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3GPP TSG-SA5 (Telecom Management) S5-058269
Meeting #41bis, Sophia Antipolis, FRANCE, 14 - 18 Mar 2005

Title: **Reply LS on tracing information for MBMS services**
Response to: **LS (N3-050205 / S5-058215) on tracing information for MBMS services from CN3**
Release: **Release 6**
Work Item: **OAM-Trace**

Source: **SA5 SWG-D**
To: **CT3**
Cc: **CT4, SA2, RAN, GERAN**

Contact Person
Name: **Gyula BÓDOG**
Tel. Number: +36209849272
E-mail Address: Gyula.Bodog@nokia.com

Attachments: Rel-6 TS 32.421 and TS 32.422

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1. Overall Description:

SA5 would like to thank CT3 for the LS on MBMS tracing. SA5 has reviewed the CR that has been discussed in CT3 for introducing Trace possibilities in the BM-SC. SA5 has concluded that CT3 used the Trace parameters that have been defined in SA5's TS 52.008, which is a GSM only specification.

Therefore SA5 would like to inform CT3 about the new Trace concepts that have been developed by SA5 and are documented in SA5's TSs 32.421/2/3.

According to the new concepts, two activation methods have been defined:

- **Signalling Based Activation (SBA)**: For SBA the Trace control and configuration parameters have to be automatically propagated between the nodes. The Trace control and configuration parameters are defined in SA5's TS 32.422, which needs to be extended for the tracing capability of the BM-SC.

- **Management Based Activation (MBA)**: For MBA, the IMSI and the IMEI(SV) needs to be made available in the node where MBA tracing is required. For BM-SC the IMSI and the IMEI(SV) needs to be made available.

Therefore, SA5 would like to inform CT3 that if tracing is needed in BM-SC, that should be specified according to the concepts described in TSs 32.42x.

SA5 used SA2's TS 23.002 as reference to define which interfaces and network elements can be used for tracing purposes and noted that the BM-SC and the Gmb interface are not defined in the latest Rel-6 version of that TS.

For further progress SA5 needs more information as follows:
Question 1: Are IMSI and IMEI(SV) available in the BM-SC?
Question 2: Which interfaces and what information should be traced in BM-SC?
Question 3: What are BM-SC triggering events to start and to stop a Trace Recording Session?
Question 4: Does tracing on individual IMSI and IMEI(SV) cover the need from CT3? If not, is a trace on a service intended, and in that case what relation would it have to the Service Level Trace function in OMA?

SA5 would also like to mention that, according to the understanding of SA5 of CT3's requirement, there is **no effect to RAN or GERAN work**, but CT4 needs to modify their solution for SBA tracing to include the MBMS tracing to the trace control and configuration parameters.

SA5 has identified that the following trace control and configuration parameters need to be extended:

- List of NE types to trace: to include BM-SC
- Triggering event for BM-SC: to define which messages should trigger the start of a Trace Recording Session and which messages should trigger the stopping of a Trace Recording Session.
- List of interfaces to trace: the list of interfaces in the BM-SC that needs to be traced should be defined.

2. Actions:

To CT3 group.

ACTION: SA5 asks CT3 group to answer to the questions above and provide information on which interfaces CT3 would like to include for tracing in BM-SC.

3. Date of Next SA5 Meetings:

TITLE	TYPE	DATES	LOCATION	CTRY
3GPPSA5#42	WG	9 - 13 May 2005	Montreal	CA
3GPPSA5#42-BIS	WG	27 Jun - 1 Jul 2005	Sophia Antipolis	FR
3GPPSA5#43	WG	29 Aug - 2 Sep 2005	TBD	TBD
3GPPSA5#44	WG	7 - 11 Nov 2005	TBD	TBD

3GPP TS 32.421 V6.5.0 (2004-12)

Technical Specification

3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Telecommunication management; Subscriber and equipment trace: Trace concepts and requirements (Release 6)

Keywords
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Postal address

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

Internet
http://www.3gpp.org

Contents

Foreword

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

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

Version x.y.z

where:

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

Introduction

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

TS 32.421: "Subscriber and equipment trace: Trace concepts and requirements";

TS 32.422: "Subscriber and equipment trace: Trace control and configuration management";

TS 32.423: "Subscriber and equipment trace: Trace data definition and management";

Subscriber and MS Trace provide very detailed information at call level on one or more specific mobile(s). This data is an additional source of information to Performance Measurements and allows going further in monitoring and optimisation operations.

Contrary to Performance Measurements, which are a permanent source of information, Trace is activated on user demand for a limited period of time for specific analysis purposes.

Trace plays a major role in activities such as determination of the root cause of a malfunctioning mobile, advanced troubleshooting, optimisation of resource usage and quality, RF coverage control and capacity improvement, dropped call analysis, Core Network and UTRAN end-to-end UMTS procedure validation.

The capability to log data on any interface at call level for a specific user (e.g. IMSI) or mobile type (e.g. IMEI or IMEISV) allows getting information which cannot be deduced from Performance Measurements such as perception of end-user QoS during his call (e.g. requested QoS vs. provided QoS), correlation between protocol messages and RF measurements, or interoperability with specific mobile vendors.

Moreover, Performance Measurements provide values aggregated on an observation period, Subscriber and Equipment Trace give instantaneous values for a specific event (e.g. call, location update, etc.).

If Performance Measurements are mandatory for daily operations, future network planning and primary trouble shooting, Subscriber and MS Trace is the easy way to go deeper into investigation and UMTS network optimisation.

In order to produce this data, Subscriber and MS Trace are carried out 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).

1 Scope

The present document describes the requirements for the management of Trace and the reporting of Trace data across UMTS networks as it refers to subscriber tracing (tracing of IMSI or Private ID) and MS tracing (tracing of IMEI or IMEISV). It defines the administration of Trace Session activation/deactivation by the Element Manager (EM) or the network itself via signalling, the generation of Trace results in the Network Elements (NEs) and the transfer of these results to one or more Operations Systems, i.e. EM(s) and/or Network Manager(s) (NM(s)).

The basic Subscriber and MS Trace concept that the present document is built upon is described in clause 4. The high level requirements for Trace data, Trace Session activation/deactivation and Trace reporting are defined in clause 5. Clause 5 also contains an overview of use cases for Trace (the use cases are described in Annex B). Annex A provides a high-level view of Trace functional architecture. Trace control and configuration management are described in 3GPP TS 32.422 [2], and Trace data definition and management are described in 3GPP TS 32.423 [3].

In this release, the present document does not cover any Trace capability limitations within a NE (e.g. maximum number of simultaneous traced mobiles for a given NE) or any functionality related to these limitations (e.g. NE aborting a Trace Session due to resource limitations).

The objectives of UMTS Trace specifications are:

- to provide the descriptions for a standard set of Trace data;
- to produce a common description of the management technique for Trace administration and result reporting; and
- to define a method for Trace results reporting across the management interfaces.

The following is beyond the scope of the present document, and therefore the present document does not describe:

- tracing non-Subscriber or non-MS related events within a network element;
- tracing of all possible parties in a multi-party call (although multiple calls related to the IMSI specified in the Trace control and configuration parameters are Traceable);
- tracing of all active sessions in a cell or a given area (based on the identification of the area itself);
- tracing within an MS (the scope of Trace is only within the network).

The definition of Trace data is intended to result in comparability of Trace data produced in a multi-vendor wireless UMTS network, for those Trace control and configuration parameters that can be standardised across all vendors' implementations.

Vendor specific extensions to the Trace control and configuration parameters and Trace data are discussed in 3GPP TS 32.422 [2] and 3GPP TS 32.423 [3].

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: "Telecommunication management; Principles and high level requirements".

[2] 3GPP TS 32.422: "Telecommunication management; Subscriber and equipment trace: Trace control and configuration management".

[3] 3GPP TS 32.423: "Telecommunication management; Subscriber and equipment trace: Trace data definition and management".

[4] 3GPP TS 23.002: "Network architecture".

[6] 3GPP TS 29.207: "Policy control over Go interface".

[7] 3GPP TS 52.008: "Telecommunication management; GSM subscriber and equipment trace".

[8] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

NOTE: Overall management principles are defined in 3GPP TS 32.101 [1].

3 Definitions, symbols and abbreviations

3.1 Definitions

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

Mobile Station (MS): term indicating Mobile Station and comparable to the terms Equipment and User Equipment

management activation/deactivation: Trace Session is activated/deactivated in different NEs directly from the EM using the management interfaces of those NEs

signalling based activation/deactivation: Trace Session is activated/deactivated in different NEs using the signalling interfaces between those elements so that the NEs may forward the activation/deactivation originating from the EM

System Context: two different realisations of the telecommunication management architecture. System Context A has the Itf-N between a Network Manager and an Element Manger. System Context B has the Itf-N between a Network Manager and a Network Element that has an embedded Element Manager. See figure 1 in TS 32.101 [1].

Trace: general term used for Subscriber and Equipment Trace

Trace record: in the NE a Trace record is a set of Traceable data collected as determined by the Trace control and configuration parameters

Trace Recording Session: time interval within a Trace Session while trace records are generated for the subscriber or MS being traced.
The triggering events starting and stopping a Trace Recording Session are defined in 3GPP TS 32.422 [2] (figure 1).

Trace Recording Session Reference: identifies a Trace Recording Session within a Trace Session (see figure 1)

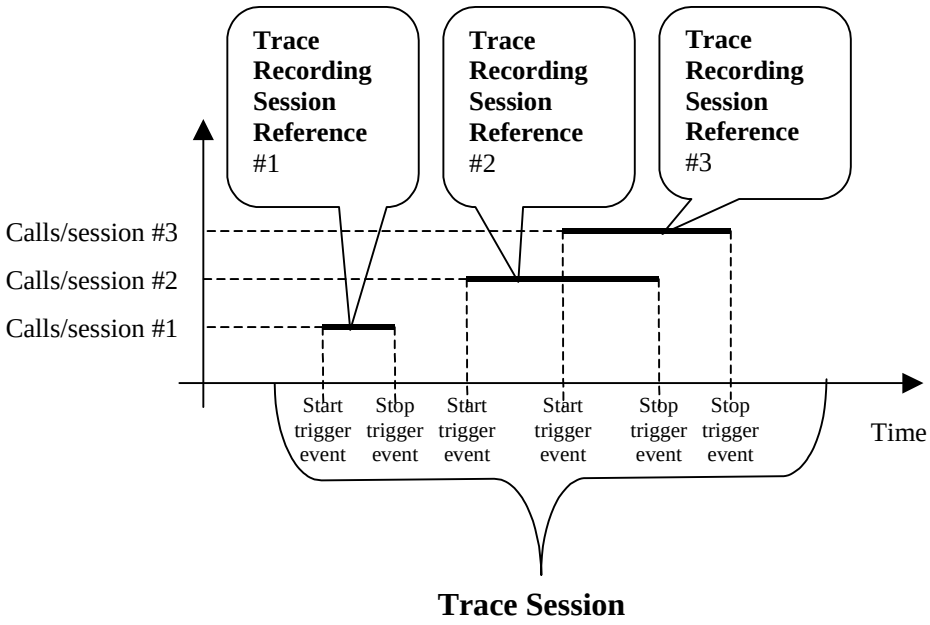

Figure 1: Trace Recording Session

Trace Reference: identifies a Trace Session and is globally unique (see figure 2)

Trace Session: time interval started with a Trace Session Activation and lasts until the Deactivation of that specific Trace Session (see figure 2)

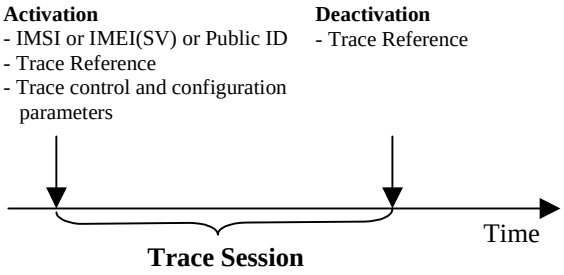

Figure 2: Trace Session

Trace Parameter Configuration: a technique whereby a request for tracing a certain subscriber or MS is sent by the EM to the Network Element for execution.

Trace Parameter Propagation: a technique by which the NE processes the trace configuration (received from the EM or another NE) and sends it to the relevant Network Element(s) via signaling interface(s).

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [8] and 3GPP TS 32.101 [1] apply.

4 Trace concepts and high-level architecture

4.1 Trace concepts

The diversity of Trace requirements makes it difficult to identify and anticipate all the operator's specific needs. Thus, the objective of this TS is not to list an exhaustive set of information to meet all the requirements. Rather, Trace data is defined without any limitation on the 2 following dimensions:

- Trace scope: NEs and signalling interfaces to Trace.
- Trace depth: level of details of Trace data.

In order not to have any limitation of Trace data, there are three levels of details defined: Maximum, Minimum and Medium. The Maximum Level allows all Trace data to be recorded. The Minimum and Medium Levels provide a decoded subset of the data in the Maximum Level and allow an operator the flexibility in selecting the appropriate Trace data to record.

The Trace Depth, specified at the Trace Session activation, is used to choose the level of detail of information to retrieve on the Itf-N.

The Maximum Level of detail allows for retrieval of signalling interface messages within the Trace Scope in encoded format (see figure 4.1.1).

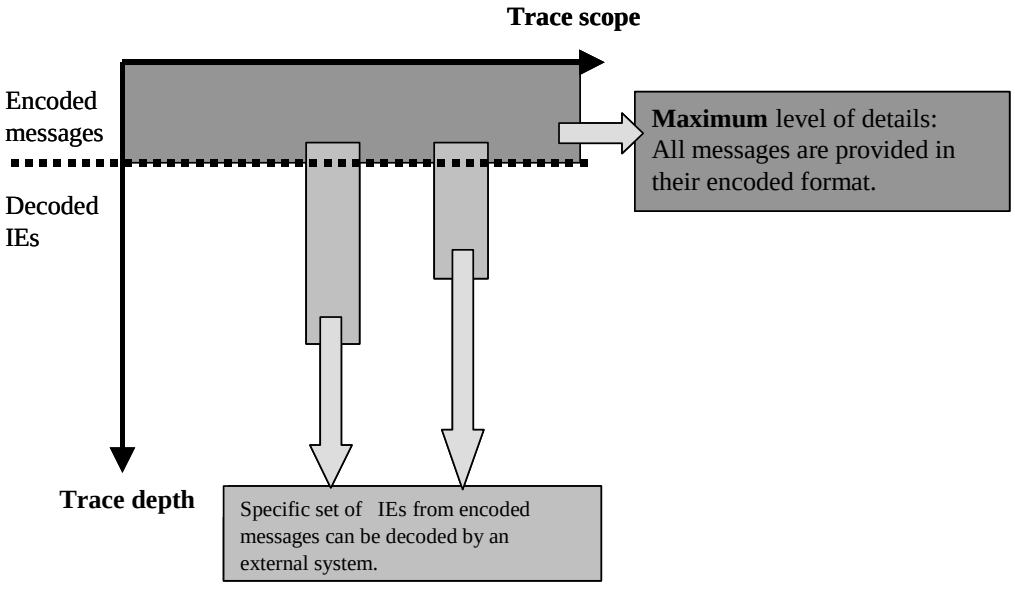

Figure 4.1.1: Maximum Level of details of Trace

The Minimum Level of detail allows for retrieval of a decoded subset of the IEs contained in the signalling interface messages (see figure 4.1.2).

