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OPENSTACK® PLATFORM

redhat.

NETWORK FUNCTIONS VIRTUALIZATION WITH RED HAT

TECHNOLOGY OVERVIEW

83%

of communications operators demand or prefer to use open systems within their networks.[1]

95%

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With a fully integrated software stack, large partner ecosystem, and enterprise-grade support and services, Red Hat delivers a scalable, high-performance, reliable, and secure platform for NFV implementations.

INTRODUCTION

Data traffic is growing at an unprecedented rate. However, revenues associated with the increase in traffic are not growing at the same rate—but the associated costs are. To compound the problem, legacy communications infrastructures simply can't keep up. Innovation is risky, and high costs, slow scaling, and inflexible environments all impede your ability to quickly adapt to fast-changing market conditions stay one step ahead of the competition. As a result, communications providers need new ways to increase service offerings while reducing infrastructure costs.

NETWORK FUNCTIONS VIRTUALIZATION IMPROVES AGILITY

Virtualizing your network infrastructure can alleviate many of the challenges of legacy environments. Network functions virtualization (NFV) implements network functions as virtual machines (VMs) on a general-purpose, cloud-based infrastructure, rather than as dedicated physical hardware. Because you're using a single infrastructure for all of your virtual network functions (VNFs), you can drastically reduce capital expenses (CapEx) and operational expenses (OpEx) through increased system utilization and streamlined administration. A massively scalable cloud framework lets you dynamically expand your infrastructure to meet demand. And, because you can create and deploy new network functions and services virtually, innovation isn't as risky—you can quickly spin up a new service to test its market opportunity and if that opportunity isn't realized, you can decommission it just as fast. All of this adds up to increased infrastructure flexibility and improved business agility.

Several industry organizations are developing specifications for various aspects of NFV. For example, the NFV architecture proposed by the European Telecommunications Standards Institute (ETSI) is shown in Figure 1. Each component of the architecture is based on industry standards to promote better stability and interoperability.

OPEN TECHNOLOGIES FOR NFV

Open technologies are essential for industry organizations trying to create standards for NFV implementation. These technologies promote better interoperability and faster innovation, so communications companies can take advantage of the latest advances easily and quickly. Open source communities encourage new ways of thinking and solving challenges. And, with an infrastructure based on open technologies, you can avoid vendor lock-in and maintain a higher level of flexibility. In fact, 83% of communications operators demand or prefer to use open systems within their networks, and 95% see open source as a positive attribute of any NFV solution.[1]

RED HAT DRIVES INNOVATION THROUGH OPEN SOURCE COMMUNITIES

With more than 20 years of leadership in the open source community, Red Hat delivers technologies that are trusted for their stability, security, and interoperability in enterprise IT environments. These technologies are trusted by 100% of telecommunications providers in the Fortune Global 500.[2]

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1 *Doyle Research, "Open Networking Drives NFV Innovation for the Telecom Industry," December 2014.*

2 *Red Hat client data and Fortune Global 500 list, 2013.*

NFV INFRASTRUCTURE COMPONENTS

- ☐ Commercial off-the-shelf (COTS) hardware
- ☐ Cloud technologies (such as OpenStack)
- ☐ Guest operating system (such as Linux®)
- ☐ Virtualization hypervisor (such as KVM)
- ☐ Open vSwitch
- ☐ Data Plane Development Kit (DPDK)
- ☐ Storage
- ☐ Containers (in development)
- ☐ Operations support systems (OSS) and business support systems (BSS)

THE RED HAT SOFTWARE STACK FOR NFV

- ☐ Red Hat Enterprise Linux
- ☐ Red Hat JBoss® Middleware
- ☐ Red Hat Enterprise Virtualization
- ☐ Red Hat Storage
- ☐ Red Hat Enterprise Linux OpenStack Platform
- ☐ Open Shift by Red Hat
- ☐ Red Hat CloudForms

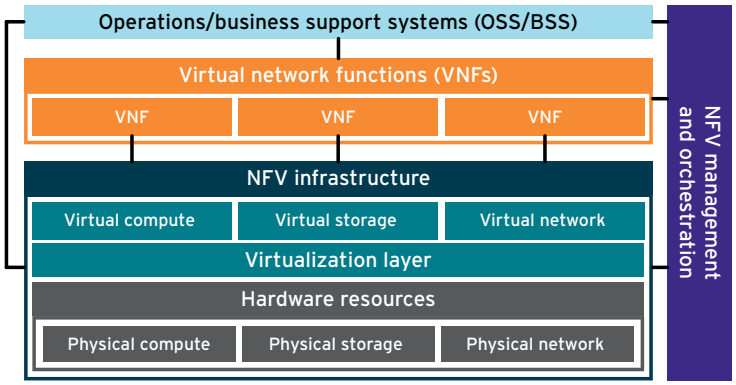


Figure 1. The ETSI-specified NFV architecture includes physical, virtual, software, and management components.

