O-RAN Working Group 3
Near-Real-time RAN Intelligent Controller
E2 Service Model (E2SM)

This is a re-published version of the attached final specification.

For this re-published version, the prior versions of the IPR Policy will apply, except that the previous requirement for Adopters (as defined in the earlier IPR Policy) to agree to an O-RAN Adopter License Agreement to access and use Final Specifications shall no longer apply or be required for these Final Specifications after 1st July 2022.

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1 Revision History

Date	Revision	Description
2020.01.22	01.00.00	Specification renamed v.01.00.00 for approval
2020.07.09	01.00.01	Inclusion of agreed CR "E2SM Change to Annex A layout"
2020.07.10	01.00.02	Clarification in table 7.8-2 within the embedded example document Reference corrected in table in 8.2.2.1
2020.07.15	v01.01	Incremented version for Publication
2021.05.28	v02.00.01	Inclusion of CR agreed at WG3#99 < NOK.AO-2021.05.05-WG3-CR-0001-E2SM+common+IEs-v01 >. Endorsed as WG3#100
2021.07.07	v02.00.02	Adopted INT.AO-CR-0010.
2021.08.10	v02.00	TSC approved
2021.11.09	V02.01.01	Inclusion of CR agreed at WG3#117 <RSYS-2021.10.05-WG3-CR-0001-E2SM-Common-Correction for UEID and NRARFCN_v0.5> Alignment of copyright notice
2021.11.22	V02.01.02	Corrections based on WG3 review comments during WG3 approval process
2022.02.07	V02.01	Version ready for Nov21 publication

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Contents

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 describes the O-RAN specified RAN Function-specific Service Models supported over E2 (E2SM) and presents a recommended layout for additional E2SM specifications 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.WG3.E2GAP, "O-RAN Working Group 3, Near-Real-time RAN Intelligent Controller, Architecture & E2 General Aspects and Principles (E2GAP)"

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

[4]   ORAN Working Group 3, Near-Real-time RAN Intelligent Controller, E2 Service Model, Network Interface (E2SM-NI).

[5]   ORAN WG3, O-RAN Working Group 3, Near-Real-time RAN Intelligent Controller, E2 Service Model, KPI Monitor (E2SM-KPM).

[6]   3GPP TS 38.413: "NG-RAN; NG Application Protocol (NGAP)".

[7]   3GPP TS 38.423: "NG-RAN; Xn Application Protocol (XnAP)".

[8]   3GPP TS 38.473: "NG-RAN; F1 Application Protocol (F1AP)".

[9]   3GPP TS 38.463: "NG-RAN; E1 Application Protocol (E1AP)".

[10]   3GPP TS 36.413: "E-UTRAN; S1 Application Protocol (S1AP)"

[11]   3GPP TS 36.423: "E-UTRAN; X2 Application Protocol (X2AP)".

[12]   3GPP TS 37.473: "W1 interface; Application Protocol (W1AP)".

[13]   3GPP TR 25.921: "Guidelines and principles for protocol description and error handling".

[14]   3GPP TS 36.331: "E-UTRA; Radio Resource Control (RRC) Protocol Specification".

[15]   3GPP TS 38.331: "NR; Radio Resource Control (RRC) Protocol Specification".

[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".

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: as defined in E2GAP [2]

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply. See E2GAP [2] for additional E2 related abbreviations.

(void)

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 the E2SM series of specifications is to define the recommended approach that a given RAN Function specific E2 Service Model would use to define the contents of these fields.

In the current version of the specifications, the following O-RAN specified E2 Service Models are supported:

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Table 5-1: O-RAN specified E2 Service Models and related OIDs

E2SM short name	OID	Scope
E2SM-NI	iso(1) identified-organization(3) dod(6) internet(1) private(4) enterprise(1) 53148 e2(1) version1 (1) e2sm(2) e2sm-NI-IEs (1)	RAN Function NI "Network Interface" 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
E2SM-KPM version1	iso(1) identified-organization(3) dod(6) internet(1) private(4) enterprise(1) 53148 e2(1) version1 (1) e2sm(2) e2sm-KPM-IEs (2)	RAN function KPM "KPM Monitor" performs the following functionalities: - Exposure of O-DU's cell related performance IEs through periodic KPM Report. - Exposure of O-CU-CP's cell/UE related performance IEs through periodic KPM Report. - Exposure of O-CU-UP's bearer related performance IEs through periodic KPM Report
E2SM-KPM version2	iso(1) identified-organization(3) dod(6) internet(1) private(4) enterprise(1) 53148 e2(1) version2 (2) e2sm(2) e2sm-KPM-IEs (2)	RAN function KPM "KPM Monitor" performs the following functionalities: - Exposure of available measurements from O-DU, O-CU-CP, and/or O-CU-UP via the RAN Function Definition IE. - Periodic reporting of measurements subscribed from Near-RT RIC.
E2SM-RC	iso(1) identified-organization(3) dod(6) internet(1) private(4) enterprise(1) 53148 e2(1) version1 (1) e2sm(2) e2sm-RC-IEs (3)	RAN function RC "RAN Control" performs the following functionalities: - Exposure of RAN control and UE context related information. - Modification and initiation of RAN control related call processes and messages - Execution of policies that may result in change of RAN control behavior

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6 Common Elements for E2SM Service Models

6.1 General

Sub clause 6.2 presents the individual information elements that may be adopted by any specific E2SM including the specifications listed in table 5-1. Sub clause 6.3 provides the corresponding ASN.1 definition of each information element, this module may be associated with the ASN.1 definitions in a specific E2SM specification using the ASN.1 "Import" instruction.

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 [13].

6.2 Information Element definitions

6.2.1 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);

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

6.2.2 E2SM common IEs

6.2.2.1 RAN Function Name

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,...))	Suitable unique short name
RAN Function Service Model OID	M		PrintableString(SIZE(1..1000,...))	Object Identifier of this specific E2SM. Formatted as per OID
RAN Function Description	M		PrintableString(SIZE(1..150,...))	Suitable text describing scope of E2SM
RAN Function Instance	O		INTEGER	Suggested when E2 Node declares multiple RAN Function ID supporting the same E2SM specification

6.2.2.2 RIC Style Type

This IE defines the identifier of a given RIC Style.

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

6.2.2.3 RIC Style Name

This IE defines the name of a given RIC Style.

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

6.2.2.4 RIC Format Type

This IE defines the identifier of a given RIC Format.

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

6.2.2.5 Cell Global ID

This IE is used to globally identify a cell in an E2 Node. The IE is derived from TS 38.423 [7] clause 9.2.3.25 "Target Cell Global ID".

