Ignite Your 5G Deployments with the VMware Telco Cloud

Operate and Monetize 5G Multi-Cloud Networks with Agility, Automation, and Assurance

THE VMWARE TELCO CLOUD FOR 5G AT A GLANCE

VMware helps communications service providers build, operate, monetize, and protect their telco cloud. Our technology empowers CSPs to transform their networks into a 5G force, accelerate the delivery of innovative services, and compete in a multi-cloud world.

The VMware telco cloud creates a consistent foundation for operating all generations of cellular and fixed-line technology while leading the way to 5G adoption. Solutions for infrastructure, orchestration, automation, assurance, optimization, and security modernize your network from the core to the edge and RAN.

TELCO CLOUD PORTFOLIO

- VMware Telco Cloud Platform
- VMware Telco Cloud Automation
- VMware Telco Cloud Operations
- VMware Telco Cloud Platform RAN
- VMware RAN Intelligent Controller (VMware RIC)
- VMware Telco Cloud Platform Edge
- VMware Telco Cloud Platform Public Cloud

Modernize to Monetize

The rollout of new 5G services will intensify the already fierce competition among communication service providers (CSPs) and their more agile hyperscaler counterparts. Thriving in a dynamic marketplace is a challenge when encumbered by rising network costs, rigid resources, and unforeseen shifts in demand. CSPs are changing to overcome these challenges, which are putting margins under pressure, hampering innovation, and placing a premium on customer experience.

With 5G, these challenges will be insurmountable without agile cloud-first methods and architectures. Customized on-demand services, enhanced mobile broadband (eMBB), massive machine-type communications (mMTC), and ultra-reliable low-latency communications (URLLC) all require new capabilities.

To capture more market share in such a highly competitive landscape, you must be able to roll out new services quickly, securely, and cost efficiently while maintaining telco-grade performance and reliability. A modern telco cloud furnishes the architectural foundation to provide operational flexibility and multi-layer automation. This software-driven, cloud-first approach empowers you to rapidly launch 5G services, dynamically scale to meet changes in demand, simplify deployments, and protect dynamic applications.

Cloud-Native Principles and Automated Operations

The path to modernization is paved by the transformational power of cloud-native principles. Kubernetes, containers, and microservices supply tools for the kind of flexible, modern operations required to thrive with 5G. The automated operations and agile methods that come with cloud-native technology streamline the development, deployment, and management of new services.

Consistent infrastructure plays a critical role in modernization by uniting clouds and multi-vendor networks in a single platform. With common infrastructure, service providers can avoid creating another network silo when they build out 5G. By simplifying complex heterogeneous environments, horizontal architectures deliver central management at scale. Ubiquitous automation ties all the moving parts together to reduce costs, promote on-demand delivery, and set the stage for service innovation. The last critical piece? End-to-end visibility and assurance let service providers exploit emerging 5G uses cases and optimize customer experiences.

Although CSPs have made progress recalibrating their networks, there are still challenges to overcome to realize the full benefits of 5G:

- The complex, siloed architecture of CSPs' existing networks stands in the way of rapid innovation and operational agility. These existing networks, which tend to be founded on vertically integrated monolithic stacks designed to run vendor-specific virtual network functions (VNFs), make automating deployment and management difficult.

VMWARE TELCO CLOUD PLATFORM AT A GLANCE

VMware Telco Cloud Platform™ is powered by the field-proven compute and networking of VMware Telco Cloud Infrastructure™ coupled with VMware Telco Cloud Automation™ and VMware Tanzu™ Standard for Telco, which is a telco-grade Kubernetes distribution. This combination empowers CSPs to rapidly deploy and efficiently operate multi-vendor CNFs and VNFs with agility and scalability.

KEY CAPABILITIES AND BENEFITS

- Deploy and manage virtual network functions (VNFs) and containerized network functions (CNFs) on consistent horizontal infrastructure
- Use microservices and optimize resources with a telco-grade Kubernetes distribution
- Automate lifecycle management of Kubernetes clusters, network functions, and 5G services
- Accelerate the deployment of network functions through the VMware Ready for Telco Cloud program

REFERENCE ARCHITECTURE

The VMware Telco Cloud can be deployed across 5G networks to meet your design and scalability objectives. The VMware telco cloud *reference architecture* provides guidance for designing and implementing an automated 5G network.

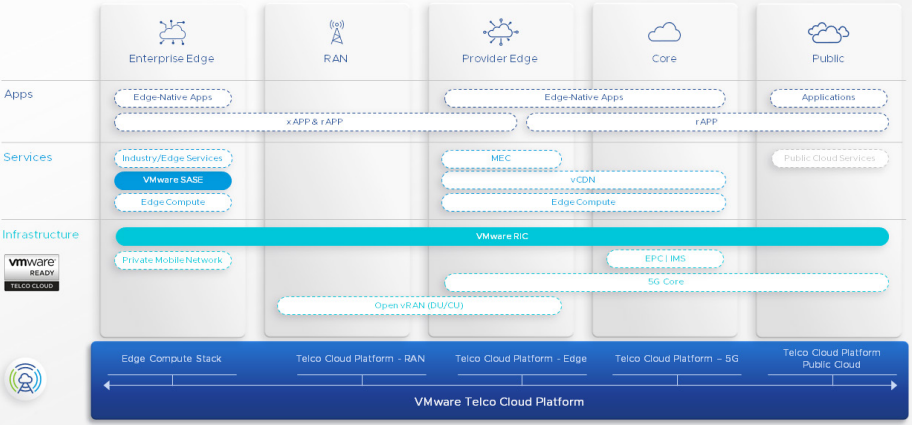

FIGURE 1: The VMware Telco Cloud includes solutions for the enterprise edge, RAN, service provider edge, 5G core, and public cloud.

