HLR-operator intervention

a)   This measurement provides the number of Insert Subscriber Data requests received from a HLR due to an HLR-operator intervention.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b)   CC.

c)   Receipt of a "MAP-INSERT-SUBSCRIBER-DATA" service request (TS 29.002 [4]).

d)   A single integer value per measurement type defined in e).

e)   SUB.AttInsertSubscrDataHlrOp:

- SUB.AttInsertSubscrDataHlrOp   Combined (don't care);

- SUB.AttInsertSubscrDataHlrOp.G   GSM;

- SUB.AttInsertSubscrDataHlrOp.U   UMTS.

f)   SgsnFunction.

g)   Valid for packet switching.

h)   GSM/UMTS.

4.2.2 Delete Subscriber Data requests received from a HLR due to an HLR-operator intervention

4.2.2.1 Attempted Delete Subscriber Data requests received from a HLR due to an HLR-operator intervention

a)   This measurement provides the number of Delete Subscriber Data requests received from a HLR due to an HLR-operator intervention.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b)   CC.

c)   Receipt of a "MAP_DELETE_SUBSCRIBER_DATA" service request (TS 29.002 [4]).

d)   A single integer value per measurement type defined in e).

e)   SUB.AttDeleteSubscrDataHlrOp:

- SUB.AttDeleteSubscrDataHlrOp   Combined (don't care);

- SUB.AttDeleteSubscrDataHlrOp.G   GSM;

- SUB.AttDeleteSubscrDataHlrOp.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.3   SRNS Relocation

4.3.1   Intra 3G-SGSN SRNS Relocations

The four measurements defined in the clause 4.3.1 are subject to the "3 out of 4 approach".

NOTE: Number of Attempted intra 3G-SGSN SRNS Relocations = Number of Successful intra 3G-SGSN SRNS Relocations + Number of Failed intra 3G-SGSN SRNS Relocations, due to internal reasons + Number of Failed intra 3G-SGSN SRNS Relocations, due to external reasons.

4.3.1.1   Attempted intra 3G-SGSN SRNS Relocations

a) This measurement provides the number of attempts intra 3G-SGSN SRNS Relocations.

b) CC.

c) Receipt of "Relocation Required" message (TS 25.413 [5]) from SRNC, where the Target ID indicates Intra SGSN SRNS Relocation.

d) A single integer value.

e) RELOC.AttIntraSGSN.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.3.1.2   Successful intra 3G-SGSN SRNS Relocations

a) This measurement provides the number of successful intra 3G-SGSN SRNS Relocations.

b) CC.

c) Receipt of "Relocation Complete" message for intra 3G-SGSN SRNS Relocation (TS 25.413 [5]) from TRNC.

d) A single integer value.

e) RELOC.SuccIntraSGSN.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.3.1.3   Failed intra 3G-SGSN SRNS Relocations, due to internal reasons

a) This measurement provides the number of failed intra 3G-SGSN SRNS Relocations, due to internal reasons.

b) CC.

c) Intra 3G-SGSN SRNS Relocation fails due to reasons located inside this SGSN:- internal resource problem- recovery- ...

d) A single integer value.

e) RELOC.FailIntraSGSNInt.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.3.1.4 Failed intra 3G-SGSN SRNS Relocations, due to external reasons

a) This measurement provides the number of failed intra 3G-SGSN SRNS Relocations, due to external reasons.

b) CC.

c) Intra 3G-SGSN SRNS Relocation fails due to reasons located in NE outside this SGSN: - "Relocation Preparation Failure" (TS 25.413 [5]) is sent to the SRNC- "Relocation Failure" (TS 25.413 [5]) is received from the TRNC- "Relocation Cancel" (TS 25.413 [5]) is received from the SRNC- missing expected message from RNC (timer expiry)- ...

d) A single integer value.

e) RELOC.FailIntraSGSNExt.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.3.2 Inter 3G-SGSN SRNS Relocations

The four measurements defined in the clause 4.3.2 are subject to the "3 out of 4 approach".

NOTE: Number Attempted inter 3G-SGSN SRNS Relocations, counted in the old 3G-SGSN = Number of Successful inter 3G-SGSN SRNS Relocations, counted in the old 3G-SGSN + Number of Failed inter 3G-SGSN SRNS Relocations, due to external reasons, counted in the old 3G-SGSN + Number of Failed inter 3G-SGSN SRNS Relocations, due to external reasons, counted in the old 3G-SGSN.

4.3.2.1 Attempted inter 3G-SGSN SRNS Relocations, counted in the old 3G-SGSN

a) This measurement provides the number of attempted inter 3G-SGSN SRNS Relocations.

b) CC.

c) Receipt of "Relocation Required" message (TS 25.413 [5]) from SRNC, where the Target ID indicates Inter SGSN SRNS Relocation.

d) A single integer value.

e) RELOC.AttInterSGSN.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.3.2.2 Successful inter 3G-SGSN SRNS Relocations, counted in the old 3G-SGSN

a) This measurement provides the number of successful Inter 3G-SGSN SRNS Relocations, counted in the old 3G-SGSN.

b) CC.

c) Receipt of "Forward Relocation Complete" message (TS 29.060 [6]) from the new SGSN.

d) A single integer value.

e) RELOC.SuccInterSGSN.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.3.2.3 Failed inter 3G-SGSN SRNS Relocations, due to internal reasons, counted in the old 3G-SGSN

a) This measurement provides the number of failed Inter 3G-SGSN SRNS Relocations, due to internal reasons.

b) CC.

c) Inter 3G-SGSN SRNS Relocation fails due to reasons located inside this SGSN:- internal resource problem- recovery- ...

d) A single integer value.

e) RELOC.FailInterSGSNInt.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.3.2.4 Failed inter 3G-SGSN SRNS Relocations, due to external reasons, counted in the old 3G-SGSN

a) This measurement provides the number of failed Inter 3G-SGSN SRNS Relocations, due to external reasons.

b) CC.

c) Inter 3G-SGSN SRNS Relocation fails due to reasons located in NE outside this SGSN:- the Cause in "Forward Relocation Response" (TS 29.060 [6]) from the new 3G-SGSN is not "Request Accepted"- "Relocation Preparation Failure" (TS 25.413 [5]) is sent to the SRNC- "Relocation Failure" (TS 25.413 [5]) is received from the TRNC- "Relocation Cancel" (TS 25.413 [5]) is received from the SRNC- missing expected message from RNC or new 3G-SGSN (timer expiry)- ...

d) A single integer value.

e) RELOC.FailInterSGSNExt.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.3.3 Inter 3G-SGSN SRNS Relocations, counted in the new 3G-SGSN

4.3.3.1 Attempted inter 3G-SGSN SRNS Relocations, counted in the new 3G-SGSN

a) This measurement provides the number of attempted inter 3G-SGSN SRNS Relocations, counted in the new 3G-SGSN.

b) CC.

c) Receipt of "Forward Relocation Request" message (TS 29.060 [6]) from the old SGSN.

d) A single integer value.

e) RELOC.AttInterSGSNNew.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.3.3.2 Successful Inter 3G-SGSN SRNS Relocations, counted in the new 3G-SGSN

a) This measurement provides the number of successful Inter 3G-SGSN SRNS Relocations, counted in the new 3G-SGSN.

b) CC.

c) Transmission of "Forward Relocation Complete" message (TS 29.060 [6]) to the old SGSN.

d) A single integer value.

e) RELOC.SuccInterSGSNNew.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.4 Security

4.4.1 P-TMSI reallocation procedures

4.4.1.1 Attempted P-TMSI reallocation procedures

a) This measurement provides the number of attempted P-TMSI reallocation, or implicitly as part of the Location Updating, procedures in this SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of "P-TMSI REALLOCATION COMMAND" message by the SGSN (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) SEC.AttPTMSIRealloc:

   - SEC.AttPTMSIRealloc   Combined (don't care);

   - SEC.AttPTMSIRealloc.G   GSM;

   - SEC.AttPTMSIRealloc.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.4.1.2 Successful P-TMSI reallocation procedures

a) This measurement provides the number of successfully performed P-TMSI reallocation procedures in this SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of "P-TMSI REALLOCATION COMPLETE" message by the SGSN (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) SEC.SuccPTMSIRealloc:

- SEC.SuccPTMSIRealloc   Combined (don't care);

- SEC.SuccPTMSIRealloc.G   GSM;

- SEC.SuccPTMSIRealloc.U   UMTS.

f)   SgsnFunction.

g)   Valid for packet switching.

h)   GSM/UMTS.

4.4.2 Identity Request procedures initiated by this SGSN

4.4.2.1 Attempted Identity Request procedures initiated by this SGSN

a) This measurement provides the number of attempted Identity Request procedures initiated by this SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of an "IDENTITY REQUEST" (with Identity Type = IMSI) message to the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) SEC.AttIdentityReqImsi:

- SEC.AttIdentityReqImsi   Combined (don't care);

- SEC.AttIdentityReqImsi.G   GSM;

- SEC.AttIdentityReqImsi.U   UMTS.

f)   SgsnFunction.

g)   Valid for packet switching.

h)   GSM/UMTS.

4.4.2.2 Successful completed Identity Request procedures initiated by this SGSN

a) This measurement provides the number of successfully completed Identity Request procedures initiated by this SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of an "IDENTITY RESPONSE" message with IMSI by the SGSN from the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) SEC.SuccIdentityReqImsi:

- SEC.SuccIdentityReqImsi   Combined (don't care);

- SEC.SuccIdentityReqImsi.G   GSM;

- SEC.SuccIdentityReqImsi.U   UMTS.

f)   SgsnFunction.

g)   Valid for packet switching.

h)   GSM/UMTS.

4.4.3 Identification information requests sent to a partner (previous) SGSN for subscribers registering afresh in this SGSN

4.4.3.1 Attempted identification information requests sent to a partner (previous) SGSN for subscribers registering afresh in this SGSN

a) This measurement provides the number of identification information requests sent to a partner (previous) SGSN for subscribers registering afresh in this SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of the "Identification Request" message to the old SGSN (TS 29.060 [6]).

d) A single integer value per measurement type defined in e).

e) SEC.AttIdentityReqToPsgsn:

- SEC.AttIdentityReqToPsgsn   Combined (don't care);

- SEC.AttIdentityReqToPsgsn.G   GSM;

- SEC.AttIdentityReqToPsgsn.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.4.3.2 Successful replied identification information requests that were sent to a partner (previous) SGSN

a) This measurement provides the number of successfully replied identification information requests that were sent to a partner (previous) SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of the "Identification Response" message from the old SGSN (TS 29.060 [6]).

d) A single integer value per measurement type defined in e).

e) SEC.SuccIdentityReqToPsgsn:

- SEC.SuccIdentityReqToPsgsn   Combined (don't care);

- SEC.SuccIdentityReqToPsgsn.G   GSM;

- SEC.SuccIdentityReqToPsgsn.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.4.4 Attempted Identity Requests sent to the MS

4.4.4.1 Attempted Identity Requests sent to the MS

a) This measurement provides the number of Identity Requests sent to the MS.
   The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of an "IDENTITY REQUEST" message (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) SEC.AttIdentityRequest:

   - SEC.AttIdentityRequest   Combined (don't care);

   - SEC.AttIdentityRequest.G   GSM;

   - SEC.AttIdentityRequest.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.4.4.2 Successful replied Identity Requests from the MS

a) This measurement provides the number of successfully replied Identity Requests from the MS.
   The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of an "IDENTITY RESPONSE" message (TS 24.008 [15]) from the MS.

d) A single integer value per measurement type defined in e).

e) SEC.SuccIdentityRequest:

   - SEC.SuccIdentityRequest   Combined (don't care);

   - SEC.SuccIdentityRequest.G   GSM;

   - SEC.SuccIdentityRequest.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.4.5 Authentication procedures that are started within this SGSN area for a subscriber using a SIM

4.4.5.1 Attempted authentication procedures that are started within this SGSN area for a subscriber using a SIM

a) This measurement provides the number of authentication procedures that are started within this SGSN area for a subscriber using a SIM.
   The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of an "AUTHENTICATION AND CIPHERING REQUEST" message to a MS using a SIM (TS 24.008 [15]).

    d) A single integer value per measurement type defined in e).

    e) SEC.AttAuthProcsSgsnSim:

-     SEC.AttAuthProcsSgsnSim   Combined (don't care);

-     SEC.AttAuthProcsSgsnSim.G   GSM;

-     SEC.AttAuthProcsSgsnSim.U   UMTS.

    f) SgsnFunction.

    g) Valid for packet switching.

    h) GSM/UMTS.

4.4.5.2 Successful authentication procedures within this SGSN area, for a subscriber using a SIM

    a) This measurement provides the number of successful authentication procedures within this SGSN area, for a subscriber using a SIM.
       The three measurement types defined in e) are subject to the "2 out of 3 approach".

    b) CC.

    c) Receipt of an "AUTHENTICATION AND CIPHERING RESPONSE" message from the MS, using a SIM, where the receipt SRES parameter value matches the value stored in the SGSN (TS 24.008 [15]).

    d) A single integer value per measurement type defined in e).

    e) SEC.SuccAuthProcsSgsnSim:

-     SEC.SuccAuthProcsSgsnSim   Combined (don't care);

-     SEC.SuccAuthProcsSgsnSim.G   GSM;

-     SEC.SuccAuthProcsSgsnSim.U   UMTS.

    f) SgsnFunction.

    g) Valid for packet switching.

    h) GSM/UMTS.

4.4.6 Authentication procedures that are started within this SGSN area for a subscriber using a USIM

4.4.6.1 Attempted authentication procedures that are started within this SGSN area for a subscriber using a USIM

    a) This measurement provides the number of authentication procedures that are started within this SGSN area for a subscriber using a USIM.
       The three measurement types defined in e) are subject to the "2 out of 3 approach".

    b) CC.

    c) Transmission of an "AUTHENTICATION AND CIPHERING REQUEST" message to a MS using a USIM (TS 24.008 [15]).

    d) A single integer value per measurement type defined in e).

    e) SEC.AttAuthProcsSgsnUsim:

-     SEC.AttAuthProcsSgsnUsim   Combined (don't care);

-     SEC.AttAuthProcsSgsnUsim.G   GSM;

- SEC.AttAuthProcsSgsnUsim.U UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.4.6.2 Successful authentication procedures within this SGSN area, for a subscriber using a USIM

a) This measurement provides the number of successful authentication procedures within this SGSN area, for a subscriber using a USIM.
   The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of an "AUTHENTICATION AND CIPHERING RESPONSE" message from the MS , using a USIM, where the receipt RES parameter value matches the value stored in the SGSN (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) SEC.SuccAuthProcsSgsnUsim:

   - SEC.SuccAuthProcsSgsnUsim Combined (don't care);

   - SEC.SuccAuthProcsSgsnUsim.G GSM;

   - SEC.SuccAuthProcsSgsnUsim.U UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.4.6.3 Received ciphering and Authentication failures within this SGSN area

a) This measurement provides the number of ciphering and Authentication failures within this SGSN area.
   The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of an "AUTHENTICATION AND CIPHERING FAILURE" message from the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) SEC.RecPOAuthFailSgsn:

   - SEC.RecPOAuthFailSgsn Combined (don't care);

   - SEC.RecPOAuthFailSgsn.G GSM;

   - SEC.RecPOAuthFailSgsn.U UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.4.7 Identification information requests that were received from a partner (new) SGSN for subscribers de-registering from this SGSN

4.4.7.1 Attempted identification information requests that were received from a partner (new) SGSN for subscribers de-registering from this SGSN

a) This measurement provides the number of identification information requests that were received from a partner (new) SGSN for subscribers de-registering from this SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of the "Identification Request" message from a partner (new) SGSN (TS 29.060 [6]).

d) A single integer value per measurement type defined in e).

e) SEC.AttIdentityReqFromPsgsn:

  - SEC.AttIdentityReqFromPsgsn   Combined (don't care);

  - SEC.AttIdentityReqFromPsgsn.G   GSM;

  - SEC.AttIdentityReqFromPsgsn.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.4.7.2 Successfully replied identification information requests that were received from a partner (new) SGSN

a) This measurement provides the number of successfully replied identification information requests that were received from a partner (new) SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of the "Identification Response" message to the new SGSN (TS 29.060 [6]).

d) A single integer value per measurement type defined in e).

e) SEC.SuccIdentityReqFromPsgsn:

  - SEC.SuccIdentityReqFromPsgsn   Combined (don't care);

  - SEC.SuccIdentityReqFromPsgsn.G   GSM;

  - SEC.SuccIdentityReqFromPsgsn.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.4.8 SGSN context requests sent to a partner (previous) SGSN for subscribers registering afresh in this SGSN

4.4.8.1 Attempted SGSN context requests sent to a partner (previous) SGSN for subscribers registering afresh in this SGSN

a) This measurement provides the number of SGSN context requests sent to a partner (previous) SGSN for subscribers registering afresh in this SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of the "Context Request" message to the previous SGSN (TS 29.060 [6]).

d) A single integer value per measurement type defined in e).

e) SEC.AttContextRequestToPsgsn:

  - SEC.AttContextRequestToPsgsn   Combined (don't care);

  - SEC.AttContextRequestToPsgsn.G   GSM;

  - SEC.AttContextRequestToPsgsn.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.4.8.2 Successfully replied SGSN context requests that were sent to a partner (previous) SGSN

a) This measurement provides the number of successfully replied SGSN context requests that were sent to a partner (previous) SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of the "Context Response" message from the previous SGSN (TS 29.060 [6]).

d) A single integer value per measurement type defined in e).

e) SEC.SuccContextRequestToPsgsn:

  - SEC.SuccContextRequestToPsgsn   Combined (don't care);

  - SEC.SuccContextRequestToPsgsn.G   GSM;

  - SEC.SuccContextRequestToPsgsn.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.4.9 SGSN context requests received from a partner (new) SGSN for a subscriber de-registering from this SGSN

4.4.9.1 Attempted SGSN context requests received from a partner (new) SGSN for a subscriber de-registering from this SGSN

a) This measurement provides the number of SGSN context requests received from a partner (new) SGSN for a subscriber de-registering from this SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of the "Context Request" message from the new SGSN (TS 29.060 [6]).

d) A single integer value per measurement type defined in e).

e) SEC.AttContextRequestFromPsgsn:

- SEC.AttContextRequestFromPsgsn   Combined (don't care);

- SEC.AttContextRequestFromPsgsn.G   GSM;

- SEC.AttContextRequestFromPsgsn.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.4.9.2 Successfully replied SGSN context requests received from a partner (new) SGSN

a) This measurement provides the number of successfully replied SGSN context requests received from a partner (new) SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of the "Context Response" message to the new SGSN (TS 29.060 [6]).

d) A single integer value per measurement type defined in e).

e) SEC.SuccContextRequestFromPsgsn:

- SEC.SuccContextRequestFromPsgsn   Combined (don't care);

- SEC.SuccContextRequestFromPsgsn.G   GSM;

- SEC.SuccContextRequestFromPsgsn.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.4.10 Number of P-TMSI - IMSI correlation failures (User Identity Confidentiality (TS 23.060 [2]))

a) This measurement provides the number of P-TMSI - IMSI correlation failures (User Identity Confidentiality (TS 23.060 [2])).

b) CC.

c) This counter is triggered before the handling of the "Security Functions" (TS 23.060 [2]), in case of "Attach Request", "Routing Area Update Request", or "Service Request": if the correlation between the received P-TMSI and the stored IMSI is not valid then this counter is incremented.

d) A single integer value.

e) SEC.NbrPTMSICorrFailRnc.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.4.11 Security mode control procedures started by the SGSN

4.4.11.1 Attempted security mode control procedures started by the SGSN

a) This measurement provides the number of security mode control procedures started by the SGSN.

b) CC.

c) Transmission of a "SECURITY MODE COMMAND" message to the MS (TS 25.413 [5]).

d) A single integer value.

e) SEC.AttSecMode.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.4.11.2 Successful security mode procedures

a) This measurement provides the number of successful security mode procedures. The Security mode command response from MS starts the uplink integrity protection (and possible ciphering), i.e. also all following messages sent from the MS are integrity protected (and possibly ciphered).

b) CC.

c) Receipt of a "SECURITY MODE COMPLETE" message from the MS (TS 25.413 [5]).

d) A single integer value.

e) SEC.SuccSecMode.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.4.12 Ciphering procedures started by the SGSN

4.4.12.1 Attempted GSM ciphering procedures started by the SGSN

a) This measurement provides the number of GSM ciphering procedures started by the SGSN.

b) CC.

c) Transmission of an "AUTHENTICATION AND CIPHERING REQUEST" message with ciphering activated ("Ciphering algorithm" is not "ciphering not used (0)") to the MS (TS 24.008 [15]).

d) A single integer value.

e) SEC.AttGsmCiphering.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM.

