# Modernizing the Radio Access Network (RAN)

## Challenges and Opportunities on the Journey to RAN Monetization

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## Summary

5G services present communication service providers (CSPs) with a great growth opportunity. However, the traditional radio access network (RAN) infrastructure presents an obstacle to realizing 5G-based strategies. Virtualization of RAN functions (vRAN), and eventually open RAN (O-RAN), offer a path forward, though challenges exist for their implementation. New solutions, such as the VMware® Telco Cloud Platform RAN™, enable CSPs to modernize RAN infrastructure and make progress on the journey to an open, profitable future.

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# Introduction

The telecommunications industry is experiencing a moment of transition that embodies stresses and challenges but also great opportunities. The advent of 5G and demand for new services offer the promise of growth. However, for many CSPs, traditional RAN infrastructure constrains their ability to execute on 5G-based competitive strategies.

High operating costs, inflexibility and security risks threaten to undermine the 5G revolution for them. vRAN, and the eventual adoption of O-RAN with disaggregation of vRAN functions, provide a way forward. Yet, these paradigms are not as easy as they look. Vendor lock-in and proprietary hardware limit the openness needed to thrive.

New solutions are emerging that enable CSPs to modernize their RAN infrastructure in ways that enable profitable RAN monetization now and in the future. This may take the form of a high-performing and highly automated vRAN platform serving as a common horizontal basis for the deployment of 5G and traditional services. VMware Telco Cloud Platform RAN meets these criteria. It offers CSPs a way to move toward the vRAN and O-RAN future, with deep automation, low latency and the potential to function as a 5G multiservices hub.

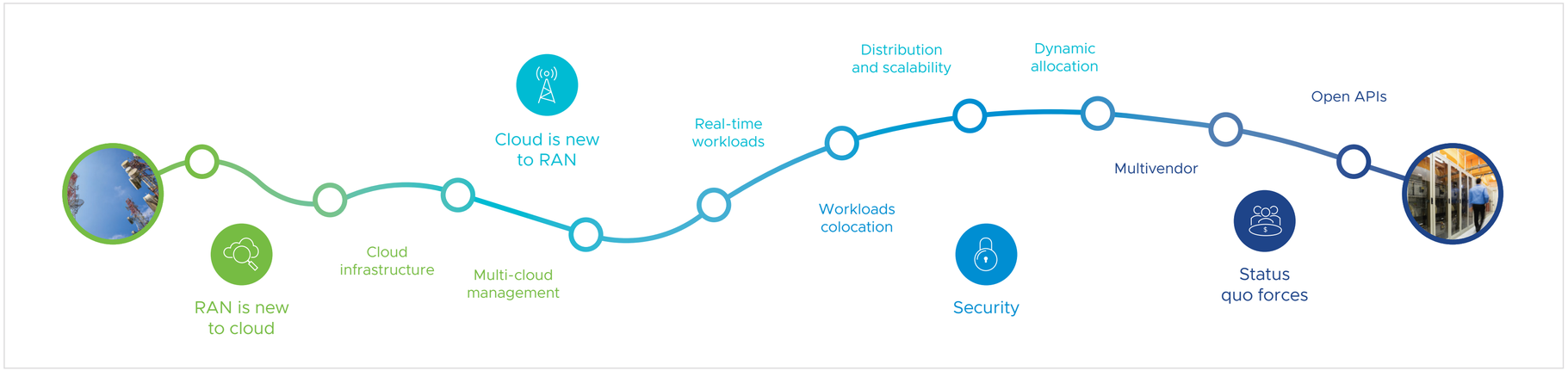


**FIGURE 1:** Serious challenges in the RAN path to cloud.

# The Growth Opportunity in the Current Moment

The telecommunications industry is on the verge of significant growth. This is due mostly to the advent of 5G technology, but also to parallel developments such as the Internet of Things, the proliferation of smart phones, smart cities and more. One *industry research study* projects that the 5G services market, comprising consumer and enterprise segments, will grow at a compound annual growth rate (CAGR) of 29.4% between now and 2026. The 5G services category will jump from its present $53 billion in revenue to $249 billion during that time.[1] A *separate study* reached similar conclusions, projecting a CAGR approaching 30% from now through 2027.[2]

This vigorous growth potential arises from 5G's ultra-high speed and low latency, which greatly enhance the user experience. The increase in speed is so significant that it will be transformative for telecommunications, healthcare, retail, automotive and industrial use cases. CSPs will have the opportunity to create new services in fields like telemedicine, municipal government and beyond.

