White Paper

Accelerating Transformation with an Application-centric Approach

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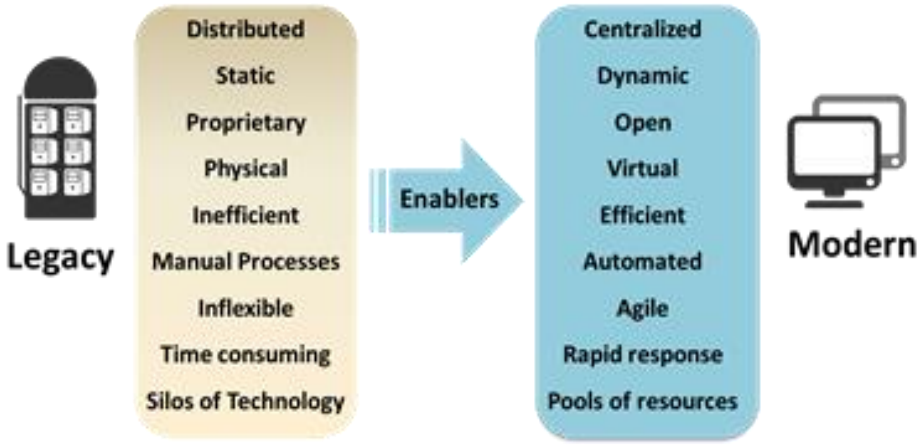
Applications Are Driving IT Transformation

Virtually every organization is either planning for or is in the midst of a massive IT transformation in order to remain competitive in an ever-changing global market. IT is deploying new technology across compute, network, and storage domains to dramatically increase the ability to respond to rapidly changing business needs. Legacy environments that required months to deploy a new or upgraded application can no longer be tolerated, as businesses must be able to make those changes in minutes, clearly a new, modern environment is required (see Figure 1).

Figure 1. Transition to a Modern Environment



Source: Enterprise Strategy Group, 2014.

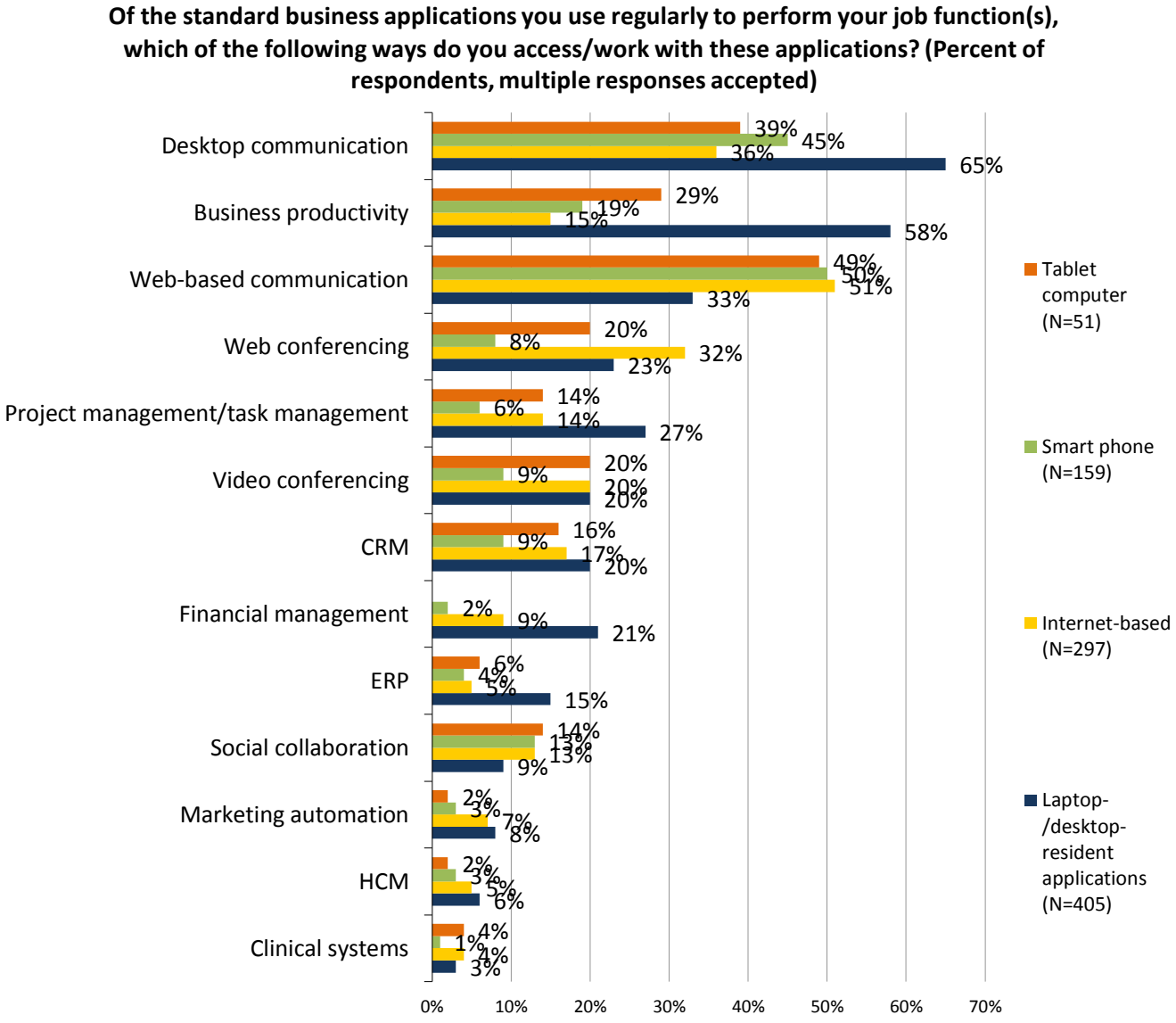
Certainly technologies like server virtualization have helped this transformation. Although the ability to transform one IT domain has reduced the time to deploy new virtual machines, organizations still struggle to support the business and its need to roll out new or upgraded applications in a timely manner because of delays in others. To really make a difference in the time to deploy new or upgraded applications, organizations need to transform all of the IT domain (network and storage) and modify operational processes.