4.4.12.2 Successful GSM ciphering procedures started by the SGSN

a) This measurement provides the number of successful GSM ciphering procedures started by the SGSN.

b) CC.

c) Receipt of an "AUTHENTICATION AND CIPHERING RESPONSE" message with ciphering activated from the MS (TS 24.008 [15]).

d) A single integer value.

e) SEC.SuccGsmCiphering.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM.

4.4.12.3 Attempted UMTS ciphering procedures started by the SGSN

a) This measurement provides the number of UMTS ciphering procedures started by the SGSN.

b) CC.

c) Transmission of a "SECURITY MODE COMMAND" message with ciphering activated ("Encryption Algorithm" is not "no encryption (0)") to the MS (TS 25.413 [5]).

d) A single integer value.

e) SEC.AttUmtsCiphering.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.4.12.4 Successful UMTS ciphering procedures started by the SGSN

a) This measurement provides the number of successful UMTS ciphering procedures started by the SGSN.

b) CC.

c) Receipt of a "SECURITY MODE COMPLETE" message with ciphering activated from the MS (TS 25.413 [5]).

d) A single integer value.

e) SEC.SuccUmtsCiphering.

f) SgsnFunction.

g) Valid for packet switching.

h) UMTS.

4.4.13 MAP V1 requests for authentication sets

4.4.13.1 Attempted MAP V1 requests for authentication sets, sent to the HLR by SGSN

a) This measurement provides the number of attempted MAP V1 requests for authentication sets, sent to the HLR by SGSN.

b) CC.

c) Transmission of a "MAP V1 SEND_AUTHENTICATION_INFO" service request, requesting authentication sets present (TS 29.002 [4]).

d) A single integer value.

e) SEC.AttReqAuthSetsHlrV1.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.4.13.2 Successful MAP V1 requests for authentication sets that were sent to the HLR

a) This measurement provides the number of successful MAP V1 requests for authentication sets that were sent to the HLR.

b) CC.

c) Receipt of a "MAP V1 SEND_AUTHENTICATION_INFO" service confirmation, containing requested authentication sets (parameter "AuthenticationSetList" present TS 29.002 [4]).

d) A single integer value.

e) SEC.SuccReqAuthSetsHlrV1.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.4.13.3 Number of empty responses to the MAP V1 request for authentication sets that were sent to the HLR

a) This measurement provides the number of empty responses to the MAP V1 request for authentication sets that were sent to the HLR.

b) CC.

c) Receipt of a MAP V1 "SEND_AUTHENTICATION_INFO_ACK" service confirmation, no Authentication sets present (TS 29.002 [4]).

d) A single integer value.

e) SEC.NbrEmptyRespAuthSetsHlrV1.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.4.14 MAP V3 requests for Authentication sets

4.4.14.1 Attempted MAP V3 requests for Authentication sets sent to the HLR by SGSN

a) This measurement provides the number of attempted MAP V3 requests for Authentication sets sent to the HLR by SGSN.

b) CC.

c) Transmission of a MAP V3 "SEND_AUTHENTICATION_INFO" service request, requesting authentication sets present (TS 29.002 [4]).

d) A single integer value.

e) SEC.AttReqAuthSetsHlrV3.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.4.14.2 Successful MAP V3 requests for authentication sets that were sent to the HLR

a) This measurement provides the number of successful MAP V3 requests for authentication sets that were sent to the HLR.

b) CC.

c) Receipt of a MAP V3 "SEND_AUTHENTICATION_INFO" service confirmation, containing requested authentication sets (parameter "AuthenticationSetList" present TS 29.002 [4]).

d) A single integer value.

e) SEC.SuccReqAuthSetsHlrV3.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.4.14.3 Number of empty responses to the MAP V3 request for authentication sets that were sent to the HLR

a) This measurement provides the number of empty responses to the MAP V3 request for authentication sets that were sent to the HLR.

b) CC.

c) Receipt of a MAP V3 "SEND_AUTHENTICATION_INFO_ACK" service confirmation, no Authentication sets present (TS 29.002 [4]).

d) A single integer value.

e) SEC.NbrEmptyRespAuthSetsHlrV3.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.5 Void

4.6 Session Management

4.6.1 PDP context activation procedures initiated by MS

4.6.1.1 Attempted PDP context activation procedures initiated by MS

a) This measurement provides the number of attempted PDP context activation procedures. These include the static as well as the dynamic PDP addresses.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "Activate PDP Context Request" message from the MS (TS 24.008 [15]).

d) A single integer value.

e) SM.AttActPdpContext:

- SM.AttActPdpContext   Combined (don't care);

- SM.AttActPdpContext.G   GSM;

- SM.AttActPdpContext.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.1.2 Successful PDP context activation procedures initiated by MS

a) This measurement provides the number of successfully completed PDP context activations. For these context activations, the GGSN is updated successfully.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of a "Activate PDP Context Accept" message to the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) SM.SuccActPdpContext:

- SM.SuccActPdpContext   Combined (don't care);

- SM.SuccActPdpContext.G   GSM;

- SM.SuccActPdpContext.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.1.3 Failed PDP context activation procedures initiated by MS

a) This measurement provides the number of Failed PDP context activation procedures. These include the static as well as the dynamic PDP addresses. This measurement is split into subcounters per failure cause. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission by the SGSN of an ACTIVATE PDP CONTEXT REJECT message indicating a PDP context activation failure, the relevant measurement is incremented according to the failure cause. Possible causes are included in TS 24.008 [15] Annex I. The sum of all supported per cause measurements should equal the total number of PDP context activation failures. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

d) A single integer value per measurement type as defined in e). The number of measurements is equal to the number of implemented per cause measurements plus a possible sum value identified by the *.sum* suffix.

e) The measurement name has the form SM.FailActPdpCtxtMs.Cause where Cause identifies the failure cause.

- SM.FailActPdpCtxtMs.*Cause*   Combined (don't care);

- SM.FailActPdpCtxtMs.*Cause*.G   GSM;

- SM.FailActPdpCtxtMs.*Cause*.U   UMTS;

where *Cause* identifies the failure cause.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.2 dynamic PDP context activation procedures initiated by MS

4.6.2.1 Attempted dynamic PDP context activation procedures initiated by MS

a) This measurement provides the number of attempted PDP context activation requests where a dynamic PDP address is required to be used.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "Activate PDP Context Request" message from the MS with an empty PDP address (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) SM.AttActPdpContextDyn:

- SM.AttActPdpContextDyn   Combined (don't care);

- SM.AttActPdpContextDyn.G   GSM;

- SM.AttActPdpContextDyn.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.2.2 Successful dynamic PDP context activation procedures initiated by MS

a) This measurement provides the number of successfully completed PDP context activations where a dynamic PDP address is used.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of a "Activate PDP Context Accept" message to the MS (TS 24.008 [15]), the PDP address has been dynamically assigned.

d) A single integer value per measurement type defined in e).

e) SM.SuccActPdpContextDyn:

- SM.SuccActPdpContextDyn   Combined (don't care);

- SM.SuccActPdpContextDyn.G   GSM;

- SM.SuccActPdpContextDyn.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.3 Mean number of activated PDP contexts

a) Mean number of activated PDP contexts.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval, the number activated PDP contexts, and then taking the arithmetic mean.

d) A single integer value per measurement type defined in e).

e) SM.MeanActPDPContext:

- SM.MeanActPDPContext   Combined (don't care);

- SM.MeanActPDPContext.G   GSM;

- SM.MeanActPDPContext.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.4 PDP context deactivation procedures initiated by the MS

4.6.4.1 Attempted PDP context deactivation procedures initiated by the MS

a) This measurement provides the number of PDP context deactivation procedures initiated by the MS.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "Deactivate PDP Context Request" message from the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) SM.AttDeactPdpContextMs:

- SM.AttDeactPdpContextMs   Combined (don't care);

- SM.AttDeactPdpContextMs.G   GSM;

- SM.AttDeactPdpContextMs.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.4.2 Successful PDP context deactivation procedures initiated by the MS

a) This measurement provides the number of successfully completed PDP context deactivations. For these context deactivations, the GGSN is updated successfully (i.e. deletion of the PDP context).
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of a "Deactivate PDP Context Accept" message to the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) SM.SuccDeactPdpContextMs:

   - SM.SuccDeactPdpContextMs   Combined (don't care);

   - SM.SuccDeactPdpContextMs.G   GSM;

   - SM.SuccDeactPdpContextMs.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.5 Number of active PDP context

a) This measurement provides the number of active PDP context.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) GAUGE.

c) The gauge will be incremented when a PDP context is created and will be decremented when a PDP context is deleted.

d) A single integer value per measurement type defined in e).

e) SM.NbrActPdpContext:

   - SM.NbrActPdpContext   Combined (don't care);

   - SM.NbrActPdpContext.G   GSM;

   - SM.NbrActPdpContext.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.6 Subscribers with activated PDP context

4.6.6.1 Number of subscribers with activated PDP context

a) This measurement provides the number of subscribers having an activated PDP context (i.e. subscribers that can send/receive GPRS packet data).
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) GAUGE.

c) Addition of first PDP context or removal of last PDP context in SGSN location register for a particular subscriber.

d) A single integer value per measurement type defined in e).

e) SM.NbrActivePdpPerSgsn:

    - SM.NbrActivePdpPerSgsn   Combined (don't care);

    - SM.NbrActivePdpPerSgsn.G   GSM;

    - SM.NbrActivePdpPerSgsn.U   UMTS.

f)   SgsnFunction.

g)   Valid for packet switching.

h)   GSM/UMTS.

4.6.6.2 Mean number of subscribers with activated PDP context

a) This measurement provides the mean number of subscribers having an activated PDP conte xt (i.e. subscribers that can send/receive GPRS packet data).
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) SI.

c) This measurement is obtained by sampling at a pre -defined interval the number of subscribers having an activated PDP context in SGSN and then taking the arithmetic mean.

d) A single integer value per measurement type defined in e).

e) SM.MeanActivePdpPerSgsn:

    - SM.MeanActivePdpPerSgsn   Combined (don't care);

    - SM.MeanActivePdpPerSgsn.G   GSM;

    - SM.MeanActivePdpPerSgsn.U   UMTS.

f)   SgsnFunction.

g)   Valid for packet switching.

h)   GSM/UMTS.

4.6.6.3 Max number of subscribers with activated PDP context

a) This measurement provides the maximum number of subscribers having an activated PDP context (i.e. subscribers that can send/receive GPRS packet data).
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) SI.

c) This measurement is obtained by sampling at a pre -defined interval the number of subscribers having an activated PDP context in SGSN and then taking the maximum.

d) A single integer value per measurement type defined in e).

e) SM.MaxActivePdpPerSgsn:

    - SM.MaxActivePdpPerSgsn   Combined (don't care);

    - SM.MaxActivePdpPerSgsn.G   GSM;

    - SM.MaxActivePdpPerSgsn.U   UMTS.

f)   SgsnFunction.

g)   Valid for packet switching.

h)   GSM/UMTS.

4.6.6.4 Mean number of subscribers with activated PDP context and direct tunnel

a) This measurement provides the mean number of subscribers having an activated PDP context with direct tunnel. The three measurement types defined in e) are subject to the "2 out of 3 approach"

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of subscribers having an activated PDP context in SGSN which has established direct tunnel between RAN and GGSN, and then taking the arithmetic mean.

d) A single integer value per measurement type defined in e).

e) SUB.MeanActivePdpDt   Combined;
   SUB.MeanActivePdpDt.G   GSM;
   SUB.MeanActivePdpDt.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.6.5 Max number of subscribers with activated PDP context and direct tunnel

a) This measurement provides the maximum number of subscribers having an activated PDP context with direct tunnel.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of subscribers having an activated PDP context in SGSN which has established direct tunnel between RAN and GGSN, and then taking the maximum.

d) A single integer value per measurement type defined in e).

e) SUB.MaxActivePdpDt   Combined;
   SUB.MaxActivePdpDt.G   GSM;
   SUB.MaxActivePdpDt.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.7 Void

4.6.8 PDP context deactivation procedures initiated by the GGSN

4.6.8.1 Attempted PDP context deactivation procedures initiated by the GGSN

a) This measurement provides the number of PDP context deactivation procedures initiated by the GGSN. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "Delete PDP Context Request" message from the GGSN (TS 29.060 [6]).

d) A single integer value per measurement type defined in e).

e) SM.AttDeactPdpContextGgsn:

   - SM.AttDeactPdpContextGgsn   Combined (don't care);

   - SM.AttDeactPdpContextGgsn.G   GSM;

- SM.AttDeactPdpContextGgsn.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.8.2   Successful PDP context deactivation procedures initiated by the GGSN

a) This measurement provides the number of successfully handled PDP context deactivations initiated by the GGSN. For these context deactivations, the MS has accepted the PDP context deactivation.
    The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of a "Delete PDP Context Response" message to the GGSN (TS 29.060 [6]).

d) A single integer value per measurement type defined in e).

e) SM.SuccDeactPdpContextGgsn:

- SM.SsuccDeactPdpContextGgsn   Combined (don't care);

- SM.SsuccDeactPdpContextGgsn.G   GSM;

- SM.SsuccDeactPdpContextGgsn.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.9   PDP context deactivation procedures initiated by the SGSN

4.6.9.1   Attempted PDP context deactivation procedures initiated by the SGSN

a) This measurement provides the number of PDP context deactivation procedures initiated by the SGSN.
    The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of a "Delete PDP Context Request" message to the GGSN (TS 29.060 [6]).

d) A single integer value per measurement type defined in e).

e) SM.AttDeactPdpContextSgsn:

- SM.AttDeactPdpContextSgsn   Combined (don't care);

- SM.AttDeactPdpContextSgsn.G   GSM;

- SM.AttDeactPdpContextSgsn.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.9.2   Successful PDP context deactivations initiated by the SGSN

a) This measurement provides the number of successfully handled PDP context deactivations initiated by the SGSN.
    The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "deactivate PDP Context Accept" message from the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) SM.SuccDeactPdpContextSgsn:

- SM.SuccDeactPdpContextSgsn Combined (don't care);

- SM.SuccDeactPdpContextSgsn.G GSM;

- SM.SuccDeactPdpContextSgsn.U UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.9.3 Abnormal PDP context Deactivation procedures

a) This measurement provides the number of PDP context deactivation procedures initiated by the SGSN. This measurement is split into subcounters per cause.

b) CC.

c) Transmission of a "Delete PDP Context Request" message to the GGSN (TS 29.060 [6]). the measurement is incremented according to the deletion cause. Possible causes are included in TS 24.008 [15]. The sum of all supported per cause measurements should equal the total number of PDP context activation failures.

d) A single integer value.

e) SM.AttDeactPdpContextSgsn.cause

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.10 SGSN-Initiated PDP context update procedures

4.6.10.1 Attempted SGSN-Initiated PDP context update procedures

a) This measurement provides the number of attempted SGSN-Initiated PDP context update procedures. An Update PDP Context Request message shall be sent from a SGSN to a GGSN as part of the GPRS Inter SGSN Routeing Update procedure or the PDP Context Modification procedure or to redistribute contexts due to load sharing. It shall be used to change the QoS and the path. The message shall be sent by the new SGSN at the Inter SGSN Routeing Update procedure.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of an "Update PDP Context Request" message to the GGSN (TS 29.060 [6]).

d) A single integer value per measurement type defined in e).

e) SM.AttUpdPdpContextSgsn:

- SM.AttUpdPdpContextSgsn Combined (don't care);

- SM.AttUpdPdpContextSgsn.G GSM;

- SM.AttUpdPdpContextSgsn.U UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.10.2 Successful SGSN-Initiated PDP context update procedures

a) This measurement provides the number of successfully handled SGSN-Initiated PDP context update procedures. These updates are performed successfully when a positive update PDP context response is received from the GGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of an "Update PDP Context Response" message from the GGSN (TS 29.060 [6]).

d) A single integer value per measurement type defined in e).

e) SM.SsuccUpdPdpContextSgsn:

- SM.SsuccUpdPdpContextSgsn   Combined (don't care);

- SM.SsuccUpdPdpContextSgsn.G   GSM;

- SM.SsuccUpdPdpContextSgsn.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.10.3 Attempted SGSN-Initiated PDP context update procedures with direct tunnel

a) This measurement provides the number of attempted SGSN-Initiated PDP context update procedures with direct tunnel. An Update PDP Context Request message shall be sent from a SGSN to a GGSN as part of the GPRS Inter SGSN Routeing Update procedure or the PDP Context Modification procedure or to redistribute contexts due to load sharing. It shall be used to change the QoS and the path. The message shall be sent by the new SGSN at the Inter SGSN Routeing Update procedure.
The three measurement types defined in e) are subject to the "2 out of 3 approach"

b) CC.

c) Transmission of an "Update PDP Context Request" message to the GGSN, which contains DTI to indicate that direct tunnel is used (TS 23.060 [6]).

d) A single integer value per measurement type defined in e).

e) SM.AttUpdPdpContextWithDtiSgsn   Combined
   SM.AttUpdPdpContextWithDtiSgsn.G   GSM;
   SM.AttUpdPdpContextWithDtiSgsn.U   UMTS

i) SgsnFunction.

j) Valid for packet switching.

k) GSM/UMTS.

