The Open SDN Architecture

The Open SDN architecture creates a flexible environment for customers to deploy unified network applications across a heterogeneous multi-vendor network of physical and virtual devices. The Open SDN architecture unlocks the latent potential of the network fabric and enables network managers to meet the business needs that have emerged in recent years—needs that are unmet by conventional, closed and proprietary network architectures.

Introduction

For over 20 years, network managers have grudgingly accepted the suboptimal nature of closed, proprietary networking architectures, which are inherently non-scalable, inflexible and administratively cumbersome. Traditional networking devices generally have proprietary management systems, implement proprietary protocols, and lack reliable APIs for external programmability or automation. While the enterprise compute sector has experienced dramatically improved flexibility and scalability over recent years, the networking industry has been slow to evolve and, therefore, is perceived by many enterprise customers as the primary inhibitor to agility and innovation.

The solution is open software-defined networking (Open SDN)—the use of standards-based protocols and open interfaces to abstract the network control plane from the data plane, Open SDN enables unified control and programmability across a network of heterogeneous physical and virtual networking devices. There is a groundswell of support for SDN initiatives amongst some of the largest technology customers in the world, leading academic institutions, and forward-looking networking vendors. Broad support for the non-profit industry consortium, the Open Networking Foundation (ONF), serves as a strong testament to the disruptive potential of SDN. The ONF membership includes leading technology companies, like Deutsche Telecom, Facebook, Google, Microsoft, Verizon, and Yahoo! The ONF serves as the independent steward of the industry's first standard protocol for a common network control plane abstraction, called OpenFlow, which has now been widely adopted throughout the networking industry. Growing industry momentum and the adoption of these emerging standards have catalyzed the movement towards software-defined networking.

Big Switch Networks Open SDN Architecture

Big Switch Networks is the leading platform-independent SDN vendor. The Open SDN architecture is built around the Big Network Controller, which provides a common data model and policy abstraction for all the network fabric elements. Big Network Controller creates a universal network abstraction by leveraging industry standards and open APIs, which enables universal programmability of the entire network with a single software application. Big Network Controller enables a broad range of network application support, including data center network virtualization.

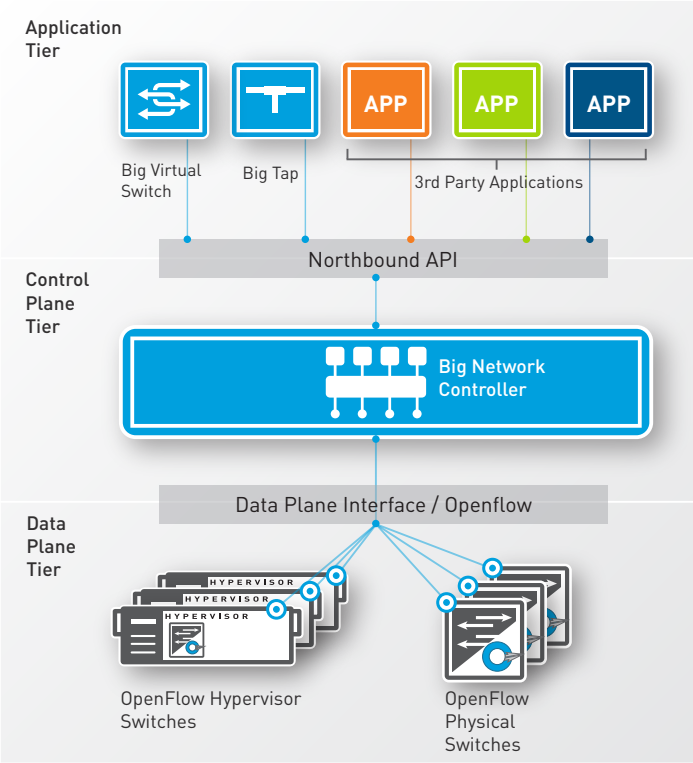


Figure 1 - Open SDN Architecture

Big Switch Networks Open SDN three-tier architecture

- Northbound open APIs for application developers
- An open-core controller
- Southbound standards-based data plane communication protocols.

1) Northbound Open APIs – Open APIs refer to the software interfaces between the software modules of the controller platform and the SDN applications running atop the network platform. The Open SDN architecture employs Northbound APIs, which expose the universal network abstraction data models and functionality within the Big Network Controller for use by network applications. These interfaces are published and open to customers, partners, and the open source community for development. The Open APIs enable maximum utility of the Open SDN architecture through the ecosystem of customers and partners developing on the platform.

