Cisco ONE Enterprise Networks Architecture: An Automated, Application-Aware Foundation for the Modern Enterprise

The Challenge

Enterprises have seen massive change over the last decade, but one thing has remained consistent: the enterprise network. Even as your network devices have become faster, more powerful, and more intelligent, the fundamental architecture of the network - and the way you provision and operate it - has stayed largely the same. Now, a series of sweeping trends is placing new requirements on the tried-and-true enterprise network model. IT is more relevant than ever before in addressing these trends:

- **Bring your own device:** The bring-your-own-device (BYOD) trend is reshaping the face of enterprise computing, introducing new mobile devices into the business environment that are owned by the user rather than the enterprise. BYOD users are accessing enterprise critical applications being served from the cloud on their devices and are demanding that the network and IT accommodate these new requirements on both wired and wireless networks. BYOD increases network complexity and raises challenges in managing access and assuring security and wired/wireless consistency.

- **Cloud adoption:** Enterprises are evolving to a cloud-based infrastructure model, reducing the overall IT footprint by consolidating and virtualizing the data center. This includes implementing internal private clouds, adopting external public cloud services, and linking these resources over the network to deliver hybrid cloud services. Cloud capabilities will increase pressure to make your applications - and the network delivering them - more flexible, elastic, and scalable.

- **X-as-a-service migration:** Enterprise applications are migrating to cloud-based delivery models, including software as a service (SaaS). This shift places new demands on the network infrastructure that delivers your applications and the way this infrastructure is managed. As XaaS services, including Salesforce and Cisco® WebEx® as examples, play a more important role in your business, you need a network that is "application aware" and capable of understanding data use, traffic, and prioritization in order to deliver cloud-based XaaS services to enterprise users anywhere and on any device with reliability, security, and great user experience.

Together, these trends introduce a number of new challenges for the enterprise IT departments. These include:

- **Growing complexity:** Increasing network provisioning and configuration complexity impedes your ability to quickly respond to changing requirements, market trends, and customer demands through configuration, provisioning, and maintenance of the network.

- **Shrinking IT budgets:** By moving to cloud-based models, lines of business are spending more on cloud providers than on their own IT. This affects IT budgets while placing increasing demands on the IT network. With shrinking resources, you need network capabilities that more readily accommodate cloud migration and support services in a more programmable, scalable, and on-demand manner.

- **Lack of visibility:** As enterprise lines of business adopt more external cloud-based applications, IT struggles to retain the granular detail and control necessary to manage and operate them optimally. These public cloud applications can have a significant effect on the performance of your WAN, LAN, and wireless environment, problems for which IT will be held accountable. But without visibility into these applications, how can you support them effectively?
- **Business agility:** Your ability to provide a compelling user experience is limited by the intelligence in your network. The network has become central to your ability to innovate. However, you might not have the network agility necessary to become an active force in rolling out new applications, services, and innovation to rapidly respond to business changes.

Solution: Cisco ONE Enterprise Networks Architecture

The Cisco Open Network Environment (ONE) is Cisco's overarching vision to bring more openness and programmability to all networks - across service providers, data centers, and enterprises. Now, you can begin making that vision a reality across campus and branch, WAN and LAN, and in both wired and wireless environments with the Cisco ONE Enterprise Networks Architecture.

The Cisco ONE Enterprise Networks Architecture transforms IT through an open and programmable platform for network services that brings networks and applications closer together. It creates a "feedback loop" between the network infrastructure and the applications running on top of it, allowing applications to access network intelligence at multiple levels and the network to be aware of the applications running on top of it. The Cisco ONE Enterprise Network Architecture goes beyond SDN by providing open APIs and programmability for deep access to network resources across the wider enterprise.

Combined with open and standard APIs, this architecture enables a rich ecosystem of third-party applications. With a high degree of programmatic access to your network, you can accelerate the deployment of enterprise services and applications. At the same time, these capabilities unlock new business opportunities by enabling sophisticated connected mobile experiences (for example, advanced location-based services), diverse cloud services, and user-developed applications, allowing enterprises to respond quickly to new business opportunities with faster time to market.

Built with the most comprehensive and best-in-class switching, routing, mobility, and security portfolio in the industry, the Cisco ONE Enterprise Networks Architecture provides a comprehensive portfolio for programmable, application-aware enterprise networks. At the same time, its openness and support for existing Cisco network infrastructure protect your network investments.