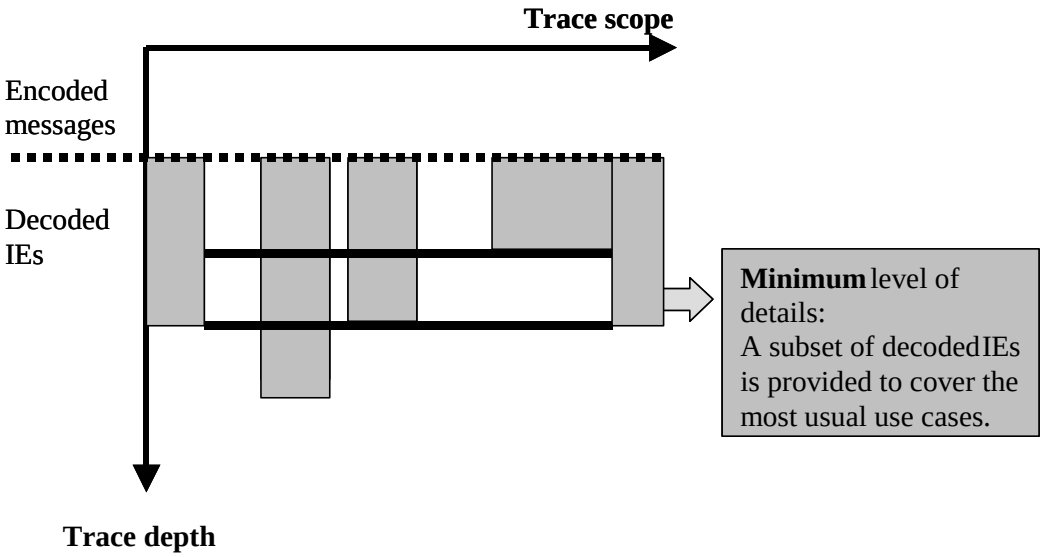

Figure 4.1.2: Minimum Level of detail of Trace

The Medium Level of detail allows for retrieval of the decoded subset of the IEs contained in the signalling interface messages in the Minimum Level plus a selected set of decoded radio measurement IEs.

The Trace data recorded at each Level is defined in 3GPP TS 32.423 [3].

4.2 Trace High Level Architecture

There are two types of activation, management based activation and signalling based activation.

Figure 4.2.1 represents the high-level view of the architecture of Trace management based activation/deactivation. This figure is only showing the interfaces in principlea high-level view. Details of Trace activation/deactivation are defined in 3GPP TS 32.422 [2].

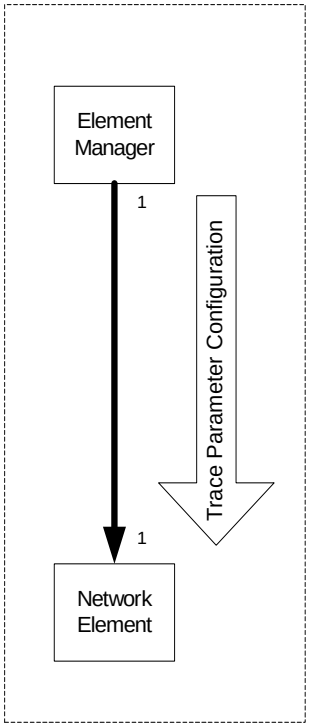

Figure 4.2.1: Architecture for management based activation/deactivation

Figure 4.2.2 represents the high-level view of the architecture of signalling based activation/deactivation. This figure is only showing the interfaces in principle. Details of Trace activation/deactivation are defined in 3GPP TS 32.422 [2].

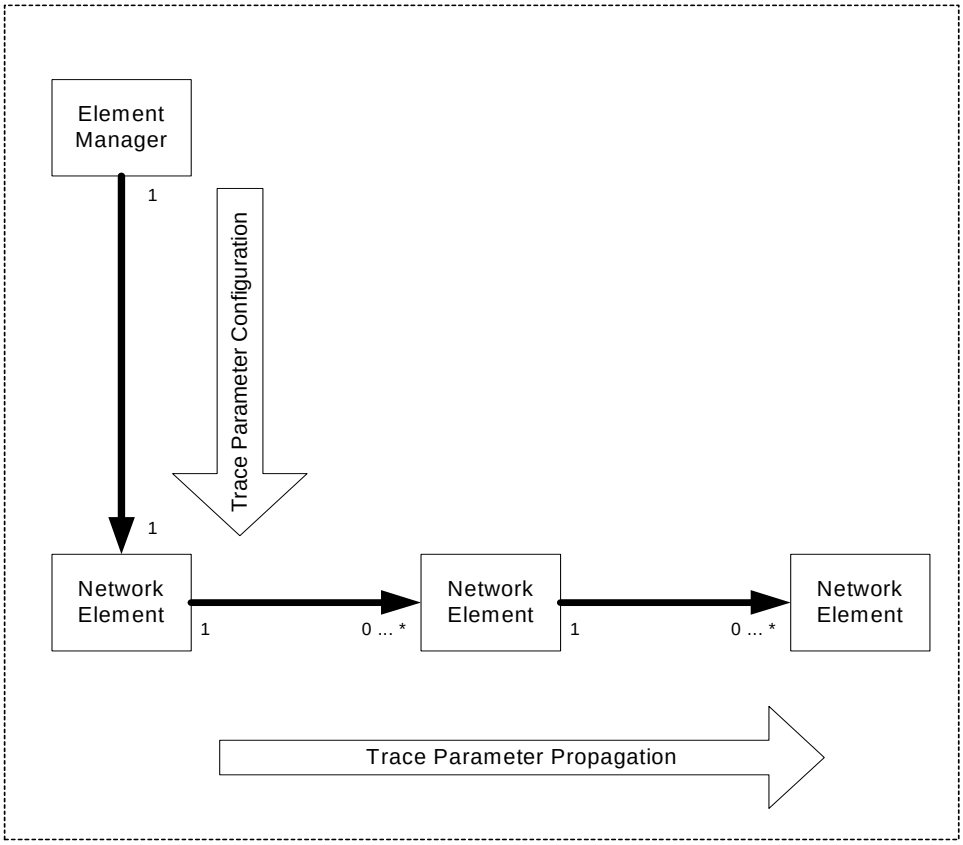

Figure 4.2.2: Architecture for Signalling Based Activation/Deactivation

Figure 4.2.3 represents the high-level view of the architecture of Trace Reporting for System Context A. This figure is only showing the interfaces in principle.

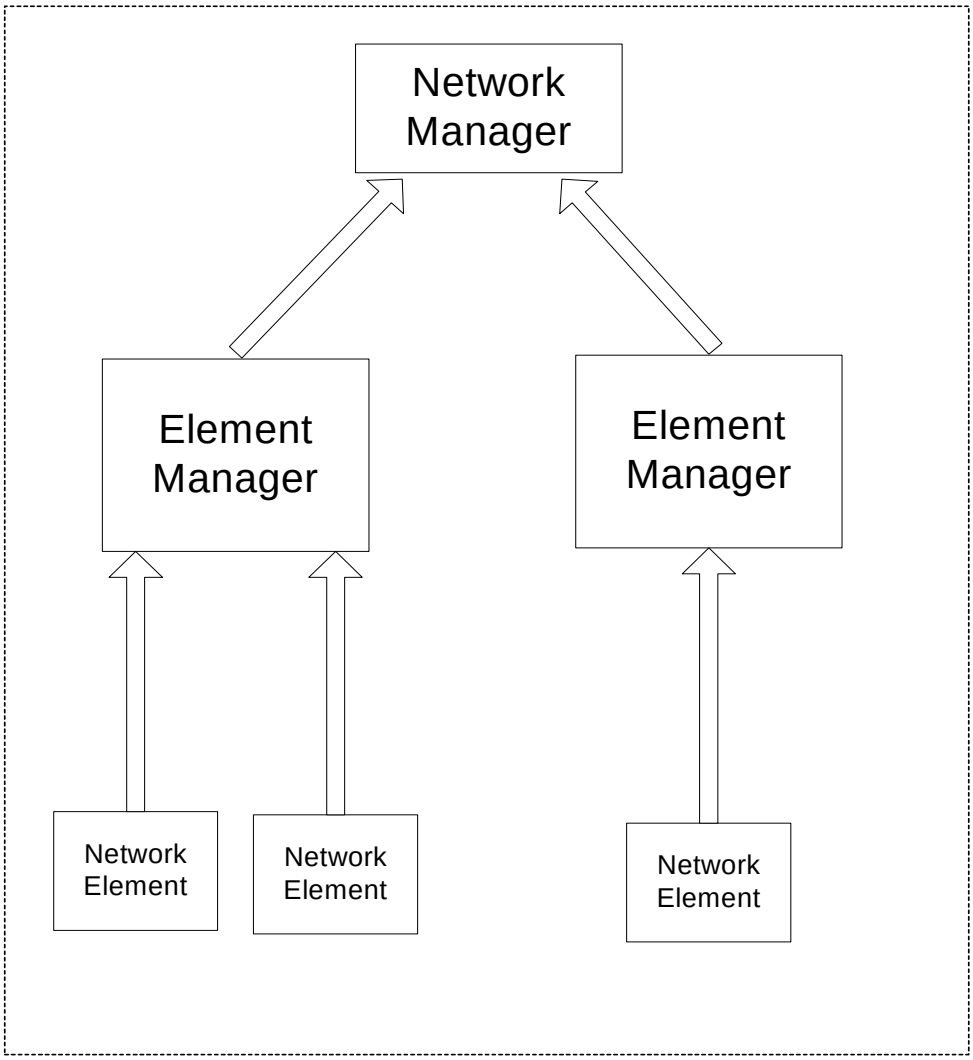

Figure 4.2.3: Architecture for High-level view of Trace Reporting in System Context A

Figure 4.2.4 represents the high-level view of the architecture of Trace Reporting for System Context B. This figure is only showing the interfaces in principle.

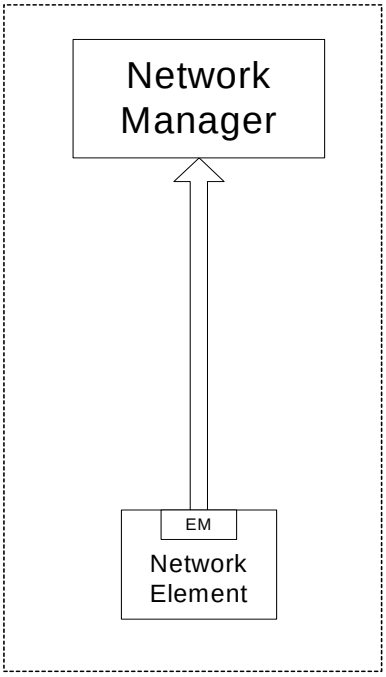

Figure 4.2.4: Architecture for Trace Reporting in System Context B

5 Trace requirements

5.1 General trace requirements

The general high-level requirements for Trace, common to both Management activation/deactivation and Signalling based activation/deactivation, are as follows:

- for the Maximum Level: Trace data encompassing all signalling messages on the different interfaces dedicated to the events of the traced subscriber or MS with their entire content (all IEs) shall be retrieved. The operator can then use an external system (e.g. an Operations System (OS) in TMN terminology) and decode specific information in line with operator requirements.

- for the Minimum Level: a selected subset of IEs shall be retrieved from the signalling interface messages. The Minimum Level provides support for the most common use cases (described in the annex B).

- for the Medium Level: a selected Minimum Level subset of IEs from the signalling interface messages and a selected set of radio measurement IEs shall be retrieved.

5.2 Requirements for Trace data

The high level requirements for Trace data, common to both Management activation/deactivation and Signalling based activation/deactivation, are as follows:

- The Trace records have to contain Information Elements or signalling messages from control signalling and/or the characteristics of the user data. The following list contains the Network Elements and the Traceable interfaces in the NEs where tracing is needed:

  - MSC Server: A, Iu-CS, Mc and MAP (G, B, E, F) interfaces;

  - MGW: ATM, IP and TDM interfaces for user plane characteristics;

  - HSS: MAP (C, D, Gc, Gr) and Cx interfaces and location and subscription information;
  - SGSN: Gb, Iu-PS, Gn, MAP (Gr, Gd, Gf), CAP (Ge) and Gs interfaces;
  - GGSN: Gn and Gi interfaces;
  - S-CSCF: Mw, Mg, Mr and Mi interfaces;
  - P-CSCF: Gm and Go interfaces;
  - RNC: Iu-CS, Iu-PS, Iur, Iub and Uu interfaces.
- A unique ID within a Trace Session shall be generated for each Trace Recording Session. This is called the Trace Recording Session Reference.

Changes to existing NEs and interfaces above may be required. These changes would be dependent upon various 3GPP working groups and possibly other non-3GPP industry groups for completion of Trace Session activation/deactivation.

For a detailed description of network elements and interfaces above see 3GPP TS 23.002 [4].

5.3 Requirements for Trace activation

5.3.1 Requirements for Trace Session activation

The high level requirements for Trace Session activation, common to both Management activation and Signalling based activation), are as follows:

- In case of subscriber Trace, the Trace Session will be activated for a certain subscriber whose identification (IMSI in UTRAN/CS/PS) shall be known in the NEs where subscriber Trace is needed.
- In case of MS Trace, the Trace Session will be activated for a certain MS whose identification (IMEI or IMEISV) shall be known in the NEs where MS Trace is needed.
- Trace Session activation shall be possible for both home subscribers and visiting subscribers.
- There are two methods for Trace Session activation: Management activation and Signalling activation.
- For an established call/session within a Network Element, it is optional for the Network Element to start a Trace Recording Session for the associated Subscriber or MS upon receipt of the Trace activation request from the EM.
- A globally unique ID shall be generated for each Trace Session to identify the Trace Session. This is called the Trace Reference.
- Trace Session may be activated from the EM simultaneously to multiple NEs with the same Trace Reference (i.e. same Trace Session).
- The Trace Scope and Depth shall be specified within the control and configuration parameters during Trace Session activation.
- There can be cases in a NE when it receives multiple Trace Session activations for the same connection (e.g. simultaneous CS/PS connections). In these cases the starting time of the Trace Session Activation and the starting time of the first Trace Recording Session is the same using signalling based activation. For these cases there are two different cases for the Trace Session activation in a Network Element when it receives another Trace Session activation to the same subscriber or MS:
  - If the Trace Reference is equal to an existing one, a new Trace Session shall not be started;
  - If the Trace Reference is not equal to an existing one, a new Trace Session may be started.
- The EM shall always provide the trace control and configuration parameters to the appropriate NEs at the time of Trace Session activation.

The high-level requirements for Trace Session activation, specific to Management activation, are as follows:

- In case of subscriber Trace, the Trace Session will be activated for a certain subscriber whose identification (IMSI in UTRAN/CS/PS or Private ID in IMS) shall be known in the NEs where subscriber Trace is needed.

5.3.2 Requirements for starting a Trace Recording Session

The high level requirements for starting a Trace Recording Session, common to both Management activation and Signalling based activation), are as follows:

- It is optional for the NE to start a Trace Recording Session if there are insufficient resources available within the NE.

- The Trace Recording Session Reference shall be unique within a Trace Session.

- The Trace Recording Session should be started after appropriate start trigger events are detected.

The high level requirements for starting a Trace Recording Session, specific to Management activation, are as follows:

- Each NE shall generate its own Trace Recording Session Reference (i.e., independent Trace Recording Sessions).

- Each NE shall start the Trace Recording Session based upon the Trace control and configuration parameters received by the NE in the Trace Session activation.

- The correlation of Trace data will be done with a Trace Reference and IMSI / IMEI / IMEISV / Private ID.

- The Trace Recording Session can start only when the IMSI (in case of subscriber trace), the IMEI / IMEISV (in case of MS trace) or Private ID (in case of IMS) is made available in the NE. In order to trace the early phases of the call the IMSI (in case of subscriber trace), the IMEI / IMEISV (in case of MS trace) or Private ID (in case of IMS) shall be made available to the NE as soon as practically possible. E.g. the IMSI and IMEI / IMEISV shall be made available to both Serving RNC and Drift RNC.

5.4 Requirements for Trace deactivation

5.4.1 Requirements for Trace Session deactivation

The high level requirements for Trace Session deactivation, common to both Management deactivation and Signalling based deactivation, are as follows:

- The Trace Session shall be deactivated using the Trace Reference specified for the Trace Session activation.

- The Trace Session shall be deactivated in all those NEs where it was activated.

- The deactivation of a Trace Session during a Trace Recording Session within a Network Element may take place anytime after the Network Element receives the deactivation request until the end of the current Trace Recording Session related to the traced Subscriber or MS.

- Trace Session deactivation in a NE could occur when two simultaneous signalling connections for a subscriber or MS exist. E.g. figure 5.4.1 shows NE 3 having two signalling connections (one of them or both of them are traced with the same Trace Reference) and a Trace deactivation message is received. The Trace Session shall be closed.

