System Description

LTE

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1 Introduction

This document describes the Ericsson Radio System for the LTE technology. The RAN overview covers the nodes, architecture, interfaces, and the OSS.

The Network section gives an overview of the Transport Network and Radio Network. It also provides information about the Non-License-Controlled Features and License-Controlled Features, and Network Planning. The Network Planning section gives an overview of the deployment when implementing a RAN system.

2 RAN Overview

This section provides a summary of the nodes and the LTE architecture in the RAN.

2.1 RAN Architecture

The RAN provides access links between UE and the EPC network. The access links are divided into the following planes:

User plane It carries the end-user payload traffic of voice, video, or any data traffic.

Control plane It carries control signaling for user plane traffic.

The RAN consists of the following elements:

- All Radio System Nodes in an operator's network
- The RAN part of one or several installations of OSS
- Infrastructure for IP transport
- ENM

The IP transport network has no functions specifically for RAT. The eNodeB is the only E-UTRAN specific node in the network carrying and controlling payload traffic.

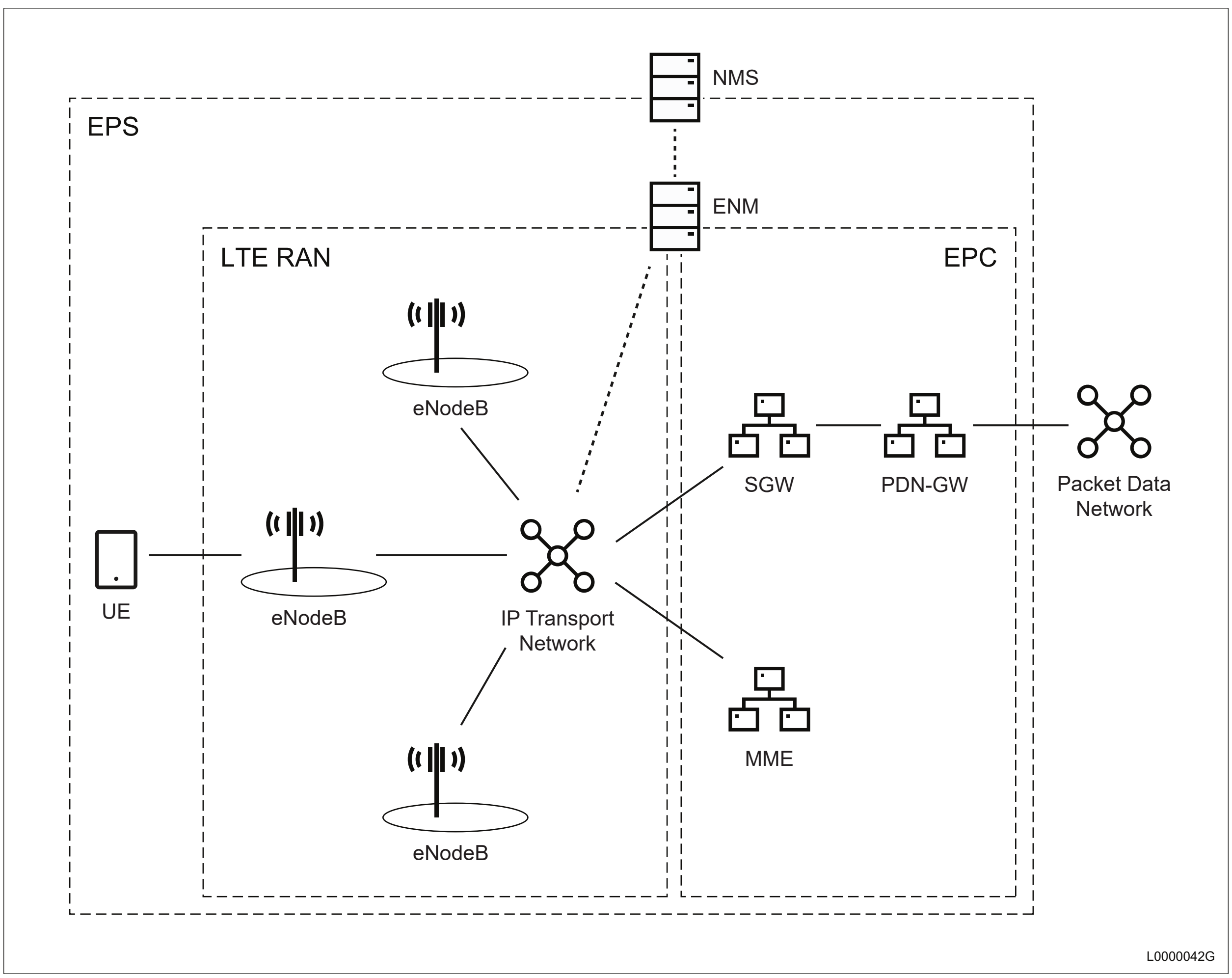

Figure 1 LTE RAN Overview in EPS

Table 1   EPS components

Component	Description
Radio Node	The Radio Node corresponds to eNodeB in 3GPP specifications. It controls the radio connections with connected UE and manages the cell resources, including connection mobility control.
EPC	EPC is the IP-based core network between the RAN and other networks. On the user plane, EPC connects the RAN with the SGW, and on the control plane, with the MME. The PDN-GW provides the user plane interface to other packet data networks. The Ericsson solution for the 3GPP nodes SGW and PDN-GW is the CPG hosting both the SGW and the PDN-GW.
EPS	Evolved Packet System The EPS includes EPC, the RAN, and the UE.
MME	Mobility Management Entity
IP Transport Network	The IP transport network provides interconnection between the eNodeBs and the nodes in the EPC network, between individual eNodeBs, and between ENM and the eNodeBs. The data transport is IP-based, permitting a range of physical layers. The following protocols are used on the layer above the IP: – UDP – SCTP – TCP Additional protocols are used for the communication with ENM.
NMS	System that manages more than one subnetwork.
PDN-GW	Packet Data Network Gateway
SGW	Serving Gateway
UE	UE includes the end-user terminals such as mobile phones and PCs.

The E-UTRAN architecture is described in *3GPP Technical Specification (TS) 36.300* and *TS 36.401*.

2.2 Radio Nodes

In LTE RAN, the Radio Node corresponds to eNodeB in 3GPP specifications.

The Radio Node provides radio resources for the RAN.

Functions are divided into Radio Network, Transport Network and O&M functions:

- The Radio Network related functions handle the user data traffic and control communication with the MME and the UE. This includes the handling of cells, channels.
- The Transport Network related functions handle Ethernet links.
- The O&M functions ensure that the system becomes and remains operational, handles equipment malfunctions, hardware, software, expansions, upgrades and monitors the performance of the node.

For more information about the radio nodes, see Node Description.

2.3 Shared LTE RAN

Conventionally, a PLMN consists of a RAN and a core network, through which only one operator provides services to its subscribers. Subscribers of other operators can receive services as national or international roamers.

An LTE RAN can be shared between up to six operators, that is, an LTE RAN can be defined with up to six PLMNs. Sharing RANs enables not only a decrease in expenditures but also a reduced environmental footprint.