4.6.10.4 Successful SGSN-Initiated PDP context update procedures with direct tunnel

a) This measurement provides the number of successfully handled SGSN-Initiated PDP context update procedures with direct tunnel. These updates are performed successfully when a positive update PDP context response is received from the GGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach"

b) CC.

c) Receipt of an "Update PDP Context Response" message from the GGSN with the value of cause is "Request Accepted". Which contains DTI to indicate that direct tunnel is used (TS 23.060 [6]).

d) A single integer value per measurement type defined in e).

e) SM.SuccUpdPdpContextWithDtiSgsn   Combined;
    SM.SuccUpdPdpContextWithDtiSgsn.G   GSM;
    SM.SuccUpdPdpContextWithDtiSgsn.U   UMTS

i) SgsnFunction.

j) Valid for packet switching.

k) GSM/UMTS.

4.6.11 GGSN-Initiated PDP context update procedures

4.6.11.1 Attempted GGSN-Initiated PDP context update procedures

a) This measurement provides the number of attempted GGSN-Initiated PDP context update procedures. An Update PDP Context Request may also be sent from a GGSN to a SGSN to re-negotiate the QoS of a PDP context. This GGSN-initiated Update PDP Context Request can also be used to provide a PDP address to the SGSN (and MS). The latter shall be used by GGSN when it acts as a DHCP Relay Agent or Mobil IP Foreign Agent.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of an "Update PDP Context Request" message from the GGSN (TS 29.060 [6]).

d) A single integer value per measurement type defined in e).

e) SM.AttUpdPdpContextGgsn:

- SM.AttUpdPdpContextGgsn   Combined (don't care);

- SM.AttUpdPdpContextGgsn.G   GSM;

- SM.AttUpdPdpContextGgsn.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.11.2 Successful GGSN-Initiated PDP context update procedures

a) This measurement provides the number of successfully handled GGSN-Initiated PDP context update procedures. These updates are performed successfully when a positive update PDP context response is received from the SGSN.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of an "Update PDP Context Response" message to the GGSN (TS 29.060 [6]).

d) A single integer value per measurement type defined in e).

e) SM.SuccUpdPdpContextGgsn:

- SM.SuccUpdPdpContextGgsn   Combined (don't care);

- SM.SuccUpdPdpContextGgsn.G   GSM;

- SM.SuccUpdPdpContextGgsn.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.12 SGSN-Initiated PDP context modifications procedures

4.6.12.1 Attempted SGSN-Initiated PDP context modifications procedures

a) This measurement provides the number of attempted SGSN-Initiated PDP context modifications procedures. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of an "Modify PDP Context Request" message to the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) SM.AttModPdpContextSgsn:

- SM.AttModPdpContextSgsn   Combined (don't care);

- SM.AttModPdpContextSgsn.G   GSM;

- SM.AttModPdpContextSgsn.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.12.2 Successfully SGSN-Initiated PDP context modifications procedures

a) This measurement provides the number of successfully handled SGSN-Initiated PDP context modifications procedures. These modifications are performed successfully when a positive Modify PDP Context Accept is received from the MS.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of an "Modify PDP Context Accept" message from the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) SM.SuccModPdpContextSgsn:

- SM.SuccModPdpContextSgsn   Combined (don't care);

- SM.SuccModPdpContextSgsn.G   GSM;

- SM.SuccModPdpContextSgsn.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.13 MS-Initiated PDP context modifications procedures

4.6.13.1 Attempted MS-Initiated PDP context modifications procedures

a) This measurement provides the number of attempted MS-Initiated PDP context modifications procedures. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of an "Modify PDP Context Request" message from the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) SM.AttModPdpContextMs:

- SM.AttModPdpContextMs   Combined (don't care);

- SM.AttModPdpContextMs.G   GSM;

- SM.AttModPdpContextMs.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.13.2 Successfully MS-Initiated PDP context modifications procedures

a) This measurement provides the number of successfully handled MS-Initiated PDP context modifications procedures. These modifications are performed successfully when a positive Modify PDP Context Accept is received from the MS.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of an "Modify PDP Context Accept" message to the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) SM.SsuccModPdpContextMs:

- SM.SsuccModPdpContextMs   Combined (don't care);

- SM.SsuccModPdpContextMs.G   GSM;

- SM.SsuccModPdpContextMs.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.14 Secondary PDP context activation procedures

4.6.14.1 Attempted Secondary PDP context activation procedures

a) This measurement provides the number of attempted Secondary PDP context activation procedures.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "Activate Secondary PDP Context Request" message from the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) SM.AttActSecondPdpContext:

- SM.AttActSecondPdpContext   Combined (don't care);

- SM.AttActSecondPdpContext.G   GSM;

- SM.AttActSecondPdpContext.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.14.2 Successful Secondary PDP context activations

a) This measurement provides the number of successfully completed Secondary PDP context activations.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of a "Activate Secondary PDP Context Accept" message to the MS (TS 24.008 [15]).

d) A single integer value per measurement type defined in e).

e) SM.SuccActSecondPdpContext:

- SM.SuccActSecondPdpContext   Combined (don't care);

- SM.SuccActSecondPdpContext.G   GSM;

- SM.SuccActSecondPdpContext.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.15 PDP context activation procedures initiated by Network

4.6.15.1 Attempted PDP context activation procedures initiated by Network

a) This measurement provides the number of attempted PDP context activation procedures initiated by Network.
These include the static as well as the dynamic PDP addresses.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "PDU Notification Request" message from the MS (TS 29.060 [6]) message from GGSN.

d) A single integer value.

e) SM.AttActPdpCtxtNtwk:

- SM.AttActPdpCtxtNtwk   Combined (don't care);

- SM.AttActPdpCtxtNtwk.G   GSM;

- SM.AttActPdpCtxtNtwk.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.15.2 Successful PDP context activation procedures initiated by Network

a) This measurement provides the number of successful PDP context activation procedures. These include the
static as well as the dynamic PDP addresses.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission by the SGSN of a "Activate PDP Context Accept" message (TS 24.008 [15]) to MS for the PDP context activation initiated by Network.

d) A single integer value.

e) SM.SuccActPdpCtxtNtwk:

- SM.SuccActPdpCtxtNtwk   Combined (don't care);

- SM.SuccActPdpCtxtNtwk.G   GSM;

- SM.SuccActPdpCtxtNtwk.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.15.3 Failed PDP context activation procedures initiated by Network

a) This measurement provides the number of Failed PDP context activation procedures. These include the static as well as the dynamic PDP addresses. This measurement is split into subcounters per failure cause.

b) CC.

c) Receipt of a " REQUEST PDP CONTEXT ACTIVATION REJECT " message from the MS (TS 24.008 [15]) message indicating a PDP context activation failure, the measurement is incremented according to the failure cause. Possible causes are included in TS 24.008 [15]. The sum of all supported per cause measurements should equal the total number of PDP context activation failures.

d) A single integer value.

e) The measurement name has the form SM.FailActPdpCtxtNtwk.Cause
where Cause identifies the failure cause.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.6.16 PDP Context set-up time, initiated by MS (Mean)

a) This measurement provides the mean time it takes for the SGSN to establish a PDP context during each collection interval. The measurement is split into subcounters per traffic class per APN (see TS 23.003 [9] for APN definition), these measurements will only be provided for a subset of all APNs. The way the list of monitored APNs is configured is outside the scope of this TS.

b) DER (n=1).

c) This measurement is obtained by accumulating the time intervals for each successful mobile originated PDP context activation between the receipt by the SGSN of an " ACTIVATE PDP CONTEXT REQUEST" from the MS and the corresponding transmission by the SGSN to the MS of an "ACTIVATE PDP CONTEXT" message over a granularity period using DER, see TS 29.060 [6], TS 24.008 [15] and TS 23.107 [8] for service class definitions. This end value of the time will then be divided by the number of successful mobile originated PDP context activations observed in the granularity period to give the arithmetic mean, the accumulator shall be reinitialised at the beginning of each granularity period.

d) Each measurement is an integer value.(in milliseconds).

e) SM. SuccActPdpContextAPNTimeMOMean.Conv
SM. SuccActPdpContextAPNTimeMOMean.Strm
SM. SuccActPdpContextAPNTimeMOMean.Intact
SM. SuccActPdpContextAPNTimeMOMean.Bgrd.

   f) SgsnFunction, per APN.

   g) Valid for packet switched traffic.

   h) GSM/UMTS.

4.6.17   PDP Context set-up time, initiated by MS (Max)

   a) This measurement provides the maximum time it takes for the SGSN to establish a PDP context during each collection interval. The measurement is split into subcounters per traffic class per APN (see TS 23.003 [9] for APN definition), these measurements will only be provided for a subset of all APNs.   The way the list of monitored APNs is configured is outside the scope of this TS.

   b) GAUGE.

   c) This measurement is obtained by monitoring the time intervals for each successful mobile originated PDP context activation between the receipt by the SGSN of an " ACTIVATE PDP CONTEXT REQUEST" from the MS and the corresponding transmission by the SGSN to the MS of an "ACTIVATE PDP CONTEXT" message over a granularity period using DER, see TS 29.060 [6], TS 24.008 [15] and TS 23.107 [8] for service class definitions. The high tide mark of this time will be stored in a gauge, the gauge shall be reinitialised at the beginning of each granularity period.

   d) Each measurement is an integer value.(in milliseconds).

   e) SM. SuccActPdpContextAPNTimeMOMax.Conv
      SM. SuccActPdpContextAPNTimeMOMax.Strm
      SM. SuccActPdpContextAPNTimeMOMax.Intact
      SM. SuccActPdpContextAPNTimeMOMax.Bgrd

   f) SgsnFunction, per APN.

   g) Valid for packet switched traffic.

   h) GSM/UMTS.

4.6.18   PDP Context set-up time, initiated by Network (Mean)

   a) This measurement provides the mean time it takes for the SGSN to establish a PDP context initiated by the network during each collection interval. The measurement is split into subcounters per traffic class per APN (see TS 23.003 [9] for APN definition), these measurements will only be provided for a subset of all APNs. The way the list of monitored APNs is configured is outside the scope of this TS.

   b) DER (n=1).

   c) This measurement is obtained by accumulating the time intervals for each successful mobile terminated PDP context activation between the transmission by the SGSN of a "REQUEST PDP CONTEXT ACTIVATION" for the MS and the corresponding transmission by the SGSN to the MS of an "ACTIVATE PDP CONTEXT" message over a granularity period using DER, see TS 29.060 [6], TS 24.008 [15] and TS 23.107 [8] for service class definitions. This end value of the time will then be divided by the number of successful mobile originated PDP context activations observed in the granularity period to give the arithmetic mean, the accumulator shall be reinitialised at the beginning of each granularity period.

   d) Each measurement is an integer value.(in milliseconds).

   e) SM. SuccActPdpContextAPNTimeMTMean.Conv
      SM. SuccActPdpContextAPNTimeMTMean.Strm
      SM. SuccActPdpContextAPNTimeMTMean.Intact
      SM. SuccActPdpContextAPNTimeMTMean.Bgrd.

   f) SgsnFunction, per APN.

   g) Valid for packet switched traffic.

   h) GSM/UMTS.

4.6.19 PDP Context set-up time, initiated by Network (Max)

a) This measurement provides the maximum time it takes for the SGSN to establish a PDP context initiated by the network during each collection interval. The measurement is split into subcounters per traffic class per APN (see TS 23.003 [9] for APN definition), these measurements will only be provided for a subset of all APNs. The way the list of monitored APNs is configured is outside the scope of this TS.

b) GAUGE

c) This measurement is obtained by monitoring the time intervals for each successful mobile terminated PDP context activation between the transmission by the SGSN of a "REQUEST PDP CONTEXT ACTIVATION" for the MS and the corresponding transmission by the SGSN to the MS of an "ACTIVATE PDP CONTEXT" message over a granularity period using DER, see TS 29.060 [6], TS 24.008 [15] and TS 23.107 [8] for service class definitions. The high tide mark of this time will be stored in a gauge, the gauge shall be reinitialised at the beginning of each granularity period.

d) Each measurement is an integer value.(in milliseconds).

e) SM. SuccActPdpContextAPNTimeMTMax.Conv
   SM. SuccActPdpContextAPNTimeMTMax.Strm
   SM. SuccActPdpContextAPNTimeMTMax.Intact
   SM. SuccActPdpContextAPNTimeMTMax.Bgrd.

f) SgsnFunction, per APN.

g) Valid for packet switched traffic.

h) GSM/UMTS.

4.6.20 Service Request related measurement

The total service requests include both MS initiated and Network initiated service requests.

The three measurement types defined in this clause are subject to the "2 out of 3 approach".

4.6.20.1 Attempted Service Request procedures

a) This measurement provides the total number of attempted Service Request procedures. The measurement defined in e) is subject to 2 out of 3 approaches.

b) CC.

c) Receipt of "SERVICE REQUEST" message from the MS (TS 23.060).

d) A single integer value.

e) SM. ServiceReqAtt

   - SM. ServiceReqAtt   Combined (don't care);

   - SM. ServiceReqAtt.U   UMTS;

   - SM. ServiceReqAtt.G   GSM.

f) SGSNFunction

g) Valid for packet switching.

h) GSM/UMTS

4.6.20.2 Successful Service Request procedures

a) This measurement provides the total number of successful Service Request procedures. The measurement defined in e) is subject to 2 out of 3 approaches.

b) CC.

c) Transmission of "SERVICE ACCEPT" message to the MS as a result of Service Request procedure. (TS23.060)

d) A single integer value.

e) SM.ServiceReqSucc.

- SM. ServiceReqSucc   Combined (don't care);

- SM. ServiceReqSucc.U   UMTS;

- SM. ServiceReqSucc.G   GSM.

f) SGSNFunction

g) Valid for packet switching.

h) GSM/UMTS

4.6.20.3 Failed Service Request procedures

a) This measurement provides the total number of failed Service Request procedures. The measurement defined in e) is subject to 2 out of 3 approaches.

b) CC.

c) Transmission of "SERVICE REJECT" message to the MS as a result of Service Request procedure. Possible reject causes are defined within TS 24.008.
The sum of all supported per cause measurements shall be equal to the total number of failed Service Request procedures. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported plus a possible sum value identified by the .sum suffix

SM.ServiceReqFail.*Cause*
- SM. ServiceReqFail.*Cause*   Combined (don't care);

- SM. ServiceReqFail.*Cause*.U   UMTS;

- SM. ServiceReqFail.*Cause*.G   GSM.

where *Cause* identifies the reject cause.

e) SGSNFunction

f) Valid for packet switching.

g) GSM/UMTS

4.6.21 Mean number of activated PDP contexts with direct tunnel related measurements

a) This measurement provides mean number of activated PDP contexts with direct tunnel.

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval, the number of activated PDP contexts with established direct tunnel (see TS 23.060 SGSN PDP Contexts, DTI is used to instruct the GGSN to apply Direct Tunnel), and then taking the arithmetic mean. (TS 23.060)

d) A single integer value.

e) SM. MeanActPDPContextDT

f) SGSNFunction

g) Valid for packet switching.

h) GSM/UMTS

4.7 CAMEL Measurements

4.7.1 CAMEL dialogues

4.7.1.1 Attempted CAMEL dialogues

a) Total number of CAMEL dialogue attempts.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Incremented when a TDP (Trigger Detection Point) is reached and CAP is informed.

d) A single integer value per measurement type defined in e).

e) CAM.AttCamelDialogues:

- CAM.AttCamelDialogues   Combined (don't care);

- CAM.AttCamelDialogues.G   GSM;

- CAM.AttCamelDialogues.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.7.1.2 Failed CAMEL dialogues, aborted locally by gprsSSF

a) Number of failed CAMEL dialogues, aborted locally by gprsSSF.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Incremented when a CAMEL dialogue is aborted locally by SSF.

d) A single integer value per measurement type defined in e).

e) CAM.FailDialoguesSsf:

- CAM.FailDialoguesSsf   Combined (don't care);

- CAM.FailDialoguesSsf.G   GSM;

- CAM.FailDialoguesSsf.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.7.1.3 Failed CAMEL dialogues, error or reject from gsmSCF

a) Number of failed CAMEL dialogues, error or reject from gsmSCF.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Incremented when a CAMEL dialogue is aborted by SCF.

d) A single integer value per measurement type defined in e).

e) CAM.FailDialoguesScf:

- CAM.FailDialoguesScf   Combined (don't care);

- CAM.FailDialoguesScf.G   GSM;

- CAM.FailDialoguesScf.U   UMTS.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM/UMTS.

