Modernize the Network with Telco Cloud Platform

Horizontal Infrastructure Optimized for Agility

At a Glance

VMware® Telco Cloud Platform™ is powered by field-proven compute, a telco-grade Kubernetes distribution, and high-performance networking coupled with telecom-specific automation and service assurance. Telco Cloud Platform empowers you to modernize your network so you can rapidly deploy and efficiently operate multi-vendor virtual network functions (VNFs) and containerized network functions (CNFs).

Key Benefits

- Gain web-scale speed and agility to accelerate the rollout of 5G and telecommunication services

- Deploy VNFs and CNFs on consistent horizontal infrastructure

- Dynamically adjust the configuration of underlying resources

- Automate lifecycle management of infrastructure, Kubernetes clusters, network functions, and services

- Simplify NOC and SOC operations with a centralized, cross-domain view

- Use closed-loop automation and rapid remediation to reduce OpEx and optimize resources and workloads to meet surges in demand

- Accelerate the deployment of network functions through the VMware Ready for Telco Cloud program

Driving Transformation with Flexibility and Efficiency

The rollout of new 5G and telecommunications 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.

The objectives of telecommunications companies have transformed from the initial need to virtualize infrastructure to being able to scale with technology, driving continuous innovation, and deploying new services fast. However, the transformation must address business growth now while paving the path toward the future. In addition, CSPs need to deploy applications, services, and greater network intelligence across the network to deliver a higher quality of experience (QoE) to their customers.

To accelerate and achieve this transformation, CSPs must modernize their existing silos of monolithic systems to be future-ready—an operating model that takes advantage of horizontal infrastructure to create agile and flexible networks. Ultimately, the transformation must enable CSPs to succeed now and to continue that success by enabling them to adopt the technologies of tomorrow without disruption.

There are, however, several challenges to the implementation of new technologies. CSPs need to be able to support all their network functions, infrastructure components, and deployment sites while reducing operational complexity with tightly coupled orchestration, automation, and assurance solutions that best suit both current and future requirements.

About Telco Cloud Platform

VMware Telco Cloud Platform is powered by field-proven compute, a telco-grade Kubernetes distribution, and high-performance networking, enabling you to run both VNFs and CNFs on consistent horizontal infrastructure while automating and assuring the deployment and management of your telco cloud.

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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 network functions from multiple vendors

- Automate lifecycle management for infrastructure, CaaS, and network functions

- Obtain rapid insights with integrated fault and performance management, service management, root-cause analysis, and impact assessment

FIGURE 1: Telco Cloud Platform combines consistent horizontal infrastructure with multi-layer automation and assurance as well as access to a broad ecosystem of certified network functions.

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

Virtual Infrastructure Manager and Containers as a Service on Horizontal Infrastructure

Telco Cloud Platform enables you to take the first step toward cloud modernization by running a broad set of VNFs and CNFs on consistent horizontal infrastructure. The VMware by Broadcom solution provides a virtual infrastructure manager (VIM) to isolate virtual resources and tightly control administrative access to VNFs while supplying containers as a service (CaaS) by using Kubernetes to orchestrate CNFs and containerized services. The solution supports deploying VNFs with virtual machines and CNFs with a microservices architecture, establishing network resiliency, creating seamless cross-domain network function 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, telco automation capabilities are tightly coupled 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

Reference Architecture

Telco Cloud Platform can be deployed across telecom 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.
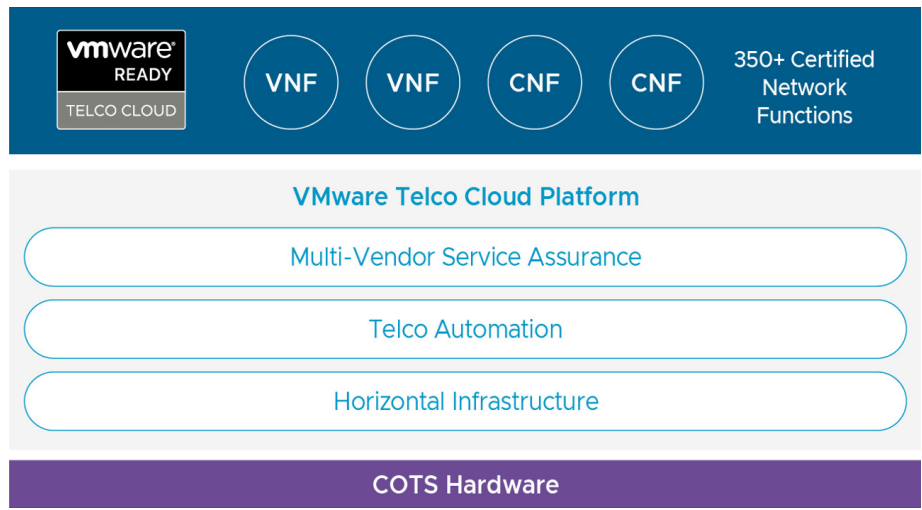
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Automation Capabilities in Telco Cloud Platform

