

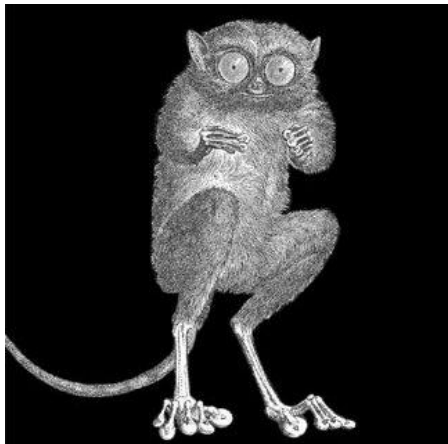
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# OpenDaylight Today

Lori Jakab – December 2018

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# \$ whoami ↩

[+] UPC alumni

[+] Cisco software engineer

[+] Open source enthusiast

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# LiSP

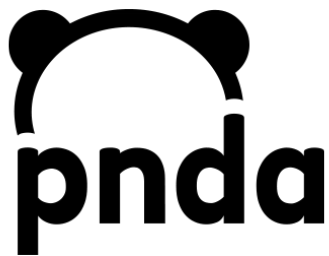
WIRESHARK

LiSPmob

OvS  
Open vSwitch

OPEN  
DAYLIGHT

# OLF NETWORKING



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OpenDaylight is a  
**modular open platform**  
for **customizing** and  
**automating networks** of  
any size and scale.

# Use cases

**Automated  
Service  
Delivery**

**Cloud and  
NFV**

**Network  
Resources  
Optimization**

**Visibility and  
Control**

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# Modularity

- SDN controllers initially OpenFlow centric
    - Application APIs were limited, and implementation was OF
  - ODL: decouple application API from SB protocol
  - (Model Driven) Service Abstraction Layer
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# YANG (RFC 6020, 7950)

Data modeling language, used in ODL for:

- Describing the **structure of data** that is exchanged
  - Defining **RPCs**, which can be called without worrying about what component will execute it
  - Publish **notifications** to registered listeners
-



## Example: LISP control packet

Type=1				A M P S p s				Reserved				IRC				Record Count			
Nonce . . .																			
. . . Nonce																			
Source-EID-AFI								Source EID Address ...											
ITR-RLLOC-AFI 1								ITR-RLLOC Address 1 ...											
...																			
ITR-RLLOC-AFI n								ITR-RLLOC Address n ...											
/	Reserved				EID mask-len				EID-Prefix-AFI										
Rec	EID-Prefix ...																		
\	Map-Reply Record ...																		

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# Example: YANG data definition

```
module odl-lisp-proto {  
    ...  
    grouping MapRequest {  
        leaf authoritative {  
            type boolean;  
        }  
        leaf mapDataPresent {  
            type boolean;  
        }  
        leaf probe {  
            type boolean;  
        }  
        leaf smr {  
            type boolean;  
        }  
        leaf pitr {  
            type boolean;  
        }  
        leaf smrInvoked {  
            type boolean;  
        }  
    }  
    ...  
}
```

```
...  
    leaf nonce {  
        type int64;  
    }  
    container SourceEid {  
        uses eid-container;  
    }  
    list itrRloc {  
        key "itr-rloc-id";  
        leaf itr-rloc-id {  
            type string;  
        }  
        uses rloc-container;  
    }  
    uses eid-list;  
    container MapReply {  
        uses mapping-record-container;  
    }  
    uses map-request-metadata;  
}
```

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# Example: YANG RPC definition

```
module odl-mappingservice {  
  
    import odl-lisp-proto { prefix lisp-proto; revision-date 2015-11-05; }  
  
    rpc add-key {  
        input {  
            uses lisp-proto:eid-container;  
            uses lisp-proto:mapping-authkey-container;  
        }  
    }  
  
    rpc get-key {  
        input {  
            uses lisp-proto:eid-container;  
        }  
        output {  
            uses lisp-proto:mapping-authkey-container;  
        }  
    }  
}
```

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# Example: RPC call

HTTP POST /restconf/operations/odl-mappingservice:add-key

```
{
  "input": {
    "eid": {
      "address-type": "ietf-lisp-address-types:ipv6-prefix-afi",
      "ipv6-prefix": "2001:db8::1/128"
    },
    "mapping-authkey": {
      "key-string": "password",
      "key-type": 1
    }
  }
}
```



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# MD-SAL based applications

- At the heart of every app are the YANG models
  - YANG models are compiled into Java classes
    - Used as consistent Data Transfer Objects (DTOs)
    - Used for automatic RESTCONF and NETCONF bindings
    - Define the tree structure of the clustered data store
  - Benefits:
    - Reduced learning curve for creating APIs and applications
    - Easier API maintenance
    - Immutability -- helps avoiding thread contention
-



## OpenDaylight RestConf API Documentation

[Controller Resources](#)[Mounted Resources](#)

Below are the list of APIs supported by the Controller.

