O-RAN.WG3.E2AP-R003-v03.01

\\

Technical Specification

O-RAN Work Group 3 (WG-3)
Near-Real-time RAN Intelligent Controller and E2 Interface

E2 Application Protocol (E2AP)

Copyright © 2023 by the O-RAN ALLIANCE e.V.
The copying or incorporation into any other work of part or all of the material available in this document in any form without the prior written permission of O-RAN ALLIANCE e.V. is prohibited, save that you may print or download extracts of the material of this document for your personal use, or copy the material of this document for the purpose of sending to individual third parties for their information provided that you acknowledge O-RAN ALLIANCE as the source of the material and that you inform the third party that these conditions apply to them and that they must comply with them.

O-RAN ALLIANCE e.V., Buschkauler Weg 27, 53347 Alfter, Germany
Register of Associations, Bonn VR 11238, VAT ID DE321720189

"© 2019. 3GPP™ TSs and TRs are the property of ARIB, ATIS, CCSA, ETSI, TSDSI, TTA and TTC who jointly own the copyright in them. They are subject to further modifications and are therefore provided to you "as is" for information purposes only. Further use is strictly prohibited."

"© 2020. 3GPP™ TSs and TRs are the property of ARIB, ATIS, CCSA, ETSI, TSDSI, TTA and TTC who jointly own the copyright in them. They are subject to further modifications and are therefore provided to you "as is" for information purposes only. Further use is strictly prohibited."

Contents

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

Foreword

This Technical Specification (TS) has been produced by O-RAN Alliance.

Modal verbs terminology

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

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

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

1 Scope

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

Release x.y.z

where:

x the first digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc. (the initial approved document will have x=01).

y the second digit is incremented when editorial only changes have been incorporated in the document.

z the third digit included only in working versions of the document indicating incremental changes during the editing process.

The present document specifies the Near-RT RIC layer signalling protocol for the E2 interface.

The E2 interface provides means for interconnecting a Near-RT RIC and an E2 Node. The E2 Application Protocol (E2AP) supports the functions of E2 interface by signalling procedures defined in the present document. E2AP is developed in accordance to the general principles stated in O-RAN E2 General Aspects & Principles [2].

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, O-RAN cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document in 3GPP Release 17.

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

[2] O-RAN-WG3.E2GAP: “O-RAN Working Group 3 Near-Real-time RAN Intelligent Controller, E2 General Aspects and Principles”.

[3] O-RAN-WG3.E2SM: “O-RAN Working Group 3, Near-Real-time RAN Intelligent Controller, E2 Application Protocol (E2AP)”.

[4] void

[5] void

[6] 3GPP TS 36.401: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Architecture Description".

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

[7] 3GPP TS 38.401: "NG-RAN; Architecture description".

[8] 3GPP TS 36.420: “X2 general aspects and principles”.

[9] void

[10] 3GPP TS 38.410: “NG general aspects and principles”.

[11] 3GPP TS 38.420: “Xn general aspects and principles”.

[12] 3GPP TS 38.470: “F1 general aspects and principles”.

[13] 3GPP TS 36.410: “S1 general aspects and principles”.

[14] 3GPP TS 25.921: “Guidelines and principles for protocol description and error handling”.

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

[16] ITU-T Recommendation X.680 (07/2002): "Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation".

[17] ITU-T Recommendation X.681 (07/2002): "Information technology – Abstract Syntax Notation One (ASN.1): Information object specification".

[18] void

[19] 3GPP TS 38.413: "NG-RAN; NG Application Protocol (NGAP)"

[20] 3GPP TS 38.423: "NG-RAN; Xn application protocol (XnAP)"

[21] 3GPP TS 37.483: "E1 Application Protocol (E1AP)"

[22] 3GPP TS 38.473: "NG-RAN; F1 application protocol (F1AP)"

[23] 3GPP TS 37.473: "W1 interface; Application Protocol (W1AP)"

[24] 3GPP TS 36.413: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)"

[25] 3GPP TS 36.423: “Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 application protocol (X2AP)”

[26] IETF RFC 5905: “Network Time Protocol Version 4: Protocol and Algorithms Specification”

[27] O-RAN.WG1.OAD: “O-RAN Architecture Description”

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, O-RAN cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area. None

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms and definitions given in TR 21.905 [1], O-RAN WG1.OAD [27] 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]. and O-RAN WG1.OAD [27]

E2 Node Component ID: Local identifier used to uniquely identify an E2 Node component.

Elementary Procedure: E2AP protocol consists of Elementary Procedures (EPs). An E2AP Elementary Procedure is a unit of interaction between the Near-RT RIC and an E2 Node. 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.

Global E2 Node ID: Global identifier of an E2 Node. Defined as the global eNB or gNB identifier and an optional local identifier of an CU-UP or DU which is required when and if an individual DU or CU-UP supports a direct E2 interface.

Global RIC ID: Global identifier of a Near-RT RIC.

RAN Function: A specific Function in a E2 Node; examples include termination of network interfaces (i.e. X2 [8], F1 [12], S1 [13], Xn [11], NGc [10]) and RAN internal functions handling UEs, Cells, etc.

RAN Function ID: Local identifier of a specific RAN Function within an E2 Node that supports one or more RIC Services using a specific E2 Service Model.

RAN Function OID: RAN Function Object Identifier. Used to identify specific RAN function definition (i.e. E2SM used by specific RAN Function).

RIC Action ID: Local identifier used Near-RT RIC to identify a specific RIC Service Action within a specific RIC Subscription Request, used by E2 Node in subsequent RIC Indication messages.

RIC Call Process ID: Local identifier used by E2 Node to identify the suspended associated procedure instance during an Insert RIC Service Action, used by Near-RT RIC in subsequent RIC Control procedure.

RIC Request ID: Local identifier used to identify a specific RIC Functional procedure among all ongoing parallel procedures of the same type initiated by the same protocol peer. Messages belonging to the same procedure use the same RIC Request ID. The RIC Request ID is determined by the initiating peer of a RIC Functional Procedure.

RIC Service: A Service provided on an E2 Node to provide access to messages and measurements and / or enable control of the E2 Node from the Near-RT RIC.

Transaction ID: Local identifier used to uniquely identify a Global Procedure among all ongoing parallel procedures of the same type initiated by the same protocol peer. Messages belonging to the same procedure use the same Transaction ID. The Transaction ID is determined by the initiating peer of a Global Procedure (Near-RT RIC or E2 Node).

3.2 Symbols

For the purposes of the present document, the following symbols apply: None

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 Error: Reference source not found, O-RAN WG1.OAD [27] 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 Error: Reference source not found and O-RAN WG1.OAD [27].

EP Elementary Procedure

4 General

4.1 Procedure Specification 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 specification principles have been applied for the procedure text in clause 8:

- The procedure text discriminates between:

  1) Functionality which "shall" be executed.

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

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

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

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

4.2 Forwards and Backwards Compatibility

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

4.3 Specification Notations

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

Procedure When referring to an elementary procedure in the specification the Procedure Name is written with the first letters in each word in upper case characters followed by the word "procedure", e.g. Handover Preparation procedure.

Message When referring to a message in the specification the MESSAGE NAME is written with all letters in upper case characters followed by the word "message", e.g. HANDOVER REQUEST message.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

IE	When referring to an information element (IE) in the specification the *Information Element Name* is written with the first letters in each word in upper case characters and all letters in Italic font followed by the abbreviation "IE", e.g. *E-RAB ID* IE.
Value of an IE	When referring to the value of an information element (IE) in the specification the "Value" is written as it is specified in the specification enclosed by quotation marks, e.g. "Value".

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

5 E2AP Services

The present clause describes the services an E2 Node offers to the Near-RT RIC.

5.1 E2AP procedure modules

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

1. RIC Functional Procedures;
2. Global Procedures;

The RIC functional procedures module contains procedures used to pass application specific messages between Near-RT RIC applications and a target RAN Function in an E2 node [2].

The Global Procedures module contains procedures that are not directly related to a specific application.

5.2 Parallel transactions

Parallel transactions, that is, multiple ongoing E2AP procedures related to the same Application and E2 node, are supported.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

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.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

7 Functions of E2AP

The functions of E2AP are described in O-RAN Working Group 3 Near-Real-time RAN Intelligent Controller, E2 General Aspects and Principles [2].

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

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
Near-RT RIC	RIC Subscription	RIC SUBSCRIPTION REQUEST	RIC SUBSCRIPTION RESPONSE	RIC SUBSCRIPTION FAILURE
Near-RT RIC	RIC Subscription Delete	RIC SUBSCRIPTION DELETE REQUEST	RIC SUBSCRIPTION DELETE RESPONSE	RIC SUBSCRIPTION DELETE FAILURE
Near-RT RIC	RIC Subscription Modification	RIC SUBSCRIPTION MODIFICATION REQUEST	RIC SUBSCRIPTION MODIFICATION RESPONSE	RIC SUBSCRIPTION MODIFICATION FAILURE
E2 Node	RIC Subscription Modification Required	RIC SUBSCRIPTION MODIFICATION REQUIRED	RIC SUBSCRIPTION MODIFICATION CONFIRM	RIC SUBSCRIPTION MODIFICATION REFUSE
Near-RT RIC	RIC Control	RIC CONTROL REQUEST	RIC CONTROL ACKNOWLEDGE	RIC CONTROL FAILURE
Near-RT RIC	RIC Query	RIC QUERY REQUEST	RIC QUERY RESPONSE	RIC QUERY FAILURE
E2 Node	E2 Setup	E2 SETUP REQUEST	E2 SETUP RESPONSE	E2 SETUP FAILURE
E2 Node	RIC Service Update	RIC SERVICE UPDATE	RIC SERVICE UPDATE ACKNOWLEDGE	RIC SERVICE UPDATE FAILURE
E2 Node	E2 Node Configuration Update	E2 NODE CONFIGURATION UPDATE	E2 NODE CONFIGURATION UPDATE ACKNOWLEDGE	E2 NODE CONFIGURATION UPDATE FAILURE
Near-RT RIC	E2 Connection Update	E2 CONNECTION UPDATE	E2 CONNECTION UPDATE ACKNOWLEDGE	E2 CONNECTION UPDATE FAILURE
Near-RT RIC or E2 Node	Reset	RESET REQUEST	RESET RESPONSE	
Near-RT RIC or E2 Node	E2 Removal	E2 REMOVAL REQUEST	E2 REMOVAL RESPONSE	E2 REMOVAL FAILURE

Table 8.1-2: Class 2 Elementary Procedures

Initiated by	Elementary Procedure	Initiating Message
E2 Node	RIC Indication	RIC INDICATION
Near-RT RIC	RIC Service Query	RIC SERVICE QUERY
E2 Node	RIC Subscription Delete Required	RIC SUBSCRIPTION DELETE REQUIRED
E2 Node or Near-RT RIC	Error Indication	ERROR INDICATION

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

8.2 RIC Functional Procedures

8.2.1 RIC Subscription procedure

8.2.1.1 General

This procedure is used to establish RIC Subscriptions on E2 Node consisting of an event trigger and a sequence of RIC Service Actions.

This procedure shall be initiated by the Near-RT RIC.

This procedure uses RIC Service signalling.

8.2.1.2 Successful Operation

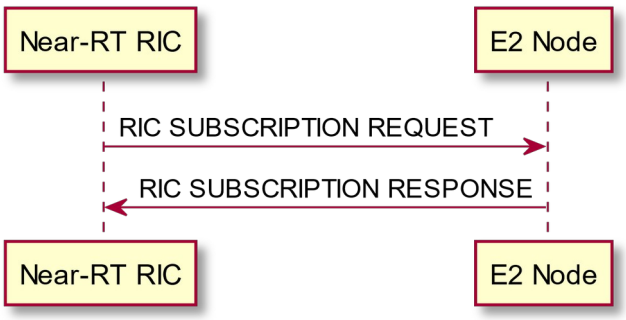

Figure 8.2.1.2-1: RIC Subscription procedure, successful operation

The Near-RT RIC initiates the procedure by sending a RIC SUBSCRIPTION REQUEST message which shall contain a unique *RIC Request ID* IE, assigned by the Near-RT RIC, to the E2 Node.

When the Near-RT RIC sends the RIC SUBSCRIPTION REQUEST message, it shall start the timer $T_{RICEVENTcreate}$.

At reception of the RIC SUBSCRIPTION REQUEST message the E2 Node shall:

- Determine the target RAN Function using the information in the *RAN Function ID* IE and configure the requested event trigger using information in the *RIC Subscription Details* IE.
- If one or more Report, Insert and/or Policy RIC Service Actions are included in the *RIC Subscription Details* IE then the target RAN Function shall validate the event trigger and requested action sequence and, if accepted, store the required *RIC Request ID, RIC Event Trigger Definition* IE and sequence of RIC Service Actions.
- If optional *RIC Subscription Start Time* IE is present and has expired, then the E2 Node shall ignore the optional *RIC Subscription Start Time* IE.

If the requested trigger and at least one required RIC Service Action are accepted by the E2 Node, the E2 Node shall reserve for each admitted RIC Service Action the necessary resources and send the RIC SUBSCRIPTION RESPONSE message back to the Near-RT RIC.

The E2 Node shall include in the response message the RIC Service Actions for which resources have been prepared at the E2 Node in the *RIC Actions Admitted List* IE.

The E2 Node shall include the RIC Service Actions that have not been admitted in the *RIC Actions Not Admitted List* IE with an appropriate cause value.

Upon reception of the RIC SUBSCRIPTION RESPONSE message the Near-RT RIC shall stop timer $T_{RICEVENTcreate}$ and terminate the RIC Subscription procedure.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

If more than one RIC Service Actions has been accepted by the E2 Node then, at each occurrence of the common Event Trigger, the sequence of RIC Service Actions shall be executed according to the following considerations:

- If optional *RIC Action Execution Order* IE is not present or is present and set to 0 (“Any order”), then the specific RIC Service Action in the sequence of RIC Service Actions may be executed in any order irrespective of the execution order of the other RIC Service Actions.
- If optional *RIC Action Execution Order* IE is present and set to a value greater than 0, then the specific RIC Service Action shall be executed in order according to the *RIC Action Execution Order* IE.
- If two or more RIC Service Actions have the same value for the optional *RIC Action Execution Order* IE then these RIC Service Actions shall be executed in parallel.

If the optional *RIC Subscription Start Time* IE is present, the E2 Node shall only enable the event trigger from the indicated start time.

If the optional *RIC Subscription End Time* IE is present, the E2 Node shall disable the event trigger when the indicated end time has expired.

Interactions with RIC Subscription Delete Required procedure:

If the optional *RIC Subscription End Time* IE is present and the indicated end time has expired, the E2 Node may send the RIC SUBSCRIPTION DELETE REQUIRED message to the Near-RT RIC with an appropriate cause value.

Interactions with RIC Subscription Delete procedure:

If the optional *RIC Subscription End Time* IE is present, the Near-RT RIC may initiate an RIC Subscription Delete procedure when the expected *RIC Subscription End Time* has expired.

8.2.1.3 Unsuccessful Operation

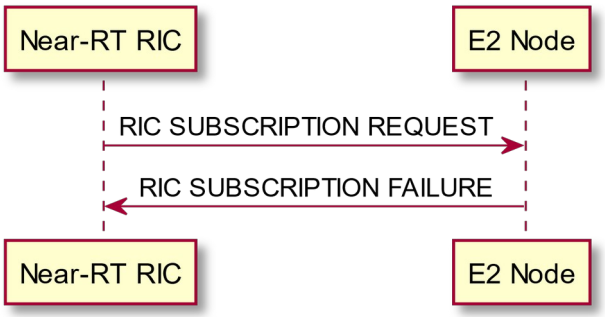

Figure 8.2.1.3-1: RIC Subscription procedure, unsuccessful operation

If a failure occurs during the RIC Subscription procedure the E2 Node shall send the RIC SUBSCRIPTION FAILURE message to the Near-RT RIC containing an appropriate cause value.

If the E2 Node admits none of the requested RIC Service Actions, or detects an inconsistency in the sequence of RIC ServiceActions, or in the optional *RIC Subsequent Action* IE definitions, the E2 Node shall send the RIC SUBSCRIPTION FAILURE message to the Near-RT RIC containing an appropriate cause value.

If the RIC Subscription procedure contains an invalid optional *RIC Subscription Start Time* IE and/or *RIC Subscription End Time* IE, the E2 Node shall send the RIC SUBSCRIPTION FAILURE message to the Near-RT RIC containing an appropriate cause value.

Upon reception of the RIC SUBSCRIPTION FAILURE message the Near-RT RIC shall stop the timer $T_{RICEVENTcreate}$ and terminate the RIC Subscription procedure.

Interactions with RIC Subscription Delete procedure:

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

If there is no response from the E2 Node to the RIC SUBSCRIPTION REQUEST message before timer $T_{RICEVENTcreate}$ expires in the Near-RT RIC, the Near-RT RIC shall initiate the RIC Subscription Delete procedure containing *RIC Request ID* IE that was previously assigned by the Near-RT RIC to cancel the RIC Subscription towards the E2 Node. The Near-RT RIC shall ignore any RIC SUBSCRIPTION RESPONSE or RIC SUBSCRIPTION FAILURE message containing *RIC Request ID* IE that was previously assigned by the Near-RT RIC received after the initiation of the RIC Subscription Delete procedure and release any resources related to the concerned E2 Node.

8.2.1.4 Abnormal Conditions

If the E2 Node receives a RIC SUBSCRIPTION REQUEST message containing *RIC Subscription Details* IE that does not align with the E2 Service Model [3], the E2 Node shall send the RIC SUBSCRIPTION FAILURE message to the Near-RT RIC containing an appropriate cause value.

If the E2 Node receives a RIC SUBSCRIPTION REQUEST message which contains an unknown *RAN Function ID* IE, the E2 Node shall send the RIC SUBSCRIPTION FAILURE message to the Near-RT RIC containing an appropriate cause value.

If the E2 Node receives a RIC SUBSCRIPTION REQUEST message containing identical contents the E2 Node shall send the RIC SUBSCRIPTION FAILURE message to the Near-RT RIC containing an appropriate cause value.

8.2.2 RIC Subscription Delete procedure

8.2.2.1 General

This procedure is used to delete RIC Subscriptions on E2 Node.

This procedure shall be initiated by the Near-RT RIC.

This procedure uses RIC Service signalling.

8.2.2.2 Successful Operation

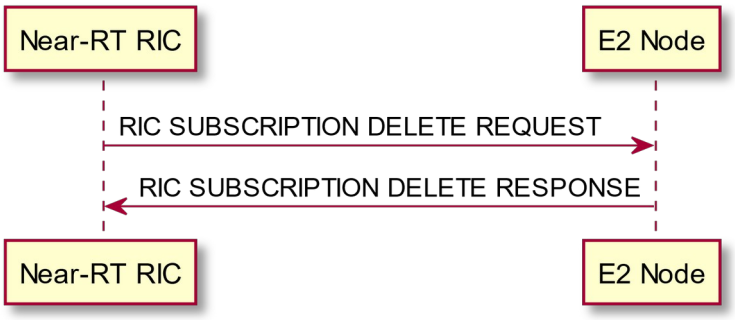

Figure 8.2.2.2-1: RIC Subscription Delete procedure, successful operation

The Near-RT RIC initiates the procedure by sending a RIC SUBSCRIPTION DELETE REQUEST message, containing *RIC Request ID* IE that was previously assigned by the Near-RT RIC during a successful RIC Subscription procedure, to the E2 Node.

When the Near-RT RIC sends the RIC SUBSCRIPTION DELETE REQUEST message, it shall start timer $T_{RICEVENTdelete.}$

At reception of the RIC SUBSCRIPTION DELETE REQUEST message the E2 Node shall delete the indicated RIC Subscription and release the corresponding necessary resources.

The E2 Node shall send the RIC SUBSCRIPTION DELETE RESPONSE message back to the Near-RT RIC.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

Upon reception of the RIC SUBSCRIPTION DELETE RESPONSE message the Near-RT RIC shall stop timer $T_{RICEVENTdelete}$, release any necessary resources associated with that RIC Subscription and terminate the RIC Subscription Delete procedure.

8.2.2.3 Unsuccessful Operation

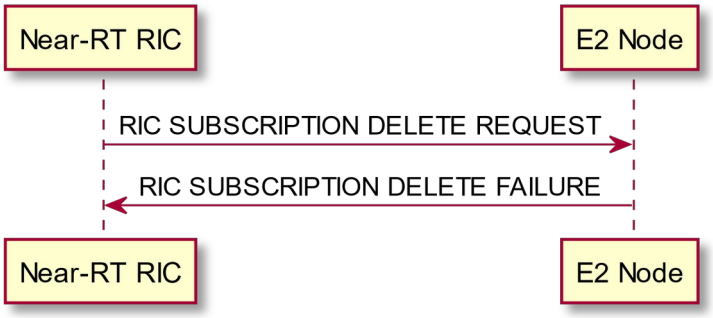

Figure 8.2.2.3-1: RIC Subscription Delete procedure, unsuccessful operation

If a failure occurs during the RIC Subscription Delete procedure, the E2 Node shall send the RIC SUBSCRIPTION DELETE FAILURE message to the Near-RT RIC containing an appropriate cause value.

If the *RIC Request ID* IE included in the RIC SUBSCRIPTION DELETE REQUEST message is unknown, the E2 Node shall send the RIC SUBSCRIPTION DELETE FAILURE message to the Near-RT RIC containing an appropriate cause value

Upon reception of the RIC SUBSCRIPTION DELETE FAILURE message the Near-RT RIC shall stop timer $T_{RICEVENTdelete}$ and terminate the RIC Subscription Delete procedure.

8.2.2.4 Abnormal Conditions

If the E2 Node receives a RIC SUBSCRIPTION DELETE REQUEST message contains an unknown *RAN Function ID* IE, the E2 Node shall send the RIC SUBSCRIPTION DELETE FAILURE message to the Near-RT RIC containing an appropriate cause value.

8.2.2A RIC Subscription Delete Required procedure

8.2.2A.1 General

This procedure is used to enable the E2 Node to request deletion of the existing RIC Subscriptions in the E2 Node previously created for the Near-RT RIC.

This procedure shall be initiated by the E2 Node.

This procedure uses RIC Service signalling.

8.2.2A.2 Successful Operation

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

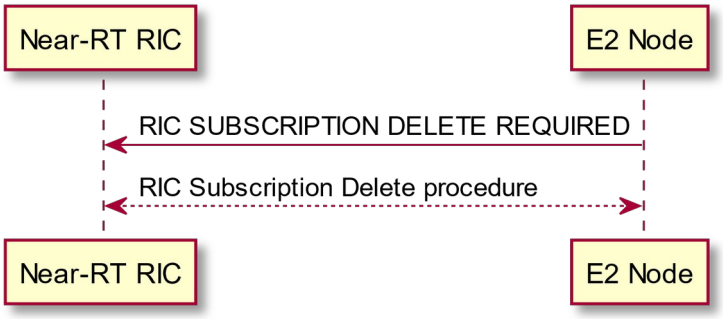

Figure 8.2.2A.2-1: RIC Subscription Delete Required procedure, successful operation

The E2 Node initiates the procedure by sending a RIC SUBSCRIPTION DELTE REQUIRED message, containing *RIC Request ID* IE that was previously assigned by the Near-RT RIC during a successful RIC Subscription procedure, to the Near-RT RIC.

The message shall contain an appropriate cause value for each RIC Subscription requesting to remove.

At reception of the RIC SUBSCRIPTION DELETE REQUIRED message, for each RIC Subscription associated with the included *RIC Request ID* IE and *RAN Function ID* IE, the Near-RT RIC may initiate the RIC Subscription Delete procedure toward the E2 Node.

8.2.2A.3 Abnormal Conditions

If the Near-RT RIC receives a RIC SUBSCRIPTION DELETE REQUIRED message for which contains an unknown *RIC Request ID* IE and *RAN Function ID* IE, the Near-RT RIC shall ignore the message.

8.2.3 RIC Indication procedure

8.2.3.1 General

The purpose of the RIC Indication procedure is to transfer Report and/or Insert RIC Service Action associated with a RIC Subscription procedure.

This procedure shall be initiated by the E2 Node.

This procedure uses RIC Service signalling.

8.2.3.2 Successful Operation

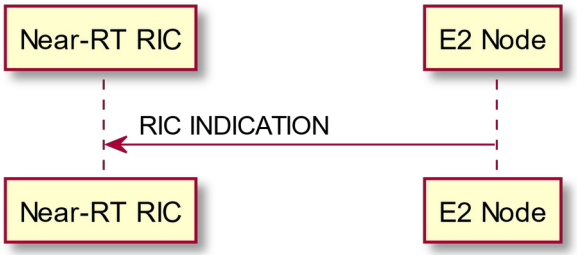

Figure 8.2.3.2-1: RIC Indication procedure, successful operation

An E2 Node initiates the procedure by sending RIC INDICATION message to the Near-RT RIC containing the *RIC Request ID* IE, that was previously assigned by the Near-RT RIC during a successful RIC Subscription procedure.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

If the RIC Indication message is in response to an Insert RIC Service Action, then the E2 Node shall provide the *RIC Call Process ID* IE within the RIC INDICATION message, and the E2 Node shall store current call state, start the associated *RIC Time to Wait* timer, and suspend further processing of the associated RAN function.

Near-RT RIC may use the *RIC Call Process ID* IE in a subsequent RIC Control procedure.

If an *RIC Subsequent Action* IE was associated to the RIC Service Action then, after successful transmission of the RIC INDICATION message, the originating E2 Node shall progress accordingly:

- If the *RIC Subsequent Action Type* IE was set to Continue or Halt, and the associated *RIC Time to Wait* timer has not expired, and a RIC CONTROL REQUEST message is received with the same *RIC Call Process ID* IE, then the E2 Node shall use the RIC CONTROL REQUEST 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 procedure prior to resuming normal functionality of the associated RAN function.
- If the *RIC Subsequent Action Type* IE was set to Continue and the associated *RIC Time to Wait* timer has expired, then the E2 Node shall use the stored call state and continue to execute any remaining RIC Service Actions in the sequence of RIC Service Actions defined in the RIC Subscription procedure.
- If the *RIC Subsequent Action Type* IE was set to Halt and the associated *RIC Time to Wait* timer has expired, then the E2 Node shall abort further processing of the associated RAN function. In this case, any remaining RIC Service Actions in the sequence of RIC Actions defined in the RIC Subscription procedure shall also be aborted.

Table 8.2.3.2-1: RIC Indication procedure, successful operation

Subsequent Action	*RIC Time to Wait* timer	Condition	Outcome
Continue or Halt	required	E2 Node detected the event trigger in the *RIC Event Trigger Definition* IE.	RIC INDICATION message shall provide the *RIC Call Process ID* IE and E2 Node shall store current call state, start the associated *RIC Time to Wait* timer, and suspend further processing of the associated RAN function.
Continue or Halt	not yet expired	E2 Node received the RIC CONTROL REQUEST message with the same *RIC call process ID* IE.	E2 Node 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 procedure.
Continue	expired		E2 Node shall use the stored call state and continue to execute any remaining actions in the sequence of RIC Actions defined in the RIC Subscription procedure.
Halt	expired		E2 Node shall abort normal functionality of the associated RAN function.

8.2.3.3 Unsuccessful Operation

Not applicable.

8.2.3.4 Abnormal Conditions

Not applicable.

8.2.4 RIC Control procedure

8.2.4.1 General

The purpose of the RIC Control procedure is to initiate or resume a specific functionality in the E2 Node.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

This procedure shall be initiated by the Near-RT RIC.

This procedure uses RIC Service signalling.

