

# Telco Cloud Automation

## Gain Operational Agility through Unified Orchestration and Automation

### AT A GLANCE

VMware Telco Cloud Automation™ is a multi-domain automation platform that accelerates time to market for network functions and services while igniting operational agility through unified automation across clouds.

### KEY CAPABILITIES AND BENEFITS

- Integrate 5G network capabilities alongside existing NFV architectures and manage them from a centralized location
- Enhance the customer experience through workload mobility, dynamic scalability, closed-loop healing, and improved resilience
- Improve agility with Kubernetes, cloud-native patterns, and CaaS automation
- Innovate faster and reduce complexity with validated solutions from various vendors in 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
- Optimize cloud resource utilization through cloud-smart placement and automated Kubernetes and infrastructure customizations
- Improve service quality and issue resolution by integrating with the AI-driven workflows of VMware Telco Cloud Service Assurance
- Consolidate workloads onto fewer servers to reduce CapEx and carbon footprints
- Improve operational efficiency and avoid error-prone manual tasks to reduce costs

Communication service providers (CSPs) are shifting from physical to cloud networks to gain operational agility, network resiliency, lower operating costs, and new routes to revenue. This transition marks a radical departure from the traditional single-purpose hardware appliance model, especially as CSPs strive to design and operate services across a web of data centers and clouds while enabling interoperability across solutions from multiple software vendors.

Given the complexity of coordinating new cloud technologies, managing network functions, and deploying multiple services, CSPs want an automated approach that removes complexity and error-prone manual processes. To address these challenges and improve operational efficiency, CSPs are turning to VMware Telco Cloud Automation.

### Unified Multi-Cloud, Multi-Layer Automation Delivers Flexibility and Agility

VMware Telco Cloud Automation is a multi-domain, multi-cloud, multi-layer automation platform that accelerates the time to market and time to revenue of communication services while igniting operational agility through unified automation across network domains and clouds. Consistent multi-cloud operations and lifecycle management for Days 0, 1 and 2 connects each layer of the telco cloud, from infrastructure to services and network slicing.

VMware Telco Cloud Automation is grounded in compliance with standards and a broad ecosystem of certified partners, which limit implementation risks and produce an open, modern architecture for managing network functions. VMware Telco Cloud Automation integrates with other VMware telco cloud solutions.

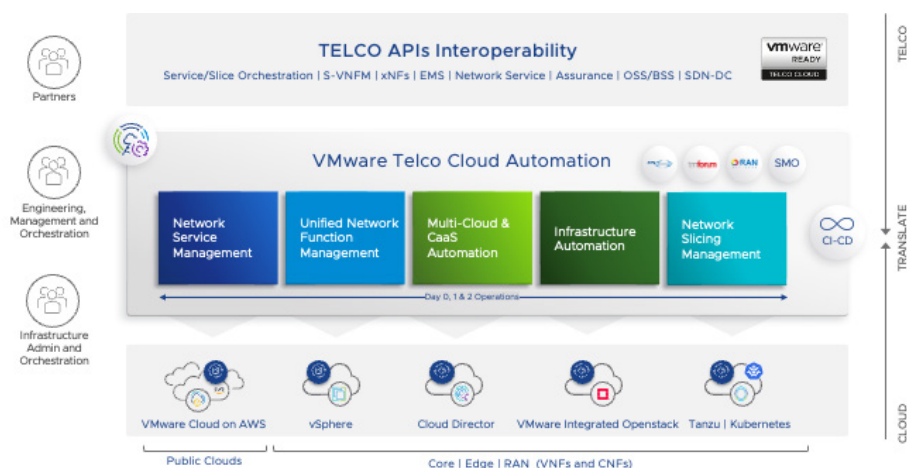


FIGURE 1: VMware Telco Cloud Automation combines multi-layer automation with access to an ecosystem of certified network functions through the VMware Ready for Telco Cloud program.

FULL-STACK SUPPORT FOR CLOUD NATIVE

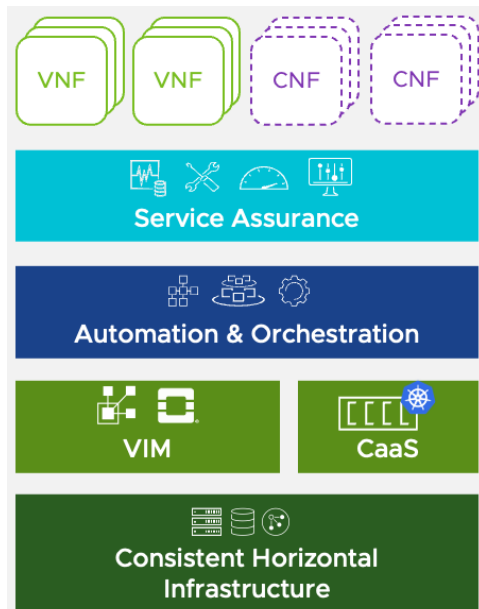


Figure 2: VMware Telco Cloud Automation simultaneously furnishes extensive network automation for 4G and 5G.

