



### **Open RAN Specifications and Deployment Status:**

Open RAN specifications allow innovative companies to develop products, software solutions and reference designs in a diverse and competitive global market. Large and small network operators are conducting trials, and interoperability testing has begun. Several carriers are starting to trial and deploy open interfaces based on O-RAN Alliance Specifications.

It is important to note that open RAN systems built to shared and open specifications are already deployed; the NTT Docomo and the Rakuten deployments in Japan are prominent examples, as are deployments by major European operators, Telefonica and Vodafone. While global standards are important to create opportunities for interoperability of scalable solutions, open interface specifications further maximize the potential to innovate and compete in virtualized infrastructure. Deployment of open network equipment needs to proceed to further evolve the specifications based on operational feedback to determine how solution can properly scale.

### **Status of Specifications:**

Global 5G specifications are developed within the 3<sup>rd</sup> Generation Partnership Project (3GPP.) 3GPP specifications are structured as “Releases” on a 15 to 18 month cadence. 3GPP Release 15, providing the first 5G enhanced mobile broadband capabilities, was approved in June 2019. Release 16, which adds functionality for mission critical applications and massive IoT, is nearing finalization. Release 16 completes 3GPP’s submission into the ITU-R for consideration as a candidate radio interface technology for IMT-2020. 3GPP specifications include interfaces between specific elements within the RAN, within the core network, and between the RAN and the core network. The existence of open and interoperable interfaces is key to disaggregating the network and to promoting a diverse ecosystem of vendors in the wireless infrastructure market.

While the 3GPP process focuses on the global specifications, the openness of the interfaces between specific elements within the RAN or core network is key to disaggregating the network and facilitating additional suppliers in entering the wireless infrastructure market. The O-RAN Alliance and other consortia such as the Telecom Infra Project (TIP) are developing specifications for these open interfaces, complementary to standards promoted by 3GPP. The O-RAN Alliance has developed specifications for certain RAN interfaces that had not been addressed by 3GPP.

Key specifications, such as the fronthaul specification that fully defines the interface between the radio and the baseband unit of the RAN, have been completed by the O-RAN Alliance. Additional O-RAN Alliance specifications such as software testing and machine learning applications, will be available in Q2 2020. Similar to 3GPP, ongoing evolutions of O-RAN Alliance specifications will continue. For example, the end-to-end system test specification is expected to be released in August. The Telecom Infra Project (TIP) also has several project groups developing technologies for open RAN and has recently formed a partnership with the O-RAN Alliance.

The goal of open interfaces is to avoid a “lock-in” effect where proprietary or semi-proprietary implementations inhibit competition among suppliers. The end result is that operators have greater options to mix equipment from different suppliers in the same RAN, and other layers of the network, providing greater flexibility and lower costs and which enables a vibrant ecosystem of suppliers driving innovation.

### **Status of Deployments and Trials:**

Large and small service providers are conducting trials, and interoperability testing has begun. Examples include the following:

#### Deployments

- Rakuten has deployed a commercial fully cloud-native mobile network with open vRAN in Japan, with radios from multiple vendors both in 4G and 5G.
- AltioStar has deployed its software with 4G/5G radios from Airspan, MTI, Nokia and Sercomm and is working with radios from Flex, Fujitsu, KMW, NEC and Xilinx to deploy by mid-year.
- On April 29, 2020, it was announced that Indian integrated telecommunications services provider, Bharti Airtel, had deployed AltioStar’s open vRAN solution across multiple major cities in India.
- DISH Network is building the United States’ first software-defined 5G wireless broadband network utilizing an open, intelligent RAN architecture. DISH has entered into a multi-year agreement with Mavenir to deliver cloud-native open RAN software.
- Mavenir has deployed with Vodafone Idea.
- NTT DOCOMO has already realized interoperability between base station equipment of Fujitsu, NEC and Nokia with O-RAN compliant fronthaul and X2 interfaces in their 5G commercial service.
- Telefónica has established an open RAN consortium of hardware and software companies aimed for the development and deployment of open RAN in 4G and 5G, comprising the necessary design, development, integration, operation and testing activities required to materialize open RAN.
- Since February 26, 2018, when JMA Wireless announced its open vRAN and work with Telecom Italia, it has since has deployed multi-operator, open, virtualized RAN in multiple locations across multiple operators, in both outdoor dense city networks and large-scale venues such as stadiums, and within buildings for private wireless use, providing validation of implementation and scale of vRAN software in real-world use.
- Parallel Wireless has been deploying open RAN since 2015 with Vodafone, Telefonica, MTN, Optus, and is a strategic partner for rural U.S. operators and members of the Competitive Carriers Association (CCA).

