Technical Specification Group Services and System Aspects
Meeting #16, Marco Island, Florida, 10-13 June 2002

TSGS#16(02)0291

Source: **SA5 (Telecom Management)**

Title: **4 Rel-5 CR 32.403 (Performance measurements - UMTS and combined UMTS/GSM)**

Document for: **Approval**

Agenda Item: **7.5.3**

Doc-1st -Level	Spec	CR	R	Phase	Subject	Cat	Ver Cur	Ver New	Doc-2nd -Level	Workitem
SP-020291	32.403	003	2	Rel-5	Introduction of "Performance Measurements Definition Process" describing the repeatable, top-down process to define measurements for inclusion in future 3GPP Releases	F	4.2.0	5.0.0	S5-028137	OAM-PM
SP-020291	32.403	004	-	Rel-5	Adding performance measurement definitions related to GGSN	B	4.2.0	5.0.0	S5-028120	OAM-PM
SP-020291	32.403	005	-	Rel-5	Introduction of an optional "Purpose" clause in the measurement template	B	4.2.0	5.0.0	S5-028142	OAM-PM
SP-020291	32.403	006	-	Rel-5	Addition of explanatory text for Radio Access Bearer (RAB) measurements	D	4.2.0	5.0.0	S5-028141	OAM-PM

3GPP TSG-SA5 (Telecom Management) **S5-028137**
Meeting #28, Sophia Antipolis, FRANCE, 20 - 24 May 2002

CR-Form-v5

CHANGE REQUEST

⌘ **32.403** **CR** **003** ⌘**rev** **2** ⌘ Current version: **4.2.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☐

Title:	⌘	Introduction of "Performance Measurements Definition Process" describing the repeatable, top-down process to define measurements for inclusion in future 3GPP Releases
Source:	⌘	SA5
Work item code:	⌘	OAM-PM
Date:	⌘	24/05/2002
Category:	⌘	**F**
Release:	⌘	*REL-5*

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	Repeatable process for defining measurements is currently not addressed in TS 32.403.
Summary of change:	⌘	Adding an informative annex containing a description of a performance measurement process. This includes the definitions of performance measurement user communities.
Consequences if not approved:	⌘	Companies will not understand the repeatable, top-down approach to define measurements that can be contributed to SA5 for potential inclusion in future 3GPP Releases.

Clauses affected:	⌘	Introduction, 2, 3.2, Annex B (new), Annex C
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	This version of this CR addresses the SA concerns discussed during SA #15 shown below. Reason for rejection: in annex B there are some "politically inappropriate" statements about the wireless industry (in clauses B.1 and B.2).

Introduction

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 3GPP 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.

Appendix B has been added to help in the definition of new performance measurements that can be submitted to 3GPP for potential adoption and inclusion in this technical specification. Appendix B discusses a top-down performance measurement definition methodology that focuses on how the end user of performance measurements can use the 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, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TS 32.101: "3G Telecom Management: Principles and high level requirements".

[2] 3GPP TS 32.102: "3G Telecom Management architecture".

[3] 3GPP TS 32.600: "Telecommunication Management; Configuration Management; 3G configuration management; Concept and main requirements".

[4] 3GPP TS 25.331: "RRC Protocol Specification".

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

[6] 3GPP TS 25.423: "UTRAN Iur Interface RNSAP Signalling".

[7] 3GPP TS 25.433: "UTRAN Iub Interface NBAP Signalling".

[8] 3GPP TS 23.107: "QoS Concept and Architecture".

[9] 3GPP TS 32.622: "Telecommunication Management; Configuration Management; Generic network resources IRP: NRM".

[10] 3GPP TS 32.632: "Telecommunication Management; Configuration Management; Core Network Resources IRP: NRM".

[11] 3GPP TS 32.642: "Telecommunication Management; Configuration Management; UTRAN network resources IRP: NRM".

[12] 3GPP TS 32.401: "Telecommunication Management; Performance Management (PM); Concept and Requirements".

[13] GSM 12.04: "Performance Management and Measurements for a GSM Public Land Mobile Network (PLMN)".

[14] 3GPP TS 52.402: "Telecommunication Management; Performance Management (PM); Performance Measurements - GSM".

[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) (GSM); General Packet Radio Service (GPRS); Base Station System (BSS) - Serving GPRS Support Node (SGSN); BSS GPRS Protocol (BSSGP)".

[17] 3GPP TS 23.060: "General Packet Radio Service (GPRS) Service description; Stage 2".

[18] 3GPP TS 29.002: "Mobile Application Part (MAP) specification".

[19] 3GPP TS 29.060: "General Packet Radio Service (GPRS); GPRS Tunnelling protocol (GTP) across the Gn and Gp interface".

[20] 3GPP TS 24.011: "Point-to-Point (PP) Short Message Service (SMS) Support on Mobile Radio Interface".

[21] Victor R Basili and H. Dieter Rombach: “The TAME project: Towards improvement-oriented software environments”, IEEE Transactions of Software Engineering, Vol. 14, No. 6, June 1988.

[22] Victor R Basili and David M. Weiss: “A Methodology for Collecting Valid Software Engineering Data”, IEEE Transactions of Software Engineering, Vol. SE- 10, No. 6, November 1984.

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
DTD	Document Type Definition
EGQM	Enhanced Goal, Question, Metric
EM	(Network) Element Manager
ETS	European Telecommunication Standard
FTAM	File Transfer Access and Management
FTP	File Transfer Protocol
GQM	Goal, Question, Metric
IEEE	Institute of Electrical and Electronics Engineers, Inc.
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	UMTS Terrestrial Radio Access Network

Annex B (Informative): Top-Down Performance Measurement Definition Process

B.1 Scope

Performance measurements within wireless telecommunications networks are required in order to meet the needs of the diverse community of end users of those measurements. New features develop, networks evolve and operating conditions change without sufficient consideration given to the measurements needed to keep the network running efficiently. While Equipment Vendors define measurements to satisfy their particular needs, other perspectives, especially the voice of the Network Operator, are often lost during Equipment Vendor development processes. Similarly, Network Operators sometimes request measurements without fully understanding who will be using the data or what actions those people will take based on the data collected. A coherent, simple, top-down methodology for defining performance measurements is lacking in the telecommunications industry.

This annex describes a methodology to handle the problems discussed above. In particular, multiple user communities have been defined representing the end users of system measurements. Performance goals and measurements are defined considering these same user communities. The definition includes identification of specific problem scenarios and corrective actions to be taken by the appropriate user community.

Measurements defined using this methodology can be contributed to 3GPP SA5 for potential adoption and inclusion in this technical specification. It is believed that this methodology will help reduce development costs for the Equipment Vendors and reduce operational costs for the Network Operators.

B.2 Overview

Performance measurements are important to the proper and efficient functioning of wireless telecommunications networks. They have numerous uses related to resource utilization, expansion planning, network optimisation, operating problem diagnosis and network availability monitoring. For the wireless telecommunications world, product performance measurements are necessary to support multiple communities of users.

In addition, once performance measurements are defined for a wireless telecommunication network they must be maintained. The evolution of a wireless telecommunication network for capacity increases and feature extensions leads to the evolution of the collected measurements. Performance measurements need to be added, modified and made obsolete from the overall measurement repository. These changes must be defined completely and accurately to meet the requirements of each community of users.

A development of a performance measurement life cycle process to oversee this need is discussed in this annex. The life cycle process addresses the multiple user communities whose perspectives are needed to supply the requirements for the performance measurements.

The proposed performance measurement life cycle process is a usage-based process. The basic Goal, Question, Metric (GQM) method is enhanced to define problem scenarios and corrective actions. These descriptions are not only used to filter out proposals for performance measurements that provide no defined benefit, but also support user community training in the use of the performance measurements.

The remainder of this annex is organised as follows.

Section B.3 defines Measurement User Communities for wireless telecommunications

Section B.4 discusses the GQM and the Enhanced GQM methods

Section B.5 discusses the measurement life cycle process

Section B.6 provides conclusions

B.3 Measurement User Communities

One objective of Performance Management as a functional subset of operations and maintenance processes is to define sets of measurements. Typical definition criteria revolve around measuring activity within the network in terms of volume, speed and accuracy. While this approach produces measurement data it does not completely address the needs and uses of the multiple consumers of network performance measurement information. The Enhanced GQM methodology extends the measurement definition criteria to better satisfy multiple groups with diverse needs for these measurements.

A qualitative judgement as to the efficacy of a Performance Management subsystem is how well served these different groups are by the measurements provided. To better understand these needs, five generic categories of users, outlined definitions and examples of their needs and requirements for measurements taken from their wireless telecommunications network are defined. These groups are referred to as measurement user communities. These five communities are:

Network Operator's Business Community

Network Operator's Maintenance Community

Network Operator's Traffic Engineering Community

Network Operator's Customer Care Community

Equipment Vendor's Performance Modelling Community

Equipment Vendor's Development Engineering Community

B.3.1 Network Operator Business Community

The first measurement user community is the Network Operator's Business Community. This community is defined under the assumption that the wireless telecommunications network is fully operational, adequately engineered for traffic load per quality of service definitions and in commercial service. The primary objective of this community is to guarantee the financial health and welfare of the Operating Company. They expect a properly configured wireless telecommunications network to supply the revenue per subscriber unit necessary to meet their financial goals.

An understanding of the elasticity of demand can help the Business Community maximize profits within their product pricing strategy as they alter prices according to various mixes of services. Typical measurements of interest to this community are those based on the actual volumes of calls completed by service type. This call volume information can lead to trends of usage over time. Correlation between price mix and call volumes can help to identify pricing strategies geared towards increasing revenue per subscriber unit.

B.3.2 Network Operator Maintenance Community

The second measurement user community is the Network Operator's Maintenance Community. This community is defined under the assumption that the wireless telecommunications network is less than fully operational, adequately engineered for traffic load per quality of service definitions and in commercial service. The primary objective of this community is to reduce Mean Time to Repair faults that occur within the network equipment of the Operating Company.