8.2.4.2 Successful Operation

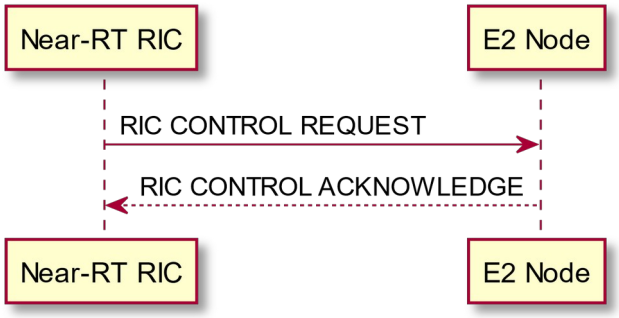

Figure 8.2.4.2-1: RIC Control procedure, successful operation

The Near-RT RIC initiates the procedure by sending a RIC CONTROL REQUEST message containing a unique *RIC Request ID* IE, assigned by the Near-RT RIC.

When the Near-RT RIC sends the RIC CONTROL REQUEST message and the optional *RIC Control Ack Request* IE has been set to "Ack", or is not present, the Near-RT RIC, it shall start the timer $T_{RICcontrol.}$

At reception of the RIC CONTROL REQUEST message the E2 Node shall:

- Determine the target RAN Function using the information in the *RAN Function ID* IE and initiate the requested RIC Control procedure action using information in the *RIC Control Message* IE.
- If the *RIC Call Process ID* IE is included in the RIC CONTROL REQUEST message, the E2 Node shall use this IE to identify a specific call process that was indicated in the RIC INDICATION message.
- If the RIC CONTROL REQUEST message contains the optional *RIC Control Ack Request* IE set to “Ack”, or if the optional *RIC Control Ack Request* IE is not present, and the E2 Node has successfully processed the requested RIC Control procedure action, then the E2 Node shall respond with the RIC CONTROL ACKNOWLEDGE message.
- If the RIC CONTROL REQUEST message contains the optional *RIC Control Ack Request* IE set to “NoAck” and the E2 Node has successfully processed the requested RIC Control procedure action, then the E2 Node shall not send the RIC CONTROL ACKNOWLEDGE message.

Upon reception of the RIC CONTROL ACKNOWLEDGE message, the Near-RT RIC shall stop timer $T_{RICcontrol}$ and terminate the RIC Control procedure.

The Near-RT RIC may use the information contained in the optional *RIC Control Outcome* IE to determine subsequent actions.

8.2.4.3 Unsuccessful Operation

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

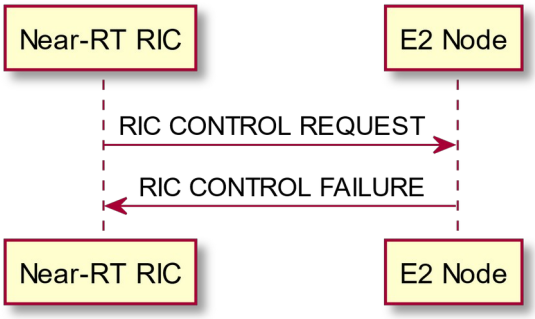

Figure 8.2.4.3-1: RIC Control procedure, unsuccessful operation

If the RIC CONTROL REQUEST message contains an invalid *RIC Call Process ID* IE, then the E2 Node shall respond with the RIC CONTROL FAILURE message with an appropriate cause value.

If the RIC CONTROL REQUEST message contains the optional *RIC Call Process ID* IE for which the associated *RIC Time to Wait* timer had expired, then the E2 Node shall respond with the RIC CONTROL FAILURE message with an appropriate cause value.

If the E2 Node fails to execute the requested RIC Control procedure E2SM specific action, then the E2 Node shall respond with the RIC CONTROL FAILURE message with an appropriate cause value.

If the E2 Node detects an encoding or functional error in the E2SM specific IEs contained in the RIC CONTROL REQUEST message, then the E2 Node shall respond with th e RIC CONTROL FAILURE message with an appropriate cause value.

If the E2 Node receives a RIC CONTROL REQUEST message which contains an unknown *RAN Function ID* IE the E2 Node shall respond with the RIC CONTROL FAILURE message containing an appropriate cause value.

If the E2 Node does not support the specific RIC Control procedure action, then the E2 Node shall respond with the RIC CONTROL FAILURE message containing an appropriate cause value.

Upon reception of the RIC CONTROL FAILURE message the Near-RT RIC shall stop timer $T_{RICcontrol,}$ if running, and terminate the RIC Control procedure.

The Near-RT RIC may use the information contained in the *Cause* IE and optional *RIC Control Outcome* IE to determine subsequent actions.

8.2.4.4 Abnormal Conditions

Upon reception of the ERROR INDICATION message including the *RIC Request ID* IEassociated to the RIC CONTROL REQUEST message, the Near-RT RIC shall stop timer $T_{RICcontrol}$, if running, and terminate the RIC Control procedure.

If timer $T_{RICcontrol}$ was set when sending the RIC CONTROL REQUEST message and there was no response from the E2 node before the timer expiry, the Near-RT RIC shall send an ERROR INDICATION with the appropriate value for the *Cause* IE.

8.2.5 RIC Subscription Modification procedure

8.2.5.1 General

The purpose of the RIC Subscription Modification procedure is to modify an existing RIC subscription on an E2 node, in terms of its event trigger definition and/or the sequence of actions.

This procedure shall be initiated by the Near-RT RIC.

This procedure uses RIC Service signalling.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

8.2.5.2 Successful Operation

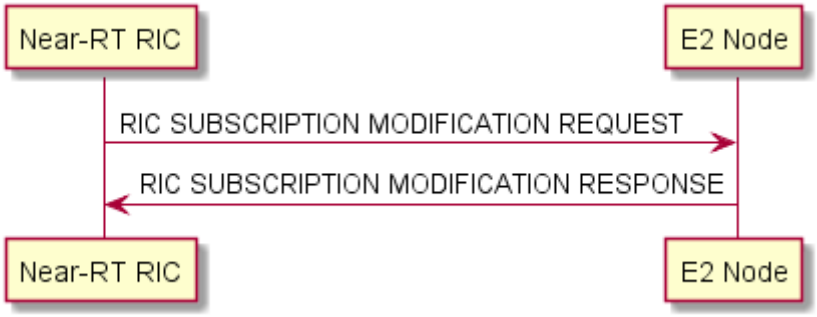

Fig 8.2.5.2-1: RIC Subscription Modification procedure, successful operation

The Near-RT RIC initiates this procedure by sending the RIC SUBSCRIPTION MODIFICATION REQUEST message to the E2 node, containing the *RIC Request ID* IE to uniquely identify the existing RIC Subscription in the E2 node.

When the Near-RT RIC sends the RIC SUBSCRIPTION MODIFICATION REQUEST message, it shall start timer $T_{RICEVENTmodify}$.

Upon reception of the RIC SUBSCRIPTION MODIFICATION REQUEST message, the E2 node shall determine the existing RIC Subscription and the target RAN Function from the *RIC Request ID* IE and the *RAN Function ID* IE, respectively.

If the *RIC Event Trigger Definition to be Modified* IE is included, then the E2 node shall validate and modify the event trigger defined for the existing RIC subscription based on the contents of the IE.

If the *RIC Actions to be Removed List* IE is included, then for every *RIC Action ID* IE included in the list, the E2 node shall delete the requested action and release the corresponding neccessary resources.

If the *RIC Actions to be Modified List* IE is included, then for every *RIC Action ID* IE included in the list for which there exists a corresponding *RIC Action Definition* IE and/or *RIC Subsequent Action* IE, the E2 node shall modify the existing behavior for the action with the requested modification in the respective IEs and modify the corresponding necessary resources.

If the *RIC Actions to be Modified List* IE is included, then for every *RIC Action ID* IE included in the list for which there exists a *RIC Action Execution Order* IE, the E2 node shall replace the current execution order for the action in the sequence of actions with the new execution order for the action in the sequence, as given in the *RIC Action Execution Order* IE.

If the *RIC Actions to be Added List* IE is included, then the E2 node shall validate and add the requested actions to the existing sequence of RIC Actions in order of the *RIC Action Execution Order* IE and reserve the neccessary resources for the new actions.

The E2 node shall send the RIC SUBSCRIPTION MODIFICATION RESPONSE message back to the Near-RT RIC when one of the following cases is successfully executed:

- If the *RIC Event Trigger Definition to be Modified* IE is present in the RIC SUBSCRIPTION MODIFICATION REQUEST message and if the requested modification for the event trigger definition was successfully performed by the E2 node, or
- If the *RIC Event Trigger Definition to be Modified* IE is not present (i.e., no modification to the event trigger definition was requested) in the RIC SUBSCRIPTION MODIFICATION REQUEST message and if at least one of the requested actions to be added or modified or removed as requested by the Near-RT RIC in *RIC Actions To Be Added List* IE or *RIC Actions to be Modified List* IE or *RIC Actions to be Removed List* IE, respectively, in the RIC SUBSCRIPTION MODIFICATION REQUEST message, was successfully performed by the E2 node.

The E2 node shall report the result of all the requested modifications to the sequence of actions, if any, back to the Near-RT RIC in the RIC SUBSCRIPTION MODIFICATION RESPONSE message as follows:

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

- A list of actions requested to be removed, indexed by the *RIC Action ID* IE, which are successfully removed by the E2 node, shall be included in the *RIC Actions Removed List* IE.
- A list of actions requested to be removed, indexed by the *RIC Action ID* IE, which failed to get removed from the sequence by the E2 node, shall be included in the *RIC Actions Failed to be Removed List* IE, with appropriate cause values.
- A list of actions requested to be modified, indexed by the *RIC Action ID* IE, which are successfully modified by the E2 node, shall be included in the *RIC Actions Modified List* IE.
- A list of actions requested to be modified, indexed by the *RIC Action ID* IE, which failed to get modified by the E2 node, shall be included in the *RIC Actions Failed to be Modified List* IE with appropriate cause values.
- A list of actions requested to be added, indexed by the *RIC Action ID* IE, which are successfully added by the E2 node, shall be included in the *RIC Actions Added List* IE
- A list of actions requested to be added, indexed by the *RIC Action ID* IE, which failed to get added to the sequence by the E2 node, shall be included in the *RIC Actions Failed to be Added List* IE with appropriate cause values.

If, for a given *RIC Action ID* IE in the *RIC Actions to be Modified List* IE, more than one modification to the RIC Service Action is requested in the form of *RIC Action Definition* IE and/or *RIC Action Execution Order* IE and/or *RIC Subsequent Action* IE, then the E2 node shall report that the requested action modification is successfully performed and shall include the action in the *RIC Actions Modified List* IE, if and only if, all the requested modifications to the action are successfully performed by the E2 node.

If one of the requested modifications to the RIC Service Action is not successfully performed by the E2 node, then the E2 node shall include the RIC Service Action in the *RIC Actions Failed to be Modified List* IE, along with an appropriate cause, to indicate failure for the requested modification to the RIC Service Action.

If, for a given *RIC Action ID* IE in the *RIC Actions to be Added* IE, either the action type in the *RIC Action Type* IE or the action definition in the *RIC Action Definition* IE or the action execution order in the *RIC Action Execution Order* IE or the subsequent action, if included, in the *RIC Subsequent Action* IE is not successfully processed by the E2 node, then the E2 node shall include the action in the *RIC Actions Failed to be Added List* IE with an appropriate cause, indicating failure to add the requested action to the existing sequence of actions.

If, after processing the RIC Subscription Modification procedure, more than one RIC Service Action remains accepted by the E2 Node then, at each occurrence of the common Event Trigger, the sequence of RIC Service Actions shall be executed according to the considerations defined in clause 8.2.1.2.

Upon reception of the RIC SUBSCRIPTION MODIFICATION RESPONSE message, the Near-RT RIC shall stop timer $T_{RICEVENTmodify}$ and terminate the RIC Subscription Modification procedure.

8.2.5.3 Unsuccessful Operation

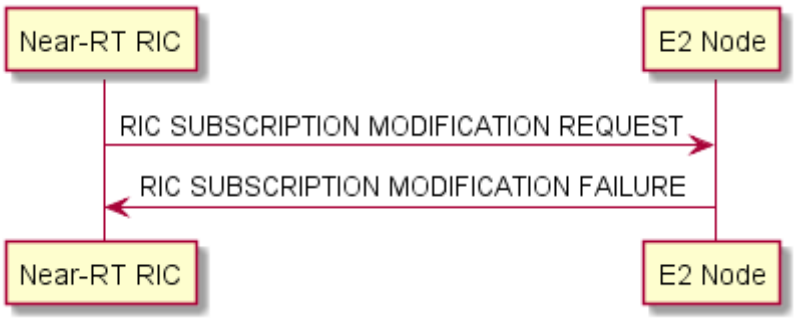

Fig 8.2.5.3-1: RIC Subscription Modification procedure, unsuccessful operation

If a failure occurs during the RIC Subscription Modification procedure the E2 node shall send a RIC SUBSCRIPTION MODIFICATION FAILURE message to the Near-RT RIC with an appropriate cause value.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

If the *RIC Event Trigger Definition to be Modified* IE is present in the RIC SUBSCRIPTION MODIFICATION REQUEST message and if the requested modification for the event trigger definition are not accepted by the E2 node, the E2 node shall send a RIC SUBSCRIPTION MODIFICATION FAILURE message to the Near-RT RIC with an appropriate cause value.

If the *RIC Event Trigger Definition to be Modified* IE is present in the RIC SUBSCRIPTION MODIFICATION REQUEST message and if the modification in the event trigger definition is inconsistent or disparate from the event trigger definition in the existing subscription, the E2 node shall send a RIC SUBSCRIPTION MODIFICATION FAILURE message to the Near-RT RIC with an appropriate cause value.

If the *RIC Event Trigger Definition to be Modified* IE is not present (i.e., no modification to the event trigger definition was requested) and if none of the requested modifications to the sequence of actions were successfully performed, that is if all of the following apply, the E2 node shall send a RIC SUBSCRIPTION MODIFICATION FAILURE message to the Near-RT RIC with an appropriate cause value:

- *RIC Actions to be Added List* IE was present in the RIC SUBSCRIPTION MODIFICATION REQUEST message and if none of the requested additions were successfully performed
- *RIC Actions to be Modified List* IE was present in the RIC SUBSCRIPTION MODIFICATION REQUEST message and if none of the requested modifications were successfully performed
- *RIC Actions to be Removed List* IE was present in the RIC SUBSCRIPTION MODIFICATION REQUEST message and if none of the requested removals were successfully performed

If the *RIC Event Trigger Definition to be Modified* IE is not present (i.e., no modification to the event trigger definition was requested) and if the E2 node detects an inconsistency across the sequence of actions and/or the subsequent actions in *RIC Actions to be Added List* IE and/or *RIC Actions to be Modified List* IE and/or *RIC Actions to be Removed List* IE, the E2 node shall send a RIC SUBSCRIPTION MODIFICATION FAILURE message to the Near-RT RIC with an appropriate cause value.

If all RIC Service Action in the existing RIC Subscription are proposed for removal, the E2 node shall send a RIC SUBSCRIPTION MODIFICATION FAILURE message to the Near-RT RIC with an appropriate cause value.

Upon reception of the RIC SUBSCRIPTION FAILURE message, the Near-RT RIC shall stop the timer $T_{RICEVENTmodify}$ and terminate the RIC Subscription Modification procedure.

8.2.5.4 Abnormal Conditions

If the E2 node receives a RIC SUBSCRIPTION MODIFICATION REQUEST message including an unknown *RAN Function ID* IE, the E2 node shall send the RIC SUBSCRIPTION MODIFICATION FAILURE message to the Near-RT RIC with an appropriate cause value.

If the E2 node receives a RIC SUBSCRIPTION MODIFICATION REQUEST message including an unknown *RIC Request ID* IE, the E2 node shall send the RIC SUBSCRIPTION MODIFICATION FAILURE message to the Near-RT RIC with an appropriate cause value.

If the E2 node receives a RIC SUBSCRIPTION MODIFICATION REQUEST message containing the same *RIC Action ID* IE value across the *RIC Actions to be Added List* IE , *RIC Actions to be Modified List* IE and/or *RIC Actions to be Removed List* IE, then the E2 node shall send the RIC SUBSCRIPTION MODIFICATION FAILURE message to the Near-RT RIC with an appropriate cause value.

8.2.6 RIC Subscription Modification Required procedure

8.2.6.1 General

This procedure is used by the E2 Node to request the Near-RT RIC for modifying an existing RIC Subscription in the E2 Node.

This procedure shall be initiated by the E2 Node.

This procedure uses RIC Service signalling.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

8.2.6.2 Successful Operation

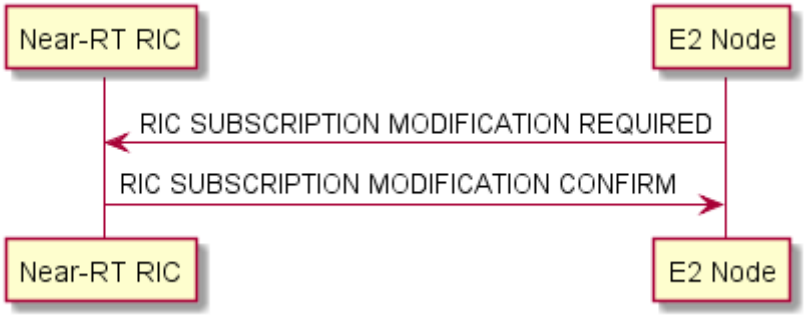

Fig 8.2.6.2-1: RIC Subscription Modification Required procedure, successful operation

The E2 Node initiates the procedure by sending the RIC SUBSCRIPTION MODIFICATION REQUIRED message, containing *RIC Request ID* IE that was previously assigned by the Near-RT RIC during a successful RIC Subscription procedure, to the Near-RT RIC

Upon reception of the RIC SUBSCRIPTION MODIFICATION REQUIRED message, the Near-RT RIC shall determine the RIC Subscription from the *RIC Request ID* IE and the target RAN Function from the *RAN Function ID* IE.

If at least one of the requested actions in *RIC Actions Required to be Modified List* IE or *RIC Actions Required to be Removed List* IE is successfully confirmed by the Near-RT RIC, then the Near-RT RIC shall perform the required procedures to update the RIC Subscription and shall send the RIC SUBSCRIPTION MODIFICATION CONFIRM message to the E2 node.

The Near-RT RIC shall report the result to the E2 node in the RIC SUBSCRIPTION MODIFICATION CONFIRM as follows:

- A list of actions requested to be modified, indexed by the *RIC Action ID* IE, which are successfully confirmed for modification by the Near-RT RIC, shall be included in the *RIC Actions Confirmed for Modification List* IE.
- A list of actions requested to be modified, indexed by the *RIC Action ID* IE, which are refused to be modified by the Near-RT RIC, shall be included in the *RIC Actions Refused to be Modified List* IE with appropriate cause values.
- A list of actions requested to be removed, indexed by the *RIC Action ID* IE, which are successfully confirmed for removal by the Near-RT RIC, shall be included in the *RIC Actions Confirmed for Removal List* IE.
- A list of actions requested to be removed, indexed by the *RIC Action ID* IE, which are refused to be removed by the Near-RT RIC, shall be included in the *RIC Actions Refused for Removal List* IE with appropriate cause values.

If, after processing the RIC Subscription Modification Required procedure, more than one RIC Service Action remains in effect at the E2 node, then at each occurrence of the common Event Trigger, the sequence of RIC Service Actions shall be executed according to the considerations defined in clause 8.2.1.2.

Upon reception of the RIC SUBSCRIPTION MODIFICATION CONFIRM message, the E2 Node shall release the necessary resources for the actions that are confirmed for removal in the *RIC Actions Confirmed for Removal List* IE, if present, and shall modify the neccessary resources for the actions that are confirmed for modification in the *RIC Actions Confirmed for Modification List* IE, if present.

8.2.6.3 Unsuccessful Operation

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

Fig 8.2.6.3-1: RIC Subscription Modification Required procedure, unsuccessful operation

If a failure occurs during the RIC Subscription Modification Required procedure the Near-RT RIC shall send the RIC SUBSCRIPTION MODIFICATION REFUSE message to the E2 node.If none of the requested modifications to the actions in the RIC SUBSCRIPTION MODIFICATION REQUIRED message (i.e., in the *RIC Actions Required to be Modified List* IE and the *RIC Actions Required to be Removed List* IE, if present) is successfully confirmed, the Near-RT RIC shall send the RIC SUBSCRIPTION MODIFICATION REFUSE message to the E2 node with an appropriate cause.

If the Near-RT RIC detects an inconsistency across the requested sequence of actions to be modified and removed in *RIC Actions Required to be Modified List* IE and the *RIC Actions Required to be Removed List* IE respectively, if present, the Near-RT RIC shall send the RIC SUBSCRIPTION MODIFICATION REFUSE message to the E2 node with an appropriate cause.

If all RIC Service Action in the existing RIC Subscription are proposed for removal, the Near-RT RIC shall send a RIC SUBSCRIPTION MODIFICATION REFUSE message to the E2 Node with an appropriate cause value.

8.2.6.4 Abnormal Conditions

If the Near-RT RIC receives a RIC SUBSCRIPTION MODIFICATION REQUIRED message which contains an unknown *RAN Function ID* IE, the Near-RT RIC shall send the RIC SUBSCRIPTION MODIFICATION REFUSE message to the E2 Node with an appropriate cause value.

If the Near-RT RIC receives a RIC SUBSCRIPTION MODIFICATION REQUIRED message containing an unknown *RIC Request ID* IE, the Near-RT RIC shall send the RIC SUBSCRIPTION MODIFICATION REFUSE message to the E2 Node with an appropriate cause value.

8.2.7 RIC Query procedure

8.2.7.1 General

This procedure is initiated by Near-RT RIC to request RAN and/or UE related information from E2 Node.

This procedure shall be initiated by the Near-RT RIC.

This procedure uses RIC Service signalling.

8.2.7.2 Successful Operation

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

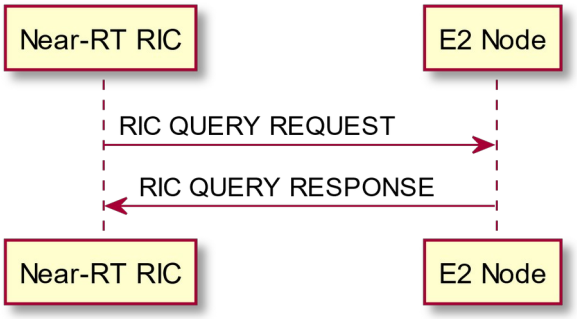

Figure 8.2.7.2-1: RIC Query procedure, successful operation

The Near-RT RIC initiates the procedure by sending the RIC QUERY REQUEST message which shall contain a unique *RIC Request ID* IE, assigned by the Near-RT RIC, to the E2 Node. When the Near-RT RIC sends the RIC QUERY REQUEST message, it shall start timer $T_{RICquery}$.

At reception of the RIC QUERY REQUEST message the E2 Node shall:

- Determine the target RAN Function using the information in the *RAN Function ID* IE.
- Validate the *RIC Query Header* IE and *RIC Query Definition* IE and if the requested information is available at E2 Node, then E2 Node shall respond back with RIC QUERY RESPONSE message containing the requested information.

Upon reception of the RIC QUERY RESPONSE message the Near-RT RIC shall stop timer $T_{RICquery}$ and terminate the RIC Query procedure.

8.2.7.3 Unsuccessful Operation

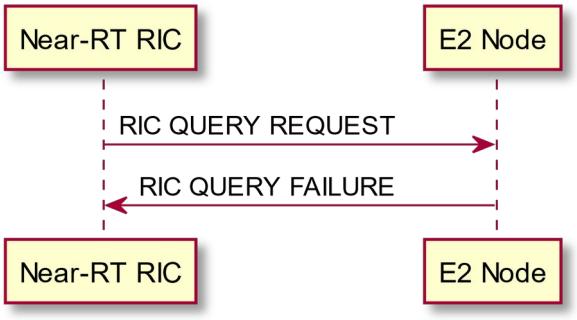

Figure 8.2.7.3-1: RIC Query procedure, unsuccessful operation

If the *RAN Function ID* IE in the RIC QUERY REQUEST message is not supported by E2 Node, then the E2 Node shall respond with the RIC QUERY FAILURE message to Near-RT RIC with an appropriate cause value.

If all of the requested information in the *RIC Query Definition* IE are invalid, then the E2 Node shall respond with the RIC QUERY FAILURE message to Near-RT RIC with an appropriate cause value.

If none of the requested information in the *RIC Query Definition* IE are available at E2 Node, then E2 Node shall respond with the RIC QUERY FAILURE message to Near-RT RIC with an appropriate cause value.

Upon reception of the RIC QUERY FAILURE message the Near-RT RIC shall stop timer $T_{RICquery}$ and terminate the RIC Query Procedure.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

8.2.7.4 Abnormal Conditions

Upon reception of the ERROR INDICATION message including the *RIC Request ID* IE corresponding to the previous RIC QUERY REQUEST message, the Near-RT RIC shall stop timer $T_{RICquery}$, if running, and terminate the RIC Query procedure.

8.3 Global Procedures

8.3.1 E2 Setup procedure

8.3.1.1 General

The purpose of the E2 Setup procedure is to exchange application level data needed for the E2 Node and Near-RT RIC to correctly interoperate on the E2 interface. This procedure shall be the first E2AP procedure triggered after the TNL association has become operational.

This procedure erases any existing application level configuration data in the two nodes and replace it by the one received.

This procedure shall be initiated by the E2 Node.

This procedure uses E2 Support Function signalling.

8.3.1.2 Successful Operation

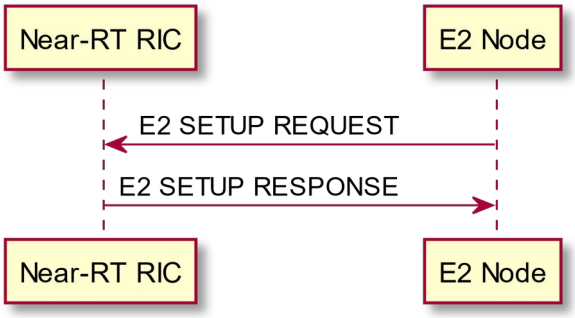

Figure 8.3.1.2-1: E2 Setup procedure, successful operation

The E2 Node initiates the procedure by sending the E2 SETUP REQUEST message including the appropriate data to a Near-RT RIC.

If the Near-RT RIC has successfully processed the *RAN Functions Added List* IE then Near-RT RIC shall contain, in the E2 SETUP RESPONSE message, the *RAN Functions Accepted List* IE and/or the *RAN Functions Rejected List* IE.

If the Near-RT RIC has successfully processed the *E2 Node Component Configuration Addition List* IE then Near-RT RIC shall contain, in the E2 SETUP RESPONSE message, the *E2 Node Component Configuration Addition Acknowledge List* IE.

8.3.1.3 Unsuccessful Operation

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

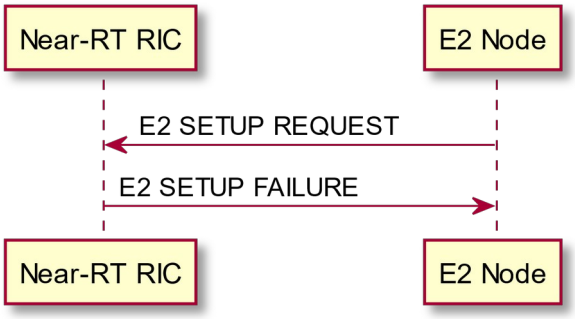

Figure 8.3.1.3-1: E2 Setup procedure, unsuccessful operation

If the Near-RT RIC cannot accept the setup it shall respond with an E2 SETUP FAILURE message with an appropriate cause value.

