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Foreword

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Contents

Foreword

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

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

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where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
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- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

Introduction

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

32.401	Performance Management (PM); Concept and requirements
52.402	Performance Management (PM); Performance measurements - GSM
32.404	Performance Management (PM); Performance measurements - Definitions and template
32.405	Performance Management (PM); Performance measurements Universal Terrestrial Radio Access Network (UTRAN)
32.406	Performance Management (PM); Performance measurements Core Network (CN) Packet Switched (PS) domain
32.407	Performance Management (PM); Performance measurements Core Network (CN) Circuit Switched (CS) domain
32.408	Performance Management (PM); Performance measurements Teleservice
32.409	Performance Management (PM); Performance measurements IP Multimedia Subsystem (IMS)
32.425	Performance Management (PM); Performance measurements Evolved Universal Terrestrial Radio Access Network (E-UTRAN)
32.426	**Performance Management (PM); Performance measurements Evolved Packet Core network (EPC)**

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 LTE SAE-system.

During the lifetime of a LTE SAE network, its logical and physical configuration will undergo changes of varying degrees and frequencies in order to optimise the utilisation of the network resources. These changes will be executed through network configuration management activities and/or network engineering, see TS 32.600 [2].

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

The purpose of the present document is to describe the mechanisms involved in the collection of the data and the definition of the data itself.

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

1 Scope

The present document describes the measurements for EPC and combined EPC/UMTS/GSM.
TS 32.401 [1] describes Performance Management concepts and requirements.
The present document is valid for all measurement types provided by an implementation of an EPC network and combined EPC/UMTS/GSM network. Only measurement types that are specific to EPC or combined EPC/UMTS/GSM networks are defined within the present documents.

Vendor specific measurement types used in EPC and combined EPC/UMTS/GSM networks are not covered. Instead, these could be applied according to manufacturer's documentation.

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

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

The structure of the present document is as follows:

- Header 1: Network Element (e.g. MME related measurements);
- Header 2: Measurement function;
- Header 3: Measurements.

2 References

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

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

[1] 3GPP TS 32.401: "Telecommunication management; Performance Management (PM); Concept and requirements".

[2] 3GPP TS 32.600: "Telecommunication management; Configuration Management (CM); Concept and high-level requirements".

[3] 3GPP TS 24.301: " Technical Specification Group Core Network and Terminals; Non-Access-Stratum (NAS) protocol for Evolved Packet System (EPS); Stage 3".

[4] 3GPP TS 29.274: "Evolved General Packet Radio Service (GPRS); Tunnelling Protocol for Control plane (GTPv2-C); Stage 3".

[5] TS 23.401: 'General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access (Release 8)'

3 Measurement family and abbreviations

3.1 Measurement family

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

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

- MM (measurements related to Mobility Management).
- SM (measurements related to Session Management)

3.2 Abbreviations

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

EPC	Evolved Packet Core
MME	Mobility Management Entity
UMTS	Universal Mobile Telecommunications System
UTRAN	Universal Terrestrial Radio Access Network
Tau	Tracking area update

4 Measurements related to the MME

4.1 Mobility Management

4.1.1 EPS attach procedures

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

4.1.1.1 Attempted EPS attach procedures

a) This measurement provides the number of attempted EPS attach procedures initiated within this MME area.

b) CC.

c) Receipt of "ATTACH REQUEST" message with "Attach type" information element indicating "EPS attach" from the MS (TS 24.301 [3]).

Editor notes: Attach type message needs to be changed according to TS24.301.

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

e) MM.EpsAttachAtt.E
Note: E indicates EPS.

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching.

h) EPS.

4.1.1.2 Successful EPS attach procedures

a) This measurement provides the number of successfully performed EPS attach procedures within this MME area.

b) CC.

c) Transmission of a "ATTACH ACCEPT" message to the MS, in response to a "ATTACH REQUEST" message with the "Attach type" information element indicating "EPS attach". If the "ATTACH ACCEPT" message is caused by a retransmission, this will not cause the counter to be increased. (TS 24.301 [3]).

Editor notes: Attach type message needs to be changed according to TS24.301.

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

e) MM.EpsAttachSucc.E
Note: E indicates EPS.

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching.

h) EPS.