The baseline metric for this community is the availability of the network equipment, where availability is composed of the sum of scheduled and unscheduled outages to the network equipment. Unscheduled outages are influenced by the inherent hardware and software quality of the products provided to the operating company. While the Maintenance Community has no direct control over that quality, they do have control over the second component of scheduled outage, Mean Time to Repair.

Mean Time to Repair is influenced by the Mean Time to Detect a fault. This community of user's defines measurements that support detecting or predicting faults within the network equipment.

Measurements that support this community can come from places other than the network equipment, itself. Several Operating Companies have been observed building information systems based on the data provided by Call Detail Records and Billing Records. Correlation is sought within these data between call faults and location within the Network. Detection of these faults serves a dual purpose: it allows the Operating Company a view of performance at the level of their Network Operator (the subscriber) and it allows the Maintenance Community to target specific network equipment for repair.

B.3.3 Network Operator Traffic Engineering Community

The third measurement user community is the Network Operator's Traffic Engineering Community. This community is defined under the assumption that the wireless telecommunications network is fully operational, inadequately engineered for current or future traffic load per quality of service definitions and in commercial service. The primary objective of this community is to keep the capacity of the network equipment within 1) the Operating Company's design criteria for the quality of service based on growth of the subscriber base, 2) changes in usage patterns based on pricing strategies and 3) introduction of new services.

The baseline metric for this community is the trend in utilization of the network equipment. A fully instrumented network would allow the Operating Company to understand the trend in performance of their principle capital investment and any leased services. As these trends pass thresholds of performance, purchasing decisions or volume pricing discounts could be triggered.

B.3.4 Network Operator Customer Care Community

The fourth measurement user community is the Network Operator's Customer Care Community. This community is defined under the assumption that the wireless telecommunications network is fully operational, functioning at a less than optimal level resulting in end user dissatisfaction and in commercial service. The primary objective of this community is interfacing with the end-user customers of offered services for the purpose of establishing and maintaining end-user customer satisfaction. This may include customer care responsibilities such as customer relationship management (or CRM), service level agreement (or SLA) management, quality of service (or QoS) management etc.

This community is interested in defining measurements related to the end-user customer experience with the network Operator's offered services in the areas of CRM, SLA, QoS, problem reports, etc. Decisions on how to best handle customer dissatisfaction or how to keep customers from becoming dissatisfied are based on these types of measurements.

B.3.5 Equipment Vendor Performance Modelling Community

The fifth measurement user community is Equipment Vendor's Performance Modelling Community. This community is defined under the assumption that the wireless telecommunications network is fully operational, adequately engineered for traffic load per quality of service definitions and in some level of call capable service. The primary objective of this community is to guarantee that the models used during analysis and design phases conform to real-world observations of the network equipment of the Operating Company.

While this community is not within the Operating Company it still provides beneficial service to the Operating Company by managing the development of subsequent features that are in line with the actual performance characteristics of the network. Many decisions within the development life cycle depend on models developed prior to shipping the product. These models need to be calibrated to network performance once the product is released. Definition of measurements in concert with calibrating these models requires the direct involvement of the people developing the models.

The network that transports Network Management data often is the same network that carries call control traffic. Clearly, the knowledge of volume levels of this traffic during anomalous operating conditions is important in order to understand the total impact to call processing. This community would define measurements to allow the monitoring of this type of phenomena.

B.3.6 Equipment Vendor Development Engineering Community

The sixth measurement user community is Equipment Vendor's Development Engineering Community. This community is also defined under the assumption that the wireless telecommunications network is fully operational, adequately engineered for traffic load per quality of service or service level agreement definitions and in commercial service. The primary objective of this community is to guarantee that the implementations of the designs conform to real- world observations of the network equipment of the Operating Company.

While this community also is not within the Operating Company, it still provides beneficial service to the Operating Company. The implementation of new algorithms carries some finite risk of performance in the Network Operator environment versus the lab environment. Many times simulators of network activity are developed to support the verification of these algorithms. These simulations need to be calibrated to network performance once the product is released. Definition of measurements in concert with calibrating these simulations requires the direct involvement of the people developing the simulations.

B.3.7 User Community Conclusion

The six measurement communities are broken into four Network Operator based groups and two Equipment Vendor groups. However, experience shows that the measurements defined for these groups are not mutually exclusive. Other groups may also use measurements needed by a particular group for the same or different purposes. Thus, the accurate definition of the measurements and how to use them is necessary to allow the Network Operator to properly combine these measurements into more complex analyses.

B.4 Enhanced GQM

The Goal, Question Metric (GQM) method requires measurement user communities to help define goals and metrics. This section first presents the standard GQM method and then presents an enhanced GQM method, which provides the measurement user communities a broader understanding of how metrics are used. Note that the term 'metric' in GQM means the same as 'measurement'.

B.4.1 GQM Methodology

Basili and Weiss [22] and others originally proposed the GQM method. This methodology provides a systematic approach for defining metrics that can be collected and analysed to determine whether or not a goal has been reached. This methodology was originally created for quality assurance of software development processes, but has been applied to other areas. GQM is comprised of the following three steps.

1. Identify and define goals for a particular group

2. Refine goals into quantifiable questions

3. Define metrics that will answer the questions

Goals are defined in terms of a purpose and a perspective. The purpose specifies the object to be analysed and why it will be analysed. The perspective specifies the relevant aspects of the object and which measurement user community is interested in the aspects.

Execution of the GQM methodology results in the formation of a GQM model. A GQM model contains the set of defined goals, questions and metrics. A GQM model provides trace-ability from the goals to the associated metrics. Figure B1 shows an example of a GQM model.

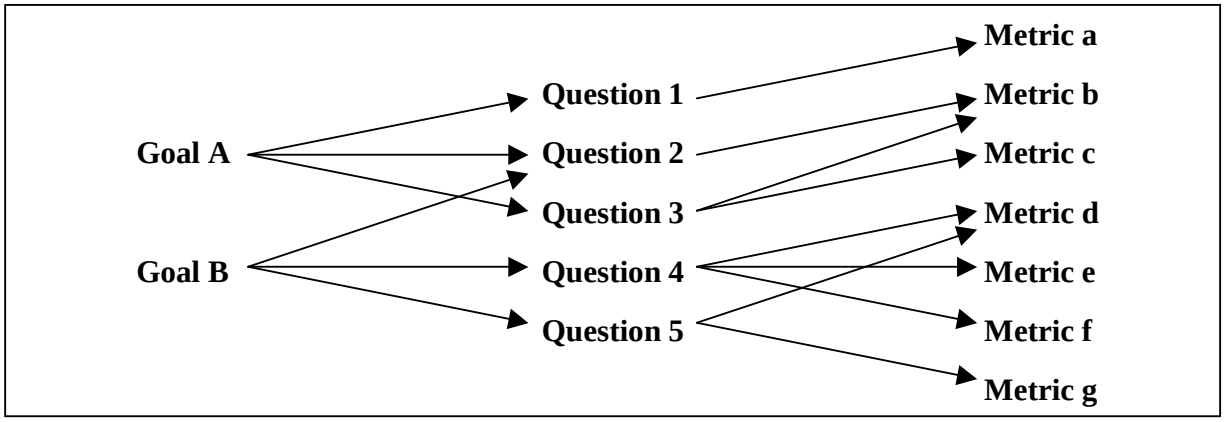

Figure B1: GQM Model

GQM definition templates are often used to help produce consistent goal, question and/or metric definitions. An example of a Goal template is shown below [21]:

Purpose: To (characterize evaluate, predict, motivate, etc.) the (process product model, metric, etc.) in order to (understand, assess, manage, engineer, learn, improve, etc.) it. Example: To evaluate the system testing methodology in order to improve it.

Perspective: Examine the (cost, effectiveness, correctness, defects, changes, product metrics, reliability, etc.) from the point of view of the (developer, manager, Network Operator, corporate perspective, etc.). Example: Examine the effectiveness from the developer's point of view.

B.4.2 Enhanced GQM (EGQM) Methodology

As it stands, the GQM methodology works well for defining metrics, but falls short in several areas. The original GQM methodology was enhanced to better fit within the wireless telecommunications industry for the following reasons.

- Allow wireless measurement user communities to specify their needs at the beginning of the performance measurement life cycle rather than waiting for product to be delivered

- Allow wireless measurement user communities to understand what performance measurements are being designed for them in time to modify the associated collection, analysis and reporting processes

- Allow wireless measurement user communities to understand how they should analyse collected measurement data and what actions they should take when analysis has been completed

- Provide criteria for rejecting unnecessary goals, useless measurements, or measurements that can not be properly collected, analysed or understood

- Provide criteria for architecting metrics into the appropriate wireless network device (based on network traffic capacity, device CPU and memory capacity, data collection capabilities, etc.)

- Allow for consistent measurement definition by providing Enhanced GQM model definition and measurement definition templates

- Help reduce development costs for Equipment Providers and reduce operational costs for the Network Operator

The Enhanced GQM, or EGQM, methodology is comprised of the following four steps.

1. Identify and define measurement goals for a particular measurement user community

2. Refine measurement goals into quantifiable problem scenarios

3. Define measurements that will determine if the goal is being accomplished

4. Define corrective actions

EGQM's first and third steps are similar to GQM's first and third steps. EGQM's second step is different than GQM's second step in that it focuses on problem scenarios associated with the goal rather than on questions associated with the goal. Problem scenarios are descriptions of real world problems the measurement user community has or will experience. Each problem scenario represents a particular aspect of the associated goal. Problem scenarios include definitions of any formulas that will allow the measurement user community to analyse the problem scenario after metric data has been collected from the field. EGQM's fourth step is new. Corrective actions are descriptions of what the measurement user community should do based on analysis of metric data collected from the resulting wireless network.

Execution of the EGQM methodology results in the formation of an EGQM model. An EGQM model contains the set of defined goal, problem scenarios, metrics and corrective actions. An EGQM model also provides trace-ability from the goals to the associated corrective actions. Figure B2 shows an example of an EGQM model.

