FUTURIOM
FUTURE OF CLOUD TECH

Market Leadership Brief Sponsored by JUNIPER NETWORKS

Juniper and Apstra Up the SONiC Ante

Highlights

- **SONiC is drawing enterprise and service provider interest.** The SONiC network operating system (NOS) has developed a rich open-source ecosystem, with many third parties providing support -- thereby removing the barriers to adoption for enterprise customers.

- **SONiC can accelerate digital transformation.** Cloud services require cloud-native networking that can be rapidly implemented – and SONiC fits the bill.

- **Juniper and Apstra recently extended SONiC support**, providing a uniform operational model across multi-vendor platform clusters.

- **Enterprises, service providers, and cloud operators need automated networking.** Solutions such as Juniper's Apstra Operating System (AOS) can be used in conjunction with SONiC to automate network control, management, and orchestration.

- **Futuriom believes that third-party products and services are essential to SONiC's future.** The ongoing development and improvement of SONiC depends on solutions, such as those offered by Juniper and Apstra, that can synergize SONiC's benefits.

Introduction

The network operating system (NOS) known as Software for Open Networking in the Cloud (SONiC) is part of a transformative shift underway in information technology (IT). Networking is no longer based chiefly in the enterprise or service provider data center, nor even across multiple data centers. Most businesses today rely for essential applications on a hybrid mix of geographically distributed data centers with external cloud-based services, both public and private.

This emerging IT landscape calls for scalability and performance at levels higher than ever before. It is no longer feasible for network operators to spend precious time configuring and reconfiguring multiple systems in order to achieve specific goals — or to laboriously monitor and troubleshoot those setups manually or with multiple tools.

Instead, we have entered a phase where speed and reliability across a range of physical and virtual environments is crucial to application and business success.

SONiC brings to this situation a common platform for multivendor switched networks. The NOS achieves this by using a Switch Abstraction Interface (SAI) to decouple the vendor-specific application-specific integrated circuit (ASIC) programming from the NOS control plane. SAI provides an abstracted common application programming interface (API) to program the forwarding ASICs of routers and switches in a vendor-independent manner.

When properly implemented, SONiC adds speed, efficiency, and cost savings to data center networks. These benefits are key to the widespread deployment of remote access in the wake of the worldwide COVID-19 pandemic. And in the near future, they'll be required even more as high-speed services based on 5G start to spread.

Years of focused improvement and implementation by the Open Compute Project (OCP) have made SONiC ready for enterprise use. Over the past year, enterprise adoption has grown exponentially, ensuring a place for the NOS in most router and switching fabrics for the foreseeable future.

For all of its benefits, however, SONiC poses some challenges. It has become clear that due in part to its open-source status, maximizing SONiC's capabilities requires expertise in software customization and development. And that's something that for all their capabilities, many enterprise network operators don't have — or need to have.

This is where vendors such as Juniper and Apstra have stepped up to the plate — in Juniper's case, with a solution that leverages SONiC's strengths to create reliable, predictable, and secure network fabrics with an operationally consistent interface. Customers can now extend their networks faster, farther, and more easily than they could via SONiC alone.

In this report, we examine SONiC's origins, review its fundamental advantages, and discuss how the technology can be enlisted to help streamline data center networking for a range of use cases now and in the future.

SONiC: Why Now?

The year 2020 was one of the most challenging in memory for most of us, not just personally but professionally. Work-from-home or "work-from-anywhere," not long ago the luxury of a trusted minority of employees, has become standard operating procedure. And the trend seems permanent: The worldwide percentage of remote workers is expected to more than double, from 16.4% before the COVID-19 pandemic to 34.4% by the end of 2021, according to a survey by Enterprise Technology Research (New York).

The move to remote work has accelerated what was already underway among large enterprises — namely, projects to replace large portions of on-premises, centralized IT infrastructure with more distributed environments that incorporate public, private, and hybrid cloud services.