FOLLOWING STANDARDS FOR INTEROPERABILITY

While many vendor solutions inherently restrict interoperability, VMware Telco Cloud Automation follows the ETSI and CNCF guidelines. The automation, 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 — giving you access to new capabilities.

VIDEO: AUTOMATION FOR 5G NETWORKS



**Automating 5G Networks:** This video discusses network automation and the vital role it plays in infrastructure for 5G networks.

Cloud-Smart Approach Supports the Transition to 5G

By applying a cloud-smart approach that abstracts the complexity of using multiple clouds, the solution delivers network resources on-demand, lowering operating expenses, optimizing infrastructure investments, and bolstering the delivery of revenue-generating services.

To address the fact that CSPs are at different stages of network maturity, VMware Telco Cloud Automation manages 4G, VNF-based networks; helps a CSP graduate to 5G, CNF-based networks; and—for those CSPs that already operate with cloud-native 5G networks—supports cutting-edge automation, such as network slicing, to unlock new revenue sources.

An effective automation solution must support both VNF- and CNF-based workloads and help carry a CSP from 4G to 5G in a way that minimizes network disruption and opens avenues to reduce costs and bolster revenues. The path to network modernization lies in embracing capabilities that can address tomorrow’s requirements and can deliver end-to-end management, automation, and orchestration for many of today’s 4G requirements at the same time. VMware Telco Cloud Automation furnishes extensive network automation for 4G and 5G networks.

Centralized Management and Automation

Centralized multi-domain, multi-cloud network management with distributed control offers a single pane of glass and consistent experience to provision and manage telco cloud network functions virtualization (NFV) and cloud-native software for radio access networks (RAN), edge deployments, and core domains over private and multi-cloud infrastructure.

VMware Telco Cloud Automation also provides APIs to act as a single point of integration to a CSP’s DevOps practices and continuous integration and continuous deployment (CI/CD) tools.

VMware Telco Cloud Automation lets CSPs use Amazon Web Services (AWS) with VMware Cloud on AWS and Amazon Elastic Kubernetes Service (EKS). VMware Telco Cloud Automation can provision cloud-native network functions directly on Amazon EKS, bringing unified management of workloads to both on-premises and public cloud infrastructure. The result improves flexibility, scalability, and reliability. This multi-cloud consistency eases workload onboarding, instantiation, and lifecycle management while promoting mobility from the network core to the edge and the RAN.

- Cross-domain orchestration simplifies the design and management of single- to multi-vendor network services in a centralized or distributed network architecture using NFV and cloud-native network functions.
- Unified network function automation standardizes multi-vendor network functions onboarding, instantiation and lifecycle management over virtual machines (VMs) and containers. Combining the network function layer with the underlying infrastructure management helps optimally place and allocate resources.
- CaaS automation reduces the complexity to deploy and operate Kubernetes at scale in a distributed and multi-cloud network architecture. CaaS automation facilitates the registration of existing Kubernetes clusters or the provisioning of new ones and their lifecycle management, including post-deployment customization and maintaining Day 2-related upgrades for Kubernetes versions by using a distinctive and powerful process called Dynamic Infrastructure Policies.

**DYNAMIC INFRASTRUCTURE POLICIES**

VMware Telco Cloud Automation dynamically configures infrastructure resources to meet the requirements of the CNFs being deployed, ensuring the right node customization at instantiation time regardless of the type of CNF or the CNF’s vendor. The automated customization of the following items lets you fulfill heterogeneous vRAN and 5G core vendor requirements with speed, consistency, and efficiency:

- Real-time Linux kernel versions
- Network adapters
- Precision Time Protocol configuration
- NUMA alignment
- Kernel arguments like Huge Pages
- Custom Linux package installations
- Configuration for the tuned daemon
- DPDK binding for SR-IOV interfaces

The result prevents the overprovisioning of hardware resources and significantly shortens the times for pre-deployment configuration and validation.