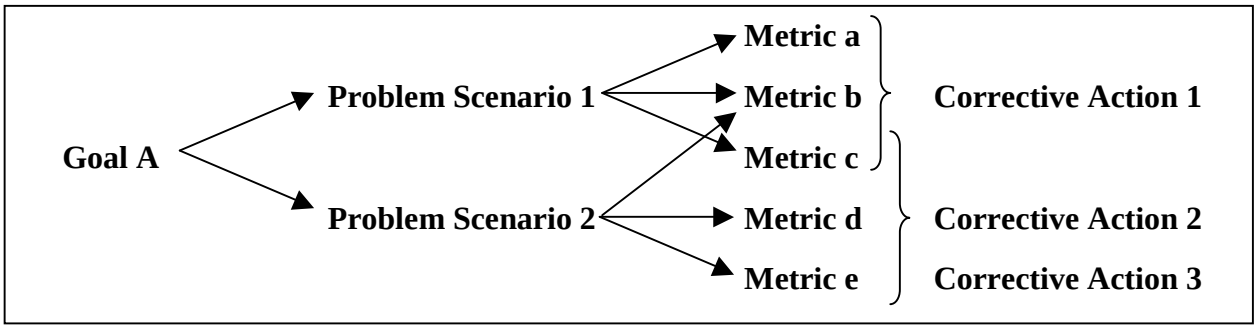

Figure B2: EGQM Model

EGQM has definition templates for producing an EGQM model and for defining metrics. The EGQM model definition template is shown in Table B1. The EGQM metric definition template that is useful for 3GPP SA5 activities is defined in section 3.3 of this document.

Goal: Provides the name of goal and non-ambiguous definition of what needs to be accomplished. Also provides the measurement user communities the goal is associated with. **Problem Scenario(s)**: Provides a description of the problem scenario associated with the goal. Contains a description of how performance measurements will be used by the user in order to meet the goal. **Required Metric(s)**: Provides a list of metrics required to assess the problem scenario to see if the goal is being accomplished. **Corrective Action(s)**: Provides descriptions of actions the user can execute based on data collected from the wireless network. Contains descriptions of expected metric data values and how those values work with the Problem Scenarios definitions.

Table B1: EGQM Model Definition Template

As described in section B.3, six measurement user communities have been defined for the wireless telecommunications industries. EGQM supports all six communities. Representatives from each community participate in all four steps of the EGQM methodology. This allows user communities to specify exactly what they need and/or want and to know exactly how they will use the metrics before any software is developed. Participation in the EGQM process increases Network Operator satisfaction through early definition of operational practices (including corrective actions) and increases product knowledge within the Network Operator organization.

The EGQM model definition and metric definition templates provide the mechanism to reject unnecessary goals, useless metrics, or metrics that can't be properly collected or computed. Reasons for the rejection of a goal include the following.

- Non-ambiguous goal definition could not be determined
- Problem scenarios could not be determined
- Definition of how performance measurement will be used within a problem scenario could not be determined
- Corrective actions could not be determined
- Metrics could not be defined to support problem scenario definitions
- Required metrics could not be architected into network devices for any of the following reasons:
    - Network device could not collect metric due to CPU utilization issues
    - Network device could not collect and/or store metric due to memory issues
    - Network could not support the uploading of measurement data from network devices to network manager
    - Network manager could not collect and/or store measurement data due to memory issues

B.5 Measurements Life Cycle Process

If the uses of performance measurements were confined to feature releases and occasional changes to those features, then EGQM would suffice. However, user community needs evolve, operating conditions change, performance models are validated, new services are introduced, etc. As these conditions change, performance measurements may need to change. Such considerations point to the need for a complete measurements life cycle model.

A simple life cycle model to handle performance measurement changes is depicted in Figure B3. New performance measurement goal and metric definitions are provided through new features. These are made available with major releases.

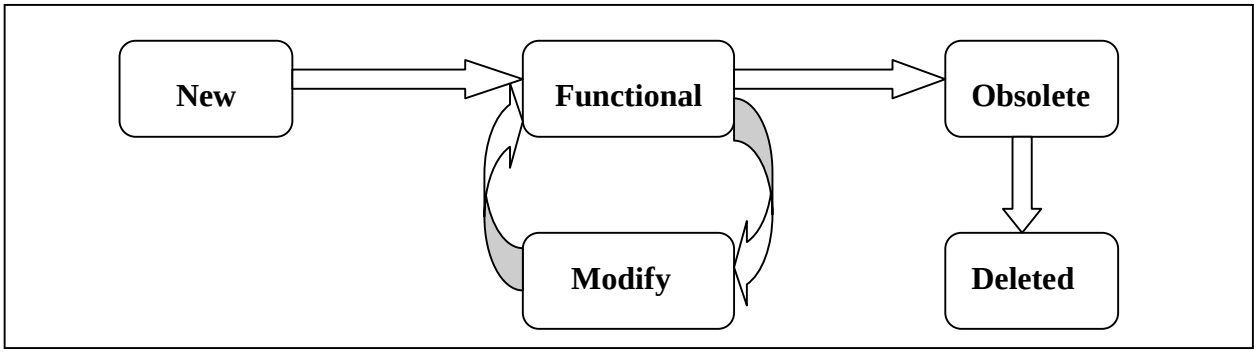

Figure B3: Measurement Life Cycle

Performance measurements may need to be periodically reviewed. Goal and metric definition updates made during this process are generally instantiated at major releases. When metrics are no longer useful they can be made obsolete and eventually deleted. A waiting period between obsolescence and deletion allows user communities time to implement and test out new metrics and analyses that are meant to replace existing metrics and analyses.

B.6 Conclusion

In the past, definition of performance measurements of wireless telecommunications networks was focused mainly on satisfying the needs of the Equipment Vendor Performance Modelling and Development Engineering measurement user communities. The needs of the wireless telecommunications Network Operator are not always addressed. The Performance Measurement Definition process described in this paper addresses the needs of all measurements user communities. The process also provides additional benefits, including the following:

- Allow measurement communities to specify their needs up front
- Allow measurement communities to prepare for and modify their measurement monitoring and reporting processes before product is released to them
- Allow measurement communities to know what actions they need to perform when assessing collected measurements
- Provides method for rejecting unrealistic goals and measurements
- Provides method for best architecting measurements into network devices
- Provides method for producing consistent measurement definitions
- Provides method for managing measurements life cycle including measurement creation, modification and obsoletion

The EGQM methodology may be used for:

- analyse and assess performance areas that are not well understood or are highly complex
- non-straightforward cases where it is difficult to create useful measurement proposals
- an understanding of real value is required before useful measurement proposals can be created
- mine for missing measurements

- mine for conflicting, overlapping, or existing measurements that are no longer useful

In summary, the EGQM methodology may be used by any company to generate measurement definitions that can then be contributed to 3GPP SA5 for potential inclusion in this specification.

Annex ~~B~~ C (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
Jun 2001	S_12	SP-010237	--	--	Submitted to TSG SA #12 for Approval.	1.0.2	4.0.0
Sep 2001	S_13	SP-010468	001	--	Corrections on UMTS and combined UMTS/GSM measurements: Addition of family name for CN measurements, addition of the list of families, addition of Annex A: "(n-1) out of n" examples, application of the "(n-1) out of n" approach to all relevant measurements, enhancement of per cause measurements	4.0.0	4.1.0

3GPP TSG-SA5 (Telecom Management) **S5-028141**
Meeting #28, Sophia Antipolis, FRANCE, 20 - 24 May 2002

CR-Form-v5

CHANGE REQUEST

⌘ **32.403** **CR** **006** ⌘ **rev** **-** ⌘ Current version: **4.2.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network **X** Core Network ☐

Title:	⌘	Addition of explanatory text for Radio Access Bearer (RAB) measurements
Source:	⌘	SA5
Work item code:	⌘	OAM-PM
Date:	⌘	24/05/2002
Category:	⌘	**D**
Release:	⌘	*REL-5*

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
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D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change:	⌘	Lack of background information for the RAB measurement definitions.
Summary of change:	⌘	Introduction of a new section in subclause 4.1 to provide an overview on the rationale behind RAB measurements.
Consequences if not approved:	⌘	The introduction in this TS of the rationale for defining RAB measurements is extremely useful for pedagogical reasons and will facilitate the reading by non-3GPP participants.

Clauses affected:	⌘	4.1, 4.2
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

4 Measurements related to the RNC

4.1 RAB management~~assignment~~

4.1.1 Overview

4.1.1.1 Measurements are based on the success and failure of procedures

The proposed measurements are not merely based on the counting of a given type of message since a same message may be repeated by an implementation dependent process. The aim here is to provide implementation independent specification.

Proposed measurements are based on the success/failure of procedures identified in the reference documents. The end of a procedure implies a stable state of the communication between the two involved parties. This stable state is normally the object of a common understanding from the two parties. As a consequence, proposed measurements are attached either to the successful or the unsuccessful issue of a procedure.

4.1.1.2 Combination of Traffic Class and Core Network domains

A Radio Access Bearer is characterized by several QOS parameters among them is the Traffic Class. Currently there are not any 3GPP specifications including TS 23.107 [8] in which may be found restrictions related to the possible combinations between Traffic Class and Core Network domain.

Consequently, as a conservative position, this specification should leave open every possible combination between Traffic Class and Core Network domain as specification TS 23.107 [8] does.

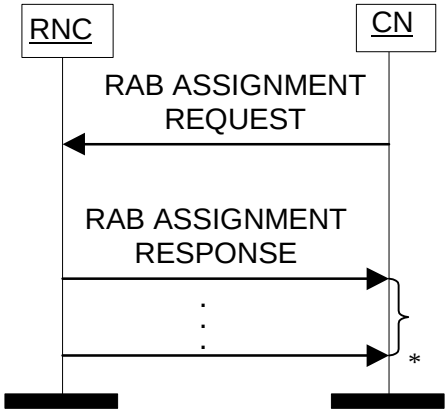
4.1.1.3 Considered Radio Access Bearer management procedures

Performance Measurement definitions in this section are based on the TS 25.413 “UTRAN Iu Interface RANAP Signalling” document [5].