- These monolithic stacks also create challenges deploying and managing containerized network functions (CNFs) along with VNFs.
- CSPs must now design and operate services across a web of heterogeneous resources that bridge physical and virtual environments while supporting interoperability with various vendors. The complexity of coordinating network functions and managing multiple services demands a simple, automated approach that speeds up deployment and automates error-prone manual processes.
- Operations that take place in silos make end-to-end visibility nearly impossible, dampening the prospect of tailored 5G services. A collaborative and integrated approach that takes advantage of machine learning can help you rapidly understand your complete 5G landscape, predict impacts of network changes, and automate actions to continuously optimize the network.
- Running CNFs alongside VNFs can add complexity and make the entire network difficult to operate. Traditional orchestration tools lack telco-centric features to automate multi-tenant, distributed cloud-native network functions and to deliver the resiliency and reliability that's required in a highly regulated industry with strict service-level agreements (SLAs) and demanding consumers.

Deliver an End-to-End Solution to Capitalize on 5G

A platform that combines telco-specific cloud-native solutions and cloud-first automation with consistent infrastructure and service assurance solves the problems standing between CSPs and the promise of 5G. The VMware Telco Cloud includes several key VMware systems that can be combined to deliver an end-to-end telecommunications solution for 5G and to address a range of use cases in core networks, edge sites, public clouds, radio access networks, and all points in between.

VMware Telco Cloud Platform

By solving the problems that undermine the architecture of existing telecommunications networks—monolithic stacks marred by complexity, silos, and vendor lock-in—VMware Telco Cloud Platform empowers you to launch innovative services on consistent infrastructure, reducing operational complexity and radically improving agility.

The fundamental elements of this architecture are VMware Telco Cloud Infrastructure and VMware Telco Cloud Automation. VMware Telco Cloud Operations can be added to furnish visibility for seamless operations and consistent service delivery.

CLOUD-NATIVE TECHNOLOGY AND CLOUD-FIRST AUTOMATION FOR 5G

Capitalizing on the opportunities of 5G in a multi-cloud world hinges on two keys ingredients: cloud-native technology and cloud-first automation.

Cloud-native technology decouples containerized functions from the infrastructure so they can be deployed quickly, shared among services, updated easily, and managed independently. Orchestration and automation dynamically scale network functions to meet changes in demand. With containers as a service (CaaS), CSPs can use the same technology to meet different requirements across their 5G networks, enabling the design of more efficient 5G networks.

Cloud-first automation unites multi-cloud resources in a centralized orchestration system and then uses intent-based placement for optimization. With cloud-first automation, which continuously synchronizes with registered clouds, CSPs obtain context-aware information about their diverse set of sites, the state of these sites, the applications running there, the embedded technologies available to foster service delivery, and the cloud resources available for allocation.

With this information, the orchestrator can automatically place network services and functions in a way that aligns requirements with available cloud resources and capabilities. In this way, cloud-first automation further simplifies the deployment and management of 5G network functions.

The Path to Cloud-Native Networks

VMware Telco Cloud Platform establishes an open, disaggregated, and vendor-agnostic ecosystem to streamline 5G service innovation. From service creation to deployment and lifecycle management, VMware Telco Cloud Platform establishes a unified architecture that simplifies innovation. This developer-friendly architecture includes capabilities for resource optimization, operational consistency, multi-cloud mobility, and multi-layer automation. Amid the monumental shift that is taking place with 5G rollouts, the following capabilities empower you to modernize your network architecture, transform your business, and accelerate the delivery of 5G services:

- **Cloud-native architecture:** You can deploy, orchestrate, and optimize cloud resources and processes with intent-based placement. The platform's architecture includes compute, networking, automation, and CaaS. Network resiliency, cross-cloud application continuity, and multi-tenant service isolation help you address business requirements and compliance regulations, such as high availability and SLAs.
- **Unified and consistent platform:** The platform's hybrid IaaS and CaaS modernizes existing clouds so they can run both VNFs and CNFs across consistent horizontal infrastructure. This architecture fosters low-latency performance in the data plane and improves scalability through virtualized networking with VMware NSX®.
- **Carrier-grade Kubernetes:** The platform lets you capitalize on a microservices architecture. You can use microservices with a resource-optimized Kubernetes runtime for device attachment, NUMA alignment, resource reservation, and placement. This architecture delivers the capability to roll out 5G networks with Multus, DPDK modules, an SR-IOV plugin, CPU/Topology Manager, and Kubernetes cluster automation tailored for telco use cases.
- **Zero-touch provisioning:** You can automate the onboarding and upgrading of network functions and infrastructure components with zero-touch provisioning. Full lifecycle management can define and apply policies using a decisioning engine to automate deployments, operations, and maintenance.

