



GET STARTED

VMware Telco Cloud Infrastructure

Succeed in a Multi-Cloud World



Transforming Clouds to Succeed Today and Tomorrow

Network function virtualization (NFV) objectives have evolved from the initial need for communications service providers (CSPs) to virtualize infrastructure to being able to scale with technology, products, and services into new and adjacent markets. There is acute focus on digital transformation, with CSPs driving continuous innovation and rapid service deployment utilizing today's NFV technologies.

However, the transformation must address CSP business growth now while paving the path toward the future with 5G. In addition, CSPs need to deploy applications, services, and greater network intelligence across the network, from core to edge, to deliver higher quality of experience (QoE) and security to their customers.

To accelerate and achieve this digital transformation, CSPs must modernize their existing siloed monolithic clouds to be future-ready—an operating model that leverages consistent horizontal infrastructure with programmable networks. Ultimately, the transformation must enable CSPs to succeed now and to continue that success by allowing them to use the technologies of tomorrow without disruption.

AT A GLANCE

VMware® Telco Cloud Infrastructure™ is a fully integrated, modular, multi-tenant network function virtualization (NFV) infrastructure solution powered by field-proven compute, storage, networking, and management and operations products. It enables communications service providers (CSPs) to simplify, scale, and protect production NFV services. The transformative solution allows CSPs to accelerate time to market and increase revenue with new services now while paving a clear and simple path toward the future using the consistent infrastructure solution.



However, there are several challenges to the implementation of new technologies and go-to-market strategies. CSPs need to be able to select the virtualized network function (VNF), infrastructure, and places of deployments as well as the management, orchestration, and automation solutions that best suit both current and future requirements. The reality, though, is that CSPs still face a wide range of vendors in various stages of deploying VNFs, a situation that brings its own challenges.

Open-source technologies that promote interoperability and faster innovation are readily available, but delivering the carrier-grade performance with “five-nines” of reliability is essential. Unfortunately, CSPs are often exposed to the complexity, hidden costs, inconsistent tooling, and lack of carrier-grade support of several open-source implementations.

With the vision of delivering any application on any cloud from anywhere, VMware has extended its technology to cross network boundaries, from the data center into telco core to edge, helping CSPs more easily achieve their business objectives.

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The VMware Approach Toward Digital Transformation

VMware Telco Cloud Infrastructure is a key technology that fulfills the vision of delivering any application on any cloud from anywhere. Purpose-built for demanding carrier environments, the modular infrastructure solution lets CSPs deploy an industry-leading ecosystem of network functions with the confidence that all the component solutions will interoperate efficiently.

VMware Telco Cloud Infrastructure also helps CSPs realize the benefits of open-source frameworks through VMware's active contributions toward various open standards and organizations. By supporting a diverse set of industry-standard orchestration and automation tools, including vendor-neutral APIs, to manage the network function lifecycle, CSPs have a proven, high-performance infrastructure to accelerate NFV deployment now while preparing for technologies of the future. The modular, agile, and flexible infrastructure provides CSPs with peace of mind, allowing them to focus on delivering profitable services.

With automation, scalability, and a flexible infrastructure for creating and delivering new services, CSPs can now modernize their existing clouds to match the agility of cloud service providers while providing telco-grade resiliency and service availability.



