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Is the Enterprise Ready for Network Functions Virtualization?

February 2016

Prepared by:

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Introduction: Digital Organizations Need an Agile Network

Digital transformation has become a top mandate for almost every IT and business leader. The ZK Research 2015 IT Priorities Survey found that 79% of businesses currently have a digital transformation initiative in progress (Exhibit 1). In the digital era, competitive advantage is no longer determined by which company has the best products or even the best people. Market leadership is based on an organization's ability to analyze information, gain insights and make fast decisions to capitalize on market transitions.
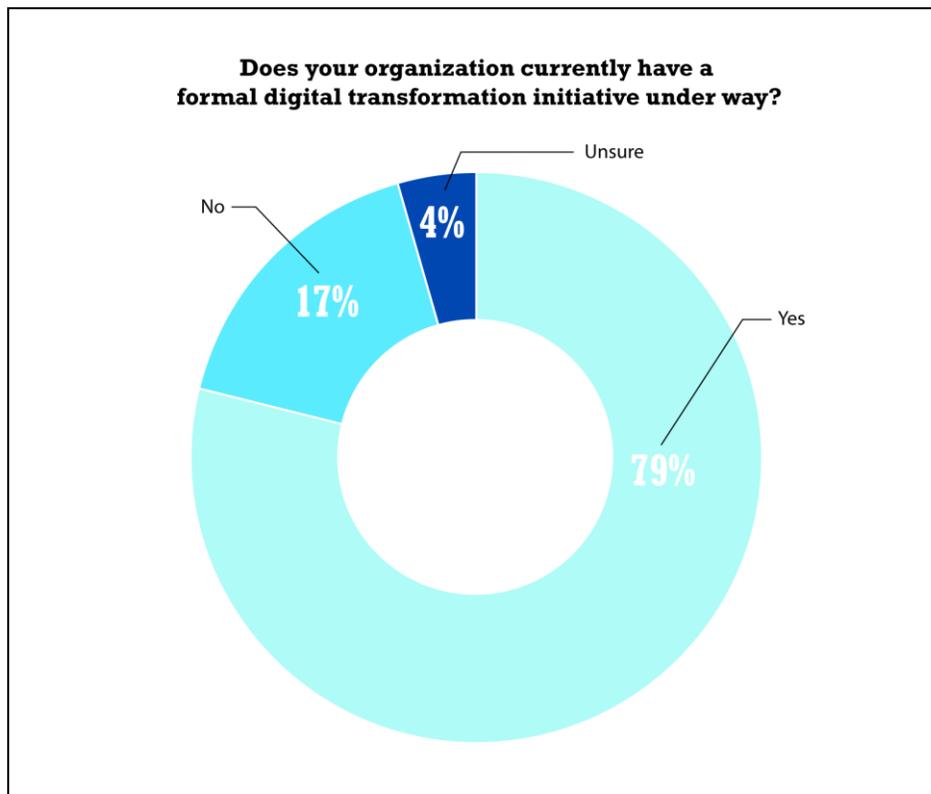
One important step in the journey to becoming a digital organization is to transform into an agile business—and it is impossible to do so without having an agile IT infrastructure to enable it. This is why businesses spent more than $12 billion on technology in 2015 to make IT more agile, according to ZK Research.

Exhibit 1: The Majority of Businesses Are Evolving into Digital Ones

Source: ZK Research 2015 IT Priorities Survey

However, one part of IT that has yet to evolve and lacks flexibility is the network. Evolving the network must be a priority for every IT and business leader because organizations are only as agile as their least agile IT component—which today is the network. Legacy networks are plagued with the following limitations that hinder their agility:

- **Traditional network management is done "box by box."** Historically, network managers have had to manage routers, switches and other network devices on a box-by-box basis through a highly manual, repetitive process. This means that even the most basic network changes can take weeks or even months to complete. Additionally, because there are so many types of devices and network operating systems, the syntax required to make a configuration change could be quite different from platform to platform—making the task even more challenging.

- **Lack of automation keeps the total cost of ownership (TCO) high.** With respect to the TCO of the network, almost 68% comes from operational costs associated with running the network. These costs are high due to the manual nature of configuring, updating and maintaining network devices. Some organizations have attempted to lower the TCO by purchasing less expensive network devices, but hardware only accounts for less than a third of network TCO. The only way to significantly lower the TCO of the network is to reduce the operational costs associated with running it—and doing so requires more processes to be automated.

