SOLUTION BRIEF

Telecommunications
Network Functions Virtualization

Get Ready for the Future Today: Accelerate Deployment of Network Functions Virtualization (NFV)

To reduce costs and speed time to market, CoSPs are accelerating NFV using the next evolution in a software-defined WAN (SDWAN 2.0) virtualized network function (VNF) and industry-standard servers based on Intel® architecture

This solution brief describes how to solve business challenges through investment in innovative technologies.

If you are responsible for...

- **Business strategy:** You will better understand how accelerating NFV with software-defined WAN virtualized network function will enable you to successfully meet your business outcomes.
- **Technology decisions:** You will learn how the software-defined WAN works to deliver IT and business value.

nuagenetworks
From Nokia

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Executive Summary

How can communications service providers (CoSPs) keep up with leaps in network traffic, cost effectively and quickly launch new services, while reducing total cost of ownership? The answer lies in ramping network functions virtualization (NFV). By accelerating NFV deployment, CoSPs stand to gain many benefits, including reduced operational and capital expenditure, enhanced business agility, an expanded vendor ecosystem and improved profit margins.

CoSPs can take NFV to a new level by deploying a software-defined wide area network (SDWAN) as a virtualized network function (VNF). The combination of virtualization and software-defined networking increases visibility, security and control across the entire network, from edge to data center to cloud.

Intel and Nokia* have collaborated to create a flexible and scalable SDWAN 2.0 platform. With this platform, CoSPs get all the advantages of 2nd Intel® Xeon® Scalable processors and Intel® QuickAssist Technology (Intel® QAT), combined with optimizations to the Nuage Networks* SDWAN 2.0 software. The optimized platform provides 2X more SDWAN IPSec throughput and 5X better VNF density, compared to using the previous-generation Intel Xeon Scalable processor without Intel QAT[1].

The SDWAN 2.0 platform is a pure VNF implementation that future-proofs the network for the imminent increase in traffic. The platform has the ability to scale to address cloud and communication network traffic demands. The SDWAN 2.0 VNF resides with other VNFs the in data center core alongside other network functions, allowing for more flexible performance scalability.

Solution Benefits

- **Cost-effective.** Replace legacy and expensive purpose-built infrastructure with affordable and scalable Intel® architecture-based servers.
- **Flexible and scalable.** Launch or customize new services quickly. Add new virtualized network functions (VNFs) on existing network functions virtualization infrastructure (NFVI).
- **Easy to manage.** Use automated and centralized management and orchestration (MANO) to reduce operational complexity and expense and enhance security.

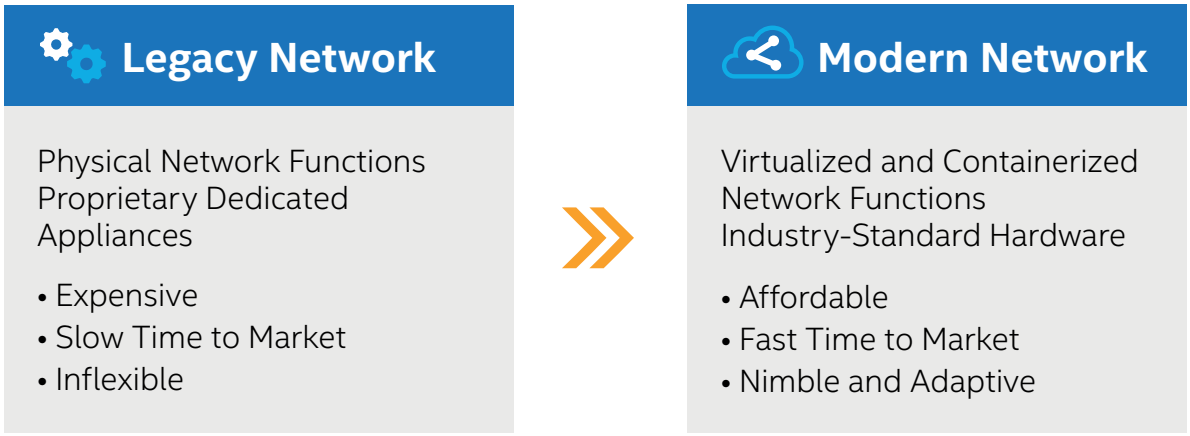

Figure 1. A software-defined wide area network (SDWAN) built on Intel® architecture uses virtualized and containerized network functions to cut costs, speed time to market and increase business agility.

