

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

A1 interface: Type Definitions

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Revision History

Date	Revision	Author	Description
2021.03.13	01.00	Patric Lind (Ericsson)	First version based on data models and policy types from A1 interface: Application Protocol v03.00
2021.07.16	02.00	Patric Lind (Ericsson)	Introducing new policy types for UE Level target and Slice SLA target. Enhancing data type definitions and JSON encodings.

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Chapter 1 Introductory Material

1.1 Scope

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

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

Release xx.yy.zz

where:

xx the first two-digit value is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc. (the initial approved document shall have xx=01).

yy the second two-digit value is incremented when editorial only changes have been incorporated in the document.

zz the third two-digit value is included only in working versions of the document indicating incremental changes during the editing process; externally published documents never have this third two-digit value included.

The present document specifies the data model and the data types that are used in the body of the procedures in the A1 interface. It is part of a TS-family covering the O-RAN WG2: A1 interface as identified below: “**General Aspects and Principles**”. “**Transport Protocol**”. “**Application Protocol**”. “**Type Definitions**”.

1.1.1 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 first 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 Chapter 5 and EI type compatibility is described in Chapter 7.

The compatibility of A1 implementations in Non/Near-RT RICs depends on which policy types and/or EI types that are implemented. The present document handles the compatibility for data types used by the A1 services while A1 interface: Application Protocol [4] handles the A1 service compatibility aspects.

1.2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document.

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

- [2] O-RAN WG2: “Non-RT RIC and A1 interface: Use Cases and Requirements,”
- [3] O-RAN WG2: “A1 interface: General Aspects and Principles”
- [4] O-RAN WG2: “A1 interface: Application Protocol”
- [5] 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”
- [6] 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”
- [7] IETF RFC8259: “The JavaScript Object Notation (JSON) Data Interchange Format”
- [8] json-schema Draft 7, <https://json-schema.org/specification-links.html#draft-7>
- [9] 3GPP TS 38.463: “3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NG-RAN; E1 application protocol (E1AP)”
- [10] 3GPP TS 38.473: “3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NG-RAN; F1 application protocol (F1AP)”
- [11] 3GPP TS 38.300: “3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; NR and NG-RAN Overall Description; Stage 2”
- [12] 3GPP TS 23.003: “3rd Generation Partnership Project; Technical Specification Group Core Network and Terminals; Numbering, addressing and identification”
- [13] 3GPP TS 23.501: “3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; System Architecture for the 5G System; Stage 2”
- [14] 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”
- [15] 3GPP TS 28.552: “3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Management and orchestration; 5G performance measurements”
- [16] 3GPP TS 38.314: “3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Layer 2 Measurements”
- [17] 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”
- [18] 3GPP TS 23.203: “3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Policy and charging control architecture”
- [19] GSMA NG.116 - Generic Network Slice Template Version 4.0 (2020-11-23)
- [20] O-RAN WG3: “Use Cases and Requirements”
- [21] Semantic Versioning 2.0.0, <https://semver.org>

1.3 Definitions and Abbreviations

1.3.1 Definitions

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1], Non-RT RIC and A1 interface: Use Cases and Requirements [2], A1 interface: General Aspects and Principles [3], A1 interface: Application Protocol [4] and the following apply.

PolicyObject	Structured Data Type representing the policy object (see A1 interface: Application Protocol [4]) that contains a ScopeIdentifier and one or more Statements.
ScopeIdentifier	Structured Data Type representing the scope identifier (see A1 interface: Application Protocol [4]).
Statement	Structured Data Type representing a policy statement (see A1 interface: Application Protocol [4]) that is policy type specific.

1.3.2 Abbreviations

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

Id	Identifier
JSON	JavaScript Object Notation
KPI	Key Performance Indicator
KQI	Key Quality Indicator
QoS	Quality of Service
QoE	Quality of Experience
REST	REpresentational State Transfer
RAN	Radio Access Network
RRM	Radio Resource Management
S-NSSAI	Single Network Slice Selection Assistance Information
SMO	Service Management and Orchestration
SPID	Subscriber Profile IDentity
UE	User Equipment
URI	Uniform Resource Identifier

Chapter 2 A1 Application data model

This document together with the A1 interface: Application Protocol [4] contains a REST method realization of the A1 interface architecture and the A1 procedures identified in A1 interface: Generic Aspects and Principles [3].

The A1 interface: Application Protocol specification [4] 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 are life cycled independently from the A1 services defined in the A1 interface: Application Protocol [4]. The documentation of the A1 data models follows the application data model used for API definitions in 3GPP TS 29.501 [5] and data types specified in 3GPP TS 29.571 [6]. It is based on structured data types and objects as specified in IETF RFC 8259 [7] and JSON schema [8].

Chapter 3 Generic aspects and common data types

3.1 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 4.2 and 4.3) and the corresponding encodings are seen in the type definitions (see clause 5.1.2 and 5.2).

Chapter 4 A1-P Data Model

4.1 Introduction

This clause specifies the application data model and data types supported by the A1-P API (see A1 interface: Application Protocol [4]). The data model is based on policy statements that include attributes and are combined with a scope identifier into policy objects.

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

- QoS targets;
- QoE targets;
- UE level targets;
- Slice SLA targets.

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

- Traffic steering optimization;
- Slice SLA assurance.

4.2 Simple data types and enumerations

This clause 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).

Simple data types and enumerations can be referenced from structured data type and policy types.

4.2.1 Simple data types

Table 4.2.1-1: 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 [9] and TS 38.473 [10]). Encoded as 16 hexadecimal characters.	5G RAN

4.2.2 Enumerations

4.2.2.1 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 4.2.2.1-1.

Table 4.2.2.1-1: Definition of PreferenceType

Enumeration value	Description	Applicability
SHALL	equals to select the resource	select the cell regardless 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

4.2.2.2 EnforcementStatusType

The enumeration EnforcementStatusType represents if a policy is enforced or not. It shall comply with the provisions defined in table 4.2.2.2-1.

Table 4.2.2.2-1: Definition of EnforcementStatusType

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

4.2.2.3 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 4.2.2.3-1.

Table 4.2.2.3-1: 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.

4.3 Structured data types

4.3.1 ScopelIdentifier

A1 policies are in A1 interface: Generic Aspects and Principles [3] defined 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 ScopeIdentifier contains the following attributes:

Table 4.3.1-1: Definition of data type ScopeIdentifier

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 4.2.1	
groupid	GroupId	C	0..1	identifies multiple UEs that policy statement(s) are applied to, see clause 4.3.1.2	
sliceld	Sliceld	C	0..1	identifies the network slice that policy statement(s) are applied to, see clause 4.3.1.1	
qosld	Qosld	C	0..1	identifies the QoS flow that policy statement(s) are applied to, see clause 4.3.1.3	
cellld	Cellld	C	0..1	identifies the cell that the policy statement(s) are applied to, see clause 4.3.1.4	

Note1: Presence condition "C" means that least one attribute shall be included when the scope is defined. The allowed combinations of attributes depend on the policy statement that is combined with the ScopeIdentifier, see Chapter 5.

Note 2: Encoding of 3GPP attributes into number and string is described in Chapter 3 and applied to the JSON encodings in Chapter 5.

4.3.1.1 Sliceld

SliceId is based on the definition of S-NSSAI (see 3GPP TS 23.003 [12]) and includes a PLMN identifier.

Table 4.3.1.1-1: 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 [12]). 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 [12]), see Table 4.3.1.5-1	4G RAN and 5G RAN

4.3.1.2 Groupld

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.

Table 4.3.1.2-1: Definition of type Groupld

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) [15]. Value range is between 1 and 256.	4G RAN
rfspIndex	integer	C	0..1	identifier of a RF selection priority that can be shared by several UEs (see 3GPP TS 23.501) [13]. 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.

4.3.1.3 Qosld

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

Table 4.3.1.3-1: Definition of type QosId

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 [13]). 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.

4.3.1.4 CellId

CellId is based on the definition of the global cell identifiers ECGI and NCGI (see 3GPP TS 23.003 [12]) for 4G and 5G RANs.

Table 4.3.1.4-1: Definition of type CId

Attribute name	Data type	P	Cardinality	Description	Applicability
ecl	integer	C	0..1	E-UTRAN Cell identifier (see 3GPP TS 23.003 [12]) 28 bits encoded as integer.	4G RAN
ncl	integer	C	0..1	NR Cell identifier (see 3GPP TS 23.003 [12]) 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 4.3.1.4-2: Definition of type CellId

Attribute name	Data type	P	Cardinality	Description	Applicability
plmnId	PlmnId	M	1	PLMN Identifier (see 3GPP TS 23.003 [12]), see Table 4.3.1.5-1	
cId	CId	M	1	Cell Identifier, see Table 4.3.1.4-1	

4.3.1.5 PlmnId

This clause contains the definition of the structured data type PlmnId. PlmnId is based on the definition in 3GPP TS 23.003 [12].

Table 4.3.1.5-1: Definition of type PlmnId

Attribute name	Data type	P	Cardinality	Description	Applicability
mcc	string	M	1	Mobile Country Code (see 3GPP TS 23.003 [12]) Contains 3 digits.	
mnc	string	M	1	Mobile Network Code (see 3GPP TS 23.003 [12]) Contains 2 or 3 digits.	

4.3.2 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.

Table 4.3.2-1: Definition of type CellIdList

Attribute name	Data type	P	Cardinality	Description	Applicability
cellIdList	array(CellId)	M	1..N	list of CellIDs, see clause 4.2.1	

Table 4.3.2-2: Definition of type Tal

Attribute name	Data type	P	Cardinality	Description	Applicability
plmnId	PlmnId	M	1	PLMN Identifier (see 3GPP TS 23.003 [12]), see Table 4.3.1.5-1	4G RAN and 5G RAN
tac	string	M	1	Tracking Area Code (see 3GPP TS 23.003 [12]). Encoded as 6 hexadecimal characters.	5G RAN

Table 4.3.2-3: Definition of type TalList

Attribute name	Data type	P	Cardinality	Description	Applicability
talList	array(Tal)	M	1..N	list of Tals, see Table 4.3.2-2	4G RAN and 5G RAN

4.3.3 Statements for policy objectives

A1 policies are in A1 interface: Generic Aspects and Principles [3] defined 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.

4.3.3.1 Introduction

Table 4.3.3.1-1 specifies the data types defined for policy objectives in the A1-P interface protocol. The possible combinations of these are defined in Chapter 5.

