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Technical Report

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Universal Mobile Telecommunications System (UMTS);
LTE;
Telecommunication management;
Study on management of
Evolved Universal Terrestrial Radio Access Network (E-UTRAN)
and Evolved Packet Core (EPC)
(3GPP TR 32.816 version 8.0.0 Release 8)**

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Foreword

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Contents

Foreword

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

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

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Introduction

The E-UTRAN and EPC systems need to be managed. As E-UTRAN and EPC are evolvements of UMTS, the management should also evolve from UMTS.

A reuse of the existing UMTS management standard solutions will have the following benefits:

- It is proven in operation;
- It will minimise both the standardisation and product development efforts (i.e. the cost and time);
- It provides a base for on which more functionality can be developed (compared with making everything new from the start);
- It will shorten the time to market for E-UTRAN and EPC systems;
- It will facilitate a seamless coexistence with UMTS management systems.

The complexity of the E-UTRAN/ EPC network will also place new demands on the Operations and Maintenance of the Network, therefore as well as re-using and evolving existing Management solutions, Management solutions for E-UTRAN/ EPC will also need to encompass some new functionality (e.g. Auto-Configuration, Auto-Optimisation, Information Model Discovery, and development of P2P Interfaces)

Functionality shall be supported by clear use cases or other documented justification.

Best Practice in O&M has changed dramatically in recent years. This has been driven both by changes in the networks being managed and also by the increase in the number and complexity of services being supported on those networks.

The emphasis has changed from infrastructure management to the management of services supported on that infrastructure.

There is less focus on having all management applications at the EMS layer and greater emphasis on interfaces and data availability such that the NMS and OSS layer have access to the required data.

The concept of Next Generation Networks decouples the supported services from the underlying access network. It was easier in the days of voice based services to assume that by managing the infrastructure the services were also managed. The multitude and complexity of today's services means that this is no longer the case.

Element Management is about managing a single domain from a single vendor. It no longer makes sense to do any significant analysis at this level since there is a strong interdependency between domains and vendors to assure end to end quality of service. It still makes sense to support some vendor/domain specific applications at this level, but the emphasis is on support of standardized interfaces that make the element management data available to the NMS and OSS.

An increased emphasis on O&M related standards is pivotal in enabling analysis applications at the NMS and OSS level. This makes it possible to do end to end analysis in the context of services rather than just RAN specific or Core specific analysis for a given vendors equipment node.

The E-UTRAN/ EPC networks will increase the numbers of NE's to be managed, while at the same time having strong requirements (ref [3]) that emphasise the need to reduce network complexity and lower operating costs.

1 Scope

The present document intends to study the reuse of UMTS management for E-UTRAN and EPC to decide on which parts shall be reused without any change, which parts shall be changed and which existing parts cannot be reused at all and make recommendations about that.

It also intends to recommend management principles for E-UTRAN and EPC.

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 TR 21.905: "Vocabulary for 3GPP Specifications".

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

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

[4] 3GPP TS 32.423: "Telecommunication management; Subscriber and equipment trace; Trace data definition and management".

[5] 3GPP TS 32.441: "Telecommunication management; Trace Management Integration Reference Point (IRP): Requirements".

[6] 3GPP TS 32.442: "Telecommunication management; Trace Management Integration Reference Point (IRP): Information service (IS)".

[7] 3GPP TS 32.443: "Telecommunication management; Trace Management Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)".

[8] 3GPP TS 32.101: "Telecommunication management; Principles and high level requirements".

[9] 3GPP TS 32.102: "Telecommunication management; Architecture".

[10] 3GPP TS 32.300: "Telecommunication management; Configuration Management (CM); Name convention for Managed Objects".

[11] 3GPP TS 32.155: "Telecommunication management; Requirements template".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] apply.

Searchlist List of frequencies and supporting information to be used for neighbour cell measurements. The Searchlist contains entries for E-UTRAN and supported IRATs.

Edtor"s note: This definition is provisional and subject to alignment with RAN2 and RAN3.

3.2 Abbreviations

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

DM Domain Manager
EPC Evolved Packet Core
E-UTRAN Evolved UTRAN
FFS For Further Study
IE Information Elements
IP Internet Protocol
MME Mobile Management Entity
OSS Operation Support System
UMTS Universal Mobile Telecommunications System

4 Concepts and background

5 Requirements

5.1 Business level requirements

5.1.1 Void

5.1.2 Void

5.1.3 High Level Use Cases

5.1.3.1 Self organising network

REQ-MVR-CON-001 Self-configuration and self-optimisation should be supported in a multiple vendor environment. Standardised procedures and O&M interfaces would be needed to avoid:

- cost-intensive mediation between different vendor nodes, and
- side effects due to different detail solutions (e.g. different optimisation algorithm leads to ping-pong effects and swinging phenomena).

Main procedures like handover or sub-tone coordination should be discussed to be standardised to minimise such problems.

5.1.3.1.1 Establishment of new eNodeB in network

A typical task for operational staff is the introduction of an eNodeB. In the following the scenario for introducing of a macro eNodeB is detailed considering already given definitions concerning self-configuration and self-optimisation functionality in clause 6.21.1.

