

E2AP V1.0.0 (2019-10)

ORAN-SC RIC Platform project; RAN Intelligent Controller (RIC); E2 application protocol (E2AP); (Release 1)

The present document has been developed within the ORAN-SC RIC Platform project and may be further elaborated for the purposes of evolving this Project. This Release 1 is provided under the Creative Commons Attribution 4.0 International license as Licensed Material. The Licensed Material herein may be copied and/or redistributed subject to the terms of this license: <https://creativecommons.org/licenses/by/4.0/legalcode>. The present document has not been subject to any approval process in ORAN and shall not be implemented as an O-RAN Specification. It is provided for information only.

This Licensed Material is provided for future development work of this Project only. The Copyright holders and Licensors of the Licensed Material provide no representation or warranty and accept no liability for any use of this Licensed Material.

Keywords
RIC, E2

Copyright Notification

© 2019, AT&T and Nokia

Contents

Foreword.....	5
1 Scope.....	6
2 References.....	6
3 Definitions, symbols and abbreviations	7
3.1 Definitions	7
3.2 Symbols	7
3.3 Abbreviations.....	7
4 General	7
4.1 Procedure description principles.....	7
4.2 Forwards and backwards compatibility	8
4.3 Notations.....	8
5 E2AP services	8
5.1 E2AP procedure modules	8
5.2 Parallel transactions	9
5.3 Indirect E2 connections	9
6 Services expected from signalling transport	9
7 Functions of E2AP	9
8 E2AP procedures.....	10
8.1 Elementary procedures	10
8.2 RIC functional procedures	11
8.2.1 RIC Subscription	11
8.2.2 RIC Subscription Delete.....	13
8.2.3 RIC Indication	14
8.2.4 RIC Control.....	15
8.2.5 RIC Service Update.....	16
8.3 Global Procedures.....	18
8.3.1 E2 Setup	18
8.3.2 Reset.....	18
8.3.3 Load Indication	18
8.3.4 Error Indication	19
8.3.5 Resource Status Reporting Initiation.....	19
8.3.6 Resource Status Reporting	19
8.3.7 RAN Configuration Update	19
9 Elements for E2AP Communication	20
9.0 General.....	20
9.1 Message Functional Definition and Content.....	20
9.1.1 Messages for RIC functional Procedures	20
9.1.2 Messages for global procedures	25
9.2 Information Element definitions	28
9.2.0 General	28
9.2.6 Cause	28
9.2.7 Criticality Diagnostics.....	28
9.2.13 Message Type.....	28
9.2.22 Global RIC ID	28
9.2.32 Time to wait	28
9.2.112 Global en-gNB ID	28
9.2.901 RIC Request ID	28
9.2.902 RAN Function ID	29
9.2.903 RIC Event Trigger Definition.....	29
9.2.904 RIC Action ID	29
9.2.905 RIC Action Type	29
9.2.906 RIC Action Definition	29

9.2.907	RIC Subsequent Action	30
9.2.908	RIC Cause	30
9.2.909	RIC Indication Sequence Number (SN)	30
9.2.910	RIC Indication Type	30
9.2.911	RIC Indication message	31
9.2.911a	RIC Indication header	31
9.2.912	RIC Call Process ID	31
9.2.913	RIC Control message	31
9.2.913a	RIC Control header	31
9.2.914	RIC Control Ack Request	32
9.2.915	RIC Control Status	32
9.2.916	RAN Function Definition	32
9.2.917	RIC Pseudo Cell Definition	32
9.3	Message and Information Element Abstract Syntax (with ASN.1)	33
9.3.1	General	33
9.3.2	Usage of Private Message Mechanism for Non-standard Use	34
9.3.3	Elementary Procedure Definitions	34
9.3.4	PDU Definitions	39
9.3.5	Information Element definitions	45
9.3.6	Common definitions	47
9.3.7	Constant definitions	47
9.3.8	Container definitions	48
9.4	Message transfer syntax	49
9.5	Timers	49
10	Handling of unknown, unforeseen and erroneous protocol data	49

Foreword

This document has been produced by AT&T and Nokia. It is not an O-RAN Specification, a 3GPP Specification or a technical specification of any other body. This document is provided under the license terms specified on the first page of this document, for information only.

The contents of the present document are subject to continuing work between AT&T and Nokia and may change following formal approval and potential subsequent submission to ORAN WG3. Should the Project modify the contents of the present document, it will be re-released with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
 - 0 draft under preparation
 - 1 targeted for release R1;
 - 2 targeted for release R2;
 - 3 or greater indicates future releases
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document specifies the signalling procedures of the control plane between a RAN node and the RIC.

E2AP supports the functions of E2 interface by signalling procedures defined in this document. E2AP is developed in accordance to the general principles stated in RIC-ARCH [2] and is defined as an extension of the 3GPP X2AP 36.423 [6]

2 References

This document references provisions of other documents.

- 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] RIC-ARCH: "RAN Intelligent Controller (RIC); Architecture Description".
- [3] RIC-E2SM: "RAN Intelligent Controller (RIC); RAN E2 Service Model".
- [4] 3GPP TS 36.413: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)".
- [5] ITU-T Recommendation X.691 (2002-07): "Information technology - ASN.1 encoding rules - Specification of Packed Encoding Rules (PER) ".
- [6] 3GPP TS 36.423: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 Application Protocol".
- [8] 3GPP TS 36.424: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); E2 data transport".
- [9] 3GPP TS 36.422: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 signaling transport".
- [10] ITU-T Recommendation X.680 (2002-07): "Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation".
- [11] ITU-T Recommendation X.681 (2002-07): "Information technology – Abstract Syntax Notation One (ASN.1): Information object specification".
- [12] 3GPP TS 23.003: "Technical Specification Group Core Network and Terminals; Numbering, addressing and identification".
- [13] 3GPP TR 25.921 (version.7.0.0): "Guidelines and principles for protocol description and error handling".
- [14] 3GPP TS 37.340: "Evolved Universal Terrestrial Radio Access (E-UTRA) and NR; Multi-connectivity; Stage 2".
- [15] 3GPP TS 36.401: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Architecture Description".
- [16] 3GPP TS 38.401: "NG-RAN; Architecture description".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

Elementary Procedure: E2AP protocol consists of Elementary Procedures (EPs). An E2AP Elementary Procedure is a unit of interaction between a RAN node and RIC. An EP consists of an initiating message and possibly a response message. Two kinds of EPs are used:

- Class 1: Elementary Procedures with response (success or failure),
- Class 2: Elementary Procedures without response.

RAN node: A specific node in a RAN. For 5G NR RAN this includes the monolithic gNB, monolithic gNB CU, gNB CU-CP, gNB CU-UP and gNB DU [16]. For a 4G LTE (formally E-UTRA) RAN this includes a monolithic eNB, eNB CU and eNB DU [15].

RAN Function: A specific Function in a RAN node, examples include X2AP, F1AP, E1AP, S1AP, NGAP interfaces and RAN internal functions UE, Cell, Node, etc.

RAN Intelligent Controller: A controller node interfaced to one or more RAN nodes via the E2 interface that provides guidance, optimization and value added services to the RAN.

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 TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

IE	Information Element
RIC	RAN Intelligent Controller
SN	Sequence Number

4 General

4.1 Procedure description principles

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

The following 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

initiating 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 Notations

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

Procedure	When referring to an elementary procedure in this document 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 this document 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 this document the <i>Information Element Name</i> 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. <i>E-RAB ID</i> IE.
Value of an IE	When referring to the value of an information element (IE) in this document the "Value" is written as it is specified in sub clause 9.2 enclosed by quotation marks, e.g. "Value".

5 E2AP services

The present clause describes the services a RAN offers to the RIC.

5.1 E2AP procedure modules

The E2 interface E2AP procedures are divided into two modules as follows:

1. E2AP RIC Functional Procedures;
2. E2AP Global Procedures;

The E2AP RIC functional procedures module contains procedures used to pass application specific messages between RIC and a target function in a RAN node [2]

The Global Procedures module contains procedures that are not directly related to a specific RAN Function and, in this version of the document, are supported using a subset of the 3GPP X2AP protocol.

As such this version of the E2AP document is essentially an extension of a subset of X2AP with references to X2AP specifications.

5.2 Parallel transactions

Parallel transactions, that is, multiple ongoing E2AP procedures related to the same RAN Function on the same RAN node, are supported.

5.3 Indirect E2 connections

E2AP messages may be passed between a RAN node and the RIC using either direct or indirect E2 connections.

Editor note: For future study.

Direct E2 connections have a direct TNL connection between a RAN node and the RIC.

6 Services expected from signalling transport

The signalling connection shall provide in sequence delivery of E2AP messages. E2AP shall be notified if the signalling connection breaks.

E2 signalling transport is identical to X2 signalling transport and is described in 3GPP TS 36.422 [9].

7 Functions of E2AP

The E2AP protocol provides the following functions:

E2AP RIC functional Procedures

- RIC Subscription management. This function is used by RIC to create, modify and delete an E2 Subscription with corresponding event trigger and subsequent action (Report, Insert and/or Policy) on a RAN function.
- RIC Indication. This function is used by the RAN function to send an E2 Indication (Report and/or Insert) message as per a previously defined E2 subscription action.
- RIC Control. This function is used by the RIC to initiate an action in a RAN function.
- RIC Service Update. This function allows updating of application level data needed for RIC to interoperate correctly over the E2 interface.

E2AP Global Procedures:

- Setting up the E2. This function is used to exchange necessary data for the RAN node for setup the E2 interface and implicitly perform an E2 Reset. Different procedures are defined for eNB and gNB
- Resetting the E2. This function is used to reset the E2 interface.
- Load Management. This function is used by RAN nodes to indicate resource status, overload and traffic load to RIC. Different procedures are defined for eNB and gNB.
- Reporting of General Error Situations. This function allows reporting of general error situations, for which function specific error messages have not been defined.

The mapping between the above functions and E2 EPs is shown in the table below.

Table 7-1: Mapping between E2AP functions and E2AP EPs

Function	Elementary Procedure(s)	Remarks
RIC Subscription management	RIC Subscription RIC Subscription delete	
RIC Indication	RIC Indication	
RIC Control	RIC Control	
RIC Service Update	RIC Service Update RIC Service Query	
Setting up the E2	eNB: X2 Setup en-gNB: EN-DC X2 Setup	
Resetting the E2	Reset	
RAN Configuration Update	eNB: eNB Configuration Update gNB: EN-DC Configuration Update	
Load Management	eNB: a) Load Indication b) Resource Status Reporting Initiation c) Resource Status Reporting gNB: n/a	Only currently applicable for eNB (due to X2AP release 15 limitations)
Reporting of General Error Situations	Error Indication	

8 E2AP 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

Initiated by	Elementary Procedure	Initiating Message	Successful Outcome	Unsuccessful Outcome
			Response message	Response message
RIC	RIC Subscription	RIC SUBSCRIPTION REQUEST	RIC SUBSCRIPTION RESPONSE	RIC SUBSCRIPTION FAILURE
RIC	RIC Subscription Delete	RIC SUBSCRIPTION DELETE REQUEST	RIC SUBSCRIPTION DELETE RESPONSE	RIC SUBSCRIPTION DELETE FAILURE
RAN	RIC Service Update	RIC SERVICE UPDATE	RIC SERVICE UPDATE ACKNOWLEDGE	RIC SERVICE UPDATE FAILURE
RIC	RIC Control	RIC CONTROL REQUEST	RIC CONTROL ACKNOWLEDGE	RIC CONTROL FAILURE
RIC	E2 Setup	eNB: X2 SETUP REQUEST gNB: EN-DC X2 SETUP REQUEST	eNB: X2 SETUP RESPONSE gNB: EN-DC X2 SETUP RESPONSE	eNB: X2 SETUP FAILURE gNB: EN-DC X2 SETUP FAILURE
RIC	Resource Status Reporting Initiation	eNB: RESOURCE STATUS REQUEST gNB: n/a	eNB: RESOURCE STATUS RESPONSE gNB: n/a	eNB: RESOURCE STATUS FAILURE gNB: n/a
RAN	RAN Configuration update	eNB: eNB CONFIGURATION UPDATE gNB: EN-DC CONFIGURATION UPDATE	eNB: eNB CONFIGURATION UPDATE ACKNOWLEDGE gNB: EN-DC CONFIGURATION UPDATE ACKNOWLEDGE	eNB: eNB CONFIGURATION UPDATE FAILURE gNB: EN-DC CONFIGURATION UPDATE FAILURE
RIC or RAN	Reset	Reset Request	Reset Response	

Table 8.1-2: Class 2 Elementary Procedures

Initiated by	Elementary Procedure	Initiating Message
RAN	RIC Indication	RIC INDICATION
RIC	RIC Service Query	RIC SERVICE QUERY
RAN	Load Indication	eNB: LOAD INFORMATION gNB: GNB STATUS INDICATION
RAN	Resource Status Reporting	eNB: RESOURCE STATUS UPDATE gNB: n/a
RAN or RIC	Error Indication	ERROR INDICATION

8.2 RIC functional procedures

8.2.1 RIC Subscription

8.2.1.1 General

This procedure is used to establish E2 subscriptions on RAN node consisting of an event trigger and a sequence of actions, each with a corresponding subsequent action.