Table 4.3.3.1-1: Statements for policy objectives

Data type	Clause defined	Description	Applicability
QosObjectives	4.3.3.2	Attributes related to QoS targets	
QoeObjectives	4.3.3.3	Attributes related to QoE targets	
UeLevelObjectives	4.3.3.4	Attributes related to UE level targets	
SliceSlaObjectives	4.3.3.5	Attributes related to slice SLA targets	

4.3.3.2 QoS target

The QosObjectives statement contains the following attributes:

Table 4.3.3.2-1: 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 [13]	
mfbr	number	C	0..1	Maximum Flow Bit Rate, see 3GPP TS 23.501 [13]	
priorityLevel	number	C	0..1	Priority Level, see 3GPP TS 23.501 [13]	
pdb	number	C	0..1	Packet Delay Budget, see 3GPP TS 23.501 [13]	

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

4.3.3.3 QoE target

The QoeObjectives statement contains the following attributes:

Table 4.3.3.3-1: 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 [14] 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 [14]	
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 [14] 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 [14] 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 network to optimize the radio resource when the application server find 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.

4.3.3.4 UE level targets

The UeLevelObjectives statement contains the following attributes:

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Table 4.3.3.4-1: 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 [15]	
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 [15]	
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 [16] and TS 28.552 [15]	
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 [16] and TS 28.552 [15]	
ulPdcpsduPacketLossRate	number	C	0..1	UL reliability as the UE performance targets or RAN optimization constraints. see 3GPP TS 28.552 [15]	
dlRlcSduPacketLossRate	number	C	0..1	DL reliability as the UE performance targets or RAN optimization constraints. see 3GPP TS 38.314 [16]	
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.	

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Note1: Presence condition "C" means that least one attribute shall be included when this statement is used.

3

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 4.3.3.4-2.

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Table 4.3.3.4-2: 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 [16]	
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	

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4.3.3.5 Slice SLA target

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The SliceSlaObjectives statement contains the following attributes:

Table 4.3.3.5-1: 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 [19]	
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 [19]	
guaDlThptPerSlice	number	C	0..1	This attribute describes the partial SLA target for providing guaranteed data rate as kbps in downlink to be served by the network slice. 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 [19] See Note 2 and Note 3 for additional details	
maxDlThptPerSlice	number	C	0..1	This attribute describes the partial SLA target for providing maximum data rate supported by the network slice for all UEs together in downlink in kbps. Scope identifier designates the respective network slice and optionally slice SLA resources can further designate targeted cells. See Clause 3.4.5 “Max downlink throughput” in NG.116 [19] See Note 2 and Note 3 for additional details	
maxDlThptPerUe	number	C	0..1	This attribute describes the maximum data rate supported by the network slice per UE in downlink in kbps. Scope identifier designates the respective network slice and optionally slice SLA resources can further designate targeted cells. See Clause 3.4.6 “Downlink maximum throughput per UE” in NG.116 [19]	
guaUlThptPerSlice	number	C	0..1	This attribute describes the partial SLA target for providing guaranteed data rate as kbps in uplink to be served by the network slice. 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 [19] See Note 2 and Note 3 for additional details	
maxUlThptPerSlice	number	C	0..1	This attribute describes the partial SLA target for providing maximum data rate supported by the network slice for all UEs together in uplink in kbps. Scope identifier designates the respective network slice and optionally slice SLA resources can further designate targeted cells. See Clause 3.4.31 “Max uplink throughput” in NG.116 [19] See Note 2 and Note 3 for additional details	
maxUlThptPerUe	number	C	0..1	This attribute describes the maximum data rate supported by the network slice per UE in uplink in kbps. Scope identifier designates the respective network slice and optionally slice SLA resources can further designate targeted cells. See Clause 3.4.32 “Uplink maximum throughput per UE” in NG.116 [19]	

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 [20].

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.

4.3.4 Statements for policy resources

A1 policies are in A1 interface: Generic Aspects and Principles [3] defined 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.

4.3.4.1 Introduction

Table 4.3.4.1-1 specifies the data types defined for policy resources in the A1-P interface protocol. The usage of these are defined in Chapter 5.

Table 4.3.4.1-1: Statements for policy resources

Data type	Clause defined	Description	Applicability
TspResources	4.3.4.2	Attributes used to schedule traffic on available cells in a different way than what would be through default behavior	
SliceSlaResources	4.3.4.3	Attributes used to indicate the RAN resources (such as cells or tracking areas) targeted for the respective slice SLA objective	

4.3.4.2 Traffic steering preference

The TspResources statement is defined in Table 4.3.4.2-2 as an array of the type TspResource defined in Table 4.3.4.2-1.

Table 4.3.4.2-1: Definition of type TspResource

Attribute name	Data type	P	Cardinality	Description	Applicability
cellIdList	CellIdList	M	1	list of CellIDs, see clause 4.3.2	
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	

Note: Presence condition "M" means that the attribute shall be included when this statement is used while "O" means that it is optional to include.

Table 4.3.4.2-2: 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*.

4.3.4.3 Slice SLA Policy Resources

The SliceSlaResources statement is defined in Table 4.3.4.3-1.

Table 4.3.4.3-1: Definition of type SliceSlaResources

Attribute name	Data type	P	Cardinality	Description	Applicability
cellIdList	CellIdList	C	0..1	list of CellIDs, see clause 4.3.2	
talList	TalList	C	0..1	list of Tals, see clause 4.3.2	

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.

4.4 Policy representations objects

This clause contains the formal representation definitions of the policy representation object types defined in the A1-P service description in see A1 interface: Application Protocol [4].

4.4.1 Policy object

4.4.1.1 General

A PolicyObject is based on IETF RFC 8259 [7] (JSON) and it always contains one set of:

- one ScopeIdentifier,
- and
- one or more Statements.

Table 4.4.1.1-1: General definition of PolicyObject

Attribute name	Data type	P	Cardinality	Description	Applicability
scope	ScopeIdentifier	M	1	See clause 4.3.1	
qosObjectives	QosObjectives	C	0..1	See clause 4.3.3.2	
qoeObjectives	QoeObjectives	C	0..1	See clause 4.3.3.3	
ueLevelObjectives	UeLevelObjectives	C	0..1	See clause 4.3.3.4	
sliceSlaObjectives	SliceSlaObjectives	C	0..1	See clause 4.3.3.5	
tspResources	TspResources	C	0..1	See clause 4.3.4.2	
sliceSlaResources	SliceSlaResources	O	0..1	See clause 4.3.4.3	

Note: Presence condition "M" means that the data type shall be included in a PolicyObject. Allowed combinations are listed in Chapter 5. 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 Chapter 5 defines PolicyObjects for usage in the A1 procedures defined in A1 interface: Application Protocol [4].

4.4.1.2 Allowed combinations

A Statement can be applied together with a ScopeIdentifier containing different combinations of identifiers attributes. Not all combinations are relevant and different combinations are relevant for different policy types (see Chapter 5).

4.4.2 Policy status object

A PolicyStatusObject is based on IETF RFC 8259 [7] (JSON) and contains:

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

Table 4.4.2.1: General definition of PolicyStatusObject

Attribute name	Data type	P	Cardinality	Description	Applicability
enforceStatus	EnforcementStatusType	M	1	See clause 4.2.2	statement indicating enforcement status of policy
enforceReason	EnforcementReasonType	C	0..1	See clause 4.2.2	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.

4.4.3 Policy type object

A PolicyTypeObject is based on IETF RFC 8259 [7] (JSON) and it contains:

- one JSON schema for PolicyObject,
- and
- one JSON schema for PolicyStatusObject.

The JSON schema [8] for a PolicyObject is used by the A1-P Producer to validate a PolicyObject during Create policy and Update policy procedures. The JSON schema [8] 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.

4.5 Binary data

Binary data is not applicable in this version of the specification.

Chapter 5 A1-P Data Types (Policy Types)

A policy type is identified by a PolicyTypeId as defined in A1 interface: Application Protocol [4]). 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 [21] 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.

5.1 Common definitions

5.1.1 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"]
}
```

5.1.2 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"}
          }
        }
      ]
    }
  }
}
```

```

1      "required": ["qosId"]
2    },
3    {
4      "type": "object",
5      "properties": {
6        "cellId": {"$ref": "#/definitions/CellId"}
7      },
8      "required": ["cellId"]
9    }
10  ]
11 }
12 },
13 "additionalProperties": false,
14 "required": ["scope"],
15
16 "definitions": {
17
18   "UeId": {
19     "type": "string",
20     "pattern": "^[A-Fa-f0-9]{16}$"
21   },
22
23   "GroupId": {
24     "oneOf": [
25       {
26         "type": "object",
27         "properties": {
28           "spId": {
29             "type": "integer",
30             "minimum": 1,
31             "maximum": 256
32           }
33         },
34         "additionalProperties": false,
35         "required": ["spId"]
36       },
37       {
38         "type": "object",
39         "properties": {
40           "rfspIndex": {
41             "type": "integer",
42             "minimum": 1,
43             "maximum": 256
44           }
45         },
46         "additionalProperties": false,
47         "required": ["rfspIndex"]
48       }
49     ]
50   },
51
52   "SliceId": {
53     "type": "object",
54     "properties": {
55       "sst": {
56         "type": "integer",
57         "minimum": 0,
58         "maximum": 255
59       },
60       "sd": {
61         "type": "string",
62         "pattern": "^[A-Fa-f0-9]{6}$"
63       },
64       "plmnId": {"$ref": "#/definitions/PlmnId"}
65     },
66     "additionalProperties": false,
67     "required": ["sst", "plmnId"]
68   },
69
70   "QosId": {
71     "oneOf": [
72       {
73         "type": "object",
74         "properties": {
75           "5qi": {
76             "type": "integer",
77             "minimum": 1,

```

```

1      "maximum": 256
2    },
3  },
4  "additionalProperties": false,
5  "required": ["5qI"]
6  },
7  {
8    "type": "object",
9    "properties": {
10      "qcI": {
11        "type": "integer",
12        "minimum": 1,
13        "maximum": 256
14      }
15    },
16    "additionalProperties": false,
17    "required": ["qcI"]
18  }
19 ]
20 },
21
22 "CellId": {
23   "type": "object",
24   "properties": {
25     "plmnId": {"$ref": "#/definitions/PlmnId"},
26     "cId": {"$ref": "#/definitions/CId"}
27   },
28   "additionalProperties": false,
29   "required": ["plmnId", "cId"]
30 },
31 "CId": {
32   "oneOf": [
33     {
34       "type": "object",
35       "properties": {
36         "ncI": {"$ref": "#/definitions/NcI"}
37       },
38       "additionalProperties": false,
39       "required": ["ncI"]
40     },
41     {
42       "type": "object",
43       "properties": {
44         "ecI": {"$ref": "#/definitions/EcI"}
45       },
46       "additionalProperties": false,
47       "required": ["ecI"]
48     }
49   ]
50 },
51 "NcI": {
52   "type": "integer",
53   "minimum": 0,
54   "maximum": 68719476735
55 },
56 "EcI": {
57   "type": "integer",
58   "minimum": 0,
59   "maximum": 268435455
60 },
61
62 "PlmnId": {
63   "type": "object",
64   "properties": {
65     "mcc": {
66       "type": "string",
67       "pattern": "^[0-9]{3}$"
68     },
69     "mnc": {
70       "type": "string",
71       "pattern": "^[0-9]{2,3}$"
72     }
73   },
74   "additionalProperties": false,
75   "required": ["mcc", "mnc"]
76 }
77

```

```

1  }
2  }

```

5.2 Policy type definitions

5.2.1 QoS Target

5.2.1.1 Policy Type Identifier

PolicyTypeId: **ORAN_QoSTarget_2.0.0**

5.2.1.2 Rationale

5.2.1.2.1 Use case

See Use case 3: QoS based resource optimization in Non-RT RIC & A1 interface: Use Cases and Requirements [2].

