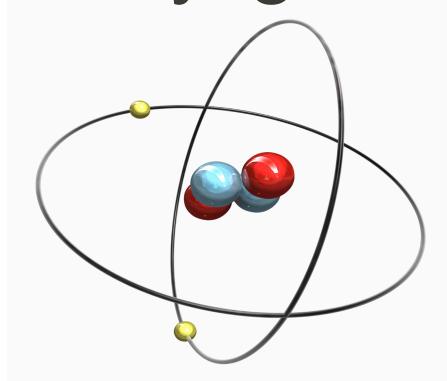
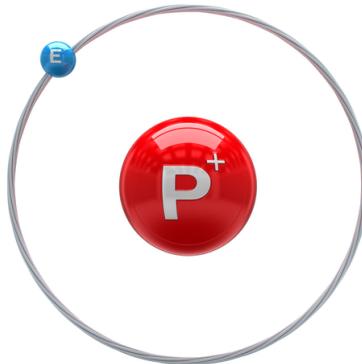




# Introduction to OpenDaylight and Hydrogen, Learnings from the Year, and What's Next for OpenDaylight



David Meyer  
CTO and Chief Scientist, Brocade  
Great Wide Open 2014  
<http://greatwideopen.org/>  
dmm@{brocade.com, uoregon.edu, cs.uoregon.edu, 1-4-5.net, ...}  
dmm613 @ twitter

# Universal Laws, Architecture, and the Hidden Nature of Complexity (and what does this have to do with SDN?)



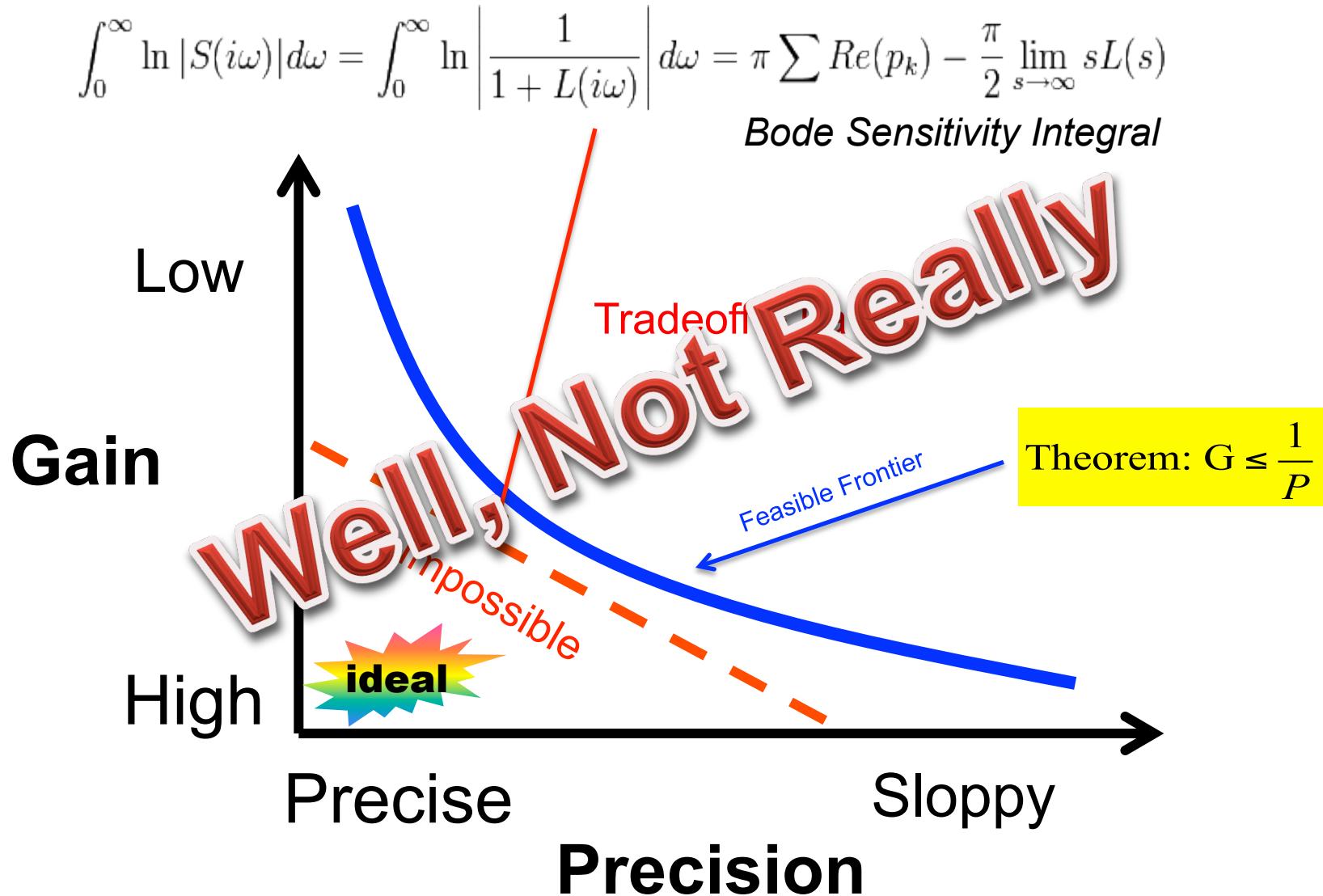
Just Kidding

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

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[dmm@{brocade.com,uoregon.edu,cs.uoregon.edu,1-4-5.net,...}](mailto:dmm@{brocade.com,uoregon.edu,cs.uoregon.edu,1-4-5.net,...})  
[http://www.1-4-5.net/~dmm/talks/macro\\_trends\\_complexity\\_and\\_sdn.pdf](http://www.1-4-5.net/~dmm/talks/macro_trends_complexity_and_sdn.pdf)

# Gain/Sensitivity Tradeoff In Feedback Control

(understanding this is going to wind up being critically important for SDN)