The Cisco ONE Enterprise Network Architecture consists of three integrated layers (Figure 1):

- **The Network Element Layer,** which encompasses the industry's broadest portfolio of devices, application-specific integrated circuits (ASICs), and Cisco IOS® Software across routing, switching, and mobility and provides programmatic access to the entire network through APIs
- **The Network Control Layer,** which abstracts away network infrastructure elements from network applications and provides automated provisioning and policy control
- **The Network Application Layer,** which consists of network-aware applications, developed by Cisco and third parties, that communicate with network infrastructure and services through the Network Control Layer in real time

Figure 1.   Cisco ONE Enterprise Networks Architecture

Network Element Layer

Integration with most of today's networks requires device-by-device configuration and provisioning, making it harder to deploy new applications and integrate cloud services. The Cisco ONE Enterprise Networks Architecture builds upon a common software data plane and ASIC data plane across multiple devices in the portfolio to provide a platform for enterprisewide automation and programmability.

Cisco brings together the industry's broadest portfolio of enterprise routing, switching, wireless, and security devices and software. These infrastructure solutions feature programmable ASICs, a service-centric operating system, and open APIs to capture and export real-time network state and intelligence to higher layers of the network architecture. With these capabilities, you gain:

- **A comprehensive view of your infrastructure across routing, switching, mobility, and security:** This architecture enables automated configuration and provisioning across all network segments, accelerates deployments, and simplifies change management of services and applications.

- **Deeper network intelligence through Cisco APIs and ASICs:** Now you can access rich network information to enable innovative new third-party applications.

- **Maximum flexibility with support for three APIs:** These include:
  - **Cisco ONE Platform Kit (onePK),** which lets you perform advanced provisioning, monitoring, and troubleshooting across enterprise, data center, and service provider platforms using a common API
  - **OpenFlow,** a standards-based protocol that allows you to employ advanced network orchestration and automation, supporting third-party network controllers and applications
  - **CLI** to support legacy device provisioning and configuration methods

- **Investment protection:** The Cisco ONE Enterprise Networks Architecture supports orchestration and automation to new Cisco devices as well as the existing installed base, providing deep investment protection.

Network Control Layer

Today's networks do not provide end-to-end visibility into network analytics data, making it difficult for IT to support external cloud services and assure the user experience that users expect. The need to provision applications and services separately for each type of network device - branch router, firewall, wireless LAN controller, and so on - also makes new service and application deployments a slow and complex process.

The Cisco ONE Enterprise Networks Architecture provides a much more efficient approach. It features an intelligent Network Control Layer that links all network elements with the applications that need to communicate with them and facilitates the exchange of real-time network data. As a result, you can provision network services and policies automatically across all of your network devices, accelerate deployments, and enable advanced applications.

At the heart of The Control Layer is the Cisco network controller, which provides the bridge between open and programmable network elements and the applications that communicate with them. The controller maintains a real-time database of all network elements. Through APIs (Cisco onePK, OpenFlow, or CLI), it provides orchestration and automated provisioning of the entire end-to-end infrastructure.

These capabilities help you scale up services and applications more quickly and provision the network in a simpler and more automated way. They also allow you to respond more quickly to the needs of your lines of business, so they don't need to bypass IT departments when deploying cloud applications for business growth. The Network Control Layer provides:

- **Broad openness:** The Cisco network controller is OpenDaylight based and provides standards-based northbound and southbound APIs (RESTful, OSGI, OpenFlow).
- **End-to-end automation:** The Network Control Layer abstracts individual network elements and enables end-to-end, zero-touch provisioning of services and applications. For example, the Cisco network controller accelerates the deployment of applications and services - QoS, access control lists (ACLs), policy changes, security and mobile services, and so on - across your environment.
- **Broad and deep networkwide analytics:** The Network Control Layer provides rich network information and analytics across LAN and WAN, wired and wireless, users and applications, allowing you to optimize services and support new applications and business models.
- **Flexibility and investment protection:** Like new Cisco network devices, the Cisco network controller supports onePK, OpenFlow, and CLI to support your existing infrastructure both today and as you evolve and grow.

