
O-RAN Working Group 2 (Non-RT RIC and A1 interface WG)

A1 interface: Type Definitions

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Foreword

This Technical Specification (TS) has been produced by O-RAN Alliance Working Group 2 (Non-RT RIC and A1 interface WG). It 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 O-RAN Drafting Rules (Verbal forms for the expression of provisions).

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

1 Scope

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

version xx.yy.zz

where:

xx: the first digit-group is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc. (the initial approved document will have xx=01). Always 2 digits with leading zero if needed.

yy: the second digit-group is incremented when editorial only changes have been incorporated in the document. Always 2 digits with leading zero if needed.

zz: the third digit-group included only in working versions of the document indicating incremental changes during the editing process. External versions never include the third digit-group. Always 2 digits with leading zero if needed.

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.

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

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

- [1] O-RAN TS: "Non-RT RIC and A1 interface: Use Cases and Requirements"
- [2] O-RAN TS: "A1 interface: General Aspects and Principles" ("A1GAP")
- [3] O-RAN TS: "A1 interface: Application Protocol" ("A1AP")
- [4] 3GPP TS 29.501: "3rd Generation Partnership Project; Technical Specification Group Core Network and Terminals; 5G System; Principles and Guidelines for Services Definition; Stage 3"
- [5] 3GPP TS 29.571: "3rd Generation Partnership Project; Technical Specification Group Core Network and Terminals; 5G System; Common Data Types for Service Based Interfaces; Stage 3"
- [6] IETF RFC8259: "The JavaScript Object Notation (JSON) Data Interchange Format"

- [7] json-schema Draft 7, <https://json-schema.org/specification-links.html#draft-7>
- [8] 3GPP TS 38.463: "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NG-RAN; E1 application protocol (E1AP)"
- [9] 3GPP TS 38.473: "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NG-RAN; F1 application protocol (F1AP)"
- [10] 3GPP TS 23.003: "3rd Generation Partnership Project; Technical Specification Group Core Network and Terminals; Numbering, addressing and identification"
- [11] 3GPP TS 23.501: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; System Architecture for the 5G System; Stage 2"
- [12] ITU-T P.1203.3: "SERIES P: TELEPHONE TRANSMISSION QUALITY, TELEPHONE INSTALLATIONS, LOCAL LINE NETWORKS; Models and tools for quality assessment of streamed media; Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport – Quality integration module"
- [13] 3GPP TS 28.552: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Management and orchestration; 5G performance measurements"
- [14] 3GPP TS 38.314: "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Layer 2 Measurements"
- [15] 3GPP TS 36.300: "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description"
- [16] 3GPP TS 23.203: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Policy and charging control architecture"
- [17] GSMA NG.116: "Generic Network Slice Template Version 4.0 (2020-11-23)"
- [18] O-RAN TS: "O-RAN Working Group 3: Use Cases and Requirements"
- [19] SemVer: "Semantic Versioning 2.0.0", <https://semver.org>
- [20] 3GPP TS 29.572: "3rd Generation Partnership Project; Technical Specification Group Core Network and Terminals; 5G System; Location Management Services; Stage 3"

2.2 Informative references

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

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

The following referenced documents are not necessary for the application of the present document, but they assist the user with regard to a particular subject area.

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 (see A1AP [3]).

Statement: structured data type representing a policy statement (see A1AP [3]) that is policy type specific.

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:

MOS	Mean Opinion Score
SDU	Service Data Unit
Tal	Tracking Area Identity
TSP	Traffic Steering Preference

4 A1 Application data model

4.1 Introduction

This document together with the 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 this document have a lifecycle that is independent from the A1 services defined in A1AP [3]. The specification of the A1 data models follows the application data model used for API definitions in 3GPP TS 29.501 [4] and data types specified in 3GPP TS 29.571 [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 this specification.

The first two-digit value of this specification 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 this specification 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 clause 7.1.2.1 and 7.2).

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.

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

- Traffic steering optimization;
- Slice SLA assurance;

- Load balancing.

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
UeId	string	UE identifier, based on RAN UE Id (see 3GPP TS 38.463 [8] and TS 38.473 [9]). Encoded as 16 hexadecimal characters.	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	http://json-schema.org/draft-07/schema	A JSON schema meta-schema following JSON Schema Draft 7 [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 favor the selection of the resource	favor 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 ScopelIdentifier 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.

6.3 Structured data types

6.3.1 ScopelIdentifier

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 ScopelIdentifier.

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

Table 6.3.1.1-1: Definition of data type ScopelIdentifier

Attribute Name	Data Type	P	Cardinality	Description	Applicability
ueld	Ueld	C	0..1	identifies the UE that policy statement(s) are applied to, see clause 6.2.1	
groupid	GroupId	C	0..1	identifies multiple UEs that policy statement(s) are applied to, see clause 6.3.1.2	
sliceld	Sliceld	C	0..1	identifies the network slice that policy statement(s) are applied to, see clause 6.3.1.3	
qosld	Qosld	C	0..1	identifies the QoS flow that policy statement(s) are applied to, see clause 6.3.1.4	
cellld	Cellld	C	0..1	identifies the cell that the policy statement(s) are applied to, see clause 6.3.1.5	

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 ScopelIdentifier 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.

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
spld	integer	C	0..1	identifier of a subscriber profile that can be shared by several UEs (see 3GPP TS 36.300) [17]. Value range is between 1 and 256.	4G RAN
rfSplIndex	integer	C	0..1	identifier of a RF selection priority that can be shared by several UEs (see 3GPP TS 23.501) [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 Sliceld

Sliceld is based on the definition of S-NSSAI (see 3GPP TS 23.003 [10]) and includes a PLMN identifier.

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

Table 6.3.1.3-1: Definition of type Sliceld

Attribute name	Data type	P	Cardinality	Description	Applicability
sst	integer	M	1	Slice/Service type part of S-NSSAI (see 3GPP TS 23.003 [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
plmnld	Plmnld	M	1	PLMN Identifier (see 3GPP TS 23.003 [10]), see Table 6.3.1.6-1	4G RAN and 5G RAN

6.3.1.4 Qosld

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

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

Table 6.3.1.4-1: Definition of type Qosld

Attribute name	Data type	P	Cardinality	Description	Applicability
qcl	integer	C	0..1	QoS Class Identifier (see 3GPP TS 23.203 [16]). Value range is between 1 and 256.	4G RAN
5ql	integer	C	0..1	5G QoS Identifier (see 3GPP TS 23.501 [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 Cellld

Cellld is based on the definition of the global cell identifiers ECGI and NCGI (see 3GPP TS 23.003 [10]) for 4G and 5G RANs.

The Cellld contains the attributes defined in table 6.3.1.5-1 and 6.3.1.5-2:

Table 6.3.1.5-1: Definition of type Cld

Attribute name	Data type	P	Cardinality	Description	Applicability
ecl	integer	C	0..1	E-UTRAN Cell identifier (see 3GPP TS 23.003 [10]) 28 bits encoded as integer.	4G RAN
ncl	integer	C	0..1	NR Cell identifier (see 3GPP TS 23.003 [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 Cellld

Attribute name	Data type	P	Cardinality	Description	Applicability
plmnld	Plmnld	M	1	PLMN Identifier (see 3GPP TS 23.003 [10]), see Table 6.3.1.6-1	
cld	Cld	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 3GPP TS 23.003 [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 3GPP TS 23.003 [10]) Contains 3 digits.	
mnc	string	M	1	Mobile Network Code (see 3GPP TS 23.003 [10]) Contains 2 or 3 digits.	