8.2.1.2 Successful Operation

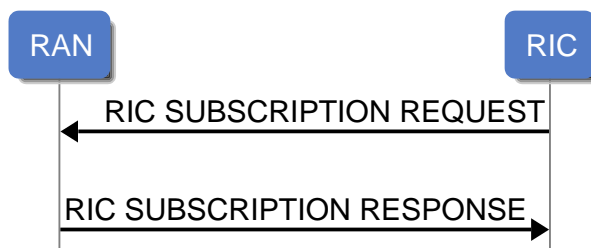


Figure 8.2.1.2-1: RIC Subscription, successful operation

The RIC initiates the procedure by sending the RIC SUBSCRIPTION message to the target RAN. When the RIC sends the RIC SUBSCRIPTION message, it shall start the timer $T_{\text{RICEVENTcreate}}$.

At reception of the RIC SUBSCRIPTION message the target RAN shall:

- Determine the target function using the information in the *RAN Function ID* IE and configure the requested event trigger using information in the *RIC Subscription Request* IE.
- If one or more Indication and/or Policy actions are included in the *RIC Subscription Request* IE then the target function shall validate the event trigger and requested action sequence and, if accepted, store the required *RIC Request ID*, *RIC Event Trigger Definition* and sequence of *RIC Action ID*, *RIC Action Type*, *RIC Action Definition*, *RIC Subsequent Action*.

If the requested trigger and at least one required Action are accepted by the RAN, the target RAN shall reserve necessary resources, and send the RIC SUBSCRIPTION RESPONSE message back to the RIC. The target RAN shall include in the response message the list of Actions for which resources have been prepared at the target RAN in the *RIC Actions Admitted List* IE. The target RAN shall include the list of Actions that have not been admitted in the *RIC Actions Not Admitted List* IE with an appropriate *RIC Cause* value.

Upon reception of the RIC SUBSCRIPTION RESPONSE message the RIC shall stop the timer $T_{\text{RICEVENTcreate}}$ and terminate the Subscription Request procedure.

8.2.1.3 Unsuccessful Operation



Figure 8.2.1.3-1: RIC Subscription, unsuccessful operation

If the target RAN does not admit at least one requested Action, detects an inconsistency in the sequence of Action and Subsequent Action definitions, or a failure occurs during the Subscription procedure, the target RAN shall send the RIC SUBSCRIPTION FAILURE message to the RIC. The RAN shall include the *RIC Actions Not Admitted List* IE with an appropriate *RIC Cause* value for each RIC action in the list.

Interactions with Subscription Delete procedure:

If there is no response from the target RAN Node to the RIC SUBSCRIPTION REQUEST message before timer $T_{\text{RICEVENTcreate}}$ expires in the RIC, the RIC should cancel the RIC Subscription procedure towards the target RAN node by initiating the RIC Subscription Delete procedure with the appropriate value for the *RIC Cause* IE. The RIC shall ignore any RIC SUBSCRIPTION RESPONSE or RIC SUBSCRIPTION FAILURE message received after the initiation of the RIC Subscription Delete procedure and remove any reference and release any resources related to the concerned RIC Subscription.

8.2.1.4 Abnormal Conditions

If the target RAN receives a RIC SUBSCRIPTION REQUEST message containing *RIC Event Trigger Definition* IE or *RIC Action Definition* IE that does not align with the RIC Service Model [4] for the target function, the target RAN shall send the RIC SUBSCRIPTION FAILURE message to the RIC.

If the target RAN receives a RIC SUBSCRIPTION REQUEST message containing a *RAN Function ID* IE that was not previously announced as a supported E2 function in the RIC SERVICE UPDATE, the target RAN shall send the RIC SUBSCRIPTION FAILURE message to the RIC.

If the target RAN receives a RIC SUBSCRIPTION REQUEST message containing identical contents, that is, same *RAN Function ID* IE, same *RIC Event Trigger Definition* IE and same sequence of actions, the target RAN shall send the RIC SUBSCRIPTION FAILURE message to the RIC.

8.2.2 RIC Subscription Delete

8.2.2.1 General

This procedure is used to delete E2 subscriptions on RAN node.

8.2.2.2 Successful Operation

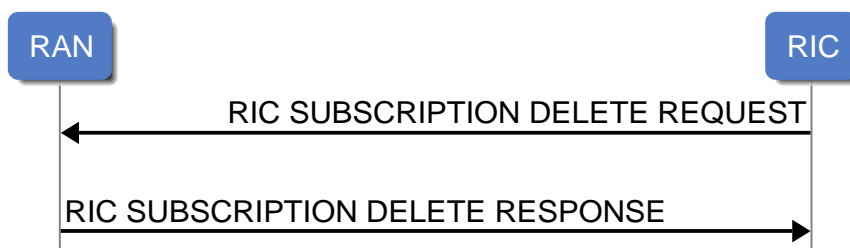


Figure 8.2.1.2-1: RIC Subscription delete, successful operation

The RIC initiates the procedure by sending the RIC SUBSCRIPTION DELETE REQUEST message to the target RAN. When the RIC sends the RIC SUBSCRIPTION DELETE message, it shall start the timer $T_{\text{RICEVENTdelete}}$.

At reception of the RIC SUBSCRIPTION DELETE message the target RAN shall:

- Determine the target function using the information in the *RAN Function ID* IE and delete the corresponding RIC EVENT trigger using information in the *RIC Request ID* IE.
- If one or more subsequent actions were included in the previously received *RIC Subscription* IE then the target function shall delete the required actions along with the corresponding *RIC Request ID* IE.

The target RAN shall release necessary resources and send the RIC SUBSCRIPTION DELETE RESPONSE message back to the RIC.

Upon reception of the RIC SUBSCRIPTION DELETE RESPONSE message the RIC shall stop the timer $T_{\text{RICEVENTdelete}}$, and terminate the Subscription delete procedure.

8.2.2.3 Unsuccessful Operation

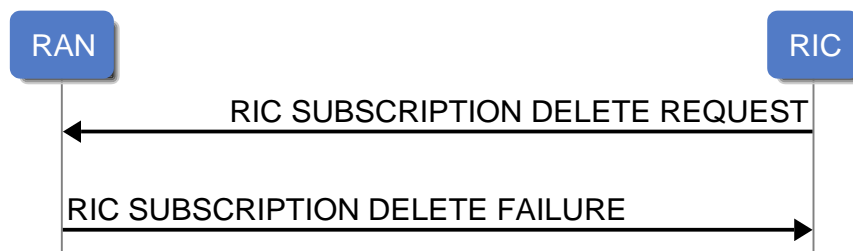


Figure 8.2.1.3-1: Subscription, unsuccessful operation

If the target RAN had previously failed to complete an RIC Subscription procedure, or a failure occurs during the RIC Subscription Delete procedure, the target RAN shall send the RIC SUBSCRIPTION DELETE FAILURE message to the RIC. The message shall contain the *Cause* IE with an appropriate value.

8.2.2.4 Abnormal Conditions

If the target RAN receives a RIC SUBSCRIPTION DELETE REQUEST message containing *RIC Request ID* IE that is not known, the target RAN shall send the SUBSCRIPTION DELETE FAILURE message to the RIC. The message shall contain the *RIC Cause* IE with an appropriate value.

If the target RAN receives a RIC SUBSCRIPTION DELETE REQUEST message contains a *RAN Function ID* IE that was not previously announced as a supported E2 function in the RIC SERVICE UPDATE, the target RAN shall send the RIC SUBSCRIPTION FAILURE message to the RIC. The message shall contain the *RIC Cause* IE with an appropriate value.

8.2.3 RIC Indication

8.2.3.1 General

The purpose of the RIC Indication procedure is to transfer a Report and/or Insert message to the RIC corresponding to a previously successful RIC SUBSCRIPTION procedure and the corresponding detection of the Event Trigger.

8.2.3.2 Successful Operation



Figure 8.2.3.2-1: RIC Indication, successful operation

A RAN node initiates the procedure by sending RIC INDICATION message containing the associated *RIC Request ID* IE, sequence number *RIC Indication SN* IE, the *RIC Indication* IE and optionally a *RIC Call Process ID* IE to the RIC.

- If the *RIC Subsequent Action* IE is set to Continue or Halt and a non-zero associated *Wait* timer, then the INDICATION message shall provide the *RIC Call Process ID* IE and the RAN function shall store current call state and suspend further processing.

The receiving RIC shall use *RIC Request ID* IE to route the Indication to the RIC functionality that originated the corresponding RIC SUBSCRIPTION.

If present, the receiving RIC shall use the *RIC Call Process ID* IE in a subsequent CONTROL message.

If the RAN node function had stored an associated *RIC Subsequent Action* IE then, after successful transmission of the RIC INDICATION, the originating RAN node function shall progress accordingly:

- If the *RIC Subsequent Action* IE is set to Continue or Halt, the associated *Wait* timer has not yet expired and a RIC CONTROL message is received with the same *RIC Call Process ID* IE, then the RAN function shall use the RIC CONTROL information along with the stored call state and continue to execute any remaining actions in the sequence of RIC Actions defined in the RIC Subscription Request prior to resuming normal functionality.
- If the *RIC Subsequent Action* IE is set to Continue and the associated *Wait* timer has expired or was set to zero, then the RAN function shall use the stored call state and continue to execute any remaining actions in the sequence of RIC Actions defined in the RIC Subscription Request prior to resuming normal functionality
- If the *RIC Subsequent Action* IE is set to Halt and the associated *Wait* timer has expired or was set to zero, then the RAN function shall abort normal functionality. In this case the any remaining actions in the sequence of RIC Actions defined in the RIC Subscription Request shall also be aborted.

8.2.3.3 Unsuccessful Operation

Not applicable.

8.2.3.4 Abnormal Conditions

Not applicable.

8.2.4 RIC Control

8.2.4.1 General

The purpose of the RIC Control Indication procedure is to initiate or resume a specific functionality in the RAN node.

