Open RAN, Virtualization, and the Cloud

USTTI 5G, Open RAN and Emerging Technologies Training

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Definitions

Open RAN

▶ The movement to create a market of open, interoperable, standards-based 5G RAN solutions

O-RAN

▶ Technology/specifications developed by the O-RAN Alliance

OpenRAN

▶ Project group in the Telecom Infra Project (TIP), focused on testing and validation of Open RAN solutions

Virtualized RAN (vRAN)

▶ Virtualized RAN, becoming less dependent on custom-designed and built hardware and using more commercial-off-the-shelf (COTS) computing products

Cloud RAN (C-RAN)

▶ Cloud-based RAN, leveraging containerized network functions to scale resources as-needed on public or private cloud services

Open vRAN/C-RAN

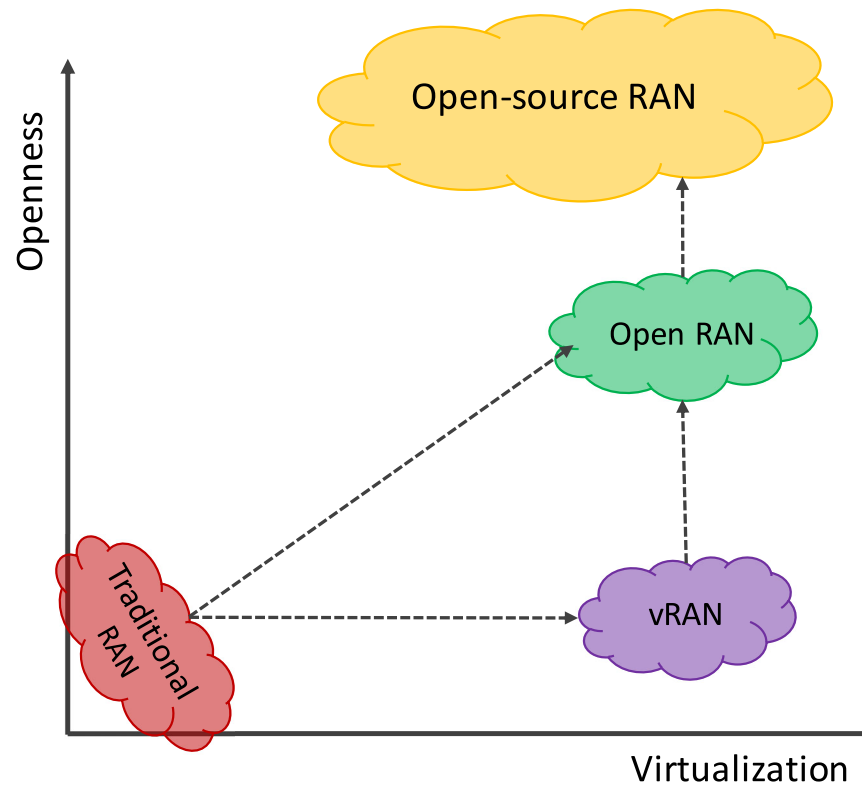▶ Application of vRAN or C-RAN in an Open RAN environment

Virtualization vs Openness

vRAN & C-RAN Architecture

Virtualized RAN
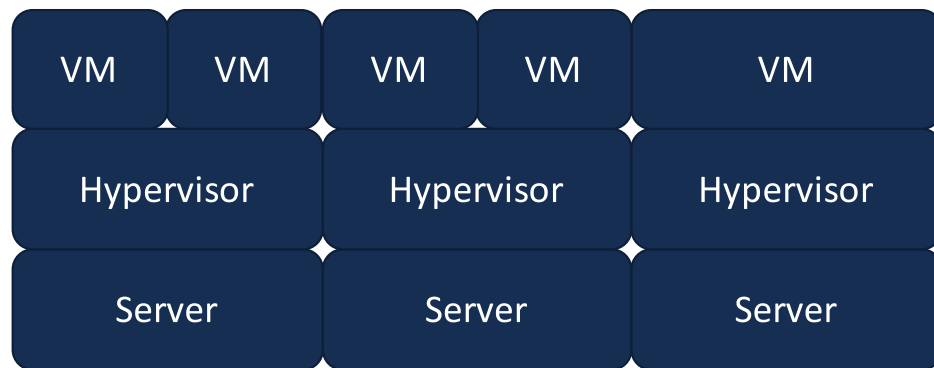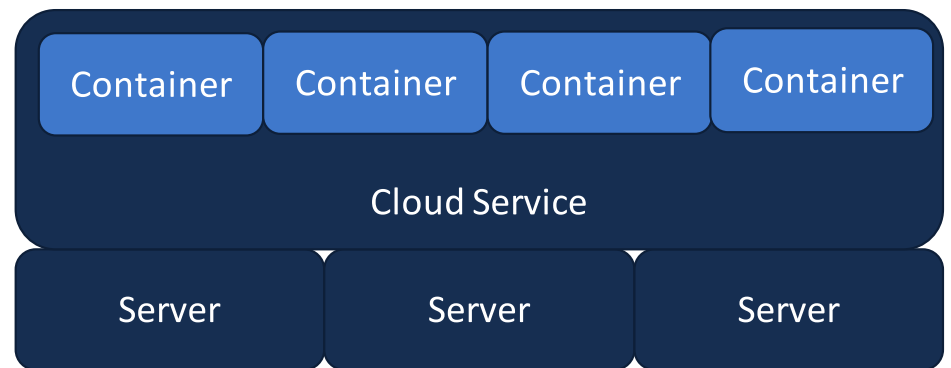
VM	VM	VM	VM	VM
Hypervisor		Hypervisor		Hypervisor
Server		Server		Server