Moving forward, this becomes more of a concern as ESG research shows that the number of applications and application upgrades continues to grow.[1] The majority of respondents (60%) support 150 or more applications and more than three quarters (77%) reported they would be supporting that number within 24 months. And 12% reported that that number would grow to be more than 1,000 applications. The pace at which these new applications are rolled out is also picking up, with 72% of those surveyed indicating that they would be rolling out up to 25 new applications per year.[2] Add application upgrades to that number, of which 46% of the surveyed organizations reported having to upgrade between 11 and 50 applications per year, with 13% reporting the need to upgrade 50 or more applications annually.[3] For many organizations, these applications may be traditional e-mail, accounting, CRM, etc., but for others, a new breed of application is forcing IT to accelerate the transformation.

The rise of mobile, social, and e-commerce applications have signaled a shift in applications being "applications of record" to "applications of engagement." These are the web 2.0, social, big data, and collaboration applications that are built using a modular approach, potentially developed on new platforms leveraging a dev/ops accelerated model and are designed to be consumed on traditional and mobile computing devices. Figure 2 highlights ESG research and demonstrates how new web-based, collaboration, and social applications are being accessed more from mobile devices.[4]

[1] Source: ESG Research Brief, *Are Legacy Networks Holding Back Application Deployments?,* August 2012.
[2] Source: Ibid.
[3] Source: Ibid.
[4] Source: ESG Research Report, *Corporate Knowledge Worker Business Application Trends*, May 2013.

Figure 2. Transition to a Modern Environment



Source: Enterprise Strategy Group, 2014.

As a result, these new or upgraded applications are far more dynamic, and the underlying IT infrastructure supporting them has to be flexible and adaptable to the specific needs of the application or workload. These changes also place more pressure on the network and existing operational models to provide the appropriate connectivity and services (security, load balancing, optimization etc.) not only between the modular applications, but also to the consumers of the application. To do this, the network needs to be aware of the application requirements and user needs so they can be automatically reflected in the network infrastructure to ensure a high-quality end-user experience.

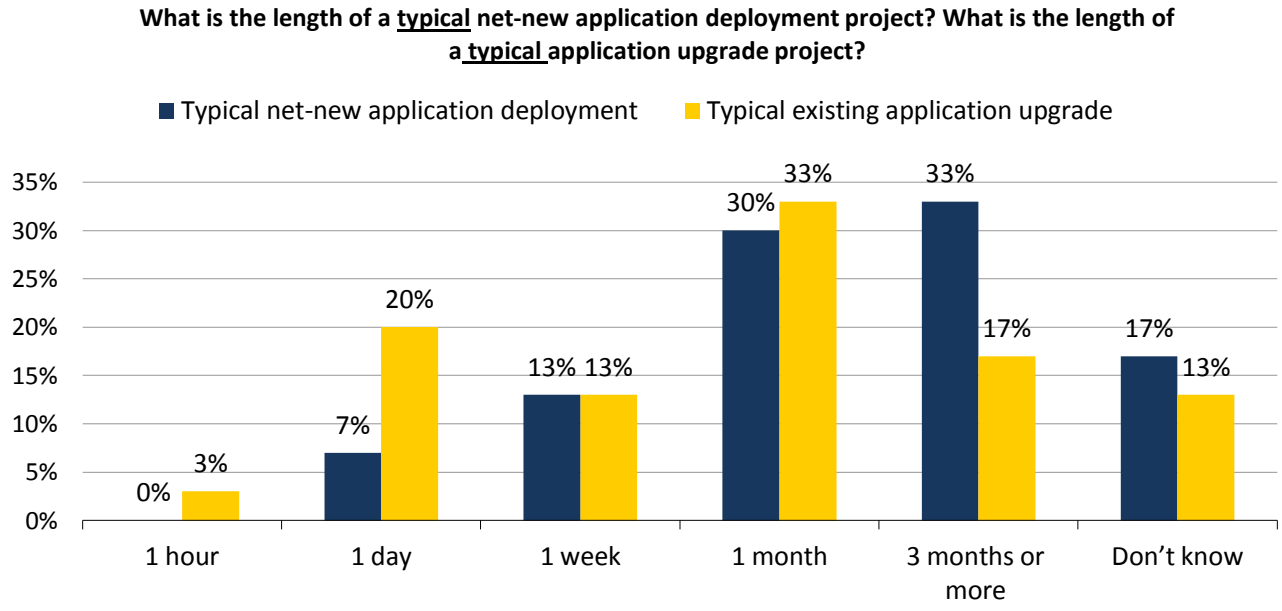
Obstacles Inhibit Responsiveness to the Business