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 TalList contains the attributes defined in table 6.3.2-2 and 6.3.2-3:

Table 6.3.2-2: Definition of type Tal

Attribute name	Data type	P	Cardinality	Description	Applicability
plmnId	PlmnId	M	1	PLMN Identifier (see 3GPP TS 23.003 [10]), see Table 6.3.1.6-1	4G RAN and 5G RAN
tac	string	M	1	Tracking Area Code (see 3GPP TS 23.003 [10]). Encoded as 6 hexadecimal characters.	5G RAN

Table 6.3.2-3: Definition of type TalList

Attribute name	Data type	P	Cardinality	Description	Applicability
talList	array(Tal)	M	1..N	list of Tals, 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	

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 3GPP TS 23.501 [11]	
mfbr	number	C	0..1	Maximum Flow Bit Rate, see 3GPP TS 23.501 [11]	
priorityLevel	number	C	0..1	Priority Level, see 3GPP TS 23.501 [11]	
pdb	number	C	0..1	Packet Delay Budget, see 3GPP TS 23.501 [11]	

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 this version of the specification, 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's 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's 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 3GPP TS 28.552 [13]	
dlThroughput	number	C	0..1	the average DL RAN UE throughput as the UE performance targets or RAN optimization constraints. see 3GPP TS 28.552 [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 3GPP TS 38.314 [14] and TS 28.552 [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 3GPP TS 38.314 [14] and TS 28.552 [13]	
ulPdcpsduPacketLossRate	number	C	0..1	UL reliability as the UE performance targets or RAN optimization constraints. see 3GPP TS 28.552 [13]	
dlRlcSduPacketLossRate	number	C	0..1	DL reliability as the UE performance targets or RAN optimization constraints. see 3GPP TS 38.314 [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 3GPP TS 38.314 [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 Clause 3.4.17 "Maximum Number of UEs" in NG.116 [17]	
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 Clause 3.4.16 "Maximum number of PDU sessions" in NG.116 [17]	
guaDIThptPerSlice	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. Scope identifier designates the respective network slice and optionally slice SLA resources can further designate targeted cells. See Clause 3.4.5 "Guaranteed downlink throughput quota" in NG.116 [17] See Note 2 and Note 3 for additional details	
maxDIThptPerSlice	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 Clause 3.4.5 "Max downlink throughput" in NG.116 [17] See Note 2 and Note 3 for additional details	
maxDIThptPerUe	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 Clause 3.4.6 "Downlink maximum throughput per UE" in NG.116 [17]	
guaUIThptPerSlice	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. Scope identifier designates the respective network slice and optionally slice SLA resources can further designate targeted cells. See Clause 3.4.31 "Guaranteed uplink throughput quota" in NG.116 [17] See Note 2 and Note 3 for additional details	

Attribute name	Data type	P	Cardinality	Description	Applicability
maxUIThptPerSlice	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 Clause 3.4.31 "Max uplink throughput" in NG.116 [17] See Note 2 and Note 3 for additional details	
maxUIThptPerUe	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 Clause 3.4.32 "Uplink maximum throughput per UE" in NG.116 [17]	
maxDIPacketDelayPerUe	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.	
maxUIPacketDelayPerUe	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.	
maxDIPdcpSduPacketLossRatePerUe	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.	
maxUIRlcSduPacketLossRatePerUe	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.	
minDIReliabilityPerUe	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 minDIReliabilityPerUe corresponds to that of dIReliability in table 6.3.3.4-1	
minUIReliabilityPerUe	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 minUIReliabilityPerUe corresponds to that of uIReliability in table 6.3.3.4-1	
maxDIJitterPerUe	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.	
maxUIJitterPerUe	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.	
dISlicePriority	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.	

Attribute name	Data type	P	Cardinality	Description	Applicability
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.	

NOTE 1: Presence condition "C" means that at least one attribute shall be included when this statement is used.

NOTE 2: The usage of guaDlThptPerSlice, maxDlThptPerSlice, guaUlThptPerSlice and maxUlThptPerSlice attributes by the Near-RT RIC is out of scope of the present specification. The usage is still under consideration and FFS by WG3. For further details, see WG3 specifications; for example, the O-RAN WG3 UCR [18].

NOTE 3: The attribute usage is evolving in WG3 and their definitions in the present document may be revised based on the progress of WG3.

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 (3GPP TS 28.552 [13] 5.1.1.2.5) 2: Mean UL PRB used for data traffic (3GPP TS 28.552 [13] 5.1.1.2.7) 3: Peak DL PRB used for data traffic (3GPP TS 28.552 [13] 5.1.1.2.9) 4: Peak UL PRB used for data traffic (3GPP TS 28.552 [13] 5.1.1.2.10) 5: Mean DL PRB used for data traffic per S-NSSAI (3GPP TS 28.552 [13] 5.1.1.2.5) 6: Mean UL PRB used for data traffic per S-NSSAI (3GPP TS 28.552 [13] 5.1.1.2.7) 7: Peak DL PRB used for data traffic per S-NSSAI (3GPP TS 28.552 [13] 5.1.1.2.9) 8: Peak UL PRB used for data traffic per S-NSSAI (3GPP TS 28.552 [13] 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.

6.3.4 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	

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	
talList	TalList	C	0..1	list of Tals, see clause 6.3.2	

NOTE: Presence condition "C" means that at least one attribute shall be included and only one of them shall be used 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	

6.4 Policy representations objects

6.4.1 Policy object

6.4.1.1 General

A PolicyObject is based on IETF RFC 8259 [6] (JSON) 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	ScopelIdentifier	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	

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 ScopelIdentifier 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] (JSON) and contains:

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

The PolicyStatusObject contains status related attributes as defined in table 6.4.2.1-1:

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 current specification. 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] (JSON) and it 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: Clause 7.2 contains definitions and policy type specific schemas for O-RAN defined A1 policy types.

The JSON schema [7] for a PolicyObject is used by the A1-P Producer to validate a PolicyObject during Create policy and Update policy procedures. The JSON schema [7] 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 this version of the specification.

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.

7.1.2 Common definitions

7.1.2.1 Scope identifier

This is a generic policy schema that includes the encoding of ScopeIdentifier data types that can be used in the definitions section of policy type schemas. The policy schema in a policy type definition may include all data types defined in the definitions part of this schema or the subset that corresponds to the restrictions stated in the policy type definition.

