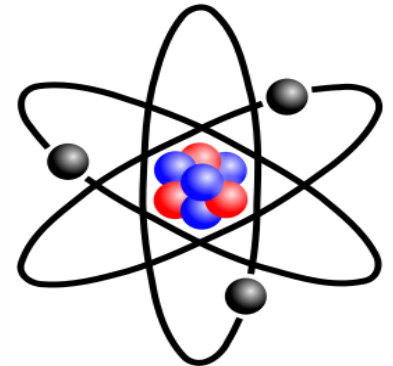
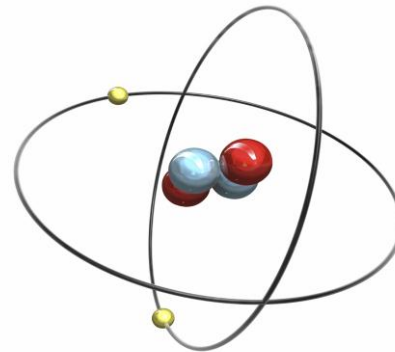
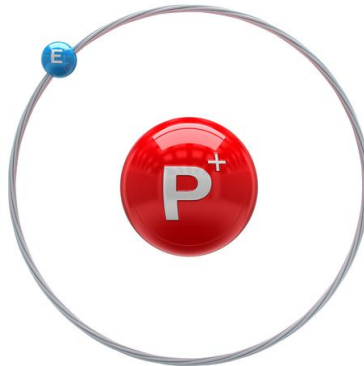




Current Events in OpenDaylight

(and where we're going)



David Meyer, CTO and Chief Scientist, Brocade
Global SDN Technology Conference 2014, Beijing, China
<http://www.conference.cn/sdnt/2014/en/Conference.asp?ArticleID=520>
dmm@{brocade.com,uoregon.edu,cs.uoregon.edu,1-4-5.net,...}
<http://www.1-4-5.net/~dmm/vita.html>
@dmm613

Agenda

- What is Hydrogen
 - And What Did We Learn?
- Introduction to Helium
- Next Steps – Beyond Helium
- Discussion/Question and Answer

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

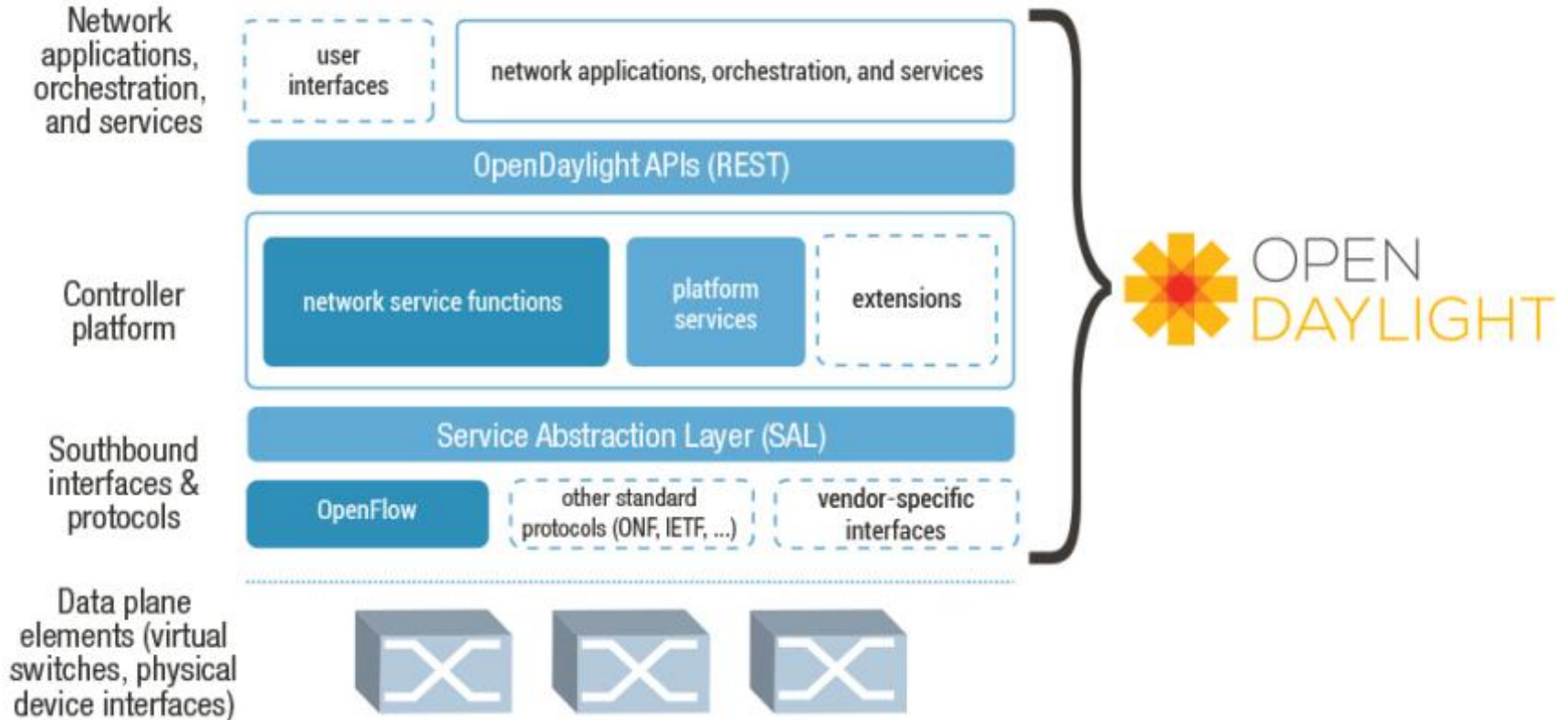
Code	Acceptance	Community
To create a robust, extensible, open source code base that covers the major common components required to build an SDN solution	To get broad industry acceptance amongst vendors and users <ul style="list-style-type: none">• Using OpenDaylight code directly or through vendor products• 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
 - Including engineering systems

Project Framework



Who is OpenDaylight Project?

Platinum



Gold



Silver



OpenDaylight Simultaneous Release

- OpenDaylight is multi-project
 - 20+ projects in Bootstrap or Incubation State
 - Bringing components together in a simultaneous release
 - CodeName: Hydrogen
 - Planned release date: Dec 12, 2013²
- 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	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. API Freeze 2. Latest possible Continuous System Test Start
M5	11/11/2013	11/13/2013	11/15/2013	<ol style="list-style-type: none"> 1. Code Freeze (bug fixes only from here) 2. String Freeze (all internationalizable strings frozen to allow for translation) 3. 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...