- **Network services are tied to specific hardware platforms.** Historically, new network services were added by deploying new hardware platforms. However, the ZK Research 2015 Network Purchase Intention Study found that, on average, it can take businesses four months to roll out new network services when you factor in purchasing, deployment and provisioning of the new hardware. Also, the multiple platforms required to deliver a full set of enterprise services add to the already complex environment.

- **The majority of a company's IT budget is used to maintain the status quo.** Currently, 83% of IT budgets is used to simply maintain the operating environment. This is up from 75% five years ago. If this trend does not change, almost the entire budget will be used to maintain the status quo within a decade, leaving very little budget for strategic initiatives.

The current state of IT is not scalable because the complexity chasm between the amount of budget required to run IT and the amount that's available continues to grow. In order for IT to adapt to the current business climate, it must move to a different IT model starting with the network. Greater network agility requires the ability to design, provision and manage network services as software. Enterprise network functions virtualization can enable this transition.

Section II: Defining Enterprise Network Functions Virtualization

Historically, network services were tied to dedicated hardware devices. Enterprise network functions virtualization (ENFV) changes this paradigm by decoupling the network functions from the underlying hardware platforms.

The shift to ENFV is similar to the transition that the compute industry experienced when server virtualization went mainstream. With server virtualization, applications ran as virtual workloads in software. Server virtualization consolidated hardware, lowered costs and improved compute utilization from approximately 25% to more than 75%. The benefits of server virtualization can now be applied to the enterprise network. ENFV enables network services such as security functions, routing and optimization features to be run as a virtual workload in software (Exhibit 2).

To date, network functions virtualization has been used primarily by service providers, but recently it has become a priority for digital organizations. This is one reason why 61% of organizations are investigating or have deployed ENFV (Exhibit 3).

However, there is one significant difference between server virtualization and ENFV. Server virtualization has primarily been used to consolidate servers in the data center. And while ENFV has tremendous value in the data center, it can also bring value to other points in the network including the campus, branch offices and even the cloud.

The first step in building an ENFV strategy is to understand the key components of an ENFV solution, which include the following:

- **Hardware platform:** Although the services are virtual, they still need to run on some kind of hardware platform. This could be a dedicated server or a partition on an existing appliance.

Exhibit 2: Traditional Deployments of Network Services vs. Enterprise Network Functions Virtualization
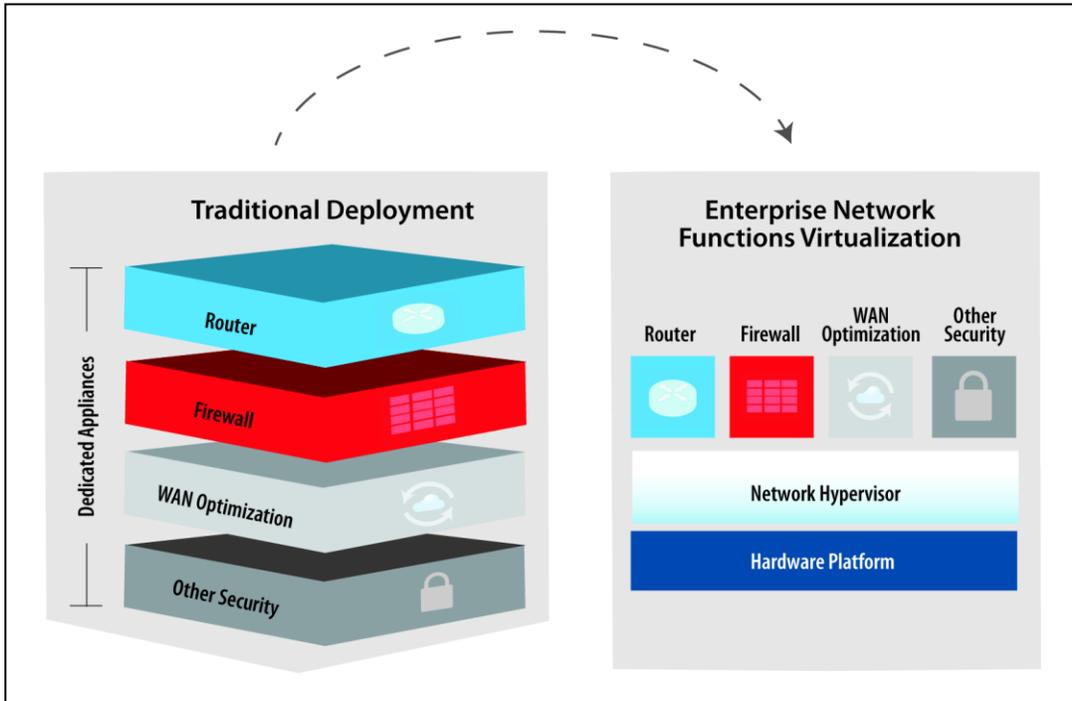
Source: ZK Research, 2016

