How to Select the Right Network Function Virtualization Solution

Choose wisely to maximize your profit potential and reduce operational expenses

Upgrading to meet new demands

Network operators often have siloed infrastructures with purpose-built hardware and solutions that can lead to redundant capital investments and complex architectures, which can make it difficult to respond to market demands. To accelerate infrastructure transformation, many operators are looking into upgrades that incorporate network functions virtualization (NFV). This platform solution can scale horizontally through virtualization, software-defined networking (SDN), and orchestration technologies. In recent years, NFV has been deployed in live networks to drive large capabilities such as mobile packet core, enterprise virtualization services, and infrastructure virtualization. Operators are looking for the best practice approach for NFV that will create true business value.

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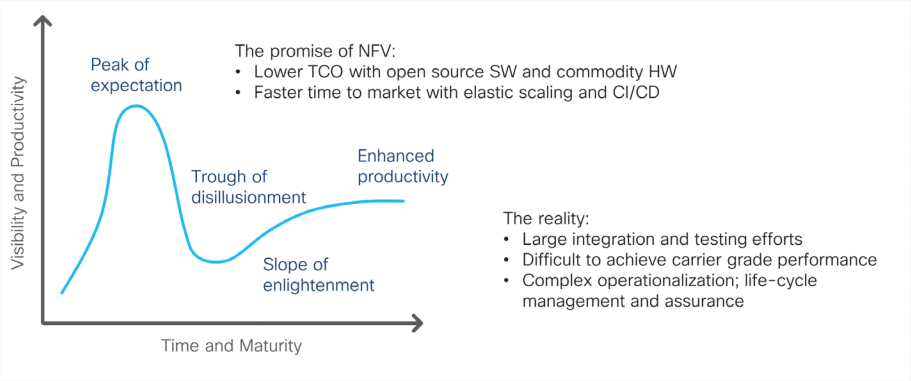
Why selecting the right platform matters

Network operators use several deployment frameworks and architectures. The options vary across single-vendor vertical stacks, horizontal disaggregated do-it-yourself (DIY) stacks, and horizontal modular platforms with multi-tenanted virtual network functions (VNFs). Among these three approaches, operators today tend to choose a platform that is open and modular with the optimal balance of open multi-function scaling, carrier-grade operational packaging, and a single point of ownership.

Deploying the right NFV platform approach for a given set of virtual network functions can have a significant impact on streamlining operational expenses.

For telecommunication service providers (SPs), the promise of NFV has traditionally been about lowering network total cost of ownership (TCO). It offers automation and simplification of network operation while improving service agility. However, like all new technologies, over time, the hype of expectation subsides, challenges are overcome, and the true benefits are revealed.

Figure 1. NFV hype cycle so far



Today, after several years of real-world implementation, NFV has become mainstream for new service provider functions. It's mainly used for mobile core and virtual network services with cloud-based management with deployments globally in mainly central and regional telco data centers. For instance, Cisco has deployed virtual packet core (VPC), virtualized managed services, and virtualized infrastructure services in more than 100 networks over the past three years.

As the industry hits the hype cycle slope of enlightenment, observers are now able to ascertain the best practice approach in NFV system design and operations. NFV is also seen as fundamental for emerging architectural shifts including 5G core, multiaccess edge computing (MEC), and cloud-native functions.