03 Feb 2014



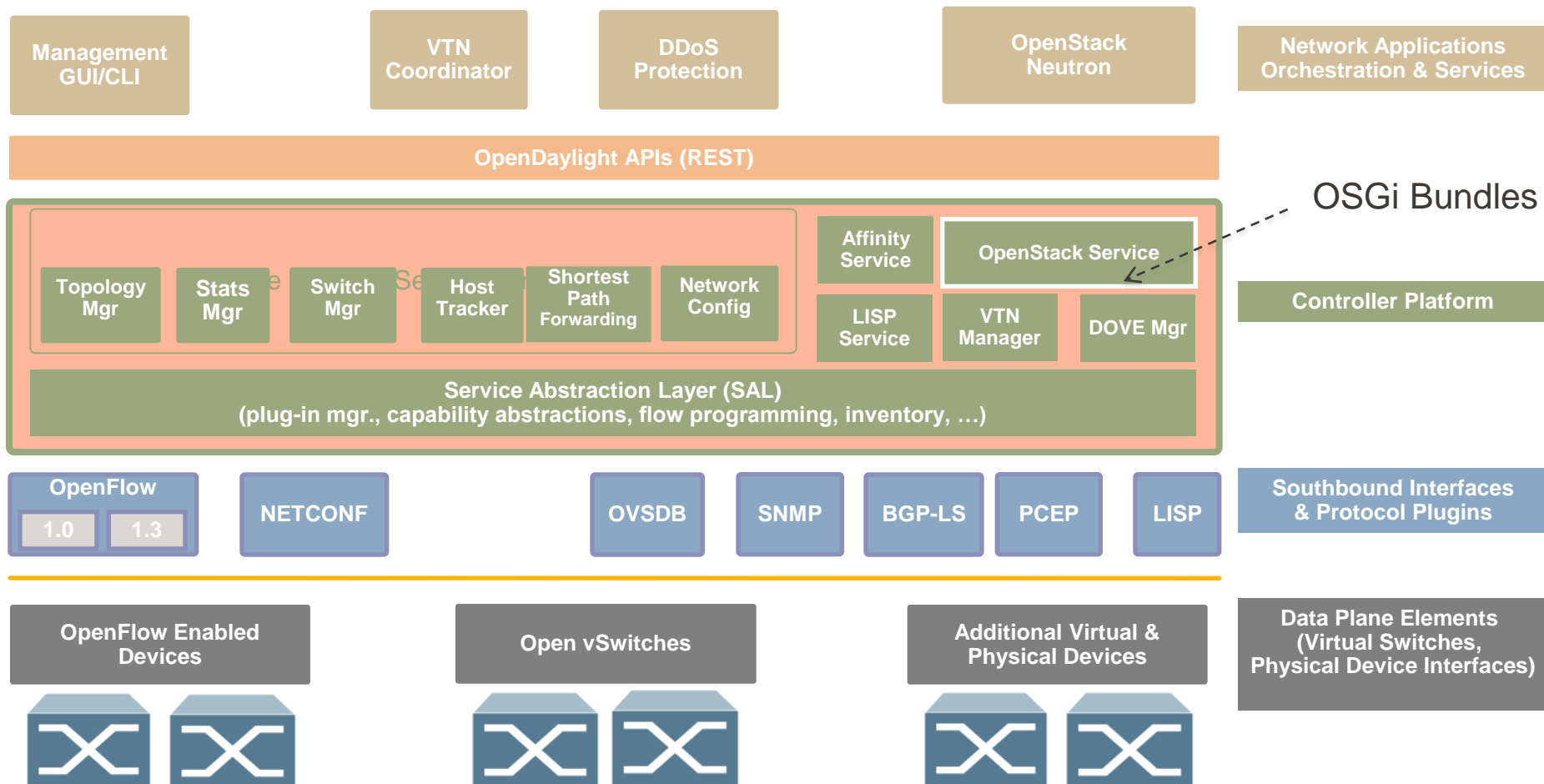
Impressive List of Projects in H₂

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





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

Management
GUI/CLI

Network Applications
Orchestration & Services

OpenDaylight APIs (REST)

