# Faucet

The open source SDN Control Plane for production networks

Version: 0.14
Last Updated: 24 October, 2016

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## Faucet

- What?
  - Drop in **replacement for L2/L3 switch with extra SDN** based functionality
  - Developed as an application for Ryu SDN Controller
  - Written in **Python** with **Apache 2 License**
- Whom?
  - **Enterprise & Campus segments** - primary focus
  - **Personas**:
    1. Network Operator - Regular Linux sysadmins, no special SDN controller ninja skills required
    2. Security Team - Network & Application Security teams
    3. Operations Manager - high level network ops & manages network Ops
    4. Business Users - need for Operational stats
    5. Application Developers - Python Developers
- Why?
  - SDN enabled switches provide numerous advantages for network operators

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## Faucet Differentiation

- Ease of **installation**: < 30min, drop in replacement
- Faster **upgrades** than non SDN (can upgrade controller in <1sec while network still runs and without rebooting the hardware) → Important with increasing number of **zero day attacks**.
- **Built-in support for Network Operations**
  - Much **easier to automate and integrate configuration** (you write a YAML file under Linux - no more expect scripts).
  - **Real-time database** integration for **stats** → Grafana dashboards
  - **NoSQL database** integration for **flows**
- **Greater control** of layer 2 than non-SDN (eliminating unicast flooding, defeating rogue DHCP servers, broadcast storms, etc).
- **Applications +**
- **Built-in Test suite (Mininet + Hardware)**

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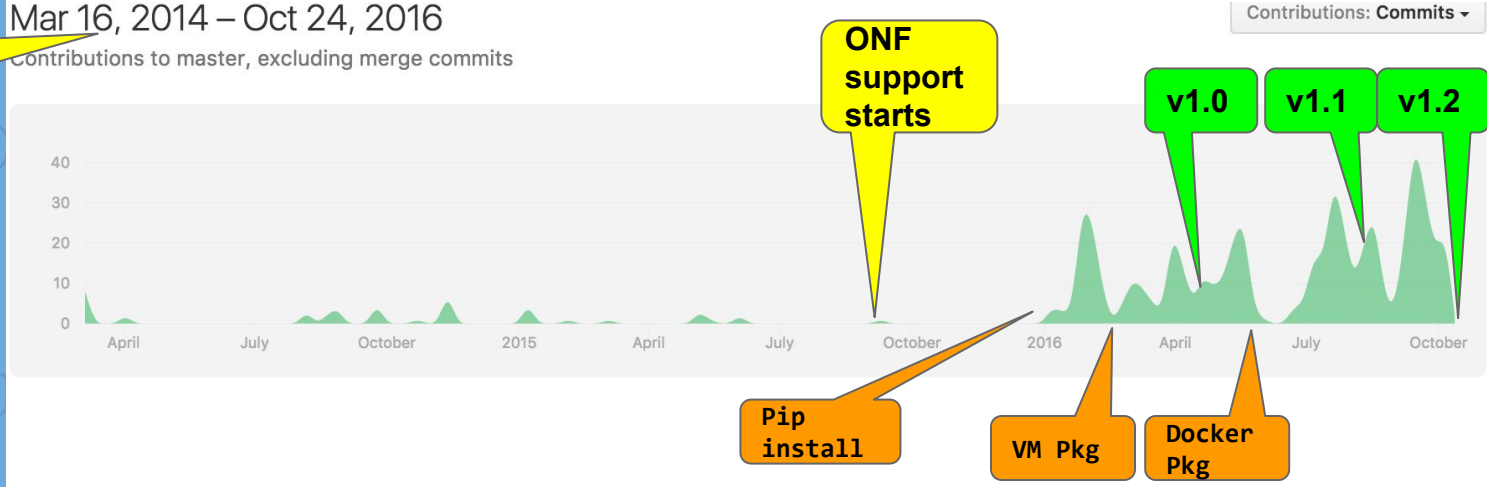
## History




