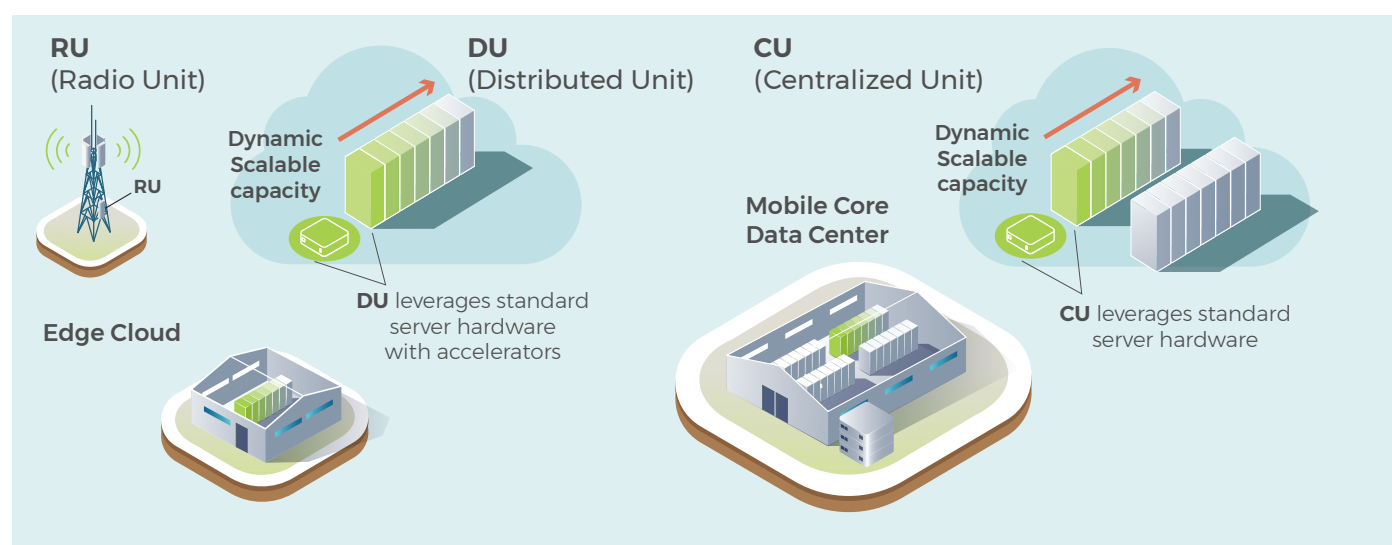
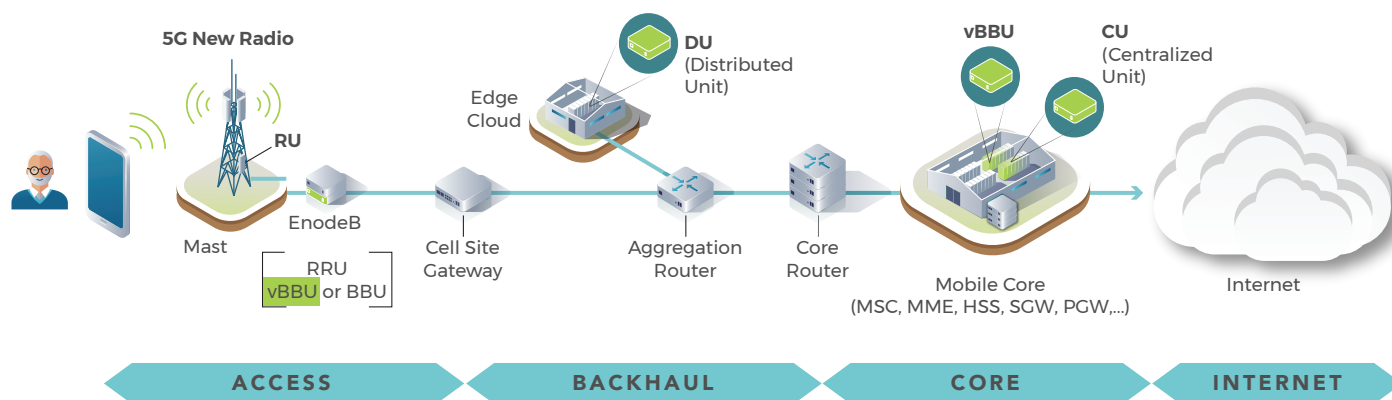


