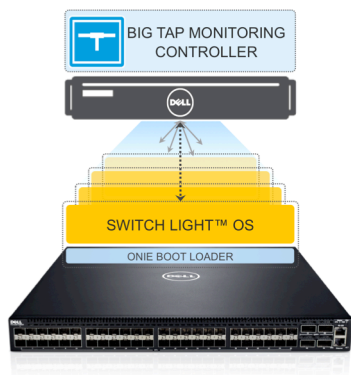


Bringing Next Generation SDN Fabrics to Enterprise Data Centers

Dell Ethernet Switches and Big Switch SDN software bring hyper-scale datacenter technologies within the reach of the enterprise IT operators

- Expand choice and capabilities for customers looking for best-of-breed Ethernet switch hardware, SDN OSs and SDN controllers
- Realize operational simplification using a controller for management, control and policy.
- Enable a range of next-gen SDN solutions starting with the **Big Tap™ Monitoring Fabric**



Enterprise Data Center Network Challenges

For decades, the networking industry has been stuck in the “mainframe era” with vertically integrated hardware and software systems that are built upon proprietary architectures. The impact of these legacy architectures and operating models is a level of network complexity that results in high operational costs on one hand and is a barrier to rapid innovation on the other. The situation is further worsened by the fact that once a networking vendor is chosen, customers have limited choice to explore other solutions without ripping and replacing their entire networking infrastructure.

Nowhere are these problems more obvious than in an Enterprise Data Center. The need to support business agility in a cost-effective manner had led many IT organizations to move mission critical applications to cloud deployment models. This has not only resulted in an explosion of data traffic, but also a shift in the patterns of traffic within the data center as a majority of the traffic goes between applications and their storage devices. Furthermore, cloud deployment models require secure multi-tenant access to shared data center resources, and to manage and modify the access policies on-demand.

As a result, data center operators have re-discovered that unlike the rest of the applications and infrastructure they manage, legacy data center networks are still highly static and require a “box-by-box” management approach. With limited choice or a migration path to next generation architectures, they are stuck with a highly fragile, inflexible and expensive infrastructure.

Solution: Software Defined Networking (SDN)

The shift towards Software Defined Networking in the data center represents the most transformative architectural trend in nearly 20 years, delivering unmatched network agility, choice and optimized network operations for customers.

Building upon the experience with SDN generation 1.0 (overlay-underlay approach to network virtualization), Big Switch’s SDN generation 2.0 technology provides a unified view of all physical and virtual (P+V) networking assets in the data center. By centrally programming and managing these P+V switching fabrics, operators are now able to achieve their business agility goals while significantly reducing the cost and complexity in their data centers.

With the availability of Big Switch Networks’ Switch Light™ OS on the Dell Ethernet switching portfolio, starting with the 1/10GE S4810-ON and S6000-ON series, Dell IT enterprise customers can benefit from the SDN 2.0 data center network designs.

Customers can now deploy production ready SDN controller applications starting with the Big Tap Monitoring Fabric.

The Big Switch + Dell Approach: Enabling Customer Choice & Path to SDN

Software Defined Networking is a modern controller based 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. This approach to data center networking has many implications for network design and goes hand in hand with the trend away from box-by-box technologies like spanning tree and the transition of the industry to network fabrics. It has also come to imply a hardware/software separation model between vendors that give customers far more choice than they previously had.

The key benefits from SDN based designs are:

- **Operational Simplification with Centralized Programmability**
- **Flexible, Scale-out Architectures**
- **Expanded Choice from Hardware / Software Separation**

Data center operators have been demanding the features of SDN, but the lack of a multi-phase, low risk migration strategy has been a barrier to widespread adoption.

Dell’s Open Networking strategy and partnership with Big Switch Networks is a ‘leap frog’ move to provide customers with choice and flexibility. By having SDN-ready Switch Light OS as one of options to be run on the Dell Ethernet switches at boot time, this partnership presents a graceful path to upgrade different parts of the network to SDN at different times.

