Technical Specification Group Services and System Aspects **TSGS#16(02)0278**
Meeting #16, Marco Island, Florida, 10-13 June 2002

**3GPP TSG-SA5 (Telecom Management)** **S5-028140**
**Meeting #28, Sophia Antipolis, FRANCE, 20 - 24 May 2002**

| | |
|---|---|
| **Title:** | LS on Subscriber and Equipment Trace Impacts |
| **Response to:** | LS (GP-011295/ S5-020411) on "Reply to LS on Availability of IMSI and IMEI in the BSC" from GERAN<br>LS (R2-020796/ S5-020417) on "Response to LS (N4-020302) on Trace and Availability of IMSI and IMEI" from RAN2 |
| **Release:** | Release 6 |
| **Work Item:** | Trace Management |
| **Source:** | 3GPP SA5 SWGD |
| **To:** | CN1, CN4, GERAN, RAN2, RAN3 |
| **Cc:** | SA |

**Contact Person:**
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**Tel. Number:** +358-50-4877010
**E-mail Address:** kari.t.ronka@nokia.com

**Attachments:**
1) S5-028135: Draft v1.0.0 TS 32.421 "Trace Concepts and Requirements"
2) S5-028134: WID for SA5 Rel-6 WT "Trace impacts on network signalling interfaces"

**1. Overall Description:**

SA5 SWGD would like to thank GERAN for their LS (GP-011295/ S5-020411) and RAN2 for their LS (R2-020796/ S5-020417).

SA5 SWGD would like to inform the related 3GPP Working Groups that:

- Specification of Subscriber and Equipment Trace functionality has been moved entirely to Release 6.
- The responsibility of trace in SA5 has been moved from SWGB to SWGD.
- The TS for trace (TS 32.108) that was planned for Release 5 will be discontinued and will be replaced in Release 6 with three TSs: TS 32.421 (Trace Concepts and Requirements), TS 32.422 (Trace Control and Configuration Management) and TS 32.423 (Trace Data Definition and Management).

SA5 SWGD earlier identified that the complete trace functionality requires some enhancements in different network signalling protocols and SA5 SWGD sent LSs related to these enhancements in Rel5 timeframe. The following potential enhancements have been identified:

- CN1 on trace activation/deactivation over SIP between S-CSCF and P-CSCF;
- CN4 on trace activation/deactivation over Mc;
- CN4 on trace activation/deactivation over Cx;
- CN4 on trace activation/deactivation impacts to MAP;
- CN4 on trace activation/deactivation impacts to GTP (SGSN – GGSN).
- GERAN for trace activation/deactivation in BSS (meaning enhancements on the signalling protocols between BSS and CN and availability of IMSI/IMEI);
- RAN3 for trace activation/deactivation in RNS (meaning enhancements on the signalling protocols between RNS and CN and availability of IMSI/IMEI);

SA5 SWGD sends as an attachment the draft Release 6 TS 32.421 "Trace Concepts and Requirements" (v1.0.0) and the WID for the SA5 Work Task related to trace impacts on network signalling interfaces for information.

**2. Actions:**

**To CN1, CN4, GERAN and RAN3 groups.**

**ACTION:**

1) Would CN1/CN4/GERAN/RAN3 agree on specifying any needed enhancements (see the list above) in co-operation with SA5 SWGD within Release 6 timeframe?
2) The attached draft TS 32.421 “Trace Concepts and Requirements” contains high-level requirements for trace. When would CN1/CN4/GERAN/RAN3 need the detailed requirements for the enhancements from SA5 SWGD to be able to meet the Release 6 timeframe?
3) If enhancements would be done in CN1/CN4/GERAN/RAN3, would CN1/CN4/GERAN/RAN3 kindly provide identification of the related work item(s) to SA5 SWGD.

**3. Date of Next SA5 Meetings:**

| Meeting | Date | Location | Host |
|---|---|---|---|
| **SA5#29** | **24-28 Jun 2002** | **Beijing, CHINA** | **Nortel Networks** |
| **SA5#30** | **19-23 Aug 2002** | **Tampere, FINLAND** | **NOKIA** |
| **SA5#31** | **7-11 Oct 2002** | **Atlanta, GA, USA** | **NA Friends** |
| **SA5#32** | **18-22 Nov 2002** | **Vienna, AUSTRIA** | **EF3** |

**3GPP TSG-SA5 (Telecom Management)** **S5-028134**
**Meeting #28, Sophia Antipolis, FRANCE, 20 - 24 May 2002**

**Source:** **Trace RG**

**Title:** **Work Item Description: [WI: title: Trace Impacts on Network Signalling Interfaces (Rel6)]**
**WI type: [Work Task]**

**Document for:** **Decision** (SWG-D agreement for submission to SA5 for approval)

**Agenda Item:**

# Work Item Description

**Title: Trace Data Definition and Management (Rel6)**

## 1 3GPP Work Area

| | |
|---|---|
| x | Radio Access |
| x | Core Network |
| x | Services |
| | Terminals |

## 2 Linked work items

- Trace RG WT "Trace Concepts and Requirements (Rel6)"
- Trace RG WT "Trace Control and Configuration Management (Rel6)"
- Trace RG WT "Trace Data Definition and Management (Rel6)"

## 3 Justification

This WT refers to the impacts of the trace functionality on any network signalling interfaces that are outside the scope of SA5. The specification of trace related issues on these impacted interfaces is expected to be done by the corresponding 3GPP WGs in close co-operation with SA5.