VMware Telco Cloud Automation

VMware Telco Cloud Automation is an orchestrator that accelerates time to market for network functions and services while igniting operational agility through unified automation across any network and any cloud. The system enables multi-cloud placement, easing workload instantiation and mobility from the network core to the edge and from private to public clouds. It also offers standards-driven modular components to integrate any multi-vendor MANO architecture.

VMware Telco Cloud Automation delivers a cloud-first solution where all layers—from infrastructure to domain orchestration (NFVO)—are coupled for consistency and optimized deployment and workload management across any cloud. VMware Telco Cloud Automation, which supports hybrid networks, is a foundational element of VMware Telco Cloud Platform.

Because VMware Telco Cloud Automation natively integrates with VMware Telco Cloud Platform and other VMware technologies, it can transform integration-intensive projects into efficient product deployments. It also eliminates the risks of error-prone configurations, simplifies upgrades, and reduces overall project costs. Close integration between VMware Telco Cloud Automation and the infrastructure means continuous knowledge of the telco cloud state, optimized placements, VIM-Kubernetes configurations, auto-discovery, and continuous synchronization of telco cloud components, including inventories, resources, faults, and performance.

The xNF manager offers a unified network function ecosystem (VNFs and CNFs) to support the design and automation of TOSCA-compliant network functions. The platform orchestrates workloads from VM- and container-based infrastructures for an

VMWARE TELCO CLOUD AUTOMATION AT A GLANCE

VMware Telco Cloud Automation accelerates time to market for network functions and services while igniting operational agility through unified automation across clouds.

KEY BENEFITS AND CAPABILITIES

- Integrate 5G network capabilities alongside existing NFV architectures
- Enhance the service experience through workload mobility, dynamic scalability, closed-loop healing and improved resilience
- Improve agility with Kubernetes, cloud-native patterns, and CaaS automation
- Maximize existing investments, innovate faster, and reduce complexity with pre-built integrations from the VMware Ready for Telco Cloud program
- Onboard network functions using standards-based templates and model network services based on multi-vendor network functions
- Centralize the creation, optimization, and management of Kubernetes clusters with CaaS automation
- Improve service quality by integrating with the AI-driven workflows of VMware Telco Cloud Operations

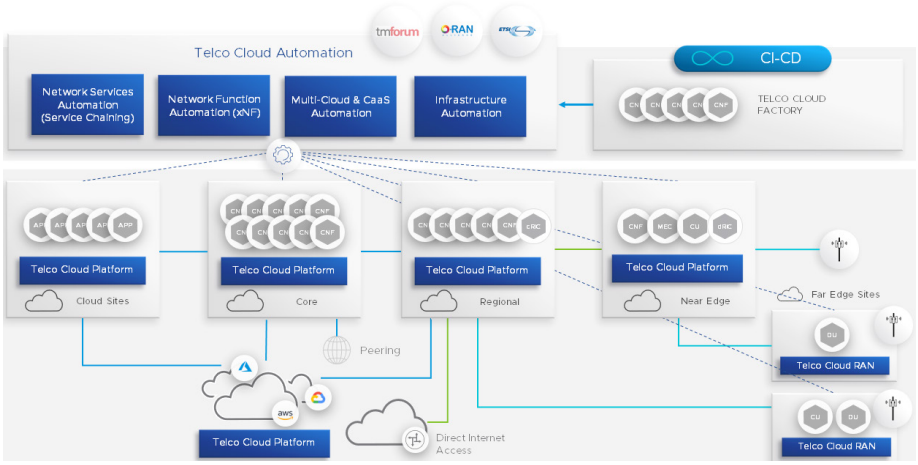

FIGURE 2: The key capabilities of VMware Telco Cloud Automation—including cloud-native technologies and automation—power flexible solutions for 5G. Access to CNFs, VNFs, and applications from multiple vendors supply extensible building blocks to deploy new services and explore emerging use cases.

optimized service-delivery foundation. Through the VMware Ready for Telco Cloud program, new versions and updates of partner network functions are validated for continued interoperability.

As your telco cloud evolves, the need to distribute workloads across core, edge, private and public clouds becomes mandatory. VMware Telco Cloud Automation integrates with VMware Telco Cloud Infrastructure, VMware Cloud Foundation, VMware Cloud on AWS, and VMware Tanzu for turnkey registration of multiple VIMs or Kubernetes clusters and consistent workload management for network functions across clouds.

VMware Telco Cloud Operations

After years of network and services evolution, CSPs are undertaking yet another transformation, this time into 5G digital service providers. Although increased service offerings have expanded the opportunity to generate new revenue, they have also increased operational challenges. These new networks, which can consist of millions of devices, must interoperate with those already in place. At the service layer, configuration interfaces and management tools have proliferated. But large CSPs might have several hundred such tools in place, typically in silos, creating complexity for network and service operations centers.

VMware Telco Cloud Operations is a mobile assurance solution to monitor and manage physical infrastructure and virtual networks as one. It enables you to rapidly resolve network performance issues and ensure consistent delivery of services.

VMware Telco Cloud Operations automatically discovers the components of complex networks and presents you with a comprehensive topology view. It automatically identifies root causes of problems, prioritizes them, suppresses extraneous alarms, and notifies the operator. Machine learning extracts network performance insights and detects anomalous behavior to preempt issues. Faster remediation comes through integration with operations support systems (OSS) and orchestration tools for closed-loop actions. In short, the solution provides an automated approach to reducing operational expenses, increasing uptime, meeting SLAs, and operationalizing new services faster.

