NVIDIA Adds to SONiC Momentum

Software for Open Networking in the Cloud (SONiC) is an open-source network opera@ng system (NOS) that MicrosoU (MSFT) developed for use in Azure circa 2016. AUer working with a range of other vendors, MicrosoU and others contributed SONiC in 2017 to the Open Compute Project (OCP) for further development.

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MicrosoU ini@ally turned to SONiC because its Azure network was ge[ng too large and complex to manage effec@vely. The cloud provider simply couldn't meet its cloud goals unless it found a way to streamline the underlying switching and rou@ng required to provision the net.

"At its core, SONiC is aimed at cloud networking scenarios, where simplicity and managing at scale are the highest priority," stated Yousef Khalidi, corporate vice president, Azure Networking, in a blog post in 2017. "Operators can plug in new components, third-party, proprietary, or open sourced soUware, with minimum effort, and tailor SONiC to their specific scenarios."

SONiC achieves these goals by decoupling, or disaggrega@ng, the soUware and hardware within a Layer 2 and Layer 3 networking environment. It uses a Linux-based, containerized architecture to set up and govern switching for ASICs, monolithic and modular switches, and line cards.

SONiC's ability to virtualize physical network elements streamlines hybrid cloud func@ons and
facilitates a range of management applica@ons, as indicated in the image below:
Ini@ally, SONiC was slow to get off the ground, despite support from hyperscalers MicrosoU and
Alibaba (BABA), but con@nual improvements caught vendor and user aden@on, and over the
last couple of years a flourishing ecosystem comprising over 50 enterprises and vendors has
sprung up around SONiC. Contributors include at least eight companies in the Fortune 500, all
of the leading router players, and most of the key datacenter component suppliers.

Source: Xin Liu, Lihua Yuan, Microso3 Azure Networking Team; OCP Summit 2019 presentaFon,
"SONiC: InnovaFng the Cloud Network"

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Cloud chip giant NVIDIA in 2020 acquired both Mellanox and Cumulus Networks, both providers
of open networking solu@ons that support SONiC. NVDIA has now announced the release
of Pure SONiC and support, providing the industry with a source to go to for SONiC bug fixes,
roadmap addi@ons, and security patches. NVIDIA also happens to be the largest contributor to
FRR, an open-source rou@ng project that is oUen used on top of SONiC. It now appears that
momentum behind SONiC has accelerated, and NVIDIA's commitment to the market is likely to
boost adop@on.

Besides adding continually to the NOS's features and functions, this

supporting group has put
the technology through its paces. The result is a collection of products, toolkits, code, and open-
source software that is ready for prime time. Hardware, software, cloud, and chip suppliers are
now incorporating SONiC in solutions at a steady rate.
Recently, SONiC's fame has expanded in the wake of the COVID-19 crisis. Enterprise demand for
cloud-based support of remote work and work from home (WFH) has been added to the
original reasons to consider SONiC — e.g., network reliability, flexibility to respond quickly to
business condi@ons, cost savings, and manageability. The result is greater interest in evalua@ng
SONiC as a key element of digital transforma@on.
In this report, we explore the nature of SONiC's growing popularity and how its future may
unfold in the world of cloud networking.
Why SONiC's Moment Has Arrived
As noted, SONiC originated as a solu@on for providers of hyperscale cloud networks. Over @me,
its adrac@ons drew many other supporters, however, as cloud infrastructure deployments
spread. This trend was boosted by the need for faster and more flexible responses to business
requirements; and lately, the crisis-oriented demand for remote, virtualized connec@vity has
kicked SONiC into a higher gear.
Telcos and second-@er cloud vendors, for example, have joined the original hyperscalers in
seeking faster ways to grow their networks quickly and efficiently; to fix bugs or make upgrades
without stopping network ac@vity; to achieve non-disrup@ve failover;