A customizable template paired with automated instantiation of virtualized RAN (vRAN) functions and dynamic infrastructure policies radically reduces the time to deploy new RAN sites.

**Dynamic Infrastructure Policies Customize Nodes To Meet Needs**

Importantly, the CaaS management of VMware Telco Cloud Automation utilizes a unique feature: Dynamic Infrastructure Policies. They configure cloud resources on-demand based on the network function requirements and then automates this process on an ongoing basis. Dynamic Infrastructure Policies address a fundamental issue for network operators: how to balance a set of diverse and heterogeneous vRAN and 5G core vendor requirements with consistent operations.

Figures 3 and 4 below highlight the importance of Dynamic Infrastructure Policies for modern network requirements.

Figure 3 illustrates the traditional path when validating, onboarding and instantiating CNFs—highlighting the complexity of maintaining manual infrastructure customizations concurrently with Kubernetes node and cluster requirements.

Figure 4, in contrast, presents the impact of Dynamic Infrastructure Policies where the underlying infrastructure and Kubernetes nodes are dynamically customized to fit changing network requirements—resulting in up to 75% time savings when validating and instantiating a CNF.

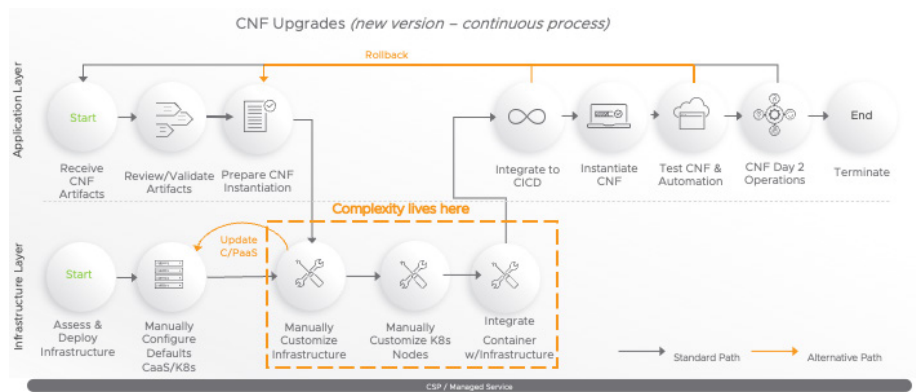


FIGURE 3: Here is a view of a CNF upgrade before the use of Dynamic Infrastructure Policies. Without Dynamic Infrastructure Policies, the customizations of Kubernetes nodes and virtual infrastructure are highly complex tasks requiring expertise in customizing applications, Kubernetes nodes, and other infrastructure, such as the virtual machines. These tasks usually require professional services and can lead to rollbacks and misconfigurations.

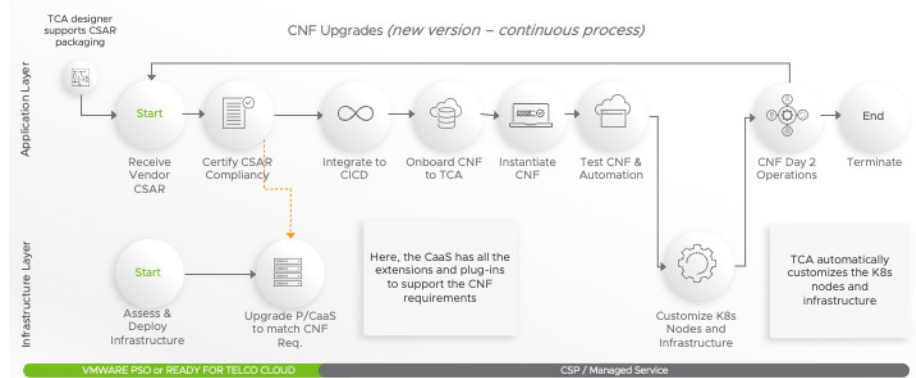


FIGURE 4: Here is a view of a CNF upgrade after the use of Dynamic Infrastructure Policies. With Dynamic Infrastructure Policies, a CNF upgrade is simplified and automated by customizing the Kubernetes nodes and other configurations, such the Linux packages, required by the CNF.

**INTEROPERABILITY**

Seamless interoperability of network functions can prove difficult. Without an automated onboarding process like the one that VMware Telco Cloud Automation facilitates, there is a steep learning curve for network function providers—you need to learn, for instance, how to write TOSCA templates and create workflows—which require robust technical knowledge.