OpenRAN at a glance

OpenRAN is an initiative to define and build 2G, 3G, 4G and 5G RAN solutions based on a general-purpose vendor-neutral hardware and software-defined technology



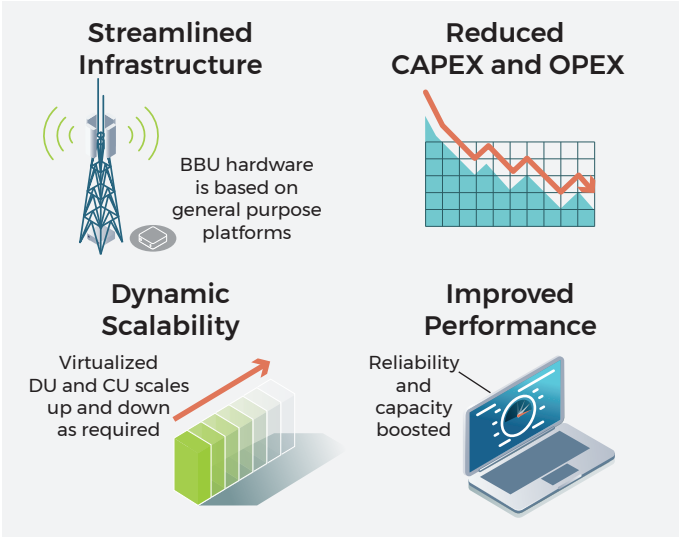
What is OpenRAN

OpenRAN's mission is to accelerate innovation and commercialization in RAN domain with multi-vendor interoperable products and solutions that are easy to integrate in the operator's network and are verified for different deployment scenarios. TIP's OpenRAN program supports the development of disaggregated and interoperable 2G/3G/4G/5G NR Radio Access Network (RAN) solutions based on service provider requirements.

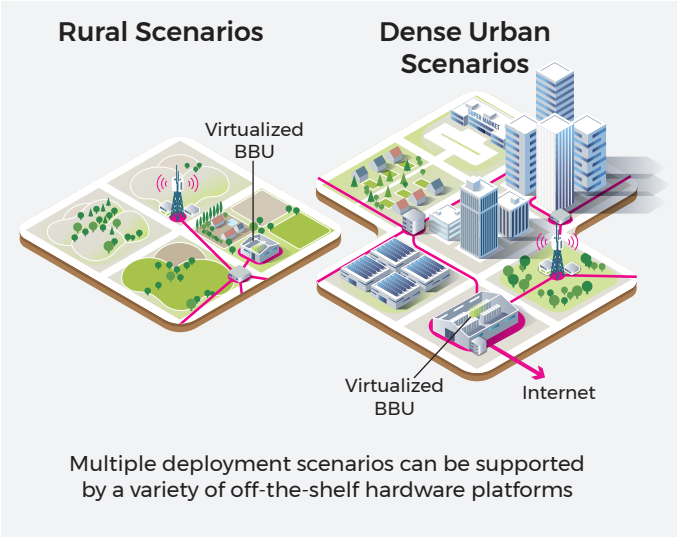
With OpenRAN

- **OEMs can develop solution equipment** that will interoperate with hardware deployed by any vendor who chooses to adopt TIP technologies.
- **GPP based development:** No vendor specific "secret sauce" – e.g. in Common Public Radio Interface (CPRI) implementation, hardware acceleration, in processor and in chipset optimization etc. thus reducing dedicated HW cost.
- **Multi-vendor flexibility within the RAN:** the ability to adopt best of breed in the RAN space and reduce reliance on a single vendor.

