Software Defined Networking (SDN)

Your Route to Agility, Accuracy and Availability

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About the Author

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As President and Chief Executive Officer of Net Optics since 2001, Bob Shaw is responsible for conceiving and implementing corporate vision and strategy to position Net Optics as the leading provider of intelligent access and monitoring architecture solutions in both physical and virtual environments. Under Shaw's guidance, Net Optics has achieved consistent double-digit growth, launched more than 35 new products, acquired over 8000 customers, and expanded its global presence in over 81 countries. The company has been included in the elite Inc. 5000 list of highest performing companies three years in a row; won Best of FOSE honors; received the coveted Red Herring Top 100 North America Award for promise and innovation, the Best Deployment Scenario Award for Network Visibility, and many other accolades. Shaw's leadership experience spans startups to Fortune 200 organizations, where he held Senior Vice Presidential executive positions. Shaw earned both a Bachelor of Arts degree in Business and a Bachelor of Science degree in Economics from Geneva College in Pennsylvania.

Software Defined Networking: Your Route to Agility, Accuracy and Availability

Ever since the network was born, business has been seeking better ways to handle and control it. Now, the search for a technology that delivers accuracy and streamlines network functions has produced Software Defined Networking (SDN). This ingenious approach decouples network control to a software application and separates the control plane of a switch from the data plane. The result has been improved flexibility, visibility and agility across the enterprise. With its obvious advantages, it's no wonder that SDN is generating high interest and commitment from major vendors. Research firm IDC expects the global SDN market to reach $2 billion by 2016.

In this eBook, you'll find out the basic properties and components of SDN and how they operate within and outside the cloud. We will also examine the potential impact of SDN developments in networks, data centers and the host company itself.

SDN—Advanced, Next-Generation Networking

SDN represents a new paradigm in networking that opens the door to advances in security and monitoring. Previous to SDN, when a packet arrived at a switch, a routing/forwarding protocol that is part of the device's proprietary firmware guided the forwarding of that packet, treating all packets essentially alike. Now, SDN separates the act of moving packets around the network (data plane) from the integrated management protocol (control plane). Another way to think of it is that it moves the management and configuration of network routers and switches from hardware into a software controller application.

SDN gives network architects tighter control over the network traffic flow than ever before. They are now able to differentiate among packets and forward them with superior precision.

Decisions of where to send the next packet are made not by static protocols but by agile, flexible and responsive external applications, all from a centralized console.

Administrators can change rules to prioritize or even block packets, which is particularly beneficial in the cloud or multi-tenant environment. They can manage traffic loads economically using off-the-shelf switches and handle switching across multi-vendor hardware and ASICs.

This capability also benefits cloud-based Infrastructure as a Service (IaaS). One of SDN's most useful characteristics is its ability to automate the provisioning and delivery of new services. It can also be used for additional purposes such as automating monitoring applications. Superior visibility allows an administrator to view the network in its entirety. All in all, rather than a static network that can only be controlled by the proprietary protocols of a specific vendor—which often limit visibility—SDN allows for experimentation in optimizing and configuring network functions. Additionally, SDN's versatility allows its employment in a wide range of hardware devices.

One Desktop Does it All

With companies constantly seeking new ways to control and automate, its no surprise that SDN is attracting attention from smaller businesses and technology giants alike. By centralizing control of network traffic from a single console, SDN strengthens and reinforces the administrator's hand. This approach obviates the need to manually access a hardware device such as a router or switch to change the amount of bandwidth they need for a particular site.

Giants such as Alcatel-Lucent and Cisco have pounced on SDN to streamline planning, configuring, managing, performance verification and billing accuracy. The growing momentum of SDN adoption is driven by IT administrators, who always need new ways to provision applications and services. SDN can help speed and automate routine data center functions and implementations, such as enabling a company to automatically allocate bandwidth for overnight backup.

Virtualized data centers present unique security challenges. SDN technology brings much-needed agility to their tasks of deployment and processing. This agility supports progress in operations quality and in attaining reliable security. It lends itself to a multi-tenanted cloud environment and helps to expand the infrastructure.

WHAT THE INDUSTRY LUMINARIES ARE SAYING

"Software Defined WAN can result in higher performance, higher network utilization and higher stability of the network."

Google

"SDN and OpenFlow-based networks have been proven to provide flexible Global-IP-Address assignment; 60% reduction of Global-IP-Address; x2 customers capacity; 100h/week reduction for service delivering."

Google

"SDN is a framework and it's very disruptive. It's sort of a radical change in how we do networking."

Verizon

"SDN can reduce CAPEX by use of commodity hardware and reduce OPEX through automation."

NTT

OpenFlow and NETCONF: the Foundations of SDN

OpenFlow is the most developed programmable network initiative, and 80% of survey respondents are including it in their purchase considerations.
Infonetics Research

Many SDN implementations are built on an open standard called OpenFlow. It's OpenFlow that gives the network administrator the wherewithal to remotely control routing and switching tables. In addition, NETCONF is a protocol designed to "install, manipulate, and delete the configuration of network devices." NETCONF provides the capabilities to edit and query network configuration, based on Extensible Markup Language (XML)-based data encoding.