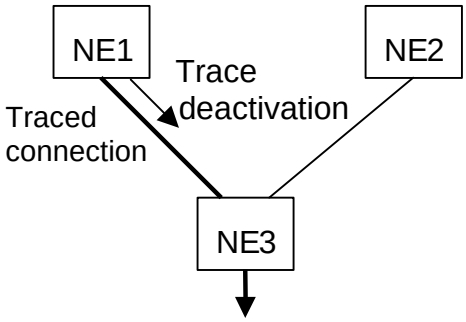

Figure 5.4.1: Trace Session closure

5.4.2 Requirements for stopping a Trace Recording Session

The high level requirements for stopping a Trace Recording Session, common to both Management deactivation and Signalling based deactivation, are as follows:

- The Trace Recording Session should be stopped after appropriate stop trigger events are detected.
- Trace Session deactivation in a NE could occur when two simultaneous signalling connections for a subscriber or MS exist. E.g. figure 5.4.2 shows NE3 having two signalling connections, but only one connection is traced. If the non-traced connection is released, the Trace Recording Session shall be kept in NE3. If the traced connection is released the Trace Recording Session shall be closed.

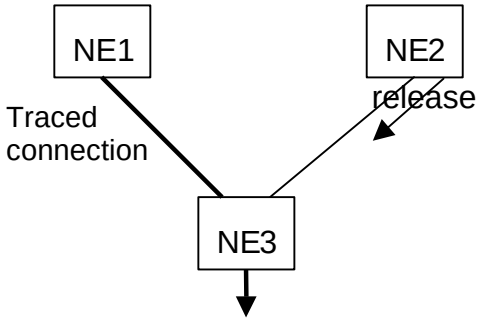

Figure 5.4.2: Trace Recording Session closure

The high level requirements for stopping a Trace Recording Session, specific to Signalling based deactivation, are as follows:

- The Trace Recording Session should be stopped after an NE receives the appropriate signalling deactivation message.

5.5 Requirements for Trace Data reporting

The high level requirements for Trace Data reporting, common to both Management activation/deactivation and Signalling based activation/deactivation, are as follows (Trace record contents, file formats and file transfer mechanisms are defined in 3GPP TS 32.423 [3]):

- Trace records should be generated in each NE where a Trace Session has been activated and a Trace Recording Session has been started.
- Format of the Trace records shall be XML Schema.
- Trace records should be transferred on the Itf-N to the Network Manager using one of two approaches: direct transfer from NE to NM or transfer from NE to NM via EM.

For transfer of Trace records via Itf-N, FTP shall be used.

5.6 Use cases for Trace

The operator can use subscriber and MS Trace for numerous purposes. However, the use cases for Trace can be divided into two basic categories:

- Troubleshooting use cases cover situations where the operator is solving an existing problem in his network;
- Validation testing use cases cover situations where the operator is not solving a known problem but merely analysing, fine-tuning or optimising his network.

A more detailed description for the following use cases for subscriber and MS Trace can be found in annex B:

- Interoperability checking between MS from different vendors;
- QoS profile checking for a subscriber after a subscriber complaint;
- Malfunctioning MS;
- Checking radio coverage in a certain area;
- Testing new features;
- Fine-tuning and optimisation of algorithms or procedures.

Annex A (informative): Trace use cases

A.1 Use case #1: multi-vendor MS validation

A.1.1 Description

The aim of this use case is to check how different vendor's MSs are working (e.g. in field testing) in the mobile network or to get detailed information on the MS.

The study can be started by an initiative from operator for verification of MS from different vendors (e.g. testing how the MS fulfils the requirements set by the standards).

The operator can perform the test using test MSs or tracing subscribers' mobiles.

A.1.2 Example of required data for this use case

The Trace parameters required to cover use case #1 are listed below:

- Tracing is needed in the Radio Network (RNC) or in the Core Network (MSS, SGSN);
- The identification of the Trace case shall be IMEI or IMEISV (and possibly IMSI);
- The level of details usually is to get the most important IEs from the signalling messages (Medium Level) or all messages with their encoded IEs (Maximum Level).

The traceable protocols are:

- In RNC: RRC, NBAP, RNSAP, RANAP.
- In MSS/SGSN: DTAP messages.

A.2 Use case #2: subscriber complaint

A.2.1 Description

The aim of this use case is to check how the complaining subscriber's services are working, to get information on the services in order to find out the reason for the complaint.

The study can be started after a subscriber is complaining at his/her home or visited operator that some of the service to which he/she subscribed is not working. E.g. the subscriber:

- cannot make calls;
- cannot use some supplementary service;
- does not get the negotiated QoS level (e.g. Mobile subscriber activates video-streaming application to watch the latest sport events and every time the subscriber tries to connect to the service the system disconnects the subscriber's UMTS bearer).

As the Trace is activated for a subscriber, the signalling based Trace Session activation shall be used, as the location of the subscriber is not known.

A.2.2 Example of required data for this use case

The Trace parameters required to cover the use case #2 are listed below:

- The list of NEs where tracing may be needed depends on the service being complained about by the subscriber. For this use case, tracing should be possible in all network elements, such as: HSS, MSS, RNC, MGW, SGSN, GGSN.
- The identification of the subscriber in a Trace is IMSI in UTRAN/CS/PS. The identification of the MS in a Trace is IMEI or IMEISV.
- The data includes those Information Elements from the signalling messages, which are related to the service(s) being complained about by the subscriber (Medium Level).

Example cases, which can be the basis for subscriber complaint:

1. The subscriber's CS call is misrouted

   This illustrates an instance where a subscriber complains that his calls are being cross-connected (or misrouted). Such a complaint involves setting up a Trace at all the 3GPP standardised interfaces being handled by the MSC. However, the Trace functionality shall not cover MSC internal or vendor proprietary interfaces. The Trace record shall need to have the dialled number and connected number.

2. The subscriber's call is dropped

   Tracing data is required from the radio network (UTRAN) or from the core network (MSS, SGSN, GGSN). In the radio network the radio coverage shall be checked. See use case #4 (checking radio coverage). Beside the radio coverage, other information can be useful as well, like RLC parameter, power information (OLPC or RRC measurement report), error ratios (BLER / BER, SDU error ratio), etc. Tracing in the core network is needed also, if the problem is not in the radio network. E.g. in case of PS domain the call can be dropped by the application due to the long delays or congestions in TCP layer or due to bad QoS. Thus in SGSN the requested and negotiated QoS parameters should be included in the Trace record.

3. The received QoS level is less than the negotiated level.

   To be able to solve the possible problem Tracing data is required from HSS, SGSN, GGSN, and UTRAN. Furthermore in case of problem in CS calls tracing in MGW shall be performed.

   From HSS Trace data the operator can monitor whether the subscriber's authentication to the network is successful, and what kind of QoS parameters are allowed to the subscriber. From SGSN Trace data the operator can monitor PDP context creation request from mobile. Request seem to contain legal QoS profile (incl. Maximum bandwidth, guaranteed bandwidth etc) and the local resources in SGSN are available to provide the service as requested by the subscriber. From UTRAN Trace data the operator can monitor whether the maximum bandwidth and guaranteed bandwidth, requested by SGSN, acceptable for UTRAN. Thus to check whether UTRAN can provide and maintain the requested radio access bearer services. From GGSN Trace data the operator can monitor PDP context activation between SGSN and GGSN. If the problem is in the CS domain the MGW Trace can provide the QoS data.

A.3 Use case #3: malfunctioning MS

A.3.1 Description

The aim of this use case is to check a MS, which is not working correctly.

The study can be initiated by the operator when he/she suspects that a MS not working according to the specifications or he/she would like to get more information on a specific MS, which is on the grey or black EIR list.

A.3.2 Example of required data for this use case

The Trace parameters required to cover the use case #3 are listed below:

- MS Tracing may be needed in the Radio Network (UTRAN) or in the Core Network (MSS, SGSN).
- The identification of the subscriber in a Trace is IMSI. The identification of the MS in a Trace is IMEI or IMEISV.
- The level of details depends on the operator needs (either Minimum Level or Medium Level).

The malfunction of MS in UTRAN can occur in different places. The problem can be in basic RRC and RANAP signalling, Radio Bearer procedures, Handover procedures, Power control etc.

Therefore, all RRC, RANAP, NBAP, RNSAP signalling procedures, transmission powers, error ratios (BLER / BER, SDU error ratio) and retransmission can be included in the Trace records.

A.4 Use case #4: checking radio coverage

A.4.1 Description

This use case aims at checking the radio coverage on a particular network area.

This study can be started by an initiative from operator for testing radio coverage on a particular geographical area following network extension for instance (e.g. new site installation).

The operator can perform a drive test on the new site area, and check that radio coverage is correct.

A.4.2 Example of required data to cover use case #4

The DL radio coverage can be checked using the values of CPICH Ec/No and RSCP measured by the mobile on the cells in the active set and the monitored set. These measurements are sent to the RNC trough the RRC message MEASUREMENT REPORT.

The UTRAN Trace record intra frequency measurement contains the required information.

The UTRAN Trace record inter frequency, and inter RAT measurements can also be used to check radio coverage with other frequencies or systems.

After a network extension, the operator can check that Ec/No and RSCP levels on the new site area are the expected ones, and there is no coverage hole.

The following Trace parameters are required to cover use case #4:

- The type of NE to Trace is RNC.
- The identification of the subscriber in a Trace is IMSI. The identification of the MS in a Trace is IMEI or IMEISV.
- The Trace data to retrieve shall contain the messages with all IEs that are relevant for radio coverage.

A.5 Use case #5: testing a new feature

A.5.1 Description

This use case aims at testing the implementation of a new feature in the network before its general deployment. The functionality can be either a standard feature or a vendor/operator specific feature.

This study is started by an initiative from the operator.

The operator can perform a drive test on the area where the feature is introduced, and check its good behaviour as well as its benefits, in term of quality or capacity. He can also rely on subscribers' Trace data when they use the feature to be tested.

A.5.2 Example of required data to cover use case #5

Depending on the feature, the list of NEs to Trace, as well as the level of details can be different.

For a feature concerning Core and UTRAN networks, for instance hard handover, SRNS relocation, or new UMTS bearer service, the operator needs to activate Trace on several NEs.

Then, the operator can be interested in:

- Only the protocol messages generated by the feature; or
- The impact of the new feature introduction on the network, for instance, the radio coverage, the capacity, the quality, or the behaviour of the existing algorithms.

In this last case, the operator needs more detailed data, for instance messages with all (Maximum Level) or part of the IEs (Minimum Level).

The following Trace parameters are required to cover use case #5:

- The types of NEs to Trace are NEs that can be traced related to the feature.
- The identification of the subscriber in a Trace is IMSI. The identification of the MS in a Trace is IMEI or IMEISV.
- The Trace data to retrieve can be either only the protocol messages (Maximum Level) or the messages with all or part of the IEs (Minimum Level).

A.6 Use case #6: fine-tuning and optimisation of algorithms/procedures

A.6.1 Description

Subscriber and MS Trace is part of the optimisation process. Trace data are used to get feedback on the network quality and capacity after optimisation operations like parameter fine-tuning, or new network design. Each intervention to improve the network behaviour can be confirmed both by measurement data and Trace data.

This study is started following an initiative from the operator.

The operator can perform a drive test on the area where the optimisation has been performed, and check its good behaviour as well as its impact on the network. He can also rely on subscribers' Trace data when they use the feature to be optimised.

A.6.2 Example of required data to cover use case #6

Depending on the optimisation operation, the list of NEs to Trace, as well as the level of details can be different. But generally, fine-tuning activities like scrambling code plan, handover and relocation algorithms, or call admission algorithm optimisation concern a very specific part of the network.

To cover this use case, the operator is usually searching for the highest level of details, on specific NEs.

The following Trace parameters are required to cover use case #6:

- The types of NEs to Trace are any NE that can be traced related to the feature to optimise.

- The identification of the subscriber in a Trace is IMSI. The identification of the MS in a Trace is IMEI or IMEISV.
- The Trace data to retrieve are the messages in encoded format with all (Maximum Level) or part of the IEs (Minimum Level).

Annex B (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
Jun 2002	S_16	SP-020330	--	--	Submitted to SA #16 for Information	1.0.0	
Dec 2002	S_18	SP-020755	--	--	Submitted to SA #18 for Approval	2.0.0	6.0.0
Mar 2003	S_19	SP-030147	001	--	Corrections to Trace requirements - Align with SA2's 23.002	6.0.0	6.1.0
Dec 2003	S_22	SP-030612	002	--	Correction of IMS subscriber identification for Trace	6.1.0	6.2.0
Mar 2004	S_23	SP-040116	003	--	Correction in Trace high level architecture	6.2.0	6.3.0
Sep 2004	S_25	SP-040542	004	--	Removal of GERAN from Rel-6 32.42x series of Trace specifications	6.3.0	6.4.0
Dec 2004	SA_26	SP-040770	005	--	Remove requirement for having ASN.1 as Trace record format	6.4.0	6.5.0
Dec 2004	SA_26	SP-040770	006	--	Remove in Rel-6 the signalling based Trace in IMS due to missing SIP signalling support from CN1/IETF	6.4.0	6.5.0

3GPP TS 32.422 V6.1.0 (2004-12)

Technical Specification

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3GPP

Postal address

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

Internet
http://www.3gpp.org

Contents

Foreword

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

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

Version x.y.z

where:

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

Introduction

The present document is part of the 32.42x-series covering the 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Telecommunication management; Subscriber and equipment trace; as identified below:

TS 32.421: "Trace concepts and requirements";

TS 32.422: "Trace control and configuration management";

TS 32.423: "Trace data definition and management".

Additionally, there is a GSM only subscriber and equipment trace specification: 3GPP TS 52.008 [5].

Subscriber and MS Trace provide very detailed information at call level on one or more specific mobile(s). This data is an additional source of information to Performance Measurements and allows going further in monitoring and optimisation operations.

Contrary to Performance Measurements, which are a permanent source of information, Trace is activated on user demand for a limited period of time for specific analysis purposes.

Trace plays a major role in activities such as determination of the root cause of a malfunctioning mobile, advanced troubleshooting, optimisation of resource usage and quality, RF coverage control and capacity improvement, dropped call analysis, Core Network and UTRAN end-to-end UMTS procedure validation.

The capability to log data on any interface at call level for a specific user (e.g. IMSI) or mobile type (e.g. IMEI or IMEISV) allows getting information which cannot be deduced from Performance Measurements such as perception of end-user QoS during his call (e.g. requested QoS vs. provided QoS), correlation between protocol messages and RF measurements, or interoperability with specific mobile vendors.

Moreover, Performance Measurements provide values aggregated on an observation period, Subscriber and Equipment Trace give instantaneous values for a specific event (e.g., call, location update, etc.).

If Performance Measurements are mandatory for daily operations, future network planning and primary trouble shooting, Subscriber and MS Trace is the easy way to go deeper into investigation and UMTS network optimisation.

In order to produce this data, Subscriber and MS Trace are carried out 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).

1 Scope

The present document describes the mechanisms used for the control and configuration of the Trace functionality at the EMs and NEs. It covers the triggering events for starting/stopping of subscriber/MS activity traced over 3GPP standardized signalling interfaces, the types of trace mechanisms, configuration of a trace, level of detail available in the trace data, the generation of Trace results in the Network Elements (NEs) and the transfer of these results to one or more EM(s) and/or Network Manager(s) (NM(s)).

The mechanisms for Trace activation/deactivation are detailed in clause 4; clause 5 details the various Trace control and configuration parameters and the triggering events that can be set in a network. Trace concepts and requirements are covered in 3GPP TS 32.421 [2] while Trace data definition and management is covered in 3GPP TS 32.423 [3].

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: "Telecommunication management; Principles and high level requirements".

[2] 3GPP TS 32.421: "Telecommunication management; Subscriber and equipment trace: Trace concepts and requirements".

[3] 3GPP TS 32.423: "Telecommunication management; Subscriber and equipment trace: Trace data definition and management".

[4] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[5] 3GPP TS 52.008: "Telecommunication management; GSM subscriber and equipment trace".

