

Telco Cloud Automation

Gain Agility and Launch New Services Faster 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
- Improve network time to market for services and reduce operating costs with Workflow Hub for VMware Telco Cloud Automation — a centralized pipeline for quickly assembling network processes that address various use cases
- 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
- Centralize the creation, optimization, and management of Kubernetes clusters with CaaS automation
- Optimize resource utilization through cloud-smart placement and automated CaaS 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

Telcos are at an inflection point. The pressing need to reduce costs, improve return on investments, increase operational agility, and boost network resiliency necessitates a transition from physical to virtual and cloud-native networks.

At the same time, macroeconomic and industry factors—from a diaspora of skilled engineers to a proliferation of 5G use cases—presents new urgency for network transformation. The pressure to evolve, however, carries a fundamental challenge because modern networks radically depart from telco's traditional single-purpose hardware appliances model.

Telcos striving to address these issues face a daunting architectural task. To achieve the requisite network modernization, they must design and operate their services across a web of data centers that bridge physical and virtual systems while enabling interoperability across a diverse, multi-vendor ecosystem. The rigors of designing and managing services combined with the intensity of coordinating VNFs and CNFs call for an automated approach that abstracts multi-cloud complexity and removes tedious manual tasks. Automation is the key to mitigating costs, opening new routes to revenue, and streamlining the creation and management of services.

In short, a comprehensive network automation, management, and orchestration platform holds important financial and operational promises. It comes as no surprise that communication service providers 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.

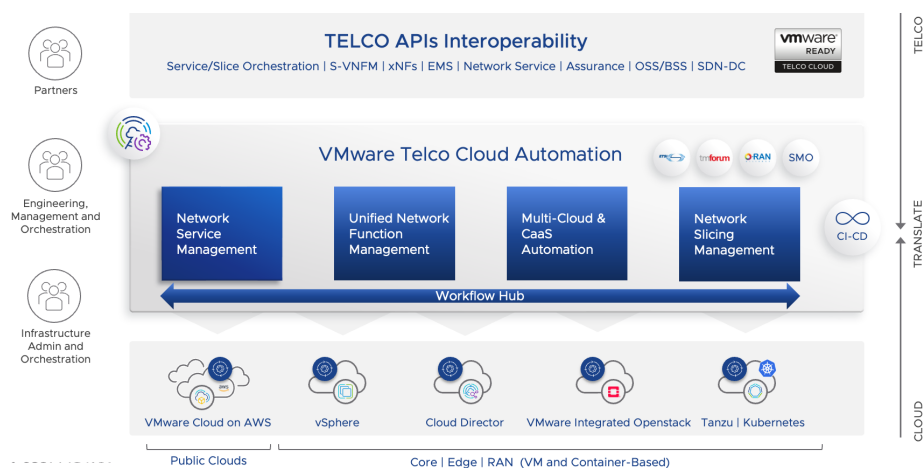


FIGURE 1: VMware Telco Cloud Automation combines multi-layer automation with access to an ecosystem of certified network functions through the VMware Ready for Telco Cloud program.

FULL-STACK SUPPORT FOR CLOUD NATIVE

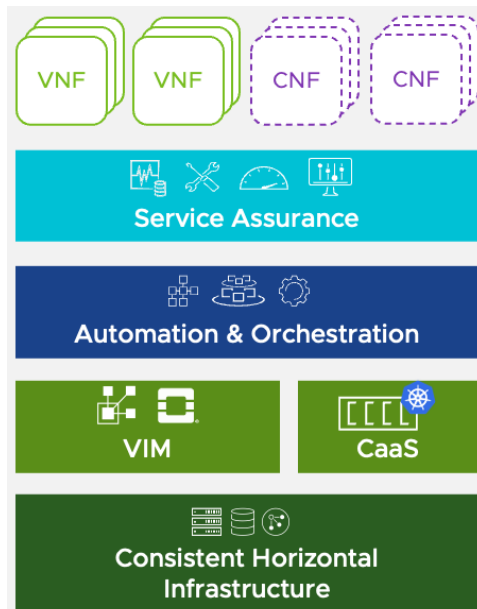


Figure 2: VMware Telco Cloud Automation simultaneously furnishes extensive network automation for 4G and 5G.

