SONiC: Software for Open Networking in the Cloud

Lihua Yuan
Microsoft Azure Network Team
for
the SONiC Community
Microsoft Cloud Network - 15 Billion Dollar Bet
SONiC Is Powering Microsoft Cloud At Scale

Tier 0 - Rack

Tier 1 - Row Leaf

Tier 2 - Spine

Tier 3 - Regional Spine
Goals of SONiC

Faster Technology Evolution

Reduce Operational Burden

Open & Modular Software

Choices of Vendors & Platforms

Disaggregation with SONiC
SONiC: Software for Open Networking in the Cloud

• Switch Abstraction Interface (SAI)
  • Cross-ASIC portability

• Modular Design with Switch State Service (SwSS)
  • Decoupling software components
  • Consistent application development model

• Containerization of SONiC
  • Serviceability
  • Cross-platform portability

• SONiC Operational Scenarios
  • Hitless upgrade
  • Network emulation with CrystalNet
Network Applications

Switch Abstraction Interface (SAI)

- 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 operation over extensible Entity/Attribute/Value data model
- Reference data-plane behavior model supports various devices
- Significant feature/partner growth since announcement in 2015
- [https://github.com/opencomputeproject/SAI](https://github.com/opencomputeproject/SAI)
SAI Function Calls & Pipelines in SONiC

- Register SAI APIs to achieve specific functions and control logging separately
- Construct the right order to execute SAI function calls
- Refer to SAI Pipelines to create the right packet action flow
SONiC: Software for Open Networking in the Cloud

• Switch Abstraction Interface (SAI)
  • Cross-ASIC portability

• Modular Design with Switch State Service (SwSS)
  • Decoupling software components
  • Consistent application development model

• Containerization of SONiC
  • Serviceability
  • Cross-platform portability

• SONiC Operational Scenarios
  • Hitless upgrade
  • Network emulation with CrystalNet
Switch State Service (SwSS)

**SAI DB**: persist SAI objects

**App DB**: persist App objects

**DB backend**: redis with object library

**SyncD**: sync SAI objects between software and hardware

**Orchestration Agent**: translation between apps and SAI objects, resolution of dependency and conflict

**Key Goal**: Evolve components independently
How SAI Objects are Stored in SAI Database

• APP DB:
  • Application oriented
  • Human readable

• SAI DB:
  • SAI oriented
  • Query-able and machine parse-able
  • Snapshot of the current SAI state

• APIs:
  • sai_create_api
  • sai_set_api
  • sai_get_api*
  • sai_remove_api

*Used only when querying ASIC settings and configurations
How Routing Works in SONiC

BGP Neighbor

BGPd → Zebra → fpmsyncd

APP DB

Orchestration Agent

SAI Redis → SAI DB

SyncD

SAI Route

ASIC

Transceivers

Host Intf netdev

socket
How LAG Works in SONiC
SONiC Containerization

- **TEAMD**
- **LLDP**
- BGP: Quagga or FRR
- SNMP: Net-SNMP + SNMP subagent
- DHCP Relay: isc dhcp
- Platform: sensors
- SWSS: switch state service
- DB: Redis
- Syncd: sairedis + syncd agent
SONiC Containerization

**Container Strength**
- Clean isolation
- Easy deployment
- Transactional
- Run universal

**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
• Cloud users demand zero-down time, but

• Security patches, bug fixes need to be rolled out in hours

• New features need to be rolled out in days
Hitless BGP Upgrade Through Docker Swarm

[Diagram showing network nodes and connections with IP addresses and BGP configurations]
Before they fly the space shuttle ....
They practice all activities and test all equipment extensively in a high-fidelity simulators.
CrystalNet: A high-fidelity, cloud-scale network emulator

SONiC Container Soft Switch
Open Invitation

• Inviting contributions in all areas
  • New ideas on white/open network devices
  • 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/