1. MarketsandMarkets, "*5G Services Market by End User (Consumers and Enterprises), Enterprise (Manufacturing, Media and Entertainment, Transportation and Logistics, Government), Application, Communication Type (eMBB, MMTC, URLLC, and FWA), and Region—Global Forecast to 2026*," March 2021.
2. Acumen Research and Consulting press release, "*5G Services Market Value Forecasted To Reach US$ 250.3 Billion By 2027*," April 2021.

5G Projected Growth

**Over 29%**
CAGR by 2026–2027

**$249 billion**
in revenue by 2026

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# Pressures and Constraints in Today's RAN Environments

CSPs that want to take advantage of 5G's upside need to innovate quickly and then deploy new services on a rapid, economical basis. The current RAN ecosystem makes this nearly impossible. Traditional RAN, running on purpose-built hardware or homogeneous cloud stacks, is too inflexible in terms of cost and time to market for viable delivery of new 5G services.

To understand why this is the case, consider that one of the 5G's massive performance improvements comes from a comprehensive redesign of antennas. The frequency characteristics of 5G antennas require many more to be deployed than in earlier generations of mobile networks. This increases cost and complexity. In addition, new 5G service quality and user experience improve if the CSP can host applications close to the end customers. Unfortunately, the space and power supply constraints inherent to traditional RAN makes this a cumbersome, cost-prohibitive proposition.

## Challenges with legacy RAN

### Costs and risks

Building enough RAN sites, especially in urban areas, to support 5G deployments will increase capital expense (CapEx) as well as operating expense (OpEx). If truck rolls are required to manage the sites, OpEx goes up all the more. The cumulative cost of the real estate required for a big increase in RAN sites will drive CapEx or OpEx costs higher, too, depending on whether the CSP buys or rents the land. It will also be costly to provide power to these sites, with geographical spread potentially pushing power costs higher in more remote locations.

### Operational complexity

Introducing new services in more RAN sites adds complexity to their operations, as well as high operational costs, especially if they are built using purpose-built hardware.

### Disjointed systems

CSPs may choose to, or be forced to, utilize inconsistent cloud and network designs when setting up new 5G RAN sites. This results in costly, operationally inefficient and disjointed systems that span 5G networks, from core to edge to RAN, diminishing the CSP's ability to introduce and scale new services.

### Deficient security

Adding more RAN sites, coupled with an increase in connected devices, expands the mobile network's cyberattack surface. Compared to previous generations of mobile networks, a 5G network embodies extreme risk exposure. Conventional, parameter-based and reactive security countermeasures are increasingly deficient in this new threat environment. While it is possible to enhance security in a legacy RAN environment, the extra processing involved can negatively affect latency.

# The Promise of the Journey from vRAN to O-RAN

Existing, traditional RAN infrastructure will not work for 5G and the anticipated onslaught of new services—as well as for customer expectations of low latency. It could work in theory, but the costs would be astronomical and it would be nearly impossible for CSPs to innovate quickly enough on inflexible platforms. RAN modernization is essential. Virtualizing and disaggregating RAN are the answer.

