

ENABLE NEXT-GEN SERVICES WITH MULTI-ACCESS EDGE COMPUTING

Accelerating New Edge Services for Service Providers

Market Trends for MEC

Multi-access Edge Computing (MEC) applies cloud architecture principles to compute, storage, and networking infrastructure at the network edge close to the user. By providing near-real time cloud-computing capabilities and an IT service environment at the network edge, MEC allows applications to leverage ultra-low latency high-bandwidth services and real-time access to network information.

By making MEC available across access networks, from LTE/5G to wired/wireless LANs, communications service providers (CSPs) are uniquely positioned to drive the adoption of next-gen applications at the network edge, including CDN, DNS and service caching, 5G and IoT telemetry, mobile traffic shaping, location services, video analytics, augmented reality, connected cars, and security and compliance.

Network functions virtualization (NFV) is a key technology that enables communications service providers to optimize their network architecture for MEC. With its advanced automation capabilities, VMware vCloud® NFV™ enables CSPs to accelerate service innovation, streamline operations, deploy an agile network, and deliver multiple services while offering carrier-grade availability, performance, and service continuity. The benefits of continuous network monitoring, health management, and service continuity, along with independence from proprietary hardware and service separation in a multitenant shared infrastructure, make NFV and MEC a compelling area of infrastructure investment for service providers.

Service Provider Challenges

With OTT competitors consistently eroding service provider revenues, and the network increasingly becoming a commodity, CSPs face a challenge in maintaining their competitive advantages. One such advantage lies in their ability to enter vertical markets by pushing cloud-native applications down to the network edge and participate in network monetization by providing a dynamically sliceable network that provides a low-latency, high-capacity, cloud-programmable environment. Machine-to-machine communications (M2M), Internet-of-Things (IoT), and Connected Car deployments are among the leading instances of virtualization of the service provider network, and are being deployed worldwide by leading operators of various sizes.

CSPs are building these next-generation networks as a software function based on certain fundamental principles: a distributed compute fabric that enables compute everywhere (especially close to the user), and a programmable connectivity fabric that supports instant changes to network topologies and the corresponding management capabilities. By leveraging a virtualized NFV architecture, service providers can not only monetize new market verticals by offering more differentiated and valuable services, they can also gain the advantages of speed and agility in delivering these services faster to the market.

NEW BUSINESS OPPORTUNITIES WITH MEC:

- **Unlock new business and revenue models** by providing edge network services for application providers
- **Create new revenue opportunities** through APIs for network and localization services, network characteristics, and traffic functions
- **Improve** user experience by providing a point of presence for applications near the end user
- **Enable efficient** use of core network resources by eliminating the need to backhaul large amounts of data and/or application traffic
- **Reduce** network capital and operating expenses by using common NFVI infrastructure for edge computing and to access VNFs

MEC – Unlocking New Market Verticals for Service Providers

Service providers are constantly looking for new revenue streams to support investments in emerging technologies. Efforts are under way to virtualize networks by decomposing key functions such as the EPC to run them as software functions on standard COTS servers, drastically reducing costs and simplifying operations. These virtualization initiatives, initially targeted at the service provider core, are now gradually moving to the edge of the network.

Additionally, parts of the core network are transitioning to the edge due to low-latency requirements of 5G. Next-gen applications, such as connected cars and augmented reality/virtual reality (AR/VR), demand massive amounts of near-real time computation. MEC addresses these challenges by enabling service providers to build vertical segments in their networks and deploy network services at the network edge.

In addition to monetizing third-party applications, MEC also enables service providers to provide their own value-added services at the edge. The diversity of MEC use cases can be efficiently delivered over the vCloud NFV platform, allowing service providers to:

- **Unlock new business models:** Combat commoditization of the network by providing edge network services to application providers, such as:
 - CDN services requiring low latency and high throughput
 - Real-time and immersive use cases such as virtual reality/augmented reality and interactive gaming
 - Connected cars and tactile Internet that require low-latency, machine-to-machine communication
 - Mobile video and premium TV services
- **Provide completely new service categories:** Use standardized APIs to expose network characteristics and traffic functions, allowing:
 - Real-time access to the network information (RAN or Wi-Fi/wired access)
 - Rich contextual location awareness for applications
 - Emergency services such as video analytics and local VoLTE networks
- **Improve user experience:** Improve quality of user experience by providing a point of presence for the application near the user:
 - Reduce application response time by being closer to the user
 - Provide IP-based services for accelerating streaming media content
 - Optimal resource utilization through horizontal and vertical network slicing
- **Reduce infrastructure and operational costs:** Minimize cost and complexity by using standard infrastructure and fully automated edge operations:
 - Run edge computing applications and access VNFs (such as vRAN, C-RAN, and vCMTS) on a common NFVI infrastructure
 - Eliminate high latency and wasted bandwidth by not backhauling large amounts of data and application traffic back to the core
 - Move the security perimeter closer to the user by deploying applications such as DDOS and cyber security at the network edge
 - Comply with geographical data traffic restrictions and enforce network access rules over the access network by using network slicing and access rights

