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| Technical Specification |
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| A1 interface: Transport Protocol |

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Contents

Foreword 3

Modal verbs terminology 3

1 Scope 4

2 References 4

2.1 Normative references 4

2.2 Informative references 5

3 Definition of terms, symbols and abbreviations 5

3.1 Terms 5

3.2 Symbols 5

3.3 Abbreviations 5

4 A1 interface protocol stack 5

4.1 General 5

4.2 Reference model 5

4.3 Functions and protocol stack 6

5 Network layer 6

6 Transport layer 7

7 Security 7

8 Application 7

9 Data interchange 7

Annex (informative): Change History 8

# Foreword

This Technical Specification (TS) has been produced by O-RAN Alliance Working Group 2. It is part of a TS-family covering the A1 interface as identified below:

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

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

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

# Modal verbs terminology

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

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

# 1 Scope

The present document specifies the transport protocol stack for the A1 interface.

# 2 References

## 2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non‑specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies. 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 in 3GPP Release 18.

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

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

[1] O-RAN TS: "A1 interface: General Aspects and Principles" ("A1GAP").

[2] O-RAN TS: "A1 interface: Application Protocol" ("A1AP").

[3] O-RAN TS: "A1 interface: Type Definitions" ("A1TD").

[4] IETF RFC 793: "Transmission Control Protocol".

[5] Void.

[6] IETF RFC 8446: "The Transport Layer Security (TLS) Protocol Version 1.3".

[7] Void.

[8] Void.

[9] Void.

[10] Void.

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

[12] IETF RFC 8200: "Internet Protocol, Version 6 (IPv6) Specification".

[13] IETF RFC 791: "Internet Protocol".

[14] Void.

[15] Void.

[16] O-RAN TS: "O-RAN Security Requirements and Controls Specifications" ("SRS").

[17] O-RAN TS: "O-RAN Security Protocols Specifications" ("SPS").

[18] IETF RFC 9110: "HTTP Semantics".

[19] IETF RFC 9112: "HTTP/1.1".

[20] IETF RFC 9113: "HTTP/2".

## 2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non‑specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies. 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 in 3GPP Release 18.

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

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

Not applicable.

# 3 Definition of terms, symbols and abbreviations

## 3.1 Terms

For the purposes of the present document, the terms given in A1GAP [1], clause 3.1, apply.

## 3.2 Symbols

Void.

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in A1GAP [1], clause 3.3, and the following apply:

IETF Internet Engineering Task Force

JWT JSON Web Tokens

RFC Request For Comments

# 4 A1 interface protocol stack

## 4.1 General

The architecture for the A1 interface is specified in A1GAP [1], clause 4.1. The protocol stack for the A1 interface supports application protocol and data models as specified in A1AP [2] and A1TD [3].

## 4.2 Reference model

The A1 interface is defined between the Non-RT RIC and the Near-RT RIC functions. The A1 architecture and principles are described in A1GAP [1], clause 4. Figure 4.2-1 illustrates the reference model for the A1 interface.



Figure 4.2-1: A1 interface reference model

## 4.3 Functions and protocol stack

The following layers of the protocol stack for the A1 interface are described in the following clauses:

* TCP as specified in IETF RFC 793 [4] provides the communication service at the transport layer;
* TLS as specified in IETF RFC 8446 [6] is used to provide secure HTTP connections;
* HTTP as specified in IETF RFC 9110 [18], IETF RFC 9112 [19] and IETF RFC 9113 [20] is used as application-level protocol;
* The data interchange layer constitutes the transport of documents in the JSON format as specified in IETF RFC 8259 [11].

Figure 4.3-1 illustrates the protocol stack of the A1 interface.



Figure 4.3-1: A1 protocol stack

# 5 Network layer

A1 may be transported over IPv6 as specified in IETF RFC 8200 [12] and/or IPv4 as specified in IETF RFC 791 [13].

# 6 Transport layer

TCP as specified in IETF RFC 793 [4] shall be used as transport protocol. An HTTP connection is mapped to a TCP connection.

Both Non-RT RIC and Near-RT RIC can act as HTTP client and HTTP server. As a result, Non-RT RIC and Near-RT RIC can establish a TCP connection for each direction.

# 7 Security

TLS, mTLS, and OAuth2.0 shall be supported as specified in SRS [16], clause 5.2.1.

mTLS and OAuth 2.0 with JWT shall be supported as specified in SPS [17], clause 4.7.

# 8 Application

As application layer, HTTP/1.1 as specified in IETF RFC 9112 [19] shall be supported, and HTTP/2 as specified in IETF RFC 9113 [20] should be supported.

HTTP over TLS as specified in IETF RFC 9110 [18] and IETF RFC 9112 [19] shall be supported. If HTTP/2 is supported, HTTP/2 over TLS as specified in IETF RFC 9113 [20] shall be supported.

HTTP details such as standard headers, custom headers, error codes, methods, URIs etc are specified in A1AP [2].

The default TCP port numbers should be used for HTTP operation.

# 9 Data interchange

As a data interchange format, JSON as specified in IETF RFC 8259 [11] shall be supported. The objects transported in HTTP messages, and the data types in JSON format, are specified in A1TD [3].

Annex (informative):   
Change History

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| --- | --- | --- |
| Date | Revision | Description |
| 2019.09.30 | 01.00 | First version |
| 2021.03.13 | 01.01 | Editorial corrections to apply latest template and update references. Clarification of HTTP port number. |
| 2022.07.30 | 02.00 | Adapting to ODR template and referring to O-RAN security specifications for mTLS and OAuth2.0 |
| 2022.11.17 | 02.01 | Aligning to O-RAN drafting rules |
| 2023.07.31 | 03.00 | Updating obsolete references and applying latest template |
| 2023.11.30 | 03.01 | ETSI PAS related editorial enhancements of references in clause 7 |
| 2024.03.31 | 03.02 | Editorial enhancement of references |
| 2024.07.31 | 03.03 | Updated specification designator to R004 |
| 2024.11.30 | 03.04 | Editorial enhancement of references |