Network Application Layer

In the past, a reliance on proprietary APIs meant that many enterprises were locked into siloed integration processes when rolling out new network applications. The need to deploy applications and collect ongoing analytics information on a per-device basis for each type of network devices made these tasks slow and complex.

The Cisco ONE Enterprise Networks Architecture enables a more efficient and flexible network applications, providing open APIs to simplify operations and accelerate innovation. Network-aware applications (developed by Cisco or third parties) use these APIs to draw on the combined intelligence of Cisco network elements and Network Control Layer orchestration capabilities to communicate and interact with the infrastructure in real time. Whether you use Cisco applications such as Cisco Prime™ or third-party network management applications, the Cisco ONE Enterprise Networks Architecture provides the network intelligence these applications need to efficiently manage and continually optimize the network.

The Network Application Layer provides:

- **An open application ecosystem** that includes innovative network applications from Cisco and an ecosystem of third-party developers. This openness lowers risks of integration and deployment and operating costs and allows you to rapidly deploy innovative services and applications.
- **A broad set of applications** across all of the major areas that matter to enterprises, including cloud, mobility, security, and more. This provides a platform for innovation and faster, simpler service deployment.
- **Network analytics that are available to all applications.** Drawing on this real-time network intelligence, you can continually optimize the network for the applications running on it and vice versa.

Cisco ONE Enterprise Networks Architecture Advantages

The combined capabilities of the Network, Control, and Application Layers of the Cisco ONE Enterprise Networks Architecture provide several important benefits. They unlock unprecedented innovation and simplify your network operations, while protecting your network investments.

Innovation

With the ability to interact with network elements and The Network Control Layer using open network APIs, detailed network information becomes available to Cisco and third-party developers to create innovative network applications. This unlocks a world of possibilities to employ rich, detailed, real-time information about the network infrastructure to optimize services, gain valuable analytics, and support new business models.

For example, with real-time network state and intelligence information across the wired and wireless network, you can support a variety of advanced location-based applications and connected mobile experiences. These can include personalized, interactive digital maps of your venue for customers and guests, location-specific communications and promotions, and much more.

Simplicity and Agility

The Cisco ONE Enterprise Networks Architecture simplifies provisioning and configuration, reduces complexity and risk, and makes it much faster and easier to provision or change network services. For example, if you want to institute a new QoS policy today to make sure live videoconferencing traffic always has the highest priority, you currently have to configure that on a device-by-device basis. With the Cisco ONE Enterprise Networks Architecture, you can define that policy once, and the Cisco controller propagates that change across the entire end-to-end network, communicating with every wired and wireless network element to effect that policy change, from branch routers all the way to the data center.

These capabilities also simplify bandwidth utilization management and quality of service as you migrate to more complex private/public/hybrid cloud environments. The intelligent Network Control Layer and network infrastructure elements work together to automate the provisioning of network resources and configuration to support cloud-based applications and assure the applications have the bandwidth and performance they need.

Investment Protection

Even as you take advantage of the new generation of Cisco network solutions and new Cisco APIs, you can continue to use the network infrastructure you have in place today. In addition to supporting Cisco onePK API to enable new specific Cisco capabilities, the Network Control Layer also supports standardized OpenFlow and CLI, so it can communicate and interact with your installed Cisco equipment.

This investment protection holds true as you continue to evolve your network. As you add new network capacity, you can continue to use the same network and Network Control Layer intelligence to automate configuration and provisioning of services and applications.

Conclusion

Enterprise networks are more complex than ever before, and consumers of network services have never been more demanding. Expect your enterprise lines of business to continue adopting more SaaS applications, your users to bring new mobile devices into the environment, and the migration to cloud to continue to blur the lines between internally and externally delivered services. These shifts are imposing new requirements on enterprise networks and making them more complex to operate. To stay ahead of these enterprise trends, you need an adaptable and programmable network platform.

The Cisco ONE Enterprise Networks Architecture provides the open, programmable, and application-aware foundation you need for today's mobile and cloud-connected world. By providing a platform for network infrastructure and applications to communicate with each other in real time, IT can automate and simplify today's complex and time-consuming deployment, operation, and management tasks. IT becomes more relevant in unlocking a new generation of innovative network applications and services.

To learn more, visit http://www.cisco.com/go/enterprise.

Printed in USA

C11-729655-00   10/13