Cloud RAN

Container	Container	Container	Container
Cloud Service			
Server	Server	Server	

Virtualization Advantages

▶ Disaggregate software and hardware

▶ Leverage commercial off the shelf hardware
- Economies of scale

▶ Leverage software development cycle
- Continuous Integration/Continuous Development (CI/CD)
- Faster time-to-market

▶ "Build-to-suit"
- Purchase the resources you need, can always incrementally add more

Cloud Advantages

▶ Same as virtualization plus:

▶ More network flexibility
- Only uses the resources you need
- Multi-use infrastructure – private cloud can be offered as MEC for customers

▶ Network centralization in dense deployment environments

Cloud and Virtualization Concerns

▶ Energy Consumption vs Application Specific Hardware

▶ COTS hardware requiring accelerator cards
  - Open RAN specific accelerators
  - GPU/FPGA acceleration
  - On CPU acceleration

▶ Security
  - More touchpoints, more risk

▶ Knowledge gap
  - Telecom world vs IT world
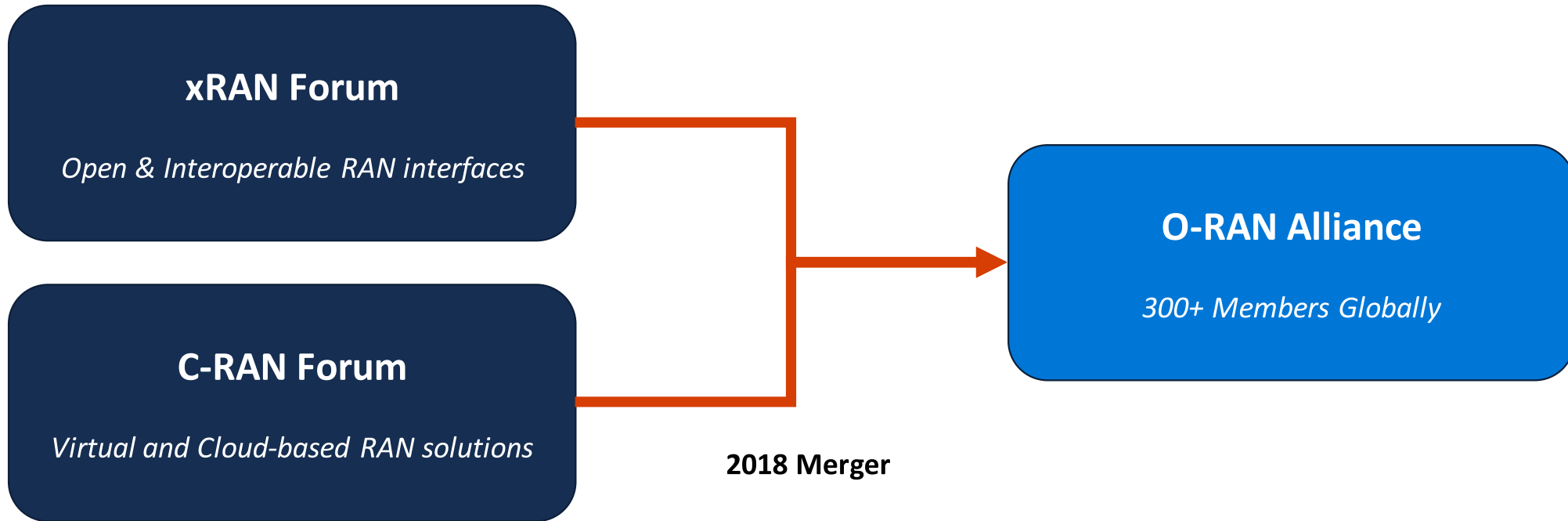
▶ Public cloud
  - Cost
  - Control
  - Availability