## Core Team:

- Josh Bailey
- Brad Cowie
- Chris Lorier
- Shivaram Mysore

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Google

REANNZ

OPEN NETWORKING FOUNDATION

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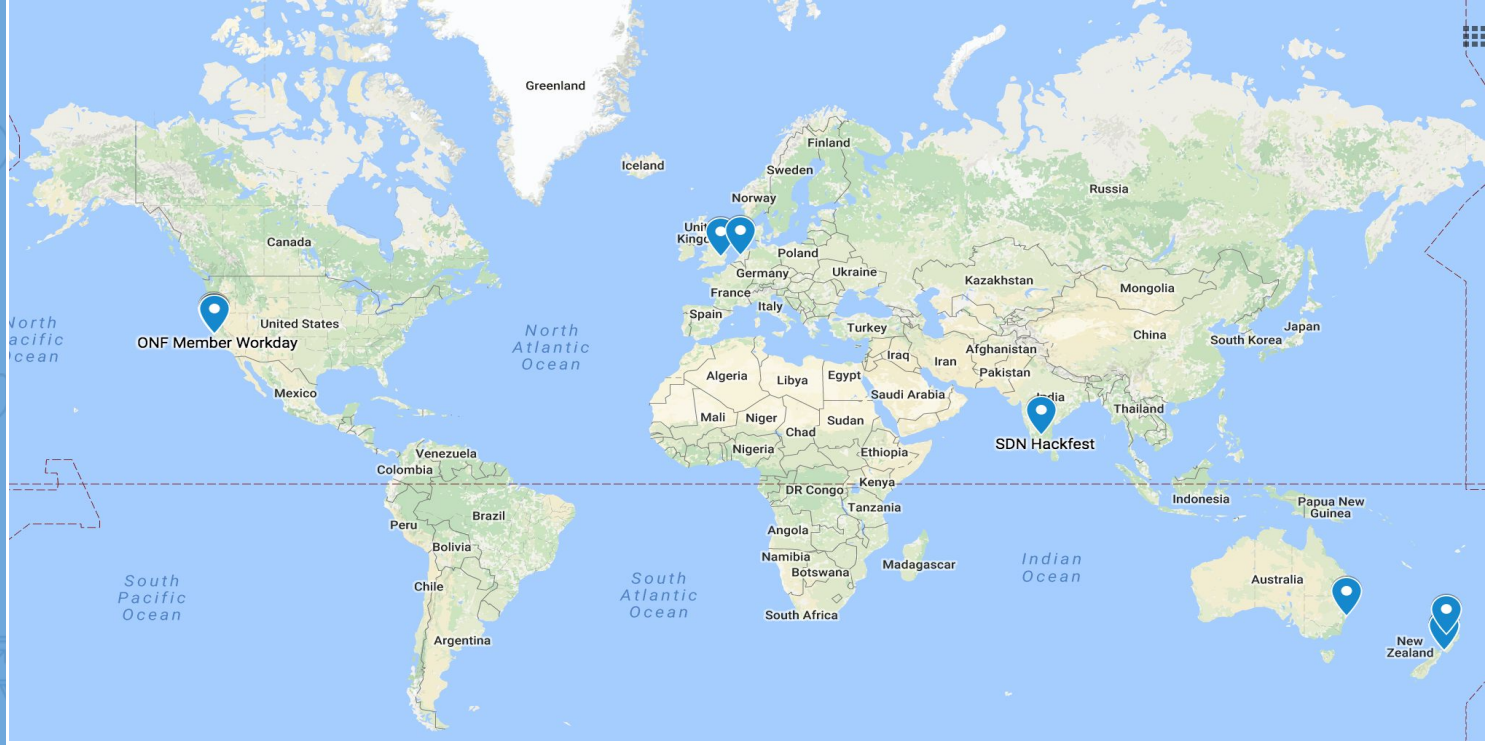
## Worldwide Deployment - October 2016




**SITES**: ONF, REANNZ(**2 years**!), AARNet, ESNet, GEANT, GEANT HQ, Victoria University of Wellington, Allied Telesis, WAND Group Waikato University

**EVENTS**: SDN Hackfest, ONF Member Workday

`https://www.google.com/maps/d/u/0/viewer?mid=1MZ0M9ZtZOp2yHWS0S-BQH0d3e4s&hl=en`