<a href="#">aaa(2016-12-14)</a>	<a href="#">Show/Hide</a>	<a href="#">List Operations</a>	<a href="#">Expand Operations</a>	<a href="#">Raw</a>
<a href="#">aaa-app-config(2017-06-19)</a>	<a href="#">Show/Hide</a>	<a href="#">List Operations</a>	<a href="#">Expand Operations</a>	<a href="#">Raw</a>
<a href="#">aaa-cert(2015-11-26)</a>	<a href="#">Show/Hide</a>	<a href="#">List Operations</a>	<a href="#">Expand Operations</a>	<a href="#">Raw</a>
<a href="#">aaa-cert-mdsal(2016-03-21)</a>	<a href="#">Show/Hide</a>	<a href="#">List Operations</a>	<a href="#">Expand Operations</a>	<a href="#">Raw</a>
<a href="#">aaa-cert-rpc(2015-12-15)</a>	<a href="#">Show/Hide</a>	<a href="#">List Operations</a>	<a href="#">Expand Operations</a>	<a href="#">Raw</a>
<a href="#">aaa-encrypt-service-config(2016-09-15)</a>	<a href="#">Show/Hide</a>	<a href="#">List Operations</a>	<a href="#">Expand Operations</a>	<a href="#">Raw</a>
<a href="#">aaa-password-service-config(2017-06-19)</a>	<a href="#">Show/Hide</a>	<a href="#">List Operations</a>	<a href="#">Expand Operations</a>	<a href="#">Raw</a>
<a href="#">cluster-admin(2015-10-13)</a>	<a href="#">Show/Hide</a>	<a href="#">List Operations</a>	<a href="#">Expand Operations</a>	<a href="#">Raw</a>
<a href="#">distributed-datastore-provider(2014-06-12)</a>	<a href="#">Show/Hide</a>	<a href="#">List Operations</a>	<a href="#">Expand Operations</a>	<a href="#">Raw</a>

**odl-lisp-sb(2015-09-04)**[Show/Hide](#) | [List Operations](#) | [Expand Operations](#) | [Raw](#)**POST** /restconf/operations/odl-lisp-sb:send-map-reply**POST** /restconf/operations/odl-lisp-sb:send-map-request**POST** /restconf/operations/odl-lisp-sb:reset-stats**POST** /restconf/operations/odl-lisp-sb:send-map-notify**POST** /restconf/operations/odl-lisp-sb:get-stats**POST** /restconf/operations/odl-lisp-sb:send-map-register**odl-mappingservice(2015-09-06)**[Show/Hide](#) | [List Operations](#) | [Expand Operations](#) | [Raw](#)**POST** /restconf/config**GET** /restconf/config/odl-mappingservice:mapping-database**PUT** /restconf/config/odl-mappingservice:mapping-database**DELETE** /restconf/config/odl-mappingservice:mapping-database**POST** /restconf/config/odl-mappingservice:mapping-database**GET** /restconf/config/odl-mappingservice:mapping-database/virtual-network-identifier/{vni}**PUT** /restconf/config/odl-mappingservice:mapping-database/virtual-network-identifier/{vni}**DELETE** /restconf/config/odl-mappingservice:mapping-database/virtual-network-identifier/{vni}**POST** /restconf/config/odl-mappingservice:mapping-database/virtual-network-identifier/{vni}

PUT

/restconf/config/odl-mappingservice:mapping-database/virtual-network-identifier/{vni}/mapping/{eid-uri}/{origin}/mapping-record/eid

## Response Class

Model | Model Schema

odl-mappingservice/mapping-database/virtual-network-identifier/mapping/mapping-record(config)eid-TOP