The Near-RT RIC may provide an alternative *Transport Layer Information* IE in the E2 SETUP FAILURE message for the E2 Node to use when reinitiating the E2 Setup procedure towards the Near-RT RIC.

If the E2 SETUP FAILURE message includes the *Time To Wait* IE, the E2 node shall wait at least for the indicated time before reinitiating the E2 Setup procedure towards the Near-RT RIC.

8.3.1.4 Abnormal Conditions

If the first message received for a specific TNL association is not an E2 SETUP REQUEST, E2 SETUP RESPONSE, E2 SETUP FAILURE or E2 NODE CONFIGURATION UPDATE message then this shall be treated as a logical error.

8.3.2 Reset procedure

8.3.2.1 General

The purpose of the Reset procedure is to initialize or re-initialise the E2 Node in the event of Near-RT RIC failure or vice-versa.

This procedure does not affect the application level data exchanged during the E2 Setup procedure, E2 Node Configuration Update procedure and RIC Service Update procedure.

This procedure shall be initiated by the E2 Node or the Near-RT RIC.

This procedure uses E2 Support Function signalling.

8.3.2.2 Successful Operation

This procedure may be initiated by either Near-RT RIC or E2 Node.

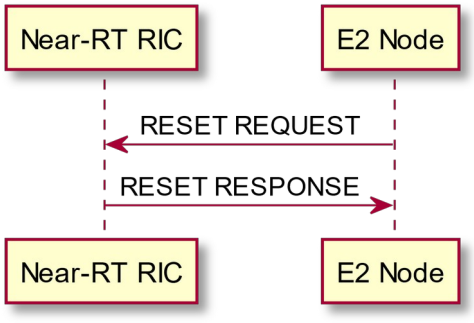

Figure 8.3.2.2-1: Reset, successful operation (E2 Node Initiated)

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

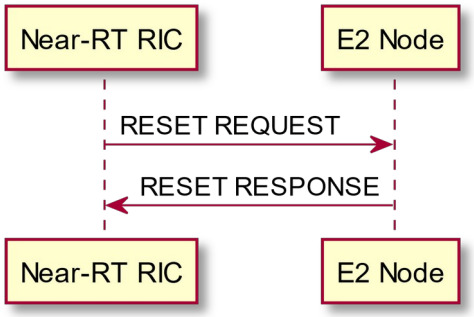

Figure 8.3.2.2-2: Reset, successful operation (Near-RT RIC Initiated)

When the Reset procedure is initiated, the Near-RT RIC and E2 Node shall:

- Delete any pre-established RIC Subscriptions,
- Gracefully terminate any ongoing Near-RT RIC call processes using Insert, Control or Policy RIC Service Actions while ensuring that impact to ongoing calls for connected UE is minimized.

After the Reset has been completed, the Near-RT RIC may re-issue any required RIC Subscriptions.

Interactions with other procedures:

If the RESET REQUEST message is received, any other ongoing procedure (except for another Reset procedure) on the same E2 interface related to ongoing RIC Services shall be aborted.

8.3.2.3 Unsuccessful Operation

Void.

8.3.2.4 Abnormal Conditions

Void.

8.3.3 Error Indication

8.3.3.1 General

The Error Indication procedure is initiated by either the E2 Node or the Near-RT RIC to report detected errors in one incoming message, provided they cannot be reported by an appropriate failure message.

This procedure shall be initiated by the E2 Node or the Near-RT RIC.

If the error situation arises due to reception of a message utilising RIC Service signalling, then the Error Indication procedure uses RIC Service signalling. Otherwise the procedure uses E2 Support Function signalling.

8.3.3.2 Successful Operation

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

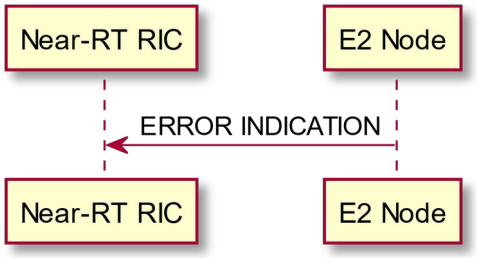

Figure 8.3.3.2-1: Error Indication, (E2 Node initiated) successful operation.

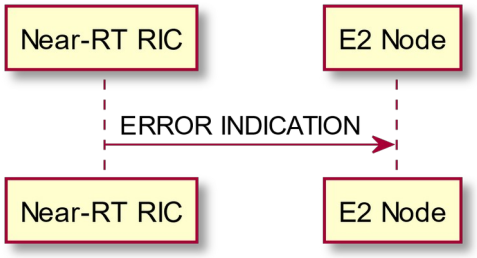

Figure 8.3.3.2-2: Error Indication, (Near-RT RIC Initiated) successful operation.

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

The ERROR INDICATION message shall contain at least either the *Cause* IE or the *Criticality Diagnostics* IE and may include *RAN Function ID* IE and *RIC Request ID* IE.

8.3.3.3 Unsuccessful Operation

Not applicable.

8.3.3.4 Abnormal Conditions

Not applicable.

8.3.4 RIC Service Update procedure

8.3.4.1 General

The purpose of the RIC Service Update procedure is to update application level RIC Service related data needed for E2 Node and Near-RT RIC to interoperate correctly over the E2 interface.

This procedure shall be initiated by the E2 Node.

This procedure uses E2 Support Function signalling.

8.3.4.2 Successful Operation

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

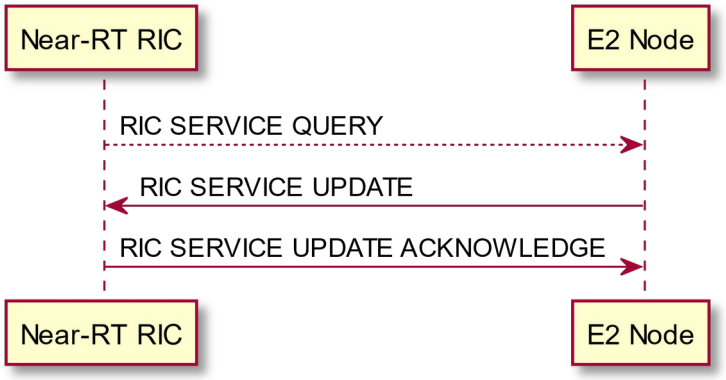

Figure 8.3.4.2-1: RIC Service Update procedure, successful operation

An E2 Node initiates the procedure by sending a RIC SERVICE UPDATE message to the Near-RT RIC.

If the E2 Node has taken into operational use one or more RAN Functions supporting RIC Services, the RIC SERVICE UPDATE message shall include the *RAN Functions Added List* IE.

If the E2 Node has modified one or more RAN Functions supporting RIC Services, the RIC SERVICE UPDATE message shall include the *RAN Functions Modified List* IE.

If the E2 Node has removed from operational use one or more RAN Functions supporting RIC Services, the RIC SERVICE UPDATE message shall include the *RAN Functions Deleted List* IE.

Upon reception of a RIC SERVICE UPDATE message, Near-RT RIC shall update the application level data for E2 Node as follows:

- If the *RAN Function Added List* IE is contained in the RIC SERVICE UPDATE message, Near-RT RIC shall add each listed accepted RAN Function according to the information in the *RAN Function ID* IE and *RAN Function Definition* IE and store the corresponding *RAN Function Revision* IE.
- If the *RAN Function Modified List* IE is contained in the RIC SERVICE UPDATE message, Near-RT RIC shall modify accepted information of supported RAN Functions according to the information in the *RAN Function Definition* IE and update the corresponding *RAN Function Revision* IE.
- If the *RAN Function Deleted List* IE is contained in the RIC SERVICE UPDATE message, Near-RT RIC shall delete information of RAN Function indicated by the *RAN Function ID* IE along with the corresponding *RAN Function Revision* IE.

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

If at least one RAN Function update request present in the RIC SERVICE UPDATE message is successful, then the Near-RT RIC shall send the RIC SERVICE UPDATE ACKNOWLEDGE message to the initiating E2 Node with :

- *RAN Functions Accepted List* IE indicating accepted requests to add, modify, and/or delete the corresponding RAN Function information
- If required, the *RAN Functions Rejected List* IE indicating rejected requests to add, modify, and/or delete the corresponding RAN Function information.

If the Near-RT RIC receives a RIC SERVICE UPDATE message without any IE except for *Message Type* IE, then the Near-RT RIC shall reply with RIC SERVICE UPDATE ACKNOWLEDGE message without any IE except for *Message Type* IE, and shall not perform any updates to the existing application level data.

Optionally, the RIC SERVICE UPDATE message to the Near-RT RIC may have been sent as a response to the Near-RT RIC initiated RIC SERVICE QUERY message.

Upon reception of the RIC SERVICE QUERY message:

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

- If the *RAN Function Accepted List* IE is not present, the E2 Node shall send the RIC SERVICE UPDATE message with the complete list of supported RAN Functions in the *RAN Function Added List* IE
- If the *RAN Function Accepted List* IE is present and aligns with the list of supported RAN Functions at the E2 Node, the E2 Node shall send the RIC SERVICE UPDATE message without the *RAN Function Added List* IE, *RAN Function Modified List* IE and *RAN Function Deleted List* IE.
- If the *RAN Function Accepted List* IE is present and the list of RAN Functions in the *RAN Function Accepted List* IE does not align with the list of supported RAN Functions at the E2 node, the E2 Node shall send the RIC SERVICE UPDATE message with the *RAN Function Added List* IE, *RAN Function Modified List* IE and/or *RAN Function Deleted List* IE to ensure realignment of RAN Functions between the E2 Node and the Near-RT RIC.

8.3.4.3 Unsuccessful Operation

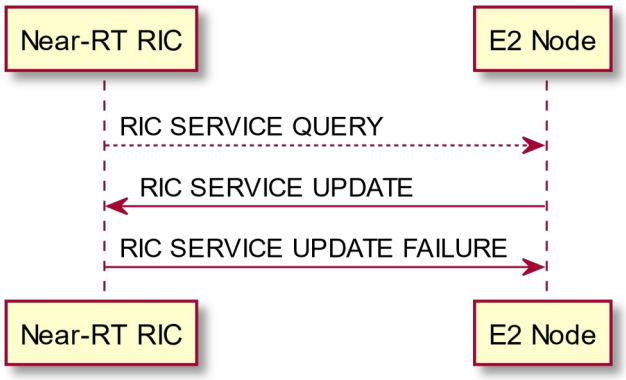

Figure 8.3.4.3-1: RIC Service Update procedure, unsuccessful operation

If the Near-RT RIC cannot accept the update it shall respond with a RIC SERVICE UPDATE FAILURE message with an appropriate cause value.

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

8.3.4.4 Abnormal Conditions

Void.

8.3.5 E2 Node Configuration Update procedure

8.3.5.1 General

The purpose of the E2 Node Configuration Update procedure is to update application level E2 Node configuration data needed for E2 Node and Near-RT RIC to interoperate correctly over the E2 interface and to support E2 Node initiated TNL association removal.

This procedure shall be initiated by the E2 Node.

This procedure uses E2 Support Function signalling.

8.3.5.2 Successful Operation

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

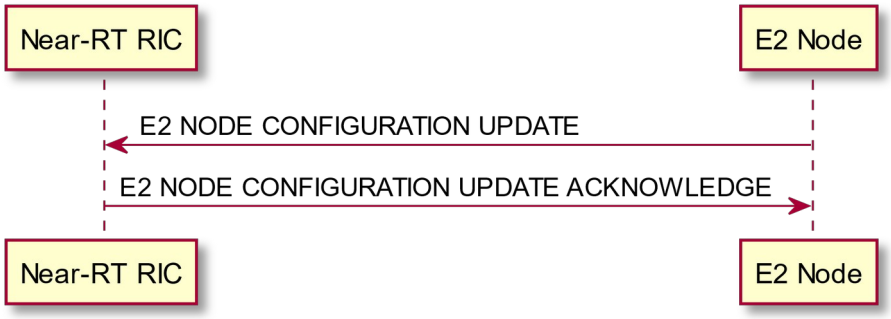

Figure 8.3.5.2-1: E2 Node Configuration Update procedure, successful operation

An E2 Node initiates the procedure by sending a E2 NODE CONFIGURATION UPDATE message to the Near-RT RIC. The message shall include an appropriate set of up-to-date E2 Node-related configuration data that the E2 Node has just taken into operational use.

Upon reception of the E2 NODE CONFIGURATION UPDATE message, Near-RT RIC shall update the application level data for the E2 Node as follows:

Update of E2 Node configuration information in Near-RT RIC:

- If *E2 Node Component Configuration Addition List* IE is contained in the E2 NODE CONFIGURATION UPDATE message, Near-RT RIC shall add the E2 Node Component Configuration information accordingly.
- If *E2 Node Component Configuration Update List* IE is contained in the E2 NODE CONFIGURATION UPDATE message, Near-RT RIC shall modify the E2 Node Component Configuration information accordingly.
- If *E2 Node Component Configuration Removal List* IE is contained in the E2 NODE CONFIGURATION UPDATE message, Near-RT RIC shall remove the E2 Node Component Configuration information accordingly

If *Global E2 Node ID* IE is contained in the E2 NODE CONFIGURATION UPDATE message for a newly established SCTP association, the Near-RT RIC shall associate the TNL association with the related E2 Node.

If the E2 NODE CONFIGURATION UPDATE message includes *E2 Node TNL Association To Remove List* IE, and the *Endpoint IP address* IE and the *Port Number* IE for both TNL endpoints of the TNL association(s) are included in the *E2 Node TNL Association To Remove List* IE, the Near-RT RIC shall, if supported, consider that the TNL association(s) indicated by both received TNL endpoints will be removed by the E2 Node.

If the E2 NODE CONFIGURATION UPDATE message includes *E2 Node TNL Association To Remove List* IE, and the *Endpoint IP address* IE, or the *Endpoint IP address* IE and the *Port Number* IE for one or both of the TNL endpoints is included in the *E2 Node TNL Association To Remove List* IE in E2 NODE CONFIGURATION UPDATE message, the Near-RT RIC shall, if supported, consider that the TNL association(s) indicated by the received endpoint IP address(es) will be removed by the E2 Node.

After successful update of requested information, Near-RT RIC shall reply with the E2 NODE CONFIGURATION UPDATE ACKNOWLEDGE message to inform the initiating E2 Node that the requested update of application level data was performed successfully.

If the Near-RT RIC receives a E2 NODE CONFIGURATION UPDATE message without any IE except for *Message Type* IE and *Transaction ID* IE, the Near-RT RIC shall reply with the E2 NODE CONFIGURATION UPDATE ACKNOWLEDGE message without performing any updates to the existing configuration.

8.3.5.3 Unsuccessful Operation

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

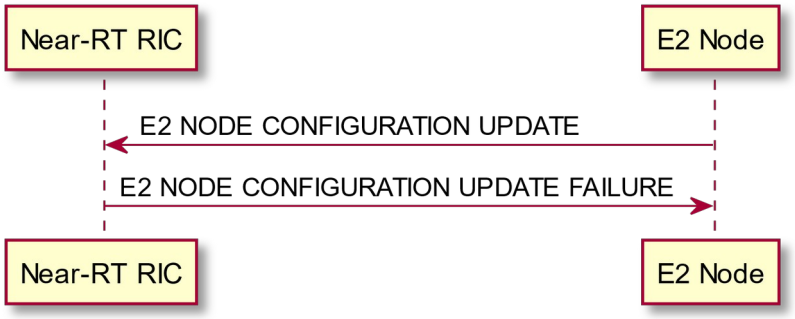

Figure 8.3.5.3-1: E2 Node Configuration Update procedure, unsuccessful operation

If Near-RT RIC cannot accept the E2 NODE CONFIGURATION UPDATE message it shall respond with the E2 NODE CONFIGURATION UPDATE FAILURE message with an appropriate cause value.

If the E2 NODE CONFIGURATION UPDATE FAILURE message includes the *Time To Wait* IE the E2 Node shall wait at least for the indicated time before reinitiating the E2 Node Configuration Update procedure towards the same Near-RT RIC.

If the Near-RT RIC receives an E2 NODE CONFIGURATION UPDATE message containing an *E2 Node Component Configuration Update Item* IE for an E2 Node component that was not previously declared by an *E2 Node Component Configuration Addition Item* IE then the Near-RT RIC shall indicate to the E2 Node that the update failed with appropriate cause value.

If the E2 Node Configuration Update procedure failure occurs, the Near-RT RIC and E2 Node shall continue to operate with their existing configuration data.

8.3.5.4 Abnormal Conditions

Void.

8.3.6 E2 Connection Update procedure

8.3.6.1 General

The purpose of the E2 Connection Update procedure is to allow the Near-RT RIC to update the TNL information associated with the E2 interface connection between the E2 Node and Near-RT RIC.

This procedure shall be initiated by the Near-RT RIC.

This procedure uses E2 Support Function signalling.

8.3.6.2 Successful Operation

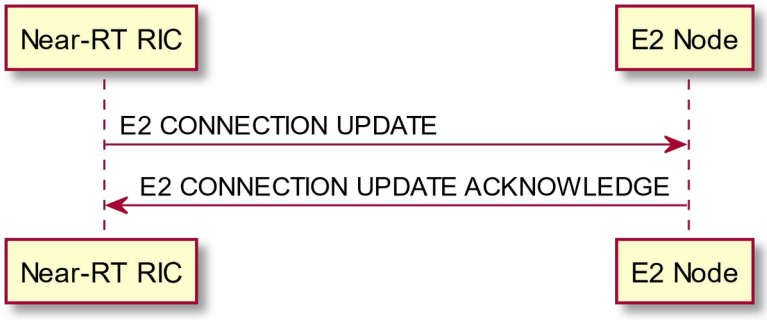

Figure 8.3.6.2-1: E2 Connection Update procedure, successful operation

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

The Near-RT RIC initiates the procedure by sending a E2 CONNECTION UPDATE message to the E2 Node. The message shall include an appropriate set of up-to-date E2 interface connection data that the E2 Node shall take into account when modifying the E2 interface connection.

Upon reception of a E2 CONNECTION UPDATE message, the E2 Node shall update as follows:

If *E2 Connection To Add List* IE is contained in the E2 CONNECTION UPDATE message, then the E2 Node shall, if supported, use the information to establish additional TNL Association(s) and configure for use for RIC services and/or E2 support functions according to the *TNL Association Usage* IE in the message.

If *E2 Connection To Modify List* IE is contained in the E2 CONNECTION UPDATE message, then the E2 Node shall, if supported, use the information to modify the existing usage for RIC services and/or E2 support functions, according to the *TNL Association Usage* IE in the message.

If *E2 Connection To Remove List* IE is contained in the E2 CONNECTION UPDATE message, then the E2 Node shall, if supported, use the information to remove the existing connection(s). If only one connection remains after successful removal of other connections, the E2 Node shall use this remaining connection for all the RIC services and E2 support functions.

After successful update of E2 interface connection(s), the E2 Node shall reply with the E2 CONNECTION UPDATE ACKNOWLEDGE message to inform the initiating Near-RT RIC that the requested E2 connection update was performed successfully.

If the E2 Node receives a E2 CONNECTION UPDATE message without any IE except for *Message Type* IE and *Transaction ID* IE, the E2 Node shall reply with the E2 CONNECTION ACKNOWLEDGE message without performing any updates to the existing connections.

E2 NODE CONFIGURATION UPDATE procedure shall be the first E2AP procedure triggered on an additional TNLA of an already setup E2 interface instance after the TNL association has become operational, and the Near-RT RIC shall associate the TNLA to the E2 interface instance using the included *Global E2 Node ID*.

An empty E2 NODE CONFIGURATION UPDATE message (i.e. without any IE expect for *Message Type* IE and *Transaction ID* IE) shall be sent by the Near-RT RIC as the first E2AP procedure on the new TNLA, if the E2 Node does not have any Configuration to be updated to Near-RT RIC.

8.3.6.3 Unsuccessful Operation

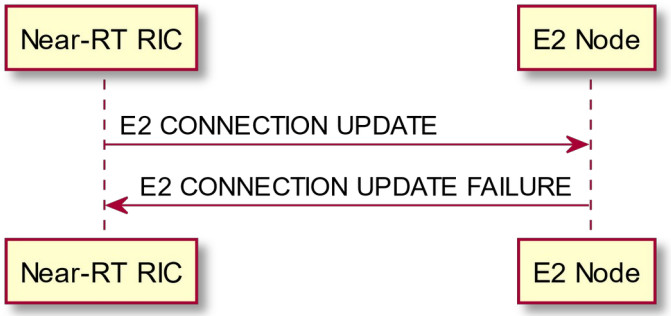

Figure 8.3.6.3-1: E2 Connection Update procedure, unsuccessful operation

If the E2 Node cannot accept the update, it shall respond with a E2 CONNECTION UPDATE FAILURE message with an appropriate cause value.

If the E2 CONNECTION UPDATE FAILURE message includes the *Time To Wait* IE, the Near-RT RIC shall wait at least for the indicated time before reinitiating the E2 Connection Update procedure towards the same E2 Node. Both nodes shall continue to operate with their existing connection(s).

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

8.3.6.4 Abnormal Conditions

Void.

8.3.7 E2 Removal procedure

8.3.7.1 General

The purpose of the E2 removal procedure is to remove the E2 signaling connection between the Near-RT RIC and the E2 node in a controlled manner.

This procedure shall be initiated by the E2 Node or the Near-RT RIC.

This procedure uses E2 Support Function signalling.

8.3.7.2 Successful Operation

This procedure may be initiated by either Near-RT RIC or E2 Node.

Successful E2 Removal, E2 Node initiated

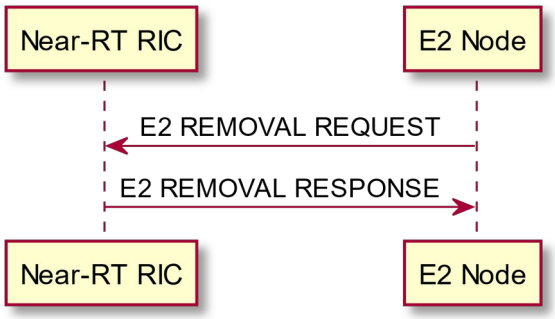

Figure 8.3.7.2-1: E2 Removal, successful operation (E2 Node Initiated)

The E2 Node shall initiate the procedure by sending the E2 REMOVAL REQUEST message to the Near-RT RIC.

Upon reception of the E2 REMOVAL REQUEST message, the Near-RT RIC shall reply with the E2 REMOVAL RESPONSE message.

After receiving the E2 REMOVAL RESPONSE message, the E2 Node shall initiate removal of the TNL association towards the Near-RT RIC, and shall release all resources associated with that E2 signaling connection.

The Near-RT RIC shall then release all resources associated with that E2 signaling connection and erase all application level data.

Successful E2 Removal, Near-RT RIC initiated

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

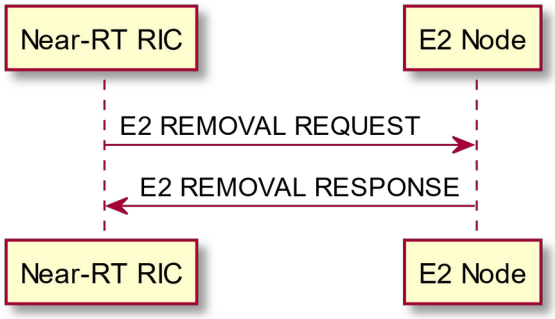

Figure 8.3.7.2-2: E2 Removal, successful operation (Near-RT RIC Initiated)

The Near-RT RIC shall initiate the procedure by sending the E2 REMOVAL REQUEST message to the E2 node.

Upon reception of the E2 REMOVAL REQUEST message the E2 node shall reply with the E2 REMOVAL RESPONSE message.

After receiving the E2 REMOVAL RESPONSE message, the Near-RT RIC may initiate removal of the TNL association towards the E2 node, and shall release all resources associated with that E2 signaling connection and erase all application level data.

The E2 node shall then release all resources associated with that E2 signaling connection.

Interactions with other procedures:

If the E2 REMOVAL REQUEST message is received, any other ongoing procedure on the same E2 interface related to ongoing RIC Services shall be aborted.

8.3.7.3 Unsuccessful Operation

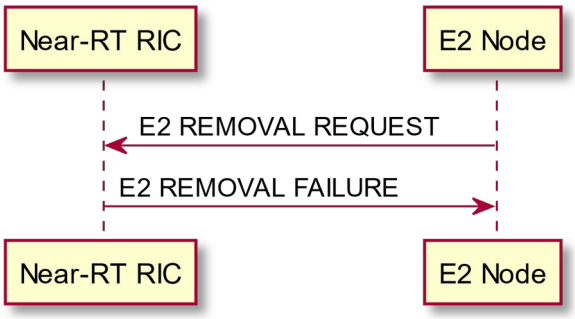

Figure 8.3.7.3-1: E2 Removal procedure (E2 Node Initiated), unsuccessful operation

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

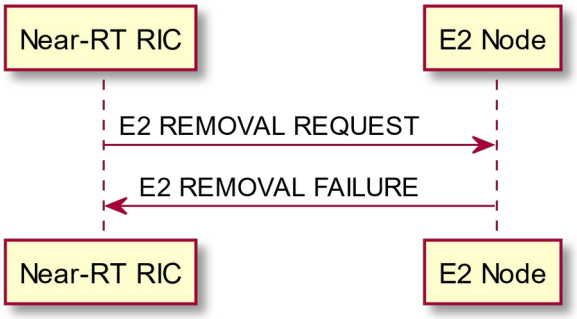

Figure 8.3.7.3-2: E2 Removal procedure (Near-RT RIC Initiated), unsuccessful operation

If the E2 Node cannot accept the E2 REMOVAL REQUEST it shall respond with E2 REMOVAL FAILURE message with an appropriate cause value.

If the Near-RT RIC cannot accept the E2 REMOVAL REQUEST it shall respond with E2 REMOVAL FAILURE message with an appropriate cause value.

8.3.7.4 Abnormal Conditions

Void.

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 [24].

NOTE: The messages have been defined in accordance to the guidelines specified in TR 25.921 [14].

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 Near-RT RIC to an E2 Node to create a new RIC Subscription in the E2 Node.

Direction: Near-RT RIC → E2 Node.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
RIC Request ID	M		9.2.7		YES	reject
RAN Function ID	M		9.2.8		YES	reject
RIC Subscription Details	M				YES	reject
>RIC Event Trigger Definition	M		9.2.9		-	
>Sequence of Actions		1.. <maxofRICactionID>			EACH	ignore
>>RIC Action ID	M		9.2.10		-	
>>RIC Action Type	M		9.2.11		-	
>>RIC Action Definition	O		9.2.12		-	
>>RIC Subsequent Action	O		9.2.13		-	
>>RIC Action Execution Order	O		9.2.35	Used to define a specific execution order	-	
RIC Subscription Start Time	O		9.2.34		YES	reject
RIC Subscription End Time	O		9.2.34		YES	reject

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

9.1.1.2 RIC SUBSCRIPTION RESPONSE

This message is sent by the E2 Node to accept the request from the Near-RT RIC to create a new RIC Subscription in the E2 Node.

Direction: E2 Node → Near-RT RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
RIC Request ID	M		9.2.7		YES	reject
RAN Function ID	M		9.2.8		YES	reject
RIC Actions Admitted List		1.. <maxofRICactionID>			YES	reject
>RIC Action ID	M		9.2.10		-	
RIC Actions Not Admitted List		0.. <maxofRICactionID>			YES	reject
>RIC Action ID	M		9.2.10		-	
>Cause	M		9.2.1		-	

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

9.1.1.3 RIC SUBSCRIPTION FAILURE

This message is sent by the E2 Node to inform the Near-RT RIC that the request to create a new RIC Subscription in the E2 Node failed.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

Direction: E2 Node → Near-RT RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
RIC Request ID	M		9.2.7		YES	reject
RAN Function ID	M		9.2.8		YES	reject
Cause	M		9.2.1		YES	reject
Criticality Diagnostics	O		9.2.2		YES	ignore

9.1.1.4 RIC SUBSCRIPTION DELETE REQUEST

This message is sent by the Near-RT RIC to an E2 Node to request the deletion of an existing Subscription in the E2 Node.

