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Publicly Available Specification (PAS); A1 interface: Type Definitions (O-RAN.WG2.A1TD-R004-v09.00)

CAUTION

The present document has been submitted to ETSI as a PAS produced by O-RAN Alliance and approved by the ETSI Technical Committee Mobile Standards Group (MSG).

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Foreword

This Technical Specification (TS) has been produced by O-RAN Alliance and approved by ETSI Technical Committee Mobile Standards Group (MSG).

The present document is part of a TS-family covering the A1 interface as identified below:

- "A1 interface: General Aspects and Principles";
- "A1 interface: Use Cases and Requirements";
- "A1 interface: Transport Protocol";
- "A1 interface: Application Protocol";
- "A1 interface: Type Definitions"; and
- "A1 interface: Test Specification".

Modal verbs terminology

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

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

1 Scope

The present document specifies the data model and the data types that are used in the body of the procedures in the A1 interface.

2 References

2.1 Normative references

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

Referenced documents which are not found to be publicly available in the expected location might be found in the ETSI docbox.

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

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

[1] ETSI TS 103 985 (V1.4.0): "Publicly Available Specification (PAS); A1 interface: Use Cases and Requirements (O-RAN.WG2.A1UCR-R004-v01.04)".

[2] ETSI TS 103 983 (V4.0.0): "Publicly Available Specification (PAS); A1 interface: General Aspects and Principles (O-RAN.WG2.A1GAP-R004-v04.0.0)".

[3] ETSI TS 103 987 (V4.3.0): "Publicly Available Specification (PAS); A1 interface: Application Protocol (O-RAN.WG2.A1AP-R004-v04.03)".

[4] ETSI TS 129 501: "5G; 5G System; Principles and Guidelines for Services Definition; Stage 3 (3GPP TS 29.501)".

[5] ETSI TS 129 571: "5G; 5G System; Common Data Types for Service Based Interfaces; Stage 3 (3GPP TS 29.571)".

[6] IETF RFC 8259: "The JavaScript Object Notation (JSON) Data Interchange Format".

[7] json-schema Draft 2020-12.

[8] ETSI TS 138 463: "5G; NG-RAN; E1 Application Protocol (E1AP) (3GPP TS 38.463)".

[9] ETSI TS 138 473: "5G; NG-RAN; F1 Application Protocol (F1AP) (3GPP TS 38.473)".

[10] ETSI TS 123 003: "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; 5G; Numbering, addressing and identification (3GPP TS 23.003)".

[11] ETSI TS 123 501: "5G; System architecture for the 5G System (5GS) (3GPP TS 23.501)".

[12] Recommendation ITU-T P.1203.3: " Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport - Quality integration module".

[13] ETSI TS 128 552: "5G; Management and orchestration; 5G performance measurements (3GPP TS 28.552)".

[14] ETSI TS 138 314: "5G; NR; Layer 2 measurements (3GPP TS 38.314)".

[15] ETSI TS 136 300: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2 (3GPP TS 36.300)".

[16] ETSI TS 123 203: "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); LTE; Policy and charging control architecture (3GPP TS 23.203)".

[17] GSMA NG.116 (23 November 2020): "Generic Network Slice Template Version 4.0".

[18] Void.

[19] SemVer: "Semantic Versioning 2.0.0".

[20] ETSI TS 129 572: "5G; 5G System; Location Management Services; Stage 3 (3GPP TS 29.572)".

[21] ETSI TS 138 413: "5G; NG-RAN; NG Application Protocol (NGAP) (3GPP TS 38.413)".

[22] ETSI TS 136 413: "LTE; Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP) (3GPP TS 36.413)".

[23] ETSI TS 132 425: "LTE; Telecommunication management; Performance Management (PM); Performance measurements Evolved Universal Terrestrial Radio Access Network (E-UTRAN) (3GPP TS 32.425)".

2.2 Informative references

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

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

The following referenced documents may be useful in implementing an ETSI deliverable or add to the reader's understanding, but are not required for conformance to the present document.

Not applicable.

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in A1GAP [2], A1AP [3] and the following apply:

ScopeIdentifier: structured data type representing the scope identifier

NOTE: See A1AP [3].

Statement: structured data type representing a policy statement that is policy type specific

NOTE: See A1AP [3].

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in A1GAP [2], A1AP [3] and the following apply:

AMF Access and Mobility Management Function
E1AP E1 Application Protocol

F1AP	F1 Application Protocol
gNB-CU-CP	gNB Central Unit Control Plane
GUAMI	Globally Unique AMF Identifier
GUMMEI	Globally Unique MME Identifier
MME	Mobility Management Entity
MOS	Mean Opinion Score
NGAP	Next Generation Application Protocol
PEE	Power, Energy and Environment
SDU	Service Data Unit
TaI	Tracking Area Identity
TSP	Traffic Steering Preference

4 A1 Application data model

4.1 Introduction

The present document together with A1AP [3] contains a REST method realization of the A1 interface architecture and the A1 procedures identified in A1GAP [2].

A1AP [3] contains the service description, service operations, resource indicators and the API definition (including the OpenAPI document) for the A1 services. The present document contains the data model and the definitions of the objects transported in the procedures defined for the A1 services.

The data types defined in the present document have a lifecycle that is independent from the A1 services defined in A1AP [3]. The A1 data models are based on the application data model used for API definitions in ETSI TS 129 501 [4] and data types specified in ETSI TS 129 571 [5]. It is based on structured data types and objects as specified in IETF RFC 8259 [6] and JSON Schema [7].

4.2 Compatibility of A1 type definitions

The version number of the present document indicates that there may be implications for the compatibility between implementations of policy types and/or EI types defined in different versions of the present document.

The first two-digit value of the present document is incremented when:

- at least one policy type and/or one EI type has been added or removed; and/or
- at least one policy type and/or one EI type has been updated in a non-backward compatible way.

The second two-digit value of the present document is incremented when at least one policy type and/or one EI type has been updated in a backward compatible way.

Policy type compatibility is described in clause 7.1.1 and EI type compatibility is described in clause 9.1.1.

The compatibility of A1 implementations in Non/Near-RT RICs depends on the policy types and/or EI types that are implemented. The present document handles the compatibility for data types used by the A1 services while A1AP [3] handles the A1 service compatibility aspects.

5 Generic aspects and common data types

5.1 Encoding of attributes in A1 data types

The encoding of 3GPP attributes into JSON is based on their original definitions, and their value ranges, rather than on encodings used in other protocols or solutions sets. The definitions are referred to in the data type definitions (see clauses 6.2 and 6.3) and the corresponding encodings are seen in the type definitions (see clauses 7.1.2.1 and 7.2).

5.2 Current type definitions

The present document defines the policy types, EI types and common data types listed in table 5.2-1.

Table 5.2-1: Type definitions in the present document

Type	Type name	Type version	Definition
Common data types	common	1.0.0	See clause 7.1.2.1
Policy types			
QoS target	QoSTarget	4.0.1	See clause 7.2.1
QoE target	QoETarget	4.0.1	See clause 7.2.2
Traffic steering preferences	TrafficSteeringPreference	4.0.1	See clause 7.2.3
QoS optimization with resource directive	QoSandTSP	4.0.1	See clause 7.2.4
QoE optimization with resource directive	QoEandTSP	4.0.1	See clause 7.2.5
UE level target	UELevelTarget	3.0.1	See clause 7.2.6
Slice SLA target	SliceSLATarget	3.0.0	See clause 7.2.7
Load balancing	LoadBalancing	1.0.2	See clause 7.2.8
Energy saving	EnergySaving	2.0.0	See clause 7.2.9
EI types			
UE location and velocity information	UEGeoandVel	3.0.1	See clause 9.2.1

6 A1-P data model

6.1 Introduction

This clause specifies the application data model and data types supported by the A1-P API specified in A1AP [3]). The data model is based on policy statements that include attributes and are combined with a scope identifier into policy objects.

Simple data types and enumerations can be referenced from structured data type and policy types. Clause 6.3 defines attributes to be used for scope information and attributes that are not defined as part of the statements (structured data types as defined in coming clauses).

For policy objectives, policy statements for the following characteristics are defined:

- QoS targets;
- QoE targets;
- UE level targets;
- Slice SLA targets;
- Load balancing targets; and
- Energy saving targets.

For policy resources, policy statements for the following characteristics are defined:

- Traffic steering optimization;
- Slice SLA assurance;
- Load balancing; and
- Energy saving.

Clause 6.4 contains the formal representation definitions of the policy representation object types defined in the A1-P service description in A1AP [3].

6.2 Simple data types and enumerations

6.2.1 Simple data types

The simple data types are defined in table 6.2.1-1.

Table 6.2.1-1: Definition of simple data types for scope and statements

Type Name	Type Definition	Description	Applicability
RanUeId	string	UE identifier, based on RAN UE Id (see ETSI TS 138 463 [8] and ETSI TS 138 473 [9]). Encoded as 16 hexadecimal characters.	5G RAN
AmfUeNgapId	integer	AMF UE NGAP ID (see ETSI TS 138 413 [21], clause 9.3.3.1). Integer with value range 0 to 2^{40} -1.	4G RAN/5G RAN
AmfRegionId	string	AMF Region ID (see ETSI TS 138 413 [21], clause 9.3.3.3). Encoded as two hexadecimal characters.	4G RAN/5G RAN
AmfSetId	string	AMF Set ID uniquely identifies an AMF Set within the AMF Region (see ETSI TS 138 413 [21], clause 9.3.3.12). Encoded as three hexadecimal characters where the first character is limited to values 0 to 3.	4G RAN/5G RAN
AmfPointer	string	AMF Pointer identifies one or more AMF(s) within the AMF Set (see ETSI TS 138 413 [21], clause 9.3.3.19). Encoded as two hexadecimal characters where the first character is limited to values 0 to 3.	4G RAN/5G RAN
MmeUeS1apId	integer	MME UE S1AP ID (see ETSI TS 136 413 [22], clause 9.2.3.3). Integer with value range 0 to 2^{32} -1.	4G RAN
MmeGroupId	string	MME Group ID (see ETSI TS 136 413 [22], clause 9.2.3.9). Encoded as four hexadecimal characters.	4G RAN
MmeCode	string	MMEC (see ETSI TS 136 413 [22], clause 9.2.3.12). Encoded as two hexadecimal characters.	4G RAN
GnbCuUeF1apId	integer	gNB-CU UE F1AP ID (see ETSI TS 138 473 [9], clause 9.3.1.4). Integer with value range 0 to 2^{32} -1.	5G RAN
GnbCuCpUeE1apId	integer	gNB-CU-CP UE E1AP ID (see ETSI TS 138 463 [8], clause 9.3.1.4). Integer with value range 0 to 2^{32} -1.	5G RAN

The simple data type for JSON schemas is defined in table 6.2.1-2.

Table 6.2.1-2: Definition of JsonSchema

Type Name	Type Definition	Description	Applicability
JsonSchema	https://json-schema.org/draft/2020-12/schema	A JSON schema meta-schema following JSON Schema [7]	

6.2.2 Enumerations

6.2.2.1 PreferenceType

The enumeration PreferenceType represents the preference of a specific network resource (e.g. cell usage). It shall comply with the provisions defined in table 6.2.2.1-1.

Table 6.2.2.1-1: Definition of PreferenceType

Enumeration value	Description	Applicability
SHALL	equals to select the resource	select the cell regardless of if connection retainability might be at risk
PREFER	equals to favour the selection of the resource	favour the selection of the cell even if it is not with the best radio quality if the connection retainability is not at risk
AVOID	equals to avoid selecting the resource	avoid selecting the cell unless the connection retainability is at risk
FORBID	equals to not select the resource	do not select the cell under any conditions

6.2.2.2 EnforcementStatusType

The enumeration EnforcementStatusType represents if a policy is enforced or not. It shall comply with the provisions defined in table 6.2.2.2-1.

Table 6.2.2.2-1: Definition of EnforcementStatusType

Enumeration value	Description	Applicability
ENFORCED	equals that the policy is enforced	
NOT_ENFORCED	equals that the policy is not enforced	

6.2.2.3 EnforcementReasonType

The enumeration EnforcementReasonType represents the reason why notification is sent (e.g. why enforcement status has changed). It also represents the latest reason for change of enforcement status to NON_ENFORCED in case policy status is queried. It shall comply with the provisions defined in table 6.2.2.3-1.

Table 6.2.2.3-1: Definition of EnforcementReasonType

Enumeration value	Description	Applicability
SCOPE_NOT_APPLICABLE	One or more attributes of the ScopeIdentifier cannot be applied	The scope provided can no longer be applied for enforcing the policy
STATEMENT_NOT_APPLICABLE	Policy statement(s) cannot be applied	The statement(s) can no longer be applied due to other changes
OTHER_REASON	Any other reason	Policy can no longer be enforced for other reasons than scope or statement becoming inapplicable

6.2.2.4 AvoidanceType

The enumeration AvoidanceType represents the avoidance of a specific network resource (e.g. cell usage). It shall comply with the provisions defined in table 6.2.2.4-1.

Table 6.2.2.4-1: Definition of AvoidanceType

Enumeration value	Description	Applicability
AVOID	equals to avoid selecting the network resource	avoid selecting the cell as network resource
FORBID	equals to forbid selecting the network resource	do not select the cell as network resource under any conditions

6.3 Structured data types

6.3.1 ScopeIdentifier

6.3.1.1 Introduction

A1 policies are defined in A1GAP [2] as containing a scope identifier and one or more policy statements where policy statements contain policy objectives and/or policy resources. This clause defines the structured data type ScopeIdentifier.

The ScopeIdentifier contains the attributes defined in table 6.3.1.1-1:

Table 6.3.1.1-1: Definition of data type ScopeIdentifier

Attribute Name	Data Type	P	Cardinality	Description	Applicability
ueId	UeId	C	0..1	identifies the UE that policy statement(s) are applied to, see clause 6.3.1.7	
groupId	GroupId	C	0..1	identifies multiple UEs that policy statement(s) are applied to, see clause 6.3.1.2	
sliceId	SliceId	C	0..1	identifies the network slice that policy statement(s) are applied to, see clause 6.3.1.3	
qosId	QosId	C	0..1	identifies the QoS flow that policy statement(s) are applied to, see clause 6.3.1.4	
cellId	CellId	C	0..1	identifies the cell that the policy statement(s) are applied to, see clause 6.3.1.5	
cellIdList	CellIdList	C	0..1	identifies the list of cells that the policy statement(s) are applied to, see Table 6.3.2-1	
talList	TalList	C	0..1	identifies the list of TAIs that the policy statement(s) are applied to, see Table 6.3.2-3	
NOTE 1: Presence condition "C" means that least one attribute shall be included when the scope is defined. The allowed combinations of attributes depend on the policy statement that is combined with the ScopeIdentifier and is policy type specific, see clause 7.2. NOTE 2: Encoding of 3GPP attributes into number and string is described in clause 5.1 and applied to the JSON encodings in clause 7.1.2.1. NOTE 3: cellId and cellIdList shall not be present at the same time in a ScopeIdentifier for defining A1 policies. NOTE 4: CellIdList shall include only those cells that are associated with unique Near-RT RIC. NOTE 5: TaIList shall include only those tracking area codes that cover cells associated with a unique Near-RT RIC.					

6.3.1.2 GroupId

GroupId is defined based on different RF selection priority parameters for 4G and 5G networks. GroupId does not explicitly define a UE group, and does not enable any group management operations, but is a property that several UE can share and thereby enables implicit identification of a dynamic set of UEs for which the same policy can be applied.

The GroupId contains the attributes defined in table 6.3.1.2-1:

Table 6.3.1.2-1: Definition of type GroupId

Attribute name	Data type	P	Cardinality	Description	Applicability
spId	integer	C	0..1	identifier of a subscriber profile that can be shared by several UEs (see ETSI TS 136 300 [15]). Value range is between 1 and 256.	4G RAN
rfspIndex	integer	C	0..1	identifier of a RF selection priority that can be shared by several UEs (see ETSI TS 123 501 [11]). Value range is between 1 and 256.	5G RAN
NOTE: Presence condition "C" means that one and only attribute shall be included when this data type is used.					

6.3.1.3 SliceId

SliceId is based on the definition of S-NSSAI (see ETSI TS 123 003 [10]) and includes a PLMN identifier.

The SliceId contains the attributes defined in table 6.3.1.3-1:

Table 6.3.1.3-1: Definition of type SliceId

Attribute name	Data type	P	Cardinality	Description	Applicability
sst	integer	M	1	Slice/Service type part of S-NSSAI (see ETSI TS 123 003 [10]). Integer with value range 0 to 255.	5G RAN
sd	string	O	0..1	Slice Differentiator of S-NSSAI Encoded as 6 hexadecimal characters	5G RAN
plmnId	PlmnId	M	1	PLMN Identifier (see ETSI TS 123 003 [10]), see table 6.3.1.6-1	4G RAN and 5G RAN

6.3.1.4 QosId

QosId is defined based on different QoS identifiers for 4G and 5G networks.

The QosId contains the attributes defined in table 6.3.1.4-1:

Table 6.3.1.4-1: Definition of type QosId

Attribute name	Data type	P	Cardinality	Description	Applicability
qcI	integer	C	0..1	QoS Class Identifier (see ETSI TS 123 203 [16]). Value range is between 1 and 256.	4G RAN
5qI	integer	C	0..1	5G QoS Identifier (see ETSI TS 123 501 [11]). Value range is between 1 and 256.	5G RAN
NOTE: Presence condition "C" means that one and only attribute shall be included when this data type is used.					

6.3.1.5 CellId

CellId is based on the definition of the global cell identifiers ECGI and NCGI (see ETSI TS 123 003 [10]) for 4G and 5G RANs.

The CellId contains the attributes defined in tables 6.3.1.5-1 and 6.3.1.5-2:

Table 6.3.1.5-1: Definition of type CId

Attribute name	Data type	P	Cardinality	Description	Applicability
ecI	integer	C	0..1	E-UTRAN Cell identifier (see ETSI TS 123 003 [10]) 28 bits encoded as integer.	4G RAN
ncI	integer	C	0..1	NR Cell identifier (see ETSI TS 123 003 [10]) 36 bits encoded as integer.	5G RAN
NOTE: Presence condition "C" means that one and only attribute shall be included when this data type is used.					

Table 6.3.1.5-2: Definition of type CellId

Attribute name	Data type	P	Cardinality	Description	Applicability
plmnId	PlmnId	M	1	PLMN Identifier (see ETSI TS 123 003 [10]), see table 6.3.1.6-1	
cId	CId	M	1	Cell Identifier, see table 6.3.1.5-1	

6.3.1.6 PlmnId

This clause contains the definition of the structured data type PlmnId. PlmnId is based on the definition in ETSI TS 123 003 [10].

The PlmnId contains the attributes defined in table 6.3.1.6-1:

Table 6.3.1.6-1: Definition of type PlmnId

Attribute name	Data type	P	Cardinality	Description	Applicability
mcc	string	M	1	Mobile Country Code (see ETSI TS 123 003 [10]) Contains 3 digits.	
mnc	string	M	1	Mobile Network Code (see ETSI TS 123 003 [10]) Contains 2 or 3 digits.	

