VMware Telco Cloud Platform

Deploy and Operate 5G Functions and Services on Consistent Infrastructure with Cloud-Smart Automation

AT A GLANCE

VMware Telco Cloud Platform™ – 5G Edition is powered by field-proven compute and networking coupled with VMware Telco Cloud Automation™ and a telco-grade Kubernetes distribution. VMware Telco Cloud Platform empowers CSPs to modernize their 5G networks so they can rapidly deploy and efficiently operate multi-vendor CNFs and VNFs.

KEY BENEFITS

- Gain web-scale speed and agility to accelerate the rollout of 5G core services
- Deploy virtual network functions (VNFs) and containerized network functions (CNFs) on consistent horizontal infrastructure
- Dynamically adjust the configuration of underlying resources
- Automate lifecycle management of infrastructure, Kubernetes clusters, network functions, and services
- Accelerate the deployment of network functions through the VMware Ready for Telco Cloud program
- Follow a reference architecture from VMware to implement a solution that works best for your business
- Add optional components to meet your requirements, including VMware NSX Advanced Load Balancer, VMware vRealize® Orchestrator, VMware vSAN™, VMware Telco Cloud Service Assurance™, and a VIM — either VMware Cloud Director or VMware® Integrated OpenStack

Solving Problems through Modernization

The rollout of new 5G services will intensify the already fierce competition among communication service providers (CSPs). Rising network costs, rigid resources, and unforeseen shifts in demand are putting margins under pressure, hampering innovation, and placing a premium on customer experience.

To capture more market share in such a highly competitive landscape, a CSP must be able to cost-effectively roll out new services with agility and speed while maintaining telco-grade performance and reliability. A modern telco cloud platform should furnish the architectural foundation to deliver operational flexibility, cloud-smart automation to reduce operational complexities, and multi-layer assurance to maintain continuous service delivery.

This path to modernization is lit up by the transformational power of cloud-native principles. Kubernetes, containers, and microservices help supply the technology for modernization; DevOps practices, continuous integration and continuous delivery (CI/CD) pipelines, and automated operations streamline the development, deployment, and management of new services.

Consistent infrastructure also plays a critical role in modernization because it can unite multiple clouds and multi-vendor networks of VNFs and CNFs into a simple solution that can be centrally managed at scale. Ubiquitous automation ties all the moving parts together to lower costs, promote on-demand delivery, and set the stage for service assurance and innovation.

About VMware Telco Cloud Platform – 5G Edition

VMware Telco Cloud Platform is powered by field-proven compute and networking coupled with *VMware Telco Cloud Automation* and a telco-grade Kubernetes distribution. VMware Telco Cloud Platform empowers CSPs to modernize their 5G networks so they can rapidly deploy and efficiently operate multi-vendor CNFs and VNFs.

The compute and networking, which are supplied by VMware vSphere® and VMware NSX-T™ Data Center, enable CSPs to run both CNFs and VNFs on consistent horizontal infrastructure. The Kubernetes distribution—Tanzu Standard for Telco—is designed to support telecommunications use cases. The platform implements containers as a service for deploying and managing CNFs.

The platform expedites the innovation cycle, simplifies operations, and reduces costs to modernize your network and accelerate the deployment of 5G core services.

Containers as a Service on Horizontal Infrastructure

VMware Telco Cloud Platform enables CSPs to take the first step toward cloud modernization by running a broad set of network functions on consistent horizontal

KEY CAPABILITIES

- Architect the network for optimum application response, scale, and service availability
- Utilize microservices and optimize resources with a telco-grade Kubernetes distribution
- Gain repeatability across network functions and services
- Onboard network functions using standards-based templates
- Model network services based on multi-vendor network functions
- Automate lifecycle management for infrastructure, CaaS, and network functions
- Accelerate the time it takes to deploy functions and services through automated provisioning and the VMware Ready for Telco Cloud program