# Agenda

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

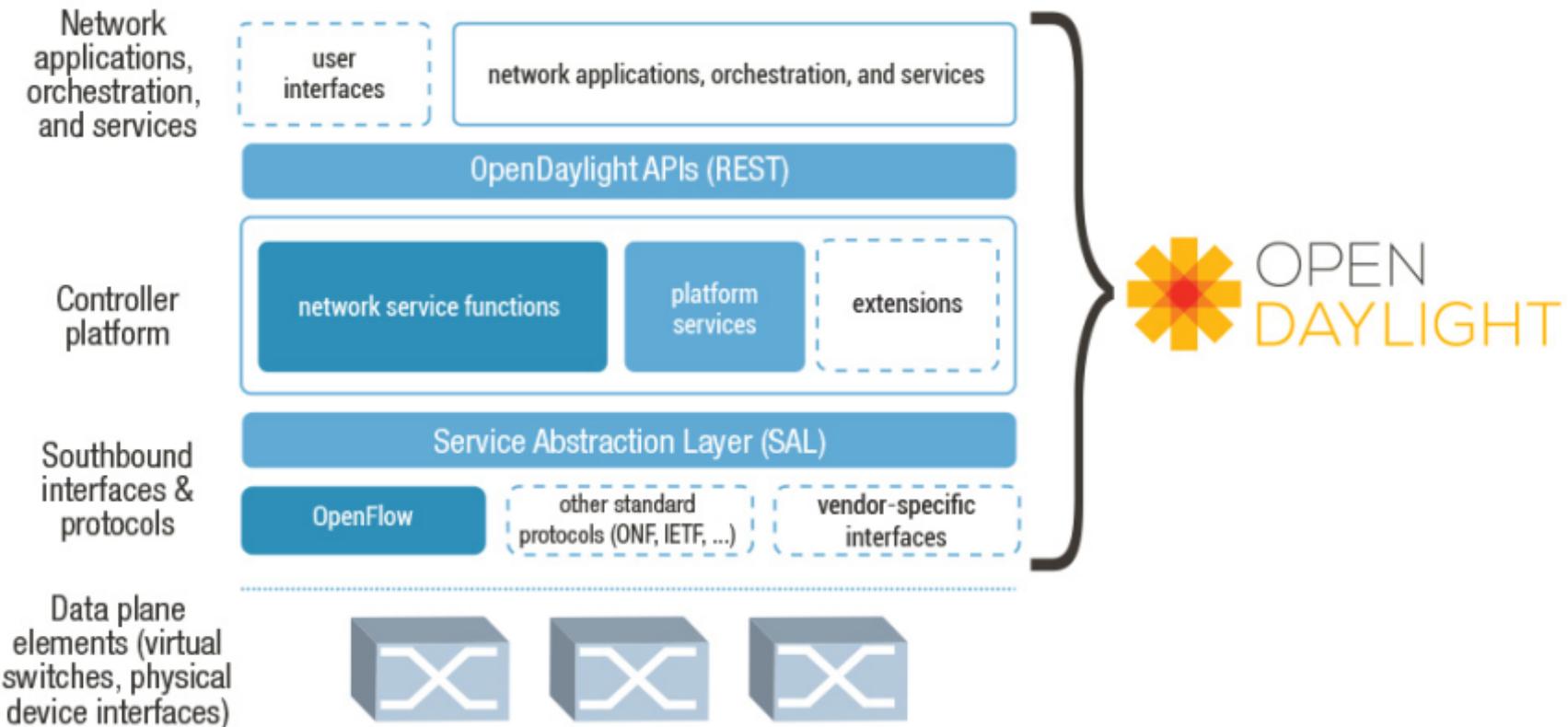
Code	Acceptance	Community
To create a robust, extensible, open source code base that covers the major common components required to build an SDN solution	To get broad industry acceptance amongst vendors and users <ul style="list-style-type: none"><li>• using OpenDaylight code directly or through vendor products</li><li>• Vendors using OpenDaylight code as part of commercial products</li></ul>	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)

## Platinum Members



## Gold Members



## Silver Members



# OpenDaylight Simultaneous Release

- OpenDaylight is multi-project
  - 15 projects currently in “bootstrap” or “incubation”
  - Bringing components together in a simultaneous release
    - CodeName: Hydrogen
    - Due Date: Dec 9, 2013
- Several “editions” to group related functionality together
  - base, virtualization, service provider
  - virtualization edition will provide OpenStack integration

# Simultaneous Release Plan

Milestone	Offset 0 Date	Offset 1 Date	Offset 2 Date	Events
M0	6/24/2013	6/26/2013	6/28/2013	Simultaneous Release Open
M1	7/22/2013	7/24/2013	7/26/2013	1. Projects must have declared intent to participate in Simultaneous Release 2. Participating Projects must have published a candidate Release Plan for public comment
M2	8/19/2013	8/21/2013	8/23/2013	Participating Projects must have declared their final Release Plan
M3	9/16/2013	9/18/2013	9/20/2013	Latest possible Continuous Integration Test Start
M4	10/14/2013	10/16/2013	10/18/2013	1. API Freeze 2. Latest possible Continuous System Test Start
M5	11/11/2013	11/13/2013	11/15/2013	Code Freeze (bug fixes only from here) String Freeze (all internationalizable strings frozen to allow for translation) Latest possible date for commencing User Facing Documentation
RC0	11/18/2013	11/20/2013	11/22/2013	
RC1	11/25/2013	11/27/2013	11/29/2013	
RC2	12/2/2013	12/4/2013	12/6/2013	Participating Projects must hold their Release Reviews, including User Facing Documentation.
Formal Release	12/9/2013			

Well



# What Hydrogen Delivered

- OpenDaylight is multi-project
  - 14 projects
  - Project diversity v. mono-culture
- *Simultaneous Release*
- Release Date: Dec 9, 2013 ~ Feb 03 2014
- Various Issues/Learnings