This migration often proves challenging. “As a retailer, we’ve been investing in a technology strategy for the last four or five years,” said Pablo Espinosa, VP of engineering at Target Corp., during an online presentation on SONiC at the OCP Virtual Summit in May 2020. ”However, what that’s resulted in is a higher reliance and added complexity in a network ecosystem that is already complex in itself.”

Target decided to move to SONiC to create a simpler means of overseeing its networks — about 80% to 85% of which are now virtual — while maintaining vendor neutrality.

Target isn’t alone. As networks grow and change, SONiC ensures that even when switches are replaced, the network configuration, monitoring, and analytics remain in place. “Even if we have to change the hardware and go with other chipsets…. You don’t want your software investment to go away,” said Parantap Lahiri, VP of network and data center engineering at eBay, during the OCP presentation in May. “We wanted a platform we could continually invest in without fear that the platform would go away.”

SONiC’s advantages will only become more important as automated solutions increase and 5G networking emerges in full force. Fleets of new devices will populate Internet of Things (IoT) and Industrial IoT (IIoT) environments. The network edge — whether on premises or on a telco or cloud provider’s network — will become crucial for virtual banking, smart cities, augmented reality, vision computing, connected cars, content delivery, and other high-speed, cloud-based applications. In these environments, the importance of a vendor-neutral operational model will become even more crucial.

SONiC’s Evolution

To see how SONiC has reached its current level of popularity, it is helpful to look at its past. SONiC got its start circa 2016, when Microsoft Corp. found its Azure cloud network getting too large and complex to manage efficiently. Realizing that the underlying switching and routing elements in Azure were a major roadblock to scalability, Microsoft sought a simplified approach.

After working on the solution for months with several interested vendors and hyperscalers, including Alibaba, Microsoft in 2017 contributed SONiC to the OCP for further development as an open-source technology.

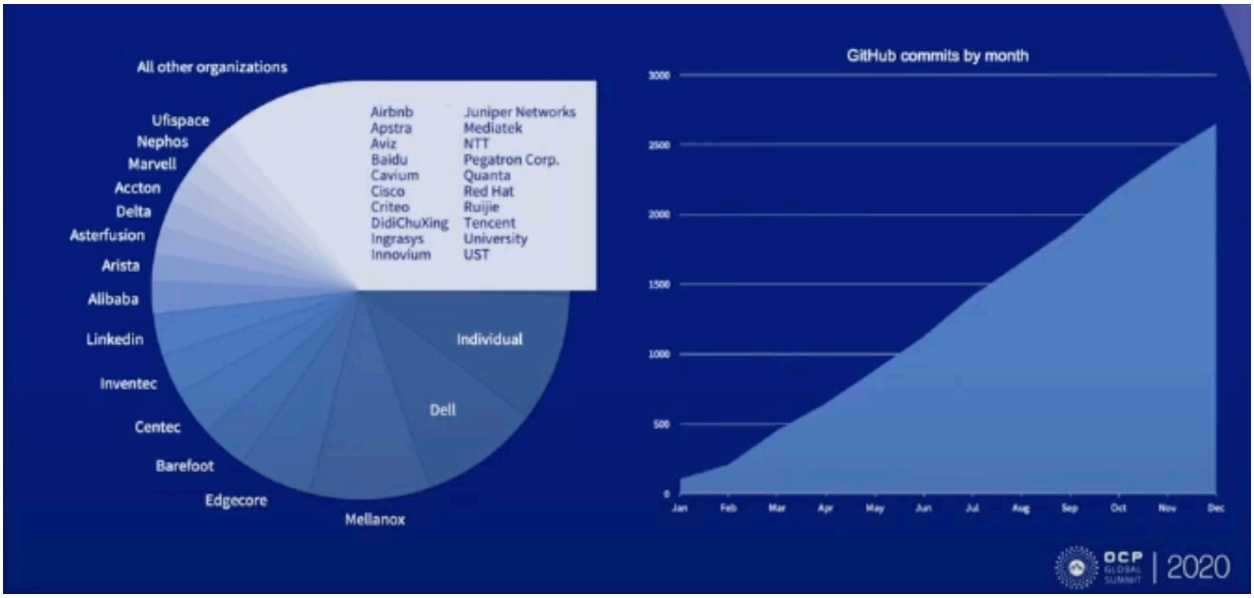
From that time to the present, work has continued on improving SONiC’s functions. The last year has seen a particular uptick in interest, as multiple enterprises and service providers have followed leading public cloud suppliers into SONiC deployment, thanks to improved support as noted below:

SONiC 2020	
Public cloud implementations	~ 10
Total worldwide SONiC Ethernet ports	~ 4 million
Top switch speed supported	400 Gbit/s
Number of silicon sources supported	10
Types of switches supported	Chassis, monolithic

Source: David Maltz, Microsoft, and OCP

Today, over four years since its inception, all of TOR and leaf layers in Azure data centers run on SONiC. Over 50 enterprises and vendors support SONiC, including at least eight companies in the Fortune 500, all of the leading router and switch companies, and all of the key data center component suppliers.

General support for SONiC via the OCP is illustrated in the slide below, taken from an OCP Virtual Summit presentation in May of 2020 by David Maltz, a Distinguished Engineer at Microsoft:



Source: David Maltz, Microsoft, and OCP

This ecosystem has produced products, toolkits, code, open-source software, and several vendor-supported products, including the most recent release of Juniper's Apstra Operating System (AOS). Use of these tools has helped put SONiC through its paces and fostered confidence in the technology among large enterprises. Besides Target and eBay, these include Comcast, Criteo, and T-Mobile, to name just a few.

Work on SONiC continues. A detailed roadmap (Link: https://github.com/Azure/SONiC/wiki/Sonic-Roadmap-Planning) lays out a range of near-term improvements currently underway, including routing enhancements and improvements to the management framework.
And in his OCP Virtual Summit presentation, David Maltz laid out a series of improvements OCP intends to address over the longer term. These include SONiC adaptations for the 5G edge, SONiC-based load balancers, machine-learning-based monitoring, management of smart network interface cards (NICs), and running WAN protocols.

SONiC's Challenges

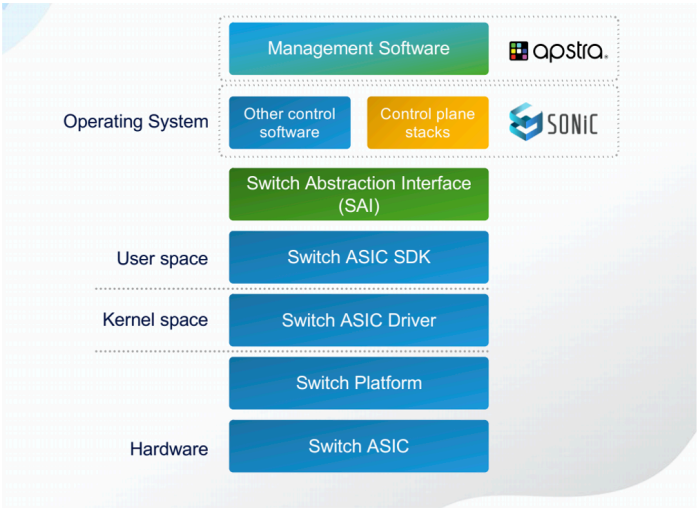
It is generally understood that true innovation never comes without challenges, and SONiC has its share. As noted earlier, its open-source status means that SONiC bristles with elements in various stages of completion. Substantial development expertise — typically beyond the skills of many network operators — can be needed to adjust the parts to fit a specific network whole.

SONiC also suffers from support issues. Some suppliers and OEMs balk at contracting for service on SONiC-based networks because its open-source nature breeds inconsistencies.

But perhaps the leading challenge of SONiC is that it lacks a management interface with sufficient breadth and depth of features to support multivendor data center implementations.

When asked about management at the last OCP Virtual Summit in May 2020, panelists from Comcast, Criteo, eBay, Target, and T-Mobile agreed that it's easiest to incorporate SONiC as "just another NOS" in the data center. But this approach leads to rudimentary management, without the level of network design, configuration, troubleshooting, and security required in most enterprise networks today. Also missing is the automation that ensures the agility, scalability, and resilience needed, particularly where edge networking prevails.