[6] 3GPP TS 23.060: "General Packet Radio Service (GPRS) Service description; Stage 2".

[7] 3GPP TS 23.205: "Bearer-independent circuit-switched core network; Stage 2".

[8] 3GPP TS 23.108: "Mobile radio interface layer 3 specification core network protocols; Stage 2 (structured procedures)".

NOTE: Overall management principles are defined in 3GPP TS 32.101 [1].

3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [4], 3GPP TS 32.101 [1] and the following apply:

P-CSCF Proxy - Call Session Control Function

4 Trace activation and deactivation

4.1 Trace session activation / deactivation

4.1.2 Management activation

4.1.2.1 General

In Management activation, the Trace Control and Configuration parameters are sent directly to the concerned NE (by its EM). This NE shall not propagate the received data to any other NE's - whether or not it is involved in the actual recording of the call.

Once the parameters have been provided, the NE looks for the IMSI or IMEI (IMEISV) passing through it. If it does not have them, these shall be provided to the NE (that performs the trace recording) as part of traffic signalling by the CN.

The figure below presents the management based trace functionality within a PLMN. The figure represents a typical PLMN network. A dotted arrow with "Trace Parameter Configuration" represents the availability of the management based trace functionality at the EM for that domain.

NOTE: There is no propagation of trace parameters in management based trace activation.

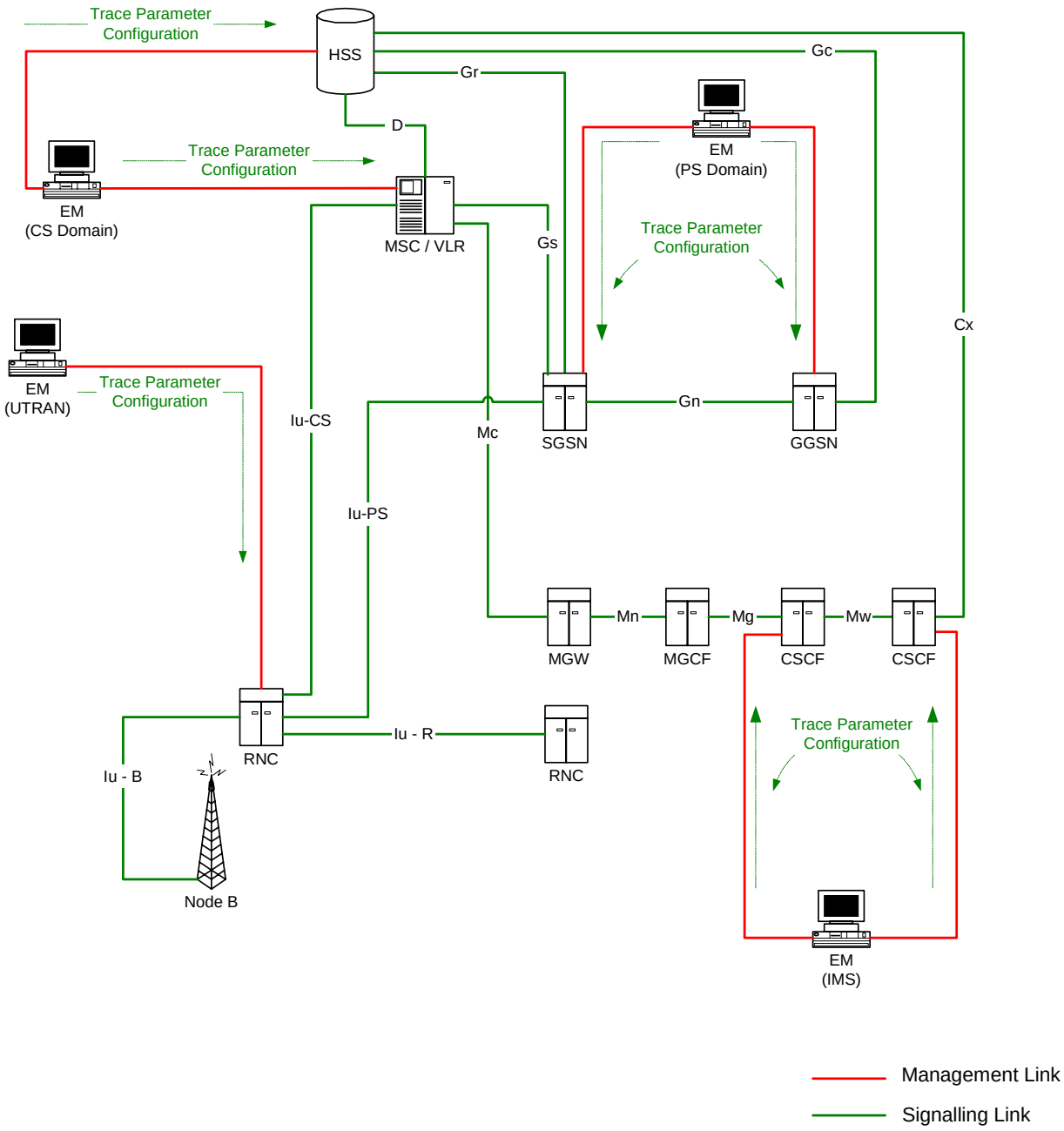


Figure 4.1.1: Overview of management activation

4.1.2.2 UTRAN activation mechanisms

When an RNC receives Trace Session activation from the EM it shall start a Trace Session. The trace control and configuration parameters of the Trace Session are received in Trace Session activation from the EM. The RNC shall not forward these trace control and configuration parameters to other nodes. The received trace control and configuration parameters shall be saved and used to determine when and how to start a Trace Recording Session. (Starting a Trace Recording Session is described in subclause 4.2.2.1). A Trace Session may be requested for a limited geographical area.

When the Trace session is requested for an IMEI(SV) or a list of IMEI(SV), the RNC shall send the requested IMEI(SV)/list of IMEI(SV)s in Uplink Information Transfer Indication to the interacting MSC Server(s) and SGSN(s). The MSC Servers and SGSNs shall store the requested IMEI(SV)s per RNC. For each subscriber/MS activity the MSC Servers and SGSNs shall request IMEI(SV), if it is not already provided. For each subscriber/MS activity the MSC server/SGSN shall check whether a trace request is active in an RNC for the IMEI(SV). If a match is found, the MSC Server/SGSN shall inform the RNC about the IMEI(SV) in CN Invoke Trace, so that the RNC can trace the control signalling according to the trace control and configuration parameters that are received from its EM.

If an Inter-MSC SRNS Relocation or an Inter-SGSN SRNS relocation occurs, the anchor MSC Server or source SGSN shall transfer the IMSI and IMEI(SV) for the subscriber/MS activity to the non anchor MSC Server or target SGSN. The non anchor MSC Server/target SGSN shall check whether it has received a trace request from the target RNC for the transferred IMEI(SV). If a match is found on the IMEI(SV) in the non anchor MSC Server/target SGSN, the MSC Server/SGSN shall inform the RNC about the IMEI(SV) in the CN Invoke Trace. The IMSI shall be transferred from the non anchor MSC Server/target SGSN to the target RNC in Relocation Request. The RNC can then trace the subscriber/MS activity according to the trace control and configuration parameters that are received from its EM.

4.1.2.3 PS Domain activation mechanisms

When a SGSN or GGSN receives Trace Session activation from the EM it shall start a Trace Session. The trace control and configuration parameters of the Trace Session are received in the Trace Session activation from the EM. The SGSN/GGSN shall not forward these trace control and configuration parameters to other nodes. The received trace control and configuration parameters shall be saved and used to determine when and how to start a Trace Recording Session. (Starting a Trace Recording Session is described in subclause 4.2.2.2)

4.1.2.4 CS Domain activation mechanisms

When a MSC Server receives Trace Session activation from the EM it shall start a Trace Session. The trace control and configuration parameters of the Trace Session are received in the Trace Session activation from the EM. The MSC Server shall not forward these trace control and configuration parameters to other nodes. The received trace control and configuration parameters shall be saved and used to determine when and how to start a Trace Recording Session. (Starting a Trace Recording Session is described in subclause 4.2.2.3)

4.1.2.5 IP Multimedia Subsystem activation mechanisms

When a S-CSCF/P-CSCF receives Trace Session activation from EM, the S-CSCF/P-CSCF shall start a Trace Session. The Trace control and configuration parameters of the Trace Session, received from EM in the Trace Session activation, shall be saved. The Trace control and configuration parameters define when the S-CSCF and P-CSCF shall start and stop a Trace Recording Session. For detailed information on starting and stopping Trace Recording Session in IMS see sub clauses 4.2.2.4 and 4.2.4.4.

Figure 4.1.2 illustrates the Trace Session activation in S-CSCF and in P-CSCF in case of Management based activation.

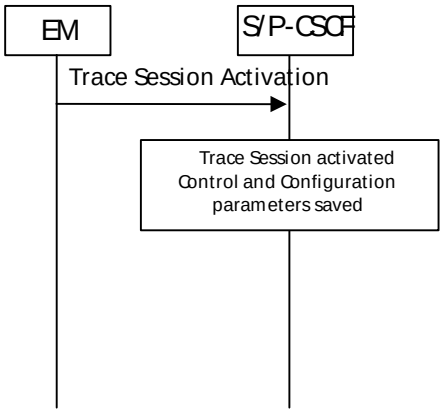


Figure 4.1.2: Trace Session activation in IMS

4.1.3 Signalling activation

4.1.3.1 General

In Signalling activation, the Trace Activation shall be carried out from the Core Network EM only [EM (PS), EM (CS), and EM (HSS) are generally considered to be in the Core Network. A Core Network EM can be any of these or their combinations].

In case of home subscriber trace (i.e. in the HPLMN) the Trace Session activation shall go to the HSS / MSC Server / SGSN. Instances where the home subscriber is roaming in a VPLMN, the HSS may initiate a trace in that VPLMN. The VPLMN may reject such requests.

In case of foreign subscriber trace (i.e. the HPLMN operator wishes to trace foreign subscribers roaming in his PLMN) the Trace Session activation shall go the MSC Server/VLR or SGSN. Depending on the Trace Control and Configuration parameters received, the Core Network shall propagate the activation to selected NE's in the entire network – UTRAN and CN.

4.1.3.2 Intra PLMN signalling activation

Figure 4.1.3 presents the signalling based trace functionality within a PLMN. The figure represents a typical PLMN network. A dotted arrow with "Trace Parameter Configuration" represents the availability of the trace functionality at the EM for that domain. E.g. you cannot invoke a Signalling Trace at the EM (UTRAN) because there is no such arrow shown in the figure. You can however do it from the EM (CS Domain). Similarly "Trace Parameter Propagation" is allowed only for the interfaces indicated in the figure. E.g. there is no parameter propagation over Iu-B.

NOTE: For tracing on the basis of IMEI(SV), the signalling based activation can be only initiated from the MSC/VLR or SGSN.

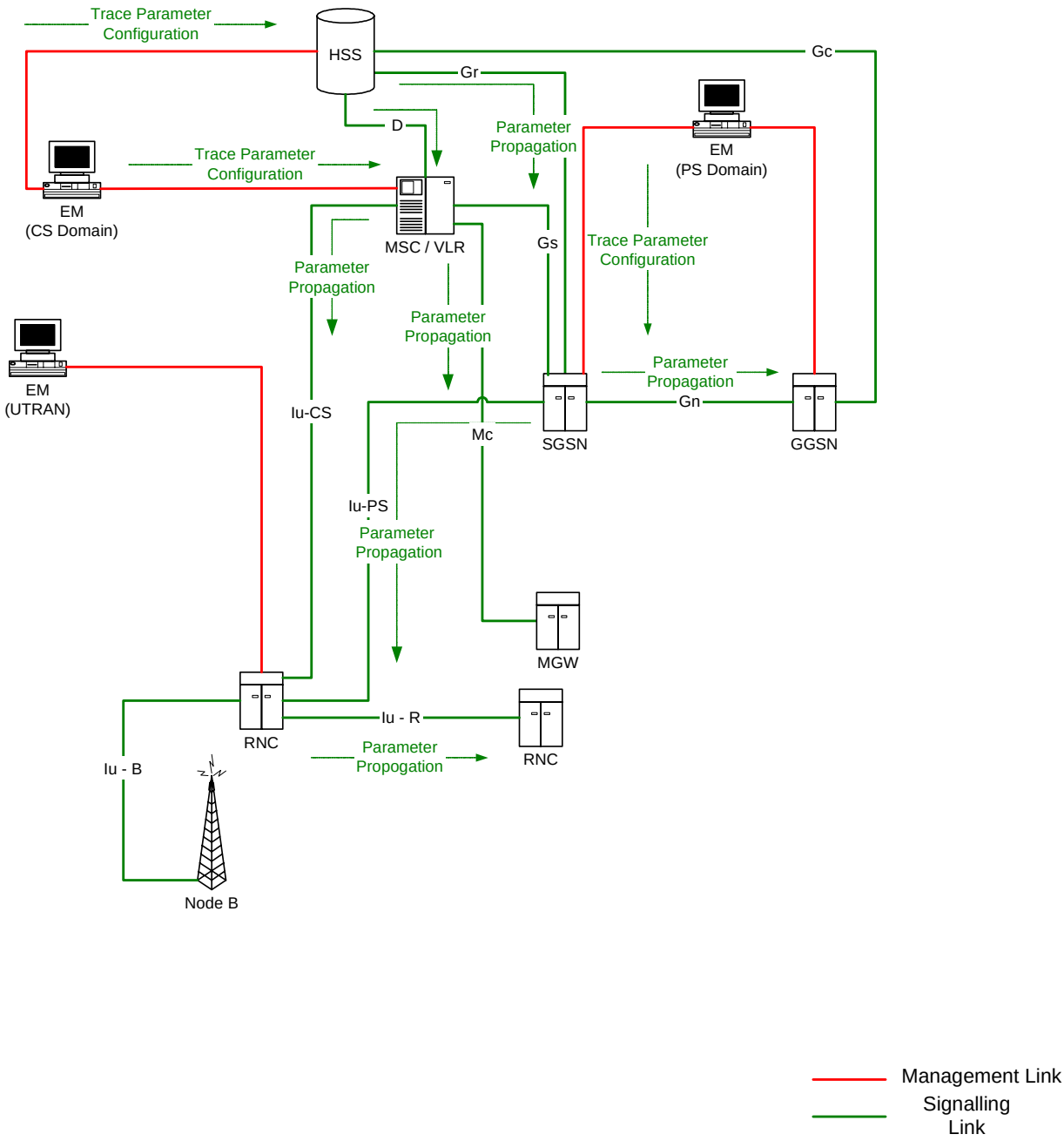


Figure 4.1.3: Overview of Intra-PLMN Signalling Activation

4.1.3.3 Inter PLMN Signalling Activation

Figure 4.1.4 presents the signalling based trace functionality between PLMNs. This is particularly useful when a roaming subscriber needs to be traced in a network. The figure represents a typical PLMN network and its connections with another PLMN's HSS. A dotted arrow with "Trace Parameter Configuration" represents the availability of the trace functionality at the EM for that domain. E.g. you cannot invoke a Signalling Trace at the EM (UTRAN) because there is no such arrow shown in the figure. You can however do it from the EM (CS Domain). Similarly "Trace Parameter Propagation" is allowed only for the interfaces indicated in the figure. E.g. there is no parameter propagation over Iu-B.

NOTE: There is no intention to allow tracing of a home subscriber roaming in a foreign network i.e. the trace function is limited to a single PLMN.