VMware Telco Cloud Automation streamlines these otherwise complex, manual onboarding processes through a simple workflow editor GUI and debuggers—which ease difficult, manual processes and accelerate onboarding of VNFs and CNFs.

**Standard Interfaces**

- Ve-Vnfm-vnf: ETSI NFV IFA008/SOL002; VNF and NS descriptors compliant with IFA011/SOL001; VNF and NSD package format of IFA014/SOL004
- Ve-Vnfm-em: Third-party EMS per ETSI NFV IFA008/SOL002
- Or-Vnfm: ETSI NFV IFA007/SOL003
- Os-Ma-nfvo: ETSI NFV IFA013/SOL005 and TM Forum

**Network Slicing Management**

- Service Ordering: TMF641
- Service Catalog Management: TMF633
- Service Inventory: TMF638

**Open Architecture**

- Modular NFVO/G-VNFM architecture, interacting through REST APIs and using ETSI-MANO SOL003/IFA007 API standards
- Pre-built integration with VMware technologies, such as vRealize® and VMware Telco Cloud Service Assurance
- Support for Ansible Playbooks and ConfigMaps for commissioning
- Simplified integration with third-party OSS, VIM, VNF, SDN-C and S-VNFM
- Support for 3GPP network slicing management functions: CSMF, NSMF and NSSMF

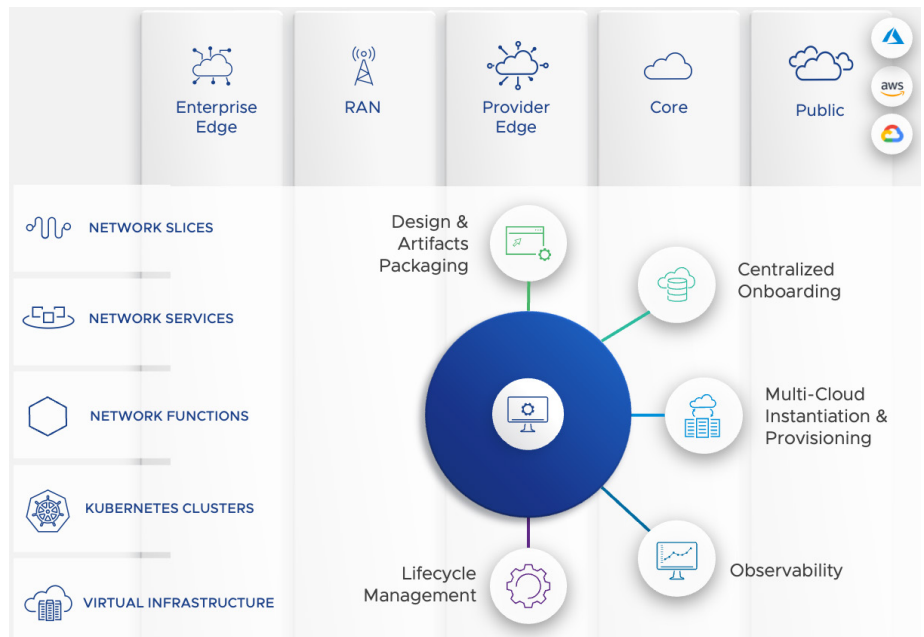


FIGURE 5: Centralized multi-cloud automation powers your network expansion.

**Operational Efficiency and Multi-Cloud Agility**

VMware Telco Cloud Automation delivers operational efficiency at scale to accelerate the time to market for new services, adapt existing services to meet customer requests, mitigate the cost of managing more complex networks, improve the customer experience, and driving new revenues. VMware Telco Cloud Automation enables multi-cloud operational agility through simplified design, onboarding, and the placement and management of network functions and services across data centers and telco cloud tenants.

Here are some key features of VMware Telco Cloud Automation:

**Automate the Network Expansion**

VMware Telco Cloud Automation accelerates network expansion by automating the provisioning software at new sites or adding compute capacity to existing ones. VMware Telco Cloud Automation centrally manages the provisioning and configuration of telco cloud software and a software-defined data center (SDDC) using pre-defined templates for the various site types of each telco cloud domain. The provisioning extends beyond the SDDC to include Kubernetes clusters and nodes in addition to network functions, services, and slices.

**Unified Automation for NFV and Cloud-Native Networks**

The platform provides a unified framework and the same user interface for Day 0, 1 and 2 operations of onboarded standards-compliant network functions. Network functions are managed using a shared catalog and inventory. The northbound APIs also follow industry standards.