## 4 Objective

- Identify all network signalling interfaces that may be impacted by the trace functionality, assumably related mostly to the trace activation and deactivation procedures as specified in TS 32.422
- Identify the changes needed for the network signalling interfaces.
- Provide the 3GPP WGs responsible for the impacted interfaces with detailed information about the required changes.
- Specify the use of the impacted network signalling interfaces from the SA5 perspective. The specification of the changes in interface specifications outside the scope of SA5 is expected to be done by the 3GPP WG responsible for the interface in question.

## 5 Service Aspects

*None*

## 6 MMI-Aspects

*None*

## 7 Charging Aspects

*None*

## 8 Security Aspects

*None*

## 9 Impacts

| Affects: | USIM | ME | AN | CN | Others |
|---|---|---|---|---|---|
| **Yes** | | | X | X | |
| **No** | X | X | | | |
| **Don't know** | | | | | X |

## 10 Expected Output and Time scale (to be updated at each plenary)

| New specifications | | | | | | |
|---|---|---|---|---|---|---|
| **Spec No.** | **Title** | **Prime resp. WG** | **2ndary resp. WG(s)** | **Presented for information at plenary#** | **Approved at plenary#** | **Comments** |
| 32.422 | Trace Control and Configuration Management | SA5 | | TSG#19 (03/03) | TSG#20 (06/03) | |

| Affected existing specifications | | | | |
|---|---|---|---|---|
| **Spec No.** | **CR** | **Subject** | **Approved at plenary#** | **Comments** |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

## 11 Work item rapporteur

Kari T. RÖNKÄ (Nokia) kari.t.ronka@nokia.com

## 12 Work item leadership

SWG-D Trace Rapporteur Group

## 13 Supporting Companies

Lucent Technologies, Motorola, Nokia, Nortel Networks, Orange

## 14 Classification of the WI (if known)

| | |
|---|---|
| | Feature (go to 14a) |
| | Building Block (go to 14b) |
| X | Work Task (go to 14c) |

14c The WI is a **Work Task**: parent **Building Block**

Rel6 – Trace Management

**3GPP TSG-SA5 (Telecom Management)** **S5-028135**
**Meeting #28, Sophia Antipolis, FRANCE, 20 - 24 May 2002**

| | |
|---|---|
| **Source:** | **Trace RG** |
| **Title:** | **Draft TS 32.421 Trace Concepts and Requirements (Rel6) v1.0.0** |
| **Document for:** | **Information** |
| **Agenda Item:** | |
| **Work Item:** | **Trace Mg** |
| **WT addressed** | **WT1 Trace Concepts and Requirements** |
| **Specs involved:** | **32.421, Release 6** |

The attached draft (32421-100, with both a clean version and a version with revision marks) was produced by the Trace RG in SA5#28 and is requested to be approved for sending to TSG-SA for information (for Release 6).

# Presentation of Technical Specification to TSG SA

| | |
|---|---|
| **Presentation to:** | **TSG SA Meeting #16** |
| **Document for presentation:** | **TS 32.421, Version 1.0.0** |
| **Presented for:** | **Information** |
| **Abstract of document:** | This is a draft Technical Specification on the concepts and requirements of Subscriber and Equipment Trace for Release 6. |
| **Changes since last presentation to TSG-SA Meeting #15:** | New |

**Outstanding Issues:**

- The scope needs refinement due to the split of trace specification into three technical specifications for Rel6
- The references, definitions, symbols and abbreviations need further work
- Three use cases are missing from the informative annex B.
- Equipment identification needs clarification
- Simultaneous tracing in different domains has not been defined yet
- Trace record transfer conventions need further study

**Contentious Issues:**

None

# 3GPP TS 32.421 ~~V0~~V1.~~1~~0.~~1~~ 0 (2002-05)

*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
<keyword[, keyword]>

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# Contents

# Foreword

~~[Editor's note: This document has been created from draft TS 32.108 v0.2.0, as agreed in SA5#27.]~~

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

Subscriber and Equipment 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 (IMSI) or mobile type (IMEI) 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, contrary to Performance Measurements that provide values aggregated on an observation period, Subscriber and Equipment Trace give instantaneous values that are more accurate.

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

In order to produce this data, Subscriber and Equipment 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

[Editor's note: The text is still partly from 12.08. More updating and restructuring needed. Also, the impact of the split to three specifications shall be studied further in SA5#29.]

This Technical Specification (TS) specifies the Trace facility for 3G mobile networks where it refers to:

- Subscriber tracing (tracing of IMSI or Public ID);
- Equipment tracing (tracing of IMEI).

It does not cover:

- Types of trace which relate more to network elements than to individual subscribers e.g. tracing events within a Base Station System (BSS), and so on;
- Tracing of all possible parties in e.g. a multi-party call, (although multiple calls related to the IMSI specified in the trace type field are traceable).

The control signallings on different interfaces and the characteristics of user data are within the scope of this TS, but not the actual contents of the user data.

This TS does not specify any notification mechanisms or IRPs for trace. Only file transfer mechanism is specified for trace data transfer.

[Editor's note: the mechanism for retrieving the trace data from the network to the NM is for further study. This TS does not specify any data compression mechanisms for trace data transfer.]

In this release, this TS does not cover any Trace capability limitations (e.g. maximum number of simultaneous traced mobiles for a given NE).

# 2 References

[Editor's note: The references that were ~~are~~ solely from 12.08. ~~Update needed.~~have been removed from this version. The references (most likely only a few) that will be needed for this TS will be further studied in SA5#29.]

