O-RAN Working Group 3
Near-Real-time RAN Intelligent Controller
E2 Service Model (E2SM),
RAN Function Network Interface (NI)

1 Revision History

Date	Revision	Author	Description
2020.01.22	01.00.00	Alistair URIE, Paul STEPHENS (Nokia)	Specification renamed v01.00.00 for approval
2020.01.29	0.1.00.00	Alistair URIE, Paul STEPHENS (Nokia)	Corrected based on remarks during electronic vote.

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Contents

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1 Scope

This Technical Specification has been produced by the O-RAN Alliance.

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 E2 Service Model (E2SM) "Network Interface" (NI) for the RAN function handling the Network Interfaces in an E2 Node. Further information on this RAN function is described in Annex A.

2 References

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

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

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document.

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

[2]   O-RAN Working Group 3, Near-Real-time RAN Intelligent Controller, Architecture & E2 General Aspects and Principles (E2GAP)

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

[4]   3GPP TR 25.921: "Guidelines and principles for protocol description and error handling".

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

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

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

[8]   reserved

[9]   reserved

[10]   3GPP 36.413, Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)

[11]   3GPP 36.423, Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 application protocol (X2AP)

1 [12] 3GPP 38.413, NG-RAN; NG Application Protocol (NGAP)

2 [13] 3GPP 38.423, NG-RAN; Xn application protocol (XnAP)

3 [14] F1 interface, NG-RAN; F1 application protocol (F1AP), 3GPP 38.473

4 [15] E1 interface, NG-RAN; E1 Application Protocol (E1AP), 3GPP 38.463

3 Definitions and Abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

E2 Node: as defined in E2GAP [2].

RAN Function: as defined in E2GAP [2]

E2 Service Model: The description of the Services exposed by a specific RAN function within an E2 node over the E2 interface towards the Near-RT RIC.

Network Interface: Network interface used to carry a network protocol between network nodes

3.2 Abbreviations

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

O-CU	O-RAN Central Unit
O-CU-CP	O-RAN Central Unit – Control Plane
O-CU-UP	O-RAN Central Unit – User Plane
O-DU	O-RAN Distributed Unit
Near-RT RIC	Near-real-time RAN Intelligent Controller

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

4.3 Specification Notations

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

Service	when referring to a Service in the specification the **SERVICE NAME** is written with upper case characters and in bold followed by the word "service", e.g. **REPORT** service.
Procedure	When referring to an elementary procedure in the specification the Procedure Name is written with the first letters in each word in upper case characters followed by the word "procedure", e.g. Handover Preparation procedure.
Message	When referring to a message in the specification the MESSAGE NAME is written with all letters in upper case characters followed by the word "message", e.g. HANDOVER REQUEST message.
IE	When referring to an information element (IE) in the specification the *Information Element Name* is written with the first letters in each word in upper case characters and all letters in Italic font followed by the abbreviation "IE", e.g. *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".

4.3 Identifiers

For the purposes of the present document, the following identifiers are defined:

Style Type   The identifier used to nominate a specific approach or Style used to exposing a given RIC Service (REPORT, INSERT, CONTROL and POLICY). The same E2SM may support more than one Style for each RIC Service.

Format Type   The identifier used to nominate a specific formatting approach used to encode one of the E2AP IEs defined in this E2SM. The same E2SM may support more than one encoding Formats for each E2AP IE and each E2AP IE message encoding Format may be used by one or more RIC Service Styles.

5 E2SM services

As defined in E2 General Aspects and Principles [2], a given RAN Function offers a set of services to be exposed over the E2 (**REPORT**, **INSERT**, **CONTROL** and/or **POLICY**) using E2AP [3] defined procedures. Each of the E2AP Procedures listed in table 5-1 contains specific E2 Node RAN Function dependent Information Elements (IEs).

Table 5-1: Relationship RAN Function specific E2AP Information elements and E2AP Procedures

RAN Function specific E2AP Information Elements	E2AP Information Element reference	Related E2AP Procedures
RIC Event Trigger Definition IE	E2AP [3] section 9.2.9	RIC Subscription
RIC Action Definition IE	E2AP [3] section 9.2.12	RIC Subscription
RIC Indication Header IE	E2AP [3] section 9.2.17	RIC Indication
RIC Indication Message IE	E2AP [3] section 9.2.16	RIC Indication
RIC Call Process ID IE	E2AP [3] section 9.2.18	RIC Indication RIC Control
RIC Control Header IE	E2AP [3] section 9.2.20	RIC Control
RIC Control Message IE	E2AP [3] section 9.2.19	RIC Control
RIC Control Outcome IE	E2AP [3] section 9.2.25	RIC Control
RAN Function Definition IE	E2AP [3] section 9.2.23	E2 Setup RIC Service Update

All of these RAN Function specific E2AP IEs are defined in E2AP [3] as "OCTET STRING".

The purpose of this specification is to define the contents of these fields for the specific RAN function "NI" (Network Interface).

6 RAN Function Service Model Description

6.1 RAN Function Overview

For the purposed of this E2 Service Model, E2SM-NI, the E2 Node terminating the E2 Interface is assumed to host the RAN Function NI "Network Interface" which performs the following functionalities:

- Exposure of Network Interfaces

- Modification of both incoming and outgoing network interface message contents

- Execution of policies that may result in change of network behavior

This E2SM specification provides a set of RAN Function exposure services described in clause 6.2 and has been prepared with the assumption that the same E2SM may be used to describe either a single RAN Function handling all Network Interfaces or more than one RAN function with each one handling a subset of the Network Interfaces terminated on the E2 Node.

6.2 RAN Function exposure services

6.2.1 **REPORT** service

The "Network Interface" RAN Function provides selective support of the following **REPORT** services:

- Copy of Complete message with header providing network interface type, identifier and direction with optional network interface timestamp

- Copy of Partial message selected by target message protocol IE identifier with with header providing network interface type, identifier, direction and message type with optional network interface timestamp

These services may be initiated according to:

- Target network interface type, identifier, direction and message type along with the presence of a sequence of one or more message protocol IE identifiers with optional message protocol IE contents selection rules.

6.2.2 **INSERT** service

The "Network Interface" RAN Function provides selective support of the following **INSERT** services:

- Forwarding of Complete message with header providing network interface type, identifier and direction with optional network interface timestamp

This service may be initiated according to:

- Target network interface type, identifier and direction, message type and presence of a sequence of one or more message protocol IE identifiers with optional message protocol IE contents selection rules.

6.2.3 **CONTROL** service

The "Network Interface" RAN Function provides selective support of the following **CONTROL** services:

- Injection of Complete message with header providing target network interface type, identifier and direction and optional RIC Control Message Priority

6.2.4 **POLICY** service

The "Network Interface" RAN Function provides selective support of the following **POLICY** services:

- Handling of Message Admission process according to a list of parameters to be applied to different RAN UE groups

1   This service may be initiated according to:

2   -   Target network interface type, identifier and direction, message type and presence of a sequence of one or more
3   message protocol IE identifiers with optional message protocol IE contents selection rules.

4 7 RAN Function Description

5 7.1 Description

6   The E2AP [3] procedures E2 Setup and RIC Service Update are used to transport the RAN Function Description.

7   For the specific RAN Function, the _RAN Function Description_ IE shall report the following information:

8   -   RAN Function name along with associated information on E2SM definition

9   -   Event trigger styles list along with the corresponding encoding type for each associated E2AP IE.

10   -   RIC **REPORT** Service styles list along with the corresponding encoding type for each associated E2AP IE.

11   -   RIC **INSERT** Service styles list along with the corresponding encoding type for each associated E2AP IE.

12   -   RIC **CONTROL** Service styles list along with the corresponding encoding type for each associated E2AP IE.

13   -   RIC **POLICY** Service styles list along with the corresponding encoding type for each associated E2AP IE.

14 7.2 RAN Function name

15   RAN Function Short Name "ORAN-E2SM-NI"

16   RAN Function name description "Network Interface"

17   RAN Function Instance, required when and if E2 Node exposes more than one instance of a RAN Function based on
18   this E2SM.