8.2.4.2 Successful Operation

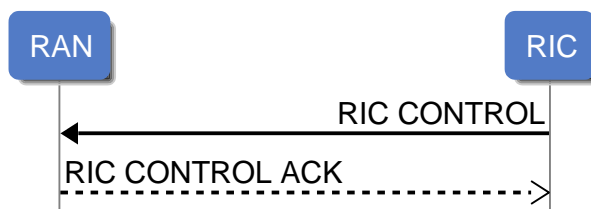


Figure 8.2.4.2-1: RIC Control, successful operation

The RIC initiates the procedure by sending RIC CONTROL message containing the associated *RIC Control ID* IE, *RAN Function ID* IE, *RIC Call process ID* IE and the *RIC Control Message* IE to the RIC. When the RIC sends the RIC CONTROL message and the optional *RIC Control Ack* IE has been set, it shall start the timer $T_{RICcontrol}$.

At reception of the RIC CONTROL message the target RAN shall:

- Determine the target function using the information in the *RAN Function ID* IE and initiate the requested CONTROL action using information in the *RIC Control Message* IE, using optional *RIC Call process ID* IE to identify specific call process that was previously announced in an INDICATION message.
- If the RIC CONTROL contains the optional *RIC Control Ack* IE and the RAN has successfully processed the requested CONTROL action then the RAN shall respond with RIC CONTROL ACKNOWLEDGE message

Upon reception of the RIC CONTROL ACK message the RIC shall stop the timer $T_{RICcontrol}$ and terminate the RIC Control procedure.

8.2.4.3 Unsuccessful Operation

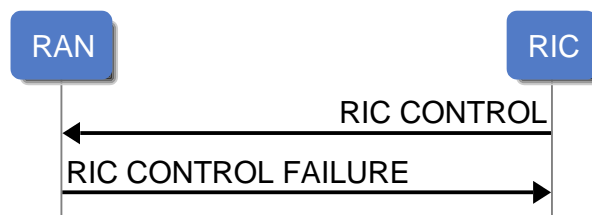


Figure 8.2.4.3-1: RIC Control, unsuccessful operation

If the RIC CONTROL message contains an optional *RIC Call process ID* IE that refers to a Call Process with an expired Wait timer or a non-defined optional *RIC Call process ID* IE then the RAN shall respond with a RIC CONTROL FAILURE message.

If the RAN fails to perform the requested CONTROL action then the RAN shall respond with a RIC CONTROL FAILURE message.

8.2.4.4 Abnormal Conditions

If the target RAN receives a RIC CONTROL message contains a *RAN Function ID* IE that was not previously announced as a supported E2 function in the RIC SERVICE UPDATE or the RAN does not support the specific CONTROL action, then the target RAN shall ignore message and send an ERROR INDICATION message to the RIC.

If there is no response from the target RAN Node to the RIC CONTROL message with the optional *RIC Control Ack* IE set before timer $T_{RICcontrol}$ expires in the RIC, the RIC should send an Error Indication with the appropriate value for the *RIC Cause* IE.

8.2.5 RIC Service Update

8.2.5.1 General

The purpose of the RIC Service Update procedure is to update application level configuration data needed for RAN node and RIC to interoperate correctly over the E2 interface.

8.2.5.2 Successful Operation

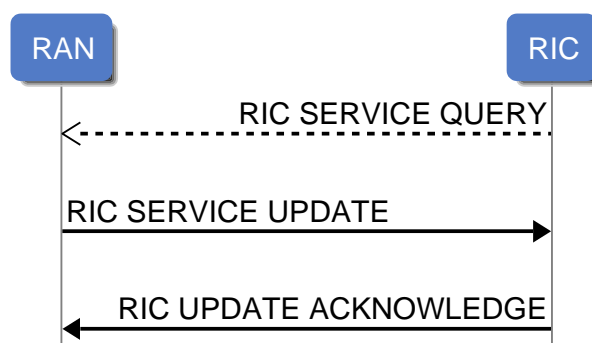


Figure 8.2.5.2-1: RIC SERVICE Update, successful operation

An RAN node initiates the procedure by sending an RIC SERVICE UPDATE message to the RIC. Such message shall include an appropriate set of up-to-date RIC service related configuration data, including, but not limited to, the complete lists of added, modified and deleted supported RIC Service functions that RAN node has just taken into operational use.

Upon reception of a RIC UPDATE UPDATE message, RIC shall update the information for RAN node as follows:

Update of Supported RIC service Information:

- If *RAN Function List To Add* IE is contained in the RIC SERVICE UPDATE message, RIC shall add each listed accepted function information according to the information in the *RAN Function ID* IE and *RAN Function Definition* IE.
- If *RAN Function List To Modify* IE is contained in the RIC SERVICE UPDATE message, RIC shall modify accepted information of supported functions according to the information in the *RAN Function Definition* IE.
- If *RAN Function List To Delete* IE is contained in the RIC SERVICE UPDATE message, RIC shall delete information of cell indicated by *Old RAN Function List* IE.

These changes may be processed in the RIC and may be used when issuing RIC SUBSCRIPTION REQUEST and RIC CONTROL to provide valid *RAN Function ID* IE.

After successful update of requested information, RIC shall reply with the RIC SERVICE UPDATE ACKNOWLEDGE message to inform the initiating RAN node that the requested update of application data was performed successfully. In case the RIC receives an RIC SERVICE UPDATE without any IE except for *Message Type* IE it shall reply with RIC SERVICE UPDATE ACKNOWLEDGE message without performing any updates to the existing configuration.

The RAN node may initiate a further RIC SERVICE Update procedure only after a previous RAN Configuration Update procedure has been completed.

Optionally, the RAN node RIC SERVICE UPDATE message to the RIC may have been sent as a response to the RIC initiated RIC SERVICE QUERY. In this case the RAN shall use RIC supplied *RAN Function Accepted List* IE to prepare the *RAN Function List To Add* IE, *RAN Function List To Modify* IE and *RAN Function List To Delete* IE to ensure realignment between RAN and RIC.

8.2.5.3 Unsuccessful Operation

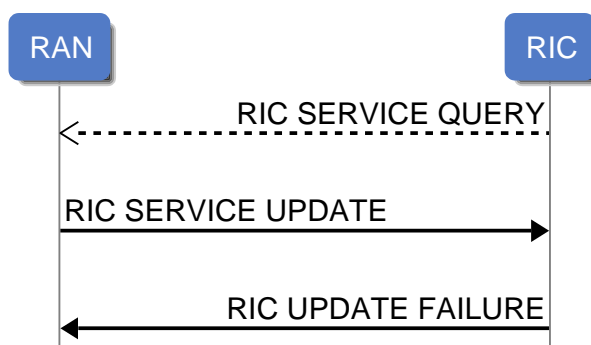


Figure 8.2.5.3-1: RIC SERVICE Update, unsuccessful operation

If the RIC can not accept the update it shall respond with an RIC SERVICE UPDATE FAILURE message and appropriate cause value.

If the RIC SERVICE UPDATE FAILURE message includes the *Time To Wait* IE the RAN node shall wait at least for the indicated time before reinitiating the RIC Service Update procedure towards the same RIC. Both nodes shall continue to operate the E2 with their existing RIC Service data.

8.2.5.4 Abnormal Conditions

If the RAN node after initiating RIC Service Update procedure receives neither RIC SERVICE UPDATE ACKNOWLEDGE message nor RIC SERVICE UPDATE FAILURE message, the RAN node may reinitiate the RIC Service Update procedure towards the same RIC, provided that the content of the new RIC SERVICE UPDATE message is identical to the content of the previously unacknowledged RIC SERVICE UPDATE message.

If the RIC does not support any of the functions that remain in updated list in the RAN node *Function List* IE then the RIC shall respond with an RIC SERVICE UPDATE FAILURE message.

If the RAN receives a RIC SERVICE QUERY with one or more unknown entries in the *Function List* IE then the RAN shall ignore this list and resume with a complete list of supported functions in the *Function List To Add* IE.

8.3 Global Procedures

8.3.1 E2 Setup

The purpose of the E2 Setup procedure is to establish the signalling connection between RAN node and RIC and present the same information that a RAN node would provide during an X2 or Xn Setup procedure. This procedure erases any existing application level configuration data in the two nodes and replaces it by the one received. This procedure also resets the E2 interface like a Reset procedure would do.

The procedure uses non UE-associated X2AP signalling and is implemented using the same procedure as defined in:

- X2AP TS36.423 [X2AP] EN-DC X2 Setup procedure for RAN node of type en-gNB, en-gNB CU and en-gNB-CU-CP.
- X2AP TS36.423 [X2AP] X2 Setup procedure for RAN node of type eNB

Note that this procedure performs the basic interface setup and transfers RAN specific configuration information to the RIC which acts as an eNB.

The RAN configuration information may be processed in the RIC.

This procedure shall be initiated by the RIC and contain a “pseudo eNB” configuration to satisfy backward compatibility with the X2AP specification.

Following completion of the X2 setup, a RAN supporting RIC services shall use the “pseudo eNB” configuration declaration from the RIC to recognise that the X2 interface is not towards an eNB and shall initiate a RIC SERVICE UPDATE procedure to complete the E2 set up.

8.3.2 Reset

The purpose of the Reset procedure is to align the resources in RAN node and RIC in the event of an abnormal failure. The procedure resets the E2 interface. This procedure doesn't affect the application level configuration data exchanged during the E2 Setup procedure, RAN Configuration Update and RIC Service Update.

When E2 Reset procedure is initiated the RIC and RAN shall:

- Delete any pre-established Subscriptions,
- Gracefully terminate any ongoing RIC call processes using INSERT, CONTROL or POLICY procedures while ensuring that impact to ongoing calls for connected UE is minimised.

After the E2 Reset has been completed the RIC shall re-issue any required Subscriptions.

The procedure uses non UE-associated X2AP signalling and is implemented using the same procedure as defined in:

- X2AP TS36.423 [X2AP] X2 Reset procedure for RAN node of type en-gNB, en-gNB CU, en-gNB-CU-CP and eNB

This procedure may be initiated by either RIC or RAN node.

8.3.3 Load Indication

8.3.3.1 General

The purpose of the Load Indication procedure is to transfer load and interference co-ordination information between RAN node and RIC.

The procedure uses non UE-associated X2AP signalling and is implemented using using the same procedure as defined in:

- X2AP TS36.423 [X2AP] X2 Load Indication for RAN node of type eNB

This procedure may be initiated by the RAN Node.

Editor's Note: This procedure is not defined in 3GPP Release 15 for en-gNB nor gNB. To be added in later release when supported by 3GPP.

8.3.4 Error Indication

8.3.4.1 General

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

The procedure uses non UE-associated X2AP signalling and is implemented using using the same procedure as defined in:

- X2AP TS36.423 [X2AP] X2 Error Indication for RAN node of type en-gNB, en-gNB CU, en-gNB-CU-CP and eNB

8.3.5 Resource Status Reporting Initiation

8.3.5.1 General

This procedure is used by the RIC to request the reporting of load measurements to the RAN node.

The procedure uses non UE-associated X2AP signalling and is implemented using using the same procedure as defined in:

- X2AP TS36.423 [X2AP] X2 Resource Status Reporting Initiation for RAN node of type eNB

Editor's Note: This procedure is not defined in 3GPP Release 15 for en-gNB nor gNB. To be added in later release when supported by 3GPP.

8.3.6 Resource Status Reporting

8.3.6.1 General

This procedure is initiated by RAN node to report the result of measurements admitted by RAN node following a successful Resource Status Reporting Initiation procedure.

The procedure uses non UE-associated X2AP signalling and is implemented using using the same procedure as defined in:

- X2AP TS36.423 [X2AP] X2 Resource Status Reporting for RAN node of type eNB

Editor's Note: This procedure is not defined in 3GPP Release 15 for en-gNB nor gNB. To be added in later release when supported by 3GPP.

