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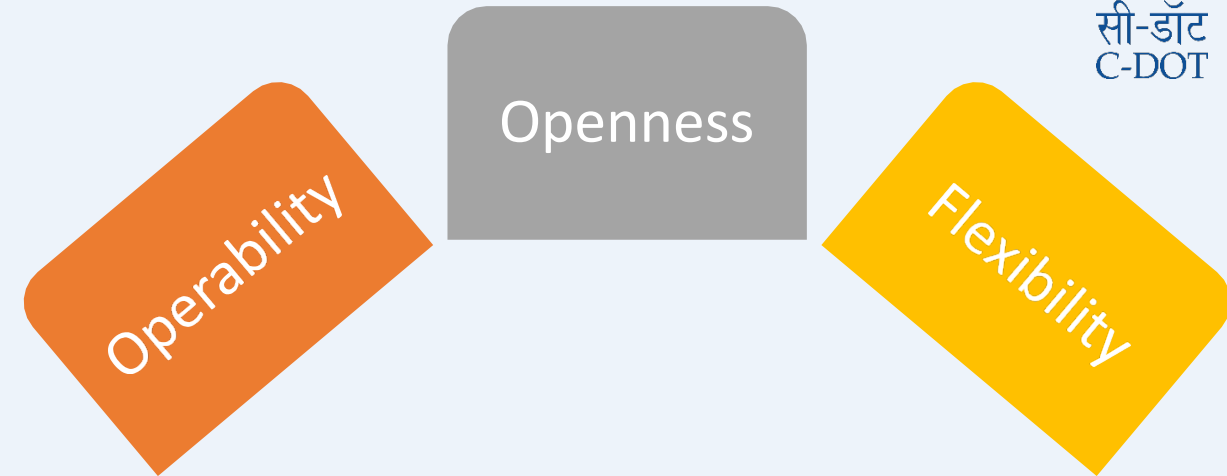
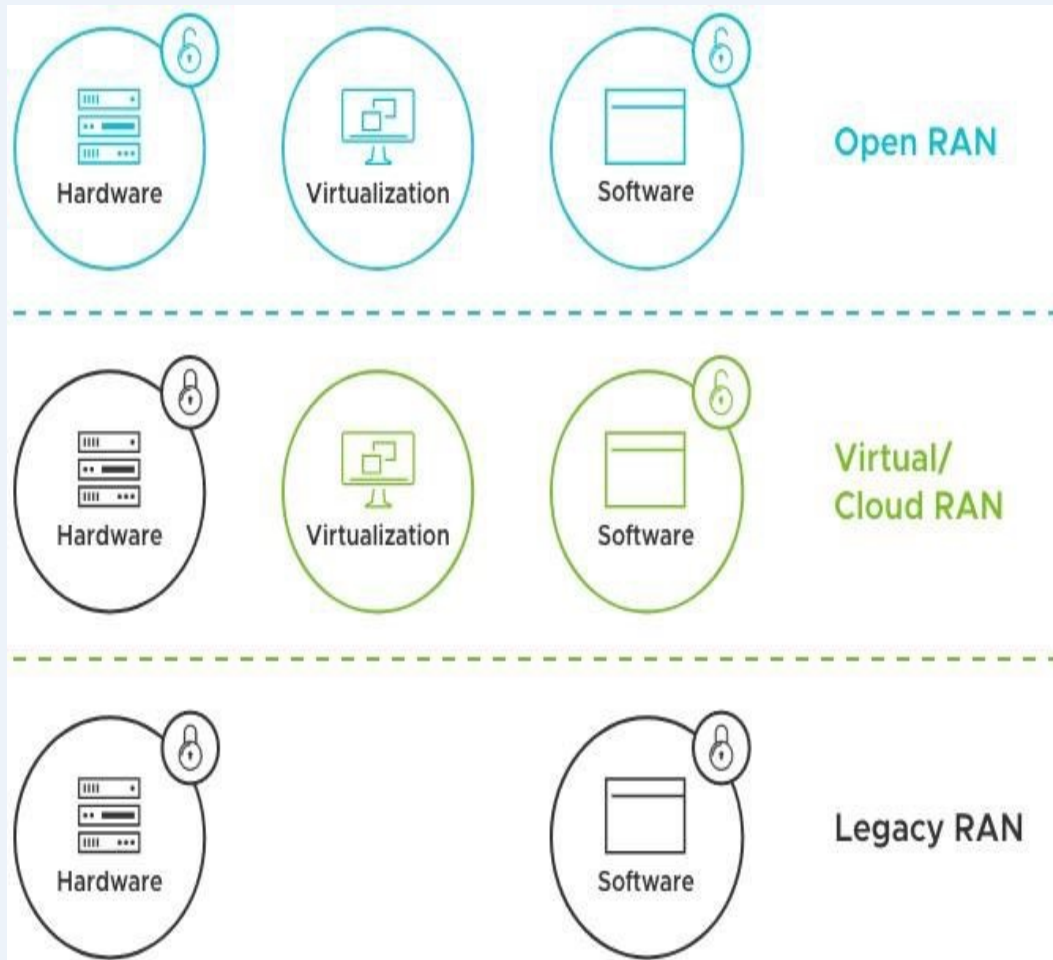
Open RAN best practices for affordable Data Services