Business Challenge: Do More—and Do it Quickly—for Less

CoSPs face three primary challenges (see Figure 2):

- **Increase business agility.** Customer expectations change rapidly—something that was popular six months ago may not be popular six months from now. There is a great need to be able to deploy services faster, support innovative business models for customers and quickly adapt and customize services to accommodate customer requirements.
- **Lower total cost of ownership (TCO).** Dedicated, purpose-built physical hardware is expensive to build out, and deploying new services on such hardware can take two to three years—during which costs continue to rise and new revenue opportunities are lost.
- **Improve margins.** Changes in consumer behavior relating to traditional communication services, a decline in total consumer spend on services even while overall communications activity grows, and an increasing number of disruptors entering the communications services market—these all put pressure on service providers' profit margin[2].

In response to these pressures, CoSPs are modernizing their networks, shifting from proprietary dedicated appliances to a software-defined wide area network (SDWAN) with virtualized network functions (VNFs) and containerized network functions (CNFs) running on an industry-standard, Intel® architecture-based network functions virtualization infrastructure (NFVI).

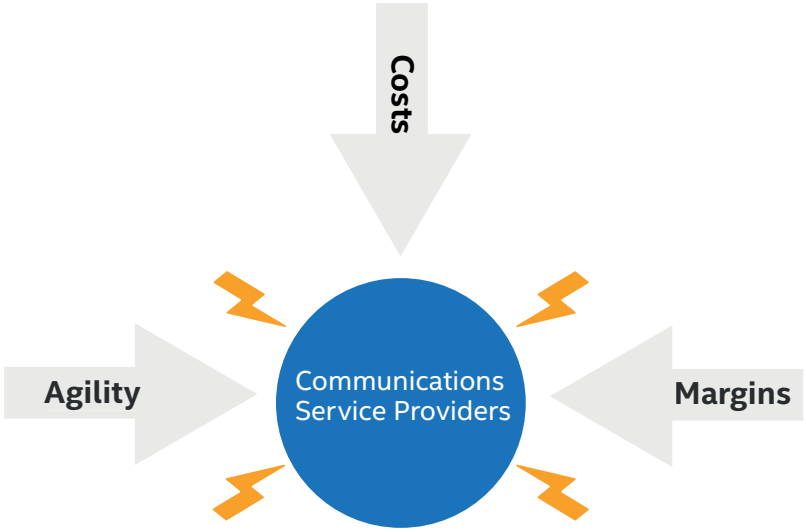

Figure 2. Communications service providers (CoSPs) are under pressure to move faster, cut costs and increase profits.

Deploying the SDWAN as a VNF

Deploying SDWAN within the NFVI as a VNF forms the basis for network automation and control across the entire network. With an SDWAN deployed across the network as a VNF, distributed with the compute resources, the network can then be programmed with an intelligent overlay that immediately opens up application level visibility and control. This approach allows the network to be programmed to adapt to the ever-changing network compute requirements, as workloads or virtual machines (VMs) or containers come and go to support their parent VNFs. The network adapts transparently in the background, maintaining connectivity at a level that enables services to meet their service-level agreements (SLAs).

Furthermore, the SDWAN centralized policy and control infrastructure can create network policies that intelligently program the network to support the optimal hierarchical processing of applications based on their unique characteristics, such as latency, signaling requirements and bandwidth requirements.