19 7.3 Event trigger definition styles

20 7.3.1 RIC Event trigger definition IE style list

RIC Style Type	Style Name	Supported RIC Service Style			Style Description
		Report	Insert	Policy	
1	Interface Message Event	1, 2	1	1	_RIC Event trigger definition_ IE based on arrival of defined message

21

22 7.3.2 _RIC Event trigger definition_ IE style 1: Interface Message Event

23   This _RIC Event Trigger Definition_ IE style is used to detect a specific interface message event in E2 Node RAN
24   Function based on specified target Network Interface Type, Network Interface Identifier, Network Interface Direction,
25   Network Interface Message Type, Message Protocol IE Identifier, Message Protocol IE Test Condition and Message
26   Protocol IE Test Value.

27   This _RIC Event Trigger Definition_ IE style uses _RIC Event Trigger Definition_ IE Format 1 (8.2.1.1.1)

7.4 Supported RIC **REPORT** Service styles

7.4.1 **REPORT** Service style list

RIC Style Type	Style Name	Style Description
1	Complete message	Used to send copy of complete message from E2 Node RAN Function
2	Partial message	Used to send copy of part of message from E2 Node RAN Function

7.4.2 **REPORT** Service Style 1: Complete message

7.4.2.1 **REPORT** Service Style description

This **REPORT** Service style provides a copy of a complete network interface message with the network interface specific encoded message carried as a transparent container with an associated header providing information on the target Network Interface Type, Network Interface Identifier, Network Interface Direction and optional Network Interface Timestamp. The addition of optional information time stamp in the Indication Header is controlled using the associated RIC Action Parameter

7.4.2.2 **REPORT** Service *RIC Action Definition* IE contents

This **REPORT** Service style uses the following RAN parameters with *RIC Action Definition* IE Format 1 (8.2.1.1.1) where AddTimestamp is used to request the inclusion of optional Network Interface Timestamp information in *RIC Indication header* IE:

RAN Parameter ID	RAN Parameter Name	RAN Parameter Type	Parameter description
1	AddTimestamp	BOOLEAN	TRUE=Use optional Network Interface Timestamp in RIC Indication Header

7.4.2.3 **REPORT** Service *RIC Indication header* IE contents

REPORT Service *RIC Indication Header* IE contains the Network Interface Type, Network Interface Identifier, Network Interface Direction and optional Network Interface Timestamp.

This **REPORT** Service style uses *RIC Indication header* IE Format 1 (8.2.1.3.1)

7.4.2.4 **REPORT** Service *RIC Indication message* IE contents

REPORT Service *RIC Indication message* IE contains contains a transparent container used to carry the complete message with contents defined by the specific network interface specification.

This **REPORT** Service style uses *RIC Indication message* IE Format 1 (8.2.1.4.1)

7.4.3 **REPORT** Service Style 2: Partial message

7.4.3.1 **REPORT** Service Style description

This **REPORT** Service style provides a copy of a specific information element extracted from a network interface message with the network interface specific encoded message carried as a transparent container associated with an indication header providing information on the target Network Interface Type, Network Interface Identifier, Network Interface Direction, Network Interface Message Type and optional Network Interface Timestamp. The addition of optional Network Interface Timestamp in the Indication Header and the rules for extracting the part of the message are controlled using the associated RIC Action Parameter

7.4.3.2 **REPORT** Service *RIC Action Definition* IE contents

This **REPORT** Service style uses the following RAN parameters with *RIC Action Definition* IE Format 1 (8.2.1.1.1) where AddTimestamp is used to request the inclusion of optional Timestamp information in *RIC Indication header* IE and Target Protocol IE Identifier is used to specify the required IE to be copied from the message.

RAN Parameter ID	RAN Parameter Name	RAN Parameter Type	Parameter description
1	AddTimestamp	BOOLEAN	TRUE=Use optional Network Interface Timestamp in RIC Indication Header
2	Target Protocol IE Identifier	INTEGER	Identifies the target Protocol IE identifier to be copied from the message and sent in Indication Message IE. Specified in terms of Protocol IE ID using the definition of the specific network interface type

7.4.3.3 **REPORT** Service *RIC Indication header* IE contents

REPORT Service *RIC Indication Header* IE contains the Network Interface Type, Network Interface Identifier, Network Interface Direction and optional Network Interface Timestamp.

This **REPORT** Service style uses *RIC Indication header* IE Format 1 (8.2.1.3.1)

7.4.3.4 **REPORT** Service *RIC Indication message* IE contents

REPORT Service *RIC Indication message* IE contains a transparent container used to carry the extracted part of the message with contents defined by the specific network interface specification.

This **REPORT** Service style uses *RIC Indication message* IE Format 1 (8.2.1.4.1)

7.5 Supported RIC **INSERT** Service styles

7.5.1 RIC **INSERT** Service style list

RIC Style Type	Style Name	Style Description
1	Complete message	Used to forward a complete message from E2 Node RAN function

7.5.2 **INSERT** Service Style 1: Complete message

7.5.2.1 **INSERT** Service Style description

This **INSERT** Service style provides the forwarding of a complete network interface message with the network interface specific encoded message carried as a transparent container with an associated header providing information on the target Network Interface Type, Network Interface Identifier, Network Interface Direction and optional Network Interface Timestamp. The addition of optional information timestamp in the Indication Header is controlled using the associated RIC Action Parameter

7.5.2.2 **INSERT** Service *RIC Action Definition* IE contents

RAN Parameter ID	RAN Parameter Name	RAN Parameter Type	Parameter description
1	AddTimestamp	BOOLEAN	TRUE=Use optional *Timestamp* IE in *RIC Indication Header*

7.5.2.3 **INSERT** Service *RIC Indication header* IE contents

INSERT Service *RIC Indication Header* IE contains the following information Network Interface Type, Network Interface Identifier, Network Interface Direction and optional Network Interface Timestamp.

This **INSERT** Service style uses *RIC Indication header* Format 1 (8.2.1.3.1)

7.5.2.4 **INSERT** Service *RIC Indication message* IE contents

INSERT Service *RIC Indication message* IE contains a transparent container used to carry the complete message with contents defined by the specific network interface specification.

This **INSERT** Service style uses *RIC Indication message* IE Format 1 (8.2.1.4.1)

7.5.2.5 **INSERT** Service *RIC Call Process ID* IE contents

RIC Call Process ID contains identifier used by the RAN Function to match the outgoing **INSERT** Service message with a subsequent incoming **CONTROL** Service message.

This **INSERT** Service style uses *RIC Call Process ID* type 1 (8.2.1.5.1) to carry a local RAN Function assigned call process instance sequence number that, under normal traffic conditions, shall be unique to the given RAN function instance for a period of 1 hour.

7.6 Supported RIC **CONTROL** Service styles

7.6.1 RIC **CONTROL** Service style list

RIC Style Type	Style Name	Style Description
1	Complete message	Used to inject a complete message into E2 Node RAN Function

7.6.2 **CONTROL** Service Style 1: Complete message

7.6.2.1 **CONTROL** Service Style description

This **CONTROL** Service style provides the injection of a complete message carried as a transparent container with an associated header providing the target Network Interface Type, Network Interface Identifier and Network Interface Direction along with an option RIC Control Message Priority.

The RIC Control Message Priority shall be used by the RAN Function to order the queuing of incoming Control messages and E2 Node originated messages on the same network interface. The following rules shall apply:

- Control messages with higher priority shall be handled prior to Control messages with lower priority

- Positive RIC Control Message Priority implies a priority over E2 Node originated messages

- Negative priority implies that E2 Node originated messages shall be sent prior to incoming Control messages.

- Default Control priority = 0 implies Control messages shall be treated with the same priority as E2 Node originated messages

7.6.2.2 **CONTROL** Service *RIC Control Header* IE contents

RIC Control Header contains the following information Network Interface Type, Network Interface Identifier and Network Interface Direction and the optional RIC Control Message Priority. This **CONTROL** style uses *RIC Control Header* Format 1 (8.2.1.6.1)

7.6.2.3 **CONTROL** Service *RIC Control Message* IE contents

RIC Control Message contains a transparent container used to carry the complete message with contents defined by the specific network interface specification.

This **CONTROL** style uses *RIC Control Message* Format 1 (8.2.1.7.1)

7.6.2.4 **CONTROL** Service *RIC Call Process ID* IE contents

CONTROL Service *RIC Call Process ID* contains identifier used by the Near-RT RIC to allow the RAN Function to match the outgoing **INSERT** Service message with a subsequent incoming **CONTROL** Service message.