Direction: Near-RT RIC → E2 Node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
RIC Request ID	M		9.2.7		YES	reject
RAN Function ID	M		9.2.8		YES	reject

9.1.1.5 RIC SUBSCRIPTION DELETE RESPONSE

This message is sent by the E2 Node to accept the request from a Near-RT RIC to delete an existing RIC Subscription in the E2 Node

Direction: E2 Node → Near-RT RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
RIC Request ID	M		9.2.7		YES	reject
RAN Function ID	M		9.2.8		YES	reject

9.1.1.6 RIC SUBSCRIPTION DELETE FAILURE

This message is sent by the E2 Node to inform the Near-RT RIC that the request to delete an existing RIC Subscription in the E2 Node failed.

Direction: E2 Node → Near-RT RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
RIC Request ID	M		9.2.7		YES	reject
RAN Function ID	M		9.2.8		YES	reject
Cause	M		9.2.1		YES	ignore
Criticality Diagnostics	O		9.2.2		YES	ignore

9.1.1.6A RIC SUBSCRIPTION DELETE REQUIRED

This message is sent by the E2 Node to request deletion of the existing RIC Subscriptions in the E2 Node.

Direction: E2 Node → Near-RT RIC.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
List of RIC Subscriptions To Be Removed		*1.. <maxofRICrequestID>*			EACH	ignore
>RIC Request ID	M		9.2.7		-	-
>RAN Function ID	M		9.2.8		-	-
>Cause	M		9.2.1		-	-

Range bound	Explanation
maxofRICrequestID	Maximum no. of RIC subscription requests supported by Near-RT RIC toward an E2 Node. Value is <1024>.

9.1.1.7 RIC INDICATION

This message is sent by an E2 Node to transfer Report and Insert RIC Service Action information to a Near-RT RIC.

Direction: E2 Node → Near-RT RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
RIC Request ID	M		9.2.7		YES	reject
RAN Function ID	M		9.2.8		YES	reject
RIC Action ID	M		9.2.10		YES	reject
RIC Indication SN	O		9.2.14		YES	reject
RIC Indication Type	M		9.2.15		YES	reject
RIC Indication Header	M		9.2.17		YES	reject
RIC Indication Message	M		9.2.16		YES	reject
RIC Call process ID	O		9.2.18		YES	reject

9.1.1.8 RIC CONTROL REQUEST

This message is sent by a Near-RT RIC to an E2 Node to initiate or resume a control function logic.

Direction: Near-RT RIC → E2 Node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
RIC Request ID	M		9.2.7		YES	reject
RAN Function ID	M		9.2.8		YES	reject
RIC Call Process ID	O		9.2.18		YES	reject
RIC Control Header	M		9.2.20		YES	reject
RIC Control Message	M		9.2.19		YES	reject
RIC Control Ack Request	O		9.2.21		YES	reject

9.1.1.9 RIC CONTROL ACKNOWLEDGE

This message is sent by the E2 Node to inform the Near-RT RIC that the RIC CONTROL REQUEST message was received and to provide information on the outcome of the request.

Direction: E2 Node → Near-RT RIC.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
RIC Request ID	M		9.2.7		YES	reject
RAN Function ID	M		9.2.8		YES	reject
RIC Call process ID	O		9.2.18		YES	reject
RIC Control Outcome	O		9.2.25		YES	reject

9.1.1.10 RIC CONTROL FAILURE

This message is sent by the E2 Node to inform the Near-RT RIC that the RIC CONTROL REQUEST message has failed to be executed.

Direction: E2 Node → Near-RT RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
RIC Request ID	M		9.2.7		YES	reject
RAN Function ID	M		9.2.8		YES	reject
RIC Call process ID	O		9.2.18		YES	reject
Cause	M		9.2.1		YES	ignore
RIC Control Outcome	O		9.2.25		YES	Reject
Criticality Diagnostics	O		9.2.2		YES	ignore

9.1.1.11 RIC SUBSCRIPTION MODIFICATION REQUEST

This message is sent by the Near-RT RIC to an E2 Node to modify an existing Subscription in the E2 Node.

Direction: Near-RT RIC → E2 Node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
RIC Request ID	M		9.2.7		YES	reject
RAN Function ID	M		9.2.8		YES	reject
RIC Event Trigger Definition to be Modified	O		9.2.9		YES	ignore
RIC Actions to be Removed List		*0..1*			YES	ignore
>Action to be Removed Item IEs		*1..<maxofRICactionID>*			EACH	ignore
>>RIC Action ID	M		9.2.10		-	
RIC Actions to be Modified List		*0..1*			YES	ignore
>Action to be Modified Item IEs		*1..<maxofRICactionID>*			EACH	ignore
>>RIC Action ID	M		9.2.10		-	
>>RIC Action Definition	O		9.2.12		-	
>>RIC Action Execution Order	O		9.2.35			
>>RIC Subsequent Action	O		9.2.13		-	
RIC Actions to be Added List		*0..1*			YES	ignore
>Action to be Added Item IEs		*1..<maxofRICactionID>*			EACH	ignore
>>RIC Action ID	M		9.2.10		-	
>>RIC Action Type	M		9.2.11		-	
>>RIC Action Definition	M		9.2.12		-	
>>RIC Action Execution Order	M		9.2.35			
>>RIC Subsequent Action	O		9.2.13		-	

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

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

9.1.1.12 RIC SUBSCRIPTION MODIFICATION RESPONSE

This message is sent by the E2 Node to accept the request from the Near-RT RIC to modify an existing E2 subscription in the E2 Node.

Direction: E2 Node → Near-RT RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
RIC Request ID	M		9.2.7		YES	reject
RAN Function ID	M		9.2.8		YES	reject
RIC Actions Removed List		*0..1*			YES	ignore
>Action Removed Item IEs		*1..<maxofRICactionID>*			EACH	ignore
>>RIC Action ID	M		9.2.10		-	
RIC Actions Failed to be Removed List		*0..1*			YES	ignore
>Action Failed to be Removed Item IEs		*1..<maxofRICactionID>*			EACH	ignore
>>RIC Action ID	M		9.2.10		-	
>>Cause	M		9.2.1		-	
RIC Actions Modified List		*0..1*			YES	ignore
>Action Modified Item IEs		*1..<maxofRICactionID>*			EACH	ignore
>>RIC Action ID	M		9.2.10		-	
RIC Actions Failed to be Modified List		*0..1*			YES	ignore
>Action Failed to be Modified Item IEs		*1..<maxofRICactionID>*			EACH	ignore
>>RIC Action ID	M		9.2.10		-	
>>Cause	M		9.2.1		-	
RIC Actions Added List		*0..1*			YES	ignore
>Action Added Item IEs		*1..<maxofRICactionID>*			EACH	ignore
>>RIC Action ID	M		9.2.10		-	
RIC Actions Failed to be Added List		*0..1*			YES	ignore
>Action Failed to be Added Item IEs		*1..<maxofRICactionID>*			EACH	Ignore
>>RIC Action ID	M		9.2.10		-	
>>Cause	M		9.2.1		-	

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

9.1.1.13 RIC SUBSCRIPTION MODIFICATION FAILURE

This message is sent by the E2 Node to inform the Near-RT RIC that the request to modify an existing E2 subscription in the E2 Node failed.

Direction: E2 Node → Near-RT RIC.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
RIC Request ID	M		9.2.7		YES	reject
RAN Function ID	M		9.2.8		YES	reject
Cause	M		9.2.1		YES	reject
Criticality Diagnostics	O		9.2.2		YES	ignore

9.1.1.14 RIC SUBSCRIPTION MODIFICATION REQUIRED

This message is sent by the E2 Node to request the Near-RT RIC to modify an existing E2 subscription in the E2 Node.

Direction: E2 Node → Near-RT RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
RIC Request ID	M		9.2.7		YES	reject
RAN Function ID	M		9.2.8		YES	reject
RIC Actions Required to be Modified List		*0..1*			YES	ignore
>**Action Required to be Modified Item IEs**					EACH	ignore
>>RIC Action ID	M		9.2.10		-	
>>RIC Time to Wait before subsequent action	M		ENUMERATED (1ms, 2ms, 5ms, 10ms, 20ms, 30ms, 40ms, 50ms, 100ms, 200ms, 500ms, 1s, 2s, 5s, 10s, 20s, 60s, …)		-	
RIC Actions Required to be Removed List		*0..1*			YES	ignore
>Action Required to be Removed Item IEs		*1..<maxofRICactionID>*			EACH	ignore
>>RIC Action ID	M		9.2.10		-	
>>Cause	M		9.2.1		-	

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

9.1.1.15 RIC SUBSCRIPTION MODIFICATION CONFIRM

This message is sent by the Near-RT RIC to accept the request from the E2 Node to modify an existing E2 subscription in the E2 Node.

Direction: Near-RT RIC → E2 Node.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
RIC Request ID	M		9.2.7		YES	reject
RAN Function ID	M		9.2.8		YES	reject
RIC Actions Confirmed for Modification List		*0..1*			YES	ignore
>RIC Action Confirmed for Modification Item IEs		*1..<maxofRICactionID>*			EACH	ignore
>>RIC Action ID	M		9.2.10		-	
RIC Actions Refused to be Modified List		*0..1*			YES	ignore
>Action Refused to be Modified Item IEs		*1..<maxofRICactionID>*			EACH	ignore
>>RIC Action ID	M		9.2.10		-	
>>Cause	M		9.2.1		-	
RIC Actions Confirmed for Removal List		*0..1*			YES	ignore
>Action Confirmed for Removal Item IEs		*1..<maxofRICactionID>*			EACH	ignore
>>RIC Action ID	M		9.2.10		-	
RIC Actions Refused to be Removed List		*0..1*			YES	ignore
>Action Refused to be Removed Item IEs		*1..<maxofRICactionID>*			EACH	ignore
>>RIC Action ID	M		9.2.10		-	
>>Cause	M		9.2.1		-	

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

9.1.1.16 RIC SUBSCRIPTION MODIFICATION REFUSE

This message is sent by the Near-RT RIC to deny the request from the E2 Node to modify an existing E2 subscription in the E2 Node.

Direction: Near-RT RIC → E2 Node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
RIC Request ID	M		9.2.7		YES	reject
RAN Function ID	M		9.2.8		YES	reject
Cause	M		9.2.1		YES	reject
Criticality Diagnostics	O		9.2.2		YES	ignore

9.1.1.17 RIC QUERY REQUEST

This message is sent by the Near-RT RIC to an E2 Node to request RAN and/or UE related information from the E2 Node.

Direction: Near-RT RIC → E2 Node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
RIC Request ID	M		9.2.7		YES	reject
RAN Function ID	M		9.2.8		YES	reject
RIC Query Header	M		9.2.36		YES	reject
RIC Query Definition	M		9.2.37		YES	reject

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

9.1.1.18 RIC QUERY RESPONSE

This message is sent by the E2 Node to Near-RT RIC in response to RAN and/or UE related information requested by Near-RT RIC.

Direction: E2 Node → Near-RT RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
RIC Request ID	M		9.2.7		YES	reject
RAN Function ID	M		9.2.8		YES	reject
RIC Query Outcome	M		9.2.38		YES	reject

9.1.1.19 RIC QUERY FAILURE

This message is sent by the E2 Node to inform the Near-RT RIC that the requested RAN and/or UE related Information has failed.

Direction: E2 Node → Near-RT RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
RIC Request ID	M		9.2.7		YES	reject
RAN Function ID	M		9.2.8		YES	reject
Cause	M		9.2.1		YES	reject
Criticality Diagnostics	O		9.2.2		YES	ignore

9.1.2 Messages for Global Procedures

9.1.2.1 ERROR INDICATION

This message is used to indicate that some error has been detected in the E2 Node or Near-RT RIC.

Direction: E2 Node → Near-RT RIC or Near-RT RIC → E2 Node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	ignore
Transaction ID	O		9.2.33	Required if *RIC Request ID* IE is not present	YES	reject
RIC Request ID	O		9.2.7	Required if *Transaction ID* IE is not present	YES	reject
RAN Function ID	O		9.2.8		YES	reject
Cause	O		9.2.1		YES	ignore
Criticality Diagnostics	O		9.2.2		YES	ignore

9.1.2.2 E2 SETUP REQUEST

This message is sent by an E2 Node to a Near-RT RIC to transfer the initialization information.

Direction: E2 Node → Near-RT RIC

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
Transaction ID	M		9.2.33	.	YES	reject
Global E2 Node ID	M		9.2.6		YES	reject
RAN Functions Added List		*1*		List of RAN functions in E2 node	YES	reject
>RAN Function item		*1.. <maxofRANfunctionID>*				
>>RAN Function ID	M		9.2.8	Id of the declared Function	-	
>>RAN Function Definition	M		9.2.23	Definition of Function	-	
>>RAN Function Revision	M		9.2.24	Revision counter	-	
>>RAN Function OID	M		9.2.31	Object identifier of corresponding E2SM	-	
E2 Node Component Configuration Addition List		*1*		List of E2 Node component configuration information	YES	reject
>E2 Node Component Configuration Addition Item		*1.. <maxofE2nodeComponents>*			EACH	reject
>>E2 Node Component Interface Type	M		9.2.26	E2 Node component interface type	-	
>>E2 Node Component ID	O		9.2.32	E2 Node Component Identifier	-	
>>E2 Node Component Configuration	M		9.2.27	Contents depends on component interface type	-	

Range bound	Explanation
maxofRANfunctionID	Maximum no. of RAN Functions supported by E2 Node. Value is 256.
maxofE2nodeComponents	Maximum no. of E2 Node components supported by E2 Node. Value is 1024

9.1.2.3 E2 SETUP RESPONSE

This message is sent by a Near-RT RIC to an E2 Node to transfer the initialization information.

Direction: Near-RT RIC →E2 Node

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
Transaction ID	M		9.2.33	.	YES	reject
Global RIC ID	M		9.2.4		YES	reject
RAN Functions Accepted List		*0..1*		Complete list of Functions accepted by Near-RT RIC		
>RAN Functions ID item		*1 .. <maxofRANfunctionID>*			YES	Reject
>>RAN Function ID	M		9.2.8	Id of the declared Function	-	
>>RAN Function Revision	M		9.2.24	Revision counter	-	
RAN Functions Rejected List		*0..1*		Complete list of Functions not accepted by Near-RT RIC		
RAN Functions ID Cause Item		*1 .. <maxofRANfunctionID>*			YES	reject
>>RAN Function ID	M		9.2.8	Id of the declared Function	-	
>>Cause	M		9.2.1	Reason for not accepting function	-	
E2 Node Component Configuration Addition Acknowledge List		*1*		Complete list of E2 Node Components in the E2 SETUP REQUEST message	YES	reject
>E2 Node Component Configuration Addition Acknowledge Item		*1.. <maxofE2nodeComponents>*			EACH	reject
>>E2 Node Component Interface Type	M		9.2.26	E2 Node component interface type	-	
>>E2 Node Component ID	M		9.2.32	E2 Node Component Identifier	-	
>>E2 Node Component Configuration Acknowledge	M		9.2.28	Success or failure with Cause	-	

Range bound	Explanation
maxofRANfunctionID	Maximum no. of RAN Functions supported by E2 Node. Value is 256.
maxofE2nodeComponents	Maximum no. of E2 Node components supported by E2 Node. Value is 1024

9.1.2.4 E2 SETUP FAILURE

This message is sent by the Near-RT RIC to indicate E2 Setup failure.

Direction: Near-RT RIC → E2 Node

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
Transaction ID	M		9.2.33	.	YES	reject
Cause	M		9.2.1		YES	ignore
Time To Wait	O		9.2.5		YES	ignore
Criticality Diagnostics	O		9.2.2		YES	Ignore
Transport Layer Information	O		9.2.29		YES	ignore

9.1.2.5 RESET REQUEST

This message is sent from a Near-RT RIC to an E2 Node or from an E2 Node to a Near-RT RIC and is used to request the E2 interface between the E2 node and the Near-RT RIC to be reset.

Direction: Near-RT RIC → E2 Node, or E2 Node → Near-RT RIC

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
Transaction ID	M		9.2.33	.	YES	reject
Cause	M		9.2.1		YES	ignore

9.1.2.6 RESET RESPONSE

This message is sent by an E2 Node to a Near-RT RIC or from a Near-RT RIC to an E2 Node as a response to a RESET REQUEST message.

Direction: Near-RT RIC → E2 Node, or E2 Node → Near-RT RIC

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
Transaction ID	M		9.2.33	.	YES	reject
Criticality Diagnostics	O		9.2.2		YES	ignore

9.1.2.7 RIC SERVICE UPDATE

This message is sent by an E2 Node to the Near-RT RIC to transfer updated information on RIC Services supported by the E2 Node.

Direction: E2 Node → Near-RT RIC

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
Transaction ID	M		9.2.33	.	YES	reject
RAN Functions Added List		*0..1*		List of added RAN functions in E2 node		
>RAN Functions Item		*1 .. <maxofRANfunctionID>*			YES	reject
>>RAN Function ID	M		9.2.8	Id of the declared Function	-	
>>RAN Function Definition	M		9.2.23	Definition of Function	-	
>>RAN Function Revision	M		9.2.24	Revision counter	-	
>>RAN Function OID	M		9.2.31	Object identifier of corresponding E2SM	-	
RAN Functions Modified List		*0..1*		List of Modified RAN functions in E2 node		
>RAN Functions Item		*1 .. <maxofRANfunctionID>*			YES	reject
>>RAN Function ID	M		9.2.8	Id of the declared Function	-	
>>RAN Function Definition	M		9.2.23	Definition of Function	-	
>>RAN Function Revision	M		9.2.24	Revision counter	-	
>>RAN Function OID	M		9.2.31	Object identifier of corresponding E2SM	-	
RAN Functions Deleted List		*0..1*		List of deleted RAN functions in E2 node		
>RAN Functions ID Item		*1 .. <maxofRANfunctionID>*			YES	reject
>>RAN Function ID	M		9.2.8	Id of the declared Function	-	
>>RAN Function Revision	M		9.2.24	Revision counter	-	

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

9.1.2.8 RIC SERVICE UPDATE ACKNOWLEDGE

This message is sent by the Near-RT RIC to the E2 Node to acknowledge update of RIC Services supported by the E2 Node.

Direction: Near-RT RIC → E2 Node.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
Transaction ID	M		9.2.33	.	YES	reject
RAN Functions Accepted List		*0..1*		List of Functions accepted by Near-RT RIC		
>RAN Functions ID Item		*1 .. <maxofRANfunctionID>*			YES	reject
>>RAN Function ID	M		9.2.8	Id of the declared Function	-	
>>RAN Function Revision	M		9.2.24	Revision counter	-	
RAN Functions Rejected List		*0..1*		List of Functions not accepted by Near-RT RIC		
>RAN Functions Cause Item		*1 .. <maxofRANfunctionID>*			YES	reject
>>RAN Function ID	M		9.2.8	Id of the declared Function	-	
>>Cause	M		9.2.1	Reason for not accepting function	-	

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

9.1.2.9 RIC SERVICE UPDATE FAILURE

This message is sent by the Near-RT RIC to the E2 Node to indicate RIC SERVICE Update Failure.

Direction: Near-RT RIC → E2 Node

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
Transaction ID	M		9.2.33	.	YES	reject
Cause	M		9.2.1	Reason for failure	YES	reject
Time To Wait	O		9.2.5		YES	ignore
Criticality Diagnostics	O		9.2.2		YES	ignore

9.1.2.10 RIC SERVICE QUERY

This message is sent by a Near-RT RIC to an E2 Node to request a E2 Node initiated RIC Service Update procedure.

Direction: Near-RT RIC → E2 Node.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
Transaction ID	M		9.2.33	.	YES	reject
RAN Functions Accepted List		*0..1*		Complete list of Functions previously accepted by Near-RT RIC		
>RAN Functions ID Item		*1 .. <maxofRANfunctionID>*			YES	reject
>>RAN Function ID	M		9.2.8	Id of the declared Function	-	
>>RAN Function Revision	M		9.2.24	Revision counter	-	

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

9.1.2.11 E2 NODE CONFIGURATION UPDATE

This message is sent by an E2 Node to the Near-RT RIC to transfer updated information on the E2 Node Configuration information.

Direction: E2 Node → Near-RT RIC

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
Transaction ID	M		9.2.33		YES	reject
Global E2 Node ID	O		9.2.6	Required when sent as first message on new TNL association	YES	reject
E2 Node Component Configuration Addition List		*0..1*			YES	reject
>E2 Node Component Configuration Addition Item		*1.. <maxofE2nodeComponents>*			EACH	reject
>>E2 Node Component Interface Type	M		9.2.26	E2 Node component interface type	-	
>>E2 Node Component ID	M		9.2.32	E2 Node Component Identifier	-	
>>E2 Node Component Configuration	M		9.2.27	Contents depends on component type	-	
E2 Node Component Configuration Update List		*0..1*			YES	reject
>E2 Node Component Configuration Update Item		*1.. <maxofE2nodeComponents>*			EACH	reject
>>E2 Node Component Interface Type	M		9.2.26	E2 Node component interface type	-	
>>E2 Node Component ID	M		9.2.32	E2 Node Component Identifier	-	
>>E2 Node Component Configuration	M		9.2.27	Contents depends on component type	-	
E2 Node Component Configuration Removal List		*0..1*			YES	reject
>E2 Node Component Configuration Removal Item		*1.. <maxofE2nodeComponents>*			EACH	reject
>>E2 Node Component Interface Type	M		9.2.26	E2 Node component interface type	-	
>>E2 Node Component ID	M		9.2.32	E2 Node Component Identifier	-	
E2 Node TNL Association To Remove List		*0..1*			YES	reject
>E2 Node TNL Association To Remove Item IEs		*1..<maxofTNLA>*			EACH	reject
>> Transport Layer Information	M		9.2.29	Transport Layer Address of the E2 node.	-	-
>> Transport Layer Information Near-RT RIC	O		9.2.29	Transport Layer Address of the Near-RT RIC.	-	-

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

Range bound	Explanation
maxofE2nodeComponents	Maximum no. of E2 Node components supported by E2 Node. Value is 1024.
maxofTNLA	Maximum no. of TNL Associations supported by E2 Node. Value is 32.

9.1.2.12 E2 NODE CONFIGURATION UPDATE ACKNOWLEDGE

This message is sent by Near-RT RIC to E2 Node to acknowledge update of E2 Node Configuration supported by the E2 Node.

Direction: Near-RT RIC → E2 Node.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
Transaction ID	M		9.2.33	.	YES	reject
E2 Node Component Configuration Addition Acknowledge List		*0..1*			YES	reject
>E2 Node Component Configuration Addition Acknowledge Item		*1.. <maxofE2node Components>*			EACH	reject
>>E2 Node Component Interface Type	M		9.2.26	E2 Node component interface type	-	
>>E2 Node Component ID	M		9.2.32	E2 Node Component Identifier	-	
>>E2 Node Component Configuration Acknowledge	M		9.2.28	Success or failure with Cause	-	
E2 Node Component Configuration Update Acknowledge List		*0..1*			YES	reject
>E2 Node Component Configuration Update Acknowledge Item		*1.. <maxofE2node Components>*			EACH	reject
>>E2 Node Component Interface Type	M		9.2.26	E2 Node component interface type	-	
>>E2 Node Component ID	O		9.2.32	E2 Node Component Identifier	-	
>>E2 Node Component Configuration Update Acknowledge	M		9.2.28	Success or failure with Cause	-	
E2 Node Component Configuration Removal Acknowledge List		*0..1*			YES	reject
>E2 Node Component Configuration Removal Acknowledge Item		*1.. <maxofE2node Components>*			EACH	reject
>>E2 Node Component Interface Type	M		9.2.26	E2 Node component interface type	-	
>>E2 Node Component ID	M		9.2.32	E2 Node Component Identifier	-	
>>E2 Node Component Configuration Acknowledge	M		9.2.28	Success or failure with Cause	-	

Range bound	Explanation
maxofE2nodeComponents	Maximum no. of E2 Node components supported by E2 Node. Value is 1024.

9.1.2.13 E2 NODE CONFIGURATION UPDATE FAILURE

This message is sent by Near-RT RIC to E2 Node to indicate E2 Node Configuration Update Failure.

Direction: Near-RT RIC → E2 Node

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
Transaction ID	M		9.2.33	.	YES	reject
Cause	M		9.2.1	Cause	YES	reject
Time To Wait	O		9.2.5		YES	ignore
Criticality Diagnostics	O		9.2.2		YES	ignore

9.1.2.14 E2 CONNECTION UPDATE

This message is sent by Near-RT RIC to E2 Node to initiate update of E2 Connection supported by the E2 Node.

Direction: Near-RT RIC 🖴 E2 Node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
Transaction ID	M		9.2.33	.	YES	reject
E2 Connection To Add List		*0..1*			YES	ignore
>E2 Connection to Add Item IEs		*1.. <maxofTNLA>*			EACH	ignore
>>Transport Layer Information	M		9.2.29	Transport layer address and port number of Near-RT RIC		
>>TNL Association Usage	M		9.2.30	Indicates how E2 connection is to be used		
E2 Connection To Remove List		*0..1*			YES	ignore
>E2 Connection to Remove Item IEs		*1.. <maxofTNLA>*			EACH	ignore
>>Transport Layer Information	M		9.2.29	Transport layer address and port number of Near-RT RIC		
E2 Connection To Modify List		*0..1*			YES	ignore
>E2 Connection to Modify Item IEs		*1.. <maxofTNLA>*			EACH	ignore
>>Transport Layer Information	M		9.2.29	Transport layer address and port number of Near-RT RIC		
>>TNL Association Usage	M		9.2.30	Indicates how E2 connection is to be used		

Range bound	Explanation
maxofTNLA	Maximum no. of TNL Associations supported by E2 Node. Value is 32.

9.1.2.15 E2 CONNECTION UPDATE ACKNOWLEDGE

This message is sent by E2 Node to the Near-RT RIC to acknowledge update of E2 Connection supported by the E2 Node.

Direction: E2 Node 🖴 Near-RT RIC.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
Transaction ID	M		9.2.33	.	YES	reject
E2 Connection Setup List		*0..1*			YES	ignore
>E2 Connection Setup Item IEs		*1.. <maxofTNLA>*			EACH	ignore
>>Transport Layer Information	M		9.2.29	Transport layer address and port number of Near-RT RIC		
>>TNL Association Usage	M		9.2.30	Indicates how E2 connection is to be used		
E2 Connection Failed to Setup List		*0..1*			YES	ignore
>E2 Connection failed to setup Item IEs		*1.. <maxofTNLA>*			EACH	ignore
>>Transport Layer Information	M		9.2.29	Transport layer address and port number of Near-RT RIC		
>>Cause	M		9.2.1			

Range bound	Explanation
maxofTNLA	Maximum no. of TNL Associations supported by E2 Node. Value is 32.

9.1.2.16 E2 CONNECTION UPDATE FAILURE

This message is sent by E2 Node to the Near-RT RIC to inform failure of the requested E2 Connection updates.

Direction: E2 Node → Near-RT RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
Transaction ID	M		9.2.33	.	YES	reject
Cause	M		9.2.1		YES	reject
Time To Wait	O		9.2.5		YES	ignore
Criticality Diagnostics	O		9.2.2		YES	ignore

9.1.2.17 E2 REMOVAL REQUEST

This message is sent by either the E2 Node or the Near-RT RIC to initiate the removal of the E2 signaling connection and the related resources.