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE *RAT type*	M			
>*NR*				
>>NR CGI	M		6.2.3.7	
>*E-UTRA*				
>>E-UTRA CGI	M		6.2.3.11	

6.2.2.6 UE ID

This IE contains the O-RAN agreed UE ID data structure to be used on E2 interface.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE *UEID case*	M			
>gNB				E2 Node of type gNB when connected to 5GC
>>AMF UE NGAP ID	M		6.2.3.16	
>>GUAMI	M		6.2.3.17	
>>gNB-CU UE F1AP ID List	C-ifCUDUseparated			More than 1 F1AP ID shall be reported by E2 Node only when NR-DC is established.
>>>gNB-CU UE F1AP ID Item		*1 .. <maxF1APId>*		
>>>>gNB-CU UE F1AP ID	M		6.2.3.21	
>>gNB-CU-CP UE E1AP ID List	C-ifCPUPseparated			
>>>gNB-CU-CP UE E1AP ID Item		*1 .. <maxE1APId>*		
>>>>gNB-CU-CP UE E1AP ID	M		6.2.3.20	
>>RAN UE ID	O		6.2.3.25	
>>M-NG-RAN node UE XnAP ID	C-ifDCSetup		6.2.3.19	To be reported by both MN and SN
>>Global gNB ID	O		6.2.3.3	This IE shall not be used. *Global NG-RAN Node ID* IE shall replace this IE
>>Global NG-RAN Node ID	C-ifDCSetup		6.2.3.2	To be reported only by SN
>gNB-DU / en-gNB-DU				E2 node of type gNB-DU
>>gNB-CU UE F1AP ID	M		6.2.3.21	
>>RAN UE ID	O		6.2.3.25	
>gNB-CU-UP / en-gNB-CU-UP				E2 node of type gNB-CU-UP
>>gNB-CU-CP UE E1AP ID	M		6.2.3.20	
>>RAN UE ID	O		6.2.3.25	
>ng-eNB				E2 Node of type ng-eNB when connected to 5GC
>>AMF UE NGAP ID	M		6.2.3.16	
>>GUAMI	M		6.2.3.17	
>>ng-eNB-CU UE W1AP ID	C-ifCUDUseparated		6.2.3.22	
>>M-NG-RAN node UE XnAP ID	C-ifDCSetup		6.2.3.19	To be reported by both MN and SN.
>>Global ng-eNB ID	O		6.2.3.8	This IE shall not be used. *Global NG-RAN Node ID* IE shall replace this IE
>>Global NG-RAN Node ID	C-ifDCSetup		6.2.3.2	To be reported only by SN
>ng-eNB-DU				E2 node of type ng-eNB-DU
>> ng-eNB-CU UE W1AP ID	M		6.2.3.22	
>en-gNB				E2 Node of type en-gNB when connected to EPC and EN-DC is established
>>MeNB UE X2AP ID	M		6.2.3.23	
>>MeNB UE X2AP ID Extension	O		6.2.3.24	
>>Global eNB ID	M		6.2.3.9	
>>gNB-CU UE F1AP ID	C-ifCUDUseperated		6.2.3.21	

>>gNB-CU-CP UE E1AP ID List	C-ifCPUPsep arated			
>>>gNB-CU UE E1AP ID Item		*1 .. <maxE1APId >*		
>>>>gNB-CU-CP UE E1AP ID	M		6.2.3.20	
>> RAN UE ID	O		6.2.3.25	
>eNB				E2 Node of type eNB when connected to EPC.
>>MME UE S1AP ID	M		6.2.3.26	
>>GUMMEI	M		6.2.3.18	
>>MeNB UE X2AP ID	C-ifDCSetup		6.2.3.23	To be reported by MeNB and SeNB.
>>MeNB UE X2AP ID Extension	C-ifDCSetup		6.2.3.24	To be reported by MeNB and SeNB.
>>Global eNB ID	C-ifDCSetup		6.2.3.9	To be reported only by SeNB.

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Range bound	Explanation
maxF1APId	Maximum number of F1AP UEID for a NR-NR DC is 4
maxE1APId	Maximum number of E1AP UEID for UE connected with different CU-UP is 65535

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Condition	Explanation
ifDCSetup	This IE shall be present in messages from E2 Node to NearRT-RIC if DC is established, whereas from NearRT-RIC to E2 Node messages, this IE may not be included
ifCUDUseparated	This IE shall be present in messages from E2 Node to NearRT-RIC for a CU-DU separated ng-eNB or (en-)gNB, whereas from NearRT-RIC to E2 Node messages, this IE may not be included.
ifCPUPseparated	This IE shall be present in messages from E2 Node to NearRT-RIC for a CP-UP separated (en-)gNB, whereas from NearRT-RIC to E2 Node messages, this IE may not be included.

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6.2.2.7 Group ID

5 This IE defines a generic "Group ID" suitable for both EPC and 5GC networks.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE *Core type*	M			
>5GC				
>>IRFSP	M		6.2.3.27	
>EPC				
>>SPID	M		6.2.3.28	

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6.2.2.8 Core CP ID

8 This IE defines a generic "Core CP ID" suitable for both EPC and 5GC networks.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE *Core type*	M			
>5GC				
>>GUAMI	M		6.2.3.17	
>EPC				
>>GUMMEI	M		6.2.3.18	

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1 ## 6.2.2.9 QoS ID

2 This IE defines a generic "QoS ID" suitable for both EPC and 5GC networks.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE *Core type*	M			
>*5GC*				
>>5QI	M		6.2.3.13	
>*EPC*				
>>QCI	M		6.2.3.14	

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4 ## 6.2.2.10   Network Interface Type

5 This IE defines the type of a standardized Network Interface.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Interface Type	M		ENUMERATED (NG, Xn, F1, E1, S1, X2, W1, …)	NG refers to NG interface [6] Xn refers to Xn interface [7] F1 refers to F1 interface [8] E1 refers to E1 interface [9] S1 refers to S1 interface [10] X2 refers to X2 interface [11] W1 refers to W1 interface [12]

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7 ## 6.2.2.11   Network Interface Identifier

8 This IE defines the identifier of the network node terminating a specific network interface.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE *Interface Identifier*	M			
>*NG*				For interface type NG [6]
>>GUAMI	M		6.2.3.17	
>*Xn*				For interface type Xn [7]
>>Global NG-RAN Node ID	M		6.2.3.2	
>*F1*				For interface type F1 [8]
>>Global gNB ID	M		6.2.3.2	
>>gNB-DU ID	M		6.2.3.6	
>*E1*				For interface type E1 [9]
>>Global gNB ID	M		6.2.3.2	
>>gNB-CU-UP ID	M		6.2.3.5	
>*S1*				For interface type S1 [10]
>>GUMMEI	M		6.2.3.18	
>*X2*				For interface type X2 [11]
>>**CHOICE** *Node Type*	M			
>>>Global eNB ID			6.2.3.9	For eNB
>>>Global en-gNB ID			6.2.3.4	For en-gNB
>*W1*				For interface type W1 [12]
>>Global ng-eNB ID	M		6.2.3.8	
>>ng-eNB-DU ID	M		6.2.3.10	