This **CONTROL** Service style uses *RIC Call Process ID* IE Format 1 (8.2.1.5.1)

7.6.2.5 **CONTROL** Service *RIC Control Outcome* IE contents

RIC Control Outcome IE contains a transparent container used to carry the outcome of executing the RIC Control Request. In particular this message reports on the time that the RIC Control Request was received by the RAN Function and the time that the network interface message contained in the RIC Control Message IE was transmitted by the RAN function over the specified network interface. The difference between these two timestamps reflects both internal processes delays and the impact of the requested RIC Control Message Priority with respect to E2 Node originated network interface messages

This **CONTROL** style uses *RIC Control Outcome* Format 1 (8.2.1.8.1)

RAN Parameter ID	RAN Parameter Name	RAN Parameter Type	Parameter description
1	ReceivedTimestamp	NetworkInterfaceTimestamp	Time RIC Control Request received by RAN Function
2	TransmitteTimestamp	NetworkInterfaceTimestamp	Time RIC Control Request message contents transmitted by RAN Function

7.7 Supported RIC **POLICY** Service styles

7.7.1 RIC **POLICY** Service style list

RIC Style Type	Style Name	Style Description
1	Message Admission	Used to control the execution of the Message Admission process for an incoming message into E2 Node RAN Function

7.7.2 **POLICY** Service style 1: Message admission

7.7.2.1 **POLICY** Service style description

This **POLICY** Service style is used to provide an Imperative Policy to control execution of a Message Admission process for an incoming message of type "REQUEST" received by the specific E2 Node RAN Function. The associated *Action Definition* IE provides the rules to be executed as an Imperative E2 Policy with different parameters assigned to each RAN UE Group.

A positive outcome of the Imperative policy results in the incoming message being forwarded to the E2 Node without modification.

1 A negative outcome of the Imperative policy results in the creation of an appropriate request rejection message as
2 defined in Annex A.2.1

3 ### 7.7.2.2 **POLICY** Service *RIC Action Definition* IE contents

4 This **POLICY** Service style uses *RIC Action Definition* IE Format 2 (8.2.1.1.2) where:

5 - RAN UE group is described in terms of a list of test conditions using RAN Parameters. A given UE is to be
6 considered to be assigned to a specific RAN UE Group when all test conditions are met. RAN UE Group ID = 0
7 is used for the default case and so applies to any UE that is not assigned to any other RAN UE Group

8 - Imperative E2 Policy is encoded in terms of a list of specific RAN Parameters and shall be applied to any UE
9 within a given RAN UE Group. The default UE policy corresponding to the default behavior of the RAN
10 function without an active Imperative E2 Policy is used for UE assigned to RAN UE Group ID = 0

11 # 7.8 Supported RIC Service Styles and E2SM IE Formats

12 Table 7.8-1 and 7.8-2 provide a summary of the E2SM IE Formats defined to support the set of RIC Event Triggers and
13 RIC Service Styles defined in this E2SM specification.

14

15 **Table 7.8-1: Summary of the E2SM IE encoding Formats defined to support the set of RIC Event
16 Trigger styles**

RIC Service and Style	Event Trigger Definition Format
Event Trigger	
Style 1	1

17

18 **Table 7.8-1: Summary of the E2SM IE encoding Formats defined to support the set of RIC Service
19 Styles**

RIC Service and Style	Action Definition Format	Indication header Format	Indication message Format	Call Process ID Format	Control header Format	Control message Format
REPORT						
Style 1	1	1	1			
Style 2	1	1	1			
INSERT						
Style 1	1	1	1	1		
CONTROL						
Style 1				1	1	1
POLICY						
Style 1	2					

20

21

8 Elements for E2SM Service Model

8.1 General

Sub clause 8.2 describes the structure of the information elements as required for the E2SM-NI Service Model in tabular format. Sub clause 8.3 presents the individual information elements. Sub clause 8.4 provides the corresponding ASN.1 definition of each information element.

The following attributes are used for the tabular description of the messages and information elements:

NOTE: The messages have been defined in accordance to the guidelines specified in 3GPP TR 25.921 [4].

8.2 Message Functional Definition and Content

8.2.1 Messages for RIC Functional procedures

8.2.1.1 RIC Event Trigger Definition IE

This information element is part of the RIC SUBSCRIPTION REQUEST message sent by the Near-RT RIC to a E2 Node and is required for event triggers used to initiate REPORT, INSERT and POLICY actions.

Direction: Near-RT RIC → E2 Node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE Format				
>E2SM-NI Event Trigger Definition Format 1	M		8.2.1.1.1	

8.2.1.1.1 E2SM-NI Event Trigger Definition Format 1

This RIC Event Trigger Definition style allows to select a specific target using:

- Network Interface Type IE used to select a specific interface type,

- Network Interface Identifier used to select a specific interface instance,

- Network Interface Direction used to select a specific interface direction (incoming or outgoing),

- Network Interface Message Type used to select a specific message on the interface,

- Message Protocol IE Identifier used to select a specific protocol element in the selected message,

- Message Protocol IE Test Condition and Message Protocol IE Test Value are used to test if the selected protocol element meets a specific test condition where the trigger condition applies when and only if all of the test conditions are TRUE (i.e. logical ADD of each test condition).

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Network Interface Type	M		8.3.21	
Network Interface Identifier	O		8.3.22	"Any" instance to be used if absent
Network Interface Direction	O		8.3.23	"Both" directions to be used if absent
Network Interface Message Type	O		8.3.25	"Any" message type to be used if absent
Sequence of Message Protocol Tests		0.. <maxof Interface Protocol Test>		"Any" message if zero message protocol tests in list
>Message Protocol IE ID	M		8.3.26	Protocol IE ID presence in message if test condition is absent
>Message Protocol IE Test condition	O		8.3.27	
>Message Protocol IE Value	O		8.3.28	Shall be included if test condition is present

1

Range bound	Explanation
maxof Interface Protocol Test	Maximum no. of Network Interface Protocol Test in event trigger definition supported by RAN Function. Value is <15>.

2

8.2.1.2 RIC Action Definition IE

This information element is part of the RIC SUBSCRIPTION REQUEST message sent by the Near-RT RIC to a E2 Node and is required for POLICY actions and optional for REPORT and INSERT actions. This information element provides addition information for the nominated Action (Report, Insert, Policy)

Direction: Near-RT RIC → E2 Node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Style Type	M		8.3.3	
CHOICE Format				
>E2SM-NI Action Definition Format 1	M		8.2.1.2.1	
> E2SM-NI Action Definition Format 2	M		8.2.1.2.2	

8

8.2.1.2.1   E2SM-NI Action Definition Format 1

The *E2SM-NI Action Definition* IE Format 1 supports a sequence of RAN Parameters sent as ID/Value pairs. The meaning of the ID/Value pairs is defined in section 7.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Sequence of RAN Parameters		0.. <maxofActionParameters>		
>RAN Parameter ID	M		8.3.7	
>RAN Parameter Value	M		8.3.9	

12

Range bound	Explanation
maxofActionparameters	Maximum no. of RAN Parameters. Value is <255>

13

1 8.2.1.2.2   E2SM-NI Action Definition Format 2

2 The *E2SM-NI Action Definition* IE Format 2 supports a POLICY encoded as a list of RAN UE Groups, each with a
3 group identifier, group definition described in terms of a list of RAN parameters with test conditions and a command
4 described in terms of a list of RAN parameters. The meaning of the ID/Value pairs is defined in section 7 and Annex A.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Sequence of RAN UE Group		0..<maxofRANueGroups>		
>RAN UE Group ID	M		8.3.14	
>RAN UE Group Definition	M		8.3.15	Defines RAN UE group
>RAN Imperative Policy	M		8.3.16	Defines policy to be applied to RAN UE Group

5

Range bound	Explanation
maxofRANueGroups	Maximum no. of RAN UE Groups in action definition supported by RAN Function. Value is 255.

6

7 8.2.1.3 RIC Indication Header IE

8 This information element is part of the RIC INDICATION message sent by the E2 Node to a Near-RT RIC node and is
9 required for REPORT and INSERT actions.