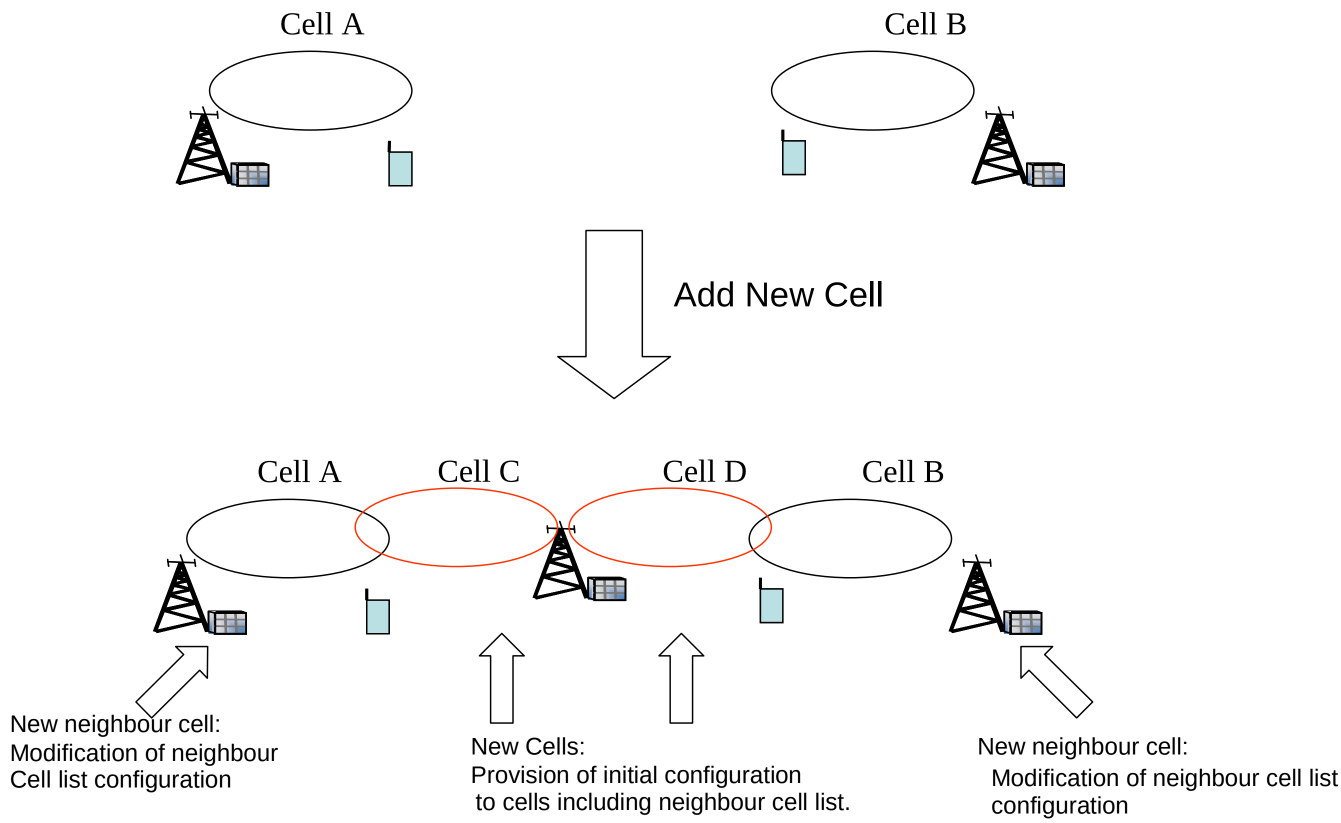

Figure 5.1.3.1.1-1: Introduction of new eNodeB

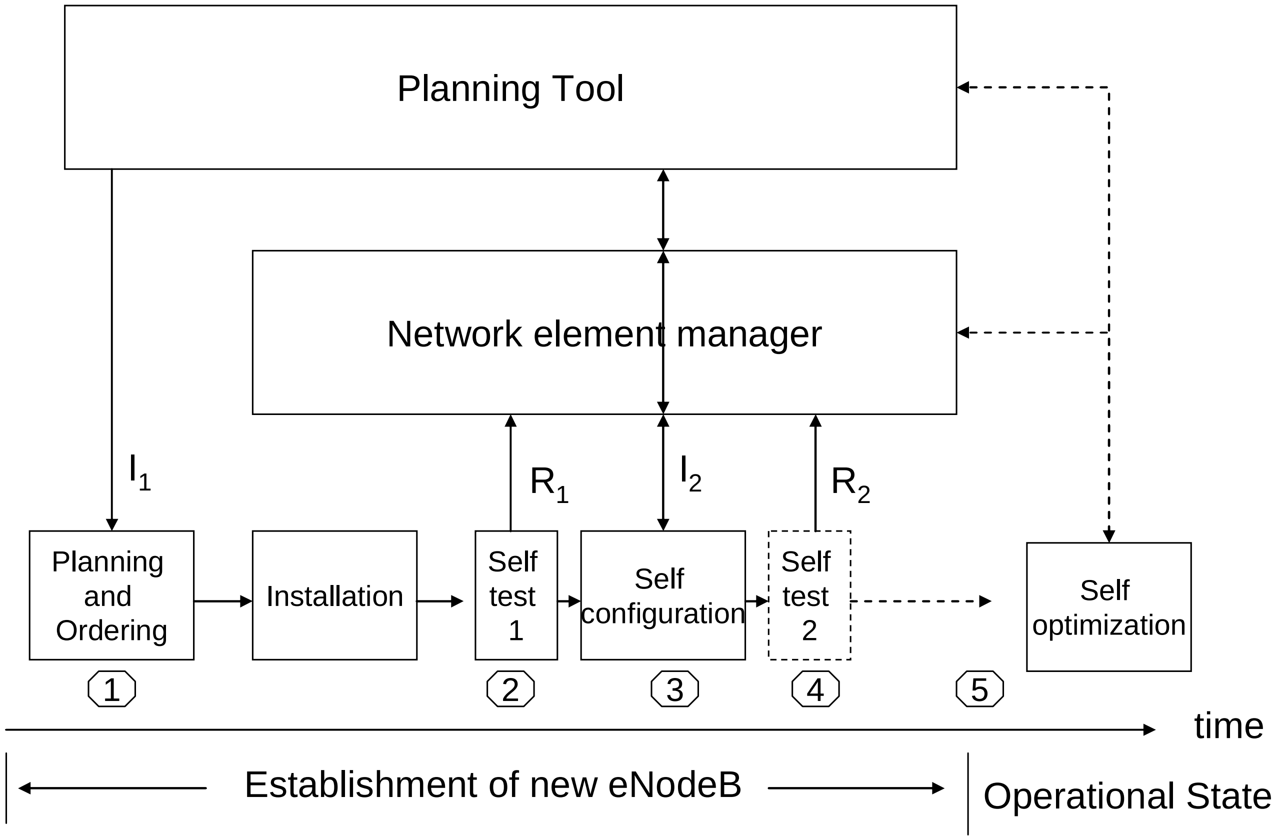

Figure 5.1.3.1.1-2: Logical procedure to establish new eNodeB (covering both use case 1 and 2). Actions 1 – 4 is representing use case 1.

1) The first step is obviously the planning of a new site based on coverage and capacity requirements. The process can be supported by measurements to indicate coverage or capacity problems in the network (see use case 3). A first initial set of parameters I_1 is: location, eNodeB type, antenna type, cell characteristics (sectors), required maximum capacity …

2) After the physical installation of the eNodeB a first initial self test will start with a possible report R1 in case of failure to the net element manager.

3) In the next step self configuration starts: The eNodeB requests its basic setup information (see figure in 6.21.1): including configuration of IP-address and detection of OAM, authentication of eNodeB, association of a GW, downloading of eNodeB software.
Then as a second part of the self configuration the initial radio configuration I_2 will be done: the following data might be provided via the network element manager from the planning tool or another self-configuration related instance:

- cell-id
- pilot sub-tones
- pilot power
- antenna tilt
- clustering information (e.g. location area, routing area)
- initial sub-tone information
- Neighbourhood list information: cell-ids, IP addresses…
- IP addresses of neighbourhood eNodeBs
- ….

In case any data are missing all parameter should be also derivable from a default value by an auto optimisation and it should be possible to send back this data to the element manager and planning tool.
At the end of the procedure it is necessary to inform the neighbour eNodeBs about the existence of the new eNodeB and to include the new cells in the corresponding neighbourhood list of the neighbouring eNodeBs and to set neighbour specific parameters in these cells.

4) An additional self test like for example a plausibility check of parameter with possible report R2 to the element manager could be done.

5) At the end of the installation the eNodeB is ready for commercial use and a test call can be done successfully.

Optimisation of the neighbourhood list

Based on the assumed initial neighbour set a further optimisation of neighbour list (including 2G/3G) is needed considering e.g. radio measurements of eNodeBs and UEs or call events like call drops, handover problems etc.. For this approach RRC connections (calls, signalling procedures) and their accompanying measurements can be used to gather the needed information about neighbours. Known neighbours can be checked if they are really appropriate concerning real RF conditions, new ones can be included based on information about detected cells in UEs. Not forgotten must be the optimisation of parameters in neighbour eNodeB cells.

The following text is one example of neighbour cell list optimization.

Scenario description: Neighbour cell list optimisation

- Objective: Optimisation of neighbour cell list of self-configuration instance
- Scheduling: On demand or periodic
- Input information (all input optional depending on algorithm):
  - Location of the neighbours (distance),
  - UE measurement reporting or eNodeB radio scanning for neighbours,
  - Field strength information,
  - Event measurements like cell specific call drops or handover failures
  - NMS/EMS configuration data
  - Planning tool data
  - …
- Functionality: an algorithm selects the neighbours and/or optimises neighbour related parameterisation based on the input observation
- Actions:
  - Establish X2 interface towards neighbour eNodeB (if new)
  - Configuration of optimised neighbour related parameters in both eNodeBs (if any)
- Expected results: Optimised neighbour cells list and neighbour related parameter. This list and parameter can be sent to the management system for potential statistical collection, acknowledgement or correction.

EXAMPLE (Informative description):
In operational phase, a further optimisation of neighbour list (including 2G/3G) can be done considering e.g. radio measurements of eNodeBs and UEs or call events like call drops, handover problems etc.. For this approach RRC connections (calls, signalling procedures) and their accompanying measurements can be used to gather the needed information about neighbours. Known neighbours can be checked if they are really appropriate concerning real RF conditions, new ones can be included based on information in UEs about detected cells.

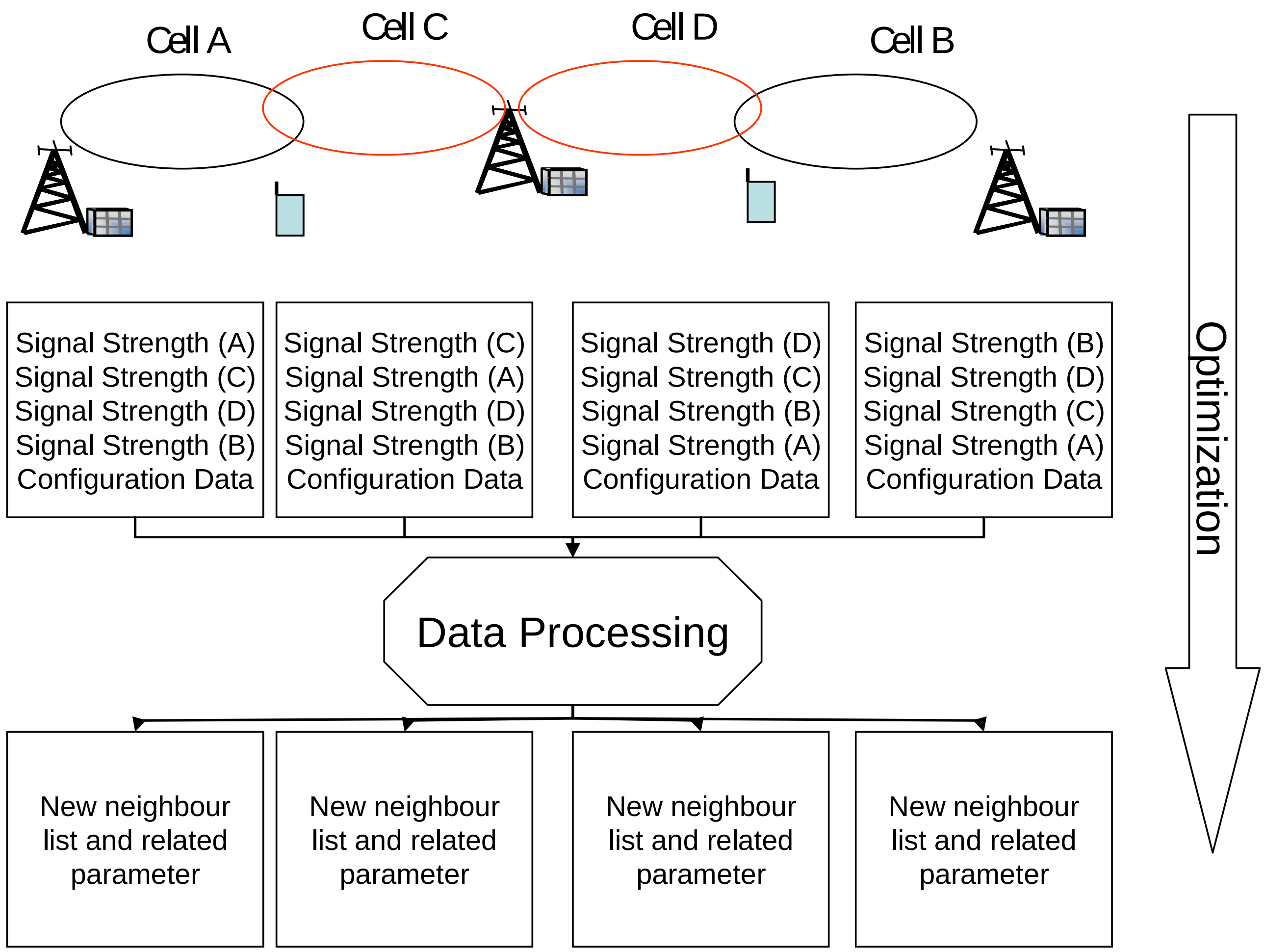

Figure 5.1.3.1.2-1: Optimisation of neighbour list and related cell parameters

5.1.3.1.3 Coverage and capacity optimisation

A typical operational task is to optimise the network according to coverage and capacity. Planning tools support this task based on theoretical models but for both problems measurements must be derived in the network. Call drop rates give a first indication for areas with insufficient coverage, traffic counters identify capacity problems.
Following parameters are identified as possibly beneficial to be optimised:

- sub-tones (sub-tone sets planned for cell borders),
- antenna tilt,
- power settings,
- radio resource management parameters
- …

For a deeper analysis e.g. the detection of the location of these areas detailed measurements are requested.
The current method for solving these problems and determining the correct configuration relies upon special tools to analyse RRM related measurements, interface tracing and drive tests.
For E-UTRAN the appropriate measurements, significant statistical base of performance measurements, problem specific measurement configuration and the full support of processing this valuable information shall be supported by 3GPP Telecom Management specifications.