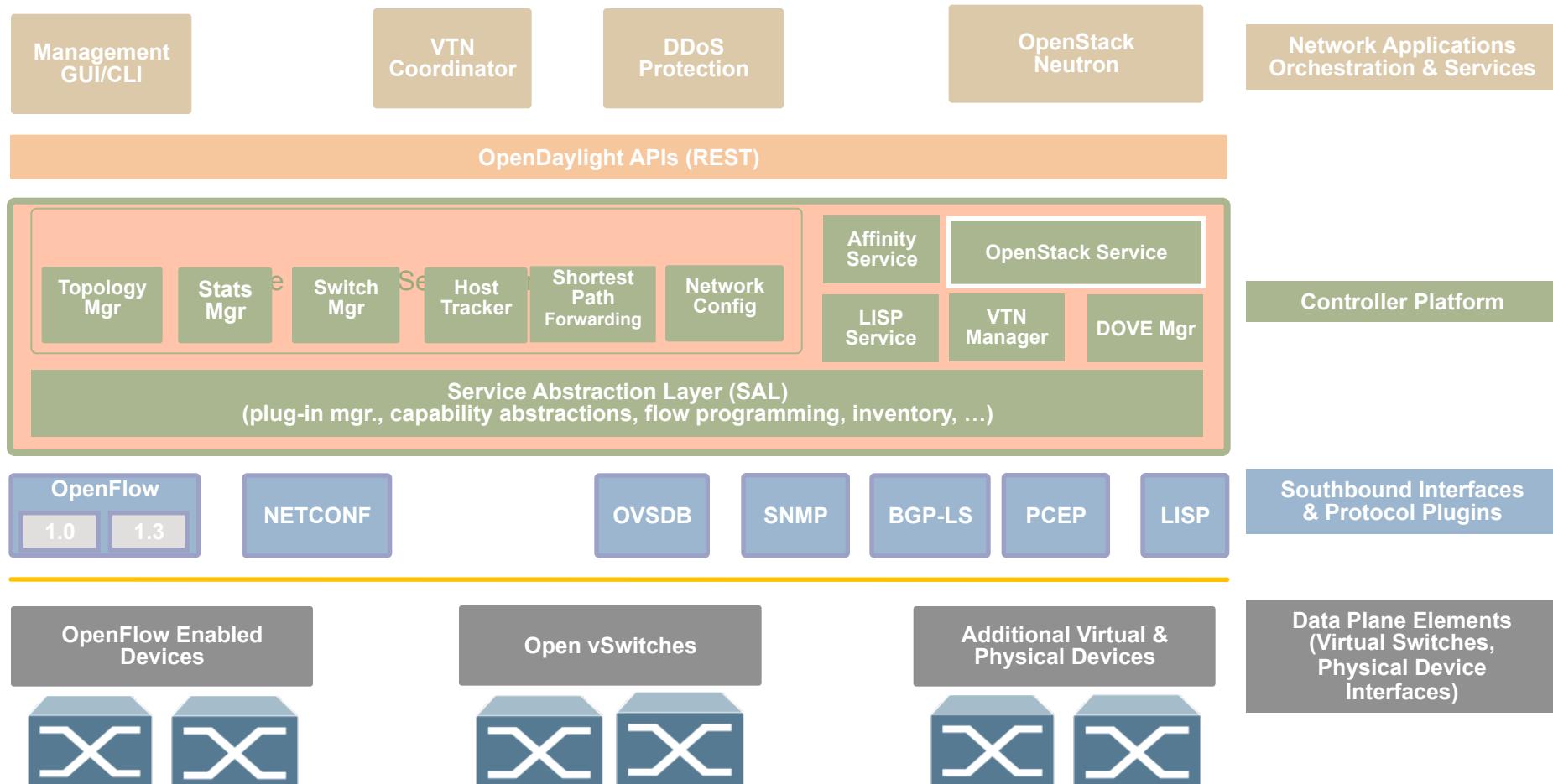
# Impressive List of Projects in H<sub>2</sub>

- [Controller](#)
- [VTN](#)
- [OpenDove](#)
- [Affinity Management Service](#)
- [LISP Mapping Service](#)
- [Yang Tools](#)
- [Defense4All](#)
- [BGP-LS/PCEP](#)
- [OpenFlow Protocol](#)
- [OpenFlow SB Plugin](#)
- [OVSDB](#)
- [SNMP4SDN](#)
- [DLUX](#)
- [STI](#)