5.2.1.2.2 Statements, restrictions and extensions

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

Table 5.2.1.2.2-1: Allowed combinations of qosObjectives statement with ScopelIdentifier

Policy statement	ScopelIdentifier	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.

5.2.1.3 JSON schemas

5.2.1.3.1 Policy schema

```

19 {
20   "$schema": "http://json-schema.org/draft-07/schema#",
21   {
22     "$schema": "http://json-schema.org/draft-07/schema#",
23     "description": "O-RAN standard QoS Target policy",
24     "type": "object",
25     "properties": {
26       "scope": {
27         "anyOf": [
28           {
29             "type": "object",
30             "properties": {
31               "ueId": {"$ref": "#/definitions/UeId"},
32               "groupId": {"$ref": "#/definitions/GroupId"},
33               "qosId": {"$ref": "#/definitions/QosId"},
34               "cellId": {"$ref": "#/definitions/CellId"}
35             },
36             "additionalProperties": false,
37             "required": ["ueId", "qosId"]
38           },
39           {
40             "type": "object",
41             "properties": {
42               "ueId": {"$ref": "#/definitions/UeId"},
43               "sliceId": {"$ref": "#/definitions/SliceId"},

```

```

1      "qosId": {"$ref": "#/definitions/QosId"},
2      "cellId": {"$ref": "#/definitions/CellId"}
3    },
4    "additionalProperties": false,
5    "required": ["ueId", "qosId"]
6  },
7  {
8    "type": "object",
9    "properties": {
10     "groupId": {"$ref": "#/definitions/GroupId"},
11     "qosId": {"$ref": "#/definitions/QosId"},
12     "cellId": {"$ref": "#/definitions/CellId"}
13   },
14   "additionalProperties": false,
15   "required": ["groupId", "qosId"]
16 },
17 {
18   "type": "object",
19   "properties": {
20     "sliceId": {"$ref": "#/definitions/SliceId"},
21     "qosId": {"$ref": "#/definitions/QosId"},
22     "cellId": {"$ref": "#/definitions/CellId"}
23   },
24   "additionalProperties": false,
25   "required": ["sliceId", "qosId"]
26 },
27 {
28   "type": "object",
29   "properties": {
30     "qosId": {"$ref": "#/definitions/QosId"},
31     "cellId": {"$ref": "#/definitions/CellId"}
32   },
33   "additionalProperties": false,
34   "required": ["qosId"]
35 }
36 ]
37 },
38 "qosObjectives": {
39   "type": "object",
40   "properties": {
41     "gfbr": {"type": "number"},
42     "mfbr": {"type": "number"},
43     "priorityLevel": {"type": "number"},
44     "pdb": {"type": "number"}
45   },
46   "minProperties": 1,
47   "additionalProperties": false
48 }
49 },
50 "additionalProperties": false,
51 "required": ["scope", "qosObjectives"],
52
53 "definitions": {
54   "UeId": {
55     "type": "string",
56     "pattern": "^[A-Za-f0-9]{16}$"
57   },
58   "GroupId": {
59     "oneOf": [
60       {
61         "type": "object",
62         "properties": {
63           "spId": {
64             "type": "integer",
65             "minimum": 1,
66             "maximum": 256
67           }
68         },
69         "additionalProperties": false,
70         "required": ["spId"]
71       },
72       {
73         "type": "object",
74         "properties": {
75           "rfspIndex": {
76             "type": "integer",
77             "minimum": 1,

```

```

1      "maximum": 256
2    },
3  },
4  "additionalProperties": false,
5  "required": ["rfspIndex"]
6  }
7  ]
8  },
9  "SliceId": {
10   "type": "object",
11   "properties": {
12     "sst": {
13       "type": "integer",
14       "minimum": 0,
15       "maximum": 255
16     },
17     "sd": {
18       "type": "string",
19       "pattern": "^[A-Za-f0-9]{6}$"
20     },
21     "plmnId": {"$ref": "#/definitions/PlmnId"}
22   },
23   "additionalProperties": false,
24   "required": ["sst", "plmnId"]
25 },
26 "QosId": {
27   "oneOf": [
28     {
29       "type": "object",
30       "properties": {
31         "5qI": {
32           "type": "integer",
33           "minimum": 1,
34           "maximum": 256
35         }
36       },
37       "additionalProperties": false,
38       "required": ["5qI"]
39     },
40     {
41       "type": "object",
42       "properties": {
43         "qcI": {
44           "type": "integer",
45           "minimum": 1,
46           "maximum": 256
47         }
48       },
49       "additionalProperties": false,
50       "required": ["qcI"]
51     }
52   ]
53 },
54 "CellId": {
55   "type": "object",
56   "properties": {
57     "plmnId": {"$ref": "#/definitions/PlmnId"},
58     "cId": {"$ref": "#/definitions/CId"}
59   },
60   "additionalProperties": false,
61   "required": ["plmnId", "cId"]
62 },
63 "CId": {
64   "oneOf": [
65     {
66       "type": "object",
67       "properties": {
68         "ncI": {"$ref": "#/definitions/NcI"}
69       },
70       "additionalProperties": false,
71       "required": ["ncI"]
72     },
73     {
74       "type": "object",
75       "properties": {
76         "ecI": {"$ref": "#/definitions/EcI"}
77       },

```



```

1      "additionalProperties": false,
2      "required": ["ecI"]
3    }
4  ],
5  },
6  "NcI": {
7    "type": "integer",
8    "minimum": 0,
9    "maximum": 68719476735
10  },
11  "EcI": {
12    "type": "integer",
13    "minimum": 0,
14    "maximum": 268435455
15  },
16  "PlmnId": {
17    "type": "object",
18    "properties": {
19      "mcc": {
20        "type": "string",
21        "pattern": "^[0-9]{3}$"
22      },
23      "mnc": {
24        "type": "string",
25        "pattern": "^[0-9]{2,3}$"
26      }
27    },
28    "additionalProperties": false,
29    "required": ["mcc", "mnc"]
30  }
31 }
32 }

```

5.2.1.3.2 Policy status schema

The generic policy status schema in 5.1.1 is used.

5.2.2 QoE Target

5.2.2.1 Policy Type Identifier

PolicyTypeId: ORAN_QoETarget_2.0.0

5.2.2.2 Rationale

5.2.2.2.1 Use case

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

5.2.2.2.2 Statements, restrictions and extensions

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

Table 5.2.2.2-1: Allowed combinations of qoeObjectives statement with ScopelIdentifier

Policy statement	ScopelIdentifier	ueld	groupid	sliceld	qosld	cellld
qoeObjectives		1	0	1	0..1	0..1
qoeObjectives		1	0	0	1	0..1
qoeObjectives		0	0	1	0..1	0..1
qoeObjectives		0	0	0	1	0..1

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

5.2.2.3 JSON schemas

5.2.2.3.1 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": {"$ref": "#/definitions/CellId"}
          },
          "additionalProperties": false,
          "required": ["qosId"]
        }
      ]
    },
    "qoeObjectives": {
      "type": "object",
      "properties": {
        "qoeScore": {"type": "number"},
        "initialBuffering": {"type": "number"},
        "reBuffFreq": {"type": "number"},
        "stallRatio": {"type": "number"}
      },
      "minProperties": 1,
      "additionalProperties": false
    }
  },
  "additionalProperties": false,
  "required": ["scope", "qoeObjectives"],
  "definitions": {
    "UeId": {
      "type": "string",
      "pattern": "^[A-Za-f0-9]{16}$"
    },
    "SliceId": {
      "type": "object",
      "properties": {

```

```

1      "sst": {
2          "type": "integer",
3          "minimum": 0,
4          "maximum": 255
5      },
6      "sd": {
7          "type": "string",
8          "pattern": "^[A-Za-f0-9]{6}$"
9      },
10     "plmnId": {"$ref": "#/definitions/PlmnId"}
11 },
12 "additionalProperties": false,
13 "required": ["sst", "plmnId"]
14 },
15 "QosId": {
16     "oneOf": [
17         {
18             "type": "object",
19             "properties": {
20                 "5qI": {
21                     "type": "integer",
22                     "minimum": 1,
23                     "maximum": 256
24                 }
25             },
26             "additionalProperties": false,
27             "required": ["5qI"]
28         },
29         {
30             "type": "object",
31             "properties": {
32                 "qcI": {
33                     "type": "integer",
34                     "minimum": 1,
35                     "maximum": 256
36                 }
37             },
38             "additionalProperties": false,
39             "required": ["qcI"]
40         }
41     ]
42 },
43 "CellId": {
44     "type": "object",
45     "properties": {
46         "plmnId": {"$ref": "#/definitions/PlmnId"},
47         "cId": {"$ref": "#/definitions/CId"}
48     },
49     "additionalProperties": false,
50     "required": ["plmnId", "cId"]
51 },
52 "CId": {
53     "oneOf": [
54         {
55             "type": "object",
56             "properties": {
57                 "ncI": {"$ref": "#/definitions/NcI"}
58             },
59             "additionalProperties": false,
60             "required": ["ncI"]
61         },
62         {
63             "type": "object",
64             "properties": {
65                 "ecI": {"$ref": "#/definitions/EcI"}
66             },
67             "additionalProperties": false,
68             "required": ["ecI"]
69         }
70     ]
71 },
72 "NcI": {
73     "type": "integer",
74     "minimum": 0,
75     "maximum": 68719476735
76 },
77 "EcI": {

```