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "description": "scope identifier definitions",
  "type": "object",
  "properties": {
    "scope": {
```



```

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

  "definitions": {

    "UeId": {
      "type": "string",
      "pattern": "^[A-Za-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-Za-f0-9]{6}$"
        },
        "plmnId": {"$ref": "#/definitions/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"]
        }
    ]
},
"CellId": {
    "type": "object",
    "properties": {
        "plmnId": {"$ref": "#/definitions/PlmnId"},
        "cId": {"$ref": "#/definitions/CId"}
    },
    "additionalProperties": false,
    "required": ["plmnId", "cId"]
},
"CId": {
    "oneOf": [
        {
            "type": "object",
            "properties": {
                "ncI": {"$ref": "#/definitions/NcI"}
            },
            "additionalProperties": false,
            "required": ["ncI"]
        },

```

```

        {
          "type": "object",
          "properties": {
            "ecI": {"$ref": "#/definitions/EcI"}
          },
          "additionalProperties": false,
          "required": ["ecI"]
        }
      ]
    },
    "NcI": {
      "type": "integer",
      "minimum": 0,
      "maximum": 68719476735
    },
    "EcI": {
      "type": "integer",
      "minimum": 0,
      "maximum": 268435455
    },
    "PlmnId": {
      "type": "object",
      "properties": {
        "mcc": {
          "type": "string",
          "pattern": "^[0-9]{3}$"
        },
        "mnc": {
          "type": "string",
          "pattern": "^[0-9]{2,3}$"
        }
      },
      "additionalProperties": false,
      "required": ["mcc", "mnc"]
    }
  }
}

```

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": "http://json-schema.org/draft-07/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"]
}

```

7.2 Policy type definitions

7.2.1 QoS target

7.2.1.1 Policy type identifier

PolicyTypeId: **ORAN_QoSTarget_2.0.0**

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 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

Policy statement	ScopeIdentifier	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

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "description": "O-RAN standard QoS Target policy",
  "type": "object",
  "properties": {
    "scope": {
      "anyOf": [
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "#/definitions/UEId"},
            "groupId": {"$ref": "#/definitions/GroupId"},
            "qosId": {"$ref": "#/definitions/QosId"},
            "cellId": {"$ref": "#/definitions/CellId"}
          },
          "additionalProperties": false,
          "required": ["ueId", "qosId"]
        },
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "#/definitions/UEId"},

```

```

        "sliceId": {"$ref": "#/definitions/SliceId"},
        "qosId": {"$ref": "#/definitions/QosId"},
        "cellId": {"$ref": "#/definitions/CellId"}
    },
    "additionalProperties": false,
    "required": ["ueId", "qosId"]
},
{
    "type": "object",
    "properties": {
        "groupId": {"$ref": "#/definitions/GroupId"},
        "qosId": {"$ref": "#/definitions/QosId"},
        "cellId": {"$ref": "#/definitions/CellId"}
    },
    "additionalProperties": false,
    "required": ["groupId", "qosId"]
},
{
    "type": "object",
    "properties": {
        "sliceId": {"$ref": "#/definitions/SliceId"},
        "qosId": {"$ref": "#/definitions/QosId"},
        "cellId": {"$ref": "#/definitions/CellId"}
    },
    "additionalProperties": false,
    "required": ["sliceId", "qosId"]
},
{
    "type": "object",
    "properties": {
        "qosId": {"$ref": "#/definitions/QosId"},
        "cellId": {"$ref": "#/definitions/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"],

"definitions": {
    "UeId": {
        "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-Za-f0-9]{6}$"
            },
            "plmnId": {"$ref": "#/definitions/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"]
            }
        ]
    },
    "CellId": {
        "type": "object",
        "properties": {
            "plmnId": {"$ref": "#/definitions/PlmnId"},
            "cId": {"$ref": "#/definitions/CId"}
        },
        "additionalProperties": false,
        "required": ["plmnId", "cId"]
    },
    "CId": {
        "oneOf": [
            {
                "type": "object",

```

```

        "properties": {
          "ncI": {"$ref": "#/definitions/NcI"}
        },
        "additionalProperties": false,
        "required": ["ncI"]
      },
      {
        "type": "object",
        "properties": {
          "ecI": {"$ref": "#/definitions/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"]
  }
}

```

7.2.1.3.2 Policy status schema

The generic policy status schema in 7.1.2.2 is used.

7.2.2 QoE target

7.2.2.1 Policy type identifier

PolicyTypeId: ORAN_QoETarget_2.0.0

7.2.2.2 Rationale

7.2.2.2.1 Use case

See "Use case 2: QoE use case" in Non-RT RIC & A1 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 7.2.2.2-1: Allowed combinations of qoeObjectives statement with ScopelIdentifier

Policy statement	ScopelIdentifier	ueId	groupId	sliceId	qosId	cellId
qoeObjectives	1	0	0	1	0..1	0..1
qoeObjectives	1	0	0	0	1	0..1
qoeObjectives	0	0	0	1	0..1	0..1
qoeObjectives	0	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

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "description": "O-RAN standard QoE Target policy",
  "type": "object",
  "properties": {
    "scope": {
      "anyOf": [
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "#/definitions/UEId"},
            "sliceId": {"$ref": "#/definitions/SliceId"},
            "qosId": {"$ref": "#/definitions/QosId"},
            "cellId": {"$ref": "#/definitions/CellId"}
          },
          "additionalProperties": false,
          "required": ["ueId", "sliceId"]
        },
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "#/definitions/UEId"},
            "qosId": {"$ref": "#/definitions/QosId"},
            "cellId": {"$ref": "#/definitions/CellId"}
          },
          "additionalProperties": false,
          "required": ["ueId", "qosId"]
        },
        {
          "type": "object",
          "properties": {
            "sliceId": {"$ref": "#/definitions/SliceId"},
            "qosId": {"$ref": "#/definitions/QosId"},
            "cellId": {"$ref": "#/definitions/CellId"}
          },
          "additionalProperties": false,
          "required": ["sliceId"]
        },
        {
          "type": "object",
          "properties": {
            "qosId": {"$ref": "#/definitions/QosId"},
            "cellId": {"$ref": "#/definitions/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"],

"definitions": {
  "UeId": {
    "type": "string",
    "pattern": "^[A-Fa-f0-9]{16}$"
  },
  "SliceId": {
    "type": "object",
    "properties": {
      "sst": {
        "type": "integer",
        "minimum": 0,
        "maximum": 255
      },
      "sd": {
        "type": "string",
        "pattern": "^[A-Fa-f0-9]{6}$"
      },
      "plmnId": {"$ref": "#/definitions/PlmnId"}
    },
    "additionalProperties": false,
    "required": ["sst", "plmnId"]
  },
  "QosId": {
    "oneOf": [
      {
        "type": "object",
        "properties": {
          "5qI": {
            "type": "integer",
            "minimum": 1,
            "maximum": 256
          }
        }
      },
      {
        "type": "object",
        "properties": {
          "qcI": {
            "type": "integer",
            "minimum": 1,
            "maximum": 256
          }
        },
        "additionalProperties": false,
        "required": ["qcI"]
      }
    ]
  },
  "CellId": {
    "type": "object",
    "properties": {
      "plmnId": {"$ref": "#/definitions/PlmnId"},
      "cId": {"$ref": "#/definitions/CId"}
    },
    "additionalProperties": false,
    "required": ["plmnId", "cId"]
  },

```

```

    "CId": {
      "oneOf": [
        {
          "type": "object",
          "properties": {
            "ncI": {"$ref": "#/definitions/NcI"}
          },
          "additionalProperties": false,
          "required": ["ncI"]
        },
        {
          "type": "object",
          "properties": {
            "ecI": {"$ref": "#/definitions/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"]
    }
  }
}

```

7.2.2.3.2 Policy status schema

The generic policy status schema in 7.1.2.2 is used.