Response Content Type application/json ▼

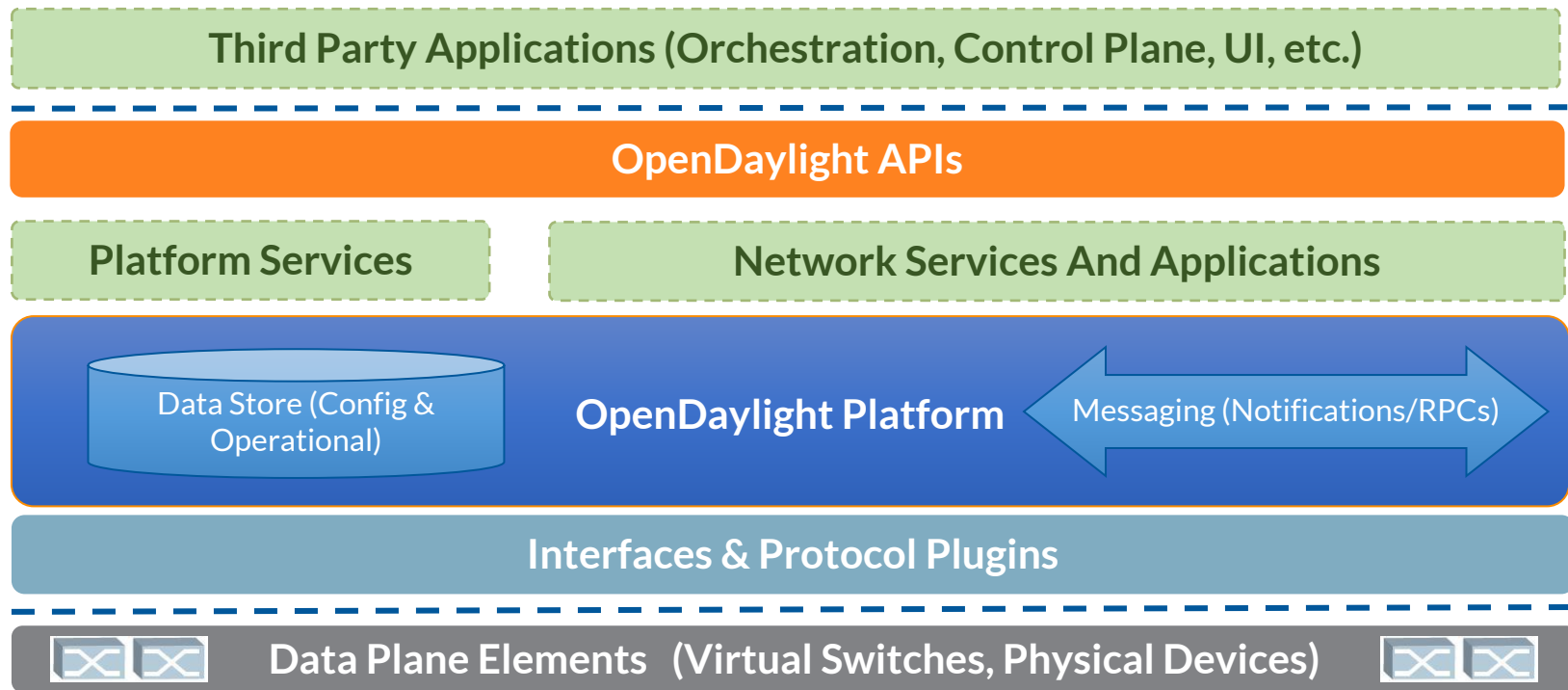
## Parameters

Parameter	Value	Description	Parameter Type	Data Type
vni	<input type="text"/>	The 24-bit Virtual Network Identifier	path	string
eid-uri	<input type="text"/>		path	string
origin	<input type="text"/>	Mapping origin	path	string
(config)eid	<div><div></div></div>		body	odl-mappingservice/mapping-database/virtual-network-identifier/mapping/mapping-record(config)eid-TOP