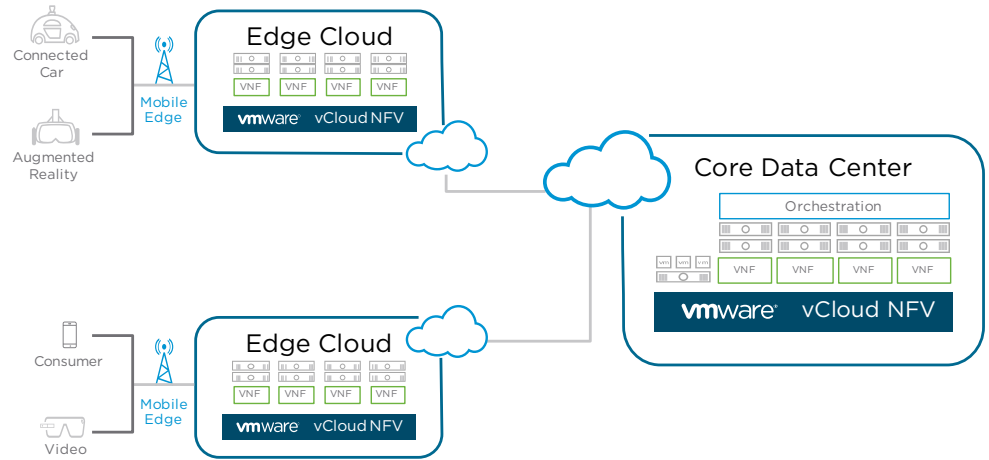


FIGURE 1. Multi-access Edge Computing Network

VMWARE VCLLOUD NNFV DELIVERS:

- **Reliability:** Tested, optimized, and proven NFVI in over 70 NFV implementations worldwide
- **Interoperability:** The largest number of certified VNF partners and the most comprehensive testing and certification program with the VMware Ready for NFV program
- **Extensibility:** Ability to extend and unify automation and control in a cross-cloud environment: IT, NFV, public, and managed clouds
- **Operations:** End-to-end operational intelligence and management from physical layer to Applications and VNFs
- **Support:** VMware Carrier Grade Support for NFV

MEC using VMware vCloud NNFV

VMware vCloud® NNFV™, as an ETSI-compliant platform, is a carrier-grade multitenant NFV platform that has been tested and proven for service provider requirements. With optimized resource management for service provider workloads, vCloud NNFV allows service providers to accelerate service innovation, streamline operations, deploy an agile network, and deliver multiple services, including vIMS, vCPE, vEPC, SD-WAN, while evolving network architectures to 5G. By teaming up with VMware, service providers benefit from:

- **Faster deployment and agility with advanced networking and security** – vCloud NNFV embeds networking and security functionality and provides a complete set of logical networking elements and services, including switching, routing, firewall, QoS, and monitoring, that can be programmatically provisioned and managed. Networks and VNFs are secure from any outside threats with automated, fine-grained policies tied to the virtual machines.
- **Carrier-grade platform** – The high-performance and high-availability capabilities offered in vCloud NNFV deliver a highly scalable NFVI platform that meets carrier-grade network requirements.
- **Automation and network infrastructure orchestration** – vCloud NNFV provides a Virtualized Infrastructure Manager (VIM) that manages the NFVI compute, storage, and network resources. Service providers can automate and orchestrate network infrastructure without worrying about the underlying physical configuration of resources. With vCloud NNFV, service providers gain the flexibility to use either native VMware vCloud Director® or VMware® Integrated OpenStack, a full OpenStack implementation that is completely tested and integrated. Both VIMs support templated service descriptions as well as multitenancy and robust networking, enabling the automation of onboarding VNFs and allocation of network resources.
- **Simplified operations and analytics for improved network performance** – vCloud NNFV offers a pre-integrated and extensible operations management solution, providing a single pane of glass with complete visibility into all service components, including the underlying servers, the hypervisor, networking, VNF virtual machines, and the service itself. VMware vRealize® Operations Manager™

collects near-real time data to provide correlated health, performance, capacity, and availability metrics along with recommendations. vRealize Operations Manager can be configured to generate prioritized alert notifications for closed-loop integration into resource and service orchestration workflows, providing complete 360-degree monitoring capabilities across service, virtual, and physical tiers. Service providers can optimize capacity by dynamically allocating and balancing VMs to guarantee optimal access to VNF resources.

- **Secure multitenancy** – vCloud NFV delivers native secure network multitenancy through vCloud Director, VMware Integrated OpenStack, and VMware NSX® integration. Service providers can segment virtual resource pools, networking, security, and services into isolated network slices with well-defined service levels, providing security from the Internet as well as potential rogue VNFs. This allows multi-VNFs with multiple services to seamlessly share the same NFV infrastructure, yet maintain complete isolation from each other.
- **Reduced infrastructure and operational costs** – vCloud NFV is a virtualized, vendor-agnostic NFV platform running on COTS equipment. Carriers are not locked into proprietary hardware as network virtualization frees them to implement the most cost-effective solutions. Service providers can run edge computing applications (their own and/or third-party applications) as well as virtual access VNFs (such as vRAN, C-RAN, vCMTS, etc.) on a common NFV infrastructure, further reducing infrastructure cost and operational complexity through automated edge operations.
- **Rich VNF partner ecosystem** – VMware has brought together the largest partner ecosystem of VNFs, including orchestration, routing/SD-WAN, security, analytics, etc. Working with these technology partners, VMware offers pre-certified VMware Ready™ for NFV turn-key solutions that can deliver MEC solutions in hours or days as opposed to months. VMware's vision is to enable standardized virtualization solutions for service providers by partnering with "best-of-class" VNF solutions. The partner ecosystem is very broad, enabling us to serve the diverse needs of service providers by allowing them to pick the best-in-breed of each network function, as well as the flexibility to easily replace it.

VMware NFV: Removing Key Barriers for Business Transformation

vCloud NFV is a fully integrated, modular and extensible NFV Infrastructure platform. It allows multivendor VNFs to share a pooled capacity of resources that can be intelligently orchestrated and automated for the provisioning and delivery of services in a cross-cloud environment. This enables service providers to support an elastic business model of multicloud services and personalized offerings while simplifying and automating networks, accelerating time-to-market and reducing TCO.

Learn More

For more information about the VMware vCloud NFV platform, please visit <http://www.vmware.com/go/nfv>.