Direction: Near-RT RIC → E2 Node, or E2 Node → Near-RT RIC

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
Transaction ID	M		9.2.33		YES	reject

9.1.2.18 E2 REMOVAL RESPONSE

This message is sent by either the E2 Node or the Near-RT RIC to acknowledge the initiation of removal of the E2 signaling connection and the related resources.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

Direction: Near-RT RIC → E2 Node, or E2 Node → Near-RT RIC

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
Transaction ID	M		9.2.33	.	YES	reject
Criticality Diagnostics	O		9.2.2		YES	ignore

9.1.2.19 E2 REMOVAL FAILURE

This message is sent by either the E2 Node or the Near-RT RIC to indicate that removing the E2 signaling connection and the related resources cannot be accepted.

Direction: Near-RT RIC → E2 Node, or E2 Node → Near-RT RIC

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.3		YES	reject
Transaction ID	M		9.2.33	.	YES	reject
Cause	M		9.2.1		YES	ignore
Criticality Diagnostics	O		9.2.2		YES	ignore

9.2 Information Element definitions

9.2.0 General

When specifying 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.

9.2.1 Cause

The purpose of the *Cause* IE is to indicate the reason for a particular event for the E2AP protocol.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
CHOICE *Cause Group*	M			
>RIC services				
>>RIC Request	O		ENUMERATED (RAN Function ID invalid, Action not supported, Excessive actions, Duplicate action, Duplicate Event Trigger, Function resource limit, RIC Request ID unknown, Inconsistent Action/subsequent Action sequence, Control message invalid, RIC Call process ID invalid, Control timer expired, Control failed to execute, System not ready,	

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

			unspecified, …, RIC Subscription End Time expired, RIC Subscription Time invalid, Duplicate RIC Request ID, Event Trigger not supported, Requested Information Unavailable, Invalid Information Request)	
>>RIC Service	O		ENUMERATED RAN Function not supported, Excessive functions, RIC resource limit,…)	
>>E2 Node	O		ENUMERATED (E2 node component unknown, …)	
>Transport Layer				
>>Transport Layer Cause	M		ENUMERATED (Unspecified, Transport Resource Unavailable, ...)	
>Protocol				
>>Protocol Cause	M		ENUMERATED (Transfer Syntax Error, Abstract Syntax Error (Reject), Abstract Syntax Error (Ignore and Notify), Message not Compatible with Receiver State, Semantic Error, Abstract Syntax Error (Falsely Constructed Message), Unspecified, ...)	
>Misc				
>>Miscellaneous Cause	M		ENUMERATED (Control Processing Overload, Hardware Failure, O&M Intervention, Unspecified, ...)	

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

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

RIC Request cause	Meaning
Unspecified	Sent for RIC service cause when none of the specified cause values applies.
RAN Function ID invalid	Requested function Id invalid or not known by E2 Node
Action not supported	Requested Action not supported by RAN function
Excessive actions	Excessive number of actions requested for RAN Function
Duplicate action	Same action requested more than once in same subscription request
Duplicate Event Trigger	Subscription request has same event trigger as previously accepted subscription request
Function resource limit	RAN function has reached resource limit
RIC Request ID unknown	RIC Request ID sent to Near-RT RIC is unknown
Inconsistent Action/subsequent Action sequence	RAN Function has detected inconsistent sequence of requested Action and Subsequent Action
Control message invalid	RAN Function has detected invalid RIC CONTROL REQUEST message
RIC Call process ID invalid	RAN function has detected invalid RIC Call Process ID in RIC CONTROL REQUEST
Control timer expired	RIC Control Request received by E2 Node after the associated RIC Time to Wait timer had expired
Control failed to execute	Requested control procedure initiated by RIC Control Request failed to be executed in the E2 Node
System not ready	RAN Function is not ready to receive RIC Subscription or RIC Control message
RIC Subscription End Time expired	RIC SUBSCRIPTION DELETE REQUIRED is triggered to inform Near-RT RIC that end time has expired.
RIC Subscription Time invalid	E2 Node received RIC SUBSCRIPTION REQUEST containing an invalid RIC Subscription Start Time and/or RIC Subscription End Time.
Duplicate RIC Request ID	E2 node does not support handling of same RIC Request ID as previously accepted subscription request
Event Trigger not supported	Requested event trigger definition or modification - not supported by RAN function
Requested Information Unavailable	Information requested by Near-RT RIC is not available at E2 Node
Invalid Information Request	Information requested by Near-RT RIC is invalid

RIC Service cause	Meaning
RAN Function not supported	The RAN Function described by E2 Node is not supported by Near-RT RIC
Excessive functions	RIC has reached a limit on the number of declared RAN functions
RIC resource limit	RIC has reached a resource limit

E2 Node configuration cause	Meaning
E2 Node component unknown	The received message refers to an unknown E2 Node component

Transport Layer cause	Meaning
Unspecified	Sent when none of the cause values below applies but still the cause is Transport Network Layer related.
Transport Resource Unavailable	The required transport resources are not available.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

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

Miscellaneous cause	Meaning
Control Processing Overload	Control processing overload.
Not Enough User Plane Processing Resources Available	Not enough resources are available related to user plane processing.
Hardware Failure	Action related to hardware failure.
O&M Intervention	The action is due to O&M intervention.
Unspecified Failure	Sent when none of the above cause values applies and the cause is not related to any of the categories Radio Network Layer, Transport Network Layer, NAS or Protocol.

9.2.2 Criticality Diagnostics

The *Criticality Diagnostics* IE is sent by the E2 Node or the Near-RT RIC when parts of a received message have not been comprehended, or were missing, or if the message contained logical errors. When applicable, it contains information about which IEs were not comprehended or were missing.

For further details on how to use the *Criticality Diagnostics* IE, (see clause 10). The conditions for inclusion of the *Transaction ID* IE are described in clause 10.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Procedure Code	O		INTEGER (0..255)	Procedure Code is to be used if Criticality Diagnostics is part of Error Indication procedure, and not within the response message of the same procedure that caused the error.
Triggering Message	O		ENUMERATED (initiating message, successful outcome, unsuccessful outcome)	The Triggering Message is used only if the Criticality Diagnostics is part of Error Indication procedure.
Procedure Criticality	O		ENUMERATED (reject, ignore, notify)	This Procedure Criticality is used for reporting the Criticality of the Triggering message (Procedure).
RIC Request ID	O		9.2.7	
Information Element Criticality Diagnostics		*0 .. <maxnoof Errors>*		
>IE Criticality	M		ENUMERATED (reject, ignore, notify)	The IE Criticality is used for reporting the criticality of the triggering IE. The value 'ignore' shall not be used.
>IE ID	M		INTEGER (0..65535)	The IE ID of the not understood or missing IE.
>Type of Error	M		ENUMERATED (not understood, missing, ...)	

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

9.2.3 Message Type

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

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Message Type				
>Procedure Code	M		INTEGER (0..255)	
>Type of Message	M		CHOICE (Initiating Message, Successful Outcome, Unsuccessful Outcome, ...)	

9.2.4 Global RIC ID

This IE is used to globally identify the Near-RT RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
PLMN Identity	M		3GPP 38.423 clause 9.2.2.4	
Near-RT RIC ID	M		BIT STRING (SIZE(20))	

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

9.2.5 Time to wait

This IE defines the minimum allowed waiting times.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Time to wait	M		ENUMERATED(1s, 2s, 5s, 10s, 20s, 60s)	

9.2.6 Global E2 Node ID

This IE is used to globally identify an E2 node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE	M			
>gNB				To be used when E2 Node supports gNB mode or both gNB and en-gNB modes
>>Global gNB ID	M		3GPP 38.423 clause 9.2.2.1	
>>Global en-gNB ID	O		3GPP 36.423 clause 9.2.112	Required when E2 node also supports NR with en-gNB mode
>>gNB-CU-UP ID	O		3GPP 37.483 clause 9.3.1.15	Required when E2 Node supports only gNB-CU-UP functionality
>>gNB-DU ID	O		3GPP 38.473 clause 9.3.1.9	Required when E2 Node supports only gNB-DU functionality
>en-gNB				To be used when E2 Node supports en-gNB mode only
>>Global en-gNB ID	M		3GPP 36.423 clause 9.2.112	
>>en-gNB-CU-UP ID	O		3GPP 37.483 clause 9.3.1.15	Required when E2 Node supports only gNB-CU-UP functionality
>>en-gNB-DU ID	O		3GPP 38.473 clause 9.3.1.9	Required when E2 Node supports only gNB-DU functionality
>ng-eNB				To be used when E2 Node supports ng-eNB mode or both ng-eNB and eNB modes
>>Global ng-eNB ID	M		3GPP 38.423 clause 9.2.2.2	
>>Global eNB ID	O		3GPP 36.423 clause 9.2.22	Required when E2 Node also supports E-UTRA with eNB mode
>>ng-eNB-DU ID	O		3GPP 37.473 clause 9.3.1.9	Required when E2 nodesupports only ng-eNB DU functionality
>eNB				To be used when E2 Node supports eNB mode only
>>Global eNB ID	M		3GPP 36.423 clause 9.2.22	

9.2.7 RIC Request ID

This information element indicates the RIC Request ID , and shall be unique for a given E2 Node.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

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

9.2.8 RAN Function ID

This information element indicates the RAN Function ID, and shall be unique within a given E2 Node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RAN Function ID	M		INTEGER (0..4095)	Value 0 reserved for Near-RT RIC internal usage

9.2.9 RIC Event Trigger Definition

This information element indicates the RIC event trigger description used by the RIC Subscription procedure.

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

9.2.10 RIC Action ID

This information element indicates the Action ID number for a RIC Service Action, and shall be unique within the given RIC Request ID.

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

9.2.11 RIC Action Type

This IE defines the type of RIC Service Action to be executed.

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

9.2.12 RIC Action Definition

This information element provides parameters to used when executed a Report, Insert or Policy RIC Service Actions .

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

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

9.2.13 RIC Subsequent Action

This IE defines the subsequent action to be taken after completing a particular RIC Service Action and shall be present when RIC Action Type set to Insert.

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

9.2.14 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)	

9.2.15 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, …)	

9.2.16 RIC Indication message

This information element carries the RIC indication message used for Insert and Report RIC Service Actions .

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

9.2.17 RIC Indication header

This information element carries the RIC indication header used for Insert and Report RIC Service Actions .

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

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

9.2.18 RIC Call Process ID

This information element carries the RIC Call Process ID used for the Insert and Control RIC Service Actions. The RIC Call Process ID shall be unique within a given RAN Function on a given E2 Node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Call Process ID	M		OCTET STRING	Defined in RAN Function specific E2 Service model [3]

9.2.19 RIC Control message

This information element carries the RIC Control message.

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

9.2.20 RIC Control header

This information element carries the RIC Control Header.

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

9.2.21 RIC Control Ack Request

This IE defines whether and when the RIC CONTROL ACKNOWLEDGE message shall be sent by the E2 Node as described in the below table.

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

The meaning of the different values is described in the following table.

RIC Service cause	Meaning
NoAck	Optional RIC Control Acknowledgement is not required
Ack	Optional RIC Control Acknowledgement is required

9.2.22 Void

9.2.23 RAN Function Definition

This information element carries the RAN Function Definition.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

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

9.2.24 RAN Function Revision

This information element carries the RAN Function Revision.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RAN Function Revision	M		INTEGER (0..4095)	

9.2.25 RIC Control Outcome

This information element carries the RIC Control Outcome.

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

9.2.26 E2 Node Component Interface Type

This IE is used to identify an E2 node component type.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
E2 node component interface type	M		ENUMERATED (ng, xn, e1, f1, w1, s1, x2, …)	

9.2.27 E2 Node Component Configuration

This IE is used to carry the E2 Node component configuration update information of a specific E2 Node component.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
SEQUENCE	M			
>E2 Node Component Request Part	M		OCTET STRING	Contents depend on component type and used to carry new or updated component configuration. See the table below.
>E2 Node Component Response Part	M		OCTET STRING	Contents depend on component type and used to carry new or updated component configuration. See the table below.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

In all cases the information is a data structure defined by the applicable 3GPP specification as specified in the following table.

	Component Addition list		Component Update list	
E2 Node component message content	**Request part**	**Response part**	**Request part**	**Response part**
gNB case				
>NG (AMF Name)	NG SETUP REQUEST, 3GPP 38.413 [19] clause 9.2.6.1	NG SETUP RESPONSE, 3GPP 38.413 [19] clause 9.2.6.2	RAN CONFIGURATION UPDATE, 3GPP 38.413 [19] clause 9.2.6.4 Or AMF CONFIGURATION UPDATE, 3GPP 38.413 [19] clause 9.2.6.7	RAN CONFIGURATION UPDATE ACKNOWLEDGE, 3GPP 38.413 [19] clause 9.2.6.5 Or AMF CONFIGURATION UPDATE ACKNOWLEDGE, 3GPP 38.413 [19] clause 9.2.6.8
>Xn (Neighbour Global NG-RAN Node ID)	XN SETUP REQUEST, 3GPP 38.423 [20] clause 9.1.3.1	XN SETUP RESPONSE, 3GPP 38.423 [20] clause 9.1.3.2	NG-RAN NODE CONFIGURATION UPDATE, 3GPP 38.423 [20] clause 9.1.3.4	NG-RAN NODE CONFIGURATION UPDATE ACKNOWLEDGE, 3GPP 38.423 [20] clause 9.1.3.5
>E1 (gNB-CU-UP ID)	GNB-CU-UP E1 SETUP REQUEST, 3GPP 37.483 [21] clause 9.2.1.4 Or GNB-CU-CP E1 SETUP REQUEST, 3GPP 37.483 [21] clause 9.2.1.7	GNB-CU-UP E1 SETUP RESPONSE, 3GPP 37.483 [21] clause 9.2.1.5 Or GNB-CU-CP E1 SETUP RESPONSE, 3GPP 37.483 [21] clause 9.2.1.8	GNB-CU-UP CONFIGRATION UPDATE, 3GPP 37.483 [21] clause 9.2.1.10 Or GNB-CU-CP CONFIGURATION UPDATE, 3GPP 37.483 [21] clause 9.2.1.13	GNB-CU-UP CONFIGRATION UPDATE ACKNOWLEDGE, 3GPP 37.483 [21] clause 9.2.1.11 Or GNB-CU-CP CONFIGURATION UPDATE ACKNOWLEDGE, 3GPP 37.483 [21] clause 9.2.1.14
>F1 (gNB-DU ID)	F1 SETUP REQUEST, 3GPP 38.473 [22] clause 9.2.1.4	F1 SETUP RESPONSE, 3GPP 38.473 [22] clause 9.2.1.5	GNB-DU CONFIGRATION UPDATE, 3GPP 38.473 [22] clause 9.2.1.7 Or GNB-CU CONFIGURATION UPDATE, 3GPP 38.473 [22] clause 9.2.1.10	GNB-DU CONFIGRATION UPDATE ACKNOWLEDGE, 3GPP 38.473 [22] clause 9.2.1.8 Or GNB-CU CONFIGURATION UPDATE ACKNOWLEDGE, 3GPP 38.473 [22] clause 9.2.1.11
>X2 (Neighbour Global eNB ID)	EN-DC X2 SETUP REQUEST, 3GPP 36.423 [25] clause 9.1.2.31	EN-DC X2 SETUP RESPONSE, 3GPP 36.423 [25] clause 9.1.2.32	EN-DC CONFIGURATION UPDATE, 3GPP 36.423 [25] clause 9.1.2.34	EN-DC CONFIGURATION UPDATE ACKNOWLEDGE, 3GPP 36.423 [25] clause 9.1.2.35

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

	Component Addition list		Component Update list	
E2 Node component message content	**Request part**	**Response part**	**Request part**	**Response part**
eNB case				
>NG (AMF Name)	NG SETUP REQUEST, 3GPP 38.413 [19] clause 9.2.6.1	NG SETUP RESPONSE, 3GPP 38.413 [19] clause 9.2.6.2	RAN CONFIGURATION UPDATE, 3GPP 38.413 [19] clause 9.2.6.4 Or AMF CONFIGURATION UPDATE, 3GPP 38.413 [19] clause 9.2.6.7	RAN CONFIGURATION UPDATE ACKNOWLEDGE, 3GPP 38.413 [19] clause 9.2.6.5 Or AMF CONFIGURATION UPDATE ACKNOWLEDGE, 3GPP 38.413 [19] clause 9.2.6.8
>Xn (Neighbour Global NG-RAN Node ID)	XN SETUP REQUEST, 3GPP 38.423 [20] clause 9.1.3.1	XN SETUP RESPONSE, 3GPP 38.423 [20] clause 9.1.3.2	NG-RAN NODE CONFIGURATION UPDATE, 3GPP 38.423 [20] clause 9.1.3.4	NG-RAN NODE CONFIGURATION UPDATE ACKNOWLEDGE, 3GPP 38.423 [20] clause 9.1.3.5
>W1 (ng-eNB-DU ID)	W1 SETUP REQUEST, 3GPP 37.473 [23] clause 9.2.1.4	W1 SETUP RESPONSE, 3GPP 37.473 [23] clause 9.2.1.5	NG-ENB-DU CONFIGURATION UPDATE, 3GPP 37.473 [23] clause 9.2.1.7 Or NG-ENB-CU CONFIGURATION UPDATE, 3GPP 37.473 [23] clause 9.2.1.10	NG-ENB-DU CONFIGURATION UPDATE ACKNOWLEDGE, 3GPP 37.473 [23] clause 9.2.1.8 Or NG-ENB-CU CONFIGURATION UPDATE ACKNOWLEDGE, 3GPP 37.473 [23] clause 9.2.1.11
>S1 (MME Name)	S1 SETUP REQUEST, 3GPP 36.413 [24] clause 9.1.8.4	S1 SETUP RESPONSE, 3GPP 36.413 [24] clause 9.1.8.5	ENB CONFIGURATION UPDATE, 3GPP 36.413 [24] clause 9.1.8.7 Or MME CONFIGURATION UPDATE, 3GPP 36.413 [24] clause 9.1.8.10	ENB CONFIGRATION UPDATE ACKNOWLEDGE, 3GPP 36.413 [24] clause 9.1.8.8 Or MME CONFIGURATION UPDATE ACKNOWLEDGE, 3GPP 36.413 [24] clause 9.1.8.11
>X2 (when neighbour is eNB) (Neighbour Global eNB ID)	X2 SETUP REQUEST, 3GPP 36.423 [25] clause 9.1.2.3	X2 SETUP RESPONSE, 3GPP 36.423 [25] clause 9.1.2.4	ENB CONFIGURATION UPDATE, 3GPP 36.423 [25] clause 9.1.2.8	ENB CONFIGRATION UPDATE ACKNOWLEDGE, 3GPP 36.423 [25] clause 9.1.2.9
>X2 (when neighbour is en-gNB) (Neighbour Global	EN-DC X2 SETUP REQUEST, 3GPP 36.423 [25] clause 9.1.2.31	EN-DC X2 SETUP RESPONSE, 3GPP 36.423 [25] clause 9.1.2.32	EN-DC CONFIGURATION UPDATE, 3GPP 36.423 [25] clause 9.1.2.34	EN-DC CONFIGURATION UPDATE ACKNOWLEDGE, 3GPP 36.423 [25]

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

	Component Addition list		Component Update list	
E2 Node component message content	**Request part**	**Response part**	**Request part**	**Response part**
eNB ID)				clause 9.1.2.35

9.2.28 E2 Node Component Configuration Acknowledge

This IE is used to carry the E2 Node component configuration update acknowledge of a specific E2 Node component.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Outcome	M		ENUMERATED (success, failure,…)	
Cause	O		9.2.1	Cause for failure

9.2.29 Transport Layer Information

This information element provides Near-RT RIC address and optionally port number to be used by an E2 Node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Transport Layer Address	M		BIT STRING (SIZE(1..160,…))	To be passed to transport layer without interpretation
Transport Layer Port	O		BIT STRING (SIZE(16))	To be passed to transport layer without interpretation

9.2.30 TNL Association Usage

This information element provides TNL association usage.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
TNL Association Usage	M		ENUMERATED (ric service, support functions, both,..)	Indicates whether E2 connection to be used for RIC services only, or E2 support functions only, or both

9.2.31 RAN Function OID

This information element carries the RAN Function OID and shall uniquely refer to a specific E2 Service Model (E2SM).

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RAN Function Service Model OID	M		PrintableString(SIZE(1..1000,...))	Object Identifier of the specific RAN Function definition. Formatted as per OID

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

9.2.32 E2 Node Component ID

This IE is used to locally identify an E2 node component.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE *E2 node component interface type*	M			
>NG				
>>AMF name	M		3GPP 38.413 [19] clause 9.3.3.21	Serving AMF
>Xn				
>>Global NG-RAN Node ID	M		3GPP 38.423 [20] clause 9.2.2.3	Neighbour gNB or ng-eNB
>E1				
>>gNB-CU-UP ID	M		3GPP 37.483 [21] clause 9.3.1.15	
>F1				
>>gNB-DU ID	M		3GPP 38.473 [22] clause 9.3.1.9	
>W1				
>>ng-eNB-DU ID	M		3GPP 37.473 [23] clause	
>S1				
>>MME name	M		3GPP 36.413 [24], clause 9.1.8.5	Serving MME
>X2				
>>Global eNB ID	O		3GPP 36.423 [25] clause 9.2.22	Neighbour eNB
>>Global en-gNB ID	O		3GPP 36.423 [25] clause 9.2.112	Neighbour en-gNB

9.2.33 Transaction ID

The *Transaction ID* IE uniquely identifies a procedure among all ongoing parallel procedures of the same type initiated by the same protocol peer. Messages belonging to the same procedure shall use the same Transaction ID. The Transaction ID is determined by the initiating peer of a procedure.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Transaction ID	M		INTEGER (0..255, …)	

9.2.34 RIC Subscription Time

The *RIC Subscription Time* IE is used to set the start and end time of a RIC Subscription.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Subscription time	M		OCTET STRING (SIZE(8))	Encoded using the 64-bit timestamp format as defined in clause 6 of IETF RFC 5905 [26].

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

9.2.35 RIC Action Execution Order

This IE is used to modify the default RIC service action execution order.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Action Execution Order	M		INTEGER (0..255, ...)	0 used to indicate “Any-order” 1..255 Used to enforce a specific execution order

9.2.36 RIC Query Header

This information element carries the RIC Query Header.

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

9.2.37 RIC Query Definition

This information element carries the RIC Query Definition.

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

9.2.38 RIC Query Outcome

This information element carries the RIC Query Outcome.

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

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.691 [15], ITU-T Rec. X.680 [16] and ITU-T Rec. X.681 [17].

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

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

"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 where 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 will 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 subclause 10.3.6.

9.3.2 Usage of private message mechanism for non-standard use

The private message mechanism for non-standard are not supported with E2AP.

9.3.3 Elementary Procedure Definitions

```
-- ASN1START
-- **************************************************************
--
-- Elementary Procedure definitions
-- Derived from 3GPP 38.413 v15.4.0 NGAP
-- **************************************************************

E2AP-PDU-Descriptions {
iso(1) identified-organization(3) dod(6) internet(1) private(4) enterprise(1) 53148 e2(1) version2
(2) e2ap(1) e2ap-PDU-Descriptions (0) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

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

IMPORTS
    Criticality,
    ProcedureCode
FROM E2AP-CommonDataTypes



    E2connectionUpdate,
    E2connectionUpdateAcknowledge,
    E2connectionUpdateFailure,
    E2nodeConfigurationUpdate,
    E2nodeConfigurationUpdateAcknowledge,
    E2nodeConfigurationUpdateFailure,
    E2RemovalRequest,
    E2RemovalResponse,
    E2RemovalFailure,
    E2setupFailure,
    E2setupRequest,
    E2setupResponse,
    ErrorIndication,
    ResetRequest,
    ResetResponse,
    RICcontrolAcknowledge,
    RICcontrolFailure,
    RICcontrolRequest,
    RICindication,
    RICserviceQuery,
    RICserviceUpdate,
    RICserviceUpdateAcknowledge,
    RICserviceUpdateFailure,
    RICsubscriptionFailure,
    RICsubscriptionRequest,
    RICsubscriptionResponse,
    RICsubscriptionDeleteFailure,
    RICsubscriptionDeleteRequest,
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
    RICsubscriptionDeleteResponse,
    RICsubscriptionDeleteRequired,
    RICsubscriptionModificationRequest,
    RICsubscriptionModificationResponse,
    RICsubscriptionModificationFailure,
    RICsubscriptionModificationRequired,
    RICsubscriptionModificationConfirm,
    RICsubscriptionModificationRefuse,
    RICqueryRequest,
    RICqueryResponse,
    RICqueryFailure
FROM E2AP-PDU-Contents

    id-E2connectionUpdate,
    id-E2nodeConfigurationUpdate,
    id-E2removal,
    id-E2setup,
    id-ErrorIndication,
    id-Reset,
    id-RICcontrol,
    id-RICindication,
    id-RICserviceQuery,
    id-RICserviceUpdate,
    id-RICsubscription,
    id-RICsubscriptionDelete,
    id-RICsubscriptionDeleteRequired,
    id-RICsubscriptionModification,
    id-RICsubscriptionModificationRequired,
    id-RICquery
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}),
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
    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 ::= {
    ricSubscription                                     |
    ricSubscriptionDelete                               |
    ricSubscriptionModification                         |
    ricSubscriptionModificationRequired                 |
    ricQuery                                            |
    ricServiceUpdate                                    |
    ricControl                                          |
    e2setup                                             |
    e2nodeConfigurationUpdate                           |
    e2connectionUpdate                                  |
    reset                                               |
    e2removal,
    ...
}

E2AP-ELEMENTARY-PROCEDURES-CLASS-2 E2AP-ELEMENTARY-PROCEDURE ::= {
    ricIndication                                       |
    ricServiceQuery                                     |
    errorIndication                                     |
    ricSubscriptionDeleteRequired,
    ...
}

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

-- New for v01.01
e2connectionUpdate      E2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      E2connectionUpdate
    SUCCESSFUL OUTCOME      E2connectionUpdateAcknowledge
    UNSUCCESSFUL OUTCOME    E2connectionUpdateFailure
    PROCEDURE CODE          id-E2connectionUpdate
    CRITICALITY             reject
}

e2nodeConfigurationUpdate   E2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      E2nodeConfigurationUpdate
    SUCCESSFUL OUTCOME      E2nodeConfigurationUpdateAcknowledge
    UNSUCCESSFUL OUTCOME    E2nodeConfigurationUpdateFailure
    PROCEDURE CODE          id-E2nodeConfigurationUpdate
    CRITICALITY             reject
}

-- New for v02.01
e2removal   E2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      E2RemovalRequest
    SUCCESSFUL OUTCOME      E2RemovalResponse
    UNSUCCESSFUL OUTCOME    E2RemovalFailure
    PROCEDURE CODE          id-E2removal
    CRITICALITY             reject
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
}

e2setup E2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      E2setupRequest
    SUCCESSFUL OUTCOME      E2setupResponse
    UNSUCCESSFUL OUTCOME    E2setupFailure
    PROCEDURE CODE          id-E2setup
    CRITICALITY             reject
}

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

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

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

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

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
}

ricSubscriptionDeleteRequired E2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      RICsubscriptionDeleteRequired
    PROCEDURE CODE          id-RICsubscriptionDeleteRequired
    CRITICALITY             ignore
}

ricSubscriptionModification E2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      RICsubscriptionModificationRequest
    SUCCESSFUL OUTCOME      RICsubscriptionModificationResponse
    UNSUCCESSFUL OUTCOME    RICsubscriptionModificationFailure
    PROCEDURE CODE          id-RICsubscriptionModification
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
    CRITICALITY             reject
}

ricSubscriptionModificationRequired E2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      RICsubscriptionModificationRequired
    SUCCESSFUL OUTCOME      RICsubscriptionModificationConfirm
    UNSUCCESSFUL OUTCOME    RICsubscriptionModificationRefuse
    PROCEDURE CODE          id-RICsubscriptionModificationRequired
    CRITICALITY             reject
}

ricQuery E2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      RICQueryRequest
    SUCCESSFUL OUTCOME      RICQueryResponse
    UNSUCCESSFUL OUTCOME    RICQueryFailure
    PROCEDURE CODE          id-RICquery
    CRITICALITY             reject
}

END
-- ASN1STOP
```