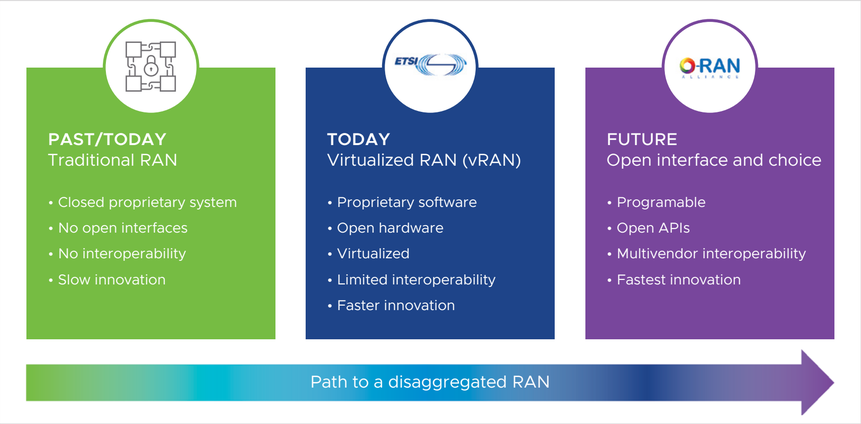
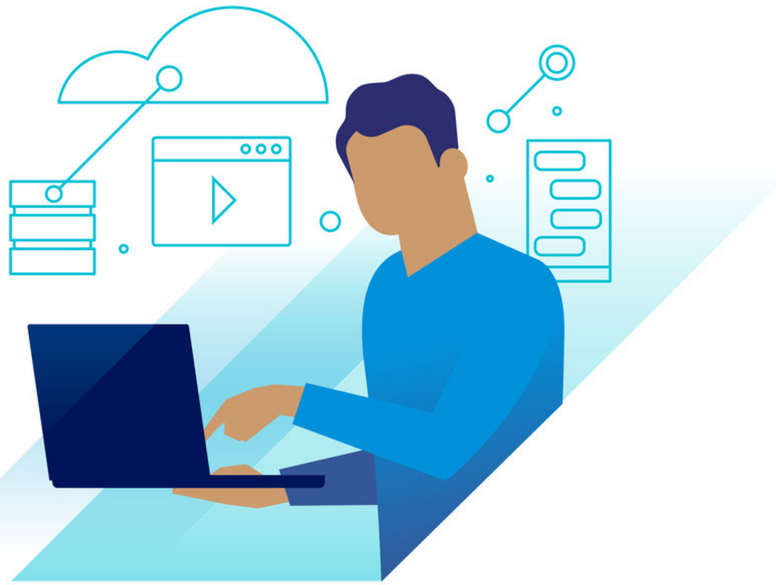



FIGURE 2: Evolution of RAN infrastructure.

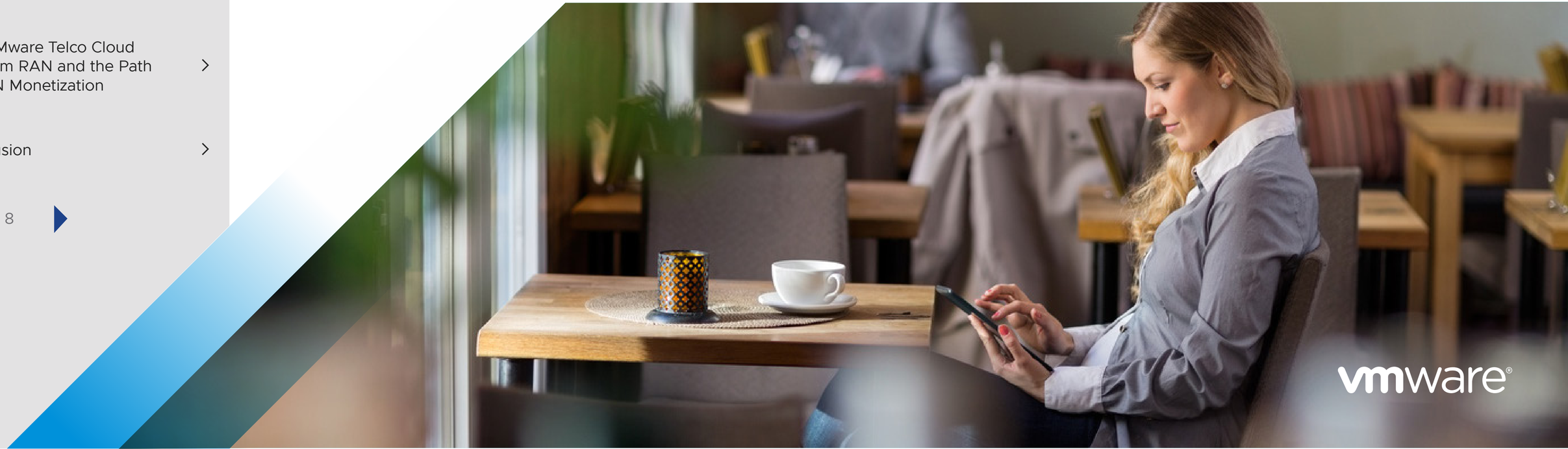
vRAN virtualizes RAN functions. It is analogous to computer virtualization technology that separates operating systems and applications from underlying hardware. vRAN instantiates RAN functions on a horizontal platform and deploys them at the best locations. The technology moves RAN controller functions to centralized servers. As a result, the CSP can pool and adjust RAN resources to accommodate traffic and service delivery in an optimal way. With vRAN, it is no longer necessary to run proprietary hardware. It can run on standard servers, though ideally on machines that are equipped for telecom workloads.



