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Technical Specification

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X2 Application Protocol (X2AP)
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Foreword

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Contents

Foreword

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

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1 Scope

The present document specifies the radio network layer signalling procedures of the control plane between eNBs in EUTRAN. X2AP supports the functions of X2 interface by signalling procedures defined in this document. X2AP is developed in accordance to the general principles stated in [2] and [3].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 36.401: 'E-UTRAN Architecture Description'.

[3] 3GPP TS 36.420: 'X2 General Aspects and Principles'.

[4] 3GPP TS 36.413: 'S1 Application Protocol (S1AP)'.

[5] ITU-T Recommendation X.691 (07/2002): "Information technology - ASN.1 encoding rules - Specification of Packed Encoding Rules (PER)

[6] 3GPP TS 32.422: 'Subscriber and Equipment Trace; Trace Control and Configuration Management '.

[7] 3GPP TS 32.421: "Trace concepts and requirements".

[8] 3GPP TS 36.424: 'Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 data transport'.

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in [1].

***<defined term>**: <definition>.*

3.2 Symbols

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

<symbol> <Explanation>

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in [1].

DL	Downlink
eNB	E-UTRAN NodeB
EP	Elementary Procedure
EPC	Evolved Packet Core
E-UTRAN	Evolved UTRAN
GUMMEI	Globally Unique MME Identifier
HFN	Hyper Frame Number
IE	Information Element
MME	Mobility Management Entity
PDCP	Packet Data Convergence Protocol
PLMN	Public Land Mobile Network
SN	Sequence Number
UE	User Equipment
UL	Uplink

4 General

4.1 Procedure specification principles

The principle for specifying the procedure logic is to specify the functional behaviour of the terminating eNB exactly and completely. Any rule that specifies the behaviour of the originating eNB shall be possible to be verified with information that is visible within the system.

The following specification principles have been applied for the procedure text in clause 8:

- The procedure text discriminates between:

  1) Functionality which "shall" be executed

  The procedure text indicates that the receiving node "shall" perform a certain function Y under a certain condition. If the receiving node supports procedure X but cannot perform functionality Y requested in the REQUEST message of a Class 1 EP, the receiving node shall respond with the message used to report unsuccessful outcome for this procedure, containing an appropriate cause value.

  2) Functionality which "shall, if supported" be executed

  The procedure text indicates that the receiving node "shall, if supported," perform a certain function Y under a certain condition. If the receiving node supports procedure X, but does not support functionality Y, the receiving node shall proceed with the execution of the EP, possibly informing the requesting node about the not supported functionality.

- Any required inclusion of an optional IE in a response message is explicitly indicated in the procedure text. If the procedure text does not explicitly indicate that an optional IE shall be included in a response message, the optional IE shall not be included. For requirements on including *Criticality Diagnostics* IE, see section 10.

4.2 Forwards and backwards compatibility

The forwards and backwards compatibility of the protocol is assured by a mechanism where all current and future messages, and IEs or groups of related IEs, include ID and criticality fields that are coded in a standard format that will not be changed in the future. These parts can always be decoded regardless of the standard version.

4.3 Specification notations

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

Procedure	When referring to an elementary procedure in the specification the Procedure Name is written with the first letters in each word in upper case characters followed by the word "procedure", e.g. Handover Preparation procedure.
Message	When referring to a message in the specification the MESSAGE NAME is written with all letters in upper case characters followed by the word "message", e.g. HANDOVER REQUEST message.
IE	When referring to an information element (IE) in the specification the *Information Element Name* is written with the first letters in each word in upper case characters and all letters in Italic font followed by the abbreviation "IE", e.g. *SAE Bearer ID* IE.
Value of an IE	When referring to the value of an information element (IE) in the specification the "Value" is written as it is specified in subclause 9.2 enclosed by quotation marks, e.g. "Value".

5 X2AP services

The present clause describes the services an eNB offers to its neighbours.

5.1 X2AP procedure modules

The X2 interface X2AP procedures are divided into two modules as follows:

1. X2AP Basic Mobility Procedures;
2. X2AP Global Procedures;

The X2AP Basic Mobility Procedures module contains procedures used to handle the mobility within E-UTRAN.

The Global Procedures module contains procedures that are not related to a specific UE. The procedures in this module are in contrast to the above module involving two peer eNBs.

5.2 Parallel transactions

Unless explicitly indicated in the procedure specification, at any instance in time one protocol peer shall have a maximum of one ongoing X2AP procedure related to a certain UE.

6 Services expected from signalling transport

Editors Note: More clarification to be added here when definition clearer in 36.401.

The signalling connection shall provide in sequence delivery of X2AP messages. X2AP shall be notified if the signalling connection breaks.

7 Functions of X2AP

The X2AP protocol provides the following functions:

- Mobility Management. This function allows the eNB to move the responsibility of a certain UE to another eNB. Forwarding of user plane data is a part of the mobility management.
- Load Management. This function is used by eNBs to indicate overload and traffic load to each other.

- Reporting of General Error Situations. This function allows reporting of general error situations, for which function specific error messages have not been defined.
- Resetting the X2. This function is used to completely reset the X2 interface.
- Setting up the X2. This function is used to exchange necessary data for the eNB for setup the X2 interface.

8 X2AP procedures

8.1 Elementary procedures

In the following tables, all EPs are divided into Class 1 and Class 2 EPs.

Table 8.1-1: Class 1 Elementary Procedures

Elementary Procedure	Initiating Message	Successful Outcome	Unsuccessful Outcome
		Response message	Response message
Handover Preparation	HANDOVER REQUEST	HANDOVER REQUEST ACKNOWLEDGE	HANDOVER PREPARATION FAILURE
Reset	RESET REQUEST	RESET RESPONSE	
X2 Setup	X2 SETUP REQUEST	X2 SETUP RESPONSE	X2 SETUP FAILURE
eNB Configuration Update	ENB CONFIGURATION UPDATE	ENB CONFIGURATION UPDATE ACKNOWLEDGE	ENB CONFIGURATION UPDATE FAILURE
Resource Status Reporting Initiation	RESOURCE STATUS REQUEST	RESOURCE STATUS RESPONSE	RESOURCE STATUS FAILURE

Table 8.1-2: Class 2 Elementary Procedures

Elementary Procedure	Initiating Message
Load Indication	LOAD INFORMATION
Handover Cancel	HANDOVER CANCEL
SN Status Transfer	SN STATUS TRANSFER
UE Context Release	UE CONTEXT RELEASE
Resource Status Reporting	RESOURCE STATUS UPDATE
Error Indication	ERROR INDICATION

8.2 Basic mobility procedures

8.2.1 Handover Preparation

8.2.1.1 General

This procedure is used to establish necessary resources in a eNB for an incoming handover.

8.2.1.2 Successful Operation

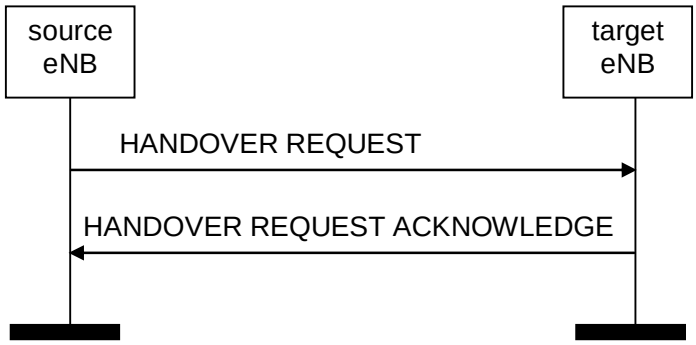

Figure 8.2.1.2-1: Handover Preparation, successful operation

The source eNB initiates the procedure by sending the HANDOVER REQUEST message to the target eNB. When the source eNB sends the HANDOVER REQUEST message, it shall start the timer $T_{RELOCprep}$

If at least one of the requested SAE bearers is admitted to the cell, the target eNB shall reserve necessary resources, and send the HANDOVER REQUEST ACKNOWLEDGE message back to the source eNB. The target eNB shall include the SAE Bearers for which resources have been prepared at the target cell in the *SAE Bearers Admitted List* IE. The target eNB shall include the SAE bearers that have not been admitted in the *SAE Bearers Not Admitted List* IE with an appropriate cause value.

For each bearer for which the source eNB proposes to do forwarding of downlink data, the source eNB shall include the *DL forwarding* IE within the *SAE Bearer Info* IE of the HANDOVER REQUEST message. For each bearer that it has decided to admit, the target eNB may include the *DL GTP Tunnel endpoint* IE within the *SAE Bearer Info* IE of the HANDOVER REQUEST ACKNOWLEDGE message to indicate that it accepts the proposed forwarding of downlink data for this bearer. This GTP tunnel endpoint may be different than the corresponding *GTP TEID* IE in the *SAE Bearer To Be Switched in Downlink List* of the PATH SWITCH REQUEST message (see [4]) depending on implementation choice.

For each bearer in the *SAE Bearers Admitted List* IE, the target eNB may include the *UL GTP Tunnel Endpoint* IE if it requests data forwarding of uplink packets to be performed for that bearer.

Upon reception of the HANDOVER REQUEST ACKNOWLEDGE message the source eNB shall stop the timer $T_{RELOCprep}$, start the timer $TX2_{RELOCOverall}$ and terminate the Handover Preparation procedure. The source eNB is then defined to have a Prepared Handover for that X2 UE-associated signalling.

If the *Trace activation* IE is included in the HANDOVER REQUEST message then the target eNB should initiate the requested trace function as described in [6].

The HANDOVER REQUEST message shall contain the *Handover Restriction List* IE, if available.

If the *Handover Restriction List* IE is

- contained in the HANDOVER REQUEST message, the target eNB shall store this information and the target eNB should use the information in *Handover Restriction List* IE to determine a target cell for subsequent handover attempts.

- not contained in the HANDOVER REQUEST message, the target eNB shall consider that no access restriction applies to the UE.

If the *Location Reporting Information* IE is included in the HANDOVER REQUEST message then the eNB shall initiate the requested location reporting procedure as defined in [4].

Editor"s Note: The reporting of Cell ID with regard to cell change caused by X2 handover is FFS.

8.2.1.2.1 UE History Information

Configuration may be used to instruct an eNB about collection of UE historical information.

When configured to collect UE historical information, the eNB shall:

- Collect information about the UE for as long as the UE stays in one of its cells, and store the collected information to be used for future handover preparations.
- At handover preparation, add the stored information to the *Last Visited Cell* IE and include the *UE History Information* IE in the HANDOVER REQUEST message.
- At reception of the HANDOVER REQUEST message in where the *UE History Information* IE is included, collect the same type of information as that included in the *UE History Information* IE and act according to the bullets above.

8.2.1.3 Unsuccessful Operation

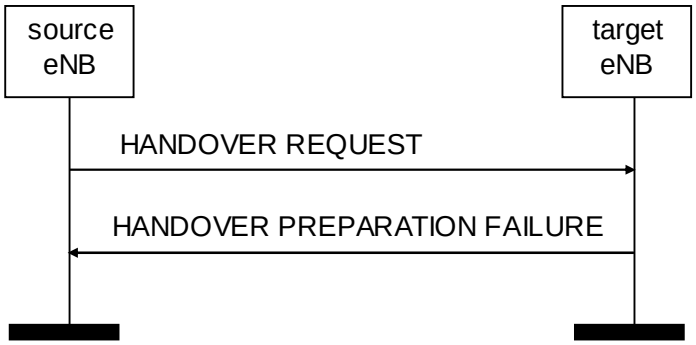

Figure 8.2.1.3-1: Handover Preparation, unsuccessful operation

If the target eNB is not able to accept any of the SAE bearers or a failure occurs during the Handover Preparation, the target eNB shall send the HANDOVER PREPARATION FAILURE message to the source eNB. The message shall contain the *Cause* IE with an appropriate value.

Interactions with Handover Cancel procedure:

If there is no response from the target eNB to the HANDOVER REQUEST message before timer $T_{RELOCprep}$ expires in the source eNB, the source eNB should cancel the Handover Preparation procedure towards the target eNB by initiating the Handover Cancel procedure with the appropriate value for the *Cause* IE, e.g. "$T_{RELOCprep}$ expiry".

8.2.1.4 Abnormal Conditions

Void.

8.2.2 SN Status Transfer

8.2.2.1 General

The purpose of the SN Status Transfer procedure is to transfer the uplink PDCP-SN and HFN receiver status and the downlink PDCP-SN and HFN transmitter status from the source to the target eNB during an X2 handover for each respective SAE bearer for which PDCP SN and HFN status preservation applies.

8.2.2.2 Successful Operation

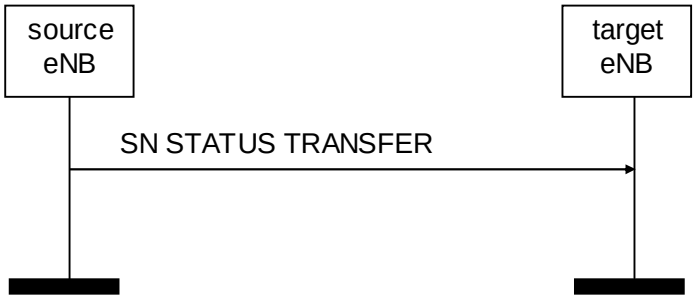

Figure 8.2.2.2-1: SN Status Transfer, successful operation

The source eNB initiates the procedure by sending the SN STATUS TRANSFER message to the target eNB at the time point when it considers the transmitter/receiver status to be frozen. After sending this message the source eNB shall stop assigning PDCP SNs to downlink SDUs and shall stop delivering UL SDUs toward the EPC. At that point of time, the source eNB shall either:

- discard the uplink packets received out of sequence for each bearer for which PDCP SN status preservation applies but not forwarding,
- forward the uplink packets received out of sequence for each bearer for which the source eNB has accepted the request from the target eNB for uplink forwarding,
- send the uplink packets received out of sequence to the EPC for each bearer for which the PDCP SN status preservation doesn"t apply.

For each bearer for which PDCP SN status preservation applies, the source eNB shall include the *UL COUNT value* IE within the *SAE Bearers Subject to Status Transfer Item* IE.

The source eNB shall also include in the SN STATUS TRANSFER message the missing and received uplink SDUs in the *Receive status of UL PDCP SDUs* IE for each bearer for which the source eNB has accepted the request from the target eNB for uplink forwarding.

For each bearer for which the *UL COUNT value* IE is received in the SN STATUS TRANSFER message, the target eNB shall use it and not deliver any uplink packet which has a PDCP SN lower than the value contained in the *PDCP-SN* IE of this IE.

If the *Receive status of UL PDCP SDUs* IE is included in the SN STATUS TRANSFER message for at least one bearer, the target eNB may use it in a Status Report message sent to the UE over the radio.

For each bearer for which PDCP SN status preservation applies, the source eNB shall include the *DL COUNT value* IE within *SAE Bearers Subject to Status Transfer Item* IE.

