# ETSI TS 104 233 V4.3.0 (2026-02)

TECHNICAL SPECIFICATION

# Publicly Available Specification (PAS); O-RAN Transport Protocols for R1 Services (O-RAN.WG2.R1TP-R004-v4.03)

***CAUTION***

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

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650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

# Contents

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# Foreword

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

# Modal verbs terminology

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

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# 1 Scope

The present document specifies the transport protocols for R1 services.

# 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.

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

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

[1] IETF RFC 791 (September 1981): "Internet Protocol".

[2] IETF RFC 793 (September 1981): "Transmission Control Protocol".

[3] Void.

[4] Void.

[5] Void.

[6] Void.

[7] Void.

[8] IETF RFC 8259 (December 2017): "The JavaScript Object Notation (JSON) Data Interchange Format".

[9] IETF RFC 8200 (July 2017): "Internet Protocol, Version 6 (IPv6) Specification".

[10] IETF RFC 8446 (August 2018): "The Transport Layer Security (TLS) Protocol Version 1.3".

[11] O-RAN.WG11.TS.SRCS.0-R004: "O-RAN R1 interface: General Aspects and Principles".

[12] O-RAN.WG11.TS.SRCS.0-R004: "O-RAN Security Requirements and Controls Specifications".

[13] O-RAN.WG11.TS.SecProtSpec.0-R004: "O-RAN Security Protocols Specifications".

[14] IETF RFC 6749 (October 2012): "The OAuth 2.0 Authorization Framework".

[15] IETF RFC 7519 (May 2015): "JSON Web Token (JWT)".

[16] IETF RFC 9110 (June 2022): "HTTP Semantics".

[17] IETF RFC 9112 (June 2022)2: "HTTP/1.1".

[18] IETF RFC 9113 (June 2022): "HTTP/2".

[19] O-RAN.WG2.TS.R1AP-R004: "Application Protocols for R1 Services"("R1AP").

[20] Kafka: "Kafka protocol guide".

## 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.

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

[i.1] Kafka: "Kafka Documentation".

# 3 Definition of terms, symbols and abbreviations

## 3.1 Terms

Void.

## 3.2 Symbols

Void.

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in O-RAN TS R1GAP [11] and the following apply:

| | |
|---|---|
| HTTP | HyperText Transfer Protocol |
| JSON | JavaScript Object Notation |
| JWT | JSON Web Tokens |
| TCP | Transmission Control Protocol |
| TLS | Transport Layer Security |

# 4 Transport protocols for R1 Services

## 4.1 General

The R1 interface is defined between the rApps and the Non-RT RIC framework, as defined in R1GAP [11].

# 5 REST based protocol stack

## 5.1 General

The layers of the protocol stack for the R1 interface are described in the following chapters:

- TCP [2] provides the communication service at the transport layer,
- TLS [10] is used as specified in SPS [13], clause 4.2 to provide secure HTTP [17] [18] connections,
- HTTP [16] [17] [18] is used as application-level protocol,

- the data interchange layer constitutes the transport of documents in the JSON format [8].

Figure 5.1-1 illustrates the REST based protocol stack for the R1 interface.

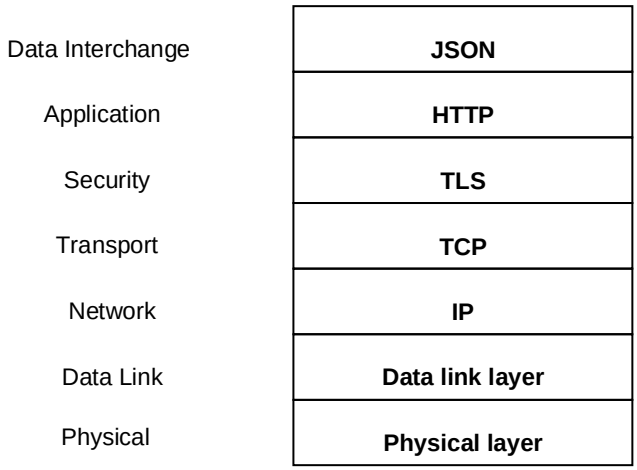


**Figure 5.1-1: REST Based Protocol Stack for the R1 Interface**

## 5.2 Network layer

As network layer at least one of IPv6 [9] or IPv4 [1] shall be supported.