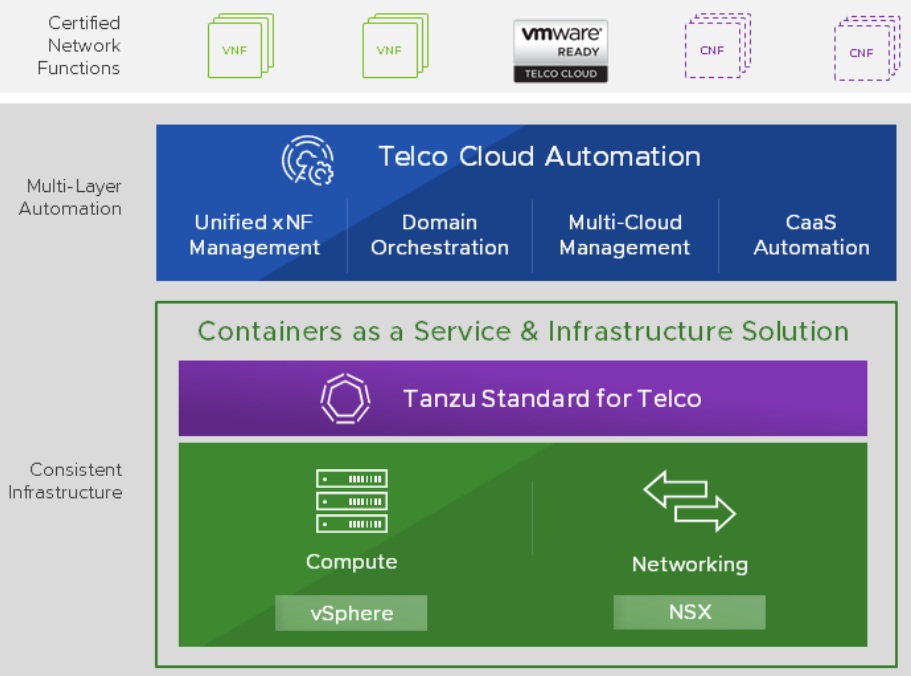

FIGURE 1: VMware Telco Cloud Platform combines consistent horizontal infrastructure with multi-layer automation and access to an ecosystem of certified network functions.

REFERENCE ARCHITECTURE

VMware Telco Cloud Platform can be deployed across 5G networks to meet target design and scalability objectives. The VMware telco cloud *reference architecture* provides guidance for designing and creating an infrastructure and automation solution. The reference architecture describes the high-level design principles and considerations to implement the environment. It also provides example scenarios to help understand the solution's capabilities.

infrastructure. The solution provides containers as a service (CaaS) and uses Kubernetes to orchestrate CNFs and containerized services. The solution supports deploying applications with a microservices architecture, establishing network resiliency, creating seamless cross-cloud application continuity, and isolating multi-tenant services to address business requirements and compliance regulations, such as high availability and service-level agreements.

Cloud-Smart Automation

As part of the platform, VMware Telco Cloud Automation is natively integrated with the infrastructure and the CaaS layer to automate and orchestrate the following aspects of the telco stack:

- Infrastructure layer
- Containers as a service layer
- Network functions layer
- Network services layer
- *Network slicing layer*

The multi-layer automation enables CSPs to accelerate time-to-market for their network functions and services while igniting operational agility through unified lifecycle management across clouds and domains.

The cloud-smart approach of VMware Telco Cloud Automation provisions the underlying infrastructure at the time of network function instantiation based on the network function's resource requirements. It also offers standards-driven generic modular components to integrate and extend an existing multi-vendor MANO architecture.

ACHIEVE CLOUD MODERNIZATION

Gain web-scale speed and agility to accelerate the innovation cycle and deliver new services to the market faster while maintaining telco-grade performance, reliability, and quality.

Key Capabilities and Benefits of VMware Telco Cloud Platform

VMware Telco Cloud Platform establishes an open, vendor-agnostic ecosystem to streamline 5G core service delivery from design to lifecycle management automation while creating a unified, operator-friendly architecture with key capabilities for resource optimization, operational consistency, and multi-layer automation.