International Telecommunications Union (ITU) Webinar

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Open RAN – Key elements



- ❖ **Cloudification:** Disaggregation of hardware and software as cloud-native functions
- ❖ **Intelligent automation:** Orchestration systems with Artificial Intelligence Capabilities
- ❖ **Open interfaces:** open internal interfaces, defined by O-RAN Alliance, between the different parts of the RAN, combined with 3GPP-defined interfaces

Potential Impact/Benefits of Open RAN

Diversification of supplier ecosystem

Telcos to avoid vendor lock-in by replacing vendor-proprietary interfaces with a fully disaggregated RAN based on open Standards

New innovation Models

New avenues of service innovation and agility by breaking the RAN into Separately configurable component parts

Lower Cost of Ownership (CO)

Disaggregated, cloud-native RAN functions can bring down the network CO in terms of energy use, resource distribution, operations, by evolving the network in a continuous integration/ continuous delivery (CI/CD) manner

New revenue opportunities

Telcos can customize RAN hardware and software in an Open RAN deployment to deliver features based on the enterprise use case Scenario

Scalability

Open RAN can provide a flexible and scalable solution that can be adapted to meet the needs of different operators.

Greenfield Models of Open RAN deployments



Greenfield Network Model :

- ❖ New networks are built without legacy constraints (suitable for scratch and low scale deployment)
- ❖ Catering to deployments with an opportunity to design cost-effective and flexible systems.
- ❖ Rapid scaling of services.

Some Greenfield deployments (Use Cases)

- ❖ **Greenfield Deployment:** Dish (US), Rakuten Mobile (Japan), One-on-One (Germany)
- ❖ **Private Networks with OpenRAN** - Healthcare in Brazil, Agri (APAC), Smart Cities (Ireland, UK, Indonesia, Europe)
- ❖ **Indoor 5G small cells** - China Unicom (China); Malaysia; UK
- ❖ **AI/ML in RAN** - BT in UK, DT in Germany: xAPP and rAPPs in energy management, traffic steering, QoS optimisation, interference management
- ❖ OpenRAN for **macro rural on neutral host** : Indonesia; Romania

Brownfield models of Open RAN deployments

Brownfield Network Model :

- ❖ Model involves integrating Open RAN into existing network infrastructures.
- ❖ Cost reductions and efficiency gains by allowing operators to integrate new technologies with legacy systems.
- ❖ High capacity network solutions catering to high Scale deployments
- ❖ Ex:- Vodafone has deployed Open RAN sites in several countries. Telefonica plans to achieve 50% of the new RAN site deployments based on Open. Etisalat has run a production trial of Open RAN for all mobile generations* (*Source :ITU)