8.3.7 RAN Configuration Update

The purpose of the E2 RAN configuration Update procedure is to update application level RAN related configuration data needed for RIC and RAN node to interoperate correctly over the E2 interface.

The procedure uses non UE-associated X2AP signalling and is implemented using the same procedure as defined in:

- X2AP TS36.423 [X2AP] EN-DC Configuration Update procedure for RAN node of type en-gNB, en-gNB CU and en-gNB-CU-CP.
- X2AP TS36.423 [X2AP] eNB Configuration Update procedure for RAN node of type eNB

Note that this procedure performs the basic RAN specific configuration information to the RIC which acts as an eNB.

This procedure shall be initiated by the RAN node only.

Following completion of the RAN configuration Update, a RAN supporting RIC services may then initiate a RIC SERVICE UPDATE procedure to complete the update process covering both RAN and RIC Service level information.

9 Elements for E2AP Communication

9.0 General

Sub clauses 9.1 and 9.2 describe the structure of the messages and information elements required for the E2AP protocol in tabular format. Sub clause 9.3 provides the corresponding ASN.1 definition.

The following attributes are used for the tabular description of the messages and information elements: Presence, Range Criticality and Assigned Criticality. Their definition and use can be found in TS 36.413 [4].

NOTE: The messages have been defined in accordance to the guidelines specified in TR 25.921 [13].

9.1 Message Functional Definition and Content

9.1.1 Messages for RIC functional Procedures

9.1.1.1 RIC SUBSCRIPTION REQUEST

This message is sent by the RIC to a RAN node to create a new Subscription in the RAN node at the request of the RIC.

Direction: RIC → RAN node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
RIC Request ID	M		9.2.901		YES	reject
RAN Function ID	M		9.2.902		YES	reject
RIC Subscription	M				YES	reject
>RIC Event Trigger Definition	M		9.2.903		YES	reject
>Sequence of Actions		1.. <maxofRICactionID>			YES	reject
>>RIC Action ID	M		9.2.904		YES	reject
>>RIC Action Type	M		9.2.905		YES	reject
>>RIC Action Definition	O		9.2.906		YES	reject
>>RIC Subsequent Action	O		9.2.907		YES	reject

Range bound	Explanation
maxofRICActionID	Maximum no. of Actions to be requested by RIC. Value is 16.

9.1.1.2 RIC SUBSCRIPTION RESPONSE

This message is sent by a RAN node to accept the request from the RIC to create a new Event in the RAN node

Direction: RAN node → RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
RIC Request ID	M		9.2.901		YES	reject
RAN Function ID	M		9.2.902		YES	reject
RIC Actions Admitted List		1.. <maxofRICactionID>			YES	reject
>RIC Action ID	M		9.2.904			
RIC Actions not Admitted List		0.. <maxofRICactionID>			YES	reject
>RIC Action ID	M		9.2.904			
>RIC Cause	M		9.2.908			

Range bound	Explanation
maxofRICActionID	Maximum no. of Actions to be requested by RIC. Value is 16.

9.1.1.3 RIC SUBSCRIPTION FAILURE

This message is sent by a RAN node to inform the RIC that the request to create a new Event in the RAN node failed.

Direction: RAN node → RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
RIC Request ID	M		9.2.901		YES	reject
RAN Function ID	M		9.2.902		YES	reject
Actions not Admitted List		1.. <maxofRICactionID>			YES	reject
>RIC Action ID	M		9.2.904			
>RIC Cause	M		9.2.908			
Criticality Diagnostics	O		9.2.7		YES	reject

Range bound	Explanation
maxofRICActionID	Maximum no. of Actions to be requested by RIC. Value is 16.

9.1.1.4 RIC SUBSCRIPTION DELETE REQUEST

This message is sent by the RIC to a RAN node to request the deletion of an existing Event in the RAN node previously created for the RIC

Direction: RIC → RAN node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
RIC Request ID	M		9.2.901		YES	reject
RAN Function ID	M		9.2.902		YES	reject

9.1.1.5 RIC SUBSCRIPTION DELETE RESPONSE

This message is sent by a RAN node to accept the request from the RIC to delete an existing Event in the RAN node

Direction: RAN node → RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
RIC Request ID	M		9.2.901		YES	reject
RAN Function ID	M		9.2.902		YES	reject

9.1.1.6 RIC SUBSCRIPTION DELETE FAILURE

This message is sent by a RAN node to inform the RIC that the request to delete an existing Event in the RAN node failed.

Direction: RAN node → RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
RIC Request ID	M		9.2.901		YES	reject
RAN Function ID	M		9.2.902		YES	reject
RIC Cause	M		9.2.908			ignore
Criticality Diagnostics	O		9.2.7		YES	reject

9.1.1.7 RIC INDICATION

This message is sent by a RAN node to RIC to transfer Report information to the RIC.

Direction: RAN node → RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
RIC Request ID	M		9.2.901		YES	reject
RAN Function ID	M		9.2.902		YES	reject
RIC Action ID	M		9.2.904		YES	reject
RIC Indication SN	M		9.2.909		YES	reject
RIC Indication Type	M		9.2.910		YES	reject
RIC Indication Header	M		9.2.911a		YES	reject
RIC Indication message	M		9.2.911		YES	reject
RIC Call process ID	O		9.2.912		YES	reject

9.1.1.8 RIC CONTROL REQUEST

This message is sent by the RIC to the RAN to initiate or resume a control function logic.

Direction: RIC → RAN node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
RIC Request ID	M		9.2.901		YES	reject
RAN Function ID	M		9.2.902		YES	reject
RIC Call process ID	O		9.2.912			
RIC Control Header	M		9.2.913a		YES	reject
RIC Control Message	M		9.2.913		YES	reject
RIC Control Ack Req	O		9.2.914			

9.1.1.9 RIC CONTROL ACKNOWLEDGE

This message is sent by a RAN node to inform the RIC that the request Control message was received and outcome.

Direction: RAN node → RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
RIC Request ID	M		9.2.901		YES	reject
RAN Function ID	M		9.2.902		YES	reject
RIC Call process ID	O		9.2.912			
RIC Control Status	M		9.2.915			

9.1.1.10 RIC CONTROL FAILURE

This message is sent by a RAN node to inform the RIC that the Control request towards the RAN node failed.

Direction: RAN node → RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
RIC Request ID	M		9.2.901		YES	reject
RAN Function ID	M		9.2.902		YES	reject
RIC Call process ID	O		9.2.912			
RIC Cause	M		9.2.908			ignore

9.1.1.11 RIC SERVICE UPDATE

This message is sent by a RAN node to the RIC to transfer updated information on RIC Services supported by the RAN.

Direction: RAN node → RIC

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
Functions To Add		0 .. <maxofRANfunctionID>			YES	reject
>RAN Function ID	M		9.2.902	Id of the declared Function	YES	reject
>RAN Function Definition	M		9.2.916	Definition of Function	YES	reject
Functions To Modify		0 .. <maxofRANfunctionID>			YES	reject
>Old RAN Function ID	M		9.2.902	Id of the declared Function	YES	reject
>RAN Function Definition	M		9.2.916	Definition of Function	YES	reject
Functions To Delete		0 .. <maxofRANfunctionID>			YES	reject
>Old RAN Function ID	M		9.2.902	Id of the declared Function	YES	reject

Range bound	Explanation
maxofRANfunctionID	Maximum no. of Functions accepted by RIC. Value is 256.

9.1.1.12 RIC SERVICE UPDATE ACKNOWLEDGE

This message is sent by RIC to RAN node to acknowledge update of RIC Services supported by the RAN.

Direction: RIC → RAN node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
List of Accepted Functions		0 .. <maxofRANfunctionID>		Complete list of Functions accepted by RIC	YES	reject
>RAN Function ID	M		9.2.902	Id of the declared Function	YES	reject
List of not Accepted Functions		0 .. <maxofRANfunctionID>		Complete list of Functions not accepted by RIC	YES	reject
>RAN Function ID	M		9.2.902	Id of the declared Function	YES	reject
>RIC Cause	M		9.2.908	Reason for not accepting function	YES	ignore

Range bound	Explanation
maxofRANfunctionID	Maximum no. of Functions accepted by RIC. Value is 256.

9.1.1.13 RIC SERVICE UPDATE FAILURE

This message is sent by RIC to RAN node to indicate RIC SERVICE Update Failure.

Direction: RIC →RAN node

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
List of not Accepted Functions		1 .. <maxofRANfunctionID>		Complete list of Functions not accepted by RIC	YES	reject
>RAN Function ID	M		9.2.902	Id of the declared Function	YES	reject
>RIC Cause	M		9.2.908	Reason for not accepting function	YES	ignore
Time To Wait	O		9.2.32		YES	ignore
Criticality Diagnostics	O		9.2.7		YES	ignore

Range bound	Explanation
maxofRANfunctionID	Maximum no. of Functions accepted by RIC. Value is 256.

9.1.1.14 RIC SERVICE QUERY

This message is sent by RIC to RAN node to request a RAN initiated RIC SERVICE UPDATE.

Direction: RIC → RAN node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
List of Accepted Functions		0 .. <maxofRANfunctionID>		Complete list of Functions previously accepted by RIC	YES	reject
>RAN Function ID	M		9.2.902	Id of the declared Function	YES	reject

Range bound	Explanation
maxofRANfunctionID	Maximum no. of Functions accepted by RIC. Value is 256.

9.1.2 Messages for global procedures

9.1.2.1 LOAD INFORMATION

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

Direction: eNB → RIC.

Content as defined in X2AP 36.423 section 9.1.2.1

9.1.2.2 ERROR INDICATION

This message is used to indicate that some error has been detected in the eNB/en-gNB or RIC.

Direction: eNB → RIC or RIC → eNB or RIC → en-gNB or en-gNB → RIC.

Content as defined in X2AP 36.423 section 9.1.2.2 and, when initiated by RIC the Global RIC ID presented as a Global eNB ID

9.1.2.3 X2 SETUP REQUEST

This message is sent by a RIC to an eNB or en-gNB to transfer the initialization information for a TNL association.

Direction: RIC → eNB/en-gNB.

Content as defined in X2AP 36.423 section 9.1.2.3 with one single cell described as defined in section 9.2.917 “RIC Pseudo cell message” and Global RIC ID presented as a Global eNB ID.

9.1.2.4 X2 SETUP RESPONSE

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

Direction: eNB → RIC

Content as defined in X2AP 36.423 section 9.1.2.4

9.1.2.5 X2 SETUP FAILURE

This message is sent by the eNB to indicate E2 Setup failure.

Direction: eNB → RIC

Content as defined in X2AP 36.423 section 9.1.2.5

9.1.2.6 RESET REQUEST

This message is sent from RIC to an eNB/en-gNB or from eNB/en-gNB to a RIC and is used to request the E2 interface between the RAN node and RIC to be reset.

Direction: eNB → RIC, RIC → eNB, RIC → en-gNB or en-gNB → RIC

Content as defined in X2AP 36.423 section 9.1.2.6 and, when initiated by RIC, the Global RIC ID presented as a Global eNB ID

9.1.2.7 RESET RESPONSE

This message is sent by an eNB/en-gNB to a RIC or from RIC to an eNB/en-gNB as a response to a RESET REQUEST message.

Direction: RIC → eNB, eNB → RIC, en-gNB → RIC or RIC → en-gNB

Content as defined in X2AP 36.423 section 9.1.2.7 and, when responding by RIC, the Global RIC ID presented as a Global eNB ID

9.1.2.8 ENB CONFIGURATION UPDATE

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

Direction: eNB → RIC.