The following paragraphs of this document are of interest for our purpose:

- RAB Assignment
- RAB Release Request
- RAB ASSIGNMENT REQUEST
- RAB ASSIGNMENT RESPONSE
- RAB RELEASE REQUEST

These paragraphs show in particular the following diagrams:



* it can be several responses

Figure 1: RAB Assignment procedure. Successful operation.

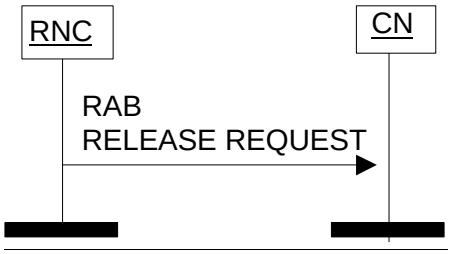


Figure 2: RAB Release Request procedure.

4.1.2 RAB assignment for CS domain

The five measurement types defined in the clause 4.1.2~~n~~ for CS domain ~~(respectively PS domain)~~ are subject to the "4 out of 5 approach".

4.1.2.1 Attempted RAB establishments for CS domain

a) This measurement provides the number of RAB assignment attempts for CS domain. The measurement is pegged by traffic class.

b) CC.

c) On receipt by the RNC of a RANAP RAB ASSIGNMENT REQUEST message for CS domain, each RAB assignment request is added to the relevant measurement according to the traffic class requested. See TS 25.413 and TS 23.107.

d) Four integer values.

e) RAB.AttEstabCS.Conv
RAB.AttEstabCS.Strm
RAB.AttEstabCS.Intact
RAB.AttEstabCS.Bgrd

f) RNCFunction.

g) Valid for circuit switched traffic.

h) UMTS.

4.1.2.2 Successful RAB establishments without queuing for CS domain

a) This measurement provides the number of successfully established RABs for CS domain in which a queuing process has not been involved. The measurement is pegged by traffic class.

b) CC.

c) On transmission by the RNC of a RANAP RAB ASSIGNMENT RESPONSE message for CS domain, each successfully established RAB is added to the relevant measurement according to the traffic class requested in the RAB ASSIGNMENT REQUEST message. See TS 25.413 and TS 23.107.

NOTE: The addition is performed with the condition the RAB has not been mentioned as queued in a previous RANAP RAB ASSIGNMENT RESPONSE.

d) Four integer values.

e) RAB.SuccEstabCSNoQueuing.Conv
RAB.SuccEstabCSNoQueuing.Strm
RAB.SuccEstabCSNoQueuing.Intact
RAB.SuccEstabCSNoQueuing.Bgrd

f) RNCFunction.

g) Valid for circuit switched traffic.

h) UMTS.

4.1.2.3 Failed RAB establishments without queuing for CS domain

a) This measurement provides the number of RAB establishment failures for CS domain in which a queuing process has not been involved. The measurement is pegged by failure cause.

b) CC.

c) On transmission by the RNC of a RANAP RAB ASSIGNMENT RESPONSE message for CS domain, each RAB failed to establish is added to the relevant measurement according to the failure cause. Possible causes are included in TS 25.413. The sum of all supported per cause measurements shall equal the total number of RAB Establishment Failures. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

NOTE: The addition is performed with the condition the RAB has not been mentioned as queued in a previous RANAP RAB ASSIGNMENT RESPONSE.

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.

e) The measurement name has the form RAB.FailEstabCSNoQueuing.*Cause*
where *Cause* identifies the failure cause.

f) RNCFunction.

g) Valid for circuit switched traffic.

h) UMTS.

4.1.2.4 Successful RAB establishments with queuing for CS domain

a) This measurement provides the number of successfully established RABs for CS domain in which a queuing process has been involved. The measurement is pegged by traffic class.

b) CC.

c) On transmission by the RNC of a RANAP RAB ASSIGNMENT RESPONSE message for CS domain, each successfully established RAB is added to the relevant measurement according to the traffic class. See TS 25.413 and TS 23.107.

NOTE: The addition is performed with the condition the RAB has been mentioned as queued in a previous RANAP RAB ASSIGNMENT RESPONSE.

d) Four integer values.

e) RAB.SuccEstabCSQueuing.Conv
RAB.SuccEstabCSQueuing.Strm
RAB.SuccEstabCSQueuing.Intact
RAB.SuccEstabCSQueuing.Bgrd

f) RNCFunction.

g) Valid for circuit switched traffic.

h) UMTS.

4.1.2.5 Failed RAB establishments with queuing for CS domain

a) This measurement provides the number of RAB establishment failures for CS domain in which a queuing process has been involved. The measurement is pegged by failure cause.

b) CC.

c) On transmission by the RNC of a RANAP RAB ASSIGNMENT RESPONSE message for CS domain, each RAB failed to establish is added to the relevant measurement according to the cause. Possible causes are included in TS 25.413. The sum of all supported per cause measurements shall equal the total number of RAB Establishment Failures. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

NOTE: The addition is performed with the condition the RAB has been mentioned as queued in a previous RANAP RAB ASSIGNMENT RESPONSE.

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

e) The measurement name has the form RAB.FailEstabCSQueuing.*Cause*
where *Cause* identifies the failure cause.

f) RNCFunction.

g) Valid for circuit switched traffic.

h) UMTS.

4.1.3 RAB assignment for PS domain

The five measurement types defined in the clause 4.1.3 for PS domain are subject to the "4 out of 5 approach".

~~4.1.6~~4.1.3.1 Attempted RAB establishments for PS domain

a) This measurement provides the number of RAB assignment attempts for PS domain. The measurement is pegged by traffic class.

b) CC.

c) On receipt by the RNC of a RANAP RAB ASSIGNMENT REQUEST message for PS domain, each RAB assignment request is added to the relevant measurement according to the traffic class requested. See TS 25.413 and TS 23.107.

d) Four integer values.

e) RAB.AttEstabPS.Conv
RAB.AttEstabPS.Strm

RAB.AttEstabPS.Intact
RAB.AttEstabPS.Bgrd

f) RNCFunction.

g) Valid for packet switched traffic.

h) UMTS.

~~4.1.7~~4.1.3.2 Successful RAB establishments without queuing for PS domain

a) This measurement provides the number of successfully established RABs for PS domain in which a queuing process has not been involved. The measurement is pegged by traffic class.

b) CC.

c) On transmission by the RNC of a RANAP RAB ASSIGNMENT RESPONSE message for PS domain, each successfully established RAB is added to the relevant measurement according to the traffic class. See TS 25.413 and TS 23.107.

NOTE: The addition is performed with the condition the RAB has not been mentioned as queued in a previous RANAP RAB ASSIGNMENT RESPONSE.

d) Four integer values.

e) RAB.SuccEstabPSNoQueuing.Conv
RAB.SuccEstabPSNoQueuing.Strm
RAB.SuccEstabPSNoQueuing.Intact
RAB.SuccEstabPSNoQueuing.Bgrd

f) RNCFunction.

g) Valid for packet switched traffic.

h) UMTS.

~~4.1.8~~4.1.3.3 Failed RAB establishments without queuing for PS domain

a) This measurement provides the number of RAB establishment failures for PS in which a queuing process has not been involved. The measurement is pegged by failure cause.

b) CC.

c) On transmission by the RNC of a RANAP RAB ASSIGNMENT RESPONSE message for PS domain, each RAB failed to establish is added to the relevant measurement according to the failure cause. Possible causes are included in TS 25.413. The sum of all supported per cause measurements shall equal the total number of RAB Establishment Failures. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

NOTE: The addition is performed with the condition the RAB has not been mentioned as queued in a previous RANAP RAB ASSIGNMENT RESPONSE.

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

e) The measurement name has the form RAB.FailEstabPSNoQueuing.*Cause*
where *Cause* identifies the failure cause.

f) RNCFunction.

g) Valid for packet switched traffic.

h) UMTS.

~~4.1.9~~4.1.3.4 Successful RAB establishments with queuing for PS domain

a) This measurement provides the number of successfully established RABs for PS domain in which a queuing process has been involved. The measurement is pegged by traffic class.

b) CC.

c) On transmission by the RNC of a RANAP RAB ASSIGNMENT RESPONSE message for PS domain, each successfully established RAB is added to the relevant measurement according to the traffic class. See TS 25.413 and TS 23.107.

NOTE: The addition is performed with the condition the RAB has been mentioned as queued in a previous RANAP RAB ASSIGNMENT RESPONSE.

d) Four integer values.

e) RAB.SuccEstabPSQueuing.Conv
RAB.SuccEstabPSQueuing.Strm
RAB.SuccEstabPSQueuing.Intact
RAB.SuccEstabPSQueuing.Bgrd

f) RNCFunction.

g) Valid for packet switched traffic.

h) UMTS.

~~4.1.10~~4.1.3.5 Failed RAB establishments with queuing for PS domain

a) This measurement provides the number of RAB establishment failures for PS domain in which a queuing process has been involved. The measurement is pegged by failure cause.

b) CC.

c) On transmission by the RNC of a RANAP RAB ASSIGNMENT RESPONSE message for PS domain, each RAB failed to establish is added to the relevant measurement according to the cause. Possible causes are included in TS 25.413. The sum of all supported per cause measurements shall equal the total number of RAB Establishment Failures. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

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

e) The measurement name has the form RAB.FailEstabPSQueuing.*Cause*
where *Cause* identifies the failure cause.

f) RNCFunction.

g) Valid for packet switched traffic.

h) UMTS.