7.2.3 Traffic steering preferences

7.2.3.1 Policy type identifier

PolicyTypeId: **ORAN_TrafficSteeringPreference_2.0.0**

7.2.3.2 Rationale

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

7.2.3.2.1 Use case

7.2.3.2.2 Statements, restrictions and extensions

A TSP statement can be applied together with ScopelIdentifier containing different combinations of identifiers. Not all combinations are relevant. The following table indicates combinations that are allowed.

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

Policy statement	ScopelIdentifier	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

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "description": "O-RAN standard Traffic Steering Preference policy",
  "type": "object",
  "properties": {
    "scope": {
      "anyOf": [
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "#/definitions/ueId"},
            "sliceId": {"$ref": "#/definitions/SliceId"},
            "qosId": {"$ref": "#/definitions/QosId"},
            "cellId": {"$ref": "#/definitions/CellId"}
          },
          "additionalProperties": false,
          "required": ["ueId"]
        },
        {
          "type": "object",
          "properties": {
            "sliceId": {"$ref": "#/definitions/SliceId"},
            "qosId": {"$ref": "#/definitions/QosId"},
            "cellId": {"$ref": "#/definitions/CellId"}
          },
          "additionalProperties": false,
          "required": ["sliceId"]
        }
      ]
    },
    "tspResources": {
      "type": "array",
      "items": {
        "$ref": "#/definitions/TspResource"
      },
      "minItems": 1
    }
  },
  "additionalProperties": false,
  "required": ["scope", "tspResources"],
  "definitions": {
    "ueId": {
      "type": "string",
      "pattern": "^[A-Za-f0-9]{16}$"
    }
  }
}
```

```

    },
    "SliceId": {
      "type": "object",
      "properties": {
        "sst": {
          "type": "integer",
          "minimum": 0,
          "maximum": 255
        },
        "sd": {
          "type": "string",
          "pattern": "^[A-Za-f0-9]{6}$"
        },
        "plmnId": {"$ref": "#/definitions/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"]
        }
      ]
    },
    "CellId": {
      "type": "object",
      "properties": {
        "plmnId": {"$ref": "#/definitions/PlmnId"},
        "cId": {"$ref": "#/definitions/CId"}
      },
      "additionalProperties": false,
      "required": ["plmnId", "cId"]
    },
    "CId": {
      "oneOf": [
        {
          "type": "object",
          "properties": {
            "ncI": {"$ref": "#/definitions/NcI"}
          },
          "additionalProperties": false,
          "required": ["ncI"]
        },
        {
          "type": "object",
          "properties": {
            "ecI": {"$ref": "#/definitions/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"]
  },
  "PreferenceType": {
    "type": "string",
    "enum": [
      "SHALL",
      "PREFER",
      "AVOID",
      "FORBID"
    ]
  },
  "CellIdList": {
    "type": "array",
    "items": {
      "$ref": "#/definitions/CellId"
    }
  },
  "TspResource": {
    "type": "object",
    "properties": {
      "cellIdList": {"$ref": "#/definitions/CellIdList"},
      "preference": {"$ref": "#/definitions/PreferenceType"},
      "primary": {"type": "boolean"}
    },
    "required": ["cellIdList", "preference"],
    "additionalProperties": false
  }
}

```

7.2.3.3.2 Policy status schema

The generic policy status schema in 7.1.2.2 is used.

7.2.4 QoS optimization with resource directive

7.2.4.1 Policy type identifier

PolicyTypeId: **ORAN_QoSandTSP_2.0.0**

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

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "description": "O-RAN standard QoS Target and Traffic Steering Preference policy",
  "type": "object",
  "properties": {
    "scope": {
      "anyOf": [
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "#/definitions/UeId"},
            "sliceId": {"$ref": "#/definitions/SliceId"},
            "qosId": {"$ref": "#/definitions/QosId"},
            "cellId": {"$ref": "#/definitions/CellId"}
          },
          "additionalProperties": false,
          "required": ["ueId", "qosId"]
        },
        {
          "type": "object",
          "properties": {
            "sliceId": {"$ref": "#/definitions/SliceId"},
            "qosId": {"$ref": "#/definitions/QosId"},
            "cellId": {"$ref": "#/definitions/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": "#/definitions/TspResource"
      },
      "minItems": 1
    }
  },
  "additionalProperties": false,
  "required": ["scope", "qosObjectives", "tspResources"],
}
```

```

"definitions": {
  "UeId": {
    "type": "string",
    "pattern": "^[A-Za-f0-9]{16}$"
  },
  "SliceId": {
    "type": "object",
    "properties": {
      "sst": {
        "type": "integer",
        "minimum": 0,
        "maximum": 255
      },
      "sd": {
        "type": "string",
        "pattern": "^[A-Za-f0-9]{6}$"
      },
      "plmnId": {"$ref": "#/definitions/PlmnId"}
    },
    "additionalProperties": false,
    "required": ["sst", "plmnId"]
  },
  "QosId": {
    "oneOf": [
      {
        "type": "object",
        "properties": {
          "5qI": {
            "type": "integer",
            "minimum": 1,
            "maximum": 256
          }
        },
        "additionalProperties": false,
        "required": ["5qI"]
      },
      {
        "type": "object",
        "properties": {
          "qcI": {
            "type": "integer",
            "minimum": 1,
            "maximum": 256
          }
        },
        "additionalProperties": false,
        "required": ["qcI"]
      }
    ]
  },
  "CellId": {
    "type": "object",
    "properties": {
      "plmnId": {"$ref": "#/definitions/PlmnId"},
      "cId": {"$ref": "#/definitions/CId"}
    },
    "additionalProperties": false,
    "required": ["plmnId", "cId"]
  },
  "CId": {
    "oneOf": [
      {
        "type": "object",
        "properties": {
          "ncI": {"$ref": "#/definitions/NcI"}
        },
        "additionalProperties": false,
        "required": ["ncI"]
      },
      {
        "type": "object",

```

```

        "properties": {
            "ecI": {"$ref": "#/definitions/EcI"}
        },
        "additionalProperties": false,
        "required": ["ecI"]
    }
],
},
"NcI": {
    "type": "integer",
    "minimum": 0,
    "maximum": 68719476735
},
"EcI": {
    "type": "integer",
    "minimum": 0,
    "maximum": 268435455
},
"PlmnId": {
    "type": "object",
    "properties": {
        "mcc": {
            "type": "string",
            "pattern": "^[0-9]{3}$"
        },
        "mnc": {
            "type": "string",
            "pattern": "^[0-9]{2,3}$"
        }
    },
    "additionalProperties": false,
    "required": ["mcc", "mnc"]
},

"PreferenceType": {
    "type": "string",
    "enum": [
        "SHALL",
        "PREFER",
        "AVOID",
        "FORBID"
    ]
},

"CellIdList": {
    "type": "array",
    "items": {
        "$ref": "#/definitions/CellId"
    }
},

"TspResource": {
    "type": "object",
    "properties": {
        "cellIdList": {"$ref": "#/definitions/CellIdList"},
        "preference": {"$ref": "#/definitions/PreferenceType"},
        "primary": {"type": "boolean"}
    },
    "required": ["cellIdList", "preference"],
    "additionalProperties": false
}
}
}

```

7.2.4.3.2 Policy status schema

The generic policy status schema in 7.1.2.2 is used.