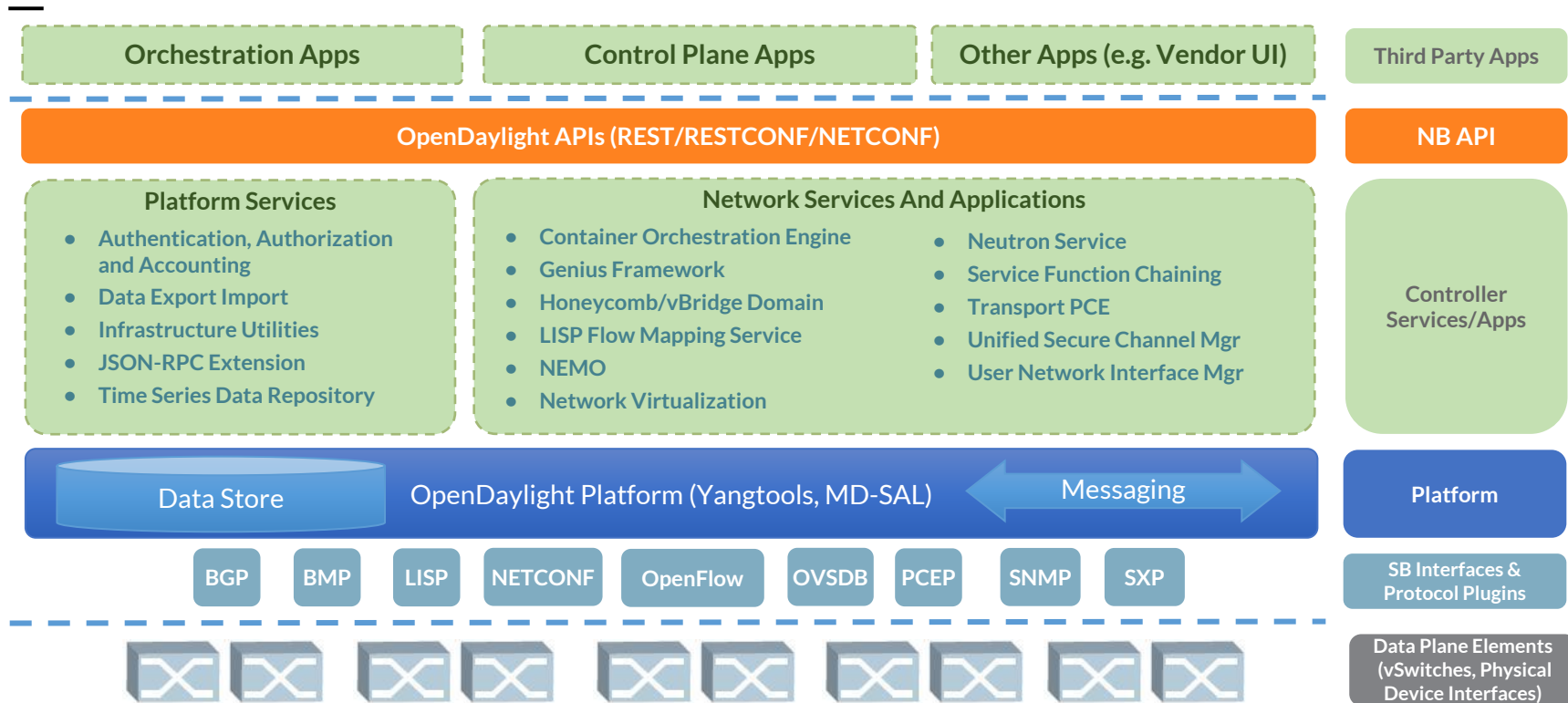
Parameter content type: application/json ▼

Try it out!

