ETSI TS 132 600 V15.1.0 (2019-10)

TECHNICAL SPECIFICATION

**Digital cellular telecommunications system (Phase 2+) (GSM);
Universal Mobile Telecommunications System (UMTS);
LTE;
Telecommunication management;
Configuration Management (CM);
Concept and high-level requirements
(3GPP TS 32.600 version 15.1.0 Release 15)**

A GLOBAL INITIATIVE

Reference
RTS/TSGS-0532600vf10

Keywords
GSM,LTE,UMTS

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:
http://www.etsi.org/standards-search

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at www.etsi.org/deliver.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at
https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx

If you find errors in the present document, please send your comment to one of the following services:
https://portal.etsi.org/People/CommiteeSupportStaff.aspx

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (https://ipr.etsi.org/).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

Legal Notice

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

The present document may refer to technical specifications or reports using their 3GPP identities. These shall be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between 3GPP and ETSI identities can be found under http://webapp.etsi.org/key/queryform.asp.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

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

Configuration Management (CM), in general, provides the operator with the ability to assure correct and effective operation of the PLMN network as it evolves. CM actions have the objective to control and monitor the actual configuration on the Network Elements (NEs) and network resources , and they may be initiated by the operator or by functions in the Operations Systems (OSs) or NEs.

CM actions may be requested as part of an implementation programme (e.g. additions and deletions), as part of an optimisation programme (e.g. modifications), and to maintain the overall Quality of Service (QoS). The CM actions are initiated either as single actions on single NEs of the PLMN network, or as part of a complex procedure involving actions on many resources/objects in one or several NEs.

Clauses 4 to 6 give an introduction and description of the main concepts of CM, which are not mandatory for compliance with this specification. Clause 7 contains the specific definitions for the standardised interface Itf-N, which are necessary to follow for compliance.

Clause 4 provides a brief background of CM, while Clause 5 explains CM services available to the operator. Clause 6 breaks these services down into individual CM functions, which support the defined services. Clause 7 defines the Itf-N (see 3GPP TS 32.102 [2]) to be used for CM.

1 Scope

The present document describes the Configuration Management (CM) aspects of managing a PLMN network. This is described from the management perspective in 3GPP TS 32.101 [1] and 3GPP TS 32.102 [2].

The present document defines a set of controls to be employed to effect set-up and changes to a PLMN network in such a way that operational capability and Quality Of Service (QOS), network integrity and system inter working are ensured. In this way, the present document describes the interface definition and behaviour for the management of relevant NEs in the context of the described management environment. The context is described for both the management system (OS) and Network Element (NE) functionality.

Clause 7 contains the specific definitions for the standardised Itf-N, which are necessary to follow for compliance to this specification.

The Itf-N for CM is built up by a number of Integration Reference Points (IRPs) and a related Name Convention, which realise the functional capabilities over this interface. The basic structure of the IRPs is defined in 3GPP TS 32.150 [9]. For CM, a number of IRPs (and a Name Convention see 3GPP TS 32.300 [8]) are defined, used by this as well as by other specifications for Telecom Management produced by 3GPP.

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 32.102: "Telecommunication management; Architecture".

[3] 3GPP TS 32.622: "Telecommunication management; Configuration Management (CM); Generic network resources Integration Reference Point (IRP): Network Resource Model (NRM)".

[4] ITU-T Recommendation X.721: "Information technology - Open Systems Interconnection - Structure of management information: Definition of management information".

[5] ITU-T Recommendation X.730: "Information technology - Open Systems Interconnection - Systems Management: Object Management Function".

[6] ITU-T Recommendation X.731: "Information technology - Open Systems Interconnection - Systems Management: State management function".

[7] ITU-T Recommendation X.734: "Information technology - Open Systems Interconnection - Systems Management: Event report management function".

[8] 3GPP TS 32.300: "Telecommunication management; Configuration Management (CM); Name convention for Managed Objects".

[9] 3GPP TS 32.150: "Telecommunication management; Integration Reference Point (IRP) Concept and definitions".

[10] 3GPP TS 28.622: "Telecommunication management; Generic Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)".

[11] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [11], 3GPP TS 32.101 [1], 3GPP TS 32.102 [2] and 3GPP TS 32.150 [9] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [11], 3GPP TS 32.101 [1], 3GPP TS 32.102 [2] and 3GPP TS 32.150 [9].

Firmware: is a term used in contrast to software to identify the hard-coded program, which is not downloadable on the system.

Managed Object (MO): See 3GPP TS 32.150 [9].

Managed Object Class (MOC): See 3GPP TS 32.150 [9].

Managed Object Instance (MOI): See 3GPP TS 32.150 [9].