The eNodeB support for shared LTE RAN includes the following configuration alternatives:

- Both the eNodeBs and the MMEs are shared by two or more operators, see Gateway Core Network (GWCN) in Figure 2.

- Only the eNodeBs are shared between two or more operators, see Multi Operator Core Network (MOCN) in Figure 2.

These configurations are standardized scenarios for network sharing and are specified in *3GPP TS23.251*.

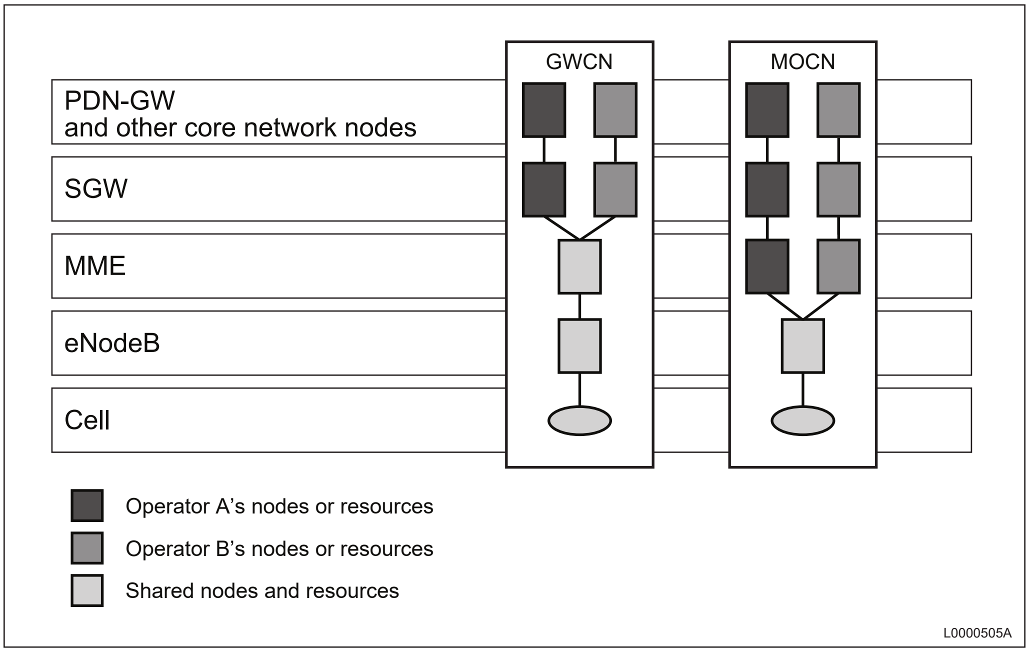

Figure 2   Shared LTE RAN Configurations

More information can be found in Shared LTE RAN.

2.4 Interfaces in LTE

LTE interfaces are divided to internal interfaces and external interfaces. Internal interfaces are used for communication between nodes in the LTE network as shown in Figure 3. An external interface is used for communication between a node in the LTE network and a node external to the LTE network as shown in Figure 4. There are five types of interfaces in LTE, as shown in Table 2.

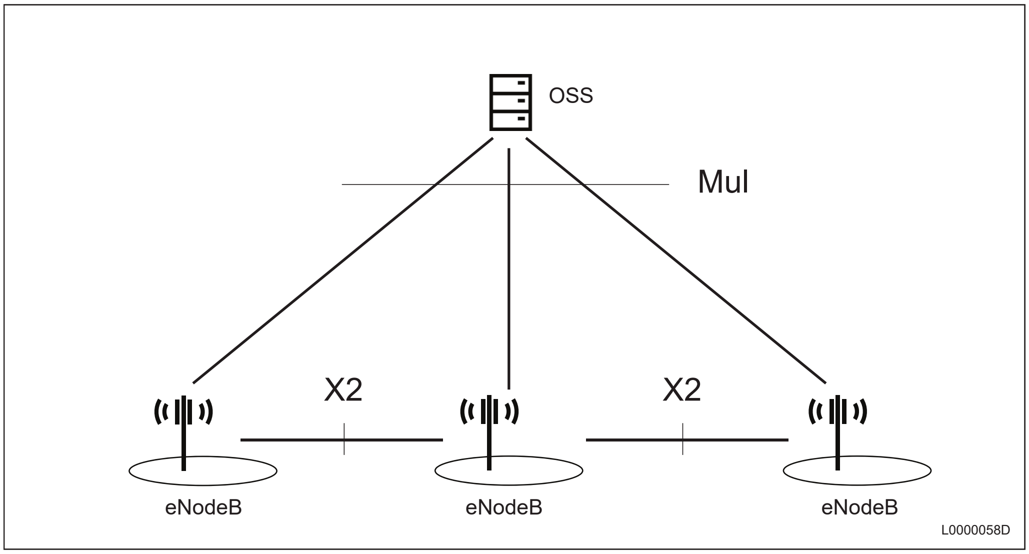

Figure 3 Internal Interfaces Between Nodes in LTE

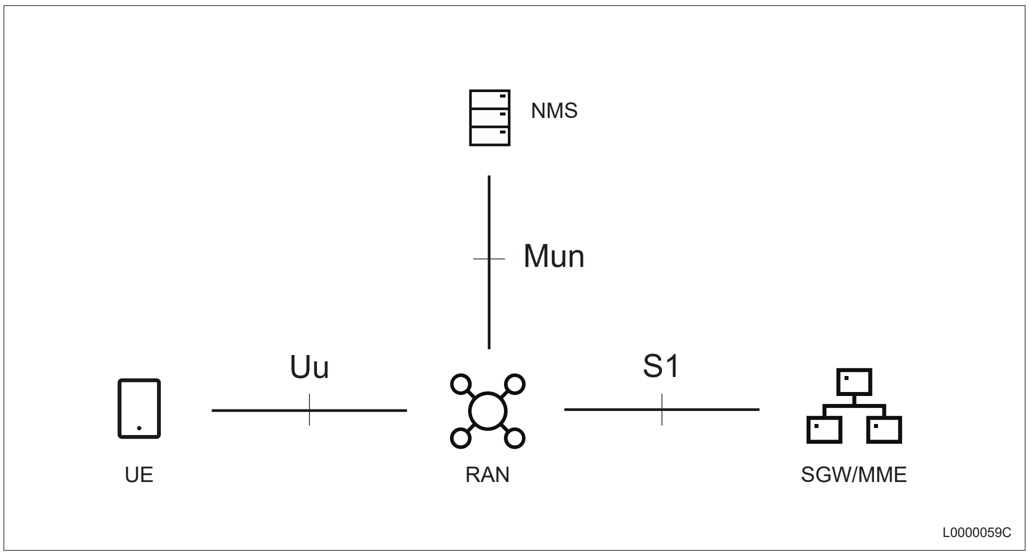

Figure 4 External Interfaces in LTE

Table 2 LTE Interfaces

Interface	Description
Mul	Interface between the eNodeB and the OSS for network management. The Mul interface is also used to manage the node on site using client software on a PC.
Mun	Provides access to the OSS for external Network Management Systems.
S1	Interface between the eNodeB and EPC. The S1 interface is divided into the control plane and the user plane. The S1 control plane terminates in the MME core network node. The S1 user plane terminates in the SGW core network node. The S1 interface provides the capability for individual eNodeBs to connect to several MME and SGW nodes.
Uu	The Uu is the radio interface or the air interface and connects the eNodeB and the UE. The Uu interface carries payload data and control information for the radio connection in terms of mobility, security, and bearer management.
X2	Connects eNodeB pairs having neighboring cells.