If the *DL COUNT value* IE is received in the SN STATUS TRANSFER message for one bearer, the target eNB shall use it to mark with the value contained in the *PDCP-SN* IE of this IE the first downlink packet for which there is no PDCP SN yet assigned.

8.2.2.2 Abnormal Conditions

If the target eNB receives this message for a UE for which no prepared handover exists at the target eNB, the target eNB shall ignore the message.

8.2.3 UE Context Release

8.2.3.1 General

The UE Context Release procedure is initiated by the target eNB to signal to the source eNB that control plane resources for the handed over UE context can be released.

8.2.3.2 Successful Operation

Figure 8.2.3.2-1: UE Context Release, successful operation

The UE Context Release procedure is initiated by the target eNB. By sending UE CONTEXT RELEASE the target eNB informs success of Handover to source eNB and triggers the release of resources.

Upon reception of the UE CONTEXT RELEASE message, the source eNB can release radio and control plane related resources associated to the UE context. For bearers for which data forwarding has been performed, the source eNB should continue forwarding of U-plane data as long as packets are received at the source eNB from the EPC or the source eNB buffer has not been emptied (an implementation dependent mechanism decides that data forwarding can be stopped).

8.2.3.3 Unsuccessful Operation

Not applicable.

8.2.3.4 Abnormal Conditions

If the UE Context Release procedure is not initiated towards the source eNB from any prepared eNB before the expiry of the timer $TX2_{RELOCoverall}$, the source eNB shall release all resources associated to the UE context and request the MME to release the UE context.

If the UE returns to source eNB before the reception of the UE CONTEXT RELEASE message or the expiry of the timer $TX2_{RELOCoverall}$, the source eNB shall stop the $TX2_{RELOCoverall}$ and continue.

8.2.4 Handover Cancel

8.2.4.1 General

The Handover Cancel procedure is used to cancel an already prepared handover.

8.2.4.2 Successful Operation

Figure 8.2.4.2-1: Handover Cancel, successful operation

The source eNB initiates the procedure by sending the HANDOVER CANCEL message to the target eNB. The source eNB shall indicate the reason for cancelling the handover by means of an appropriate cause value.

At the reception of the HANDOVER CANCEL message, the target eNB shall remove any reference to, and release any resources previously reserved to the concerned UE context.

8.2.4.3 Unsuccessful Operation

Not applicable.

8.2.4.4 Abnormal Conditions

Should the HANDOVER CANCEL message refer to a context that does not exist, the target eNB shall ignore the message.

8.3 Global Procedures

8.3.1 Load Indication

8.3.1.1 General

The purpose of the Load Indication procedure is to transfer load and interference co-ordination information between intra-frequency neighboring eNBs.

The procedure uses non UE associated signalling.

8.3.1.2 Successful Operation

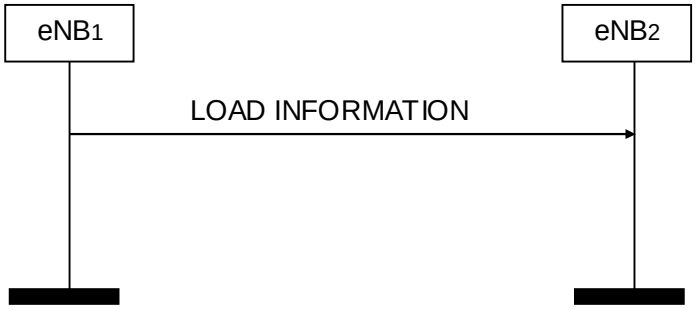

Figure 8.3.1.2-1: Load Indication

An eNB initiates the procedure by sending LOAD INFORMATION message to intra-frequency neighbouring eNBs.

If the *UL Interference Overload Indication* IE is received in the LOAD INFORMATION message, it indicates the interference level experienced by the sending eNB on some resource blocks. The receiving eNB may take such information into account when setting its scheduling policy and shall consider the received *UL Interference Overload Indication* IE value valid until reception of a new LOAD INFORMATION message carrying an update of the same IE.

If the *UL High Interference Indication* IE is received in the LOAD INFORMATION message, it indicates, per PRB, the occurrence of high interference sensitivity, as seen from the sending eNB. The receiving eNB should try to avoid scheduling cell edge UEs in its cells for the concerned PRBs. The *Target Cell ID* IE received within the *UL High Interference Information* IE group in the LOAD INFORMATION message indicates the cell for which the corresponding UL High Interference Indication is meant. The receiving eNB shall consider the value of the *UL High Interference Information* IE group valid until reception of a new LOAD INFORMATION message carrying an update.

If the *Maximum Tx Power per PRB Normalized* IE is received in the LOAD INFORMATION message, it indicates, per PRB, whether downlink transmission power exceeds a certain threshold (FFS). The receiving eNB may take such information into account when setting its scheduling policy and shall consider the received *Maximum Tx Power per PRB Normalized* IE value valid until reception of a new LOAD INFORMATION message carrying an update.

8.3.1.3 Unsuccessful Operation

Not applicable.

8.3.1.4 Abnormal Conditions

Void.

8.3.2 Error Indication

Editor Note: Used by peer node to report detected errors in a received message.

8.3.2.1 General

The Error Indication procedure is initiated by an eNB to report detected errors in one incoming message, provided they cannot be reported by an appropriate failure message.

If the error situation arises due to reception of a message utilising UE associated signalling, then the Error Indication procedure uses UE associated signalling. Otherwise the procedure uses non UE associated signalling.

8.3.2.2 Successful Operation

Figure 8.3.2.2-1: Error Indication, successful operation.

When the conditions defined in clause 10 are fulfilled, the Error Indication procedure is initiated by an ERROR INDICATION message sent from the node detecting the error situation.

The ERROR INDICATION message shall contain at least either the *Cause* IE or the *Criticality Diagnostics* IE.

In case the Error Indication procedure is triggered by UE associated signalling the *Old eNB UE X2AP ID IE* and *New eNB UE X2AP ID IE* shall be included in the ERROR INDICATION message. If one or both of *Old eNB UE X2AP ID* IE and *New eNB UE X2AP ID* IE are not correct, the cause shall be set to appropriate value e.g. 'unknown Old eNB UE X2AP ID', 'unknown New eNB UE X2AP ID' or 'unknown pair of UE X2AP ID '.

8.3.2.3 Unsuccessful Operation

Not applicable.

8.3.2.4 Abnormal Conditions

Not applicable.

8.3.3 X2 Setup

8.3.3.1 General

The purpose of the X2 Setup procedure is to exchange application level data needed for two eNBs to interoperate correctly over the X2 interface.

The procedure uses non UE associated signalling.

8.3.3.2 Successful Operation

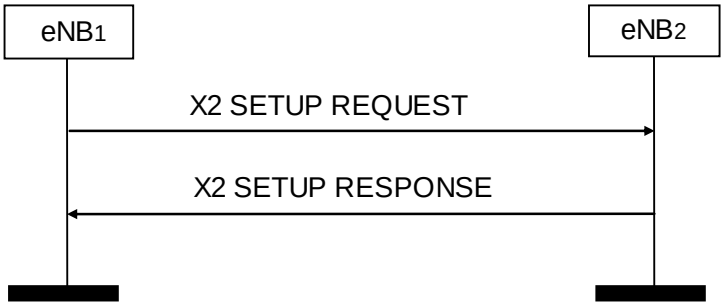

Figure 8.3.3.2-1: X2 Setup, successful operation

An eNB, initiates the procedure by sending an X2 SETUP REQUEST to a candidate eNB. Candidate eNB replies with X2 SETUP RESPONSE. The initiating eNB transfers a list of served cells to the candidate eNB. Candidate eNB replies with a list of its served cells.

8.3.3.3 Unsuccessful Operation

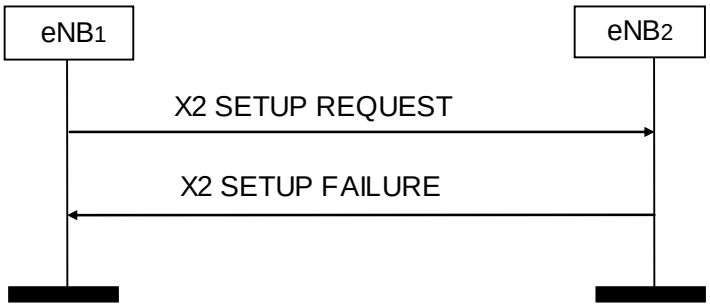

Figure 8.3.3.3-1: X2 Setup, unsuccessful operation

If the candidate eNB can not accept the setup it shall respond with an X2 SETUP FAILURE with appropriate cause value.

If the X2 SETUP FAILURE messages include the *Time To Wait* IE the eNB shall wait at least for the indicated time before reinitiating the X2 setup towards the same eNB.

8.3.3.4 Abnormal Conditions

If X2 SETUP REQUEST is not the first message received for a specific TNL association then this shall be treated as a logical error.

8.3.4 Reset

8.3.4.1 General

The purpose of the Reset procedure is to align the resources in eNB1 and eNB2 in the event of an abnormal failure. The procedure resets the whole X2 interface.

The procedure uses non UE associated signalling.

8.3.4.2 Successful Operation

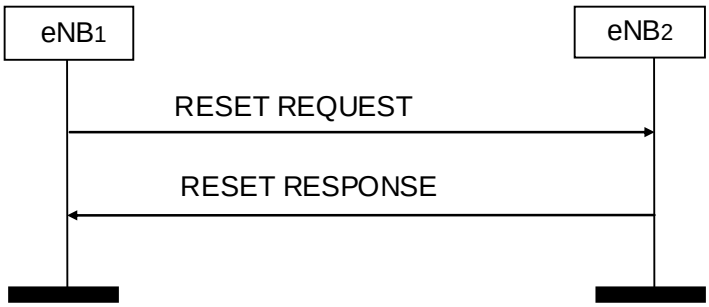

Figure 8.3.4.2-1: Reset, successful operation

The procedure is initiated with a RESET REQUEST message sent from the eNB_1 to the eNB_2. Upon receipt of this message, eNB_2 shall abort any other ongoing procedures over X2 between eNB_1 and eNB_2. The eNB_2 shall delete all the context information related to the eNB_1 including the X2AP ID for the contexts. After completion of release of the resources, the eNB_2 shall respond with a RESET RESPONSE message.

8.3.4.3 Unsuccessful Operation

Void.

8.3.4.4 Abnormal Conditions

If the RESET REQUEST message is received, any other ongoing procedure (except another Reset procedure) on the same X2 interface shall be aborted.

If Reset procedure is ongoing and eNB receives a RESET REQUEST message from the peer entity on the same X2 interface, the eNB shall respond with RESET RESPONSE message as described in 8.3.4.2.

8.3.5 eNB Configuration Update

8.3.5.1 General

The purpose of the eNB Configuration Update procedure is to update application level data needed for two eNBs to interoperate correctly over the X2 interface.

8.3.5.2 Successful Operation

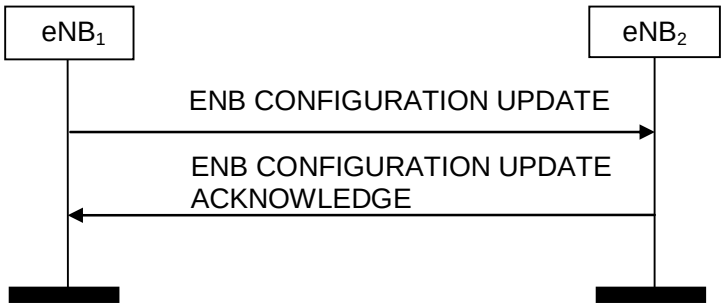

Figure 8.3.5.2-1: eNB Configuration Update, successful operation

An eNB initiates the procedure by sending an ENB CONFIGURATION UPDATE to a peer eNB. The initiating eNB exchanges all Served Cell information for cells added or modified, modified cells are also identified by adding the old Cell Global Identifier to the list of Served Cell information. Deleted cells are identified through the old Cell Global Identifier only.

Upon reception of ENB CONFIGURATION UPDATE, the eNB shall update cell information accordingly and reply with the ENB CONFIGURATION UPDATE ACKNOWLEDGE message to inform the initiating eNB that the requested update of application data was performed successfully. In case the peer eNB receives an ENB CONFIGURATION UPDATE without any *Served Cells to add* IE, *Served Cells to modify* IE or *Served Cells to delete* IE it should reply with ENB CONFIGURATION UPDATE ACKNOWLEDGE message without performing any updates to the existing configuration.

8.3.5.3 Unsuccessful Operation

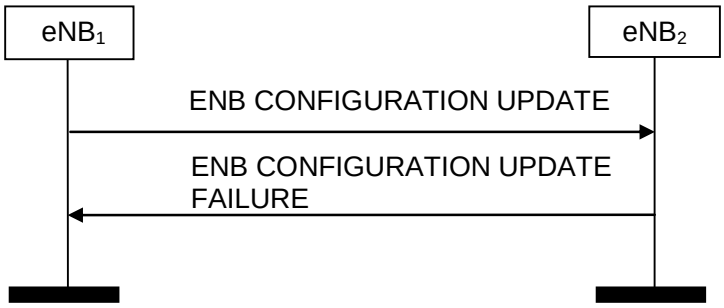

Figure 8.3.x.3-1: eNBConfiguration Update, unsuccessful operation

If the eNB can not accept the update it shall respond with an ENB CONFIGURATION UPDATE FAILURE message and appropriate cause value.

If the ENB CONFIGURATION UPDATE FAILURE message includes the *Time To Wait* IE the eNB shall wait at least for the indicated time before reinitiating the eNB Configuration Update procedure towards the same eNB. Both nodes shall continue to operate the X2 with the existing configuration data.

8.3.6 Resource Status Update Initiation

8.3.6.1 General

This procedure is used by an eNB to request the reporting of load measurements to another eNB.

8.3.6.2 Successful Operation

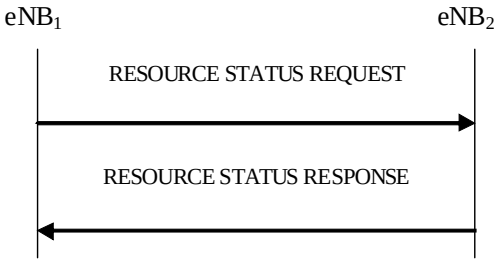

Figure 8.3.6.2-1: Resource Status Initiation, successful operation

The procedure is initiated with a RESOURCE STATUS REQUEST message sent from eNB1 to eNB2. Upon receipt, eNB2 shall initiate the requested measurement according to the parameters given in the request in case the *Registration Request* IE set to 'start' and shall terminate the reporting in case the *Registration Request* IE set to 'stop'.

Reporting Periodicity

If *Reporting Period* IE is included, eNB2 shall use it as the reporting period. If this value is not specified, eNB2 shall apply a default value or shall fail the procedure.

Cell Id List

If the cell Id list is included, eNB2 shall perform and report measurements only for the cells included in the list. If this value is not specified, eNB2 shall report all the cells it controls.