Content as defined in X2AP 36.423 section 9.1.2.8

9.1.2.9 ENB CONFIGURATION UPDATE ACKNOWLEDGE

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

Direction: RIC → eNB

Content as defined in X2AP 36.423 section 9.1.2.9 and RIC responding as a eNB with the Global RIC ID presented as a Global eNB ID

9.1.2.10 ENB CONFIGURATION UPDATE FAILURE

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

Direction: RIC → eNB.

Content as defined in X2AP 36.423 section 9.1.2.10 and the Global RIC ID presented as a Global eNB ID

9.1.2.11 RESOURCE STATUS REQUEST

This message is sent by an RIC to an eNB to initiate the requested measurement according to the parameters given in the message.

Direction: RIC → eNB.

Content as defined in X2AP 36.423 section 9.1.2.11 and the Global RIC ID presented as a Global eNB ID

9.1.2.12 RESOURCE STATUS RESPONSE

This message is sent by the eNB to indicate that the requested measurement, for all or for a subset of the measurement objects included in the measurement is successfully initiated.

Direction: eNB → RIC

Content as defined in X2AP 36.423 section 9.1.2.12

9.1.2.13 RESOURCE STATUS FAILURE

This message is sent by the eNB₂ to indicate that for none of the requested measurement objects the measurement can be initiated.

Direction: eNB → RIC.

Content as defined in X2AP 36.423 section 9.1.2.13

9.1.2.14 RESOURCE STATUS UPDATE

This message is sent by eNB to RIC to report the results of the requested measurements.

Direction: eNB → RIC

Content as defined in X2AP 36.423 section 9.1.2.14

9.1.2.31 EN-DC X2 SETUP REQUEST

This message is sent by RIC to a en-gNB node, to transfer the initialization information for a TNL association.

Direction: RIC → en-gNB.

Content as defined in X2AP 36.423 section 9.1.2.31 with one single cell described as defined in section 9.2.917 “RIC Pseudo cell message” and Global RIC ID presented as a Global eNB ID.

9.1.2.32 EN-DC X2 SETUP RESPONSE

This message is sent by a neighbouring node to an initiating node, both nodes able to interact for EN-DC, to transfer the initialization information for a TNL association.

Direction: en-gNB → RIC.

Content as defined in X2AP 36.423 section 9.1.2.32

9.1.2.33 EN-DC X2 SETUP FAILURE

This message is sent by the neighbouring node to indicate EN-DC X2 Setup failure.

Direction: en-gNB → RIC

Content as defined in X2AP 36.423 section 9.1.2.33

9.1.2.34 EN-DC CONFIGURATION UPDATE

This message is sent by an initiating node to a peer neighbouring node, both nodes able to interact for EN-DC, to transfer updated information for a TNL association.

Direction: en-gNB → RIC.

Content as defined in X2AP 36.423 section 9.1.2.34

9.1.2.35 EN-DC CONFIGURATION UPDATE ACKNOWLEDGE

This message is sent by a RIC to an en-gNB to acknowledge update of information for a TNL association.

Direction: RIC → en-gNB.

Content as defined in X2AP 36.423 section 9.1.2.35 and RIC responding as a eNB with Global RIC ID presented as a Global eNB ID

9.1.2.36 EN-DC CONFIGURATION UPDATE FAILURE

This message is sent by a neighbouring node to a peer node to indicate EN-DC eNB Configuration Update Failure.

Direction: RIC → en-gNB.

Content as defined in X2AP 36.423 section 9.1.2.36 and Global RIC ID presented as a Global eNB ID

9.2 Information Element definitions

9.2.0 General

When describing information elements which are to be represented by bit strings, if not otherwise specifically stated in the semantics description of the concerned IE or elsewhere, the following principle applies with regards to the ordering of bits:

- The first bit (leftmost bit) contains the most significant bit (MSB);
- The last bit (rightmost bit) contains the least significant bit (LSB);
- When importing bit strings from other specifications, the first bit of the bit string contains the first bit of the concerned information.

9.2.6 Cause

See X2AP [36.423] section 9.2.6

9.2.7 Criticality Diagnostics

See X2AP [36.423] section 9.2.7

9.2.13 Message Type

See X2AP [36.423] section 9.2.13

9.2.22 Global RIC ID

Formatted as Global eNB ID using 20bit “Macro eNB ID” option. See X2AP [36.423] section 9.2.22

9.2.32 Time to wait

See X2AP [36.423] section 9.2.32

9.2.112 Global en-gNB ID

See X2AP [36.423] section 9.2.112

9.2.901 RIC Request ID

This information element indicates the REQUEST ID number.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Requestor ID	M		INTEGER (0..65535)	
RIC Request Sequence Number	M		INTEGER (0..65535)	

9.2.902 RAN Function ID

This information element indicates the Function ID number.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RAN Function ID	M		INTEGER (0..4095)	Value 0 reserved for E2 interface termination

9.2.903 RIC Event Trigger Definition

This information element indicates the RIC event trigger description.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Event Trigger Definition	M		OCTET STRING	Defined in RAN E2 Service Model [3]

9.2.904 RIC Action ID

This information element indicates the Action ID number.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Action ID	M		INTEGER (0..255)	

9.2.905 RIC Action Type

This IE defines the subsequent action to be taken after completing a particular Action. Wait then option IE setting minimum allowed waiting time is required.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Action Type	M		ENUMERATED (Insert, Report, Policy, ...)	

9.2.906 RIC Action Definition

This information element indicates the RIC report description.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Action Definition	M		OCTET STRING	Defined in RAN E2 Service Model [3]

9.2.907 RIC Subsequent Action

This IE defines the subsequent action to be taken after completing a particular Action. Wait then option IE setting minimum allowed waiting time is required.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Subsequent Action Type	M		ENUMERATED (Continue, Halt, ...)	
RIC Time to Wait	O		ENUMERATED (zero, 1ms, 2ms, 5ms, 10ms, 20ms, 30ms, 40ms, 50ms, 100ms, 200ms, 500ms, 1s, 2s, 5s, 10s, 20s, 60s, ...)	Required when required Wait greater than zero.

9.2.908 RIC Cause

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

This field extends the X2AP Cause IE with RIC specific cases.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
CHOICE Cause Group	M			
>RIC services				
>>RIC Request	O		ENUMERATED (Function ID Invalid, Action not supported, Excessive actions, Duplicate action, Duplicate Event Trigger, Function resource limit, Request ID unknown, Inconsistent Action/subsequent Action sequence, Control message invalid, Call process ID Invalid ...)	
>> RIC Service	O		ENUMERATED (Function Not Required, Excessive functions, RIC Resource Limit,...)	

9.2.909 RIC Indication Sequence Number (SN)

This information element indicates the Indication Sequence Number (SN).

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Indication SN	M		INTEGER (0..65535)	

9.2.910 RIC Indication Type

This IE defines the Indication Type.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Indication Type	M		ENUMERATED (Insert, Report, ...)	

9.2.911 RIC Indication message

This information element carries the RIC indication message used for INSERT and REPORT procedures.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Indication message	M		OCTET STRING	Defined in RAN E2 Service Model [3]

9.2.911a RIC Indication header

This information element carries the RIC indication header used for INSERT and REPORT procedures.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Indication header	M		OCTET STRING	Defined in RAN E2 Service Model [3]

9.2.912 RIC Call Process ID

This information element carries the Call Process ID, meaning shall be unique within a given Function on a given RAN node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Call Process ID	M		OCTET STRING	Defined by RAN implementation

9.2.913 RIC Control message

This information element carries the RIC CONTROL Request.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Control Message	M		OCTET STRING	Defined in RAN E2 Service model [3]

9.2.913a RIC Control header

This information element carries the RIC indication message used for INSERT and REPORT procedures.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Control header	M		OCTET STRING	Defined in RAN E2 Service Model [3]

9.2.914 RIC Control Ack Request

This IE defines the Indication Type.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Control Ack Request	M		ENUMERATED (NoAck, Ack, NAck, ...)	

9.2.915 RIC Control Status

This IE defines the Indication Type.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Control Status	M		ENUMERATED (Success, Rejected, Failed ...)	

9.2.916 RAN Function Definition

This information element carries the RAN Function Definition

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RAN Function Definition	M		OCTET STRING	Defined in RAN E2 Service Model [3]

9.2.917 RIC Pseudo Cell Definition

This IE contains pseudo cell configuration information of a cell that a RIC claims to support. May be used by eNB or en-gNB to detect that SETUP REQUEST is from a RIC and not a peer RAN node.

This information element uses the format defined in 3GPP 36.423 section 9.2.8 Served Cell Information with the following specific values.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
PCI	M		INTEGER (0..503, ...)	Physical Cell ID Set to 503	–	–
Cell ID	M		ECGI, as defined in 3GPP 36.423 section 9.2.14	Global eNB ID part set to equal Global RIC Id (9.2.22) Remaining bits set to zero	–	–
TAC	M		OCTET STRING(2)	Tracking Area Code Set to zero	–	–
Broadcast PLMNs		<i>1..<maxnoof BPLMNs></i>		Broadcast PLMNs	–	–
>PLMN Identity	M	<i>RICflag</i>	As defined in 3GPP 36.423 section 9.2.4	Set to 0xBBBCCC (RIC Flag)	–	–
CHOICE <i>EUTRA-Mode-Info</i>	M				–	–
> <i>FDD</i>						
>> FDD Info		1			–	–
>>>UL EARFCN	M	0	EARFCN, as defined in 3GPP 36.423 section 9.2.26	Set to zero	–	–
>>>DL EARFCN	M	0	EARFCN, as defined in 3GPP 36.423 section 9.2.26	Set to zero	–	–
>>>UL Transmission Bandwidth	M	<i>bw6</i>	Transmission Bandwidth, as defined in 3GPP 36.423 section 9.2.27		–	–
>>>DL Transmission Bandwidth	M	<i>bw15</i>	Transmission Bandwidth, as defined in 3GPP 36.423 section 9.2.27		–	–

Range bound	Explanation
maxnoofBPLMNs	Maximum no. of Broadcast PLMN Ids. Value is 1
RICflag	Set to 0xBBBCCC

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

9.3.1 General

E2AP ASN.1 definition conforms to ITU-T Rec. X.680 [10] and ITU-T Rec. X.681 [11].

Sub clause 9.3 presents the Abstract Syntax of the E2AP protocol with ASN.1. In case there is contradiction between the ASN.1 definition in this sub clause and the tabular format in sub clause 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 E2AP messages. E2AP 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 an E2AP message according to the PDU definitions module and with the following additional rules:

- 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.

NOTE: In the above, "IE" means an IE in the object set with an explicit ID. If one IE needs to appear more than once in one object set, then the different occurrences have different IE IDs.

If an E2AP 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.

NOTE WELL: The ASN.1 files attached below contain reference to objects defined in 3GPP 36.423 [6] X2AP ASN.1 files. When compiling the ASN.1 module contained in sections 9.3 and the following additional modules published in [6] are also required:

- X2AP-PDU-Contents available in [6] section 9.3.4
- X2AP-IEs available in [6] section 9.3.5
- X2AP-CommonDataTypes available in [6] section 9.3.6
- X2AP-Constants available in [6] section 9.3.7
- X2AP-Containers available in [6] section 9.3.8

Overall map of ASN.1 modules is presented in table 9.3.1-1.