4.1.1.3 Failed EPS attach procedures

a) This measurement provides the number of failed EPS attach procedures. The measurement is split into subcounters per the reject cause.

b) CC

c) Transmission by the MME of the ATTACH REJECT message to the MS, in response to a "ATTACH REQUEST" message with the "Attach type" information element indicating "EPS attach", the relevant measurement is incremented according to the reject cause. Possible reject causes are defined within TS 24.301 [3].
The sum of all supported per cause measurements shall be equal to the total number of failed EPS attach procedures. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

Editor notes: Attach type message needs to be changed according to TS24.301.

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

e) MM.EpsAttachFail.*Cause*.E
where *Cause* identifies the reject cause, E indicates EPS.

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching

h) EPS.

4.1.2 UE-initiated EPS Detach procedure

4.1.2.1 Attempted EPS detach procedures by UE

a) This measurement provides the number of attempted EPS detach procedures initiated by UE within this MME area.

b) CC.

c) Receipt of "DETACH REQUEST" message with "detach type" information element indicating "EPS detach" from the UE (TS 24.301 [3]).

Editor notes: Attach type message needs to be changed according to TS24.301.

d) A single integer value.

e) MM.EpsDetachUeAtt

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code)

g) Valid for packet switching.

h) EPS.

4.1.2.2 Successful EPS detach procedures by UE

a) This measurement provides the number of successful EPS detach procedures initiated by UE within this MME area.

b) CC

c) Transmission of "DETACH ACCEPT" message from the MME (TS 24.301 [3]).

d) A single integer value.

e) MM.EpsDetachUeSucc

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code)

g) Valid for packet switching.

h) EPS

4.1.3 MME-initiated EPS Detach procedure

4.1.3.1 Attempted EPS detach procedures by MME

a) This measurement provides the number of attempted EPS detach procedures initiated by MME.

b) CC

c) Transmission of "DETACH REQUEST" message by UE from the MME, not including repeat (TS 24.301 [3]).

d) A single integer value.

e) MM.EpsDetachMMEAtt

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code)

g) Valid for packet switching.

h) EPS

4.1.3.2 Successful EPS detach procedures by MME

a) This measurement provides the number of successful EPS detach procedures initiated by MME.

b) CC

c) Receipt of "DETACH ACCEPT" message by MME from the UE (TS 24.301 [3]).

d) A single integer value.

e) MM.EpsDetachMMESucc

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code)

g) Valid for packet switching.

h) EPS

4.1.4 HSS-initiated EPS Detach procedure

4.1.4.1 Attempted EPS detach procedures by HSS

a) This measurement provides the number of attempted EPS detach procedures initiated by HSS.

b) CC

c) Receipt of "CANCEL LOCATION" message by MME from HSS with "cancel type" information element indicating 'delete user', not including repeat (TS 24.301 [3]).

d) A single integer value.

e) MM.EpsDetachHssAtt

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code)

g) Valid for packet switching.

h) EPS

4.1.4.2 Successful EPS detach procedures by HSS

a) This measurement provides the number of successful EPS detach procedures initiated by HSS.

b) CC

c) Transmission of "CANCEL LOCATION ACK" message by HSS from the MME (TS 24.301 [3]).

d) A single integer value.

e) MM.EpsDetachHssSucc

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code)

g) Valid for packet switching.

h) EPS

4.1.5 Tracking area update procedure with Serving GW change

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

4.1.5.1 Attempted tracking area update procedure with Serving GW change

a) This measurement provides the number of attempted tracking area update procedures with Serving GW change initiated within this MME area.

b) CC.

c) Receipt of "TRACKING AREA UPDATE REQUEST" message from a MS with "Last visited registered TAI" information element indicating to the MME that it wishes to be served by a new Serving GW (different to the old Serving GW (TS 24.301 [3])).

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

e) MM.TauInterSgwAtt

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching.

h) EPS.

4.1.5.2 Successful tracking area update procedure with Serving GW change

a) This measurement provides the number of successfully performed tracking area update procedures with Serving GW change within this MME area.

b) CC.

c) Transmission of a "TRACKING AREA UPDATE ACCEPT" message to the MS, in response to a "TRACKING AREA UPDATE REQUEST" message in which the "Last visited registered TAI" information element indicated to the MME that it wishes to be served by a new Serving GW (different to the old Serving GW). If the "TRACKING AREA UPDATE ACCEPT" message is caused by a retransmission, this will not cause the counter to be increased. (TS 24.301 [3]).