Response message
If eNB2 was able to initiate the measurement requested by eNB1, it shall respond with the RESOURCE STATUS RESPONSE message.

8.3.6.3 Unsuccessful Operation

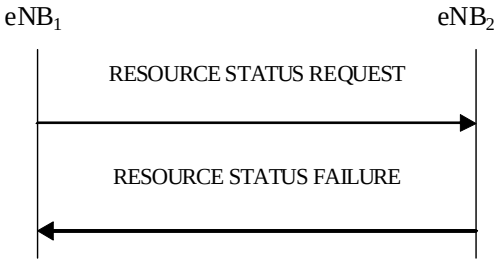

Figure 8.3.6.3-1: Resource Status Initiation, unsuccessful operation

If the requested measurement cannot be initiated, eNB2 shall send a RESOURCE STATUS FAILURE message. The message shall include the *Cause* IE set to an appropriate value.

8.3.6.4 Abnormal Conditions

Void

8.3.7 Resource Status Reporting

8.3.7.1 General

This procedure is used by a eNB2 to report the result of measurements requested by eNB1 using the Resource Status Update Initiation.

8.3.7.2 Successful Operation

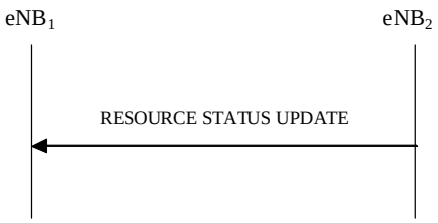

Figure 8.3.7.2-1: Resource Status Reporting, successful operation

Report Contents

The eNB2 shall report the results of the measurements in RESOURCE STATUS UPDATE message for each requested cell.

Editor Note: The report contents are FFS.

9 Elements for X2AP Communication

9.1 Message Functional Definition and Content

Editors Note: Details on the Connection Management Identifiers is FFS. When general principles and consistency with S1AP has been decided all X2AP procedures will need to be revised.

9.1.1 Messages for Basic Mobility Procedures

9.1.1.1 HANDOVER REQUEST

This message is sent by the source eNB to the target eNB to request the preparation of resources for a handover.

Direction: source eNB → target eNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	reject
Old eNB UE X2AP ID	M		INTEGER (0..4095)	eNB UE X2AP ID allocated at the old eNB	YES	reject
Cause	M		9.2.8		YES	ignore
Target Cell ID	M		CGI 9.2.16		YES	reject
GUMMEI	M		9.2.18		YES	reject
UE Context Information	M				YES	reject
> MME UE S1AP ID	M		INTEGER ($0..2^{32}-1$)	MME UE S1AP ID allocated at the MME	–	–
> Aggregate Maximum Bit Rate	O		9.2.14		–	–
> SAE Bearers To Be Setup List	M				–	–
>> SAE Bearer Info		1 to <maxnoof SAEbearers>			EACH	ignore
>>> SAE Bearer ID	M		BIT STRING (SIZE (8))		–	–
>>> SAE Bearer Level QoS Parameters	M		9.2.11	Inlcudes necessary QoS parameters	–	–
>>> DL Forwarding	O		9.2.7		–	–
>>> UL GTP Tunnel Endpoint	M		GTP Tunnel Endpoint 9.2.1	SGW tunnel endpoint. For delivery of UL PDUs	–	–
> RRC Context	M		OCTET STRING	to transfer UE RAN context, details are FFS	–	–
>Handover Restriction List	O		9.2.5		–	–
>Location Reporting Information	O		9.2.23	Includes the necessary parameters for location reporting	–	–
UE History Information	O		9.2.3		YES	ignore
Trace activation	O		9.2.2		YES	ignore

Editors Note: The details of required IEs to transfer RRC context, security information, roaming restriction information, potentially some user plane related context, etc., are left FFS.

Range bound	Explanation
maxnoofSAEbearers	Maximum no. of SAE bearers. Value is 256(FFS).

9.1.1.2 HANDOVER REQUEST ACKNOWLEDGE

This message is sent by the target eNB to inform the source eNB about the prepared resources at the target.

Direction: target eNB → source eNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	reject
Old eNB UE X2AP ID	M		INTEGER (0..4095)	eNB UE X2AP ID allocated at the old eNB	YES	reject
New eNB UE X2AP ID	M		INTEGER (0..4095)	New eNB UE X2AP ID allocated at the new eNB	YES	reject
SAE Bearers Admitted List	O				YES	ignore
> SAE Bearer Info		1 to <maxnoof SAEbearers>			EACH	ignore
>> SAE Bearer ID	M		BIT STRING (SIZE (8))		–	–
>> UL GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	Target eNB tunnel endpoint. For delivery of UL PDUs	–	–
>> DL GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	Target eNB tunnel endpoint. For delivery of DL PDUs	–	–
SAE Bearers Not Admitted List	O				YES	ignore
> SAE Bearer Info		1 to <maxnoof SAEbearers>			EACH	ignore
>> SAE Bearer ID	M		BIT STRING (SIZE (8))		–	–
>> Cause	M		9.2.8		–	–
Target eNodeB to Source eNodeB Transparent Container	M		OCTET STRING	It includes HO info for the UE	YES	ignore
Criticality Diagnostics	O		9.2.9		YES	ignore

Range bound	Explanation
maxnoofSAEbearers	Maximum no. of SAE bearers. Value is 256(FFS).

9.1.1.3 HANDOVER PREPARATION FAILURE

This message is sent by the target eNB to inform the source eNB that the Handover Preparation has failed.

Direction: target eNB → source eNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	reject
Old eNB UE X2AP ID	M		INTEGER (0..4095)	eNB UE X2AP ID allocated at the old eNB	YES	reject
Cause	M		9.2.8		YES	ignore
Criticality Diagnostics	O		9.2.9		YES	ignore

9.1.1.4 SN STATUS TRANSFER

This message is sent by the source eNB to the target eNB to transfer the uplink/downlink PDCP-SN status during a handover.

Direction: source eNB → target eNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	ignore
Old eNB UE X2AP ID	M		INTEGER (0..4095)	eNB UE X2AP ID allocated at the old eNB	YES	reject
New eNB UE X2AP ID	M		INTEGER (0..4095)	eNB UE X2AP ID allocated at the new eNB	YES	reject
SAE Bearers Subject to Status Transfer List	M				YES	ignore
>SAE Bearers Subject to Status Transfer Item		1 to <maxnoof SAEbearers>			EACH	ignore
>> SAE Bearer ID	M		BIT STRING (SIZE (8))		–	–
>> Receive status of UL PDCP SDUs	O		BIT STRING (SIZE (4096))	PDCP Sequence Number = (First Missing SDU Number + bit position) modulo 4096 0: PDCP SDU has not been received. 1: PDCP SDU has been received correctly.	–	–
>> UL COUNT value	M		9.2.17	PDCP-SN and Hyper Frame Number of the first missing UL SDU	–	–
>> DL COUNT value	M		9.2.17	PDCP-SN and Hyper frame number that the target eNB should assign for the next DL SDU not having an SN yet	–	–

Range bound	Explanation
maxnoofSAEbearers	Maximum no. of SAE bearers. Value is 256 FFS.

9.1.1.5 UE CONTEXT RELEASE

This message is sent by the target eNB to the source eNB to indicate that resources can be released.

Direction: target eNB → source eNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	ignore
Old eNB UE X2AP ID	M		INTEGER (0..4095)	eNB UE X2AP ID allocated at the old eNB	YES	reject
New eNB UE X2AP ID	M		INTEGER (0..4095)	eNB UE X2AP ID allocated at the new eNB	YES	reject

9.1.1.6 HANDOVER CANCEL

This message is sent by the source eNB to the target eNB to cancel an ongoing handover.

Direction: source eNB → target eNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	ignore
Old eNB UE X2AP ID	M		INTEGER (0..4095)	eNB UE X2AP ID allocated at the old eNB	YES	reject
New eNB UE X2AP ID	M		INTEGER (0..4095)	eNB UE X2AP ID allocated at the new eNB	YES	reject
Cause	M		9.2.8		YES	ignore

9.1.2 Messages for global procedures

9.1.2.1 LOAD INFORMATION

This message is sent by an eNB to neighbouring eNBs to transfer load and interference co-ordination information.

Direction: $eNB_1 \rightarrow eNB_2$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	ignore
Cell Information		*1 to maxCellineNB*			EACH	ignore
>Cell ID	M		9.2.16	Id of the source cell	-	
>UL Interference Overload Indication	O		9.2.19		-	
> UL High Interference Information		*0 to maxCellineNB*			-	
>>UL High Interference Indication	M		9.2.20		-	
>>Target Cell ID	M		9.2.16	Id of the cell for which the HII is meant	-	
>Maximum Tx Power per PRB normalized	O		9.2.21		-	

Range bound	Explanation
maxCellineNB	Maximum no. cells that can be served by an eNB. Value is 256 FFS.

9.1.2.2 ERROR INDICATION

This message is used to indicate that some error has been detected in the eNB.

Direction: eNB1 → eNB2

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	ignore
Old eNB UE X2AP ID	O		INTEGER (0..4095)		YES	ignore
New eNB UE X2AP ID	O		INTEGER (0..4095)		YES	ignore
Cause	O		9.2.8		YES	ignore
Criticality Diagnostics	O		9.2.9		YES	ignore

9.1.2.3 X2 SETUP REQUEST

This message is sent by an eNB to a neighbouring eNB to transfer the initialization information for a TNL association.

Direction: eNB1 → eNB2.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	reject
eNB Global ID	M		INTEGER (0..65535)	Coding FFS	YES	reject
Served Cells		*1 to maxnoofCelline NB*		This is all the eNB cells	YES	reject
>Served Cell information	M		9.2.10		–	–
GU Group Id List		*0 to maxnoofPools*		This is all the pools to which the eNB belongs to	YES	reject
>GU Group Id	M		9.2.22		-	-

Range bound	Explanation
maxnoofPools	Maximum no. of pools an eNB can belong to. Value is 16 FFS.

9.1.2.4 X2 SETUP RESPONSE

This message is sent by an eNB to a neighbouring eNB to transfer the initialization information for a TNL association.

Direction: eNB2 → eNB1.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	reject
eNB Global ID	M		INTEGER (0..65535)	Coding FFS	YES	reject
Served Cells		*1 to maxnoofCellineNB*		This is all the eNB cells	YES	reject
>Served Cell information	M		9.2.10		–	–
GU Group Id List		*0 to maxnoofPools*		This is all the pools to which the eNB belongs to	YES	reject
>GU Group Id	M		9.2.22		-	-
Criticality Diagnostics	O		9.2.9		YES	ignore

Range bound	Explanation
maxnoofPools	Maximum no. of pools an eNB can belong to. Value is 16 FFS.

9.1.2.5 X2 SETUP FAILURE

This message is sent by the eNB to indicate X2 Setup failure.

Direction: eNB2 → eNB1.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	reject
Cause	M		9.2.8		YES	ignore
Time To Wait	O		OCTET STRING	Coding FFS	YES	ignore
Criticality Diagnostics	O		9.2.9		YES	ignore

9.1.2.6 RESET REQUEST

This message is sent from one eNB to another eNB and is used to request that the X2 interface between the two eNB to be reset.

Direction: eNB1 → eNB2.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	reject
Cause	M		9.2.8		YES	ignore

9.1.2.7 RESET RESPONSE

This message is sent by a eNB as a response to a RESET REQUEST message.

Direction: eNB2 → eNB1.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	reject
Criticality Diagnostics	O		9.2.9		YES	ignore

9.1.2.8 ENB CONFIGURATION UPDATE

This message is sent by an eNB to a peer eNB to transfer updated information for a TNL association.

Direction: eNB1 → eNB2.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	reject
Served Cells to add		*0 to maxnoofCellineNB*			GLOBAL	reject
>Served Cell information	M		9.2.10		–	–
Served Cells to modify		*0 to maxnoofCellineNB*			GLOBAL	reject
>Old CGI	M		9.2.16	This is the old Cell Global Indentfier	-	-
>Served Cell information	M		9.2.10		–	–
Served Cells to delete		*0 to maxnoofCellineNB*			GLOBAL	reject
>Old CGI	M		9.2.16	This is the old Cell Global Indentfier of the cell to be deleted	-	-

9.1.2.9 ENB CONFIGURATION UPDATE ACKNOWLEDGE

This message is sent by an eNB to a peer eNB to acknowledge update of information for a TNL association.

Direction: eNB2 → eNB1.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	reject
Criticality Diagnostics	O		9.2.9		YES	ignore

9.1.2.10 ENB CONFIGURATION UPDATE FAILURE

This message is sent by an eNB to a peer eNB to indicate eNB Configuration Update Failure.

Direction: eNB2 → eNB1.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	reject
Cause	M		9.2.8		YES	ignore
Time to wait	M		OCTET STRING		YES	ignore
Criticality Diagnostics	O		9.2.9		YES	ignore

9.1.2.11 RESOURCE STATUS REQUEST

This message is sent by an eNB1 to neighbouring eNB2 to initiate the requested measurement according to the parameters given in the message.

Direction: eNB1 → eNB2.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	reject
Registration Request	M		ENUMERATED(Start, Stop)			
Cell To Report List		0 to maxCellineNB			EACH	ignore
>Cell ID	M		9.2.16	Cell ID list for which measurement is needed		
Reporting Periodicity	O		ENUMERATED (FFS)	Unit: FFS Range:FFS	YES	ignore

Range bound	Explanation
maxCellineNB	Maximum no. cells that can be served by an eNB. Value is 256 FFS

9.1.2.12 RESOURCE STATUS RESPONSE

This message is sent by the eNB2 to indicate that the requested measurements are successfully initiated. Direction: eNB2 → eNB1.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	reject
Criticality Diagnostics	O		9.2.9		YES	ignore

9.1.2.13 RESOURCE STATUS FAILURE

This message is sent by the eNB2 to indicate requested measurements cannot be initiated.

Direction: eNB2 → eNB1.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	reject
Cause	M		9.2.8		YES	ignore
Criticality Diagnostics	O		9.2.9		YES	ignore

9.1.2.14 RESOURCE STATUS UPDATE

This message is sent by eNB2 to neighbouring eNB1 to report the results of the requested measurements.

Direction: eNB2 → eNB1.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	reject
Cell Measurement Result		*1 to maxCellineNB*			EACH	ignore
>Cell ID	M		9.2.16			
> Resource Status	O		INTEGER	The content is FFS.		

Range bound	Explanation
maxCellineNB	Maximum no. cells that can be served by an eNB. Value is 256 FFS

9.2 Information Element definitions

9.2.1 GTP Tunnel Endpoint

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Transport Layer Address	M		BIT STRING (SIZE(1..160, ...))	For details on the Transport Layer Address, see ref. [8]		
GTP TEID	M		OCTET STRING (SIZE (4))			

9.2.2 Trace activation

Defines parameters related to trace activation.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Trace Reference	M		OCTET STRING (8)			
Interfaces To Trace		1 to <maxInterfaces>				
>Interface	M		ENUMERATED (s1, x2 Uu, ...)			
>Trace depth	M		ENUMERATED(minimum, medium, maximum, vendorMinimum, vendorMedium, vendorMaximum, ...)	Defined in [7]		

Range bound	Explanation
maxInterfaces	Maximum no. of Interface. Value is FFS.

