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Agenda Item:	**7.5.3**

SP-040117 New Rel-6 TS 32.422-100: "Telecommunication management; Subscriber and equipment trace: Trace control and Configuration Management" - **For SA Information**

3GPP TSG-SA5 (Telecom Management)　　　　　　　　　　　**S5-042147**
Meeting #37, Malaga, SPAIN, 23 - 27 Feb 2004

Presentation of Specification to TSG or WG

Presentation to:	**TSG SA Meeting #23**
Document for presentation:	**TS 32.422, v.1.0.0**
	Trace control and Configuration Management
Presented for:	**Information**

Abstract of document:

This TS is a member of a family consisting of:

Number	Title
32.421	Telecommunication management; Subscriber and equipment trace: Trace concepts and requirements
32.422	**Telecommunication management; Subscriber and equipment trace: Trace control and Configuration Management**
32.423	Telecommunication management; Subscriber and equipment trace: Trace data definition and management

Work done against the WID contained in SP-020332 (Work Item ID: OAM-Trace).

TS 32.422 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 standardised 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)).
Trace concepts and requirements are covered in TS 32.421.

Changes since last presentation to TSG SA:
New.

Outstanding Issues:
- The UTRAN sections need to be completed but this is partly dependant on a solution from RAN3 that is being awaited.
- Waiting for solution from CN1/IETF & CN4 on the signalling based activation in IMS.
- Level of detail in trace parameters.
- No progress of work in SA5 on GERAN sections due to lack of contributions. Hence, there is a danger that this will not be part of Rel-6.

Contentious Issues:
- Trace propagation over Gs.
- Availability of trace functionality in a D-RNC.

3GPP TS 32.422 V1.0.0 (2004-03)

Technical Specification

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

Keywords

Trace Management, Configuration Management

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Contents

Foreword

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

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

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.

[Editor's Note]: Check that IMS domain usage is consistent across all Trace specs.

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. Annex A provides the high-level functional architecture for Trace Session activation and deactivation. 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 Definitions and abbreviations

3.1 Definitions

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

active pending: state of an activated trace is called "Active Pending" in a particular NE when the subscriber or equipment being traced is not registered in that NE

3.2 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 General

[Editor's Note: This clause would explain trace act/de-act in at a higher level. A diagram MAY also be included explaining the overall picture.]

4.2 Trace session activation / deactivation

4.2.1 General

[Editor's Note: Awaiting contributions.]

4.2.2 Management activation

A Trace Session is always limited to one node. The Trace Control and Configuration Data shall be kept in the node that shall perform the trace recording. The IMSI and IMEI/IMEISV shall be provided to the node that shall perform the trace recording as a part of traffic signalling.

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.
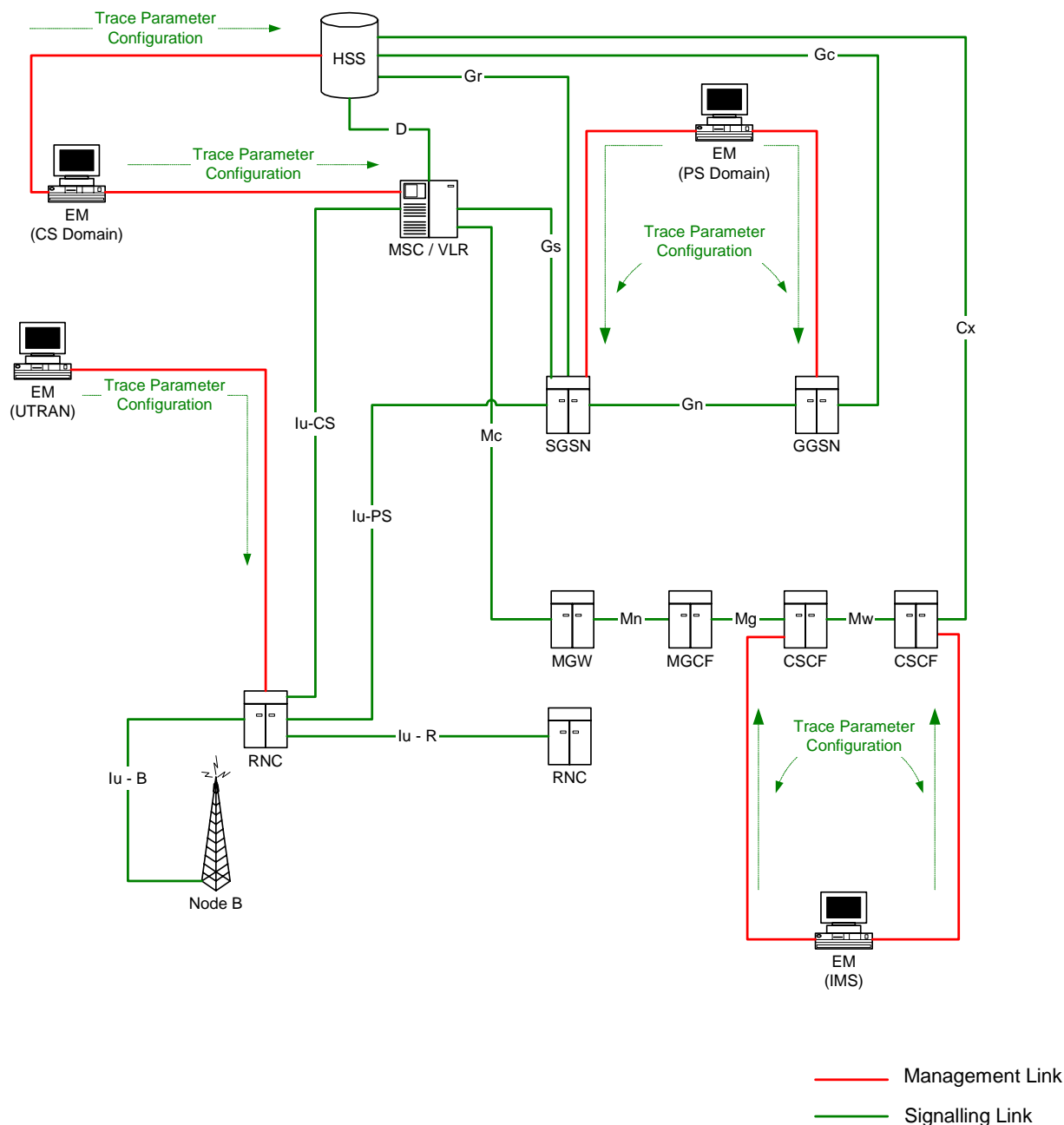
Figure 1: Overview of management activation

4.2.2.1   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 a Trace Session activation message 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 4.3.2.1). A Trace Session may be requested for a limited geographical area.

S5-038004r3 (Presentation)

S5-028619 (RAN3 LS)].

4.2.2.2 PS Domain activation mechanisms

When an 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 message 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 4.3.2.2)

4.2.2.3 CS Domain activation mechanisms

When an 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 message 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 4.3.2.3)

4.2.2.4 GERAN activation mechanisms

[Editor's Note: Awaiting contributions.]