OpenFlow is the communications interface between the control and forwarding layers of an SDN architecture. This open standard and communication protocol permits direct access to, and manipulation of, the forwarding plane of network devices such as switches and routers, both physical and virtual (hypervisor-based).

As the ultimate SDN enabler, OpenFlow lets researchers run experimental protocols over networks which are in daily use. The protocol may also be added to commercial Ethernet switches, routers and wireless access points. OpenFlow does not require exposing the internal workings of network devices and is accepted by major vendors, with OpenFlow-enabled switches commercially available.

Basically, OpenFlow allows for the definitive decoupling of the control and data planes, which lets the software used by administrators make accurate forwarding decisions among packets passing through a network. If a network administrator wants to control how switch ports are mirrored to Intrusion Detection Systems, Intrusion Prevention Systems or Data Loss Prevention Systems, OpenFlow can deliver this functionality as well.

Centralizing the control plane lets administrators acquire new capabilities in bounded sections of the network that do not have an impact on the rest of the architecture. Now they have the freedom and flexibility to introduce new applications without the inconvenience and complexity of configuring individual devices.

IT pros who've implemented or plan to have SDN think it will boost network utilization and efficiency (42%), automate more provisioning and management (35%), and improve security (32%).
Jim Metzler

OpenFlow Is the Smart Solution for Evolution

SDN via OpenFlow revolutionizes and expands the capabilities of networking architecture and provides key benefits to the ever-changing data center. With rapid innovation and experimentation now possible through software control, OpenFlow offers the flexibility to combat current and future network problems. Not only are there more choices regarding new applications, but more vendor markets are also made accessible. Evolving from a hardware-based to a software-based networking architecture opens up options for network operators to select different vendors for the control and data planes.

In addition, SDN's division of the planes works to lower both CAPEX and OPEX costs while simplifying management complexity. In operation, OpenFlow permits the path of network packets to be determined by software running on two or more routers.

Separating control from the forwarding function informs traffic management beyond routing protocols or access control lists. With SDN, the administrator can set "if…then" rules to guide forwarding actions in various situations—or simply send the packet to the normal switch processing destination. If a packet matches no rules in the flow table, it's sent to the controller for a decision, such as including new flow rules to the switch telling it how to handle that type of packet.

This arrangement can temporarily slow performance, but once a flow rule is created and saved, future packets travel with little delay.

NETCONF Is the Enabler

NETCONF is a protocol that provides the ability to modify a networking device's configuration. It differs from OpenFlow in that OpenFlow lets a user modify the forwarding table. To reconfigure a device, one uses NETCONF; to acquire a new function, users can directly modify the forwarding plane by using OpenFlow.

NETCONF can allow a user to install policy-based route maps and support devices from multiple vendors. The NETCONF controller can also embody vendor-specific information. Both NETCONF (for configuring existing software running in networking devices) and OpenFlow (to add new functionality where needed) are necessary in an SDN configuration. Using NETCONF, an administrator can install route maps on policy-based routing, for example, but installing the same entries via OpenFlow may be easier, as well as device- and vendor-independent. Configurations and changes made by NETCONF can be saved, while OpenFlow-created entries are temporary and don't appear in device configuration. They are also lost on device reload or link loss.

The flexibility allowed by OpenFlow in an SDN implementation lets a security engineer try out tactics such as rearranging data paths on the network to gain visibility, or experiment with ways to detect and shape malicious traffic. Of course, this flexibility of control can also make for errors and unintended outcomes in configuration, but that's the beauty of experimentation: learning and growth.

SDN and Net Optics: The Need for Superior Access and Visibility Drives a Partnership

SDN technology moves the management and configuration of network devices out of the hardware and into software. As networks expand and cloud computing adds complexity, SDN provides greater control and a sophisticated platform for new applications. Business benefits include saving employee time in deployment and managing, plus the ability to shop among vendors for an advantageous relationship, rather than remaining in the hands of only one vendor.

The pre-SDN network was static and proprietary, with vendor-specific protocols determining (and limiting) control. Visibility into Layer 2 devices was confined to the network edge or to random monitoring of data that was easily viewable.

Visibility increasingly became an issue as applications grew more diverse and devices that accessed or hosted these applications grew more pervasive. For now, and going forward, visibility is critical to obtaining accurate information about the state of the network and the threats it faces.

Nine out of Ten network security vendors will support OpenFlow by 2014.
Gartner

The Advantages of SDN Are Available Now

Net Optics SDN comprises a risk management and mitigation plan, an SDN controller, Network Packet Brokering (NPB) and access devices, plus the customer's own security tools and instrumentation. The goal is for customers to be able to react to threats and changes with agility and accuracy.

