Open RAN - Comment Perspectives d’un nouveau fournisseur

Mars 2022

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Chief Technologist Telco
APAC
Company overview

The world’s leading provider of open source enterprise IT solutions

More than 90% of the Fortune 500 use Red Hat products and solutions¹

~19,500 employees

105+ offices

40+ countries

The first $3 billion open source company in the world²

Sources: ¹ Red Hat client data and Fortune 500 list, Jul. 2021. ² Red Hat SEC filings prior to the acquisition by IBM. Note: Currency in U.S. dollars.
RAN Evolution: Key Terminology Used
Open RAN, OpenRAN, O-RAN, vRAN, Cloud RAN, ...

1. **Open RAN** is a generic term that refers to industry movement and open RAN architectures including open interfaces, virtualization / containerization and use of AI/ML, etc.

2. **OpenRAN** is a project initiated by the Telecom Infra Project (TIP). It’s an attempt to realize the Open RAN concept on its own part. Its work covers 2G/3G/4G/5G. As inputs, OpenRAN uses 3GPP and O-RAN Alliance specifications.

3. **O-RAN** (ORAN) refers to the O-RAN Alliance or standards created by the O-RAN Alliance, which complements 3GPP specifications by defining interface profiles, new open interfaces and new nodes.

4. **vRAN (Virtualized RAN)**: Whereas Open RAN focuses on openness, vRAN is really about decoupling software from hardware.

5. **Cloud RAN (C-RAN)** is vRAN built on cloud native technologies, such as microservices, containers and CI/CD. Confusingly, C-RAN is also sometimes used to mean Centralized RAN where baseband processing is centralized and relocated out from antenna site to edge data center, but in most cases that is written as CRAN.

Source: Devopedia 2021.
Mobile Network Radio Base Station

RAN Evolution: Open RAN Model with Containerized RAN Workloads on Container Platform

- Functional Split / Disaggregation per 3GPP Rel 15
- F1 Interface (midhaul) by 3GPP
- Standard interface (backhaul) towards Core Network(s)
- Three entity model: Radio Unit (RU), Distributed Unit (DU), Centralized Unit (CU, Control and User Planes)
- Cloud Platform to host DU and CU workloads, can be VMs or containers, but increasingly containers
- Single RAN vendor model
- Red Hat OpenShift Container Platform or Red Hat OpenStack Platform as Cloud Platform
Mobile Network Radio Base Station

RAN Evolution: Open RAN Model aligned with O-RAN Alliance

- Functional Split / Disaggregation per 3GPP Rel 15
- Open Fronthaul by ORAN Alliance
- F1 Interface (Midhaul) by 3GPP
- Standard interface (Backhaul) towards Core Network(s)
- Three entity model: Radio Unit (RU), Distributed Unit (DU), Centralized Unit (CU, Control and User Planes)
- O-RAN Alliance nomenclature: O-RU, O-DU, O-CU
- Cloud Platform (O-Cloud) to host O-DU and O-CU workloads
- **Goal: multi vendor**
- **Red Hat OpenShift Container Platform as O-Cloud**
Overview for Rakuten MNO Architecture

Rakuten Network, World’s First Cloud Native Platform

1. Open, Virtualized and Disaggregated RAN
2. Fully virtualized with common and distributed Telco Cloud
3. Mobile Edge Computing
4. 5G systems architecture based design from launch
5. 5G enabled IPv6 transport/Mobile Backhaul Architecture
6. SDN Enabled Centralized and Regional Datacenter Fabrics for 5G
7. Common Hardware SKUs – Standardization and Simplification
8. End-to-End Infrastructure and Service Automation
9. Unified OSS/BSS
10. New Business Models – Opening up new ecosystems

18,000 4G and 1,000 5G base stations in March 2021

Source
Rakuten group result presentation Q3 2021
RAN Evolution Adds New Requirements to Cloud Platforms

These are three of the most important new areas to cover ...

- **Realtime Kernel (RT)**
  Workloads stringent low-latency determinism requirements for core kernel features such as interrupt handling and process scheduling in the microsecond (μs) range.