2) Open Core Controller – At the center of the Open SDN architecture is an open core controller. Floodlight is the open-source core of Big Network Controller, the commercial controller from Big Switch Networks. Big Switch Networks maintains API consistency between Floodlight and Big Network Controller, and applications written for Floodlight will work with Big Network Controller. Floodlight is distributed under Apache License Version 2.0, which provides customers and application developers with maximum investment protection since their SDN architecture will always remain independent of vendor interests.

3) Standards-based Southbound Protocols –Big Switch Networks ultilizes standards-based connectivity for the "Southbound Protocols," which define the control communications between the controller platform and data plane devices, including physical and virtual switches. The majority of the Big Switch Networks' development efforts in this area have been dedicated towards the OpenFlow protocol, but the Open SDN architecture is flexible and can leverage other protocols in addition to Openflow. Support for a wide range of physical and virtual switches ensure that customers have maximum choice and flexibility designing and deploying their software-defined network.

Open SDN: Network Applications

The Open SDN architecture creates a flexible environment for customers to deploy unified network applications across a heterogeneous multi-vendor network of physical and virtual devices. The Open SDN architecture unlocks the latent potential of the network fabric and enables network managers to meet the business needs that have emerged in recent years—needs that are unmet by conventional, closed and proprietary network architectures.

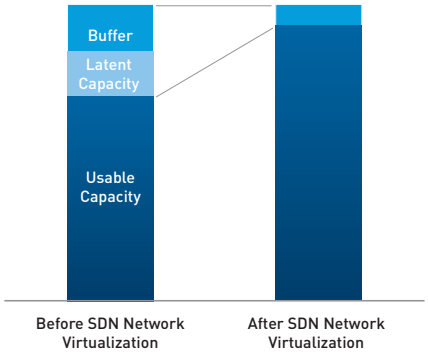
Network Virtualization with Big Virtual Switch

Datacenter network virtualization is the best example of a network application that can address challenges in the modern datacenter, and highlights the benefits of the Open SDN architecture. Modern virtualized datacenters with dynamic cloud workloads have radically changed user expectations for the network. Network designs originally targeting 20 statically defined physical servers per rack are now growing to hundreds or even thousands of VMs per rack that are expected to be mobile. Conventional network switches cannot meet the requirement of these new designs. Attempts to apply traditional network engineering constructs like L2 VLAN segmentation or L3 subnet isolation for new cloud workloads simply fail to scale at the pace required by cloud computing providers and customers. While self-provisioned cloud workloads are created in minutes, traditional network change management processes take days or weeks, creating large gaps in expectations. The traditional model completely melts down when trying to create a multi-tenant environment with overlapping IP address ranges, requiring the manual deployment of FW/VPN gateways to tunnel private segments within a cloud environment. The multitude of

architectural and operational networking challenges that stem from virtualized and cloud data centers demand new ways of thinking about networking.

Using Big Virtual Switch, a datacenter architect can implement Virtual Network Segments across their physical and virtual fabric. These virtual network slices are dynamically associated with selected pools of workloads via integration with cloud management platforms. This dynamic provisioning bypasses traditional manually configured L2 and L3 constructs, like VLANs and routed subnets. Unlike VLANs, which suffer from scalability and stability constraints, these Virtual Network Segments can automatically migrate with dynamic VMs, can span across L3 domains, and can easily accommodate a range of overlapping L2 and L3 designs.

Big Virtual Switch, a network virtualization application, not only dramatically reduces network provisioning response times, but also drives tremendous administrative efficiencies and increases server compute resource utilization. When new VMs can be dynamically added and migrate between host servers without VLAN or ACL restrictions, a large percentage of the service request tickets related to moves, adds, and changes simply disappear. And, when data center operators can co-mingle groups of mixed trust VMs across a pool of server resources using Virtual Network Segmentation, regardless of rack or physical interface, they can dramatically increase server utilization, in many cases by as much as 50%. Dynamic moves and tenant isolation produce millions of dollars of data center infrastructure savings, and extends the utility of each data center rack. The increased server utilization also drives dramatic reductions in power and cooling requirements on a per VM basis.



Unified Network Monitoring and Analysis with Big Tap

While network traffic monitoring is a powerful tool providing rich security, compliance, performance monitoring, and forensic capabilities, it is underutilized in most networks due to the excessive cost and inflexibility of conventional monitoring architectures. Big Tap, a unified monitoring and analysis application, provides network operators an extremely flexible and cost-effective platform to extend the utility of their monitoring and security tools to achieve ubiquitous and continuous network visibility.

