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Latin America: Delivering Connectivity with Open vRAN

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Summary

This white paper introduces the concepts of virtual radio access networks (vRANs) 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, particularly their radio access networks. It presents the key benefits service providers can expect from the adoption of virtual RAN or open RAN, which include flexibility, scalability, agility, innovation, vendor diversity, lower cost of ownership, and simplicity of operations.

The second part looks specifically at the case of Latin America. Latin America is a diverse region where service providers face numerous challenges including declining average revenue per user (ARPU), and a large population of unconnected people who live in widely spread and isolated rural regions that are characterized by rugged terrain and lack of availability of fiber. A number of service providers view open vRAN as the solution that will enable them to deliver connectivity solutions efficiently by using a horizontal cloud-native platform that seamlessly spans multiple environments. This platform will ensure a service provider's open vRAN architecture is built on a cloud-native foundation that is interconnected with open application programming interfaces (APIs) that increase flexibility and consistency while ensuring total cost of ownership (TCO) is kept low. For this they are deploying open vRAN solutions with their partners to experiment and learn about working with disaggregated software-based networks and cloud-native solutions.

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

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

Service providers around the world are continuously investing in their networks to augment their capacity in order to address the rapid increase in traffic and 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 service providers have been looking for new approaches and ways to modernize their network. Network functions 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 service providers are now well advanced in that transition, they are moving into the next phase: the virtualization of the RAN domain.

Virtual RAN creates an opportunity to disaggregate the base station hardware and software and to run 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 VMs and to adopt cloud principles such as development and operations (DevOps) and GitOps, which describes and observes systems such as the RAN with declarative specifications.

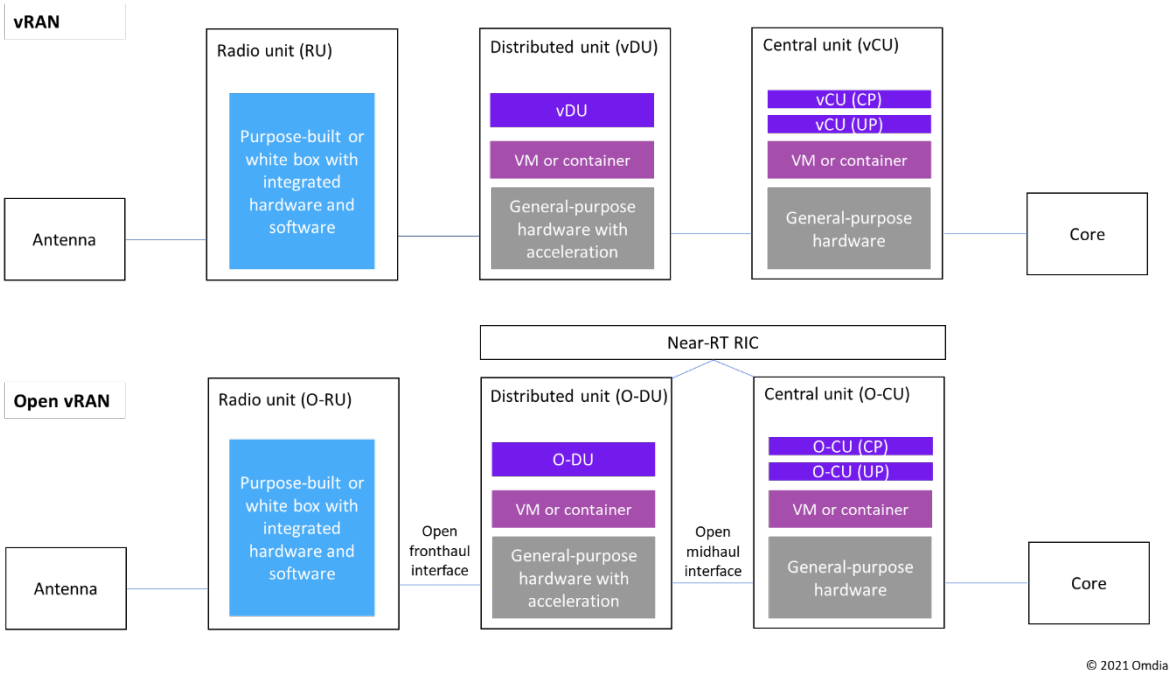
Recently, service providers have also shown a lot of appetite for open RAN. Open RAN describes the opening of interfaces within the radio access network domain and, in particular, the interface between the two main elements that constitute the base station: the radio unit (RU) and the baseband unit (BBU)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

A third trend is the functional disaggregation of the RAN. The 3rd Generation Partnership Project (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.