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

e) MM.TauInterSgwSucc

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching.

h) EPS.

4.1.5.3 Failed tracking area update procedure with Serving GW change

a) This measurement provides the number of failed tracking area update procedure with Serving GW change. The measurement is split into subcounters per the reject cause.

b) CC

c) Transmission of a 'TRACKING AREA UPDATE REJECT' message to the MS, in response to a " TRACKING AREA UPDATE REQUEST" message with in which the "Last visited registered TAI" information element indicated to the MME that it wishes to be served by a new Serving GW (different to the old Serving GW), the relevant measurement is incremented according to the reject cause. Possible reject causes are defined within TS 24.301. The sum of all supported per cause measurements shall be equal to the total number of failed Tracking Area Update procedure with Serving GW change. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

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

e) MM.TauInterSgwFail.*Cause*
where Cause identifies the reject cause.

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching

h) EPS.

4.1.6 Tracking area update procedure without Serving GW change

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

4.1.6.1 Attempted tracking area update procedure without Serving GW change

a) This measurement provides the number of attempted tracking area update procedures without Serving GW change initiated within this MME area.

b) CC.

c) Receipt of "TRACKING AREA UPDATE REQUEST" message from a MS with "Last visited registered TAI" information element indicating to the MME that it wishes to be served by the same Serving GW as the old Serving GW (TS 24.301 [3]).

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

e) MM.TauIntraSgwAtt

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching.

h) EPS.

4.1.6.2 Successful tracking area update procedure without Serving GW change

a) This measurement provides the number of successfully performed tracking area update procedures without Serving GW change within this MME area.

b) CC.

c) Transmission of a "TRACKING AREA UPDATE ACCEPT" message to the MS, in response to a "TRACKING AREA UPDATE REQUEST" message in which the "Last visited registered TAI" information element indicated to the MME that it wishes to be served by the same Serving GW as the old Serving GW. If the "TRACKING AREA UPDATE ACCEPT" message is caused by a retransmission, this will not cause the counter to be increased. (TS 24.301 [3]).

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

e) MM.TauIntraSgwSucc

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching.

h) EPS.

4.1.6.3 Failed tracking area update procedure without Serving GW change

a) This measurement provides the number of failed tracking area update procedure without Serving GW change. The measurement is split into subcounters per the reject cause.

b) CC

c) Transmission of a 'TRACKING AREA UPDATE REJECT' message to the MS, in response to a " TRACKING AREA UPDATE REQUEST" message in which the "Last visited registered TAI" information element indicated to the MME that it wishes to be served by the same Serving GW as the old Serving GW, the relevant measurement is incremented according to the reject cause. Possible reject causes are defined within TS 24.301. The sum of all supported per cause measurements shall be equal to the total number of failed Tracking Area

Update procedure with Serving GW change. In case only a subset of per cause measurements is supported, a sum subcounter will be provided first.

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

e) MM.TauIntraSgwFail.*Cause*
where Cause identifies the reject cause.

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching

h) EPS.

4.1.9 EPS paging procedures

The three measurement types defined in clauses 4.1.9.n are subject to the "2 out of 3 approach".

4.1.9.1 Attempted EPS paging procedures

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

b) CC.

c) Incremented when an EPS paging procedure is started i.e. at the transmission of the first "Paging" message (TS 36.413 [4]) from the MME to the eNodeB, which are counted when paging area is smaller than or equal to one TA.

d) A single integer value.

e) MM.PagingEpsAtt

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching.

h) EPS.

4.1.9.2 Successful EPS paging procedures

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

b) CC.

c) Incremented when a paging_response is received by the MME from the UE as response to an EPS PS paging procedure (Receipt of "SERVICE REQUEST" message with Service Type = Paging Response from the UE (TS 24.301 [3])) , which are counted when paging area is smaller than or equal to one TA.

d) A single integer value.

e) MM.PagingEpsSucc

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching.

h) EPS.