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## Production Quality Code

- ~4,000 lines + documentation
- 2,200+ lines of test code
  - Mininet & hardware support
- 40+ devs contributed code
- Language: python
- Delivery:
  - Python pip install
  - Virtual appliance - VMDK, OVF, ISO
  - Docker package
- Dataplane support

suse studio

docker

OvS Open vSwitch

lagopus

Allied Telesis

NoviFlow switching made smarter

Northbound NETWORKS

Hewlett Packard Enterprise aruba

OpenWrt Wireless Freedom

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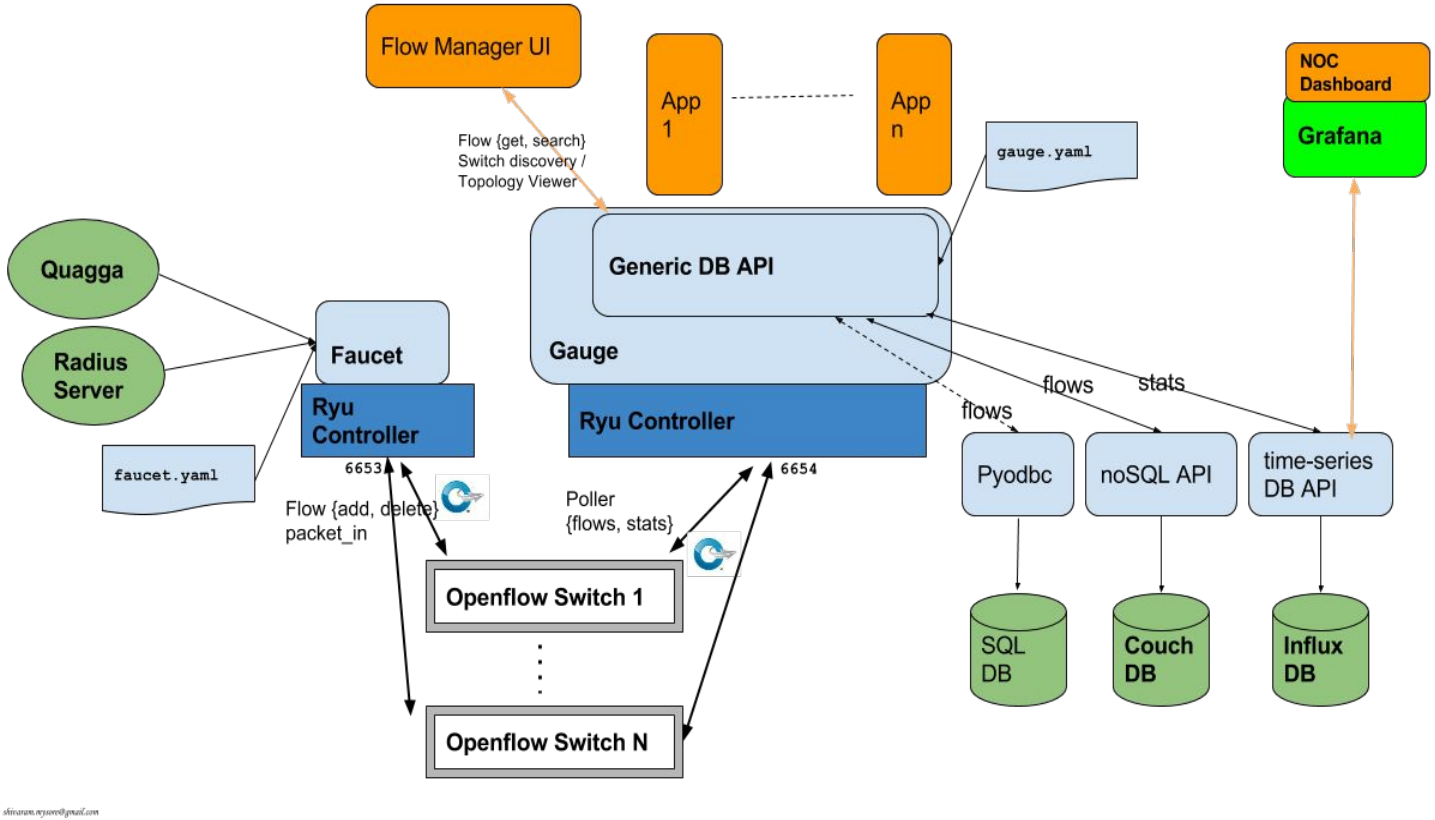
# Faucet Architecture




@author: shivaram.mysore@gmail.com

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## Installation 1-2-3 Go!

