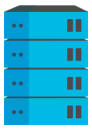
RED HAT® OPENSTACK® PLATFORM

INCREASE BUSINESS AGILITY WITH NETWORK FUNCTIONS VIRTUALIZATION

TECHNOLOGY OVERVIEW



COMMUNICATIONS INDUSTRY: NFV INFRASTRUCTURE

31%
of network operators expect more than
20%
of their revenue to come from digital services in 2017.[1]

Digitally transforming and virtualizing network functions gives you unprecedented business agility and cost control, so you can compete more effectively in the digital economy.

VIRTUALIZING COMMUNICATIONS INFRASTRUCTURE

Telecommunications customers expect services to be delivered on demand, across devices, at all times. With many options available, customers are likely to switch communications service providers (CSPs) if they do not feel they are receiving the best value. To keep current customers and gain new ones, CSPs must cost-effectively deliver high-quality service and continually create compelling new offerings.

Even so, conventional network environments that rely on dedicated proprietary hardware to implement each network function can impede business agility and innovation. This siloed, hardware-centric infrastructure approach increases costs and complexity. Scalability is limited and deployment is often sluggish, as expensive new servers must be acquired and provisioned. Staffing costs escalate as increased expertise is needed to design, integrate, operate, and maintain the various network function appliances. These issues make it difficult to innovate and compete.

Digitally transforming your network infrastructure and operations with network functions virtualization (NFV) can provide the flexibility and agility needed to successfully compete in today's evolving communications landscape. NFV implements network functions in software running on shared commercial off-the-shelf (COTS) servers instead of using dedicated proprietary hardware. This virtualized approach decouples the network hardware from the network functions and results in increased infrastructure flexibility and reduced hardware acquisition and operational costs. Because the infrastructure is simplified and streamlined, new and expanded services can be created quickly and with less expense.

Open source technologies add to the benefits of NFV. Open source communities promote collaboration between developers, end users, and commercial organizations. This increases interoperability and innovation, as solutions and advances are shared across industries and viewpoints. Open source technologies also reduce vendor lock-in and provide a higher level of flexibility, allowing you to prepare for future network innovation and evolution.

Based on open source technologies and industry standards, Red Hat and Intel collaborate to provide an NFV infrastructure that helps you build and launch new services faster, innovate more easily, and reduce network infrastructure costs.

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1 *"Digital Transformation Operator Survey Report: The Impact on Revenue and Network Assurance." Telecoms.com Intelligence. February 2017.*

Virtualizing your network infrastructure can increase business agility, enhance service scalability, and improve subscriber experience.

VIRTUAL FUNCTIONS WITH PHYSICAL FUNCTION PERFORMANCE

Performance, low cost, and high availability are critical to a successful NFV implementation. In order for NFV to be of value, it must be designed to be cost-effective and provide virtual network performance and reliability comparable to that of physical network function implementations. NFV implementations reduce costs by using inexpensive, commonly available hardware, but many fail to provide the required performance due to the added overhead of the virtual infrastructure and virtualized data planes. In these instances, network packets are delayed by unnecessary routing through the operating system, hypervisor, and processor, reducing virtual network function performance. High availability is also a concern, and considerations must be taken into account when building an NFV environment to ensure that it meets enterprise reliability standards.

Unlike other NFV solutions, the Red Hat® and Intel NFV infrastructure eliminates virtual data plane overheads to provide comparable performance to physical network function implementations—in addition to cost savings from widely available commercial hardware and open source software. Intel® Xeon® Scalable processors and Intel Ethernet technology deliver extreme processing power and fast, efficient networking for the infrastructure. The Data Plane Development Kit (DPDK) library allows virtual network function (VNF) software to route network packets around the Linux® operating system kernel, which can significantly improve packet processing performance. Open vSwitch accelerates virtual switching and network performance throughout the environment. Intel Data Center Solid State Drives (SSDs) deliver data to VNFs and workloads quickly and reliably.

Red Hat Enterprise Linux and the Kernel-based Virtual Machine (KVM) hypervisor provide the secure, reliable operating environment and flexible, high-performance, cost-effective virtualization needed to decouple network functions from the hardware on which they run. Red Hat OpenStack® Platform controls the overall NFV infrastructure and provides an open interface for a wide variety of network orchestration tools and VNF software. Red Hat OpenShift Container Platform provides an environment for quickly building, developing, and deploying applications and workloads across hybrid infrastructures. Red Hat Ansible® Automation delivers simple, powerful automation for infrastructure, applications, and processes.