```

1  "type": "integer",
2  "minimum": 0,
3  "maximum": 268435455
4  },
5  "PlmnId": {
6    "type": "object",
7    "properties": {
8      "mcc": {
9        "type": "string",
10       "pattern": "^[0-9]{3}$"
11     },
12     "mnc": {
13       "type": "string",
14       "pattern": "^[0-9]{2,3}$"
15     }
16   },
17   "additionalProperties": false,
18   "required": ["mcc", "mnc"]
19 }
20 }
21 }

```

5.2.2.3.2 Policy status schema

The generic policy status schema in 5.1.1 is used.

5.2.3 Traffic Steering Preferences

5.2.3.1 Policy Type Identifier

PolicyTypeId: **ORAN_TrafficSteeringPreference_2.0.0**

5.2.3.2 Rationale

See Use case 1: Traffic Steering use case in Non-RT RIC & A1 interface: Use Cases and Requirements [2].

5.2.3.2.1 Use case

5.2.3.2.2 Statements, restrictions and extensions

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

Table 5.2.3.2.2-1: Allowed combinations of tspResources statement with ScopeIdentifier

Policy statement	ScopeIdentifier	ueld	groupId	sliceld	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.

5.2.3.3 JSON schemas

5.2.3.3.1 Policy schema

```

39 {
40   "$schema": "http://json-schema.org/draft-07/schema#",
41   "description": "O-RAN standard Traffic Steering Preference policy",
42   "type": "object",
43   "properties": {
44     "scope": {
45       "anyOf": [
46         {

```

```

1      "type": "object",
2      "properties": {
3        "ueId": {"$ref": "#/definitions/UEId"},
4        "sliceId": {"$ref": "#/definitions/SliceId"},
5        "qosId": {"$ref": "#/definitions/QosId"},
6        "cellId": {"$ref": "#/definitions/CellId"}
7      },
8      "additionalProperties": false,
9      "required": ["ueId"]
10     },
11     {
12       "type": "object",
13       "properties": {
14         "sliceId": {"$ref": "#/definitions/SliceId"},
15         "qosId": {"$ref": "#/definitions/QosId"},
16         "cellId": {"$ref": "#/definitions/CellId"}
17       },
18       "additionalProperties": false,
19       "required": ["sliceId"]
20     }
21   ],
22 },
23 "tspResources": {
24   "type": "array",
25   "items": {
26     "$ref": "#/definitions/TspResource"
27   },
28   "minItems": 1
29 },
30 },
31 "additionalProperties": false,
32 "required": ["scope", "tspResources"],
33
34 "definitions": {
35   "UEId": {
36     "type": "string",
37     "pattern": "^[A-Za-z0-9]{16}$"
38   },
39   "SliceId": {
40     "type": "object",
41     "properties": {
42       "sst": {
43         "type": "integer",
44         "minimum": 0,
45         "maximum": 255
46       },
47       "sd": {
48         "type": "string",
49         "pattern": "^[A-Za-z0-9]{6}$"
50       },
51       "plmnId": {"$ref": "#/definitions/PlmnId"}
52     },
53     "additionalProperties": false,
54     "required": ["sst", "plmnId"]
55   },
56   "QosId": {
57     "oneOf": [
58       {
59         "type": "object",
60         "properties": {
61           "5qI": {
62             "type": "integer",
63             "minimum": 1,
64             "maximum": 256
65           }
66         },
67         "additionalProperties": false,
68         "required": ["5qI"]
69       },
70       {
71         "type": "object",
72         "properties": {
73           "qcI": {
74             "type": "integer",
75             "minimum": 1,
76             "maximum": 256
77           }
78         }
79       }
80     ]
81   }
82 }

```

```

1      },
2      "additionalProperties": false,
3      "required": ["qcI"]
4    }
5  ]
6
7  },
8  "CellId": {
9    "type": "object",
10   "properties": {
11     "plmnId": {"$ref": "#/definitions/PlmnId"},
12     "cId": {"$ref": "#/definitions/CId"}
13   },
14   "additionalProperties": false,
15   "required": ["plmnId", "cId"]
16 },
17 "CId": {
18   "oneOf": [
19     {
20       "type": "object",
21       "properties": {
22         "ncI": {"$ref": "#/definitions/NcI"}
23       },
24       "additionalProperties": false,
25       "required": ["ncI"]
26     },
27     {
28       "type": "object",
29       "properties": {
30         "ecI": {"$ref": "#/definitions/EcI"}
31       },
32       "additionalProperties": false,
33       "required": ["ecI"]
34     }
35   ]
36 },
37 "NcI": {
38   "type": "integer",
39   "minimum": 0,
40   "maximum": 68719476735
41 },
42 "EcI": {
43   "type": "integer",
44   "minimum": 0,
45   "maximum": 268435455
46 },
47 "PlmnId": {
48   "type": "object",
49   "properties": {
50     "mcc": {
51       "type": "string",
52       "pattern": "^[0-9]{3}$"
53     },
54     "mnc": {
55       "type": "string",
56       "pattern": "^[0-9]{2,3}$"
57     }
58   },
59   "additionalProperties": false,
60   "required": ["mcc", "mnc"]
61 },
62 "PreferenceType": {
63   "type": "string",
64   "enum": [
65     "SHALL",
66     "PREFER",
67     "AVOID",
68     "FORBID"
69   ]
70 },
71
72 "CellIdList": {
73   "type": "array",
74   "items": {
75     "$ref": "#/definitions/CellId"
76   }
77 }

```

```

1  "TspResource": {
2    "type": "object",
3    "properties": {
4      "cellIdList": {"$ref": "#/definitions/CellIdList"},
5      "preference": {"$ref": "#/definitions/PreferenceType"},
6      "primary": {"type": "boolean"}
7    },
8    "required": ["cellIdList", "preference"],
9    "additionalProperties": false
10  }
11 }
12 }
13 }

```

5.2.3.3.2 Policy status schema

The generic policy status schema in 5.1.1 is used.

5.2.4 QoS optimization with resource directive

5.2.4.1 Policy Type Identifier

PolicyTypeId: **ORAN_QoSandTSP_2.0.0**

5.2.4.2 Rationale

5.2.4.2.1 Use case

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

5.2.4.2.2 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.

5.2.4.3 JSON schemas

5.2.4.3.1 Policy schema

```

27 {
28   "$schema": "http://json-schema.org/draft-07/schema#",
29   "description": "O-RAN standard QoS Target and Traffic Steering Preference policy",
30   "type": "object",
31   "properties": {
32     "scope": {
33       "anyOf": [
34         {
35           "type": "object",
36           "properties": {
37             "ueId": {"$ref": "#/definitions/UeId"},
38             "sliceId": {"$ref": "#/definitions/SliceId"},
39             "qosId": {"$ref": "#/definitions/QosId"},
40             "cellId": {"$ref": "#/definitions/CellId"}
41           },
42           "additionalProperties": false,
43           "required": ["ueId", "qosId"]
44         },
45         {
46           "type": "object",
47           "properties": {
48             "sliceId": {"$ref": "#/definitions/SliceId"},
49             "qosId": {"$ref": "#/definitions/QosId"},
50             "cellId": {"$ref": "#/definitions/CellId"}
51           },
52           "additionalProperties": false,
53           "required": ["sliceId", "qosId"]
54         }
55       ]
56     }
57   }
58 }

```

```

1      ]
2    },
3    "qosObjectives": {
4      "type": "object",
5      "properties": {
6        "gfbr": {"type": "number"},
7        "mfbr": {"type": "number"},
8        "priorityLevel": {"type": "number"},
9        "pdb": {"type": "number"}
10     },
11     "minProperties": 1,
12     "additionalProperties": false
13   },
14   "tspResources": {
15     "type": "array",
16     "items": {
17       "$ref": "#/definitions/TspResource"
18     },
19     "minItems": 1
20   }
21 },
22 "additionalProperties": false,
23 "required": ["scope", "qosObjectives", "tspResources"],
24
25 "definitions": {
26   "UeId": {
27     "type": "string",
28     "pattern": "^[A-Za-f0-9]{16}$"
29   },
30   "SliceId": {
31     "type": "object",
32     "properties": {
33       "sst": {
34         "type": "integer",
35         "minimum": 0,
36         "maximum": 255
37       },
38       "sd": {
39         "type": "string",
40         "pattern": "^[A-Za-f0-9]{6}$"
41       },
42       "plmnId": {"$ref": "#/definitions/PlmnId"}
43     },
44     "additionalProperties": false,
45     "required": ["sst", "plmnId"]
46   },
47   "QosId": {
48     "oneOf": [
49       {
50         "type": "object",
51         "properties": {
52           "5qI": {
53             "type": "integer",
54             "minimum": 1,
55             "maximum": 256
56           }
57         },
58         "additionalProperties": false,
59         "required": ["5qI"]
60       },
61       {
62         "type": "object",
63         "properties": {
64           "qcI": {
65             "type": "integer",
66             "minimum": 1,
67             "maximum": 256
68           }
69         },
70         "additionalProperties": false,
71         "required": ["qcI"]
72       }
73     ]
74   },
75   "CellId": {
76     "type": "object",
77     "properties": {

```



```

1      "plmnId": {"$ref": "#/definitions/PlmnId"},
2      "cId": {"$ref": "#/definitions/CId"}
3    },
4    "additionalProperties": false,
5    "required": ["plmnId", "cId"]
6  },
7  "CId": {
8    "oneOf": [
9      {
10       "type": "object",
11       "properties": {
12         "ncI": {"$ref": "#/definitions/NcI"}
13       },
14       "additionalProperties": false,
15       "required": ["ncI"]
16     },
17     {
18       "type": "object",
19       "properties": {
20         "ecI": {"$ref": "#/definitions/EcI"}
21       },
22       "additionalProperties": false,
23       "required": ["ecI"]
24     }
25   ]
26 },
27 "NcI": {
28   "type": "integer",
29   "minimum": 0,
30   "maximum": 68719476735
31 },
32 "EcI": {
33   "type": "integer",
34   "minimum": 0,
35   "maximum": 268435455
36 },
37 "PlmnId": {
38   "type": "object",
39   "properties": {
40     "mcc": {
41       "type": "string",
42       "pattern": "^[0-9]{3}$"
43     },
44     "mnc": {
45       "type": "string",
46       "pattern": "^[0-9]{2,3}$"
47     }
48   },
49   "additionalProperties": false,
50   "required": ["mcc", "mnc"]
51 },
52
53 "PreferenceType": {
54   "type": "string",
55   "enum": [
56     "SHALL",
57     "PREFER",
58     "AVOID",
59     "FORBID"
60   ]
61 },
62
63 "CellIdList": {
64   "type": "array",
65   "items": {
66     "$ref": "#/definitions/CellId"
67   }
68 },
69
70 "TspResource": {
71   "type": "object",
72   "properties": {
73     "cellIdList": {"$ref": "#/definitions/CellIdList"},
74     "preference": {"$ref": "#/definitions/PreferenceType"},
75     "primary": {"type": "boolean"}
76   },
77   "required": ["cellIdList", "preference"],

```