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.

With VMware Telco Cloud Automation, consistent multi-cloud operations and lifecycle management for Days 0, 1 and 2 connect each layer of the telco cloud, from infrastructure to services and network slicing.

The addition of Workflow Hub for VMware Telco Cloud Automation promotes the unification of each abstraction layer and substantially improves your ability to operate the platform and create new, multi-cloud workloads by using its CI/CD pipeline to rapidly develop, connect, test, deploy, and manage virtualized network functions (VNFs) and containerized network functions (CNFs).

VMware Telco Cloud Automation is grounded in compliance with standards and a broad ecosystem of certified partners and products, which limit implementation risks and produce an open, modern architecture for managing network functions. VMware Telco Cloud Automation works with other VMware telco cloud solutions and, with Workflow Hub, third-party automation tools for creating network services.

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 communication service providers (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

CSPs find themselves at different stages of network maturity, complicating network management. While some work with 3G-based physical network functions, others are firmly grounded in 4G environments running virtualized network functions (VNFs), and still others are in the middle ground between 4G VNF-based networks and 5G cloud-native network functions (CNFs). Finally, a few are constructing purely 5G standalone cloud-native networks.

In short, most CSPs share similar industry imperatives, but substantial fragmentation of their approaches exists—creating an equally fragmented market for vendors' network management solutions.

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.

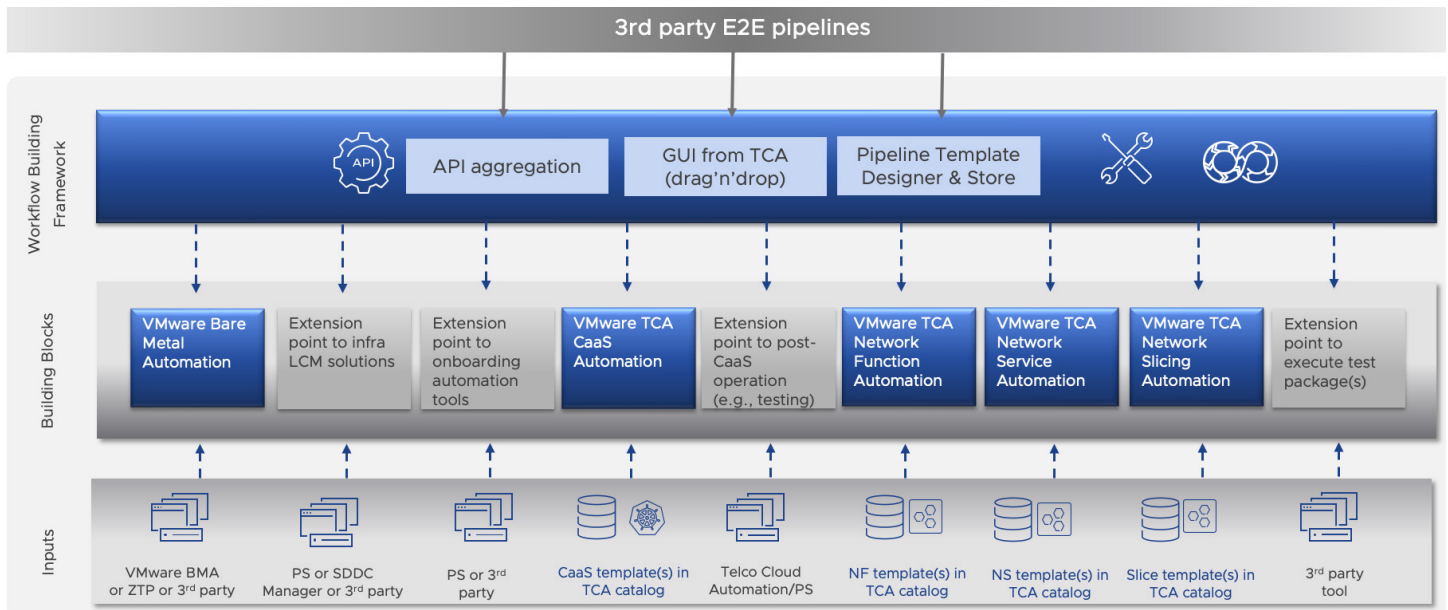


FIGURE 3: Workflow Hub for VMware Telco Cloud Automation enables you to use templates to string together processes that automate telecommunications networks and services.

