SONiC: Software for Open Networking in the Cloud

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Microsoft Cloud Network – A Multi-Billion Dollar Bet
Goals of SONiC

- Fast Technology Evolution
- Reduce Operational Burden
- Modular & Composable Software
- Choices of Vendors & Platforms

Disaggregation with SONiC
Switch Abstraction Interface (SAI)

Network Applications

Hello

Switch Abstraction Interface

Simple, consistent, and stable network application stack

Helps consume the underlying complex, heterogeneous hardware easily and faster
Switch Abstraction Interface

CRUD operations over extensible Entity/Attribute/Value data model

Reference data-plane behavior model supports many devices

Significant feature/partner growth since announcement in 2015

https://github.com/opencomputeproject/SAI
SONiC High-Level Architecture
SONiC Containerization

**Strengths of Containers**
- Clean isolation
- Easy deployment
- Transactional
- Run universally

**SONiC Benefits**
- Serviceability
- Extensibility
- Development agility
- Cross-platform
SONiC Containerization

Components developed in different environments

Source code may not be available

Enables choices on a per-component basis
SONiC for Network Engineers and Software Engineers

CLI-style interaction enabled by scripts written in Python

Contributed largely by Network Engineers who are using SONiC

Linux bash prompt enables direct access to containers and Redis
Build a SONiC Image

**Preparation:**
any server > 1T hard disk, ubuntu linux 16.04
Prerequisite: install PIP and JINJIA on the host build machine
Clone code repos with all Git submodules
Build image with a specific ASIC choice

```
make configure PLATFORM=[ASIC_VENDOR]
make all
```

Each module compiles the source code and generates the .deb package
Main .deb package and zero or more derived packages

From the .deb packages
docker-<image(s>).gz
Sonic-<image>.bin

[Building guide on Wiki](http://example.com)
Warm Boot – Subsecond Disruption

Control plane disruption < 90 seconds
Data plane disruption < 1 second

Control plane
Routing
Data Plane

O.S Reboot
SONiC Starts
ASIC Warm Init
Warm Reboot Finishes
State Reconciliation, via SAI state-driven API
SONiC Is Powering Microsoft Cloud At Scale
Debugging Datacenter Network is a Daunting Task

DCNs are **large** and **complex**
- O(100K) low-cost devices
- Complex software stack

**Network faults are unavoidable and diverse**
- Packet drop, latency spike, low throughput, load imbalance, loop...

**Existing tools insufficient**
- Device counters, ping, traceroute...
Example #1: Silent Packet Drop

SOS: application requests encounter timeouts!!

Diagram showing the flow from Client to Load balancer to Server with requests, retries, and timeouts indicated.
Counters and Traceroute Cannot Help

- Counters: no significant drops
- Exhaustive traceroute: prohibitively expensive or even infeasible
Example #2: Latency Spikes

Queue size watermarks: too coarse-grained to correlate w/ affected flows
Ping & traceroute: cannot measure per hop delay
Azure Scale Monitoring -- EverFlow

Guided prober
Packet drop
Latency spike
Loop
Load imbalance

EverFlow controller

Query

Distributed storage

Azure Storage

Azure Analytics

Cloud Network Challenge

Cloud Scale Data

Match & mirror

Load-balancer

Collector

Filter & aggregation

Collector

Collector
## SONiC Keeps Evolving

<table>
<thead>
<tr>
<th>Year</th>
<th>Features</th>
<th>Platforms</th>
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</table>
| 2016 | - Linux  
- Basic L2/L3  
- Containerized  
- Redis DB | 31 platforms |
| 2017 | - RDMA/QoS  
- IPv6  
- Mgmt. via Swarm  
- Fast Reboot (<30s) | 100G  
- ASIC: Trident 2  
- MLNX: Spectrum  
- Cavium: Xpliant  
- Centec: Goldengate | 16 platforms |
| 2018 | - Streaming Telemetry  
- Config DB  
- Support Virtualization  
- Warm Reboot (<1s)  
- Restful API | 100G  
- ARM based  
- ASIC: Tomahawk, Tomahawk2  
- Marvell: Prestera  
- Barefoot: Tofino | 31 platforms |
| 2019 | - Richer Routing Stack: FRR, cRPD  
- Management Framework  
- Dev/Test Enhancements  
- NAT | 40G  
- Chassis Support  
- BRCM: Jericho2  
- Innovium: Teralynx  
- Marvell: Falcon  
- MLNX: Spectrum II  
- Cisco: Silicon One | 92 platforms |
| 2020 | | | |
Open Invitation to the SONiC Community

Inviting contributions in all areas
- New ideas on white/open network devices
- SAI proposals
- Hardware platform
- New features, applications and tools
- Download it, Test, Deploy!

Website:    https://azure.github.io/SONiC/
Mailing list:  sonicproject@googlegroups.com
GitHub:   https://github.com/Azure/SONiC
Wiki:    https://github.com/Azure/SONiC/wiki/
Thank You

Microsoft

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