~~4.2~~4.1.4 RAB release

~~4.2.1~~4.1.4.1 RAB releases for CS domain

a) This measurement provides the number of RAB releases for CS domain pegged by cause.

b) CC.

c) On transmission by the RNC of a RANAP RAB RELEASE REQUEST message for CS domain, each RAB requested to be released is added to the relevant per cause measurement. Possible causes are included in TS 25.413. The sum of all supported per cause measurements shall equal the total number of RAB Releases for the CS domain. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

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

e) The measurement name has the form RAB.RelCS.*Cause*
where *Cause* identifies the release cause.

f) RNCFunction.

g) Valid for circuit switched traffic.

h) UMTS.

~~4.2.2~~4.1.4.2 RAB releases for PS domain

a) This measurement provides the number of RAB releases for PS domain pegged by cause.

b) CC.

c) On transmission by the RNC of a RANAP RAB RELEASE REQUEST message for PS domain, each RAB requested to be released is added to the relevant per cause measurement. Possible causes are included in TS 25.413. The sum of all supported per cause measurements shall equal the total number of RAB Releases for the PS domain. In case only a subset of per cause measurements is supported, a sum measurement subtype will be provided first.

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

e) The measurement name has the form RAB.RelPS.*Cause*
where *Cause* identifies the release cause.

f) RNCFunction.

g) Valid for packet switched traffic.

h) UMTS.

3GPP TSG-SA5 (Telecom Management) **S5-028142**
Meeting #28, Sophia Antipolis, FRANCE, 20 - 24 May 2002

CR-Form-v5

CHANGE REQUEST

⌘ **32.403** **CR** **005** ⌘ **rev** **-** ⌘ Current version: **4.2.0** ⌘

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☒ Core Network ☒

Title:	⌘	Introduction of an optional "Purpose" clause in the measurement template
Source:	⌘	SA5
Work item code:	⌘	OAM-PM
Date:	⌘	24/05/2002
Category:	⌘	**B**
Release:	⌘	*REL-5*

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
2 *(GSM Phase 2)*
R96 *(Release 1996)*
R97 *(Release 1997)*
R98 *(Release 1998)*
R99 *(Release 1999)*
REL-4 *(Release 4)*
REL-5 *(Release 5)*

Reason for change:	⌘	The "Purpose" clause allows to identify the targetted measurement user communities and helps to justify the definition of measurements.
Summary of change:	⌘	A new optional clause "Purpose" is added in the measurement template.
Consequences if not approved:	⌘	In the absence of this clause, it will be more difficult to make a qualitative judgement on the interest of measurement definitions.

Clauses affected:	⌘	3.1, 3.3
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	This new optional clause may be used for future measurement definitions. Existing measurements have not been updated.

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

"*(n-1)* out of *n*" approach:

- The measurements result values generated by a NE can be obtained in a number of different ways. Therefore, the "*(n-1)* out of *n* approach" has been defined in order to avoid redundancy in the measurements.
- The "*(n-1)* out of *n* approach" allows a vendor to choose any (n-1) out of the n defined counters for implementation but some choices can offer more detailed information than others. The missing n^{th} value can be calculated in post-processing.
- If multiple measurements are included in one template, then the applicability of the "(n-1) out of n" scenario are mentioned in template item A with the following sentence "The *n* measurement types defined in item E are subject to the "*(n-1)* out of *n* approach"". The item D will specify the measurement result per measurement type specified in template item E.
- If the measurements that are applicable to the "*(n-1)* out of *n*" scenario are defined in separate templates, then they will be grouped together into a common clause of the TS, and the applicability of the approach will be mentioned in the supersection that groups the measurements.
- Examples of measurements which are subject to the "*(n-1)* out of *n*" approach are provided in the Annex A.

Measurement community

Several measurement communities are defined in the present document to identify the end users of system measurements. Each measurement should be defined to address the needs of at least one of these user communities.

Six communities have been identified so far:

Network Operator's Business Community

Network Operator's Maintenance Community

Network Operator's Traffic Engineering Community

Network Operator's Customer Care Community

Equipment Vendor's Performance Modelling Community

Equipment Vendor's Development Engineering Community

A comprehensive description of measurement communities is provided in Annex B. The user communities names are a composite of the various terms used in the industry and might be subject to modification or refinement in future releases.

Measurement family

The measurement names defined in the present document are all beginning with a prefix containing the measurement family name (e.g. RAB.AttEstabCS.Conv, MM.AttGprsAttach). This family name identifies all measurements which relate to a given functionality and it may be used for measurement administration (see 3GPP TS 32.401 [12]).

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

- RAB (measurements related to Radio Access Bearer management)
- SIG (measurements related to Signalling)
- RRC (measurements related to Radio Resource Control)
- SHO (measurements related to Soft Handover)
- HHO (measurements related to Hard Handover)

- RELOC (measurements related to SRNS Relocation)
- IRATHO (measurements related to inter-Radio Access Technology Handover)
- MM (measurements related to Mobility Management)
- SUB (measurements related to Subscriber Management)
- SEC (measurements related to Security)
- SMS (measurements related to Short Message Service)
- SM (measurements related to Session Management)
- CAM (measurements related to CAMEL)
- ISYSC (measurements related to GSM/UMTS Intersystem changes)
- GTP (measurements related to GTP)

3.3 Measurement definition template

Following is the template used to describe the measurements contained in this clause.

C.x.y. Measurement Name (clause header)

This is a descriptive name of the measurement type that is specified as clause C.x.y of the present document.

The measurement name shall be written in lower-case characters except abbreviations (e.g. RNC).

A measurement name can apply to one or more measurements. If the measurement name applies to several measurements then all fields of the template will take this into account.

a) Description

This clause contains an explanation of the measurement operation.

b) Collection Method

This n contains the form in which this measurement data is obtained:

- **CC** (Cumulative Counter);
- **GAUGE** (dynamic variable), used when data being measured can vary up or down during the period of measurement;
- **DER** (Discrete Event Registration), when data related to a particular event are captured every n^{th} event is registered, where n can be 1 or larger;
- **SI** (Status Inspection).

c) Condition

This clause contains the condition which causes the measurement result data to be updated;
This will be defined by identifying protocol related trigger events for starting and stopping measurement processes, or updating the current measurement result value. Where it is not possible to give a precise condition, then the conditional circumstances leading to the update are stated.

If a measurement is not available for FDD or TDD, then the measurement description shall contain a statement.

d) Measurement Result (measured value(s), Units)

This clause contains a description of expected result value(s) (e.g. a single integer value).

The definition applies for each measurement result.

e) Measurement Type

This clause contains a short form of the measurement name specified in the header, which is used to identify the measurement type in the result files.

The measurement names are dotted sequences of items. The sequence of elements identifying a measurement is organised from the general to the particular.

- The first item identifies the measurement family (e.g. HHO, RAB, SMS). Note that this family may also be used for measurement administration purpose.
- The second item identifies the name of the measurement itself.
- Depending on the measurement type, additional items may be present to specify sub-counters (failure causes, traffic classes, min, max, avg, G, U ...). When available, the template will describe to which standard it is referring to for these additional items (e.g. cause, traffic class). Otherwise, the additional item semantics must be described in details in the present document. Standardised causes will be a number. (e.g. RRC.ConnEstab.1) but non standardised causes should be a string (e.g. RRC.ConnEstab.NoReply).

It is to be noted that the set of values issued for a measurement does not depend on the associated collection method (CC, SI, Gauge, DER). For instance, a gauge collected counter does not necessarily provide min, max, average values.

In addition, it is recommended that a prefix is added for non-UMTS measurements:

- VS for vendor-specific measurements;
- Q3 for Q3 measurements;
- MIB for IETF measurements (ATM, IP);
- OS for other standards measurements.

NOTE: The 3GPP standardised measurements name must not commence with the above prefixes.

Examples of valid measurement names are:

- VS.HO.InterSGSNReject.NoResource;
- HHO.SuccOutIntraCell;
- MM.AttachedSubs.Max;
- RAB.EstabAttCS.Conversational;
- RRC.ConnEstab.*Cause*
  where *Cause* identifies the failure cause.

Abbreviations to be used within measurement types can be found in clause 3.2 of the present document.

f) Measurement Object Class

This clause describes the measured object class (e.g. UtranCell, RncFunction, SgsnFunction). The object class used for this purpose shall be in accordance with the Network Resource Model defined in 3GPP TSs 32.622 [9], 32.632 [10], 32.642 [11].

For object classes currently not defined in CM, the present document defines its own nomenclature (e.g. RA, LAC).

g) Switching Technology

This clause contains the Switching domain(s) this measurement is applicable to i.e. Circuit Switched and/or Packet Switched.

h) Generation

The generation determines if it concerns a GSM, UMTS, or combined (GSM+UMTS) measurement.

- **GSM**: pure GSM measurement; it only counts GSM events. In a combined (GSM+UMTS) NE the count would be exactly the same as in a pure GSM NE. In a pure UMTS NE this counter does not exist;

- **UMTS**: pure UMTS measurement; it only counts UMTS events. In a combined (GSM+UMTS) NE the count would be exactly the same as in a pure UMTS NE. In a pure GSM NE this counter does not exist;

- **GSM/UMTS**: measurement applicable to both GSM and UMTS systems; in a combined (GSM+UMTS) NE separate subcounts for GSM and/or UMTS events can be obtained;

- **Combined**: measurement applicable to combined GSM and UMTS systems, but regardless of whether the measured event occurred on the GSM or UMTS part of the system. This means that in a combined NE only one total (i.e. GSM+UMTS) count is obtained for the measured event.

The above aspects are also reflected in the measurement type name in template item E by adding a "G" to the GSM measurements and "U" to the UMTS measurements.

NOTE: The 2G component of a combined 2G/3G equipment may actually choose to implement GSM measurements according to the present document or GSM12.04/TS52.402, based on GSM standards.

i) Purpose

This optional clause aims at describing who will be using the measurement. It is proposed to indicate in this clause the targetted categories of users based on the measurement user communities described in Annex B.

When available, this clause provides additional information on the interest of the measurement but is however purely indicative.