VMWARE TELCO CLOUD OPERATIONS AT A GLANCE

VMware Telco Cloud Operations furnishes end-to-end assurance to holistically manage the performance, faults, and business impacts of complex, multi-vendor 5G networks.

KEY BENEFITS AND CAPABILITIES

- Single location network management that correlates service health to virtual and physical network infrastructure
- Performance analytics based on machine learning reveal actionable insights, detect performance anomalies, and trigger alerts
- Closed-loop actions and remediation of problems through integration with orchestration and OSS tools
- Automatic discovery of network topology, customizable dashboards, and automated actions
- Auto-discovery and prescriptive diagnosis of root causes
- Proactive configuration management of underlying hardware and SLA management with historical and real-time views

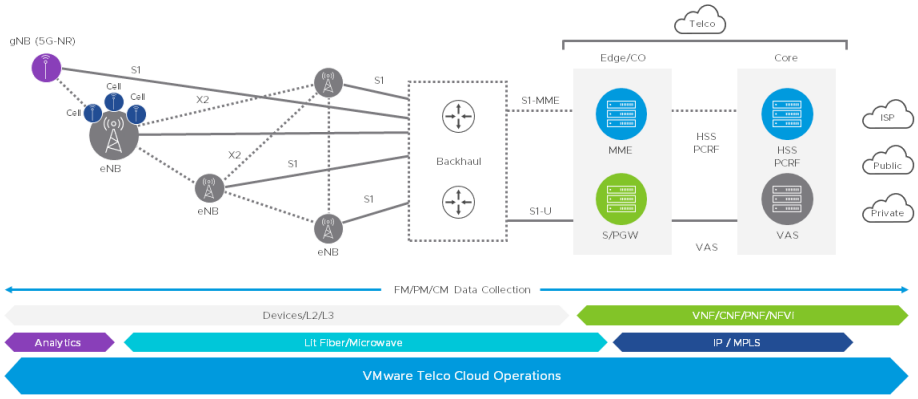

FIGURE 3: VMware Telco Cloud Operations monitors the layers of a 5G network.

Monitor the Layers of a 5G Network

VMware Telco Cloud Operations supports many aspects of a 5G network. Focusing on the health of the service versus individual components, it enables operators to monitor not only the underlying equipment that is part of the 5G physical network but also the virtual network functions and services riding on top.

When paired with VMware Telco Cloud Infrastructure, VMware Telco Cloud Operations supports VIMs and monitors the health of VNFs. In the case of a virtual RAN deployment, the servers, VMs, and VNFs sitting at thousands of cell sites can be monitored remotely to ensure maximum uptime and quality of service.

VMware Telco Cloud Operations also integrates with orchestrators to enable further automation in a coordinated fashion. For example, it supports Virtual IP Multimedia Subsystem (vIMS) for VoLTE in a 4G or 5G network. VMware Telco Cloud Operations monitors the complete service, from the underlying servers to the VMs and VNFs. If an alarm is raised, such as a high session count indicating that too many VoLTE calls are being handled by a particular component, VMware Telco Cloud Operations immediately correlates the alarm with the related vIMS service (since this could result in dropped calls and the inability to initiate additional calls). A workflow in the related orchestrator can be automatically triggered to scale up the capacity of the vIMS service. Once the job is completed, the alarms are automatically eliminated.

Already in use with 4G but a key part of 5G network architecture, Virtual Evolved Packet Core (vEPC) is becoming mainstream, with some mobile operators already running half of their mobile traffic across virtual infrastructure. VMware Telco Cloud Operations supports a common information model and enables automatic discovery and monitoring of vEPC infrastructure, supporting the Affirmed Networks vEPC and others via the common model. It also supports the policy and charging rules function (PCRF), mobility and management entity (MME), serving gateway (SGW), and packet data network gateway (PGW) VNF layers for 4G LTE and VoLTE.

Maximize Uptime with Closed-Loop Automation

Through integration with RAN automation platforms such as Cellwize, VMware Telco Cloud Operations provides a holistic end-to-end view of your mobile network. VMware Telco Cloud Operations can map and continuously monitor the 4G and 5G infrastructure and the logical and physical connections between elements of the RAN and EPC network, down to the X2 and S1 connections between cellular sites.

VMWARE TELCO CLOUD PLATFORM RAN AT A GLANCE

VMware Telco Cloud Platform RAN™ is powered by field-proven virtualized compute coupled with VMware Telco Cloud Automation™ and VMware Tanzu™ for Telco RAN, a telco-grade Kubernetes distribution. VMware Telco Cloud Platform RAN paves a clear path to RAN modernization by enabling CSPs to evolve from their traditional RAN to vRAN and, eventually, open RAN.

