Publication date:
November 2021
Author:
Rémy Pascal

Japan is open vRAN global leader

Commissioned by:

Brought to you by Informa Tech

Contents

Summary

This white paper introduces the concepts of virtual RAN and open RAN and explains how these new approaches to building mobile networks are transforming the ways service providers design, build, operate, optimize, and maintain their mobile networks and particularly their radio access networks. It presents the key benefits operators can expect from the adoption of virtual RAN, including flexibility, scalability, agility, innovation, vendor diversity, cost of ownership, and simplicity of operations.

The second part looks specifically at the case of Japan. Japan has been an early adopter of both vRAN and open RAN, and thanks to its favorable market environment and its operators' initiatives to accelerate the adoption of open vRAN, it has become a de facto benchmark for operators around the world. In fact, even Japanese operators are only at the beginning of their network transformation journey, but their deployments will prove educational for the industry as a whole.

Such early deployments are also an opportunity for Red Hat and Intel to validate and demonstrate the solutions and capabilities they offer to support service providers' transformation.

A brief introduction to vRAN, open RAN, and RAN functional disaggregation

Mobile network operators around the world are continuously investing in their network to augment their capacity to address the rapidly increasing traffic and to support new applications and scenarios. However, the traditional approach where mobile networks are built using dedicated equipment presents some limits in terms of scalability, flexibility, and agility.

This is why telecom operators have been looking for new approaches and ways to modernize their networks. Network function virtualization (NFV) introduced the concept of deploying network functions on virtual machines (VMs) running on general-purpose infrastructure instead of dedicated hardware. This trend started about a decade ago in the core network domain, and because many operators are now well advanced in the transition, they are moving into the next phase, the virtualization of the radio access network (RAN) domain.

Virtual RAN (vRAN) creates the possibility of disaggregating the base station hardware and software and of running the baseband software function on generic commercial off-the-shelf (COTS) servers. A further evolution is to run RAN functions as microservices on containers instead of virtual machines and to adopt cloud principles such as DevOps and GitOps.

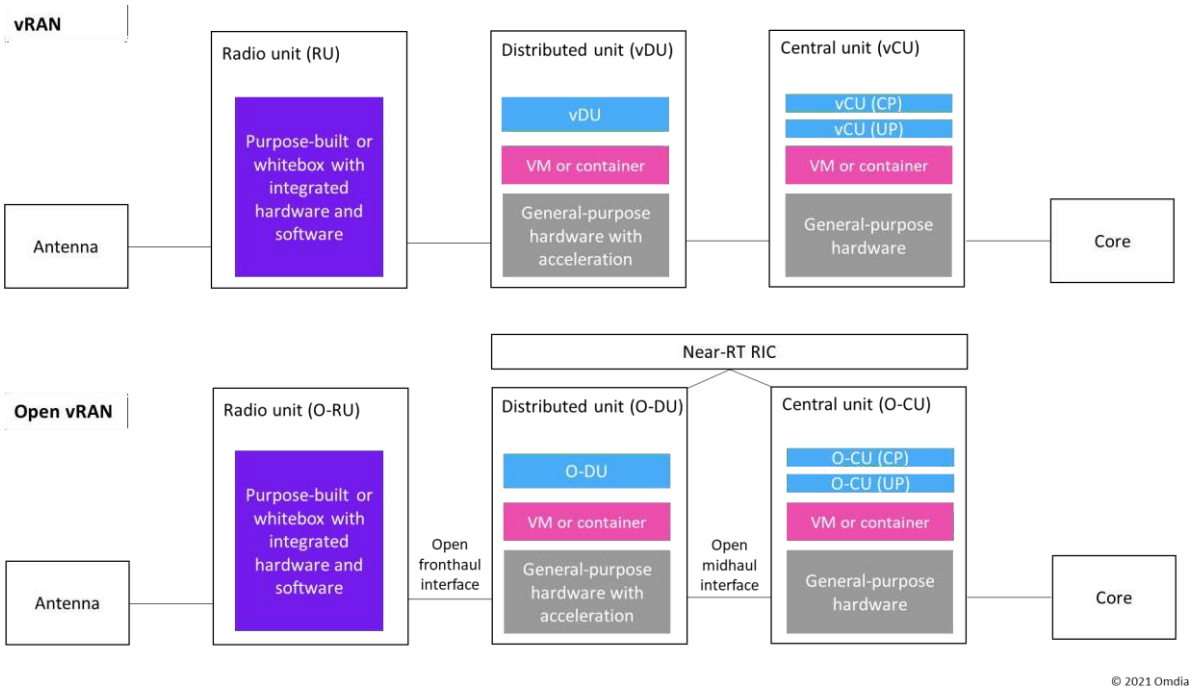
Recently, operators have also shown a lot of appetite for open RAN. Open RAN describes the opening of interfaces within the radio access network domain and, in particular, the interface between the two main elements that constitute the base station: the radio unit (RU) and the baseband unit or digital unit (BBU or DU), known as the fronthaul interface. Opening interfaces enables buyers to separately purchase the RU and the DU and mix and match products from different vendors.