# Hydrogen Release (Jan 2014)



VTN: Virtual Tenant Network

DOVE: Distributed Overlay Virtual Ethernet

DDoS: Distributed Denial Of Service

LISP: Locator/Identifier Separation Protocol

OVSDB: Open vSwitch DataBase Protocol

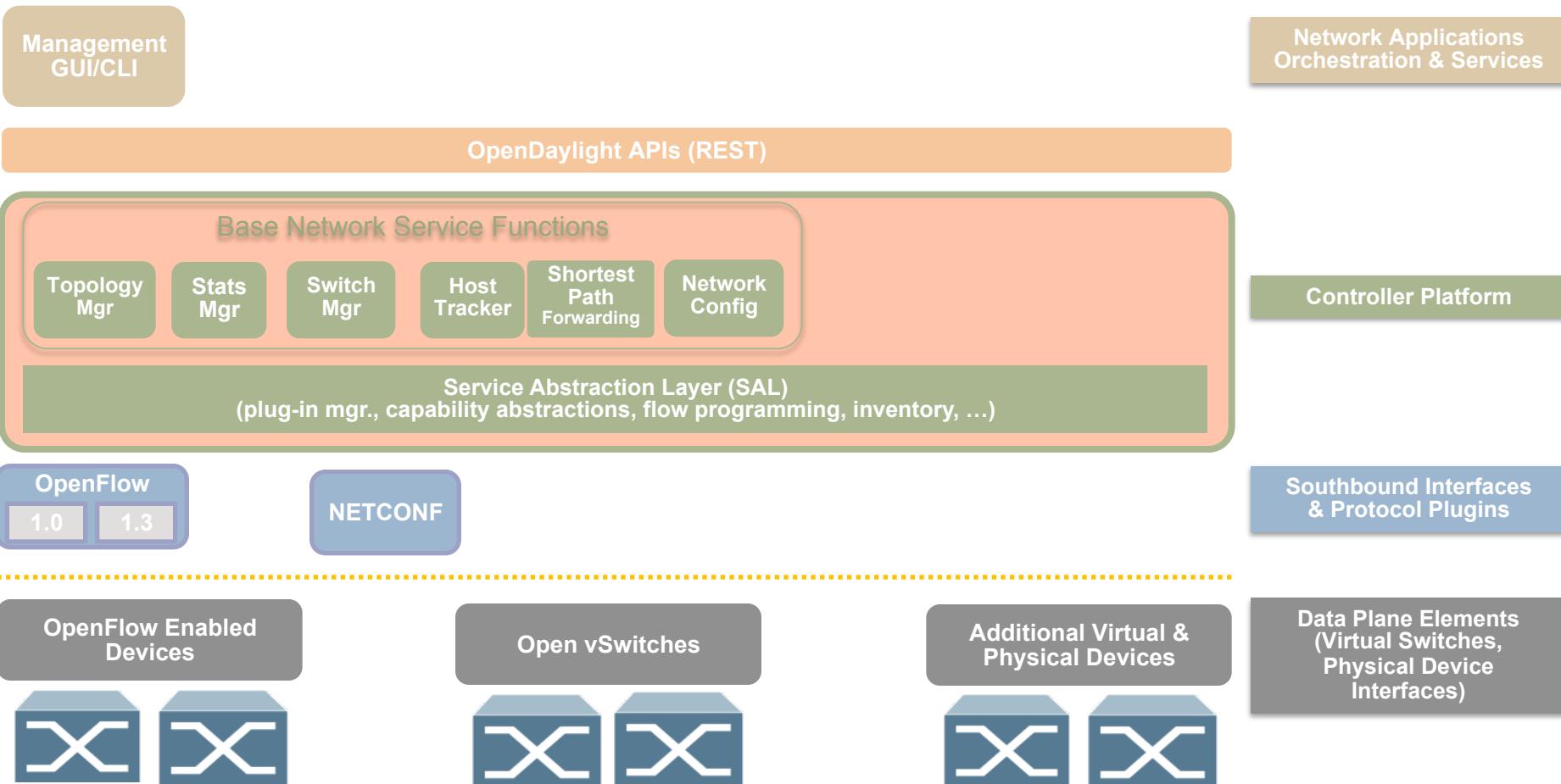
BGP: Border Gateway Protocol

PCEP: Path Computation Element Communication Protocol

SNMP: Simple Network Management Protocol



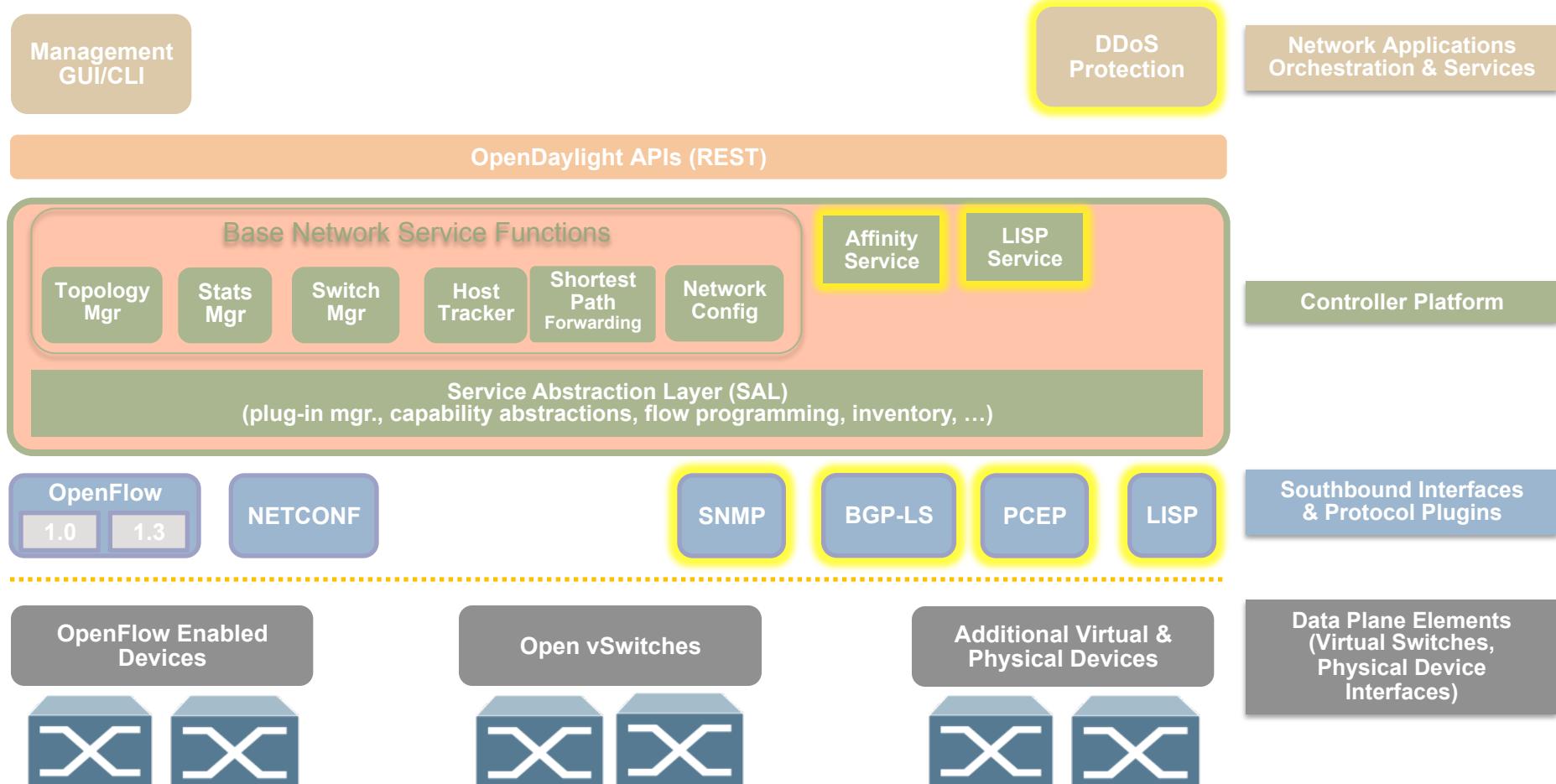
# Base Edition



*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  
PCEP: Path Computation Element Communication Protocol  
SNMP: Simple Network Management Protocol*