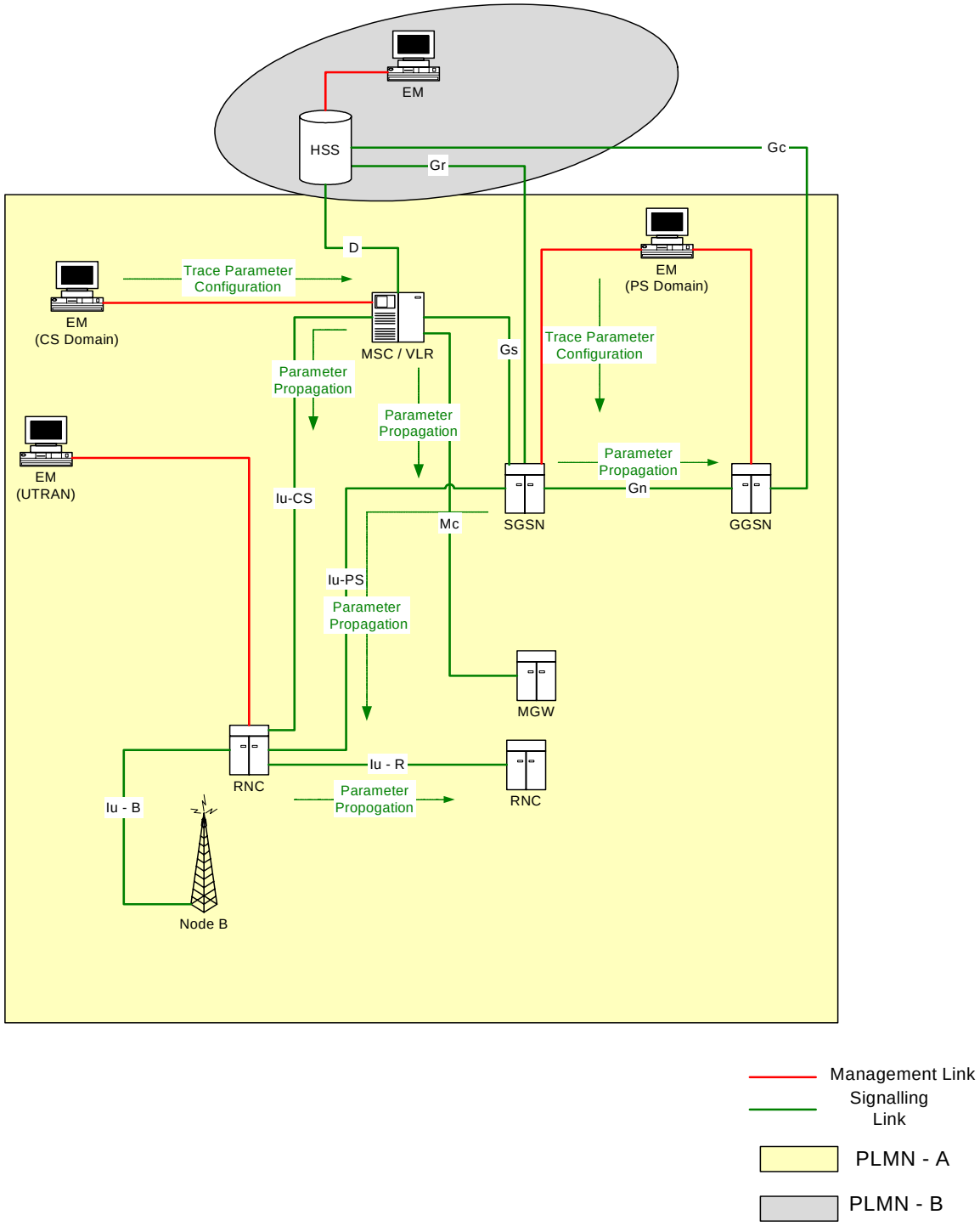


Figure 4.1.4: Overview of Inter-PLMN Signalling Activation

4.1.3.4 UTRAN activation mechanisms

See subclause 4.2.3.1.

4.1.3.5 PS Domain activation mechanisms

Figure 4.1.5 shows the Trace Session activation in the PS domain. The figure is an example of tracing PDP context.

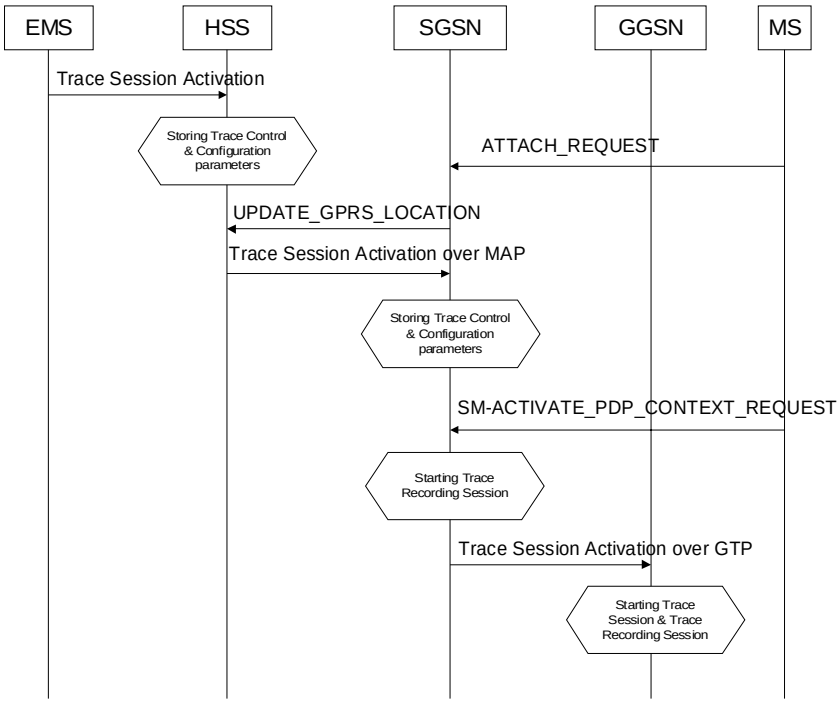


Figure 4.1.5: Trace session activation in PS domain

When HSS receives a Trace Session activation from its EMS, it shall store the received trace control and configuration parameters.. At this point a Trace Session shall be started in the HSS.

When a MS registers with the network by sending an ATTACH_REQUEST message to the SGSN, it updates the location information in the HSS by sending the UPDATE_GPRS_LOCATION message to the HSS. The HSS checks if the MS is being traced. If it is being traced, the HSS shall propagate the trace control and configuration parameters to the SGSN by sending a Trace Session Activation message to the SGSN. When an inter-SGSN routing area update occurs, HSS shall send the Trace Session Activation message to the new SGSN.

When SGSN receives the Trace Session activation message it shall store the trace control and configuration parameters and shall start a Trace Session.

When any of the triggering events defined in the trace control and configuration parameters occur, (e.g. PS session is started (i.e. a ACTIVATE PDP CONTEXT REQUEST message is received from the MS)) the SGSN shall propagate the trace control and configuration parameters to the GGSN and to the radio network by sending a Trace Session activation message, if it is defined in the trace control and configuration parameters (NE types to trace). The Trace Session activation to UTRAN is described in sub clauses 4.1.3.4.

When HSS sends the Trace Session activation message to SGSN it shall include the following parameters to the message:

- IMSI or IMEI (SV) (M).
- Trace reference (M).
- Triggering events (M).
- Trace Depth (M).
- List of NE types to trace (M).
- List of interfaces (O).

When the SGSN sends the Trace Session activation message to GGSN it shall include the following parameters to the message:

- IMSI or IMEI (SV) (M).

- Trace reference (M).
- Trace Recording Session Reference (M).
- Triggering events (M).
- Trace Depth (M).
- List of interfaces (O).

4.1.3.6 CS Domain activation mechanisms

Figure 4.1.6 shows the Trace Session activation in the CS domain. The figure is an example of tracing Mobile Originating Call.

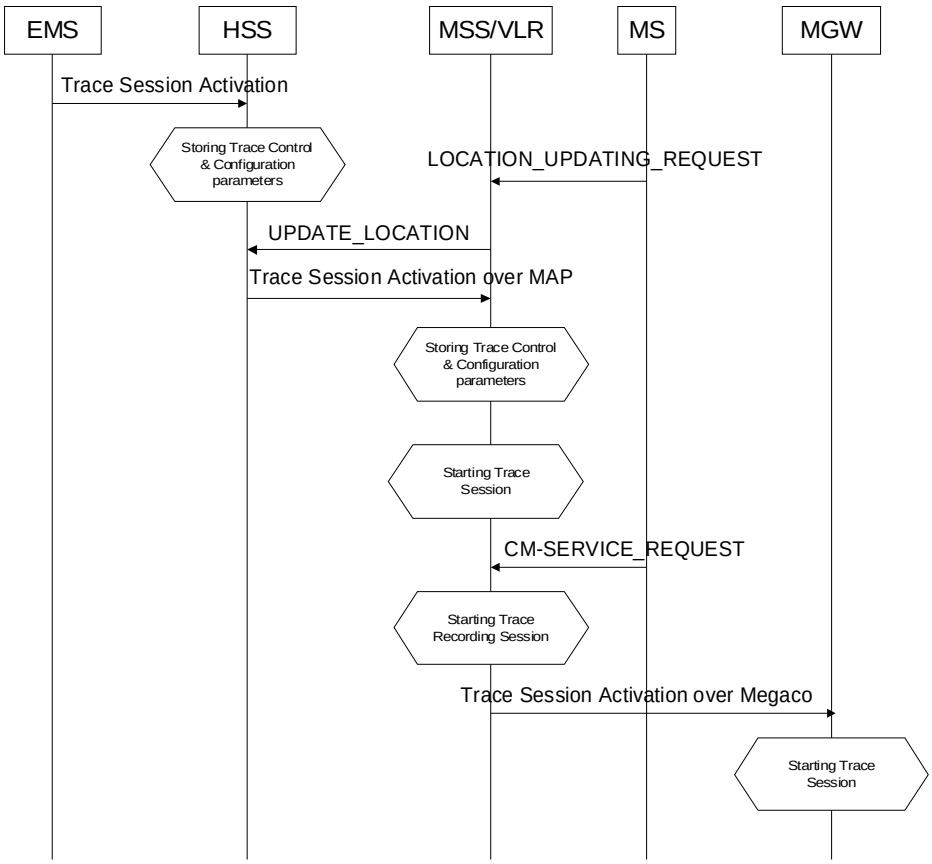


Figure 4.1.6: Trace Session Activation in CS domain

When HSS receives Trace Session activation from the EMS it should store the trace control and configuration parameters associated to the Trace Session.

If the MS registers to the network, by sending a LOCATION UPDATING REQUEST message to the MSC/VLR, the MSC Server/VLR updates the location information in the HSS by sending the MAP-UPDATE_LOCATION message to the HSS. After receiving the UPDATE_LOCATION message HSS shall propagate the trace control and configuration parameters by sending a Trace Session Activation message to the MSC Server/VLR.

When the MSC Server/VLR receives a Trace Session activation message from the HSS, it shall store the trace control and configuration parameters.

When any of the triggering event, defined in the trace control and configuration parameters, occurs (e.g. in case of Mobile Originating Call is started (i.e. the MSC Server receives the CM_SERVICE_REQUEST message with service type set to originating call establishment)) the MSC Server should propagate the trace control and configuration parameters to the MGW and to the radio network if it is defined in the trace control and configuration parameters (NE types to trace). Trace Session activation for UTRAN is described in sub clauses 4.1.3.4. In case of inter-MSC Server handover the MSC Server-A should propagate the trace control and configuration parameters to the MSC Server-B.

When HSS sends the Trace Session activation message to MSC Server it shall include the following parameters to the message:

- IMSI or IMEI (SV) (M).
- Trace reference (M).
- Triggering events (M).
- Trace Depth (M).
- List of NE types to trace (M).
- List of interfaces (O).

When the MSC Server sends the Trace Session activation message to MGW it shall include the following parameters to the message:

- IMSI or IMEI (SV) (M).
- Trace reference (M).
- Trace Recording Session Reference (M).
- Triggering events (M).
- Trace Depth (M).
- List of interfaces - (O).

4.1.3.7 Void

4.1.3.8 Tracing roaming subscribers

If a HPLMN operator activates a Trace Session for a home subscriber, while it (MS) is roaming in a VPLMN, it (HSS) may restrict the propagation of the Trace Session activation message to a MSC Server/VLR or to a SGSN located in the VPLMN.

Also, a MSC Server/VLR or a SGSN located in a VPLMN may accept any Trace Session activation message(s) coming from an HSS located in another PLMN. However, there shall be a capability to reject activations from another PLMN.

4.1.4 Management deactivation

4.1.4.1 UTRAN deactivation mechanisms

When last Trace session is requested to be ended for an IMEI(SV) or a list of IMEI(SV), the RNC shall send the requested IMEI(SV)/list of IMEI(SV)s in Uplink Information Transfer Indication to the interacting MSC Server(s) and SGSN(s). The MSC Servers and SGSNs shall remove the requested IMEI(SV)s for the RNC in question.

4.1.4.2 PS Domain deactivation mechanisms

When a SGSN or GGSN receives a Trace Session Deactivation from its EM, the Trace Session identified by the Trace Reference, shall be deactivated in SGSN/GGSN.

If a Trace Recording Session is active at the time of receiving a Trace Session deactivation from the EM, the SGSN/GGSN may choose to continue the Trace Recording Session till it ends gracefully or may stop it immediately. In all cases, the SGSN/GGSN shall deactivate the requested Trace Session immediately at the end of the Trace Recording Session.

4.1.4.3 CS Domain deactivation mechanisms

When a MSC Server receives a Trace Session Deactivation from its EM, the Trace Session identified by the Trace Reference, shall be deactivated in MSC Server.

If a Trace Recording Session is active at the time of receiving a Trace Session deactivation from the EM, the MSC Server may choose to continue the Trace Recording Session till it ends gracefully or may stop it immediately. In all cases, the MSC Server shall deactivate the requested Trace Session immediately at the end of the Trace Recording Session.

4.1.4.4 IP Multimedia Subsystem deactivation mechanisms

When a S-CSCF/P-CSCF receives a Trace Session deactivation from the EM, the Trace Session identified by the Trace Reference, shall be deactivated.

If a Trace Recording Session is active at the time of receiving a Trace Session deactivation from the EM, the S-CSCF/P-CSCF may choose to continue the Trace Recording Session till it ends gracefully or may stop it immediately. In all cases, the S-CSCF/P-CSCF shall deactivate the requested Trace Session immediately at the end of the Trace Recording Session.

Figure 4.1.7 illustrates how the Trace Session is deactivated when a Trace Recording Session is going on (e.g. a SIP INVITE method is being traced in S-CSCF).

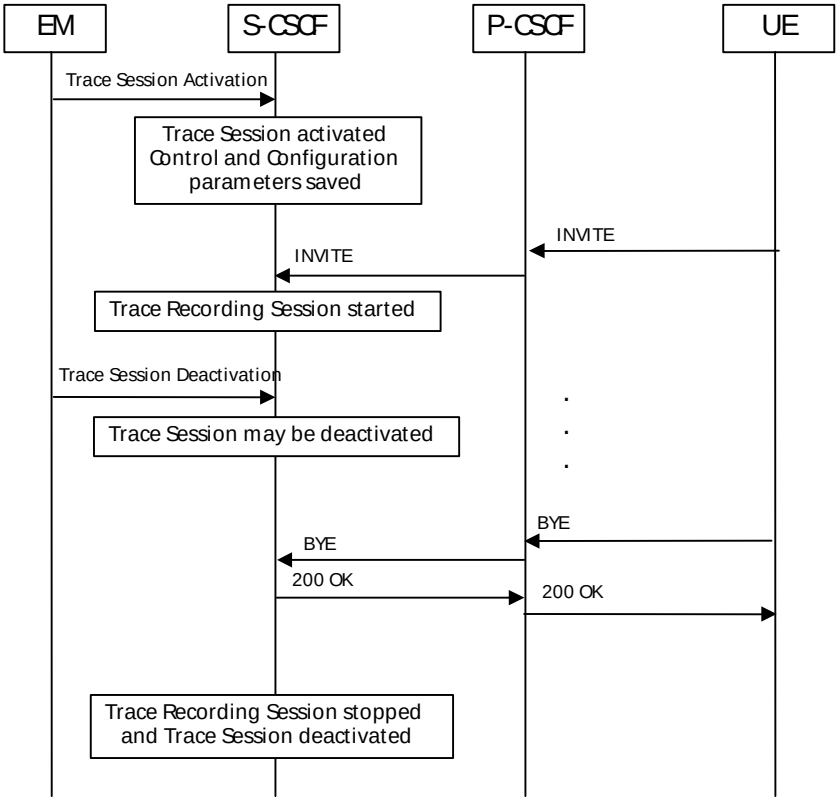


Figure 4.1.7: Trace session deactivation in IMS

4.1.5 Signalling deactivation

4.1.5.1 General

In Signalling deactivation, the Trace Deactivation shall always be carried out from the Core Network EM only [EM (PS), EM (CS), and EM (HSS) are generally considered to be in the Core Network. A Core Network EM can be any of these or their combinations]. In case of home subscriber trace (i.e. in the HPLMN) the Trace Session deactivation shall go to the HSS, MSC Server/VLR, or SGSN. In case of foreign subscriber trace (i.e. the HPLMN operator wishes to deactivate tracing on foreign subscribers roaming in his PLMN) the Trace Session deactivation shall go the MSC Server/VLR or SGSN. The Management System shall deactivate the Trace Session in the same NE where it activated the Trace Session.