It sounds simple: Just make the infrastructure focus on the needs of the application. However, like most challenges, it is much easier said than done. Transforming an IT infrastructure from its current state to a far more modern and application-focused one will require time, technology, and new operational models. Organizations can no longer afford to keep working in separate technology silos. The key is finding solutions that not only enable these critical the transitions, but also help to accelerate the operational changes too. Without new and enabling technology and new operational models, organizations will be challenged to keep pace with demand and face a growing agility gap that at some point may be too large to overcome.

History has shown how the right solution can assist and accelerate data center processes. To be truly effective, solutions need to help with design (application layout, security requirements, design of connectivity, and L4-7 services), implementation (installation, upgrades, test, certification, and provisioning), and operations (monitor, re-provision, comply, scale continually to optimize for changing QoS, and provide availability, security, and utilization). Take server virtualization for example: Technology rapidly enabled the compute domain to transform from a legacy to a modern environment and improved its processes. As a result, a virtual-first approach is now being taken by most organizations as they continue to transform their compute environment. It should also be noted, however, that during this transition, technology vendors adapted and developed specialized infrastructure (blade servers), software, and new operational processes to help expand the adoption of virtualization technology. An example of this would be the Cisco UCS hardware and service profile software.

While this technology drove new processes and accelerated the deployment of new VMs, delays in other areas slowed down application deployments. According to ESG research, 63% of surveyed organizations reported that it required one to three months or more to deploy net new applications, and 50% reported that it took the same amount of time to deploy upgrades to existing applications (see Figure 3).[5] Why did it take so long? The respondents' most cited network infrastructure as the primary problem.[6]

Figure 3. Typical Length of Time to Upgrade

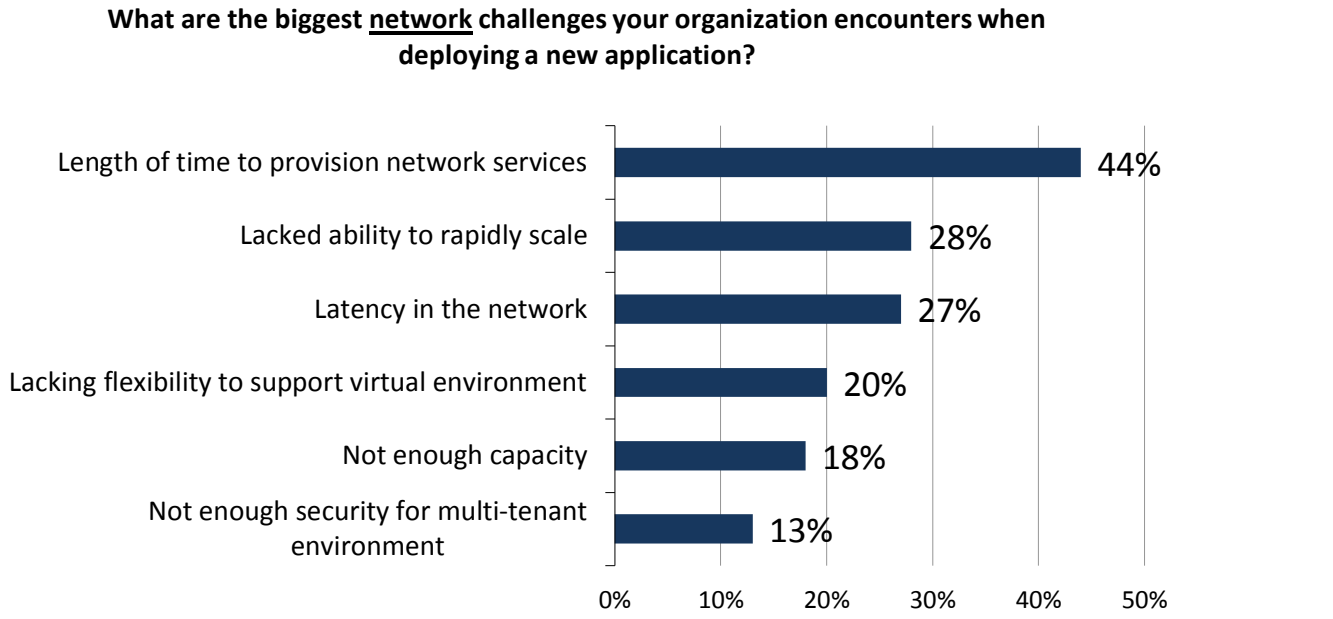


Source: Enterprise Strategy Group, 2014.

Existing network infrastructures burdened with so many time-consuming manual processes struggle to keep pace with the demand for new applications. According to the ESG research conducted, the top network challenges when deploying new applications include the length of time to provision network services, the ability to rapidly scale, network performance, and inability to support highly flexible virtual environments (see Figure 4).[7] It's important to keep in mind that "provisioning" incorporates a number of steps including design, implementation, and operations, and that organizations are still supporting physical and virtual environments.