# Service Provider Edition



VTN: Virtual Tenant Network  
DOVE: Distributed Overlay Virtual Ethernet

DDoS: Distributed Denial Of Service

LISP: Locator/Identifier Separation Protocol

OVSDB: Open vSwitch DataBase Protocol

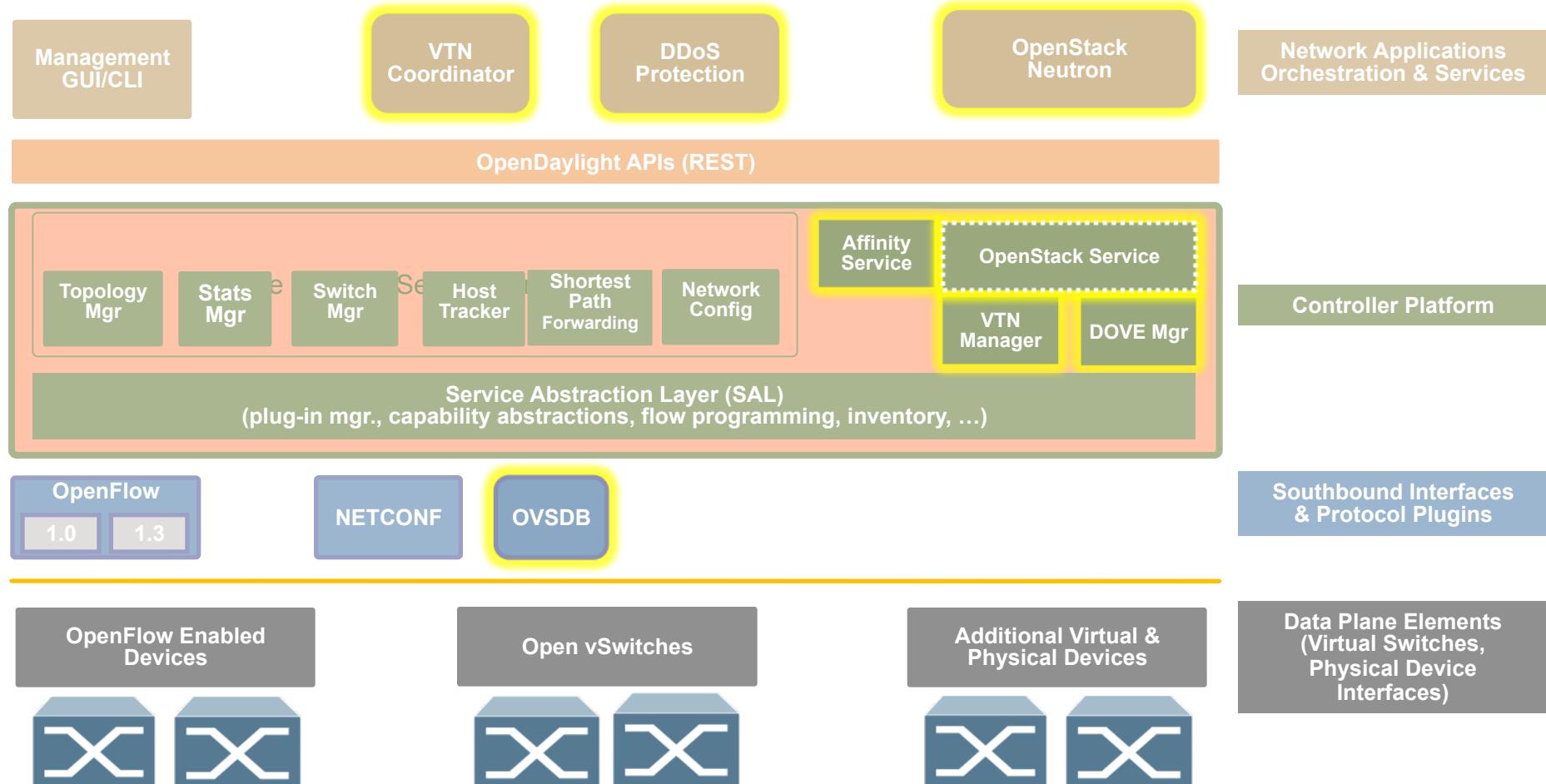
BGP: Border Gateway Protocol

PCEP: Path Computation Element Communication Protocol

SNMP: Simple Network Management Protocol

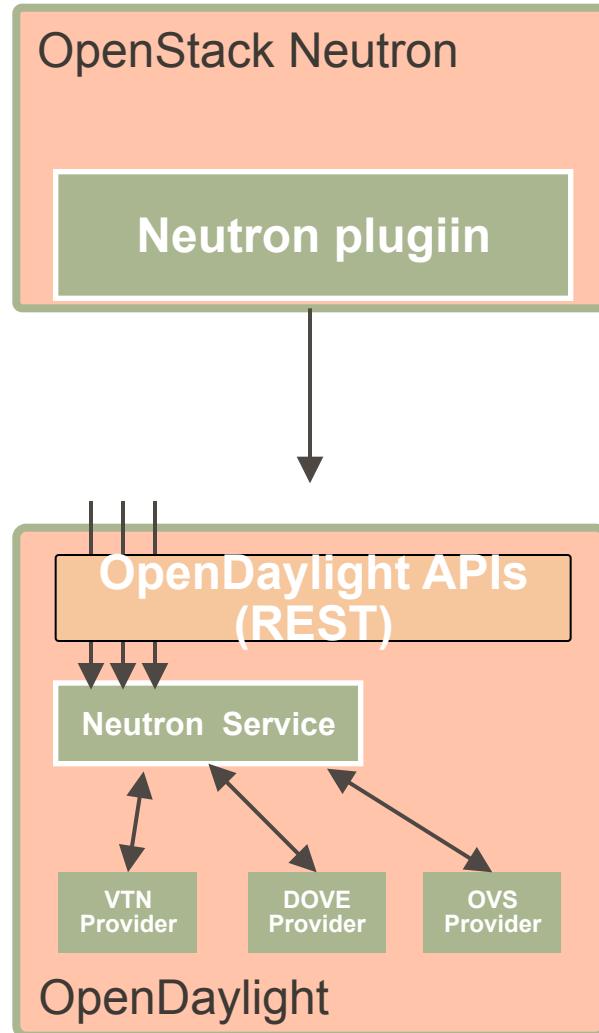


# Virtualization Edition



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  
PCEP: Path Computation Element Communication Protocol  
SNMP: Simple Network Management Protocol