4.8 UMTS-GSM Intersystem Change

4.8.1 Intra SGSN inter system changes from UMTS to GSM

4.8.1.1 Attempted intra SGSN inter system changes from UMTS to GSM

a) Number of attempted intra SGSN inter system changes from UMTS to GSM.

b) CC.

c) Receipt of "Routing Area Update REQUEST" message from the MS, where the SGSN determines that it concerns a intra SGSN inter system changes from UMTS to GSM. (TS 24.008 [15]).

d) A single integer value.

e) ISYSC.AttIntraSgsnUmtsGsmRau.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.8.1.2 Successful intra SGSN inter system changes from UMTS to GSM

a) Successful intra SGSN inter system changes from UMTS to GSM.

b) CC.

c) Transmission of "ROUTING AREA UPDATE ACCEPT" message to the MS (TS 24.008 [15]). Only the cases where this message is sent for "UMTS to GSM Intra SGSN Change" are counted.

d) A single integer value.

e) ISYSC.SuccIntraSgsnUmtsGsmRau.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.8.1.3 Failed intra SGSN inter system changes UMTS to GSM RAU, due to internal reasons

a) Number of failed intra SGSN inter system UMTS to GSM RAU, due to internal reasons.

b) CC.

c) "UMTS to GSM Intra SGSN Change" fails due to reasons located inside this 2G+3G-SGSN:- internal resource problem- recovery- ...

d) A single integer value.

e) ISYSC.FailIntraSgsnUmtsGsmRauInt.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.8.1.4 Failed intra SGSN inter system changes UMTS to GSM RAU, due to external reasons

a) Number of failed intra SGSN inter system UMTS to GSM RAU, due to external reasons.

b) CC.

c) "UMTS to GSM Intra SGSN Change" fails due to reasons located in NE outside this 2G+3G-SGSN, such as abnormal (reject, failure,..)/missing responses from SRNS, MSC/VLR, HLR, ...

d) A single integer value.

e) ISYSC.FailIntraSgsnUmtsGsmRauExt.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.8.2 Intra SGSN inter system changes from GSM to UMTS

4.8.2.1 Attempted intra SGSN inter system changes from GSM to UMTS

a) Number of attempted intra SGSN inter system changes from GSM to UMTS.

b) CC.

c) Receipt of "Routing Area Update REQUEST" message from the MS, where the SGSN determines that it concerns a intra SGSN inter system changes from GSM to UMTS (TS 24.008 [15]).

d) A single integer value.

e) ISYSC.AttIntraSgsnGsmUmtsRau.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.8.2.2 Successful intra SGSN inter system changes from GSM to UMTS

a) Successful intra SGSN inter system changes from GSM to UMTS.

b) CC.

c) Transmission of "ROUTING AREA UPDATE ACCEPT" message to the MS (TS 24.008 [15]). Only the cases where this message is sent for "GSM to UMTS Intra SGSN Change" are counted.

d) A single integer value.

e) ISYSC.SuccIntraSgsnGsmUmtsRau.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.8.2.3 Failed intra SGSN inter system changes GSM to UMTS RAU, due to internal reasons

a) Number of failed intra SGSN inter system GSM to UMTS RAU, due to internal reasons.

b) CC.

c) "GSM to UMTS Intra SGSN Change" fails due to reasons located inside this 2G+3G-SGSN:- internal resource problem- recovery- ...

d) A single integer value.

e) ISYSC.FailIntraSgsnGsmUmtsRauInt.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.8.2.4 Failed intra SGSN inter system changes GSM to UMTS RAU, due to external reasons

a) Number of failed intra SGSN inter system GSM to UMTS RAU, due to external reasons.

b) CC.

c) "GSM to UMTS Intra SGSN Change" fails due to reasons located in NE outside this 2G+3G-SGSN, such as abnormal (reject, failure,..)/missing responses from SRNS, MSC/VLR, HLR, ...

d) A single integer value.

e) ISYSC.FailIntraSgsnGsmUmtsRauExt.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.9 UMTS GTP Measurements

4.9.1 GTP-U Iu

4.9.1.1 Number of outgoing GTP data packets on the Iu interface

a) This measurement provides the number of GTP data PDUs which have been generated by the GTP-U protocol entity on the Iu interface.

b) CC.

c) Transmission by the SGSN of a GTP data PDU on the Iu interface to the MS.

d) A single integer value.

e) GTP.GtpuOutDataPktIu.

f) SgsnFunction
IupsLink.

g) Valid for packet switching.

h) UMTS.

4.9.1.2 Number of incoming GTP data packets on the Iu interface

a) This measurement provides the number of GTP data PDUs which have been accepted and processed by the GTP-U protocol entity on the Iu interface.

b) CC.

c) Reception by the SGSN of a GTP data PDU on the Iu interface from the MS.

d) A single integer value.

e) GTP.GtpuInDataPktIu.

f) SgsnFunction
IupsLink.

g) Valid for packet switching.

h) UMTS.

4.9.1.3 Number of octets of outgoing GTP data packets on the Iu interface

a) This measurement provides the byte number of outgoing data packets on the Iu interface without the GTP-U header.

b) CC.

c) Transmission by the SGSN of an GTP-Data-PDU (T-PDU) on the Iu interface to the MS.

d) A single integer value.

e) GTP.GtpuOutDataOctIu.

f) SgsnFunction
IupsLink.

g) Valid for packet switching.

h) UMTS.

4.9.1.4 Number of octets of incoming GTP data packets on the Iu interface

a) This measurement provides the byte number of incoming data packets on the Iu interface without the GTP-U header.

b) CC.

c) Reception by the SGSN of an GTP-Data-PDU (T-PDU) on the Iu interface from the MS.

d) A single integer value.

e) GTP.GtpuInDataOctIu.

f) SgsnFunction
IupsLink.

g) Valid for packet switching.

h) UMTS.

4.9.2 GTP Gn

4.9.2.1 Number of outgoing GTP data packets on the Gn interface, from SGSN to GGSN

a) This measurement provides the number of GTP data PDUs which have been generated by the GTP protocol entity on the Gn interface.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission by the SGSN of a GTP data PDU on the Gn interface to the GGSN.

d) A single integer value per measurement type defined in e).

e) GTP.OutDataPktGnGGSN:

   - GTP.OutDataPktGnGGSN   the total regardless of the GTP version used;

   - GTP.OutDataPktGnGGSN.v0   only the GTPv0 part;

   - GTP.OutDataPktGnGGSN.v1   only the GTPv1 part.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.9.2.2 Number of incoming GTP data packets on the Gn interface, from GGSN to SGSN

a) This measurement provides the number of GTP Data PDUs which have been accepted and processed by the GTP protocol entity on the Gn interface.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Reception by the SGSN of a GTP data PDU on the Gn interface from the GGSN.

d) A single integer value per measurement type defined in e).

e) GTP.InDataPktGnGGSN:

   - GTP.InDataPktGnGGSN   the total regardless of the GTP version used;

   - GTP.InDataPktGnGGSN.v0   only the GTPv0 part;

   - GTP.InDataPktGnGGSN.v1   only the GTPv1 part.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.9.2.3 Number of octets of outgoing GTP data packets on the Gn interface, from SGSN to GGSN

a) This measurement provides the number of octets of outgoing GTP data packets on the Gn interface.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission by the SGSN of an GTP-Data-PDU (T-PDU) on the Gn interface to the GGSN.

d) A single integer value per measurement type defined in e).

e) GTP.OutDataOctGnGGSN:

- GTP.OutDataOctGnGGSN   the total regardless of the GTP version used;

- GTP.OutDataOctGnGGSN.v0   only the GTPv0 part;

- GTP.OutDataOctGnGGSN.v1   only the GTPv1 part.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.9.2.4 Number of octets of incoming GTP data packets on the Gn interface, from GGSN to SGSN

a) This measurement provides the number of octets of incoming GTP data packets on the Gn interface.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Reception by the SGSN of an GTP-Data-PDU (T-PDU) on the Gn interface from the GGSN.

d) A single integer value per measurement type defined in e).

e) GTP.InDataOctGnGGSN:

- GTP.InDataOctGnGGSN   the total regardless of the GTP version used;

- GTP.InDataOctGnGGSN.v0   only the GTPv0 part;

- GTP.InDataOctGnGGSN.v1   only the GTPv1 part.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.9.2.5 Number of outgoing GTP signalling packets on the Gn interface, from SGSN to GGSN

a) This measurement provides the number of GTP signalling PDUs which have been generated by the GTP protocol entity on the Gn interface.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission by the SGSN of a GTP signalling PDU on the Gn interface to the GGSN.

d) A single integer value per measurement type defined in e).

e) GTP.OutSigPktGnGGSN:

- GTP.OutSigPktGnGGSN   the total regardless of the GTP version used;

- GTP.OutSigPktGnGGSN.v0   only the GTPv0 part;

- GTP.OutSigPktGnGGSN.v1   only the GTPv1 part.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.9.2.6 Number of incoming GTP signalling packets on the Gn interface, from GGSN to SGSN

a) This measurement provides the number of GTP signalling PDUs which have been accepted and processed by the GTP protocol entity on the Gn interface.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Reception by the SGSN of a GTP signalling PDU on the Gn interface from the GGSN.

d) A single integer value per measurement type defined in e).

e) GTP.InSigPktGnGGSN:

   - GTP.InSigPktGnGGSN   the total regardless of the GTP version used;

   - GTP.InSigPktGnGGSN.v0   only the GTPv0 part;

   - GTP.InSigPktGnGGSN.v1   only the GTPv1 part.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.9.2.7 Number of octets of outgoing GTP signalling packets on the Gn interface, from SGSN to GGSN

a) This measurement provides the number of octets of outgoing GTP signalling packets on the Gn interface.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission by the SGSN of an GTP-Signalling-PDU on the Gn interface to the GGSN.

d) A single integer value per measurement type defined in e).

e) GTP.OutSigOctGnGGSN:

   - GTP.OutSigOctGnGGSN   the total regardless of the GTP version used;

   - GTP.OutSigOctGnGGSN.v0   only the GTPv0 part;

   - GTP.OutSigOctGnGGSN.v1   only the GTPv1 part.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.9.2.8 Number of octets of incoming GTP signalling packets on the Gn interface, from GGSN to SGSN

a) This measurement provides the number of octets of incoming GTP signalling packets on the Gn interface.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Reception by the SGSN of an GTP-Signalling-PDU on the Gn interface from the GGSN.

d) A single integer value per measurement type defined in e).

e) GTP.InSigOctGnGGSN:

- GTP.InSigOctGnGGSN   the total regardless of the GTP version used;

- GTP.InSigOctGnGGSN.v0   only the GTPv0 part;

- GTP.InSigOctGnGGSN.v1   only the GTPv1 part.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.9.2.9 Number of outgoing GTP data packets on the Gn interface, from SGSN to SGSN

a) This measurement provides the number of GTP data PDUs which have been generated by the GTP protocol entity on the Gn interface.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission by the SGSN of a GTP data PDU on the Gn interface to the SGSN.

d) A single integer value per measurement type defined in e).

e) GTP.OutDataPktGnSGSN:

- GTP.OutDataPktGnSGSN   the total regardless of the GTP version used;

- GTP.OutDataPktGnSGSN.v0   only the GTPv0 part;

- GTP.OutDataPktGnSGSN.v1   only the GTPv1 part.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.9.2.10 Number of incoming GTP data packets on the Gn interface, from SGSN to SGSN

a) This measurement provides the number of GTP Data PDUs which have been accepted and processed by the GTP protocol entity on the Gn interface.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Reception by the SGSN of a GTP data PDU on the Gn interface from the SGSN.

d) A single integer value per measurement type defined in e).

e) GTP.InDataPktGnSGSN:

- GTP.InDataPktGnSGSN   the total regardless of the GTP version used;

- GTP.InDataPktGnSGSN.v0   only the GTPv0 part;

- GTP.InDataPktGnSGSN.v1   only the GTPv1 part.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.9.2.11 Number of octets of outgoing GTP data packets on the Gn interface, from SGSN to SGSN

a) This measurement provides the number of octets of outgoing GTP data packets on the Gn interface.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission by the SGSN of an GTP-Data-PDU (T-PDU) on the Gn interface to the SGSN.

d) A single integer value per measurement type defined in e).

e) GTP.OutDataOctGnSGSN:

- GTP.OutDataOctGnSGSN the total regardless of the GTP version used;

- GTP.OutDataOctGnSGSN.v0 only the GTPv0 part;

- GTP.OutDataOctGnSGSN.v1 only the GTPv1 part.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.9.2.12 Number of octets of incoming GTP data packets on the Gn interface, from SGSN to SGSN

a) This measurement provides the number of octets of incoming GTP data packets on the Gn interface.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Reception by the SGSN of an GTP-Data-PDU (T-PDU) on the Gn interface from the SGSN.

d) A single integer value per measurement type defined in e).

e) GTP.InDataOctGnSGSN:

- GTP.InDataOctGnSGSN the total regardless of the GTP version used;

- GTP.InDataOctGnSGSN.v0 only the GTPv0 part;

- GTP.InDataOctGnSGSN.v1 only the GTPv1 part.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.9.2.13 Number of outgoing GTP signalling packets on the Gn interface, from SGSN to SGSN

a) This measurement provides the number of GTP signalling PDUs which have been generated by the GTP protocol entity on the Gn interface.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission by the SGSN of a GTP signalling PDU on the Gn interface to the SGSN.

d) A single integer value per measurement type defined in e).

e) GTP.OutSigPktGnSGSN:

- GTP.OutSigPktGnSGSN   the total regardless of the GTP version used;

- GTP.OutSigPktGnSGSN.v0   only the GTPv0 part;

- GTP.OutSigPktGnSGSN.v1   only the GTPv1 part.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.9.2.14 Number of incoming GTP signalling packets on the Gn interface, from SGSN to SGSN

a) This measurement provides the number of GTP signalling PDUs which have been accepted and processed by the GTP protocol entity on the Gn interface.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Reception by the SGSN of a GTP signalling PDU on the Gn interface from the SGSN.

d) A single integer value per measurement type defined in e).

e) GTP.InSigPktGnSGSN:

- GTP.InSigPktGnSGSN   the total regardless of the GTP version used;

- GTP.InSigPktGnSGSN.v0   only the GTPv0 part;

- GTP.InSigPktGnSGSN.v1   only the GTPv1 part.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.9.2.15 Number of octets of outgoing GTP signalling packets on the Gn interface, from SGSN to SGSN

a) This measurement provides the number of octets of outgoing GTP signalling packets on the Gn interface.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission by the SGSN of an GTP-Signalling-PDU on the Gn interface to the SGSN.

d) A single integer value per measurement type defined in e).

e) GTP.OutSigOctGnSGSN:

- GTP.OutSigOctGnSGSN   the total regardless of the GTP version used;

- GTP.OutSigOctGnSGSN.v0   only the GTPv0 part;

- GTP.OutSigOctGnSGSN.v1   only the GTPv1 part.

f) SgsnFunction.

g) Valid for packet switching.

h)   Combined.

4.9.2.16   Number of octets of incoming GTP signalling packets on the Gn interface, from SGSN to SGSN

a)   This measurement provides the number of octets of incoming GTP signalling packets on the Gn interface. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b)   CC.

c)   Reception by the SGSN of an GTP-Signalling-PDU on the Gn interface from the SGSN.

d)   A single integer value per measurement type defined in e).

e)   GTP.InSigOctGnSGSN:

-   GTP.InSigOctGnSGSN   the total regardless of the GTP version used;

-   GTP.InSigOctGnSGSN.v0   only the GTPv0 part;

-   GTP.InSigOctGnSGSN.v1   only the GTPv1 part.

f)   SgsnFunction.

g)   Valid for packet switching.

h)   Combined.

4.10   UMTS Bearer Service

4.10.1   UMTS Bearer Service CS time to register (Mean)

a)   This measurement provides the mean time it takes for the subscribers to register with the network for circuit switched (CS) services during each granularity period.

b)   DER (n=1)

c)   This measurement is obtained by accumulating the time intervals for each successful attach between the receipt by the VLR of an "ATTACH REQUEST" from the MS and the corresponding receipt by the VLR of an "ATTACH COMPLETE" message over a granularity period using DER, see TS 24.008 [15]. This end value of the time will then be divided by the number of successful attach requests for CS domain observed in the granularity period to give the arithmetic mean, the accumulator shall be reinitialised at the beginning of each granularity period.

d)   Each measurement is an integer value.(in milliseconds).

e)   UBS.TimeToRegisterCSMean

f)   VlrFunction

g)   Valid for circuit switched traffic.

h)   UMTS.

4.10.2   UMTS Bearer Service CS time to register (Max)

a)   This measurement provides the maximum time it takes for the subscribers to register with the network for circuit switched (CS) services during each granularity period.

b)   GAUGE.

c)   This measurement is obtained by monitoring the time intervals for each successful attach between the receipt by the VLR of an "ATTACH REQUEST" from the MS and the corresponding receipt by the VLR of an "ATTACH COMPLETE" message over a granularity period, see TS 24.008 [15]. The high tide mark of this time will be stored in a gauge, the gauge shall be reinitialised at the beginning of each granularity period.

d) Each measurement is an integer value.(in milliseconds).

e) UBS.TimeToRegisterCSMax.

f) VlrFunction.

g) Valid for circuit switched traffic.

h) UMTS.

4.10.3 UMTS Bearer Service PS time to register (Mean)

a) This measurement provides the mean time it takes for the subscribers to register with the network for packet switched (PS) services during each granularity period.

b) DER (n=1).

c) This measurement is obtained by accumulating the time intervals for each successful attach between the receipt by the SGSN of an "ATTACH REQUEST" from the MS and the corresponding receipt by the SGSN of an "ATTACH COMPLETE" message over a granularity period using DER, see TS 24.008 [15]. This end value of the time will then be divided by the number of successful attach requests for PS domain observed in the granularity period to give the arithmetic mean.

d) Each measurement is an integer value.(in milliseconds).

e) UBS.TimeToRegisterPSMean.

f) SgsnFunction.

g) Valid for packet switched traffic.

h) UMTS.

