Introduction to OpenDaylight and Hydrogen, Learnings from the Year, and What’s Next for OpenDaylight

David Meyer, CTO and Chief Scientist, Brocade
dmm@{brocade.com,uoregon.edu,cs.uoregon.edu,1-4-5.net,…}
@dmm613
Kyle Mestery, Principal Engineer, Cisco
mestery@mestery.com
@mestery
Universal Laws, Architecture, and the Hidden Nature of Complexity (and what does this have to do with SDN?)

\[
\int_0^\infty \ln |S(i\omega)| d\omega = \int_0^\infty \ln \left| \frac{1}{1 + L(i\omega)} \right| d\omega = \pi \sum Re(p_k) - \frac{\pi}{2} \lim_{s \to \infty} sL(s)
\]
Gain/Sensitivity Tradeoff In Feedback Control
(understanding this is going to wind up being critically important for SDN)

\[ \int_0^\infty \ln |S(i\omega)| \, d\omega = \int_0^\infty \ln \left| \frac{1}{1 + L(i\omega)} \right| \, d\omega = \pi \sum \text{Re}(p_k) - \frac{\pi}{2} \lim_{s \to \infty} sL(s) \]

Bode Sensitivity Integral

Gain

Precision

Low

High

Precise

Sloppy

Well, Not Really

Theorem: \( G \leq \frac{1}{P} \)
Agenda

- What is OpenDaylight/Hydrogen
- Key Personal Learning from a Year Inside ODP
- A Few Hydrogen/ODP Metrics
- What Is Queued up for “Helium”
- Were we’re going
What is OpenDaylight

OpenDaylight is an **Open Source Software** project under the **Linux Foundation** with the goal of furthering the adoption and innovation of Software Defined Networking (SDN) through the creation of a common industry supported platform

<table>
<thead>
<tr>
<th>Code</th>
<th>Acceptance</th>
<th>Community</th>
</tr>
</thead>
</table>
| To create a robust, extensible, open source code base that covers the major common components required to build an SDN solution | To get broad industry acceptance amongst vendors and users  
- Using OpenDaylight code directly or through vendor products  
- Vendors using OpenDaylight code as part of commercial products | To have a thriving and growing technical community contributing to the code base, using the code in commercial products, and adding value above, below and around. |
What is OpenDaylight building?

OpenDaylight is an open community that is building:

- An evolvable SDN platform capable of handling diverse use cases and implementation approaches
- Common abstractions of capabilities NorthBound for people to program
- Intermediation of those capabilities to multiple Southbound implementations
- Programmable Network services
- Network Applications
- Whatever else we need to make it work
Project Framework
Who is OpenDaylight?
(the corporate sponsors)
OpenDaylight Simultaneous Release

- OpenDaylight is multi-project
  - 15 projects currently in “bootstrap” or “incubation”

- Bringing components together in a simultaneous release
  - CodeName: Hydrogen
  - Release on: Jan 28, 2014

- Several “editions” to group related functionality together
  - base, virtualization, service provider
  - *virtualization edition will provide OpenStack integration*
# Simultaneous Release Plan

<table>
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<tr>
<th>Milestone</th>
<th>Offset 0 Date</th>
<th>Offset 1 Date</th>
<th>Offset 2 Date</th>
<th>Events</th>
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<tr>
<td>M0</td>
<td>6/24/2013</td>
<td>6/26/2013</td>
<td>6/28/2013</td>
<td>Simultaneous Release Open</td>
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<tr>
<td>M1</td>
<td>7/22/2013</td>
<td>7/24/2013</td>
<td>7/26/2013</td>
<td>1. Projects must have declared intent to participate in Simultaneous Release 2. Participating Projects must have published a candidate Release Plan for public comment</td>
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<td>8/23/2013</td>
<td>Participating Projects must have declared their final Release Plan</td>
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<td>9/16/2013</td>
<td>9/18/2013</td>
<td>9/20/2013</td>
<td>Latest possible Continuous Integration Test Start</td>
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<tr>
<td>M4</td>
<td>10/14/2013</td>
<td>10/16/2013</td>
<td>10/18/2013</td>
<td>1. API Freeze 2. Latest possible Continuous System Test Start</td>
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<td>11/13/2013</td>
<td>11/15/2013</td>
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<tr>
<td>RC0</td>
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<td>11/20/2013</td>
<td>11/22/2013</td>
<td>Latest possible date for commencing User Facing Documentation</td>
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<tr>
<td>Formal Release</td>
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[Image: www.opendaylight.org]
What Hydrogen Delivered