KEY BENEFITS AND CAPABILITIES

- Run virtualized baseband functions, virtualized distributed units (vDUs), and virtualized central units (vCUs) in accordance with stringent RAN performance and latency requirements
- Optimize the placement of DUs and CUs through programmable resource provisioning
- Use the same common platform to virtualize the RAN and migrate to O-RAN.
- Deploy and operate both RAN and non-RAN workloads on a horizontal platform
- Transform the RAN into a 5G multi-services hub
- Use a security-hardened Linux host called Photon OS that is optimized for running containers on VMware vSphere®
- Isolate containerized network functions (CNFs) on virtual machines and the VMware hypervisor, VMware ESXi™, to establish a strong security boundary
- Automate lifecycle management of infrastructure, Kubernetes clusters, vRAN functions, and 5G services

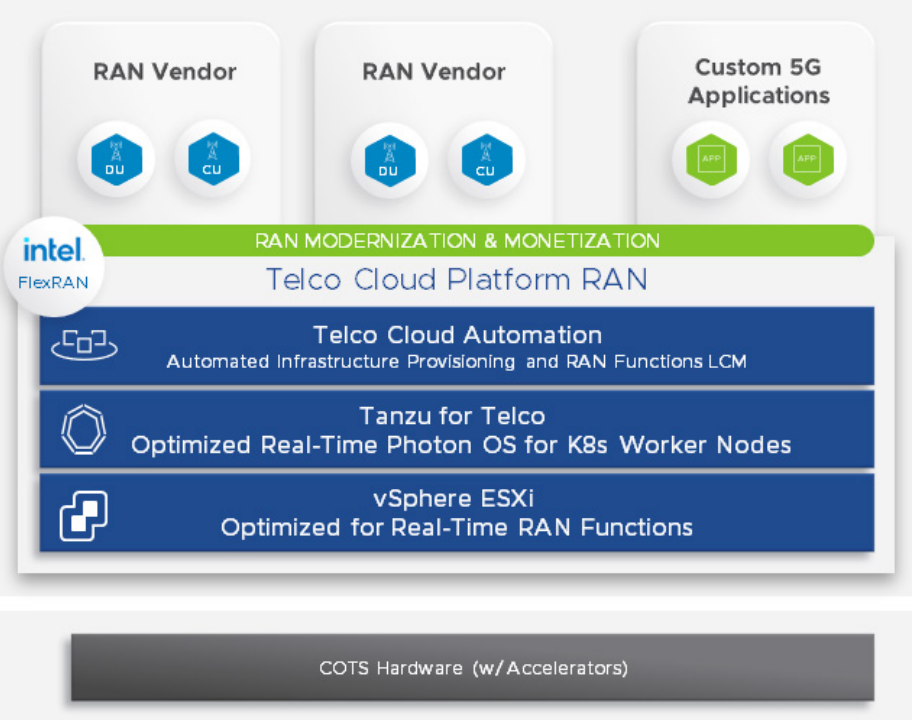

FIGURE 4: VMware Telco Cloud Platform RAN modernizes the radio access network.

For example, if an SGW goes down in the network, VMware Telco Cloud Operations can identify which services are impaired. It then sends a request to VMware Telco Cloud Automation to repair or replace the serving gateway. Once the SGW is deployed, the alert is cleared and the network status returns to fully operational.

This closed-loop automation helps you maximize uptime and provide a high quality of service to subscribers.

VMware Telco Cloud Platform RAN

VMware Telco Cloud Platform RAN is powered by field-proven virtualized compute solution coupled with Tanzu for Telco RAN, a telco-grade Kubernetes distribution, and VMware Telco Cloud Automation. The platform paves a clear RAN modernization path: CSPs can move from their traditional RAN to vRAN now and start to move in the direction of O-RAN.

VMware Telco Cloud Platform RAN transforms the RAN into a 5G multi-services hub that enables you to develop and deploy custom 5G applications alongside vRAN functions while delivering superior quality 5G services and customer experiences. As a result, you can monetize the RAN.

VMware Telco Cloud Platform RAN helps you virtualize RAN functions on a horizontal platform optimized for the RAN using the Intel FlexRAN software reference design. The same platform becomes the foundation for moving to O-RAN by giving you the flexibility to evolve toward the future without disrupting your operations or overhauling your network design. Furthermore, VMware Telco Cloud Platform RAN simplifies operations with consistency across distributed RAN sites, regardless of the vRAN functions each site hosts. Simplified operations are achieved through centralizing cloud-first automation, which reduces OpEx.

AUTOMATION AND PROGRAMMABILITY TO OPTIMIZE THE RAN

VMware Telco Cloud Platform RAN delivers the automation and programmability needed for a 5G future and the rise of edge computing.

- Programmable resource provisioning optimizes where to locate DUs and CUs. When you onboard a virtualized RAN function, you can programmatically adjust the underpinning platform availability and resource configuration based on the function's requirements.
- To meet high-performance, low-latency requirements, DUs can be placed at the far edge near users.
- CUs, which might not need to meet the same high-performance, low-latency requirements as DUs, can be automatically placed or dynamically moved to be closer to the core to maximize resource utilization.

These late-binding capabilities of VMware Telco Cloud Automation let you dynamically move DU and CU resources on demand to improve resource utilization or to add more resources when necessary.

If, for example, you need more resources for DU automation, you can move CU resources closer to the core.

Key Capabilities and Benefits of VMware Telco Cloud Platform RAN

VMware Telco Cloud Platform RAN is a cloud-native RAN solution designed specifically for running virtualized baseband functions, virtualized distributed units (vDUs) and virtualized central units (vCUs), meeting or exceeding the stringent performance and latency requirements inherent to RAN. VMware Telco Cloud Platform RAN is also capable of developing, deploying and operating non-RAN workloads on the same platform.