[5] Source: ESG Research Brief, *Are Legacy Networks Holding Back Application Deployments?*, August 2012.
[6] Source: Ibid.
[7] Source: Ibid.

Figure 4. Biggest Network Challenges When Deploying a New Application

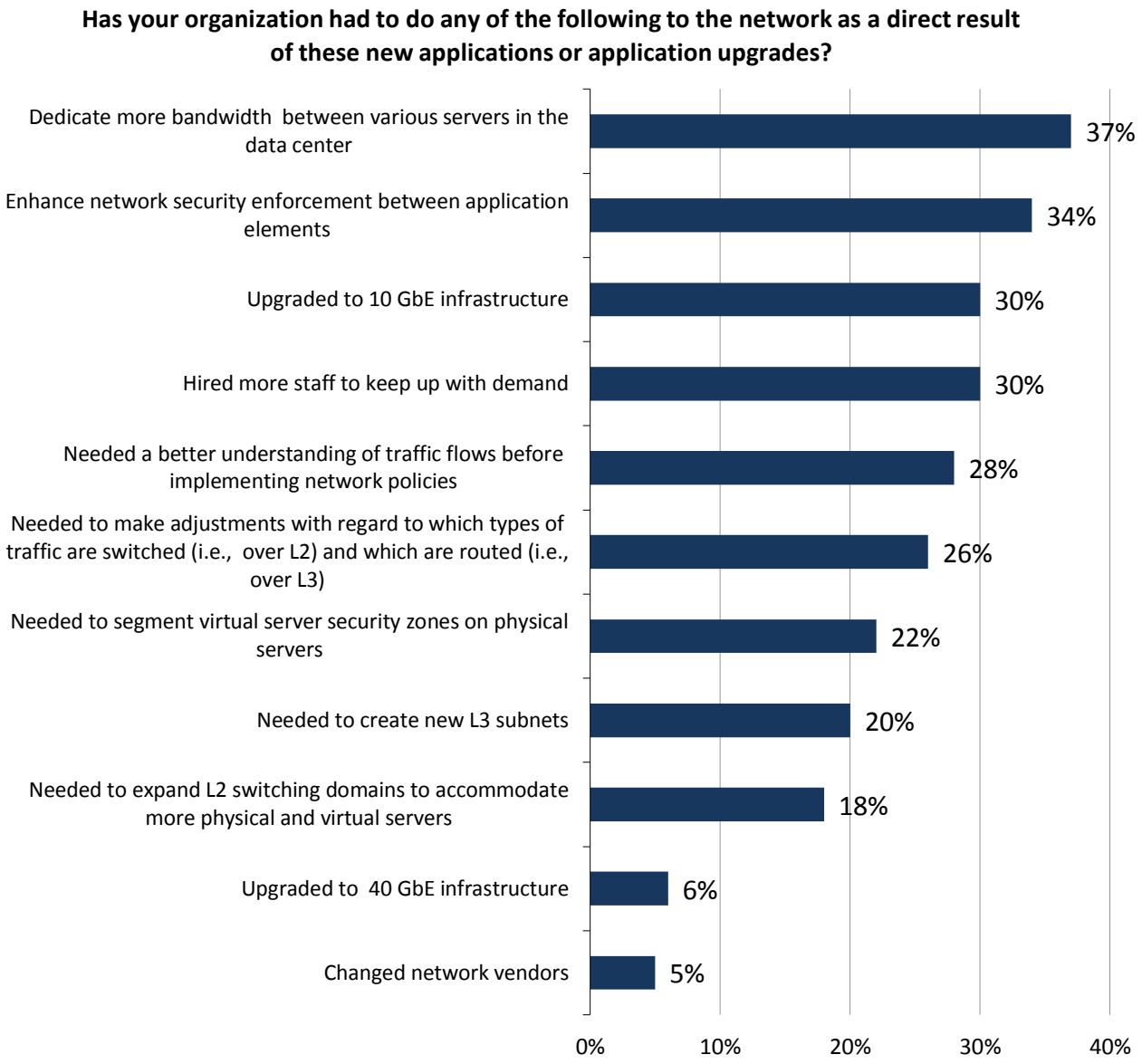


Source: Enterprise Strategy Group, 2014.

These challenges directly impede a business's ability to adapt to rapidly changing application requirements. Organizations have to be able to react quickly and legacy network architectures create unwanted and unnecessary delays. As the last challenge highlights, the network is not fully capable of supporting organizations' matured virtualized server environments. It's not like organizations haven't taken steps to overcome these challenges: In attempts to better support these applications, ESG research indicates that surveyed organizations have tried to dedicate more bandwidth, enhance security, hire more staff (not sustainable), and understand application traffic flows to implement policies (see Figure 5).[8]

[8] Source: ESG Research Brief, *Are Legacy Networks Holding Back Application Deployments?*, August 2012.

Figure 5. Typical Length of Time to Upgrade



Source: Enterprise Strategy Group, 2014.