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1 ## 6.2.2.12   Network Interface Message ID

2 This IE defines the identifier for a specific message of a given Network Interface.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Interface Procedure ID	M		INTEGER	Elementary Procedure Code
Message Type	M		ENUMERATED (InitiatingMessage, SuccessfulOutcome, UnsuccessfulOutcome, …)	

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4 ## 6.2.2.13   RRC Message ID

5 This IE defines the identifier for a specific RRC message defined in either TS 36.331 [14] or TS 38.331 [15].

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IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE *RRC Type*	M			
>*LTE*				
>>LTE RRC Class	M		ENUMERATED (BCCH-BCH, BCCH-BCH-MBMS, BCCH-DL-SCH, BCCH-DL-SCH-BR, BCCH-DL-SCH-MBMS, MCCH, PCCH, DL-CCCH, DL-DCCH, UL-CCCH, UL-DCCH, SC-MCCH, …)	Refers to RRC message class defined in TS 36.331 [14] clause 6.2.1.
>*NR*				
>>NR RRC Class	M		ENUMERATED (BCCH-BCH, BCCH-DL-SCH, DL-CCCH, DL-DCCH, PCCH, UL-CCCH, UL-CCCH1, UL-DCCH, …)	Refers to RRC message class defined in TS 38.331 [15] clause 6.2.1.
RRC Message ID	M		INTEGER	Number starts from 0 from the first entry of a given RRC message class defined in TS 36.331 [14] or TS 38.331 [15].

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9 ## 6.2.2.14   Serving Cell PCI

10 This IE is used to identify the serving cell PCI in an E2 Node. The IE is derived from TS 38.473 [8] clause 9.3.1.10 and
11 TS 36.423 [11] clause 9.2.8.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE *RAT type*	M			
>*NR*				
>>NR PCI	M		6.2.3.29	
>*E-UTRA*				
>>E-UTRA PCI	M		6.2.3.32	

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13 ## 6.2.2.15   Serving Cell ARFCN

14 This IE is used to identify the serving cell ARFCN in an E2 Node. The IE is derived from TS 38.473 [8] clause 9.3.1.17
15 and TS 36.423 [11] clause 9.2.26.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE *RAT type*	M			
>*NR*				
>>NR ARFCN	M		6.2.3.30	
>*E-UTRA*				
>>EARFCN	M		6.2.3.33	

6.2.3   3GPP derived IEs

6.2.3.1 PLMN Identity

This IE indicates the PLMN Identity.

Derived from 3GPP TS 38.413 [6] clause 9.3.3.5.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
PLMN Identity	M		OCTET STRING (SIZE(3))	Defined in TS 38.413 [6] clause 9.3.3.5.

6.2.3.2 Global NG-RAN Node ID

This IE is used to globally identify an NG-RAN node of gNB and ng-eNB cases only.

Derived from 3GPP TS 38.423 [7] clause 9.2.2.3.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE *NG-RAN node*	M			
>*gNB*				
>>Global gNB ID	M		6.2.3.3	
>*ng-eNB*				
>>Global ng-eNB ID	M		6.2.3.8	

6.2.3.3 Global gNB ID

This IE is used to globally identify a gNB.

Derived from TS 38.413 [6] clause 9.3.1.6.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
PLMN Identity	M		6.2.3.1	
CHOICE *gNB ID*	M			
>*gNB ID*				
>>gNB ID	M		BIT STRING (SIZE(22..32))	Defined in TS 38.413 [6] clause 9.3.1.6.

6.2.3.4 Global en-gNB ID

This IE is used to globally identify an en-gNB.

Derived from TS 36.423 [11] clause 9.2.112.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
PLMN Identity	M		6.2.3.1	
CHOICE *en-gNB ID*	M			
>*en-gNB ID*				
>>en-gNB ID	M		BIT STRING (SIZE(22..32))	Defined in TS 36.423 [11] clause 9.2.112.

6.2.3.5 gNB-CU-UP ID

This IE uniquely identifies the gNB-CU-UP at least within a gNB-CU-CP.

Derived from TS 38.463 [9] clause 9.3.1.15.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
gNB-CU-UP ID	M		INTEGER $(0 .. 2^{36}-1)$	Defined in TS 38.463 [9] clause 9.3.1.15.

6.2.3.6 gNB-DU ID

This IE uniquely identifies the gNB-DU at least within a gNB-CU.

Derived from TS 38.473 [8] clause 9.3.1.9.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
gNB-DU ID	M		INTEGER $(0 .. 2^{36}-1)$	Defined in TS 38.473 [8] clause 9.3.1.9.

6.2.3.7 NR CGI

This IE is used to globally identify an NR cell.

Derived from TS 38.413 [6] clause 9.3.1.7.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
PLMN Identity	M		6.2.3.1	
NR Cell Identity	M		BIT STRING (SIZE(36))	Defined in TS 38.413 [6] clause 9.3.1.7.

6.2.3.8 Global ng-eNB ID

This IE is used to globally identify an ng-eNB.

Derived from TS 38.413 [6] clause 9.3.1.8.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
PLMN Identity	M		6.2.3.1	
CHOICE ng-eNB ID	M			
>Macro ng-eNB ID				
>>Macro ng-eNB ID	M		BIT STRING (SIZE(20))	Defined in TS 38.413 [6] clause 9.3.1.8.
>Short Macro ng-eNB ID				
>>Short Macro ng-eNB ID	M		BIT STRING (SIZE(18))	Defined in TS 38.413 [6] clause 9.3.1.8.
>Long Macro ng-eNB ID				
>>Long Macro ng-eNB ID	M		BIT STRING (SIZE(21))	Defined in TS 38.413 [6] clause 9.3.1.8.

6.2.3.9 Global eNB ID

This IE is used to globally identify an eNB.

Derived from TS 36.413 [10] clause 9.2.1.37.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
PLMN Identity	M		6.2.3.1	
CHOICE eNB ID	M			
>Macro eNB ID				
>>Macro eNB ID	M		BIT STRING (SIZE(20))	Defined in TS 36.413 [10] clause 9.2.1.37
>Home eNB ID				
>>Home eNB ID	M		BIT STRING (SIZE(28))	Defined in TS 36.413 [10] clause 9.2.1.37.
>Short Macro eNB ID				
>> Short Macro eNB ID	M		BIT STRING (SIZE(18))	Defined in TS 36.413 [10] clause 9.2.1.37.
>Long Macro eNB ID				
>> Long Macro eNB ID	M		BIT STRING (SIZE(21))	Defined in TS 36.413 [10] clause 9.2.1.37.