4.2.2.5 IP Multimedia Subsystem activation mechanisms

When an 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. Detailed information on starting and stopping Trace Recording Session in IMS (see subclause 4.3.2.5).

Figure 2 illustrates the Trace Session activation in S-CSCF and in P-CSCF in case of Management based activation.
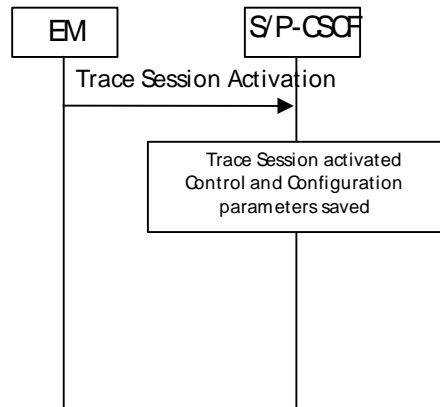
Figure 2: Trace session activation in IMS

4.2.3 Signalling activation

4.2.3.1 General

A Trace Session is activated first always from the Element Management System. In case of home subscriber trace in the HPLMN the Trace Session activation should go to the HSS. In case of foreign subscriber trace (the HPLMN operator wants to trace foreign subscribers in the PLMN) the Trace Session activation should go the MSC Server/VLR or SGSN.

4.2.1.1.1 Intra PLMN signalling activation

Figure 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.
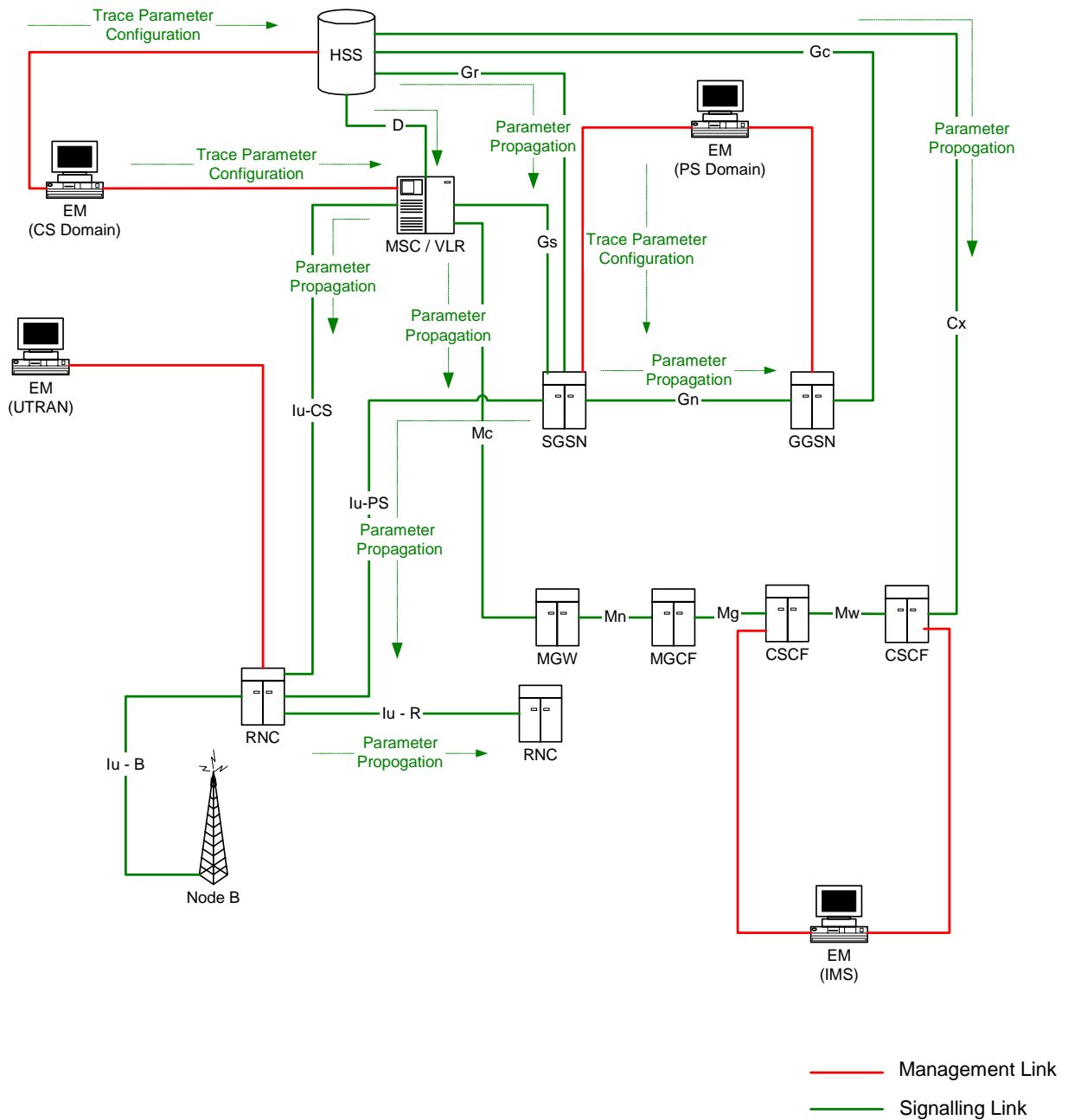
Figure 3: Overview of Intra-PLMN Signalling Activation