6.3.1.7 UeId

This clause contains the definition of the structured data type UeId.

Table 6.3.1.7-1: Definition of type GuRanUeId

Attribute name	Data type	P	Cardinality	Description	Applicability
globalGnbId	GlobalGnbId	M	1	Global GNB ID, see clause 6.3.1.8	5G RAN
ranUeId	RanUeId	M	1	RAN UE ID, see clause 6.2.1	5G RAN

Table 6.3.1.7-2: Definition of type GuAmfUeNgapId

Attribute name	Data type	P	Cardinality	Description	Applicability
guAmI	GuAmI	M	1	Globally unique AMF Identifier, see clause 6.3.1.9	4G RAN/5G RAN
amfUeNgapId	AmfUeNgapId	M	1	AMF UE NGAP ID, see clause 6.2.1	4G RAN/5G RAN

Table 6.3.1.7-3: Definition of type GuMmeUeS1apId

Attribute name	Data type	P	Cardinality	Description	Applicability
guMmeI	GuMmeI	M	1	Globally unique MME Identifier, see clause 6.3.1.10	4G RAN
mmeUeS1apId	MmeUeS1apId	M	1	MME UE S1AP ID, see clause 6.2.1	4G RAN

Table 6.3.1.7-4: Definition of type UeId

Attribute name	Data type	P	Cardinality	Description	Applicability
guRanUeId	GuRanUeId	C	0..1	Globally unique RAN UE ID, see table 6.3.1.7-1	5G RAN
guAmfUeNgapId	GuAmfUeNgapId	C	0..1	Globally unique AMF UE NGAP ID, see table 6.3.1.7-2	4G RAN/5G RAN
guMmeUeS1apId	GuMmeUeS1apId	C	0..1	Globally unique MME UE S1AP ID, see table 6.3.1.7-3	4G RAN
guGnbCuUeF1apId	GuGnbCuUeF1apId	C	0..1	Globally unique gNB-CU UE F1AP ID, see table 6.3.1.7-5	5G RAN
guGnbCuCpUeE1apId	GuGnbCuCpUeE1apId	C	0..1	Globally unique gNB-CU-CP UE E1AP ID, see table 6.3.1.7-6	5G RAN
NOTE: Presence condition "C" means that one and only attribute shall be included when this data type is used.					

Table 6.3.1.7-5: Definition of type GuGnbCuUeF1apId

Attribute name	Data type	P	Cardinality	Description	Applicability
globalGnbId	GlobalGnbId	M	1	Global GNB ID, see clause 6.3.1.8	5G RAN
gnbCuUeF1apId	GnbCuUeF1apId	M	1	gNB-CU UE F1AP ID, see clause 6.2.1	5G RAN

Table 6.3.1.7-6: Definition of type GuGnbCuCpUeE1apId

Attribute name	Data type	P	Cardinality	Description	Applicability
globalGnbId	GlobalGnbId	M	1	Global GNB ID, see clause 6.3.1.8	5G RAN
gnbCuCpUeE1apId	GnbCuCpUeE1apId	M	1	gNB-CU-CP UE E1AP ID, see clause 6.2.1	5G RAN

6.3.1.8 GlobalGnbId

This clause contains the definition of the structured data type GlobalGnbId. This is based on Global gNB ID defined in ETSI TS 138 413 [21], clause 9.3.1.6.

The GlobalGnbId contains the attributes defined in tables 6.3.1.8-1 and 6.3.1.8-2:

Table 6.3.1.8-1: Definition of type GnbId

Attribute name	Data type	P	Cardinality	Description	Applicability
gnbIdLength	integer	M	1	This indicates the number of bits for encoding the gNB ID (see ETSI TS 138 413 [21], clause 9.3.1.6). Integer with value range 22 to 32.	5G RAN
gnbIdValue	integer	M	1	gNB ID (see ETSI TS 138 413 [21], clause 9.3.1.6). Encoded as integer with value range 0 to 2^{32} -1.	5G RAN

Table 6.3.1.8-2: Definition of type GlobalGnbId

Attribute name	Data type	P	Cardinality	Description	Applicability
plmnId	PlmnId	M	1	PLMN Identifier, see clause 6.3.1.6	5G RAN
gnbId	GnbId	M	1	GNB Identifier, see table 6.3.1.8-1	5G RAN

6.3.1.9 GuAmI

This clause contains the definition of the structured data type GuAmI. This is based on GUAMI defined in ETSI TS 138 413 [21], clause 9.3.3.3.

The GuAmI contains the attributes defined in table 6.3.1.9-1:

Table 6.3.1.9-1: Definition of type GuAmI

Attribute name	Data type	P	Cardinality	Description	Applicability
plmnId	PlmnId	M	1	PLMN Identifier, see clause 6.3.1.6	4G RAN/5G RAN
amfRegionId	AmfRegionId	M	1	AMF Region Identifier, see clause 6.2.1	4G RAN/5G RAN
amfSetId	AmfSetId	M	1	AMF Set Identifier, see clause 6.2.1	4G RAN/5G RAN
amfPointer	AmfPointer	M	1	AMF Pointer, see clause 6.2.1	4G RAN/5G RAN

6.3.1.10 GuMmeI

This clause contains the definition of the structured data type GuMmeI. This is based on GUMMEI defined in ETSI TS 136 413 [22], clause 9.2.3.9.

The GuMmeI contains the attributes defined in table 6.3.1.10-1:

Table 6.3.1.10-1: Definition of type GuMmeI

Attribute name	Data type	P	Cardinality	Description	Applicability
plmnId	PlmnId	M	1	PLMN Identifier, see clause 6.3.1.6	4G RAN
mmeGroupId	MmeGroupId	M	1	MME Group Identifier, see clause 6.2.1	4G RAN
mmeCode	MmeCode	M	1	MME Code, see clause 6.2.1	4G RAN

6.3.2 Structured data types for statements

This clause contains definitions of structured data types that are used in statements for policy objectives and/or statements for policy resources.

The CellIdList contains the attributes defined in table 6.3.2-1:

Table 6.3.2-1: Definition of type CellIdList

Attribute name	Data type	P	Cardinality	Description	Applicability
cellIdList	array(CellId)	M	1..N	list of CellIds, see clause 6.3.1	

The TaIList contains the attributes defined in tables 6.3.2-2 and 6.3.2-3:

Table 6.3.2-2: Definition of type TaI

Attribute name	Data type	P	Cardinality	Description	Applicability
plmnId	PlmnId	M	1	PLMN Identifier (see ETSI TS 123 003 [10]), see table 6.3.1.6-1	4G RAN and 5G RAN
tac	string	M	1	Tracking Area Code (see ETSI TS 123 003 [10]). Encoded as 6 hexadecimal characters.	5G RAN

Table 6.3.2-3: Definition of type TaIList

Attribute name	Data type	P	Cardinality	Description	Applicability
taIList	array(TaI)	M	1..N	list of TaIs, see table 6.3.2-2	4G RAN and 5G RAN

6.3.3 Statements for policy objectives

6.3.3.1 Introduction

A1 policies are defined in A1GAP [2] as containing a scope identifier and one or more policy statements where policy statements contain policy objectives and/or policy resources. This clause defines the structured data types and attributes to be used for policy objectives.

Table 6.3.3.1-1 specifies the data types defined for policy objectives in the A1-P interface protocol. The possible combinations of these are defined in clause 7.

Table 6.3.3.1-1: Statements for policy objectives

Data type	Clause defined	Description	Applicability
QosObjectives	6.3.3.2	Attributes related to QoS targets	
QoeObjectives	6.3.3.3	Attributes related to QoE targets	
UeLevelObjectives	6.3.3.4	Attributes related to UE level targets	
SliceSlaObjectives	6.3.3.5	Attributes related to slice SLA targets	
LbObjectives	6.3.3.6	Attributes related to load balancing	
EsObjectives	6.3.3.7	Attributes related to energy saving	

6.3.3.2 QoS target

The QosObjectives statement contains the attributes defined in table 6.3.3.2-1:

Table 6.3.3.2-1: Definition of statement type QosObjectives

Attribute name	Data type	P	Cardinality	Description	Applicability
gfbr	number	C	0..1	Guaranteed Flow Bit Rate, see ETSI TS 123 501 [11]	5G RAN
mfbr	number	C	0..1	Maximum Flow Bit Rate, see ETSI TS 123 501 [11]	5G RAN
priorityLevel	number	C	0..1	Priority Level, see ETSI TS 123 501 [11]	5G RAN
pdb	number	C	0..1	Packet Delay Budget, see ETSI TS 123 501 [11]	5G RAN
NOTE: Presence condition "C" means that least one attribute shall be included when this statement is used.					

6.3.3.3 QoE target

The QoeObjectives statement contains the attributes defined in table 6.3.3.3-1:

Table 6.3.3.3-1: Definition of statement type QoeObjectives

Attribute name	Data type	P	Cardinality	Description	Applicability
qoeScore	number	C	0..1	mean opinion score (MOS) value between 1 and 5, it can be either e.g. video MOS as specified in ITU-T P.1203.3 [12] or a customized MOS	
initialBuffering	number	C	0..1	refers to the time in seconds between the initiation of video playback by the user and the actual start of the playback as specified in ITU-T P.1203.3 [12]	
reBuffFreq	number	C	0..1	it can be calculated by taking the number of stalling events (excluding the initial buffering) and dividing by the length of media as specified in ITU-T P.1203.3 [12] or by a customized time window	
stallRatio	number	C	0..1	ratio of the sum of duration of the stalling events to the total media length as specified in ITU-T P.1203.3 [12] or by a customized time window.	
NOTE 1: Presence condition "C" means that least one attribute shall be included when this statement is used. NOTE 2: In the present document, the QoE target is applicable to video streaming services.					

Application server will measure the QoE related attributes (e.g. MOS, initial buffering, reBuffFreq, stallRatio) for a specific service based on application info. However, it is too late for the network to optimize the radio resource when the application server finds the QoE is too bad. The Near-RT RIC could predict the QoE related attributes based on the network side info (e.g. QoS parameters, radio conditions, Packet measure report etc.) e.g. by performing model inference for a specific ML model received from the Non-RT RIC. The predicted value is approximately the QoE related attribute which will be measured at application server later, but it is estimated at the Near-RT RIC in real time. So, the Near-RT RIC could decide to optimize the radio resource based on the predicted value and the QoE target contained in the A1 policy.

6.3.3.4 UE level targets

The UeLevelObjectives statement contains the attributes defined in table 6.3.3.4-1:

Table 6.3.3.4-1: Definition of statement type UeLevelObjectives

Attribute name	Data type	P	Cardinality	Description	Applicability
ulThroughput	number	C	0..1	the average UL RAN UE throughput as the UE performance targets or RAN optimization constraints. See ETSI TS 128 552 [13]	
dlThroughtput	number	C	0..1	the average DL RAN UE throughput as the UE performance targets or RAN optimization constraints. See ETSI TS 128 552 [13]	
ulPacketDelay	number	C	0..1	Uplink Packet delay in the range of 0-1 millisecond as the UE performance targets or RAN optimization constraints. See ETSI TS 138 314 [14] and ETSI TS 128 552 [13]	
dlPacketDelay	number	C	0..1	Downlink Packet delay in the range of 0-1 millisecond as the UE performance targets or RAN optimization constraints. See ETSI TS 138 314 [14] and ETSI TS 128 552 [13]	
ulPdcpSduPacketLossRate	number	C	0..1	UL reliability as the UE performance targets or RAN optimization constraints. See ETSI TS 128 552 [13]	
dlRlcSduPacketLossRate	number	C	0..1	DL reliability as the UE performance targets or RAN optimization constraints. See ETSI TS 138 314 [14]	
dlReliability	ReliabilityType	C	0..1	DL reliability as the UE performance targets or RAN optimization constraints	
ulReliability	ReliabilityType	C	0..1	UL reliability as the UE performance targets or RAN optimization constraints	
NOTE: Presence condition "C" means that least one attribute shall be included when this statement is used.					

The ReliabilityType represents the success probability of transmitting a data packet of X bytes within a certain delay. It shall comply with the provisions defined in table 6.3.3.4-2.

Table 6.3.3.4-2: Definition of type ReliabilityType

Attribute name	Data type	P	Cardinality	Description	Applicability
packetSize	number	M	1	data package size in unit of bytes	
userPlaneLatency	number	M	1	the time it takes to deliver a data packet from the radio protocol layer 2/3 SDU ingress point to the radio protocol layer 2/3 SDU egress point of the radio interface in unit of ms, which can be derived from ETSI TS 138 314 [14]	
successProbability	number	M	1	the success probability of transmitting a data packet in packet size within the user plane latency, a number between 0 and 1	

6.3.3.5 Slice SLA target

The SliceSlaObjectives statement contains the attributes defined in table 6.3.3.5-1:

Table 6.3.3.5-1: Definition of statement type SliceSlaObjectives

Attribute name	Data type	P	Cardinality	Description	Applicability
maxNumberOfUes	number	C	0..1	This attribute describes the partial SLA target for providing maximum number of RRC connected UEs to be served by the network slice concurrently. Scope identifier designates the respective network slice and optionally slice SLA resources can further designate targeted cells. See NG.116 [17], clause 3.4.17 ("Maximum Number of UEs").	
maxNumberOfPdu Sessions	number	C	0..1	This attribute describes the partial SLA target for providing maximum number of PDU sessions to be supported by the network slice concurrently. Scope identifier designates the respective network slice and optionally slice SLA resources can further designate targeted cells. See NG.116 [17], clause 3.4.16 ("Maximum number of PDU sessions").	
guaDlThptPerSlice	number	C	0..1	This attribute describes the partial SLA target for providing guaranteed data rate as kbps in downlink to be served by the network slice for the aggregate of all GBR QoS flows in downlink belonging to the set of all UEs using the network slice. Scope identifier designates the respective network slice and optionally slice SLA resources can further designate targeted cells. If there are designed targeted cells, the downlink data rate is aggregated over the designated targeted cells within the respective network slice under the control of the near-RT RIC. If no cell is designated, the downlink data rate is aggregated over all the cells within the respective network slice under the control of the near-RT RIC. See NG.116 [17], clause 3.4.5 ("Guaranteed downlink throughput quota").	
maxDlThptPerSlice	number	C	0..1	This attribute describes the partial SLA target for providing maximum data rate supported by the network slice for all UEs together in downlink in kbps. Scope identifier designates the respective network slice and optionally slice SLA resources can further designate targeted cells. See NG.116 [17], clause 3.4.5 ("Max downlink throughput").	
maxDlThptPerUe	number	C	0..1	This attribute describes the maximum data rate supported by the network slice per UE in downlink in kbps. Scope identifier designates the respective network slice and optionally slice SLA resources can further designate targeted cells. See NG.116 [17], clause 3.4.6 ("Downlink maximum throughput per UE"). This attribute applies to all UEs that are a member of that slice in the designated target cells.	

Attribute name	Data type	P	Cardinality	Description	Applicability
guaUlThptPerSlice	number	C	0..1	This attribute describes the partial SLA target for providing guaranteed data rate as kbps in uplink to be served by the network slice for the aggregate of all GBR QoS flows in uplink belonging to the set of all UEs using the network slice. Scope identifier designates the respective network slice and optionally slice SLA resources can further designate targeted cells. If there are designed targeted cells, the uplink data rate is aggregated over the designated targeted cells within the respective network slice under the control of the near-RT RIC. If no cell is designated, the uplink data rate is aggregated over all the cells within the respective network slice under the control of the near-RT RIC. See NG.116 [17], clause 3.4.31 ("Guaranteed uplink throughput quota").	
maxUlThptPerSlice	number	C	0..1	This attribute describes the partial SLA target for providing maximum data rate supported by the network slice for all UEs together in uplink in kbps. Scope identifier designates the respective network slice and optionally slice SLA resources can further designate targeted cells. See NG.116 [17], clause 3.4.31 ("Max uplink throughput").	
maxUlThptPerUe	number	C	0..1	This attribute describes the maximum data rate supported by the network slice per UE in uplink in kbps. Scope identifier designates the respective network slice and optionally slice SLA resources can further designate targeted cells. See NG.116 [17], clause 3.4.32 ("Uplink maximum throughput per UE"). This attribute applies to all UEs that are a member of that slice in the designated target cells.	
maxDlPacketDelay PerUe	number	C	0..1	This attribute describes the maximum delay for DL packets in ms as the performance target that is communicated to the Near-RT RIC. This attribute applies to all UEs that are a member of the designated slice in the designated target cells. This attribute is based on *Packet Delay Budget* (see GSMA NG.116 [17], clause *3.4.26 ("Slice quality of service parameters: Packet Delay Budget*")). The *Packet Delay Budget* parameter in GSMA NG.116 [17] is for both uplink & downlink while *maxDlPacketDelayPerUe* is only for downlink. *Packet Delay Budget* parameter in GSMA NG.116 [17] is defined per 5QI per slice while *maxDlPacketDelayPerUe* is defined per slice.	
maxUlPacketDelay PerUe	number	C	0..1	This attribute describes the maximum delay for UL packets in ms as the performance target that is communicated to the Near-RT RIC. This attribute applies to all UEs that are a member of the designated slice in the designated target cells. This attribute is based on *Packet Delay Budget* (see GSMA NG.116 [17], clause *3.4.26 ("Slice quality of service parameters: Packet Delay Budget*")). The *Packet Delay Budget* parameter in GSMA NG.116 [17] is for both uplink & downlink while *maxUlPacketDelayPerUe* is only for uplink. *Packet Delay Budget* parameter in GSMA NG.116 [17] is defined per 5QI per slice while *maxUlPacketDelayPerUe* is defined per slice.	

Attribute name	Data type	P	Cardinality	Description	Applicability
maxDlPdcpSduPacketLossRatePerUe	number	C	0..1	This attribute describes the maximum DL PDCP SDU level packet loss rate, a number between 0 and 1, as the performance target that is communicated to the Near-RT RIC. This attribute applies to all UEs that are a member of the designated slice in the designated target cells. This attribute is based on *Maximum Packet Loss Rate* (see GSMA NG.116 [17], clause 3.4.26 ("*Slice quality of service parameters: Maximum Packet Loss Rate*")). The *Maximum Packet Loss Rate* parameter in GSMA NG.116 [17] is for both uplink & downlink while *maxDlPdcpSduPacketLossRatePerUe* is only for downlink.	
maxUlRlcSduPacketLossRatePerUe	number	C	0..1	This attribute describes the maximum UL RLC SDU level packet loss rate, a number between 0 and 1, as the performance target that is communicated to the Near-RT RIC. This attribute applies to all UEs that are a member of the designated slice in the designated target cells. This attribute is based on *Maximum Packet Loss Rate* (see GSMA NG.116 [17], clause 3.4.26 ("*Slice quality of service parameters: Maximum Packet Loss Rate*")). The *Maximum Packet Loss Rate* parameter in GSMA NG.116 [17] is for both uplink & downlink while *maxUlPdcpSduPacketLossRatePerUe* is only for uplink.	
minDlReliabilityPerUe	Reliability Type	C	0..1	This attribute describes the minimum DL reliability as the performance target that is communicated to the Near-RT RIC. The definition of minDlReliabilityPerUe corresponds to that of dlReliability in table 6.3.3.4-1. This attribute applies to all UEs that are a member of the designated slice in the designated target cells.	
minUlReliabilityPerUe	Reliability Type	C	0..1	This attribute describes the minimum UL reliability as the performance target that is communicated to the Near-RT RIC. The definition of minUlReliabilityPerUe corresponds to that of ulReliability in table 6.3.3.4-1. This attribute applies to all UEs that are a member of the designated slice in the designated target cells.	
maxDlJitterPerUe	number	C	0..1	This attribute describes the maximum DL jitter in ms, which is the deviation from the desired packet arrival time to the actual packet arrival time, as the performance target that is communicated to the Near-RT RIC. This attribute applies to all UEs that are a member of the designated slice in the designated target cells.	
maxUlJitterPerUe	number	C	0..1	This attribute describes the maximum UL jitter in ms, which is the deviation from the desired packet arrival time to the actual packet arrival time, as the performance target that is communicated to the Near-RT RIC. This attribute applies to all UEs that are a member of the designated slice in the designated target cells.	