When an HSS receives a Trace Session deactivation from its Management system, it shall deactivate the active Trace Session corresponding to the Trace Reference received in the deactivation message. The HSS shall delete all trace control and configuration parameters associated with this Trace Session. If a Trace Recording Session is active at the time of receiving a Trace Session deactivation message from the EM, the HSS may choose to continue the Trace Recording Session till it ends gracefully or may stop it immediately. In all cases, the HSS shall deactivate the requested Trace Session immediately at the end of the Trace Recording Session.

4.1.5.2 UTRAN deactivation mechanisms

When RNC receives the CN_DEACTIVATE_TRACE message it shall deactivate the Trace Session for the indicated Trace Reference in the CN_DEACTIVATE_TRACE message. In case of simultaneous CS/PS connections, the trace session for the indicated trace reference shall be closed upon reception of the CN DEACTIVATE TRACE message from any of the CN domain, whether it was the one which initiated trace session activation or not.

The Trace Session is also deactivated in the RNC when the Iu connection to the Core Network is released.

If CN_INVOKE_TRACE message is received for only one Iu connection (either CS or PS) the Trace Session shall be deactivated in the RNC when the IU_RELEASE_COMMAND message is received from the Core Network for that Iu connection where the CN_INVOKE_TRACE message is sent.

The following figure shows this behaviour:

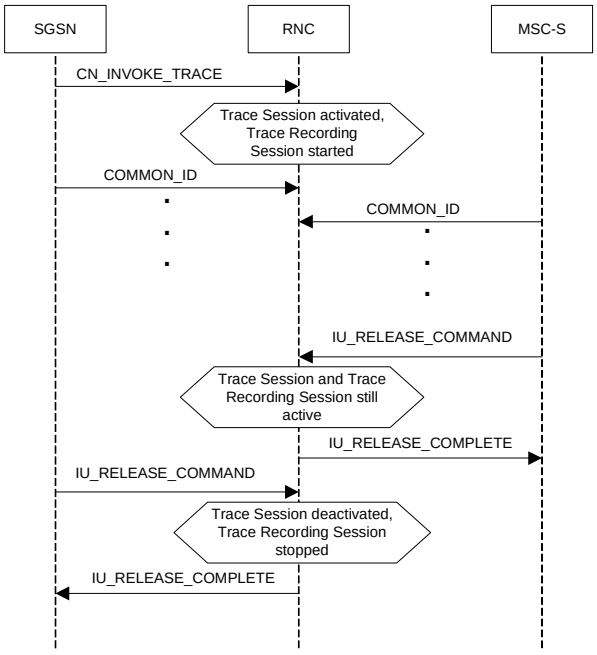


Figure 4.1.8: Trace session deactivation (Signalling) in UTRAN

If CN_INVOKE_TRACE message is received by the RNC for both Iu-CS and Iu-PS connection with the same Trace Reference number than the Trace Session shall not be deactivated in the RNC when any of the Iu connection is released (when the first IU_RELEASE_COMMAND message is received). The Trace Session shall be deactivated when the second Iu connection is released (the second IU_RELEASE_COMMAND message is received). The following figure shows the situation.

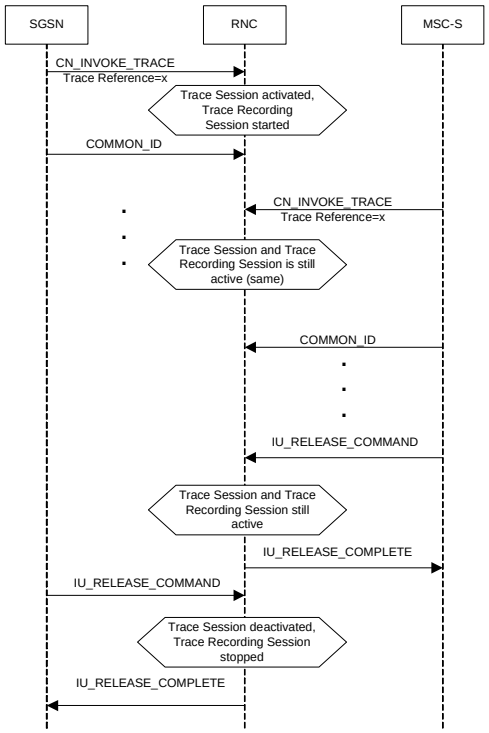


Figure 4.1.9: Trace session deactivation (Signalling) in PS Domain

Interaction with Soft-handover

The Trace Session should be deactivated in a Drift RNC when the DRNC receives the IUR_DEACTIVATE_TRACE message or the Iur connection is released.

When an RNC deactivates a Trace Session the Trace Recording Session shall also be stopped at the same time.

NOTE: In RNC the Trace Session and the Trace Recording Session always the same.

4.1.5.3 PS Domain deactivation mechanisms

When an HSS receives a Trace Session deactivation from the Management System it shall send a MAP_DEACTIVATE_TRACE_MODE message to the SGSN.

When the SGSN receives a MAP_DEACTIVATE_TRACE_MODE message it shall deactivate the Trace Session identified by the Trace reference received in the MAP_DEACTIVATE_TRACE_MODE message.

If a Trace Recording Session is active at the time of receiving a deactivation message, the SGSN (receiving it from the HSS) and/or the GGSN (receiving it from the SGSN) may choose to continue the Trace Recording Session till it ends gracefully or may stop it immediately. In all cases, the SGSN/GGSN shall deactivate the requested Trace Session immediately at the end of the Trace Recording Session. When the SGSN deactivates the Trace Session, it shall delete all trace control and configuration parameters associated with the corresponding Trace Session.

4.1.5.4 CS Domain deactivation mechanisms

When an HSS receives Trace Session deactivation from the Management System it shall send a MAP_DEACTIVATE_TRACE_MODE message to the MSC Server.

When the MSC Server receives a MAP_DEACTIVATE_TRACE_MODE message it shall deactivate the Trace Session identified by the Trace reference received in the MAP_DEACTIVATE_TRACE_MODE message.

If a Trace Recording Session is active at the time of receiving a MAP_DEACTIVATE_TRACE_MODE message from the HSS, the MSC Server may choose to continue the Trace Recording Session till it ends gracefully or may stop it immediately. In all cases, the MSC Server shall deactivate the requested Trace Session immediately at the end of the Trace Recording Session. When the MSC Server deactivates the Trace Session it shall delete all trace control and configuration parameters associated with the corresponding Trace Session.

4.1.5.5 Void

4.2 Trace recording session Start / Stop triggering

4.2.1 General

Editor's Note: For further study.

The Trace Session activation contains the triggering events parameter. The actual start/stop triggering events corresponding to the values of the triggering events parameter are defined in triggering events tables in sub-clause 5.1 in the present document.

4.2.2 Starting a trace recording session - management based

4.2.2.1 UTRAN starting mechanisms

Editor's Note: For further study.

4.2.2.2 PS Domain starting mechanisms

In a SGSN/GGSN, a Trace Recording Session should start after the reception of a Trace Session Activation from EM and if any of the defined *start triggering events* occur. During the Trace Recording Session, the SGSN/GGSN shall record those signalling messages in the interfaces that are defined in the *list of interfaces* parameter. The *Trace Depth* parameter defines whether entire signalling messages or just some IEs need to be recorded.

The SGSN/GGSN may not start a Trace Recording Session if there are insufficient resources available for the recording.

If the SGSN/GGSN receives the Trace Session Activation during an established session (e.g. during an active PDP context), it *may* start the Trace Recording Session immediately. However, if any of the start triggering events occur in the SGSN/GGSN after receiving the Trace Session Activation, it shall start the Trace Recording Session.

When a Trace Recording Session is started, the SGSN/GGSN shall assign a Trace Recording Session Reference for the Trace Recording Session.

4.2.2.3 CS Domain starting mechanisms

In a MSC Server, a Trace Recording Session shall start after the reception of a Trace Session Activation from EM and if any of the defined *start triggering events* occur. During the Trace Recording Session, the MSC Server shall record those signalling messages in the interfaces that are defined in the *list of interfaces* parameter. The *Trace Depth* parameter defines whether entire signalling messages or just some IEs needs to be recorded.

The MSC Server may not start a Trace Recording Session if there are insufficient resources available for the recording.

If the MSC Server receives the Trace Session Activation during an established call, it *may* start the Trace Recording Session immediately. However, if any of the start triggering events occurs in MSC Server after receiving the Trace Session Activation, it shall start the Trace Recording Session.

When a Trace Recording Session is started, the MSC Server shall assign a Trace Recording Session Reference for the Trace Recording Session.

4.2.2.4 IP Multimedia Subsystem starting mechanisms

Editor's Note: For further study.

4.2.3 Starting a trace recording session - signalling based

4.2.3.1 UTRAN starting mechanisms

In an RNC the Trace Recording Session will always be the same as the Trace Session as no triggering events are defined in UTRAN. Therefore a Trace Recording Session should be started in an SRNC when the SRNC receives the CN_INVOKE_TRACE message from the Core Network. If the SRNC receives a second CN_INVOKE_TRACE message from the CN with the same Trace Reference that have been received in the first CN_INVOKE_TRACE message, a new Trace Recording Session should not be started as it is already started.

If the SRNC does not have enough resources it may not start a Trace Recording Session.

The Trace Recording Session Reference shall be the same as received in the CN_INVOKE_TRACE message.

In a DRNC the Trace Recording Session should be started when the DRNC receives the IUR_INVOKE_TRACE message. If the DRNC does not have enough resources it may not start a Trace Recording Session.

The Trace Session is activated to the RNC by sending a CN_INVOKE_TRACE message from the CN (MSC Server or SGSN). When RNC receives the CN_INVOKE_TRACE message it should immediately start a Trace Session and a Trace Recording Session according to the trace control and configuration parameters received in the CN_INVOKE_TRACE message.

If there are not enough resources in RNC to start a Trace Recording Session, the RNC may reject to start a Trace Recording Session. However the RNC shall start the Trace Session.

In the case RNC receives multiple CN INVOKE TRACE messages for the same subscriber or equipment (e.g. simultaneous CS/PS connections):

- If the Trace Reference is equal to an existing one, a new trace session and trace recording session shall not be started;
- If the Trace Reference is not equal to an existing one, a new trace session and trace recording session may be started.

The following figure shows an example for a CS call how the Trace Session is activated to RNC. In the example it is assumed that there is no PS connection at all during the CS call.

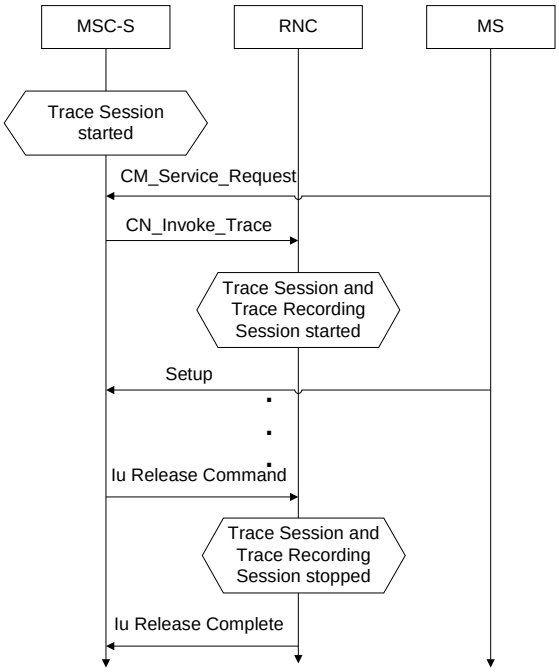


Figure 4.2.1: Starting a Trace Recording Session (Signalling) in UTRAN

Interaction with soft-handovers

If the subscriber or equipment, which is traced, makes a soft handover the SRNC should propagate the trace control and configuration parameters further to the DRNC by using the IUR_INVOKE_TRACE message. When the DRNC receives the IUR_INVOKE_TRACE message it should immediately start a Trace Session and a Trace Recording Session according to the trace control and configuration parameters received in the IUR_INVOKE_TRACE message.

If there are insufficient resources in the DRNC, the DRNC may not start a Trace Recording Session.

The Trace Recording Session Reference sent by the SRNC to the DRNC shall be the same what SRNC has received in the CN_INVOKE_TRACE message from the CN.

Interaction with Relocation

If the tracing shall continue also after the relocation has been performed, the CN Invoke Trace procedure shall be re-initiated from the CN towards the future SRNC after the Relocation Resource Allocation procedure has been executed successfully.

4.2.3.2 PS Domain starting mechanisms

In SGSN/GGSN a Trace Recording Session should start after the reception of a Trace Session Activation message and if any of the defined *start triggering events* occur. During the Trace Recording Session, the SGSN/GGSN shall record the signalling messages in the interfaces that are defined in the *list of interfaces* parameter. The *Trace Depth* parameter defines whether entire signalling messages or just some IEs need to be recorded.

The SGSN/GGSN may not start a Trace Recording Session if there are insufficient resources available for the recording.

In case of an established session, the SGSN may start the Trace Recording Session immediately after the reception of the Trace Session Activation message. However, if any of the start triggering events occurs in SGSN after receiving the Trace Session activation message, it shall start the Trace Recording.

When a Trace Recording Session is started in SGSN, it shall assign a Trace Recording Session Reference for the Trace Recording Session. When the SGSN propagates the Trace control and configuration parameters to GGSN or to UTRAN (I.e. activates a Trace Session in GGSN/UTRAN), it shall include the assigned Trace Recording Session Reference in the Trace Session Activation message. When an SGSN starts a Trace Recording Session and the list of NE types parameter requires GGSN tracing, it shall send the Trace Session activation message to GGSN. Also, when an SGSN

starts a Trace Recording Session and the list of NE types parameter requires RNC tracing, it shall send the Trace Session activation message to the RNC. In both cases the Trace Session and the Trace Recording Session in the receiving NE should start at the same time.

In case of SRNS relocation the SGSN shall send the CN_INVOKE_TRACE message to the new SRNC after the successful Relocation Resource Allocation procedure.

SGSN has to find the identity of the mobile before it activates a Trace Session towards other NE. The IMEI(SV) can be got from the Mobile by using the Identification procedure on the Iu interface.

When the SGSN sends the Trace Session activation (CN_INVOKE_TRACE) message to RNC it shall include the following parameters to the message:

- IMSI or IMEI (SV) (M).
- Trace reference (M).
- Trace Recording Session Reference (M).
- Trace Depth (M).
- List of interfaces (O).

4.2.3.3 CS Domain starting mechanisms

In MSC Server/MGW a Trace Recording Session should start after the reception of a Trace Session Activation message and if any of the defined *start triggering events* occur. During the Trace Recording Session the MSC Server/MGW shall record the signalling messages in the interfaces that are defined in the *list of interfaces* parameter. The *Trace Depth* parameter defines whether entire signalling messages or just some IEs need to be recorded.

The MSC Server may not start a Trace Recording Session if there are insufficient resources available for the recording.

In case of an established call, the MSC Server may start the Trace Recording Session immediately after the reception of the Trace Session Activation message. However, if any of the start triggering events occur in the MSC Server after receiving the Trace Session activation message, it shall start the Trace Recording Session.