7.2.5 QoE optimization with resource directive

7.2.5.1 Policy type identifier

PolicyTypeId: **ORAN_QoEandTSP_2.0.0**

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

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "description": "O-RAN standard QoE Target and Traffic Steering Preference policy",
  "type": "object",
  "properties": {
    "scope": {
      "anyOf": [
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "#/definitions/UEId"},
            "sliceId": {"$ref": "#/definitions/SliceId"},
            "qosId": {"$ref": "#/definitions/QosId"},
            "cellId": {"$ref": "#/definitions/CellId"}
          },
          "additionalProperties": false,
          "required": ["ueId", "sliceId"]
        },
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "#/definitions/UEId"},
            "qosId": {"$ref": "#/definitions/QosId"},
            "cellId": {"$ref": "#/definitions/CellId"}
          },
          "additionalProperties": false,
          "required": ["ueId", "qosId"]
        },
        {
          "type": "object",
          "properties": {
            "sliceId": {"$ref": "#/definitions/SliceId"},
            "qosId": {"$ref": "#/definitions/QosId"},
            "cellId": {"$ref": "#/definitions/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": "#/definitions/TspResource"
    },
    "minItems": 1
}
},
"additionalProperties": false,
"required": ["scope", "qoeObjectives", "tspResources"],

"definitions": {
    "UeId": {
        "type": "string",
        "pattern": "^[A-Za-f0-9]{16}$"
    },
    "SliceId": {
        "type": "object",
        "properties": {
            "sst": {
                "type": "integer",
                "minimum": 0,
                "maximum": 255
            },
            "sd": {
                "type": "string",
                "pattern": "^[A-Za-f0-9]{6}$"
            },
            "plmnId": {"$ref": "#/definitions/PlmnId"}
        },
        "additionalProperties": false,
        "required": ["sst", "plmnId"]
    },
    "QosId": {
        "oneOf": [
            {
                "type": "object",
                "properties": {
                    "5qI": {
                        "type": "integer",
                        "minimum": 1,
                        "maximum": 256
                    }
                },
                "additionalProperties": false,
                "required": ["5qI"]
            },
            {
                "type": "object",
                "properties": {
                    "qcI": {
                        "type": "integer",
                        "minimum": 1,
                        "maximum": 256
                    }
                },
                "additionalProperties": false,
                "required": ["qcI"]
            }
        ]
    },
    "CellId": {
        "type": "object",
        "properties": {
            "plmnId": {"$ref": "#/definitions/PlmnId"},

```

```

        "cId": {"$ref": "#/definitions/CId"}
    },
    "additionalProperties": false,
    "required": ["plmnId", "cId"]
},
"CId": {
    "oneOf": [
        {
            "type": "object",
            "properties": {
                "ncI": {"$ref": "#/definitions/NcI"}
            },
            "additionalProperties": false,
            "required": ["ncI"]
        },
        {
            "type": "object",
            "properties": {
                "ecI": {"$ref": "#/definitions/EcI"}
            },
            "additionalProperties": false,
            "required": ["ecI"]
        }
    ]
},
"NcI": {
    "type": "integer",
    "minimum": 0,
    "maximum": 68719476735
},
"EcI": {
    "type": "integer",
    "minimum": 0,
    "maximum": 268435455
},
"PlmnId": {
    "type": "object",
    "properties": {
        "mcc": {
            "type": "string",
            "pattern": "^[0-9]{3}$"
        },
        "mnc": {
            "type": "string",
            "pattern": "^[0-9]{2,3}$"
        }
    },
    "additionalProperties": false,
    "required": ["mcc", "mnc"]
},
"PreferenceType": {
    "type": "string",
    "enum": [
        "SHALL",
        "PREFER",
        "AVOID",
        "FORBID"
    ]
},
"CellIdList": {
    "type": "array",
    "items": {
        "$ref": "#/definitions/CellId"
    }
},
"TspResource": {
    "type": "object",
    "properties": {
        "cellIdList": {"$ref": "#/definitions/CellIdList"},

```

```

    "preference": {"$ref": "#/definitions/PreferenceType"},
    "primary": {"type": "boolean"}
  },
  "required": ["cellIdList", "preference"],
  "additionalProperties": false
}
}
}

```

7.2.5.3.2 Policy status schema

The generic policy status schema in 7.1.2.2 is used.

7.2.6 UE level target

7.2.6.1 Policy type identifier

PolicyTypeId: **ORAN_UELevelTarget_1.0.0**

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

Policy statement	Scope identifier	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

```

{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "description": "O-RAN standard UE Level Target policy",
  "type": "object",
  "properties": {
    "scope": {
      "anyOf": [
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "#/definitions/UEId"},
            "groupId": {"$ref": "#/definitions/GroupId"},
            "sliceId": {"$ref": "#/definitions/SliceId"},
            "cellId": {"$ref": "#/definitions/CellId"}
          }
        },
        {
          "type": "object",
          "properties": {
            "ueId": {"$ref": "#/definitions/UEId"},
            "groupId": {"$ref": "#/definitions/GroupId"},
            "sliceId": {"$ref": "#/definitions/SliceId"},
            "cellId": {"$ref": "#/definitions/CellId"}
          }
        }
      ],
      "additionalProperties": false,
    }
  }
}

```

```

        "required": ["ueId"]
    },
    {
        "type": "object",
        "properties": {
            "ueId": {"$ref": "#/definitions/UeId"},
            "groupId": {"$ref": "#/definitions/GroupId"},
            "sliceId": {"$ref": "#/definitions/SliceId"},
            "qosId": {"$ref": "#/definitions/QosId"},
            "cellId": {"$ref": "#/definitions/CellId"}
        },
        "additionalProperties": false,
        "required": ["ueId", "qosId"]
    },
    {
        "type": "object",
        "properties": {
            "ueId": {"$ref": "#/definitions/UeId"},
            "sliceId": {"$ref": "#/definitions/SliceId"},
            "qosId": {"$ref": "#/definitions/QosId"},
            "cellId": {"$ref": "#/definitions/CellId"}
        },
        "additionalProperties": false,
        "required": ["ueId", "sliceId"]
    }
],
"ueLevelObjectives": {
    "type": "object",
    "properties": {
        "ulThroughput": {"type": "number"},
        "dlThroughput": {"type": "number"},
        "ulPacketDelay": {"type": "number"},
        "dlPacketDelay": {"type": "number"},
        "ulPdcpsduPacketLossRate": {"type": "number"},
        "dlRlcSduPacketLossRate": {"type": "number"},
        "dlReliability": {"$ref": "#/definitions/ReliabilityType"},
        "ulReliability": {"$ref": "#/definitions/ReliabilityType"}
    },
    "minProperties": 1,
    "additionalProperties": false
},
"additionalProperties": false,
"required": ["scope", "ueLevelObjectives"],