3GPP TSG-SA5 (Telecom Management) **S5-028120**
Meeting #28, Sophia Antipolis, FRANCE, 20 - 24 May 2002

CR-Form-v5

CHANGE REQUEST

⌘ **32.403** **CR** **004** ⌘ **rev** **-** ⌘ Current version: **4.2.0** ⌘

Proposed change affects: ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Adding performance measurement definitions related to GGSN
Source:	⌘	SA5
Work item code:	⌘	OAM-PM
Date:	⌘	24/05/2002
Category:	⌘	**B**
Release:	⌘	*REL-5*

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
REL-4	*(Release 4)*
REL-5	*(Release 5)*

Reason for change:	⌘	Adding GGSN measurement definitions in REL-5.
Summary of change:	⌘	A new clause “Measurements related to GGSN” is created.
Consequences if not approved:	⌘	The absence of standardized GGSN performance measurement definitions would make network monitoring much more complex at Network Manager level.

Clauses affected:	⌘	6
Other specs affected:	⌘	☐ Other core specifications ⌘ ☐ Test specifications ☐ O&M Specifications
Other comments:	⌘	

6 Measurements related to the GGSN

6.1 Session Management

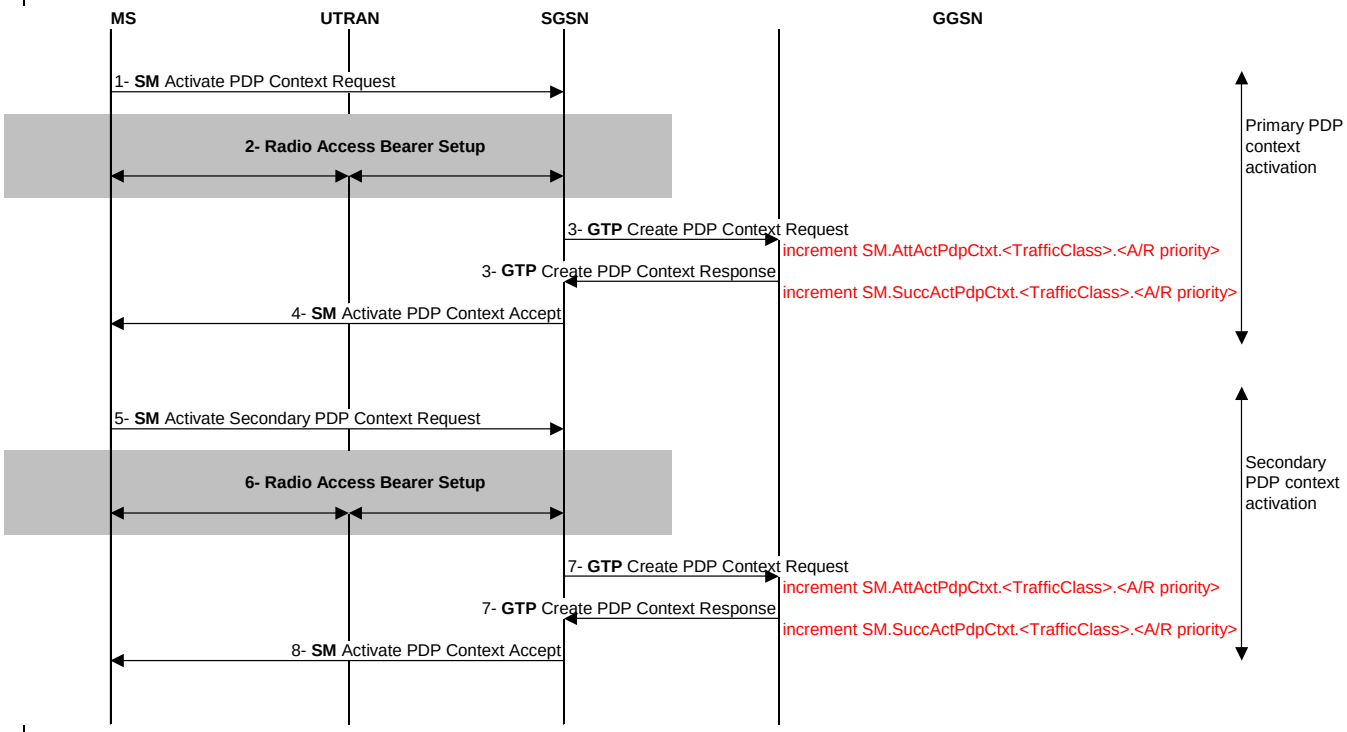
6.1.1 Session establishments

The performance counters presented in this section 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 and TS 29.060.

The figure below, from TS 23.060, 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.



The three measurement types defined in the clause 6.1.1 are subject to the "2 out of 3 approach".

6.1.1.1 Attempted session establishments

a) This measurement provides the number of attempted session establishments. This measurement is pegged by 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. See also TS 24.008 and TS 29.060.

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.

6.1.1.2 Successful session establishments

a) This measurement provides the number of sessions successfully established. This measurement is pegged by 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. See also TS 24.008 and TS 29.060.

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.

6.1.1.3 Failed session establishments

a) This measurement provides the number of session establishment failures. This measurement is pegged by 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. 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.

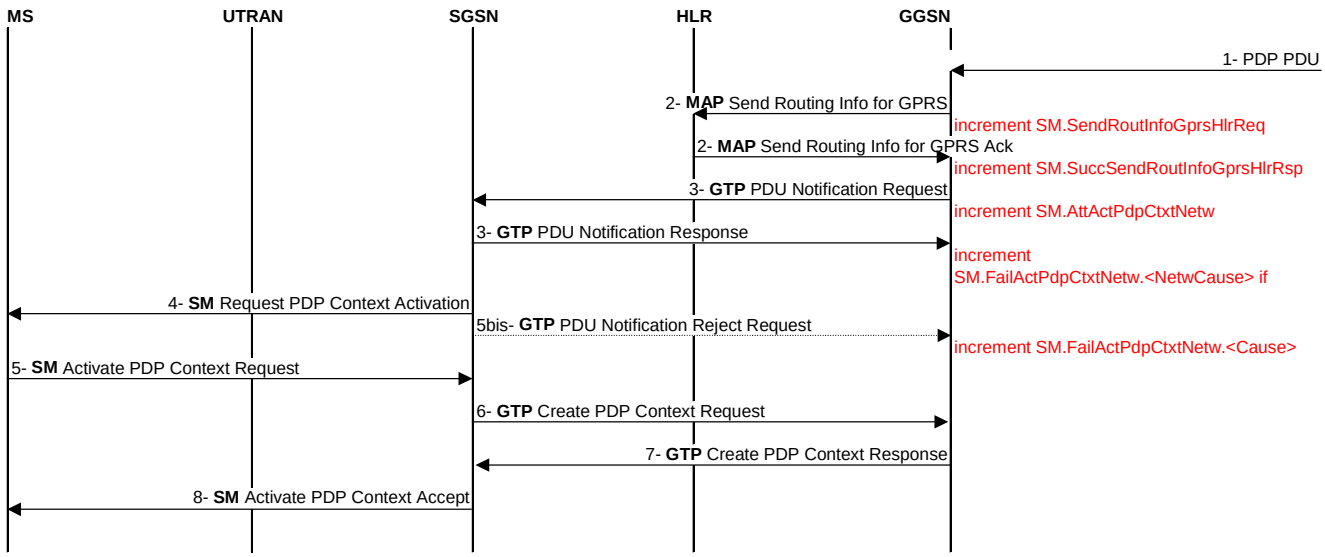
6.1.2 Network-initiated session establishments

The performance counters presented in this section 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) and to GPRS Tunnelling Protocol signalling (GTP-C for the control plane), between the SGSN and the GGSN (defined in TS 29.060).

The figure below, from TS 23.060, recalls the sequence of messages exchanged for a network initiated PDP context activation and details the events triggering the update of the counters values.



6.1.2.1 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 and TS 29.002.

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.

6.1.2.2 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 and TS 29.002.

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.

6.1.2.3 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 and TS 29.060.

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.

6.1.2.4 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 pegged by 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. 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.

6.1.2.5 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 pegged by 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. 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.

6.1.3 Number of subscribers

The performance counters presented in this section 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 simulatenous active PDP contexts per subscriber, increase of the number of subscribers, …).

6.1.3.1 Number of subscribers with an activated PDP context

a) This measurement provides the number of simultaneous subscribers with 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 and TS 23.060.

d) Integer

e) SM.NbrActSubs

f) GgsnFunction

g) Valid for packet switched traffic

h) COMB

i) This measurement is mainly dedicated to Operator Business and Vendor Performance Modelling communities.

6.1.3.2 Mean number of subscribers with an activated PDP context

a) This measurement provides the mean number of simultaneous subscribers with an activated PDP context.

b) SI

c) This measurement is obtained by sampling at a regular interval the number of subscribers that have an activated PDP context in the GGSN.

d) Integer

e) SM.MeanActSubs

f) GgsnFunction

g) Valid for packet switched traffic

h) COMB

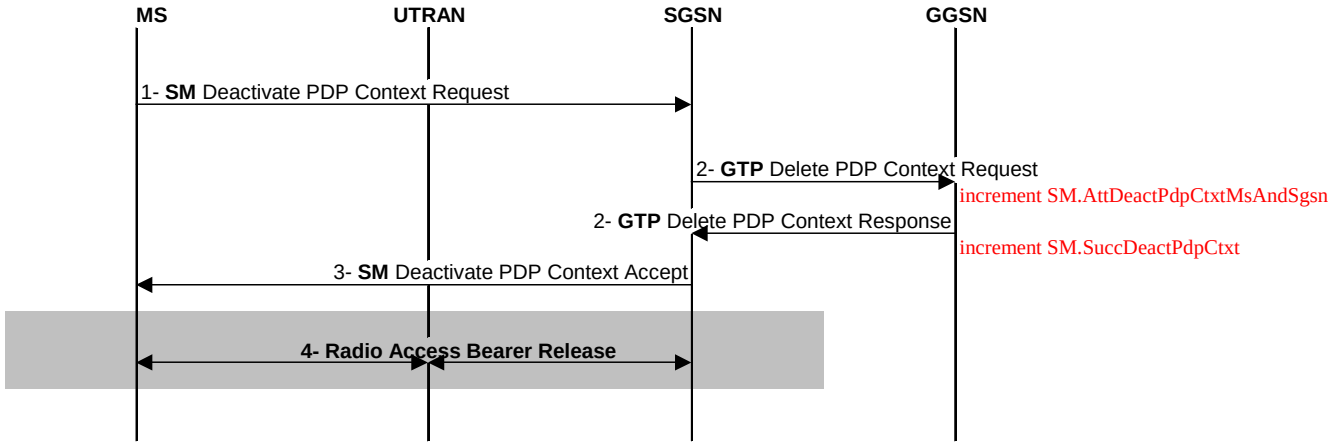
i) This measurement is mainly dedicated to Operator Business and Vendor Performance Modelling communities.