Base Network Service Functions

Topology
Mgr

Stats
Mgr

Switch
Mgr

Host
Tracker

Shortest
Path
Forwarding

Network
Config

Controller Platform

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

OpenFlow

1.0

1.3

NETCONF

Southbound Interfaces
& Protocol Plugins

OpenFlow Enabled
Devices



Open vSwitches

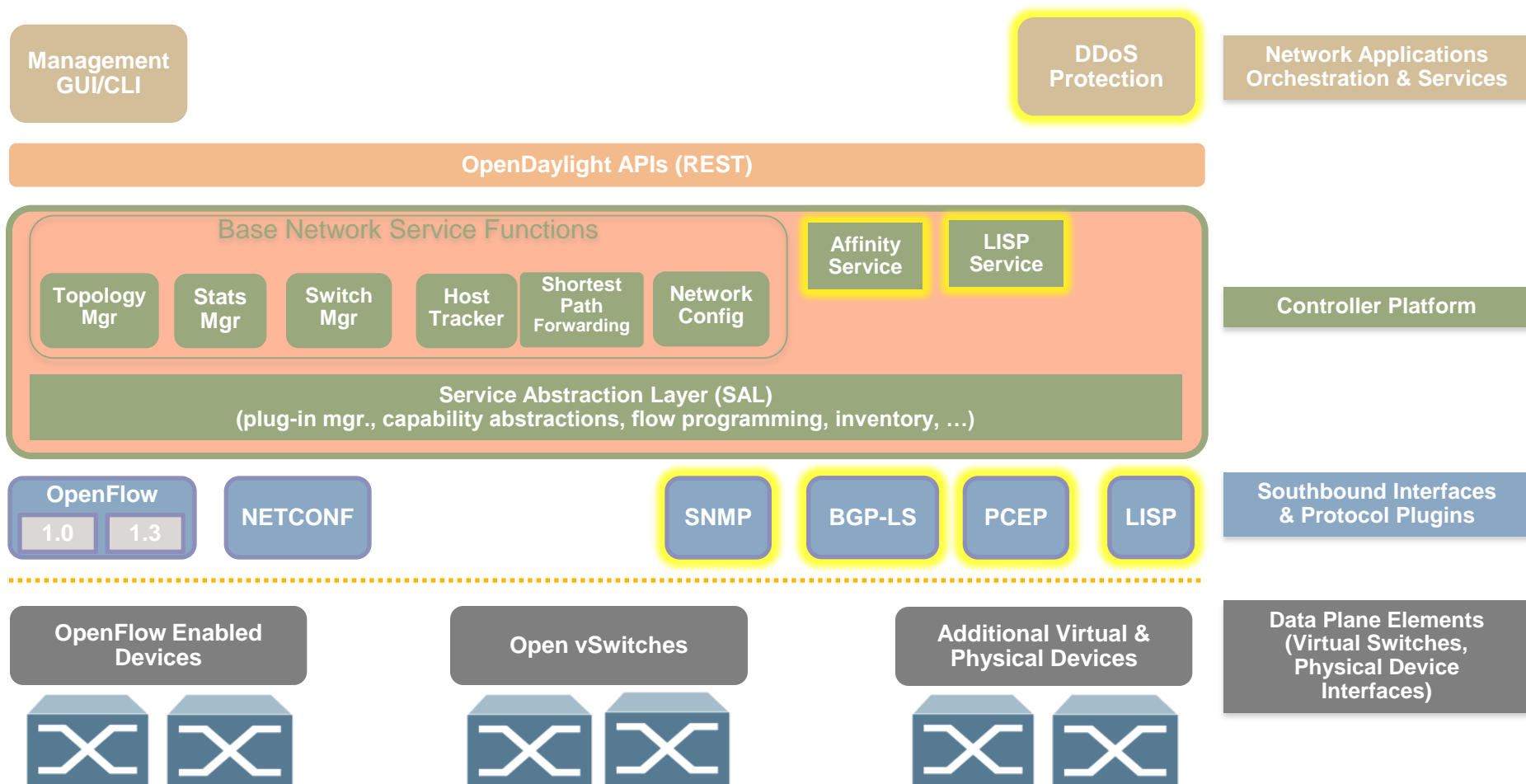


Additional Virtual &
Physical Devices

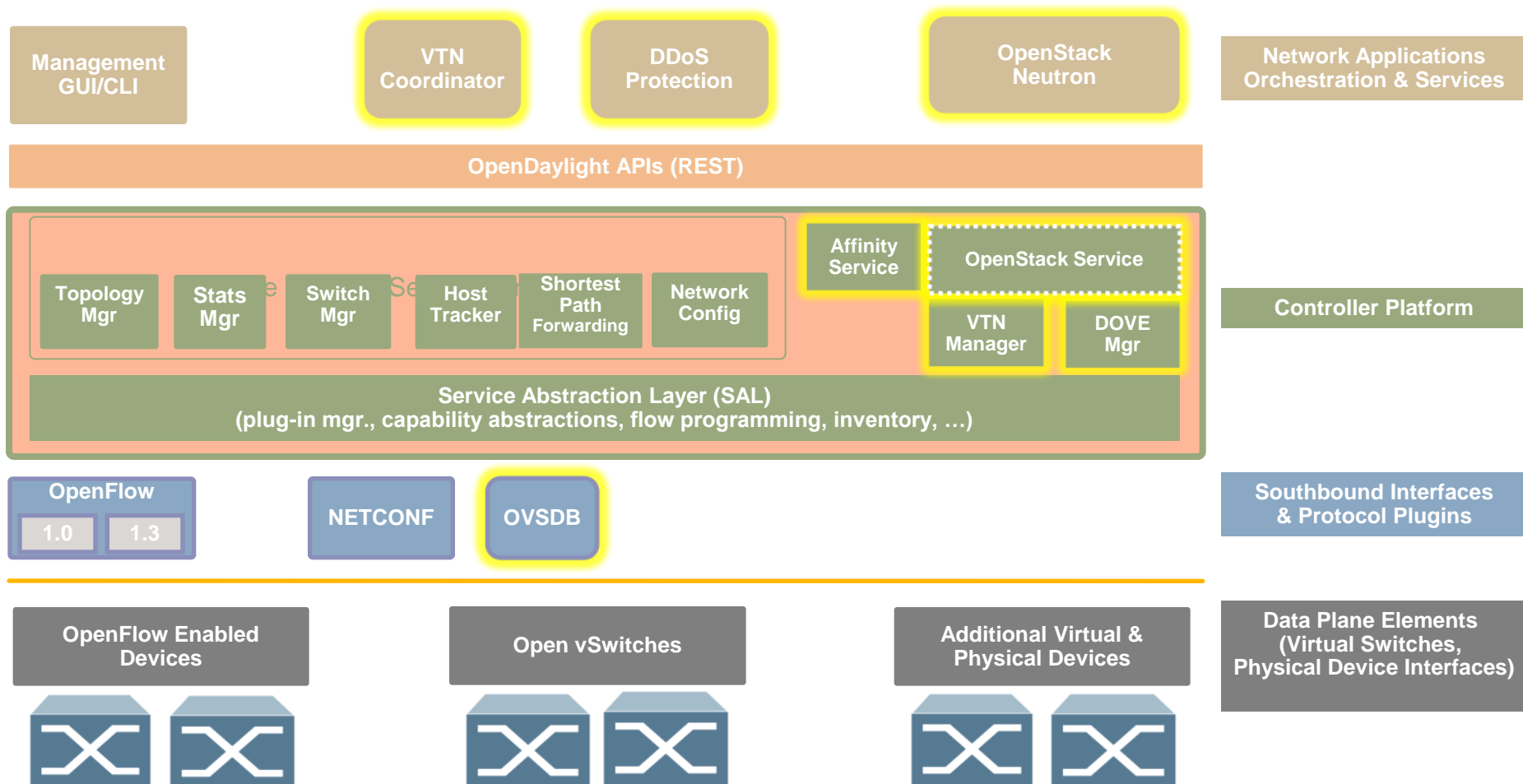


Data Plane Elements
(Virtual Switches,
Physical Device
Interfaces)

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

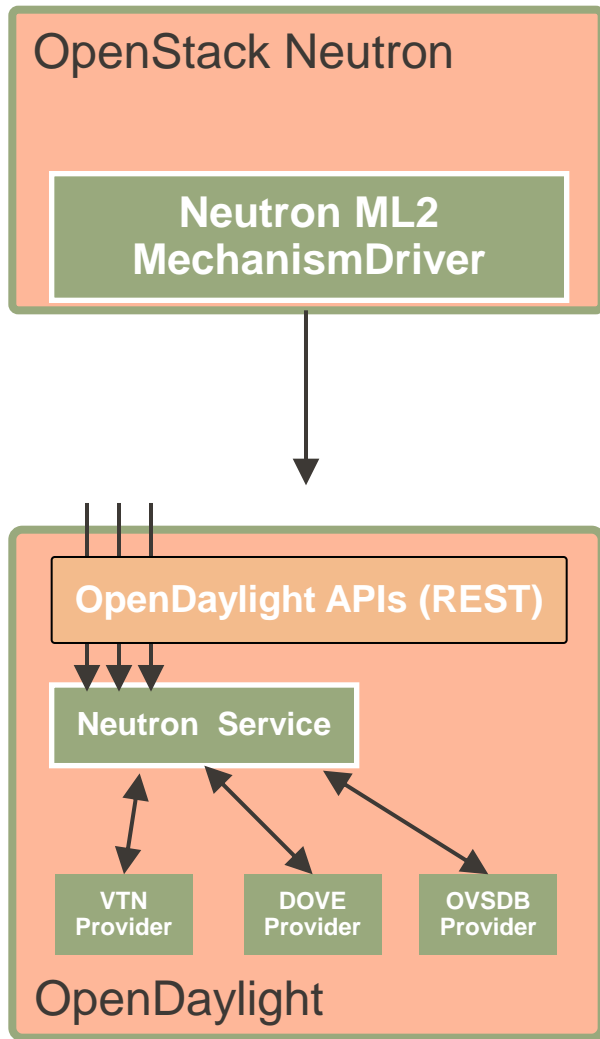


VTN: Virtual Tenant Network
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VTN: Virtual Tenant Network
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 OVSDB: Open vSwitch DataBase Protocol
 BGP: Border Gateway Protocol
 PCEP: Path Computation Element Communication Protocol
 SNMP: Simple Network 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