Editor's note: It should be clarified how RRM measurements can contribute to statistics based optimisation cycle.

5.1.3.1.4 Optimisation of parameter due to trouble shooting

In a typical workflow performance measurements indicate problems in the network caused by different reasons:

- high call drop rate
- poor Setup Success Rate
- poor average throughput
- many others

HW defects or
SW failures in the network,
user failures
wrong or not ideal parameterisation

Analyses of complex problems currently are based on drive test results, accompanied by interface traces. Typically signal strengths, Ec/No values of neighbours, special call events like call drop, handover failures etc. are valuable indications both for optimisation and trouble shooting purpose. In special cases even cell and neighbour individual parameterisation must be found to mitigate problems. Obviously network quality and performance could be improved if such individual optimisation could be done by default for every cell. Further typical configuration failures would be found (if not already avoided by intelligent self-configuration function) like missing or lost neighbours, inappropriate hysteresis values, 2G- and 3G-neighbour related parameter and others.
Generally the optimisation of multiple parameters in a wider network area must be supported by appropriate O&M functionality: the efficient transport of information about status of network elements, their configuration and a smart design to implement self-organising functionality must be a self-evident feature of an E-UTRAN system.

5.1.3.1.5 Continuous optimisation due to dynamic changes in the network (like traffic variation)

Dynamic resource shifting and optimisation leads to better resource utilisation and cost effectiveness considering roaming of customer due to their daily activities. An example: during the day traffic is concentrated more in urban areas but at night there is a shift towards the suburban areas.

In OFDM the opportunity exists to distribute air interface resources in a dynamic way to optimise on traffic situation or interference situation. Based on statistical measurements of power and interference level for single sub-channels the coordination of sub-channels and dedicated power could be done in a dynamic way.

Other parameters beside sub-tones seen as beneficial in this area are principally antenna parameters, power settings and radio resource management parameters.

5.1.3.1.6 Void

5.1.3.1.7 Handover Optimisation:

NOTE: The use case is based on experiences in GSM/UMTS and so only the principles for E-UTRAN can be presented due to missing details on handover procedure in E-UTRAN.

Scenario description: Optimisation of handover parameter like HO neighbour list, neighbour specific thresholds, margins and hysteretic parameter

- Objective: Description of procedures to optimise a certain HO parameter
- Scheduling: triggered either by network problems related to this parameter or on demand
- Input source (input optional depending on algorithm):
  - HO trigger reasons
  - KPIs: cell and neighbour specific HO success/failure rate, cell and neighbour specific Path Loss, Received signal strength and interference measurements before HO events
  - In ideal: all measurements can be linked with correct location information
  - Planning data like maps, location of cells, theoretical path loss/interference

  - Drive test results in proprietary/standardised form
  - Traces of interfaces (like Abis, Iub, Iu, A)
- Functionality: Based on input parameter all necessary optimisation is processed:
  - With human interaction: analysis of drive tests, traces
  - Without human interaction based on pre-configured action reacting on certain triggers: if certain average measurement values fall below certain threshold default configuration patterns can be set
  - Without human interaction based on autonomous intelligent actions by network: network finds optimal configuration based on complex procedures
- Actions:
  - Network monitoring
  - Deriving optimised parameter
  - Configuration of optimised parameter
  - Network monitoring and checking success of re-configuration
- Expected results: optimisation procedures lead to higher HO success rate for certain cell-cell neighbour couple with minimised operational effort

5.1.3.1.8 QoS related radio parameters optimization

Optimizing QoS related radio parameters is to ensure good quality/performance and optimal resource utilization with minimal operational configuration and optimization effort.

It is beneficial to optimize QoS related radio parameters for the purpose of performance improvement and meet QoS target for EUTRAN.

There are a lot of parameters which influence QoS target. There are radio parameters controlling radio bearer configuration etc. which influence significantly the performance experience. For example, the radio parameters influencing retransmission & discard operation in RLC layer, Congestion Control parameters, etc.

Potential actors of this use case can be Element Manager (EM), Network Manager (NM), Domain Manager (DM) and human operator.

5.1.3.1.9 MBMS network Optimization

Dynamic shifting and optimisation of MBSFN areas leads to better radio resource utilisation and cost effectiveness considering dynamic change of distribution of MBMS subscribers.

A typical example of MBMS subscribers change is depicted in Figure 1 below. We assume that originally there are eight cells within the coverage of the MBSFN Area X meaning MBMS services can be delivered to all the eight cells via SFN transmission mode. However due to the dynamic changes of the users distribution (e.g. daily activities) there will be no MBMS subscribers in cell 8 for a certain period of time. In this case, it would be beneficial to shrink the coverage the MBSFN Area X to only cover from cell 1 to cell 7 where there are still MBMS users. When cell 8 is ruled out of the MBSFN Area X, there will be more radio resources in the cell 8 that can be used to bear point to point services from the RRM (Radio Resource Management) point of view.

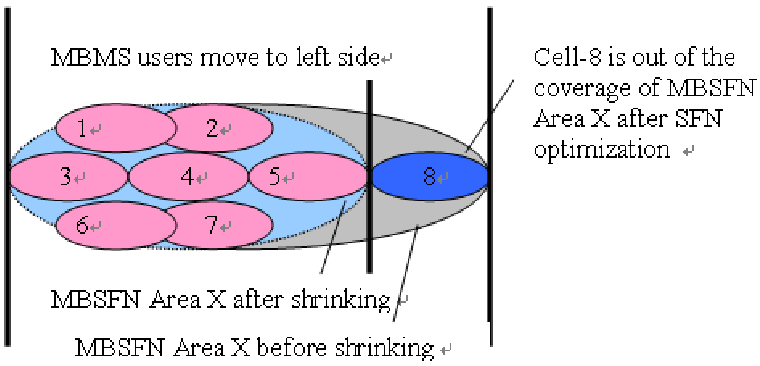

Figure 1: An exmaple of MBSFN Area optimization.

Figure 5.1.3.1.9-1: An example of MBSFN Area optimisation

As input for troubleshooting, bad Node B synchronization, misdirected antennas, wrongly set power levels etc.

It might be more suitable to collect the results of UE measurements, and trigger corrective actions in a network element that has a network level view, rather than independently for every cell or every Node B.

The logical node that has such network overview could be the SON functionality in the management domain of eUTRAN.

5.1.4 Evolution of existing SA5 specifications

A reuse of the existing UMTS management standard solutions will have the following benefits:

- It is proven in operation;
- It will minimise both the standardisation and product development efforts (i.e. the cost and time);
- It provides a base for on which more functionality can be developed (compared with making everything new from the start);
- It will shorten the time to market for E-UTRAN and EPC systems;
- It will facilitate a seamless coexistence with UMTS management systems.

5.1.5 Establishment of new eNodeB in network

5.1.5.1 Automatic Radio Network configuration data preparation

[REQ_EST_CON_1] Radio parameters for the new eNodeB should be generated as much as possible without manual intervention.

[REQ_EST_CON_2] Radio parameters of network nodes already existing and operating in the field, and whose configuration requires updates due to the insertion of the new eNodeB, should be updated in an automated manner.

[REQ_EST_CON_3] The generation of the radio configuration of the new eNodeB should work in a multi-vendor environment.

5.1.5.2 Self-Configuration of a new eNodeB

The following requirements apply to the macro eNB only. Requirements for the HNB can be found in TR 32.821.

The following requirements apply to the software download into the eNB

- [REQ_EST_CON_01] The software download should be automated as much as possible so that no or only minimal manual intervention is required.
- [REQ_EST_CON_02] The actor at NM level should have monitoring and interaction capabilities regarding the software download into the eNB.
- [REQ_EST_CON_03] The software download functions used during the establishment of a new eNodeB in the network should be reused as much as possible for software upgrade.

The following requirements apply to the automatic OAM connectivity establishment

- [REQ_EST_CON_04] The OAM connectivity (incl. the IP address allocation) shall be established in a fully automated manner.
- [REQ_EST_CON_05] The amount of parameters that needs to be preconfigured should be minimized.
- [REQ_EST_CON_06] The automatic establishment of the OAM connectivity shall be fully secured.

5.1.6 Trace in E-UTRAN/EPC

The need for trace functionality is the same as for a UMTS system (non E-UTRAN/EPC). Scenarios are described in TS 32.421 [2].

A fault can be due to node internal (vendor specific) decision, why it is beneficial to trace vendor specific data as well. To allow for this we need to have the possibility to add vendor specific data to the Equipment trace for E-UTRAN. This requires 3 new depth levels. To allow for such data to be recorded in the trace file, vendor specific data should be allowed in the trace file for E-UTRAN.

