BDTC
2014 中国大数据技术大会
BIG DATA TECHNOLOGY CONFERENCE
暨第二届CCF大数据学术会议

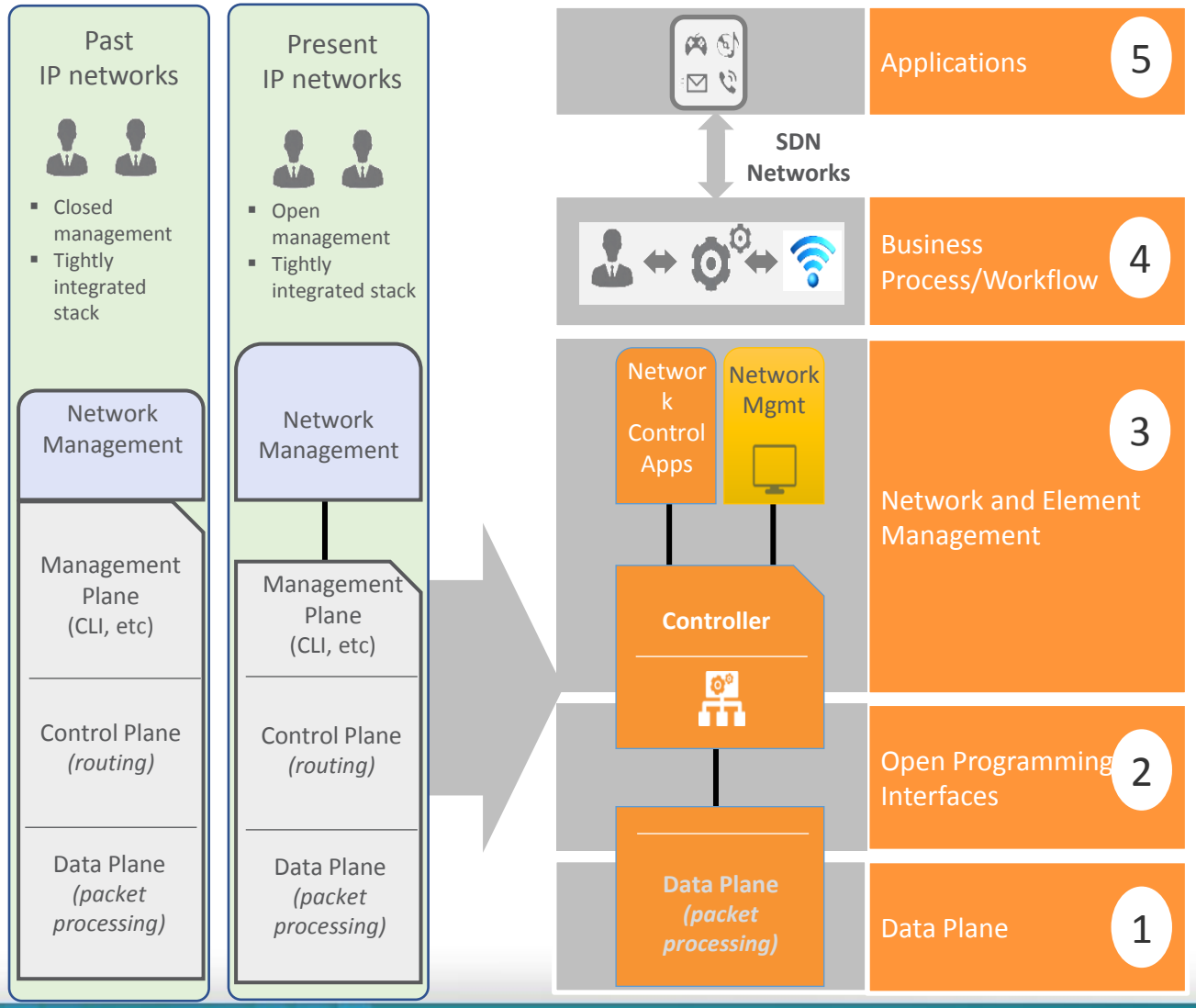
SDN powers Big Data Network with Analytics and Visualization

用于大数据可视化的SDN技术

Agenda

- **SDN Overview**
- Controller Market
- SDN Application

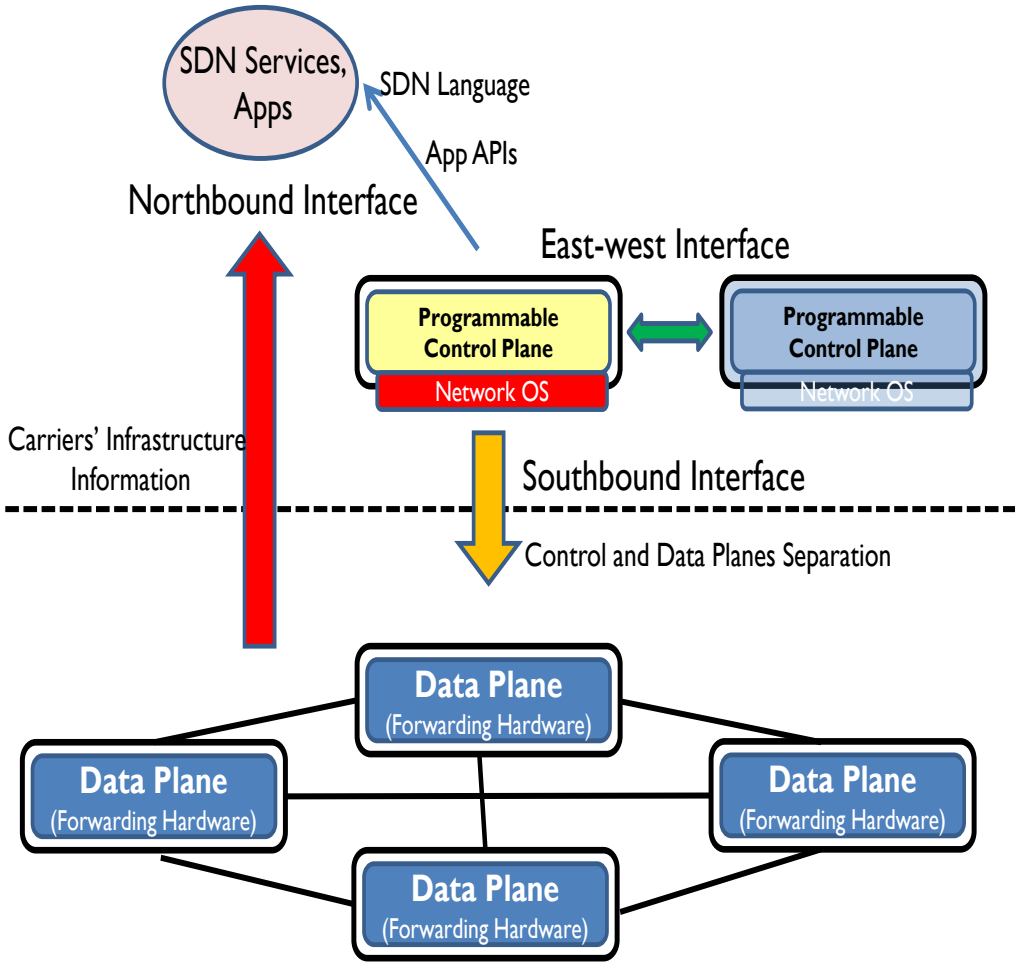
SDN Definitions – Control Stack Evolution



