



Forecast: sizing the software-defined networking market

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Cloud

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Introduction: sizing the SDN market

There is no question that the software-defined networking (SDN) arena is a hotbed of new ideas, well-funded startups, and established vendor SDN architectures. However, there is a significant question about how much future revenue the SDN market can create. VMware's \$1.2 billion acquisition of Nicira (an SDN startup with minimal current revenues) speaks volumes about the potential market size. Relatively small revenue streams in 2012 show that SDN needs to increase its acceptance to truly impact the broad IT market.

This report focuses on the market for the enterprise adoption of SDN. This includes businesses of all sizes and SDN implementations in their branch, campus, and data center networks.

There are two big challenges with regard to forecasting the enterprise market for SDN:

- How quickly and for what applications will business customers adopt SDN products?
- What products (hardware, software, and services) are included as part of an SDN market?

This report tackles the key issues with regard to SDN taxonomy, forecast assumptions, and market segmentation. This report does not address the related topic of software-defined networks (SDN) in the telecommunications network, with the exception of communications service providers (CSPs), which need to transform their data centers and data center networks.

Methodology

This report utilizes public sources of information on the SDN, network, and IT market, including company websites, standard bodies (e.g., ONF), financial reports, and other publicly available information. Analysis is derived from interviews with most of the current providers of SDN technologies including incumbent network and IT vendors and SDN startups. SDN use case information is leveraged from information on leading-edge SDN users. The SDN forecast is derived from consensus analyst forecasts on related segments of the network equipment market (e.g., ethernet switches and routers) and forecasts of public and private cloud adoption.

Defining the SDN taxonomy

The first challenge of sizing any market is defining what is and what is not included in the market. For some markets (e.g., PCs), this is relatively straightforward. For SDN, definitions are complex and evolving. For example, everyone includes OpenFlow controllers as a part of SDN, but they tend to disagree on most everything else.

Definition of software-defined networks

Defining what is included as SDN technology is critical to the discussion of market size. The SDN market is in its early stages (under \$100 million in 2012), and the market buzz around SDN can lead to confusion.

The basic definition of SDN, as defined in [a 2012 GigaOM Pro report](#), is:

1. Separation of control and data plane. This is when the intelligence of the switch or router is split from the packet-forwarding engine. Typically control will be handled centrally while data transport will be distributed.
2. Programmability, or the ability to centrally change traffic flows, partition the networks, provide application level quality of service (QoS), and improve network flexibility.

Additional capabilities that generally describe SDNs:

- Network intelligence that is centralized in software-based SDN controllers, which maintain a global view of the network. This centralized control with knowledge of the entire network topology is designed to improve network management and operations and reduce opex.
- The ability to be programmed via open APIs
- The ability to perform at scale (e.g., hyperscale data center) dynamically
- The network can be segmented (virtualized) to separate different traffic types or customers, each of which can be dynamically managed as to prioritization, security, and reliability

SDNs can be either standards-based and multivendor (for example, OpenFlow) or unique to a particular vendor.

SDN vendors and products

What follows is a partial list of the vendors and products considered to be part of the enterprise SDN market for the purpose of this report, including both established players and startups.

Table 1. Established vendors (acquisitions in bold)

Cisco Open Network Environment (ONE)	IBM distributed overlay virtual ethernet (DOVE)
VMware (Nicira)	Dell virtual network architecture (VNA)
HP Virtual Application Networks (VAN)	Extreme Networks (OpenFlow)
Juniper (Contrail Systems)	Avaya Application Development Network (ADN)
Brocade (Vyatta)	NEC (ProgrammableFlow)
Arista (EOS)	

Table 2. Startups

Adara	Pertino
Big Switch	Pica8
ConteXtream	Plexxi
Cumulus Networks	PlumGrid
Cyan	Vello Systems
Embrane	vArmour
LineRate	Midokura

Leading SDN use cases in the enterprise

There are a number of leading use cases that will drive the adoption of SDN in the enterprise, including in the public cloud and private cloud and with WAN, network slicing, network management, network security, and low-latency networks.

Public cloud

Public cloud data centers are the leading target market for new SDN technologies due to the following network characteristics:

- The need to support VM migration and rapidly spin up new workloads
- Massive scale
- Multitenancy
- Largely greenfield deployments

For example, Facebook, Zynga, Google, NTT, Rackspace, eBay, and Amazon are all implementing SDN technologies in their data centers.