Attribute name	Data type	P	Cardinality	Description	Applicability
dlSlicePriority	number	C	0..1	This attribute describes the priority of the slice in DL, that is communicated to the Near-RT RIC, for providing prioritization for using RAN resources. According to this attribute, QoS flows under a slice are prioritized. The lower the value, the higher the priority. The value shall be greater than or equal to 1.	
ulSlicePriority	number	C	0..1	This attribute describes the priority of the slice in UL, that is communicated to the Near-RT RIC, for providing prioritization for using RAN resources. According to this attribute, QoS flows under a slice are prioritized. The lower the value, the higher the priority. The value shall be greater than or equal to 1.	
maxDlPktSize	number	C	0..1	This attribute describes the maximum packet size to be supported by the network slice in the downlink in Bytes, that is communicated to the Near-RT RIC, for optimizing the RAN performance, especially for URLLC case and very small packets. Scope identifier designates the respective network slice and optionally slice SLA resources can further designate targeted cells. This attribute applies to all UEs that are a member of that slice in the designated target cells. This attribute is based on Maximum supported packet size (see GSMA NG.116 [17], clause 3.4.11 ("Maximum supported packet size")). The Maximum supported packet size in GSMA NG.116 [17] is for both uplink & downlink while maxDlPktSize is only for downlink.	
maxUlPktSize	number	C	0..1	This attribute describes the maximum packet size to be supported by the network slice in the uplink in Bytes, that is communicated to the Near-RT RIC, for optimizing the RAN performance, especially for URLLC case and very small packets. Scope identifier designates the respective network slice and optionally slice SLA resources can further designate targeted cells. This attribute applies to all UEs that are a member of that slice in the designated target cells. This attribute is based on Maximum supported packet size (see GSMA NG.116 [17], clause 3.4.11 ("Maximum supported packet size")). The Maximum supported packet size in GSMA NG.116 [17] is for both uplink & downlink while maxUlPktSize is only for uplink.	
NOTE 1: Presence condition "C" means that at least one attribute shall be included when this statement is used. NOTE 2: Void. NOTE 3: Void.					

6.3.3.6 Load balancing targets

The LbObjectives statement contains the attributes defined in table 6.3.3.6-1:

Table 6.3.3.6-1: Definition of statement type LbObjectives

Attribute name	Data type	P	Cardinality	Description	Applicability
targetPrbUsg	number	M	1	The target PRB usage in percent. The denominator is the total number of PRBs in the cell, and the numerator is the number of PRBs specified by prbUsgType. Value range: 0-100 [%]	
prbUsgType	number	M	1	This attribute specifies the PRB usage type used in the calculation of targetPrbUsg. 1: Mean DL PRB used for data traffic (see ETSI TS 128 552 [13], clause 5.1.1.2.5) 2: Mean UL PRB used for data traffic (see ETSI TS 128 552 [13], clause 5.1.1.2.7) 3: Peak DL PRB used for data traffic (see ETSI TS 128 552 [13], clause 5.1.1.2.9) 4: Peak UL PRB used for data traffic (see ETSI TS 128 552 [13], clause 5.1.1.2.10) 5: Mean DL PRB used for data traffic per S-NSSAI (see ETSI TS 128 552 [13], clause 5.1.1.2.5) 6: Mean UL PRB used for data traffic per S-NSSAI (see ETSI TS 128 552 [13], clause 5.1.1.2.7) 7: Peak DL PRB used for data traffic per S-NSSAI (see ETSI TS 128 552 [13], clause 5.1.1.2.9) 8: Peak UL PRB used for data traffic per S-NSSAI (see ETSI TS 128 552 [13], clause 5.1.1.2.10)	If only cellId is included in the scope, applicable values are 1-4. If cellId and sliceId are included in the scope, applicable values are 5-8.

6.3.3.7 Energy saving targets

The EsObjectives statement contains the attributes defined in table 6.3.3.7-1:

Table 6.3.3.7-1: Definition of statement type EsObjectives

Attribute name	Data type	P	Cardinality	Description	Applicability
targetPeeEnergy	number	C	0..1	Target average value of energy consumption PEE.Energy of PNF such as O-RU in kWh over targeted list of cells For "PEE.Energy" see ETSI TS 128 552 [13], clause 5.1.1.19.3, for 5G NR and ETSI TS 132 425 [23], clause 4.12.2, for 4G LTE.	4G, 5G
esPercentage	number	C	0..1	Energy consumption reduction of O-RU in percentage. The energy consumption i.e. PEE.Energy is measured based on method defined in ETSI TS 128 552 [13], clause 5.1.1.19.3, for 5G NR and ETSI TS 132 425 [23], clause 4.12.2, for 4G LTE. Value range is between 0 and 100.	4G, 5G
NOTE: Presence condition "C" means that one and only attribute shall be included when this data type is used.					

6.3.4 Statements for policy resources

6.3.4.1 Introduction

A1 policies are defined in A1GAP [2] as containing a scope identifier and one or more policy statements where policy statements contain policy objectives and/or policy resources. This clause defines the structured data types and attributes to be used for policy resources.

Table 6.3.4.1-1 specifies the data types defined for policy resources in the A1-P interface protocol. The usage of these is policy type specific and defined in clause 7.2.

Table 6.3.4.1-1: Statements for policy resources

Data type	Clause defined	Description	Applicability
TspResources	6.3.4.2	Attributes used to schedule traffic on available cells in a different way than what would be through default behavior	
SliceSlaResources	6.3.4.3	Attributes used to indicate the RAN resources (such as cells or tracking areas) targeted for the respective slice SLA objective	
LbResources	6.3.4.4	Attributes used for load balancing between a congested cell and indicated candidate cells	
EsResources	6.3.4.5	Attributes used to express conditions for cells to apply network energy savings	

6.3.4.2 Traffic steering preference

The TspResources statement is defined in table 6.3.4.2-2 as an array of the type TspResource defined in table 6.3.4.2-1.

Table 6.3.4.2-1: Definition of type TspResource

Attribute name	Data type	P	Cardinality	Description	Applicability
cellIdList	CellIdList	M	1	list of CellIds, see clause 6.3.2	
preference	PreferenceType	M	1	the preference of cell usage [SHALL/PREFER/AVOID/FORBID].	
primary	boolean	O	0..1	indicates applicability to the selection of primary cell	

Table 6.3.4.2-2: Definition of statement type TspResources

Attribute Name	Data Type	P	Cardinality	Description	Applicability
tspResources	array(TspResource)	M	1..N	list of TspResource	

When the value of the preference attribute is set to PREFER or AVOID, the cellIdList contains cells in descending order of importance for how they should be preferred or avoided, e.g. the first entry is *most preferred* or *most avoided*. When the preference value is set to SHALL or FORBID, the cellIdList contains cells that are of equal importance.

When the value of the primary attribute is set to *true*, and the value of the preference attribute is set to SHALL, then only a cell in the cellIdList is to be used as primary cell. When the value of the primary attribute is set to *true*, and the value of the preference attribute is set to PREFER, then a cell in the cellIdList may be used as primary cell. When the value of the primary attribute is set to *true*, and the preference value is set to AVOID or FORBID, then no cell in the cellIdList is to be used as primary cell.

When the value of the primary attribute is set to *false*, and the value of the preference attribute is set to SHALL, then only one or more cells in the cellIdList are to be used as secondary cell. When the value of the primary attribute is set to *false*, and the value of the preference attribute is set to PREFER, then one or more cells in the cellIdList may be used as secondary cell. When the value of the primary attribute is set to *false*, and the preference value is set to AVOID or FORBID, then no cell in the cellIdList is to be used as secondary cell.

When the primary attribute is not included, the statement shall be handled in the same way as when the primary attribute is set to *false*.

6.3.4.3 Slice SLA Policy Resources

The SliceSlaResources statement is defined in table 6.3.4.3-1.

Table 6.3.4.3-1: Definition of type SliceSlaResources

Attribute name	Data type	P	Cardinality	Description	Applicability
cellIdList	CellIdList	C	0..1	list of CellIds, see clause 6.3.2	
taiList	TaiList	C	0..1	list of TAIs, see clause 6.3.2	
NOTE: Presence condition "C" means that one and only one attribute shall be included when this statement is used.					

6.3.4.4 Load Balancing Policy Resources

The LbResources statement is defined in table 6.3.4.4-1.

Table 6.3.4.4-1: Definition of type LbResources

Attribute name	Data type	P	Cardinality	Description	Applicability
cellIdList	CellIdList	M	1	list of CellIds used to designate candidate cells to which cell load is to be transferred	

6.3.4.5 Energy Savings resources

The EsResources statement is defined in Table 6.3.4.5-2 as an array of the type EsResource defined in Table 6.3.4.5-1.

Table 6.3.4.5-1: Definition of type EsResource

Attribute name	Data type	P	Cardinality	Description	Applicability
operationalCells	CellIdList	C	0..1	list of Cells preferred to keep operational, see clause 6.3.2 table 6.3.2-1 for the definition of the data type CellIdList, see NOTE 1	4G, 5G
operationalPreference	AvoidanceType	C	0..1	the operational preference of the cells while performing network energy saving [AVOID/FORBID], see clause 6.2.2.4 for the definition of the data type AvoidanceType, see NOTE 2	4G, 5G
coverageCells	CellIdList	C	0..1	list of cells with coverage preferences, see clause 6.3.2 table 6.3.2-1 for the definition of the data type CellIdList, see NOTE 1	4G, 5G
coveragePreference	AvoidanceType	C	0..1	the coverage preference of the cells while performing network energy saving [AVOID/FORBID], see clause 6.2.2.4 for the definition of the data type AvoidanceType, see NOTE 3	4G, 5G
prbTotalDl	integer	O	0..1	The DL total PRB usage (in percentage). The value range of this attribute is from 0 to 100. See ETSI TS 138 314 [14], clauses 4.2.1.6 and ETSI TS 128 552 [13], clause 5.1.1.2.1. A cell shall not perform network energy saving when its DL total PRB usage is higher than the specified value. This attribute applies to all cells within the policy scope.	5G
prbTotalUl	integer	O	0..1	The UL total PRB usage (in percentage). The value range of this attribute is from 0 to 100. See ETSI TS 138 314 [14], clause 4.2.1.6 and ETSI TS 128 552 [13], clause 5.1.1.2.2. A cell shall not perform network energy saving when its UL total PRB usage is higher than the specified value. This attribute applies to all cells within the policy scope.	5G
NOTE 1: Presence condition "C" means that least operationalCells or coverageCells shall be included when this statement is used. NOTE 2: Presence condition "C" means that the operationalPreference shall only be included in case operationalCells is included. NOTE 3: Presence condition "C" means that the coveragePreference shall only be included in case coverageCells is included.					

Table 6.3.4.5-2: Definition of statement type EsResources

Attribute Name	Data Type	P	Cardinality	Description	Applicability
esResources	array(EsResource)	M	1..N	list of EsResource	4G, 5G

When the value of the operationalPreference attribute is set to FORBID, the operationalCells contains cells that are forbidden from being non-operational while performing the network energy savings. The operationalCells contains cells that are of equal importance.

When the value of the operationalPreference attribute is set to AVOID, the operationalCells contains cells that should be avoided from being non-operational while performing the network energy savings. The operationalCells contains cells in descending order of importance for how they should be avoided, e.g. the first entry is most avoided from being non-operational while performing the network energy savings.

When the value of the coveragePreference attribute is set to FORBID, the coverageCells contains cells that are forbidden from having any coverage impact while performing the network energy savings. The coverageCells contains cells that are of equal importance.

When the value of the coveragePreference attribute is set to AVOID, the coverageCells contains cells that should be avoided from having any coverage impact while performing the network energy savings. The coverageCells contains cells in descending order of importance for how they should be avoided, e.g. the first entry is most avoided from having any coverage impact while performing the network energy savings.

If prbTotalDl is present in EsResource, then a cell may perform network energy saving methods only when its DL total PRB usage is not higher than the specified prbTotalDl value. If prbTotalUl is present in EsResource, then a cell may perform network energy saving methods only when its UL total PRB usage is not higher than the specified prbTotalUl value. If both prbTotalDl and prbTotalUl are present in EsResource, then a cell may perform network energy saving methods only when its DL total PRB usage is not higher than the specified prbTotalDl value and its UL total PRB usage is not higher than the specified prbTotalUl value. The conditions should be checked when the corresponding performance measurements are available at the Near-RT RIC.

6.4 Policy representations objects

6.4.1 Policy object

6.4.1.1 General

A PolicyObject is based on IETF RFC 8259 [6] and it always contains one set of:

- one ScopeIdentifier; and
- one or more Statements.

The PolicyObject can contain objective and/or resource statements as defined in table 6.4.1.1-1.

Table 6.4.1.1-1: General definition of PolicyObject

Attribute name	Data type	P	Cardinality	Description	Applicability
scope	ScopeIdentifier	M	1	See clause 6.3.1	
qosObjectives	QosObjectives	C	0..1	See clause 6.3.3.2	
qoeObjectives	QoeObjectives	C	0..1	See clause 6.3.3.3	
ueLevelObjectives	UeLevelObjectives	C	0..1	See clause 6.3.3.4	
sliceSlaObjectives	SliceSlaObjectives	C	0..1	See clause 6.3.3.5	
lbObjectives	LbObjectives	C	0..1	See clause 6.3.3.6	
tspResources	TspResources	C	0..1	See clause 6.3.4.2	
sliceSlaResources	SliceSlaResources	O	0..1	See clause 6.3.4.3	
lbResources	LbResources	C	0..1	See clause 6.3.4.4	
esObjectives	EsObjectives	C	0..1	See clause 6.3.3.7	
esResources	EsResources	C	0..1	See clause 6.3.4.5	
NOTE: Presence condition "M" means that the data type shall be included in a PolicyObject. Allowed combinations are listed in clause 7. Presence condition "C" means that at least one Statement (for policy objectives and/or policy resources) shall be included. Presence condition "O" means that the data type can be optionally included in a PolicyObject.					

This definition is general and indicates how to formally construct a PolicyObject. The policy types in clause 7 defines PolicyObjects for usage in the A1 procedures defined in A1AP [3].

6.4.1.2 Allowed combinations

A Statement can be applied together with a ScopeIdentifier containing different combinations of identifiers attributes. Not all combinations are relevant and different combinations are relevant for different policy types (see clause 7).

6.4.2 Policy status object

A PolicyStatusObject is based on IETF RFC 8259 [6] and contains:

- one enforceStatus attribute; and conditionally;
- one enforceReason attribute.

The PolicyStatusObject contains status related attributes as defined in table 6.4.2-1:

Table 6.4.2-1: General definition of PolicyStatusObject

Attribute name	Data type	P	Cardinality	Description	Applicability
enforceStatus	EnforcementStatusType	M	1	See clause 6.2.2	statement indicating enforcement status of policy
enforceReason	EnforcementReasonType	C	0..1	See clause 6.2.2	statement indicating reason for change of enforcement status
NOTE: Presence condition "M" means that the data type shall be included in a PolicyStatusObject used with the PolicyObjects defined in the present document. A PolicyObject and a PolicyStatusObject for a future policy type may be defined based on other attributes. Presence condition "C" means that the enforceReason shall only be included in case enforceStatus is NON_ENFORCED.					

6.4.3 Policy type object

A PolicyTypeObject is based on IETF RFC 8259 [6] and contains:

- one JSON schema for PolicyObject; and optionally;
- one JSON schema for PolicyStatusObject.

The type PolicyTypeObject is defined in table 6.4.3-1.

Table 6.4.3-1: General definition of PolicyTypeObject

Attribute name	Data type	P	Cardinality	Description	Applicability
policySchema	JsonSchema	M	1	The schemas are policy type specific	
statusSchema	JsonSchema	O	0..1		
NOTE 1: Clause 7.2 contains definitions and policy type specific schemas for O-RAN defined A1 policy types. NOTE 2: The policySchema attribute shall contain the compound policy schema as described in clause 7.1.3.1.					

The JSON schema for a PolicyObject is used by the A1-P Producer to validate a PolicyObject during Create policy and Update policy procedures. The JSON schema for a PolicyStatusObject is used by the A1-P Consumer to validate a PolicyStatusObject during Query policy status and Feedback policy procedures. The PolicyTypeObject can be retrieved using the Query policy type procedure.

6.5 Binary data

Binary data is not applicable in the present document.

7 A1-P data types (A1 policy types)

7.1 Introduction

7.1.1 Identification and compatibility of policy types

A policy type is identified by a PolicyTypeId as defined in A1AP [3]. The PolicyTypeId is a string that consists of two parts: a `typename` and a `version`.

When updating a policy type, the `version` in the PolicyTypeId is updated according to SemVer [19] to reflect its compatibility with other policy types that has the same `typename`.

Two policy types are considered as different if the PolicyTypeId is different, i.e. even if the `typename` is the same and the `version` only differs in the patch version digit.

Two policy types are compatible in case the `typename` is the same and the major version digit in the `version` is the same. In general, two policy types X and Y are compatible when all objects that can be created based on policy type X can be validated by the schemas for policy type Y and all objects that can be created based on policy type Y can be validated by the schemas for policy type X.

7.1.2 Common definitions

7.1.2.1 Scope and resource identifiers

An A1 policy type always contains a ScopeIdentifier with data types defined in clause 6.3.1. It may also contain attributes for a resource statement that includes identifiers defined in clauses 6.3.2 and 6.3.4. To enable multiple policy types to be created based on the same identifiers, the policy schemas can link to the same JSON subschema for common data types.

Each policy type definition links to a specific version of the common data types schema and the compatibility relations are described in Annex C. The policy types defined in the present document link to the version of the common data types schema defined in the present document.

When updating the common data types schema, the version is updated according to SemVer [19]. The $id keyword in the common data types schema contains the version as part of the URI.