Cloud RAN, open vRAN, 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 service providers around the world committing to adopting these new approaches and many others evaluating and testing them.

It is also important to understand that vRAN can be implemented regardless of open RAN and, conversely, open RAN and open interfaces can also be implemented without virtualization. Effectively, open RAN is often associated with vRAN because the two are complementary, as summarized in **Figure 1**. The convergence of the two into open vRAN will enable service providers 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 and fostering price and technology competition, are well understood by the telecom community.

Virtualization and hardware/software disaggregation facilitate the introduction of best-of-breed vendors of hardware, the virtualization layer, and virtual network functions (VNFs). In addition, vRAN brings other benefits in terms of flexibility, scalability, efficiency, and time-to-market reduction. These are summarized in **Figure 2**.

Those benefits are known by service providers that have already virtualized their core network, but because of the sheer size of the RAN, virtualization in this domain can potentially be more transformational. Service providers 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. This is primarily because of the specificities of the RAN, including the need for real-time processing and timing and synchronization requirements.

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

Livio Silva, Chief Solutions Architect at Red Hat Americas, in the Open RAN 2021 LATAM Series event held in October, said the following:

We are in an interesting moment in the Latam region, since the service providers are currently in the race to implement 5G while studying and validating the cost benefit of open RAN solutions. Many service providers are visualizing the different deployment scenarios, with emphasis on the split 2 option. This is due to the lack of fiber availability in many cell sites, or poor network quality to guarantee a maximum distance of 20km and 0.1ms latency between the radio unit and the distributed unit to be placed on the far edge. The first deployments, however, are taking place in rural, rather than urban zones. Red Hat is helping the region's service providers work through these challenges.

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 through the addition of VMs or container-based resources, enabling the capacity of the network to be precisely adapted to 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 so 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 in terms of both hardware (including silicon) and 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), instead of having to buy an end-to-end integrated system from a single supplier.
Lower TCO 	• The use of COTS servers and of common infrastructure across domains (RAN, core, OSS/BSS) reduces 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. • 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 open vRAN is still in its early development, Omdia observes that service providers in Latin America and many other parts of the world are increasingly interested in it and in how it can benefit them. There is a strong and undeniable open vRAN momentum, seen in the membership of and participation in organizations such as the O-RAN Alliance and the Telecom Infrastructure Project, the number of trials and deployments, and service providers' announcements of their commitment to adopting open RAN.

The open vRAN concept was initially championed by the greenfield service provider Rakuten Mobile (Japan), but it has been rapidly adopted by a number of brownfield service providers, noticeably not just 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 tends to grow from a few sites initially to dozens or sometimes hundreds. There is also an increasing variety of scenarios and use cases considered, including rural, suburban, and urban deployments; outdoors and indoors; and on public and private networks. In the Latin American countries, a large proportion of the population is rural, and this includes many unconnected people who live in widely spread and difficult to reach communities characterized by rugged terrain and lack of availability of fiber. In other countries, open vRAN has also benefited from political support. While the transformation to open vRAN would likely have happened anyway, external factors can contribute to accelerate adoption in some cases.

Open vRAN is actively promoted by vendors including a few market pioneers, pure players, and new entrants, but RAN incumbents are now also adding vRAN offerings to their portfolios 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 26% of the $2.2bn RAN market in Latin America and 10% of the $35bn RAN market globally by 2025.