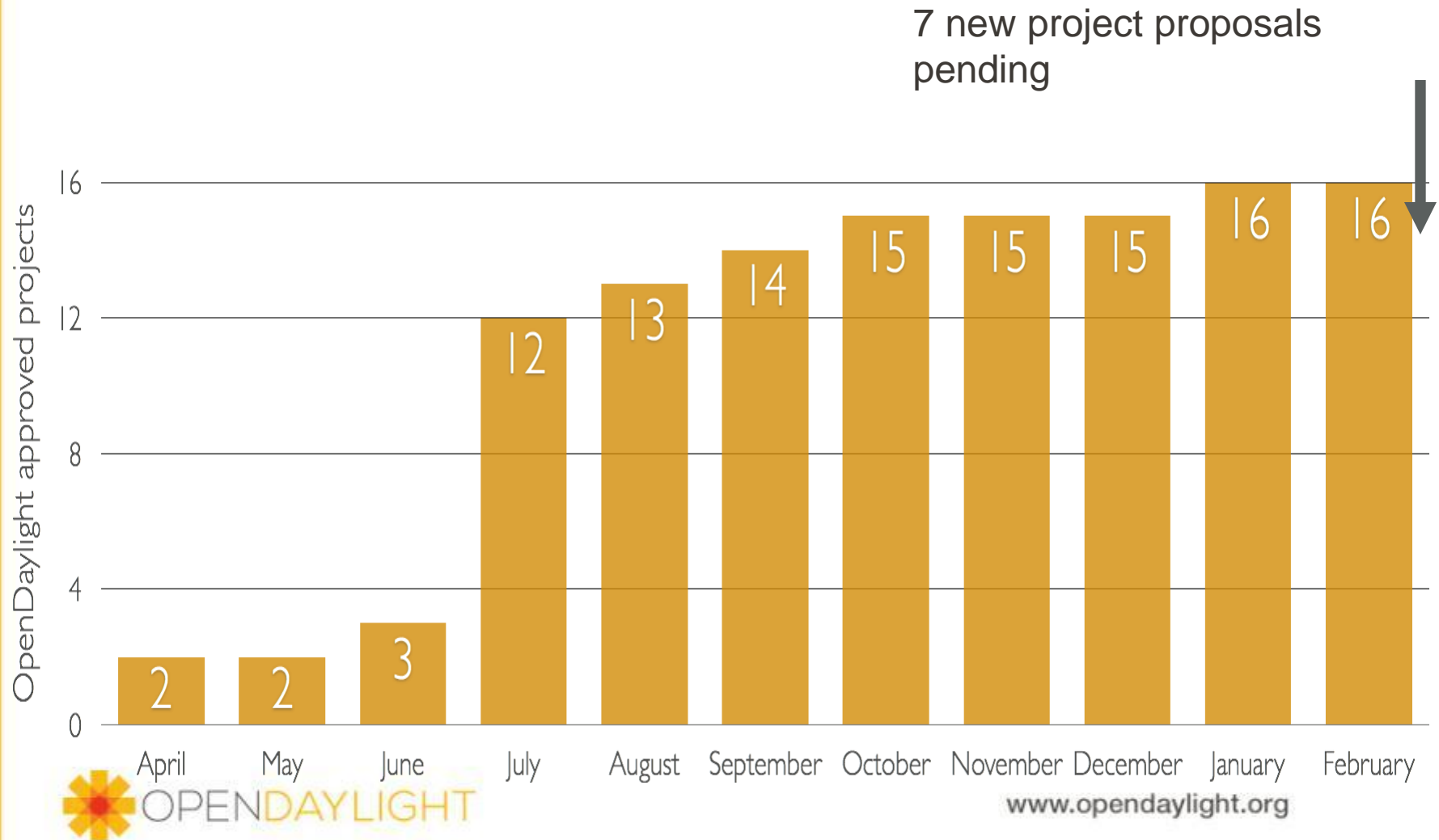


OpenStack Integration: Next Steps

- 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



OpenDaylight project creation



OpenDaylight code volume (ohloh.net)



OpenDaylight
Settings | Report Duplicate

Ohloh | BLACK DUCK
Open HUB



Very High
Activity

5

I Use This!

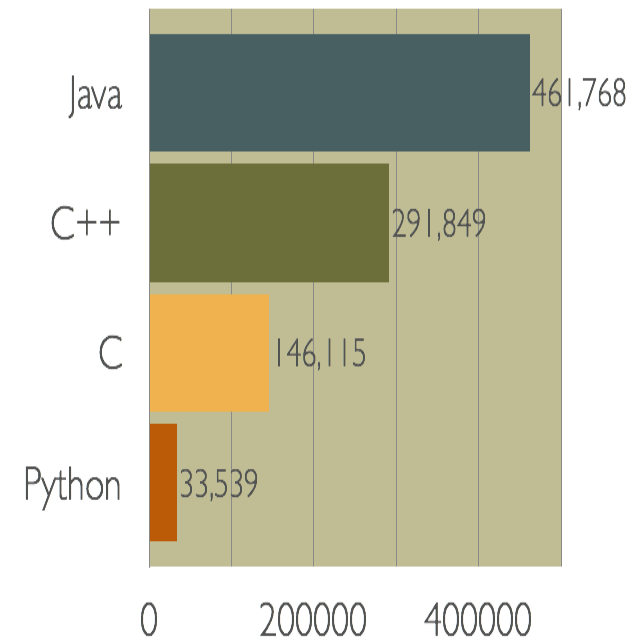
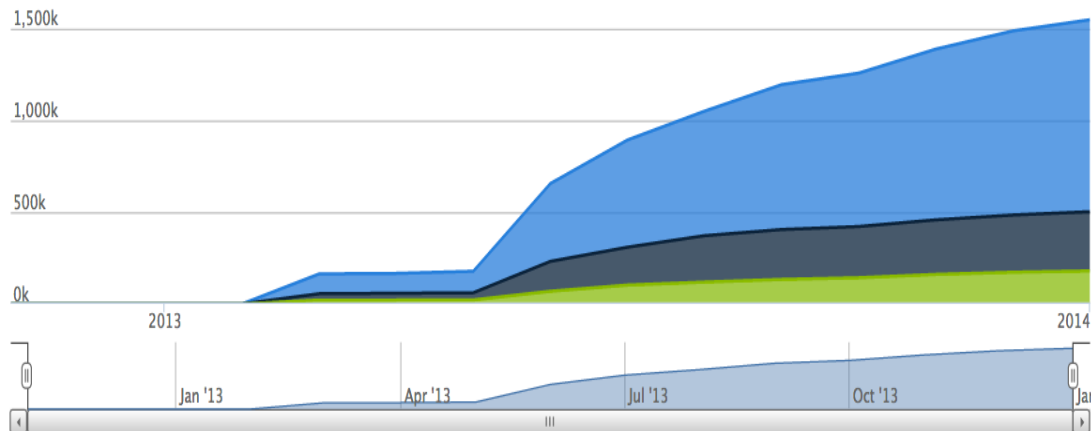
Languages

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

Zoom 1yr All



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...



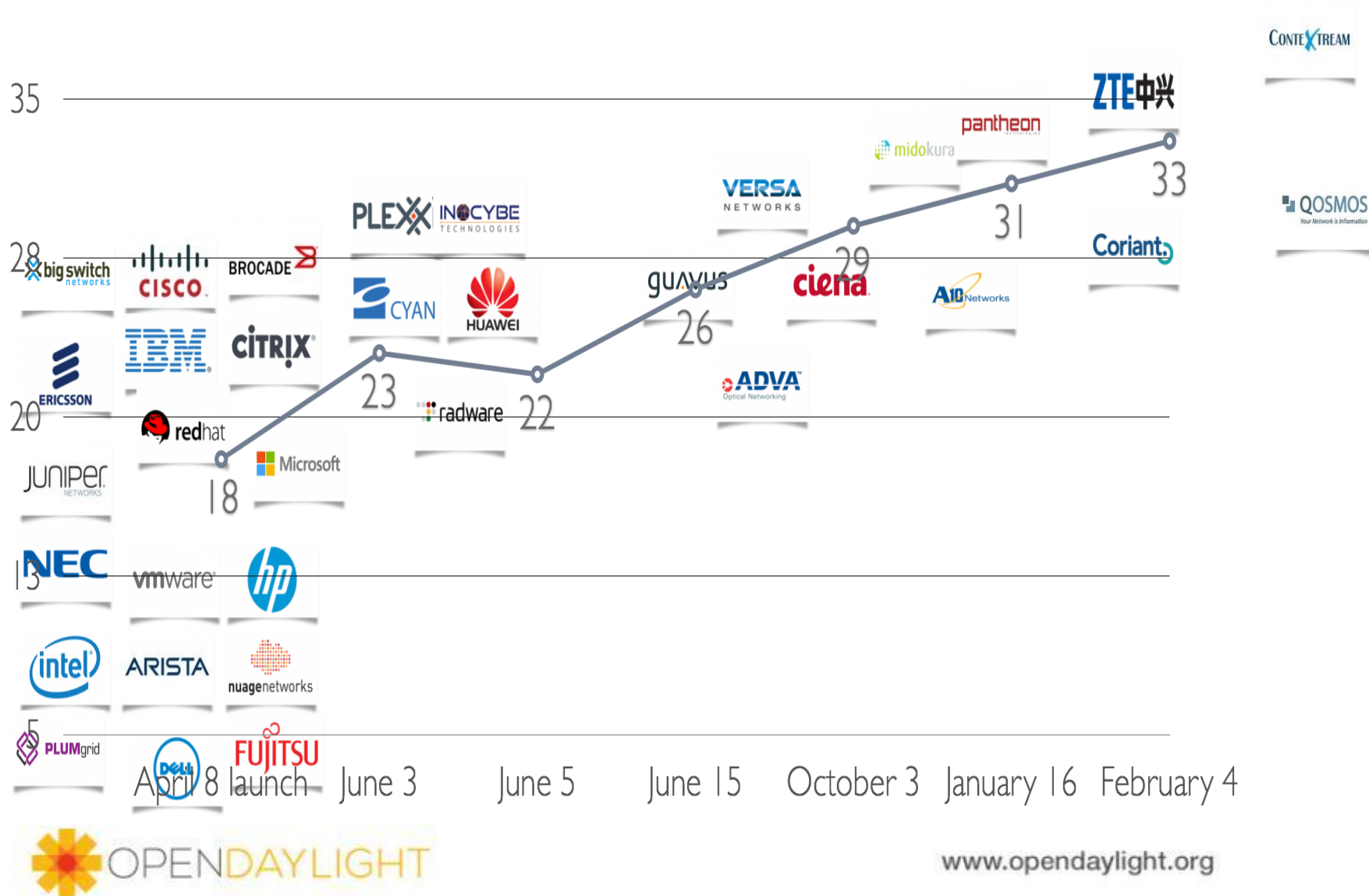
 OpenNMS

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

Membership — who wants to play



Agenda

- What is Hydrogen
 - A bit of personal learning
- Introduction to Helium
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- Discussion/Question and Answer