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$id": "https://schemas.o-ran.org/jsonschemas/a1td/common_1.0.0",
  "description": "scope identifier definitions",

  "$defs": {

    "RanUeId": {
        "type": "string",
        "pattern": "^[A-Fa-f0-9]{16}$"
    },

    "GroupId": {
        "oneOf": [
            {
                "type":"object",
                "properties": {
                    "spId": {
                        "type": "integer",
                        "minimum": 1,
                        "maximum": 256
                    }
                },
                "additionalProperties": false,
                "required": ["spId"]
            },
            {
                "type": "object",
                "properties": {
```

```
                    "rfspIndex": {
                        "type": "integer",
                        "minimum": 1,
                        "maximum": 256
                    }
                },
                "additionalProperties": false,
                "required": ["rfspIndex"]
            }
        ]
    },

    "SliceId": {
        "type": "object",
        "properties": {
            "sst": {
                "type": "integer",
                "minimum": 0,
                "maximum": 255
            },
            "sd": {
                "type": "string",
                "pattern": "^[A-Fa-f0-9]{6}$"
            },
            "plmnId": {"$ref": "#/$defs/PlmnId"}
        },
        "additionalProperties": false,
        "required": ["sst","plmnId"]
    },

    "QosId": {
        "oneOf": [
            {
                "type":"object",
                "properties": {
                    "5qI": {
                        "type": "integer",
                        "minimum": 1,
                        "maximum": 256
                    }
                },
                "additionalProperties": false,
                "required": ["5qI"]
            },
            {
                "type": "object",
                "properties": {
                    "qcI": {
                        "type": "integer",
                        "minimum": 1,
                        "maximum": 256
                    }
                },
                "additionalProperties": false,
                "required": ["qcI"]
            }
        ]
    },

    "TaIList": {
        "type":"array",
        "items": {
            "$ref": "#/$defs/TaI"
        }
    },
    "TaI": {
        "type": "object",
        "properties": {
            "plmnId": {"$ref": "#/$defs/PlmnId"},
            "tac": {
                "type": "string",
                "pattern": "^[A-Fa-f0-9]{6}$"
            }
        },
        "additionalProperties": false,
        "required": ["plmnId","tac"]
    },
```

```
        "CellIdList": {
            "type":"array",
            "items": {
                "$ref": "#/$defs/CellId"
            }
        },
        "CellId": {
            "type": "object",
                "properties": {
                    "plmnId": {"$ref": "#/$defs/PlmnId"},
                    "cId": {"$ref": "#/$defs/CId"}
                },
                "additionalProperties": false,
                "required": ["plmnId", "cId"]
        },
        "CId": {
            "oneOf": [
                {
                    "type":"object",
                    "properties": {
                        "ncI": {"$ref": "#/$defs/NcI"}
                    },
                    "additionalProperties": false,
                    "required": ["ncI"]
                },
                {
                    "type": "object",
                    "properties": {
                        "ecI": {"$ref": "#/$defs/EcI"}
                    },
                    "additionalProperties": false,
                    "required": ["ecI"]
                }
            ]
        },
        "NcI": {
            "type": "integer",
            "minimum": 0,
            "maximum": 68719476735
        },
        "EcI": {
            "type": "integer",
            "minimum": 0,
            "maximum": 268435455
        },

        "PlmnId": {
            "type": "object",
            "properties": {
                "mcc": {
                    "type": "string",
                    "pattern": "^[0-9]{3}$"
                },
                "mnc": {
                    "type": "string",
                    "pattern": "^[0-9]{2,3}$"
                }
            },
            "additionalProperties": false,
            "required": ["mcc", "mnc"]
        },

        "MmeGroupId": {
            "type": "string",
            "pattern": "^[A-Fa-f0-9]{4}$"
        },
        "MmeCode": {
            "type": "string",
            "pattern": "^[A-Fa-f0-9]{2}$"
        },
        "GuMmeI": {
            "type": "object",
            "properties": {
                "plmnId": {"$ref": "#/$defs/PlmnId"},
                "mmeGroupId": {"$ref": "#/$defs/MmeGroupId"},
                "mmeCode": {"$ref": "#/$defs/MmeCode"}
            },
            "additionalProperties": false,
```

```
            "required": ["plmnId", "mmeGroupId", "mmeCode"]
        },
        "MmeUeS1apId": {
            "type": "integer",
            "minimum": 0,
            "maximum": 4294967295
        },
        "GuMmeUeS1apId": {
            "type": "object",
            "properties": {
                "guMmeI": {"$ref": "#/$defs/GuMmeI"},
                "mmeUeS1apId": {"$ref": "#/$defs/MmeUeS1apId"}
            },
            "additionalProperties": false,
            "required": ["guMmeI", "mmeUeS1apId"]
        },

        "AmfRegionId": {
            "type": "string",
            "pattern": "^[A-Fa-f0-9]{2}$"
        },
        "AmfSetId": {
            "type": "string",
            "pattern": "^[0-3][A-Fa-f0-9]{2}$"
        },
        "AmfPointer": {
            "type": "string",
            "pattern": "^[0-3][A-Fa-f0-9]{1}$"
        },
        "GuAmI": {
            "type": "object",
            "properties": {
                "plmnId": {"$ref": "#/$defs/PlmnId"},
                "amfRegionId": {"$ref": "#/$defs/AmfRegionId"},
                "amfSetId": {"$ref": "#/$defs/AmfSetId"},
                "amfPointer": {"$ref": "#/$defs/AmfPointer"}
            },
            "additionalProperties": false,
            "required": ["plmnId", "amfRegionId", "amfSetId", "amfPointer"]
        },
        "AmfUeNgapId": {
            "type": "integer",
            "minimum": 0,
            "maximum": 1099511627775
        },
        "GuAmfUeNgapId": {
            "type": "object",
            "properties": {
                "guAmI": {"$ref": "#/$defs/GuAmI"},
                "amfUeNgapId": {"$ref": "#/$defs/AmfUeNgapId"}
            },
            "additionalProperties": false,
            "required": ["guAmI", "amfUeNgapId"]
        },

        "GnbId": {
            "type": "object",
            "properties": {
                "gnbIdLength": {
                    "type": "integer",
                    "minimum": 22,
                    "maximum": 32
                },
                "gnbIdValue": {
                    "type": "integer",
                    "minimum": 0,
                    "maximum": 4294967295
                }
            },
            "additionalProperties": false,
            "required": ["gnbIdLength","gnbIdValue"]
        },
        "GlobalGnbId": {
            "type": "object",
            "properties": {
                "plmnId": {"$ref": "#/$defs/PlmnId"},
                "gnbId": {"$ref": "#/$defs/GnbId"}
            },
```

```
            "additionalProperties": false,
            "required": ["plmnId", "gnbId"]
        },
        "GuRanUeId": {
            "type": "object",
            "properties": {
                "globalGnbId": {"$ref": "#/$defs/GlobalGnbId"},
                "ranUeId": {"$ref": "#/$defs/RanUeId"}
            },
            "additionalProperties": false,
            "required": ["globalGnbId", "ranUeId"]
        },
        "GnbCuUeF1apId": {
            "type": "integer",
            "minimum": 0,
            "maximum": 4294967295
        },
        "GuGnbCuUeF1apId": {
            "type": "object",
            "properties": {
                "globalGnbId": {"$ref": "#/$defs/GlobalGnbId"},
                "gnbCuUeF1apId": {"$ref": "#/$defs/GnbCuUeF1apId"}
            },
            "additionalProperties": false,
            "required": ["globalGnbId", "gnbCuUeF1apId"]
        },
        "GnbCuCpUeE1apId": {
            "type": "integer",
            "minimum": 0,
            "maximum": 4294967295
        },
        "GuGnbCuCpUeE1apId": {
            "type": "object",
            "properties": {
                "globalGnbId": {"$ref": "#/$defs/GlobalGnbId"},
                "gnbCuCpUeE1apId": {"$ref": "#/$defs/GnbCuCpUeE1apId"}
            },
            "additionalProperties": false,
            "required": ["globalGnbId", "gnbCuCpUeE1apId"]
        },

        "UeId": {
            "oneOf": [
                {
                    "type":"object",
                    "properties": {
                        "guRanUeId": {"$ref": "#/$defs/GuRanUeId"}
                    },
                    "additionalProperties": false,
                    "required": ["guRanUeId"]
                },
                {
                    "type":"object",
                    "properties": {
                        "guAmfUeNgapId": {"$ref": "#/$defs/GuAmfUeNgapId"}
                    },
                    "additionalProperties": false,
                    "required": ["guAmfUeNgapId"]
                },
                {
                    "type":"object",
                    "properties": {
                        "guMmeUeS1apId": {"$ref": "#/$defs/GuMmeUeS1apId"}
                    },
                    "additionalProperties": false,
                    "required": ["guMmeUeS1apId"]
                },
                {
                    "type":"object",
                    "properties": {
                        "guGnbCuUeF1apId": {"$ref": "#/$defs/GuGnbCuUeF1apId"}
                    },
                    "additionalProperties": false,
                    "required": ["guGnbCuUeF1apId"]
                },
                {
                    "type":"object",
                    "properties": {
```

```
                        "guGnbCuCpUeE1apId": {"$ref": "#/$defs/GuGnbCuCpUeE1apId"}
                    },
                    "additionalProperties": false,
                    "required": ["guGnbCuCpUeE1apId"]
                }
            ]
        }

      }
    }
```

7.1.2.2 Policy status

This is a generic policy status schema, it may be adjusted and used together with a policy schema in a PolicyTypeObject and will then be identified by the same policy type identifier as the policy schema.

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "description": "O-RAN standard policy status",
  "type": "object",
  "properties": {
    "enforceStatus": {
      "type": "string",
      "enum": [
        "ENFORCED",
        "NOT_ENFORCED"
      ]
    },
    "enforceReason": {
      "type": "string",
      "enum": [
        "SCOPE_NOT_APPLICABLE",
        "STATEMENT_NOT_APPLICABLE",
        "OTHER_REASON"
      ]
    }
  },
  "additionalProperties": false,
  "required": ["enforceStatus"]
}
```

7.1.3 Schema identification

7.1.3.1 General

The policy schemas defined in clause 7.2 (e.g. policy schema for QoS target in clause 7.2.1.3.1) are base schemas that embed a subschema with common data types definitions. The base schemas can be used for creating or validating A1 policies after embedding the content of the linked common data types schema. A schema resulting from embedding the content of a linked subschema into a base schema is referred to as a compound schema document, see JSON Schema Draft 2020-12 [7]. It is the compound policy schemas that are identified by the policy type identifier and included in the PolicyTypeObject specified in clause 6.4.3.

The base schema and the linked subschema together represent the same JSON schema as the compound schema created by embedding the linked subschema into the base schema at the place where it is linked. Hence, the versions of a compound policy schema and its base policy schema are the same, and is indicated in the policy type identifier. The policy type identifier is part of the $id keyword included in the policy schema. The $id keyword of the embedded subschemas are included in the subschema.

7.1.3.2 Schema URI structure

The base URI for A1 policy types and embedded schemas is:

{uriRoot}/a1td

where uriRoot follows an absolute URI syntax, but excludes the "query" component. The URI root contains the "scheme" component and may contain an "authority" component and may also contain a prefix subcomponent.

The $id keyword for the policy schemas are constructed from the base URI and the policy type identifier:

{uriRoot}/a1td/<policyTypeId>

The $id keyword for the subschema with common data types is constructed from the base URI, the name "common", and the version (x.y.z):

{uriRoot}/a1td/common_<x.y.z>.

In the JSON schemas defined in the present document, the default uriRoot is:

https://schemas.o-ran.org/jsonschemas

7.2 Policy type definitions

7.2.1 QoS target

7.2.1.1 Policy type identifier

PolicyTypeId: **ORAN_QoSTarget_4.0.1**

7.2.1.2 Rationale

7.2.1.2.1 Use case

See "Use case 3: QoS based resource optimization" in Non-RT RIC & A1/R1 interface: Use Cases and Requirements [1].

7.2.1.2.2 Statements, restrictions and extensions

A QoS statement can be applied together with ScopeIdentifier containing different combinations of identifiers. Not all combinations are relevant. Table 7.2.1.2.2-1 indicates the combinations that are allowed.

Table 7.2.1.2.2-1: Allowed combinations of qosObjectives statement with ScopeIdentifier

ScopeIdentifier Policy statement	ueId	groupId	sliceId	qosId	cellId
qosObjectives	1	0..1	0	1	0..1
qosObjectives	1	0	0..1	1	0..1
qosObjectives	0	1	0	1	0..1
qosObjectives	0	0	1	1	0..1
qosObjectives	0	0	0	1	0..1
NOTE: On each row is listed a combination of identifiers that is allowed for the indicated statement. Notation is the same as for cardinality: "0" means the identifier shall not occur, "0..1" means the identifier may occur and "1" means the identifier shall occur. Only at most one occurrence of an identifier is allowed in the present version.					

7.2.1.3 JSON schemas

7.2.1.3.1 Policy schema

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$id": "https://schemas.o-ran.org/jsonschemas/a1td/oran_qostarget_4.0.1",
  "description": "O-RAN standard QoS Target policy",
  "type": "object",
  "properties": {

    "scope": {
      "anyOf": [
        {
```

```
          "type": "object",
          "properties": {
            "ueId": {"$ref": "/a1td/common_1.0.0#/$defs/UeId"},
            "groupId": {"$ref": "/a1td/common_1.0.0#/$defs/GroupId"},
            "qosId": {"$ref": "/a1td/common_1.0.0#/$defs/QosId"},
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["ueId", "qosId"]
        },
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "/a1td/common_1.0.0#/$defs/UeId"},
            "sliceId": {"$ref": "/a1td/common_1.0.0#/$defs/SliceId"},
            "qosId": {"$ref": "/a1td/common_1.0.0#/$defs/QosId"},
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["ueId", "qosId"]
        },
        {
          "type": "object",
          "properties": {
            "groupId": {"$ref": "/a1td/common_1.0.0#/$defs/GroupId"},
            "qosId": {"$ref": "/a1td/common_1.0.0#/$defs/QosId"},
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["groupId", "qosId"]
        },
        {
          "type": "object",
          "properties": {
            "sliceId": {"$ref": "/a1td/common_1.0.0#/$defs/SliceId"},
            "qosId": {"$ref": "/a1td/common_1.0.0#/$defs/QosId"},
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["sliceId", "qosId"]
        },
        {
          "type": "object",
          "properties": {
            "qosId": {"$ref": "/a1td/common_1.0.0#/$defs/QosId"},
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["qosId"]
        }
      ]
    },

    "qosObjectives": {
      "type": "object",
      "properties": {
        "gfbr": {"type": "number"},
        "mfbr": {"type": "number"},
        "priorityLevel": {"type": "number"},
        "pdb": {"type": "number"}
      },
      "minProperties": 1,
      "additionalProperties": false
    }
  },

  "additionalProperties": false,
  "required": ["scope", "qosObjectives"],


  "$defs": {
    "https://schemas.o-ran.org/jsonschemas/a1td/common_1.0.0":

  }
}
```

7.2.1.3.2 Policy status schema

The generic policy status schema in clause 7.1.2.2 is used.

7.2.2 QoE target

7.2.2.1 Policy type identifier

PolicyTypeId: ORAN_QoETarget_4.0.1

7.2.2.2 Rationale

7.2.2.2.1 Use case

See "Use case 2: QoE use case" in Non-RT RIC & A1/R1 interface: Use Cases and Requirements [1].

7.2.2.2.2 Statements, restrictions and extensions

A QoE statement can be applied together with ScopeIdentifier containing different combinations of identifiers. Not all combinations are relevant. Table 7.2.2.2.2-1 indicates the combinations that are allowed.

Table 7.2.2.2.2-1: Allowed combinations of qoeObjectives statement with ScopeIdentifier

ScopeIdentifier Policy statement	ueId	groupId	sliceId	qosId	cellId
qoeObjectives	1	0	1	0..1	0..1
qoeObjectives	1	0	0	1	0..1
qoeObjectives	0	0	1	0..1	0..1
qoeObjectives	0	0	0	1	0..1
NOTE: On each row is listed a combination of identifiers that is allowed for the indicated statement. Notation is the same as for cardinality: "0" means the identifier shall not occur, "0..1" means the identifier may occur and "1" means the identifier shall occur. Only at most one occurrence of an identifier is allowed in the present version.					

7.2.2.3 JSON schemas

7.2.2.3.1 Policy schema

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$id": "https://schemas.o-ran.org/jsonschemas/a1td/oran_qoetarget_4.0.1",
  "description": "O-RAN standard QoE Target policy",
  "type": "object",
  "properties": {

    "scope": {
      "anyOf": [
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "/a1td/common_1.0.0#/$defs/UeId"},
            "sliceId": {"$ref": "/a1td/common_1.0.0#/$defs/SliceId"},
            "qosId": {"$ref": "/a1td/common_1.0.0#/$defs/QosId"},
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["ueId", "sliceId"]
        },
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "/a1td/common_1.0.0#/$defs/UeId"},
            "qosId": {"$ref": "/a1td/common_1.0.0#/$defs/QosId"},
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
```

```
          "additionalProperties": false,
          "required": ["ueId", "qosId"]
        },
        {
          "type": "object",
          "properties": {
            "sliceId": {"$ref": "/a1td/common_1.0.0#/$defs/SliceId"},
            "qosId": {"$ref": "/a1td/common_1.0.0#/$defs/QosId"},
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["sliceId"]
        },
        {
          "type": "object",
          "properties": {
            "qosId": {"$ref": "/a1td/common_1.0.0#/$defs/QosId"},
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["qosId"]
        }
      ]
    },

    "qoeObjectives": {
      "type": "object",
      "properties": {
        "qoeScore": {"type": "number"},
        "initialBuffering": {"type": "number"},
        "reBuffFreq": {"type": "number"},
        "stallRatio": {"type": "number"}
      },
      "minProperties": 1,
      "additionalProperties": false
    }
  },

  "additionalProperties": false,
  "required": ["scope", "qoeObjectives"],

  "$defs": {
    "https://schemas.o-ran.org/jsonschemas/a1td/common_1.0.0":

  }
}
```

7.2.2.3.2 Policy status schema

The generic policy status schema in clause 7.1.2.2 is used.

7.2.3 Traffic steering preferences

7.2.3.1 Policy type identifier

PolicyTypeId: **ORAN_TrafficSteeringPreference_4.0.1**

7.2.3.2 Rationale

7.2.3.2.1 Use case

See "Use case 1: Traffic Steering use case" in Non-RT RIC & A1/R1 interface: Use Cases and Requirements [1].

7.2.3.2.2 Statements, restrictions and extensions

A TSP statement can be applied together with ScopeIdentifier containing different combinations of identifiers. Not all combinations are relevant. Table 7.2.3.2.2-1 indicates combinations that are allowed.