10 Direction: E2 Node → Near-RT RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE Format				
>E2SM-NI Indication Header Format 1	M		8.2.1.3.1	

11

12 8.2.1.3.1   E2SM-NI Indication Header Format 1

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Network Interface Type	M		8.3.21	
Network Interface Identifier	M		8.3.22	
Network Interface Direction	M		8.3.23	
Network Interface Timestamp	O		8.3.24	

13

14 8.2.1.4 RIC Indication Message IE

15 This information element is part of the RIC INDICATION message sent by the E2 Node to a Near-RT RIC node and is
16 required for REPORT and INSERT actions.

17 Direction: E2 Node → Near-RT RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE Format				
>E2SM-NI Indication Message Format 1	M		8.2.1.4.1	

18

8.2.1.4.1   E2SM-NI Indication Message Format 1

Content is encoded as per definition of network interface type indicated in the Network Interface Type IE in associated RIC Indication Header IE.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Network Interface Message	M		8.3.29	

8.2.1.5 RIC Call Process ID IE

This information element is part of the RIC INDICATION message sent by the E2 Node to a Near-RT RIC node and is required for INSERT action. The same information element is used in RIC Control procedure

Direction: E2 Node → Near-RT RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE Format				
>E2SM-NI Call Process ID Format 1	M		8.2.1.5.1	
>E2SM-NI Call Process ID Format 2	M		8.2.1.5.2	

8.2.1.5.1   E2SM-NI Call Process ID Format 1

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Call process ID approach 1	M		8.3.11.1	

8.2.1.5.2   E2SM-NI Call Process ID Format 2

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Call process ID approach 2	M		8.3.11.2	

8.2.1.6 RIC Control Header IE

This information element is part of the RIC CONTROL message sent by the Near-RT RIC to a E2 Node and is required for RIC Control Procedure.

Direction: Near-RT RIC → E2 Node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE Format				
>E2SM-NI Control Header Format 1	M		8.2.1.6.1	

8.2.1.6.1   E2SM-NI Control Header Format 1

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Network Interface Type	M		8.3.21	
Network Interface Identifier	M		8.3.22	
Network Interface Direction	M		8.3.23	
RIC Control Message Priority	O		8.3.12	

8.2.1.7 RIC Control Message IE

This information element is part of the RIC CONTROL message sent by the Near-RT RIC to a E2 Node and is required for RIC Control Procedure.

Direction: Near-RT RIC → E2 Node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE Format				
>E2SM-NI Control Message Format 1	M		8.2.1.7.1	

8.2.1.7.1   E2SM-NI Control Message Format 1

Content is encoded as per definition of network interface type indicated in the Network Interface Type IE in associated RIC Control Header IE.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Network Interface Message	M		8.3.29	

8.2.1.8 RIC Control Outcome IE

This information element is part of the RIC CONTROL ACKOWLEDGEMENT and RIC CONTROL FAILURE messages and is sent by the E2 Node to the Near-RT RIC and is required for RIC Control Procedure.

Direction: Near-RT RIC → E2 Node.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE Format				
>E2SM-NI Control Outcome Format 1	M		8.2.1.8.1	

8.2.1.8.1   E2SM-NI Control Outcome Format 1

The *E2SM-NI Control Outcome* IE Format 1 supports a sequence of RAN Parameters sent as ID/Value pairs. The meaning of the ID/Value pairs is defined in section 7.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Sequence of RAN Parameters		0..<maxofRAN parameters>		
>RAN Parameter ID	M		8.3.7	
>RAN Parameter Value	M		8.3.9	

Range bound	Explanation
maxofRANparameters	Maximum no. of RAN Parameters. Value is <255>

8.2.2 Messages for RIC Global Procedures

8.2.2.1 RAN Function Definition IE

This information element is part of the E2 SETUP REQUEST and RIC SERVICE UPDATE message sent by the RAN to a NEAR-RT RIC node and is used to provide all required information for the Near-RT RIC to determine how a given E2 Node has been configured to support a given RAN Function specific E2SM.

Direction: E2 Node $\rightarrow$ Near-RT RIC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RAN Function Name	M		8.3.2	
Sequence of Network Interface Types		1.. <maxofNItypes>		
>Network Interface Type	M		8.3.21	
>Sequence of Event trigger styles		0.. <maxofRICstyles>		
>>RIC Event Trigger Style Type	M		8.3.3	ID of Event trigger style
>>RIC Event Trigger Style Name	M		8.3.4	Name of Event trigger style
>>RIC Event Trigger Format Type	M		8.3.5	Event trigger format used by Event trigger style
>Sequence of Report styles		0.. <maxofRICstyles>		
>>RIC Report Style Type	M		8.3.3	ID of Report style
>>RIC Report Style Name	M		8.3.4	Name of Report style
>>RIC Report Action Format Type	M		8.3.5	Action definition format used by Report style
>>Sequence of RAN parameters for Action		0.. <maxofRANparameters>		RAN parameters used by Report style
>>>RAN Parameter ID	M		8.3.7	
>>>RAN Parameter Name	M		8.3.10	
>>>RAN Parameter Type	M		8.3.6	
>>RIC Indication Header Format Type	M		8.3.5	Indication header format used by Report style
>>RIC Indication Message Format Type	M		8.3.5	Indication message format used by Report style
>Sequence of Insert styles		0.. <maxofRICstyles>		
>>RIC Insert Style Type	M		8.3.3	ID of Insert style
>>RIC Insert Style Name	M		8.3.4	Name of Insert style
>>RIC Insert Action Format Type	M		8.3.5	Action definition format used by Insert style
>>Sequence of RAN parameters for Action		0.. <maxofRANparameters>		RAN parameters used by Insert style
>>>RAN Parameter ID	M		8.3.7	
>>>RAN Parameter Name	M		8.3.10	
>>>RAN Parameter Type	M		8.3.6	
>>RIC Indication Header Format Type	M		8.3.5	Indication header format used by Insert style
>>RIC Indication Message Format Type	M		8.3.5	Indication message format used by Insert style
>>RIC Call Process ID Format Type	M		8.3.5	Call Processs ID format used by Insert style
>Sequence of Control styles		0.. <maxofRICstyles>		
>>RIC Control Style Type	M		8.3.3	ID of Control style

>>RIC Control Style Name	M			8.3.4	Name of Control style
>>RIC Control Header Format Type	M			8.3.5	Control header format used by control style
>>RIC Control Message Format Type	M			8.3.5	Control message format used by control style
>>RIC Call Process ID Format Type	M			8.3.5	Call Processs ID format used by control style
>>RIC Control Outcome Format Type	M			8.3.5	Call Processs ID format used by control style
>>Sequence of RAN parameters for Control Outcome		0.. <maxofRANparameters>			RAN parameters used by Control Outcome style
>>>RAN Parameter ID	M			8.3.7	
>>>RAN Parameter Name	M			8.3.10	
>>>RAN Parameter Type	M			8.3.6	
>Sequence of Policy styles		0.. <maxofRICstyles>			
>>RIC Policy Style Type	M			8.3.3	
>>RIC Policy Style Name	M			8.3.4	
>>RIC Policy Action Format Type	M			8.3.5	Action definition format used by Policy style
>>Sequence of RAN parameters for Action		0.. <maxofRANparameters>			RAN parameters used by Policy style
>>>RAN Parameter ID	M			8.3.7	
>>>RAN Parameter Name	M			8.3.10	
>>>RAN Parameter Type	M			8.3.6	

1

Range bound	Explanation
maxofNItypes	Maximum no. of Network Interface Types supported by RAN Function <63>
maxofRICstyles	Maximum no. of Style of Report, Insert, Control or Policy actions supported by RAN Function. Value is <63>.
maxofRANparameters	Maximum no. of RAN Parameters for given style. Value is <65535>

2

3

4

8.3 Information Element definitions

8.3.1 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);

1   -   When importing bit strings from other specifications, the first bit of the bit string contains the first bit of the
2   concerned information.

8.3.2   RAN Function name

4   This IE defines the Name of a given *RAN Function Name* IE as a structured data.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RAN Function Short Name	M		PrintableString(SIZE(1..150,...))	ORAN-WG3-NI
RAN Function Service Model OID	M		PrintableString(SIZE(1..1000,...))	Object Identifier of this specific E2SM. Formatted as per OID (1.3.6.1.4.1.53148.1.2.1 for E2SM-NI)
RAN Function Description	M		PrintableString(SIZE(1..150,...))	"Network Interface"
RAN Function Instance	O		INTEGER	Default 0 assumed if absent

8.3.3   RIC Style Type

7   This IE defines the Identifier of a given *RIC Style Type* IE.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Style Type	M		INTEGER	

9   Note: Assignment of RIC Style Type values is described in section 7

8.3.4   RIC Style Name

12   This IE defines the *RIC Style Name* IE.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Style Name	M		PrintableString(SIZE(1..150,...))	