and to beder orchestrate
and manage their networks overall.
T-Mobile (TMUS), for example, is evalua@ng SONiC not only to establish a common planorm for
mul@vendor hardware, but to eventually develop enough visibility using SONiC's telemetry and
management features that the company can automate end-to-end deployment of services.
Large enterprises also are moving to SONiC for speed, efficiency, and savings, but added to their
mo@va@on is the need to link their networks to the edge of mul@ple public and private clouds.
This demand for edge connec@vity has strengthened in an@cipa@on of high-speed services
based on 5G.
"We envision a more standard single opera@ng system across our fleet and across the en@re
networking system, so one of the things we're also evalua@ng [is] ... Sonic as a kind of a

prototype enabler, not just [for] the datacenter but [for] ... our store footprint, our distribu@on
footprint, whether it's public, private cloud...." said Pablo Espinosa, VP of engineering at Target
Corp. (TGT), during an online panel discussion at the virtual OCP Summit in May 2020 (link:
hdps://youtu.be/b7vkNN7Fuyk).
Enterprises such as Target and eBay also want to transform their exis@ng datacenters. They are
abandoning older IT architectures for more advanced designs that incorporate mul@-cloud and
hybrid environments, and in the process they are looking to avoid any

complica@ons from
vendor lock-in — for soUware as well as hardware.
“Even if we have to change the hardware and go with other chipsets... You don’t want your
soUware investment to go away,” said Parantap Lahiri, VP of network and datacenter
engineering at eBay (EBAY), who par@cipated in the OCP panel just cited and is overseeing the
rollout of SONiC at eBay. “We wanted a planorm we could con@nually invest in without fear that
the [underlying] planorm would go away.”

SONiC’s Main AErac>ons

Clearly, SONiC offers benefits that enterprises, as well as their service providers and vendors,
find it tough to ignore. It is a bit difficult to categorize these features, since many of them
overlap and some emanate from complicated technical implementa@ons. But in general, it’s
safe to include the following as key benefits of SONiC:

— Vendor independence via open-source technology. One of the benefits oUen cited for any
open-source soUware is the absence of vendor lock-in. An enterprise or service provider is free
to augment the basic technology as fits, instead of relying on a vendor. The downside is typically
a steep learning curve and a lack of support when things go wrong. (Note: This situa@on may
soon change for SONiC, as described in the next sec@on of this report.)

— Leveraging a community. By tapping into a larger, open community not limited to a single
vendor, users of an open-source planorm such as SONiC can take advantage of con@nuous

innova@on. NVIDIA's addi@on of Pure SONiC also means that users can adopt an open-source
product knowing they will have the full support of a large company.
— Vendor-agnos>c switching. SONiC's Switch Abstrac@on Interface (SAI), which was developed
separately and later incorporated into the NOS, is central to SONiC's value. SAI decouples router
and switch hardware from its integral, vendor-specific control plane and establishes a new
control plane. This plane enables connec@vity and management for mul@ple types of switches
from mul@ple vendors, all accessible via APIs and microservices. Also, SONiC can be used to run
"white box," or non-proprietary, hardware along with vendor-specific products. This has
enabled third-party networking vendors such as NVIDIA and others to create value by
integra@ng SONiC with high-value func@ons in their networking products.
— Unified support for hybrid and mul>-cloud networks at scale. By abstrac@ng mul@ple
networking elements regardless of type, SONiC gives IT the means to control not just datacenter
ac@vity, but also that of mul@ple connected public and private clouds — so-called hybrid cloud

and mul@-cloud environments. The ability to govern mul@ple networks without worrying about
dealing with underlying vendor-specific requirements and issues gives SONiC users the means
to scale their networks more quickly and easily than tradi@onal methods have allowed.