5.1.7 KPIs in E-UTRAN/EPC

The following guidelines and principles shall be valid for the E-UTRAN KPIs specified in SA5:

REQ-KPI-CON-001 Measure properties that the operator can control by means of dimensioning and optimisation

REQ-KPI-CON-002 Measure properties that are of economical value for the operator to improve

REQ-KPI-CON-003 Focus for the KPIs shall be on End-to-End (E2E) performance and End User Perceived Service performance:

- E2E Service Performance is the combined performance of the network nodes involved in the service delivery and the terminal/terminal equipment.
- End User Perceived Service Performance is how the user of the service perceives the service including the performance of the used terminal.

REQ-KPI-CON-004 The KPIs shall be well described, including a clear rationale,

5.1.8 Site Management

Observing the evolution of network infrastructure, it is evident that site (i.e. all the equipment and their links at the site) management is getting complex. Operators foresee substantial OPEX reduction if site resources such as power, floor space and antenna systems can be efficiently managed for sharing by say GSM BTS, WCDMA RBS, transmission equipment etc. This view necessitates the modelling of site resources as a subsystem or system.

5.1.9 Void

5.1.10 Configuration Management of E-UTRAN/EPC

5.1.10.1 General

The consistent management of handover relationships over different element managers is a tedious task. Possible functions include

- *Cell data synchronisation*: The attributes of external cell objects and the corresponding (master) cell object have to be consistent...
- *Detection of unidirectional handovers*: Most handover relationships are bidirectional. Unidirectional handovers may be due to erroneous configurations.

5.1.10.2 Pool Management

Each eNodeB may be connected to multiple ""MMEs. The MMEs may be grouped in pool called "MME Pool" as shown below. The two dotted lines illustrate the idea that some eNodeB can access members of one Pool while other eNodeBs can access members of another Pool. The NRM IRP should support such scenario.

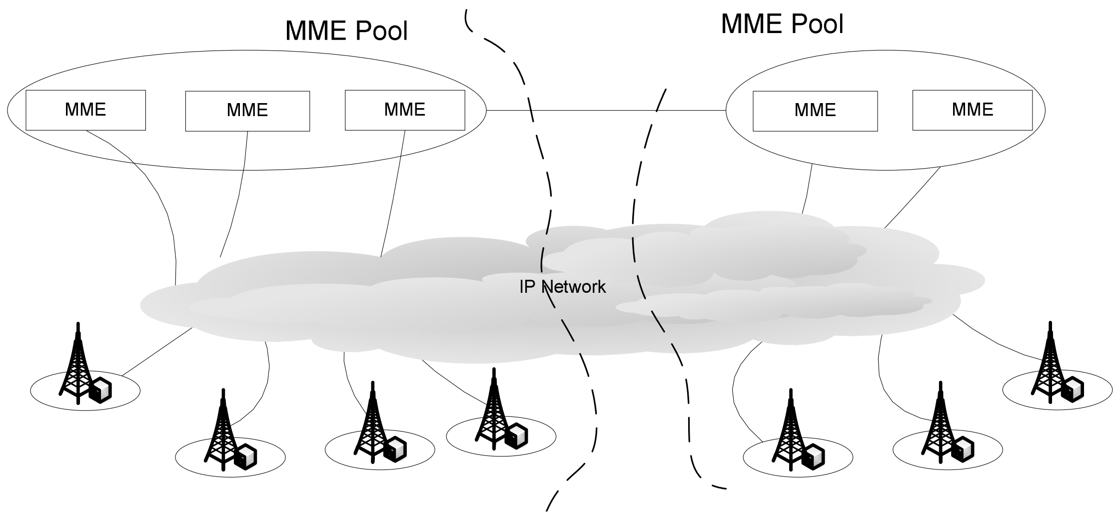

Figure 5.1.10.2-1: MME Pool

The eNodeB, operated by one operator can also be connected to MMEs operated by multiple (different) operators. These operators can organize their MME Pools as well. The NRM IRP should also model such scenario.

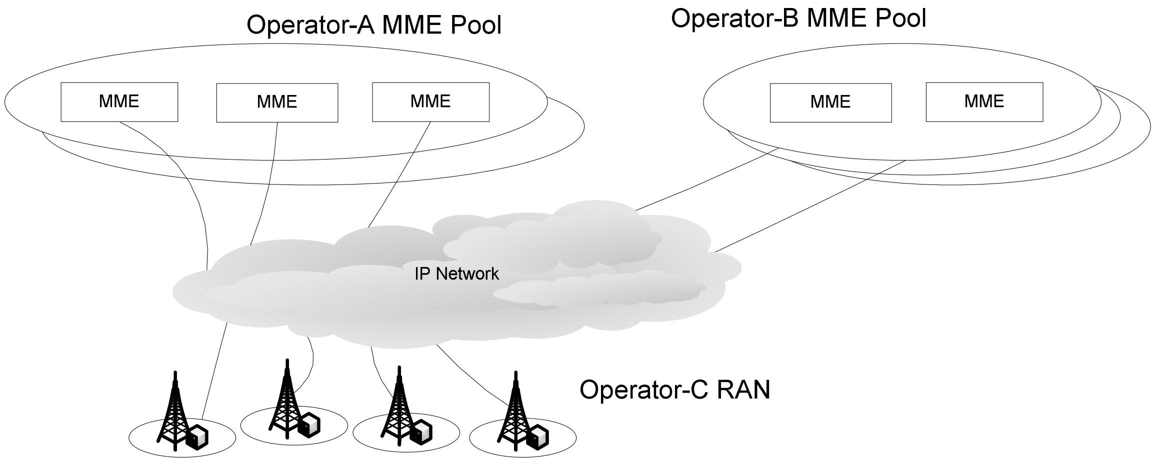

Figure 5.1.10.2-2: MME Pools in Multi CN operators scenario

In addition to support the modelling of "MME Pool", the NRM IRP specification should also support the modelling of the "MSC pool" and the "SGSN pool" scenarios, using identical principle.

5.1.11 Void

5.1.12 Neighbourhood list handling

REQ-MGMT_EUTRAN_EPC-CON-XX1 The need for planning the Neighbour Relation List shall be minimized.

5.2 Specification level requirements

5.2.1 Void

5.2.2 Void

5.2.3 Void

5.2.4 Use cases

5.2.4.1 SON Use cases

5.2.4.1.1 Void

5.2.4.1.2 Establishment of new eNodeB in network

5.2.4.1.2.1 Void

5.2.4.1.2.2 Self-Configuration of a new eNodeB

This use case starts with the first initial self test (see clause 5.1.3.1.2) and ends when the eNodeB is taken into operation. The self optimization starts when the eNodeB is taken into operation (see clause 5.1.3.1.1)

Use Case Stage	Evolution / Specification	<<Uses>> Related use
Goal (*)	Put the eNodeB after physical installation into the operational state in an automated manner.	
Actors and Roles (*)	FFS	
Telecom resources	The E-UTRAN/EPC network including its OSS.	
Assumptions	IP network connectivity exists between the eNodeB and the OAM (sub) systems providing support for the self-configuration process.	
Pre conditions	The eNodeB is physically installed and physically connected to an IP network.	
Begins when	The field personnel start the self-configuration process. It is also possible that the process is triggered automatically after the completion of an eNodeB self-test.	
Step 1 (*) (M|O)	The order of the bullet points in the list below does not imply any statements on the order of execution. [SC1] An eNodeB IP address is allocated to the new eNodeB. [SC2] Basic information about the transport network (e. g. gateways) environment is provided to the eNodeB. With this information the eNodeB is able to exchange IP packets with other internet hosts. [SC3] The eNodeB provides information about its type, hardware and other relevant data about itself to the OAM (sub) systems providing support for the self-configuration process. [SC4] The address(es) of the OAM (sub) system(s) providing support for the self-configuration process (e.g. subsystem for software download, subsystem for configuration data download) is provided to the eNodeB. The address is equal to an IP address and a port number, or a DNS name and port number, or an URI. [SC5] The address(es) of the OAM (sub)system(s) providing support for normal OAM functions after completion of the self-configuration process are provided to the eNodeB. The address is equal to an IP address and a port number, or a DNS name and port number, or an URI. [SC6] The eNodeB connects to the OAM system providing support for the software download. [SC7] The decision which software or software packages have to be downloaded to the eNodeB is taken. [SC8] The software is downloaded into the eNodeB. [SC9] The eNodeB connects to the OAM system providing support for the configuration data download. [SC10] The (transport and radio) configuration data for the eNodeB is made available by either preparing it or making prepared configuration data available. [SC11] The (transport and radio) configuration data is downloaded into the eNodeB. [SC12] Dependent nodes (MMEs, eNodeBs) are updated with new configuration data as well (if required). [SC13] The eNodeB connects to the OAM (sub) system(s) providing support for normal OAM functions after completion of the self-configuration process. [SC14] The S1-links are be set up. [SC15] The (planned) X2-links are be set up. [SC16] The inventory system in the OAM is informed that a new eNodeB is in the field.	
Step n (M|O)		
Ends when (*)	Ends when all steps identified above are successfully completed or when an exception occurs.	
Exceptions	FFS.	
Post Conditions	The eNodeB is operational and able to carry traffic.	
Traceability (*)		

5.2.4.1.3 Void

5.2.4.1.4 Void

5.2.4.1.5 Void

5.2.4.1.6 Void

5.2.4.1.7 Void

5.2.4.1.8 Void

5.2.4.1.9 Void

5.2.5 Requirements

5.2.5.1 Evolution of existing SA5 specifications

REQ-REUSE_TS-ADM-001 High level specifications, like 32.101 [8], 32.102 [9] and 32.300 [10] shall be reused. Small modifications will need to be done in some cases.