VMWARE TELCO CLOUD INFRASTRUCTURE: A FIELD-PROVEN NFW INFRASTRUCTURE

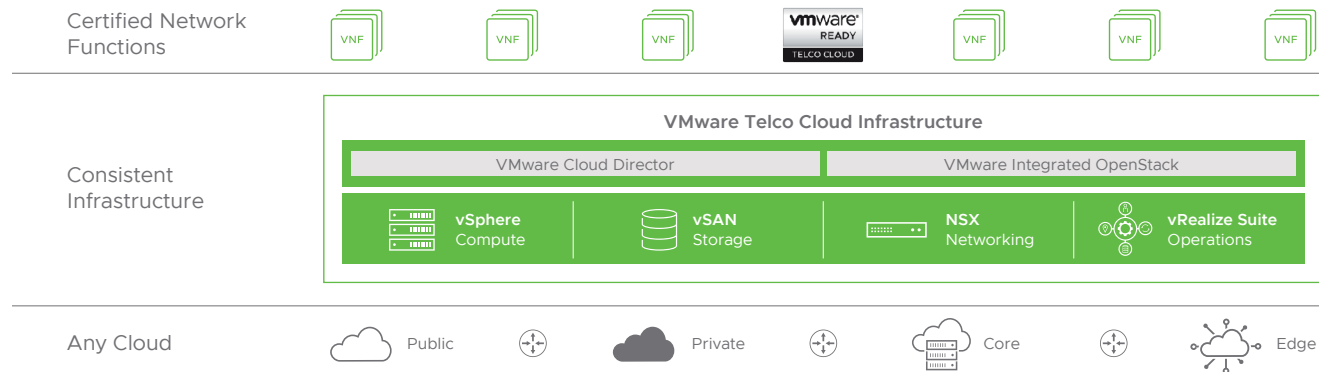


FIGURE 1: VMware Telco Cloud Infrastructure components.

VMware Telco Cloud Infrastructure is a modular NFW infrastructure solution that several of the world’s leading CSPs rely on to offer scalable telco services, achieve new revenue streams, and lower costs. Its horizontal design supports a broad set of VNFs, creating a large best-of-breed ecosystem for CSPs to rapidly deliver innovation. Its modular and consistent architecture allows CSPs to deploy various network functions across their networks from core to edge.

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VMware Telco Cloud Infrastructure includes industry-leading virtualization products—VMware vSphere® for compute, VMware vSAN™ for storage, VMware NSX® for networking, and VMware vRealize® Suite for operations—and a choice of virtualized infrastructure managers (VIMs)—VMware Integrated OpenStack and VMware Cloud Director®:

- **VMware vSphere** provides carrier-grade virtual compute designed to run both virtualized and containerized applications for optimized performance, high availability, fault tolerance, and workload optimization.
- **VMware vSAN**, with all flash performance, offers hyperconverged storage architecture to deliver elastic storage and drastically simplify storage management.
- **VMware NSX** enables overlay networking and security at the hypervisor level, providing distributed network services including granular network isolation and simplified operations.
- **VMware vRealize Suite** delivers continuous performance optimization, efficient capacity management, proactive planning, intelligent remediation, and integrated compliance while also providing centralized log management, deep operational visibility, and analytics.
- **VMware Integrated OpenStack** and **VMware Cloud Director** manage the lifecycle of the infrastructure components to streamline the operations and provide multi-tenant resource pooling for telecommunication workloads.

Field-proven and software-defined, VMware Telco Cloud Infrastructure—with its combination of modularity, horizontal architecture, multi-vendor VNF support, future-ready agility, and carrier-grade support—empowers CSPs to achieve the full benefit of NFV now and be poised for whatever comes next.

KEY ADVANTAGES

- **Accelerated network performance and scale:** Focus on optimum application throughput, response times, scale, and service continuity.
- **Intent-based assurance:** Deploy on-demand with real-time scaling, monitoring, and proactive avoidance.
- **Carrier-grade networking and security:** Get consistent connectivity with integrated security, quality of service, and automation.
- **Extensible solution:** Start with more traditional VNFs now and gradually migrate toward 5G.
- **Simplified network operations:** Implement NFV efficiently and cost-effectively.

KEY ADVANTAGES

Accelerated network performance and scale

With data traffic rapidly increasing along with demand for enhanced user experiences, CSPs are renewing their focus on optimum application throughput, response times, scale, and service continuity. VMware Telco Cloud Infrastructure delivers breakthrough performance, continuous availability, and simplified management by leveraging VMware NSX Virtual Distributed Switch (N-VDS) with DPDK, SR-IOV, optimized data plane techniques in vSphere, and elastic resource scaling across vSphere clusters.

Data plane VNFs can be deployed in data plane-intensive clusters and use N-VDS Enhanced mode to provide dedicated CPU resources that improve network performance. Control and management plane VNFs can be provisioned to use N-VDS Standard mode, which supports conventional overlay and VLAN-backed networking, achieving complete networking resource optimization.

Intent-based assurance

Deploying new services on-demand, with real-time scaling, monitoring, and proactive avoidance, has now become imperative. CSPs leverage VMware Telco Cloud Infrastructure to achieve assured application performance; increased capacity utilization (without resource contention); 360-degree visibility with real-time insights, root cause analysis, and remediation; and reduced operational costs through real-time predictive analytics, contextual troubleshooting, and closed-loop automation.