A third trend is the functional disaggregation of the RAN. The 3GPP release 15 and the O-RAN Alliance define functional disaggregation of the baseband unit into a central unit (CU) and a distributed unit (DU) offering new architecture options and more possibilities in terms of disaggregation and distribution or centralization of resources.

vRAN, open RAN, and RAN functional disaggregation will transform the way service providers build and operate their mobile networks. While they are still at an early stage, Omdia observes that these trends have gained significant momentum in the past few months, with many operators around the world committing to adopt these new approaches and many others evaluating them and testing them.

It is also important to understand that vRAN can be implemented regardless of open RAN and that, inversely, open RAN and open interfaces can also be implemented without virtualization. Effectively, open RAN is often associated with virtual RAN (vRAN) because the two are complementary and it is the convergence of the two into open vRAN that will enable operators to maximize the benefits of the transformation.

Figure 1: vRAN and open vRAN simplified architectures



Source: Omdia

The expected benefits of RAN virtualization

The key benefits of opening interfaces, including the possibility of introducing new vendors and selecting best-of-breed solutions, as well as fostering price and technology competition, are well understood by the telecom community.

Virtualization and hardware/software disaggregation also facilitate the introduction of best-of-breed vendors (of hardware, virtualization layer, and virtual network functions or VNF), and vRAN also brings additional benefits in terms of flexibility, scalability, efficiency, and time-to-market reduction, which are summarized in figure 2.

Those benefits are known by operators that have already virtualized their core network, but due to the sheer size of the RAN, virtualization in this domain can potentially be more transformational. Operators believe that the open vRAN approach is promising, but they also realize that RAN virtualization will be complex and potentially more challenging than virtualization in other network domains due to the specificities of the RAN, including the need for real-time processing and timing and synchronization requirements.

When vRAN was first introduced, vRAN vendors themselves acknowledged some challenges, particularly around latency, performance parity, features parity, and energy efficiency when compared with integrated, purpose-built RAN solutions. vRAN offerings, however, have developed very fast in the past few months and vRAN is closing the gap. In terms of performance improvement, for example, RAN-specific hardware accelerators that complement generic processors and handle some of the most demanding workloads play a key role.

In its *5G Open RAN Ecosystem whitepaper* published in June 2021, NTT DOCOMO disclosed the target for performance improvement it has set for vRAN in terms of number of cells supported per server (64T64R massive MIMO and 4T4R radio units), DL and UL throughput, and power consumption. Those targets are set in comparison with the level of performance observed by the operator for solutions available at the time of the white paper publication. Those targets are ambitious but the operator itself says that targets “should be achievable in a year … and also exceed current gNodeB performance installed in many operators.” This shows a certain optimism about the ability of vRAN to close the performance gap.