The developments



Use cases



With OpenRAN, continued

- **Allows for a wide range of vendors to provide innovative, best of breed RRUs and virtual BBUs** compatible with GPP hardware options for a diverse set of deployment scenarios.

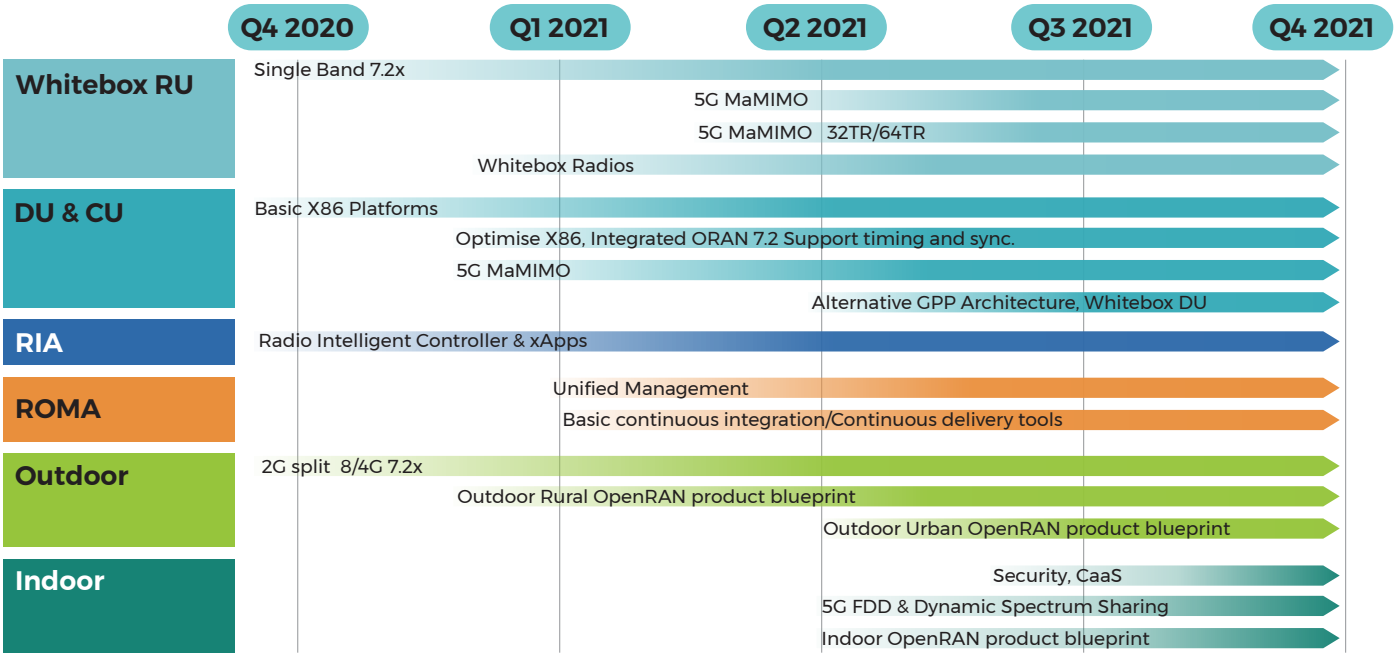
Benefits

- **Can use pluggable modules from other vendors**
- **More cost-effective** than traditional integrated platform solutions.
- **Expands RAN vendor ecosystem** and **drives innovation**.