RAN-Optimized Platform

VMware Telco Cloud Platform RAN enables you to deploy multi-vendor DUs and CUs on a common platform at RAN sites best suited to perform their functional purposes. The platform includes RAN-specific performance enhancements:

- Real-time optimization of VMware ESXi to meet the Precision Time Protocol (PTP) accuracy and latency requirements of virtualized baseband functions, including DUs and CUs.
- Real-time optimization of Photon OS and Tanzu worker nodes by supporting various plugins, such as BIOS CNF, CPU manager, NUMA topology manager, Calico, Multus, Macvlan, DPDK modules, and SR-IOV.
- Intel FlexRAN optimization for enhanced dimensioning to ensure the maximum VMware ESXi compute resources are available to RAN functions.

Cloud-First Automation

VMware Telco Cloud Platform RAN can automatically provision thousands of platform instances across distributed sites. Furthermore, by understanding the requirements, such as latency and bandwidth, of each vRAN function intended to be instantiated, the platform programmatically configures the underpinning resources for better utilization. This intelligence enables you to dynamically adjust where the functions should be deployed with cloud-first lifecycle management while providing telco-grade resiliency and service availability. The platform provides RAN-specific automation, such as the following:

- Reduce RAN sites time-to-deploy by automating the provisioning of RAN sites based on standardized templates.
- Simplify the onboarding of vRAN functions with validated and standards-compliant packages optimized for the platform.
- Automatically discover, register, and create Kubernetes clusters from a centralized location to manage thousands of distributed components with ease.

RAN-Focused Ecosystem

VMware Telco Cloud Platform RAN is hardened through strenuous testing and integration work with key RAN vendors to maximize performance and improve resource utilization. The ecosystem stems from the industry-leading RAN vendors but also includes Intel so that the platform is in conformance with Intel's FlexRAN reference design for our partners to offer RAN-specific performance enhancements, such as PTP, FEC offload, and SR-IOV.

The ecosystem along with the CI/CD pipeline provided by VMware Telco Cloud Automation enables you to onboard, deploy, and update vRAN functions quickly and reliably by removing time-consuming and complex integration work. VMware and its RAN partners test, tune, and scale vRAN functions and their interfaces against industry packaging standards to optimize performance.

5G Multi-Services Hub

In addition to operating vRAN functions, the horizontal design of VMware Telco Cloud Platform RAN provides flexibility and adaptability for CSPs and their customers to develop and deploy custom 5G applications on the same platform. VMware ESXi with

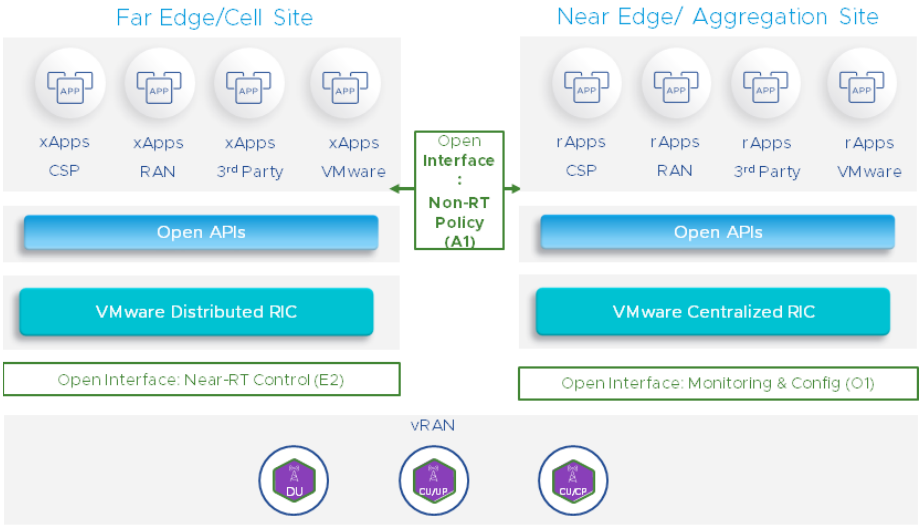

FIGURE 5: A disaggregated open RAN includes a RAN intelligent controller.

VMware Tanzu for Telco RAN provide virtualized compute resources and Kubernetes at the cell and aggregation sites.

Operating vRAN functions and custom applications on the same platform gives them direct access to ultra-high speed 5G networks to deliver services from the locations closest to customers, which improves service quality and customer experiences. With this adaptability, the RAN becomes a 5G multi-services hub for monetization.

VMware RIC

VMware RIC paves a simple path toward RAN modernization. It gives you a smooth evolution toward an open RAN future without disrupting your business operations and overhauling your network design. The advancements that VMware RIC bring to open RAN strike a balance between network performance and operational flexibility.

Driving Innovation and Reducing Costs

VMware RIC modernizes the RAN to be truly open and programmable so you can build an open RAN with solutions from a rich and vibrant ecosystem of partners while providing the RAN programmability and intelligence for all the solutions to work harmoniously. Here are some of the capabilities and benefits of VMware RIC:

- Modularity – Integrates the RIC with solutions from ecosystem partners while supporting various Kubernetes implementations.
- Programmability – Reduces operational complexity by handling RAN control and management functions with open standards.
- Monetization – The VMware RIC SDKs drive a rich and vibrant application ecosystem to enable you to create innovative services that maximize business growth.
- Ecosystem – The ecosystem partners speed up the introduction of innovative services.
- Simplicity – Centralized RAN Intelligence helps simplify RAN operations and optimizes network utilization.