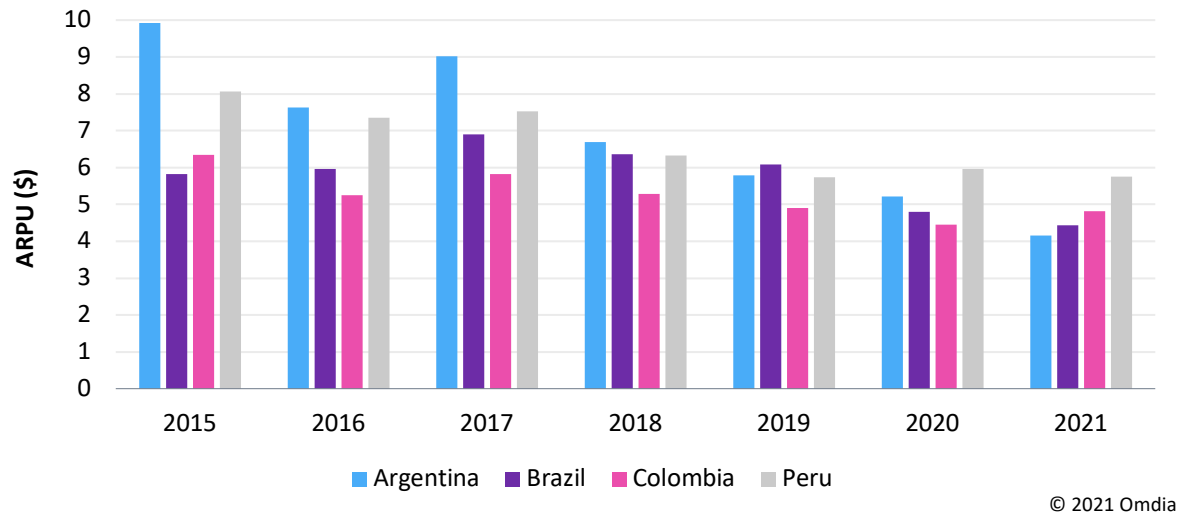
Open vRAN will help Latin America service providers deliver services more efficiently

Service providers in the region face multiple challenges that affect investment decisions

Latin America is a diverse region with a population of more than 670 million (Omdia figures, 2021), where the mobile industry plays an important role in both delivering connectivity and contributing to socioeconomic growth. Omdia estimates that mobile subscription penetration (including Internet of Things devices) will reach 107% of population by the end of 2021, but only 68% of the population has access to 4G mobile broadband (MBB) services. The numerous lockdowns during the COVID-19 pandemic, with the consequent need to work from home while remaining in contact with friends and families, have only exacerbated the customer demand for connectivity and reliable MBB services. This demand led to significant growth in mobile data traffic on most service provider networks in the region.

The service providers understand that they must continue to increase MBB penetration and reduce the digital divide, but they face challenges from declining ARPU as a result of the lack of availability of fiber in rural areas. According to Omdia research, in countries such as Argentina, Brazil, Colombia, and Peru, ARPU fell by 58%, 24%, 24%, and 29% to $4.15, $4.44, $4.82, and $5.76 respectively in the six years to 2021, as summarized in **Figure 3**.

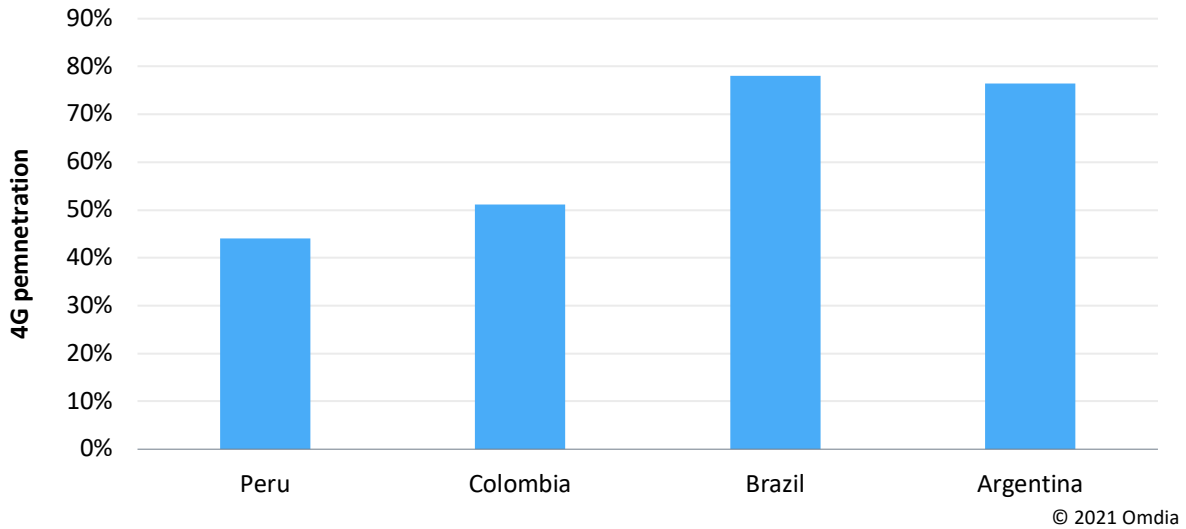
Figure 3: Selected Latin America markets, mobile ARPU, 2015–21