The advantages of vRAN are many. It uses less hardware than traditional RANs, and the hardware it does need generally costs less than purpose-built equipment. Flexibility goes up, with the CSP now able to "spin up" and "spin down" RAN capabilities with relative ease. It delivers operational efficiencies, along with elastic scale that can adapt to shifts in network demand. vRAN potentially cuts CapEx, as well.

The whole setup is more agile. The CSP can host many network functions on the same platform, regardless of location. It can apply consistent operational practices across the entire 5G network. The CSP can quickly deploy 5G solutions on vRAN infrastructure because vRAN is a software-based architecture. There is no specialized hardware to configure when launching new 5G services.

Eventually, many CSPs want to go further, implementing architectures based on O-RAN when its standards and technologies mature. O-RAN comprises an evolving set of industry standards for RAN interfaces that support interoperation among equipment from multiple vendors. O-RAN has the potential to reduce existing constraints through centralized automation that simplifies RAN operations. Therefore, many CSPs intend to use the standards when they are available. It's a journey. Today's vRAN is part of a broader, long-term transformation of RAN as CSPs enter the 5G era.



# The Target RAN Platform for the 5G Revolution

Turning the idea of vRAN into a reality means thinking through the characteristics a CSP will expect from a new-generation RAN platform. While specific expectations will vary widely by CSP, the following general qualities should rank high among target preferences:

- **Provides a common horizontal platform**—Flexibility and agility are key goals for implementing vRAN. Ideally, a CSP will be able to deploy vRAN and non-RAN workloads on the same platform. By running vRAN functions alongside 5G services, which require low latency and high throughput, from the RAN sites, physically close to customers, the CSP can maintain profitability across their operations. The common platform approach also provides the potential for a smooth evolution toward future services without disrupting operations or requiring an overhaul of network design.
- **Delivers high performance**—5G services must have low latency. They absolutely require high-performing vRAN functions. To be viable in business and technological terms, a vRAN platform must fulfill this requirement.
- **Enables automation**—The target vRAN platform needs automation capabilities. It has to be able to automate infrastructure deployment and offer programmable provisioning of the underpinning infrastructure as well as specific vRAN functionality across the service lifecycle.
- **Offers a flexible, RAN-focused ecosystem**—The new generation of vRAN platforms will align well with experienced RAN management teams if it supports multiple RAN vendors. This might mean creating integrations between the virtualized platform and vRAN functions.
- **Ensures strong security**—Security is integral to success with a new vRAN platform. It's a multidimensional issue that spans identity management and access control for users as well as endpoint protection, network security and more. Automation and artificial intelligence are essential for security because the 5G network is far too large, fast-moving and complex to defend with manual processes. The right platform will integrate with advanced incident response solutions and security operations (SecOps) tools, as well.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# The VMware Telco Cloud Platform RAN and the Path to RAN Monetization

VMware has come out with a solution that enables CSPs to set a course for RAN modernization and monetization. The VMware Telco Cloud Platform RAN provides a way for CSPs to evolve from traditional RAN to vRAN. From there, the platform establishes the foundation for the eventual migration to O-RAN.

VMware Telco Cloud Platform RAN helps CSPs virtualize RAN functions on a horizontal platform that is specifically optimized for RAN with Intel FlexRAN. As a RAN-optimized horizontal platform, it has been hardened through strenuous testing and integration work with key RAN vendors. These processes serve to maximize performance and improve resource utilization, meeting and exceeding stringent requirements inherent to RAN.