With both telecommunications and cloud service providers increasingly moving to a multi-cloud environment that accommodates edge computing, use cases for the SDWAN VNF are multiplying. Here are two in addition to simply serving as the anchor VNF for a network:

- **SDWAN 2.0 evolution.** At the enterprise branch, dedicated appliances that provided services such as firewalls, WAN optimizers, deep packet inspection (DPI) and session border controllers are evolving as VNFs running on an Intel architecture-based server rather than on traditional customer-premises equipment (CPE). With the SDWAN 2.0 installed as a VNF, the existing and consolidated SDWAN infrastructure can be used to program the forwarding plane while also providing a well-defined interface to orchestration. This creates an intelligent network fabric where the forwarding plane is programmable and by using capabilities like service chaining, the operator can ensure that each packet flow is processed through the proper VNF. For example, a video packet flow is destined for a final location but before it gets there, a service chain could be established to direct this flow through a video optimization function that may be hosted locally. Then the same packet could be sent to a security function hosted in a central office or another data center, and finally to its final destination.
- **5G technology.** The stage is set for faster speeds and other advancements such as reduced latency, increased capacity and improved machine to machine communications. Smart City security, autonomous vehicles, connected machines with vision capabilities, advanced drones with high-resolution cameras, sensors on manufacturing equipment will all contribute to an explosion of traffic. And CoSPs' security, network and analytics capabilities need to be ready. An SDWAN deployed at the edge of the network will be able to provide visibility and control for each of these emerging applications, providing the network performance that each application needs, as well as enhancing security for each application through software-defined security measures.

Solution Value: Scalability, Agility, Affordability… and More

Recognizing the pitfalls of physical buildout, forward-looking CoSPs are increasing capacity and launching new services through NFV. NFV decouples the networking hardware from the service software, so that many virtualized network nodes can run on the same generalized servers (see Figure 3).