Key Personal Learning: Open Source is the New Way to Develop Non-Differentiated “Plumbing”



- **Community building** is a core Open Source objective
- **Code** is the coin of the realm
- **Engineering systems** are as important as artifacts

Putting this all together →



www.opendaylight.org

**Implication: Engineering artifacts are
no longer the source of sustainable
advantage and/or innovation**



**What you build isn't as
important as how you build it**

our
as well as
ephemeral entities and
that the only source of sustainable
advantage/innovation consists of

- Engineering Systems
- Culture
- People/Process

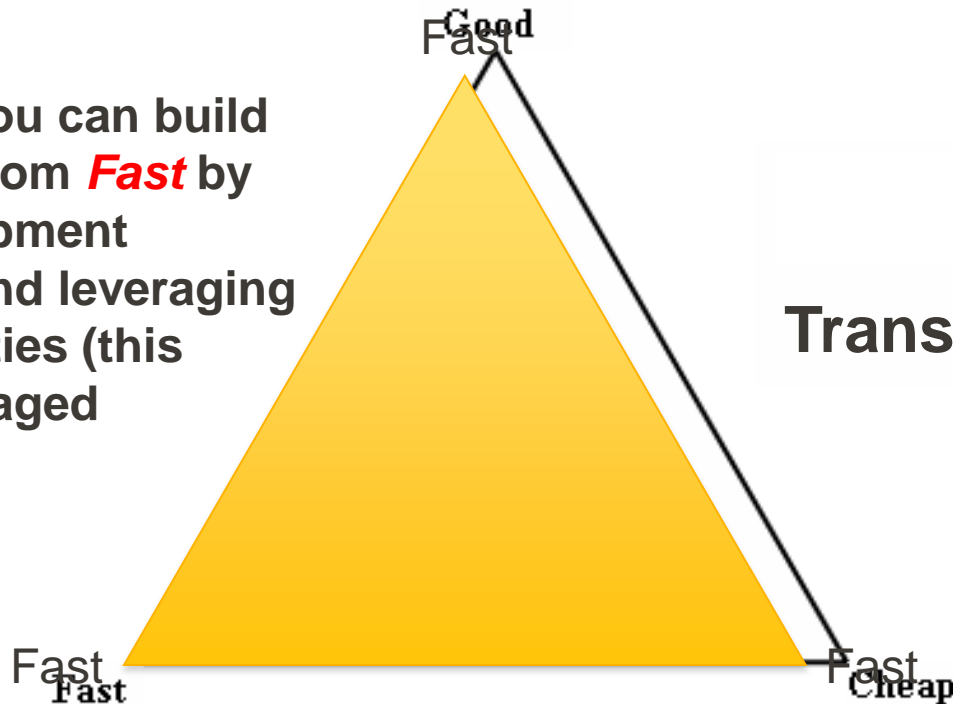
<http://www.sdncentral.com/education/david-meyer-reflections-opendaylight-open-source-project-brocade/2014/03/>



www.opendaylight.org

Said Another Way: *Open Source has Transformed the Good-Cheap-Fast Development Cycle*

Why? Because you can build
Good or **Cheap** from **Fast** by
using OS Development
methodologies and leveraging
the OS communities (this
is a form of leveraged
Investment)



Agenda

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Introduction to Helium -- Naming

Periodic Table of Elements

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1	1 H Hydrogen 1.00794	1 Atomic # Symbol Name Atomic Mass																2 He Helium 4.002602	
2	3 Li Lithium 6.941	4 Be Beryllium 9.012182	C Solid Hg Liquid H Gas Rf Unknown		Metals Lanthanoids Actinoids								Nonmetals Other nonmetals Noble gases						
3	11 Na Sodium 22.98976928	12 Mg Magnesium 24.3050			Alkali metals		Alkaline earth metals		Transition metals		Poor metals			5 B Boron 10.811	6 C Carbon 12.0107	7 N Nitrogen 14.0067	8 O Oxygen 15.9994	9 F Fluorine 18.9984032	10 Ne Neon 20.1797
4	19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.955912	22 Ti Titanium 47.867	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938045	26 Fe Iron 55.845	27 Co Cobalt 58.933195	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.64	33 As Arsenic 74.92160	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.798	
5	37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90585	40 Zr Zirconium 91.224	41 Nb Niobium 92.90638	42 Mo Molybdenum 95.96	43 Tc Technetium (97.9072)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.90550	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.60	53 I Iodine 126.90447	54 Xe Xenon 131.293	
6	55 Cs Cesium 132.9054519	56 Ba Barium 137.327	57–71		72 Hf Hafnium 178.49	73 Ta Tantalum 180.94788	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.217	78 Pt Platinum 195.084	79 Au Gold 196.966569	80 Hg Mercury 200.59	81 Tl Thallium 204.3833	82 Pb Lead 207.2	83 Bi Bismuth 208.98040	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
7	87 Fr Francium (223)	88 Ra Radium (226)	89–103		104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (266)	107 Bh Bohrium (264)	108 Hs Hassium (277)	109 Mt Meitnerium (268)	110 Ds Darmstadtium (271)	111 Rg Roentgenium (272)	112 Uub Ununbium (285)	113 Uut Ununtrium (284)	114 Uuq Ununquadium (289)	115 Uup Ununpentium (288)	116 Uuh Ununhexium (292)	117 Uus Ununseptium (294)	118 Uuo Ununoctium (294)

For elements with no stable isotopes, the mass number of the isotope with the longest half-life is in parentheses.

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57	La Lanthanum 138.90547	58	Ce Cerium 140.116	59	Pr Praseodymium 140.90765	60	Nd Neodymium 144.242	61	Pm Promethium (145)	62	Sm Samarium 150.36	63	Eu Europium 151.964	64	Gd Gadolinium 157.25	65	Tb Terbium 158.92535	66	Dy Dysprosium 162.500	67	Ho Holmium 164.93032	68	Er Erbium 167.259	69	Tm Thulium 168.93421	70	Yb Ytterbium 173.054	71	Lu Lutetium 174.9668
89	Ac Actinium (227)	90	Th Thorium 232.03806	91	Pa Protactinium 231.03688	92	U Uranium 238.02891	93	Np Neptunium (237)	94	Pu Plutonium (244)	95	Am Americium (243)	96	Cm Curium (247)	97	Bk Berkelium (247)	98	Cf Californium (251)	99	Es Einsteinium (252)	100	Fm Fermium (257)	101	Md Mendelevium (258)	102	No Nobelium (259)	103	Lr Lawrencium (262)

