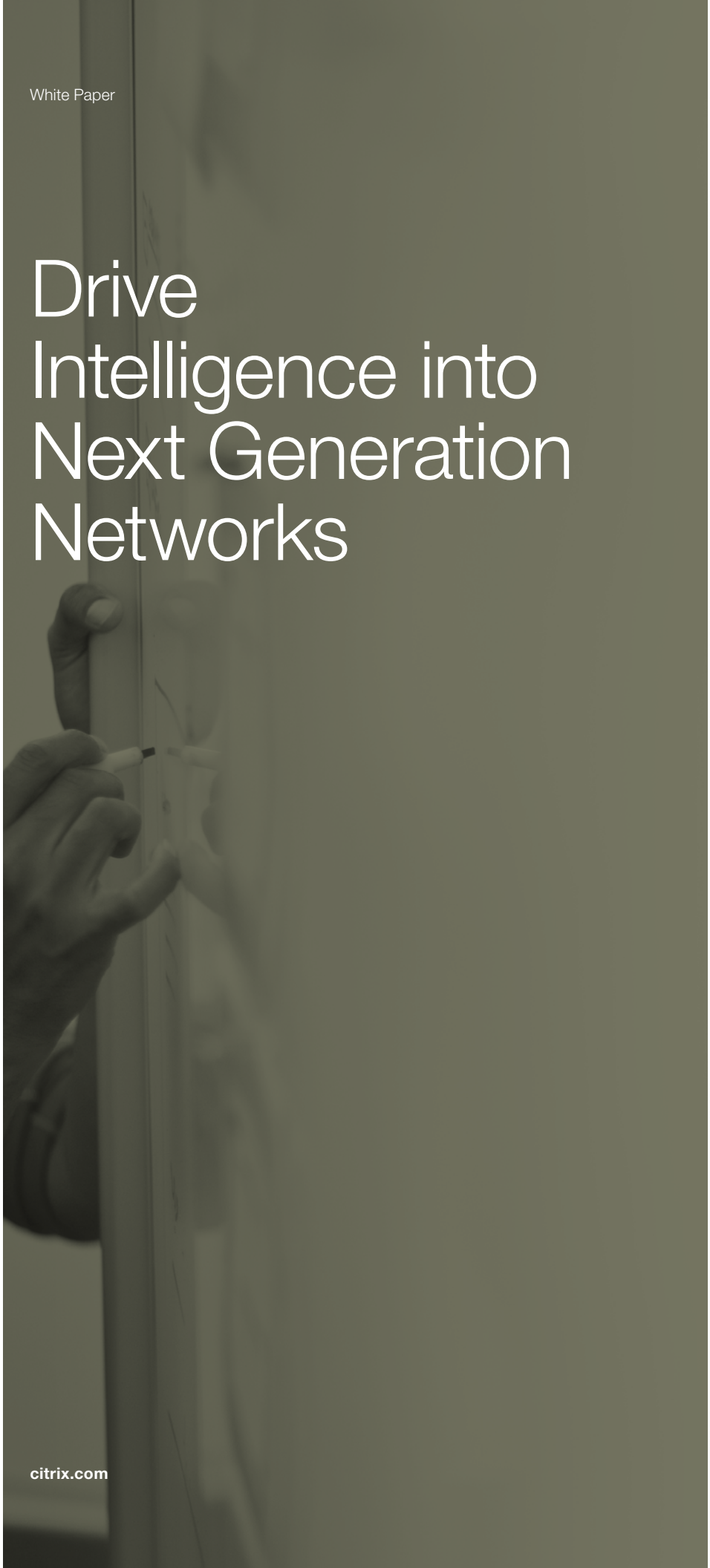
White Paper

Drive Intelligence into Next Generation Networks



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Virtualization has made compute infrastructure and storage infrastructure an order of magnitude more flexible, yielding huge gains in IT efficiency. However, the network has not achieved the same efficiency gains. Unlike the advancements in compute and storage virtualization, networking has not kept pace, and has become a barrier to achieving the promise of enterprise cloud computing. As enterprise IT continues its transition to the Cloud Era, the data center network is once again taking center stage.

The Fundamental Networking Problem

The two fundamental issues plaguing the enterprise network have not changed. First, because of its size, and because it is inherently shared infrastructure, the network is the most static and brittle part of the data center infrastructure. Anytime the network is changed, be it for onboarding a new application, equipment upgrades, or even just adding capacity, everyone holds his or her breath. Ironically, while compute and storage virtualization have made those infrastructures more efficient, they have in many cases made the network's configuration even more convoluted, making the network even more fragile.