6.2.3.10   ng-eNB-DU ID

This IE uniquely identifies the ng-eNB-DU at least within an ng-eNB-CU.

Derived from TS 37.473 [12] clause 9.3.1.9.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
ng-eNB-DU ID	M		INTEGER $(0 .. 2^{36}-1)$	Defined in TS 37.473 [12] clause 9.3.1.9.

6.2.3.11 E-UTRA CGI

This IE is used to globally identify an E-UTRA cell.

Derived from TS 38.413 [6] clause 9.3.1.9.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
PLMN Identity	M		6.2.3.1	
E-UTRA Cell Identity	M		BIT STRING (SIZE(28))	Defined in TS 38.413 [6] clause 9.3.1.9.

6.2.3.12 S-NSSAI

This IE is used to indicate the S-NSSAI.

Derived from TS 38.413 [6] clause 9.3.1.24.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
SST	M		OCTET STRING (SIZE(1))	Defined in TS 38.413 [6] clause 9.3.1.24.
SD	O		OCTET STRING (SIZE(3))	Defined in TS 38.413 [6] clause 9.3.1.24.

6.2.3.13 5QI

This IE is used to indicate 5QI value.

Derived from TS 38.413 [6] clause 9.3.1.28.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
5QI	M		INTEGER (0..255, ...)	Defined in TS 38.413 [6] clause 9.3.1.28.

6.2.3.14 QCI

This IE is used to indicate QCI value.

Derived from TS 36.413 [10] clause 9.2.1.15.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
QCI	M		INTEGER (0..255)	Defined in TS 36.413 [10] clause 9.2.1.15.

6.2.3.15 QoS Flow Identifier (QFI)

This IE identifies a QoS flow within a PDU Session.

Derived from TS 38.413 [6] clause 9.3.1.51.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
QoS Flow Identifier	M		INTEGER (0..63, …)	Defined in TS 38.413 [6] clause 9.3.1.51.

6.2.3.16   AMF UE NGAP ID

This IE uniquely identifies a UE over the NG interface within a NG-RAN node.

Derived from 3GPP TS 38.413 [6] clause 9.3.3.1.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
AMF UE NGAP ID	M		INTEGER (0..2^{40}-1)	Defined in TS 38.413 [6] clause 9.3.3.1.

6.2.3.17   GUAMI

This IE indicates the AMF identity.

Derived from 38.413 [6] clause 9.3.3.3.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
PLMN Identity	M		6.2.3.1	
AMF Region ID	M		BIT STRING (SIZE(8))	
AMF Set ID	M		BIT STRING (SIZE(10))	Defined in TS 38.413 [6] clause 9.3.3.12.
AMF Pointer	M		BIT STRING (SIZE(6))	Defined in TS 38.413 [6] clause 9.3.3.19.

6.2.3.18   GUMMEI

This IE indicates the globally unique MME identity.

Derived from TS 36.413 [10] clause 9.2.3.9.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
PLMN Identity	M		6.2.3.1	
MME Group ID	M		OCTET STRING (SIZE(2))	
MME code	M		OCTET STRING (SIZE (1))	Defined in TS 36.413 [10] clause 9.2.3.12.

6.2.3.19   NG-RAN Node UE XnAP ID

This IE uniquely identifies a UE over the Xn interface within a NG-RAN node.

Derived from TS 38.423 [7] clause 9.2.3.16.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
NG-RAN node UE XnAP ID	M		INTEGER (0 .. 2^{32}-1)	Defined in TS 38.423 [7] clause 9.2.3.16.

6.2.3.20   gNB-CU-CP UE E1AP ID

This IE uniquely identifies a UE over the E1 interface within a gNB-CU-CP.

Derived from TS 38.463 [9] clause 9.3.1.4.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
gNB-CU-CP UE E1AP ID	M		INTEGER $(0 .. 2^{32}-1)$	Defined in TS 38.463 [9] clause 9.3.1.4.

6.2.3.21   gNB-CU UE F1AP ID

This IE uniquely identifies a UE over the F1 interface within a gNB-CU.

Derived from TS 38.473 [8] clause 9.3.1.4.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
gNB-CU UE F1AP ID	M		INTEGER $(0 .. 2^{32}-1)$	Defined in TS 38.473 [8] clause 9.3.1.4.

6.2.3.22   ng-eNB-CU UE W1AP ID

This IE uniquely identifies a UE over the W1 interface within an ng-eNB-CU.

Derived from TS 37.473 [12] clause 9.3.1.4.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
ng-eNB-CU UE W1AP ID	M		INTEGER $(0 .. 2^{32}-1)$	Defined in TS 37.473 [12] clause 9.3.1.4.

6.2.3.23   eNB UE X2AP ID

This IE, combined with the eNB UE X2AP ID Extension when present regardless its value, uniquely identifies a UE over the X2 interface within an eNB.

Derived from TS 36.423 [11] clause 9.2.24.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
eNB UE X2AP ID	M		INTEGER (0..4095)	Defined in TS 36.423 [11] clause 9.2.24.

6.2.3.24   eNB UE X2AP ID Extension

This IE, combined with the eNB UE X2AP ID uniquely identifies a UE over the X2 interface within an eNB. If the setup of an UE associated signalling connection was initiated including the eNB UE X2AP ID Extension, the eNB UE X2AP ID Extension shall be used by both peers for the life-time of the respective UE-associated signalling connection.

Derived from TS 36.423 [11] clause 9.2.86.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
eNB UE X2AP ID Extension	M		INTEGER (0..4095, …)	Defined in TS 36.423 [11] clause 9.2.86.

6.2.3.25   RAN UE ID

This UE Identifier identifies an UE over E1 and F1 interface within a gNB.

Derived from TS 38.473 [8] clause 9.2.2.1.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RAN UE ID	O		OCTET STRING (SIZE (8))	Defined in TS 38.473 [8] clause 9.2.2.1

6.2.3.26   MME UE S1AP ID

This IE uniquely identifies a UE over the S1 interface within a MME.

Derived from TS 36.413 [10] clause 9.2.3.3.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
MME UE S1AP ID	M		INTEGER $(0 .. 2^{32}-1)$	Defined in TS 36.413 [10] clause 9.2.3.3.

6.2.3.27   Index to RAT/Frequency Selection Priority (IRFSP)

This IE is used to define local configuration for RRM strategies such as camp priorities in Idle mode and control of inter-RAT/inter-frequency handover in Active mode.

Derived from TS 38.413 [6] clause 9.3.1.61.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Index to RAT/Frequency Selection Priority	M		INTEGER (1..256, …)	Defined in TS 38.413 [6] clause 9.3.1.61.

6.2.3.28   Subscriber Profile ID for RAT/Frequency priority (SPID)

This IE is used to define camp priorities in Idle mode and to control inter-RAT/inter-frequency handover in Active mode.