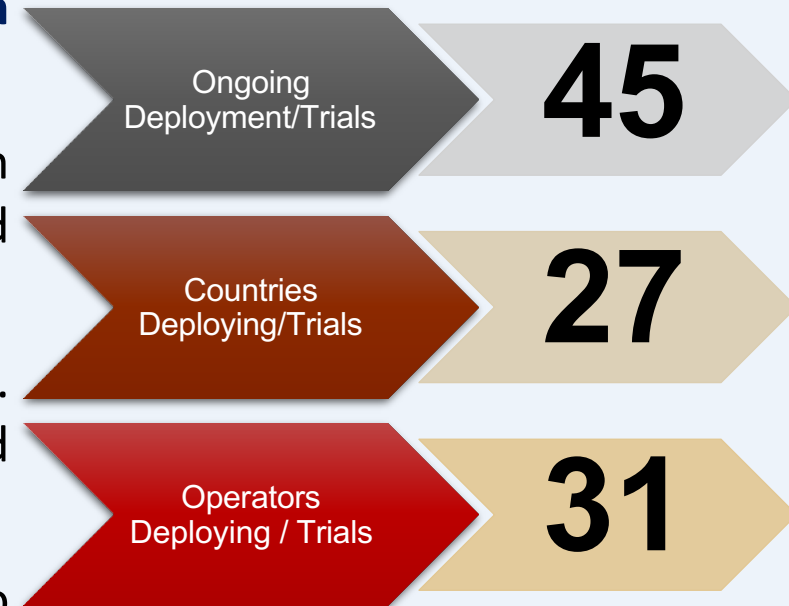
Some major Brownfield deployments (with Multiple Use Cases)

- ❖ Brownfield Deployment: AT&T, Verizon, Bell Canada, Deutsche Telekom, Vodafone, Telefonica, Orange, Airtel, STC Group, Jio
- ❖ The world is moving towards solving brownfield, but more work required on standards, on deployment models, on performance and TCO.

Some leading developments for wider Open RAN adoption



- ❖ **AT&T (US)** has commercially deployed an Open RAN-based 5G network in Dallas with Ericsson and Samsung. **AT&T's spend could approach roughly \$14 billion over the 5-year term of the contract with Ericsson.** *
- ❖ India's **Bharat 6G Alliance** and **US-based NextG Alliance**, signed an agreement to collaborate in the fields of open RAN and research in 5G and 6G. ***
- ❖ Formulation of the **US-India Open RAN Acceleration Roadmap** with the US. This milestone agreement promotes collaboration for interoperability and scaled deployments of Open RAN products.
- ❖ Under the **EU-India Trade and Technology Council** India and EU planned to enhance mutual cooperation in the field of Standardisation of Open RAN.
- ❖ **Vodafone, Telefonica, Deutsche Telekom, Orange and Telecom Italia** signed MoU to support the rollout of Open RAN networks across Europe**
- ❖ **Dish Network (US)** is building the cloud-native, Open RAN technology-based 5G broadband network**



*<https://att.com>,

**<https://tecknexus.com>,

***<https://telecom.economictimes.indiatimes.com/>

Some Key Players of Open RAN Industry

SYSTEMS INTEGRATORS	 CISCO.	 FUJITSU	 IBM	 Rakuten	 NEC	 Tech Mahindra	 World Wide Technology
vRAN SOFTWARE SUPPLIERS	 ALTIOSTAR <small>Leading Network Transformation</small>	 JMA	 MAVENIR	 Parallel WIRELESS			
RU HARDWARE AND SOFTWARE SUPPLIERS	 Airspan	 flex.	 FUJITSU	 KMW	 nW	 NEC	 SERCOM
CU AND DU HARDWARE SUPPLIERS	 DELL	 Hewlett Packard Enterprise	 kontron	 QCT	 SUPERMICRO		
SECURE VIRTUALIZATION PLATFORM SUPPLIERS	 IBM	 redhat.	 CISCO.	 NEC	 ROBIN	 vmware	 WIND RIVER
CHIPSET SUPPLIERS	 intel	 NVIDIA.	 Qualcomm	 XILINX®			

