Outline

- Stratum Basics
  - APIs and Architecture
- Open Source Launch
  - Supported platforms
  - What to expect
  - Quick tour of available resources
  - How to find more
- What’s next? (project roadmap)
- Setting the stage for the rest of the sessions
- Stratum Community
  - Companies
  - Individual recognition
Agenda

● Stratum Basics
● Open Source Launch
● What’s Next?
● Preview of Stratum @ ONF Connect ‘19
● Stratum Community
What is Stratum?

Open source, production targeted, thin switch OS that implements NG-SDN interfaces and models
API Overview
Why Stratum?

Stratum’s SDN-ready Interfaces

Built from today’s SDNs & Optimized for NG-SDN

Value Proposition:

1. Hardware Independence / Vendor Optionality
2. Automated Full-Lifecycle Operation
3. Zero-Touch Provisioning
4. Data Plane Programmability and Agility
Top-Down Data Plane Programmability

- **My Station (Routing Classifier)**
- **L3 Routing (IP w/ ECMP)**
- **ACL (Redirect, drop & Pkt in)**
- **L2 Forwarding**

**P4 compiler**
- Generate control plane contract
- demo.p4info

**fpm backend (Broadcom)**
- Allocate resources to realize the pipeline, and generate runtime mapping
- bcm_demo.bin

**Tofino backend (Barefoot)**
- demo.p4
- bf_demo.bin

**Control plane**
- p4runtime.proto

**P4Runtime server**
- Target driver
- Switch ASIC
Platform Independence

Control plane

gnmi.proto

OpenConfig

openconfig.yang

gNMI Server

OpenConfig Mapper

Stratum Config DB

Stratum Platform Manager

ONL Platform API (ONLPv2)

ONLP Platform impl.
libonlp-<platform>.so

ONL Platform Linux

Stratum
Supporting Cloud-Style Agility

- Stratum deployment and testing framework enable best practices in CI/CD
- Telemetry and end-to-end verification allow for failure detection and rollback
Testing Stratum Devices

**Test Vectors serve as compliance tests** for Stratum-based devices

They can be written **manually** or **generated automatically**
- Stratum comes with a Contract Definition language (cdlang) for generating test vectors

**Test Vector**

<table>
<thead>
<tr>
<th>Test Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulus 1</td>
</tr>
<tr>
<td>Stimulus 2</td>
</tr>
<tr>
<td>...</td>
</tr>
</tbody>
</table>

**TestVectors Runner** is a data-driven framework that enables users to execute TestVectors
- Reference impl. in **golang**; supports **P4RT/gNMI**

**Humans**

- Test Scenarios in CDLang
- CDLang Compiler
- Test Vectors
- Test Scenarios in CDLang
- TestVectors Runner
- gRPC
- Switch Under Test
- Switch Ports
- Traffic generators and validators
- Automatic Test Vector Generators
Stratum Open Source Launch
Stratum Approved for Open Source

https://github.com/stratum/stratum

Stratum - Enabling the era of next-generation SDN

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Stratum is an open source silicon-independent switch operating system for software defined networks. It is building an open, minimal production-ready distribution for white box switches. Stratum exposes a set of next-generation SDN interfaces including P4Runtime and OpenConfig, enabling interchangeability of forwarding devices and programmability of forwarding behaviors. Current support includes Barefoot Tofino and Broadcom Tomahawk devices, as well as the bmv2 software switch.
Getting Started in 30 Seconds

```bash
$ docker run --privileged --rm -it -p 50001:50001 opennetworking/mn-stratum
latest: Pulling from opennetworking/mn-stratum
ebdf1d4878b0: Downloading 19.81MB/22.09MB
59d22e604484: Downloading 17.79MB/18.8MB
c14e43091500: Download complete
e7d961c080e0: Download complete
37b69b5d17d3: Download complete
c688bd238f6d: Download complete
```
Getting Started in 30 Seconds

For a basic tutorial, visit https://github.com/stratum/tutorial

Works on hardware switches, too!

- Canonical port for NG-SDN gRPC interfaces is 28000
- Need to mount /dev, /sys, and ONLP libraries into the container
What to Expect

Open Source Launch is an Alpha Release
- Software Architecture is in place
- Support for fixed-function and programmable targets
- Some features not yet implemented

What can I do with Stratum today?
- Demos (ONF has done several over the past year)
- User Experimentation; Porting to New Platforms

Stratum can now be incorporated into vendors’ products
# Stratum Switch Support Today

<table>
<thead>
<tr>
<th>Switch Vendor</th>
<th>Switching ASIC</th>
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<th>Switching ASIC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tofino</strong></td>
<td>Up to 6.5 Tbps</td>
<td><strong>AG9064v1</strong></td>
<td><strong>Wedge100BF-32X</strong></td>
<td><strong>D5054</strong></td>
<td><strong>BF6064X</strong></td>
</tr>
<tr>
<td><strong>Tomahawk</strong></td>
<td>Up to 3.2 Tbps</td>
<td></td>
<td><strong>Wedge100BF-65X</strong></td>
<td></td>
<td>64 x 100 Gbps</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Z9100</strong></td>
<td><strong>AS7712</strong></td>
<td><strong>D7032</strong></td>
<td>32 x 100 Gbps</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>T7032-IX1</strong></td>
<td></td>
<td>32 x 100 Gbps</td>
</tr>
</tbody>
</table>