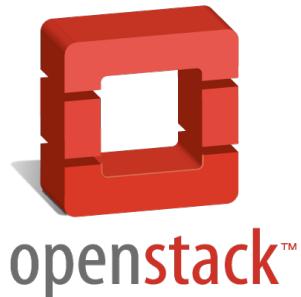
# OpenStack Integration



- 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 and Next Steps

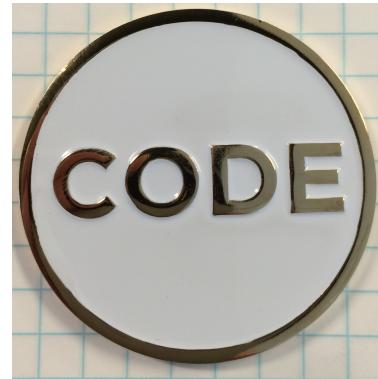
- *OpenStack Neutron API Service* available now in OpenDaylight
  - provides Neutron API handling for multiple implementations
- Initial ML2 plugin focused on core Neutron functionality
  - L4-L7 service support as a next step
- Plugin planned to be upstreamed into OpenStack Neutron during the Icehouse release



# Agenda

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

# Key Learnings (at least for me)

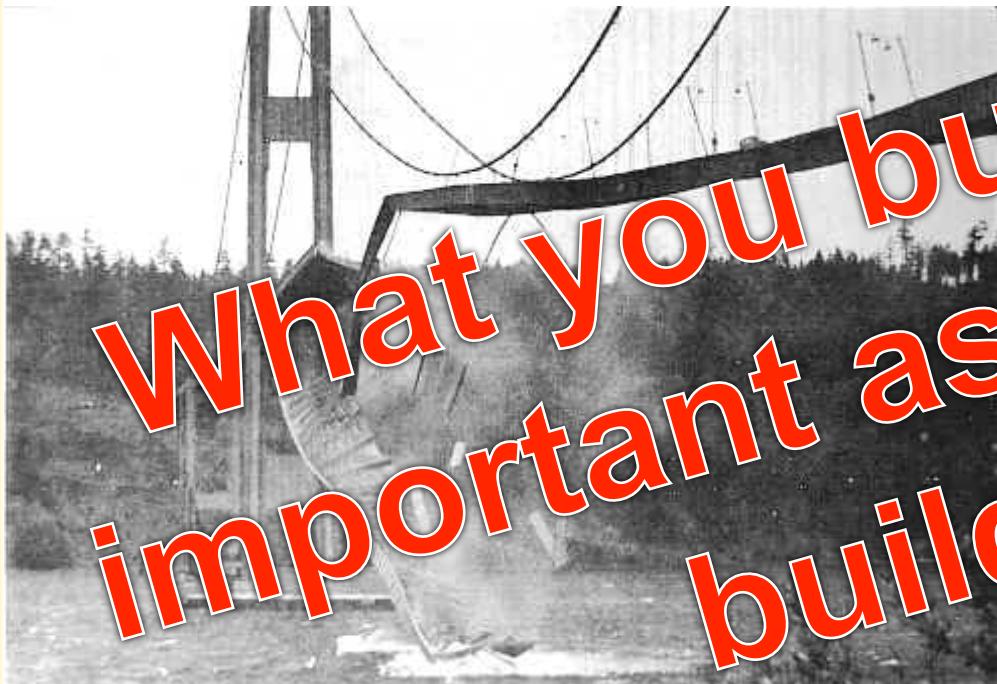


- **Community building** is a core objective
  - In fact, *innovation through collaboration* is one of the most powerful features of OSD
- **Code** is the coin of the realm
- **Engineering systems** are as important as artifacts

***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” nature of 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

<http://en.wikipedia.org/wiki/Aeroelasticity - Flutter>

# One Way To Think About OSD

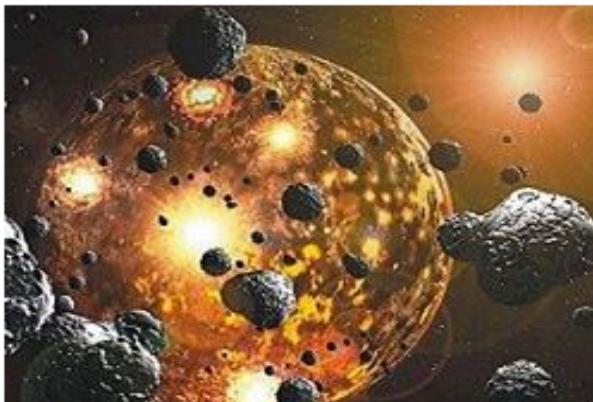


David Meyer

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](http://en.wikipedia.org/wiki/Late_Heavy_Bombardment)