Figure 2: Key benefits expected from the adoption of vRAN

Expected benefit	How is it realized?
Flexibility, scalability, and optimization of resources 	• Scale-in and scale-out easily via the addition of virtual machines or container-based resources, enabling the capacity of the network to be precisely adapted to the actual demand in real time. • A horizontal cloud platform across access, edge, and core will play a critical role, ensuring consistency and reducing integration efforts.
Easier and faster innovation 	• Installation, configuration, updates, and upgrades are software based and, therefore, can be introduced to the market faster and in a continuous manner. • It is possible to benefit from innovation from the broader IT/cloud community both in terms of hardware (including silicon) and of software (including open source).
Greater vendor diversity 	• A larger choice of suppliers is available with new entrants. • Disaggregation enables the supply of different components from different vendors and the selection of best-of-breed components from specialists in each area (COTS hardware, acceleration, virtualization, vRAN software), rather than having to buy an end-to-end integrated system from a single supplier.
Lower total cost of ownership 	• The use of COTS servers and of common infrastructure across domains (RAN, core, OSS/BSS) reduces the capex. • The pooling and sharing of hardware resources enables increased resource utilization and the simplification of cell sites, which in turn means a small footprint and rent and fewer site visits, etc. • Automation is necessary to deploy and maintain vRAN. A zero-touch approach to automation is the desired state to realize the reliability and resilience and for self healing and scaling of a highly distributed system.
Simplify operations and improve operational agility 	• Automated service provisioning reduces human intervention and associated costs. • Operators are able to manage and maximize the lifecycle of their RAN. • Simplified workflows reduce complexity and ensure reliability.

Source: Omdia

Omdia's view: The global perspective

While still in its early development, Omdia observes that operators in Japan and many other parts of the world are increasingly interested in open vRAN and how it can benefit them. There is a strong and undeniable open vRAN momentum as seen in the membership of and participation in organizations like the O-RAN Alliance and the Telecom Infra Project, the number of trials and deployments, and operators' announcements of their commitment to adopt open RAN.

The open vRAN concept was initially championed by a greenfield operator, Rakuten Mobile, but it has been rapidly adopted by a number of brownfield operators too, and noticeably not just the ones in the most technology advanced markets, but in all types of markets and on all continents.

While most initiatives are often small-scale, the size of trials and deployments also tends to grow from a few sites initially to dozens or sometimes hundreds now. There is also an increasing variety of scenarios and use cases considered, including rural and urban deployments, outdoor and indoor, and public and private networks. In some countries open vRAN also benefits from political support. This transformation would have likely happened anyway, but external factors could contribute to the acceleration of adoption in some cases.

In terms of vendors, open vRAN is actively promoted by a few market pioneers, pure players, and new entrants, but RAN incumbents are now also adding vRAN offerings to their portfolio and opening their interfaces as a response.

Omdia believes that while purpose-built integrated RAN will continue to be dominant for years, open vRAN deployments will play an increasingly important role, and this segment will grow faster than the rest of the market. In its current forecast, Omdia estimates that open vRAN deployments will represent approximately 10% of the $35bn RAN market globally by 2025.

Japan is open vRAN global leader

The market environment in Japan is favorable to the adoption of vRAN

Japan offers a favorable environment for the development of open vRAN for various reasons. Firstly, it is a mature and advanced telecom market and an early adopter of the latest technologies such as 5G and virtualization. This is also a quality-focused market where operators invest in the best available solutions and the most advanced functionalities rather than being low-cost oriented. Japan is also an increasingly competitive market, particularly since Rakuten Mobile entered as the fourth mobile network operator (MNO), and competition is not just price based but also technology and network based.

Japan is also special because of the quality of its transport network. The fiber infrastructure is widely available and connects a majority of cell sites, which has enabled Japanese operators to use a centralized RAN (C-RAN) architecture since the early stage of LTE. Japan is one of the few countries that have had the fiber resources to support the capacity and latency requirements of fronthaul links between remote radio units and centralized baseband units for many years. This will serve as the foundation for the deployment of vRAN.

By pooling baseband resources in baseband hotels or datacenters rather than distributing the resource at cell sites, operators can realize savings in terms of rent, electricity, and cooling. They can also achieve faster deployment and reduce the need to visit cell sites.

Japanese operators are embracing open vRAN

Rakuten Mobile is the undisputed pioneer in open vRAN. It was the first operator in the world to deploy open vRAN at scale and, as a matter of fact, nationwide. Rakuten Mobile's network ticks all the boxes: it is virtualized, disaggregated, and open.

- Rakuten Mobile operates a virtual and disaggregated network with very lean cell sites (only radio and antennas) and the rest of the network functions run as software on commercial off-the-shelf servers at edge and central locations.
- Rakuten Mobile is on a journey to move from virtual machine-based vRAN toward a fully cloud-native architecture.
- This is a multivendor network with open interfaces and a mix of traditional suppliers and new ones.
- Rakuten also claims an advanced level of automation and application of machine learning to RAN use cases, including radio planning, deployment, and operations.