1. Rack up FAUCET-supporting switch.
2. Connect to controller PC,

```
# pip install ryu_faucet
```

3. Edit `faucet.yaml` config file, start controller


✓ Faucet Installation

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# Configuration File - faucet.yaml

```
version: 2
vlans:
    100:
        name: "clock"
        max_hosts: 3 # Max of 3 hosts can go on this VLAN
    4090:
        name: "trusted network"
dps:
    zodiac-fx-1:
        dp_id: 0x70B3D56CD399
        hardware: "ZodiacFX"
        interfaces:
            1:
                native_vlan: 100
                name: "zfx-port1"
            2:
                native_vlan: 100
                name: "zfx-port2"
            3:
                native_vlan: 100
                name: "zfx-port3"

   allied-telesis:
        dp_id: 0x0000eccd6dd0c176
        description: "OpenFlow Wired-Wifi AT-X930"
        hardware: "Allied-Telesis"
        interfaces:
            1:
                native_vlan: 4090
                name: "atport1.0.1"
            2:
                native_vlan: 4090
                name: "atport1.0.2"

....

           24:
                native_vlan: 4090
                name: "atport1.0.24"
```

Config file format version

VLAN Information

Datapaths managed by this controller

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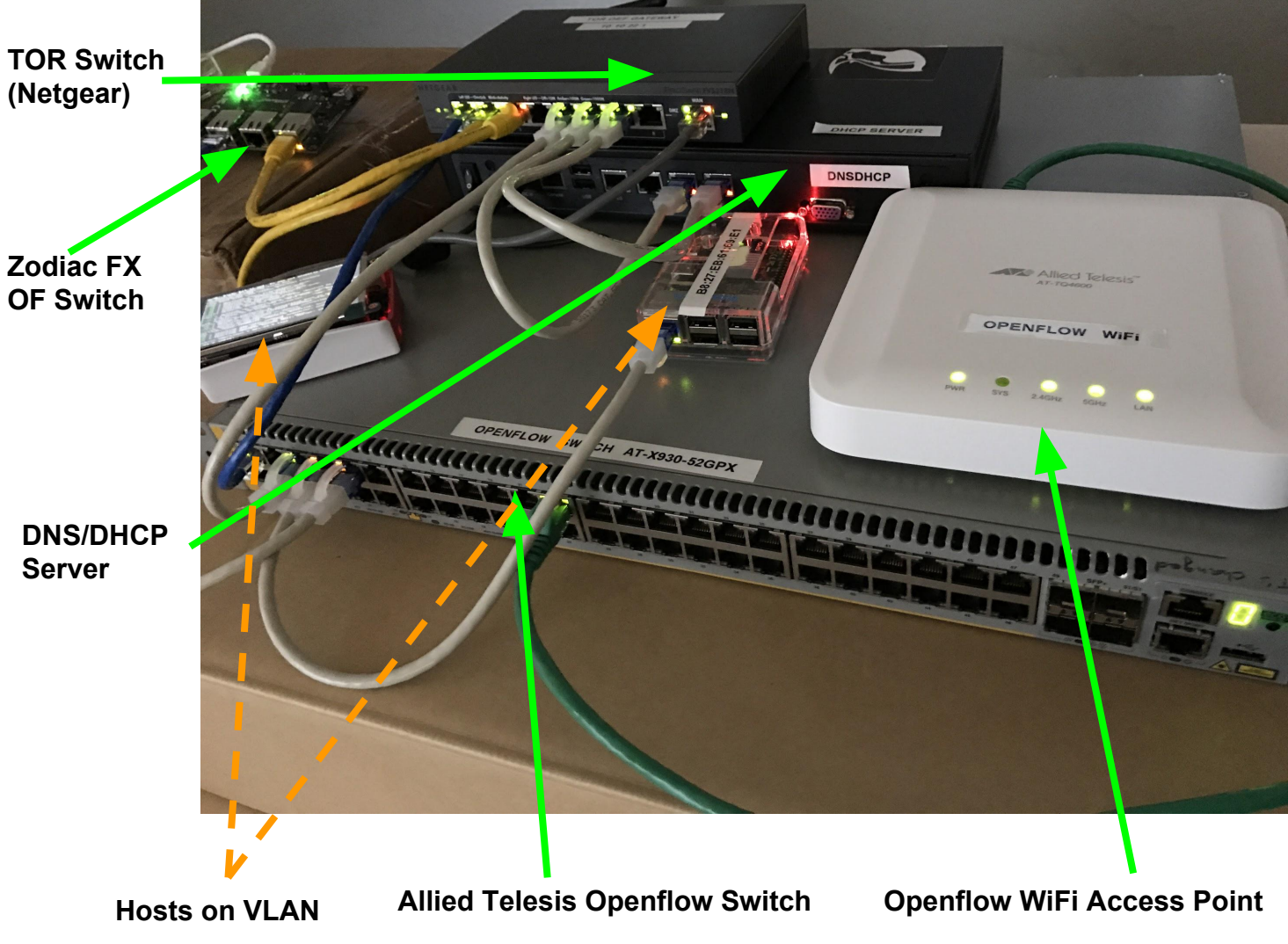
## Deployment