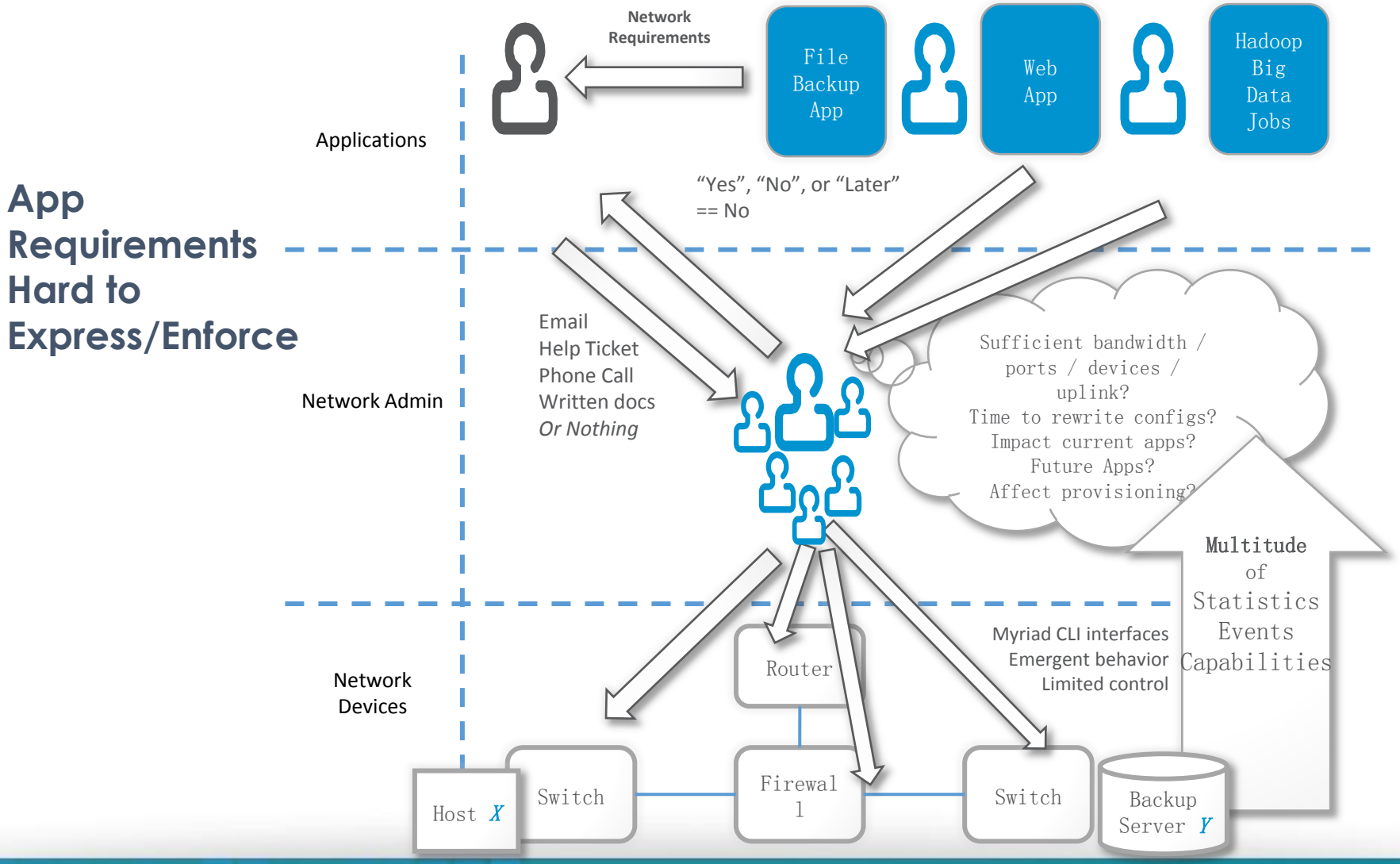
SDN Definitions – Software Directions

- Northbound Interface
  - In computer networking and computer architecture, a northbound interface of a component is an interface that conceptualizes the lower level details (e.g., data or functions) used by, or in, the component
    - Examples: SMMP, CORBA, SNMP
- Southbound Interface
  - Allows a particular network component to communicate with a lower-level component
    - Example: Openflow, Netconf, SNMP
- East-West Interface
  - Communicate between groups or federations of controllers to synchronize state for high availability