— Streamlined access to upper-layer networking func>ons. Network virtualiza@on and SAI,
along with integral closed-loop database, telemetry, and repor@ng func@ons, give SONiC
networks rela@vely smooth access to features such as load balancing, monitoring, and intent-
based networking (IBN) and orchestra@on.
— Network automa>on. Done right, SONiC management accommodates ar@ficial intelligence
(AI) and machine learning (ML), which are basic to IBN and other forms of automa@on. This
characteris@c is par@cularly adrac@ve to communica@on service providers preparing for the
scale and diversity 5G networks will bring.
— BeEer network performance. SONiC's support for features such as Remote Direct Memory
Access (RDMA), along with quality of service, policy control, and priori@za@on protocols,
improves efficiency, throughput, and latency in hybrid cloud networks.
— Streamlined DevOps. Once exper@se is achieved, SONiC is rela@vely easy to program and
customize, thanks to its containerized architecture, which supports Docker and Kubernetes.
Features such as Free Range Rou@ng (FRR) link incorporate network elements such as switches,
hosts, LAN segments, or virtual machines in management setups without calling for code or
kernel changes. Further, SONiC's microservices approach makes it faster and easier to mi@gate
any failures or to perform soUware updates or fixes.
— Opera>onal savings. Since SONiC simplifies and speeds up network func@ons of all kinds, it
also requires less human interven@on. This results in opera@onal

savings across the board, from
monitoring in the trenches to DevOps adjustments.

The Future of SONiC

As SONiC's popularity grows, so does the future poten@al of the NOS. At the present @me,
several emerging trends point to possible direc@ons the technology will take over the next
couple of years.

5G will drive SONiC rollouts. As noted previously, communica@on service providers such as T-
Mobile realize that offering 5G networking will demand much more scalability and automa@on.

Fleets of new devices will pop up on carrier networks, including ones adached to Internet of
Things (IoT) and Industrial IoT (IIoT) implementa@ons. 5G also will demand service providers to
furnish new kinds of solu@ons, such as cloud gaming, smart ci@es, augmented reality, and
connected cars, all of which depend on dynamic, real-@me connec@vity and other features that
can't be supported by humans alone.

In a recent survey of 113 service providers, Futuriom found that a plurality of respondents
believe automa@on to be crucial to successful 5G deployment, as show in the chart below:

SONiC also should make it easier and faster to connect enterprise hybrid networks with new
services from a range of cloud providers.

MicrosoU has encouraged this view. "We are working on deploying SONiC at the edge for 5G
deployments to places where we need to put compu@ng right up next

to the wireless edge,”
said David Maltz, MicrosoU Dis@nguished Engineer and a long@me SONiC advocate, during a
keynote speech at the OCP Virtual Summit in May 2020. “SONiC will be there offering a trusted
base planorm that can be used to bootstrap securely all the other infrastructure necessary at
the edge.”
Widespread enterprise adop7on is on the way. Though SONiC presently has only a handful of
large enterprise adopters — and most of those are in the earliest evalua@on stages — it is likely
we’ll see much more enterprise movement in SONiC’s direc@on over the next 18 to 24 months.
Boos@ng this trend will be ongoing demand for cloud services suppor@ng remote and WFH
connec@vity. While there may be a pause in greenfield purchases due to economic uncertainty,

Source: Futuriom “CSP Network AutomaFon Leadership Survey,” August 2020: hOps://
www.futuriom.com/internal/free-research/FINAL-Futuriom-CSP-Network-AutomaFon-Leadership-

most financial experts agree the enterprise move toward cloud will con@nue to gain
momentum.
Another trend booster is the recent introduc@on of supported SONiC products. A handful of
vendors, including Apstra, Dell, and NVIDIA, now offer supported SONiC-based solu@ons. While
these require the use of the vendors’ products (perhaps an ironic form of lock-in), they do

guarantee that enterprises don’t have to go it alone in implemen@ng SONiC. This ameliorates some of the difficulty of coming up to speed and staying current with the complexi@es of the technology.

Security will become a SONiC priority. While SONiC’s management assets have adracted aden@on from automa@on and IBN suppliers, there has been compara@vely lidle men@on of how these assets can be adapted to beder security.

It’s not that security is an aUerthought. At the OSP, security func@ons have always been part of developments. S@ll, to date, a lot of the focus has been on keeping code from hackers during development. The kind of overarching zero-trust security needed in today’s end-user cloud environments will likely be devised for SONiC by third-party vendors and offered as a service.