Exhibit 3: ENFV Is Seeing Strong Enterprise Adoption
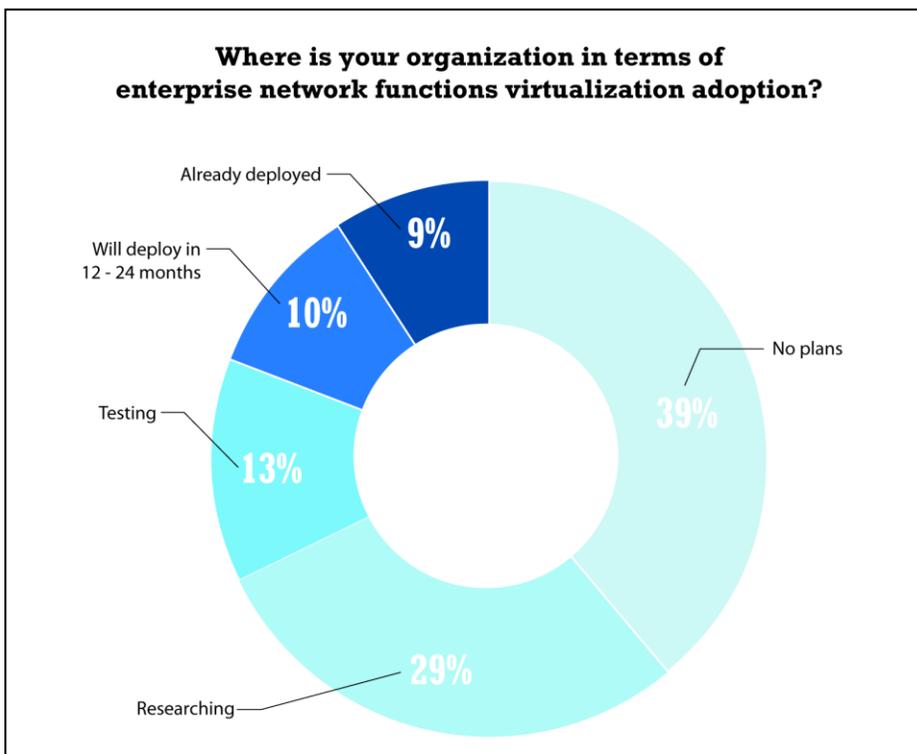
Source: ZK Research 2015 Network Purchase Intention Study

- **Network hypervisor:** This encapsulates the virtual service, similar to the role of a hypervisor on a server.
- **Virtual network functions:** These are the actual services run on the network. Some examples are routers, firewalls and WAN optimization.
- **Management platform:** A strong management tool is required for enterprise-wide control, orchestration and automation.

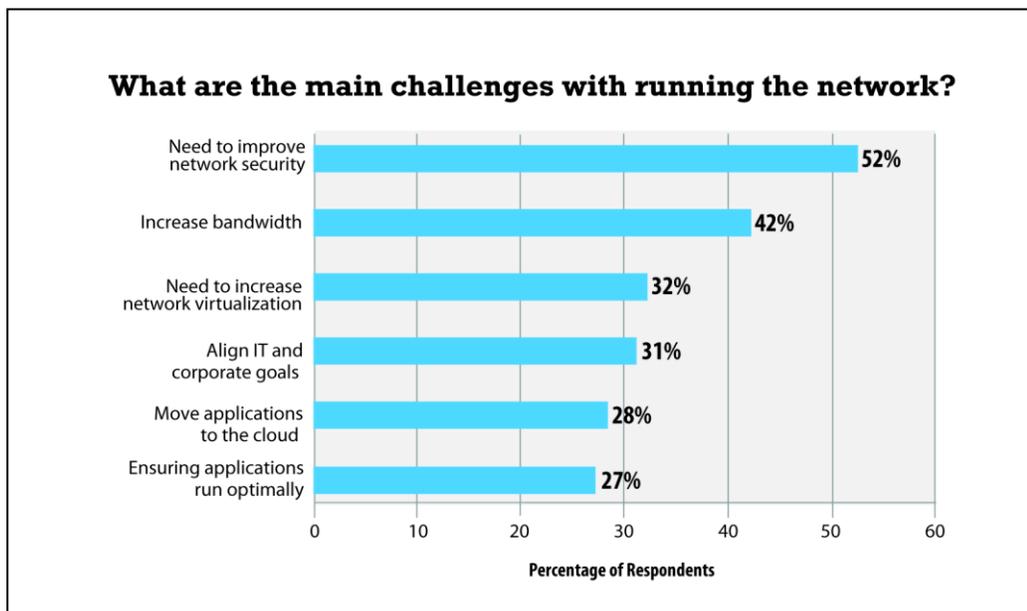## Section III: Benefits of Enterprise Network Functions Virtualization