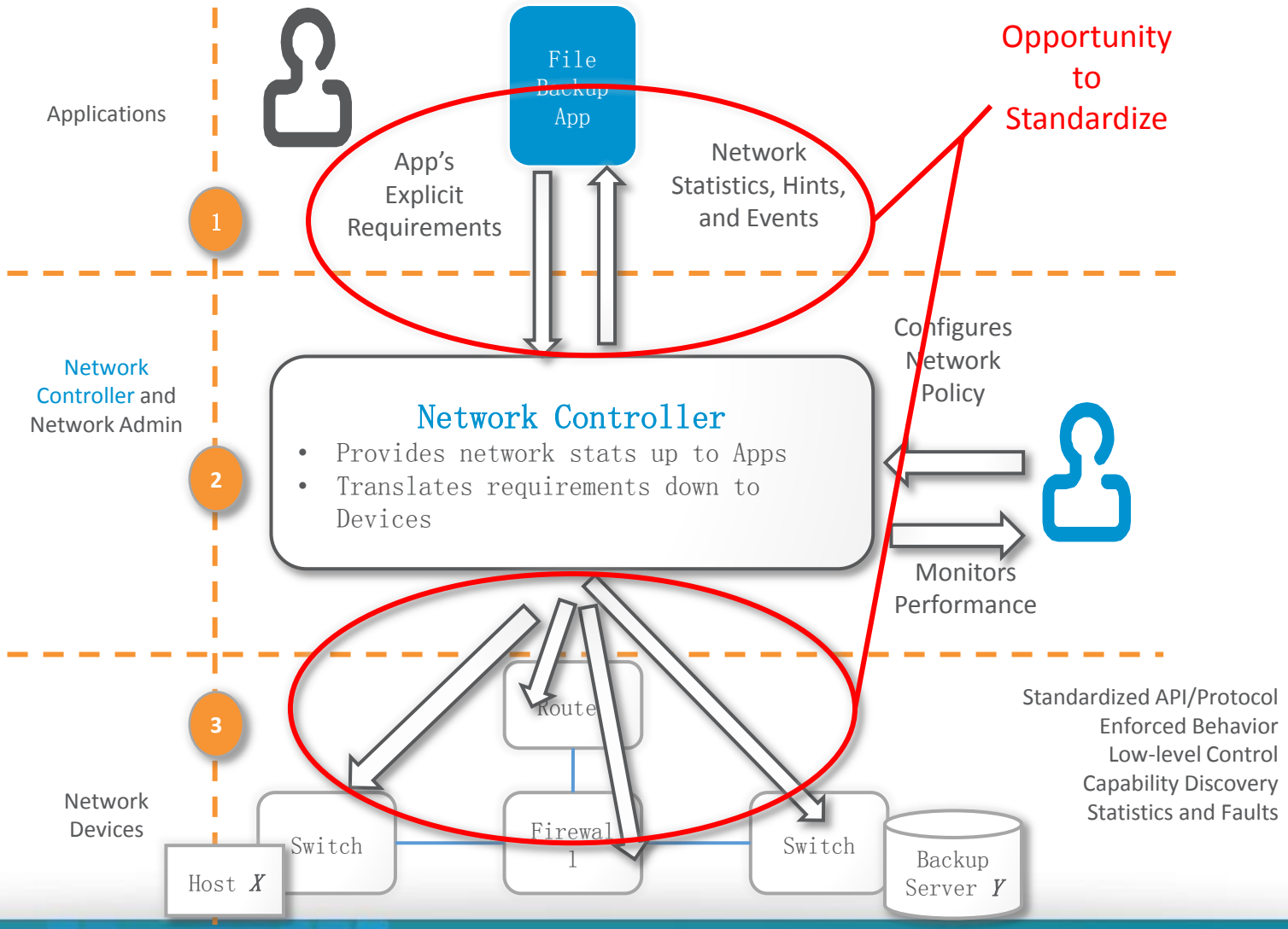
SDN Definitions – Framework



Why SDN? –Apps vs. Network



Why SDN? – Express/Enforce Requirements via API



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OpenDaylight SDN Platform

Linux Foundation

Open Source

Collaboration

Software Defined Networking

Network Function Virtualization

Innovation

SDN, NFV and OpenDaylight

New Revenue

Open, Programmable APIs

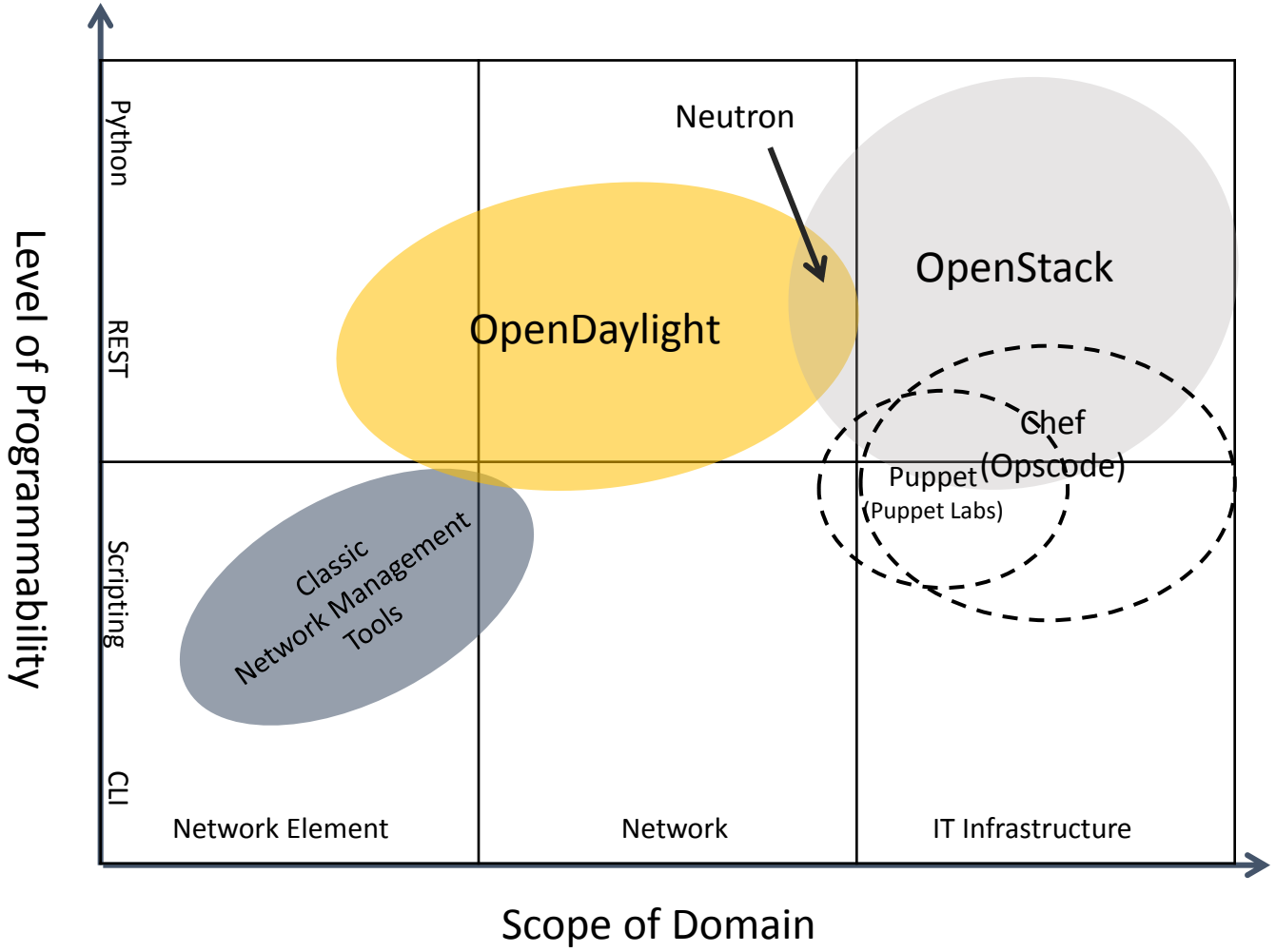
Service Agility

Orchestration, Automation and MANO

Virtualization and Abstraction Layer

Lower Cost

OpenDaylight compared with OpenStack



Why Open Source?

Flexibility

Innovation

Choice

Control

- Faster, lower cost and higher quality development through sharing of resources via collaboration
- Community decisions about new features and roadmaps
- A common environment for uses and App developers
- Ability to focus resources on differentiating development

Controller Market Overview

"an open source SDN controller"

- Linux Foundation
- Members:
  - Cisco, IBM, BigSwitch, Brocade, Juniper, Microsoft, Citrix, NEC, HP ….
- Origination, March 2013:
  - Cisco ONE/onePK for the Service Abstraction Layer (SAL)
  - Beacon (OpenFlowJ) API for OpenFlow
  - Applications by NEC, IBM, and others

OpenDayLight Momentum Building

OpenDaylight becomes the clear choice for the industry

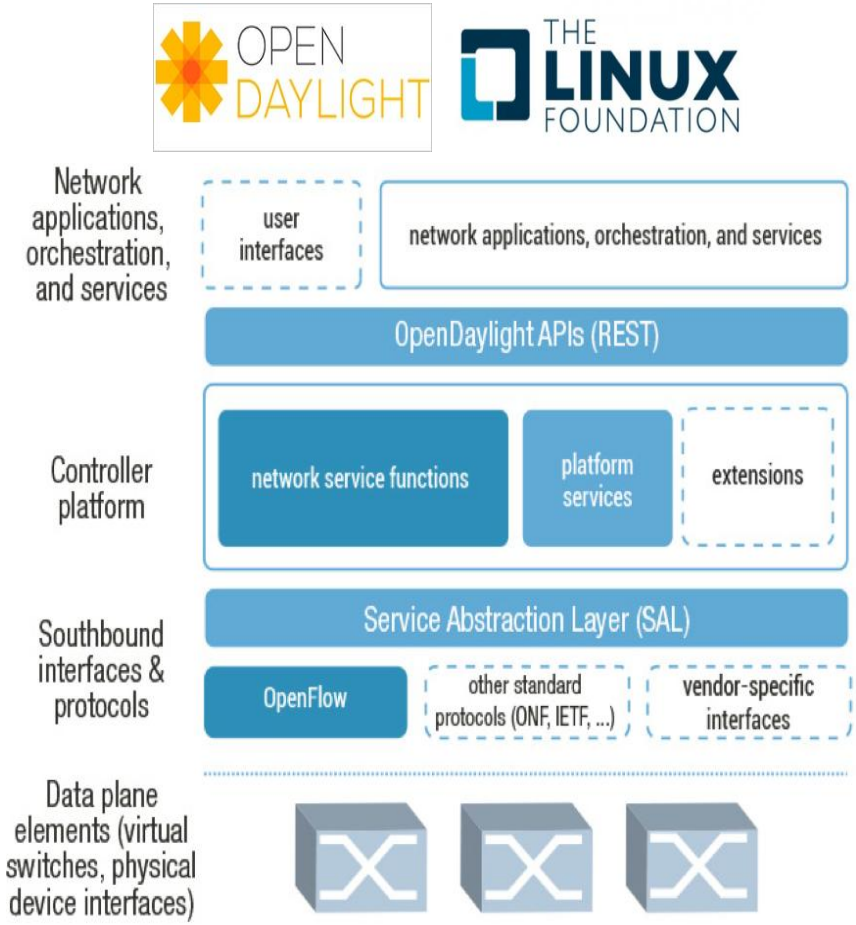
- Gigaom Research (April 2014)*
  - 95% of those surveyed want open source in their SDN solution
  - 76% of those surveyed prefer a commercial supplier for their open source-based product
- Growth in total Membership 18 to 39 members since launch (2 more in September)
- Developer growth to over 200 developers
- Growth in number of projects From 14 to 25
- Press mentions - over 3000 stories this year and 2.7 million keyword impressions
- Companies who've announced ODL based products 10
- The platform has over 1.7 million lines of code

*Gigaom Research: The report surveyed 600 IT decision makers and technologists in medium to large organizations within enterprise (300) and service provider (300) organizations in North America.

Continuous Growth to 39 Members

The OpenDaylight Project

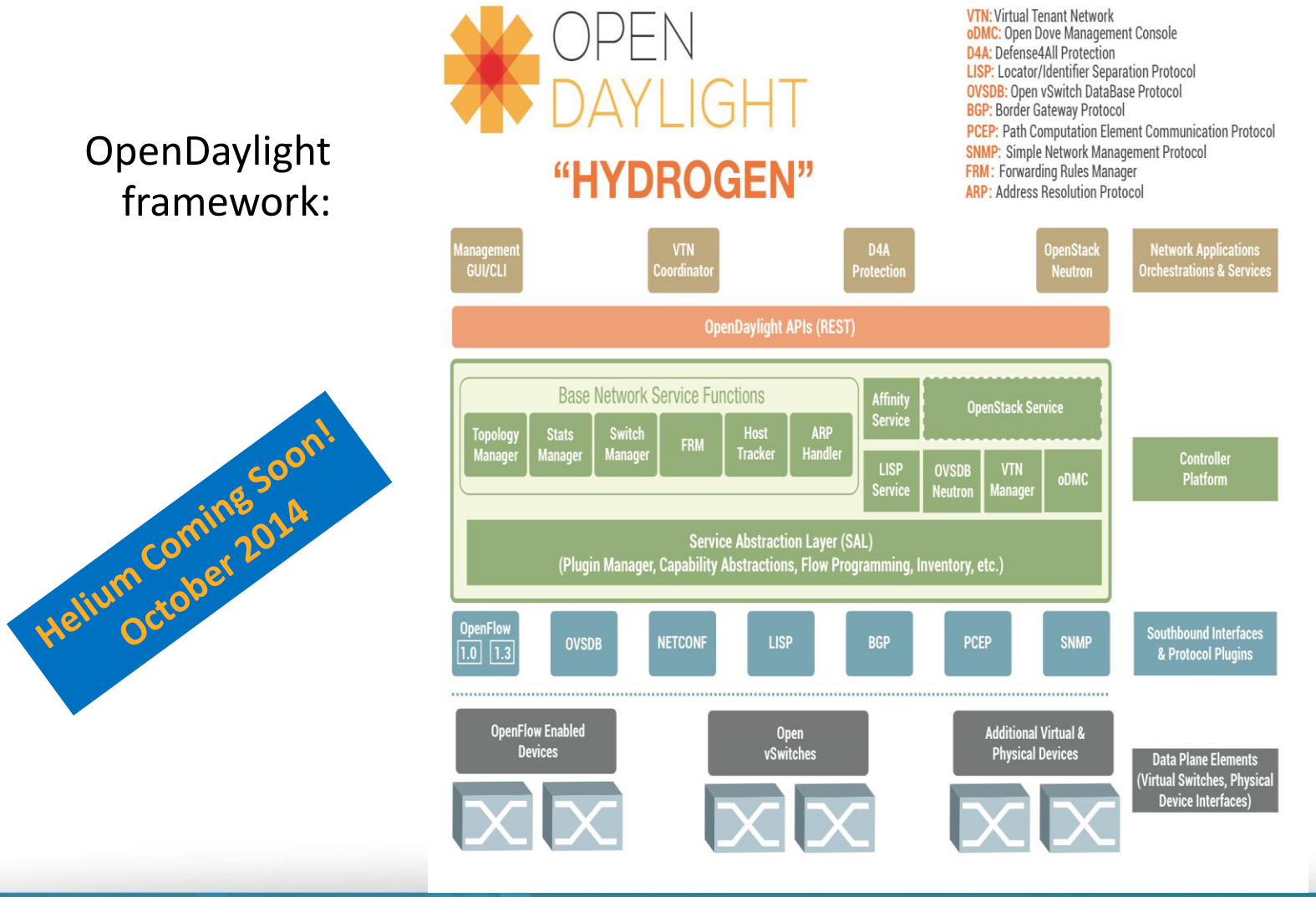
THE LINUX FOUNDATION'S OPENSOURCE CONTROL PLANE FOR SDN AND NFV



- OpenDaylight is a widely supported framework for SDN and NFV control
- Supporting vendors include: Brocade, Cisco, IBM, Arista, Juniper, Ciena, Hewlett Packard, NEC, VMWare, Huawei and many others
- Important Features of the OpenDaylight Framework:
  - Standardized REST API (northbound) for application developers
  - Standard and vendor-specific plugins (southbound) allow a wide range of switch and router supplier options
  - **Service abstraction infrastructure simplifies network complexity and allows SW developers to focus on business logic rather than proprietary vendor interfaces.**