**Multi-Layer Automation for the Telco Cloud**

VMware Telco Cloud Automation delivers lifecycle management automation for network slicing, network services, network functions, CaaS, and virtual infrastructure over the same platform—something that typically requires various separate tools offered through diverse vendors. Although each module is self-contained, the

**PURPOSE-BUILT NETWORK OVERLAYS**

The network slicing capabilities of VMware Telco Cloud Automation let you create differentiated service offerings according to your use case’s requirements.

- Create on-demand isolated or shared, QoS-driven logical end-to-end networks.
- Build custom overlay network compositions tailored to meet your SLA requirements.
- Share network infrastructure through the telecom-standards driven management layer (3GPP): Communication Slice Management Function, Network Slice Management Function, Network Slice Subnet Management Function (NSSMF).

**BUILT FOR A THRIVING, OPEN MULTI-VENDOR ECOSYSTEM**

While many vendor ecosystems inherently restrict interoperability, VMware Telco Cloud Automation follows ETSI guidelines. The network function manager and domain orchestrator are used as combined or standalone modules interfacing with ETSI SOL-compliant components of the MANO framework — operating support system (OSS), business support system (BSS), element management system (EMS) or VNFM, etc. The solution’s network function composer, coupled with the VMware Ready for Telco Cloud program, bolsters innovation and interoperability — giving you access to new capabilities.

**VIDEO: NETWORK SLICING**



**Network Slicing:** 5G has ushered in new consumer and enterprise use cases that demand high levels of connectivity with low latency. In this video demonstration, Network Slicing for VMware Telco Cloud Automation unlocks these new use cases.

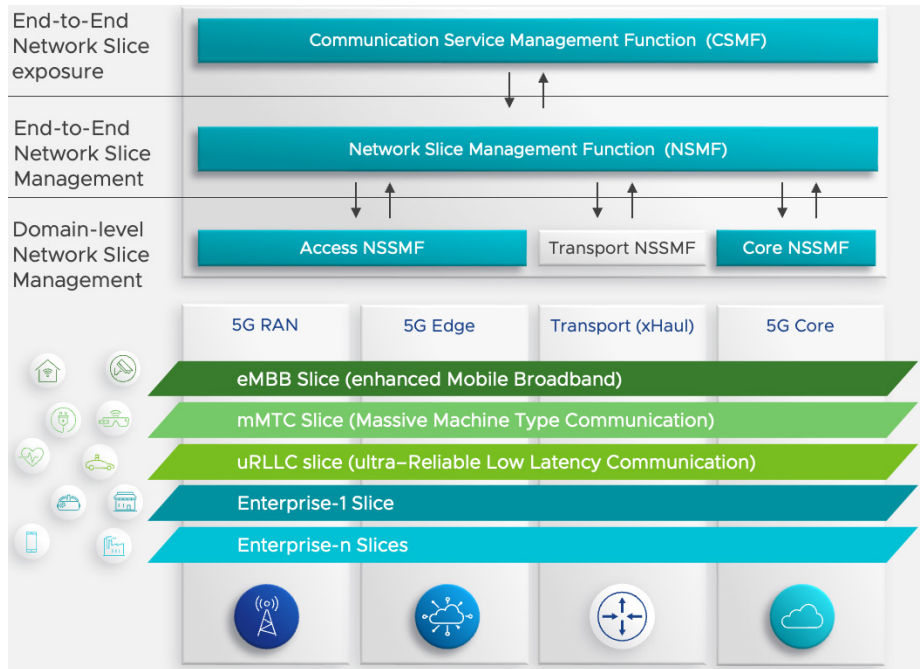


FIGURE 6: VMware Telco Cloud Automation empowers you to create and manage end-to-end network slices.

combination of modules enables advanced configuration for automation to align each layer of the cloud architecture to the context. Each layer of automation includes design tools to help create automation templates, software onboarding guidelines, placement and policy engines, and manual and auto-operation frameworks for Day 2 actions such as upgrade, heal, and scale.

**Proactive Management of Telco Cloud Software**

VMware Telco Cloud Service Assurance can be optionally used with VMware Telco Cloud Automation to provide visibility and collect fault and performance indicators of registered clouds and instantiated software. This information coupled with automated Day 1 and Day 2 operations like healing and scaling enables closed-loop action for issue remediation. Optionally integrating with VMware Telco Cloud Service Assurance delivers end-to-end root-cause analysis and the application of custom resolution workflows. The platform can also integrate with a CSP’s AIOps.