Red Hat integrates key technologies from open source communities, including OpenStack® and Linux®, into its enterprise-grade products. And, the company continues to encourage innovation through ongoing contributions to communities that are developing technologies needed for NFV.

- **Open Platform for NFV (OPNFV).** Red Hat is a founding member of OPNFV, a project to create a carrier-grade, integrated, open source reference platform. Built by industry leaders, this platform will promote consistency, performance, and interoperability throughout the NFV stack.
- **Open Daylight.** Red Hat also contributes to the Open Daylight project. Open Daylight aims to develop an open platform to enable software-defined networking (SDN) and create a solid foundation for NFV implementations of any size and scale.
- **OpenStack.** OpenStack is a key component in any NFV implementation. Red Hat is a top contributor to OpenStack and is a gold member of the OpenStack Foundation.

RED HAT DELIVERS THE ENTIRE CORE SOFTWARE STACK FOR NFV

Red Hat provides an ideal platform for your NFV infrastructure. As the only open technology vendor that delivers the entire core software stack needed for NFV, Red Hat can ensure better interoperability, stability, and security across your NFV environment. As shown in Figure 2, each layer of the Red Hat stack delivers key features for your enterprise NFV environment.

With this integrated software stack, Red Hat delivers the scalability, deployability, availability, performance, and security needed for effective, enterprise-grade NFV implementations.

- **Scalability.** Your NFV infrastructure has to scale quickly to meet fast-growing demand for data and services. The OpenStack framework is designed specifically for scalability, and Red Hat Enterprise Linux OpenStack Platform delivers this scalability in a stable and secure solution.
- **Deployability.** Any NFV solution must be easily deployable, simply maintained, and supported at an enterprise level to be effective. Red Hat is an expert in making open technologies consumable for enterprise use through commercial hardening, integration across the software stack, consulting and training services, and full enterprise-grade support.
- **High availability.** Your network infrastructure need to be available to deliver services to your customers around the clock. Every Red Hat product is subjected to intense testing protocols that ensure reliability and interoperability with the rest of your environment.

Red Hat's integrated software stack delivers the scalability, deployability, high availability, performance, and security you need for a stable, effective NFV implementation.

- **Performance.** For an NFV solution to be of any use, its virtualized functions must meet or exceed the performance of physical implementations. Red Hat's virtualization technologies are based on the high-performance Kernel-based Virtual Machine (KVM) hypervisor, the most popular hypervisor for OpenStack and cloud deployments.[3]
- **Security.** As security threats become more prevalent, you must ensure that your data is protected. Advanced security features, including SELinux and sVirt, are built in to Red Hat's products. In fact, many highly security-conscious organizations, including the U.S. National Security Agency and more than 90% of Fortune 500 companies, rely on Red Hat.[4]

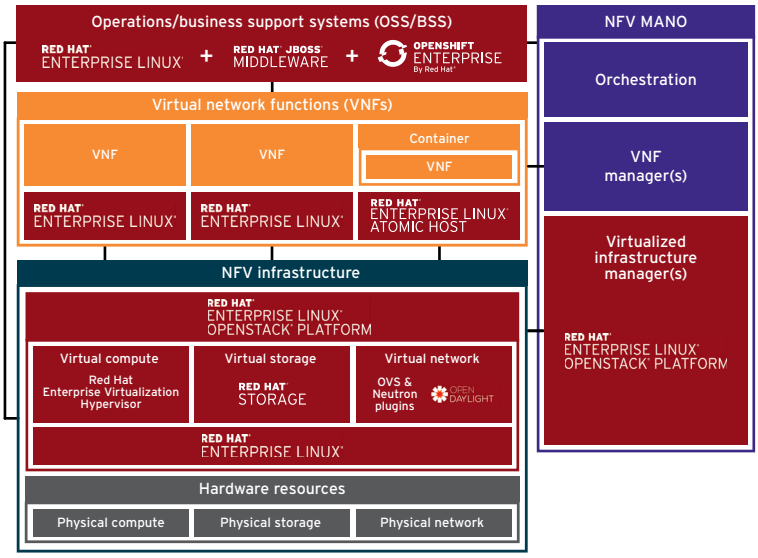


Figure 2. Red Hat delivers the entire core software stack needed for your NFV infrastructure. Red Hat's industry-leading partner ecosystem provides carrier-grade hardware, VNFs, and NFV management and orchestration tools.