Table 7.2.3.2.2-1: Allowed combinations of tspResources statement with ScopeIdentifier

ScopeIdentifier / Policy statement	ueId	groupId	sliceId	qosId	cellId
tspResources	1	0	0..1	0..1	0..1
tspResources	0	0	1	0..1	0..1
NOTE: On each row is listed a combination of identifiers that is allowed for the indicated statement. Notation is the same as for cardinality: "0" means the identifier shall not occur, "0..1" means the identifier may occur and "1" means the identifier shall occur. Only at most one occurrence of an identifier is allowed in the present version.					

7.2.3.3 JSON schemas

7.2.3.3.1 Policy schema

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$id": "https://schemas.o-ran.org/jsonschemas/a1td/oran_ trafficsteeringpreference_4.0.1",
"description": "O-RAN standard Traffic Steering Preference policy",
  "type": "object",
  "properties": {

    "scope": {
      "anyOf": [
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "/a1td/common_1.0.0#/$defs/UeId"},
            "sliceId": {"$ref": "/a1td/common_1.0.0#/$defs/SliceId"},
            "qosId": {"$ref": "/a1td/common_1.0.0#/$defs/QosId"},
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["ueId"]
        },
        {
          "type": "object",
          "properties": {
            "sliceId": {"$ref": "/a1td/common_1.0.0#/$defs/SliceId"},
            "qosId": {"$ref": "/a1td/common_1.0.0#/$defs/QosId"},
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["sliceId"]
        }
      ]
    },

    "tspResources": {
      "type": "array",
      "items": {
        "$ref": "#/$defs/TspResource"
      },
      "minItems": 1
    }
  },

  "additionalProperties": false,
  "required": ["scope", "tspResources"],

  "$defs": {
    "PreferenceType": {
      "type": "string",
        "enum": [
          "SHALL",
          "PREFER",
          "AVOID",
          "FORBID"
        ]
    },
    "TspResource": {
      "type": "object",
        "properties": {
```

```
          "cellIdList": {"$ref": "/a1td/common_1.0.0#/$defs/CellIdList"},
          "preference": {"$ref": "#/$defs/PreferenceType"},
          "primary": {"type": "boolean"}
        },
        "required": ["cellIdList", "preference"],
        "additionalProperties": false
    },
    "https://schemas.o-ran.org/jsonschemas/a1td/common_1.0.0":

  }
}
```

7.2.3.3.2 Policy status schema

The generic policy status schema in clause 7.1.2.2 is used.

7.2.4 QoS optimization with resource directive

7.2.4.1 Policy type identifier

PolicyTypeId: **ORAN_QoSandTSP_4.0.1**

7.2.4.2 Rationale

7.2.4.2.1 Use case

Addresses both the QoS based resource optimization and Traffic steering preferences use cases.

7.2.4.2.2 Statements, restrictions and extensions

The allowed combinations of ScopeIdentifier and statements is the common subset of those defined for the policy type QoS Target and the policy type Traffic Steering Preferences.

7.2.4.3 JSON schemas

7.2.4.3.1 Policy schema

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$id": "https://schemas.o-ran.org/jsonschemas/a1td/oran_qosandtsp_4.0.1",
  "description": "O-RAN standard QoS Target and Traffic Steering Preference policy",
  "type": "object",
  "properties": {

    "scope": {
      "anyOf": [
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "/a1td/common_1.0.0#/$defs/UeId"},
            "sliceId": {"$ref": "/a1td/common_1.0.0#/$defs/SliceId"},
            "qosId": {"$ref": "/a1td/common_1.0.0#/$defs/QosId"},
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["ueId", "qosId"]
        },
        {
          "type": "object",
          "properties": {
            "sliceId": {"$ref": "/a1td/common_1.0.0#/$defs/SliceId"},
            "qosId": {"$ref": "/a1td/common_1.0.0#/$defs/QosId"},
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["sliceId", "qosId"]
        }
```

```
      ]
    },

    "qosObjectives": {
      "type": "object",
      "properties": {
        "gfbr": {"type": "number"},
        "mfbr": {"type": "number"},
        "priorityLevel": {"type": "number"},
        "pdb": {"type": "number"}
      },
      "minProperties": 1,
      "additionalProperties": false
    },

    "tspResources": {
      "type": "array",
      "items": {
        "$ref": "#/$defs/TspResource"
      },
      "minItems": 1
    }
  },

  "additionalProperties": false,
  "required": ["scope", "qosObjectives", "tspResources"],

  "$defs": {
    "PreferenceType": {
      "type": "string",
        "enum": [
          "SHALL",
          "PREFER",
          "AVOID",
          "FORBID"
        ]
    },
    "TspResource": {
      "type": "object",
        "properties": {
          "cellIdList": {"$ref": "#/a1td/common_1.0.0/$defs/CellIdList"},
          "preference": {"$ref": "#/$defs/PreferenceType"},
          "primary": {"type": "boolean"}
        },
        "required": ["cellIdList", "preference"],
        "additionalProperties": false
    },
    "https://schemas.o-ran.org/jsonschemas/a1td/common_1.0.0":

  }
}
```

7.2.4.3.2 Policy status schema

The generic policy status schema in clause 7.1.2.2 is used.

7.2.5 QoE optimization with resource directive

7.2.5.1 Policy type identifier

PolicyTypeId: **ORAN_QoEandTSP_4.0.1**

7.2.5.2 Rationale

7.2.5.2.1 Use case

Addresses both the QoE and Traffic steering preferences use cases.

7.2.5.2.2 Statements, restrictions and extensions

The allowed combinations of ScopeIdentifier and statements is the common subset of those defined for the policy type QoE Target and the policy type Traffic Steering Preferences.

7.2.5.3 JSON schemas

7.2.5.3.1 Policy schema

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$id": "https://schemas.o-ran.org/jsonschemas/a1td/oran_qoeandtsp_4.0.1",
  "description": "O-RAN standard QoE Target and Traffic Steering Preference policy",
  "type": "object",
  "properties": {

    "scope": {
      "anyOf": [
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "/a1td/common_1.0.0#/$defs/UeId"},
            "sliceId": {"$ref": "/a1td/common_1.0.0#/$defs/SliceId"},
            "qosId": {"$ref": "/a1td/common_1.0.0#/$defs/QosId"},
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["ueId", "sliceId"]
        },
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "/a1td/common_1.0.0#/$defs/UeId"},
            "qosId": {"$ref": "/a1td/common_1.0.0#/$defs/QosId"},
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["ueId", "qosId"]
        },
        {
          "type": "object",
          "properties": {
            "sliceId": {"$ref": "/a1td/common_1.0.0#/$defs/SliceId"},
            "qosId": {"$ref": "/a1td/common_1.0.0#/$defs/QosId"},
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["sliceId"]
        }
      ]
    },

    "qoeObjectives": {
      "type": "object",
      "properties": {
        "qoeScore": {"type": "number"},
        "initialBuffering": {"type": "number"},
        "reBuffFreq": {"type": "number"},
        "stallRatio": {"type": "number"}
      },
      "minProperties": 1,
      "additionalProperties": false
    },

    "tspResources": {
      "type": "array",
      "items": {
        "$ref": "#/$defs/TspResource"
      },
      "minItems": 1
    }
  },

  "additionalProperties": false,
  "required": ["scope", "qoeObjectives", "tspResources"],
```

```
  "$defs": {
    "PreferenceType": {
      "type": "string",
        "enum": [
          "SHALL",
          "PREFER",
          "AVOID",
          "FORBID"
        ]
    },
    "TspResource": {
      "type": "object",
        "properties": {
          "cellIdList": {"$ref": "/a1td/common_1.0.0#/$defs/CellIdList"},
          "preference": {"$ref": "#/$defs/PreferenceType"},
          "primary": {"type": "boolean"}
        },
        "required": ["cellIdList", "preference"],
        "additionalProperties": false
    },
    "https://schemas.o-ran.org/jsonschemas/a1td/common_1.0.0":

  }
}
```

7.2.5.3.2 Policy status schema

The generic policy status schema in clause 7.1.2.2 is used.

7.2.6 UE level target

7.2.6.1 Policy type identifier

PolicyTypeId: **ORAN_UELevelTarget_3.0.1**

7.2.6.2 Rationale

7.2.6.2.1 Use case

Addresses the QoS based resource optimization use case.

7.2.6.2.2 Statements, restrictions and extensions

A UE level statement can be applied together with scope identifiers containing different combinations of identifiers. Not all combinations are relevant. Table 7.2.6.2.2-1 indicates the combinations that are allowed.

Table 7.2.6.2.2-1: Allowed combinations of ueLevelObjectives statement with ScopeIdentifier

Scope identifier / Policy statement	ueId	groupId	sliceId	qosId	cellId
ueLevelObjectives	1	0..1	0..1	0	0..1
ueLevelObjectives	1	0..1	0..1	1	0..1
ueLevelObjectives	1	0	1	0..1	0..1
NOTE: On each row is listed a combination of identifiers that is allowed for the indicated statement. Notation is the same as for cardinality: "0" means the identifier shall not occur, "0..1" means the identifier may occur and "1" means the identifier shall occur. Only at most one occurrence of an identifier is allowed in the present version.					

7.2.6.3 JSON schemas

7.2.6.3.1 Policy schema

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$id": "https://schemas.o-ran.org/jsonschemas/a1td/oran_ueleveltarget_3.0.1",
  "description": "O-RAN standard UE Level Target policy",
  "type": "object",
  "properties": {

    "scope": {
      "anyOf": [
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "/a1td/common_1.0.0#/$defs/UeId"},
            "groupId": {"$ref": "/a1td/common_1.0.0#/$defs/GroupId"},
            "sliceId": {"$ref": "/a1td/common_1.0.0#/$defs/SliceId"},
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["ueId"]
        },
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "/a1td/common_1.0.0#/$defs/UeId"},
            "groupId": {"$ref": "/a1td/common_1.0.0#/$defs/GroupId"},
            "sliceId": {"$ref": "/a1td/common_1.0.0#/$defs/SliceId"},
            "qosId": {"$ref": "/a1td/common_1.0.0#/$defs/QosId"},
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["ueId", "qosId"]
        },
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "/a1td/common_1.0.0#/$defs/UeId"},
            "sliceId": {"$ref": "/a1td/common_1.0.0#/$defs/SliceId"},
            "qosId": {"$ref": "/a1td/common_1.0.0#/$defs/QosId"},
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["ueId", "sliceId"]
        }
      ]
    },

    "ueLevelObjectives": {
      "type": "object",
      "properties": {
        "ulThroughput": {"type": "number"},
        "dlThroughput": {"type": "number"},
        "ulPacketDelay": {"type": "number"},
        "dlPacketDelay": {"type": "number"},
        "ulPdcpSduPacketLossRate": {"type": "number"},
        "dlRlcSduPacketLossRate ": {"type": "number"},
        "dlReliability": {"$ref": "#/$defs/ReliabilityType"},
        "ulReliability": {"$ref": "#/$defs/ReliabilityType"}
      },
      "minProperties": 1,
      "additionalProperties": false
    }
  },

  "additionalProperties": false,
  "required": ["scope", "ueLevelObjectives"],

  "$defs": {
    "ReliabilityType": {
      "type": "object",
      "properties": {
        "packetSize": {"type": "number"},
        "userPlaneLatency": {"type": "number"},
        "successProbility": {"type": "number"}
```

```
      },
      "required": ["packetSize","userPlaneLatency","successProbility"]
    },
    "https://schemas.o-ran.org/jsonschemas/a1td/common_1.0.0":

  }
}
```

7.2.6.3.2 Policy status schema

The generic policy status schema in clause 7.1.2.2 is used.

7.2.7 Slice SLA target

7.2.7.1 Policy type identifier

PolicyTypeId: **ORAN_SliceSLATarget_3.0.0**

7.2.7.2 Rationale

7.2.7.2.1 Use case

See "Use case 5: RAN Slice SLA Assurance" defined in Non-RT RIC and A1/R1 interface: Use Cases and Requirements [1].

7.2.7.2.2 Statements, restrictions and extensions

The sliceSlaObjectives statement can be applied together with ScopeIdentifier containing sliceId identifier. Table 7.2.7.2.2-1 indicates the combination that is allowed.

Table 7.2.7.2.2-1: Allowed combinations of sliceSlaObjectives statement with ScopeIdentifier

ScopeIdentifier Policy statement	ueId	groupId	sliceId	qosId	cellId
sliceSlaObjectives	0	0	1	0	0
NOTE: "0" means the identifier shall not occur, "1" means the identifier shall occur.					

The sliceSlaResources statement can optionally be applied together with sliceSlaObjectives statement.

7.2.7.3 JSON schemas

7.2.7.3.1 Policy schema

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$id": "https://schemas.o-ran.org/jsonschemas/a1td/oran_sliceslatarget_3.0.0",
  "description": "O-RAN standard slice SLA policy",
  "type": "object",
  "properties": {

    "scope": {
      "type": "object",
      "properties": {
        "sliceId": {"$ref": "/a1td/common_1.0.0#/$defs/SliceId"}
      },
      "additionalProperties": false,
      "required": ["sliceId"]
    },

    "sliceSlaObjectives": {
      "type": "object",
      "properties": {
```

```
        "maxNumberOfUes": {"type": "number"},
        "maxNumberOfPduSessions": {"type": "number"},
        "guaDlThptPerSlice": {"type": "number"},
        "maxDlThptPerSlice": {"type": "number"},
        "maxDlThptPerUe": {"type": "number"},
        "guaUlThptPerSlice": {"type": "number"},
        "maxUlThptPerSlice": {"type": "number"},
        "maxUlThptPerUe": {"type": "number"},
        "maxDlPacketDelayPerUe": {"type": "number"},
        "maxUlPacketDelayPerUe": {"type": "number"},
        "maxDlPdcpSduPacketLossRatePerUe": {
          "type": "number",
          "minimum": 0,
          "maximum": 1
        },
        "maxUlRlcSduPacketLossRatePerUe": {
          "type": "number",
          "minimum": 0,
          "maximum": 1
        },
        "minDlReliabilityPerUe": {"$ref": "#/$defs/ReliabilityType"},
        "minUlReliabilityPerUe": {"$ref": "#/$defs/ReliabilityType"},
        "maxDlJitterPerUe": {"type": "number"},
        "maxUlJitterPerUe": {"type": "number"},
        "dlSlicePriority": {
          "type": "number",
          "minimum": 1
        },
        "ulSlicePriority": {
          "type": "number",
          "minimum": 1
        },
        "maxDlPktSize": {"$type": "number"},
        "maxUlPktSize": {"$type": "number"}
      },
      "minProperties": 1,
      "additionalProperties": false
    },

    "sliceSlaResources": {
      "type": "object",
      "properties": {
        "cellIdList": {"$ref": "/a1td/common_1.0.0#/$defs/CellIdList"},
        "taIList": {"$ref": "/a1td/common_1.0.0#/$defs/TaIList"}
      },
      "additionalProperties": false,
      "oneOf": [
        {"required": ["cellIdList"]},
        {"required": ["taIList"]}
      ]
    }
  },

  "additionalProperties": false,
  "required": ["scope", "sliceSlaObjectives"],

  "$defs": {
    "ReliabilityType": {
      "type": "object",
      "properties": {
        "packetSize": {"type": "number"},
        "userPlaneLatency": {"type": "number"},
        " successProbability": {
          "type": "number",
          "minimum": 0,
          "maximum": 1
        }
      },
      "required": ["packetSize","userPlaneLatency"," successProbability"]
    },
    "https://schemas.o-ran.org/jsonschemas/a1td/common_1.0.0":

  }
}
```

7.2.7.3.2 Policy status schema

The generic policy status schema in clause 7.1.2.2 is used.

7.2.8 Load balancing

7.2.8.1 Policy type identifier

PolicyTypeId: **ORAN_LoadBalancing_1.0.2**

7.2.8.2 Rationale

7.2.8.2.1 Use case

See "Use case 5: RAN Slice SLA Assurance use case" in Non-RT RIC & A1/R1 interface: Use Cases and Requirements [1].

7.2.8.2.2 Statements, restrictions and extensions

A lbObjectives statement can be applied together with ScopeIdentifier containing different combinations of identifiers. Not all combinations are relevant. Table 7.2.8.2.2-1 indicates the combinations that are allowed.

ScopeIdentifier is used to designate a cell from which load needs to be transferred to other cells. If sliceId is applied together with cellId, only a part of the load associated with a designated slice among the cell load is transferred to other cells.

ScopeIdentifier also indicates the measurement range for calculating the load specified by prbUsgType in lbObjectives statement. If only cellId is applied, applicable values for prbUsgType are 1-4. If sliceId is applied together with cellId, applicable values for prbUsgType are 5-8.

Regardless of the combination of ScopeIdentifier and lbObjectives statement, lbResources statement indicates the target cells to which the load is transferred.

Table 7.2.8.2.2-1: Allowed combinations of lbObjectives statement with ScopeIdentifier

ScopeIdentifier Policy statement	ueId	groupId	sliceId	qosId	cellId
lbObjectives	0	0	0..1	0	1
NOTE: On each row is listed a combination of identifiers that is allowed for the indicated statement. Notation is the same as for cardinality: "0" means the identifier shall not occur, "0..1" means the identifier may occur and "1" means the identifier shall occur. Only at most one occurrence of an identifier is allowed in the present version.					

The lbObjectives statement is applied together with lbResources statement.

7.2.8.3 JSON schemas

7.2.8.3.1 Policy schema

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$id": "https://schemas.o-ran.org/jsonschemas/a1td/oran_loadbalancing_1.0.2",
  "description": "O-RAN standard Load Balancing policy",
  "type": "object",
  "properties": {

    "scope": {

      "anyOf": [
        {
          "type": "object",
          "properties": {
            "sliceId": {"$ref": "/a1td/common_1.0.0#/$defs/SliceId"},
```

```
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["cellId"]
        }
      ]
    },

    "lbObjectives": {
      "type": "object",
      "properties": {
        "targetPrbUsg": {"type": "number"},
        "prbUsgType": {"type": "number"}
      },
      "additionalProperties": false,
      "required": ["targetPrbUsg", "prbUsgType"]
    },

    "lbResources": {
      "type": "object",
      "properties": {
        "cellIdList": {"$ref": "/a1td/common_1.0.0#/$defs/CellIdList"}
      },
      "required": ["cellIdList"],
      "additionalProperties": false
    }
  },

  "additionalProperties": false,
  "required": ["scope", "lbResources", "lbObjectives"],

  "$defs": {
    "https://schemas.o-ran.org/jsonschemas/a1td/common_1.0.0":

  }
}
```

7.2.9 Energy Savings

7.2.9.1 Policy type identifier

PolicyTypeId: **ORAN_EnergySaving_2.0.0**

7.2.9.2 Rationale

7.2.9.2.1 Use case

See "Use case 8: Network Energy saving Use Cases " in Non-RT RIC & A1 interface: Use Cases and Requirements [1].

7.2.9.2.2 Statements, restrictions and extensions

An energy saving statement (i.e. esObjectives and/or esResources) can be applied together with ScopeIdentifier containing different combinations of identifiers. Not all combinations are relevant. The following table indicates combinations that are allowed.