Table 9.3.1-1: Required ASN.1 Modules

Module type	E2AP Modules	X2AP Modules
Elementary Procedure Definitions	E2AP-PDU-Descriptions	
PDU Definitions	E2AP-PDU-Contents	X2AP-PDU-Contents
Information Element Definitions	E2AP-IEs	X2AP-IEs
Common Definitions		X2AP-CommonDataTypes
Constant definitions	E2AP-Constants	X2AP-Constants
Container definitions		X2AP-Containers

9.3.2 Usage of Private Message Mechanism for Non-standard Use

Editors note: Not supported in this release

9.3.3 Elementary Procedure Definitions

```
-- ASN1START
-- *****
--
-- Elementary Procedure definitions
-- Derived from 3GPP X2AP 36.423v15.4.0 section 9.3.4 x2ap-PDU-Descriptions
-- *****

E2AP-PDU-Descriptions {
iso(1) identified-organization(3) dod(6) internet(1) private(4) enterprise(1) 28458 exp(99)
mobileDomain (0) ric (21) modules (3) e2ap (2) version1 (1) e2ap-PDU-Descriptions (0) }

DEFINITIONS AUTOMATIC TAGS ::=
```

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

IMPORTS
    Criticality,
    ProcedureCode
FROM X2AP-CommonDataTypes

    ENBConfigurationUpdate,
    ENBConfigurationUpdateAcknowledge,
    ENBConfigurationUpdateFailure,
    ErrorIndication,
    LoadInformation,
    ResetRequest,
    ResetResponse,
    ResourceStatusFailure,
    ResourceStatusRequest,
    ResourceStatusResponse,
    ResourceStatusUpdate,
    X2SetupFailure,
    X2SetupRequest,
    X2SetupResponse,
    ENDCX2SetupRequest,
    ENDCX2SetupResponse,
    ENDCX2SetupFailure,
    ENDCConfigurationUpdate,
    ENDCConfigurationUpdateAcknowledge,
    ENDCConfigurationUpdateFailure,
    GNBStatusIndication
FROM X2AP-PDU-Contents

    id-eNBConfigurationUpdate,
    id-errorIndication,
    id-loadIndication,
    id-reset,
    id-resourceStatusReporting,
    id-resourceStatusReportingInitiation,
    id-x2Setup,
    id-endcX2Setup,
    id-endcConfigurationUpdate,
    id-gNBStatusIndication
FROM X2AP-Constants

    RICsubscriptionRequest,
    RICsubscriptionResponse,
    RICsubscriptionFailure,
    RICsubscriptionDeleteRequest,
    RICsubscriptionDeleteResponse,
    RICsubscriptionDeleteFailure,
    RICindication,
    RICcontrolRequest,
    RICcontrolAcknowledge,
    RICcontrolFailure,
    RICserviceUpdate,
    RICserviceUpdateAcknowledge,
    RICserviceUpdateFailure,
    RICserviceQuery
FROM E2AP-PDU-Contents

    id-RICsubscriptionRequest,
    id-RICsubscriptionResponse,
    id-RICsubscriptionFailure,
    id-RICsubscriptionDeleteRequest,
    id-RICsubscriptionDeleteResponse,
    id-RICsubscriptionDeleteFailure,
    id-RICindication,
    id-RICcontrolRequest,
    id-RICcontrolAcknowledge,
    id-RICcontrolFailure,
    id-RICserviceUpdate,
    id-RICserviceUpdateAcknowledge,
    id-RICserviceUpdateFailure,
    id-RICserviceQuery
```

```

FROM E2AP-Constants;

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

E2AP-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
--
-- *****

E2AP-PDU ::= CHOICE {
    initiatingMessage      InitiatingMessage,
    successfulOutcome      SuccessfulOutcome,
    unsuccessfulOutcome    UnsuccessfulOutcome,
    ...
}

InitiatingMessage ::= SEQUENCE {
    procedureCode          E2AP-ELEMENTARY-PROCEDURE.&procedureCode({E2AP-ELEMENTARY-PROCEDURES}),
    criticality            E2AP-ELEMENTARY-PROCEDURE.&criticality({E2AP-ELEMENTARY-PROCEDURES}{@procedureCode}),
    value                  E2AP-ELEMENTARY-PROCEDURE.&InitiatingMessage({E2AP-ELEMENTARY-PROCEDURES}{@procedureCode})
}

SuccessfulOutcome ::= SEQUENCE {
    procedureCode          E2AP-ELEMENTARY-PROCEDURE.&procedureCode({E2AP-ELEMENTARY-PROCEDURES}),
    criticality            E2AP-ELEMENTARY-PROCEDURE.&criticality({E2AP-ELEMENTARY-PROCEDURES}{@procedureCode}),
    value                  E2AP-ELEMENTARY-PROCEDURE.&SuccessfulOutcome({E2AP-ELEMENTARY-PROCEDURES}{@procedureCode})
}

UnsuccessfulOutcome ::= SEQUENCE {
    procedureCode          E2AP-ELEMENTARY-PROCEDURE.&procedureCode({E2AP-ELEMENTARY-PROCEDURES}),
    criticality            E2AP-ELEMENTARY-PROCEDURE.&criticality({E2AP-ELEMENTARY-PROCEDURES}{@procedureCode}),
    value                  E2AP-ELEMENTARY-PROCEDURE.&UnsuccessfulOutcome({E2AP-ELEMENTARY-PROCEDURES}{@procedureCode})
}

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

E2AP-ELEMENTARY-PROCEDURES E2AP-ELEMENTARY-PROCEDURE ::= {
    E2AP-ELEMENTARY-PROCEDURES-CLASS-1      |
    E2AP-ELEMENTARY-PROCEDURES-CLASS-2,
    ...
}

E2AP-ELEMENTARY-PROCEDURES-CLASS-1 E2AP-ELEMENTARY-PROCEDURE ::= {
-- Defined in e2ap-PDU-Contents
    ricSubscription          |
    ricSubscriptionDelete   |
    ricServiceUpdate        |
    ricControl               |
}

```

```

-- Defined in x2ap-PDU-Contents
x2Setup                               |
endcX2Setup                           |
resourceStatusReportingInitiation     |
eNBConfigurationUpdate                |
endcConfigurationUpdate               |
reset,                                 |
...
}

E2AP-ELEMENTARY-PROCEDURES-CLASS-2 E2AP-ELEMENTARY-PROCEDURE ::= {
-- Defined in e2ap-PDU-Contents
ricIndication                         |
ricServiceQuery                       |

-- Defined in x2ap-PDU-Contents
loadIndication                        |
gNBStatusIndication                  |
resourceStatusReporting               |
errorIndication,                     |
...
}

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

ricSubscription E2AP-ELEMENTARY-PROCEDURE ::= {
INITIATING MESSAGE      RICsubscriptionRequest
SUCCESSFUL OUTCOME      RICsubscriptionResponse
UNSUCCESSFUL OUTCOME    RICsubscriptionFailure
PROCEDURE CODE          id-ricSubscription
CRITICALITY              reject
}

ricSubscriptionDelete E2AP-ELEMENTARY-PROCEDURE ::= {
INITIATING MESSAGE      RICsubscriptionDeleteRequest
SUCCESSFUL OUTCOME      RICsubscriptionDeleteResponse
UNSUCCESSFUL OUTCOME    RICsubscriptionDeleteFailure
PROCEDURE CODE          id-ricSubscriptionDelete
CRITICALITY              reject
}

ricServiceUpdate E2AP-ELEMENTARY-PROCEDURE ::= {
INITIATING MESSAGE      RICserviceUpdate
SUCCESSFUL OUTCOME      RICserviceUpdateAcknowledge
UNSUCCESSFUL OUTCOME    RICserviceUpdateFailure
PROCEDURE CODE          id-ricServiceUpdate
CRITICALITY              reject
}

ricControl E2AP-ELEMENTARY-PROCEDURE ::= {
INITIATING MESSAGE      RICcontrolRequest
SUCCESSFUL OUTCOME      RICcontrolAcknowledge
UNSUCCESSFUL OUTCOME    RICcontrolFailure
PROCEDURE CODE          id-ricControl
CRITICALITY              reject
}

x2Setup E2AP-ELEMENTARY-PROCEDURE ::= {
INITIATING MESSAGE      X2SetupRequest
SUCCESSFUL OUTCOME      X2SetupResponse
UNSUCCESSFUL OUTCOME    X2SetupFailure
PROCEDURE CODE          id-x2Setup
CRITICALITY              reject
}

endcX2Setup E2AP-ELEMENTARY-PROCEDURE ::= {
INITIATING MESSAGE      ENDCX2SetupRequest
SUCCESSFUL OUTCOME      ENDCX2SetupResponse
UNSUCCESSFUL OUTCOME    ENDCX2SetupFailure
PROCEDURE CODE          id-endcX2Setup
CRITICALITY              reject
}

```

```

resourceStatusReportingInitiation E2AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE      ResourceStatusRequest
  SUCCESSFUL OUTCOME      ResourceStatusResponse
  UNSUCCESSFUL OUTCOME    ResourceStatusFailure
  PROCEDURE CODE          id-resourceStatusReportingInitiation
  CRITICALITY             reject
}

-- en-dc gNB version of resourceStatusReportingInitiation not defined in 3GPP X2AP rel15 (to be
added when available)

eNBConfigurationUpdate E2AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE      ENBConfigurationUpdate
  SUCCESSFUL OUTCOME      ENBConfigurationUpdateAcknowledge
  UNSUCCESSFUL OUTCOME    ENBConfigurationUpdateFailure
  PROCEDURE CODE          id-eNBConfigurationUpdate
  CRITICALITY             reject
}

endcConfigurationUpdate E2AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE      ENDCConfigurationUpdate
  SUCCESSFUL OUTCOME      ENDCConfigurationUpdateAcknowledge
  UNSUCCESSFUL OUTCOME    ENDCConfigurationUpdateFailure
  PROCEDURE CODE          id-endcConfigurationUpdate
  CRITICALITY             reject
}

reset E2AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE      ResetRequest
  SUCCESSFUL OUTCOME      ResetResponse
  PROCEDURE CODE          id-reset
  CRITICALITY             reject
}

ricIndication E2AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE      RICindication
  PROCEDURE CODE          id-ricIndication
  CRITICALITY             ignore
}

ricServiceQuery E2AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE      RICserviceQuery
  PROCEDURE CODE          id-ricServiceQuery
  CRITICALITY             ignore
}

loadIndication E2AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE      LoadInformation
  PROCEDURE CODE          id-loadIndication
  CRITICALITY             ignore
}

gNBStatusIndication E2AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE      GNBStatusIndication
  PROCEDURE CODE          id-gNBStatusIndication
  CRITICALITY             ignore
}

resourceStatusReporting E2AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE      ResourceStatusUpdate
  PROCEDURE CODE          id-resourceStatusReporting
  CRITICALITY             ignore
}

-- en-dc gNB version of resourceStatusReporting not defined in 3GPP X2AP rel15 (to be added when
available)

errorIndication E2AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE      ErrorIndication
  PROCEDURE CODE          id-errorIndication
  CRITICALITY             ignore
}

END
-- ASN1STOP

```

9.3.4 PDU Definitions

In addition to the following ASN.1 file also, use ASN.1 module X2AP-PDU-Contents available in [6] section 9.3.4

```
-- ASN1START
-- *****
--
-- PDU definitions for E2AP
-- Derived from 3GPP X2AP 36.423v15.4.0 section 9.3.4 x2ap-PDU-Contents
--
-- *****

E2AP-PDU-Contents {
iso(1) identified-organization(3) dod(6) internet(1) private(4) enterprise(1) 28458 exp(99)
mobileDomain (0) ric (21) modules (3) e2ap (2) version1 (1) e2ap-PDU-Contents (1) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

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

IMPORTS

    RANfunctionID,
    RANfunctionDefinition,
    RICactionDefinition,
    RICactionID,
    RICactionType,
    RICcallProcessID,
    RICcause,
    RICcontrolAckRequest,
    RICcontrolMessage,
    RICcontrolStatus,
    RICeventTriggerDefinition,
    RICindicationType,
    RICindicationMessage,
    RICrequestID,
    RICsubsequentAction
FROM E2AP-IEs