4.1.9.3 Failed EPS paging procedures

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

b) CC.

c) Incremented when an EPS PS paging procedure times out, which are counted when paging area is smaller than or equal to one TA.

d) A single integer value.

e) MM.PagingEpsFail

f) TA, specified by a concatenation of the MCC (Mobile Country Code), MNC (Mobile Network Code), TAC (Tracking Area Code).

g) Valid for packet switching.

h) EPS.

4.2 Session Management

4.2.1 Number of dedicated EPS bearers in active mode (Mean)

a) This measurement provides the mean number of dedicated EPS bearers.

b) SI

c) The measurement is obtained by sampling at a pre-defined interval, the number of dedicated EPS bearer established by MME in active mode and then taking the arithmetic mean.

d) A single integer value

e) SM.MeanNbrActDedicatedBearer

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.2 Number of dedicated EPS bearers in active mode (Maximum)

a) This measurement provides the maximum number of dedicated EPS bearers in active mode.

b) SI

c) The measurement is obtained by sampling at a pre-defined interval, the number of dedicated EPS bearer established by MME in active mode and then taking the.maximum

d) A single integer value

e) SM.MaxNbrActDedicatedBearer

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.3 Dedicated bearer set-up time by MME (Mean)

a) The measurement provides the valid time per dedicated bearer set-up procedure by MME, (unit: second).

b) DER (n=1)

c) This measurement is obtained by accumulating the time intervals for every successful dedicated bearer setup by MME between the transmission by the MME of a "ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST" and the corresponding "ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT" message receipt by the MME the over a granularity period using DER. If the dedicated bearer setup procedure is beyond one granularity period, only the set-up time for procedures whose message 'ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT' is received in the granularity period can be accumulated. The end value of this time will then be divided by the number of successful dedicated bearer set-up procedures in the granularity period to give the arithmetic mean, the accumulator shall be reinitialised at the beginning of each granularity period.

d) A single integer value

e) SM.EstabActDedicatedEpsBearerTimeMean

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.4 MME initiated dedicated bearer activation

4.2.4.1 Attempted dedicated bearer activation procedures by MME

a) The measurement provides the number of attempted dedicated bearer activation procedures by MME.

b) CC

c) Transmission of 'ACTIVATE DEDICATED EPS BEARER CONTEXT REQUEST' message by MME (TS 24.301 [3])

d) A single integer value

e) SM.ActDedicatedEpsBearerAtt

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.4.2 Successful dedicated bearer activation procedures by MME

a) The measurement provides the number of successful dedicated bearer activation procedures by MME

b) CC

c) Receipt of 'ACTIVATE DEDICATED EPS BEARER CONTEXT ACCEPT' message by MME (TS 24.301 [3]).

d) A single integer value

e) SM.ActDedicatedEpsBearerSucc

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.4.3 Failed dedicated bearer activation procedures by MME

a) The measurement provides the number of failed dedicated bearer activation procedures by MME, which is incremented according to the reject cause.

b) CC

c) Receipt of 'ACTIVATE DEDICATED EPS BEARER CONTEXT REJECT' message by MME from UE with 'ESM Cause' indicating the cause of failure. Each measurement type defined in e) is corresponding to a reject cause, possible reject causes are defined within TS 24.301 [3].

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

e) SM.ActDedicatedEpsBearerFail.*Cause*
where *Cause* identifies the reject cause.

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.5 MME initiated dedicated bearer deactivation

4.2.5.1 Attempted dedicated bearer deactivation procedures by MME

a) The measurement provides the number of attempted dedicated bearer deactivation procedures by MME

b) CC

c) Transmission of 'DEACTIVATE EPS BEARER CONTEXT REQUEST' message by MME (TS 24.301 [3])

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

e) SM.DeactEpsDedicatedBearerAtt

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.5.2 Successful dedicated bearer deactivation procedures by MME

a) The measurement provides the number of successful dedicated bearer deactivation procedures by MME.

b) CC

c) Receipt of 'DEACTIVATE EPS BEARER CONTEXT ACCEPT' message by MME (TS 24.301 [3]).

d) A single integer value

e) SM.DeactEpsDedicatedBearerSucc

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.6. MME initiated EPS bearer modification