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*.

[<seq>] <doctype> <#>[ ([up to and including]{yyyy[-mm]|V<a[.b[.c]]>}[onwards])]: "<Title>".

~~[1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".~~

~~[2] GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".~~

[3] GSM 08.06: "Digital cellular telecommunications system (Phase 2+); Signalling transport mechanism specification for the Base Station System – Mobile-services Switching Centre (BSS - MSC) interface".

[4] GSM 08.08: "Digital cellular telecommunications system (Phase 2+); Mobile Switching Centre - Base Station System (MSC - BSS) interface Layer 3 specification".

[5] GSM 08.58: "Digital cellular telecommunications system (Phase 2+); Base Station Controller - Base Transceiver Station (BSC - BTS) interface Layer 3 specification".

[6] GSM 09.02: "Digital cellular telecommunications system (Phase 2+); Mobile Application Part (MAP) specification".

[7] GSM 12.00 (ETS 300 612-1): "Digital cellular telecommunications system (Phase 2); Objectives and structure of Network Management (NM)".

[8] GSM 12.01 (ETS 300 612-2): "Digital cellular telecommunications system (Phase 2); Common Aspects of GSM Network Management (NM)".

[9] GSM 12.02: "Digital cellular telecommunications system (Phase 2+); Subscriber, Mobile Equipment (ME) and services data administration".

[10] GSM 12.05: "Digital cellular telecommunications system (Phase 2+); Subscriber related event and call data".

[11] GSM 12.20 (ETS 300 622): "Digital cellular telecommunications system (Phase 2); BSS Management Information".

[12] CCITT Recommendation X.227 - ISO 8650: "Information technology - Open Systems Interconnection - Connection-oriented protocol for the association control service element: Protocol specification".

[13] CCITT Recommendation X.721 (ITU-T | ISO/IEC 10165-1): "Information technology - Open Systems Interconnection - Structure of management information: Definition of management information".

[14] CCITT Recommendation X.734 (ITU-T | ISO/IEC 10164-5): "Information technology - Open Systems Interconnection - Systems Management: Event report management function".

[15] CCITT Recommendation X.735 (ITU-T | ISO/IEC 10164-6): "Information technology - Open Systems Interconnection - Systems Management: Log control function".

[16] CCITT Recommendation X.731 (ITU-T | ISO/IEC 10164-2): "Information technology - Open Systems Interconnection - Systems Management: State management function".

[17] GSM 03.79: "Digital cellular telecommunications system (Phase 2+); Support of Optimal Routeing (SOR) - Technical Realisation".

[18] GSM 03.63: "Digital cellular telecommunications system (Phase 2+); Packet Data on Signalling channels service (PDS); Service description, Stage 2".

# 3 Definitions, symbols and abbreviations

[Editor's note: All terminology shall be checked to ensure consistency with TSs 32.101 and 32.102.]

## 3.1 Definitions

[Editor's note: The definitions are partially from 12.08 and need to be checked and updated. At least The the following definitions need to be added: ongoing trace, trace type, signalling based activation and management activation.]

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

**activation of a trace:** An action taken at the OSF through MMI commands to allow a trace record to be produced for a particular IMSI or IMEI when an Invocation Event occurs. This equates to "activation of a trace" in GSM 09.02 [6].

**active pending:** The 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.

**invocation of a trace:** An event relating to a particular IMSI or IMEI that occurs in the network that causes data to be collected in a trace record in circumstances where trace has been activated for that IMSI or IMEI. This equates to "tracing subscriber activity" in GSM 09.02 [6] and "Trace Invocation" in GSM 08.08 [4]. It is possible that an event relating to the IMSI/IMEI may still be active when another event or events relating to the same IMSI/IMEI occurs which requires additional information to be collected. These additional events are termed parallel events. This additional trace information for parallel events is collected in the same trace record as the first event.

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

**Signalling based activation/deactivation**: Trace 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.

**trace record:** In the NEF a trace record is a set of traceable data collected as determined by the trace type. The trace record is collected under the trace record criteria specified by the OSF and transferred to the OSF.

## 3.2 Symbols

[Editor's note: Shall be checked later.]

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

*Symbol format*

<symbol> <Explanation>

## 3.3 Abbreviations

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

[Editor's note: Shall be checked later. In 12.08 only a reference to GSM 01.04 existed here. TS 32.401 abbreviations can be used as a starting point.]

*Abbreviation format*

<ACRONYM> <Explanation>

# 4 Concepts and Requirements

## 4.1 Requirements for Trace Activation

The high level requirements for trace activation are as follows:

- In case of subscriber trace the trace will be activated for a certain subscriber whose identification (IMSI or Public ID) must be known in the NEs where subscriber trace is needed,
- In case of equipment trace the trace will be activated for a certain mobile equipment whose identification (IMEI) must be known in the NEs where equipment trace is needed,

[Editor's note: ~~should we include~~ The need for IMEISV as identification is FFS~~?~~]

- Trace activation shall be possible for both home subscribers and visiting subscribers,

- In addition to the subscriber identification for subscriber trace and the equipment identification for equipment trace a unique trace identification (the method is sill FFS) is needed to correctly identify and combine trace data from different sources,

- Trace can be activated either through the management interfaces or through CN signalling.

[Editor's note: Requirements for trace activation in UTRAN in case of simultaneous CS/PS connections is FFS.]

