Software Defined Networking

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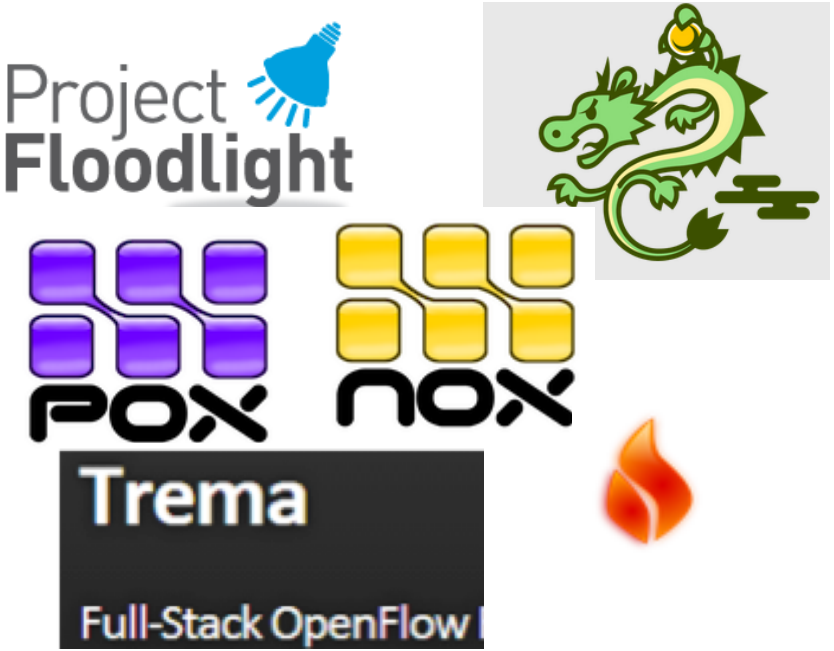
In this course, you will learn about software defined networking and how it is changing the way communications networks are managed, maintained, and secured.

Lesson Overview

- Overview of different SDN Controllers
- Basic understanding of each controller
  - Concepts
  - Architecture
  - Programming Model
- Pros and cons of each controller
- Ideal situations for each controller

Many Different SDN Controllers

- NOX/POX
- Ryu
- Floodlight
- OpenDaylight
- Pyretic
- Frenetic
- Procera
- RouteFlow
- Trema



Many Considerations

- Programming Language (can affect performance)
- Learning curve
- User base and community support
- Focus
  - Southbound API
  - Northbound API / “Policy Layer”
  - Support for OpenStack
  - Education, Research, or Production?

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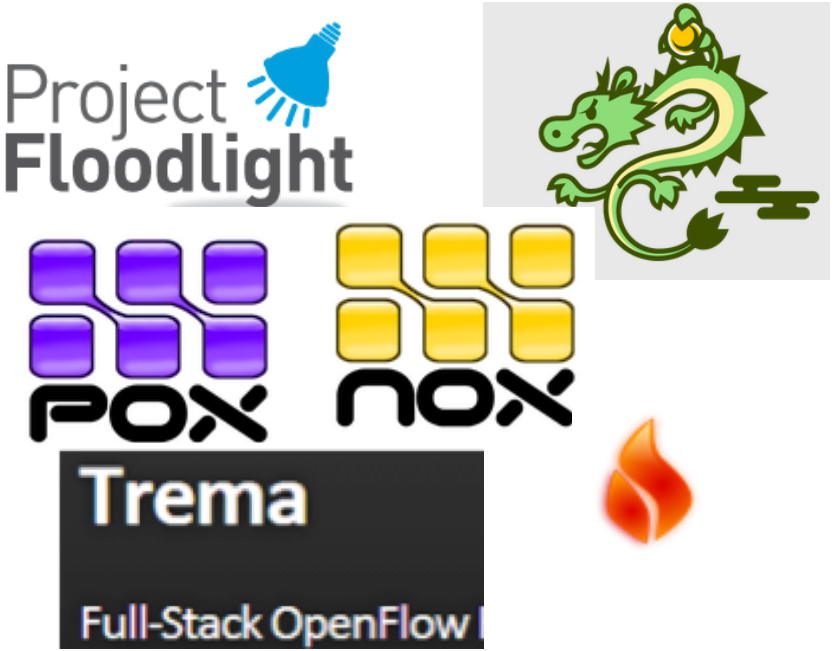