A commercial LTE network contains multiple instances of each interface.

2.4.1 Traffic Interfaces

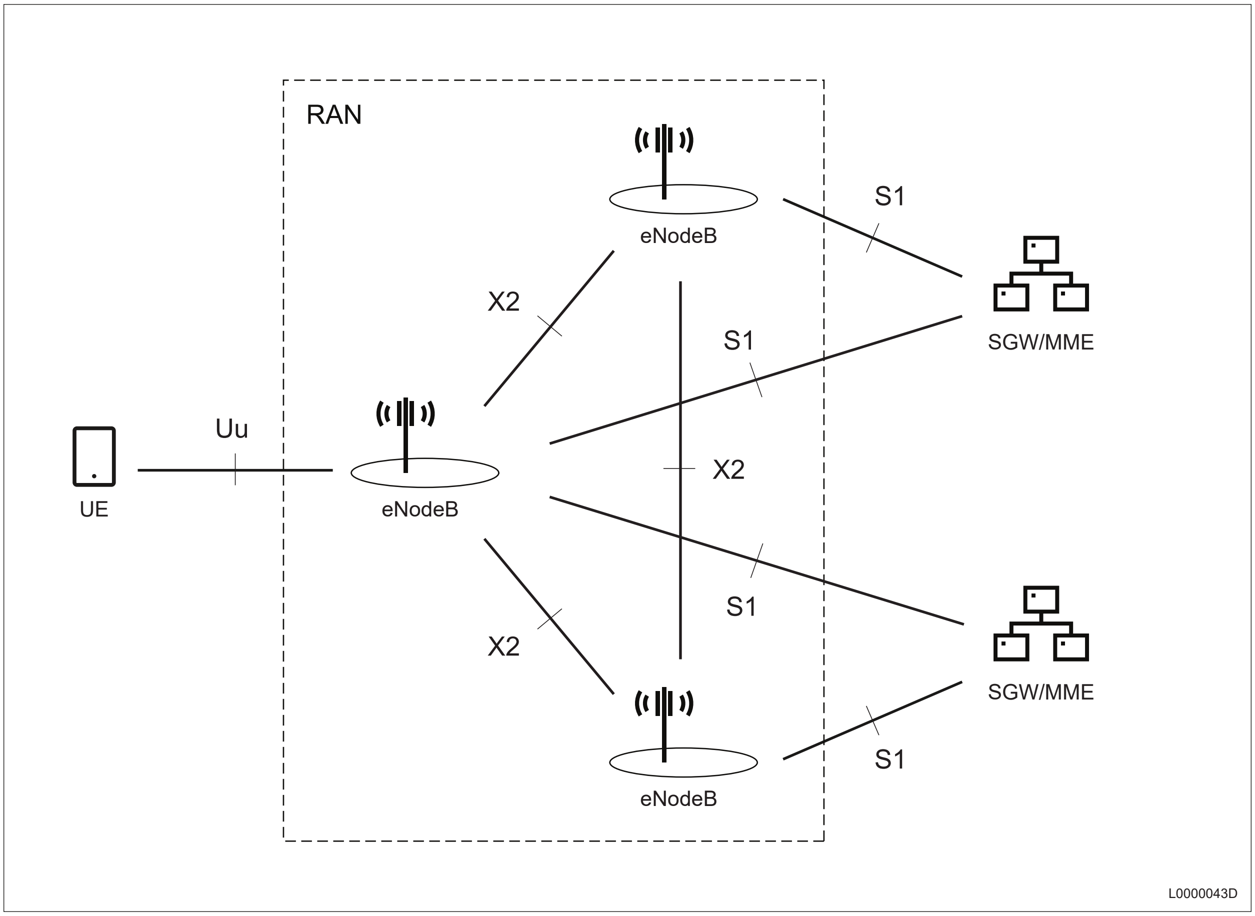

Figure 5 LTE Traffic Interfaces

The S1 interface connects the eNodeB and the core network. In the core network, the interface terminates in the SGW on the user plane and in the MME on the control plane. The eNodeB is the terminating point for both control plane and user plane towards the UE. The S1 protocols are carried over the IP layer.

The S1 interface is a many-to-many interface. Each eNodeB can connect to many MMEs and SGWs. Each MME and SGW can connect to many eNodeBs.

The MME uses the S1 control plane interface to manage the bearers between the SGW and the UE. The MME manages the connection, the radio and S1 bearers carry EPS bearers, and the access stratum security functions. The signaling protocol is called S1AP and is carried over SCTP and IP to provide reliable transmission over the S1 interface. One SCTP connection exists for each MME-eNodeB relation. S1AP handles functions such as user plane tunnel management, S1 bearer management, paging, and mobility.

GTP-U carries the user data, path management, and tunnel management messages. The user data consists of complete PDCP data units. The GTP-U header includes a Tunnel Endpoint ID (TEID) to identify the S1 bearer. The GTP-U Packet Data Unit (PDU) is sent over an UDP/IP connection, identified by source and destination UDP port and IP address.

Figure 6 shows the Uu control plane protocol stack, and Figure 7 the protocol stack for the user plane.