VMware RIC gives you the flexibility and choice to build future-proof radio access networks with multi-vendor solutions while protecting your investments and improving the adaptability of the RAN.

VMware Telco Cloud Platform Edge

VMware Telco Cloud Platform Edge is a multi-cloud platform adapted for the edge to modernize the network and monetize 5G. The platform's automation centralizes management of distributed edge services. Operational consistency cost-effectively streamlines the deployment of edge services across common infrastructure. And access to a multi-vendor ecosystem helps you move in a predictable yet agile way.

Combined with 5G, the edge represents a major opportunity to reimagine communication services, build new compute capabilities and monetize innovations. The edge brings processing capabilities and data closer to where it consumed so you can do the following:

- Modernize your networks with edge compute sites closer to customer endpoints.
- Enhance wireless network connectivity services with 5G.
- Deliver on-demand services that meet your customers' use cases and availability requirements, even when they differ across customers and locations.
- Monetize new edge compute services beyond connectivity by using a horizontal compute platform for third-party application providers, including services to host RAN intelligent controller (RIC) and MEC applications.

Knowing where and when to invest is difficult in a rapidly evolving edge market with tight competition. Participants are under pressure to form a partner ecosystem, work well with developers, and improve security. The costs of developing too many edge sites or engaging with new audiences where it is unwarranted will lead to suboptimal business outcomes. Business models need to be flexible. Success requires agility.

The pressure to get the investment right raises a critical question: What is an economically optimal approach to building and operating a large network of distributed edge sites?

That's where VMware Telco Cloud Platform Edge comes in. It's a consistent platform that fast-tracks success at the edge by empowering you to modernize your networks, tap robust partner ecosystems with confidence, attract innovative developers, and monetize new services. VMware Telco Cloud Platform Edge can be deployed at both the Provider and Enterprise edge.

Benefits of VMware Telco Cloud Platform Edge

Here are some key benefits of VMware Telco Cloud Platform Edge:

- Deploy service provider and enterprise edge sites faster and manage them with less effort through automation and a unified management plane
- Integrate edge sites into to your network modernization efforts by using common, open standard interfaces (ETSI, TMF and O-RAN)
- Run heterogeneous applications on the same platform to support network modernization and edge monetization
- Accelerate edge revenues by rolling out differentiated communication services and new offerings through validated partner solutions
- Keep control of your edge strategy by owning the platform that hosts the services and by having the freedom to select your vendors of choice.

VMware Telco Cloud Platform Edge is deployed on commercial off the shelf (COTS) hardware and composed of VMware vSphere, VMware Tanzu Standard, and VMware Telco Cloud Automation. The platform can be extended with add-ons like VMware vSAN and VMware SD-WAN and SASE to fulfill telco and enterprise edge use cases.

- VMware Telco Cloud Automation supplies a centralized management plane for network domains and multi-cloud operations. It delivers automation at every layer of the telco cloud from infrastructure and CaaS to network functions and services.

INTRINSIC SECURITY FOR 5G

With the VMware Telco Cloud, security is intrinsic — integrated with the software and built into the infrastructure so that security is programmable, automated, adaptive, and context-aware. Intrinsic security improves visibility, reduces complexity, and focuses your defenses by enabling you to apply and automate adaptive security measures like micro-segmentation in the right place.

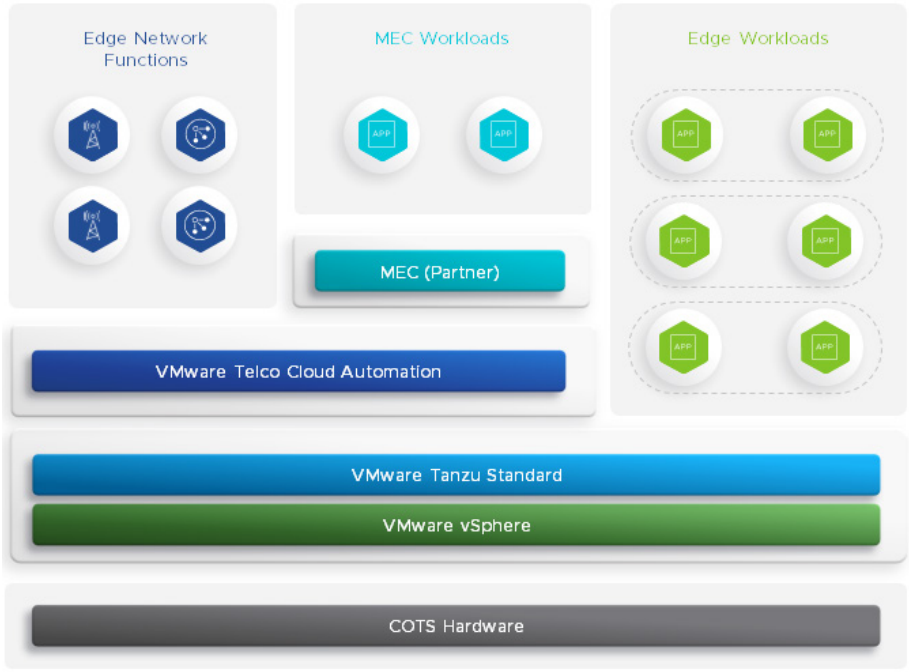

FIGURE 6: The architecture of VMware Telco Cloud Platform Edge.