Carrier-grade networking and security

CSPs increasingly seek a solution that provides consistent connectivity with integrated security, quality of service (QoS), and automation to deliver applications and services, when and where needed. VMware Telco Cloud Infrastructure facilitates this fundamental shift in networking capabilities by offering multi-tenant service separation, distributed stateful firewalling, simplified administration of application QoS profiles, and enhanced network resilience.

Field-proven and software-defined, VMware Telco Cloud Infrastructure empowers CSPs to achieve the full benefit of NFV now and be poised for whatever comes next.

Extensible solution

By combining the infrastructure with service orchestration; service assurance; and management, orchestration, and automation capabilities to support more than 200 network functions, VMware Telco Cloud Infrastructure helps CSPs operationalize telco cloud services incrementally, starting with more traditional VNFs now and gradually migrating toward standalone 5G. This returns a better business case and ensures less need for new operational skills and processes, providing a more manageable on-ramp to 5G-based service deployment.

Simplified network operations

NFV promises to give CSPs agility and flexibility in deploying and operating their networks. However, it has become apparent that implementing NFV introduces a host of operational challenges that CSPs must address to make this network transformation efficient and cost-effective. To combat these operational challenges, VMware Telco Cloud Infrastructure powered by VMware vRealize Suite takes a full lifecycle approach, incorporating core attributes such as simplification, multi-tenancy, proactivity, and efficiency across all aspects of large-scale telco operations, including:

- **Service onboarding** capabilities, including service and resource discovery, security and alert definitions, multi-tenant dashboards, and network micro-segmentation
- **Unified visibility** from applications to infrastructure, capacity and performance monitoring, dashboards and analytics, and API access
- **Capacity and utilization analysis** including trending, forecasting, remediation, and resource reclamation
- **Service issue isolation** including service-level agreement (SLA) and performance degradation alerts, recommendations, and 360-degree network and application visibility
- **Automated workflows** for closed-loop optimization, predictive resource scheduling, and pattern recognition-driven alerts



The intelligence built in the infrastructure provides agility and efficiency out of the box, enabling seamless Day 0, Day 1, and Day 2 operations. In addition to keeping the lights on and ensuring the highest degree of service availability and quality, VMware Telco Cloud Infrastructure's operational capabilities provide real-time service optimization and forecasting functionalities, making the solution truly telco-grade.



FIGURE 2: Operations Management.



A Multi-Service Multi-Tenant Solution for NFV

VMware Telco Cloud Infrastructure provides a robust horizontal infrastructure that tightly integrates with a wide range of industry-leading network equipment providers (NEPs), creating a solid foundation for agile, modernized clouds for today and tomorrow. This horizontal infrastructure can be securely shared across multiple isolated tenants.

Tenants are isolated using policy-based allocation of segmented compute, storage, and networking resources mapped to individual tenants on the infrastructure, providing a secure and locked-down environment for each tenant. Provider- and tenant-based roles and service policies further help establish delegated access, availability, and performance boundaries across the infrastructure, enabling CSPs to create a portfolio of networking, managed hosting, and on-demand cloud services similar to those managing workloads in cloud data centers.

The evolution to agile and modernized clouds enables CSPs to accelerate the speed of innovation and delivery of new services while driving down costs.

VMware Telco Cloud Infrastructure provides a robust horizontal infrastructure that tightly integrates with a wide range of industry-leading NEPs, creating a solid foundation for agile, modernized clouds for today and tomorrow.

Service agility is further enhanced through standard and pre-defined tenant services that can be deployed in response to changing customer and network requirements. Tenant-specific portals and northbound APIs enable operational intelligence capabilities, such as monitoring, issue isolation and remediation, automation workflows, and capacity planning and forecasting.

Supporting Diverse Use Cases

As much as NFV is about technology innovation, it is also about business model and services innovation. New service descriptions, pricing models, and go-to-market strategies all make up the key pillars of successfully realized NFV-based services.

With its consistent and horizontal architecture design, VMware Telco Cloud Infrastructure fundamentally changes the ways CSPs develop, deploy, and run a wide variety of virtualized services to exceed expectations from customers who demand a broad range of innovative services.