Helium Simultaneous Release Plan

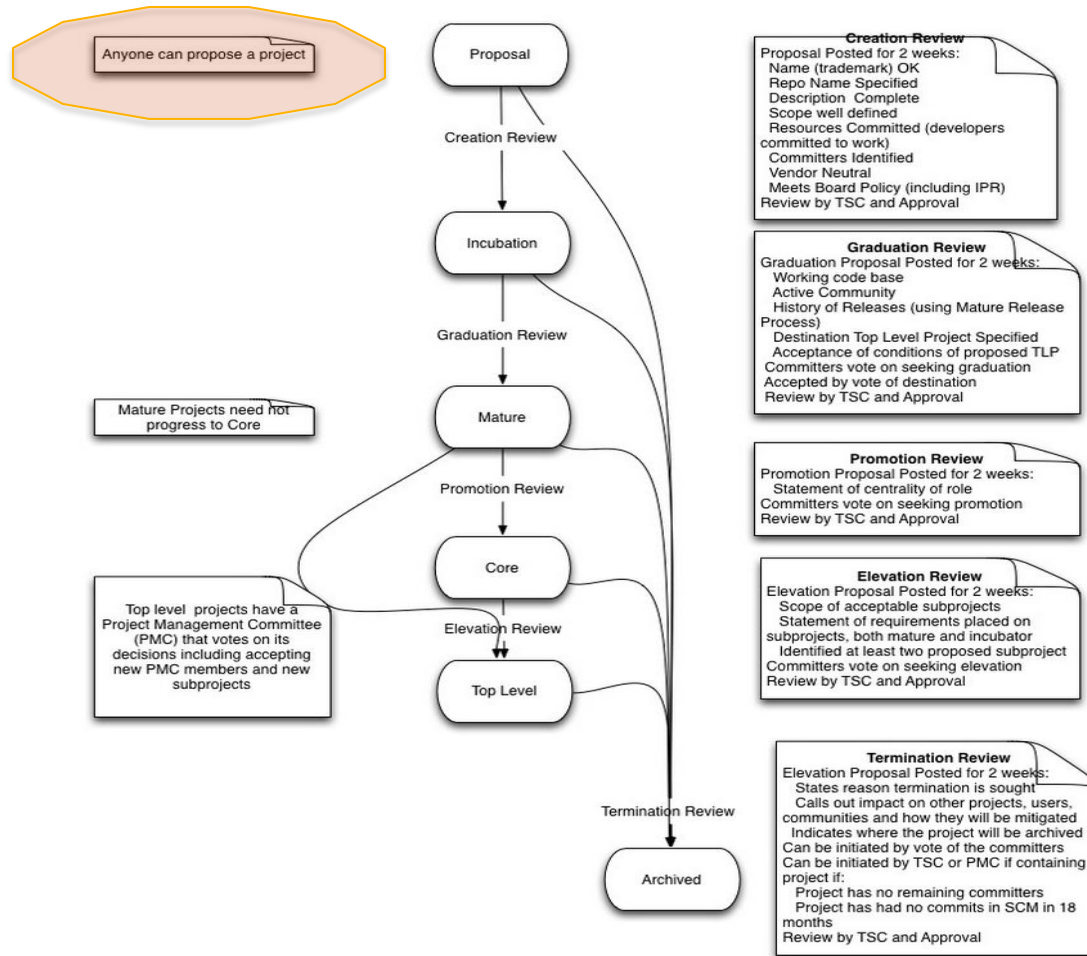
Milestone	Date	Events
M0	4/14/2014	Simultaneous Release Open
Last call for new projects eligible to join	4/30/2014	This is the latest date a project proposal can be brought and still have the two week public comment period before its project creation review at the last TSC meeting before it needs to declare its intent to join the Simultaneous Release at M1.
M1	5/12/2014	<ol style="list-style-type: none"> 1. Projects must have declared intent to participate in Simultaneous Release 2. Participating Projects must have published a candidate Release Plan for public comment (Release Plan Template) 3. TSC commits to initiate public discussion of Lithium Simultaneous Release Plan
M2	6/09/2014	<ol style="list-style-type: none"> 1. Participating Projects must have declared their final Release Plan 2. TSC commits to finalize basic dates and Milestones for the Lithium Simultaneous Release Plan (some details of requirements and Milestone contents may be decided later). 3. TSC commits to initiate public discussion of Release Vehicles
M3	7/07/2014	<ol style="list-style-type: none"> 1. Latest possible Continuous Integration Test Start 2. TSC commits to decide on Final Release Vehicles Defined 3. Latest possible date for commencing Documentation
M4	8/04/2014	<ol style="list-style-type: none"> 1. API Freeze 2. Latest possible Continuous System Test Start 3. TSC commits to begin public discussion of Stable Update Expectations
M5	9/1/2014	<ol style="list-style-type: none"> 1. Code Freeze (bug fixes only from here) 2. String Freeze (all internationalizable strings frozen to allow for translation) 3. TSC commits to have finalized Stable Update Expectations
RC0	9/9/2014	
RC1	9/15/2014	
RC2	9/22/2014	Participating Projects must hold their Release Reviews, including User Facing Documentation.
Formal Helium Release	9/29/2014	<ol style="list-style-type: none"> 1. Formal Helium Release 2. Latest possible date for each project to add a stable/helium branch
SU1 (Stable Update 1 aka Helium.1)	11/10/2014	First Stable Update for Helium. See Stable Update section. NOTE: This date is provisional, but will not move earlier. Please note, event based Updates (security/critical bugs) are distinct and may occur at any point.
SU2 (Stable Update 2 aka Helium.2)	01/12/2015	Second Stable Update for Helium. See Stable Update section. NOTE: This date is provisional, but will not move earlier. Please note, event based Updates (security/critical bugs) are distinct and may occur at any point.

What's in the queue for Helium?

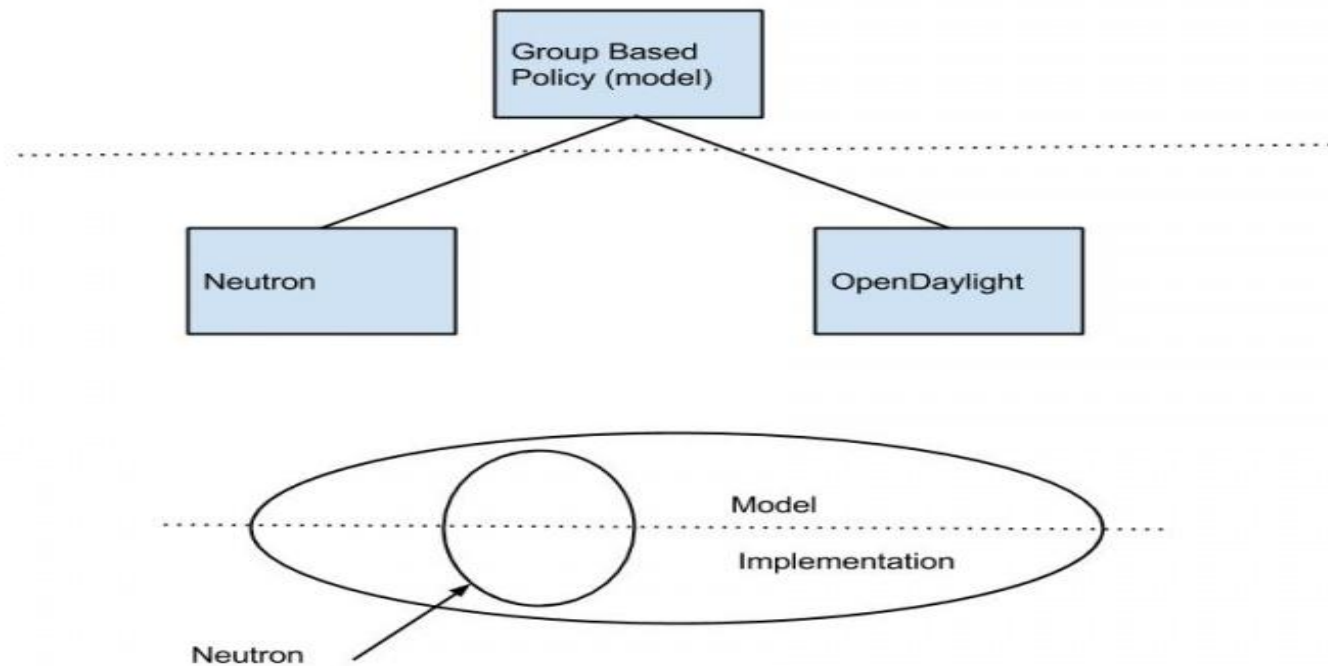
(projects that have advanced to Incubation state)

