Challenges Faced by 5G vRAN Providers and Open-Source Solutions

Panel Discussion
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General Manager, Rakuten Symphony

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Director - Inventive Science, AT&T

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Head of Telco Industry Partnerships, Google

Jim Nelson
OCP Edge Co-Lead, Flex
Agenda

5G Cloud and vRAN architecture with Disaggregation

Challenges facing 5G vRAN Providers
  • Panel Discussion

Question and Answers
Disaggregation Opportunity for 5G vRAN

Traditional RAN vs Virtualized RAN vs Open RAN

Traditional RAN
- Proprietary Hardware
- Proprietary Interfaces

Open RAN
- GPP based COTS Hardware
- Open Interfaces
  - Any vendor’s SW can work on this HW
- COTS Server
  - Proprietary Software with Virtualized Functions
  - Virtualized RAN (vRAN)

SOURCE: National Instruments; YouTube: Open RAN, Virtualized RAN & vRAN

NOTES: GPP = General Purpose Processor; COTS = Commercial-Off-The-Shelf

OPEN POSSIBILITIES.
## Challenges facing 5G vRAN Providers

vRAN Providers are not alone in dealing with the growing demands on data centers and edge infrastructure, however vRAN Providers challenges are more pronounced, more extreme, due to more users, more services and more servers.

<table>
<thead>
<tr>
<th>Time to market</th>
<th>Customized solution</th>
<th>Global flexibility</th>
<th>Value Delivery</th>
<th>Sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exceeding TTM expectations to hit the opportunity window and beat competition to service deployment</td>
<td>New workload and software demands require specialized hardware designs to right-size solutions</td>
<td>Data localization laws regulating the storage and transmission of data require a global strategy</td>
<td>Heavier workloads from AI/ML applications are demanding greater processing power balanced by TCO</td>
<td>Advance environmental goals to reduce carbon emissions and improve energy efficiency</td>
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Disruption-as-a-Service

Azita Arvani
GM, Rakuten Symphony
A young company already transforming the Telco industry

- Apr 2018: Secured bandwidth approval
- Feb 2019: Network goes live!
- Apr 2019: 5G Spectrum License granted
- Apr 2020: Commercial launch
- Jun 2020: First 1 million signups
- Sep 2020: 5G launch
- Jan 2021: 1GB Free for any user
- Aug 2021: Over 5 million accounts
Four strategic innovations enabling transformation

- Disaggregated Radio
- Unified Cloud
- Massive Automation
- Platform Organization
Our architecture vision and design principles

<table>
<thead>
<tr>
<th>5G RADIO</th>
<th>HARDWARE</th>
<th>CLOUD INFRA</th>
<th>PLATFORM</th>
<th>OPERATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>O-RAN ARCHITECTURE</td>
<td>STANDARD COTS</td>
<td>COTS-BASED MEC DESIGN</td>
<td>CLOUD NATIVE TELCO PLATFORM</td>
<td>AUTOMATION &amp; AI OPS</td>
</tr>
<tr>
<td>Disaggregated and Cloud Native RAN Architecture</td>
<td>x86 COTS hardware for the entire network infrastructure</td>
<td>Optimal mix of edge data centers and central data centers</td>
<td>Unified E2E platform designed for elasticity, security, networking, and scalability</td>
<td>Automation for everything supported with AI models</td>
</tr>
</tbody>
</table>

Rakuten Mobile Japan Cloud Native Architecture

- **Network Capabilities**:
  - Transport Capacity: 8 Tbps
  - Fiber Length: 5,061 km

- **Fronthaul**: 32,000+
- **4G/5G O-RAN Macro + OIDSs**: 50,000+
- **4G Femtos**: 38,000+
- **Regional Data Centers**: 50+
- **Central Data Centers**: 3

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Ranked among the best networks of the world

Rakuten Mobile named a 5G Global Leader
OpenSignal 5G Global Mobile Network Experience Awards 2021
Vision
Connect everything to fulfill its potential for a sustainable future

Purpose
Empower industries, societies and individuals to transform themselves through cloud, edge and automation technologies
# Rakuten Symphony

Organized around five unique business opportunities

<table>
<thead>
<tr>
<th>Internet &amp; Ecosystem Services</th>
<th>Membership &amp; Loyalty Platforms</th>
<th>Media &amp; Gaming Platforms</th>
<th>Payment &amp; Finance Platforms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Experience</td>
<td>Business Support System</td>
<td>Marketplace</td>
<td></td>
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<tr>
<td>Intelligent Operations</td>
<td>Operation Support Systems</td>
<td>Network &amp; Service Orchestration</td>
<td>Automation &amp; Artificial Intelligence</td>
</tr>
<tr>
<td>Network Functions</td>
<td>RAN</td>
<td>CORE</td>
<td>EDGE</td>
</tr>
<tr>
<td>Unified Cloud</td>
<td>Cloud Infrastructure</td>
<td>Cloud Orchestration</td>
<td></td>
</tr>
</tbody>
</table>
Collaboration in Technology and Policy Groups

Rakuten Symphony is designed and built upfront as a platform to enable co-innovation and openness:

**Leveraging open-source technology** across the board as a critical enabler to drive innovation and openness:

- Actively driving and **co-innovating on key industry** cloud native open source initiatives such as:

  - Telecom Infra Project
  - O-RAN Alliance
  - Open RAN Policy Coalition
  - Cloud Native Computing Foundation

- Creating a **global network of co-innovation labs** with Rakuten Symphony customers:
  - Tokyo
  - San Mateo
  - Rome
  - Bangalore
  - Singapore
Leading OpenRAN greenfield competition
Driving brownfield telco transformation

OpenRAN Greenfield Innovators
- Rakuten Mobile
- 1&1
- dish

Early Brownfield Adopters
- Telefónica
- stc

Majority Operators

2019  2021  2023  2025
Road to vRAN

Kaustubh ‘KJ’ Joshi, Director – AT&T Labs

Nov 10, 2021
AT&T’s road to vRAN

State of the Union

75% core network virtualized by 2020 (1)

=> RAN is next

Nation’s best 5G network (2)
100M+ devices, 250M covered by 5G

Aggressive C-band rollout
70-75M covered by 2022, 200M by 2023 (3)

Early days for VRAN
FDD stable, TDD maturing

Brownfield is critical
Seamless customer experience, integrity

Previous announcements
Early pilots and partners

More will follow

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(2) https://about.att.com/story/2021/att_nations_best_5g.html
AT&T’s Road to vRAN
The deployment perspective

Life’s great ...