14   Note: Assignment of RIC Style Name values is described in section 7

8.3.5   RIC Format Type

17   This IE defines the Identifier of a given *RIC Format Type* IE.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RIC Format Type	M		INTEGER	

19   Note: Assignment of RIC Format Type values is described in section 7 and summarized in section 7.8.

8.3.6 RAN Parameter Type

This IE defines the RAN function specific *RAN Parameter Type* IE.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RAN Parameter Type	M		ENUMERATED (integer, enumerated, boolean, bit string, octet string, printable string…)	

8.3.7 RAN Parameter ID

This IE defines the RAN function specific *RAN parameter ID* IE.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RAN Parameter ID	M	0..maxofRANparameters	INTEGER	

Range bound	Explanation
maxofRANparameters	Maximum no. of RAN Parameter ID. Value is < 65535>

8.3.8 RAN Parameter Test Condition

This IE defines the RAN Function specific *RAN Parameter Test Condition* IE to be used to compare the particular value of a given parameter with the target value.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RAN Parameter Test Condition	M		ENUMERATED (equal, greaterthan, lessthan, contains, present, …)	

For all cases the test condition is Value (*RAN Parameter ID*) (*RAN Parameter Test Condition*) (*RAN Parameter Value*).

For example:

- If RAN Parameter Test Condition = "equal" then test condition is:
  Value (RAN Parameter ID) = (RAN Parameter Value)

- If RAN Parameter Test Condition = "greaterthan" then test condition is:
  Value (RAN Parameter ID) > (RAN Parameter Value)

8.3.9 RAN Parameter Value

This IE defines the *RAN Parameter Value* IE.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE RAN Parameter Value	M			
>INTEGER			INTEGER	
>ENUMERATED			INTEGER	
>BOOLEAN			BOOLEAN	
>BIT STRING			BIT STRING	
>OCTET STRING			OCTET STRING	
>PRINTABLE STRING			PrintableString	

8.3.10 RAN Parameter Name

This IE defines the *RAN Parameter Name* IE of a given RAN Parameter ID.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RAN Parameter Name	M		PrintableString(SIZE(1..150,...))	

8.3.11 RAN Call process ID

8.3.11.1   RAN Call process ID approach 1

This IE defines the required Call process ID approach 1.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Call process ID number			INTEGER	

8.3.11.1   RAN Call process ID approach 2

This IE defines the required Call process ID approach 2 IE.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Call process ID string			PrintableString(SIZE(1..150,…))	

8.3.12 RIC Control Message Priority

This IE defines the *RIC Control Message Priority* IE

IE/Group Name	Presence	Range	IE type and reference	Semantics description
ControlMessagePriority	M		INTEGER	

8.3.13 reserved

8.3.14 RAN UE Group ID

This IE defines the generic *RAN UE Group ID* IE

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RAN UE Group ID	M		INTEGER	

Range bound	Explanation
maxofRANueGroups	Maximum no. of RAN UE Groups. Value is <255>

8.3.15 RAN UE Group Definition

This IE defines the generic *RAN UE Group Definition* IE

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Sequence of RAN Parameters		0..<maxofRANparameters>		Defines RAN UE group
>RAN Parameter ID	M		8.3.7	
>RAN Parameter Test Condition	M		8.3.8	
>RAN Parameter Value	M		8.3.9	

Range bound	Explanation
maxofRANparameters	Maximum no. of RAN Parameter ID. Value is <255>

8.3.16 RAN Imperative Policy

This IE defines the generic *RAN Imperative Policy* IE

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Sequence of RAN Parameters		0..<maxofRAN parameters>		Defines RAN UE group
>RAN Parameter ID	M		8.3.7	
>RAN Parameter Value	M		8.3.9	

Range bound	Explanation
maxofRANparameters	Maximum no. of RAN Parameter types in action definition supported by RAN Function. Value is <255>.

8.3.17 reserved

8.3.18 reserved

8.3.19 reserved

8.3.20 reserved

8.3.21 Network Interface Type

This IE defines the Network Interface Type as a list referring to a standardized Network Interface Type.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
NetworkInterfaceType	M		ENUMERATED (S1, X2, NG, Xn, F1, E1, …)	

1   Where:

2   - S1 means S1 interface [10]

3   - X2 means X2 interface [11]

4   - NG means NG (N2) interface [12]

5   - Xn means Xn interface [13]

6   - F1 means F1 interface [14]

7   - E1 means E1 interface [15]

8

9   8.3.22 Network Interface Identifier

10
11 This IE defines the Network Interface Identifier in terms of global identifier of the network node terminating a specific network interface.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE NetworkInterfaceIdentifier	M			
>Global eNB ID			As defined in spec 3GPP 36.413 [10] section 9.2.1.37	For S1, X2
>Global en-gNB ID			As defined in spec 3GPP 36.423 [11] section 9.2.112	For X2
>Global ng-RAN ID			As defined in spec 3GPP 38.413 [12] section 9.3.1.5	For NG, Xn, F1, E1
>Global gNB-DU ID				For F1
>> Global ng-RAN ID	M		As defined in spec 3GPP 38.413 [12] section 9.3.1.5	Used as prefix to gNB-DU ID
>>gNB-DU ID	M		As defined in spec 3GPP 38.473 [14] section 9.3.1.9	For F1
>Global gNB-CU-UP ID				For E1
>> Global ng-RAN ID	M		As defined in spec 3GPP 38.413 [12] section 9.3.1.5	Used as prefix to gNB-CU-UP ID
>>gNB-CU-UP ID	M		As defined in spec 3GPP 38.463 [15] section 9.3.1.15	For E1

12

13 Notes:

14
15 - O-CU and O-CU-CP nodes terminating F1 and O-CU-CP nodes terminating E1 interfaces are identified by the associated Global RAN Node ID

16
17 - O-DU nodes terminating F1 and O-CU-UP terminating E1 interfaces are identified by the local gNB-DU-ID or gNB-CU-UP ID with a prefix Global RAN Node ID identifying logical gNB

18   8.3.23 Network Interface Direction

19 This IE defines the *Network Interface Direction* IE.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
NetworkInterfaceDirection	M		ENUMERATED (incoming, outgoing, both, …)	

20

1 ## 8.3.24 Network Interface Timestamp

2 This IE defines the NetworkInterfaceTimestamp.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
NetworkInterfaceTimestamp	M		OCTET STRING (SIZE(8))	UTC time encoded as the 64-bit timestamp format as defined in section 6 of IETF RFC 5905 [35] containing both seconds and fraction parts

3

4 ## 8.3.25 Network Interface Message Type

5
6 This IE defines the NetworkInterfaceMessageType in terms of Message Type structure data of the specific network interface.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE NetworkInterfaceMessageType	M			
>S1 message type			As defined in spec 3GPP 36.413 [10] section 9.3.1.1	For S1
>X2 message type			As defined in spec 3GPP 36.423 [11] section 9.2.13	For X2
>NG message type			As defined in spec 3GPP 38.413 [12] section 9.3.1.1	For NG
>Xn message type			As defined in spec 3GPP 38.423 [12] section 9.2.3.1	For Xn
>F1 message type			As defined in spec 3GPP 38.473 [12] section 9.3.1.1	For F1
>E1 message type			As defined in spec 3GPP 38.463 [12] section 9.3.1.1	For E1

7

8 ## 8.3.26 Message Protocol IE Identifier

9 This IE defines the MessageProtocolIE-ID

IE/Group Name	Presence	Range	IE type and reference	Semantics description
MessageProtocolIE-ID	M		INTEGER	

10

11 Notes:

12
13 - Refer to the specific target interface specification for the assignment of network interface specific Message Protocol IE Identifier

14
15 - Comon definition of type "INTEGER" has been observed to be adopted by all 3GPP interfaces and so assumed here.