Switch Light OS

Switch Light OS is a complete SDN operating system for physical Ethernet switches, and is based on Open Network Linux (ONL), an open source effort within the Open Compute Project.

Leveraging the emerging industry standard Open Network Install Environment (ONIE), Switch Light is designed with customer choice and migration in mind. On switch startup, a user can opt to boot up either the Switch Light OS from Big Switch Networks, traditional networking OSs from Dell or its partners or a hardware diagnostic OS. There are no hardware or cabling changes required to go between SDN controller-based and traditional box-by-box networking designs – a simple, low-risk migration path to Software Defined Networking.

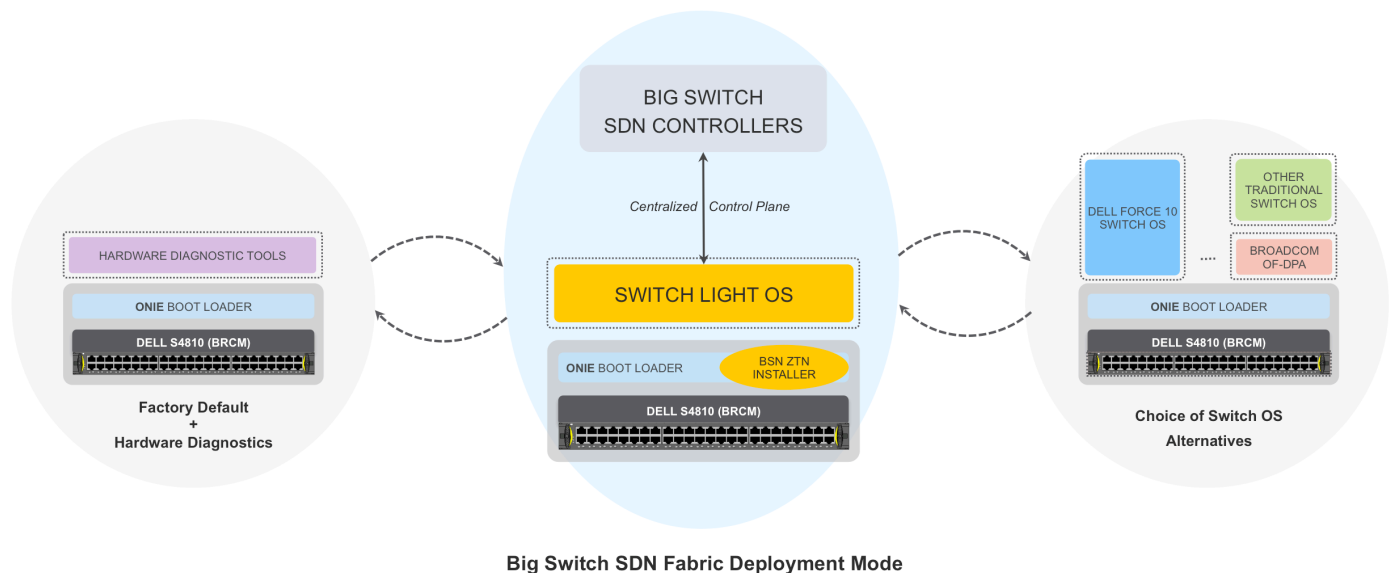


Figure 1: Low Risk Migration Path to Software Defined Networking

Big Tap Monitoring Fabric: Practical Entry Point for Software Defined Networking

Big Tap Monitoring Fabric is an advanced network monitoring solution that leverages high-performance Dell Ethernet switches to provide the most scalable, flexible and cost-effective monitoring fabric. Using an SDN-centric architecture, Big Tap enables tapping traffic everywhere in the network and delivers it to any troubleshooting, network monitoring, application performance monitoring or security tools.