9.2.3 UE History Information

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Last Visited Cell List		1 to MaxNrOfCells		Most recent information is added to the top of this list		
>Last Visited Cell Information	M		9.2.4			

Editors Note: Maximum size of the list (MaxNrOfCells) is FFS.

9.2.4 Last Visited Cell Information

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Global Cell ID	M		9.2.16			
Cell type	M		ENUMERATED(macro, micro, pico, femto)			
Time UE stayed in cell	O		INTEGER	In seconds		

Editors Note: The definition of 'Cell Type' is FFS

9.2.5 Handover Restriction list

This IE defines area roaming or access restrictions for handover. If the eNB receives the Handover Restriction List, it shall overwrite previously received restriction information.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Serving PLMN	M		9.2.6			
Equivalent PLMNs		0..<maxnoofEPLMNs>		Allowed PLMNs in addition to Serving PLMN. This list corresponds to the list of 'equivalent PLMNs' as defined in [TS 24.008].		
>PLMN Identity	M		9.2.6			
Forbidden TAs		0..<maxnoofEPLMNsPlusOne>		intra E-UTRAN roaming restrictions		
>PLMN Identity	M		9.2.6	The PLMN of forbidden TACs		
>Forbidden TACs		1..<maxnoofForbTACs>				
>>TAC	M		OCTET STRING	The forbidden TAC		
Forbidden LAs		0..<maxnoofEPLMNsPlusOne>		inter-3GPP RAT roaming restrictions		
>PLMN Identity	M		9.2.6			
>Forbidden LACs		1..<maxnoofForbLACs>				
>>LAC	M		OCTET STRING(2)			
Forbidden inter RATs	O		ENUMERATED(ALL, GERAN, UTRAN, …)	inter-3GPP RAT access restrictions		

Range bound	Explanation
maxnoofEPLMNs	Maximum no. of equivalent PLMN Ids. Value is 15.
maxnooffEPLMNsPlusOne	Maximum no. of equivalent PLMN Ids plus one. Value is 16.
maxnoofforbiddenTACs	Maximum no. of forbidden Tracking Area Codes. Value is 256.
maxnoofforbiddenLACs	Maximum no. of forbidden Location Area Codes. Value is 256.

9.2.6 PLMN Identity

This information element indicates the PLMN Identity.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
PLMN identity	M		OCTET STRING (SIZE (3))	- digits 0 to 9, encoded 0000 to 1001, - 1111 used as filler digit, two digits per octet, - bits 4 to 1 of octet n encoding digit 2n-1 - bits 8 to 5 of octet n encoding digit 2n -The Selected PLMN identity consists of 3 digits from MCC followed by either -a filler digit plus 2 digits from MNC (in case of 2 digit MNC) or -3 digits from MNC (in case of a 3 digit MNC).

9.2.7 DL Forwarding

This element indicates that the SAE bearer is proposed for forwarding of downlink packets.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
DL Forwarding	M		ENUMERATED (DL forwarding proposed, …)	

9.2.8 Cause

The purpose of the cause information element is to indicate the reason for a particular event for the whole protocol.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
CHOICE *Cause Group*	M			
>Radio Network Layer				
>>Radio Network Layer Cause	M		ENUMERATED (Unspecified, Handover Desirable for Radio Reasons, Time Critical Handover, Resource Optimisation Handover, Reduce Load in Serving Cell, Partial Handover, Unknown New eNB UE X2AP ID, Unknown Old eNB UE X2AP ID, Unknown Pair of UE X2AP ID, HO Target not Allowed, $T_{RELOCoverall}$ Expiry, $T_{RELOCprep}$ Expiry, Cell not Available, No Radio Resources Available in Target Cell, Invalid MME Group ID, Unknown MME Code, ...)	
>Transport Layer				
>>Transport Layer Cause	M		ENUMERATED (Transport Resource Unavailable, Unspecified, ...)	
>Protocol				
>>Protocol Cause	M		ENUMERATED (Transfer Syntax Error, Abstract Syntax Error (Reject), Abstract Syntax Error (Ignore and Notify), Message not Compatible with Receiver State, Semantic Error, Unspecified, Abstract Syntax Error (Falsely Constructed Message),...)	
>Misc				
>>Miscellaneous Cause	M		ENUMERATED (Control Processing Overload, Hardware Failure, O&M Intervention, Not enough User Plane Processing Resources, Unspecified,...)	

The meaning of the different cause values is described in the following table. In general, "not supported" cause values indicate that the concerned capability is missing. On the other hand, "not available" cause values indicate that the concerned capability is present, but insufficient resources were available to perform the requested action.

Radio Network Layer cause	Meaning
Handover Desirable for Radio Reasons	The reason for requesting handover is radio related.
Time Critical Handover	handover is requested for time critical reason i.e. this cause value is reserved to represent all critical cases where the connection is likely to be dropped if handover is not performed.
Resource Optimisation Handover	The reason for requesting handover is to improve the load distribution with the neighbour cells.
Reduce Load in Serving Cell	Load on serving cell needs to be reduced.
Partial Handover	Provides a reason for the handover cancellation. The target eNB did not admit all SAE Bearers included in the HANDOVER REQUEST and the source eNB estimated service continuity for the UE would be better by not proceeding with handover towards this particular target eNB.
Unknown New eNB UE X2AP ID	The action failed because the New eNB UE X2AP ID is unknown
Unknown Old eNB UE X2AP ID	The action failed because the Old eNB UE X2AP ID is unknown
Unknown Pair of UE X2AP ID	The action failed because the pair of UE X2 AP IDs is unknown
Handover Target not Allowed	Handover to the indicated target cell is not allowed for the UE in question
$T_{RELOCoverall}$ Expiry	The reason for the action is expiry of timer $T_{RELOCoverall}$
$T_{RELOCprep}$ Expiry	Handover Preparation procedure is cancelled when timer $T_{RELOCprep}$ expires.
Cell not Available	The concerned cell is not available.
No Radio Resources Available in Target Cell	The target cell doesn"t have sufficient radio resources available.
Invalid MME Group ID	The target eNB doesn"t belong to the same pool area of the source eNB i.e. S1 handovers should be attempted instead.
Unknown MME Code	The target eNB belongs to the same pool area of the source eNB and recognizes the MME Group ID. However, the MME Code is unknown to the target eNB.
Unspecified	Sent when none of the above cause values applies but still the cause is Radio Network Layer related

Transport Network Layer cause	Meaning
Transport resource unavailable	The required transport resources are not available
Unspecified	Sent when none of the above cause values applies but still the cause is Transport Network Layer related

Protocol cause	Meaning
Abstract Syntax Error (Reject)	The received message included an abstract syntax error and the concerned criticality indicated "reject" (see subclause 10.3)
Abstract Syntax Error (Ignore and Notify)	The received message included an abstract syntax error and the concerned criticality indicated "ignore and notify" (see subclause 10.3)
Abstract syntax error (falsely constructed message)	The received message contained IEs or IE groups in wrong order or with too many occurrences (see subclause 10.3)
Message not Compatible with Receiver State	The received message was not compatible with the receiver state (see subclause 10.4)
Semantic Error	The received message included a semantic error (see subclause 10.4)
Transfer Syntax Error	The received message included a transfer syntax error (see subclause 10.2)
Unspecified	Sent when none of the above cause values applies but still the cause is Protocol related

Miscellaneous cause	Meaning
Control Processing Overload	eNB control processing overload
Hardware Failure	eNB hardware failure
Not enough User Plane Processing Resources	eNB has insufficient user plane processing resources available
O&M Intervention	Operation and Maintenance intervention related to eNB equipment
Unspecified	Sent when none of the above cause values applies and the cause is not related to any of the categories Radio Network Layer, Transport Network Layer or Protocol.

9.2.9 Criticality Diagnostics

The *Criticality Diagnostics* IE is sent by the RNC or the CN when parts of a received message have not been comprehended or were missing, or if the message contained logical errors. When applicable, it contains information about which IEs were not comprehended or were missing.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Criticality Diagnostics				
>Procedure Code	O		INTEGER (0..255)	Procedure Code is to be used if Criticality Diagnostics is part of Error Indication procedure, and not within the response message of the same procedure that caused the error
>Triggering Message	O		ENUMERATED(initiating message, successful outcome, unsuccessful outcome, outcome)	The Triggering Message is used only if the Criticality Diagnostics is part of Error Indication procedure.
>Procedure Criticality	O		ENUMERATED(reject, ignore, notify)	This Procedure Criticality is used for reporting the Criticality of the Triggering message (Procedure).
Information Element Criticality Diagnostics		0 to <maxnoof errors>		
>IE Criticality	M		ENUMERATED(reject, ignore, notify)	The IE Criticality is used for reporting the criticality of the triggering IE. The value 'ignore' shall not be used.
>IE ID	M		INTEGER (0..65535)	The IE ID of the not understood or missing IE
>Type of Error	M		ENUMERATED(not understood, missing, …)	

Range bound	Explanation
maxnooferrors	Maximum no. of IE errors allowed to be reported with a single message. The value for maxnooferrors is 256.

9.2.10 Served Cell Information

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
PhyCID	M		OCTET STRING	Physical Cell ID	-	
Cell ID	M		CGI 9.2.16		-	
TAC	M		OCTET STRING	Tracking Area Code	-	
Broadcast PLMNs		1..<maxnoofBPLMNs>		Broadcast PLMNs	-	
>PLMN Identity	M		9.2.6		-	
Frequency	M		OCTET STRING	(Center frequency and/or frequency band)	-	

Range bound	Explanation
maxnoofBPLMNs	Maximum no. of Broadcast PLMN Ids. Value is FFS.

9.2.11 SAE Bearer Level QoS Parameters

This IE defines the QoS to be applied to a SAE bearer.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
SAE Bearer Level QoS Parameters				
>QCI	M		INTEGER (1..256)	Coded as specified in TS 23.401, which will be defined in SA2
>Allocation and Retention Priority	M (FFS)		OCTET STRING	The ARP definition is left FFS in SA2.
>SAE Bearer Type	M		9.2.12	Either GBR or non-GBR Bearer

9.2.12 SAE Bearer Type

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Choice **SAE Bearer Type**				
> SAE GBR bearer				
>> SAE Bearer Maximum Bit Rate Downlink	M		SAE Bearer Bit Rate 9.2.13	to be added
>> SAE Bearer Maximum Bit Rate Uplink	M		SAE Bearer Bit Rate 9.2.13	to be added
>> SAE Bearer Guaranteed Bit Rate Downlink	M		SAE Bearer Bit Rate 9.2.13	to be added
>> SAE Bearer Guaranteed Bit Rate Uplink	M		SAE Bearer Bit Rate 9.2.13	to be added
>SAE Non-GBR bearer				
>> Non GBR bearer			ENUMERATED (Non GBR bearer,…)	

9.2.13 SAE Bearer Bit Rate

IE/Group Name	Presence	Range	IE type and reference	Semantics description
SAE Bearer Bit Rate	M		INTEGER (0..10,000,000,000)	This IE indicates the number of bits delivered by E-UTRAN and to E-UTRAN within a period of time, divided by the duration of the period. The unit is: bit/s

9.2.14 Aggregate Maximum Bit Rate

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Aggregate Maximum Bit Rate				Applicable for non-GBR SAE Bearers, provided at initial context setup
>Aggregate Maximum Bit Rate Downlink	M		SAE Bearer Bit Rate 9.2.13	to be added
>Aggregate Maximum Bit Rate Uplink	M		SAE Bearer Bit Rate 9.2.13	to be added

9.2.15 Message Type

The *Message Type* IE uniquely identifies the message being sent. It is mandatory for all messages.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Message Type				Assumed max no of messages is 256.
>Procedure Code	M		(Handover Preparation, SN Status Transfer, Release Resource, Handover Cancel, Load Indication, Error Indication, X2 Setup, Reset, …)	
>Type of Message	M		CHOICE (Initiating Message, Successful Outcome, Unsuccessful Outcome, Outcome, …)	

9.2.16 CGI

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
CGI					-	
> PLMN identity	M		9.2.6		-	
> LAC	M		OCTET STRING (2)	0000 and FFFE not allowed.	-	
>CI	M		OCTET STRING (2)		-	

9.2.17 COUNT value

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
PDCP-SN	M		INTEGER (0..4095)		–	–
HFN	M		INTEGER (0..1048575)		–	–

9.2.18 GUMMEI

This information element indicates the global unique MME identity.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
GUMMEI				
>GU Group ID	M		9.2.22	
>MME code	M		OCTET STRING (SIZE(1))	

9.2.19 UL Interference Overload Indication

This IE provides, per PRB, a report on interference overload. The interaction between the indication of UL Interference Overload and UL High Interference is implementation specific.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
UL Interference Overload Indication List		0 to <maxnoofPRBs>		
>UL Interference Overload Indication	M		ENUMERATED (high interference, medium interference, low interference, …)	Each PRB is identified by its position in the list: the first element in the list corresponds to PRB 0, the second to PRB 1, etc.

Range bound	Explanation
maxnoofPRBs	Maximum no. Physical Resource Blocks. Value is 100 or 110 (FFS).

9.2.20 UL High Interference Indication

This IE provides, per PRB, a 2 level report on interference sensitivity. The interaction between the indication of UL Overload and UL High Interference is implementation specific.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
HII	O		BIT STRING (SIZE (1..110, …))	Each position in the bitmap represents a PRB (first bit=PRB 0 and so on), for which value "1" indicates "high interference sensitivity" and value "0" indicates "low interference sensitivity". The maximum number of Physical Resource Blocks is 100 or 110 (FFS)

9.2.21 Maximum Tx Power per PRB normalized

This IE provides per PRB an indication whether DL PRBs transmission power exceeds a threshold.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
DL Tx Power per PRB	O		BIT STRING (SIZE (1..110, …))	Each position in the bitmap represents a PRB (first bit=PRB 0 and so on), for which value "1" indicates "Tx exceeding threshold" and value "0" indicates "Tx not exceeding threshold". The maximum number of Physical Resource Blocks is 100 or 110 (FFS)

9.2.22 GU Group Id

The *GU Group Id* IE is the globally unique group id corresponding to a pool area.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
GU Group Id						
>PLMN Id	M		9.2.6			
>MME Group Id	M		OCTET STRING (SIZE(2))			

9.2.23 Location Reporting Information

This information element indicates how the location information should be reported.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Location Reporting Request Information				
>Event	M		ENUMERATED(Change of serving cell, …)	
>Report Area	M		ENUMERATED(E-UTRAN CGI, …)	

9.3 Message and Information Element Abstract Syntax (with ASN.1)

9.3.1 General

Subclause 9.3 presents the Abstract Syntax of the X2AP protocol with ASN.1. In case there is contradiction between the ASN.1 definition in this subclause and the tabular format in subclause 9.1 and 9.2, the ASN.1 shall take precedence, except for the definition of conditions for the presence of conditional elements, in which the tabular format shall take precedence.