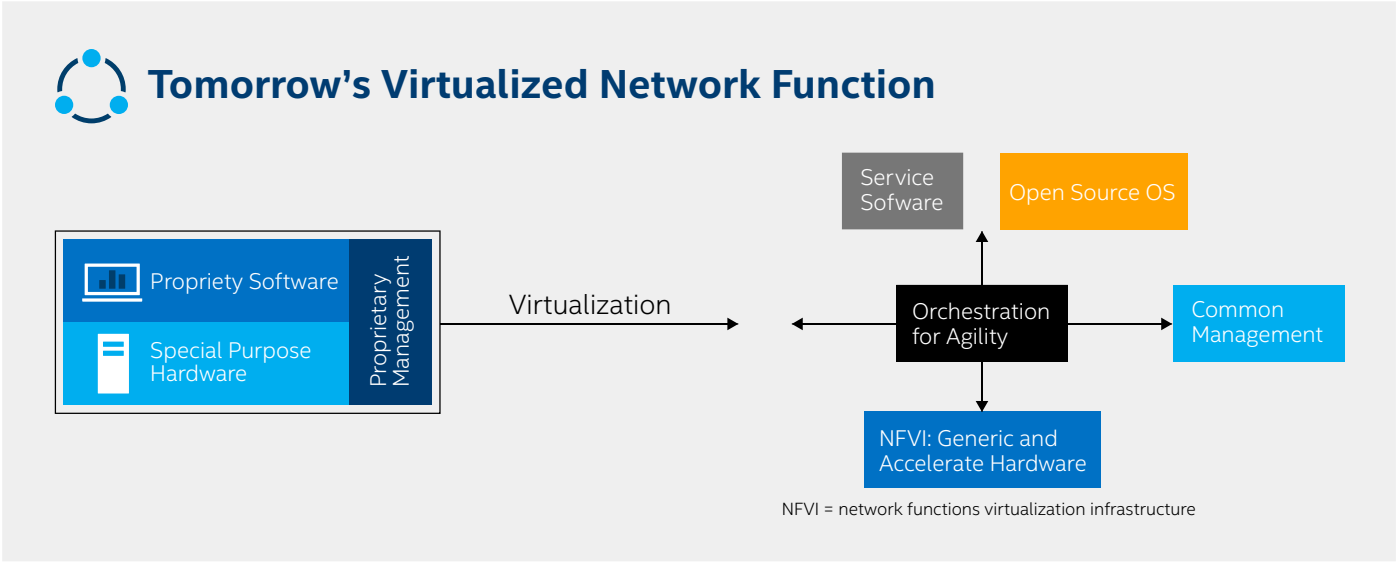

Figure 3. Replacing legacy appliances with modern virtualized and containerized network functions offers many benefits.

This virtualized approach offers a wide variety of benefits:

- **Reduced CapEx.** When launching a new service, a new, dedicated appliance is no longer necessary. Instead, the new service uses a VNF or CNF, running on affordable industry-standard commercial off-the-shelf hardware and sharing resources with other services.
- **Reduced OpEx.** Automated and centralized management and orchestration (MANO), fewer pieces of equipment to consume energy and data center space, and standardized equipment that requires fewer personnel to manage it can all contribute to lower operating expenses.
- **Increased profit margins.** The ability to quickly launch new services and affordably customize those services to end users' needs can help CoSPs to retain existing customers and attract new ones. Providing a high-quality user-focused experience is increasingly important to maintaining a competitive edge.
- **Improved agility.** Traffic demands can change rapidly, with sometimes unpredictable bursts. An SDWAN with NFV can adapt quickly to such changes by adding more VNFs or CNFs to meet demand as needed, protecting against negative impacts on user experience. And because everything is software-defined, deployment of new services is accelerated through automated testing and deployment and the use of standard application programming interfaces (APIs).
- **Expanded vendor ecosystem.** No longer locked into a single vendor that provides both hardware and software, NFV frees CoSPs to use a wide variety of suppliers—which increases flexibility and may help with cost negotiations. In addition, because applications provided by software vendor A and software vendor B can both run on the industry-standard hardware, CoSPs can more easily and objectively compare software solutions' performance and features.

As the above discussion proves, ramping and scaling NFV presents a compelling benefits package. But how does an SDWAN with VNFs and CNFs actually work?

Solution Architecture: Future-Ready Software-Defined WAN with Intel® Technology

VNFs and CNFs can be any service on the network, such as virtualized gaming, voice over IP (VoIP), load balancers, content delivery networks (CDNs), and many more. Software-defined networking (SDN) means being able to automatically and dynamically move software (that is, those VNFs and CNFs) from one to another server in response to service need or problems in the network. SDN-based control and operations connects all the pieces of the network—from the physical hardware in the data center to the edge—so they all can intelligently communicate. SDN uses virtual switches (vSwitches) on the servers to configure how the physical routers talk to each other, and the SDN controller works with the service orchestration engine to understand the needs of each service on the network.

Software-defined Security and SDWAN 2.0 Evolution

Traditional perimeter-based security capabilities do not provide adequate application visibility and detection capabilities from east to west laterally within the network. This will be exacerbated by the expected massive growth of 5G and the Internet of Things (IoT). The massive distribution of compute resources toward the edge will result in a huge increase in the network's attack surface.

With a software-defined wide area network (SDWAN), security can easily be programmed into the overall network, end to end. This makes an SDWAN an even more powerful tool.

With end to end visibility and control for each application, the operator is in a position to detect, protect resources at a very granular level, and use automation to respond in real-time to threats. For example, a packet flow could be quarantined, or routed using a service chain to a more advanced security.

As more and more of these software functions start to move around the network, something has to manage that networking: an SDWAN solution. An SDWAN makes network capabilities elastic through centralized software control that manages, configures, assigns, monitors and provisions it (in real time), so it can meet the needs of the different services. Launching a new service is as simple as accessing a portal that's connects to a service orchestrator and choosing the desired service. The service orchestrator sends the software to all the appropriate servers so it can be deployed, then the VNF manager configures the instance with the resources it needs and connects it to the operations support system (OSS) so that it is integrated into the system. Lastly, the OSS reports successful deployment to the service orchestrator. Notice that no manual configuration is necessary—it's all done automatically with software.