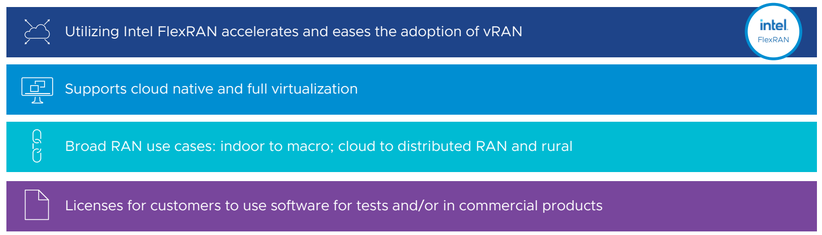
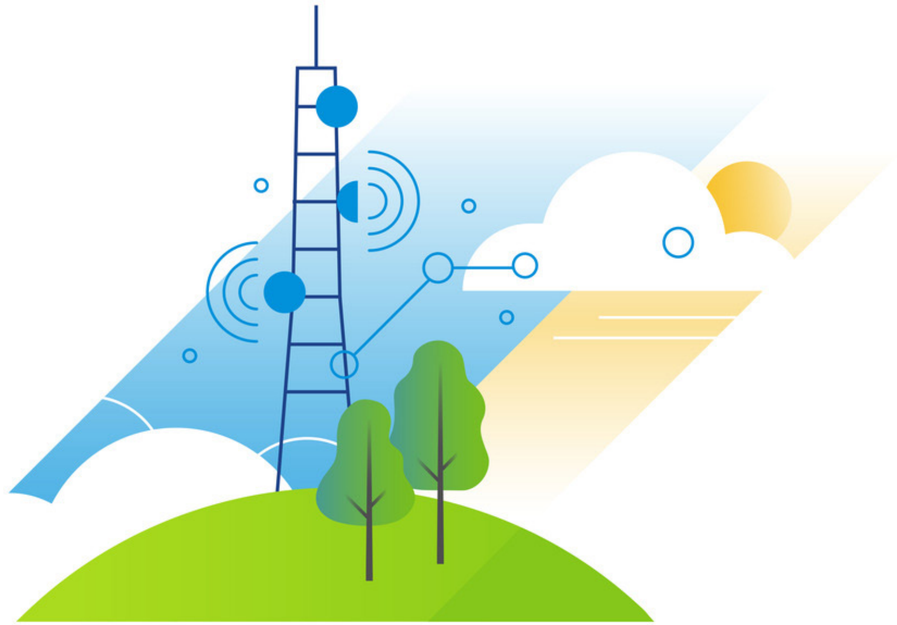



**FIGURE 3:** Intel FlexRAN summary

The platform is designed so CSPs and their customers can easily develop custom 5G services at RAN sites. It provides tooling that lets the CSP offer edge computing services. This is possible because 5G services, developed on and delivered from VMware Telco Cloud Platform RAN, can directly access ultra-high speed 5G networks end-to-end—from the service consumer to the core of the network.



## Common horizontal platform

VMware Telco Cloud Platform RAN virtualizes and disaggregates RAN functions on a horizontal platform that enables the CSP to deploy vRAN functions at sites that are best suited to perform their functional purposes. There is no need to scale the entire RAN on a linear basis. Rather, the CSP can scale based on functional need. This approach keeps the RAN site's footprint small and helps cut OpEx for space and power. It also simplifies CSP operations with consistency across distributed vRAN sites, regardless of the workloads each site hosts.