Red Hat works with communications-focused open source communities to drive NFV innovation.

RED HAT CAN HELP YOU BUILD YOUR NFV ENVIRONMENT

Building an NFV architecture from nothing can be a daunting task. Red Hat provides professional services to help you plan, design, implement, and operate your NFV environment. eNovance from Red Hat delivers services for large-scale, OpenStack-based NFV deployments. Red Hat Consulting delivers design and installation services, mentoring programs, and training and certification services for OpenStack. With services based on industry best practices, you can build a secure, stable NFV environment faster and learn how to operate it as efficiently and effectively as possible.

RED HAT IS BUILDING A COMPREHENSIVE ECOSYSTEM OF NFV PARTNERS

One of the main benefits of using open technologies is flexibility and interoperability. To ensure that you have access to the hardware, VNFs, and NFV management and orchestration tools you need, Red Hat is building a large ecosystem of expert NFV partners. By working with innovative leaders in communications, Red Hat is building out a comprehensive community that includes all parts of the

3 Open Virtualization Alliance, "KVM: The hypervisor of choice for cloud," 2013.

4 Red Hat client data and Fortune Global 500 list, 2013.

"Red Hat has an integrated and tested open reference platform built to specifically address the needs of the telecom industry. With over 20 years of open source experience, it has the experience to build new open source components within the NFV project where needed."

LEE DOYLE
"OPEN SOURCE NETWORKING DRIVES NFV INNOVATION FOR THE TELECOM INDUSTRY," DECEMBER 2014

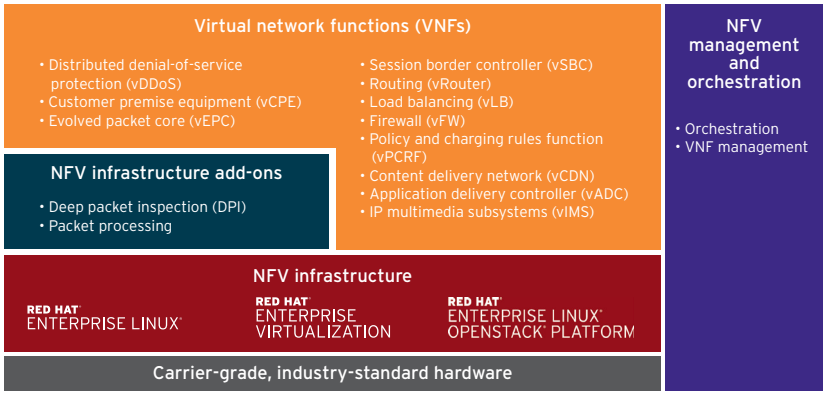


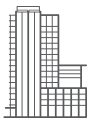
Figure 3. Red Hat is creating a comprehensive ecosystem of industry-leading partners so you can confidently choose the NFV solution components that meet your needs today and in the future.

NFV solution, including management and orchestration platforms, VNFs, and infrastructure add-ons to enhance the performance and functionality of your NFV environment. Figure 3 shows areas in which Red Hat has partners—new partners are added continually and the latest listing can be found on Red Hat's website.

CONCLUSION

Network functions virtualization is revolutionizing the way communications companies operate and deliver services. As an open technology leader, Red Hat provides a scalable, high-performance, reliable, and secure platform for your NFV infrastructure. With a fully integrated software stack, large partner ecosystem, and enterprise-grade support and services, Red Hat lets you confidently take advantage of all NFV has to offer. Contact you Red Hat sales representative to learn how an NFV infrastructure based on the Red Hat stack can help you reduce costs, improve agility, and prepare for the future.

Learn more at redhat.com/en/technologies/industries/telecommunications/nfv-platform.



ABOUT RED HAT

Red Hat is the world's leading provider of open source solutions, using a community-powered approach to provide reliable and high-performing cloud, virtualization, storage, Linux, and middleware technologies. Red Hat also offers award-winning support, training, and consulting services. Red Hat is an S&P company with more than 80 offices spanning the globe, empowering its customers' businesses.

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NORTH AMERICA
1 888 REDHAT1

EUROPE, MIDDLE EAST, AND AFRICA
00800 7334 2835
europe@redhat.com

ASIA PACIFIC
+65 6490 4200
apac@redhat.com

LATIN AMERICA
+54 11 4329 7300
info-latam@redhat.com