Derived from TS 36.413 [10] clause 9.2.1.39.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Subscriber Profile ID for RAT/Frequency Priority	M		INTEGER (1..256)	Defined in TS 36.413 [10] clause 9.2.1.39.

6.2.3.29   NR PCI

This IE is used to identify an NR cell PCI.

Derived from TS 38.473 [8] clause 9.3.1.10.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
NR PCI	M		INTEGER (0.. 1007)	Derived from TS 38.473 [8] clause 9.3.1.10.

6.2.3.30 NR ARFCN

This IE is used to identify an NR ARFCN.

Derived from TS 38.473 [8] clause 9.3.1.17.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
NR ARFCN	M		INTEGER (0..maxNRARFCN)	Derived from TS 38.473 [8] clause 9.3.1.17.

Range bound	Explanation
maxNRARFCN	Maximum value of NR ARFCNs. Value is 3279165.

6.2.3.31 5GS TAC

This IE is used to identify 5GS Tracking Area Code.

Defined in TS 38.473 [8] clause 9.3.1.29.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
5GS TAC	M		OCTET STRING (SIZE (3))	Defined in TS 38.473 [8] clause 9.3.1.29.

6.2.3.32 E-UTRA PCI

This IE is used to identify an E-UTRA cell PCI.

Derived from TS 36.423 [11] clause 9.2.8.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
E-UTRA PCI	M		INTEGER (0.. 503, …)	Derived from TS 36.423 [11] clause 9.2.8.

6.2.3.33 E-UTRA ARFCN

This IE is used to identify an E-UTRA Frequency Info.

Defined in TS 36.423 [11] clause 9.2.26.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
EARFCN	M		INTEGER (0.. maxEARFCN)	Defined in TS 36.423 [11] clause 9.2.26.

Range bound	Explanation
maxEARFCN	Maximum value of EARFCNs. Value is 65535.

6.2.3.34   E-UTRA TAC

This IE is used to identify an E-UTRA Tracking Area Code.

Derived from TS 36.423 [11] clause 9.2.8.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
E-UTRA TAC	M		OCTET STRING (SIZE(2))	Derived from TS 36.423 [11] clause 9.2.8.

6.2.3.35   NR Frequency Info

This IE is used to define the carrier frequency and bands used in a cell.

Derived from TS 38.473 [8] clause 9.3.1.17.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
NR ARFCN	M		6.2.3.30	
NR Frequency Band List		1		
>NR Frequency Band Item		1..<maxnoofNRCellBands>		
>>NR Frequency Band	M		INTEGER (1.. 1024, ...)	Defined in TS 38.473 [8] clause 9.3.1.17
>>Supported SUL band List		0..<maxnoofNRCellBands>		
>>>Supported SUL band Item	M		INTEGER (1.. 1024, ...)	Defined in TS 38.473 [8] clause 9.3.1.17
NRFrequency Shift 7p5khz	O		ENUMERATED (false, true, ...)	Defined in TS 38.473 [8] clause 9.3.1.17

Range bound	Explanation
maxnoofNRCellBands	Maximum no. of frequency bands supported for a NR cell. Value is 32.

6.3 Information Element Abstract Syntax (with ASN.1)

6.3.1   General

E2SM ASN.1 definition conforms to ITU-T Rec. X.680 [16] and ITU-T Rec. X.681 [17].

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.