4.2.1.1.2 Inter PLMN Signalling Activation

Figure 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.
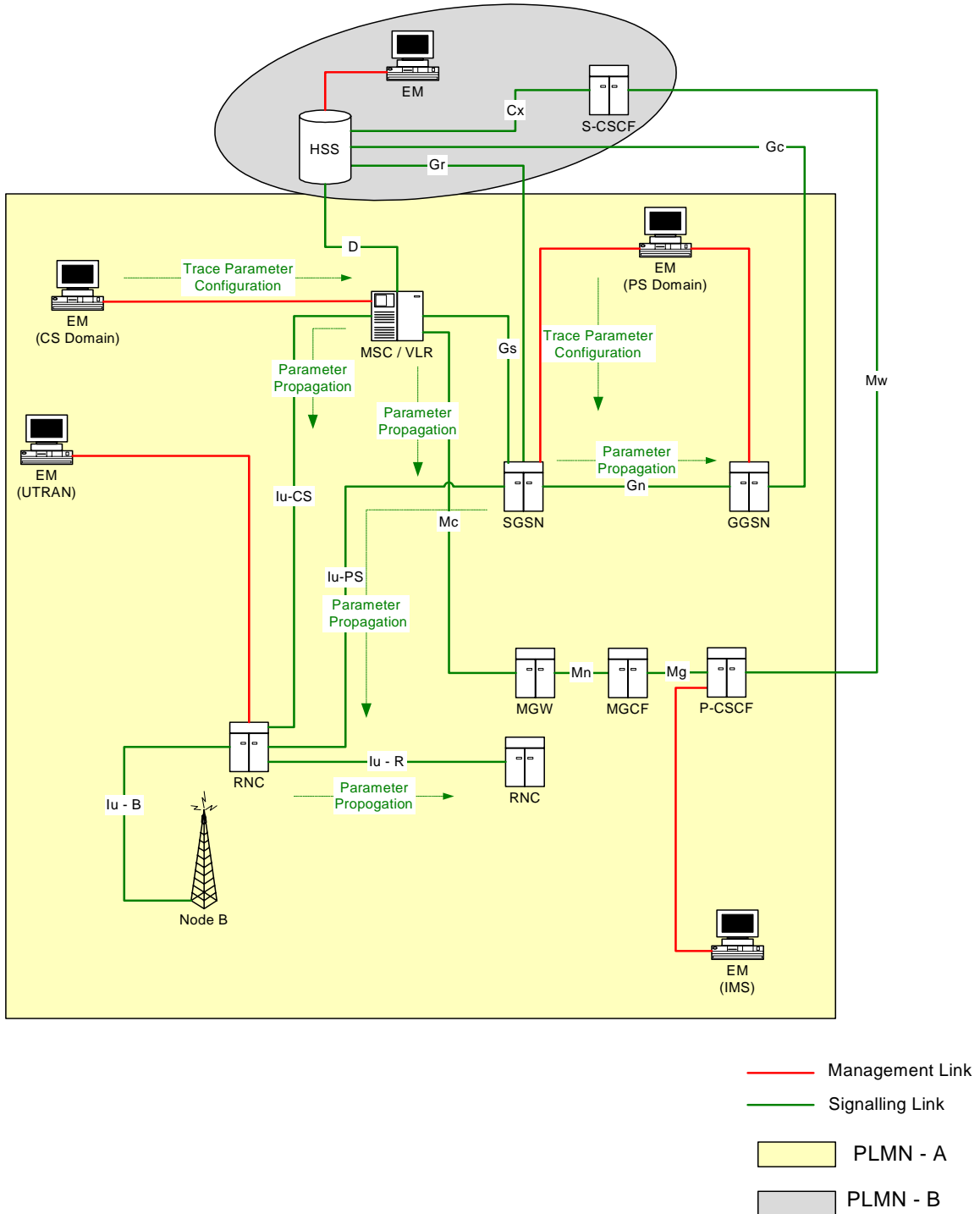
Figure 4: Overview of Inter-PLMN Signalling Activation

4.2.3.2 UTRAN activation mechanisms

clause

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S5-028619 (RAN3 LS)

4.2.3.3 PS Domain activation mechanisms

Figure 5 shows the Trace Session activation in the PS domain. The figure is an example of tracing PDP context.

Figure 5: Trace session activation in PS domain

When HSS receives Trace Session activation from EMS it should store the trace control and configuration parameters associated to the Trace Session. At this point a Trace Session is started in the HSS.

When the MS registers to the network by sending an ATTACH_REQUEST message to the SGSN, SGSN updates the location information in the HSS by sending the UPDATE_GPRS_LOCATION message to the HSS. After receiving the UPDATE_GPRS_LOCATION message, HSS shall propagate the trace control and configuration parameters to the SGSN by sending a Trace Session Activation message to the SGSN. When 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 should 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, occurs (e.g. PS session is started (i.e. a ACTIVATE PDP CONTEXT REQUEST message is received from the MS)) the SGSN should 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 and GERAN is described in subclauses 4.2.3.2 and 4.2.3.5.

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).

- Start and stop triggering events in SGSN (O).

- Start and stop triggering events in GGSN (O).

- Start and stop triggering events in RNC (O).

- Start and stop triggering events in BSC (O).

- Trace Depth (M).

- List of NE types to trace (M).

- List of interfaces to trace in SGSN (O).

- List of interfaces to trace in GGSN (O).

- List of interfaces to trace in RNC (O).

- List of interfaces to trace in BSC (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).

- Start and stop triggering events in GGSN (O).

- Trace Depth (M).

- List of interfaces to trace in GGSN (O).

4.2.3.4   CS Domain activation mechanisms

Figure 6 shows the Trace Session activation in the CS domain. The figure is an example of tracing Mobile Originating Call.
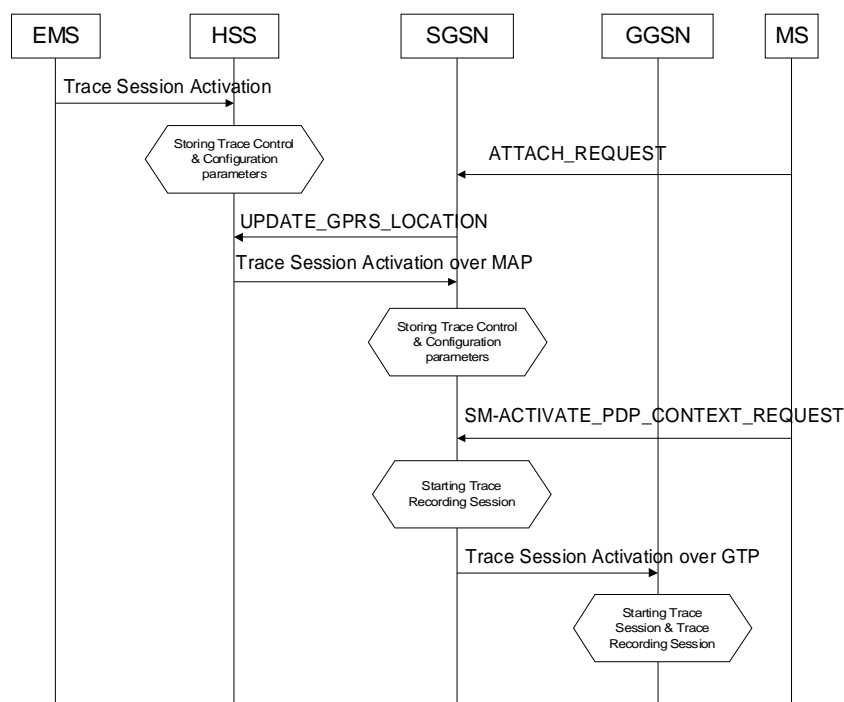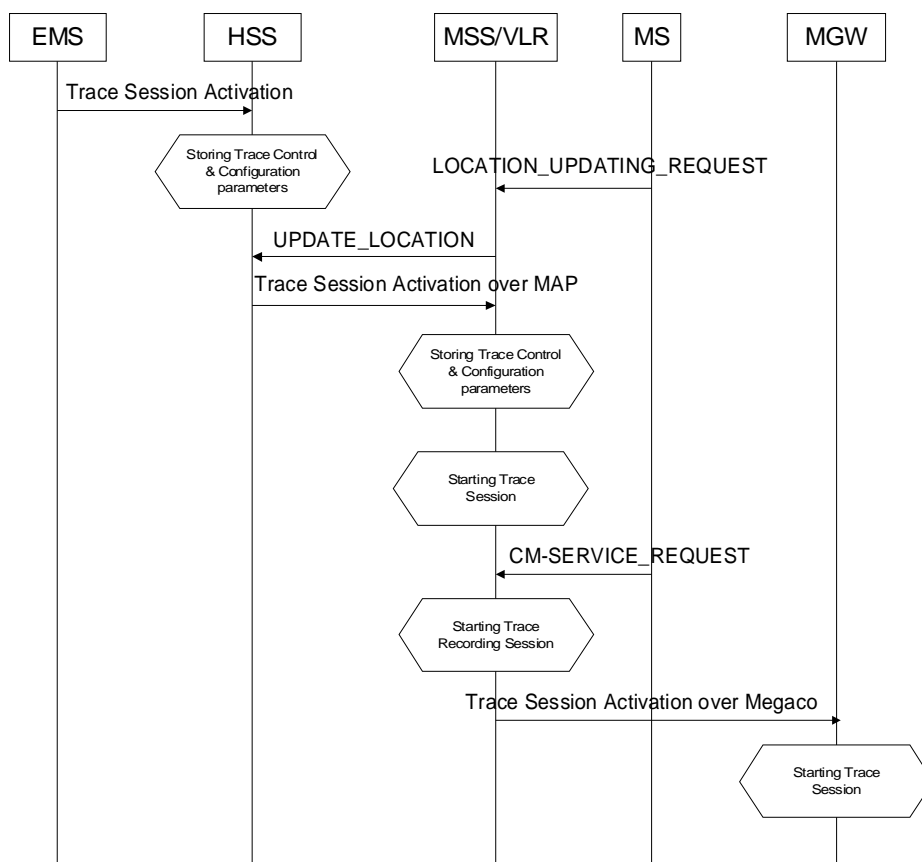