This combination of products adds up to unprecedented NFV performance and availability with a cost structure that overcomes the challenges of virtualizing network functions. With the Red Hat and Intel NFV infrastructure, you can dynamically launch, configure, and scale network functions to meet shifting traffic patterns and demands for innovative new services. Meanwhile, you can also reduce infrastructure costs and improve overall subscriber experience.

A smaller, virtualized infrastructure can provide the same service capabilities and performance as a larger, hardware-centric infrastructure at a lower cost.

VIRTUALIZE YOUR NETWORK WITH AN OPEN FOUNDATION

As shown in Figure 1, each component of the Red Hat and Intel NFV infrastructure provides a key element to help create a high-performance, cost-effective NFV solution.

- **Red Hat Enterprise Linux** provides the open source foundation, allowing secure and reliable operation for VNFs.
- **Open vSwitch and the KVM hypervisor** provide high-performance virtual network switching and virtual machines for network applications.
- **Red Hat OpenStack Platform** controls the foundation infrastructure and provides an interface to network functionality and services.
- **Red Hat OpenShift Container Platform** provides a production-grade Kubernetes environment for building, deploying, and managing container-based applications and workloads across public, private, and hybrid infrastructures that support Red Hat Enterprise Linux.
- **Red Hat Ansible Automation** is a simple, agentless, and powerful network, server, and application automation tool that uses a single language for automation across technologies and organizations.
- **Intel Xeon Scalable processors** provide the advanced performance, scalability, workload, and power management needed to contain operating costs without compromising network performance and expansion.
- **DPDK** provides high-performance network drivers and an optimized run-time environment that maximizes packet processing performance. Virtual network functions and NFV infrastructure add-on software can use the DPDK library to route network packets around the Linux kernel, reducing data plane overhead and accelerating performance significantly.
- **Intel solid state drives (SSDs)** deliver high-performance storage for virtualized workloads.
- **10 Gigabit Intel Ethernet controllers and converged network adapters** provide fast network connections throughout the NFV infrastructure.

REDUCE YOUR COSTS WITH INFRASTRUCTURE SIMPLICITY

Complex infrastructures are expensive to maintain and operate, and high infrastructure costs detract from the bottom line. The Red Hat and Intel NFV infrastructure simplifies your network environment by converging network functions onto a single, shared architecture. Widely available commercial hardware replaces proprietary appliances, significantly reducing capital expenditures. Decoupling the hardware infrastructure from the software network functions also allows hardware to be replaced less frequently, further increasing hardware return on investment (ROI). Operating expenditures are contained through advanced server power management features and streamlined administration and management. With improved, dynamic scalability, you can easily add and move resources between virtual network functions to meet shifting peaks in network traffic without maintaining fleets of extra, dedicated network appliances that remain idle much of the time. A smaller virtualized infrastructure can provide the same service capabilities and performance as a larger, hardware-centric infrastructure at a lower cost.