- OpenDaylight is multi-project
  - 15 projects
    - Project diversity v. mono-culture

- Simultaneous Release

- Release Date: Dec 9, 2013 ~ Feb 03 2014

- Various Issues/Learning's
Impressive List of Projects in H₂

- Controller
- VTN
- OpenDove
- Affinity Management Service
- LISP Mapping Service
- Yang Tools
- Defense4All
- BGP-LS/PCEP

- OpenFlow Protocol
- OpenFlow SB Plugin
- OVSDB
- SNMP4SDN
- DLUX
- STI
OpenDaylight APIs (REST)

- Topology Mgr
- Stats Mgr
- Switch Mgr
- Host Tracker
- Shortest Path Forwarding
- Network Config
- Affinity Service
- OpenStack Service
- LISP Service
- VTN Manager
- DOVE Mgr

Service Abstraction Layer (SAL)
(plug-in mgr., capability abstractions, flow programming, inventory, …)

OpenFlow
1.0
1.3

NETCONF

OVSDDB
SNMP
BGP-LS
PCEP
LISP

OpenFlow Enabled Devices

Open vSwitches

Additional Virtual & Physical Devices

Controller Platform

Southbound Interfaces & Protocol Plugins

Data Plane Elements (Virtual Switches, Physical Device Interfaces)

VTN: Virtual Tenant Network
DOVE: Distributed Overlay Virtual Ethernet
DDoS: Distributed Denial Of Service
LISP: Locator/Identifier Separation Protocol
OVSDDB: Open vSwitch DataBase Protocol
BGP: Border Gateway Protocol
PCEP: Path Computation Element Communication Protocol
SNMP: Simple Network Management Protocol
Base Edition

**OpenDaylight APIs (REST)**

- Topology Mgr
- Stats Mgr
- Switch Mgr
- Host Tracker
- Shortest Path Forwarding
- Network Config

**Base Network Service Functions**

- Service Abstraction Layer (SAL)
  (plug-in mgr., capability abstractions, flow programming, inventory, …)

**Controller Platform**

- Network Applications
  Orchestration & Services

**Southbound Interfaces & Protocol Plugins**

- OpenFlow
  1.0 1.3

**OpenFlow Enabled Devices**

- Open vSwitches

**Additional Virtual & Physical Devices**

- Data Plane Elements
  (Virtual Switches, Physical Device Interfaces)

**Management GUI/CLI**

**Network Applications**

**Software Defined Networking**

**Open vSwitch**

**Data Plane Elements**

- VTN: Virtual Tenant Network
- DOVE: Distributed Overlay Virtual Ethernet
- DDoS: Distributed Denial Of Service
- LISP: Locator-Identifier Separation Protocol
- OVSDB: Open vSwitch DataBase Protocol
- BGP: Border Gateway Protocol
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DOVE: Distributed Overlay Virtual Ethernet
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LISP: Locator/Identifier Separation Protocol
OVSDB: Open vSwitch Database Protocol
BGP: Border Gateway Protocol
PCEP: Path Computation Element Communication Protocol
SNMP: Simple Network Management Protocol
OpenStack Integration

- OpenDaylight exposes a single common OpenStack Service Northbound
  - API exposed matches Neutron API precisely
  - multiple implementations of Neutron networks in OpenDaylight
- OpenDaylight OpenStack Neutron Plugin simply passes through
  - simplifies OpenStack plugin
  - pushes complexity to OpenDaylight
OpenStack Integration: Status

- **ML2 Driver available in Icehouse release!**
  - Supports VXLAN and GRE tunnel networks
  - devstack support merged upstream
    - *Run OpenDaylight as a top-level service in devstack!*
- **OpenStack Neutron API Service** available now in OpenDaylight
  - provides Neutron API handling for multiple implementations
- Initial ML2 plugin focused on core Neutron functionality
  - Still uses Neutron [DHCP, L3] agents
OpenStack Integration: Next Steps

- Updates planned for Helium and Juno:
  - VIF plugging changes for stability improvements
  - Notify from ODL to MechanismDriver once ODL has setup the port on the host
- Security groups implemented using OpenFlow rules
- L3 routing handled by OpenDaylight
  - Removes the need for the L3 agent
- Additional refinements and bug fixes
Agenda

- What is OpenDaylight/Hydrogen
- Key Personal Learning's from a Year Inside ODP
- A Few Hydrogen/ODP Metrics
- What Is Queued up for “Helium”
- Were we’re going
Key Learnings