The ASN.1 definition specifies the structure and content of X2AP messages. X2AP messages can contain any IEs specified in the object set definitions for that message without the order or number of occurrence being restricted by ASN.1. However, for this version of the standard, a sending entity shall construct a X2AP message according to the PDU definitions module and with the following additional rules (Note that in the following IE means an IE in the object set with an explicit id. If one IE needed to appear more than once in one object set, then the different occurrences have different IE ids):

- IEs shall be ordered (in an IE container) in the order they appear in object set definitions.
- Object set definitions specify how many times IEs may appear. An IE shall appear exactly once if the presence field in an object has value "mandatory". An IE may appear at most once if the presence field in an object has value "optional" or "conditional". If in a tabular format there is multiplicity specified for an IE (i.e. an IE list) then in the corresponding ASN.1 definition the list definition is separated into two parts. The first part defines an IE container list in which the list elements reside. The second part defines list elements. The IE container list appears as an IE of its own. For this version of the standard an IE container list may contain only one kind of list elements.

If a X2AP message that is not constructed as defined above is received, this shall be considered as Abstract Syntax Error, and the message shall be handled as defined for Abstract Syntax Error in clause 10.

Editors Note: Yellow highlight indicate text that has been proposed to be removed (further checking needed)

9.3.2 Usage of Private Message Mechanism for Non-standard Use

The private message mechanism for non-standard use may be used:

- for special operator (and/or vendor) specific features considered not to be part of the basic functionality, i.e. the functionality required for a complete and high-quality specification in order to guarantee multivendor inter-operability.
- by vendors for research purposes, e.g. to implement and evaluate new algorithms/features before such features are proposed for standardisation.

The private message mechanism shall not be used for basic functionality. Such functionality shall be standardised.

9.3.3 Elementary Procedure Definitions

```
-- **************************************************************
--
-- Elementary Procedure definitions
--
```

```
-- **************************************************************

X2AP-PDU-Descriptions {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) x2ap (2) version1 (1) x2ap-PDU-Descriptions (0) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

-- **************************************************************
--
-- IE parameter types from other modules.
--
-- **************************************************************

IMPORTS
    Criticality,
    ProcedureCode
FROM X2AP-CommonDataTypes


    ErrorIndication,
    HandoverRequest,
    HandoverRequestAcknowledge,
    HandoverPreparationFailure,
    SNStatusTransfer,
    UEContextRelease,
    HandoverCancel,
    LoadInformation,
    ResetRequest,
    ResetResponse,
    X2SetupRequest,
    X2SetupResponse,
    X2SetupFailure,
    ENBConfigurationUpdate,
    ENBConfigurationUpdateAcknowledge,
    ENBConfigurationUpdateFailure,
    ResourceStatusRequest,
    ResourceStatusResponse,
    ResourceStatusFailure,
    ResourceStatusUpdate



FROM X2AP-PDU-Contents

    id-errorIndication,
    id-handoverPreparation,
    id-snStatusTransfer,
    id-uEContextRelease,
    id-handoverCancel,
    id-loadIndication,
    id-reset,
```

```
    id-x2Setup,
    id-eNBConfigurationUpdate,
    id-resourceStatusUpdateInitiation,
    id-resourceStatusReporting



FROM X2AP-Constants;

-- ************************************************************
--
-- Interface Elementary Procedure Class
--
-- ************************************************************

X2AP-ELEMENTARY-PROCEDURE ::= CLASS {
    &InitiatingMessage              ,
    &SuccessfulOutcome              OPTIONAL,
    &UnsuccessfulOutcome                OPTIONAL,
    &procedureCode          ProcedureCode   UNIQUE,
    &criticality            Criticality     DEFAULT ignore
}
WITH SYNTAX {
    INITIATING MESSAGE      &InitiatingMessage
    [SUCCESSFUL OUTCOME     &SuccessfulOutcome]
    [UNSUCCESSFUL OUTCOME       &UnsuccessfulOutcome]
    PROCEDURE CODE          &procedureCode
    [CRITICALITY            &criticality]
}

-- ************************************************************
--
-- Interface PDU Definition
--
-- ************************************************************

X2AP-PDU ::= CHOICE {
    initiatingMessage   InitiatingMessage,
    successfulOutcome   SuccessfulOutcome,
    unsuccessfulOutcome UnsuccessfulOutcome,
    ...
}

InitiatingMessage ::= SEQUENCE {
    procedureCode   X2AP-ELEMENTARY-PROCEDURE.&procedureCode        ({X2AP-ELEMENTARY-PROCEDURES}),
    criticality X2AP-ELEMENTARY-PROCEDURE.&criticality      ({X2AP-ELEMENTARY-PROCEDURES}{@procedureCode}),
    value       X2AP-ELEMENTARY-PROCEDURE.&InitiatingMessage    ({X2AP-ELEMENTARY-PROCEDURES}{@procedureCode})
}

SuccessfulOutcome ::= SEQUENCE {
    procedureCode   X2AP-ELEMENTARY-PROCEDURE.&procedureCode        ({X2AP-ELEMENTARY-PROCEDURES}),
    criticality X2AP-ELEMENTARY-PROCEDURE.&criticality      ({X2AP-ELEMENTARY-PROCEDURES}{@procedureCode}),
    value       X2AP-ELEMENTARY-PROCEDURE.&SuccessfulOutcome    ({X2AP-ELEMENTARY-PROCEDURES}{@procedureCode})
}
```

```
UnsuccessfulOutcome ::= SEQUENCE {
    procedureCode   X2AP-ELEMENTARY-PROCEDURE.&procedureCode        ({X2AP-ELEMENTARY-PROCEDURES}),
    criticality X2AP-ELEMENTARY-PROCEDURE.&criticality      ({X2AP-ELEMENTARY-PROCEDURES}{@procedureCode}),
    value       X2AP-ELEMENTARY-PROCEDURE.&UnsuccessfulOutcome  ({X2AP-ELEMENTARY-PROCEDURES}{@procedureCode})
}


-- **************************************************************
--
-- Interface Elementary Procedure List
--
-- **************************************************************

X2AP-ELEMENTARY-PROCEDURES X2AP-ELEMENTARY-PROCEDURE ::= {
    X2AP-ELEMENTARY-PROCEDURES-CLASS-1          |
    X2AP-ELEMENTARY-PROCEDURES-CLASS-2          ,
    ...
}

X2AP-ELEMENTARY-PROCEDURES-CLASS-1 X2AP-ELEMENTARY-PROCEDURE ::= {
    handoverPreparation                                     |
    reset                                                   |
    x2Setup                                                 |
    resourceStatusUpdateInitiation                          |
    eNBConfigurationUpdate                                  ,
    ...
}

X2AP-ELEMENTARY-PROCEDURES-CLASS-2 X2AP-ELEMENTARY-PROCEDURE ::= {
    snStatusTransfer                        |
    uEContextRelease                |
    handoverCancel                          |
    errorIndication                         |
    resourceStatusReporting                 |   loadIndication                        ,
    ...

}


-- **************************************************************
--
-- Interface Elementary Procedures
--
-- **************************************************************

handoverPreparation X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      HandoverRequest
    SUCCESSFUL OUTCOME      HandoverRequestAcknowledge
    UNSUCCESSFUL OUTCOME    HandoverPreparationFailure
    PROCEDURE CODE          id-handoverPreparation
    CRITICALITY             reject
}
```

```
snStatusTransfer X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      SNStatusTransfer
    PROCEDURE CODE          id-snStatusTransfer
    CRITICALITY             ignore
}

uEContextRelease X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      UEContextRelease
    PROCEDURE CODE          id-uEContextRelease
    CRITICALITY             ignore
}


handoverCancel X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      HandoverCancel
    PROCEDURE CODE          id-handoverCancel
    CRITICALITY             ignore
}

errorIndication X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      ErrorIndication
    PROCEDURE CODE          id-errorIndication
    CRITICALITY             ignore
}

reset   X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      ResetRequest
    SUCCESSFUL OUTCOME      ResetResponse
    PROCEDURE CODE          id-reset
    CRITICALITY             reject
}

x2Setup X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      X2SetupRequest
    SUCCESSFUL OUTCOME      X2SetupResponse
    UNSUCCESSFUL OUTCOME    X2SetupFailure
    PROCEDURE CODE          id-x2Setup
    CRITICALITY             reject
}


loadIndication X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      LoadInformation
    PROCEDURE CODE          id-loadIndication
    CRITICALITY             ignore
}

eNBConfigurationUpdate      X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      ENBConfigurationUpdate
    SUCCESSFUL OUTCOME      ENBConfigurationUpdateAcknowledge
    UNSUCCESSFUL OUTCOME    ENBConfigurationUpdateFailure
    PROCEDURE CODE          id-eNBConfigurationUpdate
    CRITICALITY             reject
}
```

```
resourceStatusUpdateInitiation  X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      ResourceStatusRequest
    SUCCESSFUL OUTCOME      ResourceStatusResponse
    UNSUCCESSFUL OUTCOME    ResourceStatusFailure
    PROCEDURE CODE          id-resourceStatusUpdateInitiation
    CRITICALITY             reject
}

resourceStatusReporting X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      ResourceStatusUpdate
    PROCEDURE CODE          id-resourceStatusReporting
    CRITICALITY             ignore
}

END
```