Juniper and Apstra offer a solution with the automated functions required to ensure that a network incorporating SONiC works to full advantage. A simplified view in the illustration below shows how Juniper achieves this by providing the layer of abstraction above SONiC that can leverage the NOS's capabilities:



Source: Juniper

Building on SONiC

To get specific, Juniper's Apstra AOS leverages SONiC to maximum advantage because it contains integral intent-based networking (IBN) and intent-based analytics (IBA), which automate the design and operations of the data center network.

This means that AOS goes beyond merely identifying problems. It instead abstracts data center elements, with control, in order to provide a continuous, closed-loop automation system that performs the following functions:

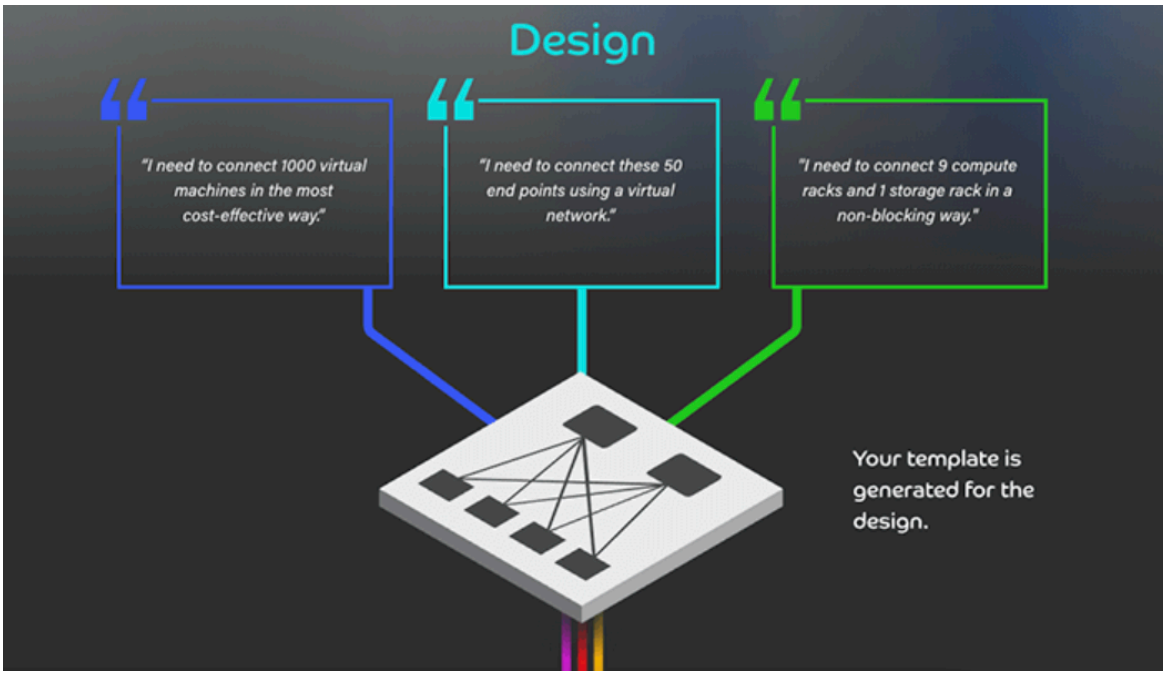
— Automatic translation of a network policy into a network reference design.

— Validation of the reference design for viability.

— Continuous monitoring to ensure all network elements correspond to the reference design.

— Automatic correction or mediation of any deviations from the reference design.

— Immediate identification of any changes affecting network performance or security.



Source: Juniper

All these features, along with additional ones, such as the ability to segment the network by application, to apply virtual as well as physical connections, and to simplify EVPN connections within the data center or between distributed data centers, contribute to what Apstra founder David Cheriton terms "self-driving network operations."