The automation capabilities in the platform vary by two packages: Essentials and Advanced.

Telco Cloud Platform Essentials

The Essentials package gives you a quick, easy way to deploy infrastructure and manage it with the following basic automation capabilities from VMware:

• Registration of pre-deployed clouds as virtual infrastructure

• CaaS Manager for lifecycle management (LCM) of Kubernetes clusters

• CaaS Dynamic Infrastructure Policies Integrator

• Infrastructure Automation

• Network Function Automation (VNFM) for VNFs only, not CNFs

• Role-Based Access Control

• Multi-Tenancy

• API Integration

Telco Cloud Platform Advanced

The Advanced package includes all the automation capabilities in the Essentials package plus the following capabilities to furnish a comprehensive automation and orchestration solution:

• Network Function Automation, including VNFs, CNFs, LCM, designer, catalog, and Dynamic Infrastructure Policies as well as third-party VNFM support

• Network Service Automation (NFVO)

• Workflow support, which runs pre- and post-instantiation workflows for network functions and services

• Workflow Hub

• Network Slicing

• GitOps support for lifecycle management of CNFs

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

The cloud-smart approach of telco automation provisions the underlying infrastructure at the time of network function instantiation based on the network function's resource requirements. Standards-driven modular components integrate with and extend an existing multi-vendor MANO architecture.

Key Capabilities and Benefits of Telco Cloud Platform

Telco Cloud Platform establishes an open, vendor-agnostic ecosystem to streamline communication service delivery from design to lifecycle management automation while creating a unified, operator-friendly architecture with key capabilities for resource optimization, operational consistency, multi-layer automation, and assurance for network functions from multiple vendors.

High Performance IaaS and CaaS infrastructure

Telco Cloud Platform enables you to deploy both VNFs and CNFs on consistent horizontal infrastructure while improving resource utilization. With the platform's enhanced data plane networking capabilities, the platform furnishes high performance and scalable connectivity between network functions, with the following functionality providing examples:

• Support for conventional performance enhancement technologies, such as DPDK and single-root input-output virtualization (SR-IOV) for data plane acceleration

• DPU-based acceleration optimizes CPU utilization by offloading telco-grade networking from the compute host onto a SmartNIC, allowing you to focus on running other critical assets, such as network functions, on the platform

• A low-latency data plane through CPU pinning, fine-grained non-uniform memory access (NUMA) placement, and vertical NUMA alignment

Virtual Infrastructure Manager and Telco-Grade Kubernetes

The platform's VIM capability enables seamless provisioning and consumption of the underlying infrastructure resources across geographically dispersed locations with an Application Programming Interface (API)-driven approach. Its multi-tenant resource pooling capability helps create virtual data centers (VDCs) from centralized or distributed infrastructure to cater to various tenants' needs, allowing you to host and serve multiple tenants from a single, centralized interface that can stretch across physical servers in various locations.

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

• Multus, Antrea, and Calico to attach multiple container networking interfaces (CNIs) to Kubernetes pods through its plugins for performance enhancement and isolation

TECHNICAL WHITE PAPER: September 2024

Accelerating Telecom Network Performance with DPU Offloading

6WIND virtual security gateway boosted by NVIDIA Data Processing Unit offloading

vmware by Broadcom | **NVIDIA** | **6WIND**

White Paper: Improving Network Performance with DPU Offloading

VMware by Broadcom, 6WIND, and NVIDIA jointly tested a 6WIND network function to show the performance advantages of Telco Cloud Platform and NVIDIA BlueField DPU. Offloading frees up CPU resources on the host, which can then be used to run larger, less latency-sensitive workloads separately from the performance-intensive network processing tasks performed by the DPU. A white paper demonstrates these performance improvements.