Controller Market Overview

OpenDaylight framework:



Helium Coming Soon!
October 2014

The Service Abstraction Layer – SAL

- Exposes device services that are managed by the APP modules at a higher layer
- Determines how to fulfill the requests from northbound APPs, irrespective of the underlying protocol (southbound interface)
- Underlying protocols that connect to the devices can be OpenFlow (1.0, 1.3), BGP-LS, Netconf, OVSDB, SNMP, etc.

The Service Abstraction Layer – SAL

- Two flavors of SAL:
  - AD-SAL
  - MD-SAL
- AD-SAL: API Driven SAL
  - Stateless
  - Limited to flow-capable devices and service models only
- MD-SAL: Model Driven SAL
  - Can store date for models defined by plugins
  - Model agnostic – can support any device and/or service model

Controller Market Overview

- Players: Open source, established vendors, start-ups

Technology	Vendor
Silicon	Broadcom, Ezchip, Intel
Switches	Arista, Brocade, Cisco, Dell, HP, IBM, Juniper, Mellanox, NEC, Pica8, Cumulus, Big Switch
Routers	Cisco, Juniper, Huawei, Brocade Vyatta
L4-7	6wind, Embrane, F5
Controllers (OpenDaylight)	Cisco APIC-EM, Brocade, Inocybe, Extreme
Controllers (Pre-OpenDaylight)	Cisco APIC, XNC, Juniper, HP, Nuage, NEC
Virtualization	VMware, Contextream, Midokura
Orchestration and Automation	Anuta, Lyattis, Plexxi

Controller Market Overview

COMPANY	SDN CONTROLLER
BigSwitch	Floodlight-Based
Cisco	APIC (App Policy Infrastructure Controller), APIC-EM, XNC, onePK
HP	VAN SDN Controller (Announced moving to ODL)
IBM	IBM Programmable Network Controller, Dove
Juniper	Contrail Controller, Open Contrail
NEC	NEC ProgrammableFlow Controller
NTT Data	NTT Virtual Network Controller
Pica8	Pica8 Integrated Open OVS Switch & Controller
Plexxi Inc.	Plexxi Control
OpenDaylight	OpenDaylight (Hydrogen, Helium (Oct 2014))
Huawei	SNC
Midokura	MidoNet

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OpenDaylight Controller Use Cases