Figure 6: Trace Session Activation in CS domain

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 and GERAN is described in subclauses 4.2.3.2 and 4.2.3.5. 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).

- Start and stop triggering events in MSC Server (O).

- Start and stop triggering events in MGW (O).

- Start and stop triggering events in RNC (O).

- Start and stop triggering events in BSC (O).

- Trace Depth (M).

- List of NE types to trace (M).

- List of interfaces to trace in MSC Server (O).

- List of interfaces to trace in MGW (O).

- List of interfaces to trace in RNC (O).

- List of interfaces to trace in BSC (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).

- Start and stop triggering events in MGW (O).

- Trace Depth (M).

- List of interfaces to trace in MGW (O).

4.2.3.5 GERAN activation mechanisms

[Editor's Note: Awaiting contributions.

4.2.3.6 IP Multimedia Subsystem activation mechanisms

[Editor's Note: Awaiting contributions.

[Contribution exists but is pending approval & CN1 response]

4.2.3.7 Tracing roaming subscribers

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

Furthermore it shall be possible to reject a Trace Session activation message in the MSC Server/VLR or in SGSN located in the VPLMN, if the Trace Session activation message is coming from the HSS located in the HPLMN.

4.2.4 Management deactivation

4.2.4.1 UTRAN deactivation mechanisms

[Editor's Note: Awaiting contributions.

S5-038004r3 (Presentation)

S5-028619 (RAN3 LS)

4.2.4.2 PS Domain deactivation mechanisms

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

If a Trace Recording Session is going on, while the SGSN/GGSN receives the Trace Session deactivation message from EM, the SGSN/GGSN may finish the recording of the procedure, which triggered the Trace Recording Session, but SGSN/GGSN shall deactivate the Trace Session immediately after the end of the Trace Recording Session.

4.2.4.3 CS Domain deactivation mechanisms

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

If a Trace Recording Session is going on, while the MSC Server receives the Trace Session deactivation message from EM, the MSC Server may finish the recording of the procedure, which triggered the Trace Recording Session, but the MSC Server shall deactivate the Trace Session immediately after the end of the Trace Recording Session.

4.2.4.4 GERAN deactivation mechanisms

[Editor's Note: Awaiting contributions.

4.2.4.5 IP Multimedia Subsystem deactivation mechanisms

When an S-CSCF/P-CSCF receives a Trace Session deactivation from the EM the Trace Session, identified by the Trace Reference, shall be deactivated. If the Trace Session deactivation is received in the S-CSCF/P-CSCF, while a Trace Recording Session is going on (i.e. SIP session is traced) the S-CSCF/P-CSCF may finish the recording of the procedure, which triggered the Trace Recording Session, but the S-CSCF/P-CSCF shall deactivate the Trace Session immediately after the end of the Trace Recording Session.

Figure 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).
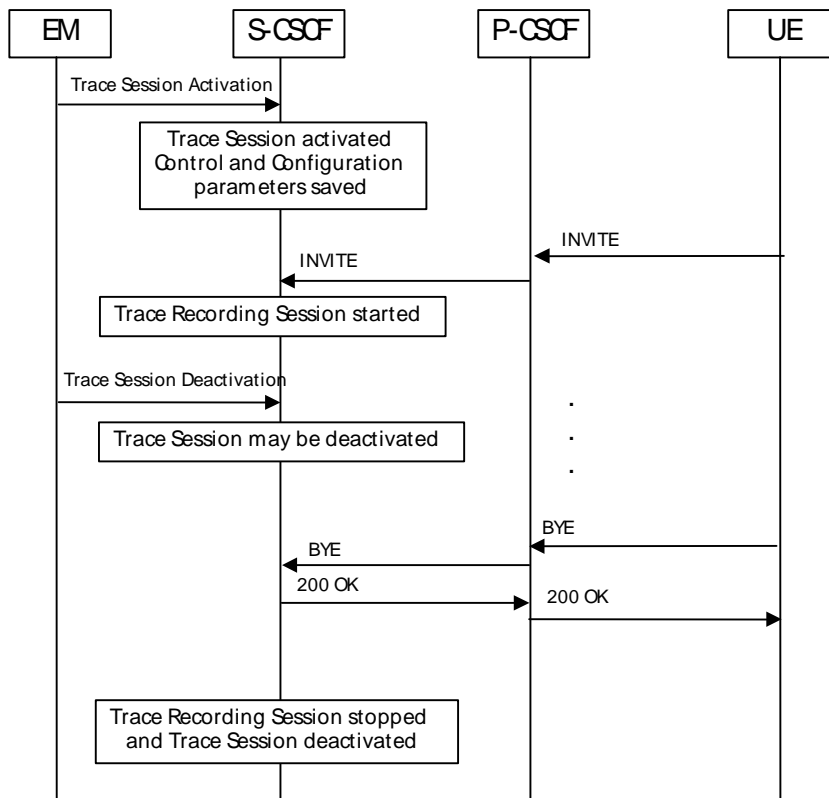
Figure 7: Trace session deactivation in IMS

4.2.5   Signalling deactivation

4.2.5.1   General

A Trace Session is deactivated first always from the Management System. In case of home subscriber trace in the HPLMN the Trace Session deactivation should go to the HSS.

In case of foreign Subscriber Trace the Trace Session deactivation should go to MSC Server/VLR or to SGSN. The Management System shall deactivate the Trace Session in the same NE where it activated the Trace Session.

When the HSS receives the Trace Session deactivation command from the Management system it shall deactivate the active Trace Session in HSS. The Trace Session to be deactivated is found based on the Trace reference received in the Trace Session deactivation command. The HSS shall delete all the trace control and configuration parameters associated with the Trace Session, which is deactivated.

If a Trace Recording Session is going on in the HSS when it received the Trace Session deactivation, the HSS may finish the Trace Recording Session and the Trace Session is deactivated after the end of the Trace Recording Session.