When a Trace Recording Session is started in MSC Server, it shall assign a Trace Recording Session Reference for the Trace Recording Session. When the MSC Server propagates the Trace control and configuration parameters to MGW or to UTRAN (I.e. activates a Trace Session in MGW/UTRAN) it shall include the assigned Trace Recording Session Reference in the Trace Session Activation message.

When an MSC Server starts a Trace Recording Session and the list of NE types parameter requires MGW tracing, it shall send the Trace Session activation message to MGW. Also, when an MSC Server starts a Trace Recording Session and the list of NE types parameter requires RNC tracing, it shall send the Trace Session activation message to the RNC. In both cases the Trace Session and the Trace Recording Session in the receiving NE should start at the same time.

MSC Server has to find the identity of the mobile before it activates a Trace Session towards other NE. The IMEI(SV) can be got from the Mobile by using the Identification procedure on the Iu interface.

In case of SRNS relocation the MSC Server shall send the CN_INVOKE_TRACE message to the new SRNC after the successful Relocation Resource Allocation procedure. The following figure shows an example how the Trace Session is activated with CN_INVOKE_TRACE message in case of relocation.

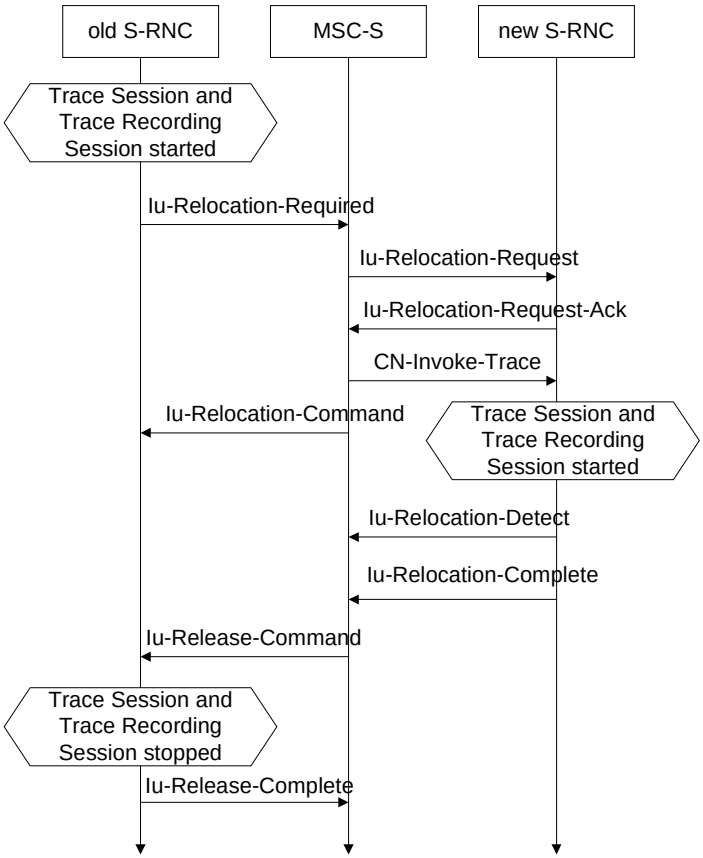


Figure 4.2.2: Starting a Trace Recording Session (Signalling) in CS Domain

When the new SRNC receives the CN_INVOKE_TRACE message it should start immediately a Trace Session and a Trace Recording session according to the trace control and configuration parameters received in the CN_INVOKE_TRACE message. The Trace Session shall automatically be deactivated in the old RNC when the Iu connection is released.

When the MSC Server sends the Trace Session activation (CN_INVOKE_TRACE) message to RNC it shall include the following parameters to the message:

- IMSI or IMEI (SV) (M).
- Trace reference (M).
- Trace Recording Session Reference (M).
- Trace Depth (M).
- List of interfaces to trace (O).

4.2.3.4 Void

4.2.4 Stopping a trace recording session - management based

4.2.4.1 UTRAN stopping mechanisms

Editor's Note: For further study.

4.2.4.2 PS Domain stopping mechanisms

In SGSN and GGSN a Trace Recording Session shall be stopped when any of the defined stop triggering events occur. If Trace Session deactivation is received during the Trace Recording Session, the SGSN is allowed to finish tracing of the on-going procedures (e.g. session). In this case the Trace Recording Session shall be stopped between the reception of the Trace Session deactivation and the appropriate stop-triggering event.

Figure 4.2.3 illustrates the successful case in tracing a PDP context when a Trace Recording Session is stopped.

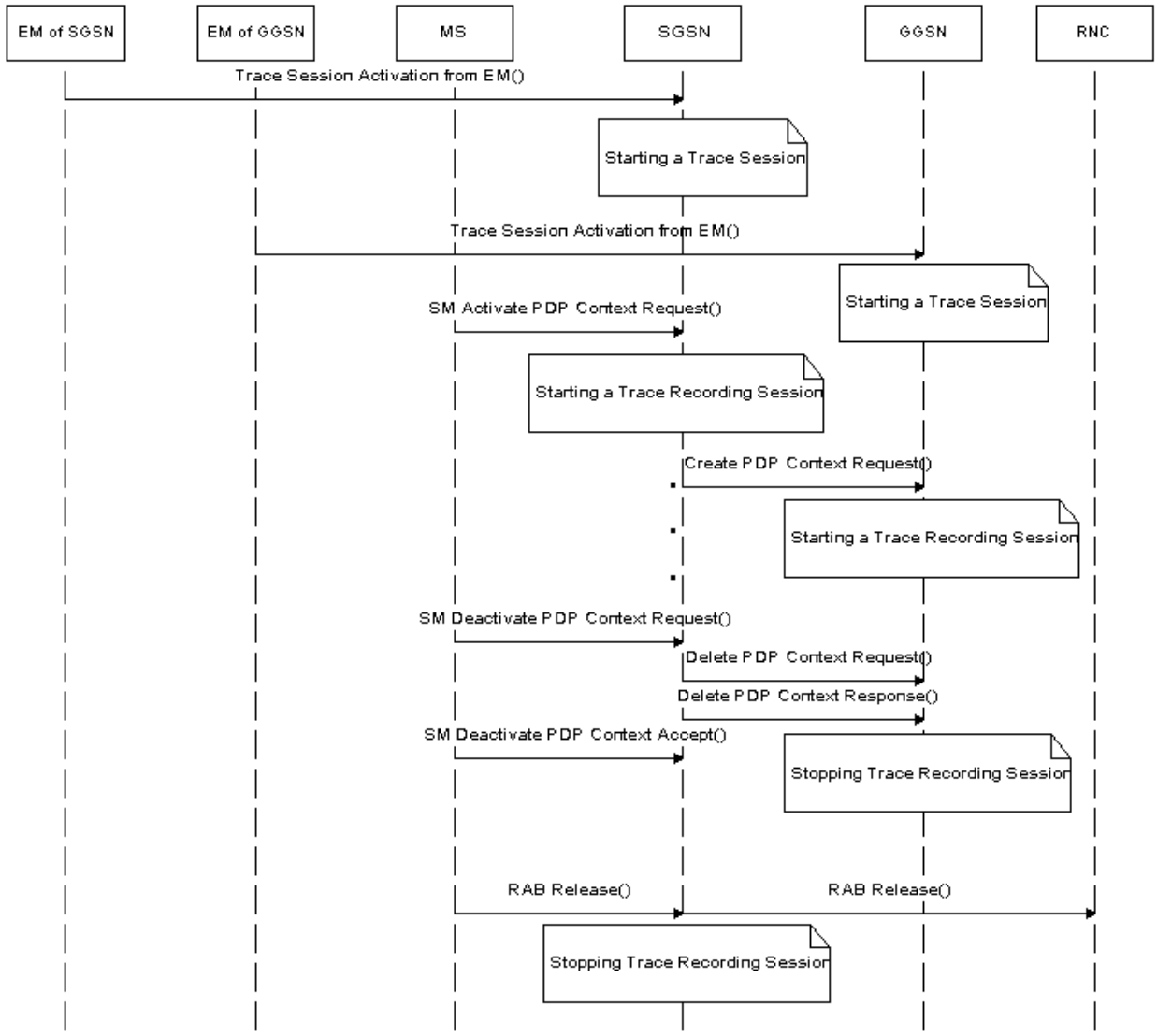


Figure 4.2.3: Stopping a Trace Recording Session (Management Based) - PS domain

4.2.4.3 CS Domain stopping mechanisms

In MSC Server a Trace Recording Session shall be stopped when any of the defined stop triggering events occur. If Trace Session deactivation is received during the Trace Recording Session, the MSC Server is allowed to finish tracing of the on-going procedures (e.g. calls). In this case the Trace Recording Session shall be stopped in MSC Server between the reception of the Trace Session deactivation and the appropriate stop-triggering event.

Figure 4.2.4 illustrates the successful case in tracing a call and the time of stopping a Trace Recording Session.

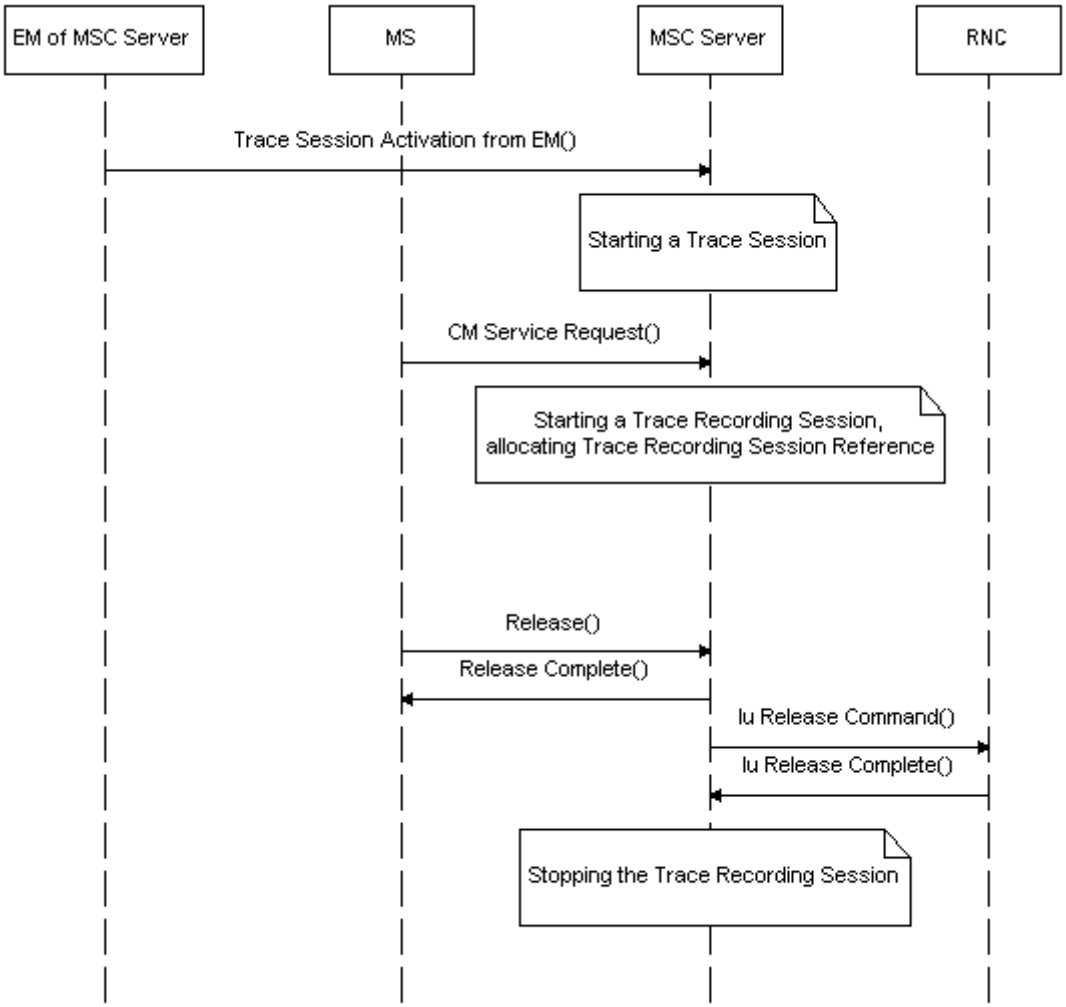


Figure 4.2.4: Stopping a Trace Recording Session (Management Based) - CS domain

4.2.4.4 IP Multimedia Subsystem stopping mechanisms

Editor's Note: For further study.

4.2.5 Stopping a trace recording session - signalling based

4.2.5.1 UTRAN stopping mechanisms

In an RNC the Trace Recording Session will always be the same as the Trace Session as no triggering events are defined in UTRAN. Therefore a Trace Recording Session shall always be stopped in an RNC when the RNC deactivates the Trace Session. For more information on Trace Session deactivation in UTRAN see subclause 4.1.5.2.

4.2.5.2 PS Domain stopping mechanisms

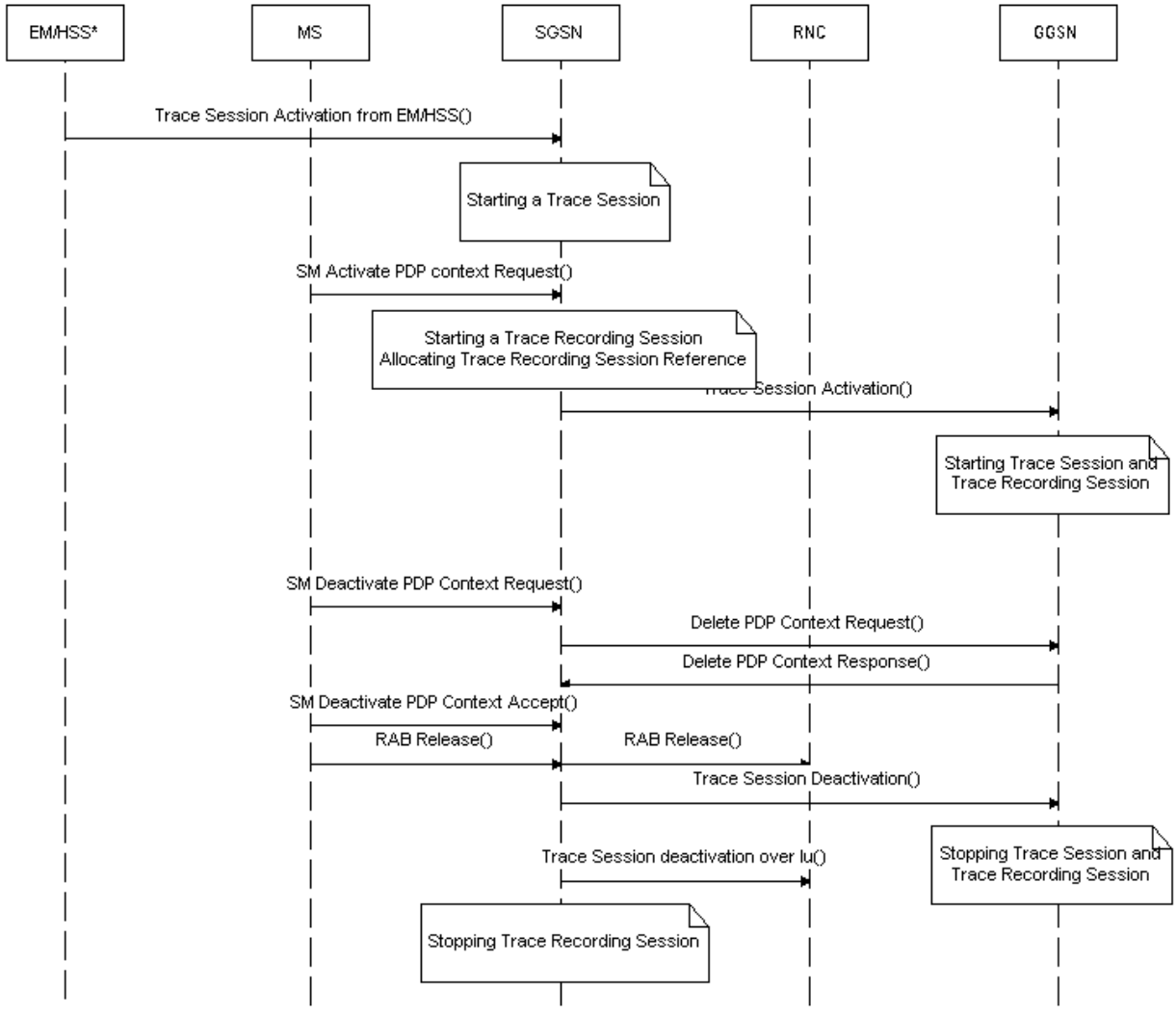
A Trace Recording Session shall be stopped when the SGSN/GGSN detect any of the stop triggering events.