16

8.3.27 Message Protocol IE Test Condition

This IE defines the network interface message protocol IE specific test condition to be used to compare the particular value of a given parameter with the target value.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
MessageProtocolIE-TestCondition	M		ENUMERATED (equal, greaterthan, lessthan, contains, present, …)	

For all cases the test condition is Value (*Message Protocol IE ID*) (*Message Protocol IE Test Condition*) (*Message Protocol IE Test Value*).

For example:

- If Message Protocol IE Test Condition = "equal" then test condition is:
  Value (Message Protocol IE ID) = (Message Protocol IE Test Value)

- If Message Protocol IE Test Condition = "greaterthan" then test condition is:
  Value (Message Protocol IE ID) > (Message Protocol IE Test Value)

8.3.28 Message Protocol IE Value

This IE defines the target value type for a particular Message Protocol IE element.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE Message Protocol IE Value	M			
>INTEGER			INTEGER	
>ENUMERATED			INTEGER	
>BOOLEAN			BOOLEAN	
>BIT STRING			BIT STRING	
>OCTET STRING			OCTET STRING	
>PRINTABLE STRING			PrintableString	

8.3.29 Network Interface Message

This IE defines the *Network Interface Message Container* IE

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Network Interface Message	M		OCTET STRING	

Note: The actual contents of the message is defined in the network interface specification.

8.4 Information Element Abstract Syntax (with ASN.1)

8.4.1 General

E2SM ASN.1 definition conforms to ITU-T Rec. X.680 [5] and ITU-T Rec. X.681 [6].

Sub clause 8.4.2 presents the Abstract Syntax of the E2SM information elements to be carried within the E2AP [3] protocol messages with ASN.1. In case there is contradiction between the ASN.1 definition in this sub clause and the tabular format in sub clause 8.2 and 8.3, the ASN.1 shall take precedence, except for the definition of conditions for the presence of conditional elements, in which the tabular format shall take precedence.

If an E2SM information element carried as an OCTET STRING in an E2AP [3] message that is not constructed as defined above is received, this shall be considered as Abstract Syntax Error, and the message shall be handled as defined for Abstract Syntax Error in clause 9.

8.4.2 Information Element definitions

```
-- ASN1START
-- ****************************************************************
-- E2SM-NI
-- Information Element Definitions
--
-- ****************************************************************

E2SM-NI-IEs {
iso(1) identified-organization(3) dod(6) internet(1) private(4) enterprise(1) 53148 e2(1) version1
(1) e2sm(2) e2sm-NI-IEs (1)}

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

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


-- ****************************************************************
-- copied from X2AP IEs v15.4.0
-- note: ie-Extensions removed
-- Note: to avoid duplicate names with XnAP, GNB-ID renamed ENGNB-ID, GlobalGNB-ID renamed
GlobalenGNB-ID
-- ****************************************************************

GlobalENB-ID ::= SEQUENCE {
    pLMN-Identity           PLMN-Identity,
    eNB-ID                  ENB-ID,
    ...
}

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))
}

GlobalenGNB-ID ::= SEQUENCE {
    pLMN-Identity           PLMN-Identity,
    gNB-ID                  ENGNB-ID,
    ...
}

ENGNB-ID ::= CHOICE {
    gNB-ID  BIT STRING (SIZE (22..32)),
    ...
}

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

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

```
1    -- copied from 38.463 v15.5.0 E1AP IEs
2    -- ****************************************************************
3    GNB-CU-UP-ID::=       INTEGER (0..68719476735)
4
5    -- ****************************************************************
6    -- copied from 38.473 v15.4.1 F1AP IEs
7    -- ****************************************************************
8    GNB-DU-ID::=          INTEGER (0..68719476735)
9
10   -- ****************************************************************
11   -- copied from 38.423 v15.5.0 XnAP IEs
12   -- note: ie-Extensions removed
13   -- note:
14   -- ****************************************************************
15   GlobalgNB-ID    ::= SEQUENCE {
16       plmn-id        PLMN-Identity,
17       gnb-id         GNB-ID-Choice,
18       ...
19   }
20   GNB-ID-Choice ::= CHOICE {
21       gnb-ID                BIT STRING (SIZE(22..32)),
22       ...
23   }
24
25
26   GlobalngeNB-ID  ::= SEQUENCE {
27       plmn-id        PLMN-Identity,
28       enb-id         ENB-ID-Choice,
29       ...
30   }
31
32   ENB-ID-Choice ::= CHOICE {
33       enb-ID-macro          BIT STRING (SIZE(20)),
34       enb-ID-shortmacro     BIT STRING (SIZE(18)),
35       enb-ID-longmacro      BIT STRING (SIZE(21)),
36       ...
37   }
38
39   GlobalNG-RANNode-ID ::= CHOICE {
40       gNB                   GlobalgNB-ID,
41       ng-eNB                GlobalngeNB-ID,
42       ...
43   }
44
45
46
47   -- ****************************************************************
48   --
49   -- copied from X2AP common data types v15.4.0
50   --
51   -- ****************************************************************
52
53   maxProtocolIEs        INTEGER ::= 65535
54
55   Criticality      ::= ENUMERATED { reject, ignore, notify }
56
57   Presence         ::= ENUMERATED { optional, conditional, mandatory }
58
59   ProcedureCode    ::= INTEGER (0..255)
60
61   ProtocolIE-ID    ::= INTEGER (0..maxProtocolIEs)
62
63
64
65   -- ****************************************************************
66   --
67   -- Lists
68   --
69   -- ****************************************************************
70
71   maxofInterfaceProtocolTests          INTEGER ::= 15
72   maxofRANueGroups                     INTEGER ::= 255
73   maxofActionParameters                INTEGER ::= 255
74   maxofRANparameters                   INTEGER ::= 65535
75   maxofNItypes                         INTEGER ::= 63
76   maxofRICstyles                       INTEGER ::= 63
77
```

```
1   -- ************************************************************
2   -- E2SM-NI Service model IEs
3   -- ************************************************************
4
5   -- ----------------------------------------------------
6   -- Event Trigger Definition OCTET STRING contents
7   -- ----------------------------------------------------
8
9   -- E2SM-NI-EventTriggerDefinition IE
10  E2SM-NI-EventTriggerDefinition ::= CHOICE{
11      eventDefinition-Format1     E2SM-NI-EventTriggerDefinition-Format1,
12      ...
13  }
14
15  -- E2SM-NI-EventTriggerDefinition IE is used for Event Trigger Definition Format 1
16  E2SM-NI-EventTriggerDefinition-Format1 ::= SEQUENCE{
17      interface-type              NI-Type,
18      interface-ID                NI-Identifier,
19      interfaceDirection          NI-Direction,
20      interfaceMessageType        NI-MessageType,
21      interfaceProtocolIE-List    SEQUENCE (SIZE(1..maxofInterfaceProtocolTests)) OF NI-ProtocolIE-
22  Item OPTIONAL,
23      ...
24  }
25
26  -- ----------------------------------------------------
27  -- Action Definition OCTET STRING contents
28  -- ----------------------------------------------------
29  -- E2SM-NI-ActionDefinition IE
30  E2SM-NI-ActionDefinition ::= SEQUENCE{
31      ric-Style-Type              RIC-Style-Type,
32      action-Definition-Format    E2SM-NI-ActionDefinitionFormat,
33      ...
34  }
35
36  E2SM-NI-ActionDefinitionFormat ::= CHOICE{
37      actionDefinition-Format1        E2SM-NI-ActionDefinition-Format1,
38      actionDefinition-Format2        E2SM-NI-ActionDefinition-Format2,
39      ...
40  }
41
42  -- E2SM-NI-ActionDefinition IE is used for Action Format 1
43  E2SM-NI-ActionDefinition-Format1 ::= SEQUENCE{
44      actionParameter-List        SEQUENCE (SIZE(1..maxofActionParameters)) OF RANparameter-Item
45  OPTIONAL,
46      ...
47  }
48
49
50  -- E2SM-NI-ActionDefinition IE is used for Action Format 2
51  E2SM-NI-ActionDefinition-Format2 ::= SEQUENCE{
52      ranUEgroup-List             SEQUENCE (SIZE(1..maxofRANueGroups)) OF RANueGroup-Item OPTIONAL,
53      ...
54  }
55
56  -- ----------------------------------------------------
57  -- Indication Header OCTET STRING contents
58  -- ----------------------------------------------------
59
60  -- E2SM-NI-IndicationHeader IE
61  E2SM-NI-IndicationHeader ::= CHOICE{
62      indicationHeader-Format1        E2SM-NI-IndicationHeader-Format1,
63      ...
64  }
65
66  -- E2SM-NI-IndicationHeader Format 1
67  E2SM-NI-IndicationHeader-Format1 ::= SEQUENCE{
68      interface-type              NI-Type,
69      interface-ID                NI-Identifier,
70      interfaceDirection          NI-Direction,
71      timestamp                   NI-TimeStamp OPTIONAL,
72      ...
73  }
74
75  -- ----------------------------------------------------
76  -- Indication Message OCTET STRING contents
77  -- ----------------------------------------------------
```