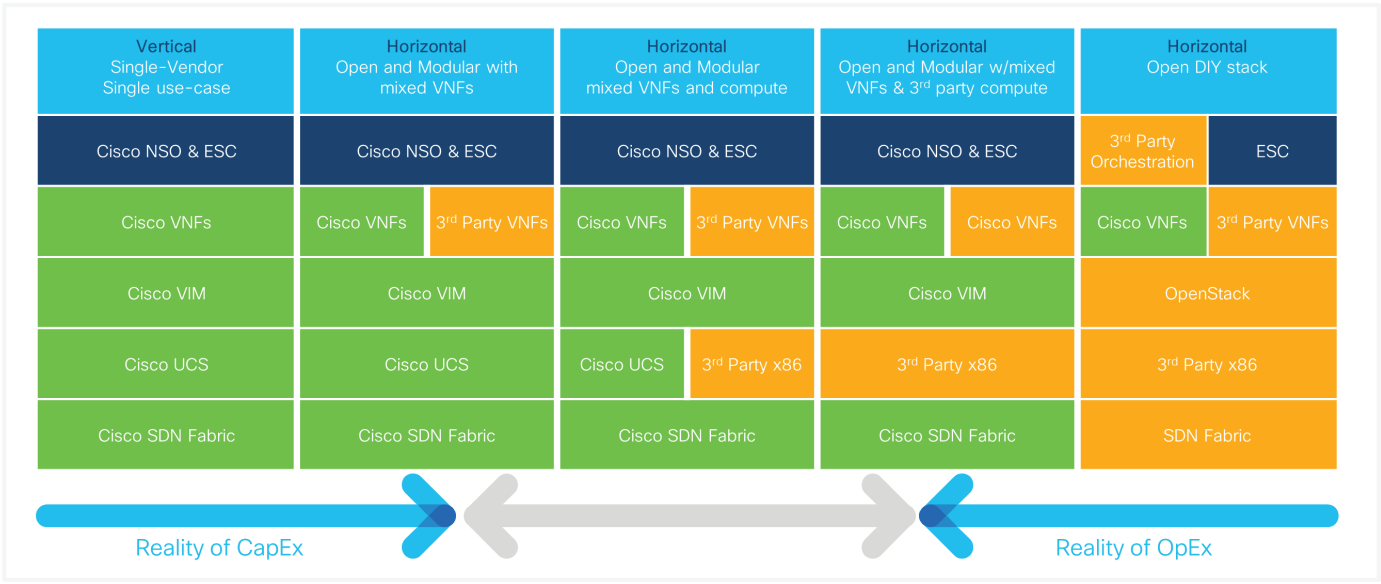
Best practice for NFV platforms

Like all new technologies, over time NFV has gone through a hype of expectation, faced realities about real-world deployment challenges, and is now maturing to best practices where the true benefits are revealed.

Figure 2 shows several approaches to implementing an NFV platform stack. Cisco products are listed as examples for each layer, but the same principles apply for other products as well.

Over time, it appears that the vertical approach using fixed configuration isn't capital efficient for some service providers because of a limited economy of scale and the potential for underutilized capacity assets. Whereas the DIY approach promises horizontal scaling, the

Figure 2. NFV platform stack approaches



complexities of integration and operations creates prohibitive additional costs. This struggle is one only large service providers are equipped to navigate. For most service providers, the most efficient approach is likely to be somewhere between the extremes, where the platform is packaged in modules for lifecycle management and open to supporting a wider variety of VNFs for horizontal scaling and breadth of functionality. Figure 3 shows how the operational implications of these approaches translate into operational cost (OpEx).