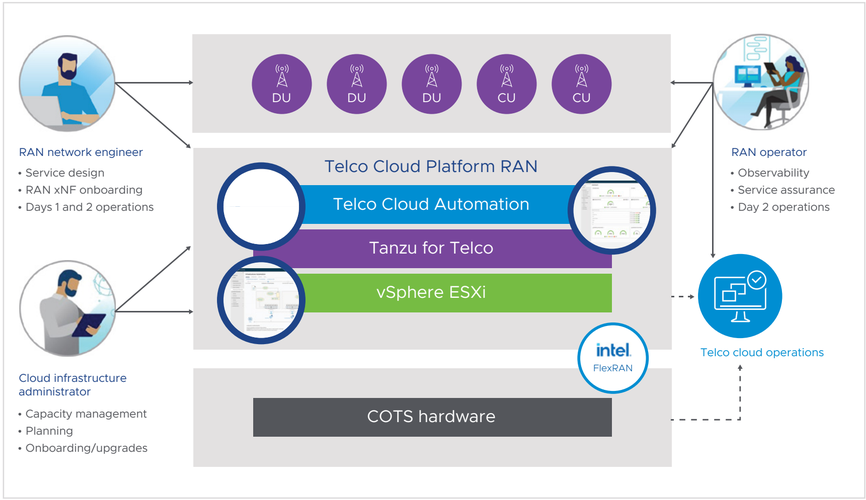



**FIGURE 4:** Bridging all the RAN stakeholders.

## 5G multiservices hub

VMware designed the VMware Telco Cloud Platform RAN to function as a 5G multiservices hub. This approach makes it possible for a CSP to deliver a variety of 5G services from RAN sites on the same horizontal platform. In technical terms, the design features VMware vSphere® and VMware Tanzu™ fully integrated with VMware Telco Cloud Platform RAN.

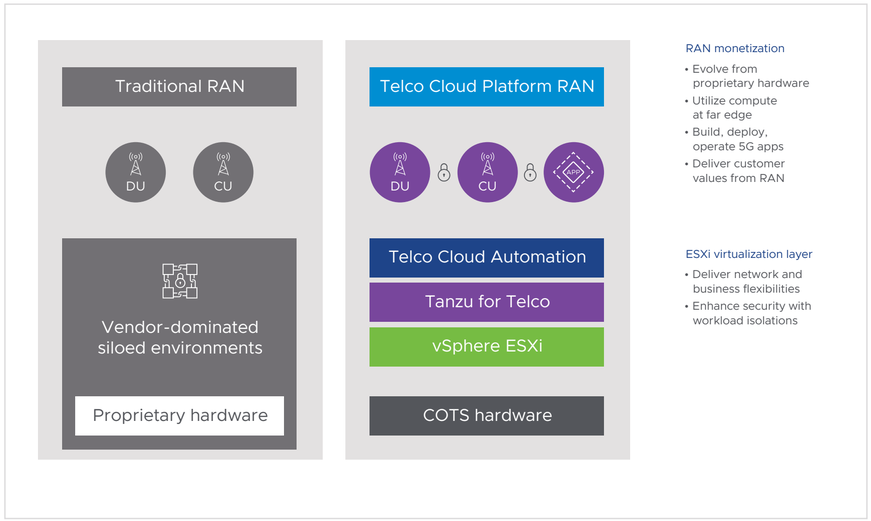



**FIGURE 5:** 5G multiservices hub.

## High-performing vRAN

The platform offers low-latency optimization, meeting and exceeding 5G's ultra-low-latency requirements. This capability is essential being able to offer ultra-reliable low-latency communication (URLLC) 5G services. The platform's architecture, which allows for deployment of vRAN functions at the best locations to serve their functional purposes, results in increased performance, coverage and capacity without linearly scaling the entire RAN. It also improves the quality of experience (QoE). The platform can cut workload processing time at the RAN's far edge site, an architecture known as a distributed unit (DU).

## Automation

The VMware Telco Cloud Platform RAN accelerates and automates the provisioning and onboarding of vRAN functions across distributed RAN sites. By simplifying Day 0, Day 1 and Day 2 operations, the platform reduces OpEx and improves the CSP's operational efficiency. Establishing consistency across distributed RAN sites further drives efficiency gains. The platform can provision vRAN functions over thousands of platforms across distributed RAN sites. It does this by understanding the requirements, such as latency and bandwidth, of each workload being installed.

## Flexible, RAN-focused ecosystem

The platform is part of a broader RAN-focused ecosystem. This includes integration with Mavenir and Altiostar. The VMware Telco Cloud Platform RAN also supports a CSP's continuous integration / continuous deployment (CI/CD) workflows for faster vRAN functions deployment. This removes traditionally complex testing and onboarding processes.