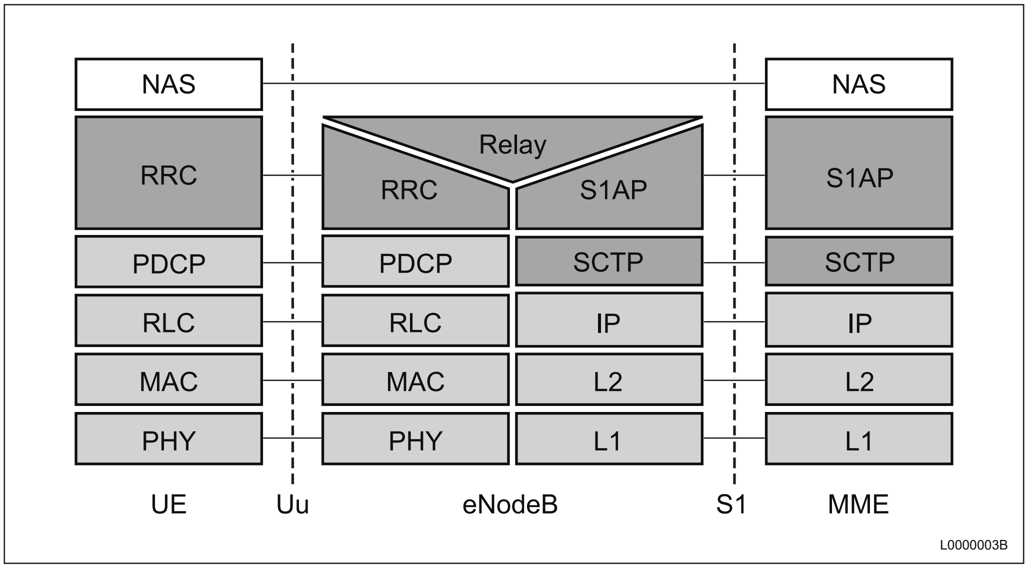

Figure 6 Control Plane Protocol Stacks from UE to MME

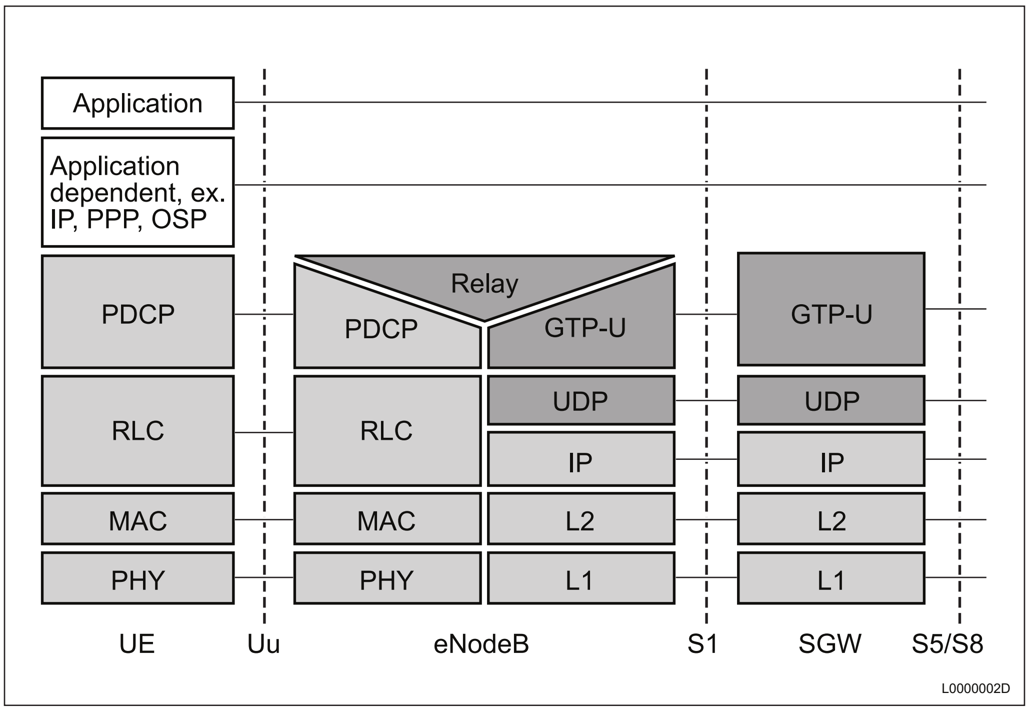

Figure 7 User Plane Protocol Stacks from UE to SGW

Layers 1, 2, and 3 are defined as the Uu or radio interface. The Uu is the interface between the eNodeB and the UE. The *3GPP TS 36.200* series describes the specifications for layer 1, the physical layer. Layers 2 and 3 are described in the 36.300 series.

The protocols are specified in the following standards:

– *3GPP TS 29.281*

– *3GPP TSs 36.410–414*

– *IETF RFC 768*

The X2 interface provides connections between eNodeBs and supports mobility for UE in connected mode. It is a many-to-many interface, so each eNodeB can connect to many other eNodeBs.

The Data Forwarding at Intra-LTE Handover feature introduces forwarding of downlink packets from source to target cell over the X2 interface. Data forwarding minimizes data loss during the handover procedure. Complete PDCP PDUs and

SDUs that are not sent to the UE are forwarded over the X2 interface.

X2AP is the signaling protocol on the X2 control plane interface. X2AP carries over SCTP and IP to provide reliable transmission, see Figure 8. One SCTP connection exists for each eNodeB-to-eNodeB relation. X2AP handles functions like user plane tunnel management and handover.

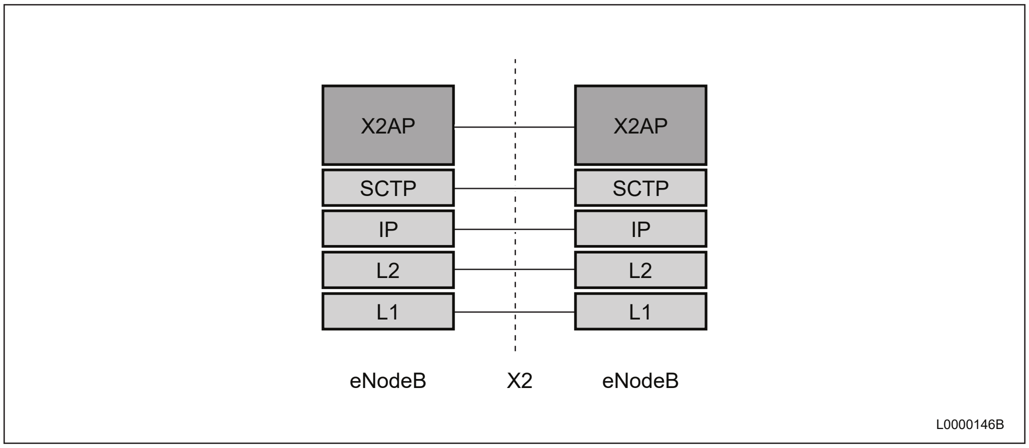

Figure 8   X2 Control Plane Protocol Stacks

The protocols are specified in *3GPP TSs 36.420–424*.

Table 3   Protocol Descriptions

Protocol	Description
GTP-U	General Packet Radio System (GPRS) Tunnelling Protocol for User Plane
IP	Internet Protocol
L1	Layer 1
L2	Layer 2
MAC	Medium Access Control Main functions for the Medium Access Control (MAC) protocol are: – HARQ – Multiplexing of logical channels on transport channels – Scheduling of user and control data over the radio interface – Link adaptation At transport block size selection, MAC (the Scheduler) interacts with RLC to obtain the correct RLC protocol data unit size for the transport block. MAC offers a number of logical channels to the RLC. A logical channel is characterized by the type of information transferred. The protocol is specified in *3GPP TS 36.321*.
NAS	Non-Access Stratum NAS is the core network signaling protocol for the control plane. The protocol is specified in *3GPP TS 24.301*.
OSP	Open Settlement Protocol
PDCP	Packet Data Convergence Protocol PDCP is used in both the control and user plane and performs header compression, integrity protection, and ciphering. Ciphering can be applied to both RRC signaling and user data. Header compression applies only to user data. Integrity protection applies only to RRC signaling. The user plane PDCP Service Data Units (SDUs) are forwarded to the RLC protocol over the S1 user plane interface. In handover, the PDCP PDUs and SDUs can be forwarded from the source eNodeB to the target eNodeB over the X2 user plane interface.
PHY	Physical Layer