+ 2 software switches: **bmv2** (functional software switch) & **dummy switch** (used for API testing)

**Near-term future platforms:**
- Additional platforms for existing targets
  - Existing vendors + Asterfusion, ...  
- Mellanox SN2700 (Spectrum)
- Datacom platforms (PowerPC-based)
Downloading Stratum

**Stratum bmv2 switch + Mininet** Docker Image:
docker pull opennetworking/mn-stratum
https://cloud.docker.com/u/opennetworking/repository/docker/opennetworking/mn-stratum

**Barefoot Tofino** Docker Image:
stratumproject/stratum-bf:8.9.1-4.14.49-OpenNetworkLinux
https://cloud.docker.com/u/opennetworking/repository/docker/opennetworking/mn-stratum

**Broadcom Tomahawk** Docker Image: *coming soon*

**ONL** OS Image: *pre-built, ONIE installable image coming soon*
Source code: https://github.com/opennetworkinglab/OpenNetworkLinux
Based on ONLPv2
How to Contribute

● Get started with the basic tutorial
  
  https://github.com/stratum/tutorial

● Stratum uses Github for source management, issue tracking and pull requests
  ○ *File bugs, request features, and submit patches on Github*

● Join the Stratum Announcement mailing list
  
  https://lists.stratumproject.org/listinfo/stratum-announce
  *(We will provide more details on joining developer lists and Slack soon)*

● Attend a Stratum Technical Steering Team call
  *(Currently, alternating between Wednesday 4:30pm & Thursday 10am Pacific)*
What’s Next for Stratum?
Stratum Roadmap

1. Pushing Stratum towards production
   ○ Work towards feature parity with ONF’s Trellis and SEBA
   ○ Additional core features for Telco stacks
     (support for MPLS, VLAN, security, QoS, etc.)

2. Additional switch chip & platform support

3. Formalizing and publishing a compliance test framework
   ○ Work to gain broader consensus on TestVectors approach
   ○ Increase repo of test cases; build tools to make test generation easier

4. Beyond packet switches
   ○ Stratum for Packet Transponders (see Leonid’s talk at 5pm today)
   ○ Stratum for Smart NICs
   ○ Stratum on a production-quality software switch
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   ○ Stratum for Packet Transponders (see Leonid’s talk at 5pm today)
   ○ Stratum for Smart NICs
   ○ Stratum on a production quality software switch

The roadmap is defined by the community!

If you have ideas or want to push Stratum in a new direction, give a presentation at one of the Stratum Technical Steering calls.
Stratum @ ONF Connect ‘19
NG-SDN Track Preview

Stratum Ecosystem and Use Cases
Wednesday & Thursday,
4:30pm - 6pm

TestVectors

Testing and Qualifying Stratum Devices
Thursday, 2pm - 4pm

TestVectors Runner

P4 Program

P4 Compiler

P4Runtime

gNMI

gNOI

Stratum Internal Deep Dive
Wednesday, 2:30pm - 4pm

μONOS Evolution
Friday, 2pm - 4pm

Switch (Broker) Interface

Table Mgr

Chip Abstraction Managers

Platform Mgr

Switch SDK

Platform API

Switch Chip(s)

Peripheral(s)

Control Plane
Demos @ ONF Connect ‘19

1. Stratum Interoperability
   - Community Launch Demo with multiple ASIC and platform vendors
   - 8 Stratum switches in an IP routed, leaf-spine fabric
   - Highlighting hardware independence and automatic full-lifecycle operation

2. µONOS
   - 3 Stratum switches
   - Highlighting zero-touch provisioning and device configuration

3. SEBA
   - 1 Stratum switch
   - Highlighting top-down data plane programmability (offloading the BNG)
Stratum Interoperability Demo

IPv4 Leaf-Spine Fabric with ECMP
L2 Bridging on the host
Connectivity to upstream router
Stratum @ ONF Connect ‘19

Tutorial: https://github.com/opennetworkinglab/ngsdn-tutorial

Next-Gen SDN Keynote on Thursday @ 11am
Stratum Community
Stratum Community

**Pioneer Phase**
- Mar. ‘18

**Member Preview Phase**
- Mar. ‘19
- Sept. ‘19

Launch Members (March 2018)
- BAREFOOT NETWORKS
- big switch networks
- BROADCOM
- CAVIUM
- China unicom
- DELTA
- EDGE-GORE NETWORKS
- Google
- Mellanox Technologies
- NTT
- Open vSwitch
- QCT
- Ruijie Networks
- Tencent 腾讯
- Türk Telekom
- VMware
- XILINX
Stratum Contributors

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Tomek Madejski, Google
Uyen Chau, ONF
Volodymyr Veskera, PLVision
Yi Tseng, ONF
Zubin Shah, Cavium

… as well as Anonymous Contributors from Google and commit co-authors
ONF’s 2019 Contributor Award

Designed to recognize top ONF Community members who are:
- Top Code Contributors (or Code Removers)
- Top Reviewers and Mentors
- Top Ambassadors or Advocates
- Contributors of Significant Components of a system
- Consistently "chopping wood and carrying water" (helping everyone be more productive)

For outstanding contributions to Stratum

Alireza Ghaffarkhah  
Google

Antonin Bas  
Barefoot Networks

Devjit Gopalpur  
Google

Yi Tseng  
ONF