Management Information Base (MIB): the set of existing managed objects in a management domain, together with their attributes, constitutes that management domain's MIB. The MIB may be distributed over several OS/NEs.

Network Manager (NM): See 3GPP TS 32.101 [1].

Network resource: See definition in TS 28.622 [10].

Network Resource Model (NRM): See definition in TS 28.622 [10].

Operations System (OS): indicates a generic management system, independent of its location level within the management hierarchy.

Operator: is either

- a human being controlling and managing the network; or
- a company running a network (the PLMN network operator).

Optimisation: of the network is each up-date or modification to improve the network handling and/or to enhance subscriber satisfaction. The aim is to maximise the performance of the system.

Re-configuration: is the re-arrangement of the parts, hardware and/or software that make up the PLMN network. A re-configuration can be of the parts of a single NE or can be the re-arrangement of the NEs themselves, as the parts of the PLMN network. A re-configuration may be triggered by a human operator or by the system itself.

Reversion: is a procedure by which a configuration, which existed before changes were made, is restored.

Up-Dates: software, firmware, equipment and hardware, designed only to consolidate one or more modifications to counter-act errors. As such, they do not offer new facilities or features and only apply to existing NEs.

Up-Grades: can be of the following types:

- enhancement - the addition of new features or facilities to the PLMN network;
- extension - the addition of replicas of existing entities.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [11] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [11].

CM	Configuration Management

FW	Firmware
IOC	Information Object Class
MOC	Managed Object Class
MOI	Managed Object Instance
PM	Performance Management

4 Network Configuration Management (CM)

4.1 General

In the development of a PLMN network, three general phases can be described which represent different degrees of stability. Once the first stage is over, the system will cycle between the second and the third phases. This is known as the network life-cycle and includes:

1) the PLMN network is installed and put into service;

2) the PLMN network reaches certain stability and is only modified (dynamically) to satisfy short-term requirements. E.g. by (dynamic) re-configuration of resources or parameter modification; this stable state of a PLMN network cannot be regarded as the final one because each equipment or SW modification will let the PLMN network progress to an unstable state and require optimisation actions again;

3) the PLMN network is being adjusted to meet the long-term requirements of the network operator and the customer, e.g. with regard to performance, capacity and customer satisfaction through the enhancement of the network or equipment up-grade.

During these phases, the operators will require adequate management functions to perform the necessary tasks.

4.1.1 Installing a PLMN network

When a 3G network is installed and initialised for the first time, all NEs need to be introduced to the NM, the data for initialisation and SW for proper functioning need to be provided. All these actions are carried out to create NEs and to initialise them.

4.1.2 Operating a PLMN network

Whilst in service, the operator needs to react to short-term incidents such as traffic load requirements, which are different from the current network capabilities, NEs/NRs need to be re-configured and parameters need to be adapted to follow these day-to-day requirements.

4.1.3 Growing/pruning a PLMN network

As the PLMN network grows and matures new equipment is installed and understanding of system behaviour increases. Subscriber requirements/wishes may demand that operators modify their system. In addition manufacturers improve the infrastructure components and add features to their products hence the operator will start modifying the PLMN network to profit from these changes and to improve subscriber satisfaction. Additionally, the PLMN network configuration will be modified (i.e. it will be up-dated or up-graded) to cope with a need for increasing or decreasing network capacity. These actions are carried out for the long-term strategy of the operators to optimise the network.

4.1.3.1 System up-date

Whenever the PLMN network needs to be improved for reasons of reducing failures, the system will be up-dated. In this case SW or equipment will be replaced without adding new functionality or resources to the network. The basic function required is:

– the modification of existing SW/equipment; it may be necessary to introduce a different set of data to cope with the modified SW/equipment.

For system up-date the network shall not be disturbed in its function until the required modification is activated. This requires mechanisms to:

- do SW/data downloading in parallel with on-going traffic;
- isolate the affected NEs/NRs from traffic before the actual modification is done;
- minimise system outage due to the activation of up-dated components.

4.1.3.2 System up-grade

System up-grade may affect all areas of PLMN network activities and can be described as enhancements, whereby either new features or new facilities are implemented. This CM aspect also covers extensions, reductions or further replications of existing facilities. The CM functions employed are:

- Creation of NEs and/or NRs;
- Deletion of NEs and/or NRs; and
- Modification of NEs and/or NRs.