ENFV is a transformative technology that can change the way network services are deployed, provisioned and managed. Organizations that choose to shift to an ENFV model will realize the following benefits:

- **Faster time to market:** With traditional network infrastructure, a physical appliance must be deployed in order to roll out network services. This often requires a truck roll, which can get very expensive if thousands or even hundreds of locations are involved. ENFV enables network services to be deployed as a virtual workload from a centralized location. Now, network services can be rolled out at cloud speed instead of waiting weeks or even months for physical hardware to be deployed. For example, a nationwide retail store used ENFV to implement a process to deploy a new network service in a location in 10 minutes. This is a significant improvement from the months it once took the store to do so.

- **Lower total cost of ownership of the network:** ENFV can reduce network TCO by lowering both capital and operational expenses. Instead of having five hardware devices for five functions, for example, businesses can run all the services on a single platform. In addition to consolidating hardware, there are real estate, space and power savings that increase the savings on capital costs. Being able to deploy and administer the network services remotely obviates the need for local IT support and the need to hire a specialist whenever problems occur in remote locations. ZK Research estimates that using ENFV can reduce operational expenses by as much as 70% and capital costs by 50%.

- **Reduced IT complexity:** EFNV reduces complexity by consolidating the number of physical devices required to run a network. This can significantly reduce the overall size of the network, making it simpler to manage. Also, troubleshooting is much faster with standardized platforms because engineers can spend less time learning the nuances of multiple hardware devices. As an added benefit, by saving time on the day-to-day maintenance of the network, IT can spend more time supporting new business initiatives and help the company win against its competition.

Exhibit 4: Security Is the Biggest Network Challenge

What are the main challenges with running the network?

Need to improve network security	52%
Increase bandwidth	42%
Need to increase network virtualization	32%
Align IT and corporate goals	31%
Move applications to the cloud	28%
Ensuring applications run optimally	27%

Percentage of Respondents

Source: ZK Research 2015 Network Purchase Intention Study

- **Improved security posture:** The ZK Research 2015 Network Purchase Intention Study revealed that improving network security is the top challenge for network professionals today (Exhibit 4). Simplifying the network will make it easier to secure. Also, ENFV will enable security and application policies to be tied to business processes and then automated, further improving an organization's security position.

- **Flexible options for consumption:** ENFV enables services to be invoked and then shut down on demand. The needs of a business can ebb and flow depending on several factors including seasonality and market conditions. ENFV provides different purchasing options so businesses can align their budgets with demand.

- **Achieving network agility:** Business leaders must be able to rapidly change or augment corporate strategy. To accomplish this, CIOs need a dynamic, agile IT infrastructure to support the business. The virtualization of network resources creates a significantly higher level of agility than legacy network models can deliver.

- **Shifting IT to an "as a service" model:** As organizations transform into digital enterprises, IT will evolve to adopt more of an "as a service" model. This will enable organizations to allocate the proper resources to the applications and services that require them according to business policy. Consequently, businesses can significantly improve resource utilization and maximize their investments in infrastructure such as servers and storage. ENFV is a key enabler of the network shifting to a service model.

Section IV: Cisco Brings Network Functions Virtualization to the Enterprise

Cisco has been the market leader and the de facto standard in networking for three decades. The company has led the networking industry through many market transitions such as VoIP, WiFi and unified computing. Now, Cisco is helping its customers take advantage of network functions virtualization.