## 4.2 Requirements for Trace Deactivation

The high level requirements for trace deactivation, common to both management deactivation and signalling based deactivation, are as follows:

- The trace has to be deactivated as soon as the tracing is not needed anymore;

- The trace has to be deactivated by using the same identification as for activation:

  a) In case of subscriber trace it is the IMSI in PS and CS domain and public ID in IMS;

  b) In case of equipment trace it is the IMEI.

– The trace has to be deactivated in all those NEs where it was activated;

– Deactivation of ongoing trace is vendor specific.

[Editor's note 1: Requirements for trace deactivation in UTRAN in case of simultaneous CS/PS connections is FFS.]

[Editor's note2: The need for IMEISV as identification is FFS.]

~~[Editor's note 2: Include here corresponding section of revised S5B020056 when agreed.]~~

## 4.3 Requirements for Trace Data

~~[Editor's note: Include here corresponding section of revised S5B020056 when agreed.]~~

The trace records have to contain Information Elements or signalling messages from control signallings 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, Mi interfaces;

- P-CSCF: Gm, Go interfaces;

- RNS/BSS: Iu,Iur, Iub, Uu, Um, Abis, A, Gb interfaces.

[Editor's note: Reference to 3GPP TS. 23.002 may be needed here.]

## 4.4 Requirements for Trace Reporting

~~[Editor's note: Include here corresponding section of revised S5B020056 when agreed~~

The high level requirements for trace reporting are as follows:

- Trace records have to be generated in each NE where trace record is needed defined by trace type;

- Trace records are transferred to the Element Manager;

[Editor's note: Further studies are needed for the trace record transfer conventions (see e.g. TS 32.401 Annex B, section B.1).]

- Format of the trace records are XML or ASN.1;

- Transfer of trace records from Element Manager to the Network Manager via ITF-N is FFS. (IRP or just FTP. Current assumption is using file transfer and no IRP for trace.)

## 4.5 Trace Concepts

[Editor's note: ~~Check the reference highlighted with yellow below!~~ Colours from the ~~pictures~~ figures might have to be removed, shall be checked.There is also something wrong with the layout of the figures. This needs to be checked, too.]

The diversity of trace requirements makes 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 that could not meet all the requirements but to define traced data without any limitation on the 2 following dimensions:

- Trace scope: NEs, network functionality, interfaces to trace~~. See chapter XX~~
- Trace depth: level of details of traced data.

This implies that the largest set of information that can be traced on the NEs shall be available on the Itf-N. Trace data must encompass at least all signalling messages, on the different interfaces, dedicated to the calls of the traced mobile with their entire content (all IEs).

In order to limit the volume of data on the Interface-N, signalling messages must be available in their encoded format (e.g. ASN.1). The operator can then use an external system (e.g. an Operations System (OS) in TMN terminology) and decode specific information in line with his requirements.

Figure 1 describes the maximum level of details of the Subscriber and Equipment trace.

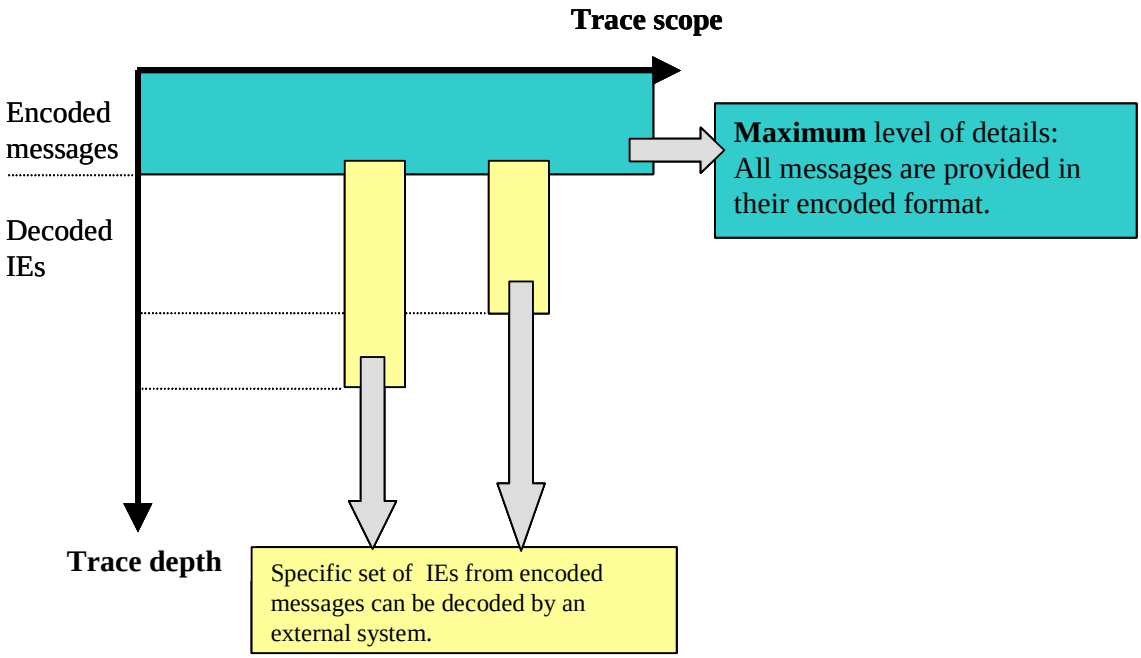


**Figure 1: Maximum level of details of Subscriber and Equipment trace**

In order to cover the most usual use cases (described in the annex XX), a set of IEs could be decoded and available on the Interface-N. The trace type, sent at the trace activation, is used to choose the level of information to retrieve on the Interface-N: encoded messages or a subset of decoded IEs.