- Group Based Policy Plugin (Application Policy Plugin)
- Packet Cable PCMM Manager
- SDNi App
- Southbound Plugin to the OpenContrail Platform
- L2 Switch
- Secure Network Bootstrapping Infrastructure
- AAA Service
- ODL Toolkit
- Dynamic Resource Reservation
- TTPs
- Opflex
- Root Parent
- Documentation
- And more...
- https://wiki.opendaylight.org/view/Project_Proposals:Main

Brief Note on Project Lifecycles

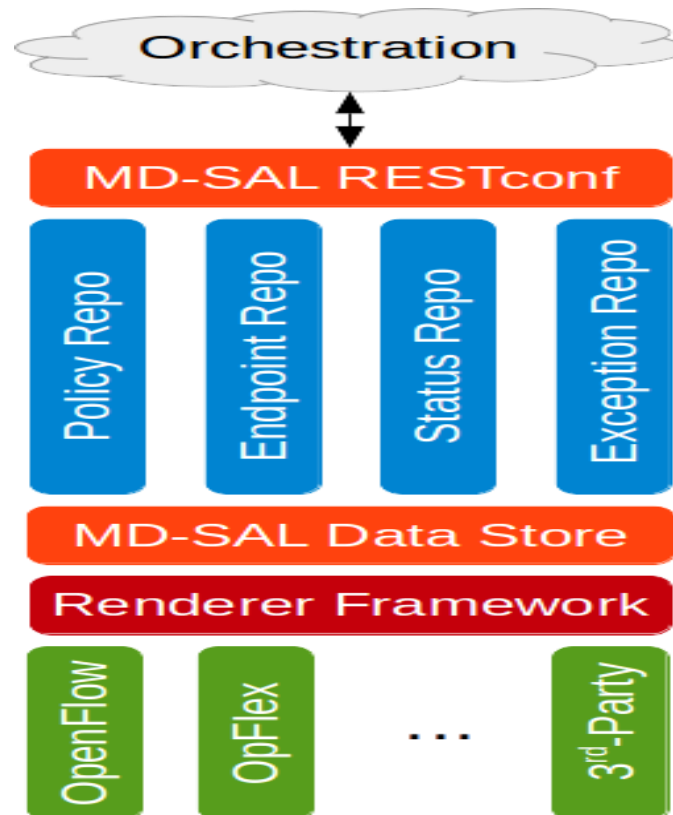


Example: Group Based Policy Generalized Policy Rendering Engine



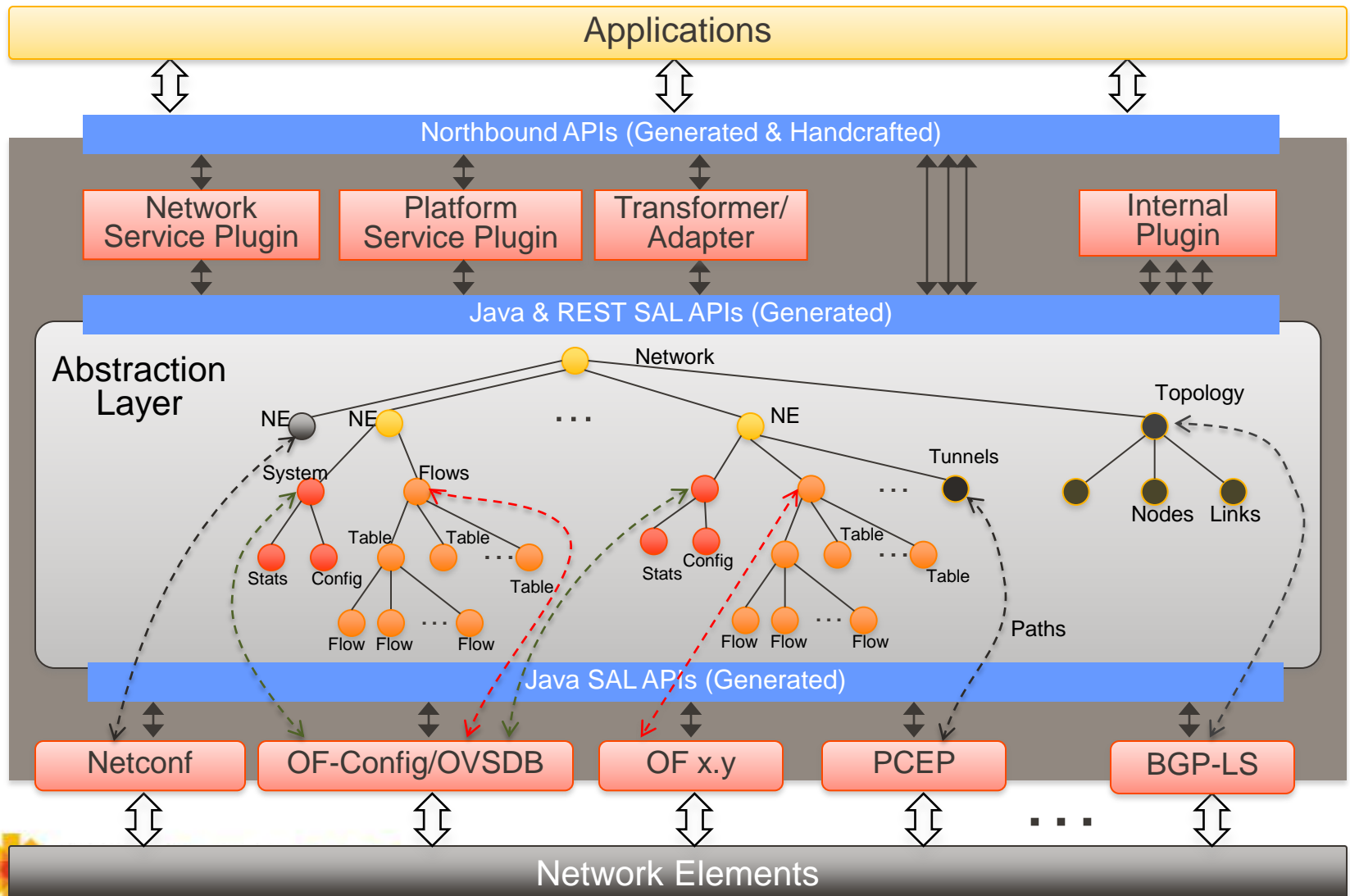
https://wiki.opendaylight.org/view/Group_Policy:Main

Example: Group Based Policy High Level Architecture



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

What is the MD-SAL?



What are the Issues with MD-SAL?

- Great S/W architecture idea
 - Everything (YANG) model-driven
 - Very dynamic
 - On-the-fly code generation
 - Connects NB REST/RESTconf APIs to SB plugins
 - Note: means that in theory ODL can consume ONF NBI models
- But the code is complex
- Issues with distributed Backing Store (Infinispan → Akka)
- Some developers want to go “slower”
 - MD-SAL complexity conflicts with stability goals
- Open question – Active debate in the ODL community

Agenda

- What is Hydrogen
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- Discussion/Question and Answer

Next Steps

A Few Technical Details

- MD-SAL
- Stable Release
- Simultaneous Release Cadence
- Future Release Vehicles/Package
 - Karaf -- <http://karaf.apache.org/>
 - Small OSGi runtime/containerization
- Quasi-technical Issues

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 Linux Foundation!
- We need more code that writes code
 - MD-SAL is an example
 - Fewer humans in the loop
 - More automation more better

Lithium?