High Performance CaaS and IaaS infrastructure

VMware Telco Cloud Platform enables CSPs to deploy both CNFs and VNFs on consistent horizontal infrastructure. With VMware NSX-T providing enhanced data plane networking between these network functions, the platform offers high performance and scaling, with the following functionality providing examples:

- VMware NSX managed Virtual Distributed Switch in Enhanced Data Path mode (N-VDS (E)) that leverages Data Plane Development Kit (DPDK) techniques to provide a fast virtual switching fabric on VMware vSphere
- Low-latency data plane through CPU pinning, fine-grained non-uniform memory access (NUMA) placement, and vertical NUMA alignment
- Improved performance through multi-tiered routing, bare-metal NSX Edge nodes, and huge pages with the access efficiency of translation lookaside buffers

Telco-Grade Kubernetes

The CaaS functionality of VMware Telco Cloud Platform simplifies the operation of Kubernetes for 5G core deployments, centralizing management and governance for clusters. The platform provides telco-grade CaaS enhancements, such as the following:

- Multus, Antrea, and Calico to attach multiple container networking interfaces (CNIs) to Kubernetes pods through its plugins for performance enhancement and isolation
- IP address management (IPAM) CNI plugin with Multus CNI to dynamically assign IP addresses to Kubernetes pods across all the nodes in a cluster using Whereabouts
- Topology Manager to optimally allocate CPU memory, and device resources on the same NUMA node to support performance-sensitive applications
- Support for affinity and anti-affinity to specify servers for hosting Kubernetes nodes so that VNFs and CNFs can continue running if a server host fails
- Support for Velero, an open source tool for backup and restore, to increase resiliency by performing disaster recovery and migrating Kubernetes cluster resources and persistent volumes

With these enhancements, CSPs can take advantage of a telco-grade Kubernetes platform to address emerging 5G use cases.

Additional performance and management enhancements include the following:

- Support for conventional performance enhancement technologies, such as DPDK and single-root input-output virtualization (SR-IOV) for data plane acceleration
- Extensions to support automated cluster configuration and provisioning
- Profile-based worker node dimensioning to optimize usage and performance
- Installation of the Avi Kubernetes Operator for lifecycle management of VMware NSX Advanced Load Balancer, which is an optional add-on.
- Installation of the Prometheus and Fluent Bit extensions for VMware Tanzu Kubernetes Grid
- Issuance of diagnostics and health checks for a Kubernetes cluster or a node pool directly from the VMware Telco Cloud Automation user interface
- Security for kubectl usage to restrict access to VMware Tanzu Kubernetes Grid through VMware Telco Cloud Automation by issuing or revoking one-time passwords and tokens with expiry dates

VMWARE READY FOR TELCO CLOUD AT A GLANCE

The VMware Ready for Telco Cloud program helps CSPs identify VMware partner network functions that have been validated to work with VMware technology. More than 260 VNFs and CNFs have been validated to meet VMware standards for integration and interoperability.

FOLLOWING STANDARDS FOR INTEROPERABILITY

While many vendor solutions inherently restrict interoperability, VMware Telco Cloud Platform follows the ETSI and CNCF guidelines. The Infrastructure, G-VNFM, and NFVO are designed to interface with ETSI SOL-compliant components of the MANO framework, such as OSS, BSS, EMS, and VNFM. And the solution's network function composer, coupled with the VMware Ready for Telco Cloud program, bolsters innovation and interoperability—providing ready access to new capabilities.

Service and application awareness

VMware Telco Cloud Platform automatically adjusts the underpinning infrastructure resources to accommodate the requirements of each network function. With this capability, CSPs can architect their 5G core networks for optimum application response, scale, and service availability. The platform supports multiple auto-operation models, triggering actions from NFV operations, VNF management, or EMS to enhance service quality and resiliency. The result helps CSPs improve resource utilization and operational efficiency.

Tailored design and onboarding

VMware Telco Cloud Platform provides a visual blueprint composer that allows network and equipment vendors to easily create and optimize network function and service templates. The platform is vendor-neutral; CSPs can onboard these functions and services with descriptors and packages compliant with ETSI SOL001/004 standards. Network services can also be designed with a combination of network functions from multiple vendors and formats (CNF and VNF). The onboarded elements are then available in centralized catalogs to maximize reusability.

Multi-layer lifecycle management automation

VMware Telco Cloud Platform lets CSPs centrally manage and automate their virtualized architecture, from CaaS to network services and slices. Application management (G-xNFM) unifies and standardizes network function management across the virtual- and container-based infrastructure. Domain orchestration (NFVO) simplifies the design and management of centralized or distributed multi-vendor network services. CSPs can onboard CNFs and VNFs using standard-compliant TOSCA templates.