The figure 2 describes the minimum level of details of Subscriber and Equipment trace.

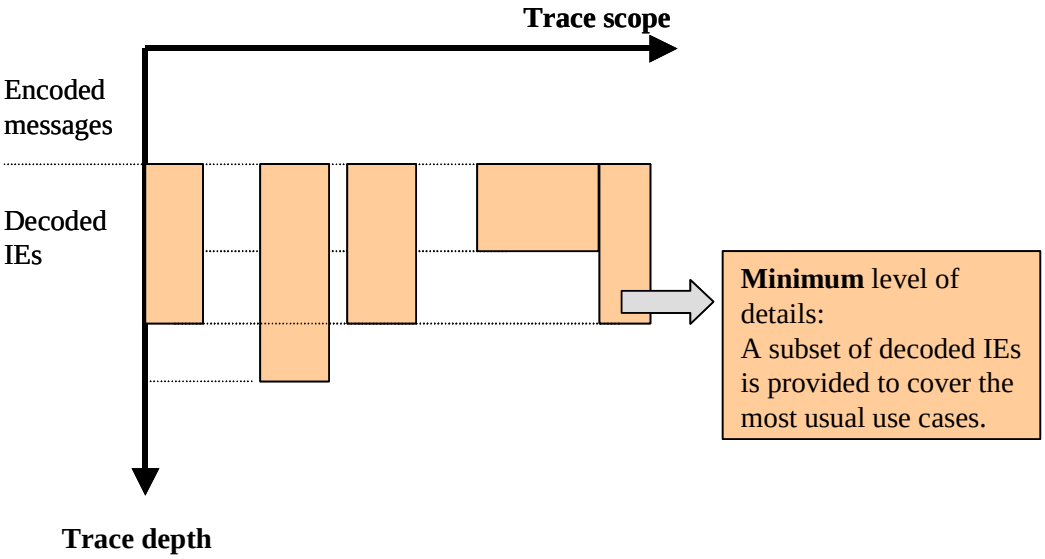


**Figure 2: Minimum level of details of Subscriber and Equipment trace**

A third level of details can be introduced for more specific needs concerning radio measurement information. It is important to give the possibility to decode or not radio measurement IEs because of the huge volume of data they can generate.

The traced data available in this medium level of details is the same as the second one plus the radio measurement IEs

## 4.6 Use Cases for Trace

The operator can use subscriber and equipment trace for numerous different 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 equipment trace can be found in Annex ~~?~~B:

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

# Annex A (informative):
# Trace Functional Architecture: High-level View

## A.1 Figure of trace functional architecture

The following figure represents the high-level view of the functional architecture of trace.

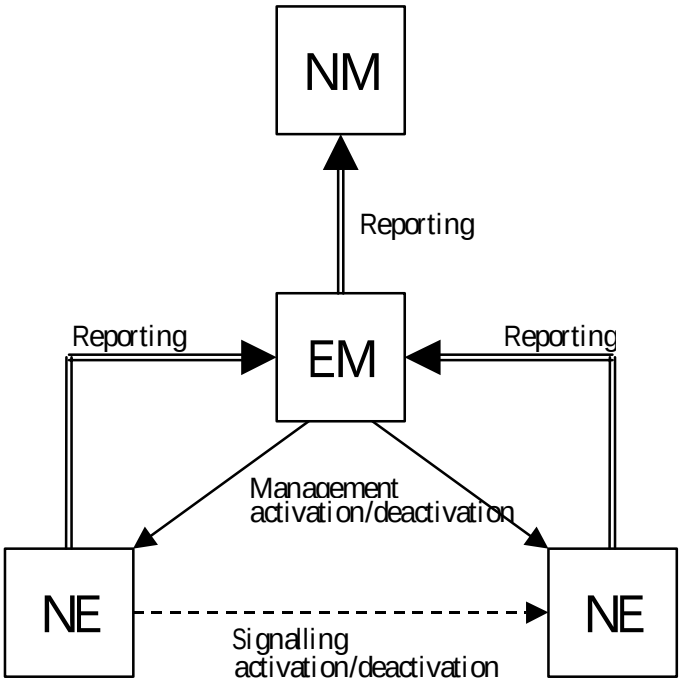


**Figure 3: High-level view of trace**

# Annex B (informative):

# Trace Use Cases

[Editor's note: Contributions for the still missing use cases are available and are to be agreed after a revision. There is also a pending Action Item for a more detailed example of the use cases. These shall be checked in SA5#29]

## B.1 Use case #1

tbd

## B.2 Use case #2

tbd

## B.3 Use case #3

tbd

## B.4 Use case #4: Checking radio coverage

### B.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

### B.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 ~~the~~ use case #4 ~~are listed below~~:

- The type of NE to trace is RNC;
- UE identifier is IMSI or possibly IMEI;
- The trace data to retrieve shall contain the messages with all IEs that are relevant for radio coverage.

## B.5 Use case #5: Testing a new feature

### B.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.

## B.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, UTRAN and GERAN 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 ~~by~~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 behavior of the existing algorithms.

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

The following trace parameters are required to cover ~~the~~ use case #5 ~~are listed below~~:

- The type of NEs to trace are any NE that can be traced related to the feature;
- UE identifier is IMSI or possibly IMEI;
- The trace data to retrieve can be either only the protocol messages or the messages with all or part of the IEs.