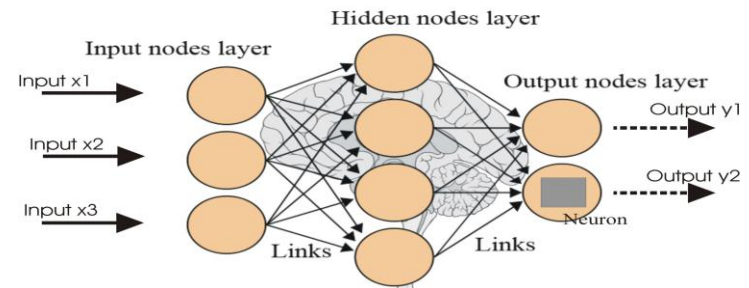
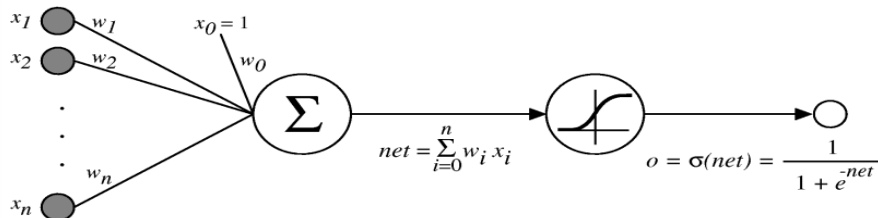
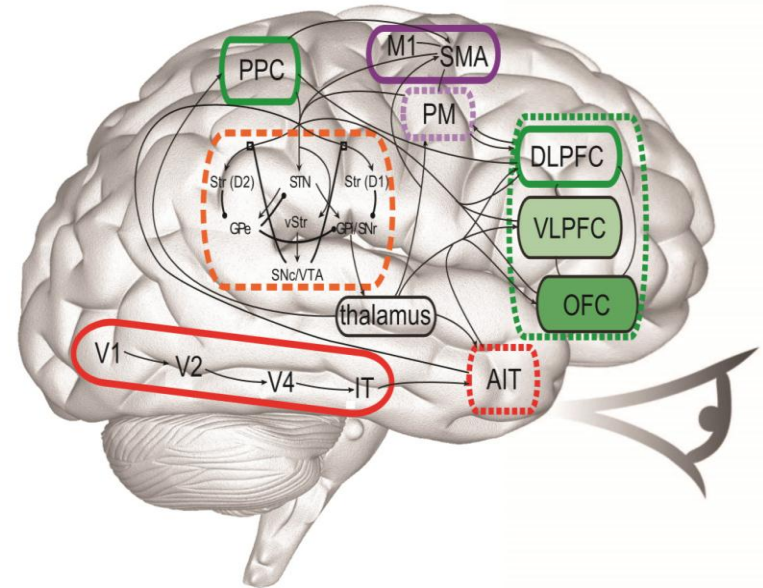
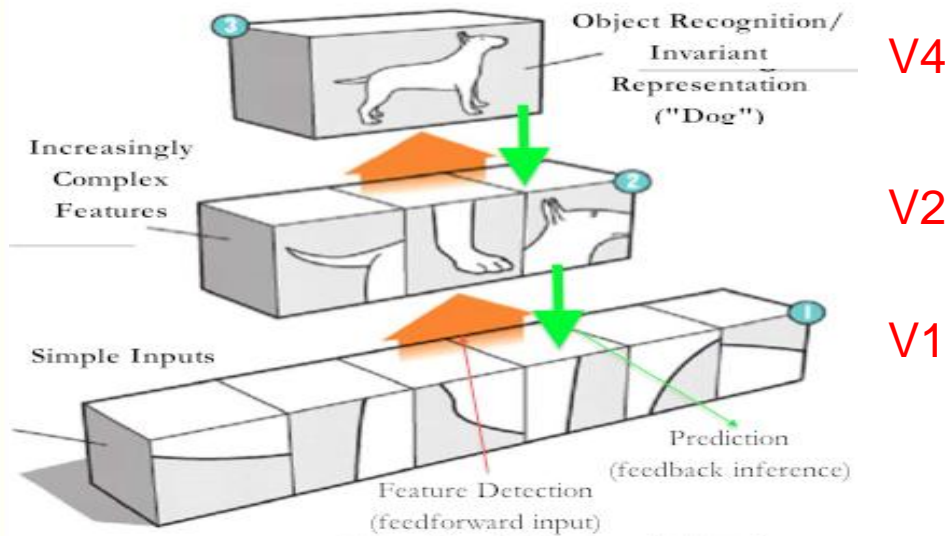
- Release after Helium
- Target Release Date: 04.20.2015
- Simultaneous Release Plan
- Regularized/Deterministic Release Cadence
- Too early for projects

Lithium Simultaneous Release Plan

Milestone	Date	Events
M0	10/6/2014	Simultaneous Release Open
Last call for new projects eligible to join	10/17/2014	This is the latest date a project proposal can be brought and still have the two week public comment period before its project creation review at the last TSC meeting before it needs to declare its intent to join the Simultaneous Release at M1.
M1	11/6/2014	<ol style="list-style-type: none"> 1. Projects must have declared intent to participate in Simultaneous Release 2. Participating Projects must have published a candidate Release Plan for public comment (Release Plan Template) 3. TSC commits to initiate public discussion of Lithium Simultaneous Release Plan
M2	12/12/2014	<ol style="list-style-type: none"> 1. Participating Projects must have declared their final Release Plan 2. TSC commits to finalize basic dates and Milestones for the Lithium Simultaneous Release Plan (some details of requirements and Milestone contents may be decided later). 3. TSC commits to initiate public discussion of Release Vehicles
M3	1/23/2015	<ol style="list-style-type: none"> 1. Latest possible Continuous Integration Test Start 2. TSC commits to decide on Final Release Vehicles Defined 3. Latest possible date for commencing Documentation
M4	2/20/2015	<ol style="list-style-type: none"> 1. API Freeze 2. Latest possible Continuous System Test Start 3. TSC commits to begin public discussion of Stable Update Expectations
M5	3/23/2015	<ol style="list-style-type: none"> 1. Code Freeze (bug fixes only from here) 2. String Freeze (all internationalizable strings frozen to allow for translation) 3. TSC commits to have finalized Stable Update Expectations
RC0	3/30/2015	
RC1	4/6/2015	
RC2	4/13/2015	Participating Projects must hold their Release Reviews, including User Facing Documentation.
Formal Lithium Release	4/20/2015	<ol style="list-style-type: none"> 1. Formal Lithium Release 2. Latest possible date for each project to add a stable/Lithium branch
SU1 (Stable Update 1 aka Lithium.1)	6/1/2015	First Stable Update for Lithium. See Stable Update section. NOTE: This date is provisional, but will not move earlier. Please note, event based Updates (security/critical bugs) are distinct and may occur at any point.
SU2 (Stable Update 2 aka Lithium.2)	7/13/2015	Second Stable Update for Lithium. See Stable Update section. NOTE: This date is provisional, but will not move earlier. Please note, event based Updates (security/critical bugs) are distinct and may occur at any point.

One More Interesting Next Step

(bringing Deep Learning to Networking/ODL)



Agenda

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 - A bit of personal learning
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- Next Steps – Beyond Helium
- Discussion/Question and Answer

Get Involved!

- TSC weekly calls open to everyone
- <http://wiki.opendaylight.org>
- Keep informed and join the conversation
 - IRC: #opendaylight on irc.freenode.net
 - Email: lists.opendaylight.org
 - Facebook: @openDaylightSDN
 - Twitter: #OpenDaylight



Thanks!