9.3.4 PDU definitions

```
-- ASN1START
-- **************************************************************
--
-- PDU definitions for E2AP
-- Derived from 3GPP 38.413 (NGAP)
--
-- **************************************************************

E2AP-PDU-Contents {
iso(1) identified-organization(3) dod(6) internet(1) private(4) enterprise(1) 53148 e2(1) version2
(2) e2ap(1) e2ap-PDU-Contents (1) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

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

IMPORTS
    Cause,
    CriticalityDiagnostics,
    E2nodeComponentConfiguration,
    E2nodeComponentConfigurationAck,
    E2nodeComponentID,
    E2nodeComponentInterfaceType,
    GlobalE2node-ID,
    GlobalRIC-ID,
    RANfunctionDefinition,
    RANfunctionID,
    RANfunctionOID,
    RANfunctionRevision,
    RICactionDefinition,
    RICactionExecutionOrder,
    RICactionID,
    RICactionType,
    RICcallProcessID,
    RICcontrolAckRequest,
    RICcontrolHeader,
    RICcontrolMessage,
    RICcontrolOutcome,
    RICeventTriggerDefinition,
    RICindicationHeader,
    RICindicationMessage,
    RICindicationSN,
    RICindicationType,
    RICrequestID,
    RICsubsequentAction,
    RICsubscriptionTime,
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
    RICqueryHeader,
    RICqueryDefinition,
    RICqueryOutcome,
    TimeToWait,
    TNLinformation,
    TNLusage,
    TransactionID
FROM E2AP-IEs

    ProtocolIE-Container{},
    ProtocolIE-ContainerList{},
    ProtocolIE-SingleContainer{},
    E2AP-PROTOCOL-IES,
    E2AP-PROTOCOL-IES-PAIR
FROM E2AP-Containers

    id-Cause,
    id-CriticalityDiagnostics,
    id-E2connectionSetup,
    id-E2connectionSetupFailed,
    id-E2connectionSetupFailed-Item,
    id-E2connectionFailed-Item,
    id-E2connectionUpdate-Item,
    id-E2connectionUpdateAdd,
    id-E2connectionUpdateModify,
    id-E2connectionUpdateRemove,
    id-E2connectionUpdateRemove-Item,
    id-E2nodeComponentConfigAddition,
    id-E2nodeComponentConfigAddition-Item,
    id-E2nodeComponentConfigAdditionAck,
    id-E2nodeComponentConfigAdditionAck-Item,
    id-E2nodeComponentConfigRemoval,
    id-E2nodeComponentConfigRemoval-Item,
    id-E2nodeComponentConfigRemovalAck,
    id-E2nodeComponentConfigRemovalAck-Item,
    id-E2nodeComponentConfigUpdate,
    id-E2nodeComponentConfigUpdate-Item,
    id-E2nodeComponentConfigUpdateAck,
    id-E2nodeComponentConfigUpdateAck-Item,
    id-E2nodeTNLassociationRemoval,
    id-E2nodeTNLassociationRemoval-Item,
    id-GlobalE2node-ID,
    id-GlobalRIC-ID,
    id-RANfunctionID,
    id-RANfunctionID-Item,
    id-RANfunctionIEcause-Item,
    id-RANfunction-Item,
    id-RANfunctionsAccepted,
    id-RANfunctionsAdded,
    id-RANfunctionsDeleted,
    id-RANfunctionsModified,
    id-RANfunctionsRejected,
    id-RICaction-Admitted-Item,
    id-RICactionID,
    id-RICaction-NotAdmitted-Item,
    id-RICactions-Admitted,
    id-RICactions-NotAdmitted,
    id-RICaction-ToBeSetup-Item,
    id-RICactionsToBeRemovedForModification-List,
    id-RICaction-ToBeRemovedForModification-Item,
    id-RICactionsToBeModifiedForModification-List,
    id-RICaction-ToBeModifiedForModification-Item,
    id-RICactionsToBeAddedForModification-List,
    id-RICaction-ToBeAddedForModification-Item,
    id-RICactionsRemovedForModification-List,
    id-RICaction-RemovedForModification-Item,
    id-RICactionsFailedToBeRemovedForModification-List,
    id-RICaction-FailedToBeRemovedForModification-Item,
    id-RICactionsModifiedForModification-List,
    id-RICaction-ModifiedForModification-Item,
    id-RICactionsFailedToBeModifiedForModification-List,
    id-RICaction-FailedToBeModifiedForModification-Item,
    id-RICactionsAddedForModification-List,
    id-RICaction-AddedForModification-Item,
    id-RICactionsFailedToBeAddedForModification-List,
    id-RICaction-FailedToBeAddedForModification-Item,
    id-RICactionsRequiredToBeModified-List,
    id-RICaction-RequiredToBeModified-Item,
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
    id-RICactionsRequiredToBeRemoved-List,
    id-RICaction-RequiredToBeRemoved-Item,
    id-RICactionsConfirmedForModification-List,
    id-RICaction-ConfirmedForModification-Item,
    id-RICactionsRefusedToBeModified-List,
    id-RICaction-RefusedToBeModified-Item,
    id-RICactionsConfirmedForRemoval-List,
    id-RICaction-ConfirmedForRemoval-Item,
    id-RICactionsRefusedToBeRemoved-List,
    id-RICaction-RefusedToBeRemoved-Item,
    id-RICcallProcessID,
    id-RICcontrolAckRequest,
    id-RICcontrolHeader,
    id-RICcontrolMessage,
    id-RICcontrolOutcome,
    id-RICeventTriggerDefinitionToBeModified,
    id-RICindicationHeader,
    id-RICindicationMessage,
    id-RICindicationSN,
    id-RICindicationType,
    id-RICrequestID,
    id-RICserviceQuery,
    id-RICsubscriptionDetails,
    id-RICsubscriptionToBeRemoved,
    id-RICsubscription-withCause-Item,
    id-RICsubscriptionStartTime,
    id-RICsubscriptionEndTime,
    id-RICqueryHeader,
    id-RICqueryDefinition,
    id-RICqueryOutcome,
    id-TimeToWait,
    id-TNLinformation,
    id-TransactionID,

    maxofE2nodeComponents,
    maxofRANfunctionID,
    maxofRICactionID,
    maxofRICrequestID,
    maxofTNLA
FROM E2AP-Constants;


-- **************************************************************
--
-- MESSAGES FOR RIC FUNCTIONAL PROCEDURES
--
-- **************************************************************

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

RICsubscriptionRequest-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-RICrequestID                CRITICALITY reject  TYPE RICrequestID
    PRESENCE mandatory}|
    { ID id-RANfunctionID               CRITICALITY reject  TYPE RANfunctionID
    PRESENCE mandatory}|
    { ID id-RICsubscriptionDetails      CRITICALITY reject  TYPE RICsubscriptionDetails
    PRESENCE mandatory},
    ...,
    { ID id-RICsubscriptionStartTime    CRITICALITY reject  TYPE RICsubscriptionTime
    PRESENCE optional}|
    { ID id-RICsubscriptionEndTime      CRITICALITY reject  TYPE RICsubscriptionTime
    PRESENCE optional}
}
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
RICsubscriptionDetails ::= SEQUENCE {
    ricEventTriggerDefinition   RICeventTriggerDefinition,
    ricAction-ToBeSetup-List    RICactions-ToBeSetup-List,
    ...
}

RICactions-ToBeSetup-List ::= SEQUENCE (SIZE(1..maxofRICactionID)) OF ProtocolIE-SingleContainer
{ {RICaction-ToBeSetup-ItemIEs} }

RICaction-ToBeSetup-ItemIEs     E2AP-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,
    ...,
    ricActionExecutionOrder     RICactionExecutionOrder OPTIONAL        -- New in E2APv03.00

}

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

RICsubscriptionResponse-IEs E2AP-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-
SingleContainer{{RICaction-Admitted-ItemIEs}}

RICaction-Admitted-ItemIEs E2AP-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-SingleContainer
{ {RICaction-NotAdmitted-ItemIEs} }

RICaction-NotAdmitted-ItemIEs E2AP-PROTOCOL-IES ::= {
    { ID id-RICaction-NotAdmitted-Item  CRITICALITY ignore  TYPE RICaction-NotAdmitted-Item
    PRESENCE mandatory },
    ...
}

RICaction-NotAdmitted-Item ::= SEQUENCE {
    ricActionID                 RICactionID,
    cause                       Cause,
    ...
}
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

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

RICsubscriptionFailure-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-RICrequestID                CRITICALITY reject  TYPE RICrequestID
    PRESENCE mandatory  }|
    { ID id-RANfunctionID               CRITICALITY reject  TYPE RANfunctionID
    PRESENCE mandatory  }|
    { ID id-Cause                       CRITICALITY reject  TYPE Cause      PRESENCE mandatory  }|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics
    PRESENCE optional   },
    ...
}

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

RICsubscriptionDeleteRequest-IEs E2AP-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 E2AP-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 E2AP-PROTOCOL-IES ::= {
    { ID id-RICrequestID                CRITICALITY reject  TYPE RICrequestID
    PRESENCE mandatory  }|
    { ID id-RANfunctionID               CRITICALITY reject  TYPE RANfunctionID
    PRESENCE mandatory  }|
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause
    PRESENCE mandatory  }|
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

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

-- **************************************************************
--
-- RIC Subscription Delete Required Elementary Procedure
--
-- **************************************************************
-- **************************************************************
--
-- RIC SUBSCRIPTION DELETE REQUIRED
--
-- **************************************************************

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

RICsubscriptionDeleteRequired-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-RICsubscriptionToBeRemoved      CRITICALITY ignore  TYPE RICsubscription-List-withCause
    PRESENCE mandatory  },
    ...
}

RICsubscription-List-withCause ::= SEQUENCE (SIZE(1..maxofRICrequestID)) OF ProtocolIE-
SingleContainer { {RICsubscription-withCause-ItemIEs} }

RICsubscription-withCause-ItemIEs   E2AP-PROTOCOL-IES ::= {
    { ID id-RICsubscription-withCause-Item  CRITICALITY ignore  TYPE RICsubscription-withCause-Item
    PRESENCE mandatory  },
    ...
}

RICsubscription-withCause-Item ::= SEQUENCE {
    ricRequestID                RICrequestID,
    ranFunctionID               RANfunctionID,
    cause                       Cause,
    ...
}

-- **************************************************************
--
-- RIC Subscription Modification Elementary Procedure
--
-- **************************************************************
-- **************************************************************
--
-- RIC SUBSCRIPTION MODIFICATION REQUEST
--
-- **************************************************************
RICsubscriptionModificationRequest ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container    {{RICsubscriptionModificationRequest-IEs}},
    ...
}


RICsubscriptionModificationRequest-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-RICrequestID                                CRITICALITY reject  TYPE RICrequestID
            PRESENCE mandatory}|
    { ID id-RANfunctionID                               CRITICALITY reject  TYPE RANfunctionID
            PRESENCE mandatory}|
    { ID id-RICeventTriggerDefinitionToBeModified       CRITICALITY ignore  TYPE
RICeventTriggerDefinition   PRESENCE optional}|
    { ID id-RICactionsToBeRemovedForModification-List   CRITICALITY ignore  TYPE RICactions-
ToBeRemovedForModification-List PRESENCE optional}|
    { ID id-RICactionsToBeModifiedForModification-List  CRITICALITY ignore  TYPE RICactions-
ToBeModifiedForModification-List    PRESENCE optional}|
    { ID id-RICactionsToBeAddedForModification-List     CRITICALITY ignore  TYPE RICactions-
ToBeAddedForModification-List       PRESENCE optional},
    ...
}

RICactions-ToBeRemovedForModification-List ::= SEQUENCE (SIZE(0..maxofRICactionID)) OF ProtocolIE-
SingleContainer {{RICaction-ToBeRemovedForModification-ItemIEs} }
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
RICaction-ToBeRemovedForModification-ItemIEs    E2AP-PROTOCOL-IES ::= {
    { ID id-RICaction-ToBeRemovedForModification-Item   CRITICALITY ignore  TYPE RICaction-
ToBeRemovedForModification-Item     PRESENCE mandatory },
    ...
}

RICaction-ToBeRemovedForModification-Item ::= SEQUENCE {
    ricActionID                 RICactionID,
    ...
}

RICactions-ToBeModifiedForModification-List ::= SEQUENCE (SIZE(0..maxofRICactionID)) OF ProtocolIE-
SingleContainer {{RICaction-ToBeModifiedForModification-ItemIEs} }

RICaction-ToBeModifiedForModification-ItemIEs   E2AP-PROTOCOL-IES ::= {
    { ID id-RICaction-ToBeModifiedForModification-Item  CRITICALITY ignore  TYPE RICaction-
ToBeModifiedForModification-Item    PRESENCE mandatory },
    ...
}

RICaction-ToBeModifiedForModification-Item ::= SEQUENCE {
    ricActionID                 RICactionID,
    ricActionDefinition         RICactionDefinition     OPTIONAL,
    ricActionExecutionOrder     RICactionExecutionOrder OPTIONAL,
    ricSubsequentAction         RICsubsequentAction     OPTIONAL,
    ...
}


RICactions-ToBeAddedForModification-List ::= SEQUENCE (SIZE(0..maxofRICactionID)) OF ProtocolIE-
SingleContainer {{RICaction-ToBeAddedForModification-ItemIEs} }

RICaction-ToBeAddedForModification-ItemIEs  E2AP-PROTOCOL-IES ::= {
    { ID id-RICaction-ToBeAddedForModification-Item CRITICALITY ignore  TYPE RICaction-
ToBeAddedForModification-Item   PRESENCE mandatory },
    ...
}

RICaction-ToBeAddedForModification-Item ::= SEQUENCE {
    ricActionID                 RICactionID,
    ricActionType               RICactionType,
    ricActionDefinition         RICactionDefinition,
    ricActionExecutionOrder     RICactionExecutionOrder,
    ricSubsequentAction         RICsubsequentAction     OPTIONAL,
    ...
}
-- **************************************************************
--
-- RIC SUBSCRIPTION MODIFICATION RESPONSE
--
-- **************************************************************
RICsubscriptionModificationResponse ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container    {{RICsubscriptionModificationResponse-IEs}},
    ...
}

RICsubscriptionModificationResponse-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-RICrequestID                                    CRITICALITY reject  TYPE
RICrequestID                    PRESENCE mandatory}|
    { ID id-RANfunctionID                                   CRITICALITY reject  TYPE
RANfunctionID                   PRESENCE mandatory}|
    { ID id-RICactionsRemovedForModification-List           CRITICALITY ignore  TYPE RICactions-
RemovedForModification-List PRESENCE optional}|
    { ID id-RICactionsFailedToBeRemovedForModification-List     CRITICALITY ignore  TYPE RICactions-
FailedToBeRemovedForModification-List   PRESENCE optional}|
    { ID id-RICactionsModifiedForModification-List          CRITICALITY ignore  TYPE RICactions-
ModifiedForModification-List    PRESENCE optional}|
    { ID id-RICactionsFailedToBeModifiedForModification-List    CRITICALITY ignore  TYPE RICactions-
FailedToBeModifiedForModification-List  PRESENCE optional}|
    { ID id-RICactionsAddedForModification-List             CRITICALITY ignore  TYPE RICactions-
AddedForModification-List   PRESENCE optional}|
    { ID id-RICactionsFailedToBeAddedForModification-List       CRITICALITY ignore  TYPE RICactions-
FailedToBeAddedForModification-List     PRESENCE optional},
    ...
}

RICactions-RemovedForModification-List ::= SEQUENCE (SIZE(0..maxofRICactionID)) OF ProtocolIE-
SingleContainer {{RICaction-RemovedForModification-ItemIEs} }
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
RICaction-RemovedForModification-ItemIEs    E2AP-PROTOCOL-IES ::= {
    { ID id-RICaction-RemovedForModification-Item   CRITICALITY ignore  TYPE RICaction-
RemovedForModification-Item     PRESENCE mandatory },
    ...
}

RICaction-RemovedForModification-Item ::=   SEQUENCE {
    ricActionID                 RICactionID,
    ...
}
RICactions-FailedToBeRemovedForModification-List ::= SEQUENCE (SIZE(0..maxofRICactionID)) OF
ProtocolIE-SingleContainer {{RICaction-FailedToBeRemovedForModification-ItemIEs} }

RICaction-FailedToBeRemovedForModification-ItemIEs  E2AP-PROTOCOL-IES ::= {
    { ID id-RICaction-FailedToBeRemovedForModification-Item CRITICALITY ignore  TYPE RICaction-
FailedToBeRemovedForModification-Item   PRESENCE mandatory },
    ...
}

RICaction-FailedToBeRemovedForModification-Item ::= SEQUENCE {
    ricActionID                 RICactionID,
    cause                       Cause,
    ...
}

RICactions-ModifiedForModification-List ::= SEQUENCE (SIZE(0..maxofRICactionID)) OF ProtocolIE-
SingleContainer {{RICaction-ModifiedForModification-ItemIEs} }

RICaction-ModifiedForModification-ItemIEs   E2AP-PROTOCOL-IES ::= {
    { ID id-RICaction-ModifiedForModification-Item  CRITICALITY ignore  TYPE RICaction-
ModifiedForModification-Item    PRESENCE mandatory },
    ...
}

RICaction-ModifiedForModification-Item ::=  SEQUENCE {
    ricActionID                 RICactionID,
    ...
}

RICactions-FailedToBeModifiedForModification-List ::= SEQUENCE (SIZE(0..maxofRICactionID)) OF
ProtocolIE-SingleContainer {{RICaction-FailedToBeModifiedForModification-ItemIEs} }

RICaction-FailedToBeModifiedForModification-ItemIEs     E2AP-PROTOCOL-IES ::= {
    { ID id-RICaction-FailedToBeModifiedForModification-Item    CRITICALITY ignore  TYPE RICaction-
FailedToBeModifiedForModification-Item  PRESENCE mandatory },
    ...
}

RICaction-FailedToBeModifiedForModification-Item ::=    SEQUENCE {
    ricActionID                 RICactionID,
    cause                       Cause,
    ...
}

RICactions-AddedForModification-List ::= SEQUENCE (SIZE(0..maxofRICactionID)) OF ProtocolIE-
SingleContainer {{RICaction-AddedForModification-ItemIEs} }

RICaction-AddedForModification-ItemIEs  E2AP-PROTOCOL-IES ::= {
    { ID id-RICaction-AddedForModification-Item CRITICALITY ignore  TYPE RICaction-
AddedForModification-Item   PRESENCE mandatory },
    ...
}

RICaction-AddedForModification-Item ::= SEQUENCE {
    ricActionID                 RICactionID,
    ...
}

RICactions-FailedToBeAddedForModification-List ::= SEQUENCE (SIZE(0..maxofRICactionID)) OF
ProtocolIE-SingleContainer {{RICaction-FailedToBeAddedForModification-ItemIEs} }

RICaction-FailedToBeAddedForModification-ItemIEs    E2AP-PROTOCOL-IES ::= {
    { ID id-RICaction-FailedToBeAddedForModification-Item   CRITICALITY ignore  TYPE RICaction-
FailedToBeAddedForModification-Item     PRESENCE mandatory },
    ...
}
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
RICaction-FailedToBeAddedForModification-Item ::=   SEQUENCE {
    ricActionID                 RICactionID,
    cause                       Cause,
    ...
}

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

RICsubscriptionModificationFailure-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-RICrequestID                CRITICALITY reject  TYPE RICrequestID
    PRESENCE mandatory}|
    { ID id-RANfunctionID               CRITICALITY reject  TYPE RANfunctionID
    PRESENCE mandatory}|
    { ID id-Cause                       CRITICALITY reject  TYPE Cause      PRESENCE mandatory}|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics
    PRESENCE optional},
    ...
}

-- **************************************************************
--
-- RIC Subscription Modification Required Elementary Procedure
--
-- **************************************************************
-- **************************************************************
--
-- RIC SUBSCRIPTION MODIFICATION REQUIRED
--
-- **************************************************************
RICsubscriptionModificationRequired ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container    {{RICsubscriptionModificationRequired-IEs}},
    ...
}

RICsubscriptionModificationRequired-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-RICrequestID                        CRITICALITY reject  TYPE RICrequestID
    PRESENCE mandatory}|
    { ID id-RANfunctionID                       CRITICALITY reject  TYPE RANfunctionID
    PRESENCE mandatory}|
    { ID id-RICactionsRequiredToBeModified-List CRITICALITY ignore  TYPE RICactions-
RequiredToBeModified-List   PRESENCE optional}|
    { ID id-RICactionsRequiredToBeRemoved-List  CRITICALITY ignore  TYPE RICactions-
RequiredToBeRemoved-List    PRESENCE optional},
    ...
}

RICactions-RequiredToBeModified-List ::= SEQUENCE (SIZE(0..maxofRICactionID)) OF ProtocolIE-
SingleContainer {{RICaction-RequiredToBeModified-ItemIEs} }

RICaction-RequiredToBeModified-ItemIEs  E2AP-PROTOCOL-IES ::= {
    { ID id-RICaction-RequiredToBeModified-Item CRITICALITY ignore  TYPE RICaction-
RequiredToBeModified-Item   PRESENCE mandatory },
    ...
}

RICaction-RequiredToBeModified-Item ::= SEQUENCE {
    ricActionID             RICactionID,
    ricTimeToWait           RICtimeToWait,
    ...
}

RICactions-RequiredToBeRemoved-List ::= SEQUENCE (SIZE(0..maxofRICactionID)) OF ProtocolIE-
SingleContainer {{RICaction-RequiredToBeRemoved-ItemIEs} }

RICaction-RequiredToBeRemoved-ItemIEs   E2AP-PROTOCOL-IES ::= {
    { ID id-RICaction-RequiredToBeRemoved-Item  CRITICALITY ignore  TYPE RICaction-
RequiredToBeRemoved-Item    PRESENCE mandatory },
    ...
}
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
RICaction-RequiredToBeRemoved-Item ::=  SEQUENCE {
    ricActionID             RICactionID,
    cause                   Cause,
    ...
}

-- **************************************************************
--
-- RIC SUBSCRIPTION MODIFICATION CONFIRM
--
-- **************************************************************
RICsubscriptionModificationConfirm ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container    {{RICsubscriptionModificationConfirm-IEs}},
    ...
}

RICsubscriptionModificationConfirm-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-RICrequestID                            CRITICALITY reject  TYPE RICrequestID
        PRESENCE mandatory}|
    { ID id-RANfunctionID                           CRITICALITY reject  TYPE RANfunctionID
        PRESENCE mandatory}|
    { ID id-RICactionsConfirmedForModification-List CRITICALITY ignore  TYPE RICactions-
ConfirmedForModification-List   PRESENCE optional}|
    { ID id-RICactionsRefusedToBeModified-List      CRITICALITY ignore  TYPE RICactions-
RefusedToBeModified-List    PRESENCE optional}|
    { ID id-RICactionsConfirmedForRemoval-List      CRITICALITY ignore  TYPE RICactions-
ConfirmedForRemoval-List    PRESENCE optional}|
    { ID id-RICactionsRefusedToBeRemoved-List       CRITICALITY ignore  TYPE RICactions-
RefusedToBeRemoved-List     PRESENCE optional},
    ...
}

RICactions-ConfirmedForModification-List ::= SEQUENCE (SIZE(0..maxofRICactionID)) OF ProtocolIE-
SingleContainer {{RICaction-ConfirmedForModification-ItemIEs} }

RICaction-ConfirmedForModification-ItemIEs  E2AP-PROTOCOL-IES ::= {
    { ID id-RICaction-ConfirmedForModification-Item         CRITICALITY ignore  TYPE RICaction-
ConfirmedForModification-Item   PRESENCE mandatory },
    ...
}

RICaction-ConfirmedForModification-Item ::= SEQUENCE {
    ricActionID                 RICactionID,
    ...
}
RICactions-RefusedToBeModified-List ::= SEQUENCE (SIZE(0..maxofRICactionID)) OF ProtocolIE-
SingleContainer {{RICaction-RefusedToBeModified-ItemIEs} }

RICaction-RefusedToBeModified-ItemIEs   E2AP-PROTOCOL-IES ::= {
    { ID id-RICaction-RefusedToBeModified-Item          CRITICALITY ignore  TYPE RICaction-
RefusedToBeModified-Item    PRESENCE mandatory },
    ...
}

RICaction-RefusedToBeModified-Item ::=  SEQUENCE {
    ricActionID                 RICactionID,
    cause                       Cause,
    ...
}

RICactions-ConfirmedForRemoval-List ::= SEQUENCE (SIZE(0..maxofRICactionID)) OF ProtocolIE-
SingleContainer {{RICaction-ConfirmedForRemoval-ItemIEs} }

RICaction-ConfirmedForRemoval-ItemIEs   E2AP-PROTOCOL-IES ::= {
    { ID id-RICaction-ConfirmedForRemoval-Item          CRITICALITY ignore  TYPE RICaction-
ConfirmedForRemoval-Item    PRESENCE mandatory },
    ...
}

RICaction-ConfirmedForRemoval-Item ::=  SEQUENCE {
    ricActionID                 RICactionID,
    ...
}

RICactions-RefusedToBeRemoved-List ::= SEQUENCE (SIZE(0..maxofRICactionID)) OF ProtocolIE-
SingleContainer {{RICaction-RefusedToBeRemoved-ItemIEs} }

RICaction-RefusedToBeRemoved-ItemIEs    E2AP-PROTOCOL-IES ::= {
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
    { ID id-RICaction-RefusedToBeRemoved-Item           CRITICALITY ignore  TYPE RICaction-
RefusedToBeRemoved-Item     PRESENCE mandatory },
    ...
}

RICaction-RefusedToBeRemoved-Item ::=   SEQUENCE {
    ricActionID                 RICactionID,
    cause                       Cause,
    ...
}

-- **************************************************************
--
-- RIC SUBSCRIPTION MODIFICATION REFUSE
--
-- **************************************************************
RICsubscriptionModificationRefuse ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container    {{RICsubscriptionModificationRefuse-IEs}},
    ...
}


RICsubscriptionModificationRefuse-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-RICrequestID                CRITICALITY reject  TYPE RICrequestID
    PRESENCE mandatory}|
    { ID id-RANfunctionID               CRITICALITY reject  TYPE RANfunctionID
    PRESENCE mandatory}|
    { ID id-Cause                       CRITICALITY reject  TYPE Cause      PRESENCE mandatory}|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics
    PRESENCE optional},
    ...
}


-- **************************************************************
--
-- RIC Indication Elementary Procedure
--
-- **************************************************************
-- **************************************************************
--
-- RIC INDICATION
--
-- **************************************************************
RICindication ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container    {{RICindication-IEs}},
    ...
}

RICindication-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-RICrequestID                CRITICALITY reject  TYPE RICrequestID
    PRESENCE mandatory  }|
    { ID id-RANfunctionID               CRITICALITY reject  TYPE RANfunctionID
    PRESENCE mandatory  }|
    { ID id-RICactionID                 CRITICALITY reject  TYPE RICactionID
    PRESENCE mandatory  }|
    { ID id-RICindicationSN             CRITICALITY reject  TYPE RICindicationSN
    PRESENCE optional   }|
    { ID id-RICindicationType           CRITICALITY reject  TYPE RICindicationType
    PRESENCE mandatory  }|
    { ID id-RICindicationHeader         CRITICALITY reject  TYPE RICindicationHeader
    PRESENCE mandatory  }|
    { ID id-RICindicationMessage        CRITICALITY reject  TYPE RICindicationMessage
    PRESENCE mandatory  }|
    { ID id-RICcallProcessID            CRITICALITY reject  TYPE RICcallProcessID
    PRESENCE optional   },
    ...
}

-- **************************************************************
--
-- RIC Control Elementary Procedure
--
-- **************************************************************
-- **************************************************************
--
-- RIC CONTROL REQUEST
--
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

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

RICcontrolRequest-IEs E2AP-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 E2AP-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-RICcontrolOutcome           CRITICALITY reject  TYPE RICcontrolOutcome
    PRESENCE optional   },
    ...
}
-- **************************************************************
--
-- RIC CONTROL FAILURE
--
-- **************************************************************
RICcontrolFailure ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container    {{RICcontrolFailure-IEs}},
    ...
}

RICcontrolFailure-IEs E2AP-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-Cause                       CRITICALITY ignore  TYPE Cause
    PRESENCE mandatory  }|
    { ID id-RICcontrolOutcome           CRITICALITY reject  TYPE RICcontrolOutcome
    PRESENCE optional   },
    ...,
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics
    PRESENCE optional   }
}

-- **************************************************************
--
-- RIC QUERY Elementary Procedure
--
-- **************************************************************
-- **************************************************************
--
-- RIC QUERY REQUEST
--
-- **************************************************************
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

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

RICQueryRequest-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-RICrequestID                CRITICALITY reject  TYPE RICrequestID
    PRESENCE mandatory  }|
    { ID id-RANfunctionID               CRITICALITY reject  TYPE RANfunctionID
    PRESENCE mandatory  }|
    { ID id-RICqueryHeader              CRITICALITY reject  TYPE RICqueryHeader
    PRESENCE mandatory  }|
    { ID id-RICqueryDefinition          CRITICALITY reject  TYPE RICqueryDefinition
    PRESENCE mandatory  },
    ...
}

-- **************************************************************
--
-- RIC QUERY RESPONSE
--
-- **************************************************************
RICQueryResponse ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container    {{RICQueryResponse-IEs}},
    ...
}

RICQueryResponse-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-RICrequestID                CRITICALITY reject  TYPE RICrequestID
    PRESENCE mandatory  }|
    { ID id-RANfunctionID               CRITICALITY reject  TYPE RANfunctionID
    PRESENCE mandatory  }|
    { ID id-RICqueryOutcome             CRITICALITY reject  TYPE RICqueryOutcome
    PRESENCE mandatory  },
    ...
}
-- **************************************************************
--
-- RIC QUERY FAILURE
--
-- **************************************************************
RICQueryFailure ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container    {{RICQueryFailure-IEs}},
    ...
}

RICQueryFailure-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-RICrequestID                CRITICALITY reject  TYPE RICrequestID
    PRESENCE mandatory  }|
    { ID id-RANfunctionID               CRITICALITY reject  TYPE RANfunctionID
    PRESENCE mandatory  }|
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause
    PRESENCE mandatory  }|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics
    PRESENCE optional   },
    ...
}

-- **************************************************************
--
-- MESSAGES FOR GLOBAL PROCEDURES
--
-- **************************************************************

-- **************************************************************
--
-- Error Indication Elementary Procedure
--
-- **************************************************************
-- **************************************************************
--
-- ERROR INDICATION
--
-- **************************************************************
ErrorIndication ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container    {{ErrorIndication-IEs}},
    ...
}
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
ErrorIndication-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-TransactionID               CRITICALITY reject  TYPE TransactionID              PRESENCE
optional    }|
    { ID id-RICrequestID                CRITICALITY reject  TYPE RICrequestID               PRESENCE
optional    }|
    { ID id-RANfunctionID               CRITICALITY reject  TYPE RANfunctionID              PRESENCE
optional    }|
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                      PRESENCE
optional    }|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics     PRESENCE
optional    },
    ...
}

-- **************************************************************
--
-- E2 Setup Elementary Procedure
--
-- **************************************************************
-- **************************************************************
--
-- E2 SETUP REQUEST
--
-- **************************************************************

E2setupRequest ::= SEQUENCE {
    protocolIEs     ProtocolIE-Container        { {E2setupRequestIEs} },
    ...
}

E2setupRequestIEs E2AP-PROTOCOL-IES ::= {
    { ID id-TransactionID                   CRITICALITY reject  TYPE TransactionID
    PRESENCE mandatory  }|
    { ID id-GlobalE2node-ID                 CRITICALITY reject  TYPE GlobalE2node-ID
    PRESENCE mandatory  }|
    { ID id-RANfunctionsAdded               CRITICALITY reject  TYPE RANfunctions-List
    PRESENCE mandatory  }|
    { ID id-E2nodeComponentConfigAddition   CRITICALITY reject  TYPE E2nodeComponentConfigAddition-
List    PRESENCE mandatory  },
    ...
}

-- **************************************************************
--
-- E2 SETUP RESPONSE
--
-- **************************************************************

E2setupResponse ::= SEQUENCE {
    protocolIEs     ProtocolIE-Container        { {E2setupResponseIEs} },
    ...
}

E2setupResponseIEs E2AP-PROTOCOL-IES ::= {
    { ID id-TransactionID                       CRITICALITY reject  TYPE TransactionID
            PRESENCE mandatory  }|
    { ID id-GlobalRIC-ID                        CRITICALITY reject  TYPE GlobalRIC-ID
            PRESENCE mandatory  }|
    { ID id-RANfunctionsAccepted                CRITICALITY reject  TYPE RANfunctionsID-List
            PRESENCE optional   }|
    { ID id-RANfunctionsRejected                CRITICALITY reject  TYPE RANfunctionsIDcause-List
            PRESENCE optional   }|
    { ID id-E2nodeComponentConfigAdditionAck    CRITICALITY reject  TYPE
E2nodeComponentConfigAdditionAck-List   PRESENCE mandatory  },
    ...
}

-- **************************************************************
--
-- E2 SETUP FAILURE
--
-- **************************************************************

E2setupFailure ::= SEQUENCE {
    protocolIEs     ProtocolIE-Container        { {E2setupFailureIEs} },
    ...
}
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
E2setupFailureIEs E2AP-PROTOCOL-IES ::= {
    { ID id-TransactionID               CRITICALITY reject  TYPE TransactionID              PRESENCE
mandatory   }|
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                      PRESENCE
mandatory   }|
    { ID id-TimeToWait                  CRITICALITY ignore  TYPE TimeToWait                 PRESENCE
optional    }|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics     PRESENCE
optional    }|
    { ID id-TNLinformation              CRITICALITY ignore  TYPE TNLinformation             PRESENCE
optional    },
    ...
}

-- **************************************************************
--
-- E2 Connection Update Elementary Procedure
--
-- **************************************************************
-- **************************************************************
--
-- E2 CONNECTION UPDATE
--
-- **************************************************************
E2connectionUpdate ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container    {{E2connectionUpdate-IEs}},
    ...
}

E2connectionUpdate-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-TransactionID               CRITICALITY reject  TYPE TransactionID
    PRESENCE mandatory  }|
    { ID id-E2connectionUpdateAdd       CRITICALITY reject  TYPE E2connectionUpdate-List
    PRESENCE optional   }|
    { ID id-E2connectionUpdateRemove    CRITICALITY reject  TYPE E2connectionUpdateRemove-List
    PRESENCE optional   }|
    { ID id-E2connectionUpdateModify    CRITICALITY reject  TYPE E2connectionUpdate-List
    PRESENCE optional   },
    ...
}

E2connectionUpdate-List ::= SEQUENCE (SIZE(1..maxofTNLA)) OF ProtocolIE-SingleContainer
{ {E2connectionUpdate-ItemIEs} }

E2connectionUpdate-ItemIEs  E2AP-PROTOCOL-IES ::= {
    { ID id-E2connectionUpdate-Item         CRITICALITY ignore  TYPE E2connectionUpdate-Item
    PRESENCE mandatory  },
    ...
}

E2connectionUpdate-Item ::= SEQUENCE {
    tnlInformation                  TNLinformation,
    tnlUsage                        TNLusage,
    ...
}

E2connectionUpdateRemove-List ::= SEQUENCE (SIZE(1..maxofTNLA)) OF ProtocolIE-SingleContainer
{ {E2connectionUpdateRemove-ItemIEs} }

E2connectionUpdateRemove-ItemIEs    E2AP-PROTOCOL-IES ::= {
    { ID id-E2connectionUpdateRemove-Item   CRITICALITY ignore  TYPE E2connectionUpdateRemove-Item
    PRESENCE mandatory  },
    ...
}

E2connectionUpdateRemove-Item ::= SEQUENCE {
    tnlInformation                  TNLinformation,
    ...
}



-- **************************************************************
--
-- E2 CONNECTION UPDATE ACKNOWLEDGE
--
-- **************************************************************
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
E2connectionUpdateAcknowledge ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container    {{E2connectionUpdateAck-IEs}},
    ...
}

E2connectionUpdateAck-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-TransactionID               CRITICALITY reject  TYPE TransactionID
    PRESENCE mandatory  }|
    { ID id-E2connectionSetup           CRITICALITY reject  TYPE E2connectionUpdate-List
    PRESENCE optional   }|
    { ID id-E2connectionSetupFailed     CRITICALITY reject  TYPE E2connectionSetupFailed-List
    PRESENCE optional   },
    ...
}

E2connectionSetupFailed-List ::= SEQUENCE (SIZE(1..maxofTNLA)) OF ProtocolIE-SingleContainer
{ {E2connectionSetupFailed-ItemIEs} }

E2connectionSetupFailed-ItemIEs     E2AP-PROTOCOL-IES ::= {
    { ID id-E2connectionSetupFailed-Item            CRITICALITY ignore  TYPE
E2connectionSetupFailed-Item        PRESENCE mandatory  },
    ...
}

E2connectionSetupFailed-Item ::= SEQUENCE {
    tnlInformation                  TNLinformation,
    cause                           Cause,
    ...
}

-- **************************************************************
--
-- E2 CONNECTION UPDATE FAILURE
--
-- **************************************************************
E2connectionUpdateFailure ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container    {{E2connectionUpdateFailure-IEs}},
    ...
}

E2connectionUpdateFailure-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-TransactionID                       CRITICALITY reject  TYPE TransactionID
            PRESENCE mandatory  }|
    { ID id-Cause                               CRITICALITY reject  TYPE Cause
            PRESENCE optional   }|
    { ID id-TimeToWait                          CRITICALITY ignore  TYPE TimeToWait
            PRESENCE optional   }|
    { ID id-CriticalityDiagnostics              CRITICALITY ignore  TYPE CriticalityDiagnostics
            PRESENCE optional   },
    ...
}

-- **************************************************************
--
-- E2 Node Configuration Update Elementary Procedure
--
-- **************************************************************
-- **************************************************************
--
-- E2 NODE CONFIGURATION UPDATE
--
-- **************************************************************
E2nodeConfigurationUpdate ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container    {{E2nodeConfigurationUpdate-IEs}},
    ...
}

E2nodeConfigurationUpdate-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-TransactionID                   CRITICALITY reject  TYPE TransactionID
            PRESENCE mandatory  }|
    { ID id-GlobalE2node-ID                 CRITICALITY reject  TYPE GlobalE2node-ID
            PRESENCE optional   }|
    { ID id-E2nodeComponentConfigAddition   CRITICALITY reject  TYPE E2nodeComponentConfigAddition-
List            PRESENCE optional   }|
    { ID id-E2nodeComponentConfigUpdate     CRITICALITY reject  TYPE E2nodeComponentConfigUpdate-
List            PRESENCE optional   }|
    { ID id-E2nodeComponentConfigRemoval    CRITICALITY reject  TYPE E2nodeComponentConfigRemoval-
List            PRESENCE optional   }|
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
    { ID id-E2nodeTNLassociationRemoval     CRITICALITY reject  TYPE E2nodeTNLassociationRemoval-
List            PRESENCE optional   },
    ...
}

E2nodeComponentConfigAddition-List ::= SEQUENCE (SIZE(1..maxofE2nodeComponents)) OF ProtocolIE-
SingleContainer { {E2nodeComponentConfigAddition-ItemIEs} }

E2nodeComponentConfigAddition-ItemIEs   E2AP-PROTOCOL-IES ::= {
    { ID id-E2nodeComponentConfigAddition-Item  CRITICALITY reject  TYPE
E2nodeComponentConfigAddition-Item      PRESENCE mandatory  },
    ...
}

E2nodeComponentConfigAddition-Item ::= SEQUENCE {
    e2nodeComponentInterfaceType        E2nodeComponentInterfaceType,
    e2nodeComponentID                   E2nodeComponentID,
    e2nodeComponentConfiguration        E2nodeComponentConfiguration,
    ...
}

E2nodeComponentConfigUpdate-List ::= SEQUENCE (SIZE(1..maxofE2nodeComponents)) OF ProtocolIE-
SingleContainer { {E2nodeComponentConfigUpdate-ItemIEs} }

E2nodeComponentConfigUpdate-ItemIEs     E2AP-PROTOCOL-IES ::= {
    { ID id-E2nodeComponentConfigUpdate-Item    CRITICALITY reject  TYPE
E2nodeComponentConfigUpdate-Item        PRESENCE mandatory  },
    ...
}

E2nodeComponentConfigUpdate-Item ::= SEQUENCE {
    e2nodeComponentInterfaceType        E2nodeComponentInterfaceType,
    e2nodeComponentID                   E2nodeComponentID,
    e2nodeComponentConfiguration        E2nodeComponentConfiguration,
    ...
}

E2nodeComponentConfigRemoval-List ::= SEQUENCE (SIZE(1..maxofE2nodeComponents)) OF ProtocolIE-
SingleContainer { {E2nodeComponentConfigRemoval-ItemIEs} }

E2nodeComponentConfigRemoval-ItemIEs    E2AP-PROTOCOL-IES ::= {
    { ID id-E2nodeComponentConfigRemoval-Item   CRITICALITY reject  TYPE
E2nodeComponentConfigRemoval-Item       PRESENCE mandatory  },
    ...
}

E2nodeComponentConfigRemoval-Item ::= SEQUENCE {
    e2nodeComponentInterfaceType        E2nodeComponentInterfaceType,
    e2nodeComponentID                   E2nodeComponentID,
    ...
}

E2nodeTNLassociationRemoval-List ::= SEQUENCE (SIZE(1..maxofTNLA)) OF ProtocolIE-SingleContainer
{ {E2nodeTNLassociationRemoval-ItemIEs} }

E2nodeTNLassociationRemoval-ItemIEs     E2AP-PROTOCOL-IES ::= {
    { ID id-E2nodeTNLassociationRemoval-Item    CRITICALITY reject  TYPE
E2nodeTNLassociationRemoval-Item        PRESENCE mandatory  },
    ...
}

E2nodeTNLassociationRemoval-Item ::= SEQUENCE {
    tnlInformation                      TNLinformation,
    tnlInformationRIC                   TNLinformation,
    ...
}

-- **************************************************************
--
-- E2 NODE CONFIGURATION UPDATE ACKNOWLEDGE
--
-- **************************************************************
E2nodeConfigurationUpdateAcknowledge ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container    {{E2nodeConfigurationUpdateAcknowledge-
IEs}},
    ...
}
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
E2nodeConfigurationUpdateAcknowledge-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-TransactionID                           CRITICALITY reject  TYPE TransactionID
                PRESENCE mandatory  }|
    { ID id-E2nodeComponentConfigAdditionAck        CRITICALITY reject  TYPE
E2nodeComponentConfigAdditionAck-List       PRESENCE optional   }|
    { ID id-E2nodeComponentConfigUpdateAck          CRITICALITY reject  TYPE
E2nodeComponentConfigUpdateAck-List     PRESENCE optional   }|
    { ID id-E2nodeComponentConfigRemovalAck         CRITICALITY reject  TYPE
E2nodeComponentConfigRemovalAck-List        PRESENCE optional   },
    ...
}

E2nodeComponentConfigAdditionAck-List ::= SEQUENCE (SIZE(1..maxofE2nodeComponents)) OF ProtocolIE-
SingleContainer { {E2nodeComponentConfigAdditionAck-ItemIEs} }

E2nodeComponentConfigAdditionAck-ItemIEs    E2AP-PROTOCOL-IES ::= {
    { ID id-E2nodeComponentConfigAdditionAck-Item           CRITICALITY reject  TYPE
E2nodeComponentConfigAdditionAck-Item   PRESENCE mandatory  },
    ...
}

E2nodeComponentConfigAdditionAck-Item ::= SEQUENCE {
    e2nodeComponentInterfaceType        E2nodeComponentInterfaceType,
    e2nodeComponentID                   E2nodeComponentID,
    e2nodeComponentConfigurationAck     E2nodeComponentConfigurationAck,
    ...
}

E2nodeComponentConfigUpdateAck-List ::= SEQUENCE (SIZE(1..maxofE2nodeComponents)) OF ProtocolIE-
SingleContainer { {E2nodeComponentConfigUpdateAck-ItemIEs} }

E2nodeComponentConfigUpdateAck-ItemIEs  E2AP-PROTOCOL-IES ::= {
    { ID id-E2nodeComponentConfigUpdateAck-Item         CRITICALITY reject  TYPE
E2nodeComponentConfigUpdateAck-Item     PRESENCE mandatory  },
    ...
}

E2nodeComponentConfigUpdateAck-Item ::= SEQUENCE {
    e2nodeComponentInterfaceType        E2nodeComponentInterfaceType,
    e2nodeComponentID                   E2nodeComponentID,
    e2nodeComponentConfigurationAck     E2nodeComponentConfigurationAck,
    ...
}

E2nodeComponentConfigRemovalAck-List ::= SEQUENCE (SIZE(1..maxofE2nodeComponents)) OF ProtocolIE-
SingleContainer { {E2nodeComponentConfigRemovalAck-ItemIEs} }

E2nodeComponentConfigRemovalAck-ItemIEs     E2AP-PROTOCOL-IES ::= {
    { ID id-E2nodeComponentConfigRemovalAck-Item            CRITICALITY reject  TYPE
E2nodeComponentConfigRemovalAck-Item    PRESENCE mandatory  },
    ...
}

E2nodeComponentConfigRemovalAck-Item ::= SEQUENCE {
    e2nodeComponentInterfaceType        E2nodeComponentInterfaceType,
    e2nodeComponentID                   E2nodeComponentID,
    e2nodeComponentConfigurationAck     E2nodeComponentConfigurationAck,
    ...
}

-- **************************************************************
--
-- E2 NODE CONFIGURATION UPDATE FAILURE
--
-- **************************************************************
E2nodeConfigurationUpdateFailure ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container    {{E2nodeConfigurationUpdateFailure-IEs}},
    ...
}

E2nodeConfigurationUpdateFailure-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-TransactionID                       CRITICALITY reject  TYPE TransactionID
                PRESENCE mandatory  }|
    { ID id-Cause                               CRITICALITY ignore  TYPE Cause
                PRESENCE mandatory  }|
    { ID id-TimeToWait                          CRITICALITY ignore  TYPE TimeToWait
                PRESENCE optional   }|
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

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

-- **************************************************************
--
-- Reset Elementary Procedure
--
-- **************************************************************

-- **************************************************************
--
-- RESET REQUEST
--
-- **************************************************************

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

ResetRequestIEs E2AP-PROTOCOL-IES ::= {
    { ID id-TransactionID              CRITICALITY reject  TYPE TransactionID              PRESENCE
mandatory   }|
    { ID id-Cause                      CRITICALITY ignore  TYPE Cause                      PRESENCE
mandatory   },
    ...
}

-- **************************************************************
--
-- RESET RESPONSE
--
-- **************************************************************

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

ResetResponseIEs E2AP-PROTOCOL-IES ::= {
    { ID id-TransactionID              CRITICALITY reject  TYPE TransactionID              PRESENCE
mandatory   }|
    { ID id-CriticalityDiagnostics     CRITICALITY ignore  TYPE CriticalityDiagnostics     PRESENCE
optional    },
    ...
}

-- **************************************************************
--
-- RIC Service Update Elementary Procedure
--
-- **************************************************************
-- **************************************************************
--
-- RIC SERVICE UPDATE
--
-- **************************************************************
RICserviceUpdate ::= SEQUENCE {
    protocolIEs                ProtocolIE-Container    {{RICserviceUpdate-IEs}},
    ...
}

RICserviceUpdate-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-TransactionID              CRITICALITY reject  TYPE TransactionID
    PRESENCE mandatory  }|
    { 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(1..maxofRANfunctionID)) OF ProtocolIE-SingleContainer
{ {RANfunction-ItemIEs} }
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
RANfunction-ItemIEs     E2AP-PROTOCOL-IES ::= {
    { ID id-RANfunction-Item            CRITICALITY ignore  TYPE RANfunction-Item
    PRESENCE mandatory  },
    ...
}


RANfunction-Item ::= SEQUENCE {
    ranFunctionID               RANfunctionID,
    ranFunctionDefinition       RANfunctionDefinition,
    ranFunctionRevision         RANfunctionRevision,
    ranFunctionOID              RANfunctionOID,
    ...
}

RANfunctionsID-List ::= SEQUENCE (SIZE(1..maxofRANfunctionID)) OF ProtocolIE-
SingleContainer{{RANfunctionID-ItemIEs}}

RANfunctionID-ItemIEs E2AP-PROTOCOL-IES ::= {
    { ID id-RANfunctionID-Item          CRITICALITY ignore      TYPE RANfunctionID-Item
    PRESENCE mandatory  },
    ...
}

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

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

RICserviceUpdateAcknowledge-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-TransactionID               CRITICALITY reject  TYPE TransactionID
    PRESENCE mandatory  }|
    { ID id-RANfunctionsAccepted        CRITICALITY reject  TYPE RANfunctionsID-List
    PRESENCE optional   }|
    { ID id-RANfunctionsRejected        CRITICALITY reject  TYPE RANfunctionsIDcause-List
    PRESENCE optional   },
    ...
}

RANfunctionsIDcause-List ::= SEQUENCE (SIZE(1..maxofRANfunctionID)) OF ProtocolIE-SingleContainer
{ {RANfunctionIDcause-ItemIEs} }

RANfunctionIDcause-ItemIEs  E2AP-PROTOCOL-IES ::= {
    { ID id-RANfunctionIEcause-Item     CRITICALITY ignore  TYPE RANfunctionIDcause-Item
    PRESENCE mandatory  },
    ...
}


RANfunctionIDcause-Item ::= SEQUENCE {
    ranFunctionID               RANfunctionID,
    cause                       Cause,
    ...
}


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

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
RICserviceUpdateFailure-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-TransactionID               CRITICALITY reject  TYPE TransactionID
    PRESENCE mandatory  }|
    { ID id-Cause                       CRITICALITY reject  TYPE Cause
    PRESENCE mandatory  }|
    { ID id-TimeToWait                  CRITICALITY ignore  TYPE TimeToWait
    PRESENCE optional   }|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics
    PRESENCE optional   },
    ...
}

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

RICserviceQuery-IEs E2AP-PROTOCOL-IES ::= {
    { ID id-TransactionID               CRITICALITY reject  TYPE TransactionID
    PRESENCE mandatory  }|
    { ID id-RANfunctionsAccepted        CRITICALITY reject  TYPE RANfunctionsID-List
    PRESENCE optional   },
    ...
}

-- **************************************************************
--
-- E2 Removal Elementary Procedure
--
-- **************************************************************
-- **************************************************************
--
-- E2 REMOVAL REQUEST
--
-- **************************************************************

E2RemovalRequest ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container    { {E2RemovalRequestIEs} },
    ...
}

E2RemovalRequestIEs E2AP-PROTOCOL-IES ::= {
    { ID id-TransactionID               CRITICALITY reject  TYPE TransactionID
    PRESENCE mandatory  },
    ...
}

-- **************************************************************
--
-- E2 REMOVAL RESPONSE
--
-- **************************************************************

E2RemovalResponse ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container    { {E2RemovalResponseIEs} },
    ...
}

E2RemovalResponseIEs E2AP-PROTOCOL-IES ::= {
    { ID id-TransactionID               CRITICALITY reject  TYPE TransactionID
    PRESENCE mandatory  }|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics     PRESENCE
optional    },
    ...
}

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

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
-- E2 REMOVAL FAILURE
--
-- **************************************************************

E2RemovalFailure ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container    { {E2RemovalFailureIEs} },
    ...
}

E2RemovalFailureIEs E2AP-PROTOCOL-IES ::= {
    { ID id-TransactionID               CRITICALITY reject  TYPE TransactionID              PRESENCE
mandatory   }|
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                      PRESENCE
mandatory   }|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics     PRESENCE
optional    },
    ...
}

END
-- ASN1STOP
```