Rakuten is not the only Japanese operator embracing these new models. NTT DOCOMO has a long history and is well established, but it is nonetheless one of the most innovative operators in the world. NTT DOCOMO was one of the founding members of the O-RAN Alliance back in 2018 and it was one of the first operators to introduce multivendor RAN at site level with open fronthaul in 4G and then again in 5G using an O-RAN compliant fronthaul interface. The operator publicly said that the next stage of its network evolution is the introduction of vRAN with vCUs and vDUs. NTT DOCOMO also operates a virtualized core network.

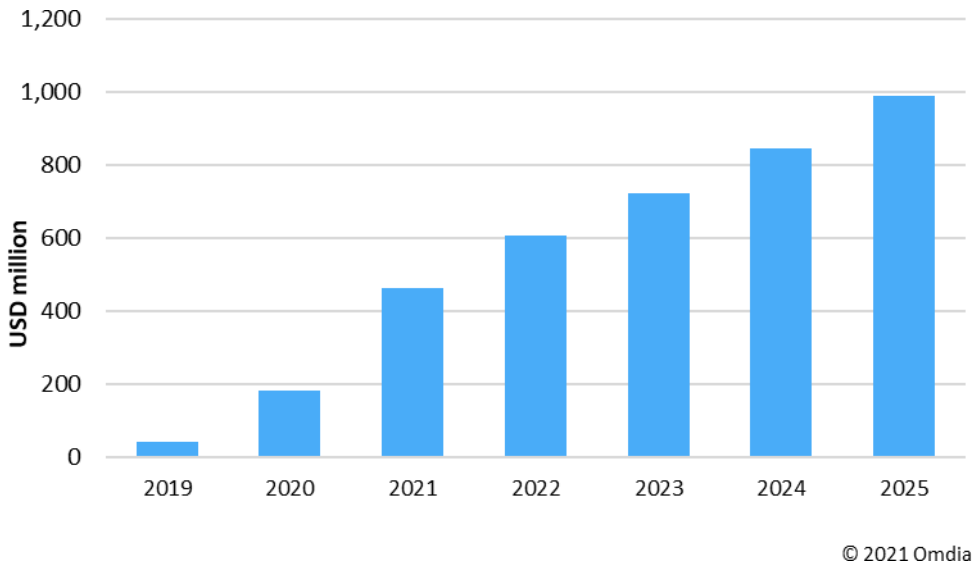
In February 2021, NTT DOCOMO announced the creation of the Open RAN Ecosystem (OREC), an alliance with 12 companies including Red Hat and Intel that aims to cooperate on the development of 5G open RAN.

Finally, KDDI has also recently announced the adoption of vRAN in its 5G network, with commercial deployment expected in the second half of 2022. The operator had also previously revealed its desire to introduce O-RAN compatible radio units in its network from 2021, and it will, therefore, effectively be an open vRAN operator from 2022.

Japan is a clear leader, but it is not the only market in Asia & Oceania where operators conduct open RAN activities. In India, Airtel, Reliance Jio, and Vodafone Idea have open RAN deployments; in Indonesia, the Telecom Infra Project opened an open RAN community lab attracting participation from various mobile operators; in Malaysia and Sri Lanka, the Axiata Group is also conducting trials; and this list is not comprehensive.

Omdia expects Asia & Oceania to be the largest regional market for Open vRAN deployment through 2025 and expects that open vRAN will represent a $1bn opportunity in this region in 2025.

Figure 3: Open vRAN forecast for Asia & Oceania ($ million)



Source: Omdia

Red Hat and Intel enable the transition to open vRAN

Red Hat joined the O-RAN Alliance in 2018 with a primary focus on the network functions virtualization infrastructure (NFVI) platform. Red Hat is one of the world's leading providers of telco-grade open-source solutions, using a community-powered approach to deliver high-performing Linux, cloud, container, and Kubernetes technologies. Red Hat integrates key technologies from open-source communities and is one of the top contributors to OpenStack NFV platform. Red Hat provides a horizontal cloud platform and automation framework that enables the disaggregation of hardware and software and the running of virtualized RAN functions on top of generic servers.

The Red Hat portfolio for vRAN includes Red Hat® Enterprise Linux®, Red Hat OpenStack Platform, Red Hat OpenShift® (Kubernetes-based), and software stack to make network functions run in a cloud environment. Together these solutions enable operators to design, deploy,and orchestrate DU and CU VNF or CNF (container network function or cloud-native network function).