Speeding Up Time to Market for Services with Workflow Hub

Workflow Hub for VMware Telco Cloud Automation represents the next evolution of centralized operations and operating expense reduction. Workflow Hub is an umbrella orchestrator that unifies not only the existing automation modules of VMware Telco Cloud Automation, but also extends to other VMware telco cloud solutions like VMware Bare Metal Automation and [VMware Telco Cloud Service Assurance](#) as well as third-party testing tools.

Workflow Hub enables you to easily define repeatable workflows that are less error prone and require less manual intervention so that you can save time and reduce operating expenses.

By using pre-built templates as building blocks in a simple drag-and-drop GUI, Workflow Hub lets you quickly stitch together processes that address various use cases. Here are some examples of what you can do with Workflow Hub:

- Construct an executable and repeatable workflow that uses automation to provision a cell site, including CNFs, in a few hours.
- Create a pipeline that application teams can use to bring up a Kubernetes cluster for network function version testing, obtain the results, and terminate the environment.
- Link deployment steps that take place outside VMware Telco Cloud Automation, such as setting up an external network, with the deployment of a network function.
- Automatically link several steps to manage the different components of your software-defined data center, such as provisioning a bare-metal server or performing lifecycle management for a VIM.
- Save a predefined workflow as code so that an operations team can execute and repeat it later after customizing it to fit its environment.

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

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.

Dynamic Infrastructure Policies, for example, let you manage the lifecycle of CNFs by using GitOps, which in turn speeds up the onboarding, deployment, and scaling of CNFs.

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 4 and 5 below highlight the importance of Dynamic Infrastructure Policies for modern network requirements.

Figure 4 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 5, 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.

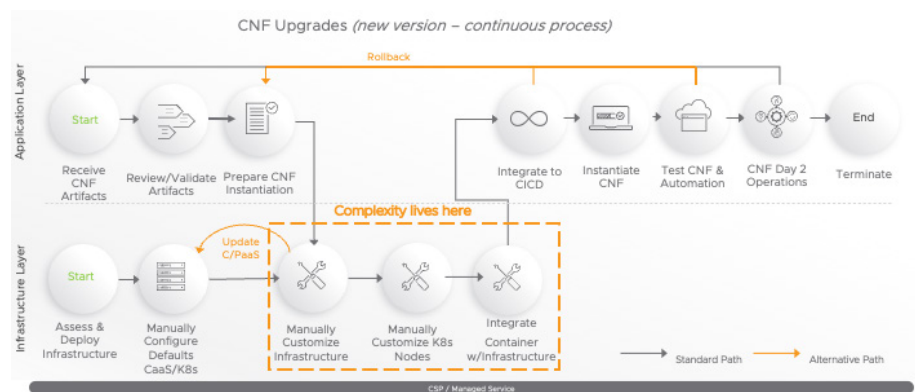


FIGURE 4: Here is a view of a CNF upgrade before the use of Dynamic Infrastructure Policies. Without Dynamic Infrastructure Policies, the customizations of Kubernetes nodes and virtual infrastructure are highly complex tasks requiring expertise in customizing applications, Kubernetes nodes, and other infrastructure, such as the virtual machines. These tasks usually require professional services and can lead to rollbacks and misconfigurations.