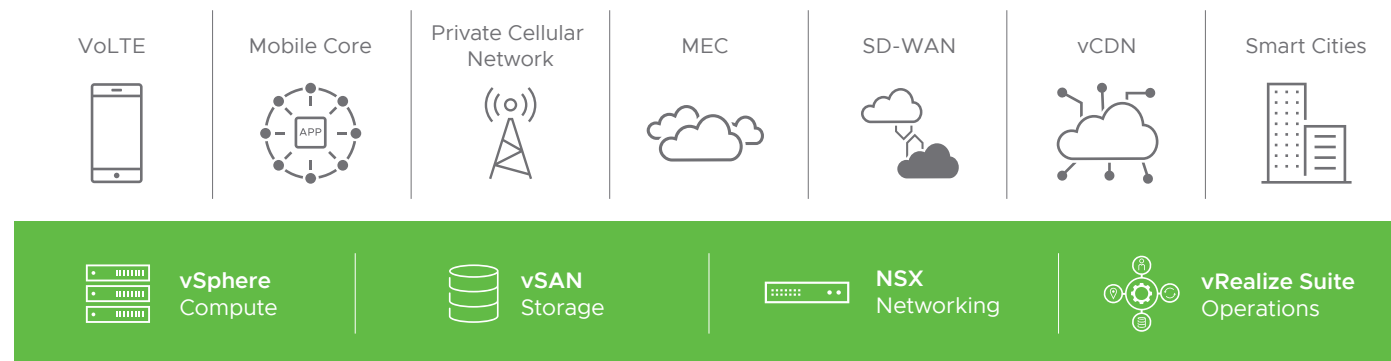


FIGURE 3: Consistent Horizontal Infrastructure for Diverse Use Cases.

VoLTE

Virtualizing the IP multimedia subsystem (IMS) gives CSPs a cost-effective, flexible solution to deploy IP telephony services quickly, efficiently, and reliably while offering a high QoE for subscribers. With simplified network provisioning; accelerated network performance with end-to-end operations management; optimized resource management; a complete set of logical networking and security elements including switching, routing, QoS, and monitoring; and a vast and growing partner ecosystem of network functions, VMware Telco Cloud Infrastructure ensures top performance, security, and service resiliency to launch vIMS-based services faster to market.

Mobile core

The explosion of data, video, and devices drives CSPs toward an agile, software-defined network that can scale with new innovative services while reducing complexity and costs. Virtualizing the evolved packet core (EPC) is a key enabler in CSPs streamlining and automating the network core. The horizontal architecture of VMware Telco Cloud Infrastructure enables CSPs to onboard control plane functions from various NEPs on a consistent infrastructure to construct an elastic mobile core. Furthermore, VMware Telco Cloud Infrastructure helps CSPs optimize the network utilization through dynamic capacity allocation, allowing CSPs to offer differentiated services with flexibility and scale in wireless and wireline converged environments.



Private cellular network

Enterprise applications such as industrial manufacturing, transportation, and smart cities have traditionally relied on Wi-Fi and fixed-line services for connectivity and communications. These networks are often unreliable and costly as well as being difficult to scale. To overcome these connectivity challenges, CSPs are now deploying dedicated private cellular networks at the enterprise site, creating a dedicated on-premises environment instead of relying on traditional macro networks. To make the site completely self-sufficient, all data and control plane components and traffic are kept in the enterprise premises. With VMware Telco Cloud Infrastructure, a factory floor, for example, can be fully automated to provide private connectivity to robotics equipment, remote operations, and content storage and distribution with the same consistent infrastructure with agility and flexibility critical to the business.

Multi-access edge computing (MEC)

By making MEC available across access networks from LTE/5G to wired/wireless LANs, CSPs are uniquely positioned to drive the adoption of next-generation applications at the network edge—including CDN, 5G and IoT applications, traffic steering/shaping, location services, video processing, augmented reality, autonomous cars, and security and compliance. The benefits of carrier-grade performance, health management, service continuity, cloud orchestration, and automation—along with independence from proprietary hardware and service separation in a horizontal multi-tenant infrastructure—make MEC built with VMware Telco Cloud Infrastructure a compelling investment for CSPs.