9.3.5 Information Element Definitions

```
-- ASN1START
-- **************************************************************
-- E2AP
-- Information Element Definitions
--
-- **************************************************************

E2AP-IEs {
iso(1) identified-organization(3) dod(6) internet(1) private(4) enterprise(1) 53148 e2(1) version2
(2) e2ap(1) e2ap-IEs (2)}

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    Criticality,
    Presence,
    ProcedureCode,
    ProtocolIE-ID,
    TriggeringMessage
FROM E2AP-CommonDataTypes

    maxnoofErrors,
    maxProtocolIEs
FROM E2AP-Constants;

-- A

-- **************************************************************
-- [New for E2AP v02.00] copied from 3GPP 38.413 (NGAP) IEs
-- **************************************************************
AMFName ::= PrintableString (SIZE(1..150, ...))

-- B
-- C
Cause ::= CHOICE {
    ricRequest          CauseRICrequest,
    ricService          CauseRICservice,
    e2Node              CauseE2node,
    transport           CauseTransport,
    protocol            CauseProtocol,
    misc                CauseMisc,
    ...
}

CauseE2node ::= ENUMERATED {
    e2node-component-unknown,
    ...
}

CauseMisc ::= ENUMERATED {
    control-processing-overload,
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
    hardware-failure,
    om-intervention,
    unspecified,
    ...
}

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

CauseRICrequest ::= ENUMERATED {
    ran-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,
    ric-call-process-id-invalid,
    control-timer-expired,
    control-failed-to-execute,
    system-not-ready,
    unspecified,
    ... ,
    ric-subscription-end-time-expired,
    ric-subscription-end-time-invalid,
    duplicate-ric-request-id,
    eventTriggerNotSupported,
    requested-information-unavailable,
    invalid-information-request
}

CauseRICservice ::= ENUMERATED{
    ran-function-not-supported,
    excessive-functions,
    ric-resource-limit,
    ...
}
CauseTransport ::= ENUMERATED {
    unspecified,
    transport-resource-unavailable,
    ...
}

-- **************************************************************
-- copied from 3GPP 38.413 (NGAP) IEs
-- note: ie-Extensions removed
-- **************************************************************
CriticalityDiagnostics ::= SEQUENCE {
    procedureCode                   ProcedureCode                           OPTIONAL,
    triggeringMessage               TriggeringMessage                       OPTIONAL,
    procedureCriticality            Criticality                             OPTIONAL,
    ricRequestorID                  RICrequestID                            OPTIONAL,
    iEsCriticalityDiagnostics       CriticalityDiagnostics-IE-List          OPTIONAL,
    ...
}

CriticalityDiagnostics-IE-List ::= SEQUENCE (SIZE(1..maxnoofErrors)) OF CriticalityDiagnostics-IE-
Item

CriticalityDiagnostics-IE-Item ::= SEQUENCE {
    iECriticality       Criticality,
    iE-ID               ProtocolIE-ID,
    typeOfError         TypeOfError,
    ...
}

-- D
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
-- E

-- Following IE used to carry 3GPP defined SETUP and RAN Configuration messages defined in F1AP,
E1AP, XnAP, etc.
E2nodeComponentConfiguration ::= SEQUENCE{
    e2nodeComponentRequestPart      OCTET STRING,
    e2nodeComponentResponsePart     OCTET STRING,
    ...
}

E2nodeComponentConfigurationAck ::= SEQUENCE{
    updateOutcome       ENUMERATED {success, failure, ...},
    failureCause        Cause           OPTIONAL,
    ...
}

E2nodeComponentInterfaceType ::= ENUMERATED {ng, xn, e1, f1, w1, s1, x2,...}

E2nodeComponentID ::= CHOICE{
    e2nodeComponentInterfaceTypeNG  E2nodeComponentInterfaceNG,
    e2nodeComponentInterfaceTypeXn  E2nodeComponentInterfaceXn,
    e2nodeComponentInterfaceTypeE1  E2nodeComponentInterfaceE1,
    e2nodeComponentInterfaceTypeF1  E2nodeComponentInterfaceF1,
    e2nodeComponentInterfaceTypeW1  E2nodeComponentInterfaceW1,
    e2nodeComponentInterfaceTypeS1  E2nodeComponentInterfaceS1,
    e2nodeComponentInterfaceTypeX2  E2nodeComponentInterfaceX2,
    ...
}

E2nodeComponentInterfaceE1 ::= SEQUENCE{
    gNB-CU-UP-ID        GNB-CU-UP-ID,
    ...
}

E2nodeComponentInterfaceF1 ::= SEQUENCE{
    gNB-DU-ID           GNB-DU-ID,
    ...
}

E2nodeComponentInterfaceNG ::= SEQUENCE{
    amf-name            AMFName,
    ...
}

E2nodeComponentInterfaceS1 ::= SEQUENCE{
    mme-name            MMEname,
    ...
}

E2nodeComponentInterfaceX2 ::= SEQUENCE{
    global-eNB-ID       GlobalENB-ID    OPTIONAL,
    global-en-gNB-ID    GlobalenGNB-ID  OPTIONAL,
    ...
}

E2nodeComponentInterfaceXn ::= SEQUENCE{
    global-NG-RAN-Node-ID       GlobalNG-RANNode-ID,
    ...
}

E2nodeComponentInterfaceW1 ::= SEQUENCE{
    ng-eNB-DU-ID        NGENB-DU-ID,
    ...
}

-- ************************************************************
-- copied from 3GPP 36.423 (X2AP) IEs
-- note: ie-Extensions removed
-- ************************************************************
ENB-ID ::= CHOICE {
    macro-eNB-ID            BIT STRING (SIZE (20)),
    home-eNB-ID             BIT STRING (SIZE (28)),
    ... ,
    short-Macro-eNB-ID      BIT STRING (SIZE(18)),
    long-Macro-eNB-ID       BIT STRING (SIZE(21))
}
-- ************************************************************
-- copied from 3GPP 38.423 (XnAP) IEs
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
-- note: choice-extension removed
-- **************************************************************
ENB-ID-Choice ::= CHOICE {
    enb-ID-macro            BIT STRING (SIZE(20)),
    enb-ID-shortmacro       BIT STRING (SIZE(18)),
    enb-ID-longmacro        BIT STRING (SIZE(21)),
    ...
}

-- **************************************************************
-- copied from 3GPP 36.423 (X2AP) IEs
-- note: ie-Extensions removed
-- Note: to avoid duplicate names with XnAP, GNB-ID renamed ENGNB-ID, GlobalGNB-ID renamed
GlobalenGNB-ID
-- **************************************************************
ENGNB-ID ::= CHOICE {
    gNB-ID  BIT STRING (SIZE (22..32)),
    ...
}

-- F
-- G
GlobalE2node-ID ::= CHOICE{
    gNB                 GlobalE2node-gNB-ID,
    en-gNB              GlobalE2node-en-gNB-ID,
    ng-eNB              GlobalE2node-ng-eNB-ID,
    eNB                 GlobalE2node-eNB-ID,
    ...
}

GlobalE2node-en-gNB-ID ::= SEQUENCE{
    global-en-gNB-ID    GlobalenGNB-ID,
    en-gNB-CU-UP-ID     GNB-CU-UP-ID    OPTIONAL,
    en-gNB-DU-ID        GNB-DU-ID       OPTIONAL,
    ...
}
GlobalE2node-eNB-ID ::= SEQUENCE{
    global-eNB-ID       GlobalENB-ID,
    ...
}
GlobalE2node-gNB-ID ::= SEQUENCE{
    global-gNB-ID       GlobalgNB-ID,
    global-en-gNB-ID    GlobalenGNB-ID  OPTIONAL,
    gNB-CU-UP-ID        GNB-CU-UP-ID    OPTIONAL,
    gNB-DU-ID           GNB-DU-ID       OPTIONAL,
    ...
}
GlobalE2node-ng-eNB-ID ::= SEQUENCE{
    global-ng-eNB-ID    GlobalngeNB-ID,
    global-eNB-ID       GlobalENB-ID    OPTIONAL,
    ngENB-DU-ID         NGENB-DU-ID     OPTIONAL,
    ...
}
-- **************************************************************
-- copied from 3GPP 36.423 (X2AP) IEs
-- note: ie-Extensions removed
-- **************************************************************

GlobalENB-ID ::= SEQUENCE {
    pLMN-Identity       PLMN-Identity,
    eNB-ID              ENB-ID,
    ...
}
-- **************************************************************
-- copied from 3GPP 36.423 (X2AP) IEs
-- Note: to avoid duplicate names with XnAP, GNB-ID renamed ENGNB-ID, GlobalGNB-ID renamed
GlobalenGNB-ID
-- **************************************************************
GlobalenGNB-ID ::= SEQUENCE {
    pLMN-Identity       PLMN-Identity,
    gNB-ID              ENGNB-ID,
    ...
}
-- **************************************************************
-- copied from 3GPP 38.423 (XnAP) IEs
-- note: choice-extension removed
-- **************************************************************
GlobalgNB-ID    ::= SEQUENCE {
```

```
    plmn-id             PLMN-Identity,
    gnb-id              GNB-ID-Choice,
    ...
}


-- ************************************************************
-- copied from 3GPP 38.423 (XnAP) IEs
-- note: choice-extension removed
-- ************************************************************
GlobalngeNB-ID  ::= SEQUENCE {
    plmn-id         PLMN-Identity,
    enb-id          ENB-ID-Choice,
    ...
}

-- ************************************************************
-- [NEW for E2AP v02.00] copied from 3GPP 38.423 (XnAP) IEs
-- Note: extension field removed
-- ************************************************************

GlobalNG-RANNode-ID ::= CHOICE {
    gNB                     GlobalgNB-ID,
    ng-eNB                  GlobalngeNB-ID,
    ...
}

GlobalRIC-ID ::= SEQUENCE{
    pLMN-Identity           PLMN-Identity,
    ric-ID                  BIT STRING (SIZE (20)),
    ...
}

-- ************************************************************
-- copied from 3GPP 37.483 (E1AP) IEs
-- ************************************************************
GNB-CU-UP-ID::=     INTEGER (0..68719476735)

-- ************************************************************
-- copied from 3GPP 38.473 (F1AP) IEs
-- ************************************************************
GNB-DU-ID::=        INTEGER (0..68719476735)

-- ************************************************************
-- copied from 3GPP 38.423 (XnAP) IEs
-- note: choice-extension removed
-- ************************************************************
GNB-ID-Choice ::= CHOICE {
    gnb-ID                  BIT STRING (SIZE(22..32)),
    ...
}
-- H
-- I
-- J
-- K
-- L
-- M

-- ************************************************************
-- [New for E2AP v02.00] copied from 3GPP 36.413 (S1AP) IEs
-- ************************************************************
MMEname ::= PrintableString (SIZE (1..150,...))

-- N

-- ************************************************************
-- copied from 3GPP 37.473 (W1AP) IEs
-- ************************************************************
NGENB-DU-ID ::= INTEGER (0..68719476735)


-- O
-- P
-- ************************************************************
-- copied from 3GPP 36.423 (X2AP) IEs
-- ************************************************************
PLMN-Identity ::= OCTET STRING (SIZE(3))
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
-- Q
-- R
-- **************************************************************
-- Following IE defined in E2SM
-- **************************************************************
RANfunctionDefinition ::= OCTET STRING

RANfunctionID ::= INTEGER (0..4095)

RANfunctionOID ::= PrintableString(SIZE(1..1000,...))

RANfunctionRevision ::= INTEGER (0..4095)

-- **************************************************************
-- Following IE defined in E2SM
-- **************************************************************
RICactionDefinition ::= OCTET STRING

-- new in E2AP-v03.00
RICactionExecutionOrder ::= INTEGER (0..255, ...)

RICactionID ::= INTEGER (0..255)

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

-- **************************************************************
-- Following IE defined in E2SM
-- **************************************************************
RICcallProcessID ::= OCTET STRING

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

-- **************************************************************
-- Following IE defined in E2SM
-- **************************************************************
RICcontrolHeader ::= OCTET STRING

-- **************************************************************
-- Following IE defined in E2SM
-- **************************************************************
RICcontrolMessage ::= OCTET STRING

-- **************************************************************
-- Following IE defined in E2SM
-- **************************************************************
RICcontrolOutcome ::= OCTET STRING

-- **************************************************************
-- Following IE defined in E2SM
-- **************************************************************
RICeventTriggerDefinition ::= OCTET STRING

-- **************************************************************
-- Following IE defined in E2SM
-- **************************************************************
RICindicationHeader ::= OCTET STRING

-- **************************************************************
-- Following IE defined in E2SM
-- **************************************************************
RICindicationMessage ::= OCTET STRING

RICindicationSN ::= INTEGER (0..65535)

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

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

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

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

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

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

-- ************************************************************
-- Following IE defined in E2SM
-- ************************************************************
RICqueryHeader ::= OCTET STRING

-- ************************************************************
-- Following IE defined in E2SM
-- ************************************************************
RICqueryDefinition ::= OCTET STRING

-- ************************************************************
-- Following IE defined in E2SM
-- ************************************************************
RICqueryOutcome ::= OCTET STRING


RICtimeToWait ::= ENUMERATED{
    w1ms,
    w2ms,
    w5ms,
    w10ms,
    w20ms,
    w30ms,
    w40ms,
    w50ms,
    w100ms,
    w200ms,
    w500ms,
    w1s,
    w2s,
    w5s,
    w10s,
    w20s,
    w60s,
    ...
}
-- S
-- T
-- ************************************************************
-- copied from 3GPP 38.413 (NGAP) IEs
-- ************************************************************
TimeToWait ::= ENUMERATED {v1s, v2s, v5s, v10s, v20s, v60s, ...}


TNLinformation ::= SEQUENCE{
    tnlAddress          BIT STRING (SIZE(1..160,...)),
    tnlPort             BIT STRING (SIZE(16))   OPTIONAL,
    ...
}

TNLusage ::= ENUMERATED{ric-service, support-function, both, ...}

TransactionID ::= INTEGER (0..255,...)

-- ************************************************************
-- copied from 3GPP 38.413 (NGAP) IEs
-- ************************************************************
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

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

-- U
-- V
-- W
-- X
-- Y
-- Z

END
-- ASN1STOP
```