"definitions": {
    "UeId": {
        "type": "string",
        "pattern": "^[A-Za-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-Za-f0-9]{6}$"
    },
    "plmnId": {"$ref": "#/definitions/PlmnId"}
  },
  "additionalProperties": false,
  "required": ["sst", "plmnId"]
},
"QosId": {
  "oneOf": [
    {
      "type": "object",
      "properties": {
        "5qI": {
          "type": "integer",
          "minimum": 1,
          "maximum": 256
        }
      }
    },
    {
      "type": "object",
      "properties": {
        "qcI": {
          "type": "integer",
          "minimum": 1,
          "maximum": 256
        }
      },
      "additionalProperties": false,
      "required": ["qcI"]
    }
  ]
},
"CellId": {
  "type": "object",
  "properties": {
    "plmnId": {"$ref": "#/definitions/PlmnId"},
    "cId": {"$ref": "#/definitions/CId"}
  },
  "additionalProperties": false,
  "required": ["plmnId", "cId"]
},
"CId": {
  "oneOf": [
    {
      "type": "object",
      "properties": {
        "ncI": {"$ref": "#/definitions/NcI"}
      },
      "additionalProperties": false,
      "required": ["ncI"]
    },
    {

```

```

        "type": "object",
        "properties": {
            "ecI": {"$ref": "#/definitions/EcI"}
        },
        "additionalProperties": false,
        "required": ["ecI"]
    }
],
"NcI": {
    "type": "integer",
    "minimum": 0,
    "maximum": 68719476735
},
"EcI": {
    "type": "integer",
    "minimum": 0,
    "maximum": 268435455
},
"PlmnId": {
    "type": "object",
    "properties": {
        "mcc": {
            "type": "string",
            "pattern": "^[0-9]{3}$"
        },
        "mnc": {
            "type": "string",
            "pattern": "^[0-9]{2,3}$"
        }
    },
    "additionalProperties": false,
    "required": ["mcc", "mnc"]
},

"ReliabilityType": {
    "type": "object",
    "properties": {
        "packetSize": {"type": "number"},
        "userPlaneLatency": {"type": "number"},
        "successProbability": {"type": "number"}
    },
    "required": ["packetSize", "userPlaneLatency", "successProbability"]
}
}
}

```

7.2.6.3.2 Policy status schema

The generic policy status schema in 7.1.2.2 is used.

7.2.7 Slice SLA target

7.2.7.1 Policy type identifier

PolicyTypeId: **ORAN_SliceSLATarget_2.0.0**

7.2.7.2 Rationale

7.2.7.2.1 Use case

See "Use case 5: RAN Slice SLA Assurance" defined in O-RAN WG2 Use Case 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

Policy statement	ScopeIdentifier	ueld	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

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "description": "O-RAN standard slice SLA policy",
  "type": "object",
  "properties": {
    "scope": {
      "type": "object",
      "properties": {
        "sliceId": {"$ref": "#/definitions/SliceId"}
      },
      "additionalProperties": false,
      "required": ["sliceId"]
    },
    "sliceSlaObjectives": {
      "type": "object",
      "properties": {
        "maxNumberOfUes": {"type": "number"},
        "maxNumberOfPduSessions": {"type": "number"},
        "guaranteedThroughputPerSlice": {"type": "number"},
        "maxDLThroughputPerSlice": {"type": "number"},
        "maxDLThroughputPerUE": {"type": "number"},
        "guaranteedThroughputPerUE": {"type": "number"},
        "maxULThroughputPerSlice": {"type": "number"},
        "maxULThroughputPerUE": {"type": "number"},
        "maxDLPacketDelayPerUE": {"type": "number"},
        "maxULPacketDelayPerUE": {"type": "number"},
        "maxDLPDCPSDUpacketLossRatePerUE": {
          "type": "number",
          "minimum": 0,
          "maximum": 1
        },
        "maxULRLCSDUpacketLossRatePerUE": {
          "type": "number",
          "minimum": 0,
          "maximum": 1
        },
        "minDLReliabilityPerUE": {"$ref": "#/definitions/ReliabilityType"},
        "minULReliabilityPerUE": {"$ref": "#/definitions/ReliabilityType"},
        "maxDLJitterPerUE": {"type": "number"},
        "maxULJitterPerUE": {"type": "number"},
        "dlSlicePriority": {
          "type": "number",
          "minimum": 1
        },
        "ulSlicePriority": {
          "type": "number",
          "minimum": 1
        }
      }
    }
  }
}
```



```

    },
    "minProperties": 1,
    "additionalProperties": false
  },
  "sliceSlaResources": {
    "type": "object",
    "properties": {
      "cellIdList": {"$ref": "#/definitions/CellIdList"},
      "taIList": {"$ref": "#/definitions/TaIList"}
    },
    "additionalProperties": false,
    "oneOf": [
      {"required": ["cellIdList"]},
      {"required": ["taIList"]}
    ]
  }
},
"additionalProperties": false,
"required": ["scope", "sliceSlaObjectives"],

"definitions": {
  "SliceId": {
    "type": "object",
    "properties": {
      "sst": {
        "type": "integer",
        "minimum": 0,
        "maximum": 255
      },
      "sd": {
        "type": "string",
        "pattern": "^[A-Za-f0-9]{6}$"
      },
      "plmnId": {"$ref": "#/definitions/PlmnId"}
    },
    "additionalProperties": false,
    "required": ["sst", "plmnId"]
  },
  "CellId": {
    "type": "object",
    "properties": {
      "plmnId": {"$ref": "#/definitions/PlmnId"},
      "cId": {"$ref": "#/definitions/CId"}
    },
    "additionalProperties": false,
    "required": ["plmnId", "cId"]
  },
  "CId": {
    "oneOf": [
      {
        "type": "object",
        "properties": {
          "ncI": {"$ref": "#/definitions/NcI"}
        },
        "additionalProperties": false,
        "required": ["ncI"]
      },
      {
        "type": "object",
        "properties": {
          "ecI": {"$ref": "#/definitions/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"]
  },
  "TaI": {
    "type": "object",
    "properties": {
      "plmnId": {"$ref": "#/definitions/PlmnId"},
      "tac": {
        "type": "string",
        "pattern": "^[A-Fa-f0-9]{6}$"
      }
    },
    "additionalProperties": false,
    "required": ["plmnId", "tac"]
  },
  "CellIdList": {
    "type": "array",
    "items": {
      "$ref": "#/definitions/CellId"
    }
  },
  "TaIList": {
    "type": "array",
    "items": {
      "$ref": "#/definitions/TaI"
    }
  },
  "ReliabilityType": {
    "type": "object",
    "properties": {
      "packetSize": {"type": "number"},
      "userPlaneLatency": {"type": "number"},
      "successProbability": {
        "type": "number",
        "minimum": 0,
        "maximum": 1
      }
    },
    "required": ["packetSize", "userPlaneLatency", "successProbability"]
  }
}

```

7.2.7.3.2 Policy status schema

The generic policy status schema in 7.1.2.2 is used.