4.10.4 UMTS Bearer Service PS time to register (Max)

a) This measurement provides the maximum time it takes for the subscribers to register with the network for packet switched (PS) services during each granularity period.

b) GAUGE.

c) This measurement is obtained by monitoring the time intervals for each successful attach between the receipt by the SGSN of an "ATTACH REQUEST" from the MS and the corresponding receipt by the SGSN of an "ATTACH COMPLETE" message over a granularity period using DER, see TS 24.008 [15]. The high tide mark of this time will be stored in a gauge, the gauge shall be reinitialised at the beginning of each granularity period.

d) Each measurement is an integer value.(in milliseconds).

e) UBS.TimeToRegisterPSMax.

f) SgsnFunction.

g) Valid for packet switched traffic.

h) UMTS.

4.10.5 UMTS Bearer Service time to establish Communications Management (CM) radio access connectivity (Mean)

a) This measurement provides the mean time it takes for the radio access network to establish a service connection (for circuit switched connection establishment, supplementary services activation, short message transfer, location services) during each granularity period.

b) DER (n=1).

c) This measurement is obtained by accumulating the time intervals for each successful service request between the receipt by the MSC of a "CM SERVICE REQUEST" from the MS and the corresponding receipt by the MSC of an "CM SERVICE ACCEPT" message over a granularity period using DER, see TS 24.008 [15]. This end value of the time will then be divided by the number of successful service requests observed in the granularity period to give the arithmetic mean, the accumulator shall be reinitialised at the beginning of each granularity period.

d) Each measurement is an integer value.(in milliseconds).

e) UBS.TimeForCMConnectRANMean.

f) MscFunction.

g) Valid for circuit switched traffic.

h) UMTS.

4.10.6 UMTS Bearer Service time to establish Communications Management (CM) radio access connectivity (Max)

a) This measurement provides the maximum time it takes for the radio access network to establish a service connection (for circuit switched connection establishment, supplementary services activation, short message transfer, location services) during each granularity period.

b) GAUGE.

c) This measurement is obtained by monitoring the time intervals for each successful service request between the receipt by the MSC of a "CM SERVICE REQUEST" from the MS and the corresponding receipt by the MSC of an "CM SERVICE ACCEPT" message over a granularity period, see TS 24.008 [15]. The high tide mark of this time will be stored in a gauge, the gauge shall be reinitialised at the beginning of each granularity period.

d) Each measurement is an integer value.(in milliseconds).

e) UBS.TimeForCMConnectRANMax

f) MscFunction.

g) Valid for circuit switched traffic.

h) UMTS.

4.11 LLC frames

4.11.1 Number of LLC frames sent

f) This measurement provides the number of LLC frames sent by the SGSN.

g) CC.

h) Transmission of a LLC frame to a peer entity (TS 44.064 [11]).

i) A single integer value

j) LLC.NbrFramesSent.

k) SgsnFunction.

l) Valid for packet switching.

m) GSM.

4.11.2 Number of LLC frames received

a) This measurement provides the number of LLC frames received by the SGSN.

b) CC.

c) Receipt of a LLC frame from a peer entity before any error checking (TS 44.064 [11]).

d) A single integer value

e) LLC.NbrFramesReceived.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM.

4.11.3   Number of erroneous LLC frames received

a) This measurement provides the number of erroneous LLC frames received by the SGSN.

b) CC.

c) Discard of an erroneous LLC frame received from a peer entity (TS 44.064 [11]).

d) A single integer value

e) LLC.NbrErroneousFrames.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM.

4.11.4   Number of LLC frames retransmitted

a) This measurement provides the number of LLC frames retransmitted in LLC acknowledge mode by the SGSN.

b) CC.

c) Receipt of a NACK or SACK frame from a peer entity (TS 44.064 [11]).

d) A single integer value

e) LLC.NbrFramesRetransmitted.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM.

4.12   SNDCP N-PDUs

4.12.1   Number of SNDCP N-PDUs sent

a) This measurement provides the number of SNDCP N-PDUs sent by the SGSN.

b) CC.

c) Transmission of a SN-DATA or SN-UNITDATA request (TS 44.065 [12]).

d) A single integer value

e) SNDCP.NbrNpdusSent.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM.

4.12.2 Number of SNDCP N-PDU octets sent

a) This measurement provides the number of octets in SNDCP N-PDUs sent by the SGSN.

b) CC.

c) Transmission of a SN-DATA or SN-UNITDATA request (TS 44.065 [12]).

d) A single integer value

e) SNDCP.NbrNpduOctetsSent.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM.

4.12.3 Number of SNDCP N-PDUs received

a) This measurement provides the number of SNDCP N-PDUs received by the SGSN.

b) CC.

c) Receipt of a SN-DATA or SN-UNITDATA indication (TS 44.065 [12]).

d) A single integer value

e) SNDCP.NbrNpdusReceived.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM.

4.12.4 Number of SNDCP N-PDU octets received

a) This measurement provides the number of octets in SNDCP N-PDUs received by the SGSN.

b) CC.

c) Receipt of a SN-DATA or SN-UNITDATA indication (TS 44.065 [12]).

d) A single integer value

e) SNDCP.NbrNpduOctetsReceived.

f) SgsnFunction.

g) Valid for packet switching.

h) GSM.

4.13 IMEI checking procedure

4.13.1 Number of check IMEI requests

n) This measurement provides the number of check IMEI requests sent to the EIR.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

o) CC.

p) Transmission of a "MAP_CHECK_IMEI" request to the EIR (TS 29.002 [4]).

q) A single integer value.

r) IMEI.CheckImeiReq.

s) SgsnFunction.

t) Valid for packet switching.

u) Combined.

4.13.2 Number of check IMEI white list responses

a) This measurement provides the number of check IMEI white list responses received from the EIR.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "MAP_CHECK_IMEI" response from the EIR with parameter "equipment status" indicating a
white listed equipment (TS 29.002 [4]).

d) A single integer value.

e) IMEI.CheckImeiRspWhite.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.13.3 Number of check IMEI grey list responses

a) This measurement provides the number of check IMEI grey list responses received from the EIR.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "MAP_CHECK_IMEI" response from the EIR with parameter "equipment status" indicating a grey
listed equipment (TS 29.002 [4]).

d) A single integer value.

e) IMEI.CheckImeiRspGrey.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.13.4 Number of check IMEI black list responses

a) This measurement provides the number of check IMEI black list responses received from the EIR.
The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "MAP_CHECK_IMEI" response from the EIR with parameter "equipment status" indicating a black
listed equipment (TS 29.002 [4]).

d) A single integer value.

e) IMEI.CheckImeiRspBlack.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.13.5 Number of check IMEI unknown equipment responses

a) This measurement provides the number of check IMEI unknown equipment responses received from the EIR. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a "MAP_CHECK_IMEI" response from the EIR with parameter "user error" indicating an unknown equipment (TS 29.002 [4]).

d) A single integer value.

e) IMEI.CheckImeiRspUnknown.

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.14 DNS

The performance counters presented in this subclause are mainly intended to:

- monitor the communication between the SGSN and the DNS server;

These counters are associated to the DNS protocol, which is playing the role to translate a domain address into an IP address, and is defined in RFC 1034 [13].

The figure below presents the message sequence during a DNS query procedure initiated by the SGSN.
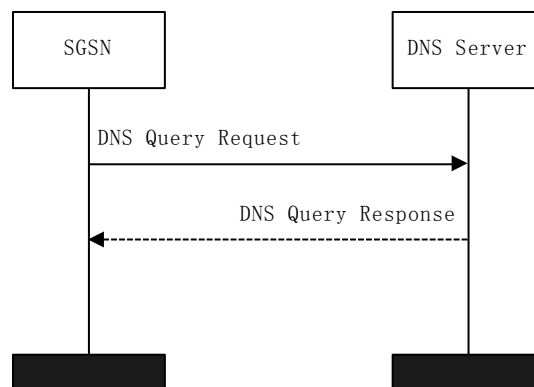
Figure: DNS Query procedure initiated by SGSN

4.14.1 Attempted DNS Query Procedures

a) This measurement provides the number of attempted DNS query procedures SGSN-initiated within this SGSN area. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Transmission of a DNS query request from the SGSN to the DNS server (RFC 1035 [14]).

d) A single integer value.

e) DNS.AttDnsQuery:

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

4.14.2 Successful DNS Query Procedures

a) This measurement provides the number of successful DNS query procedures SGSN-initiated within this SGSN area. The three measurement types defined in e) are subject to the "2 out of 3 approach".

b) CC.

c) Receipt of a DNS query response by the SGSN from the DNS server (RFC 1035 [14]).

d) A single integer value.

e) DNS.SuccDNSResp:

f) SgsnFunction.

g) Valid for packet switching.

h) Combined.

5 Measurements related to the GGSN

5.1 Session Management

5.1.1 Session establishments

The performance counters presented in this subclause are mainly intended to:

- monitor the session establishment success at the GGSN level;

- identify the main causes for GGSN originating session establishment failures;

- and study the repartition of the different traffic classes within session establishment attempts and successes.

These counters are associated to GPRS Tunnelling Protocol signalling (GTP-C for the control plane), between the SGSN and the GGSN, and defined in TS 23.060 [2] and TS 29.060 [6].

The figure below, from TS 23.060 [2], recalls the sequence of messages exchanged for a primary PDP context activation and a subsequent secondary PDP context activation and details the events triggering the update of the counters values.
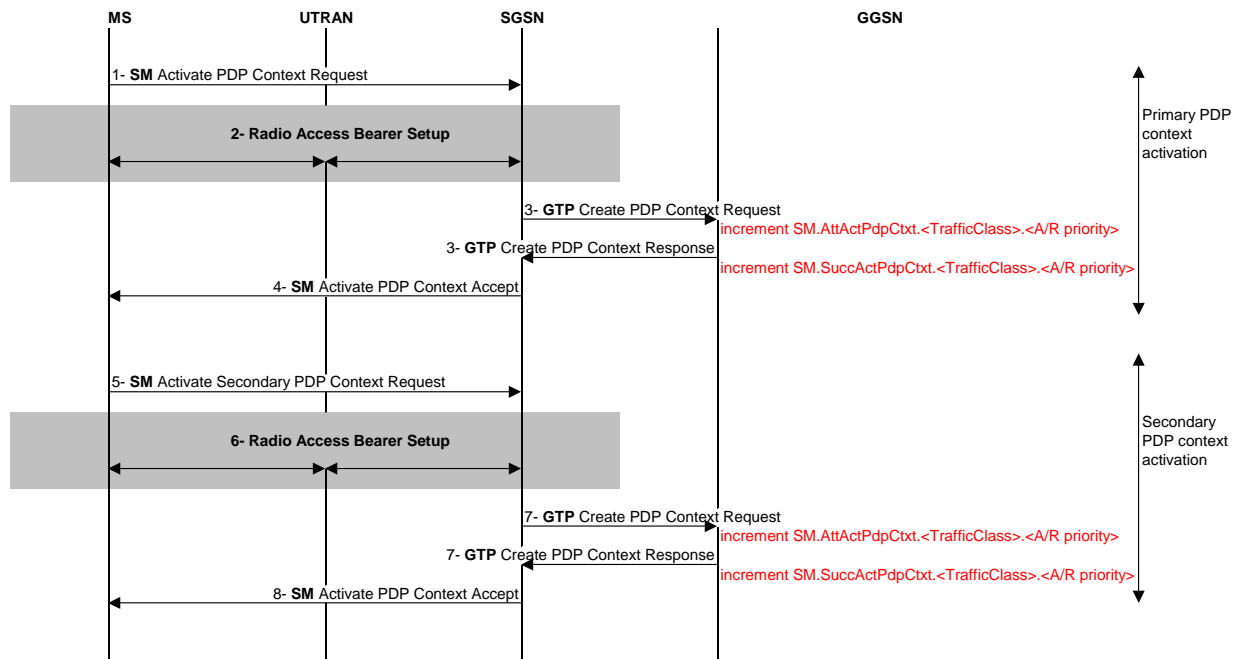
Figure from TS 23.060 [2]

The three measurement types defined in the clause 5.1.1 are subject to the "2 out of 3 approach".

5.1.1.1 Attempted session establishments

a) This measurement provides the number of attempted session establishments. This measurement is split into subcounters per traffic class and allocation/retention priority (or precedence class) indicated in the QoS profile.

b) CC.

c) On receipt of a CREATE PDP CONTEXT REQUEST message by the GGSN, the relevant measurement is incremented according to the traffic class and allocation/retention priority (or precedence class) indicated in the message. In case of a PDP context activated with R97/98 QoS attributes, the fields traffic class and allocation/retention priority used for screening are derived from delay class and precedence class respectively, as ruled in TS 23.107 [8]. See also TS 24.008 [15] and TS 29.060 [6].

d) A single integer value per measurement type defined in e).

e) SM.AttActPdpCtxt.Bgrd.Low
SM.AttActPdpCtxt.Conv.Low
SM.AttActPdpCtxt.Intact.Low
SM.AttActPdpCtxt.Strm.Low
SM.AttActPdpCtxt.Bgrd.High
SM.AttActPdpCtxt.Conv.High
SM.AttActPdpCtxt.Intact.High
SM.AttActPdpCtxt.Strm.High
SM.AttActPdpCtxt.Bgrd.Medium
SM.AttActPdpCtxt.Conv.Medium
SM.AttActPdpCtxt.Intact.Medium
SM.AttActPdpCtxt.Strm.Medium.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Operator Business and Vendor Performance Modelling communities.

5.1.1.2 Successful session establishments

a) This measurement provides the number of sessions successfully established. This measurement is split into subcounters per traffic class and allocation/retention priority (or precedence class) given in the QoS profile of the related PDP context.

b) CC.

c) The relevant measurement is incremented on transmission by the GGSN of a CREATE PDP CONTEXT RESPONSE message sent with cause "Request Accepted", according to the traffic class and allocation/retention priority of the related PDP context. In case of a PDP context activated with R97/98 QoS attributes, the fields traffic class and allocation/retention priority used for screening are derived from delay class and precedence class respectively, as ruled in TS 23.107 [8]. See also TS 24.008 [15] and TS 29.060 [6].

d) A single integer value per measurement type defined in e).

e) SM.SuccActPdpCtxt.Bgrd.Low
SM.SuccActPdpCtxt.Conv.Low
SM.SuccActPdpCtxt.Intact.Low
SM.SuccActPdpCtxt.Strm.Low
SM.SuccActPdpCtxt.Bgrd.High
SM.SuccActPdpCtxt.Conv.High
SM.SuccActPdpCtxt.Intact.High
SM.SuccActPdpCtxt.Strm.High
SM.SuccActPdpCtxt.Bgrd.Medium
SM.SuccActPdpCtxt.Conv.Medium
SM.SuccActPdpCtxt.Intact.Medium
SM.SuccActPdpCtxt.Strm.Medium.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Operator Business and Vendor Performance Modelling communities.

5.1.1.3 Failed session establishments

a) This measurement provides the number of session establishment failures. This measurement is split into subcounters per failure cause.

b) CC.

c) On transmission by the GGSN of a CREATE PDP CONTEXT RESPONSE message indicating a PDP context activation failure, the measurement is incremented according to the failure cause. Possible causes are included in TS 29.060 [6]. The sum of all supported per cause measurements should equal the total number of PDP context activation failures.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported.

e) The measurement name has the form SM.FailActPdpCtxt.Cause
where Cause identifies the failure cause.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Operator Maintenance and Vendor Performance Modelling communities.

5.1.2 Network-initiated session establishments

The performance counters presented in this subclause focus on network initiated PDP context activation procedure, that allows the GGSN to initiate the activation of a PDP context on receipt of a PDP PDU on the Gi interface. The counters proposed are mainly intended to

- monitor the signalling exchanged between the HLR and the GGSN during this procedure; and

- monitor the success rate for network-initiated session establishments. It has to be noted that measurements proposed enable to distinguish between the establishment failures occurring before and after the SGSN has sent the context activation request to the MS.

These counters are associated to the Mobile Application Part (MAP) protocol layer (defined in TS 29.002 [4]) and to GPRS Tunnelling Protocol signalling (GTP-C for the control plane), between the SGSN and the GGSN (defined in TS 29.060 [6]).

The figure below, from TS 23.060 [2], recalls the sequence of messages exchanged for a network initiated PDP context activation and details the events triggering the update of the counters values.
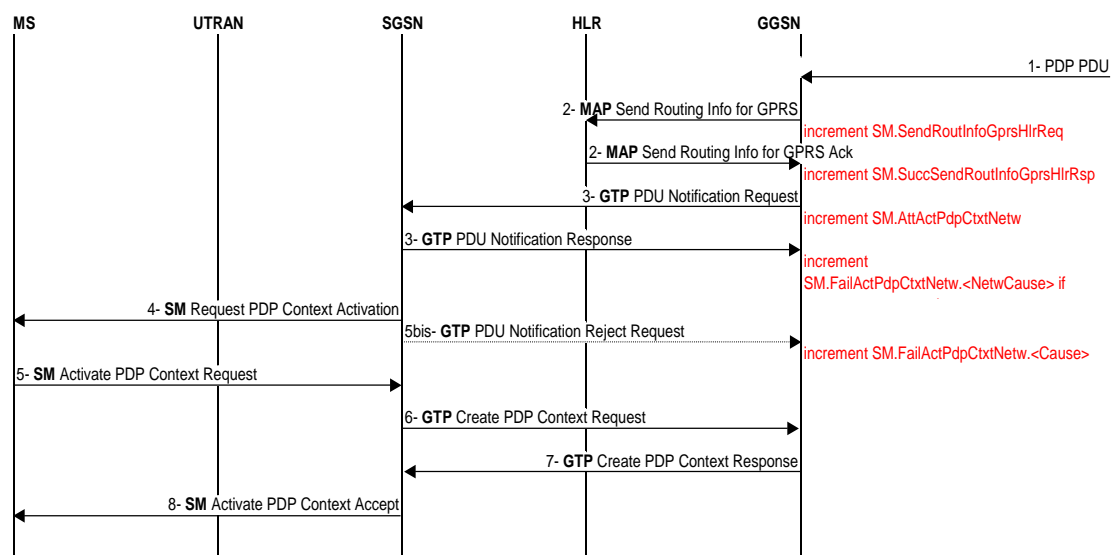
Figure from TS 23.06

5.1.2.1 Number of routing information requests for network-initiated session establishment attempts

a) This measurement provides the number of «Send Routing Info for GPRS » requests sent to the HLR.

b) CC.

c) The measurement is incremented on transmission by the GGSN of a MAP SEND ROUTING INFO FOR GPRS message to the HLR. See TS 23.060 [2] and TS 29.002 [4].

d) Integer.

e) SM.SendRoutInfoGprsHlrReq.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling community.