When this system is applied to any of the compatible switch and router operating systems on the market, such as those from Juniper, Arista, Cisco, Dell, NVIDIA, or VMware, the result is a central operational model for multivendor data center networks.

Add SONiC to the mix, and the value proposition of AOS becomes more pronounced, since the customer no longer has to develop expertise in an open-source NOS that lacks some manageability aspects today.

Juniper's Apstra AOS plus SONiC is thus able to deliver the freedom of hardware choice that SONiC provides while offering a range of other benefits, as noted below, which SONiC does not perform when treated as merely another NOS to manage:

— **Speed and reliability.** AOS allows for rapid design and deployment of data center networks, including those running SONiC, with validated, assured success and without the need for additional development work.

— **Scalability**. AOS automatically extends the range of data center interconnect, top-of-rack, and spine switched networks, avoiding any delays related to coordinating multivendor switches.

— **Operational savings.** The elimination of extra development work, plus the automated capabilities of AOS, allows network functions to be overseen by operators, not programming experts.

— **Capex savings.** AOS provides freedom of hardware choice. It also performs multiple software functions, including network orchestration, monitoring, and analytics, that would otherwise require multiple products.

— **Multivendor independence.** AOS furnishes the necessary abstraction and automation to manage networks based on multivendor SONiC implementations, avoiding lock-in to a specific vendor's SONiC-compatible management system.

Conclusion: Juniper's Apstra Plus SONiC Streamlines Digital Transformation

As noted above, SONiC offers a range of advantages to enterprises and service providers. But its open-source features also require substantial expertise to adapt to specific environments. This is why Futuriom believes that making the most of SONiC will require innovation by third-party vendors.

Juniper's Apstra AOS is an example of how this process works. By putting support of SONiC alongside support for the switching elements of vendors such as Juniper Networks, Arista, Cisco,

Dell, HPE, NVIDIA, or VMware — or any combination of these — Juniper's Apstra AOS offers customers the freedom to select the network elements that best fit their specific requirements.

Further, by furnishing a consistent operational model across networks based on multivendor hardware and network operating systems, including SONiC, AOS not only extends the security and management of data center networks but also speeds the migration of services to the network edge.

As stated previously, this migration is already underway as enterprises hurry to build out remote networking and cloud-based services in the wake of the COVID-19 crisis. There will be no slowdown as 5G rollouts build and furnish the basis for even more sophisticated applications requiring top performance.

Indeed, Futuriom believes that third-party innovations around SONiC will be essential to the growth of 5G-enabled applications that will eventually populate a market worth trillions of dollars.

Given all this, enterprises and service providers can't afford delays in the move to the edge. And they can't afford mistakes that could put their networks in jeopardy. Juniper's Apstra AOS provides several essential elements to ensure the best outcome in network expansion:

— Protection against misconfigurations. AOS's integral analytics, real-time change validation, and remediation protect against the potential for human error inherent in manual or partially manual network setups.

— Simplification of design. Use of IBN and IBA in AOS allows network operators to specify the services and policies they want without requiring them to manipulate or adjust any systems or software to implement those intentions.

— Single source of truth. AOS does away with the need for multiple tools to ensure the health and functioning of the data center fabric, so that security, agreed-on service levels, and application performance are continuously maintained at the right levels.

— Correlation of application performance with network performance. Through continuous monitoring, AOS allows network operators to see which applications are affected by specific network conditions, permitting them to make adjustments as needed to improve performance — before an outage occurs.

— Self-driven networking. By deploying a closed-loop approach, AOS establishes physical and logical parameters for a data center network and then monitors and analyzes any deviations. There is no guesswork or blind troubleshooting.

To summarize: Third-party suppliers such as Juniper are introducing enormous value to the SONiC ecosystem with automated configuration and orchestration tools.

By providing an automated, closed-loop IBN/IBA system, Juniper's Apstra AOS furnishes exactly the type of third-party leverage required to make SONiC-enabled networks operate optimally. Further, by streamlining data center operations and ensuring reliability of performance, AOS can energize the digital transformation of enterprises across industries and geographies.