4.2.6.1 Attempted EPS bearer modification procedures by MME

a) The measurement provides the number of attempted EPS bearer modification procedures by MME

b) CC

c) Transmission of 'MODIFY EPS BEARER CONTEXT REQUEST' message by MME (TS 24.301 [3])

d) A single integer value

e) SM.ModEpsBearerAtt

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.6.2 Successful EPS bearer modification procedures by MME

a) The measurement provides the number of successful EPS bearer modification procedures by MME.

b) CC

c) Receipt of 'MODIFY EPS BEARER CONTEXT ACCEPT' message by MME (TS 24.301 [3]).

d) A single integer value

e) SM.ModEpsBearerSucc

f) MMEFunction

g) Valid for packet switching

h) EPS

4.2.6.3 Failed EPS bearer modification procedures by MME

a) The measurement provides the number of failed EPS bearer modification procedures by MME, which is incremented according to the reject cause.

b) CC

c) Receipt of 'MODIFY EPS BEARER CONTEXT REJECT' message by MME from UE with 'ESM Cause' taking the reject cause. (TS 24.301 [3]).

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

e) SM.ModEpsBearerFail.*Cause*
where Cause identifies the reject cause

f) MMEFunction

g) Valid for packet switching

h) EPS

5 Measurements related to the PDN-GW for a GTP based S5/S8

5.1 Session Management

5.1.1 PDN-GW initiated Dedicated Bearer Creation

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

5.1.1.1 Attempted number of PDN-GW initiated Dedicated Bearer Creation

a) This measurement provides the number of attempted PDN-GW initiated Dedicated Bearer Creation

b) CC

c) Transmission of "Create Bearer REQUEST" message From PDN-GW, this message may contains multiple Bearer IDs, each bearer shall be cumulated to the counter. (TS 29.274 [4], TS 23.401[5]).

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

e) SM.CreationPGWInitBearerAtt

f) PGWFunction

g) Valid for packet switching.

h) EPS

5.1.1.2 Successful number of PDN-GW initiated Dedicated Bearer Creation

a) This measurement provides the number of successfully performed PDN-GW initiated Dedicated Bearer Creation.

b) CC

c) Receipt of 'Create Bearer Response' message by PDN-GW where 'Cause' IE identifies a successful bearer handling with 'Acceptance Response' from 'Cause' IE for each Bearer ID in the table 8.4-1 of TS 29.274, each bearer shall be cumulated to the counter. (TS 29.274 [4], TS 23.401[5]).

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

e) SM.CreatationPGWInitBearerSucc

f) PGWFunction

g) Valid for packet switching.

h) EPS

5.1.1.3 Failed number of PDN-GW initiated Dedicated Bearer Creation

a) This measurement provides the number of failed PDN-GW initiated Dedicated Bearer Creation. The measurement is split into subcounters per the reject cause.

b) CC

c) Receipt of 'Create Bearer Response' message by PDN-GW where 'Cause' IE identifies a failed bearer handling with 'Rejection Response' which indicates the reason of failure from 'Cause' IE for each bearer ID in the table 8.4-1 of TS 29.274, each bearer shall be cumulated to the counter. (TS 29.274 [4], TS 23.401[5]).

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

e) SM.CreatationPGWInitBearerFail.*Cause*
where Cause identifies the cause of failure.

f) PGWFunction

g) Valid for packet switching

h) EPS

5.1.2 PDN-GW initiated Dedicated Bearer Deletion

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

5.1.2.1 Attempted number of PDN-GW initiated Dedicated Bearer Deletion

a) This measurement provides the number of attempted PDN-GW initiated Dedicated Bearer Deletion

b) CC

c) Transmission of "Delete Bearer REQUEST" message From PDN-GW, this message may contains multiple Bearer IDs, each bearer shall be cumulated to the counter (TS 29.274 [4], TS 23.401[5]).

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

e) SM.DelPGWInitBearerAtt

f) PGWFunction

g) Valid for packet switching.

h) EPS

5.1.2.2 Successful number of PDN-GW initiated Dedicated Bearer Deletion

a) This measurement provides the number of successfully performed PDN-GW initiated Dedicated Bearer Deletion.

b) CC

c) Receipt of 'Delete Bearer Response' message by PDN-GW where 'Cause' IE identifies a successful bearer handling with 'Acceptance Response' from 'Cause' IE for each Bearer ID in the table 8.4-1 of TS 29.274, each bearer shall be cumulated to the counter (TS 29.274 [4], TS 23.401[5]).