- **Precision Time Protocol (PTP)**
  Time synchronization via transport networks will be critical for 5G radios. PTP remains the preferred method to deliver timing across packet-switched networks.

- **Hardware Acceleration**
  Field Programmable Gate Arrays (FPGA), SmartNIC, and other hardware acceleration components will be vital for 5G virtualized infrastructure.

5G NR deployment scenarios impose new requirements to the infrastructure layer.
RAN Evolution Adds New Requirements to Cloud Platforms

CPU Management
CPU Manager manages groups of CPUs and constrains workloads to specific CPUs. CPU Manager is useful for workloads that have some of these attributes: require as much CPU time as possible or are low-latency network applications.

Topology Management
Topology Manager collects hints from the CPU Manager, Device Manager, and other Hint Providers to align pod resources, such as CPU, SR-IOV VFs, and other device resources, for all Quality of Service (QoS) classes on the same non-uniform memory access (NUMA) node.

Low Latency
A combination of multiple factors that allow the workload the maximum processing capacity and minimizes packet delivery latencies.

Zero touch provisioning
Provides all the tools required to install, upgrade and maintain the cloud infrastructure for the RAN workload with minimum user interaction in an “appliance” like deployment. Reduced complexity with increased flexibility of options and performance.

Remote Management
Take full control of edge and RAN operation from a centralized single pane of glass. This includes, OpenShift installation and upgrade, application provisioning and monitoring.

Reduce footprint
Remote Radio sites have limited space and power, therefore edge and RAN clouds would require a small cloud footprint.
Enabling a uniform telco horizontal cloud

Public Clouds
- Telco Core
- OSS, BSS, 5GC, IMS
- Alibaba Cloud
- Microsoft Azure
- AWS
- IBM Cloud

Telco Private Clouds
- Telco Core
- vEPC, 5GC, IMS
- Bare metal
- openstack
- VMware

Telco Edge Clouds
- Telco Edge
- vCO, 5G RAN & Core
- Edge Computing, IoT Hub
- Bare metal

Customer Edge
- vCPE, STB/DVR
- Private 5G
A single platform for the edge

Radio Access Network
Centralized Unit (CU)
Distributed Unit (DU)

Mobile Core
4G S/P-GW-U
5G UPF

Edge Computing
CDN, IaaS, CaaS
AI/ML applications
Industry-specific B2B applications

A single open telco cloud platform for the edge

Optimize scarce resources at the edge (space, power, cooling)
Consistent operations, a single platform to manage instead of three
Innovation and speed to market, re-use platform to pick best of breed workloads
Key requirements for edge platform

**Radio Access Network**
Centralized Unit (CU)
Distributed Unit (DU)

Support of RAN workloads: real time Linux, low latency kernel, PTP, hardware accelerator...
**Ecosystem** of RAN network functions

**Mobile Core**
4G S/P-GW-U
5G UPF

Support of mobile user plane NFs: CPU pinning, NUMA topology, SR-IOV, DPDK, huge pages...
**Ecosystem** of mobile core network functions

**Edge Computing**
CDN, IaaS, CaaS
AI/ML applications
Industry-specific B2B applications

Support for cloud computing services: IaaS, CaaS, block, object, file storage, vGPU
Developer tools
**Ecosystem** of IT PaaS and applications ISVs

Small footprint (minimal amount of servers), management at scale of 100’s, 1000’s of edge clusters
## OpenShift ecosystem for mobile core

Status as of February 2022, more coming soon...