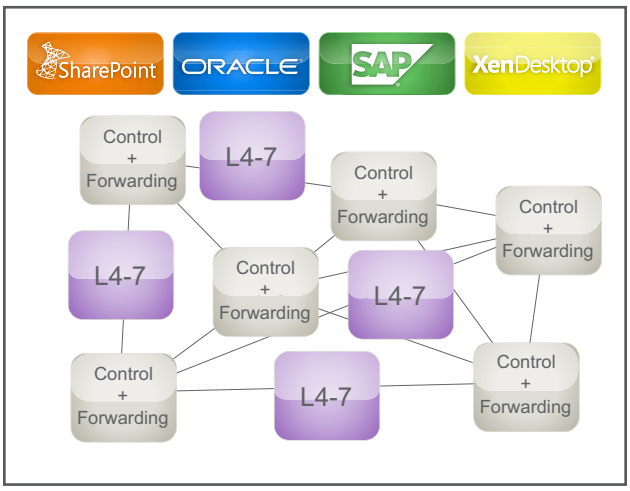

Figure 1. Apps and networks are fragmented

Second, the vast majority of data center networking gear is woefully application unaware. And the network components that are app aware – application delivery controllers, next generation firewalls, security gateways, etc. – are fragmented from each other and from the underlying transport network. The net effect is that the hugely expensive transport network just blindly forwards packets amongst users, applications, and a variety of L4-7 networking services. Network administrators must manually deploy, configure and maintain this networking infrastructure in the face of the myriad demands of hundreds of applications, largely keeping track of the interdependencies in their heads.

Generally, these are viewed as two independent issues. However, they are inherently related. Network fragility causes problems during change management. Change management in almost all cases is driven by applications. It could be:

- delivering a new application,
- delivering an existing application to new users,
- adding network capacity to handle a growing application, or
- adding network controls (e.g., security, visibility) for an application

The only way for the network to become more agile in the face of these application driven changes is for network configuration models themselves to become app-driven. Configuration can't be app-driven if the network itself isn't app-aware.

Is Software Defined Networking the Solution?

The largest and most successful public cloud providers long ago realized that the Cloud is only as powerful as the underlying network infrastructure. They therefore undertook initiatives making their networks less of a bottleneck. In some cases this is achieved by eliminating L2 segmentation and implementing a flat L3 network. In other cases, it is achieved by implementing overlay networks through techniques like tunneling IP within IP. In most cases, these initiatives focused on flattening the network by eliminating hierarchical network topologies. Flattening the network definitely helps make the network more pliable, especially for supporting server virtualization. However, efficiency gains from simply flattening the network are incremental at best. Currently, software defined networking is emerging as the long-term solution to address network fragility.

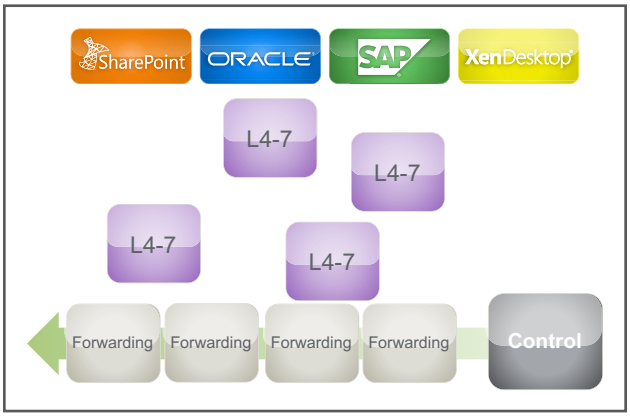

Figure 2. SDN separates L2-3 control and data forwarding

Software defined networking is, at its core, about separating network control from packet forwarding, and making the network itself programmable. Today, control and forwarding are inextricably coupled within network routers and switches. This tight coupling is at the heart of what makes today's networks

so fragile. Separating the network control plane from the data forwarding plane, and then providing the ability to program this control plane based upon the unique needs of specific applications holds the promise of making the network itself more agile. In essence, a "program" instructs the network not only what path the packets the make up the application should take, but what service levels the application requires (e.g., performance, availability, security/compliance, etc.) and thus what network services (e.g., QoS, authentication, access control, load balancing, etc.) need to be invoked to achieve those service levels.

Pragmatically however, using SDNs to make the network programmable begs two fundamental questions:

1. What exactly can be programmed?
2. What exactly is the program?

The technical agility enterprise cloud computing promises is based upon the assumption that when an application is deployed, all of the supporting infrastructure that application needs is dynamically provisioned and configured on-demand. For SDN, this implies that when an app is deployed, somewhere there is the program that tells the SDN control plane how to configure the underlying data forwarding plane.

