

The Open SDN Architecture

Big Switch Networks Open SDN™ Suite provides unmatched network agility, choice in network hardware, and optimized network operations.

Introduction

The networking industry has been stuck in the “mainframe era” with vertically integrated hardware and software systems that are built upon proprietary architectures, and are substantially the same as they were decades ago. These legacy network architectures create operational fragility, drive excessively long provisioning times, and result in unnecessarily high operational costs. The shift towards Software-Defined Networking represents the most transformative architectural trend in nearly 20 years, delivering unmatched network agility, choice in networking hardware and optimized network operations.

Software-defined networking (SDN) is a modern approach to networking that eliminates the complex and static nature of legacy distributed network architectures through the use of a standards-based software abstraction between the network control plane and underlying data forwarding plane, including both physical and virtual devices. This standards-based data plane abstraction, called OpenFlow, provides a novel approach to dynamically provision the network fabric from a centralized software-based controller. An open SDN platform with centralized software provisioning delivers dramatic improvements in your network agility via programmability and automation, while substantially reducing the cost of your network operations. And using an industry standard data plane abstraction protocol like OpenFlow, you are now free to use any type and brand of data plane devices, since all the underlying network hardware is addressable through a common abstraction protocol. Importantly, OpenFlow facilitates the use of “bare metal switches” and eliminates traditional vendor lock-in, giving you freedom of choice in networking like you have in other areas of your IT infrastructure, such as servers. SDN controllers also expose APIs northbound, which allow you to deploy a wide range of off-the-shelf and custom-built network applications – many of which were fundamentally not feasible prior to the advent of SDN.

Compared to legacy networking architectures that are vertically integrated from the underlying hardware, through the operating system, and into the network application functionality, the inherently open nature of an SDN represents a fundamental shift in power giving you choice, agility and automation of network operations not previously possible.

Big Switch Networks Open SDN Architecture

Big Switch Networks is the leader in open source Software-Defined Networking (SDN) products, delivering unmatched network agility, automated network provisioning, and dramatic reductions in the cost of network operations. The company's Open SDN™ platform offers an OpenFlow switch fabric that can run on bare metal switches and hypervisor virtual switches, and enables a wide variety of SDN network applications, including data center network virtualization and network monitoring.

Software Defined Networking delivers compelling new value in three critical areas:

- **Unmatched Network Agility** – programmability and automation provide dramatic improvements in service agility and provisioning time
- **Choice in Networking Hardware** – standards-based OpenFlow switches provide choice in networking hardware for the first time ever
- **Optimized Network Operations** – automation of network provisioning tasks and integration with data center resource orchestration platforms drives dramatic reduction in network operation tasks and requirements

As the leader in Open SDN and standards-based networking architectures, Big Switch Networks has the broadest array of open source and commercial SDN products available. The company launched Project Floodlight in January 2012, which has rapidly become the world's most popular and broadly used open source SDN controller platform for developers and users trialing new SDN constructs. In Q4 2012, Big Switch launched general availability of the Open SDN™ Suite, including Big Virtual Switch™—a network virtualization application that automates network provisioning and dramatically reduces network operating costs; and, Big Tap™—a unified network monitoring application that optimizes the utility of security tools, performance monitoring tools and network packet brokers. In Q1 2013, Big Switch launched Switch Light, an open source thin switching platform for merchant silicon-based, bare metal switches and hypervisor-based virtual switches.

Open SDN Suite

The Big Switch Networks Open SDN three-tier architecture is composed of:

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

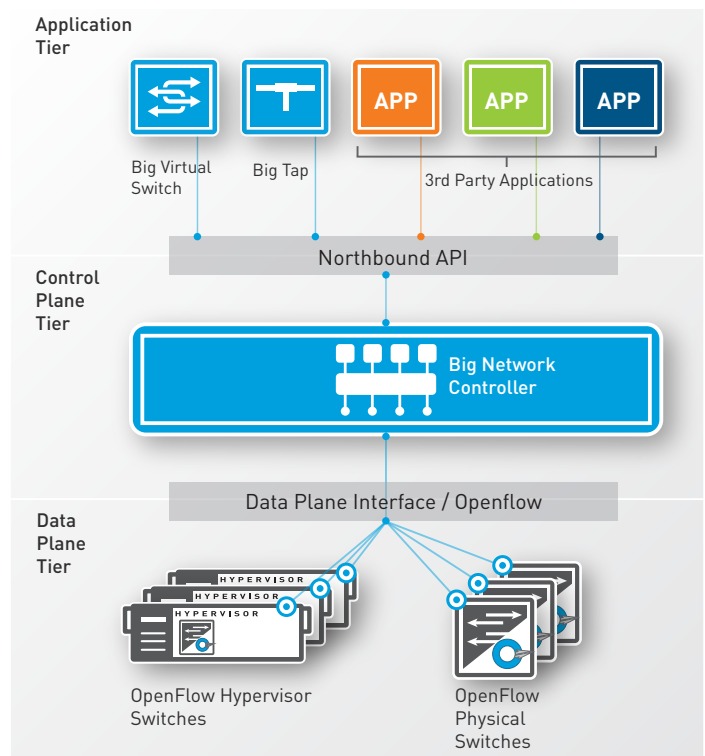


Figure 1 - Open SDN Architecture

1) Northbound Open APIs – Open APIs refer to the software interfaces between the software modules of the controller and the SDN applications. 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-Source, Open Core Controller – At the center of the Open SDN architecture is an open-source controller. Floodlight is the open-source core of Big Network Controller, the commercial controller from Big Switch Networks. Floodlight is distributed under the Apache License Version 2.0,

3) Standards-based Southbound Protocols – Big Switch Networks utilizes 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. Big Switch Networks has dedicated development efforts to the OpenFlow protocol, and has fostered this standard in collaboration with the Open Networking Foundation, leading research institutions, and network operators. Openflow is supported on a wide range

of physical and virtual switches and network engineers can also deploy Switch Light thin-switching platform on bare-metal switches, designing and deploying a software-defined network fabric that offers choice and flexibility.

The OpenFlow Protocol

The OpenFlow protocol is the only standards-based SDN protocol in the world to abstract the network control plane (where forwarding decisions are made) from the network data plane (where packets are forwarded), which enables you to create a single network control policy that universally programs the entire network fabric. OpenFlow enables a central controller to remotely provision the underlying data plane device forwarding tables in a common, scalable way, and eliminates the vendor-specific, proprietary nature of legacy networking equipment. Specifically, OpenFlow enables automation through a centralized software controller that eliminates the need to program devices and interfaces for every network service request. And, for the first time in the history of networking, it provides you with flexibility and choice in networking vendors without re-architecting your entire network around vendor-specific protocols. In short, OpenFlow represents the most transformative standards-based protocol to hit the networking industry in over 20 years.

The OpenFlow protocol is managed by the Open Networking Foundation (ONF), which was an outgrowth of principal research done at Stanford University's Clean Slate Program led by Big Switch Networks founder, Guido Appenzeller. The ONF, a non-profit user-governed consortium, has now grown to include some of the largest users in the world, including Google, Facebook, Yahoo!, Deutsche Telekom, Verizon and Goldman Sachs. Given the explicitly user-driven governance model of the ONF, the OpenFlow protocol is not subject to conventional vendor politics and manipulation that plagues other vendor-controlled industry standards bodies.

Open SDN: Network Applications

Network Virtualization

Big Virtual Switch is a network virtualization application that creates unmatched network agility and dramatically reduces costs of network operations by automating network provisioning for both increasingly dynamic virtual workloads as well bare metal workloads. A network virtualization program eliminates the conventional shortcomings and time-consuming provisioning tasks related to legacy network segmentation technologies, like switched VLANs, routed subnets, and firewall ACLs. Alternatively, an SDN-based network virtualization application supports arbitrary assignment of IP/MAC addressing schemes, while at the

same time automating network configuration tasks and enforcing expected network segmentation. Network virtualization leverages the OpenFlow protocol to dynamically and automatically provision virtual network segments and virtual routing services on both physical and virtual networking devices. You can automatically provision network security policies through a cloud orchestration platform, like OpenStack, or automatically assign workloads according to workload attributes like MAC, subnet, VLAN, IP protocol, or other attributes. Network virtualization applications eliminate the time-consuming manual provisioning process required with legacy networking gear, enable unmatched network agility, and dramatically reduce the cost of network operations.

Unified Network Monitoring and Analysis with Big Tap

While network traffic monitoring is a powerful tool for 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 dedicated network taps and 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 uses OpenFlow-enabled Ethernet Switches to create a monitoring fabric, which can filter and selectively forward network traffic to security appliances, monitoring appliances and network packet brokers. Big Tap optimizes the utility 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.

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

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