6.3.2   Information Element definitions

```
-- ASN1START
-- ************************************************************
-- E2SM
```

```
 1   -- Information Element Definitions
 2   --
 3   -- ****************************************************************
 4
 5   E2SM-COMMON-IEs {
 6   iso(1) identified-organization(3) dod(6) internet(1) private(4) enterprise(1) 53148 e2(1) version1
 7   (1) e2sm(2) e2sm-COMMON-IEs (0)}
 8
 9   DEFINITIONS AUTOMATIC TAGS ::=
10
11   BEGIN
12
13   -- --------------------------------------------------
14
15   -- Constants
16
17   -- --------------------------------------------------
18
19   maxE1APid               INTEGER ::= 65535
20   maxF1APid               INTEGER ::= 4
21
22   -- IEs derived from 3GPP 36.423 (X2AP)
23   maxEARFCN               INTEGER ::= 65535
24
25   -- IEs derived from 3GPP 38.473 (F1AP)
26   maxNRARFCN              INTEGER ::= 3279165
27   maxnoofNrCellBands      INTEGER ::= 32
28
29
30   -- --------------------------------------------------
31
32   -- E2SM Commmon IEs
33
34   -- --------------------------------------------------
35
36   CGI ::= CHOICE {
37       nR-CGI                  NR-CGI,
38       eUTRA-CGI               EUTRA-CGI,
39       ...
40   }
41
42   CoreCPID ::= CHOICE {
43       fiveGC                  GUAMI,
44       ePC                     GUMMEI,
45       ...
46   }
47
48   InterfaceIdentifier ::= CHOICE {
49       nG                  InterfaceID-NG,
50       xN                  InterfaceID-Xn,
51       f1                  InterfaceID-F1,
52       e1                  InterfaceID-E1,
53       s1                  InterfaceID-S1,
54       x2                  InterfaceID-X2,
55       w1                  InterfaceID-W1,
56       ...
57   }
58
59   InterfaceID-NG ::= SEQUENCE {
60       guami                   GUAMI,
61       ...
62   }
63
64   InterfaceID-Xn ::= SEQUENCE {
65       global-NG-RAN-ID        GlobalNGRANNodeID,
66       ...
67   }
68
69   InterfaceID-F1 ::= SEQUENCE {
70       globalGNB-ID            GlobalGNB-ID,
71       gNB-DU-ID               GNB-DU-ID,
72       ...
73   }
74
75   InterfaceID-E1 ::= SEQUENCE {
76       globalGNB-ID            GlobalGNB-ID,
77       gNB-CU-UP-ID            GNB-CU-UP-ID,
78       ...
79   }
```

```
InterfaceID-S1 ::= SEQUENCE {
    gUMMEI                  GUMMEI,
    ...
}


InterfaceID-X2 ::= SEQUENCE {
    nodeType                CHOICE {
        global-eNB-ID       GlobalENB-ID,
        global-en-gNB-ID    GlobalenGNB-ID,
        ...
    },
    ...
}


InterfaceID-W1 ::= SEQUENCE {
    global-ng-eNB-ID        GlobalNgENB-ID,
    ng-eNB-DU-ID            NGENB-DU-ID,
    ...
}


Interface-MessageID ::= SEQUENCE {
    interfaceProcedureID    INTEGER,
    messageType             ENUMERATED {initiatingMessage, successfulOutcome,
unsuccessfulOutcome, ...},
    ...
}


InterfaceType ::= ENUMERATED {nG, xn, f1, e1, s1, x2, w1, ...}


GroupID ::= CHOICE {
    fiveGC                  FiveQI,
    ePC                     QCI,
    ...
}


QoSID ::= CHOICE {
    fiveGC                  FiveQI,
    ePC                     QCI,
    ...
}


RANfunction-Name ::= SEQUENCE{
    ranFunction-ShortName   PrintableString(SIZE(1..150,...)),
    ranFunction-E2SM-OID    PrintableString(SIZE(1..1000,...)),
    ranFunction-Description PrintableString(SIZE(1..150,...)),
    ranFunction-Instance    INTEGER                                 OPTIONAL,
    ...
}


RIC-Format-Type ::= INTEGER


RIC-Style-Type ::= INTEGER


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



RRC-MessageID ::= SEQUENCE {
    rrcType         CHOICE {
        lTE             RRCclass-LTE,
        nR              RRCclass-NR,
        ...
    },
    messageID       INTEGER,
    ...
}


RRCclass-LTE ::= ENUMERATED {bCCH-BCH, bCCH-BCH-MBMS, bCCH-DL-SCH, bCCH-DL-SCH-BR, bCCH-DL-SCH-MBMS,
mCCH, pCCH, dL-CCCH, dL-DCCH, uL-CCCH, uL-DCCH, sC-MCCH, ...}


RRCclass-NR ::= ENUMERATED {bCCH-BCH, bCCH-DL-SCH, dL-CCCH, dL-DCCH, pCCH, uL-CCCH, uL-CCCH1, uL-
DCCH, ...}


ServingCell-ARFCN ::= CHOICE {
    nR                  NR-ARFCN,
    eUTRA               E-UTRA-ARFCN,
    ...
}
```

```
1
2    ServingCell-PCI ::= CHOICE {
3        nR                   NR-PCI,
4        eUTRA                E-UTRA-PCI,
5        ...
6    }
7
8
9    UEID ::= CHOICE{
10       gNB-UEID             UEID-GNB,
11       gNB-DU-UEID          UEID-GNB-DU,
12       gNB-CU-UP-UEID       UEID-GNB-CU-UP,
13       ng-eNB-UEID          UEID-NG-ENB,
14       ng-eNB-DU-UEID       UEID-NG-ENB-DU,
15       en-gNB-UEID          UEID-EN-GNB,
16       eNB-UEID             UEID-ENB,
17       ...
18   }
19
20   UEID-GNB ::= SEQUENCE{
21       amf-UE-NGAP-ID            AMF-UE-NGAP-ID,
22       guami                     GUAMI,
23       gNB-CU-UE-F1AP-ID-List    UEID-GNB-CU-F1AP-ID-List       OPTIONAL,
24   -- C-ifCUDUseparated: This IE shall be present in messages from E2 Node to NearRT-RIC for a CU-DU
25   separated gNB, whereas from NearRT-RIC to E2 Node messages, this IE may not be included. More than 1
26   F1AP ID shall be reported by E2 Node only when NR-DC is established.
27       gNB-CU-CP-UE-E1AP-ID-List UEID-GNB-CU-CP-E1AP-ID-List    OPTIONAL,
28   -- C-ifCPUPseparated: This IE shall be present in messages from E2 Node to NearRT-RIC for a CP-UP
29   separated gNB, whereas from NearRT-RIC to E2 Node messages, this IE may not be included.
30       ran-UEID                  RANUEID                        OPTIONAL,
31       m-NG-RAN-UE-XnAP-ID       NG-RANnodeUEXnAPID             OPTIONAL,
32   -- C-ifDCSetup: This IE shall be present in messages from E2 Node to NearRT-RIC if DC is
33   established, whereas from NearRT-RIC to E2 Node messages, this IE may not be included. To be
34   reported by both MN and SN.
35       globalGNB-ID              GlobalGNB-ID                   OPTIONAL,
36   -- This IE shall not be used. This IE is replaced with globalNG-RANNode-ID.
37       ...,
38       globalNG-RANNode-ID       GlobalNGRANNodeID              OPTIONAL
39   -- C-ifDCSetup: This IE shall be present in messages from E2 Node to NearRT-RIC if DC is
40   established, whereas from NearRT-RIC to E2 Node messages, this IE may not be included. To be
41   reported only by SN.
42   }
43
44   UEID-GNB-CU-CP-E1AP-ID-List ::= SEQUENCE (SIZE(1..maxE1APid)) OF UEID-GNB-CU-CP-E1AP-ID-Item
45
46   UEID-GNB-CU-CP-E1AP-ID-Item ::= SEQUENCE{
47       gNB-CU-CP-UE-E1AP-ID   GNB-CU-CP-UE-E1AP-ID,
48       ...
49   }
50
51   UEID-GNB-CU-F1AP-ID-List ::= SEQUENCE (SIZE(1..maxF1APid)) OF UEID-GNB-CU-CP-F1AP-ID-Item
52
53   UEID-GNB-CU-CP-F1AP-ID-Item ::= SEQUENCE{
54       gNB-CU-UE-F1AP-ID      GNB-CU-UE-F1AP-ID,
55       ...
56   }
57
58   UEID-GNB-DU ::= SEQUENCE{
59       gNB-CU-UE-F1AP-ID      GNB-CU-UE-F1AP-ID,
60       ran-UEID               RANUEID                           OPTIONAL,
61       ...
62   }
63
64   UEID-GNB-CU-UP ::= SEQUENCE{
65       gNB-CU-CP-UE-E1AP-ID   GNB-CU-CP-UE-E1AP-ID,
66       ran-UEID               RANUEID                           OPTIONAL,
67       ...
68   }
69
70   UEID-NG-ENB ::= SEQUENCE{
71       amf-UE-NGAP-ID         AMF-UE-NGAP-ID,
72       guami                  GUAMI,
73       ng-eNB-CU-UE-W1AP-ID   NGENB-CU-UE-W1AP-ID               OPTIONAL,
74   -- C-ifCUDUseperated: This IE shall be present in messages from E2 Node to NearRT-RIC for a CU-DU
75   seperated ng-eNB, whereas from NearRT-RIC to E2 Node messages, this IE may not be included.
76       m-NG-RAN-UE-XnAP-ID    NG-RANnodeUEXnAPID                OPTIONAL,
```

```
1    -- C-ifDCSetup: This IE shall be present in messages from E2 Node to NearRT-RIC if DC is
2    established, whereas from NearRT-RIC to E2 Node messages, this IE may not be included. To be
3    reported by both MN and SN.
4        globalNgENB-ID          GlobalNgENB-ID                  OPTIONAL,
5    -- This IE shall not be used. This IE is replaced with globalNG-RANNode-ID.
6        ...,
7        globalNG-RANNode-ID     GlobalNGRANNodeID       OPTIONAL
8    -- C-ifDCSetup: This IE shall be present in messages from E2 Node to NearRT-RIC if DC is
9    established, whereas from NearRT-RIC to E2 Node messages, this IE may not be included. To be
10   reported only by SN.
11   }
12
13
14   UEID-NG-ENB-DU ::= SEQUENCE{
15       ng-eNB-CU-UE-W1AP-ID    NGENB-CU-UE-W1AP-ID,
16       ...
17   }
18
19   UEID-EN-GNB ::= SEQUENCE{
20       m-eNB-UE-X2AP-ID             ENB-UE-X2AP-ID,
21       m-eNB-UE-X2AP-ID-Extension ENB-UE-X2AP-ID-Extension   OPTIONAL,
22       globalENB-ID                 GlobalENB-ID,
23       gNB-CU-UE-F1AP-ID            GNB-CU-UE-F1AP-ID           OPTIONAL,
24   -- C-ifCUDUseperated: This IE shall be present in messages from E2 Node to NearRT-RIC for a CU-DU
25   seperated en-gNB, whereas from NearRT-RIC to E2 Node messages, this IE may not be included.
26       gNB-CU-CP-UE-E1AP-ID-List   UEID-GNB-CU-CP-E1AP-ID-List OPTIONAL,