Source: Omdia

The service providers are nonetheless investing in 4G in order to improve access in both densely populated urban cities and rural regions. Omdia forecasts that 4G penetration in Argentina, Brazil, Colombia, and Peru will reach 76.4%, 78.1%, 51.2%, and 44.0% respectively by the end of 2021, as shown in **Figure 4**.

Figure 4: Selected Latin America markets, 4G penetration, 2021



Source: Omdia

Service providers in the region are forward thinking, and despite financial constraints, they have taken steps to reduce network congestion and increase MBB availability. Service providers in several markets have started 5G services in densely populated urban areas since 2020, using dynamic spectrum sharing (DSS) and equipment from their existing RAN vendors. Auctions of 5G spectrum have also taken place in Brazil and Chile. On December 16, 2021 Chile launched the first 5G network, making it the first country in Latin America to auction 5G spectrum and deploy a 5G network nationwide. This paves the way for even more network capacity and reduction in congestion.

Bringing MBB services to the millions of unconnected people in rural and remote villages in the region is both challenging and costly. The terrain often consists of mountains and dense forests, and access to high-quality fiber for backhaul (and fronthaul) connectivity is limited. Furthermore, given the lower ARPU in these regions than in the large cities, the return on investment is over a much longer period.

Like other global service providers, the fast-moving ones in the Latin America region understand that networks are migrating to the cloud. There are a number of expected benefits of cloud migration, which include flexibility, scalability, optimization of resources, and the ability to leverage the latest innovations and choice from a broad ecosystem of vendors. Open and hybrid cloud solutions will be the key to successful open vRAN deployments, with cloud-native container-based platforms providing the necessary deterministic performance to meet the stringent requirements of both vRAN and open RAN. Tools such as orchestration, automation, and zero-touch provisioning and operations will help service providers increase efficiency of complex and dispersed RANs, reduce network TCO, and deliver services to customers in a timely manner. The service providers that benefit most, however, are those that start earlier and make the adjustment to working in these new software-based environments.

Several service providers in Latin America are conducting open vRAN trials

Service providers in the region have announced several open vRAN trials and deployments since 2019. Red Hat has been working with them to support their journey toward telco cloud-native platforms, helping them understand how these reduce network TCO and deliver advanced capabilities for open vRAN workloads that support mobile services for both 4G and 5G.

Table 1: Latin America operators that have adopted open vRAN

Country	Operator	Radio generation	Number of sites	What was deployed
Argentina	Telefónica	4G	14	・Sites were switched on in March 2021 in the city of Puerto Madryn with 81,000 inhabitants. ・The vDU was placed at a far-edge data center (DC) in the city, while the vCU was placed at an edge DC in Bahia Blanca over 650km distance. ・IBM acted as systems integrator, while Red Hat provided the OpenStack cloud platform.