7.2.8 Load balancing

7.2.8.1 Policy type identifier

PolicyTypeId: **ORAN_LoadBalancing 1.0.0**

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 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 75.2.8.2.2-1: Allowed combinations of lbObjectives statement with ScopeIdentifier

ScopeIdentifier	ueld	groupid	sliceId	qosId	cellId
Policy statement					
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

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "description": "O-RAN standard Load Balancing policy",
  "type": "object",
  "properties": {
    "scope": {
      "anyOf": [
        {
          "type": "object",
          "properties": {
            "sliceId": {"$ref": "#/definitions/SliceId"},
            "cellId": {"$ref": "#/definitions/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": "#/definitions/CellIdList"}
    },
    "required": ["cellIdList"],
    "additionalProperties": false
}
},
"additionalProperties": false,
"required": ["scope", "lbResources", "lbObjectives"],

"definitions": {
    "SliceId": {
        "type": "object",
        "properties": {
            "sst": {
                "type": "integer",
                "minimum": 0,
                "maximum": 255
            },
            "sd": {
                "type": "string",
                "pattern": "^[A-Za-f0-9]{6}$"
            },
            "plmnId": {"$ref": "#/definitions/PlmnId"}
        },
        "additionalProperties": false,
        "required": ["sst", "plmnId"]
    },
    "CellId": {
        "type": "object",
        "properties": {
            "plmnId": {"$ref": "#/definitions/PlmnId"},
            "cId": {"$ref": "#/definitions/CId"}
        },
        "additionalProperties": false,
        "required": ["plmnId", "cId"]
    },
    "CId": {
        "oneOf": [
            {
                "type": "object",
                "properties": {
                    "ncI": {"$ref": "#/definitions/NcI"}
                },
                "additionalProperties": false,
                "required": ["ncI"]
            },
            {
                "type": "object",
                "properties": {
                    "ecI": {"$ref": "#/definitions/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"]
    },
    "CellIdList": {
      "type": "array",
      "items": {
        "$ref": "#/definitions/CellId"
      }
    }
  }
}

```

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;
- 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 EiTypeIdIdentifier for usage in the A1-EI procedures and URI structure;
- 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 subclause. 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.

This specification 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 schemas [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	http://json-schema.org/draft-07/schema	A JSON schema meta-schema following JSON Schema Draft 7 [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 ScopelIdentifier

The ScopelIdentifier is EI type specific.

If the ScopelIdentifier contains attributes corresponding to the A1 policy ScopelIdentifier, 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 2: Event-triggered measurement and reporting is FFS.

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 UEGeoandVelEIResult

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 3GPP TS 29.571 [5].	
ueld	string	M	1	UE identifier, based on RAN UE Id (see 3GPP TS 38.463 [8] and TS 38.473 [9]). Encoded as 16 hexadecimal characters.	
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 clause 6.1.6.2.6 in 3GPP TS 29.572 [20]
PointUncertaintyCircle	1	gadShape	POINT_UNCERTAINTY_CIRCLE	Geolocation consisting of a point and an uncertainty value, see clause 6.1.6.2.7 in 3GPP TS 29.572 [20]
PointUncertaintyEllipse	1	gadShape	POINT_UNCERTAINTY_ELLIPSE	Geolocation consisting of a point and an uncertainty ellipse, see clause 6.1.6.2.8 in 3GPP TS 29.572 [20]
Polygon	1	gadShape	POLYGON	Geolocation consisting of a list of points, see clause 6.1.6.2.9 in 3GPP TS 29.572 [20]
PointAltitude	1	gadShape	POINT_ALTITUDE	Geolocation consisting of a point and an altitude value, see clause 6.1.6.2.10 in 3GPP TS 29.572 [20]
PointAltitudeUncertainty	1	gadShape	POINT_ALTITUDE_UNCERTAINTY	Geolocation consisting of a point, an altitude value, and an uncertainty value, see clause 6.1.6.2.11 in 3GPP TS 29.572 [20]
EllipsoidArc	1	gadShape	ELLIPSOID_ARC	Geolocation consisting of an ellipsoid arc, see clause 6.1.6.2.12 in 3GPP TS 29.572 [20]

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	Horizontal velocity, see clause 6.1.6.2.18 in 3GPP TS 29.572 [20]
HorizontalWithVerticalVelocity	1	velocityDesc	HV_VELOCITY	Horizontal velocity and vertical velocity, see clause 6.1.6.2.19 in 3GPP TS 29.572 [1]
HorizontalVelocityWithUncertainty	1	velocityDesc	H_VELOCITY_UNCERTAINTY	Horizontal velocity with a speed uncertainty value, see clause 6.1.6.2.20 in 3GPP TS 29.572 [20]
HorizontalWithVerticalVelocityAndUncertainty	1	velocityDesc	HV_VELOCITY_UNCERTAINTY	Horizontal velocity and vertical velocity with speed uncertainty values, see clause 6.1.6.2.21 in 3GPP TS 29.572 [20]

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] (JSON) and can contain:

- one JSON schema for EiJobDefinition;
- one JSON schema for EiJobStatusObject;
- one JSON schema for EiJobResultObject;
- 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: Clause 9.2 contains definitions and EI type specific schemas for O-RAN defined A1 EI types.

The JSON schema [7] 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 [7] 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 [7] 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 [7] 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] (JSON) 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	See clause 8.2.1	
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 current specification. 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] (JSON) 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 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 current specification. 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] (JSON) 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] (JSON) 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 specification.

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.

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": "http://json-schema.org/draft-07/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.

This generic schema in clause 7.1.2.1 includes the encoding of `ScopeId` data types that can be used with the job definition statement in an EI job.

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

9.2 EI type definitions

9.2.1 UE location and velocity information

9.2.1.1 EI type identifier

EiTypeId: **ORAN_UEGeoandVel_1.0.0**

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 WG2 UCR [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	ueId	groupId	sliceId	qosId	cellId
EI job result definition					
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 Id is allowed in the scope in this release of specification. Whether the scope for UEGeoandVelEIDescription statement can be extended to a group of UEs, UEs in a slice, or UEs in a cell is FFS.

9.2.1.3 JSON schemas

9.2.1.3.1 EI job schema

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "description": "O-RAN standard UE geo-location and velocity EI job definition",
  "type": "object",
  "properties": {
    "scope": {
      "type": "object",
      "properties": {
        "ueId": {"$ref": "#/definitions/UEId"}
      },
      "additionalProperties": false,
      "required": ["ueId"]
    },
    "ueGeoandVelEIDescription": {
      "type": "object",
      "properties": {
        "gadShape": {"$ref": "#/definitions/GadShapeType"},
        "granularityPeriod": {
          "type": "number",
          "minimum": 1,
          "maximum": 60000
        },
        "reportingPeriod": {
          "type": "number",
          "minimum": 1,

```

```

        "maximum": 60000
      },
      "reportingAmount": {
        "type": "number",
        "minimum": 1,
        "maximum": 3600000
      },
      "velocityDesc": {"$ref": "#/definitions/VelocityDescType"}
    },
    "required": ["gadShape", "granularityPeriod", "reportingPeriod", "reportingAmount"],
    "additionalProperties": false
  }
},
"additionalProperties": false,
"required": ["scope", "ueGeoandVelEIDescription"],

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

```

9.2.1.3.2 EI job constraints schema

```

{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "description": "O-RAN standard UE geo-location and velocity EI job constraints",
  "type": "object",
  "properties": {
    "ueGeoandVelEIConstraints": {
      "type": "object",
      "properties": {
        "supportedGadShapes": {
          "type": "array",
          "items": {
            "$ref": "#/definitions/GadShapeType"
          },
          "minItems": 1
        },
        "supportedVelocityTypes": {
          "type": "array",
          "items": {
            "$ref": "#/definitions/VelocityDescType"
          },
          "minItems": 1
        }
      }
    }
  },
}