• 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.

With these enhancements, you can take advantage of a VIM and a telco-grade Kubernetes distribution to address emerging telecommunication use cases.

Dynamic Infrastructure Policies for Customizing Nodes

The platform automatically adjusts the underpinning infrastructure resources to accommodate the requirements of each network function so you can architect a telco cloud for optimum application response, scale, and service availability. Dynamic Infrastructure Policies let you manage the lifecycle of CNFs by using GitOps, which speeds up the onboarding, deployment, and scaling of CNFs.

The automated customization of various items empowers you to fulfill network function requirements with speed, consistency, and efficiency. The customizations for Linux and for the CaaS packages include the following items:

• Real-time Linux kernel versions

• Kernel arguments like Huge Pages

• Custom Linux package installations

• Configuration for the tuned daemon

• SR-IOV CNI installation and configuration

The hardware customizations include the following items:

• Network adapters

• NUMA alignment

• DPDK binding for SR-IOV interfaces

• Passthrough devices for PTP

• GRUB config

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

Tailored Design and Automated Onboarding

Telco Cloud Platform provides a visual blueprint composer that allows network and equipment providers to easily create and optimize network function and service templates. Since the platform is vendor-neutral, you 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 (VNF and CNF). The onboarded elements are then available in centralized catalogs to maximize reusability.
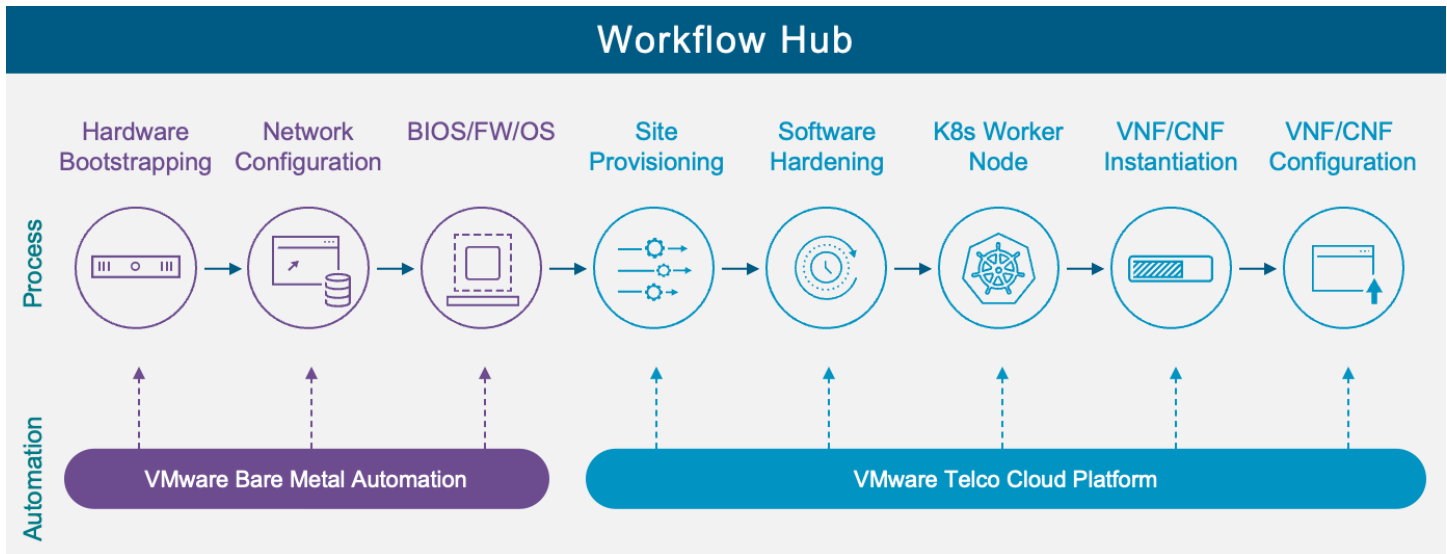
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FIGURE 2: Workflow Hub builds and executes end-to-end workflows to automate infrastructure provisioning, instantiation, and configuration.