SOFTWARE THAT CONNECTS THE NETWORK TO YOUR BUSINESS PROCESSES

Custom Analytics and Compliance

Big Data

Security

QoS and Traffic Management

Service Configuration and Policy

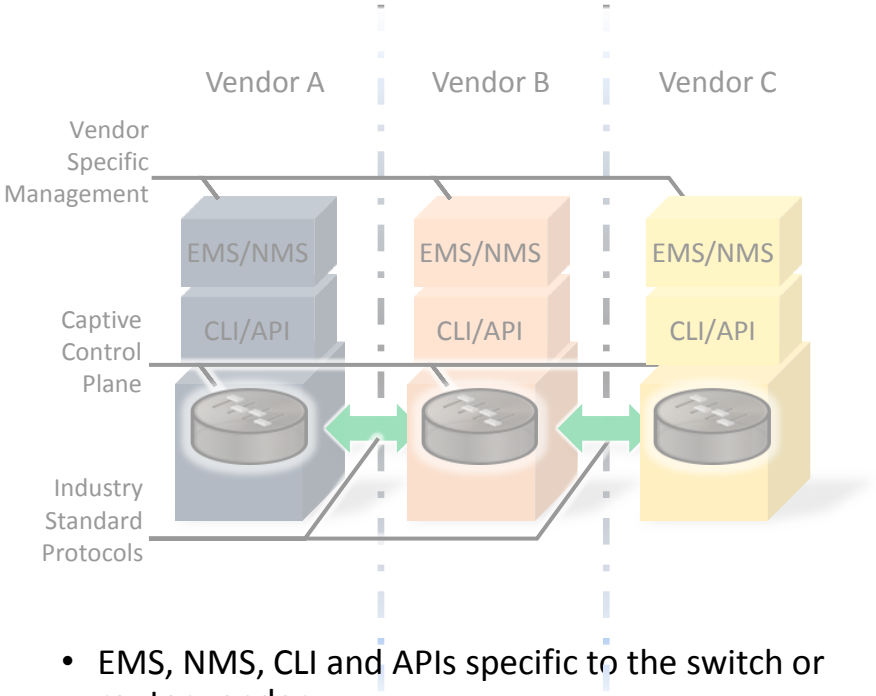
Research and New Protocols

Fault and Disaster Recovery

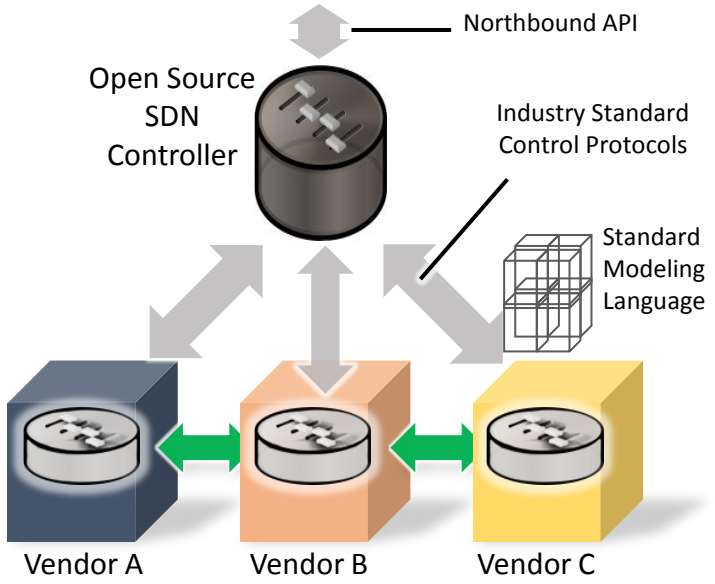
WAN Optimization

A New Network Architecture

Software Defined Networking Centralizes the Control Plane

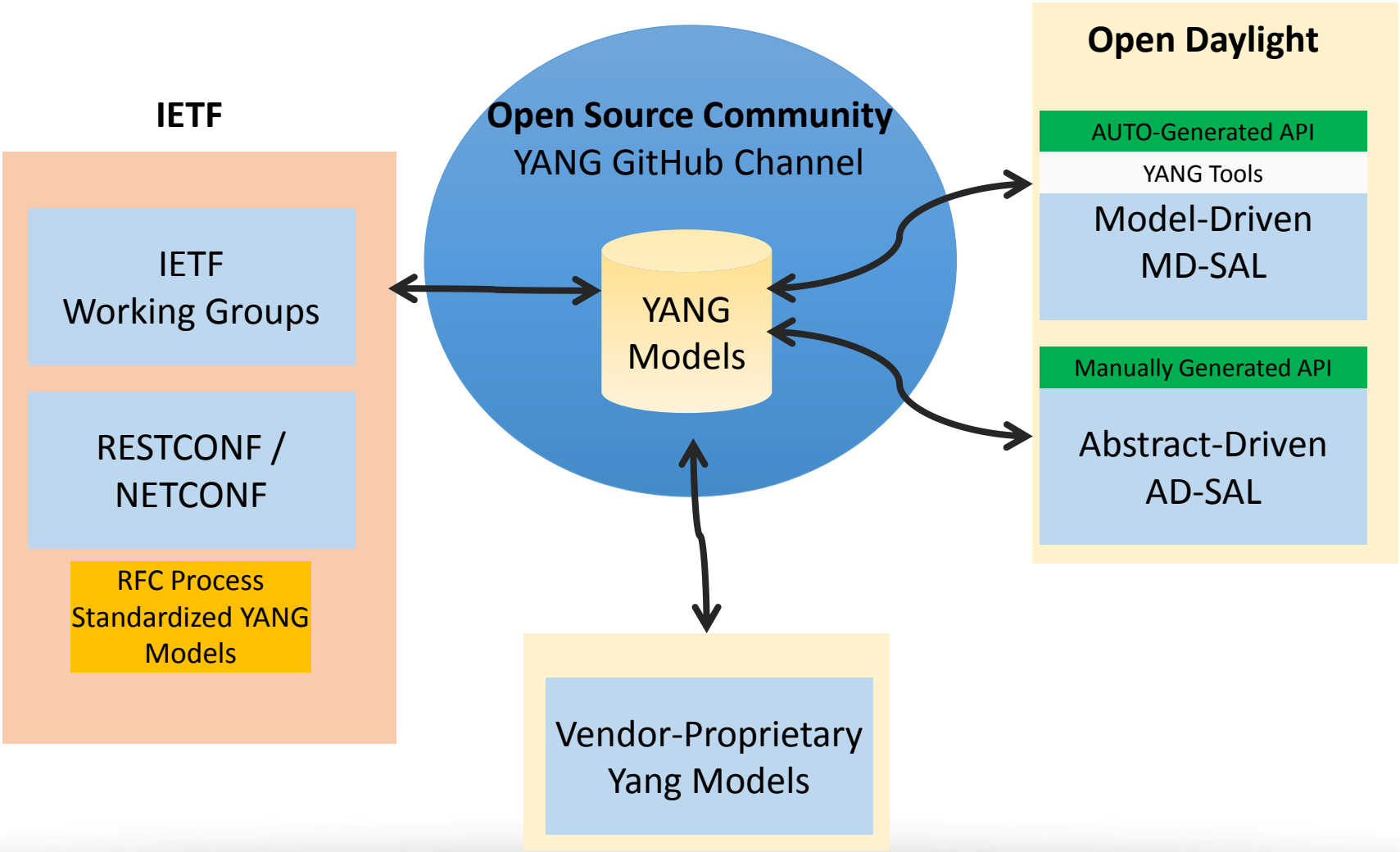


- EMS, NMS, CLI and APIs specific to the switch or router vendor
- Proprietary control plane per device
- Communication protocols standardized for interoperability



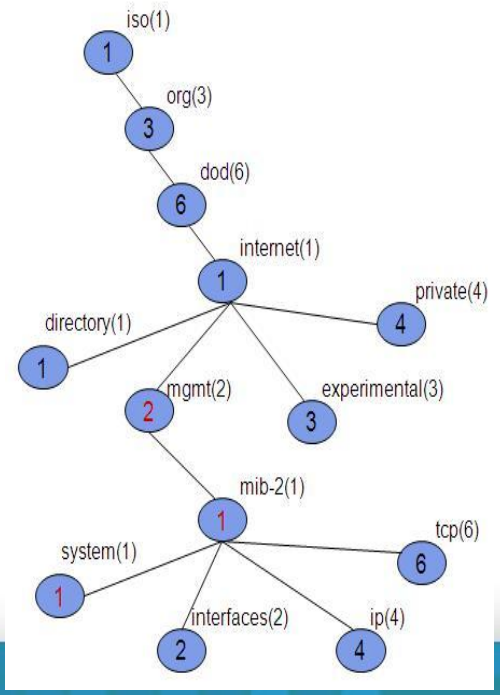
- Centralized open control plane, non-vendor specific
- Normalized programming interface
- Standard control protocols and modeling language

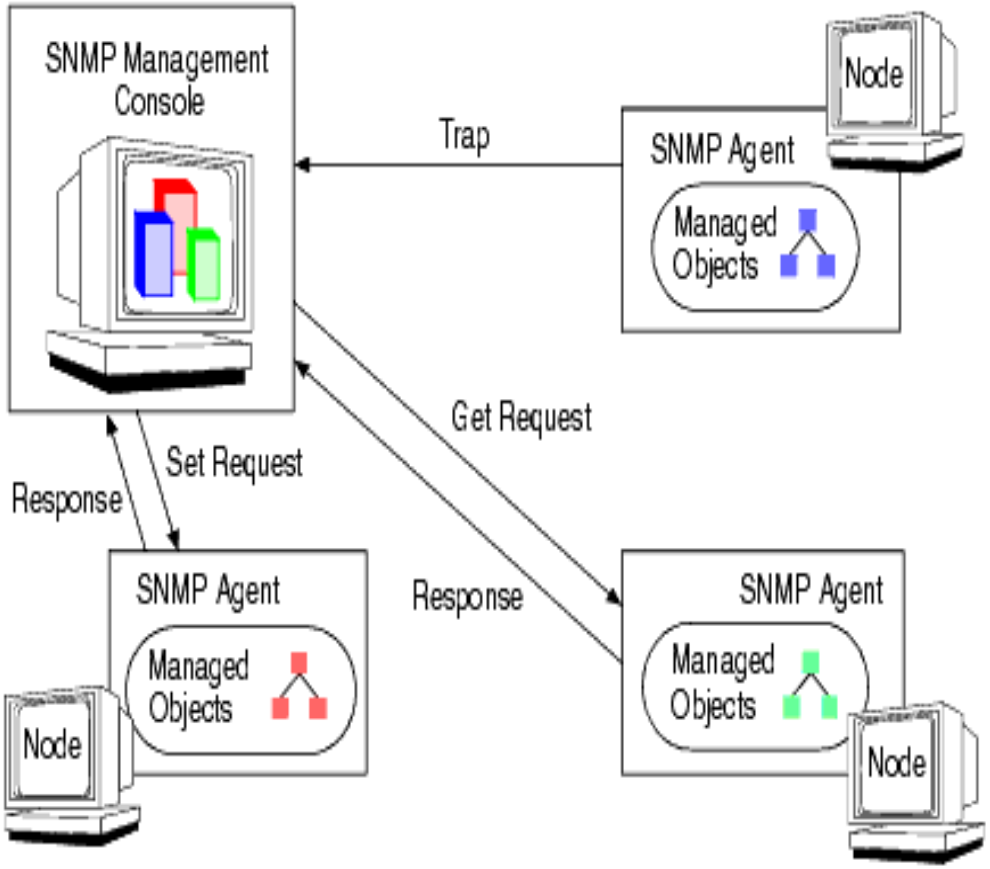
YANG Model Development and Standardization



Data Models and Protocols:

- Example:
  - Protocol – SNMP
  - Data model – MIBS



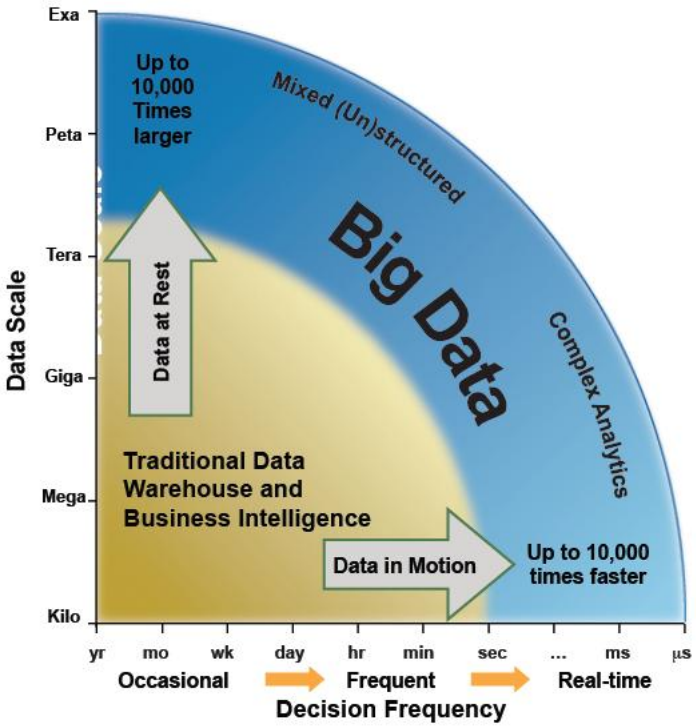


PATHS model

- Paths modeling depends on the:
  - Modeling of the nodes (hosts and switches)
  - Modeling of the link topology or physical network
  - Modeling of flows on switches.
- Uses (Layered upon):
  - Hosts
  - Switches
  - Link Topology (as discovered by LLDP)
  - Flows (implemented through the OpenFlow pluggin)
- Adds:
  - sourceIP, destinationIP "path"
  - including "waypoints"
  - CRUD of Path model derives CRUD of flows

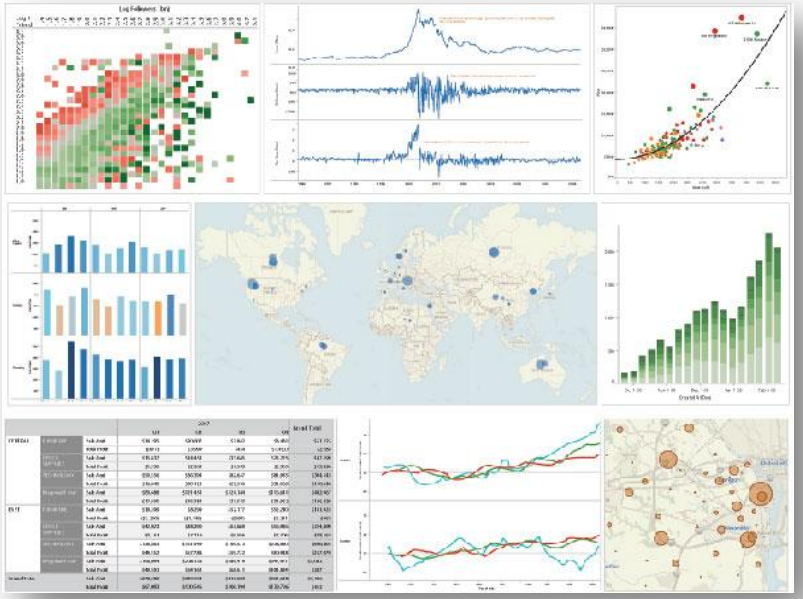
Big Data Analytics is comprised of two components:

Big Data



Defined by: Volume, Velocity, Variety

Data Analytics



The Process of: “Discovery and communication of meaningful patterns in data”

Why Analytics?

