

OpenRAN and 5G

John Baker
SVP, Business Development
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Introduction

What is OpenRAN

Benefits of OpenRAN

OpenRAN Integration (and Fake News)

The Next Generation Network

Summary



What is the Difference Between OpenRAN, O-RAN and vRAN?

OpenRAN - disaggregated RAN functionality built using open interface specifications between elements. Can be implemented in vendor-neutral hardware and software-defined technology based on open interfaces and community-developed standards.

O-RAN — refers to the O-RAN Alliance or designated specification. O-RAN Alliance is a specification group defining next generation RAN infrastructures, empowered by principles of intelligence and openness.



vRAN — an implementation of the RAN in a more open and flexible architecture which virtualizes network functions in software platforms based on general purpose processors.

vRAN utilizing open interfaces is one component of OpenRAN

What is OpenRAN?

Takes better advantage of the **rapid advances in computing power** delivered by Moore's Law. The data center industry experienced a similar disruption back in the 2000s.

Reduces **capital and operational/maintenance expenses** since there is competition among many different layers of the hardware and software supply chain.

Uses software components to not only replicate existing core network, radio and base station functionality, but **introduce new capabilities as they are developed**.

Operation and maintenance of an OpenRAN system is **simplified** because the hardware is standardized, and the software does not rely on purpose-built components.

Enables **edge centric architecture** – multiple mini data centers can be built closer to subscribers, especially in high population areas, to serve subscriber needs and support low latency connectivity for 5G applications

Uses **best of breed** components and software in architecting the network.