5.1.2.2 Number of routing information successful responses for network-initiated session establishment attempts

a) This measurement provides the number of "Send Routing Info for GPRS" response messages received from HLR indicating a positive outcome.

b) CC.

c) The measurement is incremented on receipt by the GGSN of a MAP SEND ROUTING INFO FOR GPRS response message containing an SGSN address, which indicates a successful outcome. See TS 23.060 [2] and TS 29.002 [4].

d) Integer.

e) SM.SuccSendRoutInfoGprsHlrRsp.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling and Operator Maintenance communities.

5.1.2.3 Attempted Network-initiated session establishments

5.1.2.3.1 Attempted Network-initiated session establishments

a) This measurement provides the number of network-initiated session establishments attempted. Only the session establishment attempts for which a successful routing response from the HLR has been received are counted (i.e. for which a response including an SGSN address).

b) CC.

c) The measurement is incremented on transmission by the GGSN of a PDU NOTIFICATION REQUEST message to the SGSN. See TS 23.060 [2] and TS 29.060 [6].

d) Integer.

e) SM.AttActPdpCtxtNetw.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling community.

5.1.2.3.2 Failed Network-initiated session establishments - failures occurred before sending PDP context activation request to the MS

a) This measurement provides the number of network initiated session establishment failures. This measurement is split into subcounters per failure cause.

b) CC.

c) On receipt by the GGSN of a PDU NOTIFICATION RESPONSE message with cause different from "Request Accepted", indicating a PDP context activation failure, the relevant measurement is incremented according to the failure cause. Possible causes are included in TS 29.060 [6]. The sum of all supported per cause measurements should equal the total number of PDP context activation failures occurred before sending REQUEST PDP CONTEXT ACTIVATION message to the MS.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported.

e) The measurement name has the form SM.FailActPdpCtxtNetw.NetwCause
where NetwCause identifies the failure cause.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling and Operator Maintenance communities.

5.1.2.3.3 Failed Network-initiated session establishments - failures occurred after sending PDP context activation request to the MS

a) This measurement provides the number of network initiated session establishment failures. This measurement is split into subcounters per failure cause.

b) CC.

c) On receipt by the GGSN of a PDU NOTIFICATION REJECT REQUEST, the relevant measurement is incremented according to the failure cause. Possible causes are included in TS 29.060 [6]. The sum of all supported per cause measurements should equal the total number of PDP context activation failures occurred after sending REQUEST PDP CONTEXT ACTIVATION message to the MS.

d) Each measurement is an integer value. The number of measurements is equal to the number of causes supported.

e) The measurement name has the form SM.FailActPdpCtxtNetw.MsCause
where MsCause identifies the failure cause.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling and Operator Maintenance communities.

5.1.3 Subscribers with activated PDP context

The performance counters presented in this subclause are mainly intended to establish a subscriber profile. Such a profile details the number of elementary procedures per active subscriber (PDP context activations, modifications, updates, …), usually during a busy hour. This profile may be used for 2 main purposes:

- to estimate the current load of the equipment, with details on the respective weight of each procedure in the overall load;

- to estimate the impact on the equipment of a modification of a factor in this subscriber profile (e.g. increase of the number of simultaneous active PDP contexts per subscriber, increase of the number of subscribers, …).

5.1.3.1 Number of subscribers with activated PDP context

a) This measurement provides the number of subscribers having an activated PDP context.

b) GAUGE.

c) The measurement is incremented on transmission by the GGSN of a CREATE PDP CONTEXT RESPONSE message with cause "Request Accepted" for an MSISDN that had no PDP context already activated.
The measurement is decremented on transmission by the GGSN of a DELETE PDP CONTEXT RESPONSE message with cause "Request Accepted" related to the last PDP context for an MSISDN.
See TS 29.060 [6] and TS 23.060 [2].

d) A single integer value.

e) SM.NbrActSubs.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) Combined.

i) This measurement is mainly dedicated to Operator Business and Vendor Performance Modelling communities.

5.1.3.2 Mean number of subscribers with activated PDP context

a) This measurement provides the mean number of subscribers having an activated PDP context.

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of subscribers having an activated PDP context in the GGSN and then taking the arithmetic mean.

d) A single integer value.

e) SM.MeanActSubs.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) Combined.

i) This measurement is mainly dedicated to Operator Business and Vendor Performance Modelling communities.

5.1.3.3 Max number of subscribers with activated PDP context

a) This measurement provides the maximum number of subscribers having an activated PDP context.

b) SI.

c) This measurement is obtained by sampling at a pre-defined interval the number of subscribers having an activated PDP context in the GGSN and then taking the maximum.

d) A single integer value.

e) SM.MaxActSubs.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) Combined.

i) This measurement is mainly dedicated to Operator Business and Vendor Performance Modelling communities.

5.1.4 Session conclusions

The performance counters presented in this subclause are related to PDP context deactivation procedure. The counters proposed are mainly intended to evaluate the ratio of GGSN-initiated PDP context deactivations in overall PDP context deactivations, estimate the PDP context deactivation success rate, and may also be used in the subscriber or session profile.

The figures below, from TS 23.060 [2], recall the sequence of messages exchanged for MS, SGSN or GGSN initiated PDP context deactivations and detail the events triggering the update of the counters values.
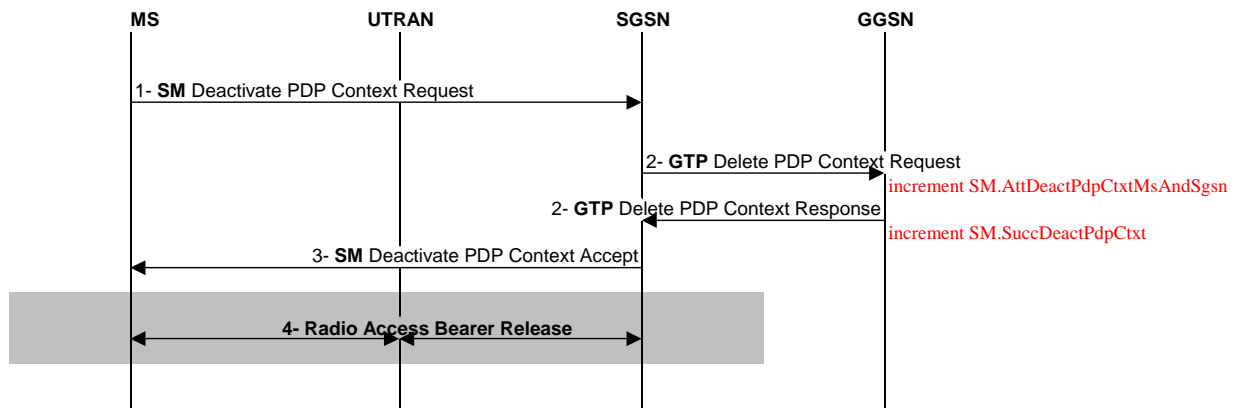
Figure: MS initiated PDP context deactivation
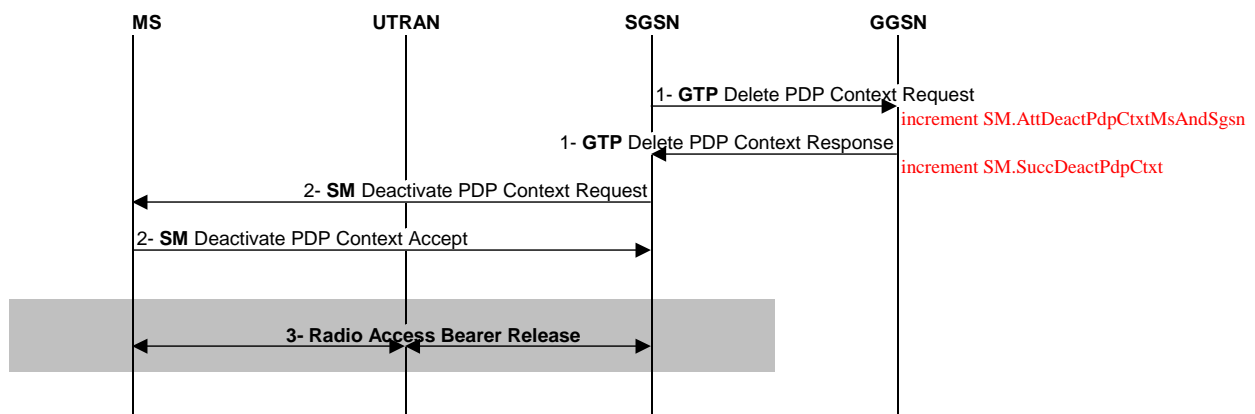
Figure: GSN initiated PDP context deactivation
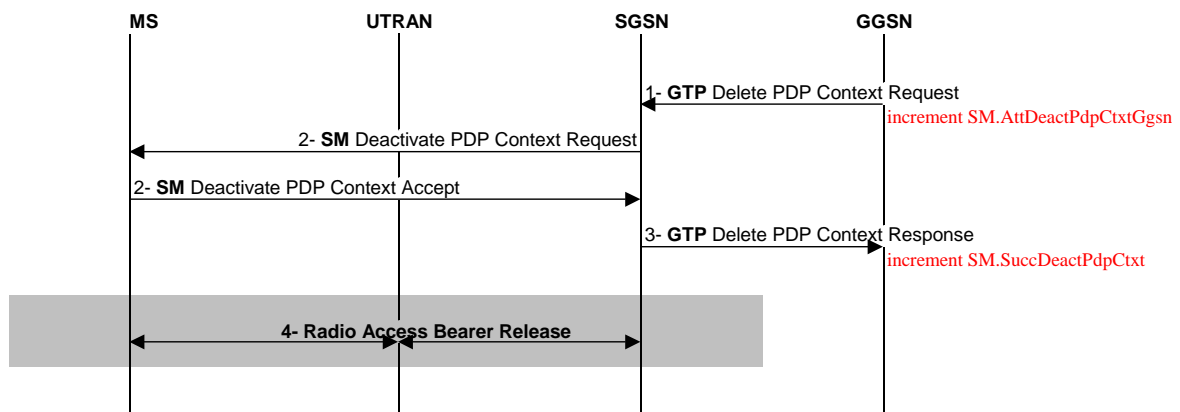
Figure: GGSN initiated PDP context deactivation

5.1.4.1 MS & SGSN-initiated session conclusions

5.1.4.1.1 Attempted MS & SGSN-initiated session conclusions

a) This measurement provides the number of attempted PDP context deactivations initiated by MS & SGSN.

b) CC.

c) The measurement is incremented on receipt by the GGSN of a DELETE PDP CONTEXT REQUEST message. See TS 29.060 [6].

d) Integer.

e) SM.AttDeactPdpCtxtMsAndSgsn.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling community.

5.1.4.1.2 Successful MS & SGSN-initiated session conclusions

a) This measurement provides the number of successful PDP context deactivations initiated by MS & SGSN.

b) CC.

c) The measurement is incremented on transmission by the GGSN of a DELETE PDP CONTEXT RESPONSE message with cause "Request Accepted". See TS 29.060 [6].

d) Integer.

e) SM.SuccDeactPdpCtxtMsAndSgsn.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling community.

5.1.4.2 GGSN-initiated session conclusions

5.1.4.2.1 Attempted GGSN-initiated session conclusions

a) This measurement provides the number of attempted PDP context deactivations initiated by GGSN.

b) CC.

c) The measurement is incremented on transmission by the GGSN of a DELETE PDP CONTEXT REQUEST message. See TS 29.060 [6].

d) Integer.

e) SM.AttDeactPdpCtxtGgsn.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling community.

5.1.4.2.2 Successful GGSN-initiated session conclusions

a) This measurement provides the number of successful PDP context deactivations initiated by GGSN.

b) CC.

c) The measurement is incremented on receipt by the GGSN of a DELETE PDP CONTEXT RESPONSE message with cause "Request Accepted". See TS 29.060 [6].

d) Integer.

e) SM.SuccDeactPdpCtxtGgsn.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling community.

5.2 Per APN measurements

These measurements will only be provided for a subset of all the APNs of the GGSN (see TS 23.003 [9] for APN definition). The way the list of monitored APNs is configured is outside the scope of the present document.

5.2.1 Session establishments

The performance counters presented in this subclause are intended to bring a more detailed view on session activations compared to counters defined in subclause 1.1. Especially, they enable to monitor the session establishment success rate when user authentication is required and when a dynamic PDP address is to be allocated by the GGSN.

Furthermore, the definition of "per APN" measurements allows to let performance monitoring focus on a "specific service" handled by a GGSN: TS 23.003 [9] indicates that an APN Network Identifier may be used to access a service associated with a GGSN and that this may be achieved by defining:

- an APN that corresponds to a DNS name of a GGSN and is locally interpreted by the GGSN as a request for a specific service; or

- an APN Network Identifier consisting of 3 or more labels and starting with a Reserved Service Label, or an APN Network Identifier consisting of a Reserved Service Label alone, that indicates a GGSN by the nature of the requested service.

The figure below, from TS 29.061 [10] details the message sequence during a PDP context activation for the non-transparent IP case, where a dynamic PDP address is to be allocated and user authentication is required.
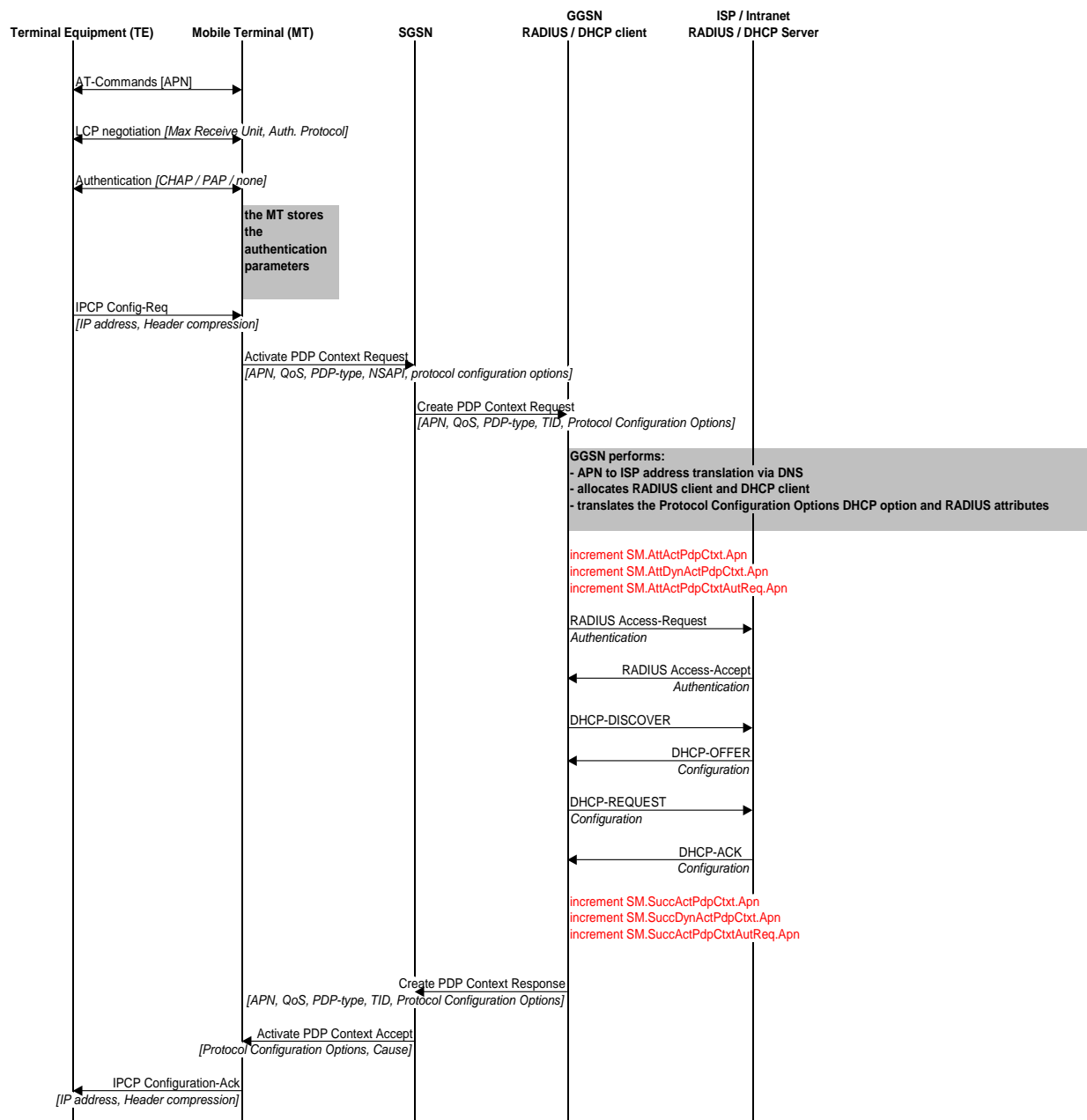
Figure

5.2.1.1 Session establishments, per APN

5.2.1.1.1 Attempted session establishments, per APN

a) This measurement provides the number of PDP context activation procedures on a per APN of the GGSN basis.

b) CC.

c) The measurement is incremented on receipt by the GGSN of a CREATE PDP CONTEXT REQUEST message from the SGSN. See TS 29.060 [6].

d) Integer.

e) SM.AttActPdpCtxt.Apn.

f) GgsnFunction, per APN.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Operator Business and Vendor Performance Modelling communities.

5.2.1.1.2 Successfully established sessions, per APN

a) This measurement provides the number of successfully completed activation PDP context procedures on a per APN of the GGSN basis.

b) CC.

c) The measurement is incremented on transmission of a CREATE PDP CONTEXT RESPONSE message with cause "Request Accepted " from GGSN. See TS 29.060 [6].

d) Integer.

e) SM.SuccActPdpCtxt.Apn.

f) GgsnFunction, per APN.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Operator Business and Vendor Performance Modelling communities.