REQ-REUSE_TS-ADM-002 The Methodology specifications shall be reused.

REQ-REUSE_TS-ADM-003 Interface IRPs shall be reused. Small modifications will need to be done in some cases.

REQ-REUSE_TS-ADM-004 State Management IRP shall be reused.

REQ-REUSE_TS-ADM-005 Security, Trace, SuM (that is not interface IRPs) TSs shall be reused. Small modifications will need to be done in some cases.

REQ-REUSE_TS-ADM-006 The NRM for Subscription Management, Generic Resources, Inventory Management Repeater, IMS shall be reused.

See Annex A for the exact list of specifications.

REQ-FUN-1: The physical cell identifier shall be assigned fully automatically without manual intervention.

REQ-FUN-3: The assigned physical cell identifier shall be collision free.

Editor's note: There was no consensus for REQ-FUN-3.

5.2.5.2 Automatic installation of NEs

A newly installed eNodeB communicates with the DM managing E-UTRAN in several stages. At the initial stage, the eNodeB will need the identity of each MME with which it will share an S1 interface. The identities or MME pool identities must be provided to the eNodeB. The eNodeB uses the information to establish the necessary S1 connections.

REQ-INST_ENB-CON-001 Devise a data format for structuring the identities of MMEs. The detail modelling of this data will depend on the E-UTRAN Network Resource Model, which is FFS.

REQ-INST_ENB-FUN-002 While defining the NRM for EPC, make sure that the NRM contains elements that support automatic configuration of the S1 connection between eNodeBs and their corresponding MMEs. Especially, the object representing an MME should include an attribute that contains the identity of its S1 interface.

REQ-INST_ENB-CON-003 The Itf-N is reused for the communication between the NMS and the DM managing EPC.

REQ-INST_ENB-FUN-004 While defining the NRM for E-UTRAN, make sure that the NRM contains elements necessary to support automatic configuration of the S1 connection between eNodeBs and their corresponding MMEs.

REQ-INST_ENB-CON-005 Reuse Itf-N for the communication between the NMS and the DM managing E-UTRAN.

5.2.5.3 Trace in E-UTRAN/EPC

To minimise the specification work for the trace functionality of E-UTRAN/EPC:

REQ-Sub_Equip_Trace-CON-001 Reuse Subscriber and Equipment Trace for E-UTRAN and EPC (32.421 [2], 32.422 [3] and 32.423 [4]).

The following general updates are required:

- Lists of systems need to be completed with E-UTRAN and EPC, where applicable.

- Lists of network elements need to be completed with network elements in E-UTRAN and EPC, where applicable.

- Lists of interfaces need to be completed with interfaces in E-UTRAN and EPC, where applicable.

REQ-Sub_Equip_Trace-CON-002 Reuse Trace IRP for E-UTRAN and EPC (32.441 [5], 32.442 [6] and 32.443 [7]).

The following general updates are required:

- Lists of systems need to be completed with E-UTRAN and EPC, where applicable.
- Lists of network elements need to be completed with network elements in E-UTRAN and EPC, where applicable.
- Lists of interfaces need to be completed with interfaces in E-UTRAN and EPC, where applicable.

REQ-Sub_Equip_Trace-CON-003 Do trace parameter propagation over X2 interface (in 32.421 [2] and 32.422 [3]) at handover. At handover between AGW pools (where there is no X2 interface), use the same route as the actual handover signalling for trace parameter propagation.

To find faults in the air interface signalling, it would be beneficial to include trace of the air interface as well.

REQ-Sub_Equip_Trace-CON-004 Extend trace to also include air interface (RRC) signalling (in 32.421 [2] and 32.422 [3]).

The trace should start as early as possible. It should be started earlier than it is started for UMTS.

REQ-Sub_Equip_Trace-CON-005 Include the information in CN INVOKE TRACE (adapted for E-UTRAN/EPC) in the "call set up message" from EPC to E-UTRAN and within EPC.

It should be possible to initiate the trace in one DM and forward the initiation over the Itf-P2P (in order to facilitate Signalling Based Activation from a radio network DM).

All trace log data from different nodes and/or DMs should be possible to collect and analyse at a selected location.

REQ-Sub_Equip_Trace-CON-006 Include IP address for trace log data to be sent to in the trace initiation.

It should be possible to provide node internal vendor specific data to be recorded.

REQ-Sub_Equip_Trace-CON-007 Extend the Trace Depth parameter from 3 to 6 values and add a new File Content Item in TS 32.423 which should be Vendor specific data (which should always be written to the end of the file to enable easy discard of this information by a user who is not able to decode it).

The Trace Depth values would now be:

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

The proposal would be to change this from the 3 values (2 bits) to 8 values (3 bits) leaving the last 2 values spare.

5.2.5.4 KPIs in E-UTRAN/EPC

KPIs should, when possible, be specified independently from the underlying technology (e.g. WCDMA).

The KPI in E-UTRAN/EPC should be defined by following categories:

Accessibility: See the definition in Itu-T E800.

Retainability: See the definition in Itu-T E800.

Mobility: To evaluate the performance of the network mobility, e.g., handover, location update. Etc;

Integrity: See the definition in Itu-T E800.

Usability: To evaluate the performance of the network usability, e.g., traffic volume, CPU usage, etc;

5.2.5.5 Void

5.2.5.6 Fault Management of E-UTRAN/EPC

Exchange of fault data over the Itf-P2P has not yet been described in 3GPP. It is proposed to investigate also here potential benefits in terms of automation of operational tasks and self-healing mechanisms.

5.2.5.7 Configuration Management of E-UTRAN/EPC

Support of Pool Management

To guide the specification of NRM IOCs, the following terms/descriptions (3 bullets) and Requirement statements are used. The terms/descriptions here should have identical meaning with those described by SA2 [1]. They are grouped here only for convenience purpose. If it differs from SA2 definitions, it will be changed to reflect description in [1] accordingly.

- An MME Pool consists of one or more MME nodes. All MME nodes of one MME Pool serve the same one and only one MME Pool Area.
- A particular MME Node can be a member of one and only one MME Pool.
- A particular TA can be a member of one or more MME Pool Area(s). In the latter case, the MME Pool Areas involved are called overlapping MME Pool Areas.

Editor"s notes: whether 'member' or 'be contained' should be used in the bullet above is FFS.

'**MME Pool Area:** An MME Pool Area is defined as an area within which a UE may be served without need to change the serving MME. An MME Pool Area is served by one or more MMEs ("pool of MMEs") in parallel. MME Pool Areas are a collection of complete Tracking Areas. MME Pool Areas may overlap each other.' [1]

O&M system needs to support the following requirements:

REQ-xxx-CON-001 Create/Destroy an MME Pool

REQ-xxx-CON-002 Add/Remove MME node to/from MME Pool

REQ-xxx-CON-003 Move MME nodes from one MME Pool to another MME Pool

REQ-xxx-CON-004 Move MME node (of MME Pool) out of and into service

REQ-xxx-CON-005 Create/Destroy an MME Pool Area

REQ-xxx-CON-006 Add/Remove TAs to/from MME Pool Area (including add/remove related eNodeB to/from MME Pool Area)

REQ-xxx-CON-007 Connect or Associate one MME Pool Area with one MME Pool

5.2.5.8 Performance Management of E-UTRAN/EPC

Exchange of performance data over the Itf-P2P has not yet been described in 3GPP. It is proposed to investigate also here potential benefits in terms of automation of operational tasks and self-healing mechanisms.

REQ-PMS-CON-001 PM IRP will be reused for the collection and monitoring of the performance measurements for E-UTRAN/EPC.

REQ-PMS-CON-002 Alarm IRP will be reused for performance alarm;

REQ-PMS-CON-003 The peformance measurement standardization must be motivated by sufficient use case, requirement, or solutions.

5.2.5.9 Establishment of new eNodeB in network

The business level requirement [REQ_EST_CON_02] regarding the software download into the eNodeB is decomposed into the following specification level requirements

- [REQ_EST_FUN_01] After the successful download and activation of the software the actor on NM level should be informed about this. The notification should include detailed information on the type, version, etc. of the downloaded software. After a failed download or failed activation the actor at NM level should be informed as well.
- [REQ_EST_FUN_02] The details of the interaction capabilities of the actor at NM level are FFS.

5.2.5.10 Optimisation of neighbourhood list

REQ-MGMT_EUTRAN_EPC-CON-XX6 A Searchlist is needed for each cell. The Searchlist should be configurable by standard means, for example the Itf-N interface.

6 E-UTRAN/EPC Management Architecture

6.1 Generic requirements for the management architecture

REQ-ARCH-CON-001 The O&M Architecture should scale gracefully, particularly for the Home Cell deployment.

REQ-ARCH-NON-002 E-UTRAN O&M Architecture and specifications should be finalised within the first release of E-UTRAN, such that it is available for first deployments of E-UTRAN.

REQ-ARCH-CON-003 The EM-NM interface (Itf-N) should always be terminated in the EM irrespective of whether EM resides within the Radio Node or not.

REQ-ARCH-CON-004 For information logically flowing between the Element and the Network Manager (i.e. through the Element Manager), the amount of information to be translated should be kept to a minimum. The X2 interface shall not be used for the indirect transfer between Network Management nodes of data originating in the Management System which is used for O&M purposes only. Note that the X2 establishment is outside the scope of SA5.

6.2 Management Reference Models

6.2.1 Existing Management Reference Model

This following picture depicts the existing Management Reference Model from TS 32.101. Unless otherwise stated this model is equally applicable to E-UTRAN/ EPC.