## 5.3 Transport layer

TCP [2] shall be supported as transport protocol.

NOTE: When using TCP as the transport protocol, an HTTP connection is mapped to a TCP connection.

## 5.4 Security

The specification of security controls on the R1 interface in SRS [12], clause 5.2.6.2 shall be followed.

These security controls refer to the detailed specification of the support and use of TLS v1.2 and TLS v1.3 (IETF RFC 8446 [10]), and OAuth2.0 [14] with JSON Web Tokens (JWT) (IETF RFC 7519 [15]) in the O-RAN TS SPS [13].

## 5.5 Application

As application layer, HTTP/1.1 [17] shall be supported, and HTTP/2 [18] should be supported. The HTTP semantics as defined in IETF RFC 9110 [16] shall be supported.

HTTP over TLS (as defined in IETF RFC 9112 for HTTP/1.1 [17] and in IETF RFC 9113 [18] for HTTP/2) shall be supported.

HTTP details such as use of standard headers, custom headers, error codes, methods, URIs, etc. will be specified in Application Protocols for R1 Services.

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

## 5.6 Data interchange

As a data interchange format, JSON [8] shall be supported.

# 6 Kafka based protocol stack

## 6.1 General

The Kafka based protocol stack for the R1 interface includes the following layers:

- TCP [2] provides the communication service at the transport layer;
- TLS [10] is used to provide secure connections at the security layer;
- the Kafka Protocol Guide [20] is used at the application layer;
- the data interchange layer constitutes the serialization format in which data are represented.

Figure 6.1-1 illustrates the Kafka based protocol stack for the R1 interface.

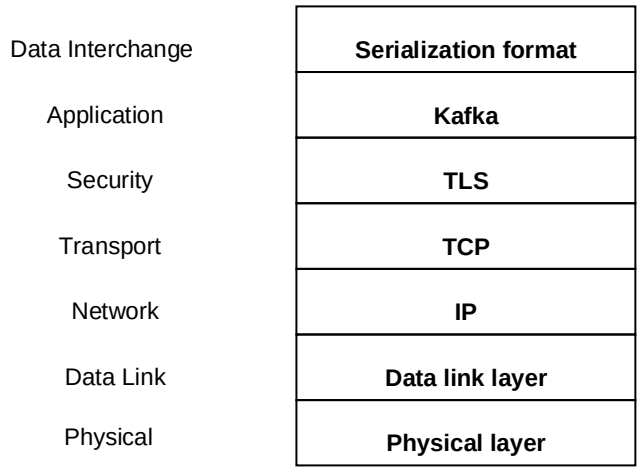


**Figure 6.1-1: Kafka Based Protocol Stack for the R1 interface**

## 6.2 Network layer

As network layer at least one of IPv6 [9] or Ipv4 [1] shall be supported.

## 6.3 Transport layer

TCP [2] shall be supported as defined in Kafka Protocol Guide [20].

## 6.4 Security

The specification of security controls on the R1 interface in SRS [12], clause 5.1.2.1 shall be followed.

## 6.5 Application

As application layer, Kafka Protocol Guide [20] version 3.0 or higher shall be supported. The Kafka semantics are defined in the Kafka Documentation [i.1].

R1 service procedures as defined in R1GAP [11] are mapped to the Kafka protocol in R1AP [19].

## 6.6 Data interchange

The Kafka based protocol stack for the R1 interface is agnostic to the data serialization format.

# History

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| V4.3.0 | February 2026 | Publication |
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