```
-- E2SM-NI-IndicationMessage IE
E2SM-NI-IndicationMessage ::= CHOICE{
    indicationMessage-Format1      E2SM-NI-IndicationMessage-Format1,
    ...
}


-- E2SM-NI-IndicationMessage IE
E2SM-NI-IndicationMessage-Format1 ::= SEQUENCE{
    interfaceMessage            NI-Message,
    ...
}


-- -------------------------------------------------
-- Call Process ID
-- -------------------------------------------------


E2SM-NI-CallProcessID ::= CHOICE{
    callProcessID-Format1      E2SM-NI-CallProcessID-Format1,
    callProcessID-Format2      E2SM-NI-CallProcessID-Format2,
    ...
}
-- E2SM-NI-callProcessID IE Format 1

E2SM-NI-CallProcessID-Format1 ::= SEQUENCE{
    callProcess-ID          RANcallProcess-ID-number,
    ...
}

E2SM-NI-CallProcessID-Format2 ::= SEQUENCE{
    callProcess-ID          RANcallProcess-ID-string,
    ...
}


-- -------------------------------------------------
-- Control Header OCTET STRING contents
-- -------------------------------------------------


-- E2SM-NI-ControlHeader IE
E2SM-NI-ControlHeader ::= CHOICE{
    controlHeader-Format1      E2SM-NI-ControlHeader-Format1,
    ...
}
-- E2SM-NI-ControlHeader Format 1
E2SM-NI-ControlHeader-Format1 ::= SEQUENCE{
    interface-type                NI-Type,
    interface-ID                  NI-Identifier,
    interface-Direction           NI-Direction,
    ric-Control-Message-Priority  RIC-Control-Message-Priority   OPTIONAL,
    ...
}


-- -------------------------------------------------
-- Control Message OCTET STRING contents
-- -------------------------------------------------


-- E2SM-NI-ControlHeader IE
E2SM-NI-ControlMessage ::= CHOICE{
    controlMessage-Format1      E2SM-NI-ControlMessage-Format1,
    ...
}

-- E2SM-NI-ControlMessage Format 1
E2SM-NI-ControlMessage-Format1 ::= SEQUENCE{
    interfaceMessage            NI-Message,
    ...
}

-- -------------------------------------------------
-- Control Outcome OCTET STRING contents
-- -------------------------------------------------


-- E2SM-NI-ControlOutcome IE
E2SM-NI-ControlOutcome ::= CHOICE{
    controlOutcome-Format1      E2SM-NI-ControlOutcome-Format1,
    ...
```

```
}

-- E2SM-NI-ControlOutcome Format 1
E2SM-NI-ControlOutcome-Format1 ::= SEQUENCE{
    outcomeElement-List     SEQUENCE (SIZE(1..maxofRANparameters)) OF RANparameter-Item OPTIONAL,
    ...
}


-- --------------------------------------------------
-- RAN Function Description OCTET STRING contents
-- --------------------------------------------------

-- E2SM-NI-RANfunction-Description
E2SM-NI-RANfunction-Description ::= SEQUENCE{
    ranFunction-Name    RANfunction-Name,
    ni-Type-List        SEQUENCE (SIZE(1..maxofNItypes)) OF E2SM-NI-RANfunction-Item OPTIONAL,
    ...
}

E2SM-NI-RANfunction-Item ::= SEQUENCE{
    interface-type          NI-Type,
    ric-EventTriggerStyle-List  SEQUENCE (SIZE(1..maxofRICstyles)) OF RIC-EventTriggerStyle-List
OPTIONAL,
    ric-ReportStyle-List        SEQUENCE (SIZE(1..maxofRICstyles)) OF RIC-ReportStyle-List OPTIONAL,
    ric-InsertStyle-List        SEQUENCE (SIZE(1..maxofRICstyles)) OF RIC-InsertStyle-List OPTIONAL,
    ric-ControlStyle-List       SEQUENCE (SIZE(1..maxofRICstyles)) OF RIC-ControlStyle-List
OPTIONAL,
    ric-PolicyStyle-List        SEQUENCE (SIZE(1..maxofRICstyles)) OF RIC-PolicyStyle-List OPTIONAL,
    ...
}

-- --------------------------------------------------
-- commmon IEs
-- --------------------------------------------------

-- A
-- B
-- C
-- D
-- E
-- F
-- G
Global-eNB-ID ::=       GlobalENB-ID
Global-en-gNB-ID ::=    GlobalenGNB-ID
Global-gNB-DU-ID ::=    SEQUENCE{
    global-ng-RAN-ID    Global-ng-RAN-ID,
    gNB-DU-ID           GNB-DU-ID
    }

Global-gNB-CU-UP-ID ::= SEQUENCE{
    global-ng-RAN-ID    Global-ng-RAN-ID,
    gNB-CU-UP-ID        GNB-CU-UP-ID
    }

Global-ng-RAN-ID ::=    GlobalNG-RANNode-ID
-- H
-- I
-- J
-- K
-- L
-- M
-- N
NI-Direction ::= ENUMERATED{
    incoming,
    outgoing,
    both,
    ...
}


NI-Identifier ::= CHOICE{
    global-eNB-ID           Global-eNB-ID,
    global-en-gNB-ID        Global-en-gNB-ID,
    global-ng-RAN-ID        Global-ng-RAN-ID,
    global-gNB-DU-ID        Global-gNB-DU-ID,
    global-gNB-CU-UP-ID     Global-gNB-CU-UP-ID,
```

```
...
}



NI-Message ::= OCTET STRING

NI-MessageType::= CHOICE{
    s1MessageType   NI-MessageTypeS1,
    x2MessageType   NI-MessageTypeX2,
    ngMessageType   NI-MessageTypeNG,
    xnMessageType   NI-MessageTypeXn,
    f1MessageType   NI-MessageTypeF1,
    e1MessageType   NI-MessageTypeE1,
    ...
}

NI-MessageTypeS1 ::= NI-MessageTypeApproach1
NI-MessageTypeX2 ::= NI-MessageTypeApproach1
NI-MessageTypeNG ::= NI-MessageTypeApproach1
NI-MessageTypeXn ::= NI-MessageTypeApproach1
NI-MessageTypeF1 ::= NI-MessageTypeApproach1
NI-MessageTypeE1 ::= NI-MessageTypeApproach1

NI-MessageTypeApproach1 ::= SEQUENCE {
    procedureCode  ProcedureCode,
    typeOfMessage  TypeOfMessage,
    ...
}

TypeOfMessage   ::= ENUMERATED { nothing, initiating-message, successful-outcome, unsuccessful-
outcome }


NI-ProtocolIE-Item ::= SEQUENCE{
    interfaceProtocolIE-ID      NI-ProtocolIE-ID,
    interfaceProtocolIE-Test    NI-ProtocolIE-Test,
    interfaceProtocolIE-Value   NI-ProtocolIE-Value,
    ...
}

NI-ProtocolIE-ID ::= ProtocolIE-ID

NI-ProtocolIE-Test ::= ENUMERATED{
    equal,
    greaterthan,
    lessthan,
    contains,
    present,
    ...
}

NI-ProtocolIE-Value ::= CHOICE{
    valueInt    INTEGER,
    valueEnum   INTEGER,
    valueBool   BOOLEAN,
    valueBitS   BIT STRING,
    valueOctS   OCTET STRING,
    valuePrtS   PrintableString,
    ...
}

NI-TimeStamp ::= OCTET STRING (SIZE(8))