<table>
<tr><th>Protocol</th><th>Description</th></tr>
<tr><td></td><td>The physical layer is described in Radio Network. The 3GPP description is found in 3GPP TS 36.201.</td></tr>
<tr><td>PPP</td><td>Point to Point Protocol</td></tr>
<tr><td>RLC</td><td>Radio Link Control
The RLC protocol provides reliable transmission over the radio interface and provides these functions:
– In-sequence delivery
– Acknowledged Mode (AM)
– Unacknowledged Mode (UM)
– Transparent Mode (TM)
– Segmentation and reassembly
– Concatenation
– Interworking with Hybrid Automatic Repeat Request (HARQ) to identify required retransmissions
Segmentation and reassembly are based on the transport block size selected by MAC at transmission and retransmission.
The protocol is specified in 3GPP TS 36.322.</td></tr>
<tr><td>RRC</td><td>Radio Resource Control
The RRC protocol handles radio-related signaling towards the UE. Examples of functions include:
– System information broadcast
– Paging
– RRC connection management
– Radio bearer management
– Handover
– UE measurement reporting and control
The protocol is specified in 3GPP TS 36.331.</td></tr>
<tr><td>S1AP</td><td>S1 Application Protocol</td></tr>
<tr><td>SCTP</td><td>Stream Control Transmission Protocol</td></tr>
<tr><td>UDP</td><td>User Datagram Protocol</td></tr>
</table>

2.4.2 Management Interfaces

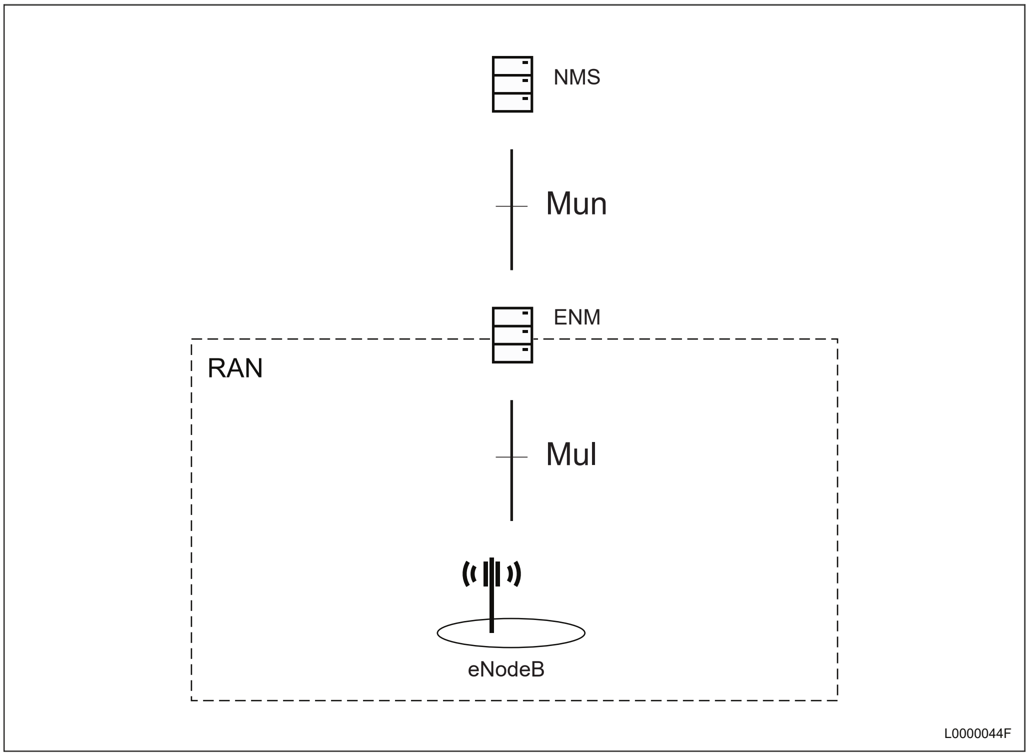

Figure 9   LTE Management Interfaces

Table 4   LTE Management Interfaces

Interface	Function
Mul Interface	Provides access for ENM to the management functions of an eNodeB. Also used for on-site access with client software on a PC. The Mul interface uses an IP stack for termination of IP packets carrying O&M data.
Mun Interface	Provides access to ENM for external network management systems.