The Cisco Enterprise Network Functions Virtualization (Enterprise NFV) offering is designed to enable organizations to create, provision and manage network functions across the enterprise. Through the solution, essential network services that were once available only on dedicated hardware platforms are now virtual workloads deployed as software on a variety of hardware platforms.

Cisco's Application Policy Infrastructure Controller Enterprise Module (APIC-EM) is a software-defined networking controller that is purpose built for the enterprise. The APIC-EM adds network abstraction and automation across the enterprise.

Business and application policy changes can be conveyed to the APIC-EM, which then creates and pushes out network configuration changes to all network devices including routers and switches.

Within the enterprise, the APIC-EM enables IT to move at digital speeds through the following:

• The APIC-EM amplifies network intelligence through northbound RESTful application program interfaces (APIs) to integrate with applications.

• The APIC-EM operates on a wide range of network devices including Cisco Catalyst switches, Integrated Services Routers (ISRs), Aggregation Services Routers (ASRs), Cloud Services Routers (CSRs), and wireless local area network (LAN) controllers and access points (APs).

• The APIC-EM can be deployed as an appliance or as a downloadable software application.

Cisco Enterprise NFV is a complete solution that includes the following key components:

- **Enterprise Service Automation (ESA)** is the management platform for Enterprise NFV that runs on the Cisco Application Policy Infrastructure Controller Enterprise Module (APIC-EM). ESA enables businesses to deploy new services and modify existing services within minutes. The platform manages the full life cycle of virtual network services by providing the following:
  - **Design:** Standardization of site design through the creation of templates for the branch and campus; policy definition based on business priorities; custom or prescriptive designs
  - **Provisioning:** Zero-touch deployment model; automated orchestration of virtual and physical network services; service chaining and licensing
  - **Management:** Health monitoring of platform and network services; dynamic scaling of services; service deployment and service-level agreement management
- **Virtual network functions** are all the essential network services needed to run a network. Cisco

Enterprise NFV includes the following services:
  - Routing (ISRv)
  - Firewall (ASAv)
  - Application acceleration (vWAAS)
  - Wireless LAN controller (vWLC)

In addition to the above services, Cisco Enterprise NFV will also enable third-party solutions to run on the platform. Customers will be able to cost effectively migrate to the platform because Cisco ONE enables license portability from physical devices to software counterparts.

- **Cisco Enterprise NFV Infrastructure Software (NFVIS)** plays a role in Enterprise NFV that is similar to a hypervisor's role in server virtualization. Enterprise NFVIS encapsulates the virtual services and provides customers with freedom of choice in deployment and platform options for the Cisco Enterprise NFV solution. By virtualizing and abstracting the network services from the underlying hardware, Enterprise NFVIS enables the virtual network services to be managed independently and to be provisioned dynamically. Enterprise NFVIS supports service chaining, zero-touch deployment, life-cycle management and programmable, open APIs for third-party applications.

Cisco ONE Software provides a flexible way for customers to buy software for their wide area networks (WANs), access networks and data centers. It improves the procurement and management of the network devices and software at each phase of the product life cycle by decoupling the acquisition of network software from that of the underlying hardware.

This paper investigates the total cost of ownership for network infrastructure using a traditional à la carte acquisition model and compares it to the TCO of the Cisco ONE Software model for multiple scenarios.

The following costs/returns are used in the models:

- *Up-front acquisition cost*

- *Ongoing technical support service*

- *Ongoing acquisition of new capabilities*

- *Device refresh costs*

- *Savings from the key underlying technology*

- Cisco Enterprise NFV is supported on **multiple hardware platforms** to give customers deployment choices. The virtual network services are supported on the following hardware platforms:

  - **Physical router with virtualized services:** The Cisco ISR 4000 with Unified Computing System (UCS) E-Series Server enables customers to keep their physical router and run the virtual services on the embedded UCS Server. This is ideal for customers that need the guaranteed performance of ISR for optimized routing or for customers that currently have a large investment in ISR 4000 routers.

  - **Virtualized router and services:** Customers can use the Cisco UCS C-Series Server to run all the network services as virtual workloads. This is a good option for customers with older routing platforms or for businesses that require routing to be an agile service.

Cisco's Enterprise NFV is a complete solution (Exhibit 5) that builds on Cisco's Digital Network Architecture (DNA), which enables organizations to reach their full potential through digital transformation.