NOX: Overview

- First-generation OpenFlow controller
  - Open source, stable, widely used
- Two “flavors” of NOX
  - **NOX-Classic:** C++/Python. No longer supported.
  - **NOX (the “new NOX”)**
    - C++ only
    - Fast, clean codebase
    - Well maintained and supported

NOX: Characteristics

- Users implement control in C++
- Supports OpenFlow v.1.0
  - A fork (CPqD) supports 1.1, 1.2, and 1.3
- Programming model
  - Controller registers for events
  - Programmer writes event handler

When to Use NOX

- You know C++
- You are willing to use low-level facilities and semantics of OpenFlow
- You need good performance

POX: Overview

- NOX in Python
  - Supports OpenFlow v. 1.0 only
- **Advantages**
  - Widely used, maintained, supported
  - Relatively easy to read and write code
- **Disadvantages:** Performance

http://www.noxrepo.org/pox/about-pox/
https://openflow.stanford.edu/display/ONL/POX+Wiki

When to Use POX

- If you know (or can learn) Python and are not concerned about controller performance
- Rapid prototyping and experimentation
  - Research, experimentation, demonstrations
  - Learning concepts

Ryu

- Open source Python controller
  - Supports OpenFlow 1.0, 1.2, 1.3, 1.4, Nicira extensions
  - Works with OpenStack
- Aims to be an “Operating System” for SDN
- **Advantages**
  - OpenStack integration, OpenFlow 1.2, 1.3, 1.4
- **Disadvantages:** Performance

http://osrg.github.io/ryu/

Floodlight

- Open-source Java controller
  - Supports OpenFlow v. 1.0
  - Fork from the Beacon Java OpenFlow controller
  - Maintained by Big Switch Networks
- **Advantages**
  - Good documentation
  - Integration with REST API
  - Production-level, OpenStack/Multi-Tenant Clouds
- **Disadvantages:** Steep learning curve

http://www.projectfloodlight.org/floodlight/

Evolving Existing Controllers: LoxiGen

- Generates OF language-specific bindings
  - Input: Wire-protocol descriptions
  - Output: Protocol-specific bindings
  - http://github.com/floodlight/loxigen
- Generates OpenFlow v1.0-v1.3.1+ bindings
  - C: for Indigo
  - Java: for Floodlight
  - Python: for OFTest
  - Wireshark/Lua

When to Use Floodlight

- You know Java
- You need production-level performance and support
- You will use the REST API to interact with the controller

OpenDaylight

- **Goal:** Common industry supported platform
  - Robust, extensible open source codebase
  - Common abstractions for northbound capabilities
- **Advantages:** Industry acceptance, integration with OpenStack, cloud applications, etc.
- **Disadvantages:** Complex, steep learning curve

Also: HP VAN

http://www.opendaylight.org/

When to Use OpenDaylight

- You know Java
- You need production-level performance and support
- You need support with cloud applications, OpenStack, etc.
- You need modular functions
- You need apps already supported by vendors

Summary

	NOX	POX	Ryu	Floodlight	ODL
Language	C++	Python	Python	Java	Java
Performance	Fast	Slow	Slow	Fast	Fast
Distributed	No	No	Yes	Yes	Yes
OpenFlow	1.0 (CPqD: 1.1, 1.2, 1.3)	1.0	1.0, 1.1, 1.3, 1.4	1.0	1.0, 1.3
Multi-tenant Clouds	No	No	Yes	Yes	Yes
Learning Curve	Moderate	Easy	Moderate	Steep	Steep

- Choice of controller depends on needs, language, etc.
- **So far:** Southbound API implementations
  Later: "Northbound" APIs