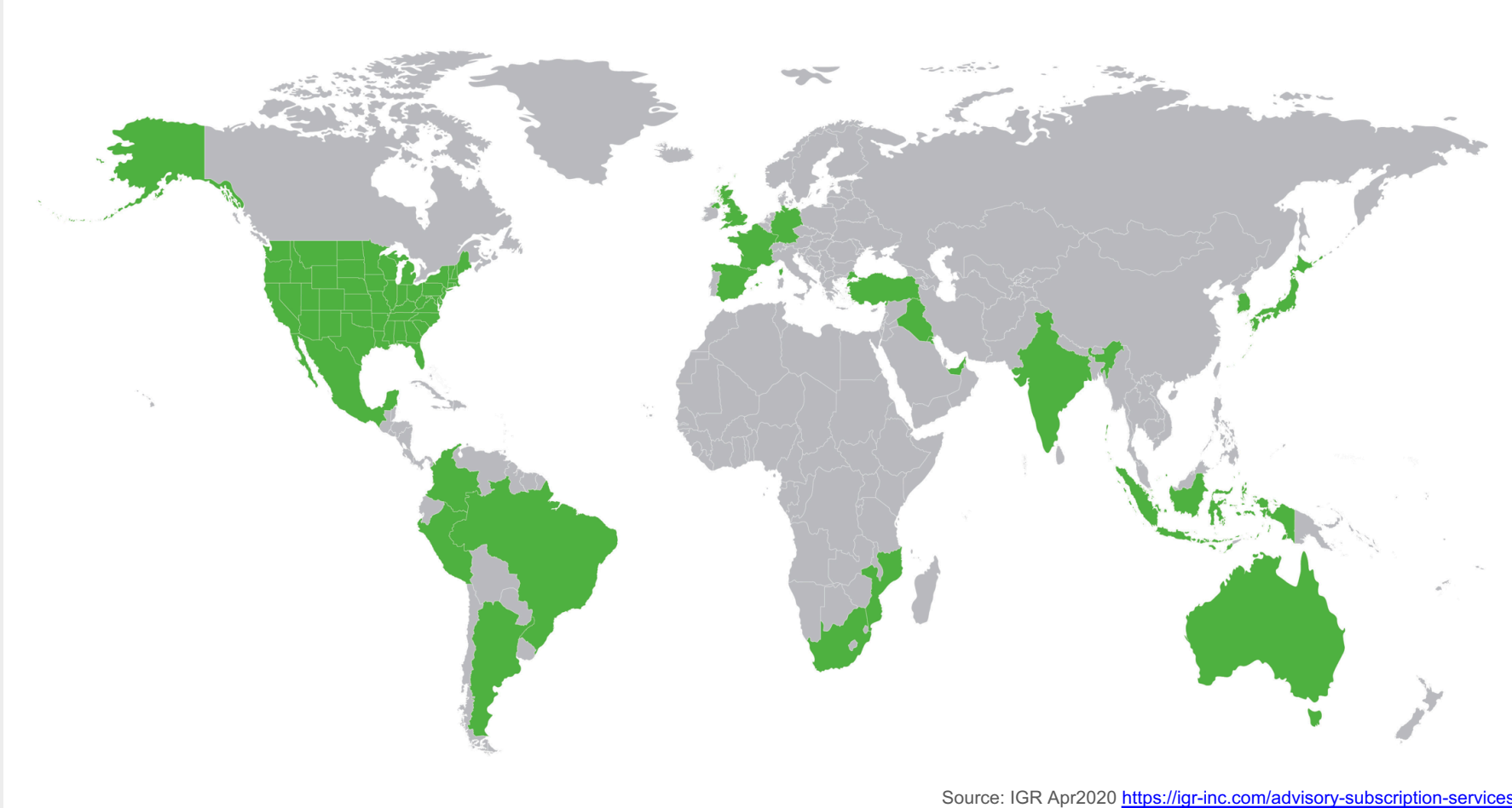
Widens
the
supply
chain

Benefits of OpenRAN for the Mobile Operator

- **Lower Costs:** – both CapEx and OpEx
- **Lower Deployment Times:** – virtualized RAN can be deployed faster than a traditional architecture since the only site installation required is for the radio and power (plus the DU if there is no local data center). The remainder of the installation uses remote software loads which **do not require an additional site visit**.
- **More options:** Upgrades from multiple vendors to future-proof the network evolution
- **Less Danger of Vendor Lock-in:** - Incoming Open RAN vendors' equipment will work with the incumbent and future vendors' solutions
- **Easier to Scale:** - disaggregating hardware from software enables carriers to respond more quickly and in a more targeted fashion when they need to increase/decrease or relocate capacity
- **Easy to add massive scale:** Ability using web scale approach, if needed



OpenRAN Commercial Deployments (*as of April 26th, 2020*)



Source: IGR Apr2020 <https://igr-inc.com/advisory-subscription-services/research-catalog/>