H/w supply chain - more choices, different power/perf tradeoffs
Rapid h/w improvement
More deployment flexibility
Automation
Open interfaces

Could be better ...

VRAN s/w feature parity
Brownfield interop - complex classic/VRAN interactions - DSS, CA, CU-DU vs integrated
Manage 3 lifecycles instead of 2 – ZTP critical
RAN/cloud cross-layer observability
Integration/certification
H/w diversity – avoid stranding

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**Large silicon diversity**
- CPU ISA, FEC or PHY accel, NICs (LLS-C1 vs C3)

**RAN is highly distributed**
- 400,000+ cell sites across all US carriers (1)
- 25,000+ COs (potential CRAN hubs) across all US carriers (1)

**RAN more s/w defined**
- RAN, management, automation

**Significant YoY h/w improvements in cap/power**

**Multi-year spectrum rollouts**

**S/w investments must be preserved despite h/w diversity**

The ideal VRAN server:
- Stable interchangeable exterior
- Diverse & innovative interior

Opportunity for open source & standards

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Opportunities for open source & standards – h/w interoperability points

- Field Replaceable Units (common chassis, power, environmental)
- Operations support & automation (BMS)
- VRAN Server (with L1 acceleration)
- RAN DU software/K8s

Leading AAL

Accelerator Abstraction Layer (AAL)
FEC (lookaside) or Hi-PHY (inline)

Using

Trialed OpenEdge
Like sled FF for ease of replacement, need wider adoption of chassis FF

Wider adoption needed - O-RAN can help get critical mass

Highly distributed

400,000+ cell sites in US
25,000+ COs in US (CRAN hubs)

Can't ignore double digit YoY h/w improvements
S/w investments must be preserved despite h/w diversity

VRAN Server
O2

O-RAN

Redfish

DMTF

Operations support & automation (BMS)

Like sled FF for ease of replacement, need wider adoption of chassis FF

Wider adoption needed - O-RAN can help get critical mass
State of Cloud Native Network Modernization

Don Tirsell
Head of Telco Industry Partnerships
November 5th, 2021
Google Cloud unveils strategy for telecommunications industry

Nokia and Google Cloud partner to develop new, cloud-based 5G radio solutions

Google Cloud and Ericsson Partner to Deliver 5G and Edge Cloud Solutions for Telecommunications Companies and Enterprises

Google joins the O-RAN ALLIANCE to advance telecommunication networks

Introducing Google Distributed Cloud—in your data center, at the edge, and in the cloud

AT&T and Google Cloud Expand 5G and Edge Collaboration

AT&T and Google Cloud Expand 5G and Edge Collaboration to Deliver Next-Generation Business Outcomes
Accelerate the journey to cloud-native networks

Anthos provides an open, multi-vendor platform for hosting cloud-native network functions - increasing velocity and flexibility. Transform your network by leveraging Google's leadership and best-practices in Kubernetes, orchestration, security, service mesh and CI/CD.

Reduce TCO of software-based networks

Anthos helps simplify network functions hosting, onboarding and orchestration - reducing infrastructure and engineering spend. Seamlessly leverage public cloud capacity for bursting, unexpected growth or to rapidly trial new capabilities.

Unlock speed, low latency and scalability with Network Functions on the Edge

Increase your performance of network functions with Anthos. Distribute your network to the Far Edge with low-footprint, efficient hosting - enabling reduced latency and unlocking new architectures (e.g. RAN disaggregation).

Solution status: Controlled availability for customer pilot programs
The journey from VNF to CNF

There is a significant change in how CSP Network Functions are designed, deployed and operated as we evolve from legacy Virtualized Network Functions (VNFs) to modern Cloud-Native Functions (CNFs).
Open RAN Challenges & Opportunities

- Everyone wants to “Monetize”, few know how, need guidance
- Legacy RAN replacement is taking considerable CSP bandwidth
- 5G ‘Cloud Native” buildout is just starting but accelerating
- Cloud RAN/VRAN Pilots are now feasible on Cloud Native
- Google is active in ORAN, Kubernetes, Service Mesh, KRM standards
- 2022 Goal - Launch several Cloud RAN market trials
Q&A

• Can you talk about your experience deploying 5G Cloud RAN and vRAN, what were the key benefits and where is there room for improvement?

• What does the industry need to do to accelerate adoption?

• What comments do you have regarding scalability nationwide and globally?
Call to Action

How to get involved in the Project/Sub-Project Community

• Telco Edge team meets at 10 am Pacific, 1 pm Eastern time on the 2\textsuperscript{nd} Tuesday of each month
• Call Calendar – www.opencompute.org/projects/telco

Where to find additional information (URL links)

• Project Wiki with latest specification –
  www.opencompute.org/projects/openedge-sub-project
• Mailing list – ocp-all.groups.io/g/OCP-Open-Edge
Thank you!
“A journey of a thousand miles begins with a single step.”
– Lao Tzu