## Intrinsic security

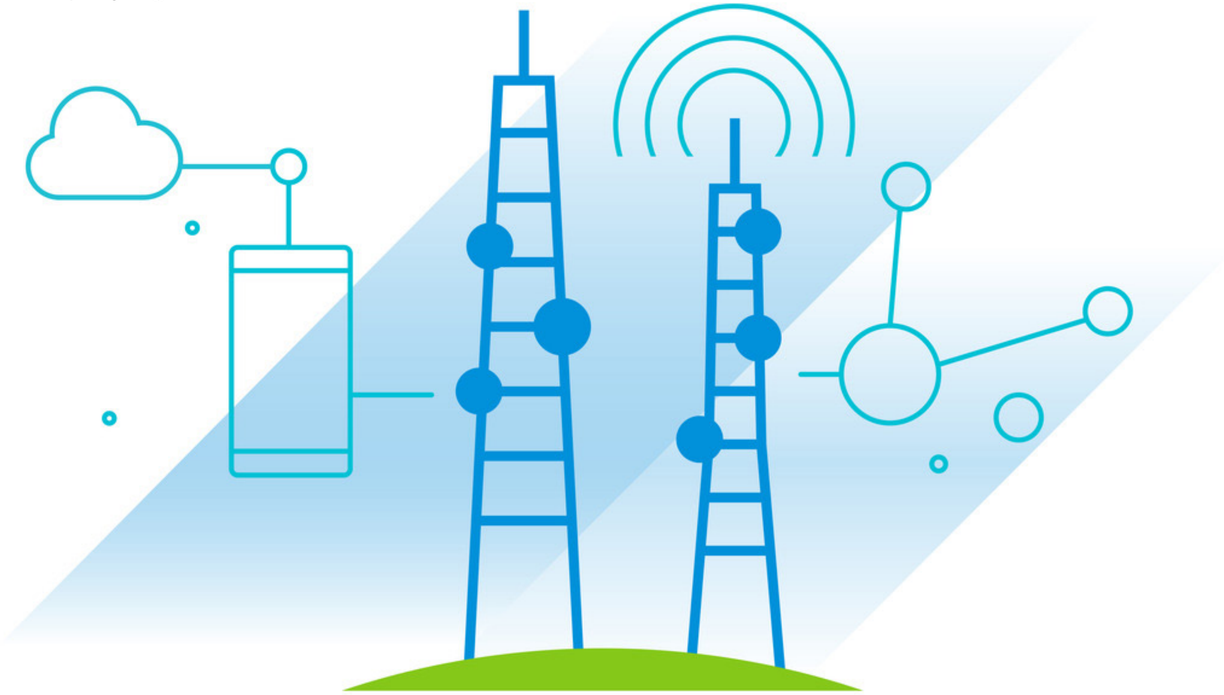
VMware has made security intrinsic for the VMware Telco Cloud Platform RAN. The platform operationalizes vRAN security policies by providing multilayer isolation inside a virtualized infrastructure. The isolation includes running a guest OS with its own process protections and permission models. The virtual machine (VM) runtime isolates the guest VM, with a further separation between the guest and the rest of the hypervisor. This approach separates the management of the virtualization plane from other systems to safeguard workloads. Each workload is isolated within its virtualization solution to prevent unauthorized access.

The VMware Telco Cloud Platform RAN's security is programmable, automated and context-aware. The platform can apply consistent security policies across distributed RAN sites, an approach that minimizes the risk of configuration errors or other changes that might expose vulnerabilities. The platform's security architecture, exemplified by its horizontal design, creates the flexibility to run multiple vRAN functions across distributed RAN more securely than is possible with conventional parameter-based and reactive security practices.

# Conclusion

CSPs are on the cusp of growth, with 5G and a host of new services driving big gains in their consumer and commercial businesses. Existing RAN infrastructure stands in the way. It's too inflexible, costly and slow to adapt. vRAN, and ultimately O-RAN, represent the future. However, the choice of vRAN platform is critical to success with 5G. A secure, high-performing and highly automated vRAN platform provides a common horizontal basis for deploying 5G and traditional services.

VMware Telco Cloud Platform RAN meets these criteria, offering CSPs a way to move toward the vRAN and O-RAN future. It provides deep automation, low latency and the potential to function as a 5G multiservices hub. The platform supports and integrates with multiple RAN equipment vendors and related technologies. These capabilities make it the optimal choice for RAN modernization and the journey to profitable RAN monetization with 5G.



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