```



```

    "required": ["supportedGadShapes"],
    "additionalProperties": false
  }
},
"additionalProperties": false,
"required": ["ueGeoandVelEIconstraints"],

"definitions": {
  "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

```

{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "description": "O-RAN standard UE geo-location and velocity EI job results",
  "type": "array",
  "items": {
    "$ref": "#/definitions/UEGeoandVelEIResult"
  },
  "minItems": 1,

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

```

```

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

```

```

    }
  },
  {
    "if": {
      "properties": { "velocityDesc": { "const": "HV_VELOCITY_UNCERTAINTY" } },
      "required": ["velocityDesc"]
    },
    "then": {
      "properties": {
        "velocity": { "$ref": "#/definitions/HorizontalWithVerticalVelocityAndUncertainty" }
      }
    }
  }
],
"required": ["timeStamp", "ueId", "gadShape", "geoLocation"]
},
"UeId": {
  "type": "string",
  "pattern": "^[A-Fa-f0-9]{16}$"
},
"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": { "$ref": "#/definitions/Point" },
    "uncertainty": { "$ref": "#/definitions/Uncertainty" }
  },
  "required": ["point", "uncertainty"]
},
"PointUncertaintyEllipse": {
  "type": "object",
  "properties": {

```

```

    "point": { "$ref": "#/definitions/Point" },
    "uncertaintyEllipse": { "$ref": "#/definitions/UncertaintyEllipse" },
    "confidence": { "$ref": "#/definitions/Confidence" }
  },
  "required": ["point", "uncertainty", "confidence"]
},
"Polygon": {
  "type": "array",
  "items": {
    "$ref": "#/definitions/Point"
  },
  "minItems": 3,
  "maxItems": 15
},
"PointAltitude": {
  "type": "object",
  "properties": {
    "point": { "$ref": "#/definitions/Point" },
    "altitude": { "$ref": "#/definitions/Altitude" }
  },
  "required": ["point", "altitude"]
},
"PointAltitudeUncertainty": {
  "type": "object",
  "properties": {
    "point": { "$ref": "#/definitions/Point" },
    "altitude": { "$ref": "#/definitions/Altitude" },
    "uncertaintyEllipse": { "$ref": "#/definitions/UncertaintyEllipse" },
    "uncertaintyAltitude": { "$ref": "#/definitions/Uncertainty" },
    "confidence": { "$ref": "#/definitions/Confidence" }
  },
  "required": ["point", "altitude", "uncertaintyEllipse", "uncertaintyAltitude", "confidence"]
},
"EllipsoidArc": {
  "type": "object",
  "properties": {
    "point": { "$ref": "#/definitions/Point" },
    "innerRadius": { "$ref": "#/definitions/InnerRadius" },
    "uncertaintyRadius": { "$ref": "#/definitions/Uncertainty" },
    "offsetAngle": { "$ref": "#/definitions/Angle" },
    "includeAngle": { "$ref": "#/definitions/Angle" },
    "confidence": { "$ref": "#/definitions/Confidence" }
  },
  "required": [
    "point",
    "innerRadius",
    "uncertaintyRadius",
    "offsetAngle",
    "includeAngle",
    "confidence"
  ]
},
"HorizontalVelocity": {
  "type": "object",
  "properties": {
    "hSpeed": { "$ref": "#/definitions/HorizontalSpeed" },
    "bearing": { "$ref": "#/definitions/Angle" }
  },
  "required": ["hSpeed", "bearing"]
},
"HorizontalWithVerticalVelocity": {
  "type": "object",
  "properties": {
    "hSpeed": { "$ref": "#/definitions/HorizontalSpeed" },
    "bearing": { "$ref": "#/definitions/Angle" },
    "vSpeed": { "$ref": "#/definitions/VerticalSpeed" },
    "vDirection": { "$ref": "#/definitions/VerticalDirection" }
  },
  "required": ["hSpeed", "bearing", "vSpeed", "vDirection"]
},
"HorizontalVelocityWithUncertainty": {
  "type": "object",
  "properties": {

```

```

        "hSpeed": { "$ref": "#/definitions/HorizontalSpeed" },
        "bearing": { "$ref": "#/definitions/Angle" },
        "hUncertainty": { "$ref": "#/definitions/SpeedUncertainty" }
    },
    "required": ["hSpeed", "bearing", "hUncertainty"]
},
"HorizontalWithVerticalVelocityAndUncertainty": {
    "type": "object",
    "properties": {
        "hSpeed": { "$ref": "#/definitions/HorizontalSpeed" },
        "bearing": { "$ref": "#/definitions/Angle" },
        "vSpeed": { "$ref": "#/definitions/VerticalSpeed" },
        "vDirection": { "$ref": "#/definitions/VerticalDirection" },
        "hUncertainty": { "$ref": "#/definitions/SpeedUncertainty" },
        "vUncertainty": { "$ref": "#/definitions/SpeedUncertainty" }
    },
    "required": ["hSpeed", "bearing", "vSpeed", "vDirection", "hUncertainty", "vUncertainty"]
},
"Uncertainty": {
    "type": "number",
    "minimum": 0
},
"UncertaintyEllipse": {
    "type": "object",
    "properties": {
        "semiMajor": { "$ref": "#/definitions/Uncertainty" },
        "semiMinor": { "$ref": "#/definitions/Uncertainty" },
        "orientationMajor": { "$ref": "#/definitions/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
    }
  }
}

```

Annex A (Informative): Policy examples

A.1 Generic scope identifier

This is an example of a policy that illustrates the usage of the generic ScopeIdentifier definitions in clause 7.1.2.1.

```

{
  "scope": {
    "ueId": "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.2 QoS (Quality of Service)

A.2.1 QoS based resource optimization per-UE

```

{
  "scope": {
    "ueId": "00000000000000855",
    "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": "00000000000000855",
    "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": "00000000000000855"
  },
  "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": "00000000000000855",
    "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": "0000000000000855",
    "qosId": {
      "5qi": 67
    }
  },
  "ueLevelObjectives": {
    "ulPacketDelay": 0.5
  }
}
```

A.8.2 UE level per-slice

```
{
  "scope": {
    "ueId": "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"
    }
  }
},
"slicesSlaObjectives": {
  "dlSlicePriority": 20,
  "ulSlicePriority": 30
},
"slicesSlaResources": {
  "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": {
    "targetPrbUsq": 80,
    "prbUsqType": 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}}
    ]
  }
}

```

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": "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": "00000000000000855",  
    "gadShape": "POINT",  
    "geoLocation": {  
      "lon": -122.960625,  
      "lat": 45.545112  
    },  
    "velocityDesc": "H_VELOCITY",  
    "velocity": {  
      "hSpeed": 15,  
      "bearing": 90  
    }  
  }  
]
```

History

Date	Revision	Description
2022.11.17	05.00	Aligning to O-RAN drafting rules. Enhanced alignment between A1-P and A1-EI, and between A1AP and A1TD.
2022.07.30	04.00	Introducing new EI type for UE location and velocity information
2022.04.01	03.00	Introducing new policy type for Load balancing
2021.07.16	02.00	Introducing new policy types for UE Level target and Slice SLA target. Enhancing data type definitions and JSON encodings.
2021.03.13	01.00	First version based on data models and policy types from A1AP v03.00