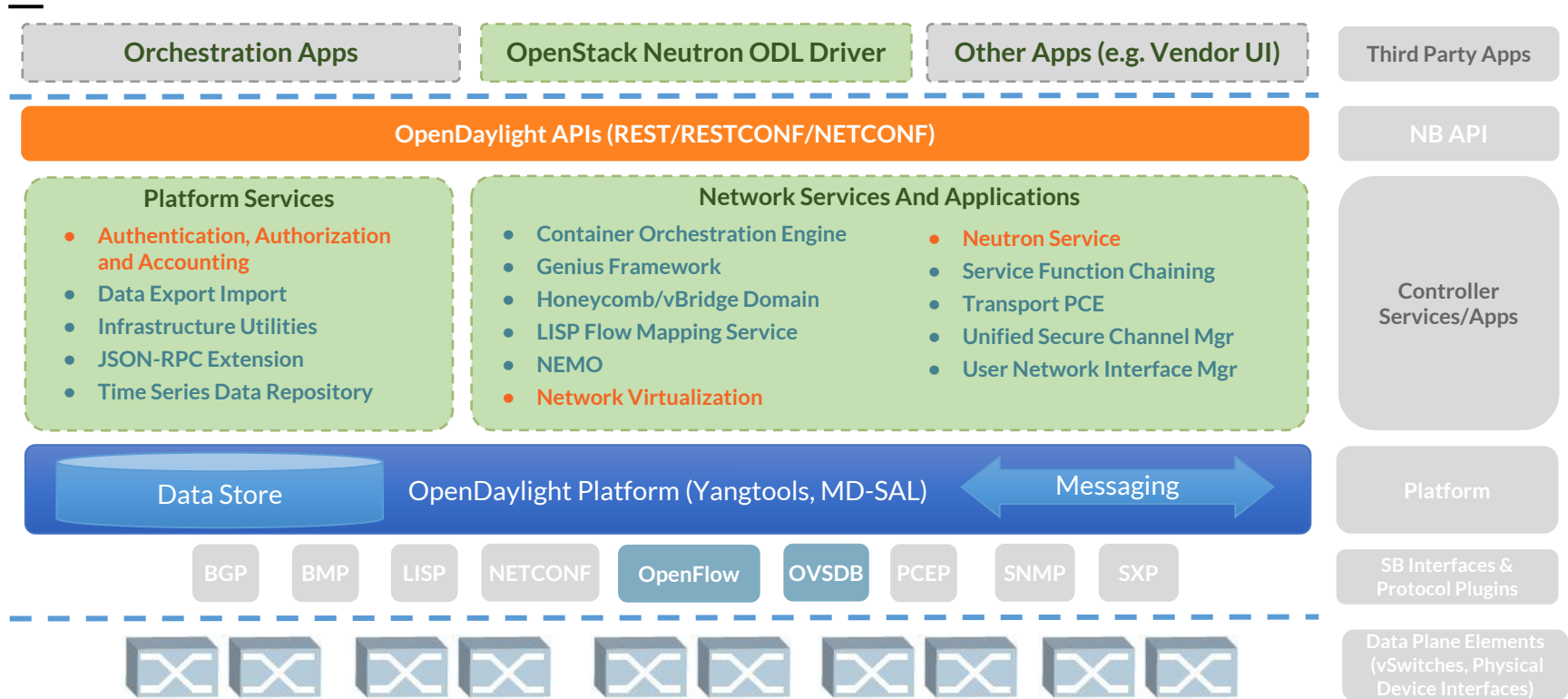




The OpenDaylight high level architecture



OpenDaylight Fluorine release



## OpenStack OpenDaylight integration

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# Automated Service Delivery

In combination with ONAP/OPNFV, major global operators use OpenDaylight to control network connectivity at different layers (L1/L2/L3) in multi-domain environments (data center, access, core) and quickly and reliably turn up connectivity for clients using heterogeneous hardware, by leveraging ODL's model based design.

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# Cloud and NFV

OpenDaylight is being used to enable the use of VNFs in the cloud to enable CORD (Central Office Re-architected as a Datacenter) and bring datacenter economics and cloud agility to the Telco Central Office.

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# Network Resources Optimization

One of the largest OpenDaylight powered network is owned by Tencent in China, who owns the QQ and WeChat messaging apps, totaling more than 500M active monthly users. They use ODL for traffic engineering, creating an SD-WAN solution that minimizes the use of expensive links.

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# Visibility and control

Telefónica I+D is experimenting with using ODL as a top level controller for more specialized controllers, creating a central point of visibility and control for the network.

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**“Code is the coin of the realm”**