```

1      "additionalProperties": false
2    }
3  }
4 }

```

5.2.4.3.2 Policy status schema

The generic policy status schema in 5.1.1 is used.

5.2.5 QoE optimization with resource directive

5.2.5.1 Policy Type Identifier

PolicyTypeId: **ORAN_QoEandTSP_2.0.0**

5.2.5.2 Rationale

5.2.5.2.1 Use case

Addresses both the QoE and Traffic steering preferences use cases.

5.2.5.2.2 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.

5.2.5.3 JSON schemas

5.2.5.3.1 Policy schema

```

18 {
19   "$schema": "http://json-schema.org/draft-07/schema#",
20   "description": "O-RAN standard QoE Target and Traffic Steering Preference policy",
21   "type": "object",
22   "properties": {
23     "scope": {
24       "anyOf": [
25         {
26           "type": "object",
27           "properties": {
28             "ueId": {"$ref": "#/definitions/UEId"},
29             "sliceId": {"$ref": "#/definitions/SliceId"},
30             "qosId": {"$ref": "#/definitions/QosId"},
31             "cellId": {"$ref": "#/definitions/CellId"}
32           },
33           "additionalProperties": false,
34           "required": ["ueId", "sliceId"]
35         },
36         {
37           "type": "object",
38           "properties": {
39             "ueId": {"$ref": "#/definitions/UEId"},
40             "qosId": {"$ref": "#/definitions/QosId"},
41             "cellId": {"$ref": "#/definitions/CellId"}
42           },
43           "additionalProperties": false,
44           "required": ["ueId", "qosId"]
45         },
46         {
47           "type": "object",
48           "properties": {
49             "sliceId": {"$ref": "#/definitions/SliceId"},
50             "qosId": {"$ref": "#/definitions/QosId"},
51             "cellId": {"$ref": "#/definitions/CellId"}
52           },
53           "additionalProperties": false,
54           "required": ["sliceId"]
55         }
56       ]
57     }
58   }
59 }

```

```

1   ]
2   },
3   "qoeObjectives": {
4     "type": "object",
5     "properties": {
6       "qoeScore": {"type": "number"},
7       "initialBuffering": {"type": "number"},
8       "reBuffFreq": {"type": "number"},
9       "stallRatio": {"type": "number"}
10    },
11    "minProperties": 1,
12    "additionalProperties": false
13  },
14  "tspResources": {
15    "type": "array",
16    "items": {
17      "$ref": "#/definitions/TspResource"
18    },
19    "minItems": 1
20  }
21 },
22 "additionalProperties": false,
23 "required": ["scope", "qoeObjectives", "tspResources"],
24
25 "definitions": {
26   "UeId": {
27     "type": "string",
28     "pattern": "^[A-Fa-f0-9]{16}$"
29   },
30   "SliceId": {
31     "type": "object",
32     "properties": {
33       "sst": {
34         "type": "integer",
35         "minimum": 0,
36         "maximum": 255
37       },
38       "sd": {
39         "type": "string",
40         "pattern": "^[A-Fa-f0-9]{6}$"
41       },
42       "plmnId": {"$ref": "#/definitions/PlmnId"}
43     },
44     "additionalProperties": false,
45     "required": ["sst", "plmnId"]
46   },
47   "QosId": {
48     "oneOf": [
49       {
50         "type": "object",
51         "properties": {
52           "5qI": {
53             "type": "integer",
54             "minimum": 1,
55             "maximum": 256
56           }
57         },
58         "additionalProperties": false,
59         "required": ["5qI"]
60       },
61       {
62         "type": "object",
63         "properties": {
64           "qcI": {
65             "type": "integer",
66             "minimum": 1,
67             "maximum": 256
68           }
69         },
70         "additionalProperties": false,
71         "required": ["qcI"]
72       }
73     ]
74   },
75   "CellId": {
76     "type": "object",
77     "properties": {

```

```

1      "plmnId": {"$ref": "#/definitions/PlmnId"},
2      "cId": {"$ref": "#/definitions/CId"}
3    },
4    "additionalProperties": false,
5    "required": ["plmnId", "cId"]
6  },
7  "CId": {
8    "oneOf": [
9      {
10       "type": "object",
11       "properties": {
12         "ncI": {"$ref": "#/definitions/NcI"}
13       },
14       "additionalProperties": false,
15       "required": ["ncI"]
16     },
17     {
18       "type": "object",
19       "properties": {
20         "ecI": {"$ref": "#/definitions/EcI"}
21       },
22       "additionalProperties": false,
23       "required": ["ecI"]
24     }
25   ]
26 },
27 "NcI": {
28   "type": "integer",
29   "minimum": 0,
30   "maximum": 68719476735
31 },
32 "EcI": {
33   "type": "integer",
34   "minimum": 0,
35   "maximum": 268435455
36 },
37 "PlmnId": {
38   "type": "object",
39   "properties": {
40     "mcc": {
41       "type": "string",
42       "pattern": "^[0-9]{3}$"
43     },
44     "mnc": {
45       "type": "string",
46       "pattern": "^[0-9]{2,3}$"
47     }
48   },
49   "additionalProperties": false,
50   "required": ["mcc", "mnc"]
51 },
52
53 "PreferenceType": {
54   "type": "string",
55   "enum": [
56     "SHALL",
57     "PREFER",
58     "AVOID",
59     "FORBID"
60   ]
61 },
62
63 "CellIdList": {
64   "type": "array",
65   "items": {
66     "$ref": "#/definitions/CellId"
67   }
68 },
69
70 "TspResource": {
71   "type": "object",
72   "properties": {
73     "cellIdList": {"$ref": "#/definitions/CellIdList"},
74     "preference": {"$ref": "#/definitions/PreferenceType"},
75     "primary": {"type": "boolean"}
76   },
77   "required": ["cellIdList", "preference"],

```

```

1      "additionalProperties": false
2    }
3  }
4 }

```

5.2.5.3.2 Policy status schema

The generic policy status schema in 5.1.1 is used.

5.2.6 UE Level Target

5.2.6.1 Policy Type Identifier

PolicyTypeId: **ORAN_UELevelTarget_1.0.0**

5.2.6.2 Rationale

5.2.6.2.1 Use case

Addresses the QoS based resource optimization use case.

5.2.6.2.2 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. The following table indicates combinations that are allowed.

Table 5.2.6.2.2-1: Allowed combinations of ueLevelObjectives statement with ScopeIdentifierScope identifier	ueId	groupId	sliceId	qosId	cellId
Policy statement					
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.

5.2.6.3 JSON schemas

5.2.6.3.1 Policy schema

PolicyTypeId: **ORAN_UELevelTarget_1.0.0**

```

22 {
23   "$schema": "http://json-schema.org/draft-07/schema#",
24   "description": "O-RAN standard UE Level Target policy",
25   "type": "object",
26   "properties": {
27     "scope": {
28       "anyOf": [
29         {
30           "type": "object",
31           "properties": {
32             "ueId": {"$ref": "#/definitions/UEId"},
33             "groupId": {"$ref": "#/definitions/GroupId"},
34             "sliceId": {"$ref": "#/definitions/SliceId"},
35             "cellId": {"$ref": "#/definitions/CellId"}
36           },
37           "additionalProperties": false,
38           "required": ["ueId"]
39         },
40         {
41           "type": "object",
42           "properties": {
43             "ueId": {"$ref": "#/definitions/UEId"},

```

```

1      "groupId": {"$ref": "#/definitions/GroupId"},
2      "sliceId": {"$ref": "#/definitions/SliceId"},
3      "qosId": {"$ref": "#/definitions/QosId"},
4      "cellId": {"$ref": "#/definitions/CellId"}
5    },
6    "additionalProperties": false,
7    "required": ["ueId", "qosId"]
8  },
9  {
10    "type": "object",
11    "properties": {
12      "ueId": {"$ref": "#/definitions/UeId"},
13      "sliceId": {"$ref": "#/definitions/SliceId"},
14      "qosId": {"$ref": "#/definitions/QosId"},
15      "cellId": {"$ref": "#/definitions/CellId"}
16    },
17    "additionalProperties": false,
18    "required": ["ueId", "sliceId"]
19  }
20 ]
21 },
22 "ueLevelObjectives": {
23   "type": "object",
24   "properties": {
25     "ulThroughput": {"type": "number"},
26     "dlThroughput": {"type": "number"},
27     "ulPacketDelay": {"type": "number"},
28     "dlPacketDelay": {"type": "number"},
29     "ulPdcpsduPacketLossRate": {"type": "number"},
30     "dlRlcSduPacketLossRate": {"type": "number"},
31     "dlReliability": {"$ref": "#/definitions/ReliabilityType"},
32     "ulReliability": {"$ref": "#/definitions/ReliabilityType"}
33   },
34   "minProperties": 1,
35   "additionalProperties": false
36 }
37 },
38 "additionalProperties": false,
39 "required": ["scope", "ueLevelObjectives"],
40
41 "definitions": {
42   "UeId": {
43     "type": "string",
44     "pattern": "^[A-Za-f0-9]{16}$"
45   },
46   "GroupId": {
47     "oneOf": [
48       {
49         "type": "object",
50         "properties": {
51           "spId": {
52             "type": "integer",
53             "minimum": 1,
54             "maximum": 256
55           }
56         },
57         "additionalProperties": false,
58         "required": ["spId"]
59       },
60       {
61         "type": "object",
62         "properties": {
63           "rfspIndex": {
64             "type": "integer",
65             "minimum": 1,
66             "maximum": 256
67           }
68         },
69         "additionalProperties": false,
70         "required": ["rfspIndex"]
71       }
72     ]
73   },
74   "SliceId": {
75     "type": "object",
76     "properties": {
77       "sst": {

```