Table 7.2.9.2.2-1: Allowed combinations of esObjectives / esResources statement with ScopeIdentifier

ScopeIdentifier / Policy statement	ueId	groupId	qosId	taList	cellId	cellIdList
esObjectives / esResources	0	0	0	0	1	0
esObjectives / esResources	0	0	0	0	0	1
esObjectives / esResources	0	0	0	1	0	0

NOTE 1: On each row is listed a combination of identifiers that is allowed for the indicated statement. Notation is the same as for cardinality: "0" means the identifier shall not occur, "0..1" means the identifier may occur and "1" means the identifier shall occur. Only at most one occurrence of an identifier is allowed in the present version.

NOTE 2: When ScopeIdentifier contains taiList or cellIdList, and esResources is present, the cells indicated in esResources should be a subset of the cells implied by the ScopeIdentifier.

7.2.9.3 JSON schemas

7.2.9.3.1 Policy schema

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$id": "https://schemas.o-ran.org/jsonschemas/a1td/oran_energysaving_2.0.0",
  "description": "O-RAN standard Energy saving policy",
  "type": "object",
  "properties": {

    "scope": {
      "anyOf": [
        {
          "type": "object",
          "properties": {
            "cellId": {"$ref": "/a1td/common_1.0.0#/$defs/CellId"}
          },
          "additionalProperties": false,
          "required": ["cellId"]
        },
        {
          "type": "object",
          "properties": {
            "cellIdList": {"$ref": "/a1td/common_1.0.0#/$defs/CellIdList"}
          },
          "additionalProperties": false,
          "required": ["cellIdList"]
        },
        {
          "type": "object",
          "properties": {
            "taIList": {"$ref": "/a1td/common_1.0.0#/$defs/TaIList"}
          },
          "additionalProperties": false,
          "required": ["taIList"]
        }
      ]
    },

    "esObjectives": {
      "oneOf": [
        {
          "type": "object",
            "properties": {
              "targetPeeEnergy": {"type": "integer"}
            },
            "additionalProperties": false,
            "required": ["targetPeeEnergy"]
        },
        {
          "type": "object",
          "properties": {
            "esPercentage": {
              "type": "integer",
```

```
                "minimum": 0,
                "maximum": 100
              }
            },
            "additionalProperties": false,
            "required": ["esPercentage"]
        }
      ]
    },

    "esResources": {
      "type": "array",
      "items": {"$ref": "#/$defs/EsResource"},
      "minItems": 1
    }
  },

  "additionalProperties": false,
  "anyOf": [
    {"required": ["scope","esObjectives"]},
    {"required": ["scope","esResources"]}
  ],

  "$defs": {
    "AvoidanceType": {
      "type": "string",
      "enum": [
        "AVOID",
        "FORBID"
      ]
    },
    "EsResource": {
      "oneOf": [
        {
          "type": "object",
          "properties": {
            "operationalCells": {"$ref": "/a1td/common_1.0.0#/$defs/CellIdList"},
            "operationalPreference": {"$ref": "#/$defs/AvoidanceType"},
            "prbTotalDl": {"type": "integer", "minimum": 0, "maximum": 100},
            "prbTotalUl": {"type": "integer", "minimum": 0, "maximum": 100}
          },
          "additionalProperties": false,
          "required": ["operationalCells","operationalPreference"]
        },
        {
          "type": "object",
          "properties": {
            "coverageCells": {"$ref": "/a1td/common_1.0.0#/$defs/CellIdList"},
            "coveragePreference": {"$ref": "#/$defs/AvoidanceType"},
            "prbTotalDl": {"type": "integer", "minimum": 0, "maximum": 100},
            "prbTotalUl": {"type": "integer", "minimum": 0, "maximum": 100}
          },
          "additionalProperties": false,
          "required": ["coverageCells","coveragePreference"]
        },
        {
          "type": "object",
          "properties": {
            "operationalCells": {"$ref": "/a1td/common_1.0.0#/$defs/CellIdList"},
            "operationalPreference": {"$ref": "#/$defs/AvoidanceType"},
            "coverageCells": {"$ref": "/a1td/common_1.0.0#/$defs/CellIdList"},
            "coveragePreference": {"$ref": "#/$defs/AvoidanceType"},
            "prbTotalDl": {"type": "integer", "minimum": 0, "maximum": 100},
            "prbTotalUl": {"type": "integer", "minimum": 0, "maximum": 100}
          },
          "additionalProperties": false,
          "required": ["operationalCells", "operationalPreference", "coverageCells",
"coveragePreference"]
        }

      ]
    },
    "https://schemas.o-ran.org/jsonschemas/a1td/common_1.0.0":

  }
}
```

7.2.9.3.2 Policy status schema

The generic policy status schema in clause 7.1.2.2 is used.

8 A1-EI data model

8.1 Introduction

This clause specifies the application data model supported by the A1-EI API specified in A1AP [3]. The purpose of the data model is to be the basis for:

- definition of EI types; and
- the EI representation objects that are transported in the body of the A1-EI procedures.

There are two kinds of EI types: those defined by O-RAN and those defined by another entity. EI types need to define:

- an EiTypeIdentifier for usage in the A1-EI procedures and URI structure; and
- the content to be transported in the body of the A1-EI procedures.

The content is referred to as EI representation objects for the O-RAN defined EI types and is defined by using the A1-EI data model specified in this clause. An EI type defined outside of O-RAN may use the A1-EI data model or another model that covers the content corresponding to the schemas and objects.

The present document covers the data model for O-RAN defined EI types. The O-RAN defined EI types are based on the statements and attributes defined in the data model and may extend it with EI type specific rules and attributes.

The O-RAN defined EI types are defined based on JSON Schema [7]. An EI type is defined by four schemas for EI job definition, EI job constraints, EI job status and EI job result. The schemas are used to validate the EI representation objects transferred in the body of the A1-EI procedures.

8.2 Simple data types and enumerations

8.2.1 Simple data types

The EI job contains URIs for EI job status notifications and EI job results. The simple data types for callback URIs are defined in table 8.2.1-1.

Table 8.2.1-1: General definition of simple data types for callback URIs

Type Name	Type Definition	Description	Applicability
JobStatusNotificationUri	string	target URI for EI job status notifications	provided in EI Job object and used in the Notify EI job notification procedure
JobResultUri	string	target URI for EI job results	provided in EI Job object and used in the Deliver EI job result procedure

The simple data type for JSON schemas is defined in table 8.2.1-2.

Table 8.2.1-2: Definition of JsonSchema

Type Name	Type Definition	Description	Applicability
JsonSchema	https://json-schema.org/draft/2020-12/schema	A JSON schema meta-schema following JSON Schema [7]	

8.2.2 Enumerations

8.2.2.1 JobStatusType

The enumeration JobStatusType represents if an EI job is confirmed to deliver EI results. It shall comply with the provisions defined in table 8.2.2.1-1.

Table 8.2.2.1-1: Enumeration JobStatusType

Enumeration value	Description	Applicability
ENABLED	the EI Job is enabled	the A1-EI producer is able to deliver EI result for the EI Job
DISABLED	the EI Job is disabled	the A1-EI producer is not able to deliver EI result for the EI Job

8.2.2.2 GadShapeType

The enumeration GadShapeType represents the different types or shapes of geographic areas. It shall comply with the provisions defined in table 8.2.2.2-1.

Table 8.2.2.2-1: Enumeration GadShapeType

Enumeration value	Description	Applicability
POINT	Ellipsoid point	
POINT_UNCERTAINTY_CIRCLE	Ellipsoid point with uncertainty circle	
POINT_UNCERTAINTY_ELLIPSE	Ellipsoid point with uncertainty ellipse	
POLYGON	Polygon	
POINT_ALTITUDE	Ellipsoid point with altitude	
POINT_ALTITUDE_UNCERTAINTY	Ellipsoid point with altitude and uncertainty ellipsoid	
ELLIPSOID_ARC	Ellipsoid arc	

8.2.2.3 VelocityDescType

The enumeration VelocityDescType represents the different types of UE velocity descriptions. It shall comply with the provisions defined in table 8.2.2.3-1.

Table 8.2.2.3-1: Enumeration VelocityDescType

Enumeration value	Description	Applicability
H_VELOCITY	Horizontal velocity	
HV_VELOCITY	Horizontal and vertical velocity	
H_VELOCITY_UNCERTAINTY	Horizontal velocity with uncertainty	
HV_VELOCITY_UNCERTAINTY	Horizontal and vertical velocity with uncertainty	

8.3 Structured data types

8.3.1 ScopeIdentifier

The ScopeIdentifier is EI type specific.

If the ScopeIdentifier contains attributes corresponding to the A1 policy ScopeIdentifier, they are the same as defined for A1-P, see clause 6.3.1.

8.3.2 Statements for EI job definition

8.3.2.1 Introduction

This clause defines the structured data type and attributes to be used for EI job definition, which are summarized in table 8.3.2.1-1.

Table 8.3.2.1-1: Statements for EI job definition

Data type	Clause defined	Description	Applicability
UeGeoandVelEIDescription	8.3.2.2	EI job definition for UE geo-location and velocity information	

8.3.2.2 UE geo-location and velocity information

The UEGeoandVelEIDescription statement contains the attributes defined in table 8.3.2.2-1:

Table 8.3.2.2-1: Definition of UEGeoandVelEIDescription

Attribute name	Data type	P	Cardinality	Description	Applicability
gadShape	GadShapeType	M	1	GAD shapes used for UE geo-location information, see clause 8.2.2.2	
velocityDesc	VelocityDescType	O	1	Type of description for UE velocity information, see clause 8.2.2.3	
granularityPeriod	integer	M	1	Interval of periodic measurement in milliseconds	
reportingPeriod	integer	M	1	Interval of periodic reporting in milliseconds	
reportingAmount	integer	M	1	Number of periodic reports	
NOTE: Event-triggered measurement and reporting is not specified in the present document.					

8.3.3 Statements for EI job result

8.3.3.1 Introduction

This clause defines the structured data type and attributes to be used for EI job result definition, which are summarized in table 8.3.3.1-1.

Table 8.3.3.1-1: Statements for EI job result definition

Data type	Clause defined	Description	Applicability
UeGeoandVelEIResult	8.3.3.2	EI job result definition for UE geo-location and velocity information	

8.3.3.2 UE geo-location and velocity EI

The UEGeoandVelEIResult statement contains the attributes defined in table 8.3.3.2-1:

Table 8.3.3.2-1: Definition of UEGeoandVelElResult

Attribute name	Data type	P	Cardinality	Description	Applicability
timeStamp	DateTime	M	1	Indicates the UTC time corresponds to the UE geo-location and velocity enrichment information, see ETSI TS 129 571 [5].	
ueId	UeId	M	1	UE identifier, see clause 6.3.1.7.	
gadShape	GadShapeType	M	1	GAD shapes used for UE geo-location information, see clause 8.2.2.2	
geoLocation	GeoLocationType	M	1	Indicates the UE geo-location enrichment information, see table 8.3.2.2-2	
velocityDesc	VelocityDescType	O	0..1	Type of description for UE velocity information, see clause 8.2.2.3	
velocity	VelocityType	C	0..1	Indicates the UE velocity enrichment information, see table 8.3.2.2-3	
NOTE: Presence condition "C" means that the attribute shall be included if the attribute "velocityDesc" is included.					

The GeoLocationType is defined in table 8.3.2.2-2 as a list of following mutually exclusive alternatives.

Table 8.3.2.2-2: Definition of GeoLocationType

Data type	Cardinality	Discriminator name	Discriminator mapping	Description
Point	1	gadShape	POINT	Geolocation consisting of a single ellipsoid point, represented by its longitude and latitude, see ETSI TS 129 572 [20], clause 6.1.6.2.6
PointUncertaintyCircle	1	gadShape	POINT_UNCERTAINTY_CIRCLE	Geolocation consisting of a point and an uncertainty value, see ETSI TS 129 572 [20], clause 6.1.6.2.7
PointUncertaintyEllipse	1	gadShape	POINT_UNCERTAINTY_ELLIPSE	Geolocation consisting of a point and an uncertainty ellipse, see ETSI TS 129 572 [20], clause 6.1.6.2.8
Polygon	1	gadShape	POLYGON	Geolocation consisting of a list of points, see ETSI TS 129 572 [20], clause 6.1.6.2.9
PointAltitude	1	gadShape	POINT_ALTITUDE	Geolocation consisting of a point and an altitude value, see ETSI TS 129 572 [20], clause 6.1.6.2.10
PointAltitudeUncertainty	1	gadShape	POINT_ALTITUDE_UNCERTAINTY	Geolocation consisting of a point, an altitude value, and an uncertainty value, see ETSI TS 129 572 [20], clause 6.1.6.2.11
EllipsoidArc	1	gadShape	ELLIPSOID_ARC	Geolocation consisting of an ellipsoid arc, see ETSI TS 129 572 [20], clause 6.1.6.2.12

The VelocityType is defined in table 8.3.2.2-3 as a list of following mutually exclusive alternatives.

Table 8.3.2.2-3: Definition of VelocityType

Data type	Cardinality	Discriminator name	Discriminator mapping	Description
HorizontalVelocity	1	velocityDesc	H_VELOCITY	Horizonal velocity, see ETSI TS 129 572 [20], clause 6.1.6.2.18
HorizontalWithVerticalVelocity	1	velocityDesc	HV_VELOCITY	Horizonal velocity and vertical velocity, see ETSI TS 129 572 [20], clause 6.1.6.2.19
HorizontalVelocityWithUncertainty	1	velocityDesc	H_VELOCITY_UNCERTAINTY	Horizonal velocity with a speed uncertainty value, see ETSI TS 129 572 [20], clause 6.1.6.2.20
HorizontalWithVerticalVelocityAndUncertainty	1	velocityDesc	HV_VELOCITY_UNCERTAINTY	Horizonal velocity and vertical velocity with speed uncertainty values, see ETSI TS 129 572 [20], clause 6.1.6.2.21

8.3.4 Statements for EI job constraints

8.3.4.1 Introduction

This clause defines the structured data type and attributes to be used for EI job constraints. Table 8.3.4.1-1 specifies the statements that can be used for EI job constraints.

Table 8.3.4.1-1: Statements for EI job constraints

Data type	Clause defined	Description	Applicability
UEGeoandVelEIConstraints	8.3.4.2	EI job constraints for UE geo-location and velocity information	

8.3.4.2 UE geo-location and velocity information

The UEGeoandVelEIConstraints contains the attributes defined in table 8.3.4.2-1:

Table 8.3.4.2-1: Definition of UEGeoandVelEIConstraints

Attribute name	Data type	P	Cardinality	Description	Applicability
supportedGadShapes	array(GadShapeType)	M	1..N	Indicates supported GAD shapes to describe UE geo-location, see clause 8.2.2.2	
supportedVelocityDescs	array(VelocityDescType)	O	0..N	Indicates supported types of UE velocity description, see clause 8.2.2.3	

8.4 EI representations objects

8.4.1 EI type object

The EI type object can be empty or contain EI type specific information.

An EiTypeObject is based on IETF RFC 8259 [6] and can contain:

- one JSON schema for EiJobDefinition;
- one JSON schema for EiJobStatusObject;
- one JSON schema for EiJobResultObject; or
- one JSON schema for EiJobConstraintsObject.

The type EiTypeObject is defined in table 8.4.1-1.

Table 8.4.1-1: General definition of EiTypeObject

Attribute name	Data type	P	Cardinality	Description	Applicability
eiJobDefinitionSchema	JsonSchema	O	0..1	The schemas are EI type specific	
eiJobStatusSchema	JsonSchema	O	0..1		
eiJobResultSchema	JsonSchema	O	0..1		
eiJobConstraintsSchema	JsonSchema	O	0..1		
NOTE 1: Clause 9.2 contains definitions and EI type specific schemas for O-RAN defined A1 EI types. NOTE 2: The eiJobDefintionSchema attribute shall contain the compound EI job definition schema as described in clause 9.1.2.2.					

The JSON schema for an EiJobDefinition is used by the A1-EI Consumer to formulate an EI job definition and by the A1-EI Producer to validate an EiJobObject during Create EI job and Update EI job procedures.

The JSON schema for an EiJobConstraintsObject is used by the A1-EI Producer to formulate EI job constraints and by the A1-EI Consumer to validate an EiJobConstraintsObject that is considered when formulating an EI job definition.

The JSON schema for an EiJobStatusObject is used by the A1-EI Producer to formulate EI job status and by the A1-EI Consumer to validate an EiJobStatusObject during Query EI job status and Notify EI job status procedures.

The JSON schema for an EiJobResultObject is used by the A1-EI Producer to formulate EI job results and by the A1-EI Consumer to validate an EiJobResultObject during Deliver EI job result procedures.

The EiTypeObject and the EiJobConstraintsObject can be retrieved using the Query EI type procedure.

8.4.2 EI job object

8.4.2.1 General

An EiJobObject is based on IETF RFC 8259 [6] and contains:

- one EI type identifier;
- one target URI for EI Job results; and
- one EI type specific job definition containing one or more EI job definition statements.

and optionally:

- one target URI for EI Job status notifications.

The type EiJobObject is defined in table 8.4.2-1.

Table 8.4.2-1: General definition of EIJobObject

Attribute name	Data type	P	Cardinality	Description	Applicability
eiTypeId	string	M	1	EI type identifier	EI type specific
jobResultUri	string	M	1	See clause 8.2.1	
jobStatusNotificationUri	string	O	0..1	See clause 8.2.1	
jobDefinition	JobDefinition	M	1	See clause 8.3.2	EI type specific
NOTE: Presence condition "M" means that the data type shall be included in an EI job object for EI types based on the present document. Additional attributes may be defined for a specific EI type.					

This definition is general and indicates how to formally construct an EiJobObject. The EI types in clause 9.2 define EI type identifiers and schemas for EI job definitions.

The EI job definition is related to the EI job results, i.e. it can express which of the possible EI job result attributes that should be delivered based on the EI job.

8.4.2.2 Allowed combinations

A job definition statement can be applied together with a ScopeIdentifier containing different combinations of identifiers attributes. Not all combinations are relevant and different combinations are relevant for different EI types (see clause 9).

8.4.3 EI job status object

An EiJobStatus object is based on IETF RFC 8259 [6] and always contains:

- one EI job status attribute.

Table 8.4.3-1: General definition of EIJobStatusObject

Attribute name	Data type	P	Cardinality	Description	Applicability
jobStatus	JobStatusType	M	1	See clause 8.2.2	statement indicating status of an EI job
NOTE: Presence condition "M" means that the data type shall be included in an EI job status object for EI types based on the present document. Additional attributes may be defined for a specific EI type.					

8.4.4 EI job result object

An EiJobResult object is based on IETF RFC 8259 [6] and it contains:

- one or more EI job result statements.

8.4.5 EI job constraints object

An EiJobConstraintsObject is based on IETF RFC 8259 [6] and it contains:

- one or more EI job constraints statements.

The content is related to the EI job definition, i.e. it can express capabilities and limitations related to supported attributes and value ranges for EI job result attributes, and EI job production and delivery attributes.

8.5 Binary data

Binary data is not applicable in this version of the present document.

9 A1-EI data types (EI types)

9.1 Introduction

9.1.1 Identification and compatibility of EI types

An EI type is identified by a EiTypeId as defined in A1AP [3]. The EiTypeId is a string that consists of two parts: a `typename` and a `version`.

When updating an EI type, the `version` in the EiTypeId is updated according to SemVer [19] to reflect its compatibility with other EI types that has the same `typename`.

Two EI types are considered as different if the EiTypeId is different, i.e. even if the `typename` is the same and the `version` only differs in the patch version digit.

Two EI types are compatible in case the `typename` is the same and the major version digit in the `version` is the same. In general, two EI types X and Y are compatible when all objects that can be created based on EI type X can be validated by the schemas for EI type Y and all objects that can be created based on EI type Y can be validated by the schemas for EI type X.

9.1.2 Common definitions

9.1.2.1 EI job status

This is a generic EI job status schema, it may be adjusted and used together with an EI job schema in an EiTypeObject and will then be identified by the same EI type identifier as the EI job schema.

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "description": "O-RAN standard EI status",
  "type": "object",
  "properties": {
    "jobStatus": {
      "type": "string",
      "enum": [
        "ENABLED",
        "DISABLED"
      ]
    }
  },
  "additionalProperties": false,
  "required": ["jobStatus"]
}
```

If an EI type specific status schema contains additional attributes, they are included based on the structure of the generic schema.