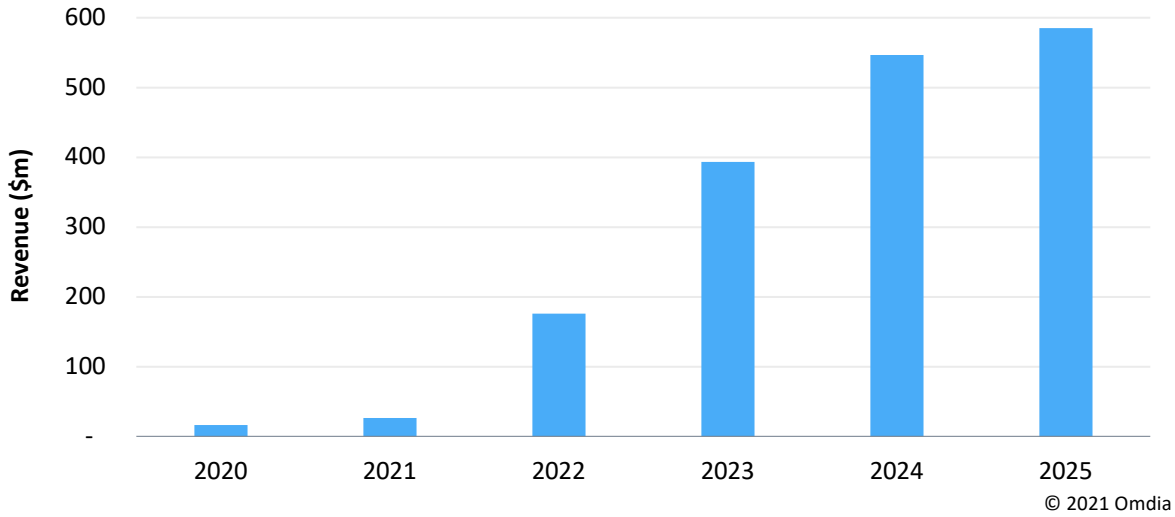
Brazil	Vivo (Telefónica)	4G	800 in total in four markets	• In May 2021, Vivo announced plans to deploy 4G open vRAN in rural regions and for private networks. • Telefónica separately announced plans for its four core markets including Brazil in September 2021. • Red Hats' OpenShift is part of the Telefónica selection in Brazil and could be used as the cloud container platform.
Colombia	Tigo (Millicom)	4G	362	• Tigo deployed open vRAN in May 2021 to cover rural regions. • As part of its 2019 spectrum auction obligations, Tigo committed to deliver services to more than 1,600 rural regions.
Peru	Internet For All (IPT) (Telefónica)	3G & 4G	More than 3,650	• Plans for open vRAN sites in rural Peru announced in May 2019

Source: Omdia

Service providers will succeed with open vRAN if they embrace cloud-native ways of working

Omdia reports four regional forecasts, including one for Latin America & the Caribbean. For Latin America & the Caribbean, we forecast service providers will spend $585m on open vRAN in 2025 (see **Figure 5)** and will deploy most of these in the rural regions and private networks in the early years. Service providers will, however, reap the full benefits of these cloud-native solutions if they develop software competencies similar to those of hyperscalers such as AWS and Microsoft Azure. But many service providers in the region show signs that they have not yet fully acquired these competencies or implemented the organizational changes required. Benefits from cloud-native and DevOps environments that use continuous integration/continuous delivery (CI/CD) and GitOps-based methodologies include accelerated service delivery and mitigated risk through consistent and compliant configuration management and automation.