The Radio Access Network (RAN) = Radio Unit and Baseband Unit

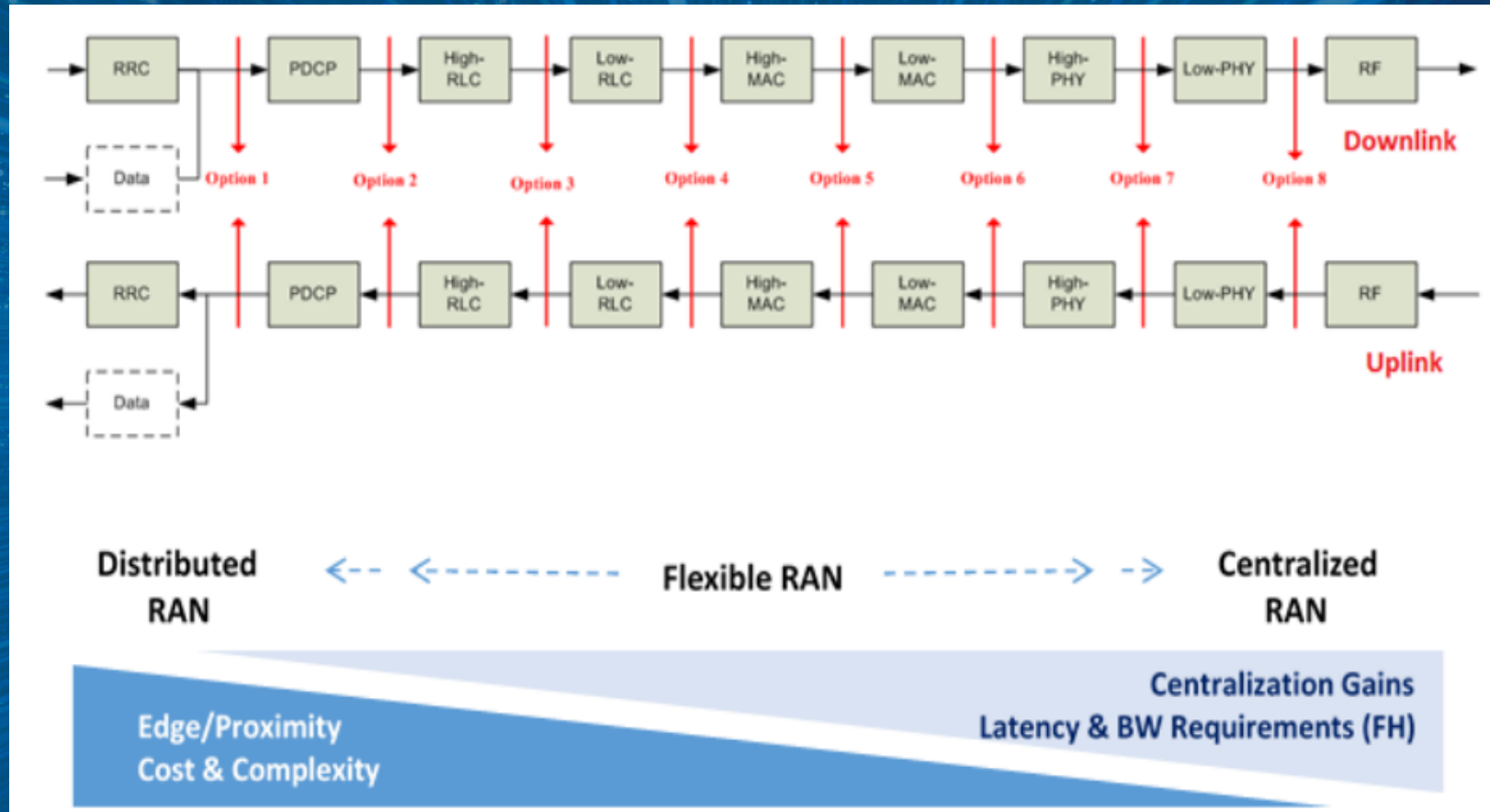
Existing RAN architecture issues:

1. Proprietary closed interface RAN product:
2. Bundled proprietary hardware and software from the OEMs is costly
3. Difficult to reprogram the RAN to meet application requirements

OpenRAN enables:

1. Vertical applications which have different network requirements in terms of performance, capacity, latency etc. vertical applications.
2. Centralized and virtualized baseband can provide pooled virtualized network functions that can dynamically allocate different resources through network slicing to efficiently and effectively
3. Creation of architecture on the fly to fit the needs of the applications

RAN Split Options



O-RAN architecture

- The O-RAN architecture supports both the Higher Layer Split (HLS) being specified by 3GPP
- O-RAN Alliance has adopted the previous conclusions of the xRAN Forum to standardize on a specific decomposition of functions between the O-RU and O-DU, termed 7-2x split.
- This split can also be configured to operate in two distinct modes, termed Category A and Category B.
 - “Category A” mode of operation
 - the pre-coding and resource element mapping operate in the O-DU
 - “Category B” mode of operation
 - the pre-coding functions are moved below the split
 - fronthaul interface to transport MIMO layers. In such a configuration
 - “modulation compression” can be used in the DL to effectively send only the bits equivalent to the constellation points
 - resulting in the bandwidth approaching that of alternative 7-3 splits
- Using such an approach, a converged fronthaul interface can be used to support a variety of use cases, from outdoor massive MIMO, to simple indoor transmit diversity systems.