Private cloud

Although this trend is in its early stages, the use of SDN to enable private cloud deployments will be a key application. Like the public cloud use case, enterprise-IT organizations deploying private clouds have the need to rapidly spin up workloads and migrate applications and VMs across network boundaries and possibly for multitenancy.

Wide-area networks (enterprise)

The programmability and traffic-prioritization capabilities of SDN offer enterprises opportunities to improve the management of their private wide-area-network traffic. For example, large enterprises and

cloud service providers need to send large amounts of traffic among their remotely located data centers. Many vendors are focusing their SDN efforts to optimize WAN traffic, including Cisco, Juniper, Adara, Pertino, and Vello Systems. Google has leveraged SDN to reduce costs and to improve the manageability and availability of its WAN.

Network management

Increases in the size of networks (e.g., hyperscale data centers) have increased the complexity and challenges of managing the network. SDN significantly improves the programmability of the network. This improvement in programming capabilities will allow for new application software to relieve the network administration burden. SDN can improve network operation via the automation of configuration and other management tasks. Via automation, SDN could help to eliminate configuration errors — a key problem for network administration.

Network security

Securing the network continues to be one of the most vexing challenges for IT, networking, and security professionals. SDN can improve network security by enabling security policies to logically follow a specific application or VM. SDN offers improved automation that allows IT managers to create security policies that follow VMs and applications wherever they physically reside. In the future, the centralized intelligence brought by SDNs will help to actively monitor traffic, diagnose threats, and mitigate security challenges. Examples of SDN vendors active in this space include Cisco, Juniper, Embrane, and vArmour.

Network slicing

Among the early adopters of SDN are a number of major universities, including Stanford and Indiana University. Major universities see the benefit of being able to virtually slice their network. For example, a specific research project can be given its own isolated piece of the network. This network slicing will also appeal to a broad range of R&D labs and companies that need to experiment with applications that require a high-performance network.

Ultra-low-latency networks

Financial institutions have been at the forefront of enterprise network designs, as their real-time trading applications require very low latency. SDN can enable financial institutions to accelerate the delivery of information to their customers. Other enterprises that are highly dependent on the speed and scale of their network can also benefit from SDNs, including retail organizations with highly distributed locations and large manufacturing organizations.

Sizing the enterprise SDN market: What is included?

This section discusses the nuts and bolts of what segmentations and technologies are included in the enterprise SDN forecast, including hardware, software, and services.

SDN software and applications

SDN software can either be control (operating system) layer software (e.g., OpenFlow) or applications that run in an SDN environment. SDN software is software sold separately from the underlying network hardware. Sales of SDN software will in some cases drive sales of dedicated servers as the hardware platform.

Examples of SDN software include the following:

- OpenFlow controller software
- Big Switch Big Network Controller
- Nicira NVP
- LineRate LROS
- Midokura MidoNet
- Vyatta
- Embrane
- Adara

Additional SDN software revenues are derived for adjacent markets, including network management, network security, server load balancers, WAN optimization, and other Layer 4-7 services. This software leverages the SDN control layer to provide SDN-related management, security, and/or Layer 4-7 services. Overall, the software-based enterprise network management market exceeds \$1 billion.

Many SDN startups are active in the Layer 4-7 services area, including Big Switch, Nicira, Embrane, Kemp, and vArmour. Traditional suppliers of network security and Layer 4-7 services, including F5 Networks, Riverbed, Cisco, Juniper, IBM, HP, Blue Coat, Citrix, and Silver Peak Systems, are starting to offer SDN-capable software products, which will add to the overall SDN software market.

Network hardware

Network hardware is the most challenging part of forecasting the size of the SDN market. This sizing is straightforward for new network equipment optimized to run SDN (e.g., OpenFlow) protocols. For example, Pica8 is leveraging merchant silicon to offer ethernet switches optimized to run OpenFlow. Cumulus Networks will also offer SDN-optimized switch products.

The key question is how to size sales of traditional network infrastructure as enterprises migrate to a hybrid SDN (SDN overlay) environment. In this case, SDN is an abstraction market: The value of SDN hardware is abstracted from the overall market (which is over \$20 billion) for enterprise ethernet switches and routers.

Dedicated server hardware revenues generated by sales of SDN control layer software are also counted in the hardware category.

Services

Opportunities for SDN services fall into two buckets: professional services and support services. Professional services are offered to enterprise customers to plan, build, migrate, and operate SDN technologies either in a greenfield installation or for the migration of an existing traditional network. Support services are services offered to manage and maintain an SDN product.

Services organizations that aren't part of a small group of experts inside the SDN vendor community will have to get up to speed on the various SDN technologies and best practices for implementation. This lag in SDN expertise in the third-party services community will limit the size of the SDN services market in the near term.