• **Community building** is a core objective
  - In fact, innovation through collaboration is one of the most powerful features of OSD

• **Code** is the coin of the realm

• **Engineering systems** are as important as artifacts

 Putting this all Together ➔

http://www.sdncentral.com/education/david-meyer-reflections-opendaylight-open-source-project-brocade/2014/03/
Trend: Engineering artifacts are no longer the source of sustainable advantage and/or innovation

Perhaps surprisingly, the “hyper-scale” and open source communities have taught me that actual artifacts (in our case network applications as well as HW/SW) are ephemeral entities and that the only source of sustainable advantage/innovation consists of:

- Engineering Systems
- Culture
- People/Process

What you build isn’t as important as how you build it.

http://en.wikipedia.org/wiki/Aeroelasticity - Flutter
One Way To Think About OSD

David Meyer
March 28 · Edited

One way to think about open source development: Early on things are chaotic, there is a lot of stuff orbiting anything with enough gravity, there are epic collisions and everything is molten (e.g., like the surface of the earth during the LHB [0]). But if you wait a couple of billion years and let things evolve you can wind up with a beautiful blue planet or the Linux kernel or ...

[0] http://en.wikipedia.org/wiki/Late_Heavy_Bombardment

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Michael Howard, Chris Grundemann, Ken'ichiro Hashimoto and 11 others like this.
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OpenDaylight project creation

7 new project proposals pending
OpenDaylight code volume (ohloh.net)

Languages

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<th>Language</th>
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<th>Code Lines</th>
<th>Percent Code Lines</th>
<th>Total Comment Lines</th>
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</tbody>
</table>

Code, Comments and Blank Lines

- Java: 461,768
- C++: 291,849
- C: 146,115
- Python: 33,539

www.opendaylight.org
Project comparisons (ohloh.net)

In a Nutshell, OpenDaylight...

- has had 4,759 commits made by 154 contributors representing 1,045,938 lines of code
- is mostly written in Java with an average number of source code comments
- has a young, but established codebase maintained by a very large development team with stable Y-O-Y commits
- took an estimated 292 years of effort (COCOMO model)

<table>
<thead>
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<tr>
<td>controller</td>
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</tr>
</tbody>
</table>

www.opendaylight.org

Quick Reference

- Project Links: [Homepage]
- Code Locations: (14 Locations)
- Licenses: EPL-1.0
- Similar Projects: CDO Model, Centreon, Re...
- Managers: mavenugo

www.opendaylight.org
Membership — who wants to play

- Cisco
- Brocade
- PLEX
- NICTY
- VEX
- Versa Networks
- Pantheon
- midokura
- Coriant
- ZTE
- IBM
- Citrix
- Red Hat
- Microsoft
- Juniper Networks
- VMware
- HP
- NEC
- Arista
- Nuage Networks
- Intel
- ASUS
- Fujitsu
- Plumgrid
- Dell
- April 8 launch
- June 3
- June 5
- June 15
- October 3
- January 16
- February 4

www.opendaylight.org
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What’s in the queue?

https://wiki.opendaylight.org/view/Project_Proposals:Main

- Application Policy Plugin
- Developer Toolkit (archetypes, etc)
- Packet Cable PCMM Manager
- Dynamic Resource Reservation
- Documentation
- SDN Simulation Platform
- Data Persistence
- Distributed Systems (Infinispan, Akka, …)
- Python OpenDaylight Client
Agenda

- Key Personal Learning from a Year Inside ODP
- Quick Level Set: What is Hydrogen
- A Few Hydrogen/ODP Metrics
- What Is Queued up for “Helium”
- Were we’re going
Quasi-technical things we want to work on (necessarily incomplete list)

- Continue to build/refine our community
  - Including increasing committer diversity across the projects
  - Code Quality and Coverage
    - Stability, Performance, Bug fixes ($Major.$Minor)
  - Distributed Systems Issues (Akka, Inifinspan)
  - Splitting up the controller
    - MD-SAL, ...

- “Staffing”
  - Release engineering
  - Documentation

- Continue to refine our engineering systems
  - Thanks Andrew!
  - Fewer humans in the loop

- We need more code that writes code
  - MD-SAL is an example
  - Fewer humans in the loop
  - More automation more better
And of course

- Sustaining Engineering
  - No end to the number of bugs we find

- Performance and scalability

- Again, Code Quality

- New Projects
  - I mentioned a few
  - Several others were informally proposed at the ODP Summit
Thanks!