RRU
REMOTE RADIO UNIT

DU
DISTRIBUTED UNIT

CU
CENTRALIZED UNIT

OpenRAN Deployments underway

OpenRAN is more than virtualized RAN

Significant Cost Savings

1 Accenture

...stated that 5G deployments that used COTS hardware and Open RAN software had seen CapEx savings of **49%** compared to traditional deployment options.

2 Senza Fili

...estimated savings for a cloud RAN deployment to be **37%** over five years, compared to a DRAN deployment. Specifically, the study showed a **49%** savings in CapEx in year one and a cumulative **31%** savings in OpEx over the five years

3 Strategy Analytics

...modelled the TCO of Open RAN over a five-year period. This model showed **40%** lower CapEx and **34%** lower OpEx compared to a legacy RAN

4 Vodafone

shared network performance information from its OpenRAN deployment in Turkey.

Vodafone stated that the network has achieved 96 KPIs in both 2G and 4G networks; achieved QoS levels that are already acceptable (as of October 2019); and that, as of October 2019, that network optimization was ongoing, and they expected to achieve the target KPIs soon.

Multi-Vendor RAN Interoperability using O-RAN Open Fronthaul



- Lower RAN TCO
- Faster innovation from diverse ecosystem
- Increase RAN supplier diversity
- O-RAN open Fronthaul interface
- TIP Evenstar Project - \$1500 Radio Unit from MTI
- Mavenir Base Band Unit

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THE DAILY FAKE NEWS EXAMINER



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Today's Fake News

OPEN RAN UNFEASABLE! JUST READ THESE "FACTS"

Integration

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Not open interfaces Support for Mimo

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Horizontal versus vertical integration

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KPI's

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More Expensive

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Split 7.2 versus 7.3

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More Power consumption

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OpenRAN Integration

1

Open RAN ecosystem integration includes the hardware, software, systems integrators, data centers and MNOs.

- The systems integrator will be responsible for integrating across the entire solution including integrating open radios. To ensure the ecosystem thrives and performs as required, the SI can be impartial and not aligned or associated with a specific hardware or software vendor.

2

System integration of the Open RAN software on COTS hardware.

- This level of integration resembles what occurs in the data center environment. In fact, many of the same tools and principles are used, which further eases Open RAN adoption.

Easy to Counter – the arguments against Open RAN integration

OLD ARGUMENT - DETAIL

1. MNO will need to integrate Open RAN solutions themselves

- With multiple vendors, solution is not integrated
- MNO will be responsible for the cost of integration
- Leads to higher overall costs and delayed time to market

2. High risk for network reliability

- With network elements from different vendors, network reliability will be compromised
- Identifying network issues more complex with multiple vendor software and hardware

CURRENT SITUATION

- Multiple vendors have developed their Open RAN solutions specifically to be integrated onto hardware and with other software
 - Systems Integration can be done by vendors or operators with numerous Open RAN deployments in live MNO networks
 - H/w and s/w vendors followed data center integration best practices from well established IT world
 - MNOs deployed Open RAN find integration costs no higher than traditional single-vendor approach
 - Traditional approach to deploying RAN still requires integration between different vendors – for example, for OSS/BSS, EPC and RAN and there are associated service agreements with each vendor
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- Open RAN network deployments have demonstrated ability to support large subscriber bases and meet network performance KPIs
 - Network management tools have been developed for Open RAN, meaning that any issues can be quickly identified and resolved
 - Modularity will help operators audit and determine problems with their network faster.

Source: IGR Apr2020 <https://igr-inc.com/advisory-subscription-services/research-catalog/>

3. Lower overall network performance

- Network elements from multiple vendors means overall network performance compromised
- Disparate network elements cannot be integrated to maximize performance

- Real Open RAN network deployments demonstrated support of large subscriber bases with network performance KPIs met.
- Vodafone KPIs from Open RAN deployment in Turkey are comparable to KPIs from the legacy vendors
- Software-based RAN allows for more rapid deployment of upgraded features, enabling operator to fine tune performance features for their network and roll out advanced new features like carrier-aggregation to boost performance.
- DevOps approach with CD/CI can push updates quickly to many different sites, all automated and orchestrated