- VMware Tanzu delivers a proven Kubernetes distribution combined with PaaS and CaaS management for edge-native applications.
- VMware vSphere powers your computing environment and is optimized for edge applications with simplicity, efficiency, scalability, and built-in security.

Tapping a Marketplace of Solutions to Conquer the Edge

A variety of VMware and partners' solutions are validated to work with VMware Telco Cloud Platform Edge through the VMware Ready for Telco Cloud program. This combination speeds up the launch of services at the network and enterprise edges:

- Network Slicing
- Multi-Access Edge Compute (MEC)
- Content delivery network (CDN
- Private mobile networks (PMN)
- Edge-native compute: VMware Edge Compute Stack is a purpose-built stack for deploying and securing edge-native apps at the far edge.

VMware Telco Cloud Platform Public Cloud

VMware Telco Cloud Platform Public Cloud enables you to modernize your networks by seamlessly incorporating public cloud infrastructure as a service (IaaS) as an integral part of your 5G architecture. With VMware Telco Cloud Platform Public Cloud, you can run both telco and IT workloads in a public cloud with consistent operations across core, edge, and RAN.

Flexibility and Choice for End-to-End Networks

VMware Telco Cloud Platform Public Cloud enables you to realize your multi-cloud visions and strategies. By providing choice and the flexibility to run workloads in multi-cloud environments with ease, you accelerate business growth with new offerings while reducing costs.

A BROAD SPECTRUM OF MULTI-VENDOR NETWORK FUNCTIONS

The VMware Ready for Telco Cloud program helps CSPs identify VMware partner network functions that have been validated to work with the VMware Telco Cloud. These network functions meet VMware standards for integration and interoperability.

VMware cooperates with multiple network function vendors to certify their functions. This comprehensive program ensures interoperability and operational readiness between third-party network functions and the VMware Telco Cloud.

The program removes time-consuming, difficult integration work so that CSPs can focus on innovation and accelerate the deployment of 5G and edge services.

vmware® READY TELCO CLOUD

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For more information about the VMware Telco Cloud for 5G, call 1-877-VMWARE (outside North America, dial +1-650-427-5000) or visit *https://telco.vmware.com/*

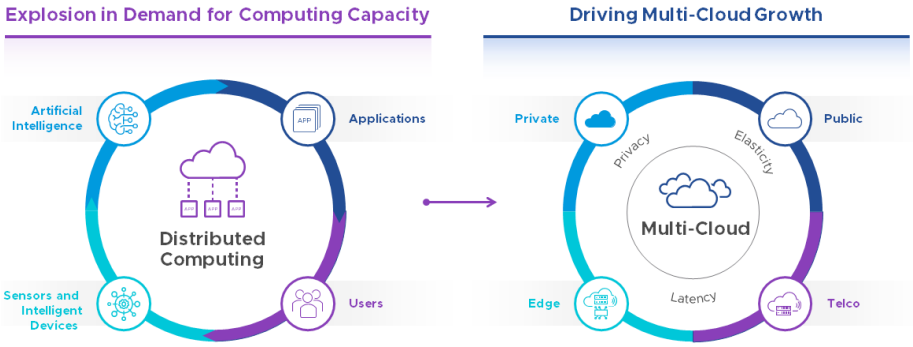

FIGURE 7: Demand for computing capacity is propelling multi-cloud growth. VMware Telco Cloud Platform Public Cloud supports CSPs as they tap multiple clouds to roll out 5G.

Capabilities and Benefits of VMware Telco Cloud Platform Public Cloud

- Data Center Extension – Adapt to ever-changing business landscapes and customer demands with ease. Seamlessly migrate your workloads from on-premises telco cloud to public cloud.
- On-Demand Capacity – Quickly scale capacity up and down with ease by utilizing public cloud. All driven by your business growth plan and change in traffic patterns.
- Workload Portability – Migrate your workloads bidirectionally between on-premises telco cloud and public cloud without expensive and time-consuming workload refactoring.
- Platform Consistency – Accelerate cloud migrations with the consistent platform and operations between on-premises telco cloud and public cloud, across your 4G, 5G and beyond.

With VMware Telco Cloud Platform Public Cloud, you can reduce costly and time-consuming workload refactoring when migrating workloads to a public cloud with the power of VMware Cloud on AWS. You can quickly adapt to ever-changing business landscapes by scaling your networks, expanding their footprints, and entering new markets without incurring heavy upfront infrastructure investments. In addition, the leasing of cloud IaaS encourages you to adopt the SaaS model that tightly aligns with your business growth plan, removing traditional up-front costs and risks.

Conclusion

To capitalize on the opportunities of 5G and to improve their competitive position, CSPs are seeking to overcome the limitations of their existing network architectures and transform their businesses into an agile force with streamlined operations. The VMware Telco Cloud combines telco-specific cloud-native solutions and cloud-first automation with consistent infrastructure and holistic assurance to propel you into the future with agility and efficiency while maintaining carrier-grade performance and reliability.