If the Trace Reference received in the Trace Session deactivation does not exist in the HSS, HSS should dismiss the Trace Session deactivation command.

4.2.5.2 UTRAN deactivation mechanisms

[Editor's Note]: The content in here has now been moved to Annex Y.11. This content would be reviewed together with contributions pertaining to this clause, when the participating companies make them.

S5-038004r3 (Presentation)

S5-028619 (RAN3 LS)

4.2.5.3 PS Domain deactivation mechanisms

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

When the SGSN receives the MAP_DEACTIVATE_TRACE_MODE message it shall deactivate the Trace Session identified by the Trace reference received in the Trace Session deactivation message (MAP_DEACTIVATE_TRACE_MODE). If a Trace Recording Session is going on in the SGSN at the time when it receives the MAP_DEACTIVATE_TRACE_MODE message, the SGSN may finish the Trace Recording Session, but shall deactivate the Trace Session immediately after the end of the Trace Recording Session. When SGSN deactivates the Trace Session it shall delete all the trace control and configuration parameters associated to the Trace Session identified by the Trace Reference received in the MAP_DEACTIVATE_TRACE_MODE message

4.2.5.4 CS Domain deactivation mechanisms

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

When the MSC Server receives the MAP_DEACTIVATE_TRACE_MODE message it shall deactivate the Trace Session identified by the Trace reference received in the Trace Session deactivation message (MAP_DEACTIVATE_TRACE_MODE). If a Trace Recording Session is going on in the MSC Server at the time when it receives the MAP_DEACTIVATE_TRACE_MODE message, the MSC Server may finish the Trace Recording Session, but shall deactivate the Trace Session immediately after the end of the Trace Recording Session. When MSC Server deactivates the Trace Session it shall delete all the trace control and configuration parameters associated to the Trace Session identified by the Trace Reference received in the MAP_DEACTIVATE_TRACE_MODE message.

4.2.5.4a GERAN deactivation mechanisms

[Editor's Note: Awaiting contributions.

4.2.5.5 IP Multimedia Subsystem deactivation mechanisms

[Editor's Note: Awaiting contributions.

[Contribution exists but is pending approval & CN1 response. The liaison (S5-038444) could also contain some information.]

4.3 Trace recording session Start / Stop triggering

4.3.1 General

[Editor's Note: Awaiting contributions.

4.3.2 Starting a trace recording session - management based

4.3.2.1 UTRAN starting mechanisms

[Editor's Note: Awaiting contributions.

S5-038004r3 (Presentation)

S5-028619 (RAN3 LS)

4.3.2.2 PS Domain starting mechanisms

In SGSN/GGSN a Trace Recording Session should start after the reception of the Trace Session Activation message from EM and if any of the defined *start triggering event* occurs. The *start triggering event* is received in the Trace Session activation message. If the start-triggering event is not given any start triggering events shall trigger a Trace Recording Session. During the Trace Recording Session the SGSN/GGSN shall record those signalling messages in the interfaces, which are defined in the *list of interfaces* parameter if it is given. If the list of interfaces parameter is not given all the interfaces shall be recorded. The *Trace Depth* parameter defines whether the whole signalling messages should be recorded or just some IEs needs to be recorded from the messages.

The SGSN/GGSN may not start a Trace Recording Session within the Trace Session if there are no sufficient available resources for the recording.

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

4.3.2.3 CS Domain starting mechanisms

In the MSC Server a Trace Recording Session should start after the reception of the Trace Session Activation message from EM and if any of the defined *start triggering event* occurs. The *start triggering event* is received in the Trace Session activation message. If the start-triggering event is not given any start triggering event shall trigger a Trace Recording Session. During the Trace Recording Session the MSC Server shall record those signalling messages in the interfaces, which are defined in the *list of interfaces* parameter if it is given. If the list of interfaces parameter is not given all the interfaces shall be recorded. The *Trace Depth* parameter defines whether the whole signalling messages should be recorded or just some IEs needs to be recorded from the messages.

The MSC Server may not start a Trace Recording Session within the Trace Session, if there are no sufficient available resources for the recording.

If the MSC Server receives the Trace Session Activation message during an established call, it may start the Trace Recording Session immediately. However, when the MSC Server receives (after receiving the Trace Session Activation message) any of the messages defined in the start triggering events parameter, it shall start the Trace Recording Session.

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

4.3.2.4 GERAN starting mechanisms

[Editor's Note: Awaiting contributions.

4.3.2.5 IP Multimedia Subsystem starting mechanisms

[Editor's Note: Awaiting contributions.

 [Liaison could have some information]

4.3.3 Starting a trace recording session - signalling based

4.3.3.1 UTRAN starting mechanisms

[Editor's Note: Awaiting contributions.

S5-038004r3 (Presentation)

S5-028619 (RAN3 LS)

4.3.3.2 PS Domain starting mechanisms

In SGSN/GGSN a Trace Recording Session should start after the reception of the Trace Session Activation message and if any of the defined *start triggering event* occurs. The *start triggering event* is received in the Trace Session activation message. If the start-triggering event is not given any start triggering events shall trigger a Trace Recording Session. During the Trace Recording Session the SGSN/GGSN shall record those signalling messages in the interfaces, which are defined in the *list of interfaces* parameter if it is given. If the list of interfaces parameter is not given all the interfaces shall be recorded. The *Trace Depth* parameter defines whether the whole signalling messages should be recorded or just some IEs needs to be recorded from the messages.

The SGSN/GGSN may not start a Trace Recording Session within the Trace Session if there are no sufficient available resources 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 the SGSN shall start the Trace Recording Session when it receives any of the messages, defined in the start triggering events parameter after receiving the Trace Session Activation message.

When a Trace Recording Session is started in SGSN, SGSN should assign a Trace Recording Session Reference for the Trace Recording Session. When SGSN propagates the Trace control and configuration parameters to GGSN or to GERAN/UTRAN (I.e. activates a Trace Session to GGSN/GERAN/UTRAN) SGSN should include the assigned Trace Recording Session Reference to the Trace Session Activation message.

The SGSN should send the Trace Session activation message to GGSN when SGSN starts a Trace Recording Session and the list of NE types to Trace requires GGSN tracing. It also means that in GGSN the starting time of a Trace Session is always the same as the starting time of a Trace Recording Session.

4.3.3.3 CS Domain starting mechanisms

In MSC Server/MGW a Trace Recording Session should start after the reception of the Trace Session Activation message and if any of the defined start triggering event occurs. The start triggering event is received in the Trace Session activation message. . If the start-triggering event is not given any start triggering events shall trigger a Trace Recording Session. During the Trace Recording Session the MSC Server/MGW shall record those signalling messages in the interfaces, which are defined in the *list of interfaces* parameter if it is given. If the list of interfaces parameter is not given all the interfaces shall be recorded. The *Trace Depth* parameter defines whether the whole signalling messages should be recorded or just some IEs needs to be recorded from the messages.

The MSC Server/MGW may not start a Trace Recording Session within the Trace Session if there are no sufficient available resources 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 the MSC Server shall start the Trace Recording Session when it receives any of the messages, defined in the start triggering events parameter after receiving the Trace Session Activation message.