Hydrogen *** H 1.008 1																	Helium *** He 4.003 2				
Lithium * Li 6.941 3	Beryllium * Be 9.012 4															Boron * B 10.81 5	Carbon * C 12.01 6	Nitrogen *** N 14.01 7	Oxygen *** O 16.00 8	Fluorine *** F 19.00 9	Neon *** Ne 20.18 10
Sodium * Na 22.99 11	Magnesium * Mg 24.31 12															Aluminum * Al 26.98 13	Silicon * Si 28.09 14	Phosphorus * P 30.97 15	Sulfur * S 32.07 16	Chlorine * Cl 35.45 17	Argon *** Ar 39.95 18
Potassium * K 39.10 19	Calcium * Ca 40.08 20	Scandium * Sc 44.96 21	Titanium * Ti 47.87 22	Vanadium * V 50.94 23	Chromium * Cr 52.00 24	Manganese * Mn 54.94 25	Iron * Fe 55.84 26	Cobalt * Co 58.93 27	Nickel * Ni 58.69 28	Copper * Cu 63.55 29	Zinc * Zn 65.39 30	Gallium * Ga 69.72 31	Germanium * Ge 72.63 32	Arsenic * As 74.92 33	Selenium * Se 78.96 34	Bromine * Br 79.90 35	Krypton *** Kr 83.80 36				
Rubidium * Rb 85.47 37	Strontium * Sr 87.62 38	Yttrium * Y 88.91 39	Zirconium * Zr 91.22 40	Niobium * Nb 92.91 41	Molybdenum * Mo 95.94 42	Technetium * Tc [98] 43	Ruthenium * Ru 101.07 44	Rhodium * Rh 102.91 45	Palladium * Pd 106.42 46	Silver * Ag 107.87 47	Cadmium * Cd 112.41 48	Indium * In 114.82 49	Tin * Sn 118.71 50	Antimony * Sb 121.76 51	Tellurium * Te 127.60 52	Iodine * I 126.91 53	Xenon *** Xe 131.29 54				
Caesium * Cs 132.91 55	Barium * Ba 137.33 56	LANTHANIDES ▼	Hafnium * Hf [178] 57	Tantalum * Ta [181] 58	Tungsten * W [184] 59	Rhenium * Re [187] 60	Osmium * Os [190] 61	Iridium * Ir [192] 62	Platinum * Pt [195] 63	Gold * Au [197] 64	Mercury ** Hg [200] 65	Thallium * Tl [204] 66	Lead * Pb [207] 67	Bismuth * Bi [209] 68	Polonium * Po [209] 69	Astatine * At [210] 70	Radon *** Rn [222] 71				
Francium * Fr [223] 87	Radium * Ra [226] 88	▼	Rf [261] 104	Db [268] 105	Sg [269] 106	Bh [270] 107	Hs [271] 108	Mt [272] 109	Ds [281] 110	Rg [281] 111	Cn [285] 112	Uut [289] 113	Ff [289] 114	Uup [289] 115	Lv [293] 116	Uus [294] 117	Og [294] 118				
Lanthanum * La 138.91 57	Cerium * Ce 140.12 58	Praseodymium * Pr 140.91 59	Neodymium * Nd 144.24 60	Promethium * Pm [145] 61	Samarium * Sm 150.36 62	Europium * Eu 151.96 63	Gadolinium * Gd 157.25 64	Terbium * Tb 158.93 65	Dysprosium * Dy 162.50 66	Holmium * Ho 164.93 67	Erbium * Er 167.26 68	Thulium * Tm 168.93 69	Ytterbium * Yb 173.04 70	Lutetium * Lu 174.97 71							
Actinium * Ac [227] 89	Thorium * Th 232.04 90	Protactinium * Pa 231.04 91	Uranium * U 238.03 92	Neptunium * Np [237] 93	Plutonium * Pu [244] 94	Americium * Am [243] 95	Curium * Cm [247] 96	Berkelium * Bk [247] 97	Californium * Cf [251] 98	Einsteinium * Es [252] 99	Fermium * Fm [257] 100	Mendelevium * Md [258] 101	Nobelium * No [259] 102	Livermorium * Lv [260] 103							

# Releases

Naming comes from the periodic table of elements.

Six month cycle to align with other (mostly LFN) projects.

# Releases

Naming comes from the periodic table of elements.

Six month cycle to align with other (mostly LFN) projects.