6.1.4 Session conclusions

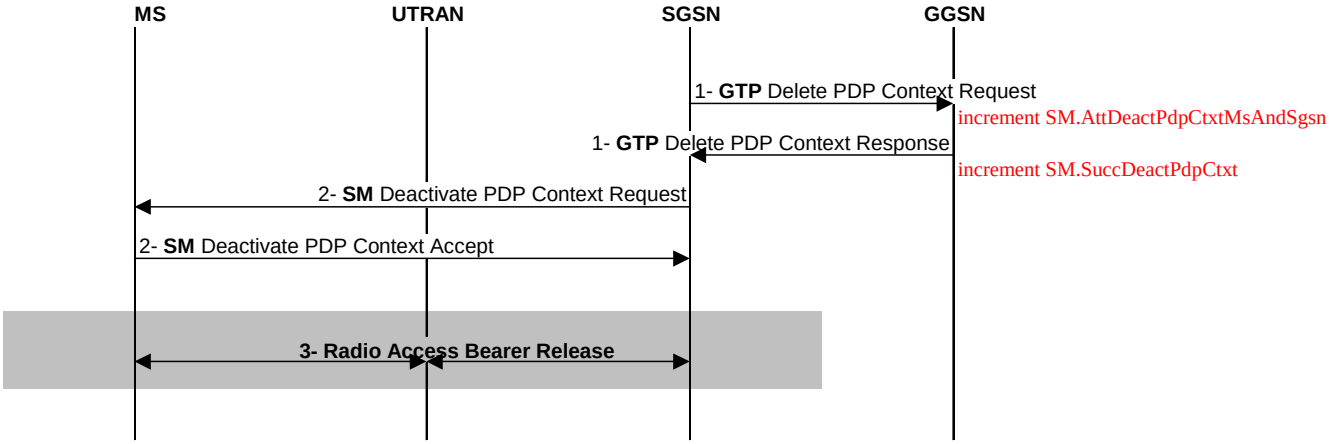
The performance counters presented in this section are related to PDP context deactivation procedure. The counters proposed are mainly intended to evaluate the ratio of GGSN-initiated PDP context deactivations in overall PDP context deactivations, estimate the PDP context deactivation success rate, and may also be used in the subscriber or session profile.

The figures below, from TS 23.060, 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.

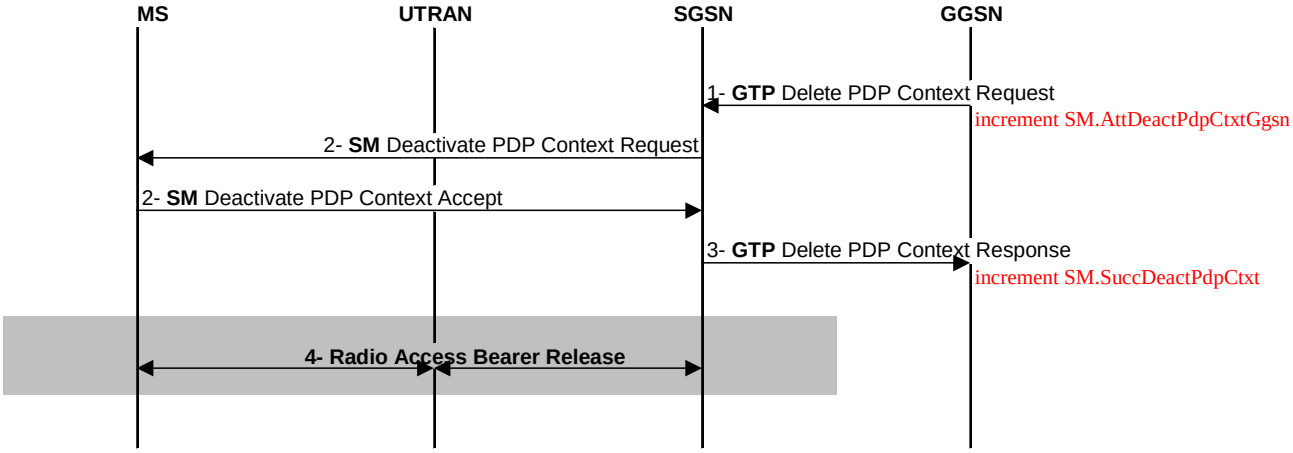
MS initiated PDP context deactivation



SGSN initiated PDP context deactivation



GGSN initiated PDP context deactivation



6.1.4.1 Attempted MS & SGSN-initiated session conclusions

a) This measurement provides the number of PDP context deactivations initiated by SGSN.

b) CC

c) The measurement is incremented on receipt by the GGSN of a DELETE PDP CONTEXT REQUEST message. See TS 29.060.

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.

6.1.4.2 Attempted GGSN-initiated session conclusions

a) This measurement provides the number of 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.

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.

6.1.4.3 Successfully concluded sessions

a) This measurement provides the number of sessions successfully concluded.

b) CC

c) The measurement is incremented on transmission or receipt by the GGSN of a DELETE PDP CONTEXT RESPONSE message with cause "Request Accepted". See TS 29.060.

d) Integer

e) SM.SuccDeactPdpCtxt

f) GgsnFunction

g) Valid for packet switched traffic

h) COMB

i) This measurement is mainly dedicated to Vendor Performance Modelling community.

6.2 Per APN measurements

These measurements will only be provided for a subset of all the APNs of the GGSN (see TS 23.003 for APN definition). The way the list of monitored APNs is configured is outside the scope of this TS.

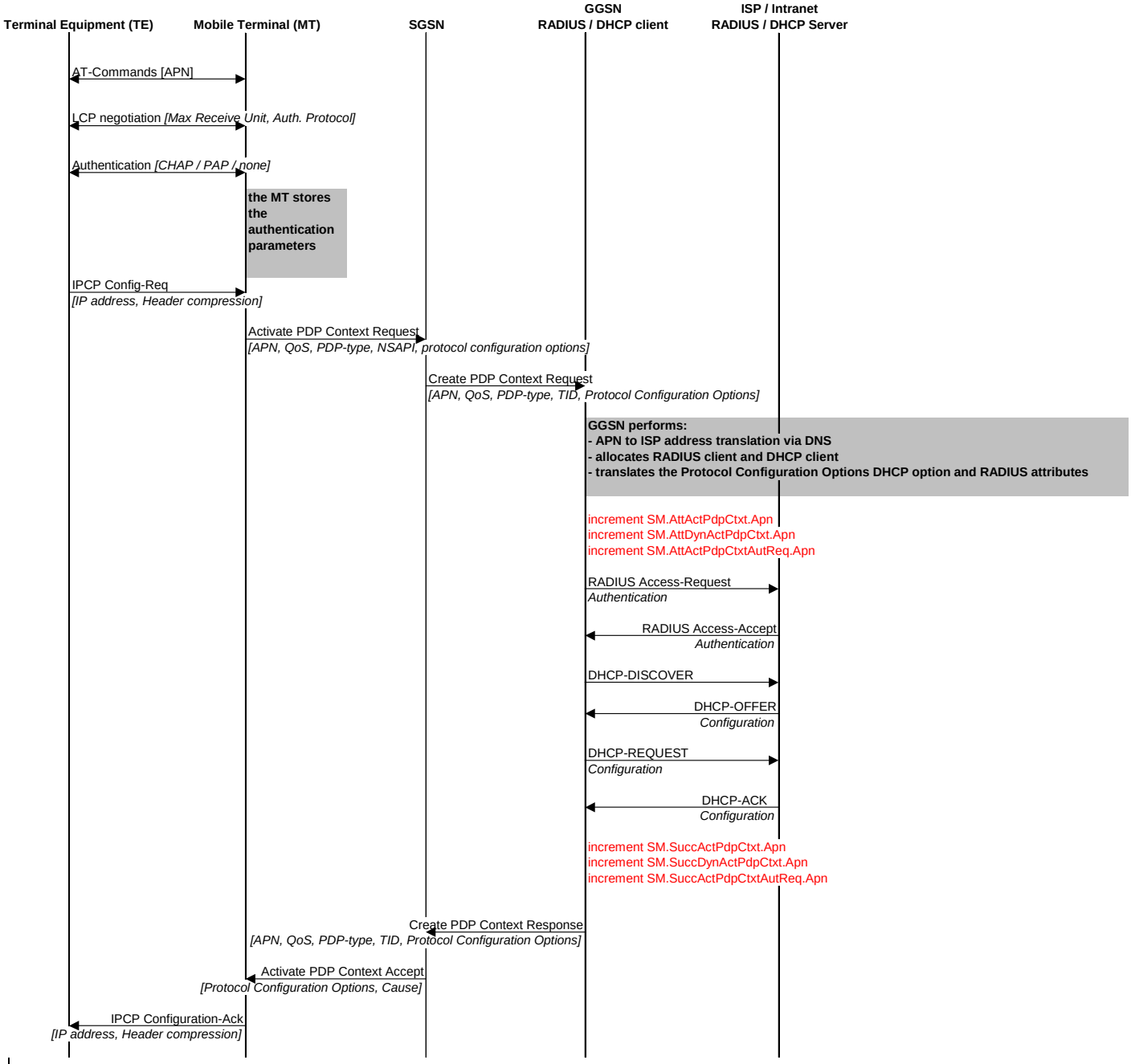
6.2.1 Session establishments

The performance counters presented in this section are intended to bring a more detailed view on session activations compared to counters defined in section 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 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 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.