    TimeToWait,
    CriticalityDiagnostics
FROM X2AP-IEs

    id-TimeToWait,
    id-CriticalityDiagnostics
FROM X2AP-Constants

    ProtocolIE-Container{},
    ProtocolIE-ContainerList{},
    ProtocolIE-Single-Container{},
    X2AP-PROTOCOL-IES,
    X2AP-PROTOCOL-IES-PAIR
FROM X2AP-Containers

    id-RANfunctionID,
    id-RANfunctionsAdded,
    id-RANfunctionsModified,
    id-RANfunctionsDeleted,
    id-RANfunction-Item,
    id-RANfunctionsAccepted,
    id-RANfunctionsRejected,
    id-RANfunctionIEcause-Item,
    id-RICrequestID,
    id-RICsubscription,
    id-RICaction-ToBeSetup-Item,
    id-RICactions-Admitted,
    id-RICactions-NotAdmitted,
    id-RICaction-Admitted-Item,
    id-RICaction-NotAdmitted-Item,
    id-RICcause,
    id-RICactionID,
```

```

    id-RICindicationSN,
    id-RICindicationHeader,
    id-RICindicationPayload,
    id-RICcallProcessID,
    id-RICcontrolMessage,
    id-RICcontrolAckRequest,
    id-RICcontrolStatus,
    id-RICserviceQuery,

    maxofRANfunctionID,
    maxofRICactionID
FROM E2AP-Constants;

-- *****
--
-- RIC SUBSCRIPTION REQUEST
--
-- *****
RICsubscriptionRequest ::= SEQUENCE {
    protocolIEs          ProtocolIE-Container    {{RICsubscriptionRequest-IEs}},
    ...
}

RICsubscriptionRequest-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-RICrequestID          CRITICALITY reject   TYPE RICrequestID
      PRESENCE mandatory } |
    { ID id-RANfunctionID        CRITICALITY reject   TYPE RANfunctionID
      PRESENCE mandatory } |
    { ID id-RICsubscription      CRITICALITY reject   TYPE RICsubscription
      PRESENCE mandatory },
    ...
}

RICsubscription ::= SEQUENCE {
    ricEventTriggerDefinition    RICEventTriggerDefinition,
    ricAction-ToBeSetup-List     RICActions-ToBeSetup-List,
    ...
}

RICActions-ToBeSetup-List ::= SEQUENCE (SIZE(1..maxofRICactionID)) OF ProtocolIE-Single-Container {
{{RICAction-ToBeSetup-ItemIEs} }

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

RICAction-ToBeSetup-Item ::= SEQUENCE {
    ricActionID                    RICActionID,
    ricActionType                  RICActionType,
    ricActionDefinition            RICActionDefinition    OPTIONAL,
    ricSubsequentAction            RICsubsequentAction    OPTIONAL,
    ...
}

-- *****
--
-- RIC SUBSCRIPTION RESPONSE
--
-- *****
RICsubscriptionResponse ::= SEQUENCE {
    protocolIEs          ProtocolIE-Container{{RICsubscriptionResponse-IEs}},
    ...
}

RICsubscriptionResponse-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-RICrequestID          CRITICALITY reject   TYPE RICrequestID
      PRESENCE mandatory } |
    { ID id-RANfunctionID        CRITICALITY reject   TYPE RANfunctionID
      PRESENCE mandatory } |
    { ID id-RICActions-Admitted   CRITICALITY reject   TYPE RICAction-Admitted-List
      PRESENCE mandatory } |
    { ID id-RICActions-NotAdmitted CRITICALITY reject   TYPE RICAction-NotAdmitted-List
      PRESENCE optional },
    ...
}

```



```

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

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

RICAction-Admitted-Item ::= SEQUENCE {
  ricActionID          RICActionID,
  ...
}

RICAction-NotAdmitted-List ::= SEQUENCE (SIZE(0..maxofRICActionID)) OF ProtocolIE-Single-Container {
{{RICAction-NotAdmitted-ItemIEs}} }

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

RICAction-NotAdmitted-Item ::= SEQUENCE {
  ricActionID          RICActionID,
  ricCause             RICcause,
  ...
}

-- *****
--
-- RIC SUBSCRIPTION FAILURE
--
-- *****
RICsubscriptionFailure ::= SEQUENCE {
  protocolIEs          ProtocolIE-Container    {{RICsubscriptionFailure-IEs}},
  ...
}

RICsubscriptionFailure-IEs X2AP-PROTOCOL-IES ::= {
  { ID id-RICrequestID          CRITICALITY reject  TYPE RICrequestID
    PRESENCE mandatory}|
  { ID id-RANfunctionID        CRITICALITY reject  TYPE RANfunctionID
    PRESENCE mandatory}|
  { ID id-RICactions-NotAdmitted  CRITICALITY reject  TYPE RICAction-NotAdmitted-List
    PRESENCE mandatory}|
  { ID id-CriticalityDiagnostics  CRITICALITY ignore  TYPE CriticalityDiagnostics
    PRESENCE optional},
  ...
}

-- *****
--
-- RIC SUBSCRIPTION DELETE REQUEST
--
-- *****
RICsubscriptionDeleteRequest ::= SEQUENCE {
  protocolIEs          ProtocolIE-Container    {{RICsubscriptionDeleteRequest-IEs}},
  ...
}

RICsubscriptionDeleteRequest-IEs X2AP-PROTOCOL-IES ::= {
  { ID id-RICrequestID          CRITICALITY reject  TYPE RICrequestID
    PRESENCE mandatory}|
  { ID id-RANfunctionID        CRITICALITY reject  TYPE RANfunctionID
    PRESENCE mandatory},
  ...
}

-- *****
--
-- RIC SUBSCRIPTION DELETE RESPONSE
--
-- *****
RICsubscriptionDeleteResponse ::= SEQUENCE {

```

```

    protocolIEs          ProtocolIE-Container    {{RICsubscriptionDeleteResponse-IEs}},
    ...
}

RICsubscriptionDeleteResponse-IEs X2AP-PROTOCOL-IES ::= {
  { ID id-RIcrequestID          CRITICALITY reject  TYPE RICrequestID
  PRESENCE mandatory}|
  { ID id-RANfunctionID        CRITICALITY reject  TYPE RANfunctionID
  PRESENCE mandatory},
  ...
}
-- *****
--
-- RIC SUBSCRIPTION DELETE FAILURE
--
-- *****
RICsubscriptionDeleteFailure ::= SEQUENCE {
  protocolIEs          ProtocolIE-Container    {{RICsubscriptionDeleteFailure-IEs}},
  ...
}

RICsubscriptionDeleteFailure-IEs X2AP-PROTOCOL-IES ::= {
  { ID id-RIcrequestID          CRITICALITY reject  TYPE RICrequestID
  PRESENCE mandatory}|
  { ID id-RANfunctionID        CRITICALITY reject  TYPE RANfunctionID
  PRESENCE mandatory}|
  { ID id-RIccause              CRITICALITY ignore  TYPE RICcause
  PRESENCE mandatory}|
  { ID id-CriticalityDiagnostics CRITICALITY ignore  TYPE CriticalityDiagnostics
  PRESENCE optional},
  ...
}
-- *****
--
-- RIC INDICATION
--
-- *****
RICindication ::= SEQUENCE {
  protocolIEs          ProtocolIE-Container    {{RICindication-IEs}},
  ...
}

RICindication-IEs X2AP-PROTOCOL-IES ::= {
  { ID id-RIcrequestID          CRITICALITY reject  TYPE RICrequestID
  PRESENCE mandatory}|
  { ID id-RANfunctionID        CRITICALITY reject  TYPE RANfunctionID
  PRESENCE mandatory}|
  { ID id-RIccactionID         CRITICALITY reject  TYPE RICactionID
  PRESENCE mandatory}|
  { ID id-RIccindicationSN     CRITICALITY reject  TYPE RICindicationSN
  PRESENCE mandatory}|
  { ID id-RIccindicationType   CRITICALITY reject  TYPE RICindicationType
  PRESENCE mandatory}|
  { ID id-RIccindicationHeader CRITICALITY reject  TYPE RICindicationHeader
  PRESENCE mandatory}|
  { ID id-RIccindicationMessage CRITICALITY reject  TYPE RICindicationMessage
  PRESENCE mandatory} |
  { ID id-RIccallProcessID     CRITICALITY reject  TYPE RICcallProcessID
  PRESENCE optional},
  ...
}
-- *****
--
-- RIC CONTROL REQUEST
--
-- *****
RICcontrolRequest ::= SEQUENCE {
  protocolIEs          ProtocolIE-Container    {{RICcontrolRequest-IEs}},
  ...
}

RICcontrolRequest-IEs X2AP-PROTOCOL-IES ::= {
  { ID id-RIcrequestID          CRITICALITY reject  TYPE RICrequestID
  PRESENCE mandatory}|
  { ID id-RANfunctionID        CRITICALITY reject  TYPE RANfunctionID
  PRESENCE mandatory}|

```

```

    { ID id-RICcallProcessID          CRITICALITY reject  TYPE RICcallProcessID
      PRESENCE optional}|
    { ID id-RICcontrolHeader          CRITICALITY reject  TYPE RICcontrolHeader
      PRESENCE mandatory}|
    { ID id-RICcontrolMessage        CRITICALITY reject  TYPE RICcontrolMessage
      PRESENCE mandatory}|
    { ID id-RICcontrolAckRequest     CRITICALITY reject  TYPE RICcontrolAckRequest
      PRESENCE optional},
    ...
  }
-- *****
--
-- RIC CONTROL ACKNOWLEDGE
--
-- *****
RICcontrolAcknowledge ::= SEQUENCE {
  protocolIEs          ProtocolIE-Container    {{RICcontrolAcknowledge-IEs}},
  ...
}

RICcontrolAcknowledge-IEs X2AP-PROTOCOL-IES ::= {
  { ID id-RICrequestID          CRITICALITY reject  TYPE RICrequestID
    PRESENCE mandatory}|
  { ID id-RANfunctionID        CRITICALITY reject  TYPE RANfunctionID
    PRESENCE mandatory}|
  { ID id-RICcallProcessID     CRITICALITY reject  TYPE RICcallProcessID
    PRESENCE optional}|
  { ID id-RICcontrolStatus     CRITICALITY reject  TYPE RICcontrolStatus
    PRESENCE mandatory},
  ...
}
-- *****
--
-- RIC CONTROL FAILURE
--
-- *****
RICcontrolFailure ::= SEQUENCE {
  protocolIEs          ProtocolIE-Container    {{RICcontrolFailure-IEs}},
  ...
}

RICcontrolFailure-IEs X2AP-PROTOCOL-IES ::= {
  { ID id-RICrequestID          CRITICALITY reject  TYPE RICrequestID
    PRESENCE mandatory}|
  { ID id-RANfunctionID        CRITICALITY reject  TYPE RANfunctionID
    PRESENCE mandatory}|
  { ID id-RICcallProcessID     CRITICALITY reject  TYPE RICcallProcessID
    PRESENCE optional}|
  { ID id-RICcause             CRITICALITY ignore  TYPE RICcause
    PRESENCE mandatory},
  ...
}
-- *****
--
-- RIC SERVICE UPDATE
--
-- *****
RICserviceUpdate ::= SEQUENCE {
  protocolIEs          ProtocolIE-Container    {{RICserviceUpdate-IEs}},
  ...
}

RICserviceUpdate-IEs X2AP-PROTOCOL-IES ::= {
  { ID id-RANfunctionsAdded     CRITICALITY reject  TYPE RANfunctions-List
    PRESENCE optional}|
  { ID id-RANfunctionsModified  CRITICALITY reject  TYPE RANfunctions-List
    PRESENCE optional}|
  { ID id-RANfunctionsDeleted   CRITICALITY reject  TYPE RANfunctionsID-List
    PRESENCE optional},
  ...
}