```

1      "type": "integer",
2      "minimum": 0,
3      "maximum": 255
4    },
5    "sd": {
6      "type": "string",
7      "pattern": "^[A-Za-f0-9]{6}$"
8    },
9    "plmnId": {"$ref": "#/definitions/PlmnId"}
10  },
11  "additionalProperties": false,
12  "required": ["sst", "plmnId"]
13 },
14 "QosId": {
15   "oneOf": [
16     {
17       "type": "object",
18       "properties": {
19         "5qI": {
20           "type": "integer",
21           "minimum": 1,
22           "maximum": 256
23         }
24       },
25       "additionalProperties": false,
26       "required": ["5qI"]
27     },
28     {
29       "type": "object",
30       "properties": {
31         "qcI": {
32           "type": "integer",
33           "minimum": 1,
34           "maximum": 256
35         }
36       },
37       "additionalProperties": false,
38       "required": ["qcI"]
39     }
40   ]
41 },
42 "CellId": {
43   "type": "object",
44   "properties": {
45     "plmnId": {"$ref": "#/definitions/PlmnId"},
46     "cId": {"$ref": "#/definitions/CId"}
47   },
48   "additionalProperties": false,
49   "required": ["plmnId", "cId"]
50 },
51 "CId": {
52   "oneOf": [
53     {
54       "type": "object",
55       "properties": {
56         "ncI": {"$ref": "#/definitions/NcI"}
57       },
58       "additionalProperties": false,
59       "required": ["ncI"]
60     },
61     {
62       "type": "object",
63       "properties": {
64         "ecI": {"$ref": "#/definitions/EcI"}
65       },
66       "additionalProperties": false,
67       "required": ["ecI"]
68     }
69   ]
70 },
71 "NcI": {
72   "type": "integer",
73   "minimum": 0,
74   "maximum": 68719476735
75 },
76 "EcI": {
77   "type": "integer",

```

```

1      "minimum": 0,
2      "maximum": 268435455
3    },
4    "PlmnId": {
5      "type": "object",
6      "properties": {
7        "mcc": {
8          "type": "string",
9          "pattern": "^[0-9]{3}$"
10       },
11       "mnc": {
12         "type": "string",
13         "pattern": "^[0-9]{2,3}$"
14       }
15     },
16     "additionalProperties": false,
17     "required": ["mcc", "mnc"]
18   },
19
20   "ReliabilityType": {
21     "type": "object",
22     "properties": {
23       "packetSize": {"type": "number"},
24       "userPlaneLatency": {"type": "number"},
25       "successProbability": {"type": "number"}
26     },
27     "required": ["packetSize", "userPlaneLatency", "successProbability"]
28   }
29 }
30 }

```

5.2.6.3.2 Policy status schema

The generic policy status schema in 5.1.1 is used.

5.2.7 Slice SLA Target

5.2.7.1 Policy Type Identifier

PolicyTypeId: **ORAN_SliceSLATarget_1.0.0**

5.2.7.2 Rationale

5.2.7.2.1 Use case

See “Use case 5: RAN Slice SLA Assurance” defined in O-RAN WG2 Use Case Requirements [2].

5.2.7.2.2 Statements, restrictions and extensions

The sliceSlaObjectives statement can be applied together with ScopeIdentifier containing sliceId identifier. The following table indicates the ScopeIdentifier combination that is allowed.

Table 5.2.7.2.2-1: Allowed combinations of sliceSlaObjectives statement with ScopelIdentifier

ScopelIdentifier	ueld	groupId	sliceld	qosId	cellId
Policy statement					
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.

5.2.7.3 JSON schemas

5.2.7.3.1 Policy schema

```

{

```



```

1  "$schema": "http://json-schema.org/draft-07/schema#",
2  "description": "O-RAN standard slice SLA policy",
3  "type": "object",
4  "properties": {
5    "scope": {
6      "type": "object",
7      "properties": {
8        "sliceId": {"$ref": "#/definitions/SliceId"}
9      },
10     "additionalProperties": false,
11     "required": ["sliceId"]
12   },
13   "sliceSlaObjectives": {
14     "type": "object",
15     "properties": {
16       "maxNumberOfUes": {"type": "number"},
17       "maxNumberOfPduSessions": {"type": "number"},
18       "guaDlThptPerSlice": {"type": "number"},
19       "maxDlThptPerSlice": {"type": "number"},
20       "maxDlThptPerUe": {"type": "number"},
21       "guaUlThptPerSlice": {"type": "number"},
22       "maxUlThptPerSlice": {"type": "number"},
23       "maxUlThptPerUe": {"type": "number"}
24     },
25     "minProperties": 1,
26     "additionalProperties": false
27   },
28   "sliceSlaResources": {
29     "type": "object",
30     "properties": {
31       "cellIdList": {"$ref": "#/definitions/CellIdList"},
32       "taIList": {"$ref": "#/definitions/TaIList"}
33     },
34     "additionalProperties": false,
35     "oneOf": [
36       {"required": ["cellIdList"]},
37       {"required": ["taIList"]}
38     ]
39   }
40 },
41 "additionalProperties": false,
42 "required": ["scope", "sliceSlaObjectives"],
43
44 "definitions": {
45   "SliceId": {
46     "type": "object",
47     "properties": {
48       "sst": {
49         "type": "integer",
50         "minimum": 0,
51         "maximum": 255
52       },
53       "sd": {
54         "type": "string",
55         "pattern": "^[A-Za-z0-9]{6}$"
56       },
57       "plmnId": {"$ref": "#/definitions/PlmnId"}
58     },
59     "additionalProperties": false,
60     "required": ["sst", "plmnId"]
61   },
62
63   "CellId": {
64     "type": "object",
65     "properties": {
66       "plmnId": {"$ref": "#/definitions/PlmnId"},
67       "cId": {"$ref": "#/definitions/CId"}
68     },
69     "additionalProperties": false,
70     "required": ["plmnId", "cId"]
71   },
72   "CId": {
73     "oneOf": [
74       {
75         "type": "object",
76         "properties": {
77           "ncI": {"$ref": "#/definitions/NcI"}

```

```

1      },
2      "additionalProperties": false,
3      "required": ["ncI"]
4    },
5    {
6      "type": "object",
7      "properties": {
8        "ecI": {"$ref": "#/definitions/EcI"}
9      },
10     "additionalProperties": false,
11     "required": ["ecI"]
12   }
13 ]
14 },
15 "NcI": {
16   "type": "integer",
17   "minimum": 0,
18   "maximum": 68719476735
19 },
20 "EcI": {
21   "type": "integer",
22   "minimum": 0,
23   "maximum": 268435455
24 },
25
26 "PlmnId": {
27   "type": "object",
28   "properties": {
29     "mcc": {
30       "type": "string",
31       "pattern": "^[0-9]{3}$"
32     },
33     "mnc": {
34       "type": "string",
35       "pattern": "^[0-9]{2,3}$"
36     }
37   },
38   "additionalProperties": false,
39   "required": ["mcc", "mnc"]
40 },
41
42 "TaI": {
43   "type": "object",
44   "properties": {
45     "plmnId": {"$ref": "#/definitions/PlmnId"},
46     "tac": {
47       "type": "string",
48       "pattern": "^[A-Fa-f0-9]{6}$"
49     }
50   },
51   "additionalProperties": false,
52   "required": ["plmnId", "tac"]
53 },
54
55 "CellIdList": {
56   "type": "array",
57   "items": {
58     "$ref": "#/definitions/CellId"
59   }
60 },
61
62 "TaIList": {
63   "type": "array",
64   "items": {
65     "$ref": "#/definitions/TaI"
66   }
67 }
68 }
69 }

```

5.2.7.3.2 Policy status schema

The generic policy status schema in 5.1.1 is used.

A1-EI Data Model

6.1 Introduction

This clause specifies the application data model supported by the A1-EI API (see A1 interface: Application Protocol [4]). 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 [8]. An EI Type is defined by three schemas for EI job, 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.

Note: No O-RAN defined EI types have been specified at the release of this specification.

6.2 Simple data types and enumerations

6.2.1 Simple data types

The EI job contains URIs for EI job status notifications and EI job results.

Table 6.2.1-1: 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

6.2.2 Enumerations

The enumeration JobStatusType represents if an EI job is confirmed to deliver EI results. It shall comply with the provisions defined in table 6.2.2-1.

Table 6.2.2-1: 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

6.3 Structured data types

6.3.1 ScopeIdentifier

The ScopeIdentifier is EI type specific.

If the ScopeIdentifier contains attributes corresponding to the A1 policy ScopeIdentifier, they are the same as defined for A1-P, see Chapter 5.

6.3.2 Job definition

The job definition is EI type specific.

6.3.3 Result definition

The result definition is EI type specific.

6.4 EI representations objects

6.4.1 EI type object

The EI type object can be retrieved using the Query EI type procedure.

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

Note: even if there are JSON schemas defined for EI job, EI job status and EI job result objects, they are not normally retrieved in run-time like the corresponding schemas for policy types.

6.4.2 EI job object

An EI job object is based on IETF RFC 8259 [7] (JSON) and contains:

- one EI Type identifier;
- one target URI for EI Job results;
- one target URI for EI Job status notifications;
- one EI type specific job definition.

Table 6.4.2-1: General definition of EIJobObject

Attribute name	Data type	P	Cardinality	Description	Applicability
eiTypeid	string	M	1	See clause 6.2.1	
jobResultUri	string	C	0..1	See clause 6.2.1	
jobStatusNotificationUri	string	O	0..1	See clause 6.2.1	
jobDefinition	JobDefinition	M	1	EI type specific	

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. Presence condition "C" means that the data type shall be included in an EI job object unless corresponding information is included in the jobDefinition. Additional attributes may be defined for a specific EI Type.

6.4.3 EI job status object

An EI job status object is based on IETF RFC 8259 [7] (JSON) and always contains:

- one job status attribute.

Table 6.4.3-1: General definition of EIJobStatusObject

Attribute name	Data type	P	Cardinality	Description	Applicability
jobStatus	JobStatusType	M	1	See 6.2.2	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.

6.4.4 EI job result object

An EI job result object is based on IETF RFC 8259 [7] (JSON) and its content is EI type specific.

6.5 Binary data

Binary data is not applicable in this version of the specification.

Chapter 6 A1-EI Data Types (EI Types)

An EI type is identified by a EiTypeId as defined in A1 interface: Application Protocol [4]). 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 [21] 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.

7.1 Common definitions

FFS

7.2 EI type definitions

FFS

Annex A (Informative) Policy Type examples

A.0 Generic scope identifier

This is an example of a policy that illustrates the usage of the generic ScopeIdentifier defintions in clause 5.1.2.