What next

- **Learn more about Telecom Infra Project**
telecominfraproject.com
- **Join the OpenRAN Project Group:**
telecominfraproject.com/openran/ to learn and contribute
- **Contact us** with questions or comments:
OpenRAN-info@telecominfraproject.com

OpenRAN tech roadmap - Aligning with 5G release plan

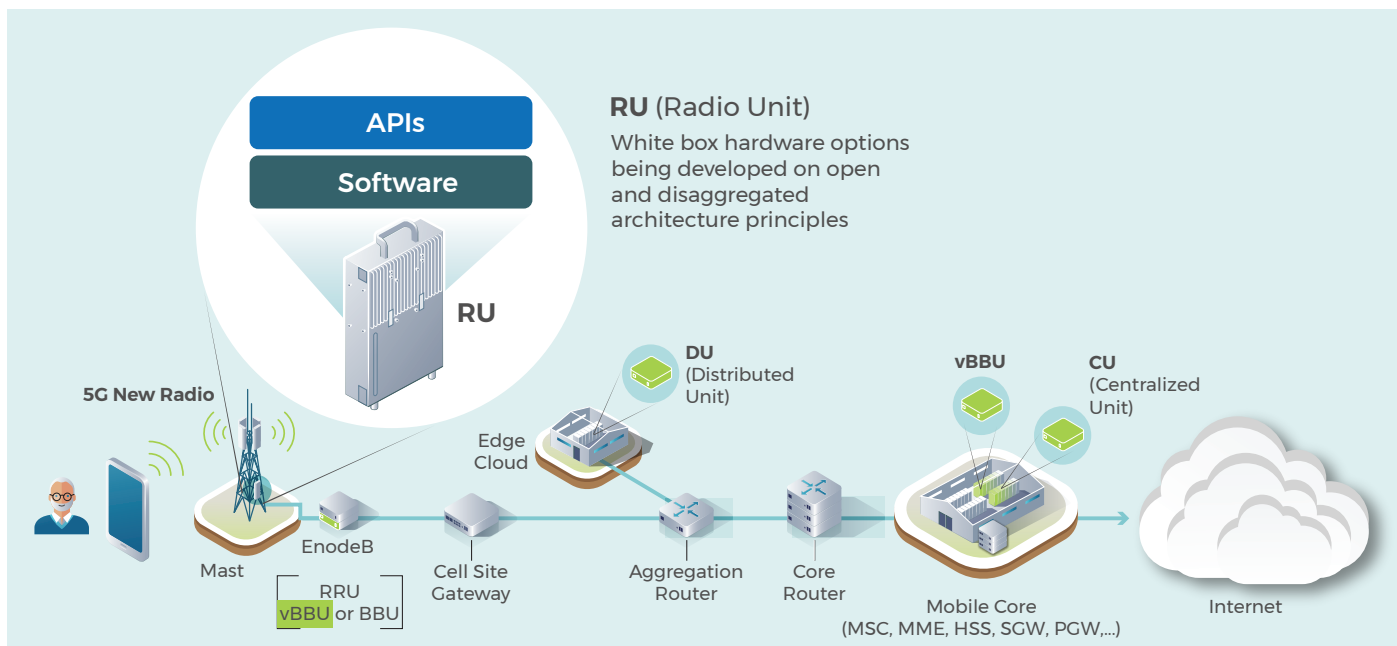


OpenRAN

RU Subgroup



Developing RU (Radio Unit) white box HW on open and disaggregated architecture. The white box RU will offer significant deployment and operational cost advantages compared to traditional proprietary base stations in mobile networks.



Why RU?

- **This subgroup focuses on defining RU product architecture and requirements** that will need to be met by the OpenRAN system in terms of HW and SW features.
- **This RU sub-group works on harmonizing the technical requirements** from the ecosystem to develop an OpenRAN reference deployment playbook.

At a glance

- **Multiple RU options** for various deployment use cases including single band RU, multi band RU, mMIMO RU.
- **Platform architecture** and HW/SW Requirements.
- **Reference architecture and design requirements** for white box RU for identified deployment use cases, defining requirements, and specifying architecture and designing requirements.