Software-defined WAN (SD-WAN)

As enterprise applications and services move to the cloud, delivering services to branch offices requires a new level of service reliability, application performance, and security that SD-WAN offers. CSPs can leverage VMware Telco Cloud Infrastructure to simplify deployment of SD-WAN services, centralize orchestration and operations management, and programmatically provision the integrated networking and security functionalities that provide a complete set of logical networking elements and services including switching, routing, QoS, and monitoring.

Virtual CDN

The overwhelming majority of the global IP traffic is now dominated by video, resulting in the exponential surge of the traffic volume. Along with the explosion of video consumption, there is a growing list of value-added auxiliary applications, such as ad insertion and forensic watermarking. By taking advantage of a virtual content delivery network (vCDN), CSPs can make processing power available on-demand at the edge of their networks to serve various applications as well as current and emerging consumer and commercial video services. With consistent infrastructure design to support multi-cloud deployment paired with the ability to separate the control and data planes, VMware Telco Cloud Infrastructure enables CSPs to serve control plane functions in the core of their networks while using their edge networks to serve data plane functions related in the video streaming process. This vCDN-optimized separation of the control and data planes enhances CSPs' operational efficiency and minimizes edge facility costs.

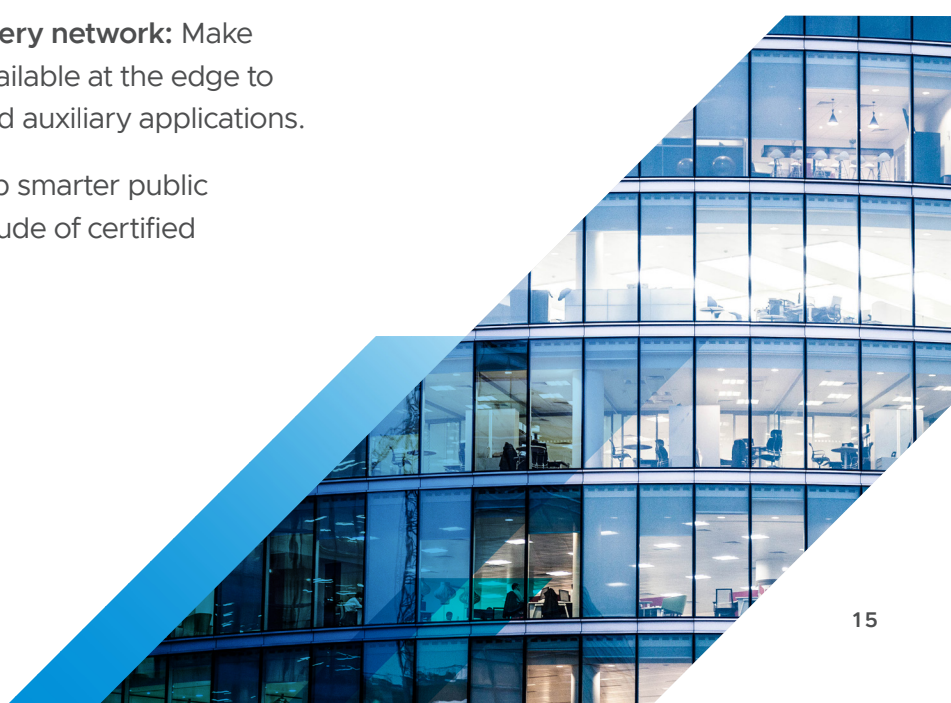


Smart cities

At the same time cities become denser, citizens demand more modernized and sustainable services, driving an acute need for cities to develop smarter public services. By leveraging their technological and operational expertise and a vast mobile infrastructure that can enable edge clouds, CSPs are uniquely positioned to help develop smart city services that require carrier-grade performance and scale, multi-tenancy, simplified VNF onboarding and operations, and a flexible topology for data and control planes. These services include networked transportation and mobility, analytics, water/waste management, video surveillance, and Internet hotspots. With a multitude of certified network functions, VMware Telco Cloud Infrastructure provides a flexible NFV infrastructure solution for developing these smart city solutions.