6.2.1.1 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.

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.

6.2.1.2 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.

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.

6.2.1.3 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.

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.

6.2.1.4 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 and TS 29.060.

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.

6.2.1.5 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 and TS 24.008.

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.

6.2.1.6 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 and TS 24.008.

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.

6.2.2 Active sessions

The performance counters presented in this section 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.

6.2.2.1 Number of simultaneous active sessions, per APN

a) This measurement provides the current number of simultaneous active sessions per APN. This measurement is pegged by 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. See also TS 24.008 and TS 29.060.

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.

6.2.2.2 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

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.

6.2.2.3 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.

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.

6.2.2.4 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.

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.

6.2.3 Session conclusions

6.2.3.1 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 and TS 29.060.

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.

6.2.3.2 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.

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.

6.2.3.3 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.

6.2.3.4 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.

6.3 GTP measurements

The performance counters presented in this section 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 and TS 29.060. 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.

6.3.1 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 pegged by 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. See also TS 29.060.

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.

6.3.2 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 pegged by 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. See also TS 29.060.

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.

6.3.3 Number of discarded GTP data packets

a) This measurement provides the number of GTP Data Packets discarded. This measurement is pegged by 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. See also TS 29.060.

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.

6.3.4 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 pegged by 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. The data packet size is extracted from the GTP header and added on to the measurement value. See TS 29.060.

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.

6.3.5 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 pegged by 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. The data packet size is extracted from the GTP header and added on to the measurement value. See TS 29.060.

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.

6.3.6 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 pegged by 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. See also TS 29.060.

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.

6.3.7 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 pegged by traffic class.

b) CC

c) The relevant measurement is incremented on transmission of a GTP siganlling 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. See also TS 29.060.

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.

6.3.8 Number of discarded GTP signalling packets

a) This measurement provides the number of GTP signalling packets discarded. This measurement is pegged by 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. See also TS 29.060.

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.

6.3.9 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 pegged by 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. The signalling packet size is extracted from the GTP header and added on to the measurement value. See TS 29.060.

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.

6.3.10 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 pegged by 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. The signalling packet size is extracted from the GTP header and added on to the measurement value. See TS 29.060.

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.

6.3.11 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.

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.

6.3.12 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.

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.

6.4 GTP' measurements

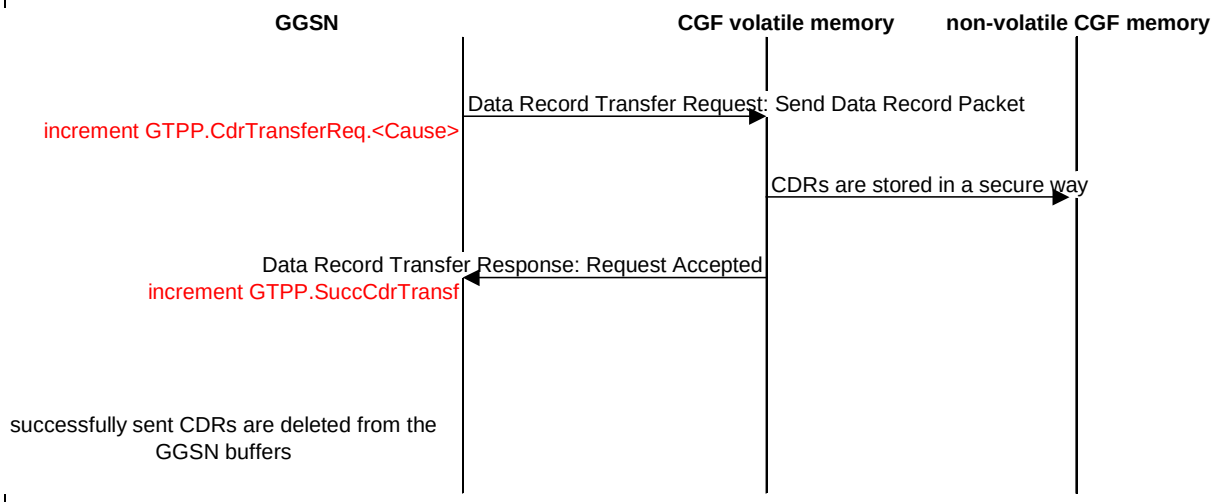
The performance counters presented in this section are intended to monitor the transfer of G-CDRs to the CGF; in particular

- 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 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.



The three measurement types defined in the clause 6.4 are subject to the "2 out of 3 approach".

6.4.1 Attempted CDR information transfers

a) This measurement provides the number of CDR information transfers attempted. This measurement is pegged by 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.

6.4.2 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.

6.4.3 Failed CDR information transfers

a) This measurement provides the number of CDR information failed to be transferred to CGF. This measurement is pegged by 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.

6.5 IP measurements

The performance counters presented in this section are mainly intended to:

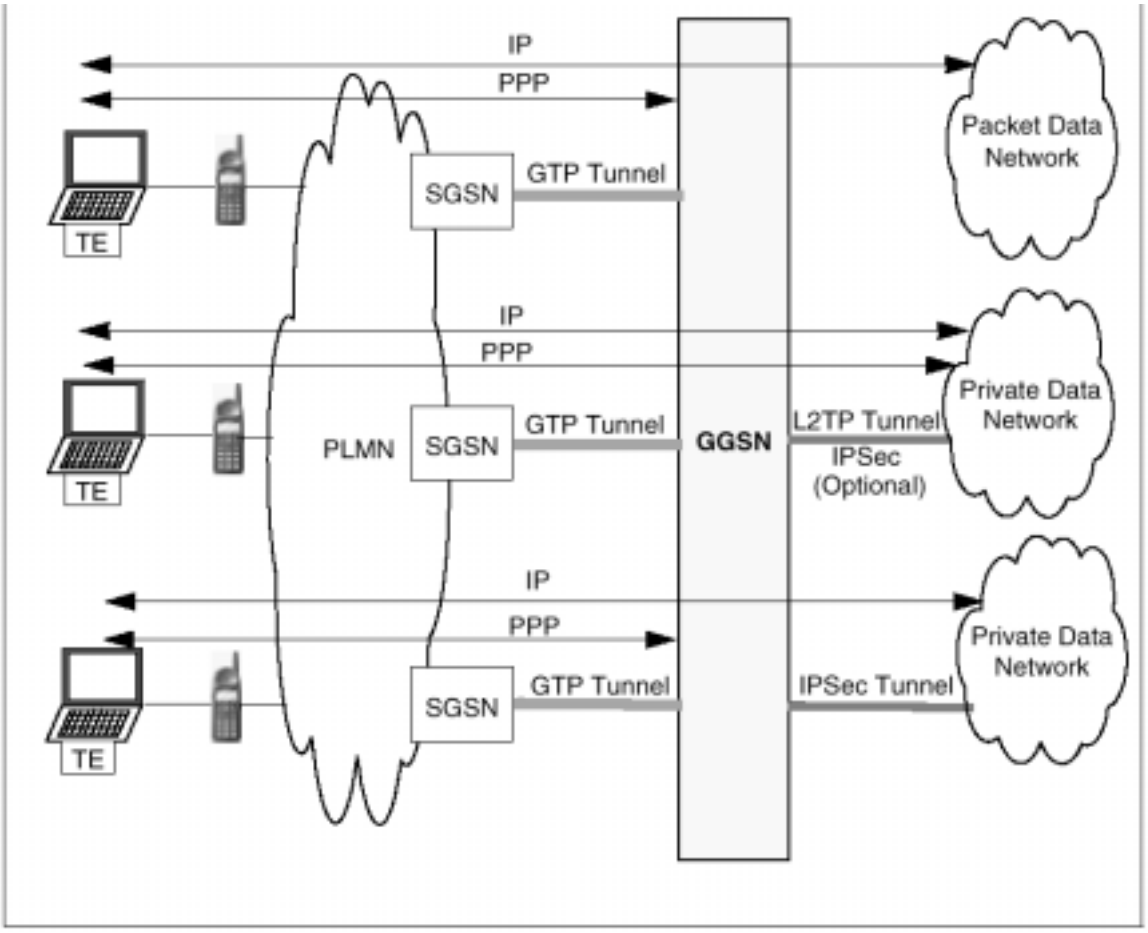
- monitor the bearer traffic exchanged between the GGSN and the external PDN on the Gi interface
- establish the session profile (including IP average packet size, uplink and downlink IP traffic per session, …), possibly per traffic class
- and monitor the GGSN load (through measurements such as the 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 and TS 29.061, 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, …)
- tunneling of packets onto the Gi interface

Any valid combinaton of these options fully defines a "Gi reference point". The figure below gives an overview of some Gi reference points.



6.5.1 Number of incoming IP data packets on the Gi interface

a) This measurement provides the number of IP data packets received on the Gi interface. This measurement is pegged by 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. See also 07 and TS 29.061.

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

e) IP.IncDataPkt.Bgrd
IP.IncDataPkt.Conv
IP.IncDataPkt.Intact
IP.IncDataPkt.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.

6.5.2 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 pegged by 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. See also TS 29.061.

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.

6.5.3 Number of IP data packets discarded due to node congestion

a) This measurement provides the number of IP data packets discarded. This measurement is pegged by 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. See also TS 29.061.

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.

6.5.4 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 pegged by 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. The data packet size is extracted from the IP header and added on to the measurement value. See nd TS 29.061.

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.

6.5.5 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 pegged by 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. The data packet size is extracted from the IP header and added on to the measurement value. See TS 29.061.

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.