While conventional monitoring systems require numerous network taps and dedicated security and monitoring appliances co-located with each tap, Big Tap leverages the flexibility and programmability of the Open SDN architecture to add network monitoring functions to standard Ethernet switches. Big Tap turns an Ethernet switch into a programmable aggregator, which can filter and selectively forward network traffic to security appliances, monitoring appliances and network packet brokers. Big Tap extends the functionality of each network security and monitoring appliance by dynamically extending its functionality across the network fabric. And, because Big Tap utilizes the underlying cost efficiencies of Ethernet switches, it is much more cost-effective than dedicated monitoring systems.

Other Network Applications

The preceding examples illustrate just two applications that can be deployed on an open and flexible network architecture, like the Big Switch Networks Open SDN architecture. This programmable and extensible architecture is an application platform that will be leveraged to address new applications over time.

Big Switch Networks and our ecosystem partners are developing an array of applications to meet customer demands for network automation, flexibility and programmability. Following are just a few more examples of the real-world applications of an Open SDN architecture:

Traffic Engineering

Optimizing traffic across a packet-based network core is a huge challenge with traditional, static L3 routing and L2 forwarding protocols. Implementing traffic engineering to provide performance SLAs typically involves the deployment of extremely expensive routing infrastructure that supports MPLS and related protocols. By contrast, the inherently centralized control plane of an Open SDN architecture can be utilized to create a centralized network topology, including link utilization and latency, to dynamically provision forwarding tables that deliver the desired network performance characteristics. Traffic engineering can now be deployed as an application for standard Ethernet switches, thus eliminating massive complexity, and dramatically reducing deployment and capital costs. Large production networks, such as the global "G-scale" WAN at Google, are doing this now.

Dynamic Network Service Delivery

Dynamic network service delivery is a near impossibility today due to the static and non-programmable nature of closed, multi-vendor networks. This prevents network engineers from meeting basic business requests to deliver dynamic network services, like bandwidth-on-demand, rate limiting, burst quality of service, and other services. With a fully programmable physical and virtual network powered by an Open SDN architecture, network operators can deliver high-value network services with speed and flexibility.

Network Access Control and BYOD

Policy-based access controls based upon user device type, location, identity, wired vs. wireless network, or time of day were once the holy grail of access networking. Remember directory-enabled networking? And the NAC-mania of a few years ago? Today BYOD is all the rage; perhaps the third time's the charm. Network industry vendors have made many attempts to commercialize such functionality. These initiatives often created an L2-overlay for authentication and access control. Some generated a dedicated overlay, an internal firewall or even a VPN policy. Others generated port manipulation based on MAC address, host and identity attributes. These initiatives proved complex precisely because they attempted to program a non-programmable network. Some initiatives proved fragile, while others turned out to be costly to deploy because they required particular hardware versions or homogeneous software and the installation of client software throughout the network. What if you could simply program the physical network with a universal policy-based access control rule that integrated with critical information systems, like Active Directory and LDAP? An Open SDN architecture can help with that.

Universal ACL Management

Most network operators implement a resource-intensive change management process that can take days or weeks to respond to basic network change requests (moves/adds/changes). This complexity results from the necessity to review proposed changes to device-level configurations across a heterogeneous network of routers, switches and firewalls that all have disparate policy definitions, management interfaces and configuration settings. With an Open SDN architecture, network administrators are able to create a universal access policy that can be distributed with a single command across the entire network fabric. With this new functionality, network change management can evolve from a manual, time-consuming task that frustrates the entire IT organization to an enabling, automated process.

Conclusion

After more than 20 years of static, closed and proprietary systems, it's time for the networking industry to evolve and catch up with modern technology trends already established in other IT sectors. It's time for the networking industry to adopt an open, flexible and dynamic network architecture. Now is the time for Software-Defined Networking—the Open SDN architecture.

About Big Switch Networks

Big Switch Networks is the leading platform-independent Software-Defined Networking (SDN) vendor. The company's highly scalable Open SDN architecture leverages industry standards and open APIs that enable customers to deploy dynamic and flexible networking applications, including data center network virtualization. Big Switch Networks is backed by the largest SDN ecosystem of OpenFlow applications and physical and hypervisor switches. The company's commercial controller, network virtualization, and applications, which accelerate delivery of cloud services, are in customer trials today. For more information, visit www.bigswitch.com

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