Improve network robustness and performance

- VXLAN Monitoring and Troubleshooting
- L2-L4 DDOS Mitigation
- Service and User Accounting
- Network Anomaly Detection
- Firewall Bypass

Network Requirements for Big Data

High Performance with Low Latency

Large data transfers and high I/O counts require a high throughput and low latency network and optimized for east/west traffic patterns

Scale-out Fabrics

Greenplum MPP architecture requires a network with a large number of 10 GbE ports and an architecture that can quickly scale-out to add capacity

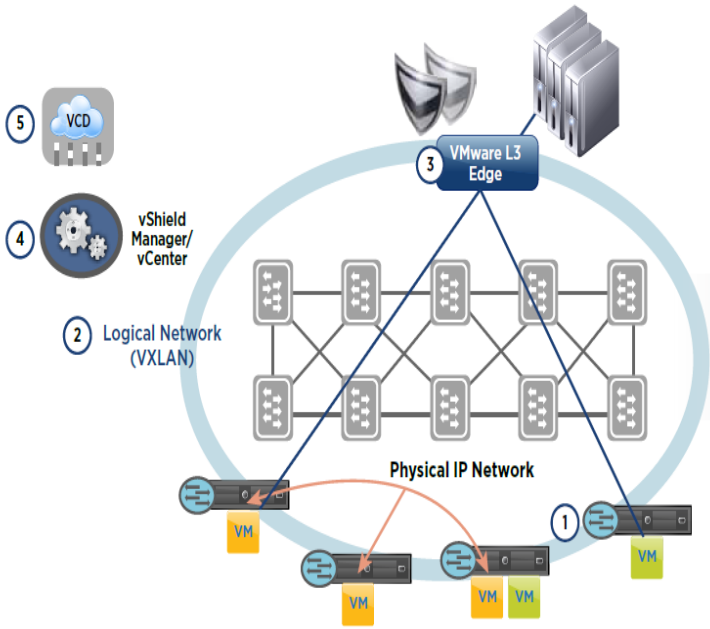
Operational Simplicity

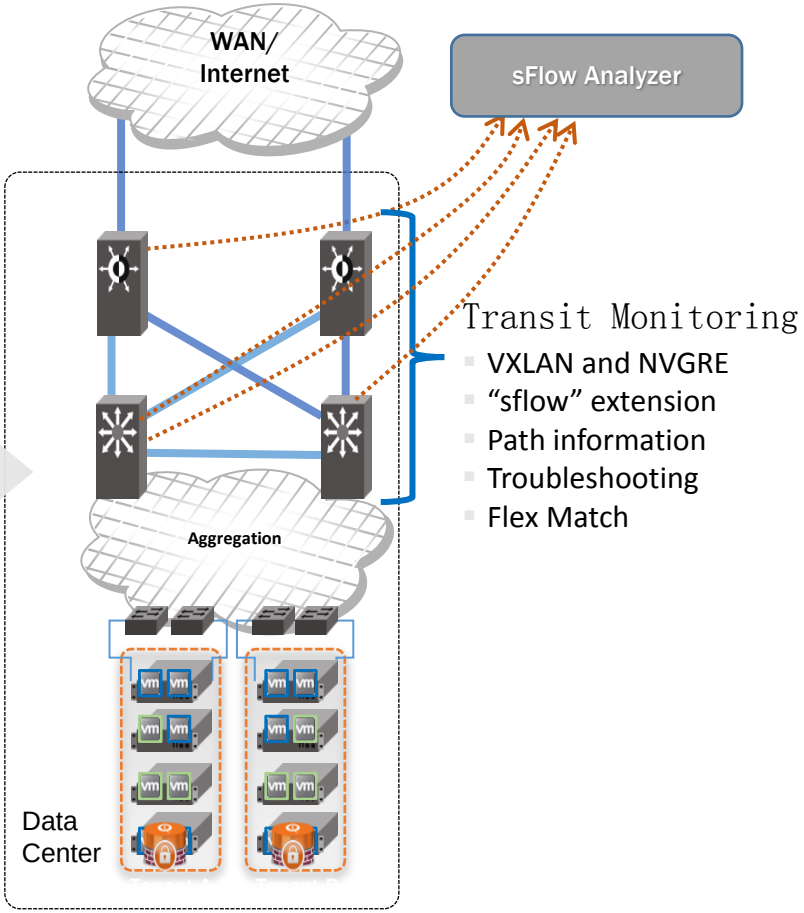
The network must be automated, with self-forming fabric, plug-and-play configuration, and entire fabric managed as a single logical switch

Non-stop Networking

Downtime must be minimized by adding or modifying links quickly and non-disruptively with rapid convergence time, and with no manual configuration

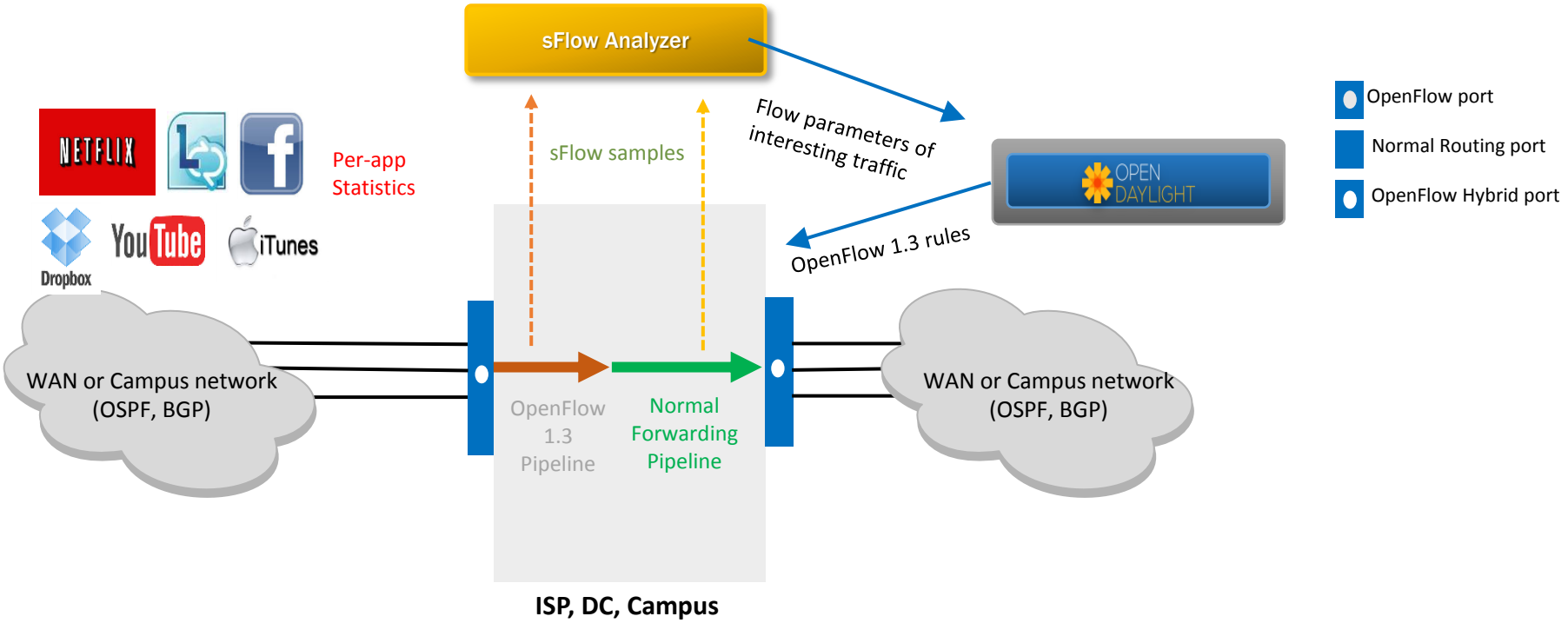
High performance VXLAN/NVGRE aware DC core and border





DC Network Operators are running blind with no VXLAN/NVGRE visibility at physical Core/Interconnect