Traditional Network Monitoring Challenges

Network monitoring is a critical function for debugging, monitoring performance, and enforcing security compliance in all networked environments. While network monitoring is a powerful tool, it is underutilized in the average network due to the excessive cost to deploy and the inflexibility of managing at scale using conventional monitoring architectures. Network monitoring aggregation tools known as “network packet brokers” (NPBs) have been brought to market to address some of these challenges. These single box devices multiplex ports coming in from taps to ports going out to tools, but they still present significant flexibility and scalability challenges. To complicate things further, the migration of networks from 1Gbps to 10/40Gbps (and 100Gbps on the horizon) creates further scalability challenges and introduces unnecessarily high implementation costs for the security and monitoring tools trying to ingest data at these rates.

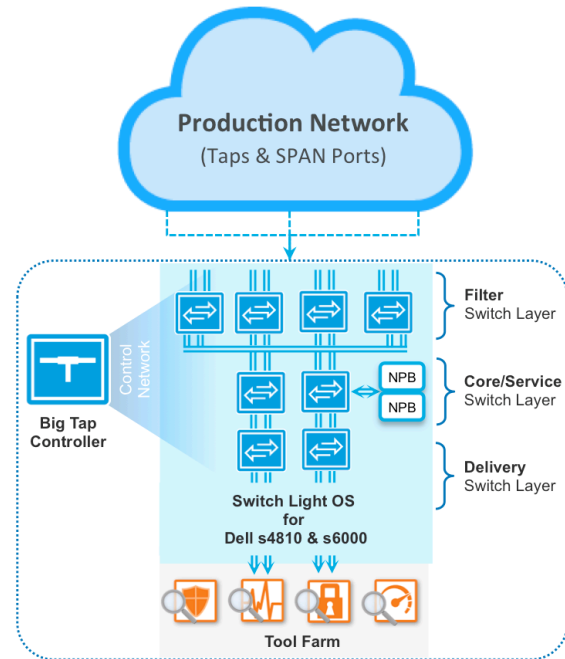
SDN Approach to Network Monitoring

The Big Tap Monitoring Fabric is designed from its inception to address the challenges with current monitoring solutions. The fabric solution features SDN design principles using high performance Dell Ethernet switches, delivering advanced monitoring functionality at ultra-low price points. Some of the key features and benefits include:

- Network-Wide Visibility – Any Tap to Any Tool at Any
- On-Demand Monitoring-as-a-Service with Multi-tenant Tap & Tool Sharing Capability
- Operational Simplification with Centralized Programmability (REST APIs)
- Significant Cost Savings – Through Opex & Capex savings when compared to NPBs

Big Tap Fabric Architecture

At the core of the Big Tap monitoring fabric is a centralized Big Tap Controller software that compiles user-defined policies into highly optimized flows that are programmed into the forwarding ASICs Dell Ethernet switches running production grade Switch Light™ SDN Operating System.



A typical Big Tap Monitoring Fabric design has a layer of Ethernet switches labeled as “filter” switches and a layer labeled as “delivery” switches. Most switch interfaces in the filter-switch layer are wired to passive optical taps or switch/router/firewall SPAN ports in the production network and are configured as “filter interfaces” in the Big Tap controller software. Switch interfaces in the delivery-switch layer are wired to tools and are configured as “delivery interfaces.” Filter interfaces (where packets come in to the fabric) and delivery interfaces (where packets go out of the fabric) represent the primary functions of the Big Tap Monitoring Fabric. In smaller deployments, it is possible to have filter interfaces, delivery interfaces as well as service interfaces on the same switch. In very large designs (500+ ports), an intermediate layer of switches known as the “core” layer can be added to increase bandwidth and scale.

About Dell

Dell Inc. listens to customers and delivers innovative technology and services that give them the power to do more. For more information, visit www.dell.com.

About Big Switch Networks

Big Switch Networks is the Bare Metal SDN company. The company's SDN Fabric solutions embrace industry standards, open APIs, open source and vendor-neutral support for both physical and virtual networking infrastructure. Big Switch Networks SDN Fabric solutions support a broad range of networking applications, including Unified Physical + Virtual (P+V) Cloud Switching and Monitoring. For additional information, follow us @bigswitch or visit <http://www.bigswitch.com>