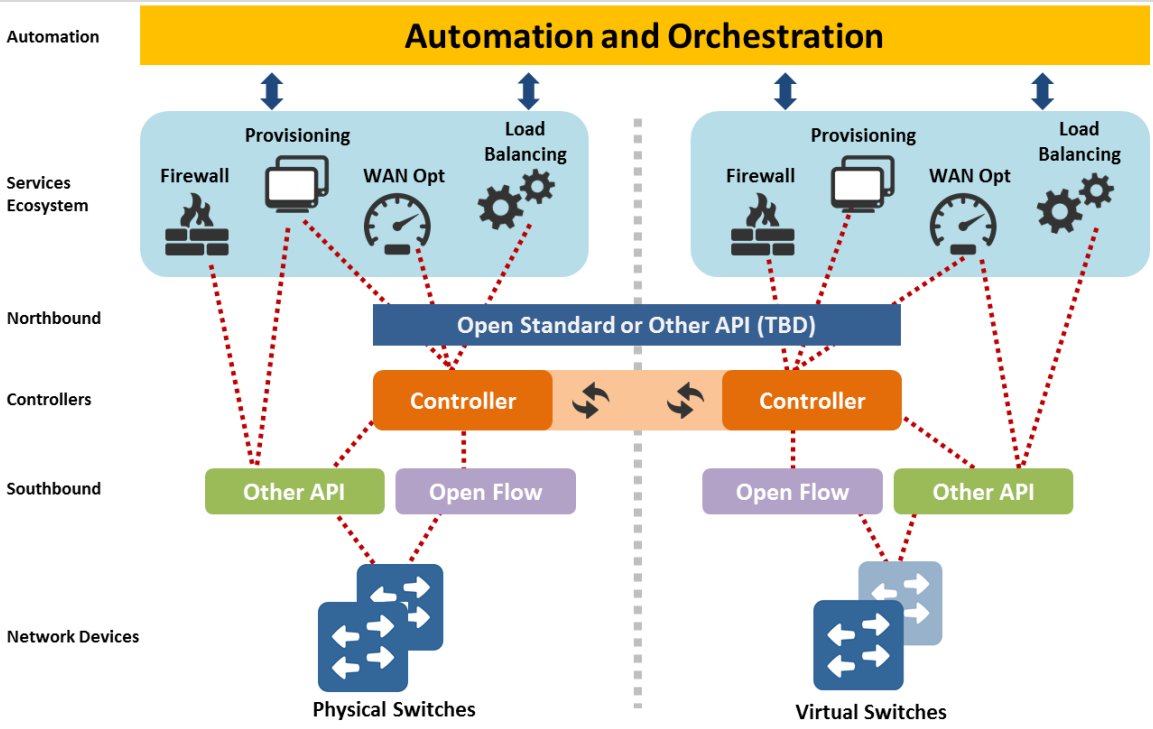
The last point is especially telling because it highlights the need to have application-level visibility in order to establish network policies based on the application traffic flows. Despite these efforts to overcome a number of challenges, organizations still struggle to support the needs of the business. Plus, all these efforts are cost intensive and resource intensive. It is no wonder that software-defined networking has gathered so much attention since it promises to solve a great number of those existing network infrastructure challenges. Clearly, a new approach to networking is needed. A much more cost-effective response would be to selectively dedicate more bandwidth, enhance security, implement network policies, and make L2/L3 tradeoffs and capacity changes depending on dynamic needs of the application.

A New Approach Is Required for Networking

The past few years have witnessed significant change in emerging network technology: Open networking and software-defined networking have created a spark that is revolutionizing the network industry. Most of the efforts have focused on how to accelerate the provisioning of the network or network services by separating the network control plane from its data plane and then applying programming or automation. The use of open or open

standards-based APIs connect the layers. Figure 6 illustrates an example of how SDN architectures are being created.

Figure 6. Software-defined Networking Architectures



Source: Enterprise Strategy Group, 2014.

As Figure 6 indicates, most of the efforts have been divided to provide solutions for either the physical or virtual network infrastructure. However, this architecture is mostly network focused and questions remain about the ability to scale with centralized control, yet since one of the main reasons for having the network is to support business applications, perhaps it would make more sense for the underlying infrastructure to have a much tighter link to the applications themselves.

An approach like this would need to:

- **Have unified control across both physical and virtual network environments.** Despite the fact that organizations have been steadily increasing their use of server virtualization technologies, not all environments are 100% virtualized, and many are still far from it. Plus, overlay networks still require a physical underlay to carry network traffic. Therefore, any comprehensive solution would need to work with both the virtualized and physical network environment. To simplify use, this solution would need to have a single management interface so organizations could control the entire network via a single pane of glass. For virtual environments, the ability to support multiple different hypervisors would be important.
- **Be applicable for dev/ops environments.** Nowhere is the need to have an agile or flexible network environment more apparent than in a dev/ops environment. These environments have been created to specifically accelerate the deployment of new or upgraded applications to better respond to business demands. The network needs to enable this by providing the appropriate services where and when needed that can easily transfer from development to production. To do this effectively one needs to understand the requirements during the design, implementation and operations phases.
- **Leverage policies based on applications.** Not every application will have the same workload requirements, and all applications are not created equally. The application-based policies need to include the ability to establish priority and quality of service as well as understand the workloads and key dependencies. These features will enable the network to provision the appropriate resources. This also entertains the possibility for applications themselves to dictate which resources are needed from the infrastructure.