Improve network utilization and reliability; Innovate services



Differentiation:

- Per-flow "In-line" analytics
- @ large scale (128k flows)
- **OpenFlow 1.3:** Match, Meter, Drop, Remark
- **Normal Forwarding:** L2, L3 and MPLS
- **No impact to original routing or switching**

Use cases

- Internet/Mobile traffic analysis: Facebook, Youtube, Netflix, …
- Business/Residential Customer Internet Accounting/Intelligence
- Campus Visibility, Accounting and Traffic Management
- Big Data analysis
- Troubleshooting analysis

Science DMZ

For Research Institutions and Universities

Customer Challenge

- Firewall is a choke point for elephant flows
- Overall performance degradation
- Requiring manual input for configuration changes can't scale, especially under peak demand

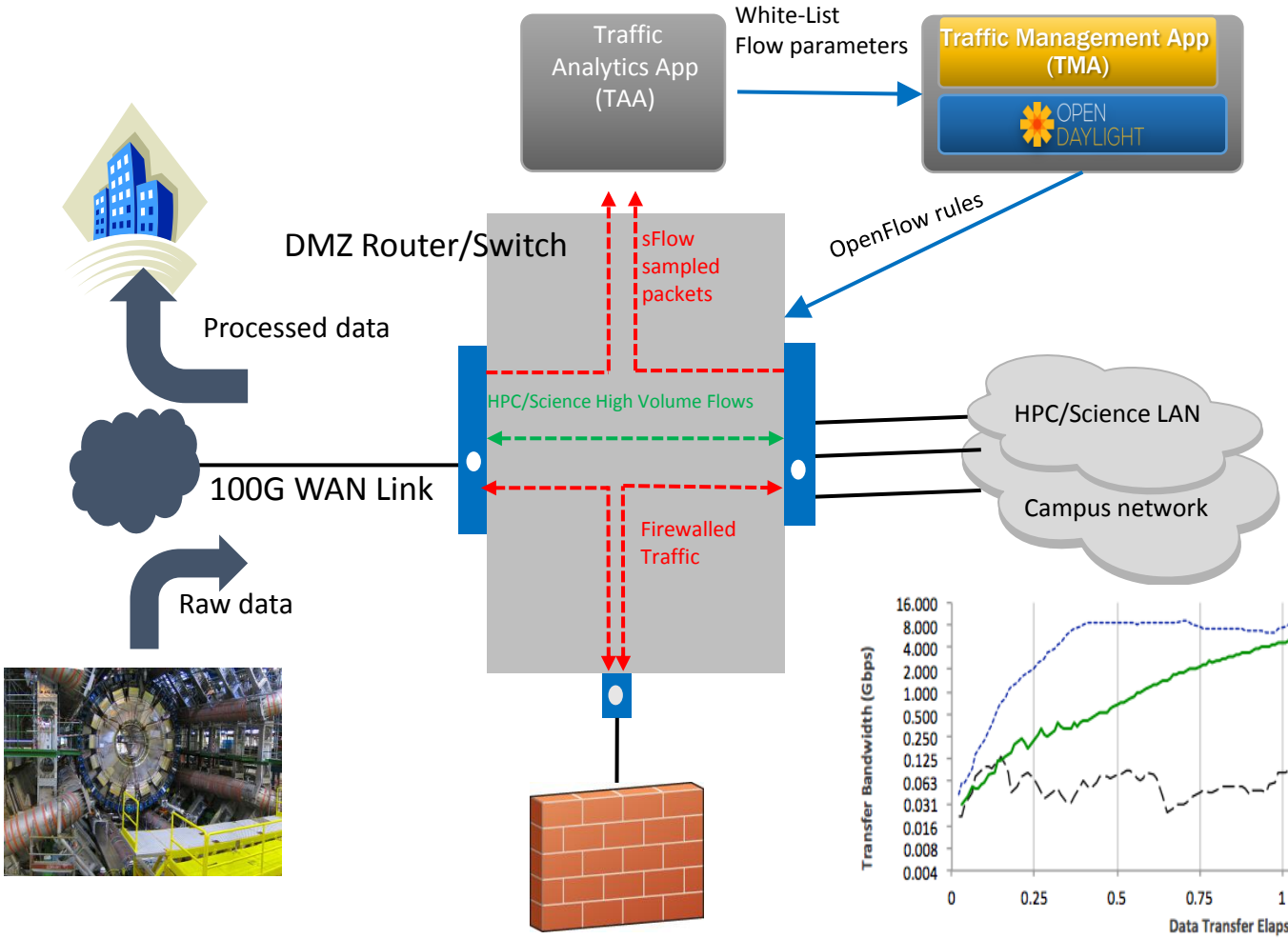
The Solution

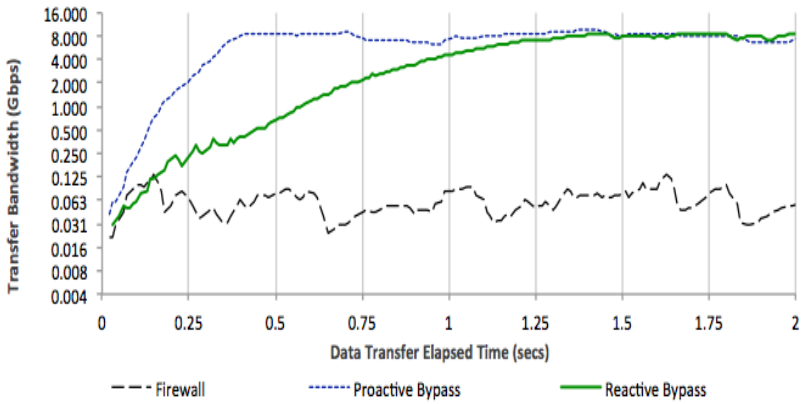
- Selectively bypass FW automatically for trusted users
  - Internet2 Science DMZ application
  - Sunshine controller
  - Openflow switch and Router

Solution Benefits

- Automation for scaling existing processes
- Big performance gain for trusted users; eases constraints on FWs, up to 100GE
- Uses existing security and NW infrastructure
- Uses standards-based API and protocols

SDN Science-DMZ Demo "Firewall Bypass" Example



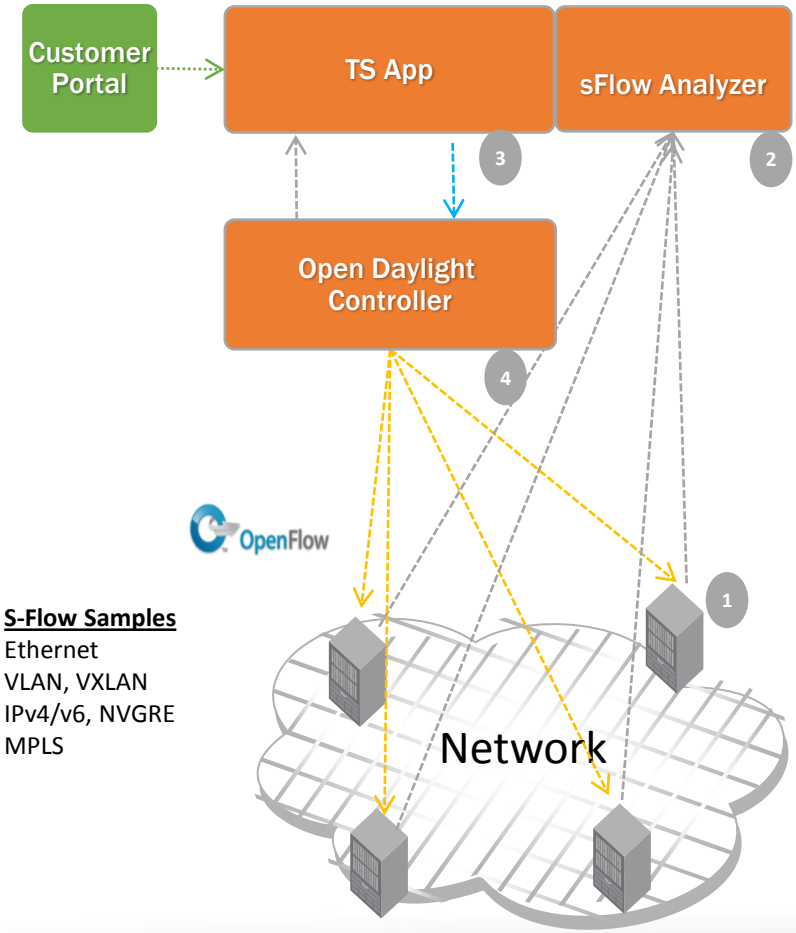


Improves 100G performance by 2x for legitimate flows

- **250ms - double throughput of firewall path**
- **1.5sec - same throughput as NO firewall**

Volumetric Attack Mitigation

Value proposition: Less expensive, Easy out-of-the-box install



1. Data Center Devices
   - Send sFlow samples to the collector
2. sFlow Analyzer
   - Analyze and report Volumetric Flow trigger
3. Traffic steering application with policy based UI and REST APIs
   - Instruct controller to redirect volumetric flows
4. OpenDayLight Controller
   - Program OpenFlow 1.3 rules in openflow router and switch