Section V: Conclusion

The era of the digital business is here to stay. Today, competitive advantage is based on an organization's ability to be agile, adapt to changes and make rapid shifts to capture market transitions. Virtualization and the cloud enable businesses to have compute agility. However, the network remains relatively inflexible. The long lead times required to deploy, change and optimize the network can be considered the hidden killer of companies, as the true cost of staying with a legacy network is missed business opportunities. At best, these missed opportunities will result in a loss of market share and revenue; at worst, they could be the death knell of an organization. IT and business leaders must make deploying enterprise network functions a priority because doing so can align a company's network with its business goals.

Exhibit 5: Cisco Enterprise NFV Architecture
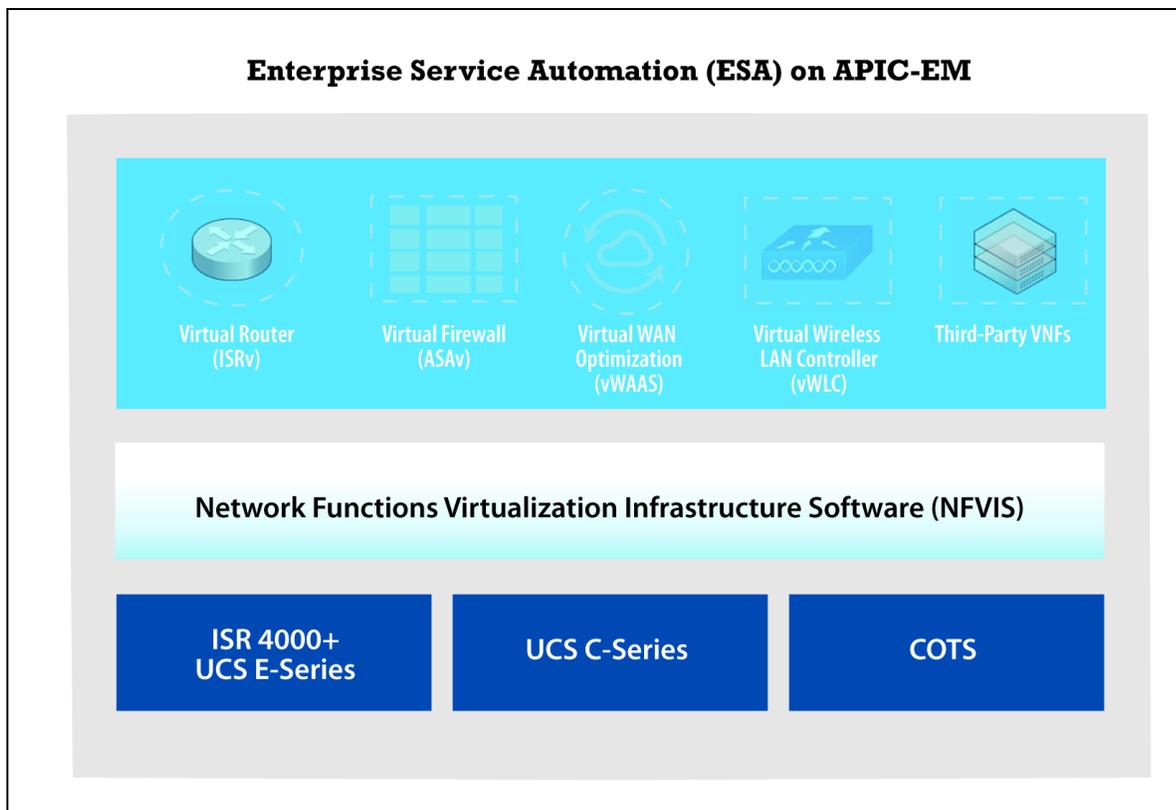
Source: ZK Research, 2016

To help organizations get started with the shift to ENFV, ZK Research recommends the following:

- **Embrace ENFV now.** Organizations have spent billions on improving their level of application and compute agility. To maximize the potential of these investments, the network must achieve the same level of agility. ENFV can deliver this while significantly reducing both operational and capital costs.

- **Start with branch offices.** Branch offices can be problematic for organizations because there is no local support and a wide range of devices are required to support the needed network services. ENFV can help businesses simplify branch operations through infrastructure consolidation and enable network services to be managed centrally.

- **Use a validated solution to minimize risk.** One option for deploying ENFV is to purchase the hardware, hypervisor and network services independently and assemble the solution. The risk with this option is that making all of the components work together is a highly complicated task. Using a validated, integrated solution can deliver all the value of ENFV without the risk associated with a "do it yourself" solution.