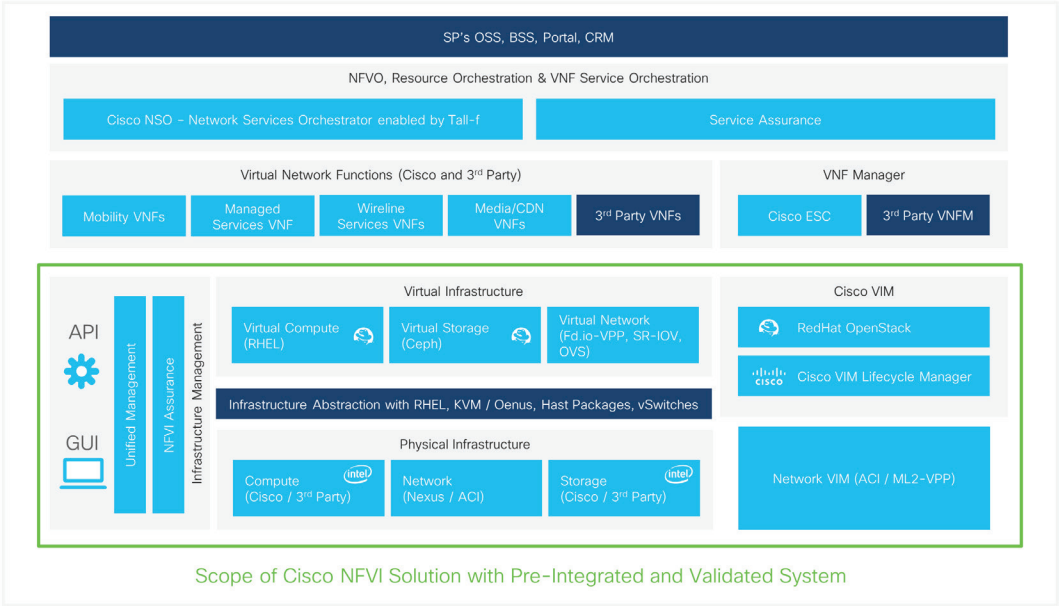
Figure 3. Operational implications of different NFV platform stack approaches

NFVI approach	Vertical	Horizontal DIY	Horizontal modular
NFV benefits of HW pooled economics	Limited set of VNFs, leaves stranded capacity	Yes, horizontal scaling	Yes, horizontal scaling
VNF eco-system	Restricted by NFVI vendor	Open	Catalogued & open eco-system
New VNF on-boarding	Only possible for pre-approved VNFs	Slow testing and validation, complex operationalisation	Catalogued pre-integrated, new on-boarding process
Service Assurance	Multi-domain correlated and single vendor	Complex route cause analysis	Multi-domain correlated
Scaling agility	Limited	Custom automation	Packaged automation
Security	Pre-hardened but isolated	Diverse threat surfaces	Process hardened
Life-cycle management	Packaged but replicated	Slow testing and validation	Process driven
Future proof	Limited	Complex integration of new environments	Supports new hybrid environments, like VMs, containers and BM

The Cisco NFVI solution

The Cisco NFV Infrastructure solution uses Open Source hardware and software components, coupled with an integrated and certified design for high throughput and performance. It also offers carrier-grade high availability, automated day-0 deployment, and smart day 1-2 operation tools.

Figure 4. Scope of Cisco NFVI Solution with Preintegrated and validated system



Scope of Cisco NFVI Solution with Pre-Integrated and Validated System

The Cisco NFVI Infrastructure helps telco operators and service providers achieve better TCO while simplifying service delivery and reducing cost with high-performance lifecycle management. Some of the key attributes and value of Cisco NFVI Solution include:

Optimized architecture

- Specialized for virtualized service delivery
- Designed to support NFV evolution, optimized investment
- Integrated solution that avoids risks and cost
- Scale to support edge architecture with centralized storage and management
- Network data center SDN that supports bare-metal, OpenStack, and Kubernetes

Simplified operations

- Fully instrumental for carrier class operations
- Simple, automated installation inclusive of hardware and OpenStack services
- Designed for reliable upgrade with telemetry and visibility to identify hot spots
- Simplified E2E operation and complexity of virtualization

