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**O-RAN Alliance Working Group 4**

**Management Plane Specification**

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# Foreword

This Technical Specification (TS) has been produced by O-RAN Alliance.

# 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).  
본 문서에서 "해야한다", "하지 않아야 한다", "해야 한다", "하지 말아야 한다", "할 수 있다", "할 필요가 없다", "할 것이다", "하지 않을 것이다", "할 수 있다", "할 수 없다"는 O-RAN 초안 작성 규칙의 조항 3.2(조항 표현을 위한 구두 형태)에 설명된 대로 해석되어야 합니다.

"must" and "must not" are NOT allowed in O-RAN deliverables except when used in direct citation.  
"must" 및 "must not"은 직접 인용에 사용되는 경우를 제외하고 O-RAN 성과물에서 허용되지 않습니다.

# Executive summary

This Technical Specification defines the Management Plane for the O-RAN Open Fronthaul based on the selected lower-layer split point as defined within the Open Fronthaul Control Plane, User Plane and Synchronization Plane specification. This Technical Specification is used in combination with a set of associated YANG models to enable operation of an O-RAN alliance defined O-RU.  
이 기술 사양은 Open Fronthaul Control Plane, User Plane 및 Synchronization Plane 사양에 정의된 선택된 하위 계층 분할 지점을 기반으로 O-RAN Open Fronthaul의 관리 평면을 정의합니다. 이 기술 사양은 연관된 YANG 모델 세트와 함께 사용되어 O-RAN 얼라이언스 정의 O-RU의 작동을 가능하게 합니다.

# 1. Scope

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

The contents of the present document are subject to continuing work within O-RAN WG4 and may change following formal O-RAN approval. Should the O-RAN.org modify the contents of the present document, it will be re-released by O-RAN Alliance with an identifying change of release date and an increase in version number as follows:

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|  | Release x.y.z | | |
|  | where: | | |
|  |  | x | the first digit is incremented for all changes of substance, i.e., technical enhancements, corrections, updates, etc. (the initial approved document will have x=01). |
|  |  | y | the second digit is incremented when editorial only changes have been incorporated in the document. |
|  |  | z | the third digit included only in working versions of the document indicating incremental changes during the editing process. |

The present document specifies the management plane protocols used over the fronthaul interface linking the O-RU (O-RAN Radio Unit) with other management plane entities, that may include the O-DU (O-RAN Distributed Unit), the O-RAN defined **Service Management and Orchestration (SMO)** functionality as well as other generic Network Management Systems (NMS).  
본 문서에서는 O-RU(O-RAN 무선 장치)와 다른 관리 평면 엔티티를 연결하는 프런트홀 인터페이스에서 사용되는 관리 평면 프로토콜을 지정합니다. 여기에는 O-DU(O-RAN 분산 장치), O-RAN에서 정의한 서비스 관리 및 오케스트레이션(SMO) 기능은 물론 기타 일반 네트워크 관리 시스템(NMS)이 포함될 수 있습니다.

# 2. References

## 2.1 Normative 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 in Release 15.

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# 3 Definitions of Terms and Abbreviations

## 3.1 Terms

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

**Antenna Line**: connection between O-RU and antenna

**C-Plane**: **Control Plane**: refers specifically to real-time control between O-DU and O-RU, and should not be confused with the UE’s control plane

**DL**: **DownLink**: data flow towards the radiating antenna (generally on the LLS interface)

**eAxC**: **extended Antenna-Carrier**: a data flow for a single antenna (or spatial stream) for a single carrier in a single sector.

**Event-Collector**: A REST server to which an O-RU supporting NON-PERSISTENT-NETCONF feature can send a JSON notification

**FHM mode**: Mode of Shared cell which is realized by FHM and several O-RUs in star topology.

**LLS**: Lower Layer Split: logical interface between O-DU and O-RU when using a lower layer (intra-PHY based) functional split.

**LLS-U**: Lower Layer Split User-plane: logical interface between O-DU and O-RU when using a lower layer functional split.

**LLS-C**: Lower Layer Split Control-plane: logical interface between O-DU and O-RU when using a lower layer functional split.

**LLS-S**: Lower Layer Split Synchronization-plane: logical interface between O-DU and O-RU when using a lower layer functional split.

**High-PHY**: those portions of the PHY processing on the O-DU side of the fronthaul interface, including FEC encode/decode, scrambling, and modulation/demodulation.

**Low-PHY**: those portions of the PHY processing on the O-RU side of the fronthaul interface, including FFT/iFFT, digital beamforming, and PRACH extraction and filtering.

**M-Plane**: Management Plane: refers to non-real-time management operations between the O-DU and the O-RU

**North-node**: the O-DU or a connected O-RU closer to the O-DU for the O-RU, e.g., the cascade O-RU#1 connected to O RU#2 is north-node for O-RU#2, when O-DU, O-RU#1 and O-RU#2 are in cascade chain topology. The O-DU in star topology connected to an FHM is north-node for the FHM.