# Over the last 6 years...

**120,047**

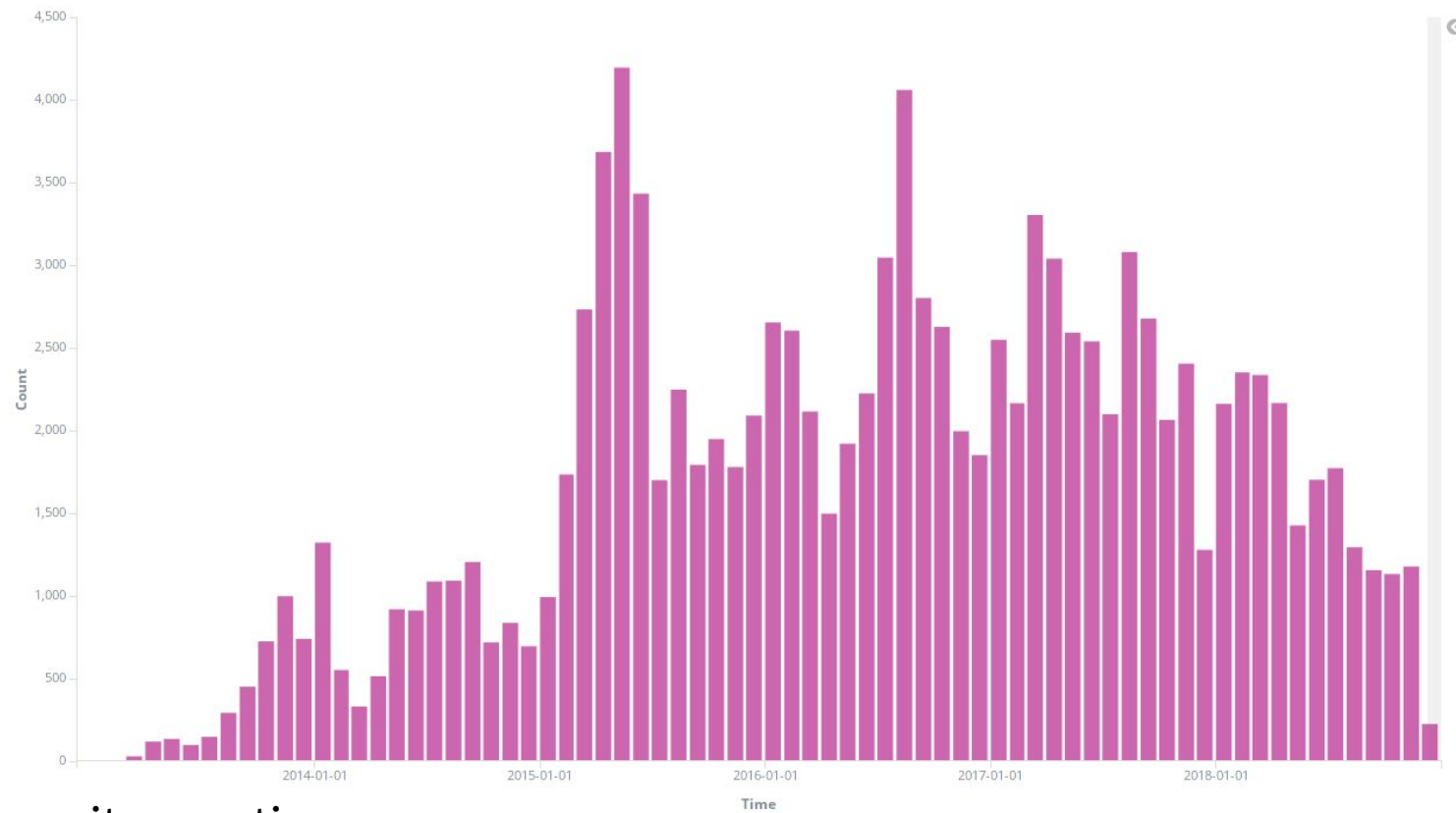
commits

**925**

authors

**87**

repositories



Git commits over time

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# Tools used

**Programming language:** (mostly) Java

**Runtime container:** OSGi / Karaf

**Build system:** Maven

**SCM / Code review:** Git / Gerrit

**CI / CD:** Jenkins

**Testing:** Robot Framework (Python)

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# Governance

- Technical Steering Committee (TSC, weekly meetings)
    - Elected insuring representation of conflicting groups
    - Elects a chair person
  - Project Technical Leads
    - Elected from among project committers
  - Committers
    - Voted internally by projects, approved by TSC
  - Board
    - Member companies + TSC representative
-

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# Resources

<https://www.youtube.com/user/opendaylightproject>

<https://docs.opendaylight.org/>

[https://wiki.opendaylight.org/view/Main\\_Page](https://wiki.opendaylight.org/view/Main_Page)

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