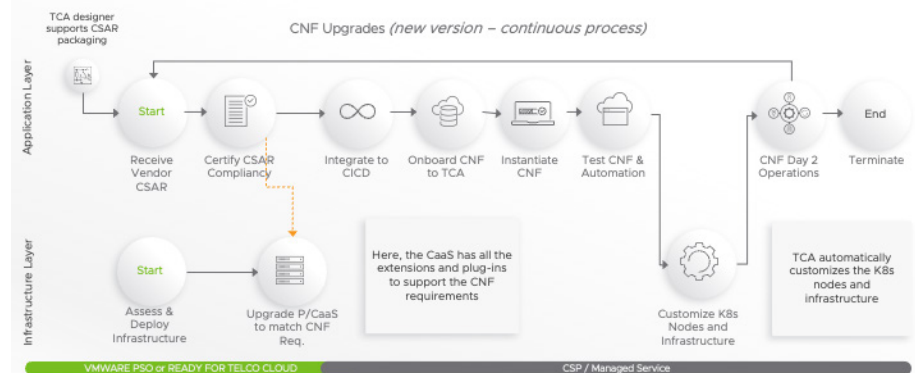


FIGURE 5: Here is a view of a CNF upgrade after the use of Dynamic Infrastructure Policies. With Dynamic Infrastructure Policies, a CNF upgrade is simplified and automated by customizing the Kubernetes nodes and other configurations, such as the Linux packages, required by the CNF.

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

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

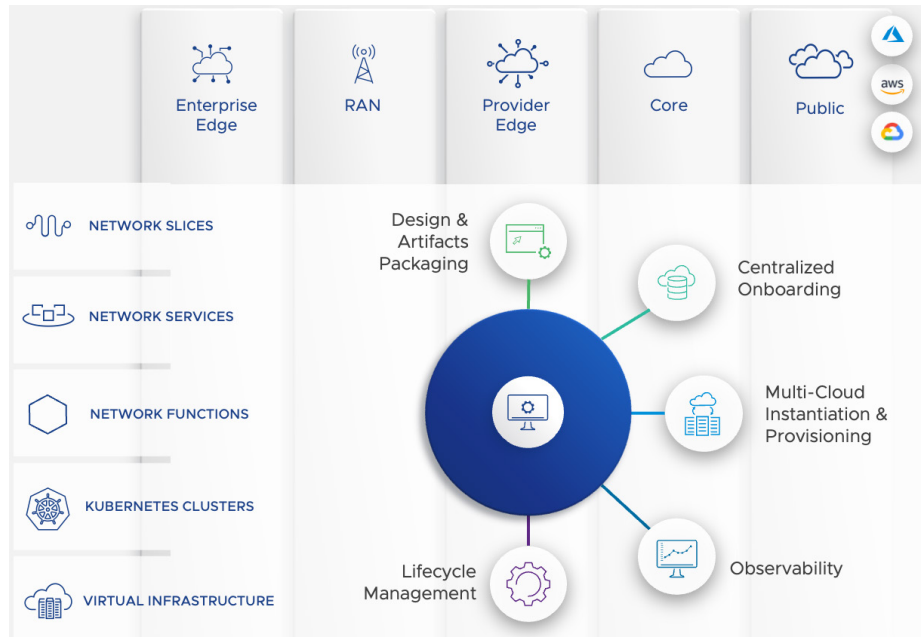


FIGURE 6: Centralized multi-cloud automation powers your network expansion.

Simplifying Multi-Cloud Management

VMware Telco Cloud Automation lets you use Amazon Web Services (AWS) with VMware Cloud on AWS and Amazon Elastic Kubernetes Service (EKS). You can also use Microsoft Azure with Azure Kubernetes Service (AKS).

VMware Telco Cloud Automation can provision cloud-native network functions directly on Amazon EKS or Microsoft AKS, 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.

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.

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:

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 and Lifecycle Management

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

With Workflow Hub, the discrete automation modules can be easily unified and orchestrated from a simple GUI — providing a critical new abstraction layer that streamlines network service creation and reduces operating costs.

Proactive Management of Telco Cloud Software

To support 5G use cases, a well-functioning multi-vendor network is critical. The multi-tenancy capability of VMware Telco Cloud Automation simplifies multi-vendor management. With multi-tenancy, an operator's VMware Telco Cloud Automation deployment can be accessed and used by several vendors without accessing one another's resources — vastly improving the control and security of your network. When VMware Telco Cloud Automation is used in conjunction with VMware Telco Cloud Service Assurance, network management becomes even easier.