9.3.6 Common definitions

```
-- ASN1START
-- **************************************************************
--
-- Common definitions
-- Derived from 3GPP 38.413 (NGAP)
--
-- **************************************************************

E2AP-CommonDataTypes {
iso(1) identified-organization(3) dod(6) internet(1) private(4) enterprise(1) 53148 e2(1) version2
(2) e2ap(1) e2ap-CommonDataTypes (3) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

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

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

ProcedureCode       ::= INTEGER (0..255)

ProtocolIE-ID       ::= INTEGER (0..65535)

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

END
-- ASN1STOP
```

9.3.7 Constant definitions

```
-- ASN1START
-- **************************************************************
--
-- Constant definitions
--
-- **************************************************************

E2AP-Constants {
iso(1) identified-organization(3) dod(6) internet(1) private(4) enterprise(1) 53148 e2(1) version2
(2) e2ap(1) e2ap-Constants (4) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    ProcedureCode,
    ProtocolIE-ID
FROM E2AP-CommonDataTypes;

-- **************************************************************
--
-- Elementary Procedures
--
-- **************************************************************
id-E2setup                                  ProcedureCode ::= 1
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
id-ErrorIndication                          ProcedureCode ::= 2
id-Reset                                    ProcedureCode ::= 3
id-RICcontrol                               ProcedureCode ::= 4
id-RICindication                            ProcedureCode ::= 5
id-RICserviceQuery                          ProcedureCode ::= 6
id-RICserviceUpdate                         ProcedureCode ::= 7
id-RICsubscription                          ProcedureCode ::= 8
id-RICsubscriptionDelete                    ProcedureCode ::= 9
id-E2nodeConfigurationUpdate                ProcedureCode ::= 10
id-E2connectionUpdate                       ProcedureCode ::= 11
id-RICsubscriptionDeleteRequired            ProcedureCode ::= 12
id-E2removal                                ProcedureCode ::= 13
id-RICsubscriptionModification              ProcedureCode ::= 14
id-RICsubscriptionModificationRequired      ProcedureCode ::= 15
id-RICquery                                 ProcedureCode ::= 16

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

maxProtocolIEs                              INTEGER ::= 65535


-- ************************************************************
--
-- Lists
--
-- ************************************************************
maxnoofErrors                               INTEGER ::= 256
maxofE2nodeComponents                       INTEGER ::= 1024
maxofRANfunctionID                          INTEGER ::= 256
maxofRICactionID                            INTEGER ::= 16
maxofTNLA                                   INTEGER ::= 32
maxofRICrequestID                           INTEGER ::= 1024


-- ************************************************************
--
-- IEs
--
-- ************************************************************
id-Cause                                                ProtocolIE-ID ::= 1
id-CriticalityDiagnostics                               ProtocolIE-ID ::= 2
id-GlobalE2node-ID                                      ProtocolIE-ID ::= 3
id-GlobalRIC-ID                                         ProtocolIE-ID ::= 4
id-RANfunctionID                                        ProtocolIE-ID ::= 5
id-RANfunctionID-Item                                   ProtocolIE-ID ::= 6
id-RANfunctionIEcause-Item                              ProtocolIE-ID ::= 7
id-RANfunction-Item                                     ProtocolIE-ID ::= 8
id-RANfunctionsAccepted                                 ProtocolIE-ID ::= 9
id-RANfunctionsAdded                                    ProtocolIE-ID ::= 10
id-RANfunctionsDeleted                                  ProtocolIE-ID ::= 11
id-RANfunctionsModified                                 ProtocolIE-ID ::= 12
id-RANfunctionsRejected                                 ProtocolIE-ID ::= 13
id-RICaction-Admitted-Item                              ProtocolIE-ID ::= 14
id-RICactionID                                          ProtocolIE-ID ::= 15
id-RICaction-NotAdmitted-Item                           ProtocolIE-ID ::= 16
id-RICactions-Admitted                                  ProtocolIE-ID ::= 17
id-RICactions-NotAdmitted                               ProtocolIE-ID ::= 18
id-RICaction-ToBeSetup-Item                             ProtocolIE-ID ::= 19
id-RICcallProcessID                                     ProtocolIE-ID ::= 20
id-RICcontrolAckRequest                                 ProtocolIE-ID ::= 21
id-RICcontrolHeader                                     ProtocolIE-ID ::= 22
id-RICcontrolMessage                                    ProtocolIE-ID ::= 23
id-RICcontrolStatus                                     ProtocolIE-ID ::= 24
id-RICindicationHeader                                  ProtocolIE-ID ::= 25
id-RICindicationMessage                                 ProtocolIE-ID ::= 26
id-RICindicationSN                                      ProtocolIE-ID ::= 27
id-RICindicationType                                    ProtocolIE-ID ::= 28
id-RICrequestID                                         ProtocolIE-ID ::= 29
id-RICsubscriptionDetails                               ProtocolIE-ID ::= 30
id-TimeToWait                                           ProtocolIE-ID ::= 31
id-RICcontrolOutcome                                    ProtocolIE-ID ::= 32
id-E2nodeComponentConfigUpdate                          ProtocolIE-ID ::= 33
id-E2nodeComponentConfigUpdate-Item                     ProtocolIE-ID ::= 34
id-E2nodeComponentConfigUpdateAck                       ProtocolIE-ID ::= 35
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
id-E2nodeComponentConfigUpdateAck-Item              ProtocolIE-ID ::= 36
id-E2connectionSetup                                ProtocolIE-ID ::= 39
id-E2connectionSetupFailed                          ProtocolIE-ID ::= 40
id-E2connectionSetupFailed-Item                     ProtocolIE-ID ::= 41
id-E2connectionFailed-Item                          ProtocolIE-ID ::= 42
id-E2connectionUpdate-Item                          ProtocolIE-ID ::= 43
id-E2connectionUpdateAdd                            ProtocolIE-ID ::= 44
id-E2connectionUpdateModify                         ProtocolIE-ID ::= 45
id-E2connectionUpdateRemove                         ProtocolIE-ID ::= 46
id-E2connectionUpdateRemove-Item                    ProtocolIE-ID ::= 47
id-TNLinformation                                   ProtocolIE-ID ::= 48
id-TransactionID                                    ProtocolIE-ID ::= 49
id-E2nodeComponentConfigAddition                    ProtocolIE-ID ::= 50
id-E2nodeComponentConfigAddition-Item               ProtocolIE-ID ::= 51
id-E2nodeComponentConfigAdditionAck                 ProtocolIE-ID ::= 52
id-E2nodeComponentConfigAdditionAck-Item            ProtocolIE-ID ::= 53
id-E2nodeComponentConfigRemoval                     ProtocolIE-ID ::= 54
id-E2nodeComponentConfigRemoval-Item                ProtocolIE-ID ::= 55
id-E2nodeComponentConfigRemovalAck                  ProtocolIE-ID ::= 56
id-E2nodeComponentConfigRemovalAck-Item             ProtocolIE-ID ::= 57
id-E2nodeTNLassociationRemoval                      ProtocolIE-ID ::= 58
id-E2nodeTNLassociationRemoval-Item                 ProtocolIE-ID ::= 59
id-RICsubscriptionToBeRemoved                       ProtocolIE-ID ::= 60
id-RICsubscription-withCause-Item                   ProtocolIE-ID ::= 61
id-RICsubscriptionStartTime                         ProtocolIE-ID ::= 62
id-RICsubscriptionEndTime                           ProtocolIE-ID ::= 63
id-RICeventTriggerDefinitionToBeModified            ProtocolIE-ID ::= 64
id-RICactionsToBeRemovedForModification-List        ProtocolIE-ID ::= 65
id-RICaction-ToBeRemovedForModification-Item        ProtocolIE-ID ::= 66
id-RICactionsToBeModifiedForModification-List       ProtocolIE-ID ::= 67
id-RICaction-ToBeModifiedForModification-Item       ProtocolIE-ID ::= 68
id-RICactionsToBeAddedForModification-List          ProtocolIE-ID ::= 69
id-RICaction-ToBeAddedForModification-Item          ProtocolIE-ID ::= 70
id-RICactionsRemovedForModification-List            ProtocolIE-ID ::= 71
id-RICaction-RemovedForModification-Item            ProtocolIE-ID ::= 72
id-RICactionsFailedToBeRemovedForModification-List  ProtocolIE-ID ::= 73
id-RICaction-FailedToBeRemovedForModification-Item  ProtocolIE-ID ::= 74
id-RICactionsModifiedForModification-List           ProtocolIE-ID ::= 75
id-RICaction-ModifiedForModification-Item           ProtocolIE-ID ::= 76
id-RICactionsFailedToBeModifiedForModification-List ProtocolIE-ID ::= 77
id-RICaction-FailedToBeModifiedForModification-Item ProtocolIE-ID ::= 78
id-RICactionsAddedForModification-List              ProtocolIE-ID ::= 79
id-RICaction-AddedForModification-Item              ProtocolIE-ID ::= 80
id-RICactionsFailedToBeAddedForModification-List    ProtocolIE-ID ::= 81
id-RICaction-FailedToBeAddedForModification-Item    ProtocolIE-ID ::= 82
id-RICactionsRequiredToBeModified-List              ProtocolIE-ID ::= 83
id-RICaction-RequiredToBeModified-Item              ProtocolIE-ID ::= 84
id-RICactionsRequiredToBeRemoved-List               ProtocolIE-ID ::= 85
id-RICaction-RequiredToBeRemoved-Item               ProtocolIE-ID ::= 86
id-RICactionsConfirmedForModification-List          ProtocolIE-ID ::= 87
id-RICaction-ConfirmedForModification-Item          ProtocolIE-ID ::= 88
id-RICactionsRefusedToBeModified-List               ProtocolIE-ID ::= 89
id-RICaction-RefusedToBeModified-Item               ProtocolIE-ID ::= 90
id-RICactionsConfirmedForRemoval-List               ProtocolIE-ID ::= 91
id-RICaction-ConfirmedForRemoval-Item               ProtocolIE-ID ::= 92
id-RICactionsRefusedToBeRemoved-List                ProtocolIE-ID ::= 93
id-RICaction-RefusedToBeRemoved-Item                ProtocolIE-ID ::= 94
id-RICqueryHeader                                   ProtocolIE-ID ::= 95
id-RICqueryDefinition                               ProtocolIE-ID ::= 96
id-RICqueryOutcome                                  ProtocolIE-ID ::= 97
END
-- ASN1STOP
```

9.3.8 Container definitions

```
-- ASN1START
-- **************************************************************
--
-- Container definitions
--
-- derived from 3GPP 38.413 (NGAP)
-- **************************************************************

E2AP-Containers {
iso(1) identified-organization(3) dod(6) internet(1) private(4) enterprise(1) 53148 e2(1) version2
(2) e2ap(1) e2ap-Containers (5) }
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

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

IMPORTS

    Criticality,
    Presence,
    ProtocolIE-ID
FROM E2AP-CommonDataTypes

    maxProtocolIEs
FROM E2AP-Constants;

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

E2AP-PROTOCOL-IES ::= CLASS {
    &id             ProtocolIE-ID                   UNIQUE,
    &criticality    Criticality,
    &Value,
    &presence       Presence
}
WITH SYNTAX {
    ID              &id
    CRITICALITY     &criticality
    TYPE            &Value
    PRESENCE        &presence
}

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

E2AP-PROTOCOL-IES-PAIR ::= CLASS {
    &id                 ProtocolIE-ID               UNIQUE,
    &firstCriticality   Criticality,
    &FirstValue,
    &secondCriticality  Criticality,
    &SecondValue,
    &presence           Presence
}
WITH SYNTAX {
    ID                      &id
    FIRST CRITICALITY       &firstCriticality
    FIRST TYPE              &FirstValue
    SECOND CRITICALITY      &secondCriticality
    SECOND TYPE             &SecondValue
    PRESENCE                &presence
}




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

ProtocolIE-Container {E2AP-PROTOCOL-IES : IEsSetParam} ::=
    SEQUENCE (SIZE (0..maxProtocolIEs)) OF
    ProtocolIE-Field {{IEsSetParam}}

ProtocolIE-SingleContainer {E2AP-PROTOCOL-IES : IEsSetParam} ::=
    ProtocolIE-Field {{IEsSetParam}}
```

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

```
ProtocolIE-Field {E2AP-PROTOCOL-IES : IEsSetParam} ::= SEQUENCE {
    id              E2AP-PROTOCOL-IES.&id              ({IEsSetParam}),
    criticality     E2AP-PROTOCOL-IES.&criticality     ({IEsSetParam}{@id}),
    value           E2AP-PROTOCOL-IES.&Value           ({IEsSetParam}{@id})
}

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

ProtocolIE-ContainerPair {E2AP-PROTOCOL-IES-PAIR : IEsSetParam} ::=
    SEQUENCE (SIZE (0..maxProtocolIEs)) OF
    ProtocolIE-FieldPair {{IEsSetParam}}

ProtocolIE-FieldPair {E2AP-PROTOCOL-IES-PAIR : IEsSetParam} ::= SEQUENCE {
    id                  E2AP-PROTOCOL-IES-PAIR.&id                  ({IEsSetParam}),
    firstCriticality    E2AP-PROTOCOL-IES-PAIR.&firstCriticality    ({IEsSetParam}{@id}),
    firstValue          E2AP-PROTOCOL-IES-PAIR.&FirstValue          ({IEsSetParam}{@id}),
    secondCriticality   E2AP-PROTOCOL-IES-PAIR.&secondCriticality   ({IEsSetParam}{@id}),
    secondValue         E2AP-PROTOCOL-IES-PAIR.&SecondValue         ({IEsSetParam}{@id})
}

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

ProtocolIE-ContainerList {INTEGER : lowerBound, INTEGER : upperBound, E2AP-PROTOCOL-IES :
IEsSetParam} ::=
    SEQUENCE (SIZE (lowerBound..upperBound)) OF
    ProtocolIE-SingleContainer {{IEsSetParam}}

ProtocolIE-ContainerPairList {INTEGER : lowerBound, INTEGER : upperBound, E2AP-PROTOCOL-IES-PAIR :
IEsSetParam} ::=
    SEQUENCE (SIZE (lowerBound..upperBound)) OF
    ProtocolIE-ContainerPair {{IEsSetParam}}


END
-- ASN1STOP
```

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 [15].

9.5 Timers

The following Timers are defined for use over the E2 interface in Near-RT RIC and E2 Node.

$T_{RICEVENTcreate}$

- Specifies the maximum time for the RIC Subscription procedure in the Near-RT RIC.

$T_{RICEVENTdelete}$

- Specifies the maximum time for the RIC Subscription Deletion procedure in the Near-RT RIC.

$T_{RICEVENTmodify}$

- Specifies the maximum time for the RIC Subscription Modification procedure in the Near-RT RIC.

$T_{RICcontrol}$

- Specifies the maximum time for the RIC Control procedure in the Near-RT RIC.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

$T_{RICquery}$

- Specifies the maximum time for the RIC Query procedure in the Near-RT RIC.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

10 Handling of Unknown, Unforeseen and Erroneous Protocol Data

Clause 10 of TS 36.413 [24] is applicable for the purposes of the present document.

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

Revision history

Date	Revision	Description
2023.01.27	03.00.01	CR < NOK-2023.01.09-WG3-CR-0019-E2AP-PAS step1-v01 > approved WG3#171
2023.02.16	03.00.02	CR <NOK-2023.02.15-WG3-CR-0020-E2AP-PAS step2-v02> approved Prague F2F 16/2/2023
2023.03.17	03.00.03	CR <NOK-2023.03.13-WG3-CR-0021-E2AP-PAS step3-v4> approved by correspondence after WG3#176
2023.03.24	03.00.04	Inclusion of corrections agreed during WG3 approval process as per < O-RAN.WG3.E2AP-R003-v03.00.03-approvalChanges-v3 >

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification

History

Date	Revision	Description
2020.07.15	01.01	Incremented version for Publication
2021.08.10	02.00	TSC Approved
2022.02.07	02.01	Version ready for Nov 21 train
2022.06.29	02.02	Version ready for March 22 train
2022.07.20	02.03	Version ready for July 22 train
2022.12.07	03.00	Version ready for Nov 22 train
2023.03.24	03.01	Version ready for March 23 train

© 2023 by the O-RAN ALLIANCE e.V. Your use is subject to the copyright statement on the cover page of this specification