<table>
<thead>
<tr>
<th>Vendor</th>
<th>CNF</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Affirmed</strong></td>
<td><strong>UnityCloud 5G Core</strong></td>
</tr>
<tr>
<td><strong>Alepo</strong></td>
<td><strong>Alepo Converged Core Solution</strong></td>
</tr>
<tr>
<td><strong>Casa Systems</strong></td>
<td><strong>Axyom™ 5G Multi Access Core</strong></td>
</tr>
<tr>
<td><strong>Cumucore</strong></td>
<td><strong>5G Core with Network Slice Manager and 5GLAN, TSN support functions</strong></td>
</tr>
<tr>
<td><strong>EEXIUM</strong></td>
<td><strong>Secure 5G Core</strong></td>
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<td><strong>Hewlett Packard Enterprise</strong></td>
<td><strong>5G Authentication, Core Charging, Policy Control Data management</strong></td>
</tr>
<tr>
<td><strong>MAVENIR</strong></td>
<td><strong>5G Core</strong></td>
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<tr>
<td><strong>NEC</strong></td>
<td><strong>5G Core</strong></td>
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<tr>
<td><strong>Nokia</strong></td>
<td><strong>5G Core, Converged Charging</strong></td>
</tr>
<tr>
<td><strong>Samsung</strong></td>
<td><strong>5G Core CNF</strong></td>
</tr>
<tr>
<td><strong>ZTE</strong></td>
<td><strong>5G Common Core i5GC</strong></td>
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OpenShift ecosystem for RAN
Status as of February 2022, more coming soon...

More than 40 certified CNFs in Red Hat Ecosystem catalog (as of February 2022)

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<th>Vendor</th>
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<tr>
<td>AltionStar</td>
<td>4G and 5G Open vRAN</td>
</tr>
<tr>
<td>Baicells</td>
<td>Aurora Airband RAN</td>
</tr>
<tr>
<td>Mavenir</td>
<td>5G RAN CU</td>
</tr>
<tr>
<td>NEC</td>
<td>5G vRAN</td>
</tr>
<tr>
<td>Juniper Networks</td>
<td>RAN Intelligent Controller (RIC)</td>
</tr>
</tbody>
</table>

Ericsson:
[Open RAN Ecosystem Evolution](#), February 2022 with Eric Parsons, VP, Cloud RAN at Ericsson

Nokia:
[Accelerating cloud RAN technology innovation in the 5G era](#), February 2022, with Jane Rygaard, Head of Dedicated Wireless Networks and Edge Clouds at Nokia

Samsung 5G vRAN:
[Samsung Joins Forces With Industry Leaders To Advance 5G vRAN Ecosystem](#), February 2022
OpenShift ecosystem for IT

Most extensive container ecosystem to build edge computing applications

- **AI / ML**
- **CognitiveScale**
- **GIGASCAPES**
- **H2O**
- **Seldon**
- **Networking**
- **Cisco**
- **nuage networks**
- **Juniper**

- **Big Data**
- **Cloudera**
- **Sas**
- **Starburst**

- **Monitoring & Management**
- **Dynatrace**
- **Instana**
- **New Relic**
- **Splunk**

- **Security**
- **Aqua**
- **Synopsys**
- **Twistlock**
- **Anchore**
- **Cyberark**

- **FSI**
- **Temenos**
- **Sas**
- **Ericsson**
- **Affirmed**
- **Nokia**

- **CNF**
- **Fiserv**
- **Samsung**
- **CNF**

- **Customer Code**
- **Application Platforms**
- **Azure**
- **AWS**
- **SAP**
- **IBM**

- **Application Runtimes**
- **Red Hat OpenShift Enterprise Linux CoreOS**
- **Red Hat OpenShift Operators**

- **DevOps Tools**
- **Kong**
- **Atlassian**
- **GitLab**
- **Jfrog**

- **Databases**
- **Couchbase**
- **NuoDB**
- **MongoDB**
- **SQL Server**

- **Storage**
- **Red Hat OpenShift Storage**
- **TRILLIUM**
- **STORAGEOS**
- **NetApp**

- **Best IT ops experience**
- **Best developer experience**
- **Cluster services**
- **Application services**
- **Service mesh**
- **Automated operations**

- **Red Hat OpenShift ecosystem for IT**
- Most extensive container ecosystem to build edge computing applications

OpenShift certified containers images
OpenShift certified containerized products
OpenShift certified OpenShift operators
OpenShift ecosystem for IT

Most extensive container ecosystem to build edge computing applications

5000+ OpenShift certified container images
300+ OpenShift certified containerized products
200+ OpenShift certified operators
End to end system integration

What has been disaggregated needs to be integrated

Red Hat Reference Architecture lab
- Operator Portals
- Assurance
- Orchestration
- Automation
- Hardware