9.3.4 PDU Definitions

```
-- **************************************************************
--
-- PDU definitions for X2AP.
--
-- **************************************************************

X2AP-PDU-Contents {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) x2ap (2) version1 (1) x2ap-PDU-Contents (1) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

-- **************************************************************
--
-- IE parameter types from other modules.
--
-- **************************************************************

IMPORTS
    AggregateMaximumBitRate,
    Bearer-ID,
    Cause,
    CGI,
    COUNTvalue,
    CriticalityDiagnostics,
    DL-Forwarding,
    ENB-Global-ID,
    GUGroupIDList,
    GUMMEI,
    HandoverRestrictionList,

    MaxTxPowerPRBNorm,
```

```
    LocationReportingInformation,
    PDCP-SN,
    PLMN-Identity,
    UE-S1AP-ID,
    ReceiveStatusofULPDCPSDUs,
    Registration-Request,
    RRC-Context,
    SAE-BearerLevel-QoS-Parameters,
    ServedCell-Information,
    ServedCells,
    TimeToWait,
    TraceActivation,
    TargeteNBtoSource-eNBTransparentContainer,
    TraceDepth,
    TraceReference,
    TransportLayerAddress,
    UE-HistoryInformation,
    UL-InterferenceOverloadIndication,
    UL-HighInterferenceIndicationInfo,
    GTPtunnelEndpoint,
    UE-X2AP-ID
FROM X2AP-IEs

    PrivateIE-Container{},
    ProtocolExtensionContainer{},
    ProtocolIE-ContainerList{},
    ProtocolIE-ContainerPair{},
    ProtocolIE-ContainerPairList{},
    ProtocolIE-Container{},
    ProtocolIE-Single-Container{},
    X2AP-PRIVATE-IES,
    X2AP-PROTOCOL-EXTENSION,
    X2AP-PROTOCOL-IES,
    X2AP-PROTOCOL-IES-PAIR
FROM X2AP-Containers

    id-Bearers-Admitted-Item,
    id-Bearers-Admitted-List,
    id-Bearers-NotAdmitted-Item,
    id-Bearers-NotAdmitted-List,
    id-Bearers-SubjectToStatusTransfer-List,
    id-Bearers-SubjectToStatusTransfer-Item,
    id-Cause,
    id-CellToReport,
    id-CellToReport-Item,
    id-CellMeasurementResult,
    id-CellMeasurementResult-Item,
    id-CellInformation,
    id-CellInformation-Item,
    id-CriticalityDiagnostics,
    id-ENB-Global-ID,
    id-GUGroupIDList,
    id-GUMMEI-ID,
    id-UE-ContextInformation,
```

```
    id-Bearers-ToBeSetup-Item,
    id-New-eNB-UE-X2AP-ID,
    id-Old-eNB-UE-X2AP-ID,
    id-Registration-Request,
    id-ReportingPeriodicity,
    id-ServedCells,
    id-TargetCell-ID,
    id-TargeteNBtoSource-eNBTransparentContainer,
    id-TimeToWait,
    id-TraceActivation,
    id-UE-HistoryInformation,
    id-UE-X2AP-ID,
    id-ServedCellsToAdd,
    id-ServedCellsToModify,
    id-ServedCellsToDelete,


    maxnoofBearers,
    maxnoofPDCP-SN,
    maxCellineNB
FROM X2AP-Constants;

-- **************************************************************
--
-- HANDOVER REQUEST
--
-- **************************************************************

HandoverRequest ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{HandoverRequest-IEs}},
    ...
}

HandoverRequest-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Old-eNB-UE-X2AP-ID              CRITICALITY reject  TYPE UE-X2AP-ID                PRESENCE mandatory } |
    { ID id-Cause                           CRITICALITY ignore  TYPE Cause                     PRESENCE mandatory } |
    { ID id-TargetCell-ID                   CRITICALITY reject  TYPE CGI                       PRESENCE mandatory } |
    { ID id-GUMMEI-ID                       CRITICALITY reject  TYPE GUMMEI                    PRESENCE mandatory } |
    { ID id-UE-ContextInformation           CRITICALITY reject  TYPE UE-ContextInformation     PRESENCE mandatory } |
    { ID id-UE-HistoryInformation           CRITICALITY ignore  TYPE UE-HistoryInformation     PRESENCE optional } |
    { ID id-TraceActivation                 CRITICALITY ignore  TYPE TraceActivation           PRESENCE optional } ,
    ...
}

UE-ContextInformation ::= SEQUENCE {
    mME-UE-S1AP-ID                      UE-S1AP-ID,
    aggregateMaximumBitRate             AggregateMaximumBitRate         OPTIONAL,
    bearers-ToBeSetup-List              Bearers-ToBeSetup-List,
    rRC-Context                         RRC-Context,

    locationReportingInformation        LocationReportingInformation    OPTIONAL,
    handoverRestrictionList             HandoverRestrictionList     OPTIONAL,

    iE-Extensions                       ProtocolExtensionContainer { {UE-ContextInformation-ExtIEs} } OPTIONAL,
```

```
    ...
}

UE-ContextInformation-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

Bearers-ToBeSetup-List ::= SEQUENCE (SIZE(0..maxnoofBearers)) OF ProtocolIE-Single-Container { {Bearers-ToBeSetup-ItemIEs} }

Bearers-ToBeSetup-ItemIEs   X2AP-PROTOCOL-IES ::= {
    { ID id-Bearers-ToBeSetup-Item   CRITICALITY ignore     TYPE Bearers-ToBeSetup-Item     PRESENCE mandatory },
    ...
}

Bearers-ToBeSetup-Item ::= SEQUENCE {
    sAE-Bearer-ID                   Bearer-ID,
    sAE-BearerLevel-QoS-Parameters      SAE-BearerLevel-QoS-Parameters,
    dL-Forwarding                   DL-Forwarding                                           OPTIONAL,
    uL-GTPtunnelEndpoint            GTPtunnelEndpoint,
    iE-Extensions                   ProtocolExtensionContainer { {Bearers-ToBeSetup-ItemExtIEs} } OPTIONAL,
    ...
}

Bearers-ToBeSetup-ItemExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}



-- **************************************************************
--
-- HANDOVER REQUEST ACKNOWLEDGE
--
-- **************************************************************

HandoverRequestAcknowledge ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{HandoverRequestAcknowledge-IEs}},
    ...
}

HandoverRequestAcknowledge-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Old-eNB-UE-X2AP-ID                          CRITICALITY reject  TYPE UE-X2AP-ID                                 PRESENCE mandatory}
|
    { ID id-New-eNB-UE-X2AP-ID                          CRITICALITY reject  TYPE UE-X2AP-ID                                 PRESENCE mandatory}
|
    { ID id-Bearers-Admitted-List                       CRITICALITY ignore  TYPE Bearers-Admitted-List                      PRESENCE optional }
|
    { ID id-Bearers-NotAdmitted-List                    CRITICALITY ignore  TYPE Bearers-NotAdmitted-List                   PRESENCE optional }
|
    { ID id-TargeteNBtoSource-eNBTransparentContainer   CRITICALITY ignore  TYPE TargeteNBtoSource-eNBTransparentContainer  PRESENCE mandatory
}|
    { ID id-CriticalityDiagnostics                      CRITICALITY ignore  TYPE CriticalityDiagnostics                     PRESENCE optional },

    ...
```

```
}

Bearers-Admitted-List       ::= SEQUENCE (SIZE (1..maxnoofBearers)) OF ProtocolIE-Single-Container { {Bearers-Admitted-ItemIEs} }

Bearers-Admitted-ItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-Bearers-Admitted-Item   CRITICALITY ignore  TYPE Bearers-Admitted-Item  PRESENCE mandatory  }
}

Bearers-Admitted-Item ::= SEQUENCE {
    bearer-ID                       Bearer-ID,
    uL-GTP-TunnelEndpoint           GTPtunnelEndpoint   OPTIONAL,
    dL-GTP-TunnelEndpoint           GTPtunnelEndpoint   OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { {Bearers-Admitted-Item-ExtIEs} } OPTIONAL,
    ...
}

Bearers-Admitted-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

Bearers-NotAdmitted-List        ::= SEQUENCE (SIZE (1..maxnoofBearers)) OF ProtocolIE-Single-Container { {Bearers-NotAdmitted-ItemIEs} }

Bearers-NotAdmitted-ItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-Bearers-NotAdmitted-Item    CRITICALITY ignore  TYPE Bearers-NotAdmitted-Item   PRESENCE mandatory   }
}

Bearers-NotAdmitted-Item ::= SEQUENCE {
    bearer-ID                       Bearer-ID,
    cause                           Cause,
    iE-Extensions                   ProtocolExtensionContainer { {Bearers-NotAdmitted-Item-ExtIEs} } OPTIONAL,
    ...
}

Bearers-NotAdmitted-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}


-- **************************************************************
--
-- HANDOVER PREPARATION FAILURE
--
-- **************************************************************

HandoverPreparationFailure ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{HandoverPreparationFailure-IEs}},
    ...
}

HandoverPreparationFailure-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Old-eNB-UE-X2AP-ID          CRITICALITY reject  TYPE UE-X2AP-ID             PRESENCE mandatory} |
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                  PRESENCE mandatory} |
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics PRESENCE optional },
```

```
    ...
}

-- **************************************************************
--
-- SN Status Transfer
--
-- **************************************************************

SNStatusTransfer ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{SNStatusTransfer-IEs}},
    ...
}

SNStatusTransfer-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Old-eNB-UE-X2AP-ID                      CRITICALITY reject  TYPE UE-X2AP-ID                                PRESENCE mandatory} |
    { ID id-New-eNB-UE-X2AP-ID                      CRITICALITY reject  TYPE UE-X2AP-ID                                PRESENCE mandatory} |
    { ID id-Bearers-SubjectToStatusTransfer-List    CRITICALITY ignore  TYPE Bearers-SubjectToStatusTransfer-List      PRESENCE mandatory} ,
    ...
}

Bearers-SubjectToStatusTransfer-List    ::= SEQUENCE (SIZE (1..maxnoofBearers)) OF ProtocolIE-Single-Container { { Bearers-SubjectToStatusTransfer-
ItemIEs} }

Bearers-SubjectToStatusTransfer-ItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-Bearers-SubjectToStatusTransfer-Item    CRITICALITY ignore  TYPE Bearers-SubjectToStatusTransfer-Item   PRESENCE mandatory   }
}

Bearers-SubjectToStatusTransfer-Item ::= SEQUENCE {
    bearer-ID                               Bearer-ID,

    receiveStatusofULPDCPSDUs               ReceiveStatusofULPDCPSDUs           OPTIONAL,
    uL-COUNTvalue                   COUNTvalue,
    dL-COUNTvalue                   COUNTvalue,
    iE-Extensions                           ProtocolExtensionContainer { {Bearers-SubjectToStatusTransfer-ItemExtIEs} } OPTIONAL,
    ...
}

Bearers-SubjectToStatusTransfer-ItemExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}




-- **************************************************************
--
-- UE Context Release
--
-- **************************************************************

UEContextRelease ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{UEContextRelease-IEs}},
```

```
    ...
}

UEContextRelease-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Old-eNB-UE-X2AP-ID          CRITICALITY reject  TYPE UE-X2AP-ID             PRESENCE mandatory} |
    { ID id-New-eNB-UE-X2AP-ID          CRITICALITY reject  TYPE UE-X2AP-ID             PRESENCE mandatory} ,
    ...
}


-- **************************************************************
--
-- HANDOVER CANCEL
--
-- **************************************************************

HandoverCancel ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{HandoverCancel-IEs}},
    ...
}

HandoverCancel-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Old-eNB-UE-X2AP-ID          CRITICALITY reject  TYPE UE-X2AP-ID             PRESENCE mandatory} |
    { ID id-New-eNB-UE-X2AP-ID          CRITICALITY reject  TYPE UE-X2AP-ID             PRESENCE mandatory} |
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                  PRESENCE mandatory} ,
    ...
}

-- **************************************************************
--
-- ERROR INDICATION
--
-- **************************************************************

ErrorIndication ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{ErrorIndication-IEs}},
    ...
}

ErrorIndication-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Old-eNB-UE-X2AP-ID          CRITICALITY ignore  TYPE UE-X2AP-ID                PRESENCE optional} |
    { ID id-New-eNB-UE-X2AP-ID          CRITICALITY ignore  TYPE UE-X2AP-ID                PRESENCE optional} |
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                     PRESENCE optional} |
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics    PRESENCE optional} ,
    ...
}

-- **************************************************************
--
-- Reset Request
--
-- **************************************************************
```

```
ResetRequest ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{ResetRequest-IEs}},
    ...
}

ResetRequest-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                     PRESENCE mandatory   },
    ...
}

-- **************************************************************
--
-- Reset Response
--
-- **************************************************************

ResetResponse ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{ResetResponse-IEs}},
    ...
}

ResetResponse-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-CriticalityDiagnostics  CRITICALITY ignore  TYPE CriticalityDiagnostics         PRESENCE optional },
    ...
}

-- **************************************************************
--
-- X2 SETUP REQUEST
--
-- **************************************************************

X2SetupRequest ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{X2SetupRequest-IEs}},
    ...
}

X2SetupRequest-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-ENB-Global-ID               CRITICALITY reject  TYPE ENB-Global-ID             PRESENCE mandatory} |
    { ID id-ServedCells                 CRITICALITY reject  TYPE ServedCells               PRESENCE mandatory} |
    { ID id-GUGroupIDList               CRITICALITY reject  TYPE GUGroupIDList             PRESENCE optional},
...
}



-- **************************************************************
--
-- X2 SETUP RESPONSE
--
-- **************************************************************

X2SetupResponse ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{X2SetupResponse-IEs}},
```

```
    ...
}

X2SetupResponse-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-ENB-Global-ID               CRITICALITY reject  TYPE ENB-Global-ID                PRESENCE mandatory} |
    { ID id-ServedCells                 CRITICALITY reject  TYPE ServedCells                  PRESENCE mandatory} |
    { ID id-GUGroupIDList               CRITICALITY reject  TYPE GUGroupIDList                PRESENCE optional}|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics       PRESENCE optional },

    ...
}



-- **************************************************************
--
-- X2 SETUP FAILURE
--
-- **************************************************************

X2SetupFailure ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{X2SetupFailure-IEs}},
    ...
}

X2SetupFailure-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Cause                   CRITICALITY ignore      TYPE Cause                          PRESENCE mandatory} |
    { ID id-TimeToWait              CRITICALITY ignore      TYPE TimeToWait                     PRESENCE optional} |
    { ID id-CriticalityDiagnostics  CRITICALITY ignore      TYPE CriticalityDiagnostics         PRESENCE optional },

    ...
}



-- **************************************************************
--
-- LOAD INFORMATION
--
-- **************************************************************

LoadInformation ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{LoadInformation-IEs}},
    ...
}

LoadInformation-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-CellInformation             CRITICALITY ignore  TYPE CellInformation-List       PRESENCE mandatory} ,
    ...
}

CellInformation-List        ::= SEQUENCE (SIZE (1..maxCellineNB)) OF ProtocolIE-Single-Container { {CellInformation-ItemIEs} }

CellInformation-ItemIEs X2AP-PROTOCOL-IES ::= {
```

```
    { ID id-CellInformation-Item    CRITICALITY ignore  TYPE CellInformation-Item   PRESENCE mandatory  }
}

CellInformation-Item ::= SEQUENCE {
    global-Cell-ID                          CGI,
    ul-InterferenceOverloadIndication       UL-InterferenceOverloadIndication       OPTIONAL,
    ul-HighInterferenceIndicationInfo       UL-HighInterferenceIndicationInfo       OPTIONAL,
    maxTxPowerPRBNorm                       MaxTxPowerPRBNorm                       OPTIONAL,
    iE-Extensions                           ProtocolExtensionContainer { {CellInformation-Item-ExtIEs} } OPTIONAL,
    ...
}

CellInformation-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

-- **************************************************************
--
-- ENB CONFIGURATION UPDATE
--
-- **************************************************************

ENBConfigurationUpdate ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{ENBConfigurationUpdate-IEs}},
    ...
}

ENBConfigurationUpdate-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-ServedCellsToAdd    CRITICALITY reject  TYPE ServedCells                PRESENCE optional} |
    { ID id-ServedCellsToModify CRITICALITY reject  TYPE ServedCellsToModify        PRESENCE optional} |
    { ID id-ServedCellsToDelete CRITICALITY reject  TYPE Old-CGIs                   PRESENCE optional} ,
    ...
}

ServedCellsToModify::= SEQUENCE (SIZE (1..maxCellineNB)) OF ServedCellsToModify-Item

ServedCellsToModify-Item::= SEQUENCE {
    old-cgi                         CGI,
    served-cells                    ServedCell-Information,
    ...
}

Old-CGIs::= SEQUENCE (SIZE (1..maxCellineNB)) OF CGI



-- **************************************************************
--
-- ENB CONFIGURATION UPDATE ACKNOWLEDGE
--
-- **************************************************************

ENBConfigurationUpdateAcknowledge ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{ENBConfigurationUpdateAcknowledge-IEs}},
```

```
    ...
}

ENBConfigurationUpdateAcknowledge-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics         PRESENCE optional   },
...
}

-- **************************************************************
--
-- ENB CONFIGURATION UPDATE FAIURE
--
-- **************************************************************

ENBConfigurationUpdateFailure ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{ENBConfigurationUpdateFailure-IEs}},
    ...
}

ENBConfigurationUpdateFailure-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                      PRESENCE mandatory   }|
    { ID id-TimeToWait                  CRITICALITY ignore  TYPE TimeToWait                 PRESENCE optional }|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics     PRESENCE optional },
    ...
}



-- **************************************************************
--
-- Resource Status Request
--
-- **************************************************************

ResourceStatusRequest ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{ResourceStatusRequest-IEs}},
    ...
}

ResourceStatusRequest-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Registration-Request    CRITICALITY reject  TYPE Registration-Request           PRESENCE mandatory} |
    { ID id-CellToReport            CRITICALITY ignore  TYPE CellToReport-List              PRESENCE optional} |
    { ID id-ReportingPeriodicity    CRITICALITY ignore  TYPE ReportingPeriod                PRESENCE optional} ,
    ...
}


CellToReport-List       ::= SEQUENCE (SIZE (1..maxCellineNB)) OF ProtocolIE-Single-Container { {CellToReport-ItemIEs} }

CellToReport-ItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-CellToReport-Item   CRITICALITY ignore  TYPE CellToReport-Item  PRESENCE mandatory  }
}

CellToReport-Item ::= SEQUENCE {
```

```
    cell-ID                             CGI,
    iE-Extensions                       ProtocolExtensionContainer { {CellToReport-Item-ExtIEs} } OPTIONAL,
    ...
}

CellToReport-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}


ReportingPeriod ::= ENUMERATED {ffs,...}
-- The Report Period gives the reporting periodicity in number of ffs ms periods.
-- E.g. value ffs means ffs ms
-- Unit ms, Step ffs ms

-- **************************************************************
--
-- Resource Status Response
--
-- **************************************************************

ResourceStatusResponse ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{ResourceStatusResponse-IEs}},
    ...
}

ResourceStatusResponse-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-CriticalityDiagnostics  CRITICALITY ignore  TYPE CriticalityDiagnostics         PRESENCE optional },
    ...
}


-- **************************************************************
--
-- Resource Status Failure
--
-- **************************************************************

ResourceStatusFailure ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{ResourceStatusFailure-IEs}},
    ...
}

ResourceStatusFailure-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Cause               CRITICALITY ignore  TYPE Cause          PRESENCE mandatory} |
    { ID id-CriticalityDiagnostics  CRITICALITY ignore  TYPE CriticalityDiagnostics         PRESENCE optional },
    ...
}


-- **************************************************************
--
-- Resource Status Reporting
--
```

```
-- **************************************************************

ResourceStatusUpdate ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{ResourceStatusUpdate-IEs}},
    ...
}

ResourceStatusUpdate-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-CellMeasurementResult   CRITICALITY ignore  TYPE CellMeasurementResult-List     PRESENCE mandatory},
    ...
}

CellMeasurementResult-List      ::= SEQUENCE (SIZE (1..maxCellineNB)) OF ProtocolIE-Single-Container { {CellMeasurementResult-ItemIEs} }

CellMeasurementResult-ItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-CellMeasurementResult-Item  CRITICALITY ignore  TYPE CellMeasurementResult-Item     PRESENCE mandatory  }
}

CellMeasurementResult-Item ::= SEQUENCE {
    cell-ID                         CGI,
    resoureStatus                   ResourceStatus          OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { {CellMeasurementResult-Item-ExtIEs} } OPTIONAL,
    ...
}

CellMeasurementResult-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

ResourceStatus          ::= INTEGER

-- **************************************************************
--
-- PRIVATE MESSAGE
--
-- **************************************************************

PrivateMessage ::= SEQUENCE {
    privateIEs      PrivateIE-Container  {{PrivateMessage-IEs}},
    ...
}

PrivateMessage-IEs X2AP-PRIVATE-IES ::= {
    ...
}

END
```