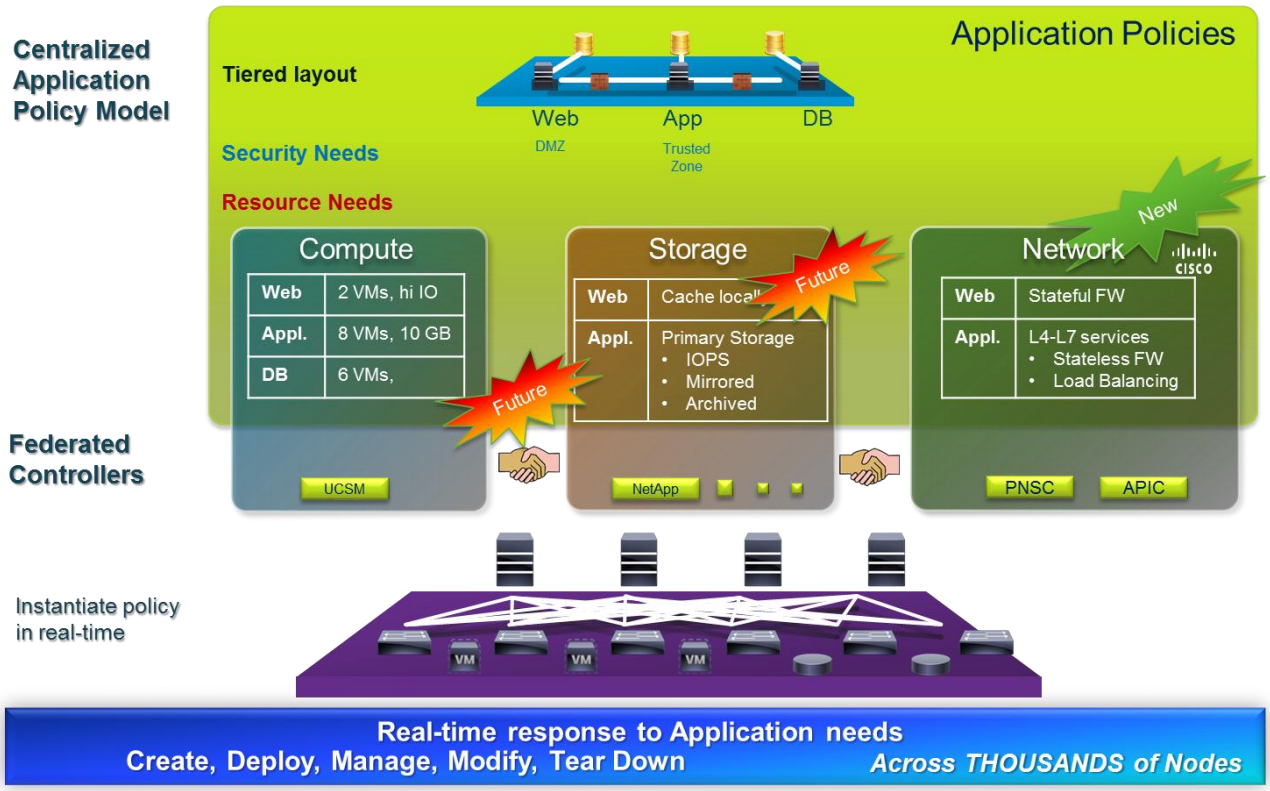
- **Scale to handle large environments.** A programmable approach that centralizes policy but distributes control enables every device to maintain an optimized state. Even very large networks connecting tens of thousands of devices can respond in real-time to dynamic changes in application and user needs. This vastly improves scalability, fault management, and interoperability in large networks because it does not rely on a single controller to manage all the device information and state across a heterogeneous infrastructure.
- **Provide visibility to all application dependencies.** Given the construct of modern applications, this is a key requirement. Modular applications will have numerous interdependencies that need to be accounted for and the network needs to be able to apply the appropriate resources and network services where and when needed. This becomes more important as workloads migrate with and between data centers.
- **Take a holistic approach to provision new applications.** When provisioning new applications, organizations need solutions that can facilitate the design, implementation, and operational phases across all technology domains (compute, network, and storage). This holistic approach provides a more comprehensive solution and should improve operational models and processes as well as reduce the amount of time required to roll out a new application.
- **Ensure open southbound and northbound interfaces to encourage a strong ecosystem.** Opening up the API interfaces enables third-party technology vendors to build a strong ecosystem of solutions for users to consume. ESG research indicates that respondent organizations are looking for prequalified solutions—in fact, it is second only to price as a top purchasing decision.[9] Furthermore, 34% of those surveyed will only buy prequalified solutions, and another 31% plan to use a combination of prequalified and homegrown solutions. Open northbound interfaces would enable ecosystems that include network services like a load balancer, firewall, WAN optimization, or even integration with a custom app or automation/orchestration solution. Having open interfaces on the southbound side would allow for control of heterogeneous virtual or physical network devices.
- **Integrate with open industry-standard initiatives.** This addresses the need for a solution to comply with open source standards. Although, in most cases, technology is driven faster through proprietary approaches, compliance with open standards will ensure strong investment protection and choice. The most notable open standard for SDN is Open Flow, which is supported by the Open Network Foundation (ONF). Open DayLight is a consortium of technology vendors driving a complete ecosystem of SDN solutions and another well-known example is the OpenStack initiative, which is helping to automate and orchestrate the entire IT domain.