**NMS**: A Network Management System dedicated to O-RU operations

**Port**: End of a transport link – in most cases this is an optical port

**Port Number**: A number which identifies a port (see Port). In case of SFP/SFP+ port, port number value is 0 to N-1 where N is number of ports in the device. Numbers 0 to N-1 are assigned to ports in order following order of labels on the device (labels for ports are not necessarily numbers starting from zero)

**O-DU**: O-RAN Distributed Unit: a logical node hosting PDCP/RLC/MAC/High-PHY layers based on a lower layer functional split.

**O-RU**: O-RAN Radio Unit: a logical node hosting Low-PHY layer and RF processing based on a lower layer functional split. This is similar to 3GPP’s “TRP” or “RRH” but more specific in including the Low-PHY layer (FFT/iFFT, PRACH extraction).

**O-RU Controller**: A network function that is permitted to control the configuration of an O-RU. Examples of O-RU controllers include, an O-DU, a classical NMS, an O-RAN Service Management and Orchestration function, or other network automation platforms.

**S-Plane**: Synchronization Plane: refers to traffic between the O-RU or O-DU to a synchronization controller which is generally an IEEE-1588 Grand Master (however, Grand Master functionality may be embedded in the O-DU).

**Shared cell**: The operation for the same cell by several O-RUs.

**Shared cell network**: the network for several cascade O-RUs in a chain topology or the network for one FHM and several O RUs in a star topology.

**South-node**: a connected O-RU far from O-DU for the O-RU, e.g., the cascade O-RU#2 connected to O-RU#1 is south-node for O-RU#1, when O-DU, O-RU#1 and O-RU#2 are in cascade chain topology. The O-RU in star topology connected to an FHM is south-node for the FHM.

**Spatial stream**: the data flow on the DL associated with precoded data (may be same as layers or different if there is expansion in the precoding), and on UL associated with the number of outputs from the digital beamforming (sometimes called “beams”).

**SSM**: Synchronization Status Message: part of ITU G.781 and G.8264 standards.

**TRX**: Refers to the specific processing chain in an O-RU associated with D/A or A/D converters. Due to digital beamforming the number of TRXs may exceed the number of spatial streams, and due to analogue beamforming, the number of TRXs may be lower than the number of antenna elements.

**U-Plane**: User Plane: refers to IQ sample data transferred between O-DU and O-RU

**UL**: Up-Link: data flow away from the radiating antenna (generally on the LLS interface)

**Virtual Connection**: a connection between O-RU and O-RU controller. This connection is established by means of autodetection procedure and is supervised by supervision procedure.

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

|  |  |  |
| --- | --- | --- |
|  | ALD | Antenna Line Device |
|  | AVP | Average Power |
|  | BCN | BTS Clock Number |
|  | CA | Certificate Authority |
|  | CA/RA | Certificate Authority/Registration Authority |
|  | CMP | Certificate Management Protocol |
|  | CRC | Cyclic Redundancy Check |
|  | CUS | Control/User/Synchronization |
|  | DHCP | Dynamic Host Configuration Protocol |
|  | DMTC | DRS Measurement Timing Configuration |
|  | DRS | Discovery Reference Signal |
|  | DSCP | Differentiated Services Code Point |
|  | FHM | Fronthaul Multiplexer |
|  | FTPES | File Transfer Protocol Explicit-mode Secure |
|  | HDLC | High-Level Data Link Control |
|  | lls-M | Lower Layer Split Management plane |
|  | LAA | Licensed Assisted Access |
|  | LBM | Loop-Back Message |
|  | LBR | Loop Back Reply |
|  | LBT | Listen Before Talk |
|  | ME | Maintenance Entity |
|  | MEP | Maintenance association End Point |
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|  |  |  |

# 4. General

## 4.1 Conventions

This management plane specification includes cross references to a set of associated YANG models. Text may reference particular YANG leafs, notifications and remote procedure calls (RPCs). In order to assist in readability, all cross references to YANG defined elements will keep the identical case format as defined in the corresponding YANG model, with the font-weight set to bold. This convention applies only to text and not to YANG elements embedded into figures.  
이 관리 플레인 사양에는 연관된 YANG 모델 집합에 대한 교차 참조가 포함됩니다. 텍스트는 특정 YANG 리프, 알림 및 원격 프로시저 호출(RPC)을 참조할 수 있습니다. 가독성을 돕기 위해 YANG 정의 요소에 대한 모든 교차 참조는 해당 YANG 모델에 정의된 것과 동일한 케이스 형식을 유지하고 글꼴 두께를 굵게 설정합니다. 이 규칙은 텍스트에만 적용되며 그림에 포함된 YANG 요소에는 적용되지 않습니다.

If there is any conflict between the YANG models and the accompanying text description in this specification, the definition of the YANG models shall take precedence.

## 4.2 Topics for Future Specification Versions