Key Indian players working on deployments of OpenRAN



Overview of Best Practices around Open RAN



Some of the key best practices for wider adoption of around Open RAN include:

- ❖ **Adopting cloud-native technologies** such as microservices and containers to enable network programmability, automation, and orchestration
- ❖ **Using open fronthaul interfaces** such as evolved Common Public Radio Interface (eCPRI) and O-RAN to enable the separation of radio units and distributed units, and the integration of multiple vendors
- ❖ **Implementing open management interfaces** such as O1 and A1 to enable the coordination and optimization of network resources and services
- ❖ **Collaboration for interoperability and scaled deployments** of Open RAN products in countries where Open RAN deployments are in progress. Sharing of lessons learnt during deployments to other concerned stakeholders.
- ❖ **Enhance mutual cooperation** in the field of Standardisation of Open RAN and setting up Global OTIC
- ❖ Countries should coordinate to develop **resilient supply chain** for trusted telecom network from trusted sources.
- ❖ Governments shall explore incentives/funding for Open RAN research, setting up of Testing Centers etc.

Open RAN Best Practices (1/3)

Adoption of Open Source Software:

- ❖ Accelerate innovation while reducing the development, time to market, and overall cost of a product.
- ❖ Reduce fragmentation and increase interoperability among different products by producing components and protocols that become the de facto standard.
- ❖ OSS also provides a platform for talented coders to openly collaborate and build software.
- ❖ Developers behave as “good citizens” in which consumers also contribute, provide useful feedback, and share fixes.
- ❖ Code reviewed by many expert eyeballs reduces software complexity and the number of bugs and allow independent verification of source code and vulnerabilities.
- ❖ Quality software at low cost.
- ❖ However security related aspects need special care.



Open RAN Best Practices (2/3)

Adoption of Network Function Virtualization:

- ❖ Open RAN leverages principles of Network Function Virtualization (NFV) to virtualize network functions and centralize software control.
- ❖ This approach allows operators to deploy network functions as software applications running on general-purpose hardware, rather than dedicated appliances.
- ❖ By virtualizing network functions, operators can achieve greater flexibility, scalability, and cost-efficiency, as they can dynamically allocate resources based on demand and deploy new services more rapidly.

Adoption of Cloud-Native Architectures:

- ❖ Open RAN embraces cloud-native architectures, which are designed to leverage cloud computing principles such as elasticity, resilience, and automation.
- ❖ By deploying Open RAN solutions in the cloud, operators can benefit from cost savings associated with resource pooling, pay-as-you-go pricing models, and automated management.
- ❖ Cloud-native architectures also enable operators to scale their networks more efficiently and
- ❖ respond quickly to changing market conditions.

Open RAN Best Practices (3/3)

Radio Integration:

- ❖ O-RAN Alliance fronthaul specifications are widely adopted and recognized as the common standard of O-DU and O-RU interface.
- ❖ Considering the limited processing resources of the O-RU, the alignment between O-DU and O-RU vendors on the features within the Interoperability Testing (IOT) profile, such as IQ data compression, synchronization modes, and etc., could be quite challenging to meet the expected KPIs.
- ❖ The best practices for O-RAN radio integration should include pre-integration planning of the detailed IOT testing.
- ❖ The automatic plug-n-play radio in an O-RAN system has not existed yet, so both O-DU and O-RU vendors must work closely together to optimize the Open RAN solution performance.



Open RAN Initiatives in Centre for Development of Telematics (C-DOT)



- ❖ C-DOT Collaborative Research Program (CCRP) : For Collaborative Development of an O-RAN compliant disaggregated 5GRAN solution in collaboration with Industry, Startups, R&D and Academia
- ❖ Incubation programs to create startup ecosystem developing solutions including Open RAN,
- ❖ Two consortiums have been funded for the development of disaggregated 5G ORAN (Bharat RAN)

Bharat RAN 1

- ❖ Consortium being led by C-DOT has **Resonous Technologies, Lekha Wireless Solutions, Signaltron Systems Pvt Ltd and Sooktha Consulting Private Limited** as partners for development of 5G Bharat RAN1. The solution is in advance phase of development

Bharat RAN 2

- ❖ Consortium being led by C-DOT with **VVDN Technologies Pvt. Ltd. and WiSig Networks** as Partners for collaborative development of 5G O-RAN compliant 5GRAN solution for public and private 5G networks (Bharat RAN2). The 5G RAN solution developed by the consortium was displayed during IMC 2023.

