

O-RAN Class

Week 4

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Network Function Virtualization (NFV)

Role of NFV in Open-RAN:

- The NFV in Open-RAN disaggregates the components such as O-RU (Radio Unit), O-DU (Distributed Unit), and O-CU (Centralized Unit).
- The NFV enhances flexibility, scalability, and vendor interoperability.

Applications of NFV Architecture in Open-RAN:

Virtualized RAN Functions (CU/DU):

- Runs the RAN components as software, improving flexibility.

Dynamic Resource Scaling:

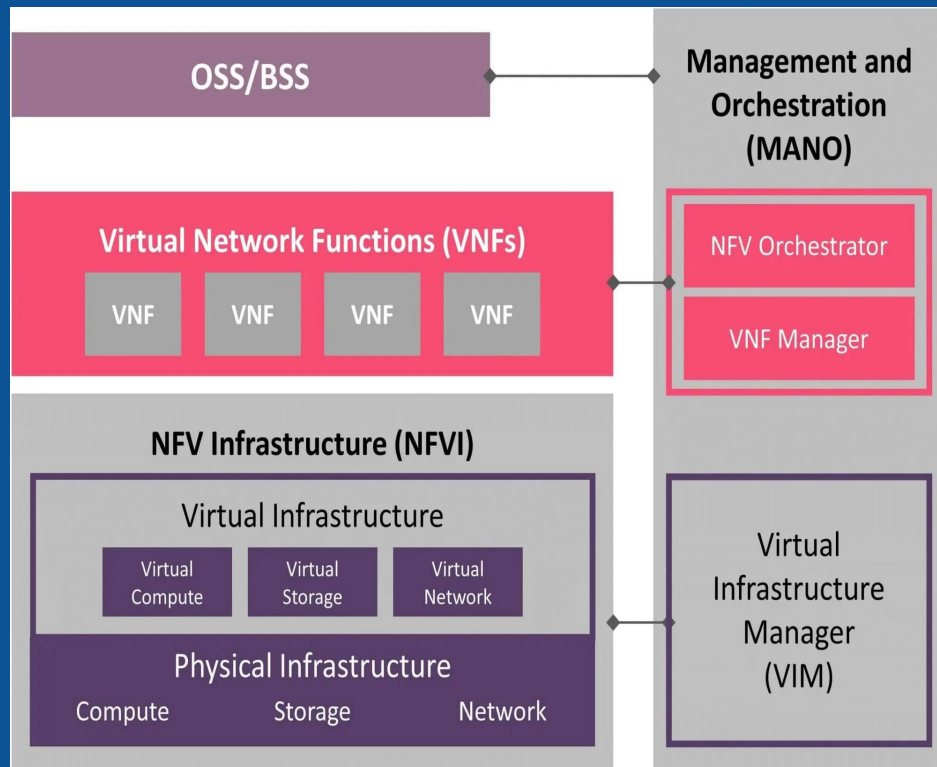
- Automatically scale network resources based on traffic load.

Multi-Vendor Interoperability:

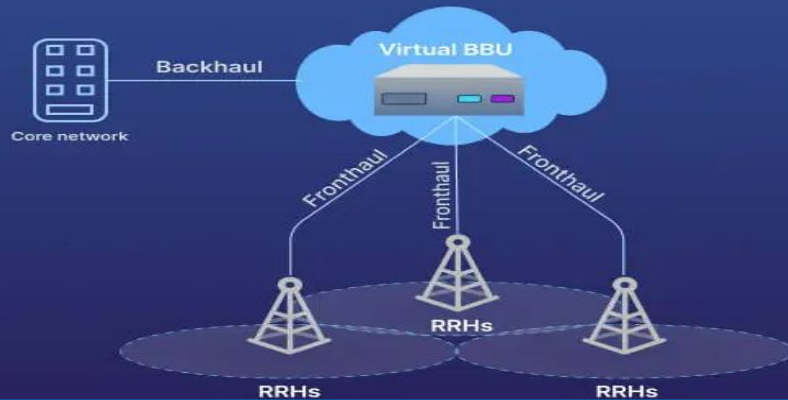
- Supports integration of RAN functions from different vendors in one network.