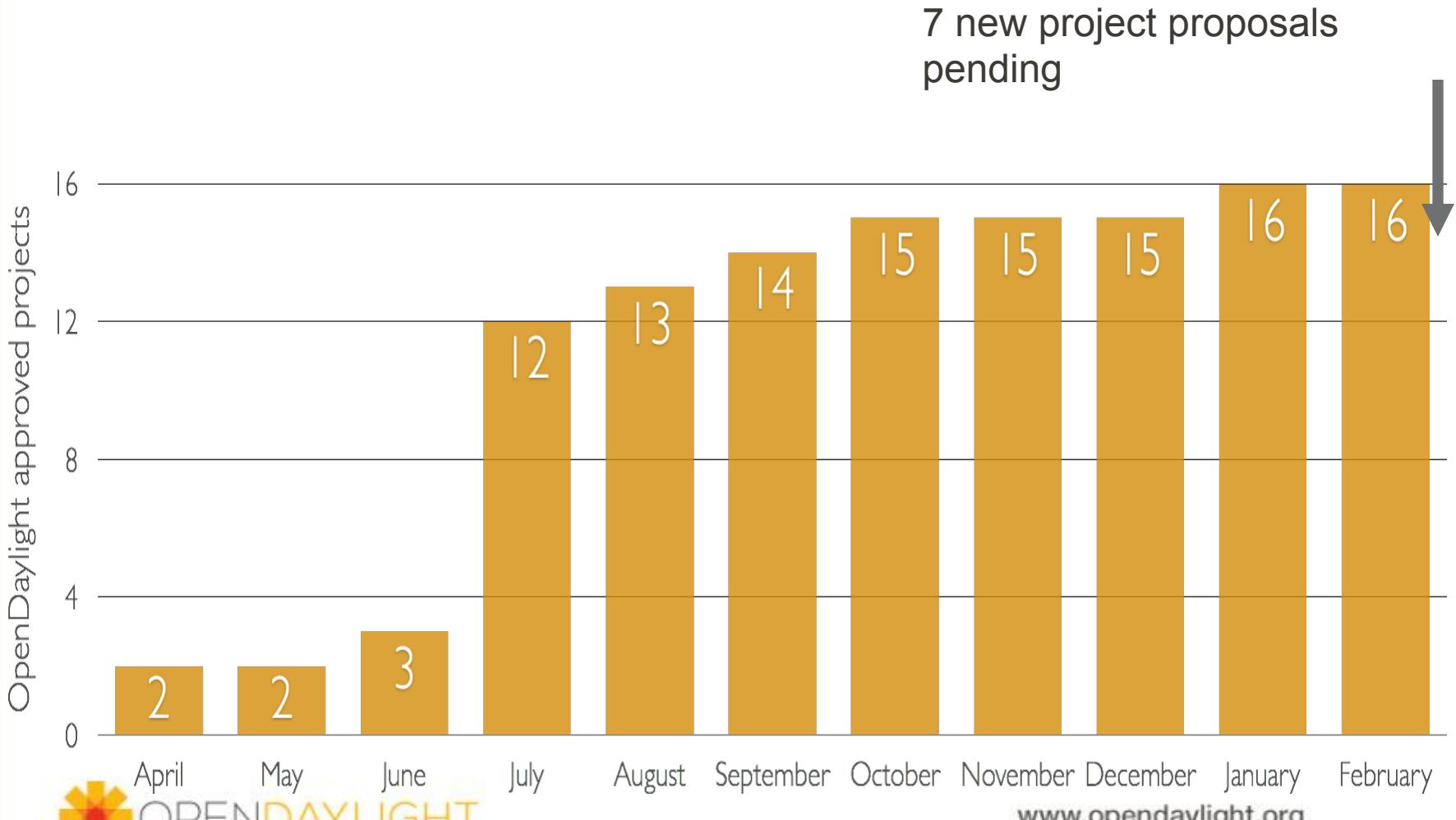
Like · Comment · Promote · Share

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

# Agenda

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

# OpenDaylight project creation



[www.opendaylight.org](http://www.opendaylight.org)

# OpenDaylight code volume ([ohloh.net](http://ohloh.net))

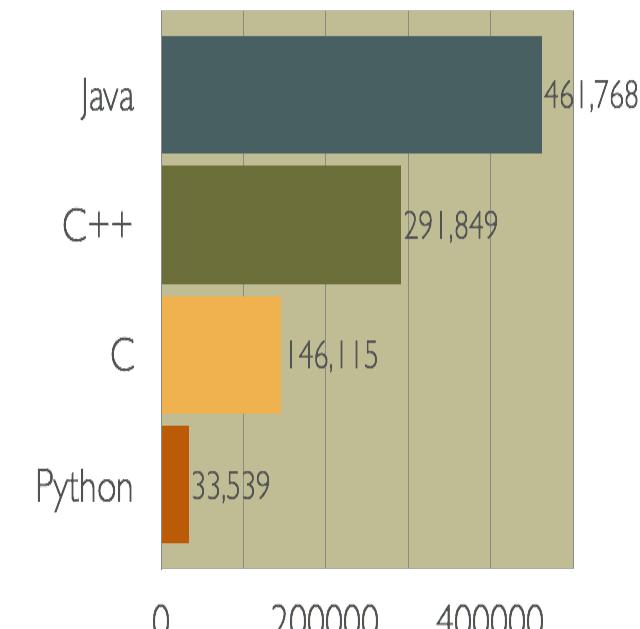
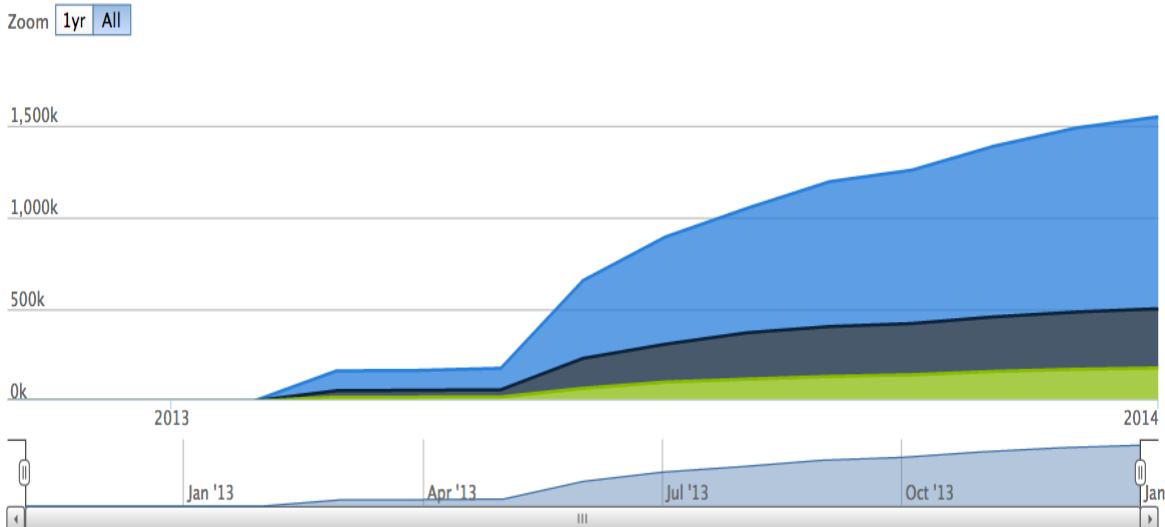