9.3.5 Information Element definitions

```
-- **************************************************************
--
-- Information Element Definitions
```

```
--
-- **************************************************************

X2AP-IEs {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) x2ap (2) version1 (1) x2ap-IEs (2) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    id-InterfacesToTrace-Item,
    maxInterfaces,
    maxNrOfErrors,
    maxnoofCells,
    maxnoofEPLMNs,
    maxnoofEPLMNsPlusOne,
    maxnoofForbLACs,
    maxnoofForbTACs,
    maxCellineNB,
    maxnoofBPLMNs,
    maxnoofPRBs,
    maxPools

FROM X2AP-Constants

    Criticality,
    ProcedureCode,
    ProtocolIE-ID,
    TriggeringMessage
FROM X2AP-CommonDataTypes

    ProtocolIE-Single-Container{},
    ProtocolExtensionContainer{},
    X2AP-PROTOCOL-IES,
    X2AP-PROTOCOL-EXTENSION
FROM X2AP-Containers;

-- A

AggregateMaximumBitRate ::= SEQUENCE {
    aggregateMaximumBitRateDownlink     SAE-Bearer-BitRate,
    aggregateMaximumBitRateUplink       SAE-Bearer-BitRate,
    ...
}

AllocationAndRetentionPriority ::= OCTET STRING


-- B

Bearer-ID ::= BIT STRING (SIZE (8))  -- To be checked, FFS
```

```
BroadcastPLMNs-Item ::= SEQUENCE (SIZE(1..maxnoofBPLMNs)) OF PLMN-Identity


-- C

Cause ::= CHOICE {
    radioNetwork        CauseRadioNetwork,
    transport           CauseTransport,
    protocol            CauseProtocol,
    misc                CauseMisc,
    ...
}

CauseMisc ::= ENUMERATED {
    control-processing-overload,
    hardware-failure,
    om-intervention,
    not-enough-user-plane-processing-resources,
    unspecified,
    ...
}

CauseProtocol ::= ENUMERATED {
    transfer-syntax-error,
    abstract-syntax-error-reject,
    abstract-syntax-error-ignore-and-notify,
    message-not-compatible-with-receiver-state,
    semantic-error,
    unspecified,
    abstract-syntax-error-falsely-constructed-message,
    ...
}

CauseRadioNetwork ::= ENUMERATED {
    handover-desirable-for-radio-reasons,
    time-critical-handover,
    resource-optimisation-handover,
    reduce-load-in-serving-cell,
    partial-handover,
    unknown-new-eNB-UE-X2AP-ID,
    unknown-old-eNB-UE-X2AP-ID,
    unknown-pair-of-UE-X2AP-ID,
    ho-target-not-allowed,
    trelocoverall-expiry,
    trelocprep-expiry,
    cell-not-available,
    no-radio-resources-available-in-target-cell,
    invalid-MME-GroupID,
    unknown-MME-Code,
    unspecified,
    ...

}
```

```
CauseTransport ::= ENUMERATED {
    transport-resource-unavailable,
    unspecified,
    ...
}

CellType ::= ENUMERATED{
    macro,
    micro,
    pico,
    femto,
    ...
}



CGI ::= SEQUENCE {
    pLMN-Identity           PLMN-Identity,
    lAC                     LAC,
    cI                      CI,
    iE-Extensions           ProtocolExtensionContainer { {CGI-ExtIEs} } OPTIONAL
}

CGI-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

CI                  ::= OCTET STRING (SIZE (2))

CriticalityDiagnostics ::= SEQUENCE {
    procedureCode                   ProcedureCode                   OPTIONAL,
    triggeringMessage               TriggeringMessage               OPTIONAL,
    procedureCriticality            Criticality                     OPTIONAL,
    iEsCriticalityDiagnostics       CriticalityDiagnostics-IE-List  OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { {CriticalityDiagnostics-ExtIEs} } OPTIONAL,
    ...
}

COUNTvalue ::= SEQUENCE {
    pDCP-SN         PDCP-SN,
    hFN             HFN,
    ...
}

CriticalityDiagnostics-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

CriticalityDiagnostics-IE-List ::= SEQUENCE (SIZE (1..maxNrOfErrors)) OF
    SEQUENCE {
        iECriticality           Criticality,
        iE-ID                   ProtocolIE-ID,
        typeOfError             TypeOfError,
```

```
        iE-Extensions           ProtocolExtensionContainer { {CriticalityDiagnostics-IE-List-ExtIEs} } OPTIONAL,
        ...
    }

CriticalityDiagnostics-IE-List-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}



-- D


DL-Forwarding ::= ENUMERATED {
    dL-forwardingProposed,
    ...
}

-- E

ENB-Global-ID       ::= INTEGER (0..65535)  -- Value to be checked FFS

EPLMNs ::= SEQUENCE (SIZE(1..maxnoofEPLMNs)) OF PLMN-Identity

EventType ::= ENUMERATED{
    change-of-serving-cell,
    ...
}


-- F

ForbiddenInterRATs ::= ENUMERATED {
    all,
    geran,
    utran,
    ...
}

ForbiddenTAs ::= SEQUENCE (SIZE(1.. maxnoofEPLMNsPlusOne)) OF ForbiddenTAs-Item

ForbiddenTAs-Item ::= SEQUENCE {
    pLMN-Identity       PLMN-Identity,
    forbiddenTACs       ForbiddenTACs
}

ForbiddenTACs ::= SEQUENCE (SIZE(1..maxnoofForbTACs)) OF TAC

ForbiddenLAs ::= SEQUENCE (SIZE(1..maxnoofEPLMNsPlusOne)) OF ForbiddenLAs-Item

ForbiddenLAs-Item ::= SEQUENCE {
    pLMN-Identity       PLMN-Identity,
    forbiddenLACs       ForbiddenLACs
}
```

```
ForbiddenLACs ::= SEQUENCE (SIZE(1..maxnoofForbLACs)) OF LAC

Frequency ::= OCTET STRING


-- G


GTPtunnelEndpoint ::= SEQUENCE {
    transportLayerAddress           TransportLayerAddress,
    gTP-TEID                        GTP-TEI,
    iE-Extensions                   ProtocolExtensionContainer { {GTPtunnelEndpoint-ExtIEs} } OPTIONAL,
    ...
}

GTPtunnelEndpoint-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

GTP-TEI                 ::= OCTET STRING (SIZE (4))

GUGroupIDList       ::= SEQUENCE (SIZE (1..maxPools)) OF GU-Group-ID


GU-Group-ID         ::= SEQUENCE {
    pLMN-Identity       PLMN-Identity,
    mME-Group-ID        MME-Group-ID,
    iE-Extensions       ProtocolExtensionContainer { {GU-Group-ID-ExtIEs} } OPTIONAL,
    ...
}

GU-Group-ID-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}


GUMMEI          ::= SEQUENCE {

    gU-Group-ID     GU-Group-ID,
    mMME-Code           MME-Code,
    iE-Extensions                   ProtocolExtensionContainer { {GUMMEI-ExtIEs} } OPTIONAL,
    ...
}

GUMMEI-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}



-- H

HandoverRestrictionList ::= SEQUENCE {
```

```
    servingPLMN                 PLMN-Identity,
    equivalentPLMNs             EPLMNs                  OPTIONAL,
    forbiddenTAs                ForbiddenTAs            OPTIONAL,
    forbiddenLAs                ForbiddenLAs            OPTIONAL,
    forbiddenInterRATs          ForbiddenInterRATs      OPTIONAL,
    iE-Extensions               ProtocolExtensionContainer { {HandoverRestrictionList-ExtIEs} } OPTIONAL,
    ...
}

HandoverRestrictionList-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

HFN ::= INTEGER (0..1048575)



-- I


InterfacesToTrace ::= SEQUENCE (SIZE(0..maxInterfaces)) OF ProtocolIE-Single-Container {{InterfacesToTrace-ItemIEs} }

InterfacesToTrace-ItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-InterfacesToTrace-Item  CRITICALITY ignore  TYPE InterfacesToTrace-Item     PRESENCE mandatory }
}

InterfacesToTrace-Item ::= SEQUENCE {
    traceInterface                  TraceInterface,
    traceDepth                      TraceDepth,
    iE-Extensions                   ProtocolExtensionContainer { {InterfacesToTrace-Item-ExtIEs} } OPTIONAL,
    ...
}

InterfacesToTrace-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}


-- J
-- K
-- L


LAC                 ::= OCTET STRING (SIZE (2)) --(EXCEPT ('0000'H|'FFFE'H))

LastVisitedCell-Item ::= SEQUENCE {
    global-Cell-ID                  CGI,
    cellType                        CellType,
    time-UE-StayedInCell            Time-UE-StayedInCell    OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { {LastVisitedCell-Item-ExtIEs} } OPTIONAL,
    ...
}

LastVisitedCell-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
```

```
    ...
}

LocationReportingInformation ::= SEQUENCE {
    eventType       EventType,
    reportArea      ReportArea,
    iE-Extensions       ProtocolExtensionContainer { {LocationReportingInformation-ExtIEs} } OPTIONAL,
    ...
}

LocationReportingInformation-ExtIEs X2AP-PROTOCOL-EXTENSION ::={
    ...
}

-- M

MaxTxPowerPRBNorm ::= BIT STRING (SIZE(1..110, ...))

MME-Group-ID    ::= OCTET STRING (SIZE (2))

MME-Code        ::= OCTET STRING (SIZE (1))

-- N


-- O
-- P

PDCP-SN ::= INTEGER (0..4095)

PhyCID ::= OCTET STRING


PLMN-Identity ::= OCTET STRING (SIZE(3))

-- Q

QCI ::= INTEGER (1..256)

-- R


ReceiveStatusofULPDCPSDUs ::= BIT STRING (SIZE(4096))

Registration-Request    ::= ENUMERATED {
    start,
    stop,
    ...
}

ReportArea ::= ENUMERATED{
    e-utran-cgi, -- FFS: The definition of E-UTRAN CGI
    ...
}
```

```
RRC-Context ::= OCTET STRING

-- S

SAE-Bearer-BitRate ::= INTEGER (0..210000000000)

SAE-BearerLevel-QoS-Parameters ::= SEQUENCE {
    qCI             QCI,
    allocationAndRetentionPriority  AllocationAndRetentionPriority,  --FFS
    sAE-BearerType          SAE-BearerType,
    ...
}


SAE-BearerType ::= CHOICE {
    sAE-GBR-bearer      SAE-GBR-Bearer,
    sAE-non-GBR-bearer      SAE-Non-GBR-Bearer,
    ...
}

SAE-GBR-Bearer ::= SEQUENCE {
    sAE-Bearer-MaximumBitrateDL         SAE-Bearer-BitRate,
    sAE-Bearer-MaximumBitrateUL         SAE-Bearer-BitRate,
    sAE-Bearer-GuaranteedBitrateDL      SAE-Bearer-BitRate,
    sAE-Bearer-GuaranteedBitrateUL      SAE-Bearer-BitRate,
    iE-Extensions                       ProtocolExtensionContainer { {SAE-GBR-Bearer-Parameters-ExtIEs} } OPTIONAL,
    ...
}

SAE-GBR-Bearer-Parameters-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}


SAE-Non-GBR-Bearer ::= SEQUENCE {
    sAE-non-GBR-Bearer-Type         SAE-Non-GBR-Bearer-Type,
    iE-Extensions                       ProtocolExtensionContainer { {SAE-non-GBR-Bearer-Parameters-ExtIEs} } OPTIONAL,
    ...
}

SAE-non-GBR-Bearer-Parameters-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

SAE-Non-GBR-Bearer-Type ::= ENUMERATED {
    non-GBR-Bearer,
    ...
}


ServedCells     ::= SEQUENCE (SIZE (1..maxCellineNB)) OF ServedCell-Information
```

```
ServedCell-Information ::= SEQUENCE {
    phyCID              PhyCID,
    cellId              CGI,
    tAC                 TAC,
    broadcastPLMNs      BroadcastPLMNs-Item,
    frequency           Frequency,
    iE-Extensions       ProtocolExtensionContainer { {ServedCell-Information-ExtIEs} } OPTIONAL,
    ...
}

ServedCell-Information-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}


-- T

TAC ::= OCTET STRING    -- FFS

TargeteNBtoSource-eNBTransparentContainer   ::= OCTET STRING

Time-UE-StayedInCell ::= INTEGER

TimeToWait ::= OCTET STRING


TraceActivation ::= SEQUENCE {
    traceReference                  TraceReference,
    interfacesToTrace               InterfacesToTrace,
    iE-Extensions                   ProtocolExtensionContainer { {TraceActivation-ExtIEs} } OPTIONAL,
    ...
}

TraceActivation-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}



TraceDepth      ::= ENUMERATED {
    minimum,
    medium,
    maximum,
    vendorMinimum,
    vendorMedium,
    vendorMaximum,
    ...
}

TraceInterface      ::= ENUMERATED {
    s1,
    x2,
    uu,
    ...
```

```
}

TraceReference                  ::= OCTET STRING (SIZE (8))


TransportLayerAddress           ::= BIT STRING (SIZE(1..160, ...))

TypeOfError ::= ENUMERATED {
    not-understood,
    missing,
    ...
}


-- U

UE-HistoryInformation ::= SEQUENCE (SIZE(1..maxnoofCells)) OF LastVisitedCell-Item


UE-S1AP-ID                  ::= INTEGER (0.. 42949672954095)

UE-X2AP-ID                  ::= INTEGER (0..4095) -- Value FFS

UL-InterferenceOverloadIndication ::= SEQUENCE (SIZE(1..maxnoofPRBs)) OF UL-InterferenceOverloadIndication-Item

UL-InterferenceOverloadIndication-Item ::= ENUMERATED {
    high-interference,
    medium-interference,
    low-interference,
    ...
}

UL-HighInterferenceIndicationInfo ::= SEQUENCE (SIZE(1..maxCellineNB)) OF UL-HighInterferenceIndicationInfo-Item

UL-HighInterferenceIndicationInfo-Item ::= SEQUENCE {
    ul-interferenceindication       UL-HighInterferenceIndication,
    target-Cell-ID                  CGI,
    iE-Extensions                   ProtocolExtensionContainer { { UL-HighInterferenceIndicationInfo-Item-ExtIEs} } OPTIONAL,
    ...
}

UL-HighInterferenceIndicationInfo-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}


UL-HighInterferenceIndication ::= BIT STRING (SIZE(1..110, ...))


-- V
-- W
-- X
-- Y
-- Z
```

```
END
```