# B.6 Use case #6: Fine-tuning and optimisation of algorithms/procedures

## B.6.1 Description

Subscriber and Equipment 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.

## B.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 optimization 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 ~~the~~ use case #6 ~~are listed below~~:

- The type of NEs to trace are any NE that can be traced related to the feature to optimise;
- UE identifier is IMSI or possibly IMEI;
- The trace data to retrieve are the messages with all or part of the IEs.

# Annex C (informative): Change history

*It is usual to include an annex (usually the final annex of the document) for specifications under TSG change control which details the change history of the specification using a table as follows:*

| Change history | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Date** | **TSG #** | **TSG Doc.** | **CR** | **Rev** | **Subject/Comment** | **Old** | **New** |
| May 2002 | | | | | Version 0.1.0 created on basis of TS 32.108 v0.2.0 as agreed in SA5#27 | | 0.1.0 |
| May 2002 | | | | | Editorial corrections due to corrupted styles | 0.1.0 | 0.1.1 |
| 22.5.2002 | | | | | Draft version 1.0.0 according to the agreements in SA5#28 | 0.1.1 | 1.0.0 |
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# 3GPP TS 32.421 V1.0.0 (2002-05)

*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)

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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.

# Introduction

Subscriber and Equipment 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 (IMSI) or mobile type (IMEI) 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, contrary to Performance Measurements that provide values aggregated on an observation period, Subscriber and Equipment Trace give instantaneous values that are more accurate.

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

In order to produce this data, Subscriber and Equipment 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

[Editor's note: The text is still partly from 12.08. More updating and restructuring needed. Also, the impact of the split to three specifications shall be studied further in SA5#29.]

This Technical Specification (TS) specifies the Trace facility for 3G mobile networks where it refers to:

- Subscriber tracing (tracing of IMSI or Public ID);
- Equipment tracing (tracing of IMEI).

It does not cover:

- Types of trace which relate more to network elements than to individual subscribers e.g. tracing events within a Base Station System (BSS), and so on;
- Tracing of all possible parties in e.g. a multi-party call, (although multiple calls related to the IMSI specified in the trace type field are traceable).

The control signallings on different interfaces and the characteristics of user data are within the scope of this TS, but not the actual contents of the user data.

This TS does not specify any notification mechanisms or IRPs for trace. Only file transfer mechanism is specified for trace data transfer.

[Editor's note: the mechanism for retrieving the trace data from the network to the NM is for further study. This TS does not specify any data compression mechanisms for trace data transfer.]

In this release, this TS does not cover any Trace capability limitations (e.g. maximum number of simultaneous traced mobiles for a given NE).

# 2 References

[Editor's note: The references that were solely from 12.08.have been removed from this version. The references (most likely only a few) that will be needed for this TS will be further studied in SA5#29.]

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.*

[<seq>] <doctype> <#>[ ([up to and including]{yyyy[-mm]|V<a[.b[.c]]>}[onwards])]: "<Title>".

# 3 Definitions, symbols and abbreviations

[Editor's note: All terminology shall be checked to ensure consistency with TSs 32.101 and 32.102.]

## 3.1 Definitions

[Editor's note: The definitions are partially from 12.08 and need to be checked and updated. At least the following definitions need to be added: ongoing trace, trace type, .]

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

**activation of a trace:** An action taken at the OSF through MMI commands to allow a trace record to be produced for a particular IMSI or IMEI when an Invocation Event occurs. This equates to "activation of a trace" in GSM 09.02 [6].

**active pending:** The 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.

**invocation of a trace:** An event relating to a particular IMSI or IMEI that occurs in the network that causes data to be collected in a trace record in circumstances where trace has been activated for that IMSI or IMEI. This equates to "tracing subscriber activity" in GSM 09.02 [6] and "Trace Invocation" in GSM 08.08 [4]. It is possible that an event relating to the IMSI/IMEI may still be active when another event or events relating to the same IMSI/IMEI occurs which requires additional information to be collected. These additional events are termed parallel events. This additional trace information for parallel events is collected in the same trace record as the first event.

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

**Signalling based activation/deactivation**: Trace 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.

**trace record:** In the NEF a trace record is a set of traceable data collected as determined by the trace type. The trace record is collected under the trace record criteria specified by the OSF and transferred to the OSF.

## 3.2 Symbols

[Editor's note: Shall be checked later.]

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

*Symbol format*

<symbol> <Explanation>

## 3.3 Abbreviations

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

[Editor's note: Shall be checked later. In 12.08 only a reference to GSM 01.04 existed here. TS 32.401 abbreviations can be used as a starting point.]

*Abbreviation format*

<ACRONYM> <Explanation>

# 4 Concepts and Requirements

## 4.1 Requirements for Trace Activation

The high level requirements for trace activation are as follows:

- In case of subscriber trace the trace will be activated for a certain subscriber whose identification (IMSI or Public ID) must be known in the NEs where subscriber trace is needed,

- In case of equipment trace the trace will be activated for a certain mobile equipment whose identification (IMEI) must be known in the NEs where equipment trace is needed,

[Editor's note: The need for IMEISV as identification is FFS]

- Trace activation shall be possible for both home subscribers and visiting subscribers,
- In addition to the subscriber identification for subscriber trace and the equipment identification for equipment trace a unique trace identification (the method is sill FFS) is needed to correctly identify and combine trace data from different sources,
- Trace can be activated either through the management interfaces or through CN signalling.

[Editor's note: Requirements for trace activation in UTRAN in case of simultaneous CS/PS connections is FFS.]