- C-DOT is setting up an O-RAN testbed with various dedicated indoor and outdoor Open RAN test facilities at its Delhi and Bengaluru campuses.
- Will greatly benefit the stakeholders of local Telecom ecosystem including R&D, academia, industry and startups by offering them a one-stop destination for carrying out the functional, conformance and interoperability testing of Open RAN-based subsystems
- To facilitate the certification and badging of subsystems that conforms to 3GPP and O-RAN alliance
- Existing setup comprising of :
 - Outdoor lab area to mount outdoor Radio Units for testing cell handover scenarios
 - Indoor lab area for indoor Radio Units and DU/CU servers for testing functionality and interoperability
 - Optical fiber links to support RAN fronthaul, midhaul and backhaul interfaces
 - Integration facility with 5G SA core network(s), Core simulators, IMS etc.
 - Capable of testing OpenRAN/ traditional RAN based system with core network and UE devices/ simulator
 - Supporting equipment e.g. PTP grandmaster, switches and routers
 - More testing equipment are getting added

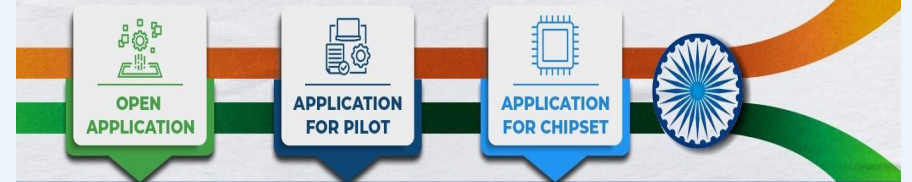
Funding Initiatives by Indian Govt.

- **C-DOT Collaborative Research Policy (CCRP):** For Collaborative Development of an **O-RAN compliant disaggregated 5GRAN solution** comprising of RU, DU, CU, RIC and SMO nodes with Open RAN interfaces in collaboration with Industry, Startups, R&D and Academia.
- **Digital Communication Innovation Square (DCIS):** To promote ecosystem for research, design, development, proof of concept testing, IPR creation, pilot project and manufacturing etc.
- **Telecom Technology Development Fund (TTDF) :** Scheme for support for domestic companies and institutions involved in R&D to enable affordable broadband and mobile services including Open RAN solutions. C-DOT is one of the Implementing Agencies (IA) of TTDF

DIGITAL COMMUNICATION INNOVATION SQUARE (DCIS)

To promote the ecosystem for research, design, development, proof of concept testing, IPR Creation, Pilot project and manufacturing

TELECOM TECHNOLOGY DEVELOPMENT FUND



Key Takeaways

- ❖ Global MNOs are realizing the economic benefits of open architecture. Open RAN has been deployed in commercial networks today and operational performance requirements and KPIs are being analyzed.
- ❖ Open RAN is now mainstream with even legacy vendors opening up their RAN for 5G.

For Wider Proliferation of OPEN RAN:

- ❖ Govts needs to Facilitate setting up of OTICs
- ❖ Development of Ongoing Mechanisms to Share Lessons Learned between operators by establishing a periodic meeting among them in a voluntary manner and consistent with anti-trust obligations
- ❖ Development of facilities for certification of successful interoperability tests across Open RAN integration centers in different countries.
- ❖ Links/Portals with mechanism to sharing of results of Open RAN interoperability testing (for a vendor combination)
- ❖ Encourage collaboration between governments and industry stakeholders to establish guidelines, best practices, and certification mechanisms ensuring the security and privacy of Open RAN networks.



Thank You

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