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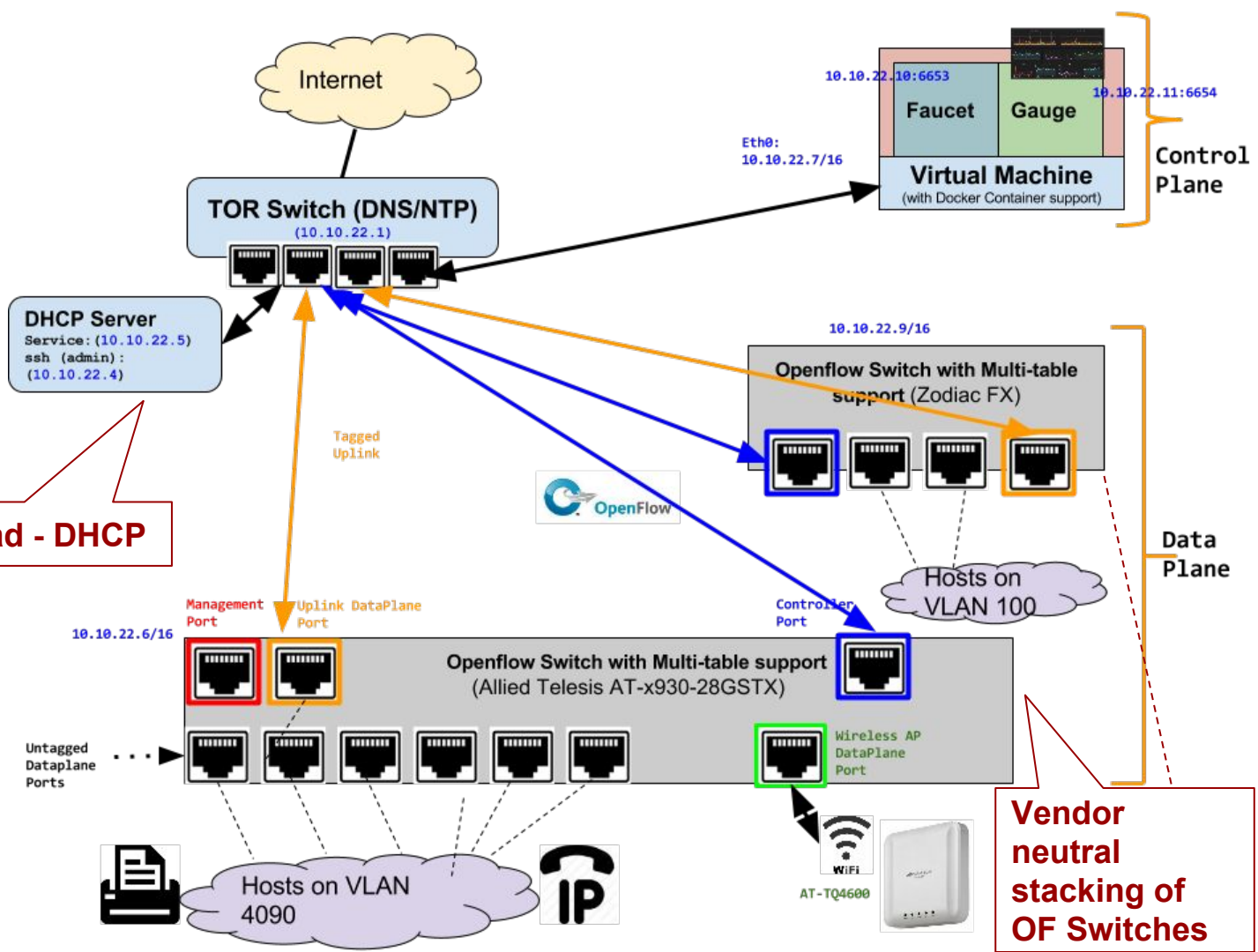
# Network Overlay Deployment Diagram