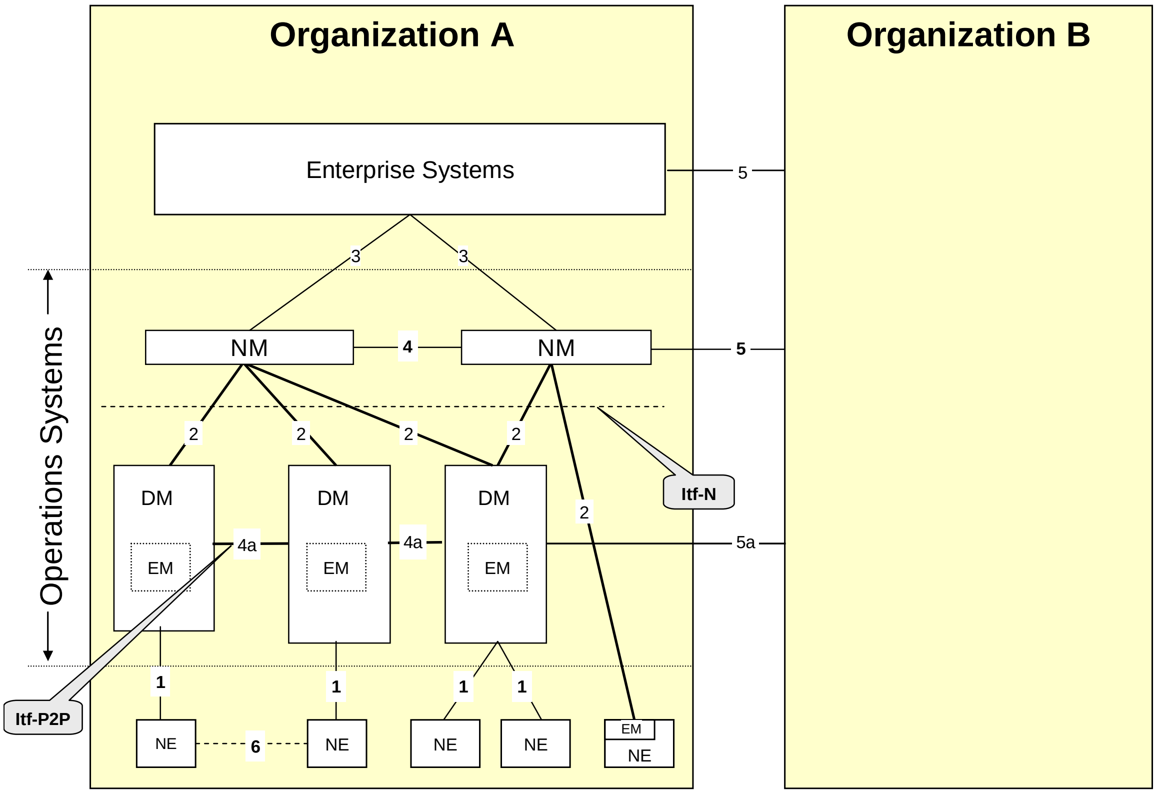

Figure 6.2.1-1:

6.2.2 Use Case Specific Management Reference Models

For the management of E-UTRAN / EPC numerous high level business use cases have been identified. More are expected to be identified in future. Each of this use cases is supported by a Use Case Specific Management Reference Model. The approach for the definition of this Reference Model is described in Chapter 6.3.

6.2.3 E-UTRAN / EPC Management Reference Model

The E-UTRAN/EPC Management Reference Model is the combination of the existing Management Reference Model and the Use Case Specific Management Reference Models.

6.3 Procedure for the specification of the E-UTRAN/EPC Function Specific Management Reference Models

The E-UTRAN/EPC Function Specific Management Reference Model is defined by applying the following steps to each E-UTRAN/EPC high level business use case.

Functional decomposition of each use case:

The high level use cases stated in the business level requirements are decomposed into smaller (atomic) functions or steps. These steps are then documented in the use case template (column Step 1 to column Step n) in the specification level requirements.

Definition of the Logical Architecture for each use case:

In a next step logical functions or functional blocks are identified. Each block supports one or more atomic functions. All functional blocks represent the logical architecture. The logical architecture does not specify where the functions are located. The logical architecture specifies the interactions and relationships between the functional blocks as well.

Definition of the Use Case Specific Reference Model for each use case

After SA5 has agreed on the logical architecture in terms of logical functions it has to be decided where these functions should be located in the existing Management Reference Model (NE, EM NM) or if a new entity should be defined. Note that the different logical functions do not need to be located all at the same place.

Relationships on open interfaces require full standardisation. Relationships between Functional Blocks inside one entity of the Management Reference Model or on closed interfaces are not standardized.

6.4 Specification of the E-UTRAN/EPC Use Case Specific Management Reference Model

6.4.1 Requirements

If possible the logical functions should be mapped to the existing Management Reference Model from TS 32.101. Only in case this is not possible the existing Management Reference Model shall be extended.

6.4.2 Use Case Specific Logical Architecture

6.4.2.1. Use case self-configuration of eNodeBs

Figure 6.4.2.1-1 depicts the Logical Architecture for the use case "self-configuration of new eNodeBs". The lines between the Functional Blocks indicate that there might be a relationship between them. Blocks not connected by lines might have relationships as well.

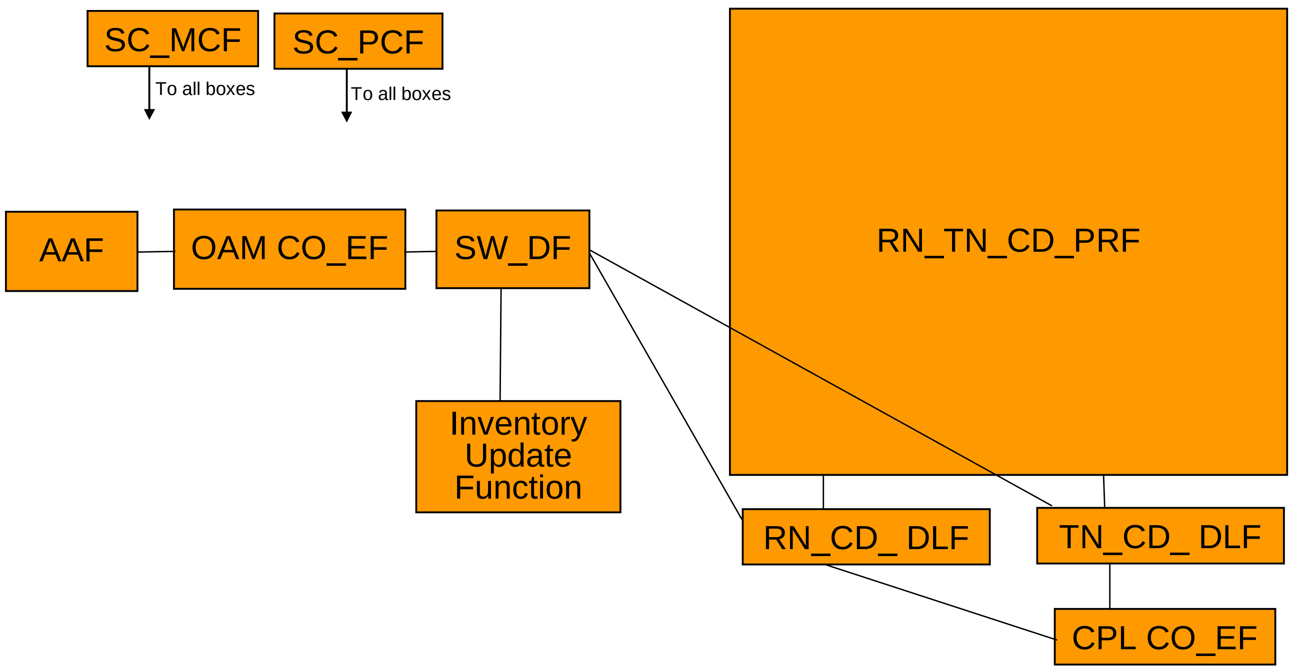

Figure 6.4.2.1-1: Logical Architecture for the use case "self-configuration of a new eNodeBs"

Logical Function Blocks

Address Allocation Function (AAF):

This functional block supports the following functions: [SC1], [SC3].

The AAF can be split into a client part and a server part.

OAM Connectivity Establishment Function (OAM CO_EF):

This functional block supports the following functions: [SC2], [SC3], [SC4], [SC5], [SC13].

The CO_EF can be split into a client part and a server part.

Software Download Function (SW_DLF):

This functional block supports the following functions: [SC3], [SC6], [SC7], [SC8].

The SW_DLF can be split into a client part and a server part.

Inventory Update Function:

This functional block supports the following functions: [SC15].

Self-Configuration Monitoring and Control Function (SC_MCF):

This functional block supports the following functions: FFS

This function monitors the self-configuration process and provides the operator with this information. This function must be able to get information about all other functional blocks. In addition to this it allows the operator to control the execution of the self-configuration process.

Editor's note: The functionality of this block requires further investigation and is not yet agreed. The functions supported by this block have to be added to the specification level requirements.

Self-Configuration Policy Control Function (SC_PCF:

This functional block supports the following functions: FFS

The self-configuration process may be controlled via policies or rules. This function allows configuring these policies.

Editor's note: The functionality of this block requires further investigation and is not yet agreed. The functions supported by this block have to be added to the specification level requirements.

Call Processing Link (CPL) Connectivity Establishment Function (CO_EF):

This functional block supports the following functions: [SC14], [SC15].

Radio Network Configuration Data Download Function (RN_CD_DLF):

This functional block supports the following functions: [SC9], [SC11], [SC12].

Transport Network Configuration Data Download Function (TN_CD_DLF):

This functional block supports the following functions: [SC9], [SC11], [SC12].