However, if a SGSN receives a Trace Session deactivation either from its EM (in case of tracing roaming subscribers) or from HSS (in case of tracing home subscribers) during an ongoing Trace Recording Session, it may stop it immediately or at any time until the occurrence of an appropriate stop-triggering event.

A GGSN shall stop a Trace Recording Session when it receives a Trace Session deactivation message from the SGSN or at any time until the occurrence of an appropriate stop-triggering event.

When a Trace Recording Session is stopped in a SGSN, the SGSN shall send a Trace Session deactivation message to the NEs where tracing was required, as defined in the "List of NE types" configuration parameter, received in the Trace Session activation message. The Trace Reference, used for the deactivation procedure, shall be the same as used in the SGSN for the activation of the Trace Session.

Figure 4.2.5 illustrates a successful case in tracing a PDP context, when a Trace Recording Session is stopped. (Reference 3GPP TS 23.060 [6].)



NOTE: The activation to SGSN can come from EM-SGSN (in the figure just EM) or from the HSS.

Figure 4.2.5: Stopping a Trace Recording Session (Signalling based) - PS domain

4.2.5.3 CS Domain stopping mechanisms

A Trace Recording Session shall be stopped when the MSC Server and MGW detect any of the stop triggering events.

However, if a MSC Server receives a Trace Session deactivation either from its EM (in case of tracing roaming subscribers) or from HSS (in case of tracing home subscribers) during an ongoing Trace Recording Session, it may stop it immediately or at any time until the occurrence of an appropriate stop-triggering event.

A MGW shall stop a Trace Recording Session when it receives a Trace Session deactivation message from the MSC Server or at any time until the occurrence of an appropriate stop-triggering event.

When a Trace Recording Session is stopped in a MSC Server, the MSC Server shall send a Trace Session deactivation message to the NEs where tracing was required, as defined in the "List of NE types" configuration parameter, received in the Trace Session activation message. The Trace Reference, used for the deactivation procedure, shall be the same as used in the MSC Server for the activation of the Trace Session.

Figure 4.2.6 illustrates a successful case in tracing a call, when a Trace Recording Session is stopped. (Reference 3GPP TS 23.205 [7] and 3GPP TS 23.108 [8].)

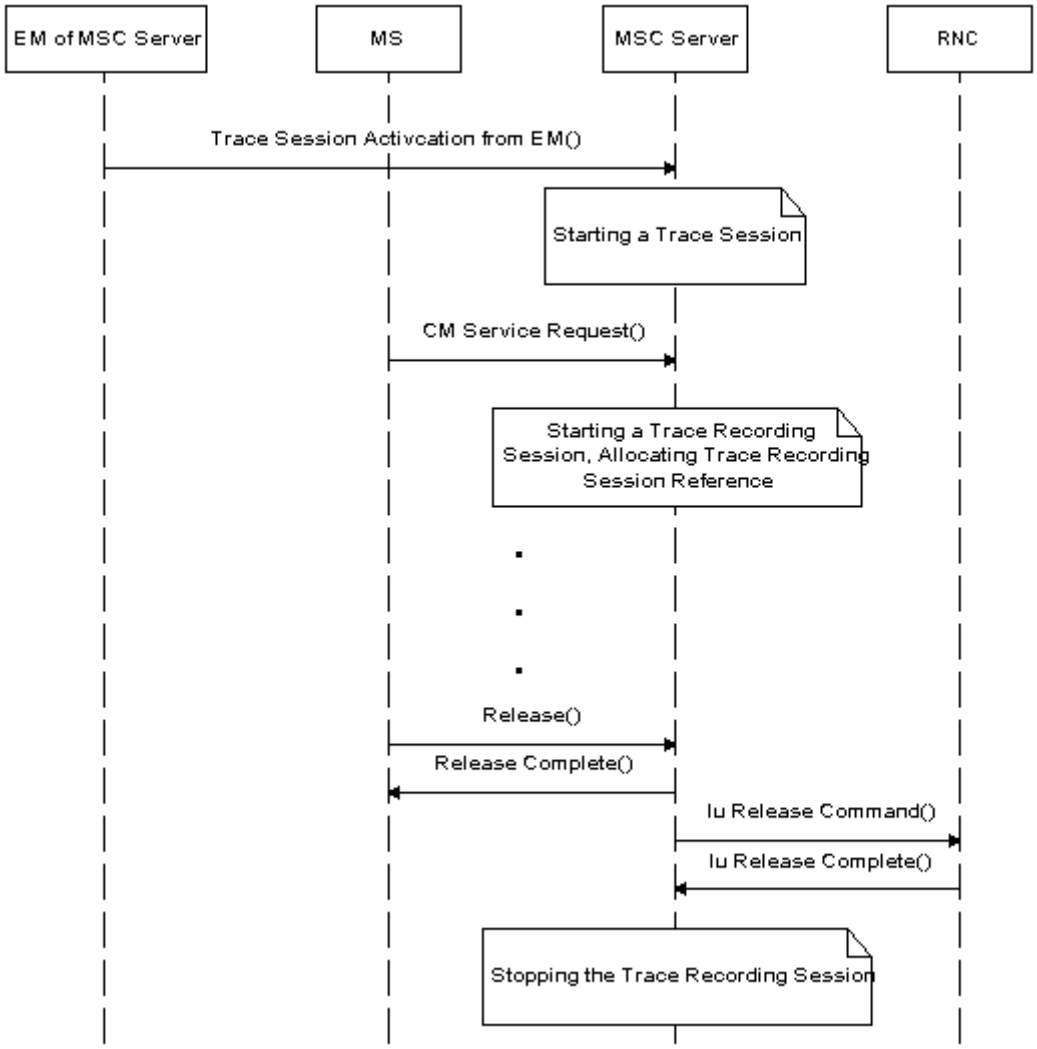


Figure 4.2.6: Stopping a Trace Recording Session (Signalling based) - CS domain

4.2.5.4 Void

5 Trace control and configuration parameters

5.1 Triggering events (M)

This mandatory parameter defines when to start a Trace Recording Session and which message shall be recorded first, when to stop a Trace Recording Session and which message shall be recorded last respectively. The messages in the start triggering event tables indicate the transaction to be recorded first and the starting time of the Trace Recording Session within a Trace Session for the traced MS/subscriber in the given NE.

The messages in the stop triggering event tables indicate the transaction to be recorded last and the stopping time of the Trace Recording Session.

MSC Server	Start triggering events	Stop triggering events
Mobile Originated Call	Receipt of the CM SERVICE-REQUEST message with service type set to originating call establishment	Reception of CC-RELEASE COMPLETE or CM-SERVICE ABORT message
Mobile Terminated Call	Sending of PAGING REQUEST message	Reception of CC-RELEASE COMPLETE or CM-SERVICE ABORT message
Mobile Originated SMS	Receipt of the CM SERVICE-REQUEST message with service type set to Short Message service	Transmission of RP-ACK/RP-NACK message
Mobile Terminated SMS	Sending of PAGING REQUEST message	Reception of RP-ACK/RP-NACK message
IMSI Attach	Receipt of the MM-LOCATION UPDATING REQUEST message	Sending of MM-LOCATION-UPDATING ACCEPT or MM-LOCATION-UPDATING-REJECT message
Location Update	Receipt of the MM-LOCATION UPDATING REQUEST message	Sending of MM-LOCATION-UPDATING ACCEPT or MM-LOCATION-UPDATING-REJECT message
IMSI Detach	Receipt of the MM-IMSI DETACH INDICATION message	Reception of MM-IMSI DETACH INDICATION message
Handover	Receipt of the BSSMAP-HANDOVER-REQUIRED message in case of GSM or RANAP-RELOCATION-REQUIRED message in case of UMTS	Reception of BSSMAP-CLEAR COMPLETE message in case of GSM or RANAP-IU RELEASE COMPLETE message in case of UMTS or BSSMAP-HANDOVER FAILURE in case of GSM or RANAP-RELOCATION FAILURE in case of UMTS.
Supplementary Service	TBD	TBD
Vendor Specific extensions	Vendor Specific extension	Vendor Specific extension

MGW	Start triggering events	Stop triggering events
Context	Reception of Megaco-ADD command, or reception of Megaco MODIFY command	Sending of Megaco- EXTRACT reply
Vendor specific extensions	Vendor specific extension	Vendor specific extension

SGSN	Start triggering events	Stop triggering events
PDP Context	Reception of SM-ACTIVATE PDP CONTEXT REQUEST or sending SM-REQUEST PDP CONTEXT ACTIVATION or reception of SM-MODIFY PDP CONTEXT REQUEST	Reception or sending of SM- DEACTIVATE PDP CONTEXT REQUEST or sending SM-ACTIVATE PDP CONTEXT REJECT
Mobile Originated SMS	Receipt of RP-DATA message	Transmission of RP-ACK/RP-NACK message
Mobile Terminated SMS	Transmission of RP-DATA message	Reception of RP-ACK/RP-NACK message
GPRS Attach	Reception of MM-ATTACH-REQUEST	Sending MM-ATTACH-ACCEPT or MM-ATTACH-REJECT
Routing Area Update	Reception of MM-ROUTING AREA UPDATE REQUEST	Sending MM-ROUTING AREA UPDATE ACCEPT or MM-ROUTING AREA UPDATE REJECT
GPRS Detach	Reception MM-DETACH REQUEST	Reception of MM-DETACH ACCEPT
Vendor specific extensions	Vendor specific extension	Vendor specific extension

GGSN	Start triggering events	Stop triggering events
PDP Context	Reception of GTP Create PDP context request or reception of GTP Update PDP context request	Sending of GTP Delete PDP context response
Vendor specific extensions	Vendor specific extension	Vendor specific extension

S-CSCF	Start triggering events	Stop triggering events
SIP INVITE method	Reception of the initial SIP INVITE request	Sending of the SIP response to the SIP BYE request (sending or receiving) or any other error response
SIP REGISTER method	Reception of SIP REGISTER request	Sending the SIP response to the SIP REGISTER request
SIP MESSAGE method	Reception of SIP MESSAGE request	Sending the SIP response to the SIP MESSAGE request
SIP SUBSCRIBE method	Reception of SIP SUBSCRIBE request	Sending the SIP response to the final SIP NOTIFY request
other SIP methods	Reception of any other SIP requests (e.g. OPTIONS, REFER, INFO)	Sending the SIP response to the appropriate SIP request

P-CSCF	Start triggering events	Stop triggering events
SIP INVITE session	Reception of the initial SIP INVITE request	Sending of the SIP response to the SIP BYE request (sending or receiving) or any other error response
SIP REGISTER method	Reception of SIP REGISTER request	Sending the SIP response to the SIP REGISTER request
SIP MESSAGE method	Reception of SIP MESSAGE request	Sending the SIP response to the SIP MESSAGE request
SIP SUBSCRIBE method	Reception of SIP SUBSCRIBE request	Sending the SIP response to the final SIP NOTIFY request
other SIP methods	Reception of any other SIP requests (e.g. OPTIONS, REFER, INFO)	Sending the SIP response to the appropriate SIP request

Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
MSC Server							
MGW							
SGSN							
GGSN							
spare							
spare							

MSC Server							
Bit 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**
spare		Vendor specific	SS	Handovers	LU, IMSI attach, IMSI detach	MO and MT SMS	MO and MT calls
spare							

MGW							
Bit 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**
spare						Vendor Specific	Context

SGSN							
Bit 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**
spare				Vendor Specific	RAU, GPRS attach, GPRS detach	MO and MT SMS	PDP context
Reserved							

GGSN							
Bit 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**
spare						Vendor Specific	PDP Context

If a bit is set to 1 the given event shall be traced, i.e. a Trace Recording Session shall be started for that event.

If a bit is set to 0 the given event should not be traced, i.e. Trace Recording Session should not be started.

5.2 Trace Depth (M)

This mandatory parameter defines how detailed information should be recorded in the Network Element. The following table describes the values of the Trace Depth parameter.

Trace Depth	Meaning
Minimum	Recording of some IEs in the signalling messages plus any vendor specific extensions to this definition, in decoded format.
Medium	Recording of some IEs in the signalling messages together with the radio measurement IEs plus any vendor specific extensions to this definition, in decoded format.
Maximum	Recording entire signalling messages plus any vendor specific extensions to this definition, in encoded format.
Vendor Specific data	Recording of any vendor specific trace data outside the scope of this specification.

At least one of Minimum, Medium or Maximum trace Depth shall be supported depending on the NE type (see trace record description in TS 32.423 [3] for details).

Trace depth shall be an enumerated parameter with the following possible values:

1 - Minimum,

2 - Medium,

3 - Maximum and

4 - Vendor specific

5.3 List of NE types (M)

This mandatory parameter defines the Network Element types where Trace Session activation is needed. This parameter has meaning only in the signalling based activation mechanism and it is used to determined whether the Trace Session Activation shall be propagated further to other Network Elements. In management based activation mechanism this parameter is not needed.

The following list contains the Network Element types:

- MSC Server
- MGW
- RNC
- SGSN
- GGSN

Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
spare	spare	spare	RNC	GGSN	SGSN	MGW	MSC-S
Spare							

If a bit is set to 1, Trace Session to that Network Element shall be activated.

If a bit is set to 0, Trace Session is not needed in that Network Element.

5.4 List of interfaces (O)

This is an optional parameter, which defines the interfaces to be recorded in the Network Element.

The following list contains the list of interfaces in each Network Element:

- MSC Server: A, Iu-CS, Mc and MAP (G, B, E, F) interfaces, CAP.

- MGW: ATM, IP and TDM interfaces for user plane characteristics.
- RNC: Iu-CS, Iu-PS, Iur, Iub and Uu interfaces.
- SGSN: Gb, Iu-PS, Gn, MAP (Gr, Gd, Gf), CAP (Ge) and Gs interfaces.
- GGSN: Gn and Gi interfaces.
- S-CSCF: Mw, Mg, Mr and Mi interfaces.
- P-CSCF: Gm and Go interfaces.
- HSS: MAP (C, D, Gc, Gr) and Cx interfaces and location and subscription information.

Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
MSC Server							
MGW							
SGSN							
GGSN							
RNC							
Spare							

MSC Server							
Bit 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**
CAP	MAP-F	MAP-E	MAP-B	MAP-G	Mc	Iu	A
spare							

SGSN							
Bit 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**
Ge	Gs	MAP-Gf	MAP-Gd	MAP-Gr	Gn	Iu	Gb
spare							

MGW							
Bit 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**
spare						Nb	Mc

GGSN							
Bit 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**
spare						Gi	Gn

RNC							
Bit 8	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**
spare				Uu	Iub	Iur	Iu

If a bit is set to 1, the interface should be traced in the given Network Element.

If a bit is set to 0, that interface should not be traced in the given Network Element.

5.5 Trace Reference (M)

This parameter shall be a 3 byte Octet String.

5.6 Trace Recording Session Reference (M)

This parameter shall be a 2 byte Octet String.

Annex A (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
Mar 2004	S_23	SP-040117	--	--	Submitted to TSG SA#23 for Information	1.0.0	
Sep 2004	S_25	SP-040543	--	--	Submitted to TSG SA#25 for Approval	2.0.0	6.0.0
Dec 2004	SA_26	SP-040770	001	--	Remove IMS entities from the Signalling Based Activation of the Trace functionality	6.0.0	6.1.0
Dec 2004	SA_26	SP-040770	002	--	Align Management Based Activation for Trace with RAN3's 25.413 (UTRAN Iu interface RANAP signalling)	6.0.0	6.1.0