5.2.1.2 Session establishments with dynamic PDP address allocation required, per APN

5.2.1.2.1 Attempted session establishments with dynamic PDP address allocation required, per APN

a) This measurement provides the number of dynamic PDP context activation procedures where a dynamic PDP address is requested on a per APN of the GGSN basis.

b) CC.

c) The measurement is incremented on receipt by the GGSN of a CREATE PDP CONTEXT REQUEST message with an empty PDP address, which indicates that the MS requires a dynamic PDP address. See TS 29.060 [6].

d) Integer.

e) SM.AttDynActPdpCtxt.Apn.

f) GgsnFunction, per APN.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling and Operator Maintenance communities.

5.2.1.2.2 Successfully established sessions with dynamic PDP address allocation required, per APN

a) This measurement provides the number of successfully attempted dynamic PDP context activation procedures where a dynamic PDP address is requested on a per APN of the GGSN basis.

b) CC.

c) The measurement is incremented on transmission by the GGSN of a CREATE PDP CONTEXT RESPONSE message with cause "Request Accepted" where the PDP address has been dynamically assigned. See TS 23.060 [2] and TS 29.060 [6].

d) Integer.

e) SM.SuccDynActPdpCtxt.Apn.

f) GgsnFunction, per APN.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling and Operator Maintenance communities.

5.2.1.3 Session establishments with user authentication required, per APN

5.2.1.3.1 Attempted session establishments with user authentication required, per APN

a) This measurement provides the number of PDP context activation procedures for which user authentication is required.

b) CC.

c) The measurement is incremented when a CREATE PDP CONTEXT REQUEST message is received by the GGSN, for which protocol configuration options indicates that user authentication is required to access the external PDN. See TS 29.060 [6] and TS 24.008 [15].

d) Integer.

e) SM.AttActPdpCtxtAutReq.Apn.

f) GgsnFunction, per APN.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling and Operator Maintenance communities.

5.2.1.3.2 Failed session establishments due to user authentication failure, per APN

a) This measurement provides the number of PDP context activation procedures failed due to user authentication failure.

b) CC.

c) The measurement is incremented when a CREATE PDP CONTEXT RESPONSE message with cause "User Authentication Failed" is received by the GGSN. See TS 29.060 [6] and TS 24.008 [15].

d) Integer.

e) SM.FailActPdpCtxtAutReq.Apn.

f) GgsnFunction, per APN.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling and Operator Maintenance communities.

5.2.2 Active sessions

The performance counters presented in this subclause are defined on a per APN basis and are mainly intended:

- to monitor the repartition of QoS attributes defined for current active sessions; and

- to establish a session profile. A session profile details the number of elementary procedures per active session (PDP context modifications, updates, …), usually during a busy hour.

5.2.2.1 Number of simultaneous active sessions, per APN

a) This measurement provides the current number of simultaneous active sessions per APN. This measurement is split into subcounters per traffic class and allocation/retention priority (or precedence class) indicated in the QoS profile.

b) GAUGE.

c) The relevant measurement is incremented on transmission by the GGSN of a CREATE PDP CONTEXT RESPONSE message with cause "Request Accepted" according to the traffic class or allocation/retention priority indicated in the QoS profile.
The relevant measurement is decremented on transmission or receipt of DELETE PDP CONTEXT RESPONSE with cause "Request Accepted" according to the traffic class or the allocation/retention priority of the PDP context.
In case of a PDP context activated with R97/98 QoS attributes, the fields traffic class and allocation/retention priority used for screening are derived from delay class and precedence class respectively, as ruled in TS 23.107 [8].
See also TS 24.008 [15] and TS 29.060 [6].

d) A single integer value per measurement type defined in e).

e) SM.NbrActPdpCtxt.Apn.Low
SM.NbrActPdpCtxt.Apn.Medium
SM.NbrActPdpCtxt.Apn.High
SM.NbrActPdpCtxt.Apn.Conv
SM.NbrActPdpCtxt.Apn.Strm
SM.NbrActPdpCtxt.Apn.Intact
SM.NbrActPdpCtxt.Apn.Bgrd.

f) GgsnFunction, per APN.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Operator Business and Vendor Performance Modelling communities.

5.2.2.2 Peak number of simultaneous active sessions, per APN

a) This measurement provides the peak number of active PDP contexts in GGSN per APN. This measurement is obtained by comparing following an update of the actual number of active PDP context in GGSN per APN, this value with the currently maximal value within the actual granularity period.

b) GAUGE.

c) The measurement is incremented on transmission by the GGSN of a CREATE PDP CONTEXT RESPONSE message with cause "Request Accepted" and decremented on transmission or receipt by the GGSN of a DELETE PDP CONTEXT RESPONSE message with cause "Request Accepted". The measurement value keeps track of the highest value experienced in the collection interval. See TS 29.060 [6].

d) Integer.

e) SM.MaxNbrActPdpCtxt.Apn.

f) GgsnFunction, per APN.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Operator Business and Vendor Performance Modelling communities.

5.2.2.3 MS & SGSN-initiated session modifications, per APN

5.2.2.3.1 Attempted MS & SGSN-initiated session modifications, per APN

a) This measurement provides the number of PDP context updates attempted, either by MS or SGSN.

b) CC.

c) The measurement is incremented on receipt by the GGSN of an UPDATE PDP CONTEXT REQUEST message. See TS 29.060 [6].

d) Integer.

e) SM.AttUpdPdpCtxtMsAndSgsn.Apn.

f) GgsnFunction, per APN.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling community.

5.2.2.3.2 Successfully performed MS & SGSN-initiated session modifications, per APN

a) This measurement provides the number of successfully performed PDP context updates initiated either by MS or SGSN.

b) CC.

c) The measurement is incremented on transmission by the GGSN of an UPDATE PDP CONTEXT RESPONSE message with cause "Request Accepted". See TS 29.060 [6].

d) Integer.

e) SM.SuccUpdPdpCtxtMsAndSgsn.Apn.

f) GgsnFunction, per APN.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling community.

5.2.3 Session conclusions

5.2.3.1 MS-initiated session conclusions, per APN

5.2.3.1.1 Attempted MS-initiated session conclusions, per APN

a) This measurement provides the number of PDP context deactivation procedures initiated by the MS on a per APN of the GGSN basis.

b) CC.

c) The measurement is incremented on receipt by the GGSN of a DELETE PDP CONTEXT REQUEST message from the SGSN. See TS 23.060 [2] and TS 29.060 [6].

d) Integer.

e) SM.AttDeactPdpCtxtMs.Apn.

f) GgsnFunction, per APN.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling community.

5.2.3.1.2 Successful MS-initiated session conclusions, per APN

a) This measurement provides the number of successfully completed PDP context deactivation procedures initiated by the MS on a per APN of the GGSN basis.

b) CC.

c) The measurement is incremented on transmission by the GGSN of a DELETE PDP CONTEXT RESPONSE message with cause "Request Accepted" to the SGSN. See TS 29.060 [6].

d) Integer.

e) SM.SuccDeactPdpCtxtMs.Apn.

f) GgsnFunction, per APN.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling community.

5.2.3.2 GGSN-initiated session conclusions, per APN

5.2.3.2.1 Attempted GGSN-initiated session conclusions, per APN

a) This measurement provides the number of PDP context deactivation procedures initiated by the GGSN, on a per APN of the GGSN basis.

b) CC.

c) The measurement is incremented on transmission by the GGSN of a DELETE PDP CONTEXT REQUEST message to the SGSN. See TS 29.60.

d) Integer.

e) SM.AttDeactPdpCtxtGgsn.Apn.

f) GgsnFunction, per APN.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling community.

5.2.3.2.2 Successful GGSN-initiated session conclusions, per APN

a) This measurement provides the number of successfully completed PDP context deactivation procedures initiated by the GGSN, on a per APN of the GGSN basis.

b) CC.

c) The measurement is incremented on receipt of DELETE PDP CONTEXT RESPONSE message with cause "Request Accepted" from the SGSN.

d) Integer.

e) SM.SuccDeactPdpCtxtGgsn.Apn.

f) GgsnFunction, per APN.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling community.

5.3 GTP measurements

The performance counters presented in this subclause are mainly intended to:

- monitor the signalling and bearer traffic exchanged between the GGSN and peer GSNs;

- establish the session profile (including GTP average packet size, signalling overhead, uplink and downlink GTP traffic per session, …); and

- monitor the GGSN load (through measurements such as the total bit rate handled by the node, the number of GTP tunnels handled or the ratio of packets discarded at GGSN level).

These counters are associated to GPRS Tunnelling Protocol (GTP-C and GTP-U), between the SGSN and the GGSN, and defined in TS 23.060 [2] and TS 29.060 [6]. The breakdown per traffic class allows to monitor the way traffic is handled by the GGSN according to QoS attributes attached to the relevant PDP context.

5.3.1 Number of incoming GTP data packets on the Gn interface

a) This measurement provides the number of GTP Data Packets received on the Gn interface. This measurement is split into subcounters per traffic class.

b) CC.

c) The relevant measurement is incremented on receipt of a GTP data packet on the Gn interface, according to the traffic class of the related PDP context. In case of a PDP context activated with R97/98 QoS attributes, the field traffic class used for screening is derived from delay class, as ruled in TS 23.107 [8]. See also TS 29.060 [6].

d) A single integer value per measurement type defined in e).

e) GTP.IncDataPkt.Bgrd
   GTP.IncDataPkt.Conv
   GTP.IncDataPkt.Intact
   GTP.IncDataPkt.Strm.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling, Operator Traffic Engineering and Vendor Development Engineering communities.

5.3.2 Number of outgoing GTP data packets on the Gn interface

a) This measurement provides the number of GTP Data Packets sent onto the Gn interface. This measurement is split into subcounters per traffic class.

b) CC.

c) The relevant measurement is incremented on transmission of a GTP data packet on the Gn interface, according to the traffic class indicated in the QoS profile of the related PDP context. In case of a PDP context activated with R97/98 QoS attributes, the field traffic class used for screening is derived from delay class, as ruled in TS 23.107 [8]. See also TS 29.060 [6].

d) A single integer value per measurement type defined in e).

e) GTP.OutDataPkt.Bgrd
GTP.OutDataPkt.Conv
GTP.OutDataPkt.Intact
GTP.OutDataPkt.Strm.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling, Operator Traffic Engineering and Vendor Development Engineering communities.

5.3.3 Number of discarded GTP data packets

a) This measurement provides the number of GTP Data Packets discarded. This measurement is split into subcounters per traffic class.

b) CC.

c) The relevant measurement is incremented when a GTP data packet is discarded, according to the traffic class indicated in the QoS profile of the related PDP context. In case of a PDP context activated with R97/98 QoS attributes, the field traffic class used for screening is derived from delay class, as ruled in TS 23.107 [8]. See also TS 29.060 [6].

d) A single integer value per measurement type defined in e).

e) GTP.DiscDataPkt.Bgrd
GTP.DiscDataPkt.Conv
GTP.DiscDataPkt.Intact
GTP.DiscDataPkt.Strm.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling, Operator Traffic Engineering and Vendor Development Engineering communities.

5.3.4 Number of octets of incoming GTP data packets on the Gn interface

a) This measurement provides the number of GTP payload octets received. This measurement is split into subcounters per traffic class.

b) CC.

c) The relevant measurement is incremented on receipt of a GTP data packet on the Gn interface, according to the traffic class indicated in the QoS profile of the related PDP context. In case of a PDP context activated with R97/98 QoS attributes, the field traffic class used for screening is derived from delay class, as ruled in TS 23.107 [8]. The data packet size is extracted from the GTP header and added on to the measurement value. See TS 29.060 [6].

d) A single integer value per measurement type defined in e).

e) GTP.IncDataOct.Bgrd
GTP.IncDataOct.Conv
GTP.IncDataOct.Intact
GTP.IncDataOct.Strm.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling and Operator Traffic Engineering communities.

5.3.5 Number of octets of outgoing GTP data packets on the Gn interface

a) This measurement provides the number of GTP payload octets sent. This measurement is split into subcounters per traffic class.

b) CC.

c) The relevant measurement is incremented on transmission of a GTP data packet on the Gn interface, according to the traffic class indicated in the QoS profile of the related PDP context. In case of a PDP context activated with R97/98 QoS attributes, the field traffic class used for screening is derived from delay class, as ruled in TS 23.107 [8]. The data packet size is extracted from the GTP header and added on to the measurement value. See TS 29.060 [6].

d) A single integer value per measurement type defined in e).

e) GTP.OutDataOct.Bgrd
GTP.OutDataOct.Conv
GTP.OutDataOct.Intact
GTP.OutDataOct.Strm.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling and Operator Traffic Engineering communities.

5.3.6 Number of incoming GTP signalling packets on the Gn interface

a) This measurement provides the number of GTP signalling packets received on the Gn interface. This measurement is split into subcounters per traffic class.

b) CC.

c) The relevant measurement is incremented on receipt of a GTP signalling packet on the Gn interface, according to the traffic class of the related PDP context. In case of a PDP context activated with R97/98 QoS attributes, the field traffic class used for screening is derived from delay class, as ruled in TS 23.107 [8]. See also TS 29.060 [6].

d) A single integer value per measurement type defined in e).

e) GTP.IncSigPkt.Bgrd
GTP.IncSigPkt.Conv
GTP.IncSigPkt.Intact
GTP.IncSigPkt.Strm.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling, Operator Traffic Engineering and Vendor Development Engineering communities.

5.3.7 Number of outgoing GTP signalling packets on the Gn interface

a) This measurement provides the number of GTP signalling packets sent onto the Gn interface. This measurement is split into subcounters per traffic class.

b) CC.

c) The relevant measurement is incremented on transmission of a GTP signalling packet on the Gn interface, according to the traffic class indicated in the QoS profile of the related PDP context. In case of a PDP context activated with R97/98 QoS attributes, the field traffic class used for screening is derived from delay class, as ruled in TS 23.107 [8]. See also TS 29.060 [6].

d) A single integer value per measurement type defined in e).

e) GTP.OutSigPkt.Bgrd
GTP.OutSigPkt.Conv
GTP.OutSigPkt.Intact
GTP.OutSigPkt.Strm.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling, Operator Traffic Engineering and Vendor Development Engineering communities.

5.3.8 Number of discarded GTP signalling packets

a) This measurement provides the number of GTP signalling packets discarded. This measurement is split into subcounters per traffic class.

b) CC.

c) The relevant measurement is incremented when a GTP signalling packet is discarded, according to the traffic class indicated in the QoS profile of the related PDP context. In case of a PDP context activated with R97/98 QoS attributes, the field traffic class used for screening is derived from delay class, as ruled in TS 23.107 [8]. See also TS 29.060 [6].

d) A single integer value per measurement type defined in e).

e) GTP.DiscSigPkt.Bgrd
GTP.DiscSigPkt.Conv
GTP.DiscSigPkt.Intact
GTP.DiscSigPkt.Strm.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling, Operator Traffic Engineering and Vendor Development Engineering communities.

5.3.9 Number of octets of incoming GTP signalling packets on the Gn interface

a) This measurement provides the number of octets of received GTP signalling packets. This measurement is split into subcounters per traffic class.

b) CC.

c) The relevant measurement is incremented on receipt of a GTP signalling packet on the Gn interface, according to the traffic class indicated in the QoS profile of the related PDP context. In case of a PDP context activated with R97/98 QoS attributes, the field traffic class used for screening is derived from delay class, as ruled in TS 23.107 [8]. The signalling packet size is extracted from the GTP header and added on to the measurement value. See TS 29.060 [6].

d) A single integer value per measurement type defined in e).

e) GTP.IncSigOct.Bgrd
GTP.IncSigOct.Conv
GTP.IncSigOct.Intact
GTP.IncSigOct.Strm.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling and Operator Traffic Engineering communities.

5.3.10 Number of octets of outgoing GTP signalling packets on the Gn interface

a) This measurement provides the number of octets of sent GTP signalling packets. This measurement is split into subcounters per traffic class.

b) CC.

c) The relevant measurement is incremented on transmission of a GTP signalling packet on the Gn interface, according to the traffic class indicated in the QoS profile of the related PDP context. In case of a PDP context activated with R97/98 QoS attributes, the field traffic class used for screening is derived from delay class, as ruled in TS 23.107 [8]. The signalling packet size is extracted from the GTP header and added on to the measurement value. See TS 29.060 [6].

d) A single integer value per measurement type defined in e).

e) GTP.OutSigOct.Bgrd
GTP.OutSigOct.Conv
GTP.OutSigOct.Intact
GTP.OutSigOct.Strm.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling and Operator Traffic Engineering communities.

5.3.11 Number of GTP tunnels on the Gn interface

a) This measurement provides the current number of simultaneous GTP tunnels on Gn interface handled by the GGSN.

b) GAUGE.

c) The measurement is incremented on transmission by the GGSN of a CREATE PDP CONTEXT RESPONSE message with cause "Request Accepted".
It is decremented on transmission by the GGSN of a DELETE PDP CONTEXT RESPONSE message with cause "Request Accepted".
The measurement includes GTP tunnels for data (user plane) as well as GTP tunnels for signalling (control plane). See TS 29.060 [6].

d) Integer.

e) GTP.NbrTunnels.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling and Operator Traffic Engineering communities.

5.3.12   Number of GTP tunnels created on the Gn interface

a) This measurement provides the number of GTP Tunnels created on Gn interface.

b) CC.

c) The measurement is incremented on transmission by the GGSN of a CREATE PDP CONTEXT RESPONSE message with cause "Request Accepted".
The measurement includes GTP tunnels for data (user plane) as well as GTP tunnels for signalling (control plane). See TS 29.060 [6].

d) Integer.

e) GTP.NbrCreatTunnels.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling and Operator Traffic Engineering communities.

5.4   GTP' measurements

The performance counters presented in this subclause are intended to monitor the transfer of G-CDRs to the CGF; in particular

- The number of CDR transfer attempts, together with the cause triggering the transfer enables to dimension both the CGF / Billing System and the Ga interface. The breakdown of causes for transfer attempts may also help in tuning the parameters associated to partial CDR creation.

- The breakdown of causes for transfer failure is provided to track and investigate any problem that could be detected thanks to the CDR transfer success rate.

These counters are associated to the GTP' protocol between the GGSN and the CGF, as defined in TS 29.060 [6] and TS 32.015.