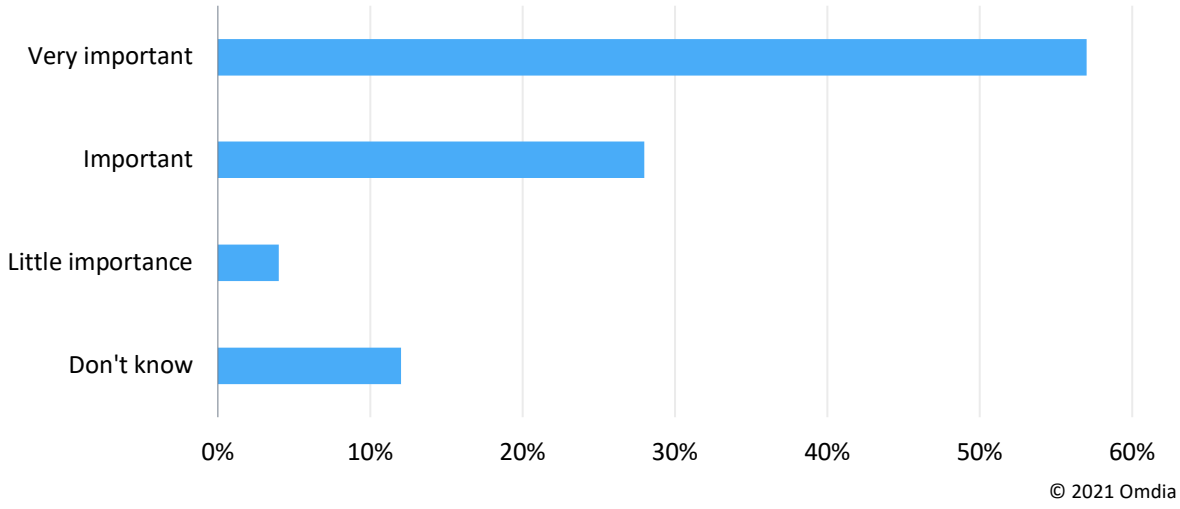
Figure 5: Latin America & the Caribbean, open vRAN forecast, 2020–25



Source: Omdia

Red Hat carried out a number of polls during the Open RAN 2021 LATAM Series event held on June 30 and September 30, attended by more than 700 individuals from the service provider, vendor, and analyst communities in the region. **Figure 6** shows that 85% of the 112 individuals that participated in the poll consider open vRAN deployment for their operations in the next two years as either important or very important.

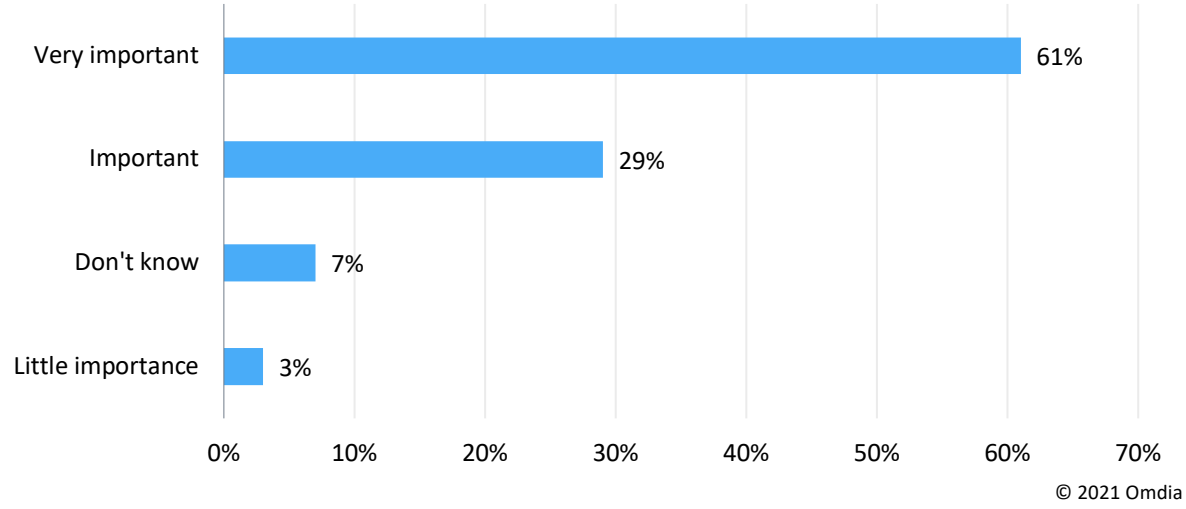
Figure 6: Importance of deploying open vRAN in the next two years



Source: Red Hat

Figure 7 shows the results from another poll showing that 90% of the 143 respondents believe that implementing automation is of importance or high importance to the successful deployment of open vRAN.