The market size per year for professional and support services can range from 10 percent to 25 percent of the underlying SDN hardware and software market.

Segmentation of the enterprise SDN market

Beyond the traditional categories of hardware, software, and services, the enterprise SDN market can be segmented by categories such as place in the network, technology, verticals, and geography.

Place in the network

The term “place in the network” refers to the location of the SDN equipment or software in terms of data center, campus LAN, campus WAN, or branch office. The largest proven SDN use case is for deployment in the data center, either as part of a public cloud service provider (e.g., Google, Amazon, or Verizon) or as part of an enterprise private cloud. Public cloud providers are clearly at the leading edge of SDN deployments, and they have the IT resources to get the most out of SDN technologies. The financial services industry has the most interest in SDN deployment for its private cloud infrastructures.

While the data center use case will be the largest driver of SDN revenues during the next five years, SDN use cases extend to the campus LAN and WAN. Universities and research institutions are deploying SDN for network slicing and improved traffic management. Branch office deployment of SDN will lag the other places in the network.

Technology segmentation

The value of the SDN market can be segmented by all the traditional categories of network equipment, including ethernet switches, routers, network security, server load balancers, WAN optimization, and network management.

While SDN creates a new market for networking software, it also relates to and is derived from the traditional network market segment. At over \$10 billion, the largest traditional network segment is ethernet switches, followed by enterprise routers and network security.

Vertical segmentation

In terms of industry segmentation, the largest buyers of SDN in the near term will be public cloud service providers (e.g., Google, Amazon, and Verizon) deploying SDN to optimize their data center operations.

The largest traditional vertical adopter will be financial services. The education vertical (mainly large universities) will be an early adopter, but revenues of the education sector will be limited. Other verticals that will drive SDN spending during the forecast period include retail, manufacturing, government, and health care. In general, the more a given vertical sector depends on its network to deliver services (either to customers or for internal IT operations), the more likely it will be to deploy SDN.

Geographic segmentation

As with most leading-edge IT technologies, SDN will first be adopted by leading-edge buyers in North America. Japan, led by research and adoption by NTT, is also a leading SDN adopter. SDN adoption will follow in Western Europe, China, and other technology-leading countries.

Impact of the channel on the forecast

SDN technology suppliers can make initial SDN sales to large cloud hosting providers, financial institutions, and other leading-edge enterprises. However, to reach the other 80 percent of the market, vendors must enable their channel partners to sell SDN to small and mid-size enterprise organizations. The effectiveness of the channel to sell SDN to a broad market audience is a key factor in determining the size of the SDN market in the upcoming three-to-five-year period.

Current state of the market

We are in the very early days of SDN. Current deployments are at the bleeding edge in resource-rich public cloud data centers and research universities. The overall market size (as defined in this report) was less than \$100 million in 2012 for SDN network equipment, software, and services. Many of the SDN vendors (both incumbents and startups) currently have only a handful of paying customers, with many more in trials or in the evaluation stages. The year 2013 will be when 100 or so leading-edge buyers get hands-on experience with SDN and start to better understand the use cases and financial justifications for SDN deployments. The period between 2014 and 2018 will see a much broader adoption of SDN, driven by the improved maturity of SDN products, the development of an application ecosystem of SDN software, and the improved ability of the channel to sell SDN to small and mid-size businesses.

Forecast assumptions

The forecast of enterprise SDN revenues relies on the following assumptions:

- Initial SDN adoption will be driven by large, hyperscale networks and data centers in the cloud service provider's infrastructure.
- SDN use in the data center will be the primary use case during the forecast period.
- IT adoption of public cloud services will continue its strong growth over the next five years. For example, GigaOM Research forecasts that the global market for cloud computing will increase from \$70 billion in 2011 to \$159 billion in 2014.
- Growth in enterprise adoption of private cloud data centers will increase the need to change the underlying network to SDN technology.
- SDN startups will continue to have good access to funding to develop innovative SDN technologies and broaden the potential use cases of SDN in the enterprise.
- The SDN market will develop an ecosystem of management, security, and application software that improves SDN ROI and increases overall SDN revenues.
- Dominant IT providers such as IBM, HP, Dell, NEC, Cisco, and others will incorporate SDN as a standard offer in their data center solutions.
- Enterprise use cases such as network segmentation, WAN traffic management, network management, and network security in aggregate will be a significant part of the SDN market at the end of the forecast period.