Faster service delivery and time-to-market

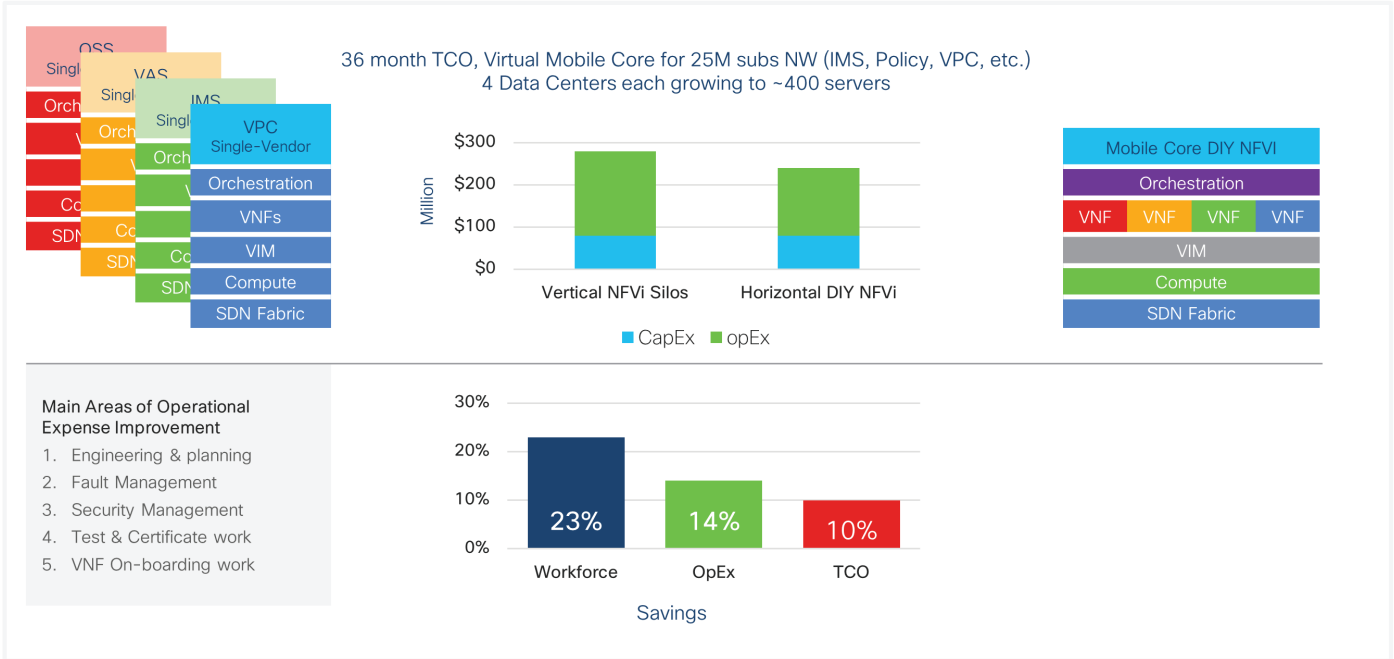
- Modular design for rapid and efficient deployment
- Integrated, validated and certified design reduces deployment from month to weeks
- Hardware and software upgrades made modular and simpler
- General multivendor and opensource NFV

Comparing the TCO of NFVI platform approaches

Cisco has worked with ACG Business Analytics to quantify the OpEx savings that can be expected by choosing the right NFVI approach for a given network function requirement.

Many operators deploy siloed NFVI and virtualized infrastructure manager (VIM) architecture for specific network solutions provided by a single vendor for quick way to deploy NFV. This approach uses dedicated infrastructure, orchestration and management tools, which lead to higher CapEx and OpEx as more VNFs are added.

Figure 5. Study of OpEx impacts of siloed vertical vs. DIY horizontal NFVI platforms



For example, when compared to building four separate vertical platforms to support different mobile core functions, building one horizontal platform results in a 14 percent improvement in OpEx over a three-year period. Note there are other benefits such as faster time to revenue from faster time to market and reduced CapEx from procurement efficiency, which weren't modeled in this study.