Developments

- **Subgroup launched with VF, Dish and FBC engineering**
- **Collected operator input** and objectives for the subgroup roadmap and use cases
- **Finalized the format of requirements doc**
- **Generated the RRH OpenRAN requirements specifications v1**

What next

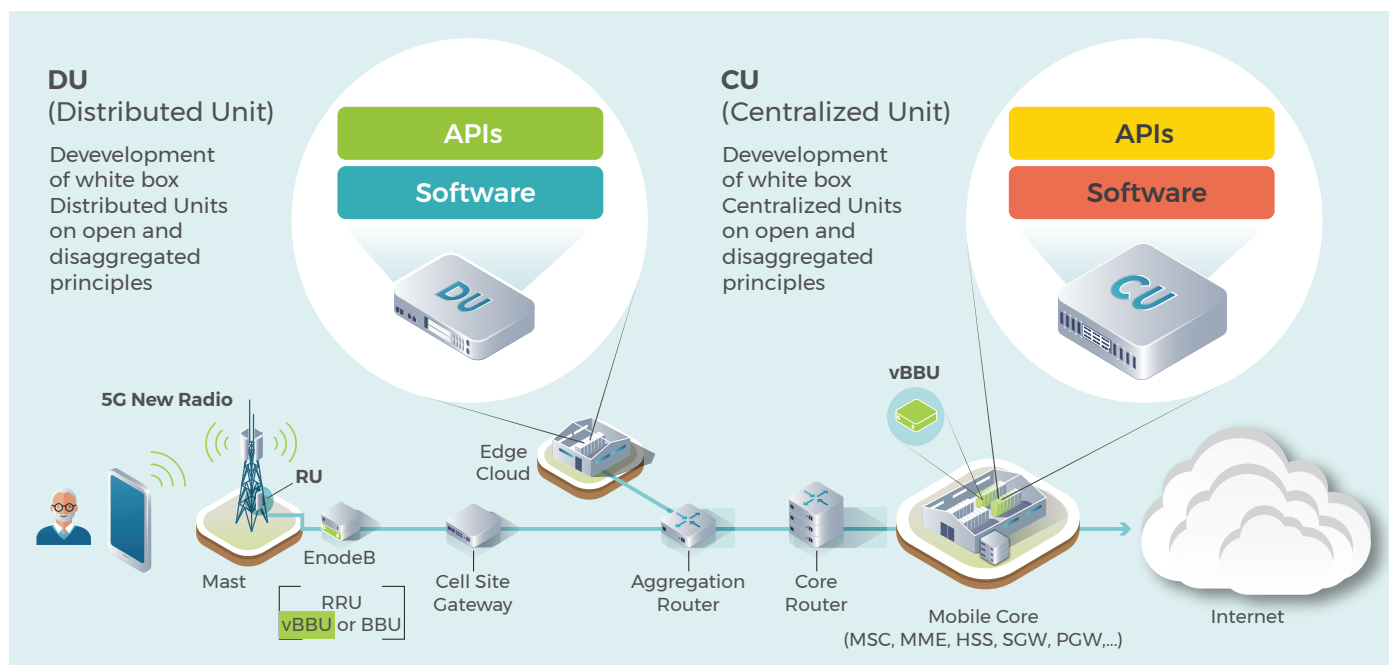
- **Learn more about Telecom Infra Project**
telecominfraproject.com
- **Join the OpenRAN Project Group:**
telecominfraproject.com/openran/ to learn and contribute
- **Contact us** with questions or comments:
OpenRAN-info@telecominfraproject.com

OpenRAN

DU & CU Subgroup



Enable and accelerate development and deployment of OpenRAN whitebox Distributed Unit (DU) / Central Unit (CU) that operators can deploy in their mobile networks to provide mobile connectivity



Why DU & CU?