It seems likely that security func@ons won’t come from just one group of suppliers. Instead, security probably will be implemented as a coopera@ve, integrated solu@on or service from specific sets of vendors — as Dell and Apstra introduced the first supported services and Apstra touts support for Juniper in its IBN offerings.

SONiC will both create and face compe77on. SONiC isn’t alone in suppor@ng the concept of a disaggregated NOS for cloud networks. Arrcus, for example, offers its own Linux-based ArcOS to streamline Layer 2/3 func@ons. Exis@ng suppliers such as Cisco (CSCO), Juniper (JNPR), and Nokia (NOK) also are redesigning their own NOSs to fit cloud needs — even as they cooperate

with the SONiC effort.
Given all this ac@vity around NOSs, plenty of compe@@on is to be expected, not only among
equipment suppliers, but between SONiC and other solu@ons. S@ll, given the enormous
complexi@es involved, it is also probable that coope@@on and alliances will emerge as a market
model, and that support of SONiC will become an expected add-on to support for other NOSs in
all kinds of gear.

SONiC Leadership Profile

With the launch of Pure SONiC and the acquisi@on of Mellanox and Cumulus Networks, NVIDIA has already
established itself as a leader of the SONiC community, providing hardware and soUware support, con@nuous
contribu@ons to the community, as well as security patches.
In September 2019, Mellanox became one of the first vendors to support its SONiC products with, among other
things, an offering for customers running SONiC on Mellanox SN2000 and SN3000 switches. Now part of the
NVIDIA family, NVIDIA Mellanox Spectrum switches offer best-in-class performance combined with the
open-source flexibility of SONiC. In addi@on, NVIDIA is the leading contributor to FRR, the primary rou@ng stack in
SONiC. Finally, NVIDIA Spectrum Ethernet Switches offer a unique advanced streaming telemetry capability in
hardware called What Just Happened (WJH) that provides real-@me visibility into problems in the network.

Expect to see many more of these kinds of supported SONiC products, or distribu@ons, in the coming months.

Benefits of using Pure SONiC from NVIDIA include:

• No single vendor reliance. Unlike a distro, pure SONiC doesn't require reliance upon a single vendor for roadmap addi@ons, bug fixes, and security patches.

• FRR Support. NVIDIA is the leading contributor of FRR, the primary rou@ng stack in SONiC.

• ASIC to protocol support. One of the key challenges of open-source is ge[ng full support. With NVIDIA, customers get support for FRR, SONiC, SAI, system, and ASIC – all in one place.

• Choice of NOS. By using NVIDIA networking products, customers can mix and match a leaf-spine architecture with SONiC, NVIDIA Cumulus Linux, Onyx, or others.

• Scalability for hybrid and mul7-cloud networks. SONiC's modular, extensible, container-based design accelerates innova@on.

• Unified management. NVIDIA is integra@ng SONiC management with exis@ng management tools across the datacenter.

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Conclusion: SONiC Gets a Big Boost from NVIDIA

AUer several years of behind-the-scenes work and rela@vely modest implementa@on, SONiC is set for substan@al growth, as cloud hyperscalers, service providers of all kinds, and enterprises seek faster, more efficient, and automated networking.

Indeed, interest in SONiC has blossomed as demand has grown for bigger and beder cloud services as well as for improved enterprise IT approaches to managing hybrid and mul@-cloud environments. Service providers need a way to handle the scale and

scope of func@ons users
are calling for; and users need to adapt their businesses to a new world in which network
con@nuity, resiliency, and flexibility are top priori@es.
Responding to these market forces ensures ongoing development that will bring advancements
to SONiC technology, and the open-source nature of SONiC will make these features and
func@ons universally available to enterprises and vendors who can implement them. But
business requires compe@@on, so expect to see plenty of itera@ons in the offering of SONiC-
based products and services in the months ahead.
Futuriom believes that NVIDIA is providing significant leadership in the SONiC market that will
provide a big boost to the SONiC community. NVIDIA's moves to buy Mellanox and Cumulus
Networks planorms and provide integra@on, support, and addi@onal security for SONiC
implementa@ons will improve confidence and adop@on in the marketplace.