9.1.2.2 Scope identifiers and common data types

The EI job definition schemas defined in clause 9.2 can be base schemas that embed a subschema with common data types definitions in same way as described for policy types in clause 7.1.

An EI type definition can link to the common data types schema defined in clause 7.1.2.1 and the compatibility relations are the same as for A1 policy types as described in Annex C. The EI types defined in the present document link to the version of the common data types schema defined in the present document.

It is the compound EI job definition schemas that are identified by the EI type identifier and included in the EiTypeObject specified in clause 8.4.1.

9.1.2.3 Schema identification

The EI type identifier is part of the $id keyword included in the EI job definition schema.

The $id keyword for the EI job definition schemas are constructed from the URI base and the EI type identifier in the same was as for policy types as described in clause 7.1.3.2. The base URI for EI types is the same as for policy types.

9.2 EI type definitions

9.2.1 UE location and velocity information

9.2.1.1 EI type identifier

EiTypeId: **ORAN_UEGeoandVel_3.0.1**

9.2.1.2 Rationale

9.2.1.2.1 Use case

See use case 4: context-based dynamic handover management for V2X, use case 5: RAN slice SLA assurance, and use case 7: massive MIMO optimization in Non-RT RIC and A1/R1 interface: Use Cases and Requirements [1].

9.2.1.2.2 Statements, restrictions and extensions

A UEGeoandVelEIDescription statement can be applied together with ScopeIdentifier containing different combinations of identifiers. Not all combinations are relevant. Table 9.2.1.2.2-1 indicates the combinations that are allowed.

Table 9.2.1.2.2-1: Allowed combinations of UEGeoandVelEIDescription with ScopeIdentifier

ScopeIdentifier EI job definition	ueId	groupId	sliceId	qosId	cellId
UEGeoandVelEIDescription	1	0	0	0	0
NOTE 1: on each row is listed a combination of identifiers that is allowed for the indicated statement. Notation is the same as for cardinality: "0" means the identifier shall not occur and "1" means the identifier shall occur.					
NOTE 2: A single UE identifier is allowed in the scope of the present document. Whether the scope for UEGeoandVelEIDescription statement can be extended to a group of UEs, UEs in a slice, or UEs in a cell is For Further Study.					

9.2.1.3 JSON schemas

9.2.1.3.1 EI job definition schema

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$id": "https://schemas.o-ran.org/jsonschemas/a1td/oran_uegeoandvel_3.0.1",
  "description": "O-RAN standard UE geo-location and velocity EI job definition",
  "type": "object",
  "properties": {

    "scope": {
      "type": "object",
      "properties": {
        "ueId": {"$ref": "/a1td/common_1.0.0#/$defs/UeId"}
      },
      "additionalProperties": false,
      "required": ["ueId"]
    },

    "ueGeoandVelEIDescription": {
      "type": "object",
```

```
      "properties": {
        "gadShape": {"$ref": "#/$defs/GadShapeType"},
        "granularityPeriod": {
          "type": "number",
          "minimum": 1,
          "maximum": 60000
        },
        "reportingPeriod": {
          "type": "number",
          "minimum": 1,
          "maximum": 60000
        },
        "reportingAmount": {
          "type": "number",
          "minimum": 1,
          "maximum": 3600000
        },
        "velocityDesc": {"$ref": "#/$defs/VelocityDescType"}
      },
      "required": ["gadShape", "granularityPeriod", "reportingPeriod", "reportingAmount"],
      "additionalProperties": false
    }
  },

  "additionalProperties": false,
  "required": ["scope", "ueGeoandVelEIDescription"],

  "$defs": {
    "GadShapeType": {
      "type": "string",
        "enum": [
          "POINT",
          "POINT_UNCERTAINTY_CIRCLE",
          "POINT_UNCERTAINTY_ELLIPSE",
          "POLYGON",
          "POINT_ALTITUDE",
          "POINT_ALTITUDE_UNCERTAINTY",
          "ELLIPSOID_ARC"
        ]
    },
    "VelocityDescType": {
      "type": "string",
        "enum": [
          "H_VELOCITY",
          "HV_VELOCITY",
          "H_VELOCITY_UNCERTAINTY",
          "HV_VELOCITY_UNCERTAINTY"
        ]
    },
    "https://schemas.o-ran.org/jsonschemas/a1td/common_1.0.0":

  }
}
```

9.2.1.3.2 EI job constraints schema

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "description": "O-RAN standard UE geo-location and velocity EI job constraints",
  "type": "object",
  "properties": {

    "ueGeoandVelEIConstraints": {
      "type": "object",
      "properties": {
        "supportedGadShapes": {
          "type": "array",
          "items": {
            "$ref": "#/$defs/GadShapeType"
          },
          "minItems": 1
        },
        "supportedVelocityTypes": {
          "type": "array",
          "items": {
            "$ref": "#/$defs/VelocityDescType"
```

```
          },
          "minItems": 1
        }
      },
      "required": ["supportedGadShapes"],
      "additionalProperties": false
    }
  },

  "additionalProperties": false,
  "required": ["ueGeoandVelEIConstraints"],

  "$defs": {
    "GadShapeType": {
      "type": "string",
        "enum": [
          "POINT",
          "POINT_UNCERTAINTY_CIRCLE",
          "POINT_UNCERTAINTY_ELLIPSE",
          "POLYGON",
          "POINT_ALTITUDE",
          "POINT_ALTITUDE_UNCERTAINTY",
          "ELLIPSOID_ARC"
        ]
    },
    "VelocityDescType": {
      "type": "string",
        "enum": [
          "H_VELOCITY",
          "HV_VELOCITY",
          "H_VELOCITY_UNCERTAINTY",
          "HV_VELOCITY_UNCERTAINTY"
        ]
    }
  }
}
```

9.2.1.3.3 EI job status schema

The generic EI job status schema in clause 9.1.2.1 is used.

9.2.1.3.4 EI job result schema

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "description": "O-RAN standard UE geo-location and velocity EI job results",
  "type": "array",
  "items": {
    "$ref": "#/$defs/UEGeoandVelEIResult"
  },
  "minItems": 1,

  "$defs": {
    "UEGeoandVelEIResult": {
      "type": "object",
      "properties": {
        "timeStamp": {"$ref": "#/$defs/DateTime"},
        "ueId": {"$ref": "/a1td/common_1.0.0#/$defs/UeId"},
        "gadShape": {"$ref": "#/$defs/GadShapeType"},
        "velocityDesc": {"$ref": "#/$defs/VelocityDescType"}
      },
      "allof": [
        {
          "if": {
            "properties": { "gadShape": { "const": "POINT" } }
          },
          "then": {
            "properties": { "geoLocation": { "$ref": "#/$defs/Point" } }
          }
        },
        {
          "if": {
            "properties": { "gadShape": { "const": "POINT_UNCERTAINTY_CIRCLE" } }
          },
          "then": {
```

```
        "properties": { "geoLocation": { "$ref": "#/$defs/PointUncertaintyCircle" } }
      }
    },
    {
      "if": {
        "properties": { "gadShape": { "const": "POINT_UNCERTAINTY_ELLIPSE" } }
      },
      "then": {
        "properties": { "geoLocation": { "$ref": "#/$defs/PointUncertaintyEllipse" } }
      }
    },
    {
      "if": {
        "properties": { "gadShape": { "const": "POLYGON" } }
      },
      "then": {
        "properties": { "geoLocation": { "$ref": "#/$defs/Polygon" } }
      }
    },
    {
      "if": {
        "properties": { "gadShape": { "const": "POINT_ALTITUDE" } }
      },
      "then": {
        "properties": { "geoLocation": { "$ref": "#/$defs/PointAltitude" } }
      }
    },
    {
      "if": {
        "properties": { "gadShape": { "const": "POINT_ALTITUDE_UNCERTAINTY" } }
      },
      "then": {
        "properties": { "geoLocation": { "$ref": "#/$defs/PointAltitudeUncertainty" } }
      }
    },
    {
      "if": {
        "properties": { "gadShape": { "const": "ELLIPSOID_ARC" } }
      },
      "then": {
        "properties": { "geoLocation": { "$ref": "#/$defs/EllipsoidArc" } }
      }
    },
    {
      "if": {
        "properties": { "velocityDesc": { "const": "H_VELOCITY" } },
        "required": ["velocityDesc"]
      },
      "then": {
        "properties": { "velocity": { "$ref": "#/$defs/HorizontalVelocity" } }
      }
    },
    {
      "if": {
        "properties": { "velocityDesc": { "const": "HV_VELOCITY" } },
        "required": ["velocityDesc"]
      },
      "then": {
        "properties": {
          "velocity": { "$ref": "#/$defs/HorizontalWithVerticalVelocity" }
        }
      }
    },
    {
      "if": {
        "properties": { "velocityDesc": { "const": "H_VELOCITY_UNCERTAINTY" } },
        "required": ["velocityDesc"]
      },
      "then": {
        "properties": {
          "velocity": { "$ref": "#/$defs/HorizontalVelocityWithUncertainty" }
        }
      }
    },
    {
      "if": {
        "properties": { "velocityDesc": { "const": "HV_VELOCITY_UNCERTAINTY" } },
        "required": ["velocityDesc"]
```

```
        },
        "then": {
          "properties": {
            "velocity": { "$ref": "#/$defs/HorizontalWithVerticalVelocityAndUncertainty" }
          }
        }
      }
    ],
    "required": ["timeStamp", "ueId", "gadShape", "geoLocation"]
  },
  "DateTime": {
    "type": "string",
    "format": "date-time"
  },
  "GadShapeType": {
    "type": "string",
      "enum": [
        "POINT",
        "POINT_UNCERTAINTY_CIRCLE",
        "POINT_UNCERTAINTY_ELLIPSE",
        "POLYGON",
        "POINT_ALTITUDE",
        "POINT_ALTITUDE_UNCERTAINTY",
        "ELLIPSOID_ARC"
      ]
  },
  "VelocityDescType": {
    "type": "string",
      "enum": [
        "H_VELOCITY",
        "HV_VELOCITY",
        "H_VELOCITY_UNCERTAINTY",
        "HV_VELOCITY_UNCERTAINTY"
      ]
  },
  "Point": {
    "type": "object",
    "properties": {
      "lon": {
        "type": "number",
        "minimum": -180,
        "maximum": 180
      },
      "lat": {
        "type": "number",
        "minimum": -90,
        "maximum": 90        }
    },
    "required": ["lon", "lat"]
  },
  "PointUncertaintyCircle": {
    "type": "object",
    "properties": {
      "point": { "$ref": "#/$defs/Point" },
      "uncertainty": { "$ref": "#/$defs/Uncertainty" }
    },
    "required": ["point", "uncertainty"]
  },
  "PointUncertaintyEllipse": {
    "type": "object",
    "properties": {
      "point": { "$ref": "#/$defs/Point" },
      "uncertaintyEllipse": { "$ref": "#/$defs/UncertaintyEllipse" },
      "confidence": { "$ref": "#/$defs/Confidence" }
    },
    "required": ["point", "uncertainty", "confidence"]
  },
  "Polygon": {
    "type": "array",
    "items": {
      "$ref": "#/$defs/Point"
    },
    "minItems": 3,
    "maxItems": 15
  },
  "PointAltitude": {
    "type": "object",
    "properties": {
```

```
      "point": { "$ref": "#/$defs/Point" },
      "altitude": { "$ref": "#/$defs/Altitude" }
    },
    "required": ["point", "altitude"]
  },
  "PointAltitudeUncertainty": {
    "type": "object",
    "properties": {
      "point": { "$ref": "#/$defs/Point" },
      "altitude": { "$ref": "#/$defs/Altitude" },
      "uncertaintyEllipse": { "$ref": "#/$defs/UncertaintyEllipse" },
      "uncertaintyAltitude": { "$ref": "#/$defs/Uncertainty" },
      "confidence": { "$ref": "#/$defs/Confidence" }
    },
    "required": ["point", "altitude", "uncertaintyEllipse", "uncertaintyAltitude", "confidence"]
  },
  "EllipsoidArc": {
    "type": "object",
    "properties": {
      "point": { "$ref": "#/$defs/Point" },
      "innerRadius": { "$ref": "#/$defs/InnerRadius" },
      "uncertaintyRadius": { "$ref": "#/$defs/Uncertainty" },
      "offsetAngle": { "$ref": "#/$defs/Angle" },
      "includeAngle": { "$ref": "#/$defs/Angle" },
      "confidence": { "$ref": "#/$defs/Confidence" }
    },
    "required": [
      "point",
      "innerRadius",
      "uncertaintyRadius",
      "offsetAngle",
      "includeAnlge",
      "confidence"
    ]
  },
  "HorizontalVelocity": {
    "type": "object",
    "properties": {
      "hSpeed": { "$ref": "#/$defs/HorizontalSpeed" },
      "bearing": { "$ref": "#/$defs/Angle" }
    },
    "required": ["hSpeed", "bearing"]    },
  "HorizontalWithVerticalVelocity": {
    "type": "object",
    "properties": {
      "hSpeed": { "$ref": "#/$defs/HorizontalSpeed" },
      "bearing": { "$ref": "#/$defs/Angle" },
      "vSpeed": { "$ref": "#/$defs/VerticalSpeed" },
      "vDirection": { "$ref": "#/$defs/VerticalDirection" }
    },
    "required": ["hSpeed", "bearing", "vSpeed", "vDirection"]
  },
  "HorizontalVelocityWithUncertainty": {
    "type": "object",
    "properties": {
      "hSpeed": { "$ref": "#/$defs/HorizontalSpeed" },
      "bearing": { "$ref": "#/$defs/Angle" },
      "hUncertainty": { "$ref": "#/$defs/SpeedUncertainty" }
    },
    "required": ["hSpeed", "bearing", "hUncertainty"]
  },
  "HorizontalWithVerticalVelocityAndUncertainty": {
    "type": "object",
    "properties": {
      "hSpeed": { "$ref": "#/$defs/HorizontalSpeed" },
      "bearing": { "$ref": "#/$defs/Angle" },
      "vSpeed": { "$ref": "#/$defs/VerticalSpeed" },
      "vDirction": { "$ref": "#/$defs/VerticalDirction" },
      "hUncertainty": { "$ref": "#/$defs/SpeedUncertainty" },
      "vUncertainty": { "$ref": "#/$defs/SpeedUncertainty" }
    },
    "required": ["hSpeed", "bearing", "vSpeed", "vDirection", "hUncertainty", "vUncertainty"]
  },
  "Uncertainty": {
    "type": "number",
    "minimum": 0
  },
  "UncertaintyEllipse": {
```

```
      "type": "object",
      "properties": {
        "semiMajor": { "$ref": "#/$defs/Uncertainty" },
        "semiMinor": { "$ref": "#/$defs/Uncertainty" },
        "orientationMajor": { "$ref": "#/$defs/Orientation" }
      },
      "required": ["semiMajor", "semiMinor", "orientationMajor"]
    },
    "Orientation": {
      "type": "integer",
      "minimum": 0,
      "maximum": 100
    },
    "Confidence": {
      "type": "number",
      "minimum": 0,
      "maximum": 100
    },
    "Altitude": {
      "type": "number",
      "minimum": -32767,
      "maximum": 32767
    },
    "InnerRadius": {
      "type": "integer",
      "minimum": 0,
      "maximum": 327675
    },
    "Angle": {
      "type": "integer",
      "minimum": 0,
      "maximum": 360
    },
    "HorizontalSpeed": {
      "type": "number",
      "minimum": 0,
      "maximum": 2047
    },
    "VerticalSpeed": {
      "type": "number",
      "minimum": 0,
      "maximum": 255
    },
    "VerticalDirection": {
      "type": "string",
        "enum": [
          "UPWARD",
          "DOWNWARD"
        ]
    },
    "SpeedUncertainty": {
      "type": "number",
      "minimum": 0,
      "maximum": 255
    },
    "https://schemas.o-ran.org/jsonschemas/a1td/common_1.0.0":

  }
}
```

Annex A (informative): Policy examples

A.1 Generic scope identifier

A.1.0 General

These are examples of policies that illustrate the usage of the generic ScopeIdentifier definitions in clause 7.1.2.1.

A.1.1 RAN UE ID based generic scope identifier

```
{
  "scope": {

    "ueId": {
      "guRanUeId": {"globalGnbId": {"plmnId": {"mcc":"123", "mnc":"45"},
      "gnbId": {"gnbIdLength": 25, "gnbIdValue": 6028163}},
      "ranUeId": "1234567890ABCDEF"}
    },

    "groupId": {
      "spId": 123
    },

    "sliceId": {
      "sst": 123, "sd": "456DEF", "plmnId": {"mcc":"123", "mnc":"45"}
    },

    "qosId": {
      "5qI": 123
    },

    "cellId": {
      "plmnId": {"mcc":"123", "mnc":"45"}, "cId": {"ncI": 12345678901}
    }

  }
}
```

A.1.2 AMF UE NGAP ID based generic scope identifier

```
{
  "scope": {

    "ueId": {
      "guAmfUeNgapId": {"guAmI": {
      "plmnId": {"mcc":"123", "mnc":"45"},"amfRegionId": "48", "amfSetId": "001", "amfPointer":
"12"},      "amfUeNgapId": 100}
    },

    "groupId": {
      "spId": 123
    },

    "sliceId": {
      "sst": 123, "sd": "456DEF", "plmnId": {"mcc":"123","mnc":"45"}
    },

    "qosId": {
      "5qI": 123
    },

    "cellId": {
      "plmnId": {"mcc":"123", "mnc":"45"}, "cId": {"ncI": 12345678901}
    }
```