Radio Network and Transport Network Configuration Data Preparation Function

This functional block supports the following functions: [SC10].

6.4.2.x Use case X

Describe here the Logical Architecture for the use case X.

6.4.3 Void

6.4.3.1 Use case self-configuration of eNodeBs

6.4.3.x Void

6.5 Void

7 Conclusions and recommendations

7.1 Establishment of new eNodeB in network

7.1.1 Automatic Radio Network configuration data preparation

The work is started but not finished.

The proposal is to continue the work in Rel-9 as a study.

Self-configuration of a new eNodeB

A Work Item is started, UID_390005 Self-Establishment of eNBs.

The proposal is to continue the work in the WI.

7.2 Optimisation of the neighbourhood list

A Work Item is started, UID_390006 SON Automatic Neighbour Relations (ANR) List Management.

The proposal is to continue the work in the WI.

7.3 Coverage and capacity optimisation

The work is started but not finished.

The proposal is to continue the work in WI for UID_390007 SON Self-Optimization & Self-Healing handling.

7.4 Optimisation of parameter due to trouble shooting

Only a use case is provided. No proposal to continue exists.

7.5 Continuous optimisation of due to dynamic changes in the network

Only a use case is provided. No proposal to continue exists.

7.6 Handover optimisation

Only a use case is provided. Work is started in work item UID_390007 SON Self-Optimization & Self-Healing handling, which is proposed to continue. RAN 3 is also working on this topic, which is why it is proposed that SA5 do not duplicate work done in RAN3.

7.7 QoS related radio parameters optimisation

The work is started when the TR is about to be concluded. Therefore the work should continue in a new study item of its own.

7.8 MBMS network optimisation

No input is submitted. No proposal on how to continue exists.

7.9 Evolution of existing SA5 specifications

The work is completed and it is recommended to reuse all specifications listed in Annex A.

7.10 Trace in E-UTRAN/EPC

A Work Item is started.

The proposal is to continue the work in the WI.

7.11 KPIs in E-UTRAN/EPC

A Work Item is started for E-UTRAN. No input is submitted for EPC.

The proposal is to continue the work in the WI E-UTRAN. For EPC no proposal for how to continue exists.

7.12 Site management

A first description is made.

No proposal on how to continue exists.

7.13 Fault management of E-UTRAN/EPC

A first description is made.

It is proposed to reuse the 'Fault Management for UMTS..

7.14 Configuration of E-UTRAN/EPC

Two work items are started: EPC NRM and E-UTRAN NRM.

The proposal is to continue the work in the WIs for the object models. For interface IRPs, it is proposed to reuse the Interface IRPs for UTRAN.

7.14.1 Pool management

The work is continued in the Work Item for EPC NRM.

The proposal is to continue the work in the WI EPC NRM.

7.15 Performance management of E-UTRAN/EPC

Two Work Items are started.

The proposal is to continue the work in the WIs.

Annex A: Reuse of 3GPP TSs for E-UTRAN and EPC management

A.1 TSs to be reused

The following TSs shall be reused for E-UTRAN:

TS 32.101	Telecommunication management; Principles and high level requirements
TS 32.102	Telecommunication management; Architecture
TS 32.111-1	Telecommunication management; Fault Management; Part 1: 3G fault management requirements
TS 32.111-2	Telecommunication management; Fault Management; Part 2: Alarm Integration Reference Point (IRP): Information Service (IS)
TS 32.111-3	Telecommunication management; Fault Management; Part 3: Alarm Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.111-5	Telecommunication management; Fault Management; Part 5: Alarm Integration Reference Point (IRP): eXtensible Markup Language (XML) definitions
TS 32.140	Telecommunication management; Subscription Management (SuM) requirements
TS 32.141	Telecommunication management; Subscription Management (SuM) architecture
TS 32.150	Telecommunication management; Integration Reference Point (IRP) Concept and definitions
TS 32.151	Telecommunication management; Integration Reference Point (IRP) Information Service (IS) template
TS 32.152	Telecommunication management; Integration Reference Point (IRP) Information Service (IS) Unified Modelling Language (UML) repertoire
TS 32.153	Telecommunication management; Integration Reference Point (IRP) technology specific templates
TS 32.154	Telecommunication management; Backward and Forward Compatibility (BFC); Concept and definitions
TS 32.171	Telecommunication management; Subscription Management (SuM) Network Resource Model (NRM) Integration Reference Point (IRP): Requirements
TS 32.172	Telecommunication management; Subscription Management (SuM) Network Resource Model (NRM) Integration Reference Point (IRP): Information Service (IS)
TS 32.175	Telecommunication management; Subscription Management (SuM) Network Resource Model (NRM) Integration Reference Point (IRP): eXtensible Markup Language (XML) definition
TS 32.300	Telecommunication management; Configuration Management (CM); Name convention for Managed Objects
TS 32.301	Telecommunication management; Configuration Management (CM); Notification Integration Reference Point (IRP): Requirements
TS 32.302	Telecommunication management; Configuration Management (CM); Notification Integration Reference Point (IRP): Information Service (IS)
TS 32.303	Telecommunication management; Configuration Management (CM); Notification Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.305	Telecommunication management; Configuration Management (CM); Notification Integration Reference Point (IRP): eXtensible Markup Language (XML) definition
TS 32.307	Telecommunication management; Configuration Management (CM); Notification Integration Reference Point (IRP): Simple Object Access Protocol (SOAP) Solution Set (SS)
TS 32.311	Telecommunication management; Generic Integration Reference Point (IRP) management; Requirements
TS 32.312	Telecommunication management; Generic Integration Reference Point (IRP) management; Information Service (IS)
TS 32.313	Telecommunication management; Generic Integration Reference Point (IRP) management; Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.317	Telecommunication management; Generic Integration Reference Point (IRP) management; Simple Object Access Protocol (SOAP) Solution Set (SS)
TS 32.321	Telecommunication management; Test management Integration Reference Point (IRP): Requirements
TS 32.322	Telecommunication management; Test management Integration Reference Point (IRP): Information Service (IS)
TS 32.323	Telecommunication management; Test management Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.325	Telecommunication management; Test management Integration Reference Point (IRP); eXtensible Markup Language (XML) definitions
TS 32.331	Telecommunication management; Notification Log (NL) Integration Reference Point (IRP): Requirements
TS 32.332	Telecommunication management; Notification Log (NL) Integration Reference Point (IRP): Information Service (IS)
TS 32.333	Telecommunication management; Notification Log (NL) Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.335	Telecommunication management; Notification Log (NL) Integration Reference Point (IRP): eXtensible Markup Language (XML) solution definitions
TS 32.341	Telecommunication management; File Transfer (FT) Integration Reference Point (IRP): Requirements
TS 32.342	Telecommunication management; File Transfer (FT) Integration Reference Point (IRP): Information Service (IS)

TS 32.343	Telecommunication management; File Transfer (FT) Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.345	Telecommunication management; File Transfer (FT) Integration Reference Point (IRP); eXtensible Markup Language (XML) definitions
TS 32.351	Telecommunication management; Communication Surveillance (CS) Integration Reference Point (IRP): Requirements
TS 32.352	Telecommunication management; Communication Surveillance (CS) Integration Reference Point (IRP): Information Service (IS)
TS 32.353	Telecommunication management; Communication Surveillance (CS) Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.361	Telecommunication management; Entry Point (EP) Integration Reference Point (IRP): Requirements
TS 32.362	Telecommunication management; Entry Point (EP) Integration Reference Point (IRP): Information Service (IS)
TS 32.363	Telecommunication management; Entry Point (EP) Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.365	Telecommunication management; Entry Point (EP) Integration Reference Point (IRP); eXtensible Markup Language (XML) definitions
TS 32.371	Telecommunication management; Security Management concept and requirements
TS 32.372	Telecommunication management; Security services for Integration Reference Point (IRP): Information Service (IS)
TS 32.373	Telecommunication management; Security services for Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.375	Telecommunication management; Security services for Integration Reference Point (IRP): File integrity solution
TS 32.381	Telecommunication management; Partial Suspension of Itf-N Integration Reference Point (IRP): Requirements
TS 32.382	Telecommunication management; Partial Suspension of Itf-N Integration Reference Point (IRP): Information Service (IS)
TS 32.383	Telecommunication management; Security Services for Integration Reference Points (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.391	Telecommunication management; Delta synchronization Integration Reference Point (IRP): Requirements
TS 32.392	Telecommunication management; Delta synchronization Integration Reference Point (IRP): Information Service (IS)
TS 32.393	Telecommunication management; Delta synchronization Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.395	Telecommunication management; Delta synchronization Integration Reference Point (IRP): eXtensible Markup Language (XML) file format definition
TS 32.401	Telecommunication management; Performance Management (PM); Concept and requirements
TS 32.404	Performance Management (PM); Performance measurements – Definitions and template
TS 32.408	Performance Management (PM); Performance measurements Teleservice
TS 32.409	Performance Management (PM); Performance measurements IP Multimedia Subsystem (IMS)
TS 32.411	Telecommunication management; Performance Management (PM) Integration Reference Point (IRP): Requirements
TS 32.412	Telecommunication management; Performance Management (PM) Integration Reference Point (IRP): Information Service (IS)
TS 32.413	Telecommunication management; Performance Management (PM) Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.415	Telecommunication management; Performance Management (PM) Integration Reference Point (IRP); eXtensible Markup Language (XML) definitions
TS 32.421	Telecommunication management; Subscriber and equipment trace; Trace concepts and requirements
TS 32.422	Telecommunication management; Subscriber and equipment trace; Trace control and configuration management
TS 32.423	Telecommunication management; Subscriber and equipment trace; Trace data definition and management
TS 32.432	Telecommunication management; Performance measurement: File format definition
TS 32.435	Telecommunication management; Performance measurement: eXtensible Markup Language (XML) file format definition
TS 32.436	Telecommunication management; Performance measurement: Abstract Syntax Notation 1 (ASN.1) file format definition
TS 32.441	Telecommunication management; Trace Management Integration Reference Point (IRP): Requirements
TS 32.442	Telecommunication management; Trace Management Integration Reference Point (IRP): Information service (IS)
TS 32.443	Telecommunication management; Trace Management Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.600	Telecommunication management; Configuration Management (CM); Concept and high-level requirements
TS 32.601	Telecommunication management; Configuration Management (CM); Basic CM Integration Reference Point (IRP); Requirements
TS 32.602	Telecommunication management; Configuration Management (CM); Basic CM Integration Reference Point (IRP): Information Service (IS)
TS 32.603	Telecommunication management; Configuration Management (CM); Basic CM Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.607	Telecommunication management; Configuration Management (CM); Basic CM Integration Reference Point (IRP): Simple Object Access Protocol (SOAP) Solution Set (SS)
TS 32.611	Telecommunication management; Configuration Management (CM); Bulk CM Integration Reference Point (IRP): Requirements
TS 32.612	Telecommunication management; Configuration Management (CM); Bulk CM Integration Reference Point (IRP): Information Service (IS)