## 4.2 Requirements for Trace Deactivation

The high level requirements for trace deactivation, common to both management deactivation and signalling based deactivation, are as follows:

- The trace has to be deactivated as soon as the tracing is not needed anymore;
- The trace has to be deactivated by using the same identification as for activation:

  a) In case of subscriber trace it is the IMSI in PS and CS domain and public ID in IMS;

  b) In case of equipment trace it is the IMEI.

– The trace has to be deactivated in all those NEs where it was activated;

– Deactivation of ongoing trace is vendor specific.

[Editor's note 1: Requirements for trace deactivation in UTRAN in case of simultaneous CS/PS connections is FFS.]

[Editor's note2: The need for IMEISV as identification is FFS.]

## 4.3 Requirements for Trace Data

The trace records have to contain Information Elements or signalling messages from control signallings 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, Mi interfaces;
- P-CSCF: Gm, Go interfaces;
- RNS/BSS: Iu,Iur, Iub, Uu, Um, Abis, A, Gb interfaces.

## 4.4 [Editor's note: Reference to 3GPP TS. 23.002 may be needed here.]Requirements for Trace Reporting

The high level requirements for trace reporting are as follows:

- Trace records have to be generated in each NE where trace record is needed defined by trace type;
- Trace records are transferred to the Element Manager;

[Editor's note: Further studies are needed for the trace record transfer conventions (see e.g. TS 32.401 Annex B, section B.1).]

- Format of the trace records are XML or ASN.1;
- Transfer of trace records from Element Manager to the Network Manager via ITF-N is FFS. (IRP or just FTP. Current assumption is using file transfer and no IRP for trace.)

## 4.5 Trace Concepts

[Editor's note: Colours from the figures might have to be removed, shall be checked.There is also something wrong with the layout of the figures. This needs to be checked, too.]

The diversity of trace requirements makes 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 that could not meet all the requirements but to define traced data without any limitation on the 2 following dimensions:

- Trace scope: NEs, network functionality, interfaces to trace
- Trace depth: level of details of traced data.

This implies that the largest set of information that can be traced on the NEs shall be available on the Itf-N. Trace data must encompass at least all signalling messages, on the different interfaces, dedicated to the calls of the traced mobile with their entire content (all IEs).

In order to limit the volume of data on the Interface-N, signalling messages must be available in their encoded format (e.g. ASN.1). The operator can then use an external system (e.g. an Operations System (OS) in TMN terminology) and decode specific information in line with his requirements.

Figure 1 describes the maximum level of details of the Subscriber and Equipment trace.

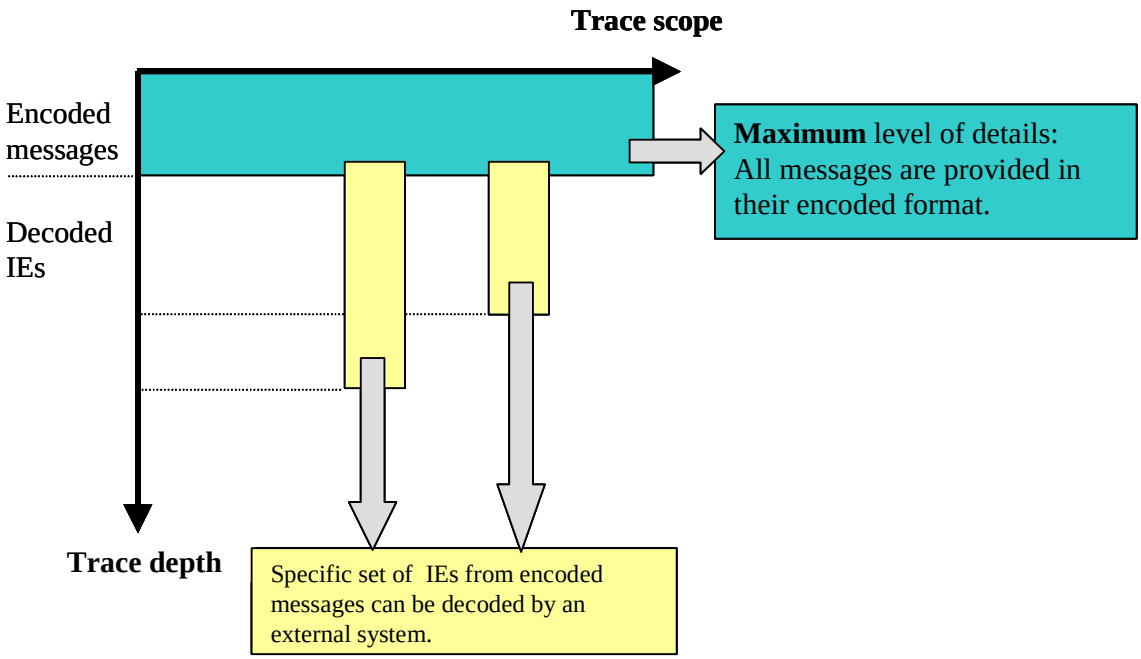


**Figure 1: Maximum level of details of Subscriber and Equipment trace**

In order to cover the most usual use cases (described in the annex XX), a set of IEs could be decoded and available on the Interface-N. The trace type, sent at the trace activation, is used to choose the level of information to retrieve on the Interface-N: encoded messages or a subset of decoded IEs.

The figure 2 describes the minimum level of details of Subscriber and Equipment trace.