SUPPORT DIVERSE USE CASES

- **VoLTE:** Deploy IP telephony services quickly, efficiently, and reliably.
- **Mobile core:** Offer differentiated services with flexibility and scale in wired and wireless environments.
- **Private cellular network:** Provide connectivity to equipment, operations, and storage and distribution with consistency, agility, and flexibility.
- **Multi-access edge computing:** Drive the adoption of next-generation applications.
- **Software-defined wide-area network:** Deploy SD-WAN services to ensure reliability, performance, and security.
- **Virtual content delivery network:** Make processing power available at the edge to optimize for video and auxiliary applications.
- **Smart cities:** Develop smarter public services with a multitude of certified network functions.



VMware Ready for Telco Cloud

Since the inception of its VNF certification program in 2015, VMware has been enhancing the program by investing significant resources to ensure the interoperability and operational readiness between VMware Telco Cloud solutions and partner network functions. With more than five years of continued commitment, VMware Ready for Telco Cloud program now offers CSPs unparalleled choice, from 200+ certified network functions to select the best solutions for their use cases.

Since 2015, VMware has enhanced its VNF certification program to ensure VMware Telco Cloud “plays well with others.” The Ready for Telco Cloud program now offers CSPs more than 200 CNFs to choose from.

Furthermore, this award-winning program removes time-consuming and difficult integration work associated with the complexity of onboarding various network functions. The objective of the program is to create a vibrant multi-vendor ecosystem so that CSPs can accelerate their innovation speed and the deployment of new services.



A FAST-GROWING ECOSYSTEM OF NETWORK FUNCTIONS

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SYSTEMS

SAMSUNG

ERICSSON

ALTIOSTAR
Leading Network Transformation

CISCO

affirmed

FORTINET

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Mitel
Powering connections

JUNIPER
NETWORKS

ACCEDIAN

ribbon

FLASH
networks

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f5

6connect

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ENEA

broadpeak

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sinch

ZTE

Radisys

A10

BENU
NETWORKS

SANDVINE

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ORACLE

TREND
MICRO

netrounds

CSG
INTERNATIONAL

NEC

ATHONET

citrix



200+

network functions certified
on [VMware marketplace](https://www.vmware.com/marketplace)

- EPC
- Mobile core
- Private cellular network
- Security

- CPE/router
- IMS
- SD-WAN

Infrastructure That Evolves with Modern Applications and Services

As evidenced by a number of our customer engagements, there is momentum among CSPs looking to deploy 5G networks while making sure current businesses are not hampered by monumental initiatives like 5G. For CSPs to increase their competitiveness and realize operational gains, they must build an agile and flexible environment where they can quickly spin up innovative services today while utilizing the same environment to offer their services tomorrow.

Existing vertically integrated clouds are already too rigid for today's services, making migration toward the future unattainable. VMware Telco Cloud Infrastructure is a consistent horizontal infrastructure solution with field-proven cloud-based components, modernizing CSPs' cloud environments so they can grow their businesses now. The infrastructure currently supports well more than 100 CSPs worldwide. In fact, the study conducted by one of the world's renowned CSPs in Europe showed that VMware Telco Cloud Infrastructure reduced its NFV deployment time by 40% while reducing the VNF cost by 50%.

By simply combining VMware Telco Cloud Infrastructure with its Telco Cloud Platform, VMware's Containers as a Service solution with multi-layer automation, CSPs can deploy a multitude of industry-leading VNFs across the core and edge of their networks while paving a clear and simple path toward cloud-native technologies for the 5G rollout. The infrastructure's agility and flexibility protects CSP investments to deploy and manage various VNFs and also reshapes their cloud environments to host both VNFs and CNFs whenever CSPs are ready.

With the largest ecosystem of network functions, and continual evolution of interfaces to meet changing market requirements, VMware Telco Cloud Infrastructure provides CSPs with a single infrastructure solution capable of supporting all business functions today and for the future.

100+
CSPs supported
worldwide

40%
reduction in NFV
deployment time

50%
reduction in
VNF cost

THE TIME IS NOW

VMware has been working with leading CSPs globally over a number of years to deliver NFV-based service infrastructure that is transforming their businesses through significant reductions in costs and increases in service agility.

Proven in production, VMware customers have seen deployment times fall from years and months to weeks and days, even hours. The VMware integrated solution's maturity, associated operational support capabilities, and resource management enable CSPs to rapidly adopt new ways of deploying service infrastructure and embrace a new digital era of communications where the operator can deliver services with cloud-grade agility and scale while maintaining uncompromised carrier-grade performance and reliability.



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