TS 32.613	Telecommunication management; Configuration Management (CM); Bulk CM Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.615	Telecommunication management; Configuration Management (CM); Bulk CM Integration Reference Point (IRP): eXtensible Markup Language (XML) file format definition
TS 32.621	Telecommunication management; Configuration Management (CM); Generic network resources Integration Reference Point (IRP); Requirements
TS 32.622	Telecommunication management; Configuration Management (CM); Generic network resources Integration Reference Point (IRP): Network Resource Model (NRM)
TS 32.623	Telecommunication management; Configuration Management (CM); Generic network resources Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.625	Telecommunication management; Configuration Management (CM); Generic network resources Integration Reference Point (IRP): Bulk CM eXtensible Markup Language (XML) file format definition
TS 32.661	Telecommunication management; Configuration Management (CM); Kernel CM; Requirements
TS 32.662	Telecommunication management; Configuration Management (CM); Kernel CM; Information service (IS)
TS 32.663	Telecommunication management; Configuration Management (CM); Kernel CM Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.664	Telecommunication management; Configuration Management (CM); Kernel CM Integration Reference Point (IRP): Common Management Information Protocol (CMIP) Solution Set (SS)
TS 32.665	Telecommunication management; Configuration Management (CM); Kernel CM Integration Reference Point (IRP): eXtensible Markup Language (XML) definitions
TS 32.667	Telecommunication management; Configuration Management (CM); Kernel CM Integration Reference Point (IRP): Simple Object Access Protocol (SOAP) Solution Set (SS)
TS 32.671	Telecommunication management; Configuration Management (CM); State Management Integration Reference Point (IRP): Requirements
TS 32.672	Telecommunication management; Configuration Management (CM); State Management Integration Reference Point (IRP): Information Service (IS)
TS 32.673	Telecommunication management; Configuration Management (CM); State Management Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.674	Telecommunication management; Configuration Management (CM); State Management Integration Reference Point (IRP): Common Management Information Protocol (CMIP) Solution Set (SS)
TS 32.675	Telecommunication management; Configuration Management (CM); State Management Integration Reference Point (IRP): Bulk CM eXtensible Markup Language (XML) file format definition
TS 32.681	Telecommunication management; Inventory Management (IM) Integration Reference Point (IRP): Requirements
TS 32.682	Telecommunication management; Inventory Management (IM) Integration Reference Point (IRP); Information Service (IS)
TS 32.683	Telecommunication management; Inventory Management (IM) Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.690	Telecommunication management; Inventory Management (IM): Requirements
TS 32.691	Telecommunication management; Inventory Management (IM) network resources Integration Reference Point (IRP): Requirements
TS 32.692	Telecommunication management; Inventory Management (IM) network resources Integration Reference Point (IRP): Network Resource Model (NRM)
TS 32.695	Telecommunication management; Inventory Management (IM) network resources Integration Reference Point (IRP): Bulk Configuration Management (CM) eXtensible Markup Language (XML) file format definition
TS 32.721	Telecommunication management; Configuration Management (CM); Repeater network resources Integration Reference Point (IRP): Requirements
TS 32.722	Telecommunication management; Configuration Management (CM); Repeater network resources Integration Reference Point (IRP): Information Service (IS)
TS 32.723	Telecommunication management; Configuration Management (CM); Repeater network resources Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.725	Telecommunication management; Configuration Management (CM); Repeater network resources Integration Reference Point (IRP): Bulk CM eXtensible Markup Language (XML) file format definition
TS 32.731	Telecommunication management; Service Specific Core Network (CN) IP Multimedia Subsystem (IMS) Network Resource Model (NRM) Integration Reference Point (IRP): Requirements
TS 32.732	Telecommunication management; Service Specific Core Network (CN) IP Multimedia Subsystem (IMS) Network Resource Model (NRM) Integration Reference Point (IRP): Information Service (IS)
TS 32.733	Telecommunication management; Service Specific Core Network (CN) IP Multimedia Subsystem (IMS) Network Resource Model (NRM) Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.735	Telecommunication management; Service Specific Core Network (CN) IP Multimedia Subsystem (IMS) Network Resource Model (NRM) Integration Reference Point (IRP): eXtensible Markup Language (XML) file format definition
TS 32.751	Telecommunication management; Evolved Packet Core (EPC) Network Resource Model (NRM) Integration Reference Point (IRP); Requirements

TS 32.752	Telecommunication management; Evolved Packet Core (EPC) Network Resource Model (NRM) Integration Reference Point (IRP): Information Service (IS)
TS 32.753	Telecommunication management; Evolved Packet Core (EPC) Network Resource Model (NRM) Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.755	Telecommunication management; Evolved Packet Core (EPC) Network Resource Model (NRM) Integration Reference Point (IRP): Bulk CM eXtensible Markup Language (XML) file format definition
TS 32.761	Telecommunication management; Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Network Resource Model (NRM) Integration Reference Point (IRP); Requirements
TS 32.762	Telecommunication management; Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Network Resource Model (NRM) Integration Reference Point (IRP): Information Service (IS)
TS 32.763	Telecommunication management; Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Network Resource Model (NRM) Integration Reference Point (IRP): Common Object Request Broker Architecture (CORBA) Solution Set (SS)
TS 32.765	Telecommunication management; Evolved Universal Terrestrial Radio Access Network (E-UTRAN) Network Resource Model (NRM) Integration Reference Point (IRP): Bulk CM eXtensible Markup Language (XML) file format definition

Annex B: Use case comparison to NGMN SON

The table shows the use case comparison between the present document and NGMN SON.

SON use cases in TR 32.816	SON use cases defined in NGMN	Comments
Establishment of new eNodeB in network	Hardware Installation Network authentication Software Installation Transport Parameter Setup Radio Parameter Setup Testing	The 3GPP use case 'Establishment of new eNodeB in network' relates to NGMN use cases applicable in network deployment phase.
Optimisation of the neighbourhood list	Radio Parameter Optimisation: Neighbour cell list optimization	
Coverage and capacity optimisation	Radio Parameter Optimisation: Interference Control	The 3GPP use case 'coverage and capacity optimisation' relates to NGMN use cases applicable in network planning phase and optimization phase.
Optimisation of parameter due to trouble shooting	Performance Management in real time Direct KPI reporting in real time Information Correlation for Fault Management Subscriber and Equipment trace Cell outage Compensation Compensation for Outage of higher level network elements Fast recovery on instable NEM system Mitigation of outage of units	**The 3GPP use case 'Optimisation of parameter due to trouble shooting' relates to several NGMN use cases in network optimization phase.** The NGMN use cases **"**Performance Management in real time", "Direct KPI reporting in real time", "Information Correlation for Fault Management" and "Subscriber and Equipment trace" are used to collect information for troubleshooting. The NGMN use cases "Cell outage Compensation", "Compensation for Outage of higher level network elements", "Fast recovery on instable NEM system" and "Mitigation of outage of units" are used to take action on system recovery.
Continuous optimisation due to dynamic changes in the network (like traffic variation)	Radio Parameter Optimisation: Neighbour cell list optimization Radio Parameter Optimisation: Interference Control Radio Parameter Optimisation: HO parameterization optimization Radio Parameter Optimisation: QoS related parameter optimization Reduction of Energy Consumption Performance Management in real time Direct KPI reporting in real time	The 3GPP use case 'Continuous optimisation due to dynamic changes in the network' relates to several NGMN use cases on continuously online optimization.
Handover Optimisation	Radio Parameter Optimisation: HO parameterization optimization	
QoS related radio parameters optimization	Radio Parameter Optimisation: QoS related parameter optimization	
MBMS network Optimization		No related NGMN use case
	NodeB Location NodeB Hardware Automatic Generation of Radio Parameters Planning of transport parameters of a new eNodeB Planning of security Node, aGW and OMC Radio Parameter Optimisation: Optimization Scenarios with Home BTS/Pico BTS **Transport Parameter Optimisation: Routing Optimisation** **Transport Parameter Optimisation: Optimization Scenarios with Home BTS/Pico BTS** **Hardware / Capacity extension** **Autonomous Inventory** **Automatic SW Download to eNodeB** **Automated NEM upgrade** Cell outage detection	No related SA5 use case

Annex C: Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
May 2007	SA_36	SP-070303	--	--	Submitted to SA#36 for Information	1.0.0	
Dec 2008	SP-42	SP-080710			Presentation to SA#42 for Approval	2.0.0	8.0.0

History

Document history		
V8.0.0	January 2009	Publication