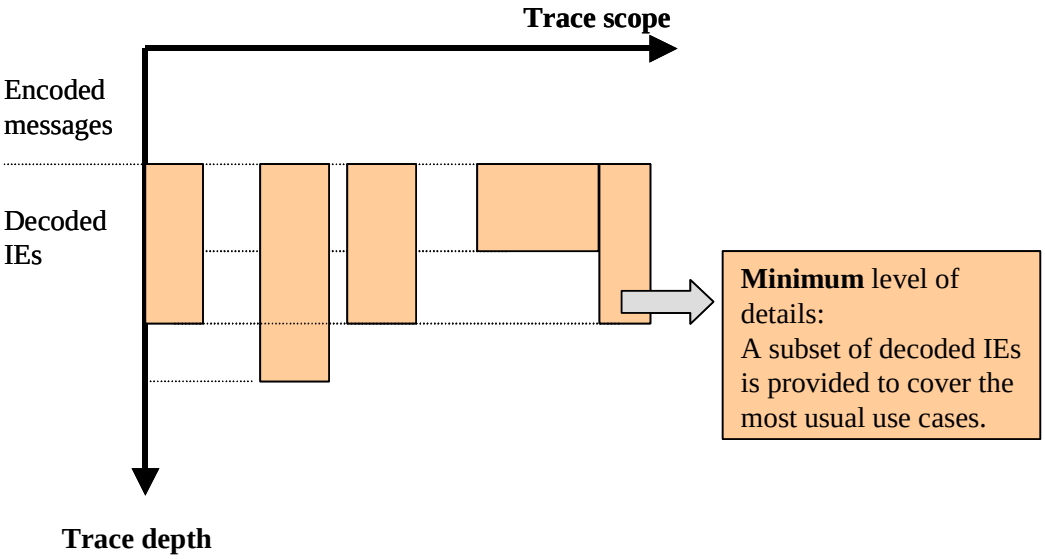


**Figure 2: Minimum level of details of Subscriber and Equipment trace**

A third level of details can be introduced for more specific needs concerning radio measurement information. It is important to give the possibility to decode or not radio measurement IEs because of the huge volume of data they can generate.

The traced data available in this medium level of details is the same as the second one plus the radio measurement IEs

## 4.6 Use Cases for Trace

The operator can use subscriber and equipment trace for numerous different 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 equipment trace can be found in Annex B:

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

# Annex A (informative): Trace Functional Architecture: High-level View

## A.1 Figure of trace functional architecture

The following figure represents the high-level view of the functional architecture of trace.

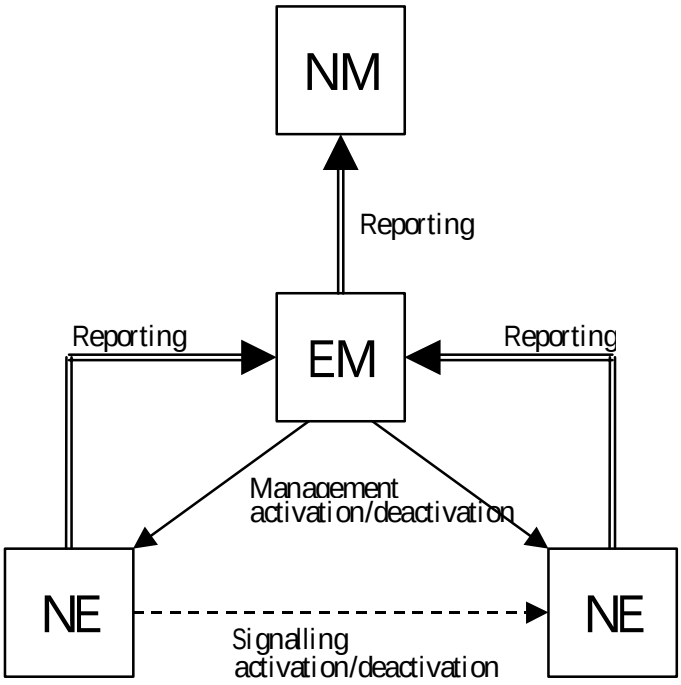


**Figure 3: High-level view of trace**

# Annex B (informative):

# Trace Use Cases

[Editor's note: Contributions for the still missing use cases are available and are to be agreed after a revision. There is also a pending Action Item for a more detailed example of the use cases. These shall be checked in SA5#29]

## B.1 Use case #1

tbd

## B.2 Use case #2

tbd

## B.3 Use case #3

tbd

## B.4 Use case #4: Checking radio coverage

### B.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

### B.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;
- UE identifier is IMSI or possibly IMEI;
- The trace data to retrieve shall contain the messages with all IEs that are relevant for radio coverage.

## B.5 Use case #5: Testing a new feature

### B.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.

### B.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, UTRAN and GERAN 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 behavior of the existing algorithms.

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

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

- The type of NEs to trace are any NE that can be traced related to the feature;
- UE identifier is IMSI or possibly IMEI;
- The trace data to retrieve can be either only the protocol messages or the messages with all or part of the IEs.

## B.6 Use case #6: Fine-tuning and optimisation of algorithms/procedures

### B.6.1 Description

Subscriber and Equipment 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.

### B.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 optimization 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 type of NEs to trace are any NE that can be traced related to the feature to optimise;
- UE identifier is IMSI or possibly IMEI;
- The trace data to retrieve are the messages with all or part of the IEs.

# Annex C (informative): Change history

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| 22.5.2002 | | | | | Draft version 1.0.0 according to the agreements in SA5#28 | 0.1.1 | 1.0.0 |
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