The figure below from TS 32.015 shows a normal CDR transfer between a GSN and a CGF and details the events triggering the update of the counters values.
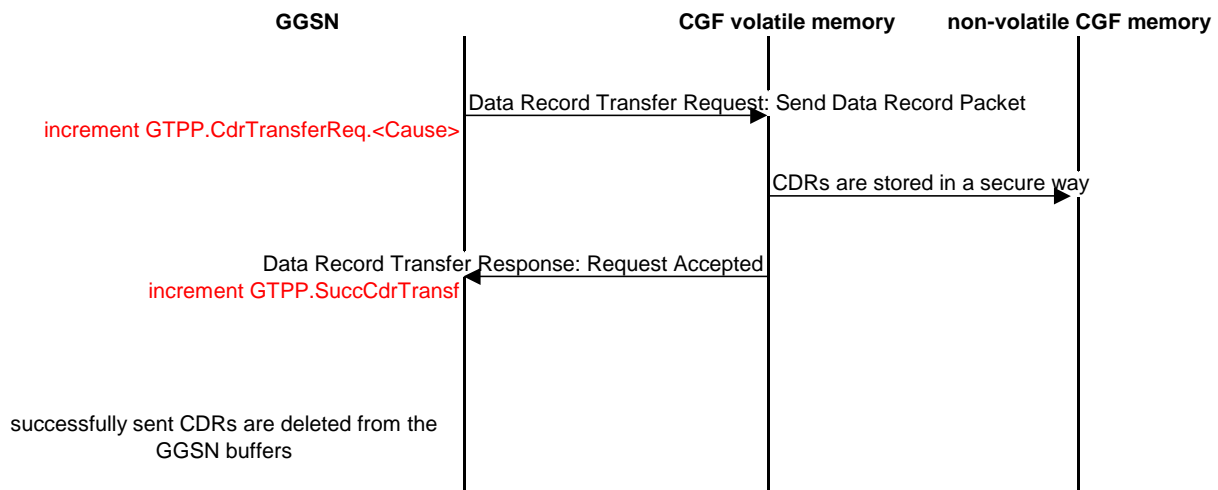
Figure from TS 32.015

The three measurement types defined in the clause 5.4 are subject to the "2 out of 3 approach".

5.4.1 Attempted CDR information transfers

a) This measurement provides the number of CDR information transfers attempted. This measurement is split into subcounters per transfer triggering cause.

b) CC.

c) The relevant measurement is incremented when a DATA RECORD TRANSFER REQUEST message used to transmit CDR information is sent to the CGF, according to the cause that triggered the transfer. Possible causes are included in TS 32.015.

d) Each measurement is an integer value.

e) The measurement name has the form GTPP.CdrTransfReq.Cause
where Cause indicates the cause that triggered the transfer.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling and Operator Traffic Engineering communities.

5.4.2 Successful CDR information transfers

a) This measurement provides the number of CDR information successfully transmitted to CGF.

b) CC.

c) The measurement is incremented on receipt by the GGSN of a DATA RECORD TRANSFER RESPONSE message with cause code "Request Accepted".

d) Integer.

e) GTPP.SuccCdrTransf.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling and Operator Traffic Engineering communities.

5.4.3 Failed CDR information transfers

a) This measurement provides the number of CDR information failed to be transferred to CGF. This measurement is split into subcounters per failure cause. Possible causes are included in TS 32.015.

b) CC.

c) The relevant measurement is incremented on receipt by the GGSN of a DATA RECORD TRANSFER RESPONSE message according to the failure cause.

d) Each measurement is an integer value.

e) The measurement name has the form GTPP.FailCdrTransf.Cause
where Cause indicates the failure cause.

f) GgsnFunction.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling, Operator Maintenance and Operator Traffic Engineering communities.

5.5 IP measurements

The performance counters presented in this subclause are mainly intended to:

- monitor the bearer traffic exchanged between the GGSN and the external PDN on the Gi interface;

- establish the session profile (including IP average packet size, uplink and downlink IP traffic per session, …), possibly per traffic class; and

- monitor the GGSN load (through measurements such as the total bit rate handled by the node, the ratio of packets discarded at GGSN level, …).

These counters are associated to IP protocol on the Gi interface.

These counters are proposed to be screened with regards to the protocol configuration options, as defined in TS 24.008 [15] and TS 29.061 [10], i.e. a set of the counters is associated to any valid combination of the different options below:

- transparent or non-transparent access to the external PDN;

- user data encryption (IPSec, …);

- tunnelling of packets onto the Gi interface.

Any valid combination of these options fully defines a "Gi reference point". The figure below gives an overview of some Gi reference points.
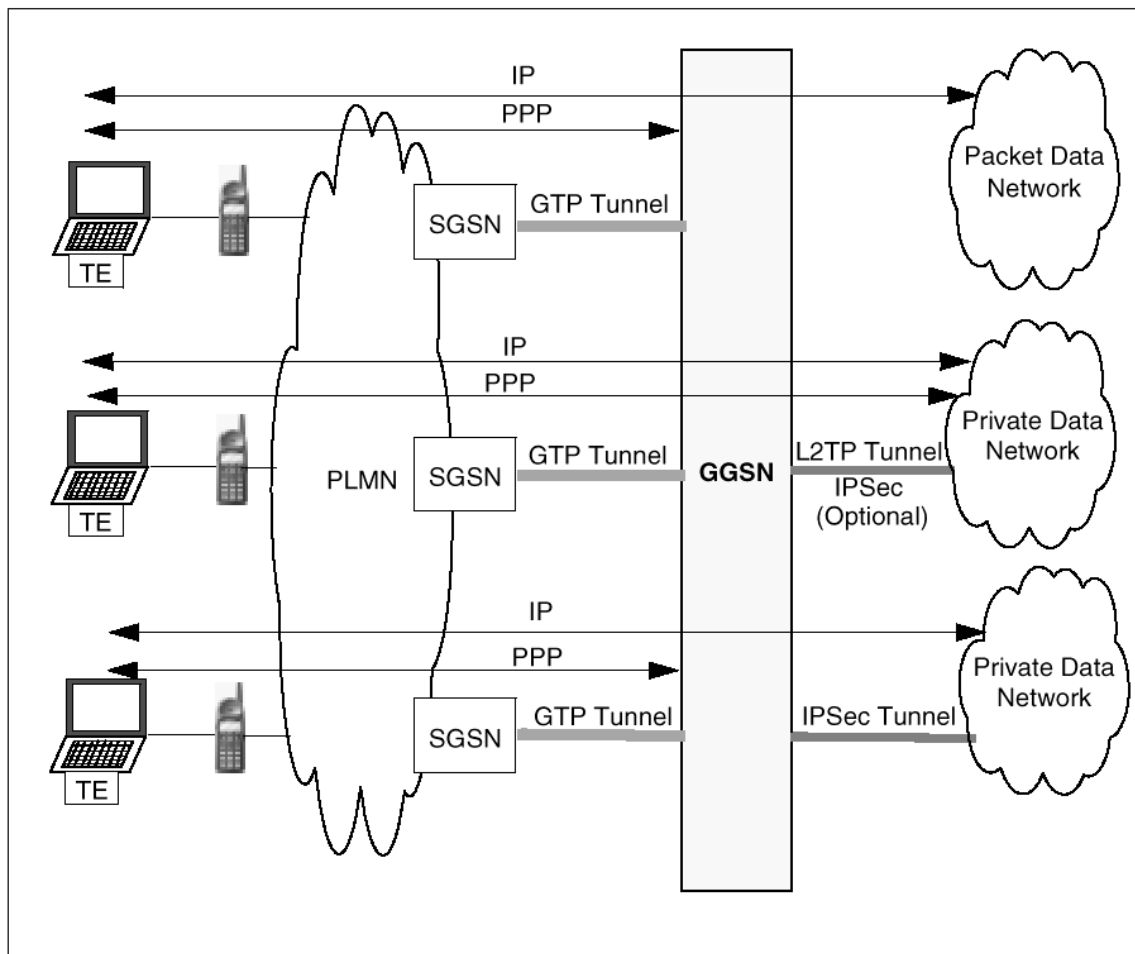
Figure: Overview of some Gi reference points

5.5.1   Number of incoming IP data packets on the Gi interface

This measurement provides the number of IP data packets received on the Gi interface. This measurement is split into subcounters per traffic class of the related PDP context.

    a) CC.

    b) The relevant measurement is incremented on receipt of an IP data packet on the Gi interface, according to the traffic class of the related PDP context. In case of a PDP context activated with R97/98 QoS attributes, the field traffic class used for screening is derived from delay class, as ruled in TS 23.107 [8]. See also 07 and TS 29.061 [10].

    c) A single integer value per measurement type defined in e).

    d) IP.IncDataPkt.Bgrd
       IP.IncDataPkt.Conv
       IP.IncDataPkt.Intact
       IP.IncDataPkt.Strm.

    e) GgsnFunction, per Gi reference point.

    f) Valid for packet switched traffic.

    g) COMB.

    h) This measurement is mainly dedicated to Vendor Performance Modelling, Operator Traffic Engineering and Vendor Development Engineering communities.

5.5.2 Number of outgoing IP data packets on the Gi interface

a) This measurement provides the number of IP data packets sent onto the Gi interface. This measurement is split into subcounters per traffic class of the related PDP context.

b) CC.

c) The relevant measurement is incremented on transmission of an IP data packet on the Gi interface, according to the traffic class of the related PDP context. In case of a PDP context activated with R97/98 QoS attributes, the field traffic class used for screening is derived from delay class, as ruled in TS 23.107 [8]. See also TS 29.061 [10].

d) A single integer value per measurement type defined in e).

e) IP.OutDataPkt.Bgrd
IP.OutDataPkt.Conv
IP.OutDataPkt.Intact
IP.OutDataPkt.Strm.

f) GgsnFunction, per Gi reference point.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling, Operator Traffic Engineering and Vendor Development Engineering communities.

5.5.3 Number of IP data packets discarded due to node congestion

a) This measurement provides the number of IP data packets discarded. This measurement is split into subcounters per traffic class of the related PDP context.

b) CC.

c) The relevant measurement is incremented when a received IP data packet is discarded due to node congestion, according to the traffic class of the related PDP context. In case of a PDP context activated with R97/98 QoS attributes, the field traffic class used for screening is derived from delay class, as ruled in TS 23.107 [8]. See also TS 29.061 [10].

d) A single integer value per measurement type defined in e).

e) IP.DiscDataPkt.Bgrd
IP.DiscDataPkt.Conv
IP.DiscDataPkt.Intact
IP.DiscDataPkt.Strm.

f) GgsnFunction, per Gi reference point.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling, Operator Traffic Engineering and Vendor Development Engineering communities.

5.5.4 Number of octets of incoming IP data packets on the Gi interface

a) This measurement provides the number of IP payload octets received on the Gi interface. This measurement is split into subcounters per traffic class of the related PDP context.

b) CC.

c) The relevant measurement is incremented on receipt of an IP data packet on the Gi interface, according to the traffic class of the related PDP context. In case of a PDP context activated with R97/98 QoS attributes, the field

traffic class used for screening is derived from delay class, as ruled in TS 23.107 [8]. The data packet size is extracted from the IP header and added on to the measurement value. See TS 29.061 [10].

d) A single integer value per measurement type defined in e).

e) IP.IncDataOct.Bgrd
   IP.IncDataOct.Conv
   IP.IncDataOct.Intact
   IP.IncDataOct.Strm.

f) GgsnFunction, per Gi reference point.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling and Operator Traffic Engineering communities.

5.5.5 Number of octets of outgoing IP data packets on the Gi interface

a) This measurement provides the number of IP payload octets sent onto the Gi interface. This measurement is split into subcounters per traffic class of the related PDP context.

b) CC.

c) The relevant measurement is incremented on transmission of an IP data packet on the Gi interface, according to the traffic class of the related PDP context. In case of a PDP context activated with R97/98 QoS attributes, the field traffic class used for screening is derived from delay class, as ruled in TS 23.107 [8]. The data packet size is extracted from the IP header and added on to the measurement value. See TS 29.061 [10].

d) A single integer value per measurement type defined in e).

e) IP.OutDataOct.Bgrd
   IP.OutDataOct.Conv
   IP.OutDataOct.Intact
   IP.OutDataOct.Strm.

f) GgsnFunction, per Gi reference point.

g) Valid for packet switched traffic.

h) COMB.

i) This measurement is mainly dedicated to Vendor Performance Modelling and Operator Traffic Engineering communities.

5.6 AAA Authentication measurements

The performance counters presented in this subclause are mainly intended to:

- monitor the AAA server performance;

- monitor the network connectivity.

These counters are associated to the AAA server, which is playing a more and more important role in a 3G environment, and is defined in RFC 2903 [17].

The figure below presents the message sequence during an AAA authentication procedure initiated by the GGSN.
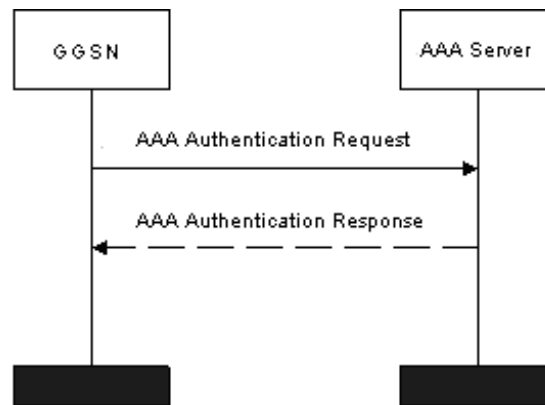
Figure: AAA authentication procedure initiated by GGSN

NOTE: In Radius, the AAA Authentication Request message is Access-Request and AAA Authentication Response is Access-Accept/ Access-Reject/ Access-Challenge (RFC 2138 [18]), where the AAA successful authentication response message is Access-Accept.

5.6.1 Attempted Authentication Procedures, per APN

a) This measurement provides the number of attempted authentication procedures per APN.

b) CC.

c) Transmission by the GGSN of an AAA authentication request message to the AAA server.

d) A single integer value.

e) AAA.AttAuthQuery.Apn.

f) GgsnFunction, per APN.

g) Valid for packet switched traffic.

h) Combined

5.6.2 Successful Authentication Procedures, per APN

a) This measurement provides the number of successful authentication procedures per APN.

b) CC.

c) Receipt by the GGSN of an AAA successful authentication response message from the AAA server.

d) A single integer value.

e) AAA.SuccAuthResp.Apn.

f) GgsnFunction, per APN.

g) Valid for packet switched traffic.

h) Combined.

Annex A (informative):
Use cases for performance measurements

A.1 Use case of implicit detach related measurements

This measurement provides the number of implicit detach procedures initiated by SGSN. After the mobile reachable timer expires, the SGSN may initiate an implicit detach procedure in order to return the MM contexts in the SGSN to IDLE state. Normally, an appropriate configuration of the timer will make the ratio of the number of implicit detach procedures to the total number of detach procedures at the SGSN side increase and decrease around a specific value resulting in an acceptable quality of service for the users. If an incorrect configuration of the timer results in this ratio being too high, the users will be implicitly detached a large number of times while using a certain application service. This is one of the issues of mobility management and the user's experience will be impaired. Furthermore, this measurement could help operators to analyse users' behaviour when the ratio has changed considerably during a specific time interval.

A.2 Use case of service request related measurements

Service request procedure is one of the important procedures initiated by MS or network when it is in PMM-IDLE state and has some data to send or receive (after the paging procedure). If the service request success rate is lower than predefined threshold, the user experience of sending / receiving the data will be affected.

A.3 Use case of Mean number of activated PDP contexts with direct tunnel related measurements

Direct Tunnel is an optional function in Iu mode that allows the SGSN to establish a direct user plane tunnel between RAN and GGSN (for connectivity with GGSN through Gn/Gp) or S-GW (for connectivity through S4) within the PS domain.

Mean number of activated PDP contexts with direct tunnel related measurements could help to reflect the ratio of mean number of activated PDP contexts with direct tunnel to mean number of activated PDP contexts. The mean number of activated PDP contexts is a different measurement from the mean number of subscribers with activated PDP context and direct tunne, which is focus on the number of activated PDP context and help operator to know about the network's plattening level. If a Secondary PDP Context Activation procedure is initiated, the mean number of activated PDP context with direct tunnel could be more than the mean number of subscribers with activated PDP context and direct tunne because a subscriber could have more than one activated PDP context.

A.4 Use case of direct tunnel related measurements

Measurements provides the number of subscribers with activated PDP context and SGSN-Initiated PDP context update procedures with direct tunnel established between RAN and GGSN by SGSN. The measurements reflect the usage of direct user plane tunnel between RAN and GGSN and SGSN-Initiated PDP context update success rate with direct tunnel, to help operators analyze service quality in PS domain more deeply.

Annex B (informative):
Change history

					Change history			
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Cat**	**Old**	**New**
Mar 2006	SA_31	SP-060109	--	--	Split of 32.403-710 into four new TSs 32.404, 32.405, 32.406, 32.408. Submitted to TSG SA #31 for Approval.	--	1.0.0	7.0.0
Jun 2006	SA_32	SP-060260	0001	--	Move SMS related Measurements from 32.406 to 32.408	F	7.0.0	7.1.0
Dec 2008	SA_42	--	--	--	Upgrade to Release 8	--	7.1.0	8.0.0
Dec 2009	--	--	--	--	Upgrade to Release 9	--	8.0.0	9.0.0
Jun 2010	SA_48	SP-100264	002	--	Correct reference of measurements cause	F	9.0.0	10.0.0
May 2011	SA_52	SP-110286	003	--	Add the measurement of number of implicit detach procedure	B	10.0.0	11.0.0
Sep 2011	SA_53	SP-110535	004	--	Addition of Direct Tunnel Related Measurements	B	11.0.0	11.1.0
Sep 2011	SA_53	SP-110535	005	--	Add service request procedure related measurements	B	11.0.0	11.1.0
Sep 2011	SA_53	SP-110535	006	--	Add mean number of activated PDP contexts with direct tunnel related measurements	B	11.0.0	11.1.0
Dec 2011	SA_54	SP-110713	007	--	Addition of Iupslink to GTP-U Iu related measurements	B	11.1.0	11.2.0
Mar 2012	SA-55	SP-120051	0010	--	Addition of RoutingArea to attached subscribers related measurements	B	11.2.0	11.3.0