```
{
  "scope": {
    "ueId": "1234567890ABCDEF",
    "groupId": {
      "spId": 123
    },
    "sliceId": {
      "sst": 123,
```

```

1  "sd": "456DEF",
2  "plmnId": {
3    "mcc": "123",
4    "mnc": "45"
5  },
6  },
7
8  "qosId": {
9    "5qi": 123
10 },
11
12 "cellId": {
13   "plmnId": {
14     "mcc": "123",
15     "mnc": "45"
16   },
17   "cId": {
18     "ncI": 12345678901
19   }
20 }
21 }
22 }
23

```

A.1 QoS (Quality of Service)

A.1.1 QoS based resource optimization per-UE

```

26 {
27   "scope": {
28     "ueId": "00000000000000855",
29     "qosId": {
30       "5qi": 67
31     }
32   },
33   "qosObjectives": {
34     "priorityLevel": 50
35   }
36 }

```

A.1.2 QoS based resource optimization per-slice

```

38 {
39   "scope": {
40     "sliceId": {
41       "sst": 11,
42       "sd": "456DEF",
43       "plmnId": {
44         "mcc": "248",
45         "mnc": "35"
46       }
47     },
48     "qosId": {
49       "5qi": 67
50     },
51     "cellId": {
52       "plmnId": {
53         "mcc": "248",
54         "mnc": "35"
55       },
56       "cId": {
57         "ncI": 24
58       }
59     }
60   },
61   "qosObjectives": {
62     "gfbr": 1000,
63     "mfbr": 500,
64     "pdb": 120
65   }
66 }

```

A.2 QoE (Quality of Experience)

A.2.1 QoE based resource optimization per-UE

```
{
  "scope": {
    "ueId": "0000000000000855",
    "qosId": {
      "5qi": 67
    }
  },
  "qoeObjectives": {
    "initialBuffering": 30,
    "reBuffFreq": 5,
    "stallRatio": 2
  }
}
```

A.2.2 QoE based resource optimization per-slice

```
{
  "scope": {
    "sliceId": {
      "sst": 11,
      "sd": "456DEF",
      "plmnId": {
        "mcc": "248",
        "mnc": "35"
      }
    }
  },
  "qoeObjectives": {
    "qoeScore": 4.25
  }
}
```

A.3 TSP (Traffic Steering Preferences)

A.3.1 Traffic steering per-UE

```
{
  "scope": {
    "ueId": "0000000000000855"
  },
  "tspResources": [
    {
      "cellIdList": [
        {"plmnId": {"mcc": "248", "mnc": "35"},
         "cId": {"ncI": 39}},
        {"plmnId": {"mcc": "248", "mnc": "35"},
         "cId": {"ncI": 40}}
      ],
      "preference": "PREFER"
    },
    {
      "cellIdList": [
        {"plmnId": {"mcc": "248", "mnc": "35"},
         "cId": {"ncI": 81}},
        {"plmnId": {"mcc": "248", "mnc": "35"},
         "cId": {"ncI": 82}},
        {"plmnId": {"mcc": "248", "mnc": "35"},
         "cId": {"ncI": 83}}
      ],
      "preference": "FORBID"
    }
  ]
}
```

A.3.2 Traffic steering per-slice

```
{
  "scope": {
```

```

1  "sliceId": {
2    "sst": 11,
3    "sd": "456DEF",
4    "plmnId": {
5      "mcc": "248",
6      "mnc": "35"
7    }
8  },
9  "qosId": {
10    "5qi": 67
11  }
12 },
13 "tspResources": [
14   {
15     "cellIdList": [
16       {"plmnId": {"mcc": "248", "mnc": "35"},
17        "cId": {"ncI": 55}},
18       {"plmnId": {"mcc": "248", "mnc": "35"},
19        "cId": {"ncI": 65}}
20     ],
21     "preference": "SHALL"
22   },
23   {
24     "cellIdList": [
25       {"plmnId": {"mcc": "248", "mnc": "35"},
26        "cId": {"ncI": 31}},
27       {"plmnId": {"mcc": "248", "mnc": "35"},
28        "cId": {"ncI": 32}},
29       {"plmnId": {"mcc": "248", "mnc": "35"},
30        "cId": {"ncI": 33}}
31     ],
32     "preference": "AVOID"
33   }
34 ]
35 }

```

A.4 QoS optimization with resource directive

```

37 {
38   "scope": {
39     "ueId": "0000000000000855",
40     "qosId": {
41       "5qi": 67
42     }
43   },
44   "qosObjectives": {
45     "priorityLevel": 50
46   },
47   "tspResources": [
48     {
49       "cellIdList": [
50         {"plmnId": {"mcc": "248", "mnc": "35"},
51          "cId": {"ncI": 39}},
52         {"plmnId": {"mcc": "248", "mnc": "35"},
53          "cId": {"ncI": 40}}
54       ],
55       "preference": "PREFER"
56     },
57     {
58       "cellIdList": [
59         {"plmnId": {"mcc": "248", "mnc": "35"},
60          "cId": {"ncI": 81}},
61         {"plmnId": {"mcc": "248", "mnc": "35"},
62          "cId": {"ncI": 82}},
63         {"plmnId": {"mcc": "248", "mnc": "35"},
64          "cId": {"ncI": 83}}
65       ],
66       "preference": "AVOID"
67     }
68   ]
69 }

```

A.5 QoE optimization with resource directive

```

70 {
71

```



```

1  "scope": {
2    "sliceId": {
3      "sst": 11,
4      "sd": "456DEF",
5      "plmnId": {
6        "mcc": "248",
7        "mnc": "35"
8      }
9    }
10 },
11 "qoeObjectives": {
12   "qoeScore": 4.25
13 },
14 "tspResources": [
15   {
16     "cellIdList": [
17       {"plmnId": {"mcc": "248", "mnc": "35"},
18        "cId": {"ncI": 55}},
19       {"plmnId": {"mcc": "248", "mnc": "35"},
20        "cId": {"ncI": 65}}
21     ],
22     "preference": "SHALL"
23   },
24   {
25     "cellIdList": [
26       {"plmnId": {"mcc": "248", "mnc": "35"},
27        "cId": {"ncI": 21}},
28       {"plmnId": {"mcc": "248", "mnc": "35"},
29        "cId": {"ncI": 22}},
30       {"plmnId": {"mcc": "248", "mnc": "35"},
31        "cId": {"ncI": 23}}
32     ],
33     "preference": "AVOID"
34   }
35 ]
36 }

```

A.6 Status object for notification

```

38 {
39   "enforceStatus": "NOT_ENFORCED",
40   "enforceReason": "SCOPE_NOT_APPLICABLE"
41 }

```

A.7 UE level

A.7.1 UE level per-QoS

```

44 {
45   "scope": {
46     "ueId": "0000000000000855",
47     "qosId": {
48       "5qi": 67
49     }
50   },
51   "ueLevelObjectives": {
52     "ulPacketDelay": 0.5
53   }
54 }

```

A.7.2 UE level per-slice

```

56 {
57   "scope": {
58     "ueId": "0000000000000855",
59     "sliceId": {
60       "sst": 11,
61       "sd": "456DEF",
62       "plmnId": {
63         "mcc": "248",
64         "mnc": "35"
65       }
66     }
67   }

```

```

1  },
2  "ueLevelObjectives": {
3    "dlThroughput": 5000
4  }
5  }

```

A.8 RAN Slice SLA Assurance

A.8.1 Support of maximum slice throughput SLA

```

8  {
9    "scope": {
10     "sliceId": {
11       "sst": 1,
12       "sd": "456DEF",
13       "plmnId": {
14         "mcc": "123",
15         "mnc": "45"
16       }
17     }
18   },
19   "sliceSlaObjectives": {
20     "maxDlThptPerUe": 50000,
21     "maxUlThptPerUe": 25000,
22     "maxDlThptPerSlice": 300000000,
23     "maxUlThptPerSlice": 150000000
24   }
25 }

```

A.8.2 Support of maximum number of UEs and PDU sessions per slice SLA