- Professional and support services provided by SDN vendors as well as IT services firms will strongly add to the SDN market by 2018.
- Sales of SDN technology by the network and IT channel will be critical to the broad adoption of SDN beyond leading-edge enterprise and cloud service providers.

Challenges to adoption

As with most new technologies, SDNs come with significant barriers to adoption. The IT community faces the following challenges to SDN adoption:

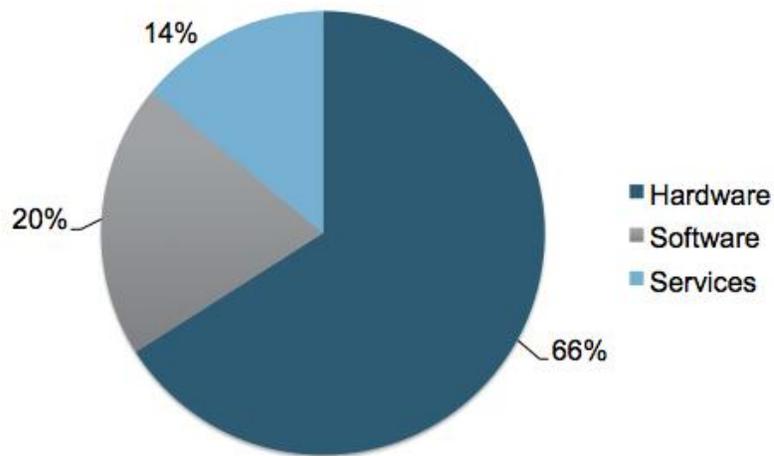
- Immature standards
- Lack of interoperability
- Lack of tools
- Need for training
- Legacy migration

The SDN forecast assumes that these challenges to SDN adoption will be gradually overcome during the next five years.

Worldwide enterprise SDN forecast

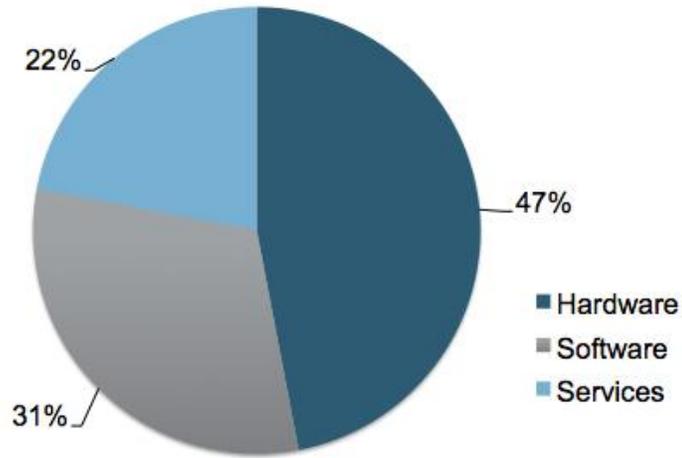
Doyle Research and GigaOM Research predict that the enterprise SDN market (as defined by this report) will reach \$320 million in 2014 and grow to \$2.45 billion by 2018. This growth will be driven by the increased use of SDN technologies to improve enterprise network operations in the data center, WAN, campus, and branch. Networking hardware (Layer 2-7) will remain the largest market segment, representing 66 percent in 2014 and declining to 47 percent in 2018 as SDN software and service revenues increase significantly.

Figure 1. 2014 total market: \$349 million



Source: Lee Doyle/GigaOM Research

Figure 2. 2018 total market: \$2.45 billion



Source: Lee Doyle/GigaOM Research

SDN market opportunities

SDN technologies offer IT and network professionals the ability to significantly transform their enterprise networks. SDN offers improved business value by reducing operational costs and improving network agility. It is early days for SDN adoption in the enterprise. Leading-edge users such as cloud service providers, universities, and financial-services firms are starting to see the benefits of SDN.

As the SDN market matures, the technology will coalesce around a few specific standards and market leaders. The SDN platform will enable a broad range of SDN applications including network management, network security, and WAN optimization. Network and IT channels will get up to speed on SDN technologies and provide the feet on the street to drive SDN sales beyond leading-edge users.

As the SDN market grows, it will offer substantial business opportunities for a wide range of providers of SDN network equipment, software, and services. Doyle Research forecasts that the worldwide market will grow from under \$100 million in 2012 to over \$2.4 billion by 2018.

About Lee Doyle

Lee Doyle is a principal analyst at Doyle Research. Doyle Research provides targeted analysis on the evolution of intelligent networks: SDN, opex, and COTS. Doyle has over 28 years of experience analyzing the IT, network, and telecom markets.

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