**Network Slicing to Monetize Services and Support Tailored SLAs**

As shown in Figure 6, Network Slicing for VMware Telco Cloud Automation lets CSPs create and monetize a new breed of services—from Massive Machine Type Communication (mMTC) or Ultra-Reliable Low Latency Communication (uRLLC) to enhanced mobile broadband (eMBB)—through standard frameworks. Network resources can be packaged and exposed directly to end users.

**Cloud-Smart Approach to Automation**

VMware Telco Cloud Automation integrates natively with the VMware Telco Cloud products, and these integrations are maintained for each new version. CSPs do not need to worry about planning and rebuilding all the integrations for every release. VMware Telco Cloud Automation deploys a control-plane function at each cloud integrated with VMware infrastructure to enable the proper placement and operations based on ubiquitous knowledge of the available multi-cloud resources and capabilities, avoiding rollbacks and misuse of the infrastructure.

**VMWARE READY FOR TELCO CLOUD AT A GLANCE**

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

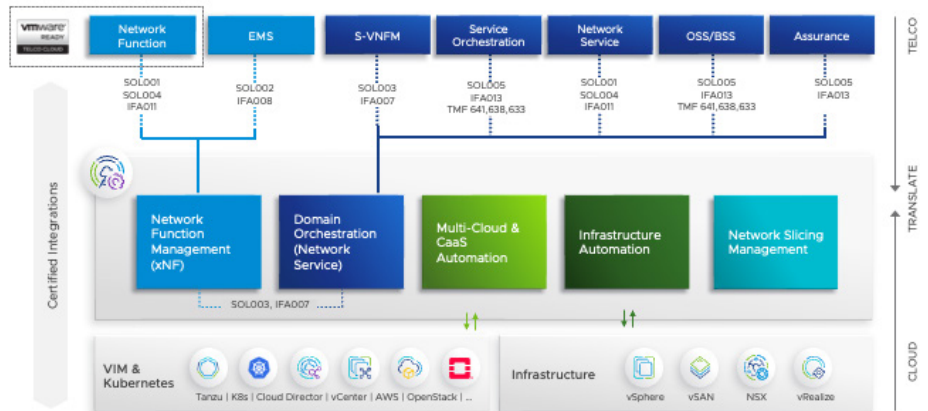


Figure 7: The key capabilities of VMware Telco Cloud Automation — including cloud-native technologies and automation — deliver flexible solutions for 5G. Access to CNFs, VNFs, and applications from multiple vendors supply extensible building blocks to deploy new services and explore emerging use cases.

VMware Telco Cloud Automation integrates with the virtualized infrastructure of VMware vSphere, the orchestration of VMware Tanzu Kubernetes Grid, and the fault monitoring and root-cause analysis of VMware Telco Cloud Service Assurance.

**Bare-Metal Automation**

VMware Telco Cloud Automation integrates with VMware Bare Metal Automation, which provisions bare-metal server infrastructure to drive rapid deployment of distributed RAN sites.

**Standard-Compliant and Open Automation Platform**

VMware Telco Cloud Automation gives CSPs a bridge to cloud computing. The platform supports telco standards, including 3GPP, ETSI-MANO, TMF, and O-RAN. Network functions compliant with ETSI-MANO standards can be onboarded to the platform catalog. A composer quickly aligns network function vendors with the right standards. Extensions are also added to support CNFs.

The CSP networks' east-west-northbound systems interacting with VMware Telco Cloud Automation can also use ETSI, TMF and O-RAN standards to simplify otherwise complex integrations. VMware Telco Cloud Automation provides a set of interfaces and libraries to quickly integrate continuous development, delivery, testing, and integration pipelines for telco cloud software.

**The VMware Ready for Telco Cloud Program**

The VMware Ready for Telco Cloud program presents hundreds of certified network functions on the VMware Marketplace. The program validates partner network function CSAR package conformity and the crucial steps of onboarding and lifecycle management with VMware technology. This certification process speeds up the deployment of network functions and limits the risks associated with interoperability.

VMware cooperates with numerous network function vendors, including key NEPs, which certify their network functions through the VMware Ready for Telco Cloud program. This comprehensive certification program ensures interoperability between third-party-developed network functions and VMware Telco Cloud Platform or VMware Telco Cloud Infrastructure. The program helps ensure that CSPs can rapidly onboard and deploy multi-vendor network functions.

**VIDEO: POWER UP NEXT-GEN SERVICES**



Watch a video overview of how VMware Telco Cloud Automation orchestrates next-gen network services and edge computing across multiple domains and clouds.

**LEARN MORE**

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