NFV Offload - DHCP

Vendor neutral stacking of OF Switches

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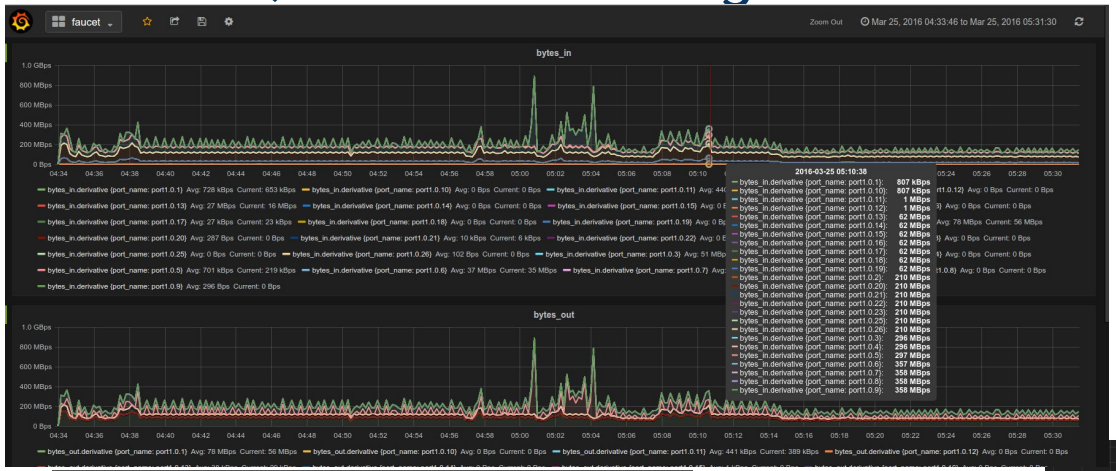
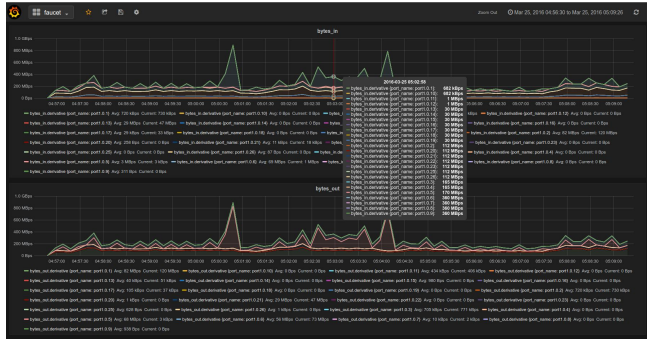
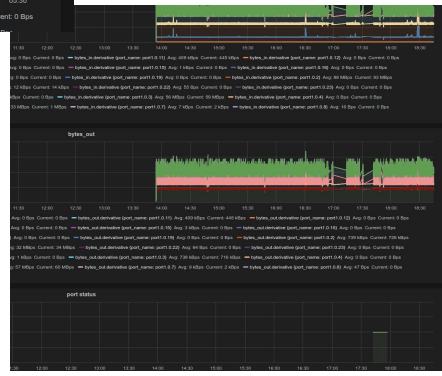
## Network Operations

- Real-time database integration for stats
- Grafana dashboards
- NoSQL database integration for flows