27   -- C-ifCPUPseparated: This IE shall be present in messages from E2 Node to NearRT-RIC for a CP-UP
28   separated en-gNB, whereas from NearRT-RIC to E2 Node messages, this IE may not be included.
29       ran-UEID                     RANUEID                     OPTIONAL,
30       ...
31   }
32
33   UEID-ENB ::= SEQUENCE{
34       mME-UE-S1AP-ID               MME-UE-S1AP-ID,
35       gUMMEI                       GUMMEI,
36       m-eNB-UE-X2AP-ID             ENB-UE-X2AP-ID             OPTIONAL,
37   -- This IE shall be present in messages from E2 Node to NearRT-RIC if DC is established, whereas
38   from NearRT-RIC to E2 Node messages, this IE may not be included. To be reported by MeNB and SeNB.
39       m-eNB-UE-X2AP-ID-Extension ENB-UE-X2AP-ID-Extension     OPTIONAL,
40       globalENB-ID                 GlobalENB-ID                OPTIONAL,
41   -- This IE shall be present in messages from E2 Node to NearRT-RIC if DC is established, whereas
42   from NearRT-RIC to E2 Node messages, this IE may not be included. To be reported only by SeNB.
43       ...
44   }
45
46   -- ************************************************************
47   -- 3GPP derived IEs
48   -- ************************************************************
49   -- NOTE:
50   -- - Extension fields removed and replaced with "..."
51   -- - IE names modified across all extracts to use "PLMNIdentity"
52
53   -- ************************************************************
54   -- IEs derived from 3GPP 36.413 (S1AP)
55   -- ************************************************************
56   -- ************************************************************
57
58   -- copied from v16.5.0
59   ENB-ID ::= CHOICE {
60       macro-eNB-ID    BIT STRING (SIZE (20)),
61       home-eNB-ID     BIT STRING (SIZE (28)),
62       ... ,
63       short-Macro-eNB-ID      BIT STRING (SIZE(18)),
64       long-Macro-eNB-ID       BIT STRING (SIZE(21))
65   }
66
67   -- copied from v16.5.0
68   GlobalENB-ID ::= SEQUENCE {
69       pLMNIdentity            PLMNIdentity,
70       eNB-ID                  ENB-ID,
71       ...
72   }
73
74
75   -- copied from v16.5.0
76   GUMMEI          ::= SEQUENCE {
77       pLMN-Identity       PLMNIdentity,
```

```
       mME-Group-ID          MME-Group-ID,
       mME-Code              MME-Code,
       ...
}


-- copied from v16.5.0
MME-Group-ID    ::= OCTET STRING (SIZE (2))

-- copied from v16.5.0
MME-Code        ::= OCTET STRING (SIZE (1))

-- copied from v16.5.0
MME-UE-S1AP-ID  ::= INTEGER (0..4294967295)

-- copied from v16.5.0
QCI             ::= INTEGER (0..255)

-- copied from v16.5.0
SubscriberProfileIDforRFP ::= INTEGER (1..256)




-- ***************************************************************
-- IEs derived from 3GPP 36.423 (X2AP)
-- ***************************************************************
-- Extension fields removed.
-- Note: to avoid duplicate names with NGAP, XnAP, etc.:
-- GNB-ID renamed ENGNB-ID,
-- GlobalGNB-ID renamed GlobalenGNB-ID,
-- UE-X2AP-ID renamed ENB-UE-X2AP-ID
-- UE-X2AP-ID-Extension renamed ENB-UE-X2AP-ID-Extension
-- ***************************************************************

-- copied from v16.5.0
EN-GNB-ID ::= CHOICE {
    en-gNB-ID   BIT STRING (SIZE (22..32)),
    ...
}

-- copied from v16.5.0
ENB-UE-X2AP-ID ::= INTEGER (0..4095)

-- copied from v16.5.0
ENB-UE-X2AP-ID-Extension ::= INTEGER (0..4095, ...)

-- copied from v16.5.0
E-UTRA-ARFCN ::= INTEGER (0..maxEARFCN)

-- copied from v16.5.0
E-UTRA-PCI ::= INTEGER (0..503, ...)

-- copied from v16.5.0
E-UTRA-TAC ::= OCTET STRING (SIZE(2))

-- copied from v16.5.0
GlobalenGNB-ID ::= SEQUENCE {
    pLMN-Identity          PLMNIdentity,
    en-gNB-ID              EN-GNB-ID,
    ...
}




-- ***************************************************************
-- IEs derived from 3GPP 37.473 (W1AP)
-- ***************************************************************

-- copied from v16.3.0
NGENB-CU-UE-W1AP-ID ::= INTEGER (0..4294967295)

-- copied from v16.3.0
NGENB-DU-ID ::= INTEGER (0..68719476735)
```

```
-- ******************************************************************
-- IEs derived from 3GPP 38.413 (NGAP)
-- Extension fields removed and replaced with ...
-- ******************************************************************

-- copied from v16.2.0
AMFPointer ::= BIT STRING (SIZE(6))

-- copied from v16.2.0
AMFRegionID ::= BIT STRING (SIZE(8))

-- copied from v16.2.0
AMFSetID ::= BIT STRING (SIZE(10))

-- copied from v16.2.0
AMF-UE-NGAP-ID ::= INTEGER (0..1099511627775)

-- copied from v16.2.0
EUTRACellIdentity ::= BIT STRING (SIZE(28))

-- copied from v16.2.0
EUTRA-CGI ::= SEQUENCE {
    pLMNIdentity            PLMNIdentity,
    eUTRACellIdentity       EUTRACellIdentity,
    ...
}

-- copied from v16.2.0
FiveQI ::= INTEGER (0..255, ...)

-- copied from v16.2.0
GlobalGNB-ID ::= SEQUENCE {
    pLMNIdentity        PLMNIdentity,
    gNB-ID              GNB-ID,
    ...
}

-- copied from v16.2.0
GlobalNgENB-ID ::= SEQUENCE {
    pLMNIdentity        PLMNIdentity,
    ngENB-ID            NgENB-ID,
    ...
}


-- copied from v16.2.0
GNB-ID ::= CHOICE {
    gNB-ID      BIT STRING (SIZE(22..32)),
    ...
}


-- copied from v16.2.0
GUAMI ::= SEQUENCE {
    pLMNIdentity        PLMNIdentity,
    aMFRegionID         AMFRegionID,
    aMFSetID            AMFSetID,
    aMFPointer          AMFPointer,
    ...
}

-- copied from v16.2.0
IndexToRFSP ::= INTEGER (1..256, ...)

-- copied from v16.2.0
NgENB-ID ::= CHOICE {
    macroNgENB-ID           BIT STRING (SIZE(20)),
    shortMacroNgENB-ID      BIT STRING (SIZE(18)),
    longMacroNgENB-ID       BIT STRING (SIZE(21)),
    ...
}

-- copied from v16.2.0
NRCellIdentity ::= BIT STRING (SIZE(36))

-- copied from v16.2.0
NR-CGI ::= SEQUENCE {
```

```
1      pLMNIdentity         PLMNIdentity,
2      nRCellIdentity       NRCellIdentity,
3      ...
4  }
5
6  -- copied from v16.2.0
7  PLMNIdentity ::= OCTET STRING (SIZE(3))
8
9  -- copied from v16.2.0
10 QosFlowIdentifier ::= INTEGER (0..63, ...)
11
12 -- copied from v16.2.0
13 SD ::= OCTET STRING (SIZE(3))
14
15 -- copied from v16.2.0
16 S-NSSAI ::= SEQUENCE {
17     sST              SST,
18     sD               SD                                        OPTIONAL,
19     ...
20 }
21
22 -- copied from v16.2.0
23 SST ::= OCTET STRING (SIZE(1))
24
25
26
27
28
29 -- ***************************************************************
30 -- IEs derived from 3GPP 38.423 (XnAP)
31 -- ***************************************************************
32
33 -- copied from v16.2.0
34 NG-RANnodeUEXnAPID ::= INTEGER (0.. 4294967295)
35
36 GlobalNGRANNodeID ::= CHOICE {
37     gNB                 GlobalGNB-ID,
38     ng-eNB              GlobalNgENB-ID,
39     ...
40 }
41
42
43
44
45 -- ***************************************************************
46 -- IEs derived from 3GPP 38.463 (E1AP)
47 -- ***************************************************************
48
49 -- copied from v16.5.0
50 GNB-CU-CP-UE-E1AP-ID      ::= INTEGER (0..4294967295)
51
52 -- copied from v16.5.0
53 GNB-CU-UP-ID             ::= INTEGER (0..68719476735)
54
55
56
57
58
59
60 -- ***************************************************************
61 -- IEs derived from 3GPP 38.473 (F1AP)
62 -- ***************************************************************
63
64 -- copied from v16.5.0
65 FiveGS-TAC        ::= OCTET STRING (SIZE(3))
66
67 -- copied from v16.5.0
68 FreqBandNrItem      ::= SEQUENCE {
69     freqBandIndicatorNr      INTEGER (1..1024, ...),
70     ...
71 }
72
73
74 -- copied from v16.5.0
75 GNB-CU-UE-F1AP-ID   ::= INTEGER (0..4294967295)
76
77 -- copied from v16.5.0
78 GNB-DU-ID        ::= INTEGER (0..68719476735)
```

```
1
2  -- copied from v16.5.0
3  NR-PCI             ::= INTEGER (0..1007)
4
5  -- copied from v16.5.0
6  NR-ARFCN           ::= SEQUENCE {
7      nRARFCN            INTEGER (0..maxNRARFCN),
8      ...
9  }
10 -- copied from v16.5.0
11 NRFrequencyBand-List ::= SEQUENCE (SIZE(1..maxnoofNrCellBands)) OF NRFrequencyBandItem
12
13 -- copied from v16.5.0
14 NRFrequencyBandItem ::= SEQUENCE {
15     freqBandIndicatorNr        INTEGER (1..1024,...),
16     supportedSULBandList       SupportedSULBandList,
17     ...
18 }
19
20 -- copied from v16.5.0
21 NRFrequencyInfo ::= SEQUENCE {
22     nrARFCN                    NR-ARFCN,
23     frequencyBand-List         NRFrequencyBand-List,
24     frequencyShift7p5khz       NRFrequencyShift7p5khz        OPTIONAL,
25     ...
26 }
27
28 -- copied from v16.5.0
29 NRFrequencyShift7p5khz ::= ENUMERATED {false, true, ...}
30
31
32 -- copied from v16.5.0
33 RANUEID            ::= OCTET STRING (SIZE (8))
34
35
36 -- copied from v16.5.0
37 SupportedSULBandList ::= SEQUENCE (SIZE(0..maxnoofNrCellBands)) OF SupportedSULFreqBandItem
38
39 -- copied from v16.5.0
40 SupportedSULFreqBandItem ::= SEQUENCE {
41     freqBandIndicatorNr        INTEGER (1..1024,...),
42     ...
43 }
44
45
46
47
48
49 END
50 -- ASN1STOP
```