When a Trace Recording Session is started in MSC Server, MSC Server should assign a Trace Recording Session Reference for the Trace Recording Session. When MSC Server propagates the Trace control and configuration parameters to MGW or to GERAN/UTRAN (I.e. activates a Trace Session to MGW/GERAN/UTRAN) MSC Server should include the assigned Trace Recording Session Reference to the Trace Session Activation message. The MSC Server should send the Trace Session activation message to MGW when MSC Server starts a Trace Recording Session and the list of NE types to Trace requires MGW tracing. It also means that in MGW the starting time of a Trace Session is always the same as the starting time of a Trace Recording Session.

4.3.3.4 GERAN starting mechanisms

[Editor's Note: Awaiting contributions.

4.3.3.5 IP Multimedia Subsystem starting mechanisms

[Editor's Note: Awaiting contributions.

4.3.4 Stopping a trace recording session - management based

4.3.4.1 UTRAN stopping mechanisms

[Editor's Note: Awaiting contributions.

S5-038004r3 (Presentation)

S5-028619 (RAN3 LS)

4.3.4.2 PS Domain stopping mechanisms

In SGSN and GGSN a Trace Recording Session should be stopped when any of the defined stop triggering events occur. The stop triggering event is received in the Trace Session activation message.

If a Trace Session deactivation message is received during the Trace Recording Session, it is allowed to finish tracing the on-going procedures (e.g. session). In this case the Trace Recording Session should be stopped between the reception of the Trace Session deactivation message and the appropriate stop-triggering event.

Figure 8 illustrates the successful case in tracing a PDP context when a Trace Recording Session is stopped.
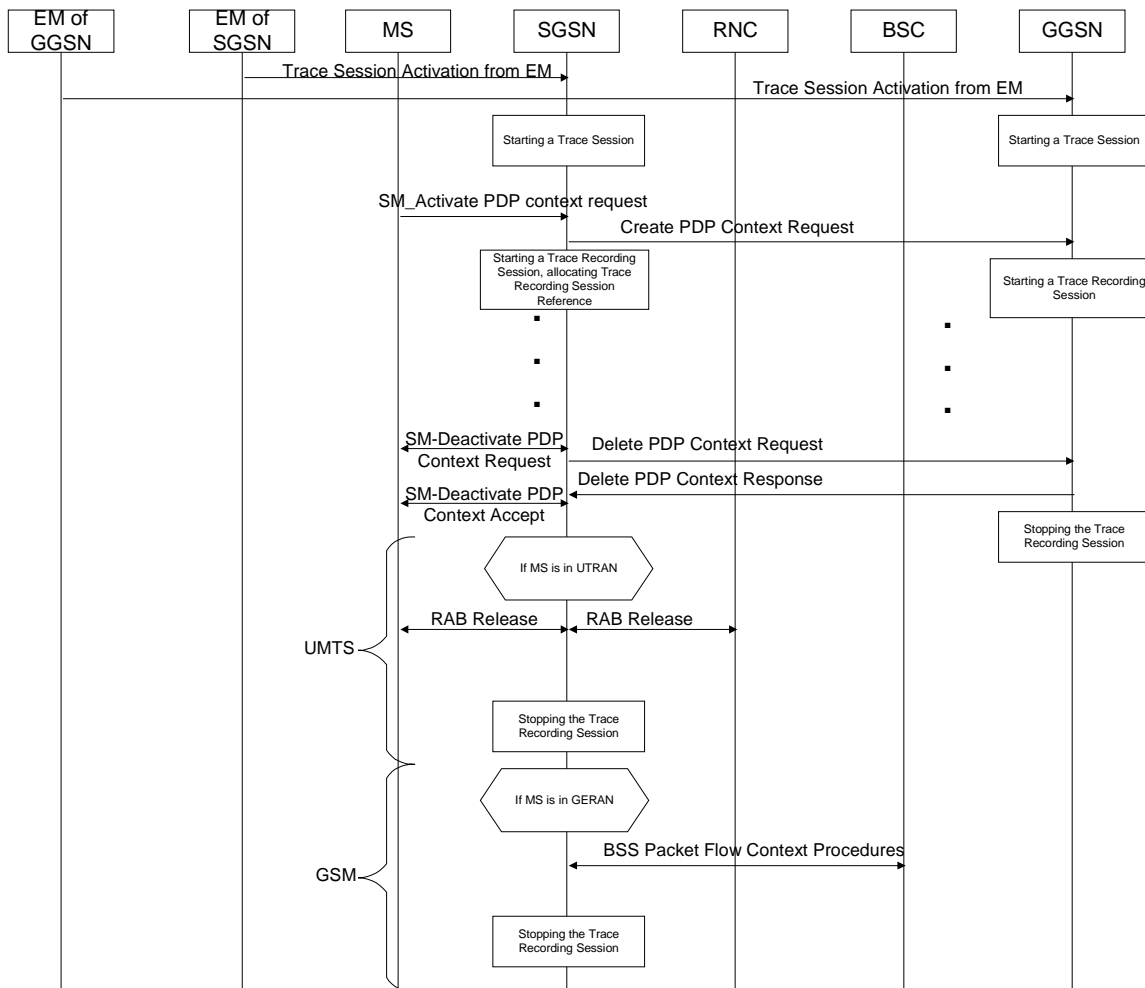
Figure 8: Stopping trace recording session in PS domain - management based

4.3.4.3 CS Domain stopping mechanisms

In MSC Server a Trace Recording Session should be stopped when any of the defined stop triggering events occur. The stop triggering event is received in the Trace Session activation message.