Red Hat collaborates closely with Intel to provide a preintegrated open platform for vRAN and cloud-native RAN combining Red Hat's virtualization layer with Intel's silicon and software. Intel supplies several critical components, including its Xeon processors for general compute; hardware accelerators including its vRAN dedicated accelerator ACC100 (ASIC) and FPGA Programmable Acceleration Card; and the FlexRAN reference architecture now used in most open vRAN deployments around the world.

Such a preintegrated solution enables operators to start from an existing framework when designing and implementing their vRAN, thereby reducing the amount of effort and time required as well as the complexity of the project.

Both Red Hat and Intel are part of NTT DOCOMO's 5G Open RAN Ecosystem (OREC) where they cooperate with other members to harmonize Kubernetes-based CNFs.

Conclusion

vRAN and open RAN will change the way operators supply, design, build, operate, and maintain their mobile networks. They represent an opportunity for service providers to innovate and reduce their costs, but this transformation also represents a major endeavor. Open vRAN is not just about introducing new vendors, it is about introducing new architectures, new ways to deploy and operate the RAN, new processes, and new methodologies. A horizontal cloud platform will allow telecom operators to manage their RAN components in a consistent and efficient manner, driving benefits that include increased agility and reduced costs. This is a fundamental transformation and a multiyear journey.

Operators need to start, and for that they should first clarify their expectations and define their requirements; they should talk to platform vendors and RAN vendors, organize tests in labs, and then in the field. Operators should naturally also verify the business case and when doing that, consider the specificities of the market where they operate, their existing assets, and internal capabilities, as there is no such thing as a standard or guaranteed level of savings. Once they have done all that, operators will be well positioned to decide when and where it makes sense to deploy open vRAN.

Some will start with virtualization, others with opening interfaces; some will try to do both in parallel, but what is probably common to all, except greenfield operators, is that they will start in pilot areas or with pilot scenarios, before progressively expanding to their entire footprint.

Finally, even if they plan to rely heavily on partners, operators should try to acquire a minimum set of skills and internal capabilities to remain in control of their transformation and manage the relationship with their technology providers and partners.

Appendix

Author

Rémy Pascal
Principal Analyst, Mobile infrastructure
customersuccess@omdia.com

Get in touch

www.omdia.com
askananalyst@omdia.com

Omdia consulting

Omdia is a market-leading data, research, and consulting business focused on helping digital service providers, technology companies, and enterprise decision-makers thrive in the connected digital economy. Through our global base of analysts, we offer expert analysis and strategic insight across the IT, telecoms, and media industries.

We create business advantage for our customers by providing actionable insight to support business planning, product development, and go-to-market initiatives.

Our unique combination of authoritative data, market analysis, and vertical industry expertise is designed to empower decision-making, helping our clients profit from new technologies and capitalize on evolving business models.

Omdia is part of Informa Tech, a B2B information services business serving the technology, media, and telecoms sector. The Informa group is listed on the London Stock Exchange.

We hope that this analysis will help you make informed and imaginative business decisions. If you have further requirements, Omdia's consulting team may be able to help your company identify future trends and opportunities.

Copyright notice and disclaimer

The Omdia research, data and information referenced herein (the "Omdia Materials") are the copyrighted property of Informa Tech and its subsidiaries or affiliates (together "Informa Tech") or its third party data providers and represent data, research, opinions, or viewpoints published by Informa Tech, and are not representations of fact.

The Omdia Materials reflect information and opinions from the original publication date and not from the date of this document. The information and opinions expressed in the Omdia Materials are subject to change without notice and Informa Tech does not have any duty or responsibility to update the Omdia Materials or this publication as a result.

Omdia Materials are delivered on an "as-is" and "as-available" basis. No representation or warranty, express or implied, is made as to the fairness, accuracy, completeness, or correctness of the information, opinions, and conclusions contained in Omdia Materials.

To the maximum extent permitted by law, Informa Tech and its affiliates, officers, directors, employees, agents, and third party data providers disclaim any liability (including, without limitation, any liability arising from fault or negligence) as to the accuracy or completeness or use of the Omdia Materials. Informa Tech will not, under any circumstance whatsoever, be liable for any trading, investment, commercial, or other decisions based on or made in reliance of the Omdia Materials.