The following requirements are to apply:

- to support expeditious handling of SW and data while minimising impact on ongoing traffic;
- to follow a required sequence of up-grades: e.g. the new SW depends upon the availability of the new equipment functionality;
- to provide the capability to create an additional logical NE/NR without having installed the physical resource supporting it: for example it should be possible to create a cell in an RNC without the physical equipment present or connected. However, additional mechanisms should be in place to prevent any service connection to any physically non-existent NE/NR or reporting failures from non-existing NE/NR;
- to provide the capability to install an additional physical NE/NR without creation of the logical resource managing it (no management functionality) and without impact of the current functionality;
- to provide the capability to prevent the erroneous taking into service of a NE/NR which is not fully installed and initialised: whenever a NE/NR is modified (extension or reduction) it shall be taken out of service until the logical part of the procedure is finished. An extended NE/NR cannot be placed into service until all needed parameters and equipment are initialised. Likewise, a reduced NE/NR cannot be placed back into service until the applicable re-configuration is performed.

When the network is up-graded by the addition of NEs or NRs or a change in the configuration, it is essential that the NE/NR can be restored to the configuration, which existed before the changes were made. This procedure is called "reversion" and is useful in maintaining service if any difficulty should arise from a network up-grade.

4.2 Operational context for CM

The CM functions available to the operator need to address various aspects beyond that which might strictly be regarded as management of the network. These include:

- assisting the operator in making the most timely and accurate changes thus avoiding lengthy waiting periods or complex scenarios;
- ensuring that CM actions will not have any secondary effects on the network other than the specified ones;
- providing mechanisms to protect the telecommunication-related traffic from effects due to CM actions - it shall be possible to inhibit traffic if a traffic affecting CM action is expected and to gracefully release calls prior to the closure of the resource;
- providing mechanisms to overcome data inconsistency problems by logging the modifications for reversion reasons, or to recover through data update from a second source.

4.2.1 Administrative aspects of CM

When managing the network by creating, deleting or modifying NEs/NRs, the operator should ensure that there is no uncontrolled impact on the network. The network management system therefore needs to support the following set of management functionalities when addressing various administrative aspects:

- Security;
- Data Validity;
- Data Consistency; and
- Resource Administration.

4.2.1.1 Security aspects

It is ultimately up to the operator to ensure the network security by employing the appropriate mechanisms for control of logical and physical access.

Changes of the network configuration shall be possible only for operators with appropriate authorisation profiles.

4.2.1.2 Data validity

It is the responsibility of all management systems and NEs that data input to and transferred between the systems is valid given the particular management context.

4.2.1.3 Data consistency and distribution of the MIB

The Network Manager (NM) and Element Manager (EM) use different object model abstractions of the network's (NEs') physical and logical resources to be managed by these systems. This is the agreed Network Resource Model (NRM) between the NM and EM/NEs to be used at the Itf-N and EM-NE interface (see ref. 3GPP TS 32.102 [2] for the definition of these interfaces). The NRM of the Itf-N is fully standardised (see 3GPP TS 32.622 [3] and other IRPs containing NRMs, listed in the Introduction clause) while the NRM for the EM-NE interface is product-specific and is not standardised in this or related TSs. The NE local representation of those physical and logical instantiated resources to be managed, as well as their accurate mapping onto the agreed object model abstraction, is also product-specific. Thus the consistency between the actual local representation of physical and logical resources to be managed within an NE, and the corresponding view of the OS, relies on:

- Which information is exchanged between the NE and the management systems; For the EM-NE interface this is defined in a product-specific NRM, where the actual network infrastructure is modelled. This is internal to a specific development organisation and does not need to be open; thus it is not further discussed in the present document. In fact, by publishing the management information portion of these interfaces, too much of the internal design will be revealed and it may become impossible or at least very expensive and time-consuming to later enhance the systems using the interface. For the Itf-N between NM and EM/NE, the NRM as mentioned above is defined in 3GPP TS 32.622 [3] and other NRM IRPs listed in the Introduction clause.
- How such information is exchanged between NE and management systems - this is for the Itf-N fully standardised by the present and related documents, while for the EM-NE interface only the protocol is standardised (cf. Figure 2 in 3GPP TS 32.102 [2]).
- How information is locally represented and treated by an NE and by its associated (OSs); this is a product-specific choice of the manufacturers of NEs and OSs.
- Where this information is kept; whether it is kept only at the "origin NEs" where the Managed Object Instances (MOIs) representing the managed NRs are created (NE-local MIB), or if also a copy of that information is kept in one or several of the OSs ("mirrored MIB"). This is again a product-specific choice of the manufacturers of NEs and OSs. If the "NE-local MIB" approach is chosen, the consistency "only" has to be maintained between the NEs, while if the "mirrored MIB" approach is chosen, the consistency has to be maintained between the NEs as well as the NM/EM and the NEs.

A peer-to-peer data consistency between NM-EM and EM-NE does not guarantee overall data consistency from a network point of view. It is however possible for the NM to maintain consistency on the network level, as far as the