Speeding Up Time to Market for Services with Workflow Hub

Workflow Hub represents the next evolution of centralized operations and operating expense reduction. Workflow Hub is an umbrella orchestrator that unifies not only the platform's existing telco automation capabilities, but also extends to VMware Bare Metal Automation and multi-vendor service assurance as well as third-party testing tools.

Workflow Hub enables you to easily define automated, repeatable workflows that minimize manual errors, 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:

• Create a pipeline that application teams can use to bring up virtual infrastructure or a Kubernetes cluster for network function version testing, obtain the results, and terminate the environment.

• Link deployment steps that take place outside the telecom automation of Telco Cloud Platform, 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.

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

Assurance Capabilities in the Telco Cloud Platform Advanced Package

The assurance capabilities in the advanced package of Telco Cloud Platform monitors, analyzes, and pro-actively manages multi-vendor physical and virtual environments in a single 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.

Streamlined Deployment and Maintenance

Because Telco Cloud Platform couples 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.

The integration between the automation and infrastructure components from VMware also furnishes 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.

Service Assurance and Automation

The service assurance capabilities of the Telco Cloud Platform Advanced package can be used with the package's telco automation capabilities to provide visibility and collect fault and performance indicators of registered clouds and instantiated software. When this information is coupled with automated Day 1 and Day 2 operations like healing and scaling, it delivers closed-loop remediation for issues. Integrating automation with the service assurance capabilities delivers end-to-end root-cause analysis and applies custom resolution workflows.

Automated Root-Cause and Service-Impact Analysis

The root-cause and service-impact analysis capabilities rapidly resolve problems by correlating symptoms from the following layers of the infrastructure stack and pinpointing the problem's root cause:

- Physical and virtual
- IaaS, CaaS, and Kubernetes clusters
- VNFs and CNFs
- Services and applications

Automated Closed-Loop Remediation

The results of business impact analysis drive closed-loop remediation through integration with resource, service and lifecycle management orchestrators that are based on SOL API standards, such as the telecom automation capabilities in Telco Cloud Platform. The platform's remediation policy framework automates the processes and procedures for common NOC faults that can be handled without human involvement.

- Define policies to allow automatic remediation actions when infrastructure faults occur that affect service.
- Take different automated remediation actions based on a problem's duration.

AI/ML-Driven Fault and Performance Management

Using artificial intelligence and machine learning, Telco Cloud Platform automatically establishes dynamic performance baselines and calculates real-time performance metrics. It identifies anomalies or performance degradations, and alerts you when anomalous behavior is detected.
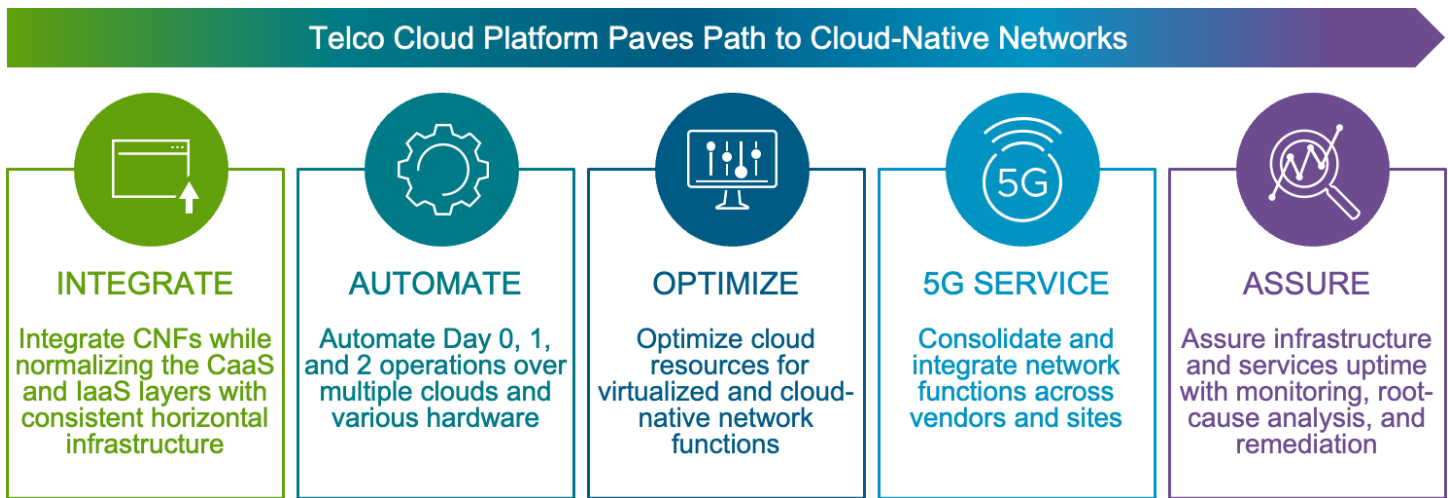
Telco Cloud Platform Paves Path to Cloud-Native Networks