9.3.6 Common definitions

```
-- **************************************************************
--
-- Common definitions
--
-- **************************************************************

X2AP-CommonDataTypes {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) x2ap (2) version1 (1) x2ap-CommonDataTypes (3)  }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

-- **************************************************************
--
-- Extension constants
--
-- **************************************************************

maxPrivateIEs                                   INTEGER ::= 65535
maxProtocolExtensions                           INTEGER ::= 65535
maxProtocolIEs                                  INTEGER ::= 65535

-- **************************************************************
--
-- Common Data Types
--
-- **************************************************************

Criticality     ::= ENUMERATED { reject, ignore, notify }

Presence        ::= ENUMERATED { optional, conditional, mandatory }

PrivateIE-ID    ::= CHOICE {
    local               INTEGER (0.. maxPrivateIEs),
    global              OBJECT IDENTIFIER
}

ProcedureCode       ::= INTEGER (0..255)


ProtocolIE-ID       ::= INTEGER (0..maxProtocolIEs)


TriggeringMessage   ::= ENUMERATED { initiating-message, successful-outcome, unsuccessful-outcome}

END
```

9.3.7 Constant definitions

```
-- **************************************************************
--
-- Constant definitions
--
-- **************************************************************

X2AP-Constants {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) x2ap (2) version1 (1) x2ap-Constants (4) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    ProcedureCode,
    ProtocolIE-ID
FROM X2AP-CommonDataTypes;

-- **************************************************************
--
-- Elementary Procedures
--
-- **************************************************************

id-handoverPreparation                                  ProcedureCode ::= 0
id-handoverCancel                                       ProcedureCode ::= 1
id-loadIndication                                       ProcedureCode ::= 2
id-errorIndication                                      ProcedureCode ::= 3
id-snStatusTransfer                                     ProcedureCode ::= 4
id-uEContextRelease                             ProcedureCode ::= 5
id-x2Setup                                              ProcedureCode ::= 6
id-reset                                                ProcedureCode ::= 7
id-eNBConfigurationUpdate                               ProcedureCode ::= 8
id-resourceStatusUpdateInitiation                       ProcedureCode ::= 9
id-resourceStatusReporting                              ProcedureCode ::= 10




-- **************************************************************
--
-- Lists
--
-- **************************************************************

maxInterfaces                           INTEGER ::= 16      -- FFS Value to be checked
maxCellineNB                            INTEGER ::= 256     -- FFS Value to be checked
maxnoofCells                            INTEGER ::= 16      -- FFS Value to be checked
```

```
maxnoofBearers                          INTEGER ::= 16      -- FFS Value to be checked
maxNrOfErrors                           INTEGER ::= 256     -- FFS Value to be checked
maxnoofPDCP-SN                          INTEGER ::= 16      -- FFS Value to be checked
maxnoofEPLMNs                           INTEGER ::= 15
maxnoofEPLMNsPlusOne                    INTEGER ::= 16
maxnoofForbLACs                         INTEGER ::= 256     -- FFS Value to be checked
maxnoofForbTACs                      INTEGER ::= 256 -- FFS Value to be checked
maxnoofBPLMNs                           INTEGER ::= 6
maxnoofPRBs                             INTEGER ::= 110     -- FFS Value to be checked
maxPools                                INTEGER ::= 16      -- FFS Value to be checked



-- ************************************************************
--
-- IEs
--
-- ************************************************************

id-Bearers-Admitted-Item                                                ProtocolIE-ID ::= 0
id-Bearers-Admitted-List                                                ProtocolIE-ID ::= 1
id-Bearers-NotAdmitted-Item                                             ProtocolIE-ID ::= 2
id-Bearers-NotAdmitted-List                                             ProtocolIE-ID ::= 3
id-Bearers-ToBeSetup-Item                                               ProtocolIE-ID ::= 4
id-Cause                                                                ProtocolIE-ID ::= 5
id-CellInformation                                                      ProtocolIE-ID ::= 6
id-CellInformation-Item                                                 ProtocolIE-ID ::= 7
id-InterfacesToTrace-Item                                               ProtocolIE-ID ::= 8
id-New-eNB-UE-X2AP-ID                                                   ProtocolIE-ID ::= 9
id-Old-eNB-UE-X2AP-ID                                                   ProtocolIE-ID ::= 10
id-TargetCell-ID                                                        ProtocolIE-ID ::= 11
id-TargeteNBtoSource-eNBTransparentContainer                            ProtocolIE-ID ::= 12
id-TraceActivation                                                      ProtocolIE-ID ::= 13
id-UE-ContextInformation                                                ProtocolIE-ID ::= 14
id-UE-HistoryInformation                                                ProtocolIE-ID ::= 15
id-UE-X2AP-ID                                                           ProtocolIE-ID ::= 16
id-CriticalityDiagnostics                                               ProtocolIE-ID ::= 17
id-Bearers-SubjectToStatusTransfer-List                                 ProtocolIE-ID ::= 18
id-Bearers-SubjectToStatusTransfer-Item                                 ProtocolIE-ID ::= 19
id-ServedCells                                                          ProtocolIE-ID ::= 20
id-ENB-Global-ID                                                        ProtocolIE-ID ::= 21
id-TimeToWait                                                           ProtocolIE-ID ::= 22
id-GUMMEI-ID                                                            ProtocolIE-ID ::= 23
id-GUGroupIDList                                                        ProtocolIE-ID ::= 24
id-ServedCellsToAdd                                                     ProtocolIE-ID ::= 25
id-ServedCellsToModify                                                  ProtocolIE-ID ::= 26
id-ServedCellsToDelete                                                  ProtocolIE-ID ::= 27
id-Registration-Request                                                 ProtocolIE-ID ::= 28
id-CellToReport                                                         ProtocolIE-ID ::= 29
id-ReportingPeriodicity                                                 ProtocolIE-ID ::= 30
id-CellToReport-Item                                                    ProtocolIE-ID ::= 31
id-CellMeasurementResult                                                ProtocolIE-ID ::= 32
id-CellMeasurementResult-Item                                           ProtocolIE-ID ::= 33
```

```
END
```

9.3.8 Container definitions

```
-- ************************************************************
--
-- Container definitions
--
-- ************************************************************

X2AP-Containers {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) x2ap (2) version1 (1) x2ap-Containers (5)  }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

-- ************************************************************
--
-- IE parameter types from other modules.
--
-- ************************************************************

IMPORTS
    maxPrivateIEs,
    maxProtocolExtensions,
    maxProtocolIEs,
    Criticality,
    Presence,
    PrivateIE-ID,
    ProtocolIE-ID
FROM X2AP-CommonDataTypes;

-- ************************************************************
--
-- Class Definition for Protocol IEs
--
-- ************************************************************

X2AP-PROTOCOL-IES ::= CLASS {
    &id             ProtocolIE-ID           UNIQUE,
    &criticality    Criticality,
    &Value,
    &presence       Presence
}
WITH SYNTAX {
    ID              &id
    CRITICALITY     &criticality
    TYPE            &Value
```

```
    PRESENCE        &presence
}

-- ************************************************************
--
-- Class Definition for Protocol IEs
--
-- ************************************************************

X2AP-PROTOCOL-IES-PAIR ::= CLASS {
    &id                     ProtocolIE-ID       UNIQUE,
    &firstCriticality       Criticality,
    &FirstValue,
    &secondCriticality      Criticality,
    &SecondValue,
    &presence               Presence
}
WITH SYNTAX {
    ID                      &id
    FIRST CRITICALITY       &firstCriticality
    FIRST TYPE              &FirstValue
    SECOND CRITICALITY      &secondCriticality
    SECOND TYPE             &SecondValue
    PRESENCE                &presence
}

-- ************************************************************
--
-- Class Definition for Protocol Extensions
--
-- ************************************************************

X2AP-PROTOCOL-EXTENSION ::= CLASS {
    &id                 ProtocolIE-ID       UNIQUE,
    &criticality        Criticality,
    &Extension,
    &presence           Presence
}
WITH SYNTAX {
    ID                  &id
    CRITICALITY         &criticality
    EXTENSION           &Extension
    PRESENCE            &presence
}

-- ************************************************************
--
-- Class Definition for Private IEs
--
-- ************************************************************

X2AP-PRIVATE-IES ::= CLASS {
    &id                 PrivateIE-ID,
    &criticality        Criticality,
```

```
    &Value,
    &presence           Presence
}
WITH SYNTAX {
    ID                  &id
    CRITICALITY         &criticality
    TYPE                &Value
    PRESENCE            &presence
}

-- **************************************************************
--
-- Container for Protocol IEs
--
-- **************************************************************

ProtocolIE-Container {X2AP-PROTOCOL-IES : IEsSetParam} ::=
    SEQUENCE (SIZE (0..maxProtocolIEs)) OF
    ProtocolIE-Field {{IEsSetParam}}

ProtocolIE-Single-Container {X2AP-PROTOCOL-IES : IEsSetParam} ::=
    ProtocolIE-Field {{IEsSetParam}}

ProtocolIE-Field {X2AP-PROTOCOL-IES : IEsSetParam} ::= SEQUENCE {
    id              X2AP-PROTOCOL-IES.&id                   ({IEsSetParam}),
    criticality     X2AP-PROTOCOL-IES.&criticality          ({IEsSetParam}{@id}),
    value           X2AP-PROTOCOL-IES.&Value                ({IEsSetParam}{@id})
}

-- **************************************************************
--
-- Container for Protocol IE Pairs
--
-- **************************************************************

ProtocolIE-ContainerPair {X2AP-PROTOCOL-IES-PAIR : IEsSetParam} ::=
    SEQUENCE (SIZE (0..maxProtocolIEs)) OF
    ProtocolIE-FieldPair {{IEsSetParam}}

ProtocolIE-FieldPair {X2AP-PROTOCOL-IES-PAIR : IEsSetParam} ::= SEQUENCE {
    id                  X2AP-PROTOCOL-IES-PAIR.&id                  ({IEsSetParam}),
    firstCriticality    X2AP-PROTOCOL-IES-PAIR.&firstCriticality    ({IEsSetParam}{@id}),
    firstValue          X2AP-PROTOCOL-IES-PAIR.&FirstValue          ({IEsSetParam}{@id}),
    secondCriticality   X2AP-PROTOCOL-IES-PAIR.&secondCriticality   ({IEsSetParam}{@id}),
    secondValue         X2AP-PROTOCOL-IES-PAIR.&SecondValue         ({IEsSetParam}{@id})
}

-- **************************************************************
--
-- Container Lists for Protocol IE Containers
--
-- **************************************************************

ProtocolIE-ContainerList {INTEGER : lowerBound, INTEGER : upperBound, X2AP-PROTOCOL-IES : IEsSetParam} ::=
```

```
    SEQUENCE (SIZE (lowerBound..upperBound)) OF
    ProtocolIE-Container {{IEsSetParam}}

ProtocolIE-ContainerPairList {INTEGER : lowerBound, INTEGER : upperBound, X2AP-PROTOCOL-IES-PAIR : IEsSetParam} ::=
    SEQUENCE (SIZE (lowerBound..upperBound)) OF
    ProtocolIE-ContainerPair {{IEsSetParam}}

-- ************************************************************
--
-- Container for Protocol Extensions
--
-- ************************************************************

ProtocolExtensionContainer {X2AP-PROTOCOL-EXTENSION : ExtensionSetParam} ::=
    SEQUENCE (SIZE (1..maxProtocolExtensions)) OF
    ProtocolExtensionField {{ExtensionSetParam}}

ProtocolExtensionField {X2AP-PROTOCOL-EXTENSION : ExtensionSetParam} ::= SEQUENCE {
    id                  X2AP-PROTOCOL-EXTENSION.&id             ({ExtensionSetParam}),
    criticality         X2AP-PROTOCOL-EXTENSION.&criticality    ({ExtensionSetParam}{@id}),
    extensionValue      X2AP-PROTOCOL-EXTENSION.&Extension      ({ExtensionSetParam}{@id})
}

-- ************************************************************
--
-- Container for Private IEs
--
-- ************************************************************

PrivateIE-Container {X2AP-PRIVATE-IES : IEsSetParam} ::=
    SEQUENCE (SIZE (1..maxPrivateIEs)) OF
    PrivateIE-Field {{IEsSetParam}}

PrivateIE-Field {X2AP-PRIVATE-IES : IEsSetParam} ::= SEQUENCE {
    id              X2AP-PRIVATE-IES.&id            ({IEsSetParam}),
    criticality     X2AP-PRIVATE-IES.&criticality   ({IEsSetParam}{@id}),
    value           X2AP-PRIVATE-IES.&Value         ({IEsSetParam}{@id})
}

END
```

9.4 Message transfer syntax

X2AP shall use the ASN.1 Basic Packed Encoding Rules (BASIC-PER) Aligned Variant as transfer syntax as specified in ref. [5].

9.5 Timers

$T_{RELOCprep}$

- Specifies the maximum time for the Handover Preparation procedure in the source eNB.

$TX2_{RELOCoverall}$

- Specifies the maximum time for the protection of the overall handover procedure in the source eNB.

10 Handling of unknown, unforeseen and erroneous protocol data

Section 10 of [4] is applicable for the purposes of the present document.

Annex A (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2007-02					First draft		0.0.1
2007-03					Minor editorials according to discussion at RAN3#55.	0.0.1	0.0.2
2007-06					Following email discussion on RAN3 reflector: Added text on HO Cancel (email discussion 07)l Added text on HO Preparation (email discussion 06) Editorial changes: Correction of numbering and format changes Moved editors note into section 9.1 Correction of wording in 8.4.1 Other changes: Added FFS on GTP tunnel endpoints Added FFS on how target eNB contacts MME		
2007-08					Updates according to discussions in RAN3#57	0.1.0	0.2.0
2007-09	37	RP-070585			Presentation to TSG-RAN for information -version 1.0.0	0.2.0	1.0.0
2007-10					Inclusion of agreements from RAN3#57bis as well as editorials	1.0.0	1.0.1
2007-11					Inclusion of agreements from RAN3#58 as well as editorials	1.0.1	1.1.0
2007-11	38	RP-070856			Presentation to TSG-RAN for approval - version 2.0.0	1.1.0	2.0.0
2007-12	38				Approved at TSG-RAN and placed under change control	2.0.0	8.0.0
2008-03	39	RP-080081	41		RAN3 agreed changes for TS 36.423	8.0.0	8.1.0
2008-06	40	RP-080305	42	1	RAN3 agreed changes for TS 36.423	8.1.0	8.2.0

History

Document history		
V8.2.0	November 2008	Publication