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 your AIOps.

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).

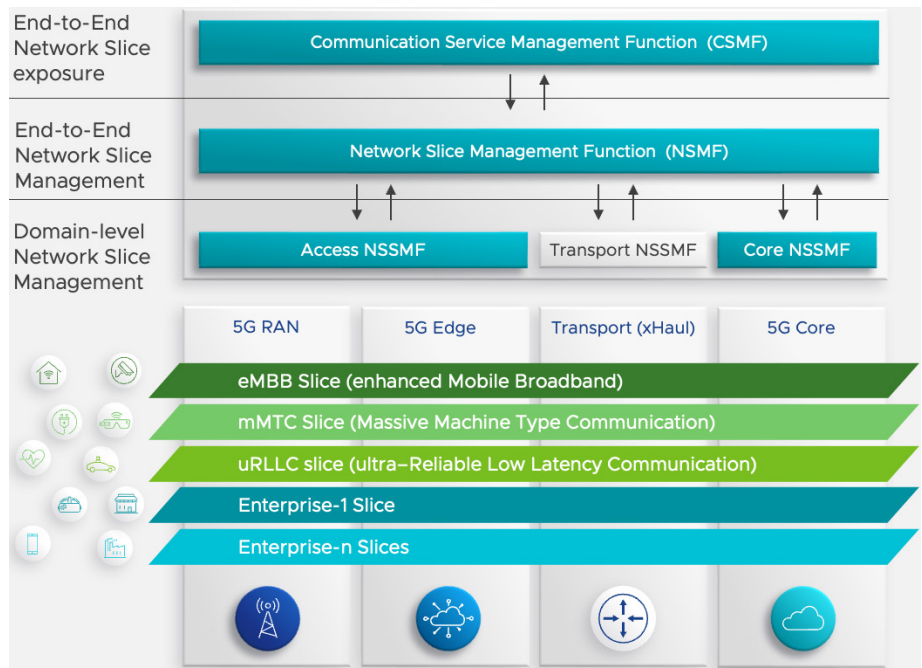


FIGURE 7: VMware Telco Cloud Automation empowers you to create and manage end-to-end network slices.

Network Slicing to Monetize Services and Support Tailored SLAs

As shown in Figure 7, Network Slicing for VMware Telco Cloud Automation lets you 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. You 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 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 you a bridge to cloud computing. The platform supports telco standards, including 3GPP, ETSI-MANO, TMF, and O-RAN.

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.

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.

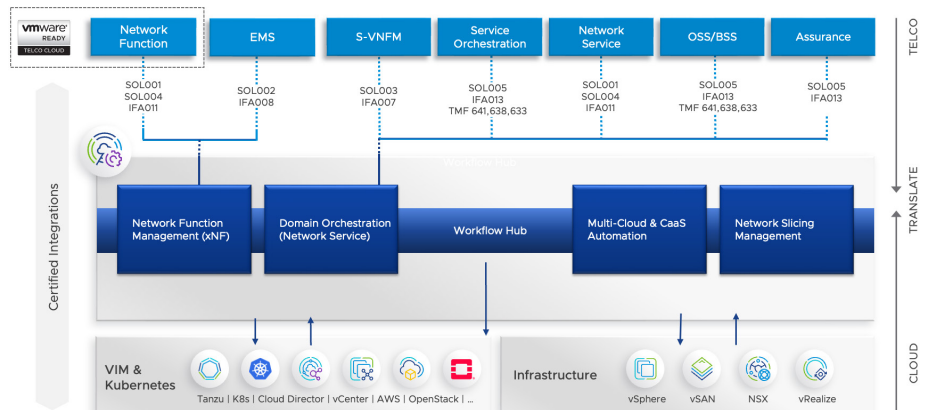


Figure 8: The key capabilities of VMware Telco Cloud Automation — including cloud-native technologies and automation — deliver flexible solutions for 5G. Access to CNFs, VNFs, and applications from multiple vendors supply extensible building blocks to deploy new services and explore emerging use cases.

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 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 you 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/>