Simplified Deployment & Maintenance:

- Faster in deployments through centralized orchestration.

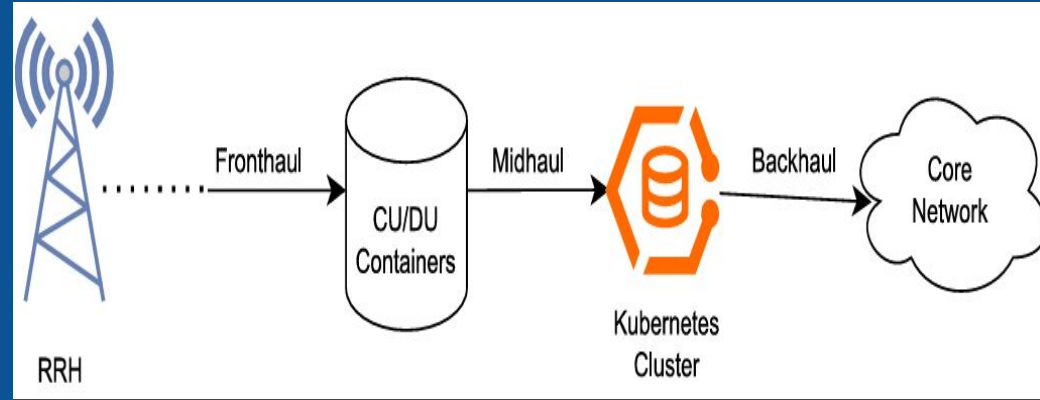


Evolution from Cloud RAN (C-RAN) to Cloud-Native RAN



Cloud-RAN (C-RAN)

- Virtual / Centralized Baseband processing, which is a VM based virtualization.
- C-RAN is cost effective.
- C-RAN fails at agility, where the scaling and upgrading are very slow due to VM dependency.



Cloud-Native RAN

- The RAN components such as CU, DU are split into independent containers.
- Kubernetes based orchestration, used for scaling and automation.
- Cloud-Native RAN has great flexibility and portability across all cloud environments.

Benefits of virtualization and cloudification: Flexibility, scalability, resource efficiency

Why Virtualization and Cloudification are useful?

These functions provides several benefits like

- **Hardware Independence:**
Decouples network functions from specialized hardware.
Runs on standard, off-the-shelf servers.
- **Faster Deployment:**
Virtual functions can be launched quickly without physical installation. Supports automated provisioning and updates.
- **Scalability and Flexibility:**
Easily scale resources based on real-time network demand.
Deploy RAN components (CU/DU) centrally or at the edge.



Benefits of virtualization and cloudification: Flexibility, scalability, resource efficiency

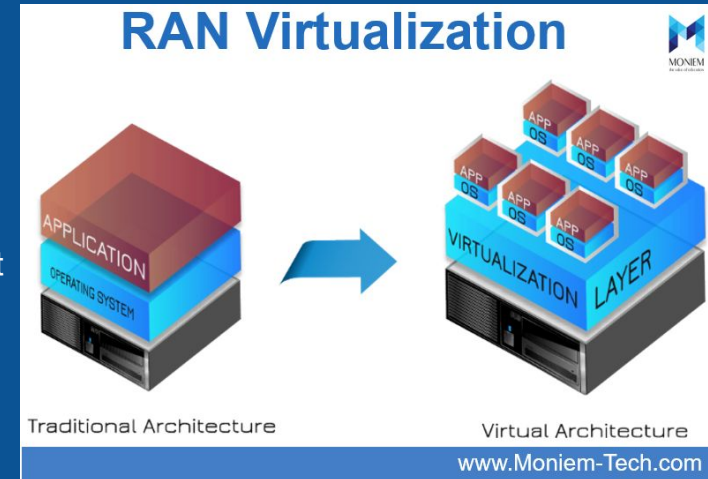
- **Resource Efficiency:**
Optimizes compute, storage, and networking through shared infrastructure. Reduces energy and space requirements.
- **Cloud-Native Evolution:**
Enables migration from VNF (Virtual Machines) to CNF (Containers). CNFs are faster, lighter, and easier to manage via Kubernetes.
- **Ideal for Open-RAN:**
Supports disaggregation and open interfaces. Enables multi-vendor, cloud-native deployments.