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

Figure 9 illustrates the successful case in tracing a call and the time of stopping a Trace Recording Session.
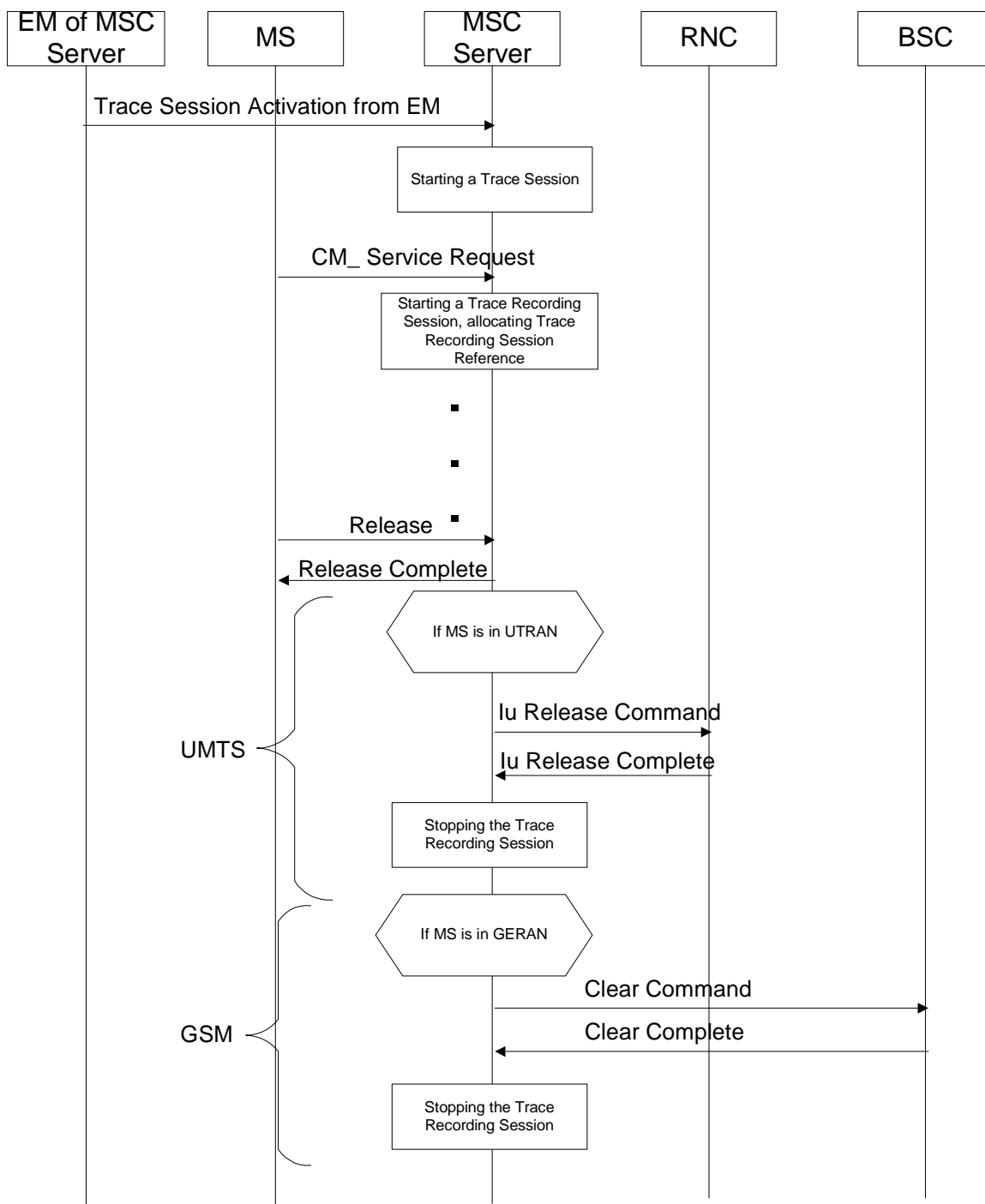

Figure 9: Stopping trace recording session in CS domain - management based

4.3.4.4 GERAN stopping mechanisms

[Editor's Note: Awaiting contributions.]

4.3.4.5 IP Multimedia Subsystem stopping mechanisms

[Editor's Note: Awaiting contributions.]

[LS might have something.]

4.3.5 Stopping a trace recording session - signalling based

4.3.5.1 UTRAN stopping mechanisms

[Editor's Note: Awaiting contributions.

S5-038004r3 (Presentation)

S5-028619 (RAN3 LS)

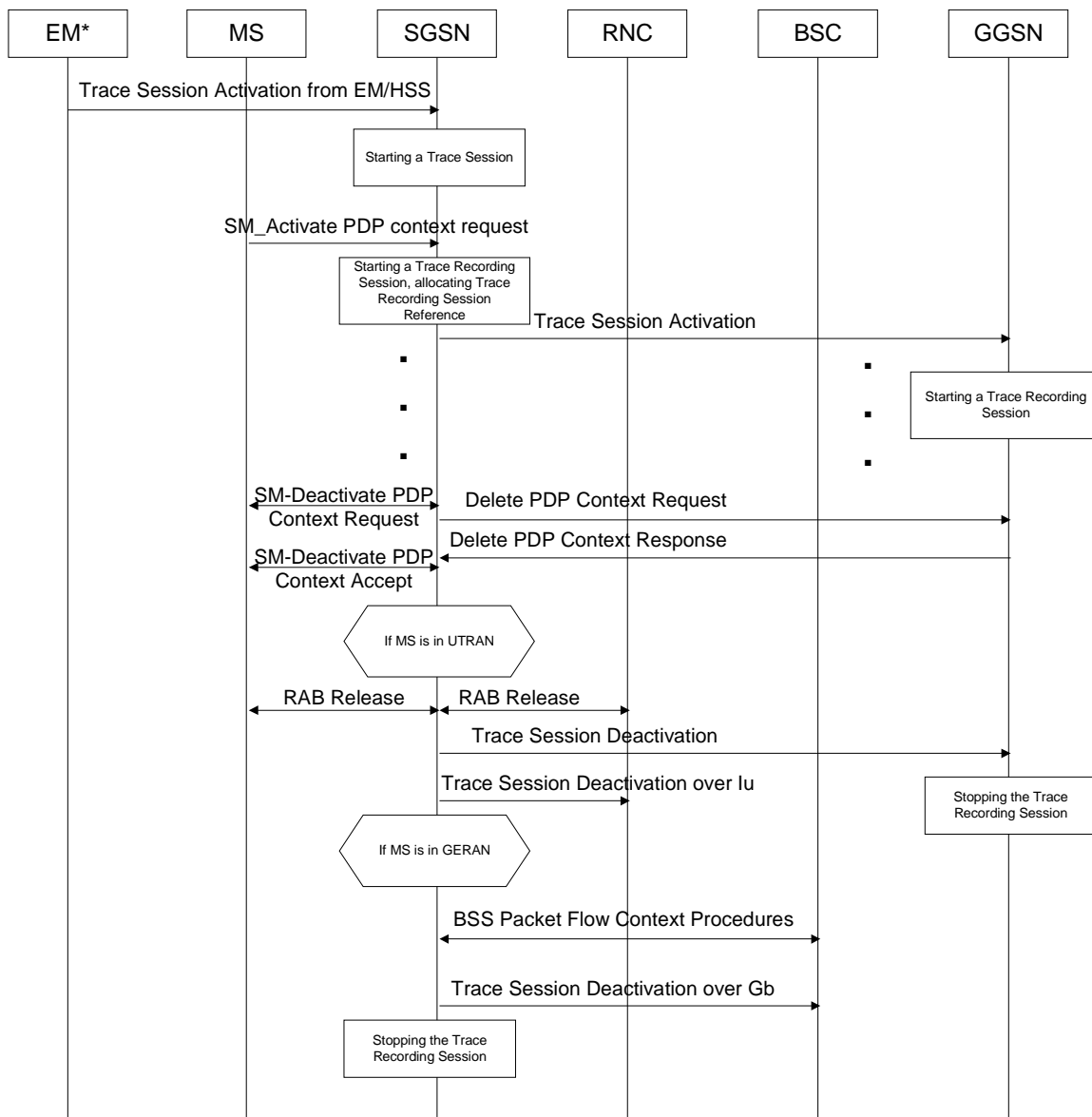### 4.3.5.2 PS Domain stopping mechanisms

The basic principle is that in SGSN and GGSN a Trace Recording Session should be stopped when the NE detects any of the stop triggering events that were defined in the Trace control and configuration parameters that this NE received in the Trace Session activation for this Trace Session.