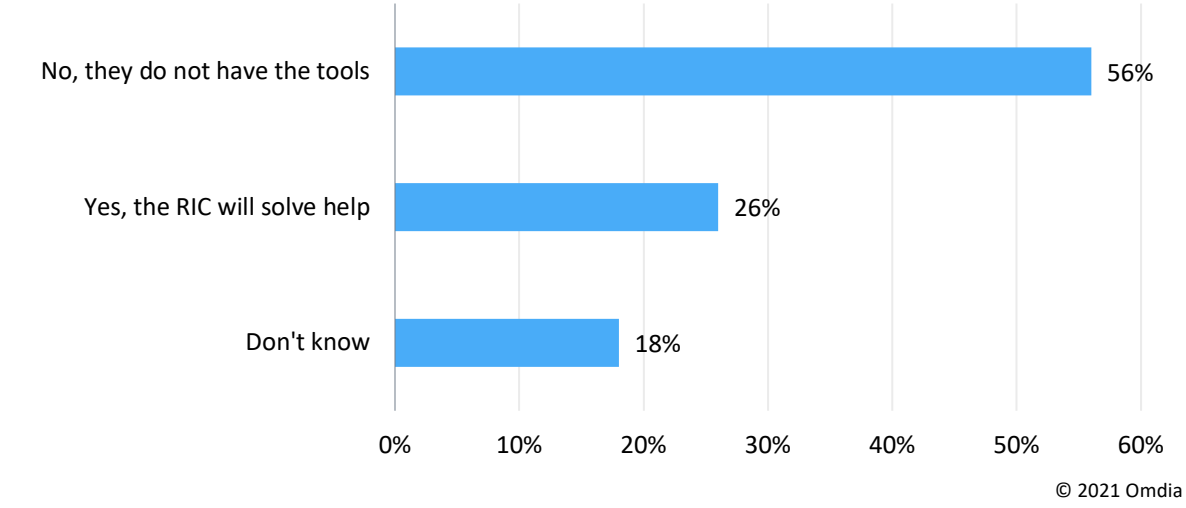
Figure 7: Importance of automation in open vRAN deployments



Source: Red Hat

Figure 8 indicates that of a total of 62 respondents, 56% do not believe that service providers have all the tools necessary to carry out open vRAN orchestration.

Figure 8: Operator preparedness for open vRAN orchestration



Source: Red Hat

Given networks are becoming more applications based, service providers can differentiate themselves by evolving their RAN to be more disaggregated, open, and programmable with cloud-native and container-based platforms that will support multiple RAN functions. A common platform will develop new revenue-generating services and shorten time to market.

Red Hat is working with its service provider partners in the region to assist with both the cultural and process transformations required and to support them on their open vRAN TCO analysis ahead of trials and rollouts set for the 2022–23 timeframe.

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 and is now one of its top 10 voting members. 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 for OpenStack. It provides a horizontal cloud platform and automation framework that allows the disaggregation of hardware and software and to run virtualized RAN functions on top of generic servers.

Red Hat's portfolio for vRAN includes Red Hat® Enterprise Linux®, Red Hat OpenStack® Platform, and Red Hat OpenShift® that makes network functions run in a cloud environment. Together these solutions enable operators to design, deploy, and orchestrate DU and CU VNF or CNF (cloud-native network functions).

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 used in most open vRAN deployments around the world today.

Such a preintegrated solution enables service providers 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 working with Telefónica in different countries for open vRAN activities.

Conclusion

Open RAN and vRAN will change the way service providers 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 and new ways to deploy and operate the RAN, working with cloud-native principles, new processes, and new methodologies. A horizontal cloud platform will allow service providers 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.

Service providers 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 and organize tests in labs and then in the field. Service providers should, naturally, also verify the business case and, when doing that, consider the specificities of the market where they operate, their existing assets, and their internal capabilities, because there is no such thing as a standard or guaranteed level of savings. Once they have done all that, service providers will be well positioned to decide when and where it makes sense to deploy open vRAN.

Some will start with virtualization and others with opening interfaces; some will try to do both in parallel, but what is probably common to all, except greenfield service providers, 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, service providers 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

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