This gets to the inherent limitations of SDN technologies as currently defined:

1. OpenFlow and other proposed SDN solutions (e.g., TRILL) focus solely on L2-3 network transport. Nowhere within their scope is any concept of the L4-7 services critical to delivering apps, desktops and content.
2. In addition to the fact that today "programming" an SDN controller is very low-level, the programming constructs themselves have no concept of L4-7 services or capabilities (e.g., persistence, compress, health checks, etc.).

For SDN to fulfill its long-term promise – provision an app and the network is automatically configured and waiting for that app – the following two things must occur:

1. An app-driven model for defining network services must emerge
2. These app-driven models must incorporate not only L2-3 transport but L4-7 delivery services

Towards the App-Aware SDN

Also left as open question is what tooling is used to define these application models and to program the SDN control plane. For both investment protection and making transitioning to SDN easier it makes sense to leverage in-place infrastructure wherever possible, especially when that in-place infrastructure is already both application and network aware.

Today's networks do contain infrastructure that is L4-7 aware. Application delivery controllers, next generation firewalls and mobility gateways are all

examples of networking gear used to control delivery of application services. Configuration of these devices is app-centric. Administrators define policies and in most cases these policies are inherently tied to a specific application. How explicit the association varies. In some cases (for example, with Link to communities page) it is very explicit: all the policies associated with an application are packaged together. In other cases, it can be less explicit: for example, in legacy firewall infrastructure there may be access control policies around an IP address, but the actual application behind that IP address isn't associated with the policies themselves.

In some cases (e.g., firewalls in regulated organizations, ADCs for e-commerce sites), certain pieces of this infrastructure are extremely critical. However, in most organizations this L4-7 delivery infrastructure is rarely managed together as a cohesive whole. This is because:

- it is frequently rolled out and deployed app-by-app
- different teams manage different components (security, visibility)
- sourcing is spread across multiple vendors
- the "spend" never attracts executive attention

If this infrastructure could be consolidated, it provides the most natural place to house app-driven networking models. This infrastructure already:

- exists within today's data center networks
- is application-aware
- has app-centric configuration

However, consolidation cannot compromise best-in-class functionality. Attempts to consolidate this infrastructure in the past have generally failed. Previous consolidation approaches have almost always hinged on sourcing everything from a single vendor, which inevitably leads to lowest-common denominator functionality. IT organizations are – and rightfully so – unwilling to trade functional depth for functional breadth. The services are just too critical for the successful delivery of applications.

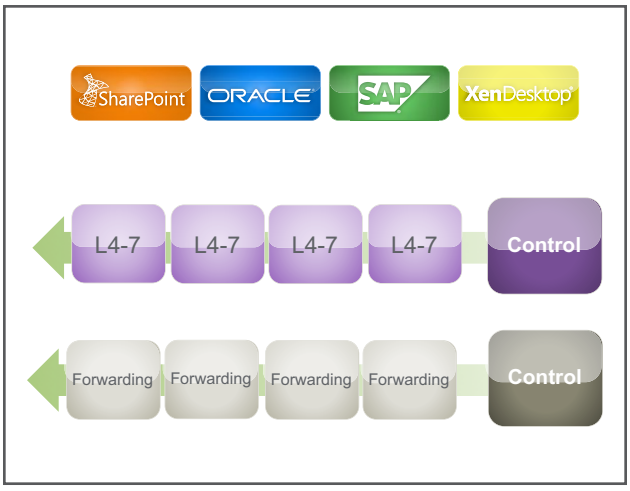

Figure 3. Unified control for L4-7

What is needed is a platform that unifies these advanced network services while preserving the ability to select best-in-class functionality. This platform becomes the natural point from which to drive application intelligence across the whole network, providing:

- Physical consolidation of related L4-7 network services
- Centralized deployment and configuration of these best-in-class services
- A unified application control layer for defining application policy
- An app-centric model for interacting with this application control layer
- The foundation for unifying not just L4-7 policy, for also interacting with SDN control planes

Next generation Citrix NetScaler SDX Platform

The next generation of the Citrix® NetScaler® SDX platform is built to do just this. The flagship NetScaler SDX platform already delivers the ability to consolidate multiple NetScaler instances onto a single purpose-built networking appliance, without compromising individual instance performance or isolation. The next generation NetScaler SDX platform extends this consolidation capability beyond NetScaler, enabling NetScaler SDX to deliver a variety of adjacent best-in-class L4-7 networking services from Citrix, and from key Citrix ecosystem partners.

Figure 4. Next Generation NetScaler SDX partners

The next generation NetScaler platforms unifies best-in-class L4-7 network services into an application control layer, and can integrate this application control with both existing transport networks and emerging SDN technologies. NetScaler SDX delivers three key capabilities critical to bring networking to par with compute and storage infrastructure.