With vertical single function stacks, the operator has four different siloed stacks compared to a horizontal NFVI. The operator can enjoy the reuse of the common building blocks, which results in better operational benefits including:

- Less integration and operation effort and expense without redundancy in operational and integration work, including operations support system/business support system integration.
- Increased network flexibility and simplicity with end to end service, and network stitching within the telco data center
- Centralized data center (DC) SDN integration with multi-pod VIM layer and network operation
- Consistent configuration management, audit management, and security policy across four use-cases.
- Centralized OpenStack and software upgrades
- Reduce the amount of time for engineering and planning design

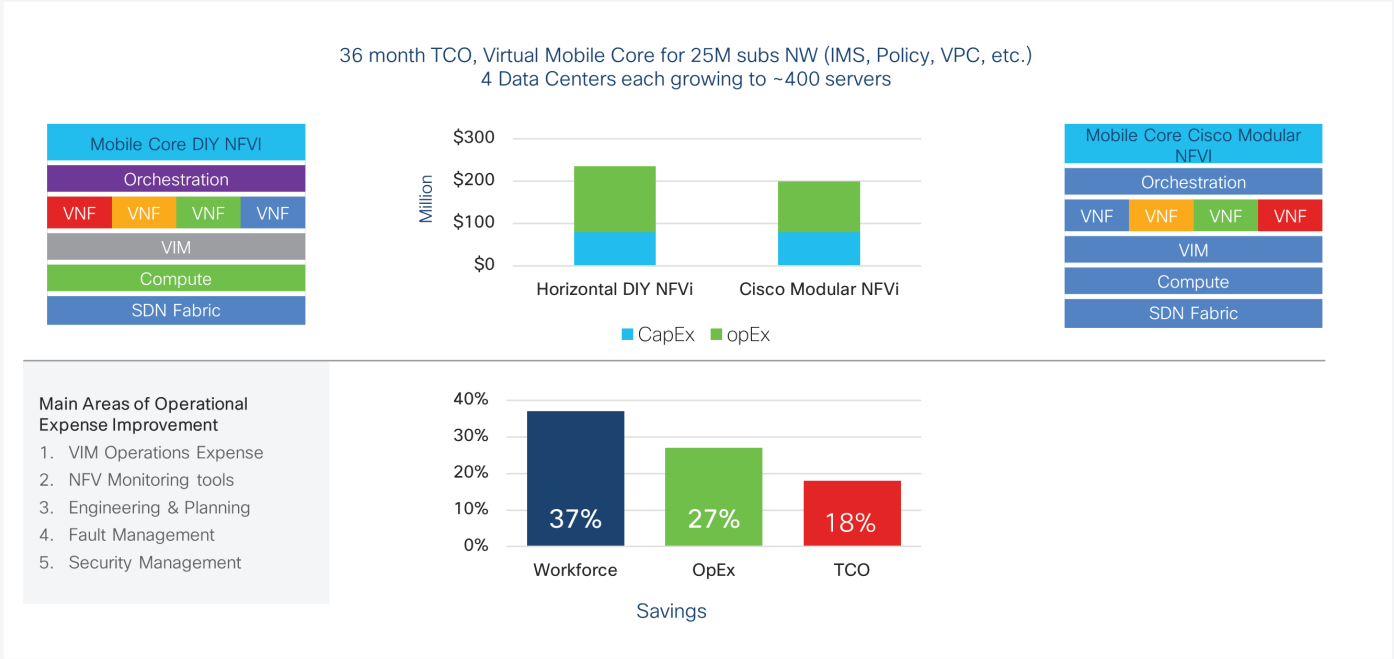
Telco and service providers may choose the DIY option if they have existing, proficient software and system engineering teams that are able to scale and support OpenStack. This support includes operations, network engineering, and software development. Having said that, some of the issues and challenges of maintaining DIY stack architecture stack include:

- Regression testing of OpenStack version, infrastructure hardware, and VNFs
- Overall solution support that requires integration with multiple vendors with complex troubleshooting
- OpenStack software and hardware installations that are siloed without validation check
- Siloed monitoring tools for OpenStack, hardware, and VM instances
- Non-integrated security patching and hardening
- Manual network integration with OpenStack services