Cisco ACI Can Help to Accelerate the Transformation

Taking a page out of its successful entry into the compute domain (UCS) playbook, Cisco has architected a network solution designed to complement and accelerate the ongoing IT transformation for networking. Cisco calls its comprehensive approach to networking Application Centric Infrastructure or ACI. The ACI vision consists of having centralized application policies that will implement policy in real time across compute, network, and storage infrastructure leveraging a federated controller. Currently, that paradigm exists for compute and now the network, with storage being a future addition. The Cisco ACI vision architecture can be seen in Figure 7.

[9] Source: ESG Research Report, *The Evolving State of the Network*, December 2013.

Figure 7. ACI Vision



Source: Cisco, 2014.

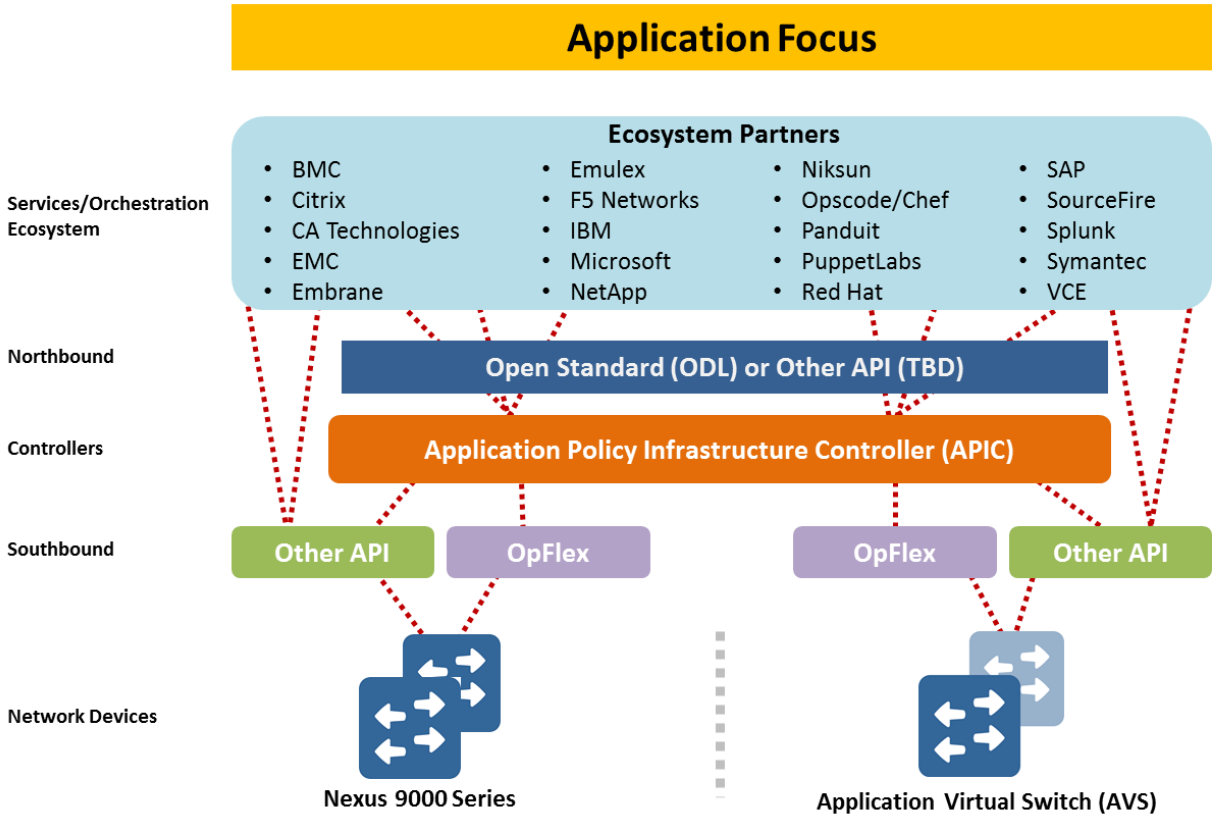
It should be noted that Cisco is able to leverage lessons it has learned from its existing policy-based compute model to help drive the network solution—more specifically, its successful Unified Compute Service (UCS) and its ability to generate application service profiles. The combination of UCS hardware specifically designed for highly virtualized environments and software-driven service profiles helped to accelerate the adoption of virtualized compute environments and propelled Cisco into the top tier of blade server providers. The ACI architecture extends that vision to include both the network (announced now) and storage in the future. Cisco wants to do for networking what it has already done for the compute environment—that is, drive innovation around a combination of hardware and software to build a solution optimized for highly dynamic, highly virtualized environments that is focused on applications.