RANfunctions-List ::= SEQUENCE (SIZE(0..maxofRANfunctionID)) OF ProtocolIE-Single-Container {
  {RANfunction-ItemIEs} }

RANfunction-ItemIEs      X2AP-PROTOCOL-IES ::= {

```

```

    { ID id-RANfunction-Item          CRITICALITY ignore  TYPE RANfunction-Item
      PRESENCE mandatory },
    ...
}

RANfunction-Item ::= SEQUENCE {
    ranFunctionID          RANfunctionID,
    ranFunctionDefinition  RANfunctionDefinition,
    ...
}

RANfunctionsID-List ::= SEQUENCE (SIZE(0..maxofRANfunctionID)) OF ProtocolIE-Single-
Container{{RANfunctionID-ItemIEs}}

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

RANfunctionID-Item ::= SEQUENCE {
    ranFunctionID          RANfunctionID,
    ...
}

-- *****
--
-- RIC SERVICE UPDATE ACKNOWLEDGE
--
-- *****
RICserviceUpdateAcknowledge ::= SEQUENCE {
    protocolIEs          ProtocolIE-Container    {{RICserviceUpdateAcknowledge-IEs}},
    ...
}

RICserviceUpdateAcknowledge-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-RANfunctionsAccepted        CRITICALITY reject  TYPE RANfunctionsID-List
      PRESENCE optional}|
    { ID id-RANfunctionsRejected        CRITICALITY reject  TYPE RANfunctionsIDcause-List
      PRESENCE optional},
    ...
}

RANfunctionsIDcause-List ::= SEQUENCE (SIZE(0..maxofRANfunctionID)) OF ProtocolIE-Single-Container {
{{RANfunctionIDcause-ItemIEs}} }

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

RANfunctionIDcause-Item ::= SEQUENCE {
    ranFunctionID          RANfunctionID,
    ricCause              RICcause,
    ...
}

-- *****
--
-- RIC SERVICE UPDATE FAILURE
--
-- *****
RICserviceUpdateFailure ::= SEQUENCE {
    protocolIEs          ProtocolIE-Container    {{RICserviceUpdateFailure-IEs}},
    ...
}

RICserviceUpdateFailure-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-RANfunctionsRejected        CRITICALITY ignore  TYPE RANfunctionsIDcause-List
      PRESENCE optional}|
    { ID id-TimeToWait                 CRITICALITY ignore  TYPE TimeToWait
      PRESENCE optional}|
}

```

```

    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics
      PRESENCE optional},
    ...
}

-- *****
--
-- RIC SERVICE QUERY
--
-- *****
RICserviceQuery ::= SEQUENCE {
    protocolIEs          ProtocolIE-Container    {{RICserviceQuery-IEs}},
    ...
}

RICserviceQuery-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-RANfunctionsAccepted      CRITICALITY reject  TYPE RANfunctionsID-List
      PRESENCE optional},
    ...
}

END
-- ASN1STOP

```

9.3.5 Information Element definitions

In addition to the following ASN.1 module, also use ASN.1 module X2AP-IEs available in [6] section 9.3.5

```

-- ASN1START
-- *****
--
-- Information Element Definitions
-- Derived from 3GPP X2AP 36.423v15.4.0 section 9.3.5 x2ap-IEs
-- see also 3GPP X2AP 36.423 section 9.3.5 x2ap-IEs
-- *****

E2AP-IEs {
iso(1) identified-organization(3) dod(6) internet(1) private(4) enterprise(1) 28458 exp(99)
mobileDomain (0) ric (21) modules (3) e2ap (2) version1 (1) e2ap-IEs (2) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    CauseRadioNetwork,
    CauseTransport,
    CauseProtocol,
    CauseMisc
FROM X2AP-IEs;

-- A
-- B
-- C

CauseRIC ::= ENUMERATED {
    function-id-Invalid,
    action-not-supported,
    excessive-actions,
    duplicate-action,
    duplicate-event,
    function-resource-limit,
    request-id-unknown,
    inconsistent-action-subsequent-action-sequence,
    control-message-invalid,
    call-process-id-invalid,
    function-not-required,
    excessive-functions,
    ric-resource-limit,
    ...
}

-- D
-- E
-- F
-- G
-- H
-- I

```

```
-- J
-- K
-- L
-- M
-- N
-- O
-- P
-- Q
-- R
RANfunctionDefinition ::= OCTET STRING

RANfunctionID ::= INTEGER (0..4095)

RICActionDefinition ::= OCTET STRING

RICActionID ::= INTEGER (0..255)

RICActionType ::= ENUMERATED{
    report,
    insert,
    policy,
    ...
}

RICcallProcessID ::= OCTET STRING

RICcause ::= CHOICE {
    radioNetwork      CauseRadioNetwork,
    transport         CauseTransport,
    protocol          CauseProtocol,
    misc              CauseMisc,
    ric               CauseRIC,
    ...
}

RICcontrolAckRequest ::= ENUMERATED{
    noAck,
    ack,
    nAck,
    ...
}

RICcontrolHeader ::= OCTET STRING

RICcontrolMessage ::= OCTET STRING

RICcontrolStatus ::= ENUMERATED{
    success,
    rejected,
    failed,
    ...
}

RICEventTriggerDefinition ::= OCTET STRING

RICindicationHeader ::= OCTET STRING

RICindicationMessage ::= OCTET STRING

RICindicationSN ::= INTEGER (0..65535)

RICindicationType ::= ENUMERATED{
    report,
    insert,
    ...
}

RICrequestID ::= SEQUENCE {
    ricRequestorID      INTEGER (0..65535),
    ricRequestSequenceNumber  INTEGER (0..65535),
    ...
}

RICsubsequentAction ::=SEQUENCE{
    ricSubsequentActionType  RICsubsequentActionType,
    ricTimeToWait            RICtimeToWait,
    ...
}
```

```

RICsubsequentActionType ::= ENUMERATED{
    continue,
    wait,
    ...
}

RICtimeToWait ::= ENUMERATED{
    zero,
    w1ms,
    w2ms,
    w5ms,
    w10ms,
    w20ms,
    w30ms,
    w40ms,
    w50ms,
    w100ms,
    w200ms,
    w500ms,
    w1s,
    w2s,
    w5s,
    w10s,
    w20s,
    w60s,
    ...
}

-- S
-- T
-- U
-- V
-- W
-- X
-- Y
-- Z

END
-- ASN1STOP

```

9.3.6 Common definitions

Use ASN.1 module X2AP-CommonDataTypes available in [6] section 9.3.6

9.3.7 Constant definitions

In addition to the following ASN.1 file, also use ASN.1 module X2AP-Constants available in [6] section 9.3.7

```

-- ASN1START
-- *****
--
-- Constant definitions
-- Derived from 3GPP X2AP 36.423v15.4.0 section 9.3.7 x2ap-Constants
-- see also 3GPP X2AP 36.423 section 9.3.7 x2ap-Constants
-- *****

E2AP-Constants {
iso(1) identified-organization(3) dod(6) internet(1) private(4) enterprise(1) 28458 exp(99)
mobileDomain (0) ric (21) modules (3) e2ap (2) version1 (1) e2ap-Constants (4) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    ProcedureCode,
    ProtocolIE-ID
FROM X2AP-CommonDataTypes;

-- *****
--
-- Elementary Procedures
-- Note: see also x2ap-Constants for ProcedureCode less than 200
-- *****

```

```

id-ricSubscription ProcedureCode ::= 201
id-ricSubscriptionDelete ProcedureCode ::= 202
id-ricServiceUpdate ProcedureCode ::= 203
id-ricControl ProcedureCode ::= 204
id-ricIndication ProcedureCode ::= 205
id-ricServiceQuery ProcedureCode ::= 206

-- *****
--
-- Lists
-- Note: see also x2ap-Constants
-- *****
maxofRANfunctionID INTEGER ::=256
maxofRICactionID INTEGER ::= 16

-- *****
--
-- IEs
-- Note: see also x2ap-Constants for ProtocolIE-ID less than 60000
-- *****
id-RANfunction-Item ProtocolIE-ID ::= 60001
id-RANfunctionDefinition ProtocolIE-ID ::= 60002
id-RANfunctionID ProtocolIE-ID ::= 60003
id-RANfunctionID-Item ProtocolIE-ID ::= 60004
id-RANfunctionIEcause-Item ProtocolIE-ID ::= 60005
id-RANfunctionsAccepted ProtocolIE-ID ::= 60006
id-RANfunctionsAdded ProtocolIE-ID ::= 60007
id-RANfunctionsDeleted ProtocolIE-ID ::= 60008
id-RANfunctionsModified ProtocolIE-ID ::= 60009
id-RANfunctionsRejected ProtocolIE-ID ::= 60010
id-RIcAction-ToBeSetup-Item ProtocolIE-ID ::= 60011
id-RIcActions-Admitted ProtocolIE-ID ::= 60012
id-RIcAction-Admitted-Item ProtocolIE-ID ::= 60013
id-RIcActions-NotAdmitted ProtocolIE-ID ::= 60014
id-RIcAction-NotAdmitted-Item ProtocolIE-ID ::= 60015
id-RIcActionDefinition ProtocolIE-ID ::= 60016
id-RIcActionID ProtocolIE-ID ::= 60017
id-RIcActionType ProtocolIE-ID ::= 60018
id-RIcCallProcessID ProtocolIE-ID ::= 60019
id-RIcCause ProtocolIE-ID ::= 60020
id-RIcControlAckRequest ProtocolIE-ID ::= 60021
id-RIcControlHeader ProtocolIE-ID ::= 60022
id-RIcControlMessage ProtocolIE-ID ::= 60023
id-RIcControlStatus ProtocolIE-ID ::= 60024
id-RIcEventTriggerDefinition ProtocolIE-ID ::= 60025
id-RIcIndicationHeader ProtocolIE-ID ::= 60026
id-RIcIndicationMessage ProtocolIE-ID ::= 60027
id-RIcIndicationSN ProtocolIE-ID ::= 60028
id-RIcIndicationType ProtocolIE-ID ::= 60029
id-RIcRequestID ProtocolIE-ID ::= 60030
id-RIcRequestorID ProtocolIE-ID ::= 60031
id-RIcRequestSequenceNumber ProtocolIE-ID ::= 60032
id-RIcSubscription ProtocolIE-ID ::= 60033
id-RIcSubsequentAction ProtocolIE-ID ::= 60034
id-RIcSubsequentActionType ProtocolIE-ID ::= 60035
id-RIcTimeToWait ProtocolIE-ID ::= 60036

END
-- ASN1STOP

```

9.3.8 Container definitions

Use ASN.1 module X2AP-Containers available in [6] section 9.3.8

9.4 Message transfer syntax

E2AP shall use the ASN.1 Basic Packed Encoding Rules (BASIC-PER) Aligned Variant as transfer syntax, as specified in ITU-T Rec. X.691 [5].

9.5 Timers

In addition to the following definition see also Timers defined in [6] section 9.3.7

$T_{\text{RICEVENTcreate}}$

- Specifies the maximum time for the RIC Subscription Request event creation procedure in the RAN node.

$T_{\text{RICEVENTdelete}}$

- Specifies the maximum time for the RIC Subscription Request event deletion procedure in the RAN node.

$T_{\text{RICcontrol}}$.

- Specifies the maximum time for the RIC Control procedure in the RAN node.

10 Handling of unknown, unforeseen and erroneous protocol data

Section 10 of TS 36.413 [4] is applicable for the purposes of the present document.

Annex A (informative): Change history

Date	Status	Author	Subject/Comment	New
2 Oct. 2019	Approved	A. URIE	Release 1 version	1.0.0