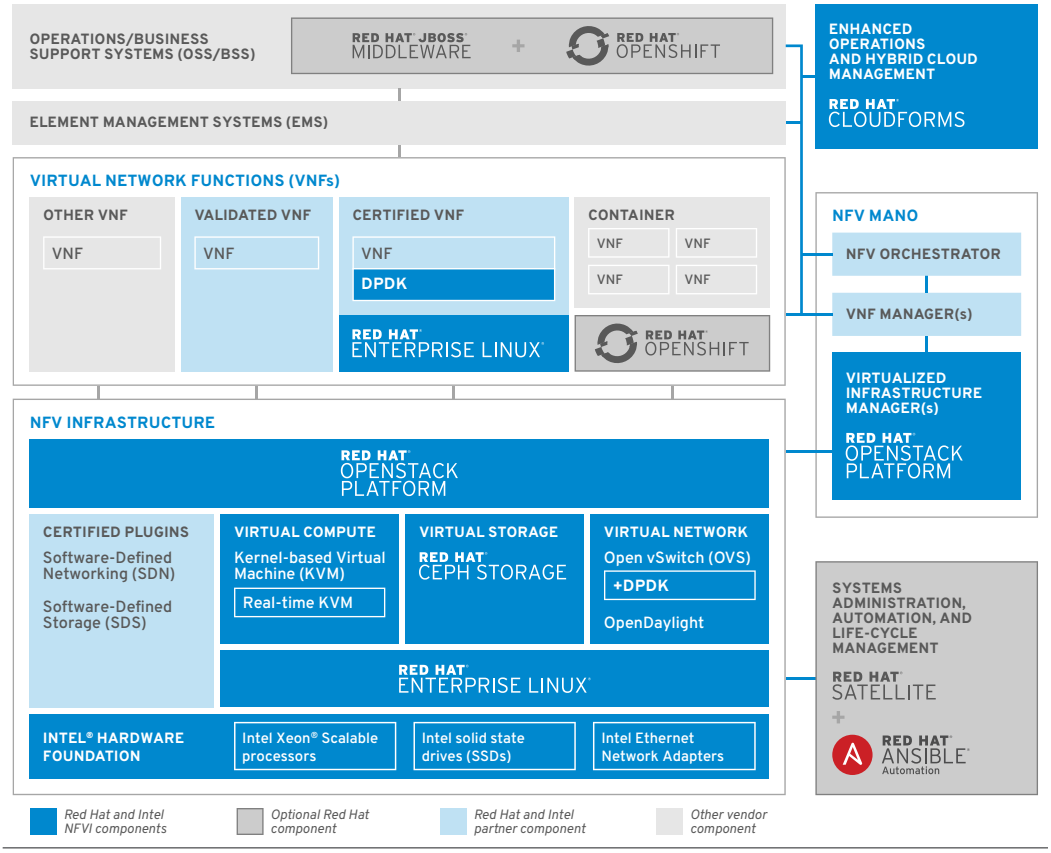

Figure 1. The components of the Red Hat and Intel NFV infrastructure work together to overcome the challenges of virtualizing network functions and provide a cost-effective, high-performance NFV foundation

VIRTUAL CENTRAL OFFICE

Quality of service and user experience are important factors for communications subscribers. Poor experiences can cost your business customers and revenue. Virtualizing central offices with the Red Hat and Intel NFV infrastructure can help you improve the performance of residential, business, and mobile services by moving compute capabilities closer to the edge of your network, where services are consumed. The virtualized environment increases agility and efficiency, reduces costs, and lets you deliver a better customer experience.

BOOST YOUR PROFITS WITH INFRASTRUCTURE AGILITY

Infrastructure flexibility allows you to dynamically modify your service offerings to meet changing market needs. The Red Hat and Intel NFV infrastructure gives you the business agility you need to succeed in an increasingly competitive industry. Dynamic infrastructure scalability and container portability allows virtual functions to be automatically migrated across shared resources to accelerate service delivery and ensure growing peak demand levels are met. The risk of innovation is greatly reduced as new, revenue-boosting services can be created quickly without the purchase of new hardware, and retired just as fast if market acceptance is not realized. This allows you to pioneer creative, new service offerings that can move you ahead of the competition.

RED HAT®
OPENSTACK®
PLATFORM

TECHNOLOGY OVERVIEW Increase business agility with network functions virtualization

The Red Hat and Intel NFV infrastructure combines fast network performance with cost-effective commodity hardware for increased infrastructure agility and business value.

ON-DEMAND SERVICES

In today's on-demand world, communications subscribers expect services to be available whenever and wherever they want to use them. With the Red Hat and Intel NFV infrastructure, shared resources can be dynamically allocated to provide any service at any time, from internet bandwidth to video-on-demand. With improved access to all services, customers are more likely to take advantage of both existing and new services.

CONCLUSION

NFV has the potential to revolutionize the way communications providers bring services to their subscribers. Red Hat is the industry leader in making innovative open technologies safe, secure, and consumable for enterprises and communications providers. The Red Hat and Intel NFV infrastructure combines the performance of physical network implementations with the cost benefits of virtualized, commodity-based environments for increased infrastructure agility and business value. Contact your Red Hat or Intel sales representative today to learn more about the Red Hat and Intel NFV infrastructure and take your network profitability to the next level.

ABOUT INTEL

Intel is a world leader in the design and manufacturing of essential products and technologies that power the cloud and an increasingly smart, connected world. Intel delivers computer, networking, and communications platforms to a broad set of customers including original equipment manufacturers (OEMs), original design manufacturers (ODMs), cloud and communications service providers, and industrial, communications, and automotive equipment manufacturers. Intel is expanding the boundaries of technology through relentless pursuit of Moore's Law and computing breakthroughs that make amazing experiences possible.

ABOUT RED HAT

Red Hat is the world's leading provider of open source software solutions, using a community-powered approach to provide reliable and high-performing cloud, Linux, middleware, storage, and virtualization technologies. Red Hat also offers award-winning support, training, and consulting services. As a connective hub in a global network of enterprises, partners, and open source communities, Red Hat helps create relevant, innovative technologies that liberate resources for growth and prepare customers for the future of IT.

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