As such, the purpose of ACI is to complement and accelerate the IT transformation in the networking space. Figure 8 outlines the architecture. Cisco ACI for networking is comprised of the following hardware, software, and ecosystem components:

- Application Virtual Switch (AVS) – These are virtual switch environments designed to accommodate application network service profiles and coordinate with Nexus 1000V in order to integrate into existing data center environments.
- Nexus 9000 Series – This new series includes the Nexus 9396PX and Nexus93128TX for top of rack and middle of row. The Nexus 9508 was designed for the end of row to create leaf and spine ACI fabrics. These switches have ten and 40GbE ports and are 100GbE ready. The fabrics are capable of handling up to one million IP addresses and 64,000 tenants with hardware-based VXLAN routing and gateways.
- Application Policy Infrastructure Controller (APIC) – The brains of the ACI fabric, APIC provides centralized policy administration of both the virtual and physical network environments. Open API interfaces enable network services and automation/orchestration. APIC is responsible for distributing application policies to the network infrastructure in an automated fashion.

- Application Centric Infrastructure Security – This creates a pool of firewall resources that the APIC can leverage to deploy firewalls where and when needed across the ACI fabric.
- Open ecosystem of partners – The ecosystem has been created to enable third-party technology vendors to integrate with Cisco ACI to provide network services like load balancing, firewalls, WAN optimization etc., as well as management and monitoring, automation and orchestration, and, in the future, storage integration. Currently, the Cisco ACI ecosystem includes partners like Citrix, EMC, F5, Microsoft, NetApp, and Opscode/Chef among others (see Figure 8).

Figure 8. ACI Architecture



Source: Enterprise Strategy Group, 2014.

As Figure 7 highlights, Cisco has taken a comprehensive approach to building out an application-centric infrastructure for networking. One should note that Cisco's APIC unifies the physical and virtual network under a single controller, simplifying control of the overlay and underlay for virtual, physical, or a combination of network environments. Cisco has also been able to attract a significant number of ecosystem partners to help deliver solutions to its customers.

The key to ACI is its application service policy, which will allow IT to automate the provisioning of the network and network services leveraging a common framework of predefined policies. While IT can create its own application policies, Cisco is pointing toward a future in which the applications themselves will come out of the box with ACI policies. For example, the partnership with Microsoft has the potential to lead to Exchange, SharePoint, or other Microsoft applications having Cisco ACI policies integrated. This could result in applications being deployed and automatically directing the infrastructure to provision the appropriate resources. Cisco also highlighted how this could be extended to the storage domain as well.

Cisco ACI has been designed to enable organizations to better support the business by:

- Leveraging application driven policy models to accelerate and simplify application deployment – This would include dramatically reducing the time to provision the network and deliver network and security services—Cisco claims ACI will shrink these efforts from days down to only minutes. This feature should eventually

enable application owners to self-provision and scale the network on demand. This includes the ability to move mixed workloads across the environment, even mixed hypervisor or bare metal.

- Providing centralized control – Using a single pane of glass, organizations can ensure consistent policies across multiple data centers and the cloud. This visibility across physical and virtual infrastructure includes application health monitoring (end to end) to ensure SLAs are being met and help to reduce troubleshooting times.
- Delivering an open and extensible solution – Cisco ACI provides open APIs and a scalable architecture to ensure investment protection and a comprehensive ecosystem. The open northbound and southbound APIs are available through the Cisco Developer Network and will enable partners to quickly integrate network and security services, monitoring and management solutions, and automation and orchestration services. ACI will also support Cisco ONE, so any existing work will transfer for ACI.

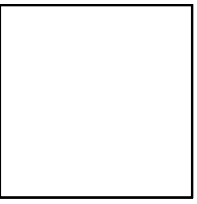
For organizations looking to get started, the Cisco Nexus 9000 series can be deployed in a standalone mode to accommodate pressing network requirements today and then be upgraded later to create ACI fabrics.

The Bigger Truth

IT has to transform to better support the business, or it places the entire organization at risk of falling behind competitors. While great strides have been made in the computing domain, the network and network services are still inhibitors. The software-defined network hype has really helped to drive awareness that a change is required in the networking space and that organizations should be rethinking how they architect network solutions and operational models for mixed or highly virtualized/cloud environments. This has created a number of initiatives and even new companies bringing new technology to market to help solve this problem. However, what is really needed is not a new point hardware or software product, but an innovative and comprehensive approach.

We have seen how this can work in the compute domain where a combination of software, hardware, and ecosystems can revolutionize a space. The concept of deploying a purpose-built hardware infrastructure to support a highly virtualized environment and leverage a common framework for service profiles served to accelerate the transformation in the compute domain. The same thing is now taking place in the network domain. Taking a comprehensive approach requires a detailed understanding of not just a network switch, a controller, a network service, or even an overlay network, but all of those things, plus placing it in the context of supporting a business application.

Cisco ACI provides that comprehensive approach and extends the concept of the application service profile it pioneered in the UCS to the network domain. The result is a solution that combines hardware and software that covers both physical and virtual environments, as well as overlay and underlay networks, and applies an application focus. The centralized policy control and common framework should help to automate and accelerate application deployments, and promises to deliver greater levels of flexibility and agility while increasing efficiency and optimization. When combined with a robust, open ecosystem of partners, Cisco ACI has the potential to bring a comprehensive suite of solutions to market and help organizations accelerate the transformation. Just imagine a time in the not-too-distant future, where an organization can provision an application that automatically allocates the appropriate resources based on an out-of-the-box application service profile. If that sounds interesting, ACI may be the enabling technology that accelerates your transformation.



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