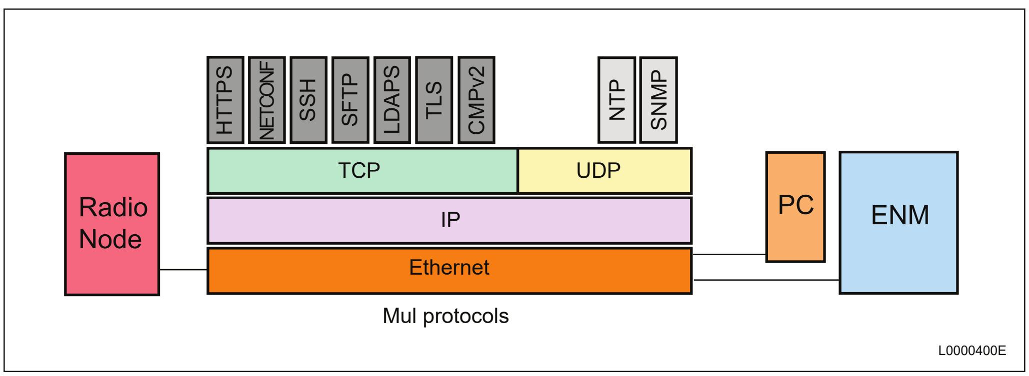

Figure 10   Mul Protocol Stack

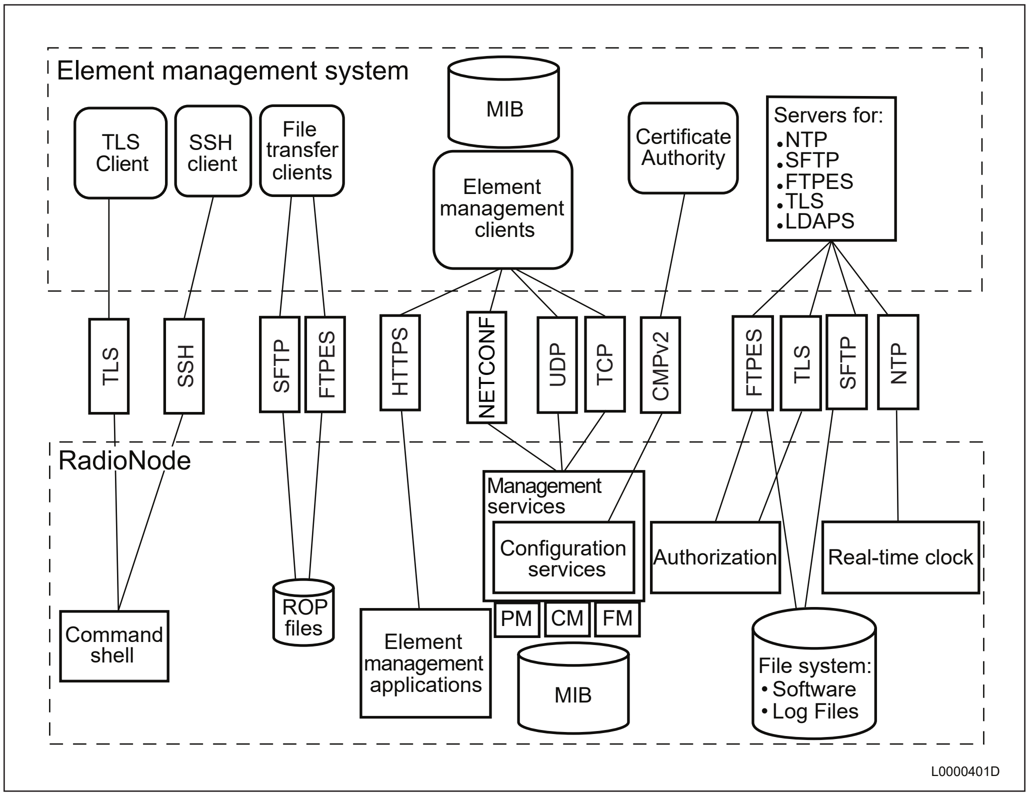

Figure 11 Mul Protocols and Applications

Table 5 Mul Protocol Descriptions

Protocol	Description
CMPv2	Certificate Management Protocol version 2 eNodeBs send certificate enrollment requests and receive signed certificates over the CMPv2. Certificates are issued by a certificate signing authority deployed on OMSAS.
DHCP	Dynamic Host Configuration Protocol DHCP clients use DHCP to obtain configuration information in a network and assign dynamic IP addresses. DHCP is used when integrating eNodeBs.
DNS	Domain Name System eNodeBs use DNS to resolve node IP addresses for O&M and user traffic. A DNS client in the eNodeB communicates with DNS servers using the DNS protocol.
ENM	Ericsson Network Manager ENM is an OSS platform, and suite of network management applications supporting operation and maintenance of radios, transport, and core networks.
FTPES	Explicit File Transfer Protocol over TLS This protocol supports transfer of the following: — Upgrade packages and configuration versions — Performance Management (PM) data — Product Inventory (PI) data — Trusted certificates — Manually enrolled credentials — Log files

Protocol	Description
HTTPS	Hypertext Transfer Protocol Secure Log file transfers and some Element Management applications use HTTPS.
LDAPS	Lightweight Directory Access Protocol Secure The protocol LDAPS (LDAP over TLS) is used to check whether a connecting user is authorized to access and maintain a certain node or not.
NETCONF	Network Configuration Protocol OSS applications use NETCONF as machine-machine protocol to manage and configure the node.
NTP	Network Time Protocol The real-time clock in the eNodeB receives network time from NTP servers over NTP.
SFTP	Secure File Transfer Protocol This protocol supports transfer of the following: — Upgrade packages and configuration versions — Performance Management (PM) data — Product Inventory (PI) data — Trusted certificates — Manually enrolled credentials — Log files
SLS	Single Log-on Service Component of the Identity Management Service that provides user credentials using the Credential Manager interface through REST API. Credentials are introduced in the form of certificates. The certificates are used to access Network Elements. To use SLS to get a certificate, it is necessary to have an entity. Entities are provided by the system administrator using PKI management. For more information on entities, see *User Management* in the ENM CPI library.
SNMP	Simple Network Management Protocol The protocol SNMP is applied to send notification to OSS during initial integration of a node.
SSH	Secure Shell Secure Shell (SSH) is used to access Command Line Interface.
TCP	Transmission Control Protocol
TLS	Transport Layer Security The TLS provides authentication, integrity and confidentiality for applications communicating using TCP.
UDP	User Datagram Protocol

The Mun interface uses a similar protocol stack as Mul. It supports IRP interface specifications from 3GPP. For further information, see ENM documentation.

2.5 Ericsson Network Manager

ENM provides centralized operation and maintenance of LTE and WCDMA radio networks.

It offers great network flexibility without downtime or freeze time. The capacity to scale from very small to very large networks and common tools for all applications with integrated help and videos are simplifying the common network operations.

ENM provides unified:

- Fault, performance and configuration management
- Software and hardware management
- Security, self-monitoring and system administration

See the ENM CPI library for a detailed description of the product and for information on how to use individual ENM applications.

3 Basic Functionality

3.1 Bearers and Services

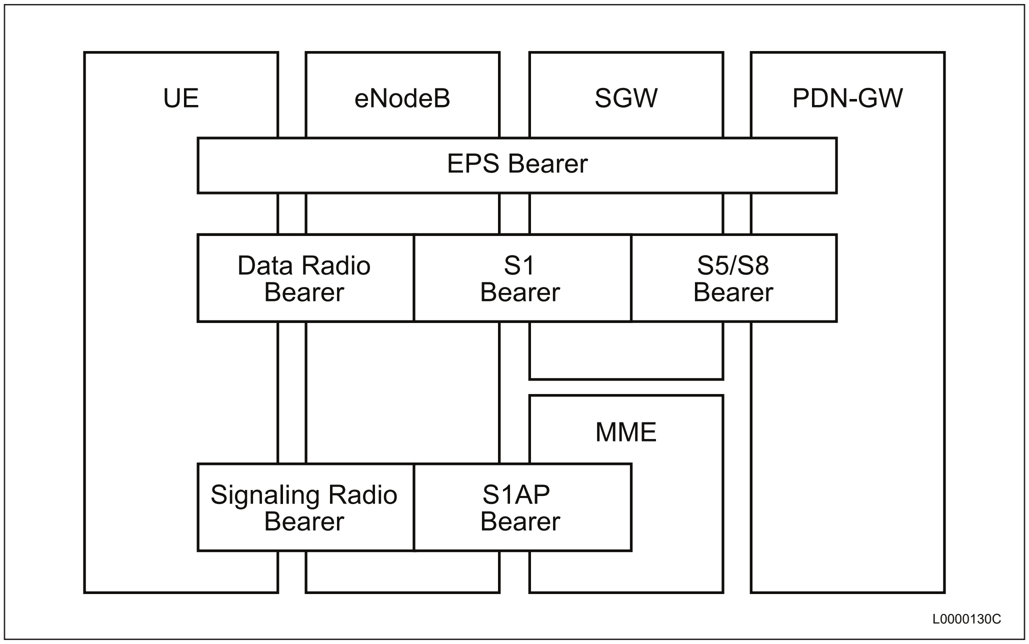

Figure 12   Bearers in EPS

Bearers represent communication links to UE, as described in Table 6.

UE in idle mode does not have any bearers established. The UE-state is RRC_IDLE.

UE in connected mode has at least a SRB established to a cell, that is, the serving cell. The corresponding UE state is RRC_CONNECTED.

Table 6   Bearers in EPS

Bearer	Function
Radio bearer	Carries data over the air interface, the Uu. Types of radio bearers include: – DRB for the user plane – SRB for the control plane
S1 bearer	Carries user plane data between the eNodeB and the SGW.
S5/S8 bearer	Carries user plane data between the SGW and the PDN-GW.
EPS bearer	Carries user plane data between the UE and the PDN-GW. Each EPS bearer is mapped to a DRB, an S1 bearer, and an S5/S8 bearer.
E-RAB	The DRB and the S1 bearer together are some times addressed as E-RAB. It carries user plane data between the UE and the SGW. E-RAB is the name used in the 3GPP S1AP specifications.
S1AP bearer	Carries control plane data between the eNodeB and the MME. The eNodeB handles much of the communication with UE. It means that not all communication over the SRB is relayed over to the S1AP bearer.