Figure 6 shows that with Cisco Modular NFVI, operators gain benefits and efficiencies that include:

- Integrated monitoring tools of OpenStack and infrastructure
- Improved security patches for OpenStack and Linux vulnerability
- Automated software upgrades
- Improved VNF and hardware onboarding process and complexity
- Centralized configuration management
- Automated network underlay and overlay with Cisco SDN
- Miscellaneous expenses such as services assurance, software licenses, testing, development, and benchmarking are reduced

Figure 6. Study of the OpEx impacts of DIY horizontal vs. Cisco Open Modular NFVI platforms

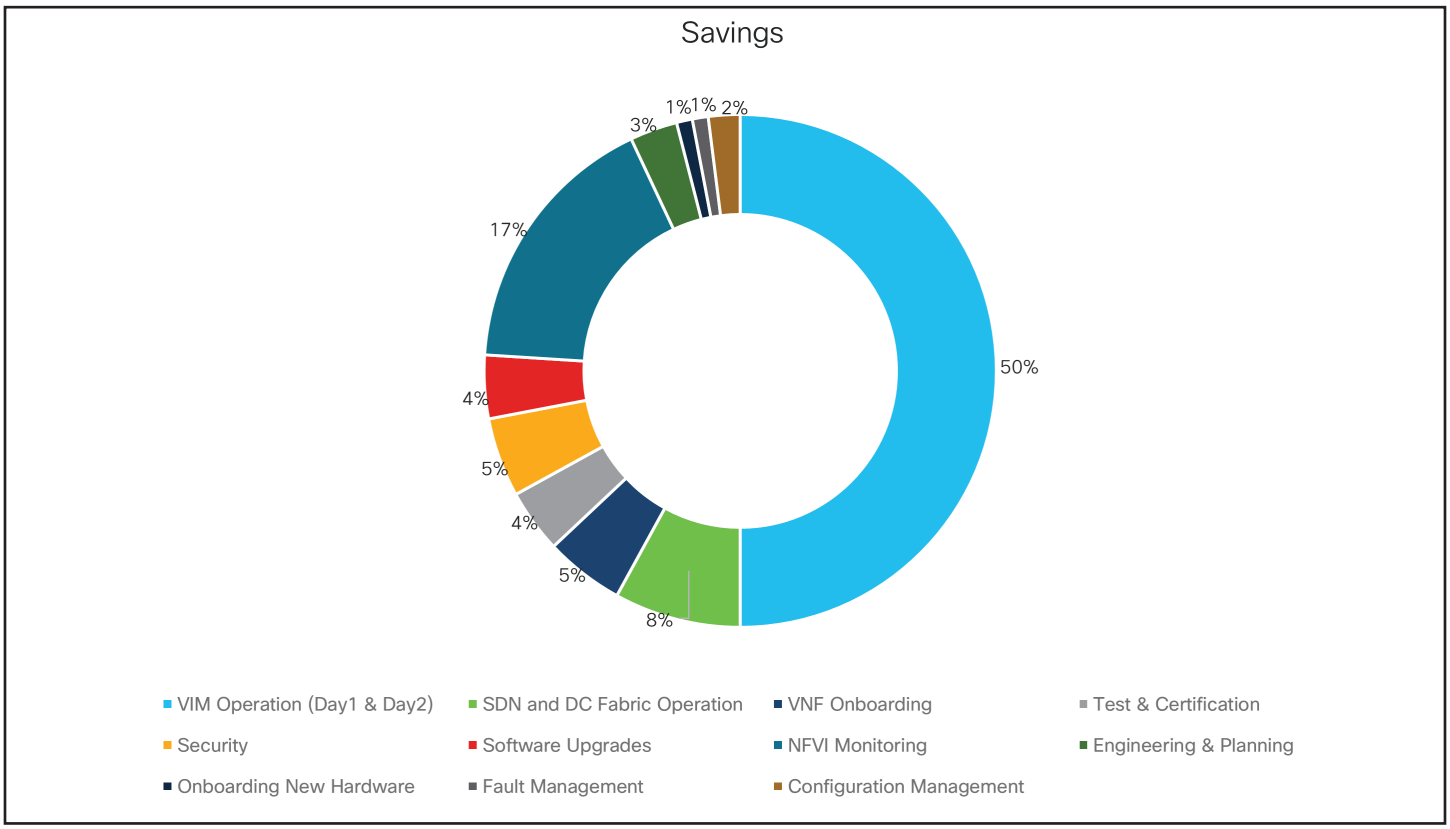


Comparing the TCO impacts of VNF validation approaches

In the second part of our TCO study with ACG Business Analytics, we modeled a virtual mobile packet core deployment through a four-year period with network growth. The NFVI platform was the Cisco open modular NFVI. In the first scenario, VNFs taken by the operator that were not pre-validated. We compare this scenario to pre-validated VNFs, either Cisco VNFs or from third parties.

The results of the model showed significant work force efficiencies when deploying and managing pre-validated VNFs. Although it was not modeled in this study, we project even more significant business benefits because of the faster time to attain new capacity or services deployed.

Figure 7. Breakdown of OpEx savings with Cisco Modular NFVI