NI-Type ::= ENUMERATED{
    s1,
    x2,
    ng,
    xn,
    f1,
    e1,
    ...
}

-- O
-- P
-- Q
```

```
1    -- R
2
3    RANcallProcess-ID-number  ::= INTEGER
4
5    RANcallProcess-ID-string  ::= PrintableString(SIZE(1..150,...))
6
7    RANfunction-Name ::= SEQUENCE{
8        ranFunction-ShortName       PrintableString(SIZE(1..150,...)),
9        ranFunction-E2SM-OID        PrintableString(SIZE(1..1000,...)),
10       ranFunction-Description     PrintableString(SIZE(1..150,...)),
11       ranFunction-Instance        INTEGER OPTIONAL,
12       ...
13   }
14
15
16   RANimperativePolicy ::= SEQUENCE{
17       ranImperativePolicy-List        SEQUENCE (SIZE(1..maxofRANparameters)) OF RANparameter-Item
18   OPTIONAL,
19       ...
20   }
21
22   RANparameter-Item ::= SEQUENCE {
23       ranParameter-ID        RANparameter-ID,
24       ranParameter-Value     RANparameter-Value,
25       ...
26   }
27
28   RANparameterDef-Item ::= SEQUENCE {
29       ranParameter-ID        RANparameter-ID,
30       ranParameter-Name      RANparameter-Name,
31       ranParameter-Type      RANparameter-Type,
32       ...
33   }
34
35   RANparameter-ID ::= INTEGER (0..maxofRANparameters)
36
37   RANparameter-Name ::= PrintableString(SIZE(1..150,...))
38
39   RANparameter-Test-Condition ::= ENUMERATED{
40       equal,
41       greaterthan,
42       lessthan,
43       contains,
44       present,
45       ...
46   }
47
48   RANparameter-Type ::= ENUMERATED{
49       integer,
50       enumerated,
51       boolean,
52       bit-string,
53       octet-string,
54       printable-string,
55       ...
56   }
57
58   RANparameter-Value ::= CHOICE{
59       valueInt    INTEGER,
60       valueEnum   INTEGER,
61       valueBool   BOOLEAN,
62       valueBitS   BIT STRING,
63       valueOctS   OCTET STRING,
64       valuePrtS   PrintableString,
65       ...
66   }
67
68
69   RANueGroupID ::= INTEGER (0..maxofRANueGroups)
70
71   RANueGroup-Item ::= SEQUENCE {
72       ranUEgroupID             RANueGroupID,
73       ranUEgroupDefinition     RANueGroupDefinition,
74       ranPolicy                RANimperativePolicy,
75       ...
76   }
77
```

```
RANueGroupDefinition ::= SEQUENCE{
    ranUEgroupDef-List      SEQUENCE (SIZE(1..maxofRANparameters)) OF RANueGroupDef-Item OPTIONAL,
    ...
}


RANueGroupDef-Item ::= SEQUENCE{
    ranParameter-ID     RANparameter-ID,
    ranParameter-Test   RANparameter-Test-Condition,
    ranParameter-Value  RANparameter-Value,
    ...
}

RIC-Control-Message-Priority ::= INTEGER


RIC-ControlStyle-List ::= SEQUENCE{
    ric-ControlStyle-Type               RIC-Style-Type,
    ric-ControlStyle-Name               RIC-Style-Name,
    ric-ControlFormat-Type              RIC-Format-Type,
    ric-ControlHeaderFormat-Type        RIC-Format-Type,
    ric-ControlMessageFormat-Type       RIC-Format-Type,
    ric-CallProcessIDFormat-Type        RIC-Format-Type,
    ric-ControlOutcomeFormat-Type       RIC-Format-Type,
    ric-ControlOutcomeRanParaDef-List   SEQUENCE (SIZE(1..maxofRANparameters)) OF RANparameterDef-
Item,
    ...
}

RIC-EventTriggerStyle-List ::= SEQUENCE{
    ric-EventTriggerStyle-Type          RIC-Style-Type,
    ric-EventTriggerStyle-Name          RIC-Style-Name,
    ric-EventTriggerFormat-Type         RIC-Format-Type,
    ...
}
RIC-InsertStyle-List ::= SEQUENCE{
    ric-InsertStyle-Type                RIC-Style-Type,
    ric-InsertStyle-Name                RIC-Style-Name,
    ric-InsertActionFormat-Type         RIC-Format-Type,
    ric-InsertRanParameterDef-List      SEQUENCE (SIZE(1..maxofRANparameters)) OF RANparameterDef-
Item,
    ric-IndicationHeaderFormat-Type     RIC-Format-Type,
    ric-IndicationMessageFormat-Type    RIC-Format-Type,
    ric-CallProcessIDFormat-Type        RIC-Format-Type,
    ...
}
RIC-PolicyStyle-List ::= SEQUENCE{
    ric-PolicyStyle-Type                RIC-Style-Type,
    ric-PolicyStyle-Name                RIC-Style-Name,
    ric-PolicyActionFormat-Type         RIC-Format-Type,
    ric-PolicyRanParameterDef-List      SEQUENCE (SIZE(1..maxofRANparameters)) OF RANparameterDef-
Item,
    ...
}

RIC-ReportStyle-List ::= SEQUENCE{
    ric-ReportStyle-Type                RIC-Style-Type,
    ric-ReportStyle-Name                RIC-Style-Name,
    ric-ReportActionFormat-Type         RIC-Format-Type,
    ric-ReportRanParameterDef-List      SEQUENCE (SIZE(1..maxofRANparameters)) OF RANparameterDef-
Item,
    ric-IndicationHeaderFormat-Type     RIC-Format-Type,
    ric-IndicationMessageFormat-Type    RIC-Format-Type,
    ...
}


RIC-Format-Type ::= INTEGER

RIC-Style-Type ::= INTEGER

RIC-Style-Name ::= PrintableString(SIZE(1..150,...))


-- S
-- T
```

```
1  -- U
2  -- V
3  -- W
4  -- X
5  -- Y
6  -- Z
7
8  END
9  -- ASN1STOP
10
11
```

8.5 Message transfer syntax

E2SM shall use the ASN.1 Basic Packed Encoding Rules (BASIC-PER) Aligned Variant as transfer syntax, as specified in ITU-T Rec. X.691 [7].

9 Handling of Unknown, Unforeseen and Erroneous Protocol Data

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

Annex A: Further information on RAN Function Network Interface

A.1 Background information

The RAN function "Network Interface" is used to provide RIC Service expose of the network interface logical function of the E2 Node.

It is assumed that the network interfaces are terminated on one of more logical functions with the E2 Node. For each logical function the E2 Node shall use the RAN Function Description to declare the list of supported Network Interfaces and the corresponding set of supported RIC Services (**REPORT**, **INSERT**, **CONTROL** and **POLICY**) and for each supported RIC Service the list of supported Styles.

Each Network Interface is uniquely identified by:

-   Network Interface Type defined by reference to the name of the interface specification (S1, F1, etc.)

-   Network Interface Identifier defined by the Global identifier of the network node terminating the network interface

Furthermore, it is assumed that a given network interface id bidirectional and so has an incoming direction terminated by the E2 Node and an outgoing direction originated by the E2 Node.

Messages on the network interface are assumed to be encoded in terms of Message Types and each message is assumed to contain one or more Protocol Information Elements (IE) each of which may de identified by the unique Protocol IE Identifier as defined in the corresponding network interface specification.

Event triggers, Indication and Control procedure message contents and Policy Action Definitions are encoded in terms of the corresponding network interface specification.

A.2 X2 Network Interface

The RAN function "Network Interface" on an E2 Node of type eNB, gNB, gNB-CU and gNB-CU-CP may be used to expose the X2AP (X2c) interface.

Editor's note:
List here the specific use cases with corresponding messages and actions that may be exposed for the X2 interface.

A.2.1 Message Admission policy handling

Use Case	RIC Service	Semantics description
EN-DC Admission Control	E2 POLICY Style 1 on E2 Node of type en-gNB	Event Trigger Definition type 1 = Incoming X2 SgNB Addition Request from eNB RAN UE Group Definition = AND combination of sequence of RAN Parameter tests RAN Imperative Policy = Sequence of RAN parameters used to enhance RAN admission algorithm Negative outcome results in EN-DC SgNB Addition Rejection message sent to eNB and incoming message dropped.

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