3.2 Radio Access

This section describes functions related to the physical layer (layer 1) of the LTE air interface Uu.

The functions provided by the physical layer include:

- Transport channel errors detection and reporting to higher layers
- FEC for encoding and decoding the transport channel
- FEC for encoding and decoding the transport channel using HARQ soft-combining
- Rate matching the coded transport channel to physical channels
- Mapping the coded transport channel onto physical channels
- Physical channel power weighting
- Physical channel modulation and demodulation
- Frequency and time synchronization
- Radio characteristics measurements and indication to higher layers
- MIMO antenna processing
- Transmit diversity

3.3 Mobility

UE mobility support in LTE is provided for connected mode and idle mode.

Connected mode mobility functions maintain sessions as UE moves between cells. In connected mode the UE has a signaling connection present in the serving cell. The corresponding UE state is RRC_CONNECTED.

The main RRC_CONNECTED mode mobility categories include:

- Intra-frequency handover where the UE remains in connected mode on the current carrier frequency in the LTE network.
- Inter-frequency handover where the UE remains in connected mode while transferring to a cell on another carrier frequency in the LTE network.
- Coverage-triggered session continuity where the eNodeB releases the UE and directs it to another carrier frequency: either an IRAT frequency or another LTE frequency.
- Coverage-triggered session continuity where the eNodeB directs the UE to another IRAT frequency
- Coverage-triggered IRAT handover where the eNodeB directs the UE to a cell of another RAT after negotiation with the other network

Following RRC connection, the eNodeB configures the UE to detect the signal quality in the serving cell and in surrounding cells. Certain conditions are defined as named events. UE reports the quality to the eNodeB through event-triggered measurement reports.

Table 7 Connected Mode UE Measurements

Event	Event Condition	Initiates Mobility Function
Event A1	Bad coverage condition ceases and serving cell becomes better than threshold	Preparations for inter-frequency handover and session continuity are stopped
Event A2	Serving cell becomes worse than threshold	– Inter-frequency handover

Event	Event Condition	Initiates Mobility Function
		– Coverage triggered IRAT handover – Coverage-triggered session continuity
Event A3	Neighbor cell becomes offset better than serving cell	Intra-frequency handover
Event A5	Serving cell becomes worse than a first threshold and an inter-frequency neighbor cell becomes better than a second threshold	– Inter-frequency handover when event A2 is already reported – Coverage-triggered session continuity when event A2 is already reported and inter-frequency handover is not possible
Event B2	Serving cell becomes worse than a first threshold and a cell in another RAT becomes better than a second threshold	– Coverage-triggered session continuity when event A2 is already reported – Coverage-triggered IRAT handover when event A2 is already reported

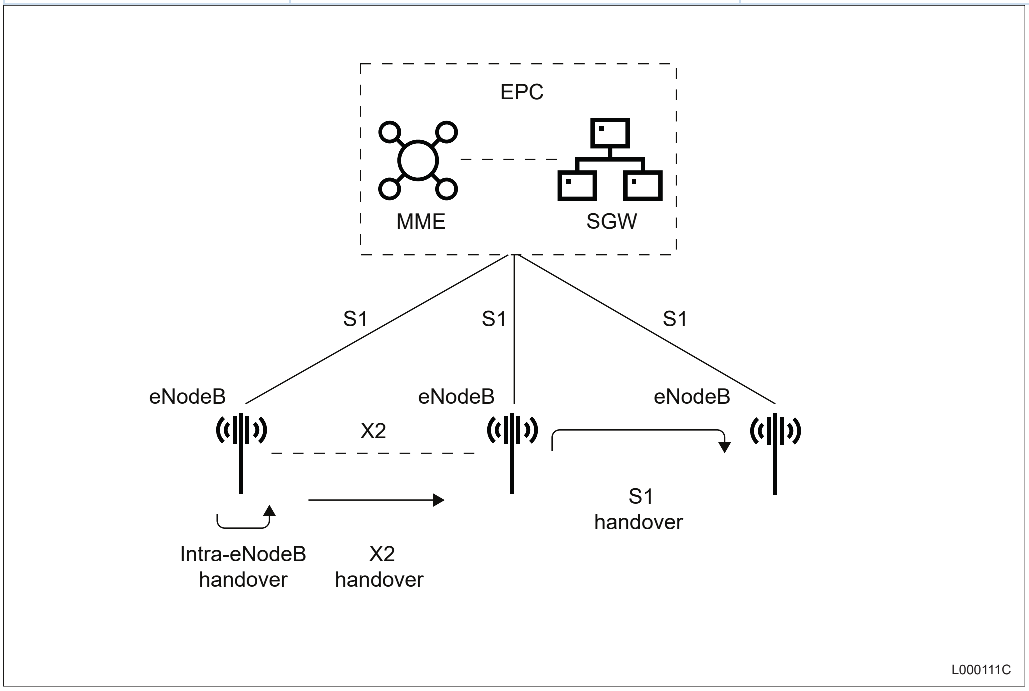

Figure 13   Types of Handovers

4 Transport Network

The LTE transport network provides communication between nodes, the core network, and the O&M system. It means that the transport network connects each Radio Node to:

- SGWs and MMEs in the core network
- RNC
- OSS
- eNodeBs with neighboring cells

In addition to the eNodeB functions, the transport network includes transmission links and transport nodes, such as routers and switches. These nodes are standard equipment, common in IP networks, and have no special functions intended for LTE, WCDMA, or EPC. They can also be used for traffic other than for LTE or WCDMA.

The Radio Node is an IP host within the LTE transport network supporting IP over Ethernet. The Radio Node also provide IP routing and bridging functionality for Traffic Aggregation and Transport Network resilience, and other functionality, such as link redundancy.

For more information about the Transport Network, see Manage Transport Network.

4.1 Transport Network Functions and Solutions

Ericsson Radio Nodes support robust connections between RadioNodes, OSS, and the core network.

LTE basic functions provide:

- Standard compliant terminations of the S1 and X2 interfaces
- Termination of the Mul interface
- QoS handling
- Network synchronization
- Transport network observability

The following additional functionality provided but not limited to are:

- Traffic Aggregation from for example external site equipment or other Radio Nodes.
- Traffic Resilience
- IPsec

More information can be found in the following documents:

- Manage Transport Network
- Manage Quality of Service
- Manage SCTP
- Manage IPsec
- Manage Network Synchronization

4.1.1 Site Transport Nodes

The STNs are located on RadioNode sites and act as interface between the IP transport network and one or more RadioNodes. The Baseband T is a hardware implementation of the STN. The STN transports the following traffic in RANs:

- GSM time-division multiplexing traffic over IP between BSC and BTS
- GSM Abis traffic over IP between the BSC and the Baseband T
- WCDMA traffic between RNC and eNodeB
- LTE traffic between EPC and eNodeB
- CDMA traffic between BSC and eNodeB
- Dynamic Routing using OSPFv2

For more information, see *Baseband T library*.