Red Hat owned and managed
- Use case based
- Pre-architected and integrated
- Interoperability & performance tested
- 80% re-usable

Telco Blueprint lab
- Operator Portals
- Assurance
- Orchestration
- Automation
- Hardware

Led by telco or system integrator (SI)
Red Hat serviced & supported
- Standardized high-level design (HLD)
- Dedicated life-cycle lab
- Continuous testing
- 20% telco service provider specific
National sovereignty

How open source can help with digital sovereignty

Security
More eyes, more security

Secure supply
Code that lasts forever

"Open Source removed the access to software as a limiting factor for businesses and individuals. However, with software proliferating into every aspect of the business – and our world in general – resulting in ever growing complexity of software stacks, the challenge is now operationalizing software.”
Our code is open
Thank you

Red Hat is the world’s leading provider of enterprise open source software solutions. Award-winning support, training, and consulting services make Red Hat a trusted adviser to the Fortune 500.

linkedin.com/company/red-hat
youtube.com/user/RedHatVideos
facebook.com/redhatinc
twitter.com/RedHat
Using color in presentations

**Red tints**
- PMS 176C
  - #FAB6B6
  - RGB 250 182 182
  - CMYK 0 35 18 0
- PMS 177C
  - #F56D6D
  - RGB 245 109 109
  - CMYK 0 72 49 0
- PMS 180C
  - #EE0000
  - RGB 238 0 0
  - CMYK 0 98 85 0
- PMS 181C
  - #5F0000
  - RGB 95 0 0
  - CMYK 0 98 85 70

**Red shades**
- White
  - #FFFFFF
  - RGB 255 255 255
  - CMYK 0 0 0 0
- Cool Gray 3C
  - #C9C9C9
  - RGB 201 201 201
  - CMYK 0 0 0 25
- Cool Gray 7C
  - #8B8B8B
  - RGB 139 139 139
  - CMYK 0 0 0 55
- Cool Gray 11C
  - #4D4D4D
  - RGB 77 77 77
  - CMYK 0 0 0 85
- Rich Black
  - #000000
  - RGB 0 0 0
  - CMYK 60 40 40 100

**Red Hat red**
- PMS 176C
  - #FAB6B6
  - RGB 250 182 182
  - CMYK 0 35 18 0
- PMS 177C
  - #F56D6D
  - RGB 245 109 109
  - CMYK 0 72 49 0
- PMS 180C
  - #EE0000
  - RGB 238 0 0
  - CMYK 0 98 85 0
- PMS 181C
  - #5F0000
  - RGB 95 0 0
  - CMYK 0 98 85 70

**Start with our core**

Whether distributed internally or externally, presentations should always feel like Red Hat. Use our core colors and adhere to the presentation template.
Using color in presentations

### Beyond red

While our core colors should work for most presentations, some slides include graphs, diagrams, and other assets that require additional colors. In these instances, choose one of the presentation palettes to keep your presentation professional and on-brand.

**Presentation palette 1**

- #F2F2F2 (gray)
- #C9C9C9 (gray)
- #6C6C6C (gray)
- #000000 (black)
- #5F0000 (red)
- #EE0000 (red)
- #F56D6D (red)
- #FDDBDB (gray)

**Presentation palette 2**

- #E4F3F4 (light blue)
- #43ADAF (dark blue)
- #1B4546 (dark blue)
- #000000 (black)
- #5F0000 (red)
- #EE0000 (red)
- #F56D6D (red)
- #FDDBDB (gray)

**Presentation palette 3**

- #E2EAF6 (light blue)
- #A7C0E4 (light blue)
- #316DC1 (dark blue)
- #261A4C (dark blue)
- #000000 (black)
- #5F0000 (red)
- #EE0000 (red)
- #F56D6D (red)
- #FDDBDB (gray)

**Presentation palette 4**

- #FDDBC7 (light blue)
- #F7823C (light blue)
- #316DC1 (dark blue)
- #142C4D (dark blue)
- #000000 (black)
- #5F0000 (red)
- #EE0000 (red)
- #F56D6D (red)
- #FDDBDB (gray)