INTEGRATE	AUTOMATE	OPTIMIZE	5G SERVICE	ASSURE
Integrate CNFs while normalizing the CaaS and IaaS layers with consistent horizontal infrastructure	Automate Day 0, 1, and 2 operations over multiple clouds and various hardware	Optimize cloud resources for virtualized and cloud-native network functions	Consolidate and integrate network functions across vendors and sites	Assure infrastructure and services uptime with monitoring, root-cause analysis, and remediation

FIGURE 3: The path to cloud-native networks is paved with integration, automation, optimization, consolidation, and assurance.

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, you can select the best solutions for your 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 Telco Cloud Platform and the network functions of VMware partners, enabling you to rapidly onboard and deploy the functions.

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 so you can focus on innovation and accelerate the deployment of 5G and other telecommunication services. The objective of the program is to create a multi-vendor ecosystem consisting of numerous network functions.

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. More than 350 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, 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.

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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.
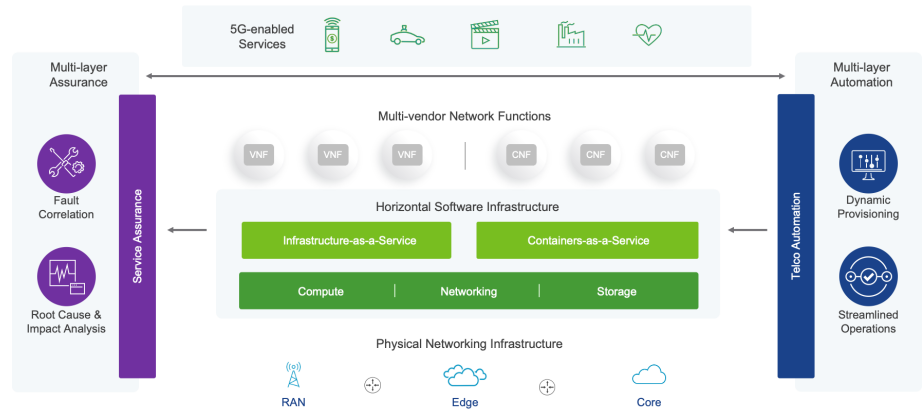

FIGURE 4: Telco Cloud Platform optimizes power with a four-point process.

The VMware Approach To Network Modernization

VMware Telco Cloud Platform solidify numerous capabilities into a powerful platform that gives you the flexibility to modernize your telecommunications network as you see fit and to tap the automation and assurance capabilities you need as you make progress toward your modernization objectives.

- Telco Cloud Platform Essentials provides a quick, simple way to start modernizing your network with foundational capabilities that can be rapidly implemented.

- Telco Cloud Platform Advanced delivers advanced telco-grade features to enhance the platform's capabilities with unified automation, orchestration, and multi-domain assurance.

Optional Components

VMware Bare Metal Automation is an add-on component that performs initial zero-touch provisioning of physical servers to speed up the deployment of telco cloud sites. Bare Metal Automation functions as a bare-metal provisioning tool to the point of installing the VMware hypervisor—bootstrapping the server and installing the software and firmware that the automation capabilities of Telco Cloud Platform require to start its CaaS automation processes.

Learn MORE

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

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