```

27 {
28   "scope": {
29     "sliceId": {
30       "sst": 3,
31       "sd": "456DEF",
32       "plmnId": {
33         "mcc": "123",
34         "mnc": "45"
35       }
36     }
37   },
38   "sliceSlaObjectives": {
39     "maxNumberOfUes": 100,
40     "maxNumberOfPduSessions": 800
41   },
42   "sliceSlaResources": {
43     "cellIdList": [
44       { "plmnId": { "mcc": "248", "mnc": "35"},
45         "cId": { "ncI": 1 } },
46       { "plmnId": { "mcc": "248", "mnc": "35"},
47         "cId": { "ncI": 2 } },
48       { "plmnId": { "mcc": "248", "mnc": "35"},
49         "cId": { "ncI": 3 } }
50     ]
51   }
52 }
53

```

Annex B (Informative) EI Type examples

FFS

Annex ZZZ : O-RAN Adopter License Agreement

BY DOWNLOADING, USING OR OTHERWISE ACCESSING ANY O-RAN SPECIFICATION, ADOPTER AGREES TO THE TERMS OF THIS AGREEMENT.

This O-RAN Adopter License Agreement (the “Agreement”) is made by and between the O-RAN Alliance and the entity that downloads, uses or otherwise accesses any O-RAN Specification, including its Affiliates (the “Adopter”).

This is a license agreement for entities who wish to adopt any O-RAN Specification.

Section 1: DEFINITIONS

1.1 “Affiliate” means an entity that directly or indirectly controls, is controlled by, or is under common control with another entity, so long as such control exists. For the purpose of this Section, “Control” means beneficial ownership of fifty (50%) percent or more of the voting stock or equity in an entity.

1.2 “Compliant Implementation” means any system, device, method or operation (whether implemented in hardware, software or combinations thereof) that fully conforms to a Final Specification.

1.3 “Adopter(s)” means all entities, who are not Members, Contributors or Academic Contributors, including their Affiliates, who wish to download, use or otherwise access O-RAN Specifications.

1.4 “Minor Update” means an update or revision to an O-RAN Specification published by O-RAN Alliance that does not add any significant new features or functionality and remains interoperable with the prior version of an O-RAN Specification. The term “O-RAN Specifications” includes Minor Updates.

1.5 “Necessary Claims” means those claims of all present and future patents and patent applications, other than design patents and design registrations, throughout the world, which (i) are owned or otherwise licensable by a Member, Contributor or Academic Contributor during the term of its Member, Contributor or Academic Contributorship; (ii) such Member, Contributor or Academic Contributor has the right to grant a license without the payment of consideration to a third party; and (iii) are necessarily infringed by a Compliant Implementation (without considering any Contributions not included in the Final Specification). A claim is necessarily infringed only when it is not possible on technical (but not commercial) grounds, taking into account normal technical practice and the state of the art generally available at the date any Final Specification was published by the O-RAN Alliance or the date the patent claim first came into existence, whichever last occurred, to make, sell, lease, otherwise dispose of, repair, use or operate a Compliant Implementation without infringing that claim. For the avoidance of doubt in exceptional cases where a Final Specification can only be implemented by technical solutions, all of which infringe patent claims, all such patent claims shall be considered Necessary Claims.

1.6 “Defensive Suspension” means for the purposes of any license grant pursuant to Section 3, Member, Contributor, Academic Contributor, Adopter, or any of their Affiliates, may have the discretion to include in their license a term allowing the licensor to suspend the license against a licensee who brings a patent infringement suit against the licensing Member, Contributor, Academic Contributor, Adopter, or any of their Affiliates.

Section 2: COPYRIGHT LICENSE

2.1 Subject to the terms and conditions of this Agreement, O-RAN Alliance hereby grants to Adopter a nonexclusive, nontransferable, irrevocable, non-sublicensable, worldwide copyright license to obtain, use and modify O-RAN Specifications, but not to further distribute such O-RAN Specification in any modified or unmodified way, solely in furtherance of implementations of an ORAN

Specification.

2.2 Adopter shall not use O-RAN Specifications except as expressly set forth in this Agreement or in a separate written agreement with O-RAN Alliance.

Section 3: FRAND LICENSE

3.1 Members, Contributors and Academic Contributors and their Affiliates are prepared to grant based on a separate Patent License Agreement to each Adopter under Fair Reasonable And Non-Discriminatory (FRAND) terms and conditions with or without compensation (royalties) a nonexclusive, non-transferable, irrevocable (but subject to Defensive Suspension), non-sublicensable, worldwide patent license under their Necessary Claims to make, have made, use, import, offer to sell, lease, sell and otherwise distribute Compliant Implementations; provided, however, that such license shall not extend: (a) to any part or function of a product in which a Compliant Implementation is incorporated

that is not itself part of the Compliant Implementation; or (b) to any Adopter if that Adopter is not making a reciprocal grant to Members, Contributors and Academic Contributors, as set forth in Section 3.3. For the avoidance of doubt, the foregoing licensing commitment includes the distribution by the Adopter's distributors and the use by the Adopter's customers of such licensed Compliant Implementations.

3.2 Notwithstanding the above, if any Member, Contributor or Academic Contributor, Adopter or their Affiliates has reserved the right to charge a FRAND royalty or other fee for its license of Necessary Claims to Adopter, then Adopter is entitled to charge a FRAND royalty or other fee to such Member, Contributor or Academic Contributor, Adopter and its Affiliates for its license of Necessary Claims to its licensees.

3.3 Adopter, on behalf of itself and its Affiliates, shall be prepared to grant based on a separate Patent License Agreement to each Members, Contributors, Academic Contributors, Adopters and their Affiliates under Fair Reasonable And Non-Discriminatory (FRAND) terms and conditions with or without compensation (royalties) a nonexclusive, non-transferable, irrevocable (but subject to Defensive Suspension), non-sublicensable, worldwide patent license under their Necessary Claims to make, have made, use, import, offer to sell, lease, sell and otherwise distribute Compliant Implementations; provided, however, that such license will not extend: (a) to any part or function of a product in which a Compliant Implementation is incorporated that is not itself part of the Compliant Implementation; or (b) to any Members, Contributors, Academic Contributors, Adopters and their Affiliates that is not making a reciprocal grant to Adopter, as set forth in Section 3.1. For the avoidance of doubt, the foregoing licensing commitment includes the distribution by the Members', Contributors', Academic Contributors', Adopters' and their Affiliates' distributors and the use by the Members', Contributors', Academic Contributors', Adopters' and their Affiliates' customers of such licensed Compliant Implementations.

Section 4: TERM AND TERMINATION

4.1 This Agreement shall remain in force, unless early terminated according to this Section 4.

4.2 O-RAN Alliance on behalf of its Members, Contributors and Academic Contributors may terminate this Agreement if Adopter materially breaches this Agreement and does not cure or is not capable of curing such breach within thirty (30) days after being given notice specifying the breach.

4.3 Sections 1, 3, 5 - 11 of this Agreement shall survive any termination of this Agreement. Under surviving Section 3, after termination of this Agreement, Adopter will continue to grant licenses (a) to entities who become Adopters after the date of termination; and (b) for future versions of ORAN Specifications that are backwards compatible with the version that was current as of the date of termination.

Section 5: CONFIDENTIALITY

Adopter will use the same care and discretion to avoid disclosure, publication, and dissemination of O-RAN Specifications to third parties, as Adopter employs with its own confidential information, but no less than reasonable care. Any disclosure by Adopter to its Affiliates, contractors and consultants should be subject to an obligation of confidentiality at least as restrictive as those contained in this Section. The foregoing obligation shall not apply to any information which is: (1) rightfully known by Adopter without any limitation on use or disclosure prior to disclosure; (2) publicly available through no fault of Adopter; (3) rightfully received without a duty of confidentiality; (4) disclosed by O-RAN Alliance or a Member, Contributor or Academic Contributor to a third party without a duty of confidentiality on such third party; (5) independently developed by Adopter; (6) disclosed pursuant to the order of a court or other authorized governmental body, or as required by law, provided that Adopter provides reasonable prior written notice to O-RAN Alliance, and cooperates with O-RAN Alliance and/or the applicable Member, Contributor or Academic Contributor to have the opportunity to oppose any such order; or (7) disclosed by Adopter with O-RAN Alliance's prior written approval.

Section 6: INDEMNIFICATION

Adopter shall indemnify, defend, and hold harmless the O-RAN Alliance, its Members, Contributors or Academic Contributors, and their employees, and agents and their respective successors, heirs and assigns (the "Indemnitees"), against any liability, damage, loss, or expense (including reasonable attorneys' fees and expenses) incurred by or imposed upon any of the Indemnitees in connection with any claims, suits, investigations, actions, demands or judgments arising out of Adopter's use of the licensed O-RAN Specifications or Adopter's commercialization of products that comply with O-RAN Specifications.

Section 7: LIMITATIONS ON LIABILITY; NO WARRANTY

EXCEPT FOR BREACH OF CONFIDENTIALITY, ADOPTER'S BREACH OF SECTION 3, AND ADOPTER'S INDEMNIFICATION OBLIGATIONS, IN NO EVENT SHALL ANY PARTY BE LIABLE TO ANY OTHER PARTY OR THIRD PARTY FOR ANY INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE OR CONSEQUENTIAL DAMAGES RESULTING FROM ITS PERFORMANCE OR NON-PERFORMANCE UNDER THIS AGREEMENT, IN EACH CASE WHETHER UNDER CONTRACT, TORT, WARRANTY, OR OTHERWISE, AND WHETHER OR NOT SUCH PARTY HAD ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES. O-RAN SPECIFICATIONS ARE PROVIDED "AS IS" WITH NO WARRANTIES OR CONDITIONS WHATSOEVER, WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE. THE O-RAN ALLIANCE AND THE MEMBERS, CONTRIBUTORS OR ACADEMIC CONTRIBUTORS EXPRESSLY DISCLAIM ANY WARRANTY OR CONDITION OF MERCHANTABILITY, SECURITY, SATISFACTORY QUALITY, NONINFRINGEMENT, FITNESS FOR ANY PARTICULAR PURPOSE, ERROR-FREE OPERATION, OR ANY WARRANTY OR CONDITION FOR O-RAN SPECIFICATIONS.

Section 8: ASSIGNMENT

Adopter may not assign the Agreement or any of its rights or obligations under this Agreement or make any grants or other sublicenses to this Agreement, except as expressly authorized hereunder, without having first received the prior, written consent of the O-RAN Alliance, which consent may be withheld in O-RAN Alliance's sole discretion. O-RAN Alliance may freely assign this Agreement.

Section 9: THIRD-PARTY BENEFICIARY RIGHTS

Adopter acknowledges and agrees that Members, Contributors and Academic Contributors (including future Members, Contributors and Academic Contributors) are entitled to rights as a third-party beneficiary under this Agreement, including as licensees under Section 3.

Section 10: BINDING ON AFFILIATES

Execution of this Agreement by Adopter in its capacity as a legal entity or association constitutes that legal entity's or association's agreement that its Affiliates are likewise bound to the obligations that are applicable to Adopter hereunder and are also entitled to the benefits of the rights of Adopter hereunder.

Section 11: GENERAL

This Agreement is governed by the laws of Germany without regard to its conflict or choice of law provisions.

This Agreement constitutes the entire agreement between the parties as to its express subject matter and expressly supersedes and replaces any prior or contemporaneous agreements between the parties, whether written or oral, relating to the subject matter of this Agreement.

Adopter, on behalf of itself and its Affiliates, agrees to comply at all times with all applicable laws, rules and regulations with respect to its and its Affiliates' performance under this Agreement, including without limitation, export control and antitrust laws. Without limiting the generality of the foregoing, Adopter acknowledges that this Agreement prohibits any communication that would violate the antitrust laws.

By execution hereof, no form of any partnership, joint venture or other special relationship is created between Adopter, or O-RAN Alliance or its Members, Contributors or Academic Contributors. Except as expressly set forth in this Agreement, no party is authorized to make any commitment on behalf of Adopter, or O-RAN Alliance or its Members, Contributors or Academic Contributors.

In the event that any provision of this Agreement conflicts with governing law or if any provision is held to be null, void or otherwise ineffective or invalid by a court of competent jurisdiction, (i) such provisions will be deemed stricken from the contract, and (ii) the remaining terms, provisions, covenants and restrictions of this Agreement will remain in full force and effect.

Any failure by a party or third party beneficiary to insist upon or enforce performance by another party of any of the provisions of this Agreement or to exercise any rights or remedies under this Agreement or otherwise by law shall not be construed as a waiver or relinquishment to any extent of the other parties' or third party beneficiary's right to assert or rely upon any such provision, right or remedy in that or any other instance; rather the same shall be and remain in full force and effect.