Traditional BBU built on proprietary technology and interface leads to single vendor lock-in, high cost of BBU equipment, and slow pace of innovation of new products and service. Unlike traditional BBU, an open and disaggregated whitebox DU/CU platform based on commercial off-the-shelf components and disaggregated software is indispensable for enabling multi-vendor flexibility that provide best of breed RUs, GPP based DU/CU and RAN SW stack options for a diverse set of deployment scenarios.

At a glance

- **Define multiple DU/CU options** for various deployment use cases including split DU/CU, and integrated DU/CU.
- **Develop reference architecture and HW/SW requirements** for white box DU and CU.
- **Develop test and validation requirements** and specification to enables whitebox DU/CU products to be listed on TIP market exchange.

Developments

- **Developed a common set of use cases** and deployment scenarios that incorporate Vodafone, T-Mobile USA and Dish's inputs.
- **Requirements document with harmonized MNOs' requirements** is to be completed by end of 2020.
- **Whitebox DU/CU test requirements** and specifications development is in progress.
- **Phase 1 of end-to-end whitebox DU/CU testing** in MPK TIP CL testing kicked off.

What next

- **Learn more about Telecom Infra Project**
telecominfraproject.com
- **Join the OpenRAN Project Group:**
telecominfraproject.com/openran/
to learn and contribute
- **Contact us** with questions or comments:
OpenRAN-info@telecominfraproject.com

TELECOM INFRA PROJECT

The diagram illustrates MNO policies and objectives for non-RT RIC wide area, holistic optimization across three environments: Rural, Peri Rural, and Urban.

MNO policies and objectives
non-RT RIC wide area, holistic optimization

The architecture shows a central cloud-based non-RT RIC (Near-RT RIC) connected to three edge clouds (Near-RT RIC) which manage the DU (Distributed Unit) and CU (Central Unit) for each environment:

- RURAL:** Low traffic, high speed mobility xAAPPs, coverage sensitive xAAPPs. The environment is characterized by mountains and sparse infrastructure.
- PERI RURAL:** The environment is characterized by a mix of rural and urban features, including fields and small settlements.
- URBAN:** High traffic, low mobility xAAPPs, near-RT RIC capacity focussed xAPP. The environment is characterized by dense city buildings and infrastructure.

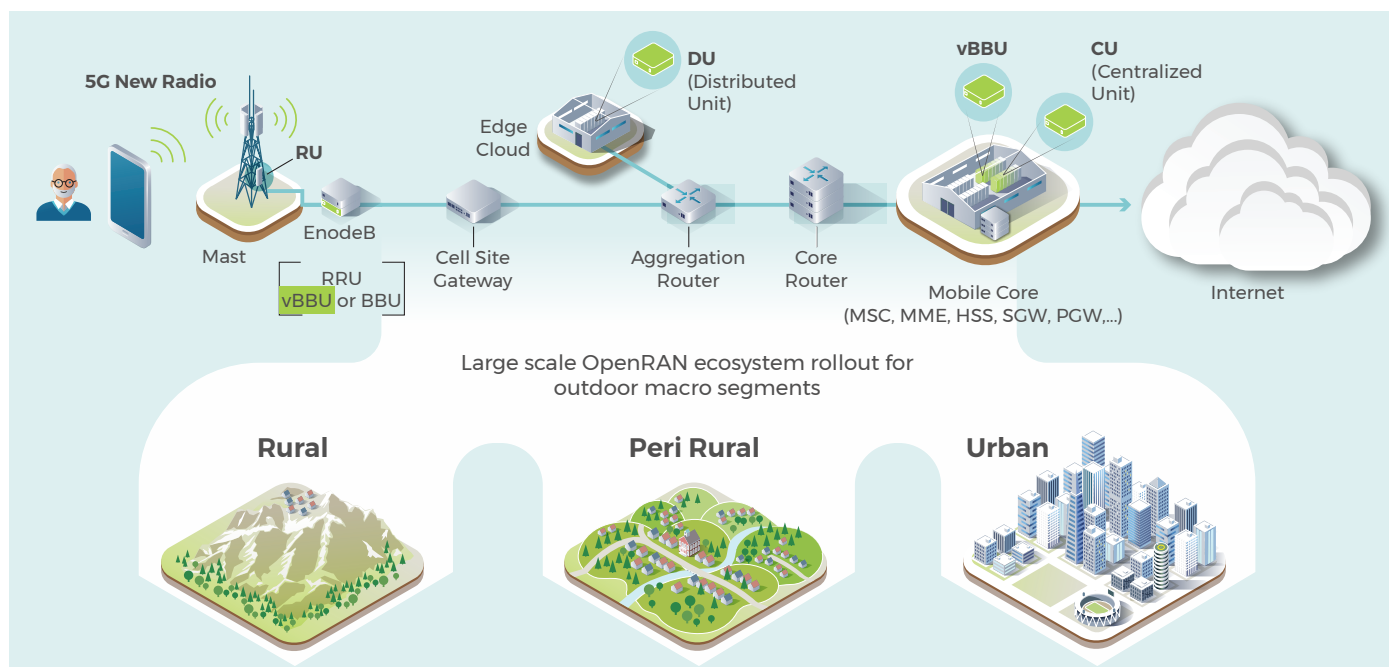
The diagram shows the flow of data and control between the central cloud, edge clouds, and the DU/CU components, highlighting the holistic optimization across the entire network.