Development of Open RAN

xRAN Forum

Open & Interoperable RAN interfaces

C-RAN Forum

Virtual and Cloud-based RAN solutions

2018 Merger

O-RAN Alliance

300+ Members Globally

Organizations Involved

3GPP — A GLOBAL INITIATIVE

- Sets overall 5G NR Specifications
- Serves as overall baseline for O-RAN

O-RAN ALLIANCE

- MNO-led organization
- Sets O-RAN Specifications, building upon 3GPP

TELECOM INFRA PROJECT

- Originally setup by Facebook/Meta
- Develops testing and some specifications for open and interoperable connectivity solutions
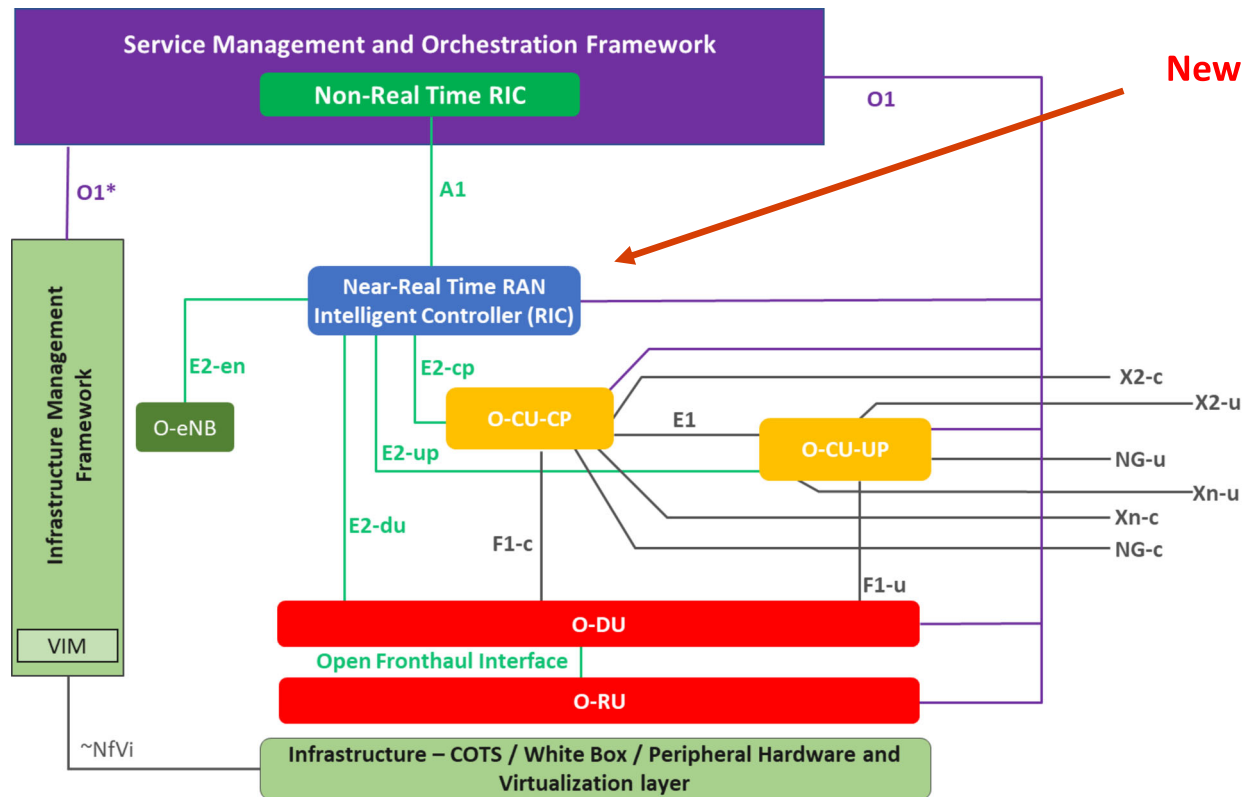- Focus on Open RAN testing

Open RAN POLICY COALITION

- Industry Organization set up to work with governments to inform policies around Open RAN and ways to incentivize innovation and deployment

Source: O-RAN Software Community

RAN Intelligent Controller

▶ Non-Real Time RIC
- >1s response
- Part of Service Management and Orchestration Function
- rApps
- Use case example: dynamic cell loading/optimization

▶ Near Real Time RIC
- 10ms-1s response
- xApps
- Use case example: efficient use of spectrum and interference mitigation

Challenges to Adoption

▶ Legacy telecom approaches
- Security
- Deployment

▶ Maturity of specifications/devices

▶ Adoption/R&D cycle

▶ Supply Chain Shortages

▶ Workforce