```
  }
}
```

A.1.3 MME UE S1AP ID based generic scope identifier

```
{
  "scope": {

    "ueId": {
      "guMmeUeS1apId": {"guMmeI": {
      "plmnId": {"mcc":"123", "mnc":"45"}, "mmeGroupId": "1111", "mmeCode": "11"},
      "mmeUeS1apId": 100}
    },

    "groupId": {
      "spId": 123
    },

    "sliceId": {
      "sst": 123, "sd": "456DEF", "plmnId": {"mcc":"123", "mnc":"45"}
    },

    "qosId": {
      "5qI": 123
    },

    "cellId": {
      "plmnId": {"mcc":"123", "mnc":"45"},"cId": {"ncI": 12345678901}
    }

  }
}
```

A.1.4 gNB-CU UE F1AP ID based generic scope identifier

```
{
  "scope": {

    "ueId": {
      "guGnbCuUeF1apId": {"globalGnbId": {
      "plmnId": {"mcc":"123","mnc":"45"}, "gnbId": {"gnbIdLength": 25, "gnbIdValue": 6028163}},
      "gnbCuUeF1apId": 100}
    },

    "groupId": {
      "spId": 123
    },

    "sliceId": {
      "sst": 123, "sd": "456DEF", "plmnId": {"mcc":"123", "mnc":"45"}
    },

    "qosId": {
      "5qI": 123
    },

    "cellId": {
      "plmnId": {"mcc":"123", "mnc":"45"}, "cId": {"ncI": 12345678901}
    }

  }
}
```

A.1.5 gNB-CU-CP UE E1AP ID based generic scope identifier

```
{
  "scope": {

    "ueId": {
      "guGnbCuCpUeE1apId": {"globalGnbId": {
      "plmnId": {"mcc":"123", "mnc":"45"}, "gnbId": {"gnbIdLength": 25,"gnbIdValue": 6028163}},
      "gnbCuCpUeE1apId": 100}
    },

    "groupId": {
      "spId": 123
    },

    "sliceId": {
      "sst": 123, "sd": "456DEF", "plmnId": {"mcc":"123", "mnc":"45"}
    },

    "qosId": {
      "5qI": 123
    },

    "cellId": {
      "plmnId": {"mcc":"123", "mnc":"45"}, "cId": {"ncI": 12345678901}
    }

  }
}
```

A.2 QoS (Quality of Service)

A.2.1 QoS based resource optimization per-UE

```
{
  "scope": {
    "ueId": {
      "guRanUeId": {"globalGnbId": {
      "plmnId": {"mcc":"123", "mnc":"45"}, "gnbId": {"gnbIdLength": 25, "gnbIdValue": 6028163}},
      "ranUeId": "0000000000000855"
      }
    },
    "qosId": {
      "5qI": 67
    }
  },

  "qosObjectives": {
    "priorityLevel": 50
  }
}
```

A.2.2 QoS based resource optimization per-slice

```
{
  "scope": {
    "sliceId": {
      "sst": 11, "sd": "456DEF", "plmnId": {"mcc":"248", "mnc":"35"}},
    "qosId": {
      "5qI": 67
    },
    "cellId": {
      "plmnId": {"mcc":"248", "mnc":"35"}, "cId": { "ncI": 24}
    }
  },

  "qosObjectives": {
    "gfbr": 1000,
    "mfbr": 500,
    "pdb": 120
```

```
  }
}
```

A.3 QoE (Quality of Experience)

A.3.1 QoE based resource optimization per-UE

```
{
  "scope": {
    "ueId": {
      "guRanUeId": {"globalGnbId": {
      "plmnId": {"mcc":"123", "mnc":"45"}, "gnbId": {"gnbIdLength": 25,"gnbIdValue": 6028163}},
      "ranUeId": "0000000000000855"}
    },
    "qosId": {
      "5qI": 67
    }
  },

  "qoeObjectives": {
    "initialBuffering": 30,
    "reBuffFreq": 5,
    "stallRatio": 2
  }
}
```

A.3.2 QoE based resource optimization per-slice

```
{
  "scope": {
    "sliceId": {
      "sst": 11, "sd": "456DEF", "plmnId": {"mcc":"248", "mnc":"35"}    }
  },

  "qoeObjectives": {
    "qoeScore": 4.25
  }
}
```

A.4 TSP (Traffic Steering Preferences)

A.4.1 Traffic steering per-UE

```
{
  "scope": {
    "ueId": {
      "guRanUeId": {"globalGnbId": {
      "plmnId": {"mcc":"248", "mnc":"35"}, "gnbId": {"gnbIdLength": 25, "gnbIdValue": 6028163 }},
      "ranUeId": "0000000000000855"}
    }
  },

  "tspResources": [
    {
      "cellIdList": [
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 39}},
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 40}}
      ],
      "preference": "PREFER"
    },
    {
      "cellIdList": [
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 81}},
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 82}},
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 83}}
      ],
      "preference": "FORBID"
```

```
    }
  ]
}
```

A.4.2 Traffic steering per-slice

```
{
  "scope": {
    "sliceId": {
      "sst": 11, "sd": "456DEF", "plmnId": {"mcc": "248", "mnc": "35"}
    },
    "qosId": {
      "5qI": 67
    }
  },

  "tspResources": [
    {
      "cellIdList": [
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 55}},
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 65}}
      ],
      "preference": "SHALL"
    },
    {
      "cellIdList": [
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 31}},
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 32}},
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 33}}
      ],
      "preference": "AVOID"
    }
  ]
}
```

A.5 QoS optimization with resource directive

```
{
  "scope": {
    "ueId": {
      "guRanUeId": {"globalGnbId": {
       "plmnId": {"mcc":"248", "mnc":"35"}, "gnbId": {"gnbIdLength": 25, "gnbIdValue": 6028163}},
       "ranUeId": "0000000000000855"
      }
    },
    "qosId": {
      "5qI": 67
    }
  },

  "qosObjectives": {
    "priorityLevel": 50
  },

  "tspResources": [
    {
      "cellIdList": [
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 39}},
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 40}}
      ],
      "preference": "PREFER"
    },
    {
      "cellIdList": [
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 81}},
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 82}},
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 83}}
      ],
      "preference": "AVOID"
    }
  ]
}
```

A.6 QoE optimization with resource directive

```
{
  "scope": {
    "sliceId": {
      "sst": 11, "sd": "456DEF", "plmnId": {"mcc":"248", "mnc":"35"}
    }
  },

  "qoeObjectives": {
    "qoeScore": 4.25
  },

  "tspResources": [
    {
      "cellIdList": [
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 55}},
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 65}}
      ],
      "preference": "SHALL"
    },
    {
      "cellIdList": [
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 21}},
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 22}},
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 23}}
      ],
      "preference": "AVOID"
    }
  ]
}
```

A.7 Status object for notification

```
{
  "enforceStatus": "NOT_ENFORCED",
  "enforceReason": "SCOPE_NOT_APPLICABLE"
}
```

A.8 UE level

A.8.1 UE level per-QoS

```
{
  "scope": {
    "ueId": {
      "guRanUeId": {"globalGnbId": {
      "plmnId": { "mcc":"123", "mnc":"45"}, "gnbId": {"gnbIdLength": 25, "gnbIdValue": 6028163}},
      "ranUeId": "0000000000000855"}
    },
    "qosId": {
      "5qI": 67
    }
  },

  "ueLevelObjectives": {
    "ulPacketDelay": 0.5
  }
}
```

A.8.2 UE level per-slice

```
{
  "scope": {
    "ueId": {
      "guRanUeId": {"globalGnbId": {
      "plmnId": {"mcc":"248", "mnc":"35"},"gnbId": {"gnbIdLength": 25,"gnbIdValue": 6028163}},
```

```
      "ranUeId": "0000000000000855"
      }
    },
    "sliceId": {
      "sst": 11, "sd": "456DEF", "plmnId": {"mcc":"248","mnc":"35"}
    }

  },

  "ueLevelObjectives": {
    "dlThroughput": 5000
  }
}
```

A.9 RAN Slice SLA assurance

A.9.1 Support of maximum slice throughput SLA

```
{
  "scope": {
    "sliceId": {"sst": 1, "sd": "456DEF", "plmnId": {"mcc":"248", "mnc":"35"}}
  },

  "sliceSlaObjectives": {
    "maxDlThptPerUe": 50000,
    "maxUlThptPerUe": 25000,
    "maxDlThptPerSlice": 300000000,
    "maxUlThptPerSlice": 150000000
  }
}
```

A.9.2 Support of maximum number of UEs and PDU sessions per slice SLA

```
{
  "scope": {
    "sliceId": {"sst": 3, "sd": "456DEF", "plmnId": {"mcc":"248", "mnc":"35"}
    }
  },

  "sliceSlaObjectives": {
    "maxNumberOfUes": 100,
    "maxNumberOfPduSessions": 800
  },
  "sliceSlaResources": {
    "cellIdList": [
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 1}},
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 2}},
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 3}}
      ]
  }
}
```

A.9.3 Support of UE-level performance targets for slice users

```
{
  "scope": {
    "sliceId": {"sst": 2, "sd": "123DEF", "plmnId": {"mcc":"248", "mnc":"35"}}
  },

  "sliceSlaObjectives": {
    "maxDlPacketDelayPerUe": 5,
    "maxUlPacketDelayPerUe": 5
  },
  "sliceSlaResources": {
    "cellIdList": [
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 1}},
```

```
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 2}},
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 3}}
    ]
  }
}
```

A.9.4 Support of slice priority

```
{
  "scope": {
    "sliceId": {"sst": 1, "sd": "123DEF", "plmnId": {"mcc":"248", "mnc":"35"}
    }
  },

  "sliceSlaObjectives": {
    "dlSlicePriority": 20,
    "ulSlicePriority": 30
  },
  "sliceSlaResources": {
    "cellIdList": [
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 1}},
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 2}},
        {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 3}}
    ]
  }
}
```

A.10 Load balancing

A.10.1 Load balancing per-cell

```
{
  "scope": {
    "cellId": {
      "plmnId": {"mcc":"123", "mnc":"45"}, "cId": {"ncI": 31}}
  },

  "lbObjectives": {
    "targetPrbUsg": 80,
    "prbUsgType": 1
  },
  "lbResources": {
    "cellIdList": [
      {"plmnId": {"mcc": "123","mnc": "45"}, "cId": {"ncI": 32}},
      {"plmnId": {"mcc": "123","mnc": "45"}, "cId": {"ncI": 33}},
      {"plmnId": {"mcc": "123","mnc": "45"}, "cId": {"ncI": 34}}
    ]
  }
}
```

A.10.2 Load balancing per-cell per-slice

```
{
  "scope": {
    "cellId": {
      "plmnId": {"mcc":"123", "mnc":"45"}, "cId": {"ncI": 31}
    },
    "sliceId": {
      "sst": 11, "sd": "456DEF", "plmnId": {"mcc": "123", "mnc": "45"}
    }
  },

  "lbObjectives": {
    "targetPrbUsg": 80,
    "prbUsgType": 1
  },
  "lbResources": {
    "cellIdList": [
```

```
      {"plmnId": {"mcc": "123","mnc": "45"}, "cId": {"ncI": 32}},
      {"plmnId": {"mcc": "123","mnc": "45"}, "cId": {"ncI": 33}},
      {"plmnId": {"mcc": "123","mnc": "45"}, "cId": {"ncI": 34}}
    ]
  }
}
```

A.11 Energy saving

A.11.1 Comprehensive energy saving

A.11.1.1 Energy saving over tracking area

```
{
    "scope": {
        "taIList": [
            {"plmnId": {"mcc": "248", "mnc": "35"}, "tac": "123456"}
        ]
    },

    "esObjectives": {
        "targetPeeEnergy": 20
    }
}
{
```

A.11.1.2 Energy saving over cell list

```
{
    "scope": {
        "cellIdList": [
            {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 71}},
            {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 72}},
            {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 73}},
            {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 81}},
            {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 82}},
            {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 83}}
        ]
    },

    "esObjectives": {
        "esPercentage": 10
    }
}
```

A.11.2 Energy saving with exclusion cell list

A.11.2.1 Energy saving over cells that are to remain operational but can have some coverage impact

```
{
    "scope": {
        "taIList": [
            {"plmnId": {"mcc": "248", "mnc": "35"}, "tac": "123456"}
        ]
    },

    "esObjectives": {
        "esPercentage": 10
    },

    "esResources": [
        {
```

```
            "operationalCells": [
                {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 91}},
                {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 92}},
                {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 93}}
            ],
            "operationalPreference": "FORBID"
        }
    ]
}
```

A.11.2.2 Energy saving over cells that are to remain operational and maintain full coverage

```
{
    "scope": {
        "taIList": [
            {"plmnId": {"mcc": "248", "mnc": "35"}, "tac": "123456"}
        ]
    },

    "esObjectives": {
        "esPercentage": 10
    },

    "esResources": [
        {
            "operationalCells": [
                {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 91}},
                {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 92}},
                {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 93}}
            ],
            "operationalPreference": "FORBID"
        },
        {
            "coverageCells": [
                {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 91}},
                {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 92}},
                {"plmnId": {"mcc": "248","mnc": "35"}, "cId": {"ncI": 93}}
            ],
            "coveragePreference": "FORBID"
        }
    ]
}
```

Annex B (informative): EI examples

B.1 Generic examples

B.1.1 EI job status

This is an example of EI job status that illustrates the usage of the generic EI job status schema defined in clause 9.1.1.

```
{
  "jobStatus": "DISABLED"
}
```

B.2 UE geo-location and velocity

B.2.1 Statement for EI job constraints

```
{
  "ueGeoandVelEIConstraints": {
    "supportedGadShapes": ["POINT", "POINT_ALTITUDE"],
    "supportedVelocityTypes": ["H_VELOCITY", "HV_VELOCITY"]
  }
}
```

B.2.2 Statement for EI job definition

```
{
  "scope": {
    "ueId": {
      "guRanUeId": {"globalGnbId": {
      "plmnId": {"mcc":"123", "mnc":"45"}, "gnbId": {"gnbIdLength": 25, "gnbIdValue": 6028163 }},
      "ranUeId": "0000000000000855"
      }
    }
  },

  "ueGeoandVelEIDescription": {
    "gadShape": "POINT",
    "granularityPeriod": 500,
    "reportingPeriod": 500,
    "reportingAmount": 1200,
    "velocityDesc": "H_VELOCITY"
  }
}
```

B.2.3 Statement for EI job result

```
[
  {
    "timeStamp": "2022-05-30T09:00:30.5Z",
    "ueId": {
      "guRanUeId": {"globalGnbId": {
      "plmnId": {"mcc":"123", "mnc":"45"}, "gnbId": {"gnbIdLength": 25, "gnbIdValue": 6028163  }},
      "ranUeId": "0000000000000855"
      }
    },
    "gadShape": "POINT",
    "geoLocation": {
      "lon": -122.960625,
      "lat": 45.545112
```

```
    },
    "velocityDesc": "H_VELOCITY",
    "velocity": {
      "hSpeed": 15,
      "bearing": 90
    }
  }
]
```

Annex C (informative): JSON schema identification and versioning

C.1 General

The base URI defined in clause 7.1 is used for the policy types and EI types, as well as the subschemas they link to, defined in the present document.

Since the base URI is the same, data types defined in the subschema can be referred to with relative URI, e.g. "/a1td/common_x.y.z/#/$defs/UeId".

C.2 Embedding a subschema

A subschema is defined with $schema and $id keywords, e.g.:

```
{
    "$schema": "https://json-schema.org/draft/2020-12/schema",
    "$id": "https://schemas.o-ran.org/jsonschemas/a1td/common_1.0.0",
    "$defs": {
...
    }
}
```

A subschema is linked using $defs keyword in the base schema, e.g.:

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$id": "https://schemas.o-ran.org/jsonschemas/a1td/ORAN_QoSTarget_4.0.1",
...
  "$defs": {
    "https://schemas.o-ran.org/jsonschemas/a1td/common_1.0.0":

  }
}
```

In a compound schema, a subschema is embedded into the base schema after the $defs where it is linked, e.g.:

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$id": "https://schemas.o-ran.org/jsonschemas/a1td/ORAN_QoSTarget_4.0.1",
...
  "$defs": {
    "https://schemas.o-ran.org/jsonschemas/a1td/common_1.0.0":
    {
        "$schema": "https://json-schema.org/draft/2020-12/schema",
        "$id": "https://schemas.o-ran.org/jsonschemas/a1td/common_1.0.0",
        "$defs": {
...
        }
    }
  }
}
```

C.3 Versioning of policy type schemas and common data types schema

C.3.1 General

The common data types schema specified in clause 7.1.2.1 and the policy schemas specified in clause 7.2 can be updated independently but a policy schema update can also require, or be required by, an update of the common data types schema. When the common data types schema is updated, all policy schemas are updated to link to the new version of common data types schema ensuring that all schemas and linking are consistent within the present document.

The following update scenarios can occur:

- Policy type is updated but the update has not required a change to the common data types. If the common data types schema is updated, the updated policy schema links to the new common data types schema, and all other policy schemas are updated to link to the new common data types schema.
- Policy type is updated and the update has required a change to the common data types. The new policy schema links to the new common data types schema. All other policy schemas are updated to link to the new common data types schema.
- The common data types are updated. All policy schemas are updated to link to the new common data types schema. Policy schemas that are impacted by the updated common data types schema also incorporate any required changes.

C.3.2 Versioning of policy types

When updating a policy schema to link to a new common data types schema, the update may result in a major, minor, or patch update to the policy type version.

NOTE: An update of a policy schema may link to a new version of the common data types schema without being impacted by the changes made to it and if it is impacted it can result in an update that is either compatible or not compatible.

When linking to a new version of the common data types schema that has impact on the compatibility of the policy type, the policy type major version is incremented.

When linking to a new version of the common data types schema and no further changes are made to the policy schema, the policy type patch version is incremented.

Annex D (informative): Change history

Date	Revision	Description
2021.03.13	01.00	First version based on data models and policy types from A1AP v03.00.
2021.07.16	02.00	Introducing new policy types for UE Level target and Slice SLA target. Enhancing data type definitions and JSON encodings.
2022.04.01	03.00	Introducing new policy type for Load balancing.
2022.07.30	04.00	Introducing new EI type for UE location and velocity information.
2022.11.17	05.00	Aligning to O-RAN drafting rules. Enhanced alignment between A1-P and A1-EI, and between A1AP and A1TD.
2023.03.22	05.01	Editorial enhancements.
2023.07.31	06.00	Enhanced descriptions for SliceSlaObjectives and UE identifier options for ScopeIdentifier, and adapting to latest template.
2023.11.30	07.00	ETSI PAS related editorial enhancements and extended description of packet delay and packet loss attributes and UE identifier options for ScopeIdentifier. Updating to latest JSON schema draft.
2024.03.31	08.00	Editorial enhancements. Introducing new policy type for Energy saving.
2024.07.31	09.00	Segmentation of JSON schemas. Adding attributes to Slice SLA target and Network energy saving policy types.

History

Document history		
V5.0.0	January 2024	Publication
V9.0.0	May 2025	Publication