## Languages

① Analyzed 10 days ago based on code collected 12 days ago

Total Lines :	1,548,552	Code Lines :	1,045,938	Percent Code Lines :	67.5%
Number of Languages :	18	Total Comment Lines :	322,675	Percent Comment Lines :	20.8%
		Total Blank Lines :	179,939	Percent Blank Lines :	11.6%

## Code, Comments and Blank Lines



[www.opendaylight.org](http://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)

## Quick Reference

**Project Links:** [Homepage](#)

**Code Locations:** (14 Locations)

**Licenses:** EPL-1.0

**Similar Projects:**  CDO Model  Centreon

Re...



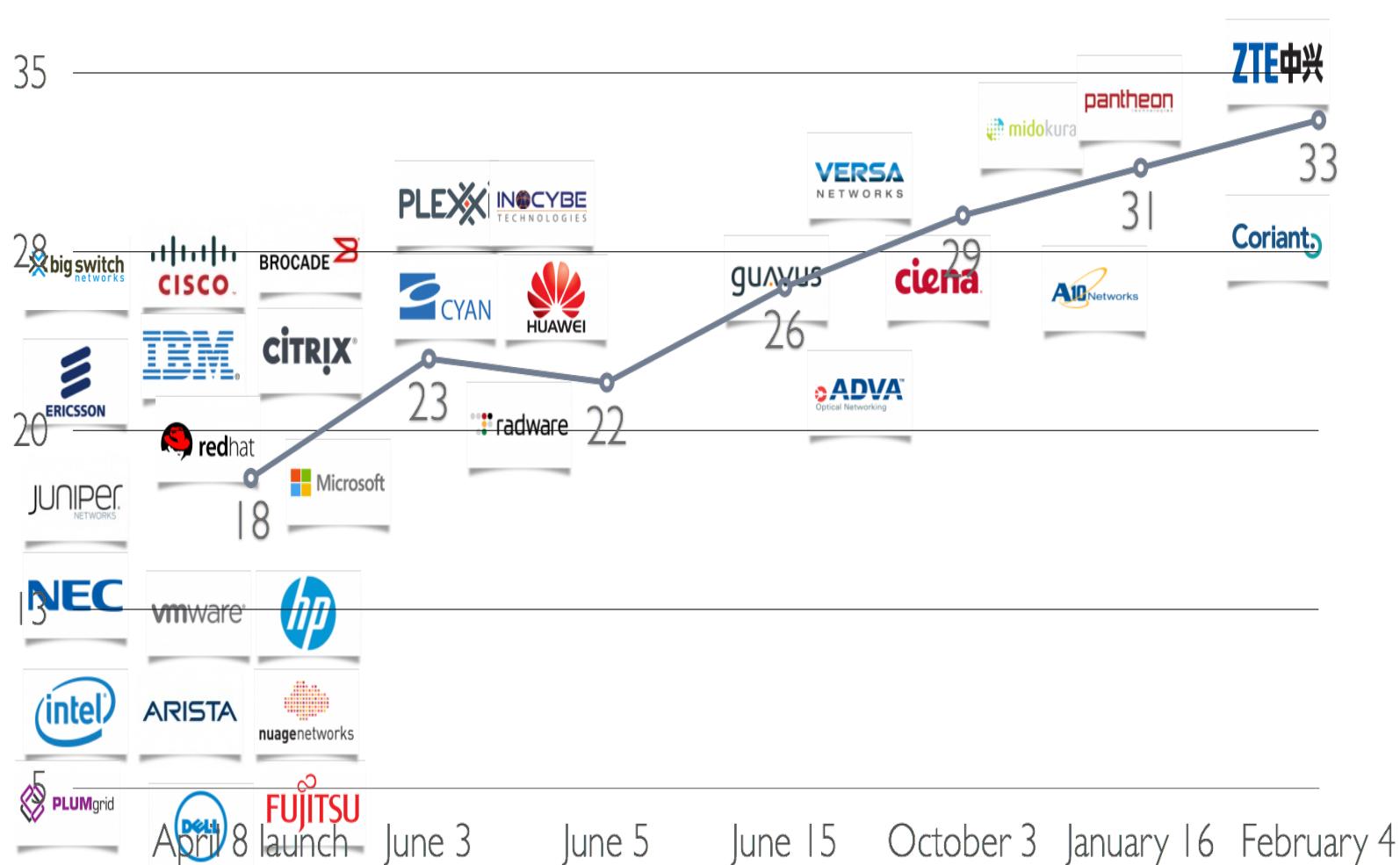
OpenNMS

**Managers:** mavenugo

	LOC	contributors
OpenStack	1.67M	1,974
CloudStack	1.5M	250
Eclipse platform	2.67M	404
OpenDaylight	1.05M	154
Floodlight	97K	52
contrail-vrouter	19K	15
contrail-controller	258K	53

[www.opendaylight.org](http://www.opendaylight.org)

# Membership — who wants to play



[www.opendaylight.org](http://www.opendaylight.org)

CONTEXSTREAM

QOSMOS  
Your Network is Information

# Agenda

- What is ODP/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's in the queue?

[https://wiki.opendaylight.org/view/Project\\_Proposals:Main](https://wiki.opendaylight.org/view/Project_Proposals:Main)

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

# 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”
- Where 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)
- “Staffing”
  - Release engineering
  - Documentation
- Continue to refine our engineering systems
  - Thanks Andrew!
  - Versioning
  - 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

# Resources

- More information and to join:
  - [wiki.opendaylight.org](http://wiki.opendaylight.org)
- Keep informed and join the conversation
  - IRC: #.opendaylight on irc.freenode.net
  - Open mailing lists: [lists.opendaylight.org](http://lists.opendaylight.org)
  - [@openDaylightSDN](https://twitter.com/openDaylightSDN)
  - #OpenDaylight





# Thanks!