#### Trials/Demos/Standards Activity

- AT&T is one of the founding members and currently chairs the O-RAN Alliance. AT&T has also conducted several demos and trials including working with CommScope and Intel to demonstrate a mmWave 5G gNB and open fronthaul leveraging developments at O-RAN.
- Verizon contributes as an active O-RAN Alliance Board member and Working Group co-chair to advance the open interface model with a wide range of ecosystem stakeholders, while, in parallel, partnering with key suppliers to successfully conduct vRAN trials as a move to hardware-agnostic solutions. Verizon is also actively working with its current suppliers and smaller software developers to advance the open interface model.
- Vodafone is currently chair of TIP and has active trials of the open RAN framework ongoing in Turkey, Mozambique, DRC, Ireland and UK with Parallel Wireless and Mavenir.

- AT&T recently hosted the O-RAN Alliance Plugfest in New York City, where Samsung demonstrated the multi-vendor compatible Configuration, Performance, and Fault Management capabilities of the O1 interface.
- Telefónica conducted in 2019 successful open RAN trials in Brazil based on 4G, which are being evolved in 2020 to more ambitious 4G/5G trials that position ourselves towards 4G/5G commercial deployments.
- VMware, Inc. and Deutsche Telekom recently announced the companies are collaborating on an open and intelligent virtual RAN (vRAN) platform, based on O-RAN standards, to bring agility to radio access networks (RANs) for both existing LTE and future 5G networks.  
This illustrates that while global standardization is important in maximizing the number of additional suppliers, deployment and scaling of open network equipment can and should be done in parallel to development of additional open RAN specifications.
- Jio is working with a group of operators and vendors to develop an Open Test and Integration Centre (OTIC) for commercializing O-RAN compliant disaggregated 5G access infrastructure and defining an end-to-end test framework specification that will be released in August 2020. Jio is currently testing multiple O-RAN compliant, disaggregated and virtualized RAN solutions in its labs.
- Radisys is helping accelerate the open RAN ecosystem by working closely with various ecosystem partners for both mmWave and Sub6 GHz solutions. Radisys RAN software is powering numerous NEPs trials/deployments with open RAN architecture across the globe.

### **Background Terminology:**

**Open RAN** - disaggregated RAN functionality built using open interface specifications between elements. Can be implemented in vendor-neutral hardware and software-defined technology based on open interfaces and community-developed standards as opposed to closed proprietary interfaces.

**O-RAN** – O-RAN Alliance or designated specifications. A specification group is defining next generation RAN infrastructures, empowered by principles of intelligence and openness. <https://www.o-ran.org>

**TIP** – Telecom Infra Project. A community of more than 500 network operators, technology companies, telecom equipment vendors, standards organizations and Internet companies developing open and interoperable technologies using open interfaces. <https://telecominfraproject.com/>

**vRAN** – an implementation of the RAN in a more open and flexible architecture which virtualizes network functions in software platforms based on general purpose processors

**3GPP** - 3rd Generation Partnership Project, composed of seven telecommunications standard development organizations (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC) which adopt 3GPP specifications as standards. The project covers cellular telecommunications technologies, including radio access, core network and service capabilities, which provide a complete system description for mobile telecommunications. <https://www.3gpp.org/>

**SCF** - Small Cell Forum, defines specifications to accelerate deployments, and works to remove commercial & technical barriers to network densification using open small cell architectures. <https://www.smallcellforum.org/>