Intel has collaborated with Nokia's Nuage Networks* and the AirFrame* teams to create an optimized edge-to-core infrastructure platform that enables the SDWAN as a VNF. The platform (see Figure 4) is optimized for two pillars: increasing security throughout the NFVI and maximizing the number of available CPU cycles on the same server to increase VM or VNF density.

The Nokia Nuage Networks SDWAN 2.0 platform takes advantage of 2nd generation Intel Xeon Scalable processors combined with an Intel® QAT acceleration adapter and the Nokia Nuage Virtual Network Gateway.

- **2nd generation Intel Xeon Scalable processors.** These CPUs are optimized for NFVI and networking workloads such as virtual switching, vector packet processing and security. They also feature Intel® Speed

Select Technology, which allows CoSP customers to use the same CPU but be able to specify either high or low frequency for a particular VNF to handle either bursts in traffic or performance-critical VNFs. Three Intel Xeon Gold processor models are available (6252N, 6230N and 5218N).

- **Intel QAT.** To improve performance, the platform allocates particular Intel QAT acceleration capabilities per VM or VNF. The system supports up to three physical functions per accelerator card, with up to 48 VNFs per card. The key takeaway here is the ability to partition the security acceleration into separate tenants or separate VNFs.
- **Nokia Nuage Networks Network Services Gateway (NSG).** The NSG provides end-to-end policy and data plane controls extending from users in branches to workloads in public or private clouds, as well as software as a service (SaaS).

In recent tests, the SDWAN 2.0 platform provided 2X more SDWAN IPSec throughput and 5X more VNF density than was provided by a similar platform using a previous-generation Intel Xeon Scalable processor without Intel QAT[3].

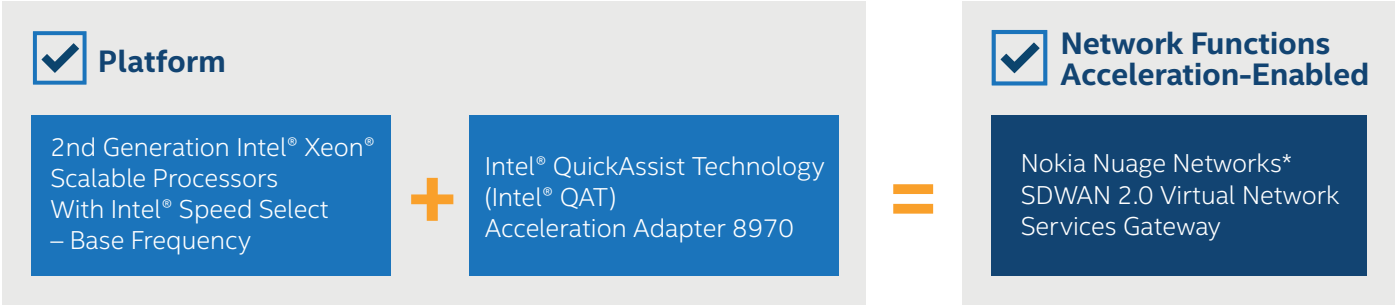

Figure 4. The software-defined wide area network (SDWAN 2.0) platform combines the latest technologies from Intel and Nokia*.

Conclusion

NFV can solve CoSPs' primary pain points, helping to reduce cost, improve margins, and enhance business agility. CoSPs can accelerate the modernization of their networks using the SDWAN 2.0 platform, which combines the latest processor and acceleration technologies from Intel integrated with and optimized for Nokia Nuage Networks to increase SDWAN IPSec throughput, while increasing VNF density. With this platform, CoSPs can scale to handle current and future traffic, launch new services and meet customer expectations.