High-level challenges of virtualizing RAN functions (performance, latency)

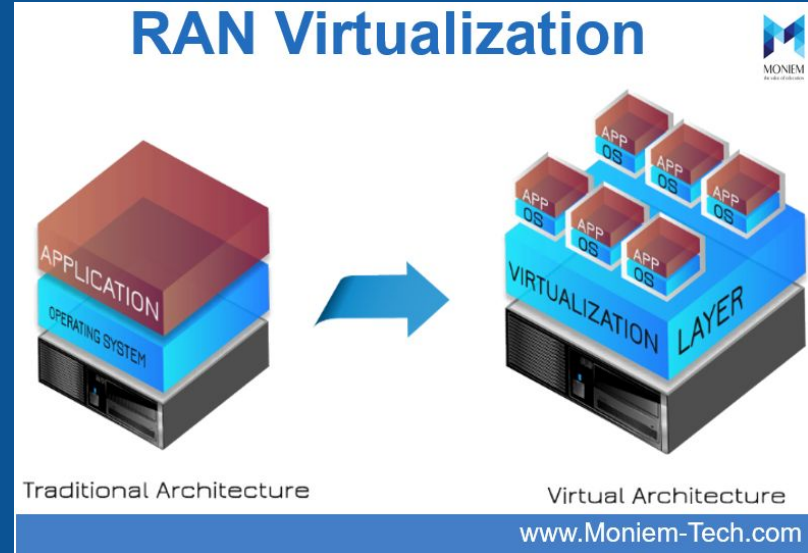
High-level Challenges:

- **Real-Time Performance Requirements:**
RAN functions (like DU) require ultra-low latency and real-time processing. General-purpose servers may struggle with strict timing needs.
- **Hardware Acceleration Needs:**
Functions like Layer 1 (PHY) often need dedicated hardware. Not all cloud environments support this efficiently.



High-level challenges of virtualizing RAN functions (performance, latency)

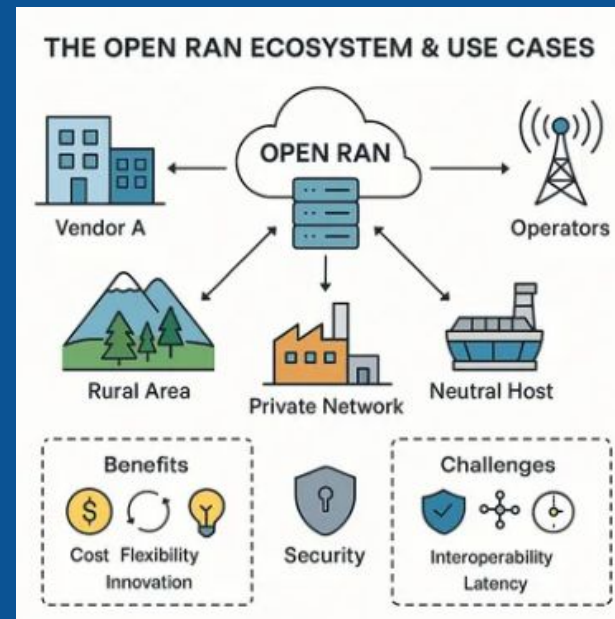
- **Resource Allocation and Isolation:**
Shared cloud infrastructure can lead to jitter or resource contention. Ensuring consistent CPU and memory availability is complex.
- **Synchronization and Timing:**
Precise time sync (e.g., via GPS or IEEE 1588 PTP) is harder to maintain in virtualized/cloud systems.
- **Complexity in Orchestration:**
Lifecycle management of virtualized RAN components is more complex. Requires integration with Cloud-native tools (etc. Kubernetes).



Coming in week 5

Benefits, Challenges, and Use Cases of Open RAN

- In-depth discussion of the potential benefits of Open RAN for mobile operators and the ecosystem.
- Key challenges and considerations for Open RAN adoption (interoperability, security, performance).
- Overview of emerging Open RAN use cases: Rural deployments, private networks, neutral host.
- The evolving Open RAN ecosystem and vendor landscape.



Thank you!

Questions?