Net Optics solutions, which use the same merchant silicon that is employed in routers and switches, already work on the same principles as SDN. Packet forwarding is determined by policy (a.k.a. "filters" in Net Optics parlance) and not according to static routing protocols. In fact, Net Optics has always worked to ensure that different routing protocols do not interfere with their packet filtering.

Net Optics is adding even more options to control and program filters remotely, allowing customers to create their own controllers and forward traffic within their networks as needed.

As applications diversity increases, and the devices that access or host them spread to every corner of the organization, visibility must become a core function, part of every network architecture. Net Optics' mission for its customers is to enable a total, comprehensive view of the network—every bit and every stream—without performance degradation. We want our users to be able to connect any security tool to an always-on network; to support any load; and to scale as needed. This adds up to a secure, productive and healthy network based on the SDN model.

We interviewed enterprises for our new data center and SDN survey.
Infonetics Research

1/4 deployed SDN technology in their data centers.

1/3 plan to do so by the end of next year.

Sources:
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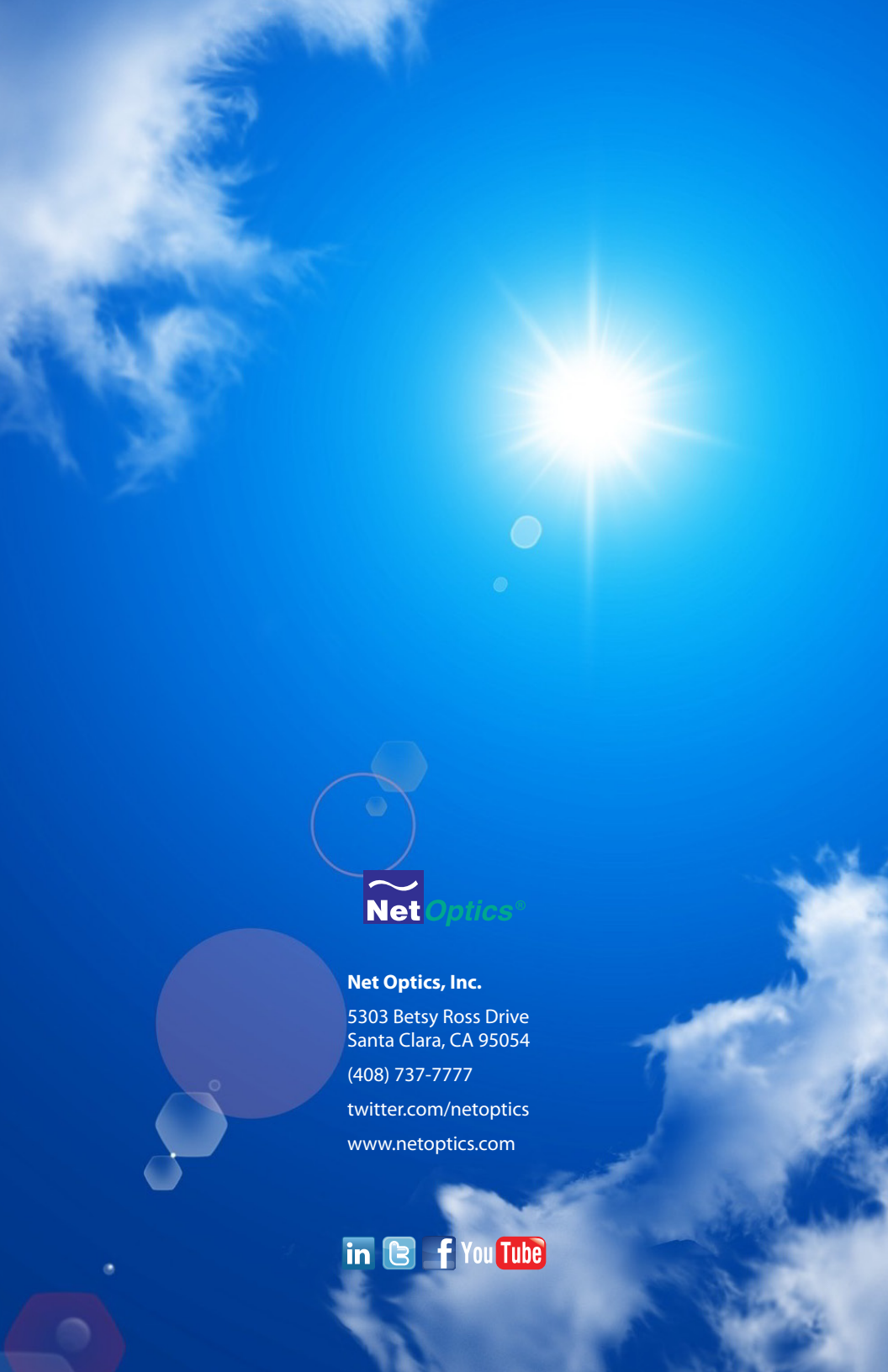

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