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

e) SM.DelPGWInitBearerSucc

f) PGWFunction

g) Valid for packet switching.

h) EPS

5.1.2.3 Failed number of PDN-GW initiated Dedicated Bearer Deletion

a) This measurement provides the number of failed PDN-GW initiated Dedicated Bearer Deletion. The measurement is split into subcounters per the reject cause.

b) CC

c) Receipt of 'Delete Bearer Response' message by PDN-GW where 'Cause' IE identifies a failed bearer handling with 'Rejection Response' which indicates the reason of failure from 'Cause' IE for each bearer ID in the table 8.4-1 of TS 29.274, each bearer shall be cumulated to the counter. (TS 29.274 [4], TS 23.401[5]).

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

e) SM.DelPGWInitBearerFail.*Cause*
where Cause identifies the cause of failure.

f) PGWFunction

g) Valid for packet switching

h) EPS

5.1.3 PDN-GW initiated Dedicated Bearer Modification with QoS update procedure

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

5.1.3.1 Attempted number of PDN-GW initiated Dedicated Bearer Modification with QoS update

a) This measurement provides the number of attempted PDN-GW initiated Dedicated Bearer Modification with QoS update.

b) CC

c) Transmission of "Update Bearer REQUEST" message From PDN-GW with 'Bearer Level QoS' IE, this message may contains multiple Bearer IDs, each bearer shall be cumulated to the counter. (TS 29.274 [4], TS 23.401[5]).

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

e) SM.ModPGWInitBearerQoSUpdateAtt

f) PGWFunction

g) Valid for packet switching.

h) EPS

5.1.3.2 Successful PDN-GW initiated Dedicated Bearer Modification with QoS update

a) This measurement provides the number of successfully performed PDN-GW initiated Dedicated Bearer Modification with QoS update.

b) CC

c) Receipt of 'Update Bearer Response' message by PDN-GW with 'Bearer Level QoS' IE in the 'Update Bearer Request' message which contains the same EPS Bearer ID and where 'Cause' IE identifies a successful bearer handling with 'Acceptance Response' from 'Cause' IE for each Bearer ID in the table 8.4-1 of TS 29.274, each bearer shall be cumulated to the counter (TS 29.274 [4], TS 23.401[5]).

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

e) SM.ModPGWInitBearerQoSUpdateSucc

f) PGWFunction

g) Valid for packet switching.

h) EPS

5.1.3.3 Failed PDN-GW initiated Dedicated Bearer Modification with QoS update

a) This measurement provides the number of failed PDN-GW initiated Dedicated Bearer Modification with QoS update procedures. The measurement is split into subcounters per the reject cause.

b) CC

c) Receipt of 'Update Bearer Response' message by PDN-GW with 'Bearer Level QoS' IE in the 'Update Bearer Request' message which contains the same EPS Bearer ID and where 'Cause' IE identifies a failed bearer handling with 'Rejection Response' which indicates the reason of failure from 'Cause' IE for each bearer ID in the table 8.4-1 of TS 29.274, each bearer shall be cumulated to the counter. (TS 29.274 [4], TS 23.401[5]).

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

e) SM.ModPGWInitBearerQoSUpdateFail.*Cause*
where Cause identifies the cause of failure.

f) PGWFunction

g) Valid for packet switching

h) EPS

5.1.4 PDN-GW initiated Dedicated Bearer Modification without QoS update procedure

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

5.1.4.1 Attempted number of PDN-GW initiated Dedicated Bearer Modification without QoS update

a) This measurement provides the number of attempted PDN-GW initiated Dedicated Bearer Modification without QoS update.

b) CC

c) Transmission of "Update Bearer REQUEST" message From PDN-GW without 'Bearer Level QoS' IE, this message may contains multiple Bearer IDs, each bearer shall be cumulated to the counter. (TS 29.274 [4], TS 23.401[5]).