- App-driven control
- Prescriptive, automated deployment
- Consolidated delivery and orchestration

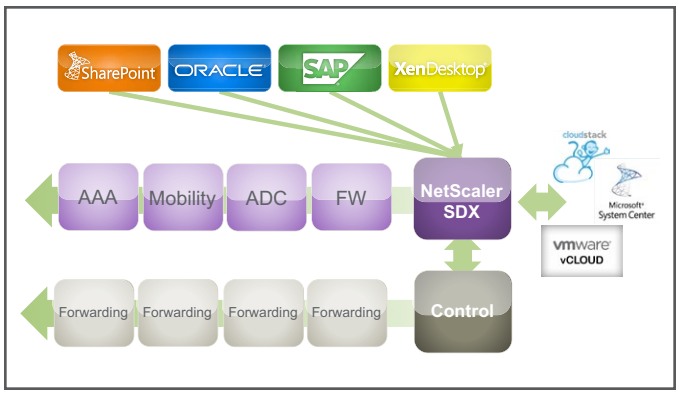

Figure 5. Next generation NetScaler SDX provides app-awareness across the whole data center

App-driven control

NetScaler SDX provides app-driven control over the whole network by creating a unified application control layer composed of best-in-class L4-L7 network services, and using the control layer to make in-place L2-3 infrastructure and emerging SDN controllers more app-aware. Turnkey AppTemplates for popular applications are provided with integrated L4-7 policies. These AppTemplates provide a container for defining network policies, while keeping the application the first class citizen around which the policies are defined. AppTemplates dramatically ease configuration for L4-7 services, and also provide the foundation for embedding application intelligence into all layers of the network.

Prescriptive, Automated Deployment

NetScaler SDX enables prescriptive, automated deployment of the network services it runs. It provides an app-centric approach for defining networking policy and topology, and the means to automating deployment and configuration. AppFormations simplify initial deployment by programmatically pre-packaging the network services, and their associated topology, a given application requires. AppFormations make it easy to dynamically provision the best-in-class network services each application requires, freeing admins from complex, error-prone per application provisioning of individual network services.

Consolidated Delivery and Orchestration

The next generation NetScaler SDX platform is open and programmable, enabling consolidated delivery and orchestration of best-in-class network services. AppFabric provides an extensible virtualization framework that supports onboarding of additional services while retaining full isolation and independence between these services. Best-in-class third party services seamlessly and securely plug into the framework, enabling NetScaler SDX to deliver them in a safe, multi-tenant manner.

In addition to orchestrating these best-in-class services, AppFabric itself is also exposed via a northbound API, providing for integration with leading cloud orchestration platforms. This enables these cloud orchestration platforms to incorporate the services running on NetScaler SDX into the larger provisioning processes that also involve compute and storage, without the cloud orchestration platform itself needing to define the intricacies of low-level network configurations. Potentially more importantly, NetScaler also provides autosense capabilities that leverages NetScaler's inherent application visibility to sense when an application needs more/less capacity, and autoscale functionality that proactively signals to the cloud orchestration platform when to add/drop application capacity.

These three core capabilities, which are all related, form the foundation for the ability to:

1) consolidating L4-7 services while retaining best-in-class functionality

2) simplifying deployment of advanced network services

3) ingraining application intelligence into emerging SDNs

Summary

Unlike the advancements in compute and storage virtualization, networking has not kept pace and has become a barrier to achieve the promise of enterprise cloud computing. The dynamic nature of cloud services requires a new level of flexibility, scalability, and programmability which go beyond the capabilities of today's data center networks. Not surprisingly, the broader networking industry has embarked on a new paradigm of software-defined networking to design in programmability and flexibility into the core network.

But networks exist to deliver applications. Current SDN technologies operate at L2-3 layers and are missing the opportunity to truly deliver on the promise of SDN. The next generation NetScaler SDX platform unifies best-in-class L4-7 network services into an application control layer, and can integrate this application control with both existing transport networks and emerging SDN technologies. This application control layer can make emerging L2-3 SDN architectures completely app-driven by using app-centric definitions and policies to simplify network design while making the whole network more intelligent.

Corporate Headquarters
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About Citrix
Citrix Systems, Inc. (NASDAQ:CTXS) is a leading provider of virtual computing solutions that help companies deliver IT as an on-demand service. Founded in 1989, Citrix combines virtualization, networking and cloud computing technologies into a full portfolio of products that enable virtual workstyles for users and virtual datacenters for IT. More than 230,000 organizations worldwide rely on Citrix to help them build simpler and more cost-effective IT environments. Citrix partners with over 10,000 companies in more than 100 countries. Annual revenue in 2010 was $1.87 billion.

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