Copyright © 2021 Telecom Infra Project, Inc. All rights reserved. The Telecom Infra Project logo is a trademark of Telecom Infra Project, Inc. in the United States or other countries, and is registered in one or more countries. THIS DOCUMENT IS PROVIDED "AS IS" AND WITHOUT ANY WARRANTY OF ANY KIND.

OpenRAN Outdoor Macro



The sub-group addresses the challenges of large scale, outdoor OpenRAN deployments by defining requirements, aggregating technology solutions and developing playbooks for accelerating OpenRAN deployments.



Why Outdoor Macro?

Traditional outdoor RAN systems built on proprietary technology and interfaces leads to a fragmented ecosystem where components from different vendors cannot interoperate with each other. Yet, no single vendor can provide best of breed solution to address a wide range of deployment scenarios from high-density high capacity urban to rural. A flexible, cost-effective disaggregated outdoor solution based on open interfaces would greatly facilitate large scale deployment to enhance mobile network capacity and coverage.

At a glance

The group will develop requirement documents for various outdoor macro segments, 1. rural 2. peri-urban and 3. urban. Key focus areas and deliverables include:

- **Reference architectures for RAN** including the components CU, DU and RU.
- **APIs and interfaces for multi-vendors'**

interoperability based on industry specifications.

- **Playbooks and test reports.**

Developments

- **Identified top priority use cases** based on input from TPG, Ooredoo, Vodafone, and Smartfren.
- **Baselined Technical requirements for RU, DU & CU** against all use cases - 1. Rural 2. Semi urban 3. Urban.
- **Initiating solution build and testing phase.**