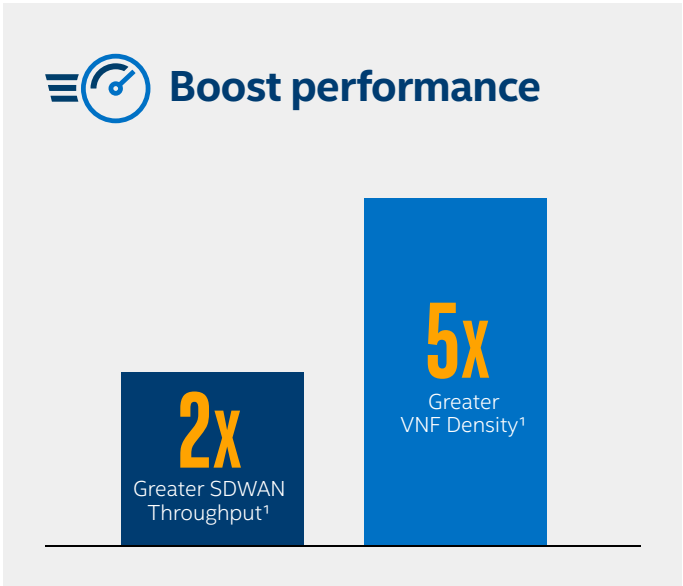

Figure 5. Real-world SDWAN performance compared to previous-generation processor (higher is better).

Learn More

You may find the following resources helpful:

- Nuage Networks
- 2nd generation Intel® Xeon® Scalable processors
- Intel® QuickAssist Technology
- Free foundational 5G training from Intel® Network Academy
- Intel® Select Solutions for NFVI
- Nuage Networks VNS, an SDWAN solution for CoSPs and Enterprises

Find the solution that is right for your organization. Contact your Intel representative or visit **intel.com/networktransformation**.

Or get more information to help guide conversations and decisions with your team about optimizing infrastructure to support NFV in the briefing sheet, **Building virtualized, cloud-optimized, 5G-ready networks**.

Solution Provided By:

[1] Results recorded by Intel on 2/14/2018 in collaborate with Nokia*. Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software or service activation. Performance varies depending on system configuration.

No product or component can be absolutely secure.

Baseline Configuration: 2x 2nd generation Intel® Xeon® Gold 5118 processor on Neon City Platform with 192 GB total memory (12 slots / 16 GB / DDR4 2667 MHz), ucode 0x4000019, BIOS: PLYXCRB 1.86B.0568.D10.1901032132, uCode: 0x4000019 on CentOS* 7.5 with Kernel 3.10.0-862, KVM* Hypervisor; Intel® Ethernet Converged Network Adapter X520-SR2; Application: Nokia Nuage Networks* SDWAN NSGv 5.3.3U3.

Test Configuration (With Intel® QuickAssist® Technology): 2x Intel 2nd generation Xeon Gold 5218N processor on Neon City Platform with 192 GB total memory (12 slots / 16 GB / DDR4 2667 MHz), ucode 0x4000019, BIOS: PLYXCRB 1.86B.0568.D10.1901032132, uCode: 0x4000019 on CentOS 7.5 with Kernel 3.10.0-862, KVM Hypervisor; 1x Intel® QuickAssist Adapter 8970, Cipher: AES-128 SHA-256; Intel Ethernet Converged Network Adapter X520-SR2; Application: Nokia Nuage Networks SDWAN NSGv 5.3.3U3.

[2] McKinsey and Company, January 2017 "Overwhelming OTT: Telcos' growth strategy in a digital world." https://www.mckinsey.com/industries/telecommunications/our-insights/overwhelming-ott-telcos-growth-strategy-in-a-digital-world

[3] See endnote 1.

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Performance results are based on testing as of the date noted in the configuration details and may not reflect all publicly available security updates. See configuration disclosure for details. No product or component can be absolutely secure.

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