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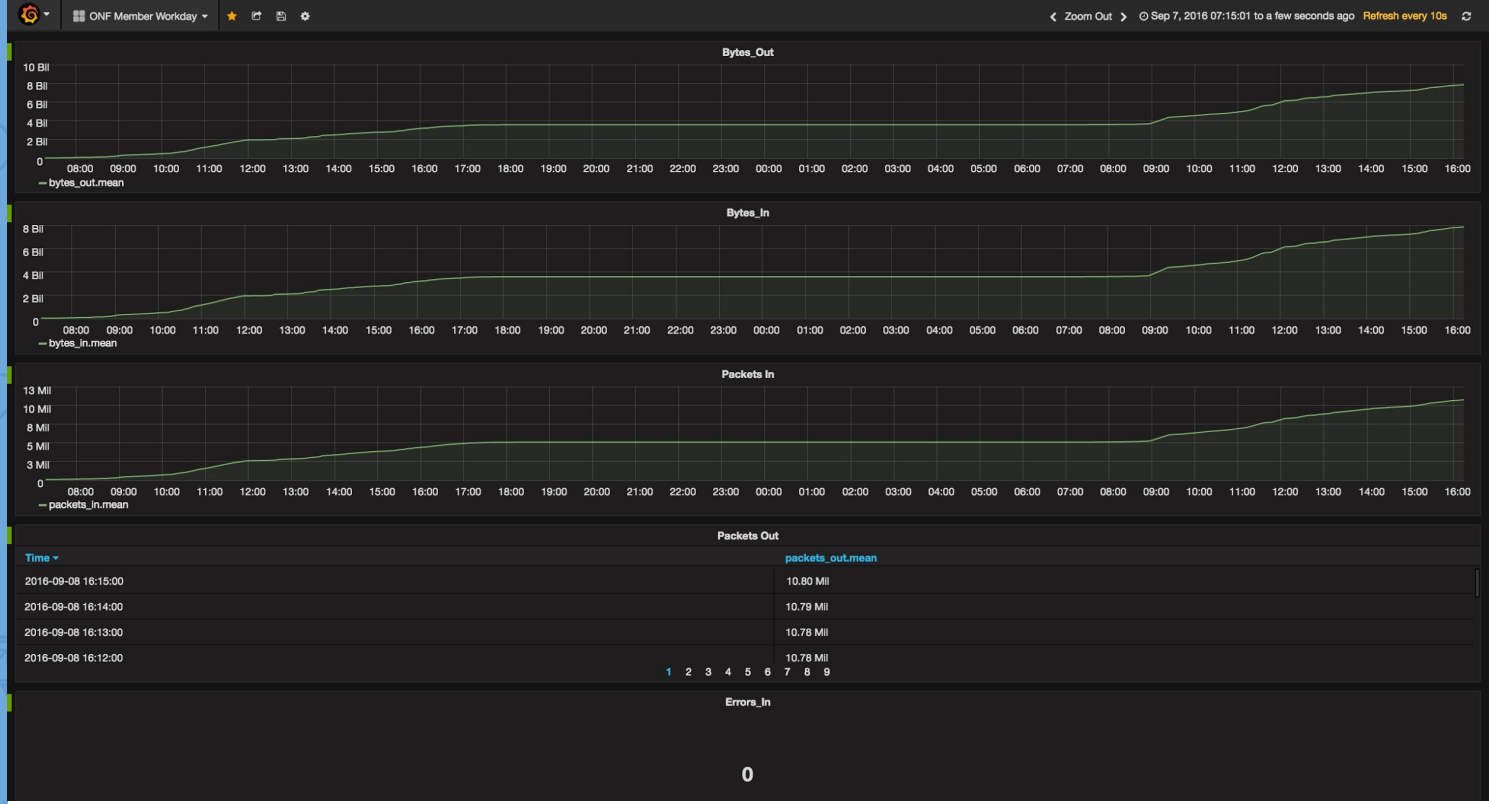
# ONF Member Workday - Network Dashboard




*2 days: Approximately 220+ clients served*
*Processed and Monitored ~8 Gigabits of Traffic*

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## OpenWRT & Faucet

- OpenWRT
  - Open source SOHO Wired/Wireless router software
  - 1200+ retail models with 30+ vendors publicly support this.
  - OpenVSwitch package available - no documentation to configure or use
- ONF
  - Configured, documented and integrated OpenWRT OVS to Faucet
- Integration Impact
  - Continue to do all the things a current router does
  - SDN for development and small scale production network now a commodity!
  - SDN controlled wired/wireless access
    - Identify devices making spurious “call home” and block them
    - Parental control
    - Bandwidth and traffic prioritization

