Juniper Networks Decouples Junos from Its Switching Hardware

Juniper Decouples Switching Hardware and Software

At its NXTWORK 2015 customer summit on November 3, Juniper Networks announced that it will decouple hardware and software across its entire line of enterprise network switches, starting with its new top-of-rack QFX5200. Juniper is fully embracing bare-metal switching. It will its highly-regarded Junos operating system (OS) and its hardware as separate products, and network operators will have three general options: They can run Juniper hardware and software as a traditional integrated package; they can run Junos on third-party network hardware; or they can run third-party network OS (NOS) software on Juniper hardware. Juniper is also opening up Junos to additional customization and programmability by providing network operators with access to the Linux kernel that Junos runs on. This access will allow engineers to install third-party software on switches powered by the NOS.

Junos Is Now a Highly Programmable, Bare-Metal Network Operating System

Juniper's decoupling of hardware and software is a response to a small but growing number of data center operators that have forced network infrastructure vendors to rethink the economics and the product engineering philosophies of their industry. By adopting bare-metal and white-box switches in their data centers, these operators are challenging the vertically-integrated approach that leading original equipment manufacturers (OEMs) of network switches have followed since before the turn of this young century. With bare-metal switches, network hardware and software is disaggregated, which gives data center operators more choices for how they procure and engineer their networks.

This disaggregation provides a number of advantages. First, the ability to run third-party NOS software on low-cost white-box switch hardware offers potential savings on capital expenses. Disaggregation also allows network operators to choose NOS software that fits their specific use cases and operational philosophies. For instance, if an organization operates a DevOps data center with unified server and network management, the network operator can choose a NOS with an exposed Linux kernel that can be managed by the same Linux tools that the operations team uses to manage its servers. Furthermore, without the one-size-fits-all feature set that characterizes vertically integrated switches, organizations can reduce the risk of software bugs and vulnerabilities because the underlying code base is more streamlined. Bare-metal switches also allow for more rapid iteration of software, which gives network operators quicker access to new features and functions.

Juniper is one of three mainstream switching OEMs that have embraced bare-metal switching. However, Juniper's approach is significantly different than that of the other two: Hewlett-Packard Enterprise (HPE) and Dell. Selling hardware that can run third-party NOS software developed by partners like Pica8, Cumulus Networks, and Big Switch Networks, HPE and Dell are focusing on the hardware aspect of bare-metal switching. In contrast, Juniper has chosen to differentiate itself in software. Over the last 18 months, the company has re-engineered Junos to be a bare-metal switch NOS.

Juniper has evolved Junos from a monolithic system to a modularized software stack that resembles a hypervisor host. The core network functions of the NOS now run as a guest Junos virtual machine (VM) on a Linux kernel with a hypervisor. Meanwhile, Juniper has broken out the hardware platform

management capabilities of Junos and packaged them as a Linux container now known as Juniper Device Manager. This allows the network functions of Junos to operate separately from the core platform of Junos. It also enables users to spin up a second Junos VM inside the NOS, which enables in-service software upgrades.

Perhaps more significantly, Juniper has exposed the Linux kernel in Junos so that third-party software can run as guest VMs on it. This third-party software can operate as co-resident applications with the Junos VM. Or software developers can leverage a REST application programming interface (API), Thrift APIs, Netconf, or SSH supported in Junos to fully integrate the application with the switch software. For example, without API integration, agent software for a DevOps automation tool like Puppet or Chef can run as a guest VM on Junos and execute basic hardware management tasks like starting up, rebooting, or shutting down the switch. With API integration, however, the agent could program automated configuration changes to the network functions within the Junos VM. It is also going to offer professional services to enable customers who want to integrate their own applications with Junos to do so.

This new version of disaggregated Junos will first be available on the new QFX5200 and gradually on other platforms. The QFX5200 is a multispeed switch series based on Broadcom's Tomahawk network chip. The QFX5200 is the first Juniper switch to support 25 and 50 Gigabit Ethernet (GbE). It is also backwards compatible with 10 GbE. The QFX5200 supports the Open Network Install Environment (ONIE), the open source boot loader that allows third-party NOS software to run on a bare-metal switch. With ONIE support, the QFX5200 will be compatible with most mainstream third-party NOS software, and Juniper advises enterprises to work with system integrators to ensure that their use of that software on the QFX5200 is successful.

At the same time, the new disaggregated Junos software will run on any third-party bare-metal switch that supports ONIE, which means that enterprises will have the option to use Junos on white-box hardware sourced through low-cost original design manufacturers (ODMs).

Regardless of whether network engineers wish to delve into bare-metal switching, they will experience some changes to how they procure Juniper switches. The company will be offering separate hardware and software SKUs for all its switches, whether the hardware and software is disaggregated or not. The majority of Juniper users, who will prefer to continue buying their network equipment as vertically integrated products, will just purchase the hardware and software as two separate line items.. However, Juniper is not removing anything Junos. Disaggregated or not, Junos will continue to have offer the same feature set, only now it will be modularized to combine high-performance networking with the flexibility, functionality and power bare-metal switching. Juniper will offer perpetual and annual subscription licenses for Junos, with three initial pricing tiers for the software A basic Junos license will contain all the functionality an enterprise will need in a generic top-of-rack data center switch. The other software tiers, for which details are forthcoming, will ship with advanced features like BGP and MPLS.

EMA Perspective

Bare-metal switching isn't for everyone, but the demand is significant enough that Juniper is one of three networking vendors to offer solutions in this segment of the market. For years, webscale companies like Google have custom-built disaggregated switching hardware and software to meet the exacting networking requirements in their data centers. Such companies maintained a small army of engineers not only to design this technology but also to develop software that could manage it. Mainstream enterprises had neither the need nor the expertise to emulate this approach to networking.

Things changed a couple years ago, however, when Facebook introduced a bare-metal switching initiative to its Open Compute Project (OCP). An ecosystem of network hardware and software vendors has since coalesced around OCP's bare-metal switching project, making the technology more consumable by organizations that may still lack the expertise to adopt it. With a vendor ecosystem developing and

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building this technology, enterprises don't need the internal resources that a company like Google maintains to its custom white-box networks. By all measures, the appetite for this technology is significant. Last year Enterprise Management Associates (EMA) surveyed enterprises that were moving toward a software-defined data center (SDDC) architecture. EMA asked those enterprises to identify traditional data center elements that lose importance with such architectures. Twenty-seven percent said that networking hardware brand preferences were in decline.[1] Juniper is responding to this shift in the market by disaggregating its entire line of switches.

This disaggregation addresses the requirements of an emerging class of data center operators who want bare-metal switching. But Juniper's strategic shift will also benefit mainstream enterprises that have no interest in disaggregation. In the process of adapting Junos for disaggregation, Juniper has made the software more programmable and resilient. It has also shifted its pricing and licensing models in such a way that even customers who continue to procure vertically integrated switches will see some increased flexibility in how they consume and pay for Juniper products.

As Juniper expands disaggregation across its switching portfolio, enterprises that are exploring bare-metal switching should evaluate the company's technology to determine if it meets their needs. Furthermore, mainstream users of Juniper switches who have mostly ignored developments in the bare-metal switching world now have a low-risk opportunity to experiment with these concepts with a trusted supplier. Network operators who are undecided on whether bare-metal switching is appropriate for their environment should look closely at Juniper and other OEMs who are offering bare-metal offerings to determine if this new way of consuming and operating network equipment is a good fit.

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[1] EMA, "Obstacles and Priorities on the Journey to the Software-Defined Data Center," January 2014.

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