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

e) SM.ModPGWInitBearerNoQoSUpdateAtt

f) PGWFunction

g) Valid for packet switching.

h) EPS

5.1.4.2 Successful number of PDN-GW initiated Dedicated Bearer Modification without QoS update

a) This measurement provides the number of successfully performed PDN-GW initiated Dedicated Bearer Modification without QoS update.

b) CC

c) Receipt of 'Update Bearer Response' message by PDN-GW without 'Bearer Level QoS' IE in the 'Update Bearer Request' message which contains the same EPS Bearer ID and where 'Cause' IE identifies a successful bearer handling with 'Acceptance Response' from 'Cause' IE for each Bearer ID in the table 8.4-1 of TS 29.274, each bearer shall be cumulated to the counter. (TS 29.274 [4], TS 23.401[5]).

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

e) SM.ModPGWInitBearerNoQoSUpdateSucc

f) PGWFunction

g) Valid for packet switching.

h) EPS

5.1.4.3 Failed number of PDN-GW initiated Dedicated Bearer Modification without QoS update

a) This measurement provides the number of failed PDN-GW initiated Dedicated Bearer Modification without QoS update. The measurement is split into subcounters per the reject cause.

b) CC

c) Receipt of 'Update Bearer Response' message by PDN-GW without 'Bearer Level QoS' IE in the 'Update Bearer Request' message which contains the same EPS Bearer ID and where 'Cause' IE identifies a failed bearer handling with 'Rejection Response' which indicates the reason of failure from 'Cause' IE for each bearer ID in the table 8.4-1 of TS 29.274, each bearer shall be cumulated to the counter. (TS 29.274 [4], TS 23.401[5]).

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

e) SM.ModPGWInitBearerNoQoSUpdateFail.*Cause*
where Cause identifies the cause of failure.

f) PGWFunction

g) Valid for packet switching

h) EPS

Annex A (informative): Use case for measurements

A.1 Use case for mobility management related measurements

A UE/user needs to register with the network to receive services that require registration. This registration is described as Network Attachment. The always-on IP connectivity for UE/users of the EPS is enabled by establishing a default EPS bearer during Network Attachment. The PCC rules applied to the default EPS bearer may be predefined in the PDN GW and activated in the attachment by the PDN GW itself. The Attach procedure may trigger one or multiple Dedicated Bearer Establishment procedures to establish dedicated EPS bearer(s) for that UE. During the attach procedure, the UE may request for an IP address allocation. Terminals utilising only IETF based mechanisms for IP address allocation are also supported.

If user or subscriber cannot attach to the PS network of EPC, they cannot access network, so they may complain about quality of service provided by EPC network. So it is necessary to define attach related measurements to evaluate network attchment performance of EPC network by attchment success rate.

A.2 Use case for detach related measurements

The detach procedure is used by the UE to detach only for EPS services or to detach for both EPS services and non-EPS services or only for non-EPS services via a combined detach procedure. Also the detach procedure can be used by the network to inform the UE that it does not have access to the EPS any longer. Three detach procedures are provided when the UE accesses the EPS through E-UTRAN. The first detach procedure is UE-initiated detach procedure and other detach procedures are network-initiated detach procedures, which are MME-initiated detach procedure and HSS-initiated detach procedure respectively.

The detach procedure shall be invoked by the UE if the UE is switched off, the USIM card is removed from the UE or the EPS capability or CS fallback capability of the UE is disabled. The detach procedure shall be invoked by the network if the UE is illegal or GPRS services are not allowed in this PLMN and etc. The UE is detached either explicitly or implicitly. Explicit detach means that the network or the UE explicitly requests detach and signal with each other; implicit detach means that the network detaches the UE without notifying the UE, which is typically the case when the network presumes that it is not able to communicate with the UE, e.g. due to radio conditions.

If the detach procedure is performed, the EPS bearer context(s) for this particular UE are deactivated locally without peer-to-peer signalling between the UE and the MME.

Due to different EMM causes, the detach procedures are invoked by the UE or the network. In order to estimate the relative performance of detach of EPC network, it is necessary to define detach related measurements by detach success rate.

A.3 Use case for tracking area update related measurements

If a user fails upating the Tracking Area, it may not be able to attach to the new Tracking Area, and then the user experience would be very intolerable. Since MME determines to relocate S-GW based on S-GW service area, which is composed of TAs, it is assumed that S-GW service area is already known in MMEs. If the MME identifies that the new TA is out of the scope of S-GW service area, it shall perform inter S-GW Tracking Area Update procedure, otherwise, it shall perform intra S-GW Tracking Area Update procedure.