However, if an SGSN receives a Trace Session deactivation either from EM (in case of tracing roaming subscribers) or from HSS (in case of tracing home subscribers) during an ongoing Trace Recording Session, it may finish tracing the ongoing procedures (e.g. a PS session). In this case the SGSN should stop the Trace Recording Session at any time between the reception of the Trace Session deactivation message and an appropriate stop triggering event, which is received in the Trace Session activation message.

Also, a GGSN shall stop a Trace Recording Session when it receives a Trace Session deactivation message from the SGSN.

When a Trace Recording Session is stopped in an SGSN, the SGSN should send a Trace Session deactivation message to the NEs where tracing was required, as defined in the "List of NE types to trace" 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 10 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 10: Stopping trace recording session in PS domain - signalling based

4.3.5.3 CS Domain stopping mechanisms

The basic principle is that in MSC Server and MGW a Trace Recording Session should be stopped when the NE detects any of the stop triggering events that were defined in the Trace control and configuration parameters that this NE received in the Trace Session activation for this Trace Session.

However, if an MSC Server receives a Trace Session deactivation either from EM (in case of tracing roaming subscribers) or from HSS (in case of tracing home subscribers) during an ongoing Trace Recording Session, it may finish tracing the ongoing procedures (e.g. a CS call). In this case the MSC Server should stop the Trace Recording Session at any time between the reception of the Trace Session deactivation message and an appropriate stop triggering event, which is received in the Trace Session activation message.

Also, a MGW shall stop a Trace Recording Session when it receives a Trace Session deactivation message from the MSC Server.

When a Trace Recording Session is stopped in an MSC Server, the MSC Server should send a Trace Session deactivation message to the NEs where tracing was required, as defined in the "List of NE types to trace" 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 11 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].)
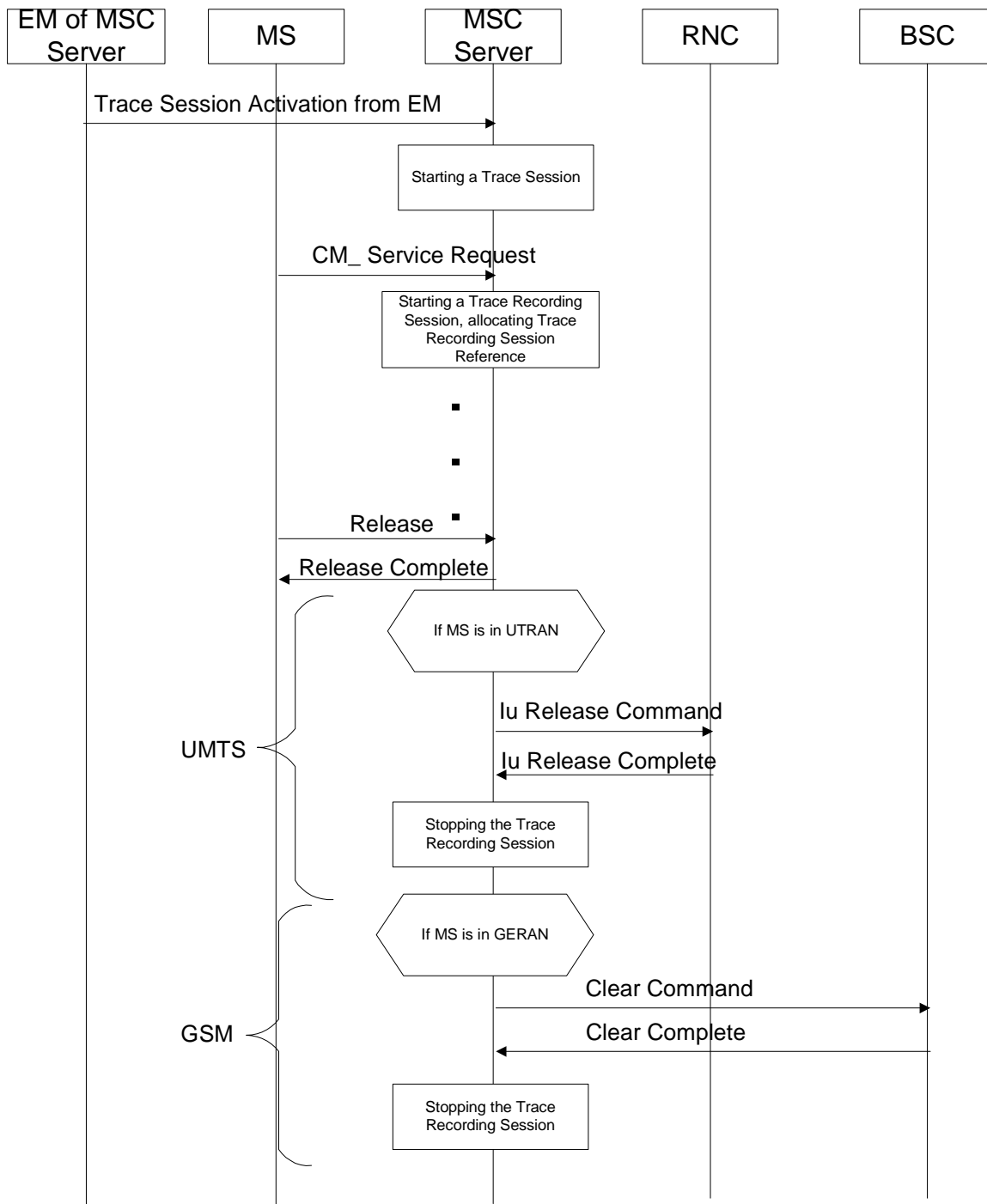

Figure 11: Stopping trace recording session in CS domain - signalling based

4.3.5.4 GERAN stopping mechanisms

[Editor's Note: Awaiting contributions.

4.3.5.5 IP Multimedia Subsystem stopping mechanisms

[Editor's Note: Awaiting contributions.

[LS might have something.]

5 Trace control and configuration parameters

[Editor's note 2: This clause should clearly introduce the Trace Types both for signalling activation and management activation. Trace Types for signalling activation and management activation should be distinguished if required.]

[Editor's Note 3]: The original contents in this clause have now been moved to Annex Y.9 since it is historical in nature.

5.1 Triggering events

This optional 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. If the parameter is not given than every transaction is traced.

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

5.2 Trace Depth

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 in decoded format
Medium	Recording of some IEs in the signalling messages together with the radio measurement IEs in decoded format
Maximum	Recording the whole signalling messages in encoded format
Vendor Specific extensions	Vendor specific extension

5.3 List of NE types to trace

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.

- BSC.

- SGSN.

- GGSN.

- S-CSCF.

- P-CSCF.

5.4 List of interfaces, protocols to trace

This is an optional parameter, which defines which interfaces, protocols should 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.

- BSC: Iu-CS, Iu-PS, Um, Abis, A and Gb 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.

Annex A (informative):
Change history

SA5-internal Change history							
Date	**SA5 #**	**SA5 Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
Mar 2004	S_23	SP-040117	--	--	Submitted to TSG SA#23 for Information	1.0.0	