4. Lower CapEx solution cost savings not realized

- Use of disparate RAN vendors results in higher initial costs, since overall volumes are lower than using a single RAN vendor

- Actual Open RAN network deployments by multiple MNOs have resulted in significantly lower costs – both CapEx and OpEx (40 percent according to Rakuten (Source: Qualcomm press event 03/2020)
- Numerous TCO studies also prove and support similar CapEx and OpEx savings (up to 40 percent) (Source: Senza Fili, Strategy Analytics)
- COTS h/w is generally lower cost, due to massive scale across enterprise IT, data center industries etc
- Software can be developed and scaled quickly and at lower cost using modern tools and practices such as DevOps, leading to lower operational costs.

5. Overall costs higher than traditional

- Even allowing for a lower cost software-based RAN solution on COTS, the overall deployment cost (including integration) will be higher

- Actual Open RAN network deployments by multiple MNOs have resulted in significantly lower costs – both CapEx and OpEx (40% Rakuten)
- Some MNOs have stated that Open RAN integration costs have actually been lower than for the traditional approach

Source: IGR Apr2020 <https://igr-inc.com/advisory-subscription-services/research-catalog/>

6. Systems integration lacking

- Open RAN solutions have not been integrated
- S/w solutions are not integrated, and that software is not integrated onto hardware

- Multiple MNO deployments show that different software components have been integrated
- Rich ecosystem of vendors for radios, baseband hardware and software already working together to ensure integrated solutions

7. Less secure

- Open RAN deployments are inherently less secure than the traditional single-vendor approach

- Open RAN deployments have followed data center, private cloud, and enterprise IT integration and security best practices
- More auditable interfaces for MNOs to control of their own security vs black box from traditional vendors
- Security is a joint responsibility across the vendors and the MNO versus a single vendor

8. Ecosystem not developed to support MNOs

- No developed ecosystem of vendors to support the national MNO
- MNO will be responsible for installation, maintenance and operational tasks

- A wide range of specialist RAN software vendors developing and deploying solutions
- Multiple vendors in ecosystem creating blueprints for available and well tested solutions
- Developed ecosystem includes Intel, Cisco, Fujitsu, MTI, VMware, Qualcomm, Airspan, NEC, Dell, Red Hat, Quanta, Gigatera Communications, Xilinx, Sercomm, Supermicro and others have announced building or contributing to Open RAN.
- The radio hardware ecosystem is rapidly developing with Telecom Infra Project (TIP) leading the Evenstar h/w development.

9. Only suited to greenfield MNO deployments

- Open RAN does not integrate well with the existing legacy 2G and 3G deployments
- The number of actual deployments, and therefore the scale, is limited to greenfield MNOs only

- Multiple MNO deployments show that Open RAN can support legacy technology networks as well as new 4G LTE and 5G deployments
- Some of the largest MNOs are deploying Open RAN for their running legacy architecture networks

OpenRAN vRAN compares equally to Distributed RAN (D-RAN)

LTE

99%

LTE Call Setup

100%

CSFB

0.48%

LTE Call Drops

98.42%

HO Success Rate

50mbps

DL Throughput @
15MHz

15mbps

UL Throughput @
15MHz

200

Connected Users per cell

VoLTE

96%

VoLTE Call
Setup

<1%

VoLTE Call
Drops

3.56

MOS
Score #

- Held to the same KPIs as incumbents
- Good KPIs and stability



Source: Mavenir

Summary

- OpenRAN network awards, POCs and deployments are happening worldwide
- System Integration – No Change
- Open standards and interfaces are achievable – Open to improvement
- OpenRAN ecosystem exists
- OpenRAN is Not a revolution – Needs Carrier adoption
- Moving the core to the edge enables 5G low latency services and a profitable business plan.

With 4G & 5G, the Industry is seeing a Significant Transformation
Beware of those that want to hold onto the past.



Thank You

John Baker
SVP Business Development
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Connect :
[linkedin.com/in/johnmarkbaker/](https://www.linkedin.com/in/johnmarkbaker/)
John.baker@mavenir.com