Thus it is necessary to define Tracking Area Update related measurements includes both Inter and Intra S-GW Tracking Area Update procedures to evaluate network tracking area update performance of EPC network by calculate success rate.

A.4 Use case for session related measurements

The purpose of the dedicated bearer context activation procedure is to establish an EPS bearer context with specific QoS and TFT (Traffic Flow Template) between the UE and the EPC. The dedicated EPS bearer context activation procedure is initiated by the network, but may be requested by the UE by means of the UE requested bearer resource allocation procedure. The dedicated bearer context activation procedure can be part of the attach procedure, and if the attach procedure fails, the UE shall consider that the dedicated bearer activation has implicitly failed.

The purpose of the EPS bearer context modification procedure is to modify an EPS bearer context with a specific QoS and TFT. The EPS bearer context modification procedure is initiated by the network in order to either modify the QoS, the TFT, or both. The EPS bearer context modification procedure is initiated by the network, but it may be initiated as part of the UE requested bearer resource allocation procedure.

The purpose of the EPS bearer context deactivation procedure is to deactivate an EPS bearer context or disconnect from a PDN by deactivating all EPS bearer contexts to the PDN. The EPS bearer context deactivation procedure is initiated by the network, and it may be triggered by the UE by means of the UE requested bearer resource release procedure or UE requested PDN disconnect procedure.

If users or subscribers cannot use the services provided by EPS successfully, the users" subjective feel to the network is influenced. So it is necessary to define session related measurements to evaluate session performance of EPC network.

A.5 Use case for EPS paging procedures

Paging success rate is one of the important performance indicators for network performance analysis. It measures the paging response acceptance rate when the CN believes that the mobile is in the coverage area and pages the mobile to find the terminating mobile party to complete the incoming call. If the paging success rate is too low, network access success rate will be impacted. Paging success rate is calculated by paging related measurements. So it is necessary to define paging related measurements.

A.6 Use case of PDN-GW initiated Dedicated Bearer Management related measurements for EPC

As PDN-GW is the element that initiate the dedicated bearer, if PDN-GW can not activate the dedicated bearer, then users or subscribers cannot use the services provided by EPS successfully, which will influence the users" subjective feel to the network. So it is necessary to define PDN-GW initiated Dedicated Bearer Creation related measurements to evaluate session performance of EPC network.

A.7 Use case of PDN-GW initiated Dedicated Bearer Management related measurements for EPC

The PDN-GW shall be able to delete the dedicated bearer to release more network resources. If the PDN-GW can not delete the dedicated bearer, then the valid network resource for user will become less and less which may leads to system crash. So it is necessary to define PDN-GW initiated Dedicated Bearer Deletion related measurements to evaluate session performance of EPC network.

A.8 Use case of PDN-GW initiated Dedicated Bearer Management related measurements for EPC

The PDN-GW shall be able to update the dedicated bearer to modify an EPS bearer with a specific QoS and TFT, if PDN-GW can not update QoS and TFT, then users or subscribers cannot achieve better network resource and the PDN-GW cannot map the service flow to the appropriate bearer, which will influence the users" subjective feel to the

network. So it is necessary to define PDN-GW initiated Dedicated Bearer Modification with QoS Update related measurements to evaluate session performance of EPC network.

A.9 Use case of PDN-GW initiated Dedicated Bearer Management related measurements for EPC

The PDN-GW shall be able to update the dedicated bearer to modify an EPS bearer with a specific TFT, if PDN-GW can not update TFT, then the PDN-GW cannot map the service flow to the appropriate bearer, which will influence the users" subjective feel to the network. So it is necessary to define PDN-GW initiated Dedicated Bearer Modification without QoS Update related measurements to evaluate session performance of EPC network.

Annex B (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
Dec 2008	SP-42	SP-080840			Presentation to SA for information		1.0.0
Mar 2009	SP-43	SP-090064	--	--	Presentation to SA for approval	2.0.0	8.0.0
Sep 2010	SP-49	SP-100487	028	--	Correct NE in measurement condition	8.0.0	8.1.0

History

Document history		
V8.0.0	April 2009	Publication
V8.1.0	October 2010	Publication