6.3.3 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].

1 2 Annex A (informative): Recommended E2SM specification content

3 Recommended table of contents for an E2SM specification is provided below.

4 Revision History

5 1 Scope

6 2 References

7 3 Definitions and Abbreviations

8 4 General

9 5 E2SM Services

10 6 RAN Function Service Model Description

11 6.1 RAN Function Overview

12 6.2 RAN Function exposure services

13 7 RAN Function Description

14 7.1 Description

15 7.2 RAN Function name

16 7.3 Event trigger definition styles

17 7.4 Supported RIC REPORT Services

18 7.5 Supported RIC INSERT Services

19 7.6 Supported RIC CONTROL Services

20 7.7 Supported RIC POLICY Services

21 7.8 Supported RIC Service Styles and E2SM IE Formats

22 8 Elements for E2SM Service Model

23 8.1 General

24 8.2 Message Functional Definition and Content

25 8.3 Information Element definitions

26 8.4 Information Element Abstract Syntax (with ASN.1)

27 8.5 Message transfer syntax

28 9 Handling of Unknown, Unforeseen and Erroneous Protocol Data

29 Annex A: Further information on RAN Function

30 Annex ZZZ : O-RAN Adopter License Agreement

31 An example specification is provided below as an attached object.

ORAN-WG3.E2SM-ex
ample-v01.00.docx

32

1

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