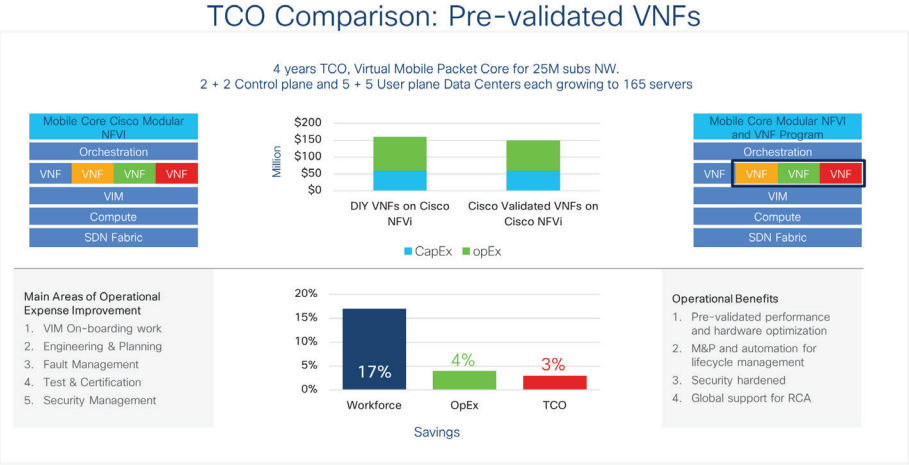
Learn more

To learn more about Cisco NFVI, visit www.cisco.com/go/nfvi and to see edge computing applications, visit www.cisco.com/go/edge

In this case, the operational efficiencies come from:

- Prevalidated performance and hardware optimization
- Materials, processes, and automation for lifecycle management
- Simplified security management with hardened configurations
- Global support for fault management and root cause analysis (RCA)

Figure 8. Study of OpEx impacts of VNFs pre-validated on Modular NFVI platforms



Deploying NFV solutions

Service providers are starting to deploy NFV solutions that promise to improve business agility and increase service revenue. To ensure the success of these deployments, it is essential that NFV applications run on a solid NFV infrastructure that includes a flexible modular approach that can support scale and functionality needs. The Cisco NFV Infrastructure provides Cisco integrated, tested, and certified solutions to run NFV network services. The primary benefits of the Cisco NFV Infrastructure are:

- Cisco packaged, tested, and certified
- High performance and scalability
- High-availability architecture
- Centralized single-interface management
- Automated OpenStack and hardware installation
- Built-in network cloud security
- Lower TCO than alternatives
- Faster time to NFV-based network services