The multi-cloud infrastructure and CaaS automation ease multi-cloud registration of Kubernetes clusters and the virtual infrastructure manager (VIM), enable centralized CaaS management, synchronize multi-cloud inventories and resources, and collect faults and performance from infrastructure up to network functions and services. Kubernetes clusters can be created and optimized automatically to align with the requirements of network functions and services.

By using the centralized VMware Telco Cloud Automation catalogs, CSPs can easily trigger an instantiation workflow. CSPs are guided at each step by an intent-based placement engine that aligns the blueprint requirements with the capabilities of each cloud to minimize rollbacks.

VMware Telco Cloud Platform also offers automation through a policy engine that executes closed-loop policies as well as standard and custom workflows for tailored decisions. For lifecycle management of network functions and services, these policies and workflows apply to the entire lifecycle—from day 0 to day 2 operations. With multi-layer lifecycle management automation, CSPs can remove complicated, tedious, and repetitive tasks while maximizing overall resource utilization through optimal placement, dynamic scaling, and dynamic workload management.

Streamlined deployment and maintenance

Because VMware Telco Cloud Platform natively integrates the automation with the underlying cloud infrastructure, it transforms integration-intensive projects into efficient product deployments. It accelerates service deployment, simplifies future upgrades, and reduces overall costs while eliminating error-prone manual configurations. Native integration between automation and infrastructure components from VMware also means continuous knowledge of the telco cloud state, optimized placements, VIM and cluster configurations auto-discovery, and continuous synchronization across the components of the telco cloud.

VMWARE TELCO CLOUD SERVICE ASSURANCE AT A GLANCE

VMware Telco Cloud Service Assurance™ is a multi-vendor, multi-cloud solution that monitors, analyzes, and pro-actively manages multi-vendor physical and virtual environments in a single platform.

VMware Telco Cloud Service Assurance is an optional add-on component for VMware Telco Cloud Platform.

Key Capabilities and Benefits

- Simplify NOC and SOC operations with a centralized, cross-domain view.
- Gain rapid insights with integrated fault and performance management, service management, root cause analysis, and impact assessment.
- Reduce costs and complexity through automation and optimization for assurance across layers and domains.
- Use closed-loop automation and rapid remediation to reduce OpEx and optimize resources and workloads to meet surges in demand.
- Use AI-based analytics to increase operational efficiency with rapid problem isolation, automatic suppression of extraneous alarms, and automated rule updates.

LEARN MORE

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

VMware Ready for Telco Cloud Certification Program

VMware further enhances interoperability by certifying partners' network functions through the VMware Ready for Telco Cloud program. With simplified and certified interoperability of functions, CSPs can select the best solutions for their use cases while reducing the risks associated with the complexity of onboarding various network functions.

This award-winning program ensures interoperability and operational readiness between VMware Telco Cloud Platform and the network functions of VMware partners, enabling CSPs to rapidly onboard and deploy the functions in their 5G cores. With close collaboration with partners, VMware creates an ETSI-compliant descriptor, workflow, resource, and artifacts for a validated and tested Cloud Service Archive (CSAR).

The program removes time-consuming, difficult integration work from CSPs so that they can focus on innovation and accelerate the deployment of 5G services. The objective of the program is to create a multi-vendor ecosystem consisting of numerous network functions.

Included Components

VMware Telco Cloud Platform – 5G Edition comprises the following VMware components.

FUNCTION	COMPONENT
CaaS orchestration	VMware Tanzu Standard for Telco
Automation	VMware Telco Cloud Automation – 5G Edition
Compute	VMware vSphere Enterprise Plus (with VMware vCenter Server as a mandatory add-on component)
Networking	VMware NSX-T Data Center

Optional Components

The following VMware products can be combined to construct a more comprehensive telco cloud environment. *VMware Telco Cloud Service Assurance*, for example, is an optional component for analytics and assurance that provides holistic end-to-end insights and fault monitoring.

FUNCTION	OPTIONAL COMPONENT
Advanced load balancer	VMware NSX Advanced Load Balancer
Infrastructure orchestration	VMware Cloud Director or VMware Integrated OpenStack
Storage	VMware vSAN Standard
Operations	VMware vRealize Orchestrator
Fault monitoring and analytics	VMware Telco Cloud Service Assurance

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