5 Radio Network

The LTE RAN consists of all the eNodeBs in a network, one or more instances of ENM (RAN part), and the transport infrastructure required to interconnect these nodes and to connect the nodes to the EPC network. ENM is also connected to the NMS.

The following concepts apply to the radio network:

- Radio Transmission
- Frequency Bands

  3GPP in TS 36.104 specifies E-UTRA operating bands. For frequency bands supported by the LTE eNodeB types, see Radio Node Configurations.

- Physical Channel Multiplexing

  LTE uses Orthogonal Frequency-Division Multiplexing (OFDM) for the downlink from the eNodeB to the UE. OFDM offers spectrum flexibility and cost-efficient solutions for wide carriers with high peak rates.

- Radio Frames

  Downlink and uplink radio transmission is divided in 10 ms long radio frames.

- Channels

  Various channels are defined on air interface Uu layers 1 and 2. Physical channels are mapped to the radio frame structure transferred over the radio interface.

- Interference Management

  Interference management reduces traffic interference in neighboring cells. The LTE radio transmission operates with high efficiency without requiring complex planning.

For more information about the Radio Network configuration, see:

- Manage Radio Network, Mobility
- Manage Radio Network, Services and Bearers
- Manage Radio Network, UE Measurement
- Manage Radio Network, ANR

5.1 Network Performance

A cell with a bandwidth of 20 MHz contains 100 PRBs in downlink and 100 PRBs in uplink, as defined by 3GPP. 3GPP allows all 100 PRBs to be used for PDSCH. Some of the PRBs must be reserved for PUCCH. In practice, 96 PRBs are reserved for PUSCH. For 10 MHz cell bandwidth, the corresponding numbers are 50 PRBs for PDSCH and 46 PRBs for PUSCH.

3GPP restricts the values that can be issued to a single UE for each PUSCH allocation. The following set is allowed: 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 15, 16, 18, 20, 24, 25, 27, 30, 32, 36, 40, 45, 48, 50, 54, 60, 64, 72, 75, 80, 81, 90, 96, 100, and 108. When there are multiple UEs, combinations of these sizes can be used. Exactly which value to use in a particular TTI is controlled by the eNodeB link adaptation, and is limited by the maximum number of PRBs available at the configured bandwidth. For example, for 10 MHz the maximum allocation is 45 PRBs in uplink since 46 is not allowed.

Some of the processing capacity is consumed for common air interface signaling, for example System Information broadcast.

The actual peak user data throughput in a cell also depends on system bandwidth for the cell, and on propagating conditions in the air interface. For end-to-end communication using TCP, the end-user received bandwidth can be heavily affected by the quality of the IP transport network and the quality of the reverse link on the air interface.

5.2 Impact on LTE from Massive IoT

> When a NB-IoT cell is configured in in-band or guard band deployment, it affects the capacity of the host LTE cell.

An in-band NB-IoT anchor carrier replaces a set of PRBs of the LTE cell, while a guard band NB-IoT cell uses a PRB in the unused guard band at the edge of the LTE cell.

NB-IoT cells are power-boosted compared to LTE. When adding a boosted NB-IoT cell, the configured power of the LTE cell is adjusted accordingly. To maintain the total power of the combined LTE and NB-IoT signals, the power of the LTE PRBs is reduced.

The NB-IoT cell also reduces the throughput of the LTE host cell. In in-band deployment, one PRB of the LTE cell is used for NB-IoT, and the other PRBs in the same downlink RBG also cannot be scheduled for LTE traffic.

The throughput reduction caused by a NB-IoT cell in guard band deployment is less than the reduction caused by in-band deployment, because no PRB of the LTE host cell is used. But the total baseband throughput is shared between the LTE and NB-IoT cells, which causes the LTE throughput to be reduced.

For more information, see *NB-IoT Access* in the Massive IoT RAN library.

6 Non-License-Controlled and License-Controlled Features

This chapter provides an overview of License Management capabilities of the RAN system. It includes supporting procedures for installing activating and deactivating features. For more information, see Manage Licenses and Hardware Activation Codes.

6.1 Radio Access Technology Activation

The LTE Radio Access Activation feature enables traffic operation in the RadioNode for the LTE RAT. Without the activation of the LTE Radio Access Activation feature, no other features can operate.

6.2 Non-License-Controlled Features

Non-License-Controlled Features consists of basic functionality in the system, that is, the functionality of the system without any license-controlled features.

For a list of non-license-controlled features, see LTE RAN Feature Status.

6.3 License-Controlled Features

Feature licenses enable use of software features adding functionality to the network.

Each feature is described individually in LTE RAN library. For a list of the available license-controlled features, see LTE RAN Feature Status.

7 Security

The following security features are provided in the LTE RAN:

Traffic Security

Radio network is protected by air ciphering over Uu.

For Cipher configuration, see *Security for O&M Node Access* in *Ericsson Connectivity Packet Platform* library.

Transport Security

Transport network can be protected by IPsec over S1, X2, and Mul interfaces. For more information, see Manage IPsec.

O&M Security

O&M security provides the following:

- O&M protocols, such as HTTPS, TLS, SSH, SFTP and FTPES
- Centralized user authentication and authorization using SLS and LDAPS in ENM

Security Logging

The eNodeB provide the following security logs:

- Security log
- Audit Trail log

For more information, see Manage Security.

8 Network Planning

This section gives an overview of the deployment activities including, dimensioning, planning, and parameter setting, when implementing a RAN system.

8.1 Network Dimensioning

Implementing RAN involves dimensioning for:

- Radio network coverage and capacity
- Transport network link capacity
- Spectral and power resources for control channels

The main input for the coverage and capacity dimensioning is the desired bit rate at the cell edge, one for downlink and one for uplink. The output is site-to-site distance, cell capacity in the uplink and downlink, and a number of parameters that control the air interface between the eNodeB and the UE, see Coverage and Capacity Dimensioning for LTE.

The main input for the transport network dimensioning is the cell peak rate and the transport overhead. The output includes the bandwidth required for the transmission link closest to the eNodeB and aggregated bandwidth required for the mobile backhaul, see Transport Network Dimensioning.

8.2 Radio Network Planning

Radio network planning involves:

- Assigning cell identities to cells
- Assigning tracking areas to cells
- Defining geographical eNodeB site locations
- Defining antenna configuration including direction, height, and tilt
- Defining initial cell neighbor relations

Ericsson recommends that cell neighbor relations are planned and configured at initial network implementations. The Automated Neighbor Relations (ANR) feature can be used to optimize and maintain neighboring cell relations.

For more details about planning the radio network, see Radio Network Configuration.

8.3 Transport Network Planning

Transport network planning involves:

- Detailed network topology and link dimensioning
- Security solutions
- QoS handling in terms of mapping the LTE capabilities such as DSCP and Pbits to capabilities of the nodes in the transport network
- Defining synchronization solutions and setup
- Assigning IP addresses to resources in eNodeBs and the rest of the network

8.4 License Planning

Licenses are planned based on the dimensioning of the radio network.