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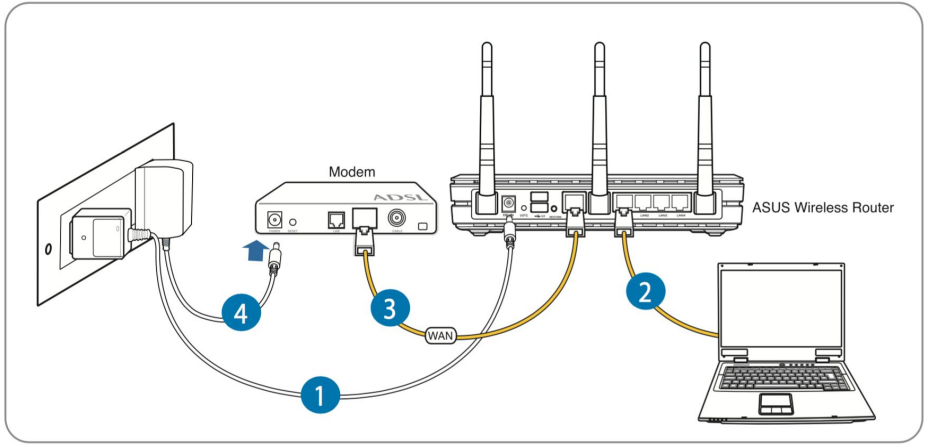
## OpenWRT Integration Architecture




Faucet

Ovsbridge (ovs_br0)

OpenWrt
Wireless Freedom

SWITCH

0

eth0.5
WAN

wlan0

1 2 3 4

eth0.1 eth0.2 eth0.3 eth0.4

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## Faucet Features (as of v1.2)

- IPv4 & IPv6
- VLAN
- ACL - port based
- Static Routing
- BGP
- Vendor neutral stacking of OF Switches
- 802.1x authentication support
- Configurable Learning
- Flooding
- Port Mirroring
- NFV Offload

- Database (CouchDB) support for flows
- Integrated support for time-series database for stats
- Grafana based dashboards for Network Operations Monitoring
- Comprehensive test suite
  - Mininet & Commercial switches
- Ability to easily integrate with Quagga (BGP), Radius (authentication), DHCP servers

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High Availability & Scalability

# High Availability

- Configure 2+ Faucet instances with the same config for the same switch
- No inter-controller configuration required

# Scalability

- Faucet is as scalable as the switch it controls for practical purposes
- @SDN Hackfest, with AT x930, we had 150+ hosts and 24,000+ flows
- More switches, just run Faucet on more Docker containers

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**Developer Profile**

## Python Programmer

- Knowledge of networking +
- Knowledge of NoSQL, Time Series database integration +
- Understanding of network deployments +

## Standard software development practices

- Git, writing test cases, documentation
- Linux usage, network configuration, Mininet
- Install and config - virtual machine, docker

## Advanced skillset (for specific projects)

- Technologies: BGP (Quagga, exabgp, Bird), OpenVSwitch, Openflow Spec, Radius, 802.1x, DHCP, DNS, Ethernet frames(L2), IP (L3), MPLS, Access Control List, Firewall,
- Software: HTML5, JavaScript, Grafana
- Deploying & configuring Cisco switches, enterprise/ campus networks

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**Faucet Applications**

1. Flow Manager UI - read for PR
2. Dynamic Firewall
3. Bro NetControl Framework
4. Simple STP
5. Broadcast helper
6. Device Health check
7. Flow Simulation

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Roadmap

## Events

- SDN Hackfest / Symposium, India, Jan/Feb 2017
- Open Network Summit, Santa Clara, CA, April 2017
- Interop Tokyo show floor - planning, June 2017

## Deployments

- “We need your help!!”

## Features

- MPLS
- Applications

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## Commercial Support

1. Shivaram@TrustStix.com
2. ASM Technologies (http://asmltd.com)
3. Others in the pipeline

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## References

- Github Repo - https://github.com/onfsdn/faucet
- Python pip - https://pypi.python.org/pypi/ryu-faucet
- Docker - https://hub.docker.com/r/faucet/
- Virtual Machine - https://susestudio.com/a/ENQFFD/ryu-faucet
- YouTube - https://www.youtube.com/playlist?list=PL2co5JVVb0LC2rz_Ygyk8OTAnWQCGnh_8
- Blog - https://faucet-sdn.blogspot.com/
- Publications: ACM Queue (Sept/Oct 2016) - Faucet: Deploying SDN in the Enterprise

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## Call To Action

1. Deploy SDN based wireless access (ex. Guest network) today
2. Provide us your use cases
3. Help us with code contributions, sponsorships for Hackfests