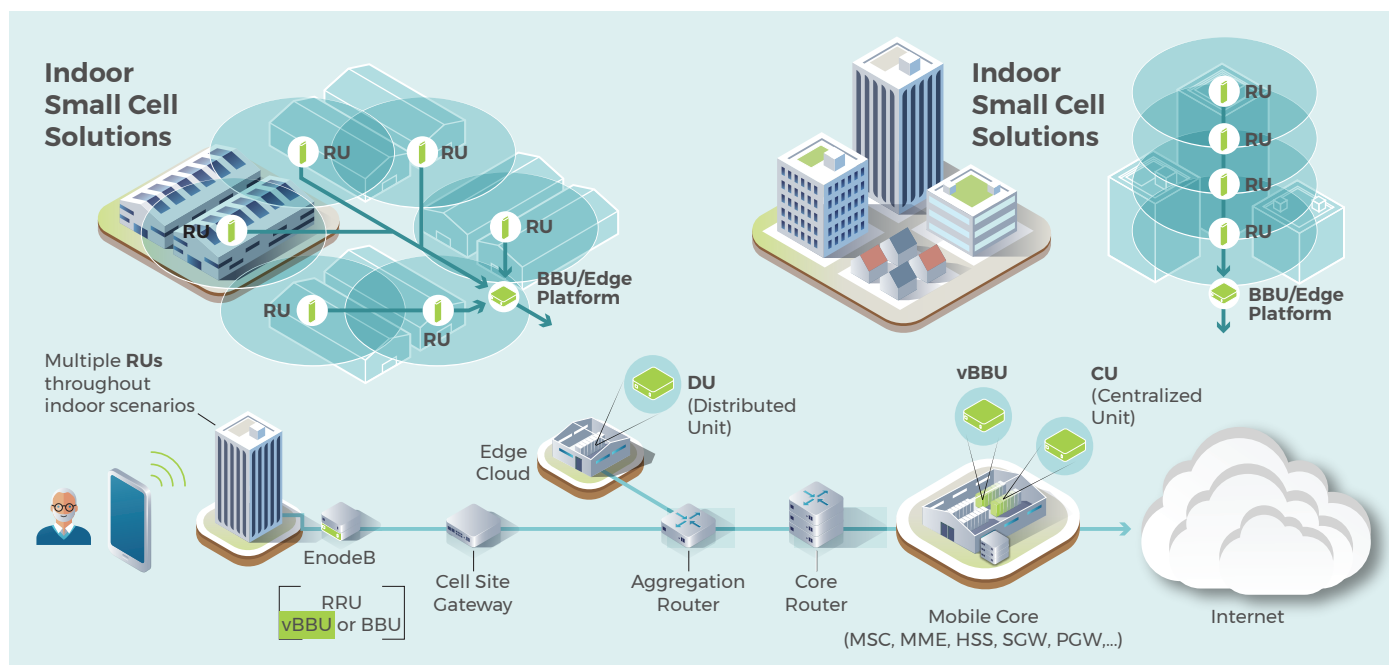
What next

- **Learn more about Telecom Infra Project**
telecominfraproject.com
- **Join the OpenRAN Project Group:**
telecominfraproject.com/openran/ to learn and contribute
- **Contact us** with questions or comments:
OpenRAN-info@telecominfraproject.com

OpenRAN Indoor Small Cell



To enable development of indoor small cell whitebox systems based on open interfaces that can be deployed cost-effectively at large scale to enhance in-building mobile capacity and coverage



Why Indoor Small Cell?

Traditional indoor small cell systems built on proprietary technology and interfaces leads to a fragmented ecosystem where components from different vendors cannot interoperate with each other. Yet, no single vendor can provide best of breed solution to address a wide range of indoor small cell deployment scenarios. A flexible, cost-effective disaggregated indoor small cells solution based on open interfaces would greatly facilitate large scale deployment.

At a glance

- **Define multiple architecture options of indoor small cell systems** to enable flexible large scale cost-effective indoor small cell in various deployment scenarios.
- **Develop HW/SW requirements of modules** and open interfaces between modules for indoor small cell system.
- **Develop test and validation requirements** and specification to ensure multi-vendor Inter-

operability and End-to-End system performance.

Developments

- **Developed and published a set of requirements documents** for 5G indoor small cell systems based on fronthaul split option 7.2.
- **Two teams, Baicells/QCT/Windriver and Inno-gence/QCT**, are participating in China Unicom's lab/field trial.
- **Development of detailed test requirements** and specification is in progress.

What next

- **Learn more about Telecom Infra Project**
telecominfraproject.com
- **Join the OpenRAN Project Group:**
telecominfraproject.com/openran/
to learn and contribute
- **Contact us** with questions or comments:
OpenRAN-info@telecominfraproject.com