Controller Cluster Load Balancing (LB)

Target: Telco Provider, Cloud Service Provider

Customer Challenge

- Even traffic distribution
- Processing computationally intense operation like SSL
- Operational overhead for configuring multiple controllers' IP addresses towards end points and applications

The Solution

- OpenFlow LB from network to controller domain
- REST (Northbound API) connection LB from applications to controller domain
  - Content based LB (ex: PUT request directed to lead of shard)
  - Request validation (ex: HTTP methods/browser filtering)
- TLS offload for OpenFlow and REST connections

Solution Benefits

- Enables controller clustering for fault tolerance and scalability
- Ensures even load distribution across controllers
- Increases network and controller scale by offloading encryption processing
- Simplifies controller operation

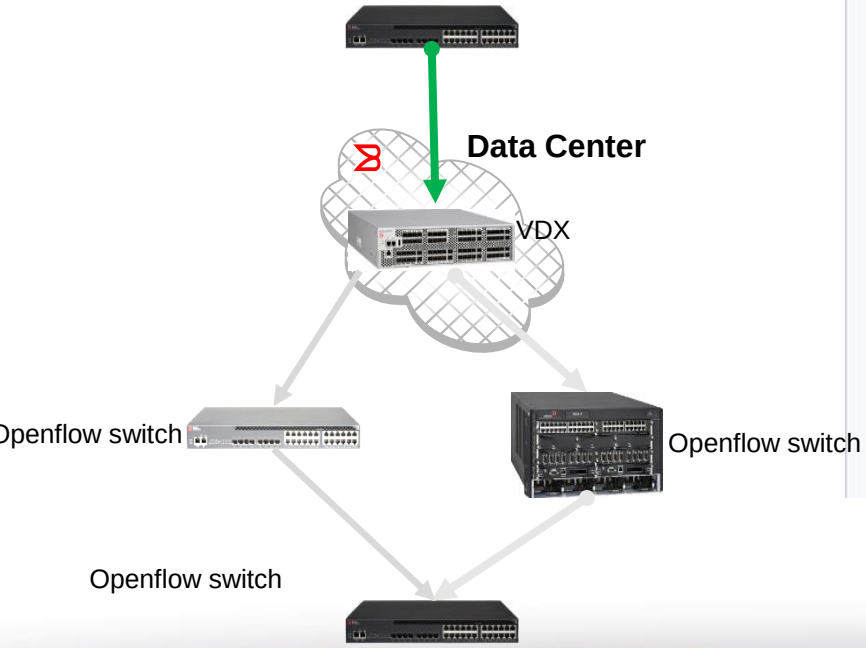
Drag and Drop Flow Modification

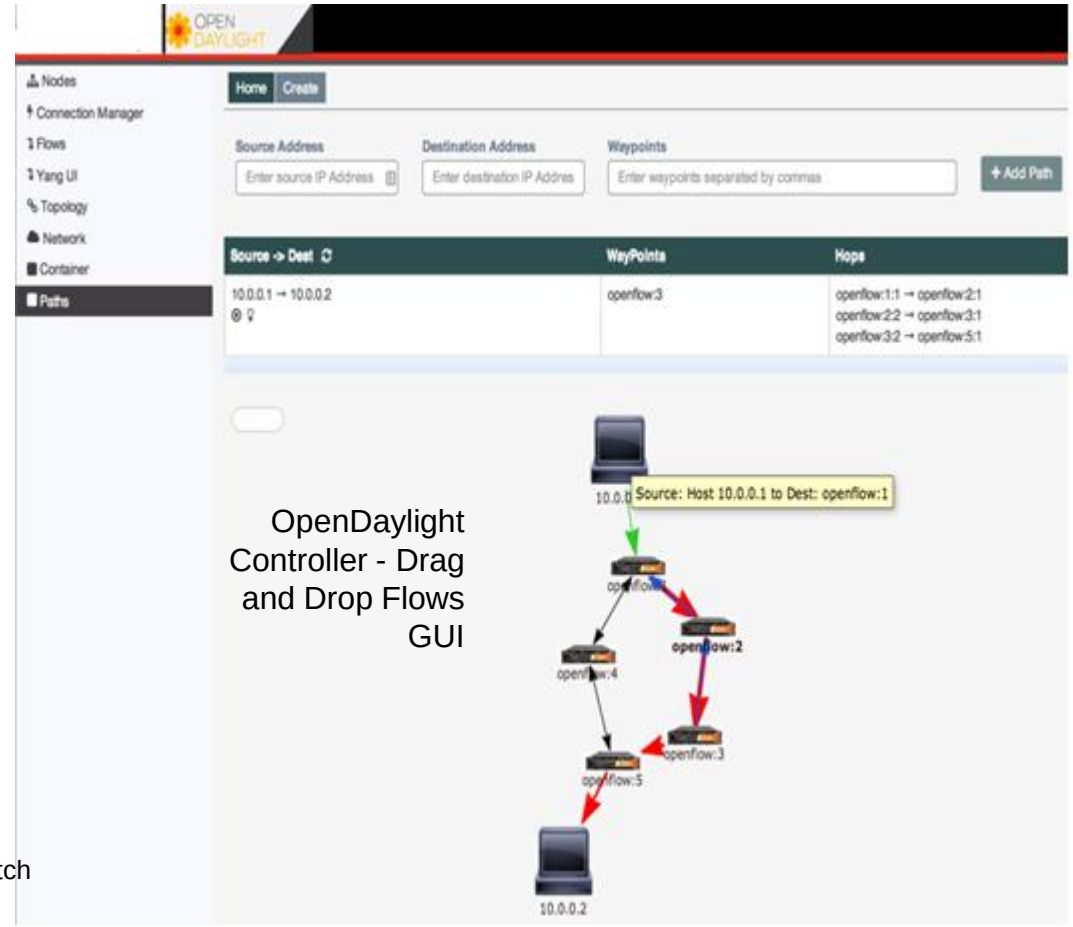
For Any Customer Using ANY OF 1.0 and 1.3 compliant switch

Customer Challenge	The Solution	Solution Benefits
• Understanding and visualizing network traffic flows • Difficulty in modifying traffic flows • Manual insertion of new network services	• Dynamic flow interaction through an intuitive GUI • OpenDaylight controller • Any OpenFlow compliant switch	• Easy to view topology and traffic flows • Intuitive traffic flow modification • Easy to understand system response • Rapid service insertion

Drag and Drop Flow Modification

- The penDaylight Controller includes a topology display and GUI objects for network flows. For any device controlled by ODL using OpenFlow 1.3, the GUI includes an end-point on the flow that can be dragged and snapped to any network element.

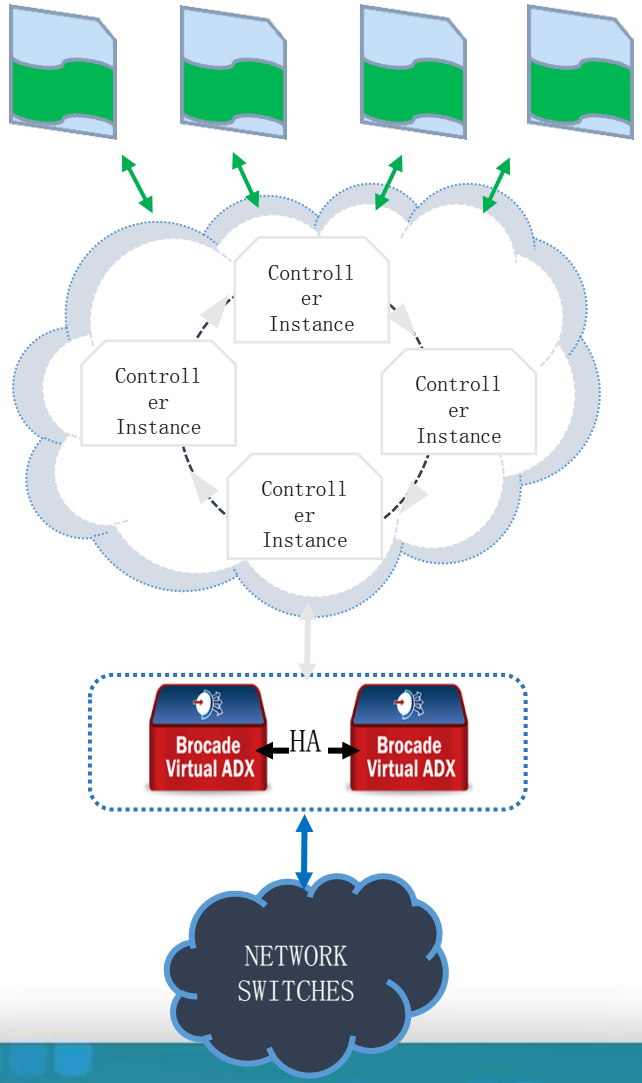




OpenDaylight Controller - Drag and Drop Flows GUI

Controller Cluster Load Balancing (LB)

OPEN DAYLIGHT by BROCADE



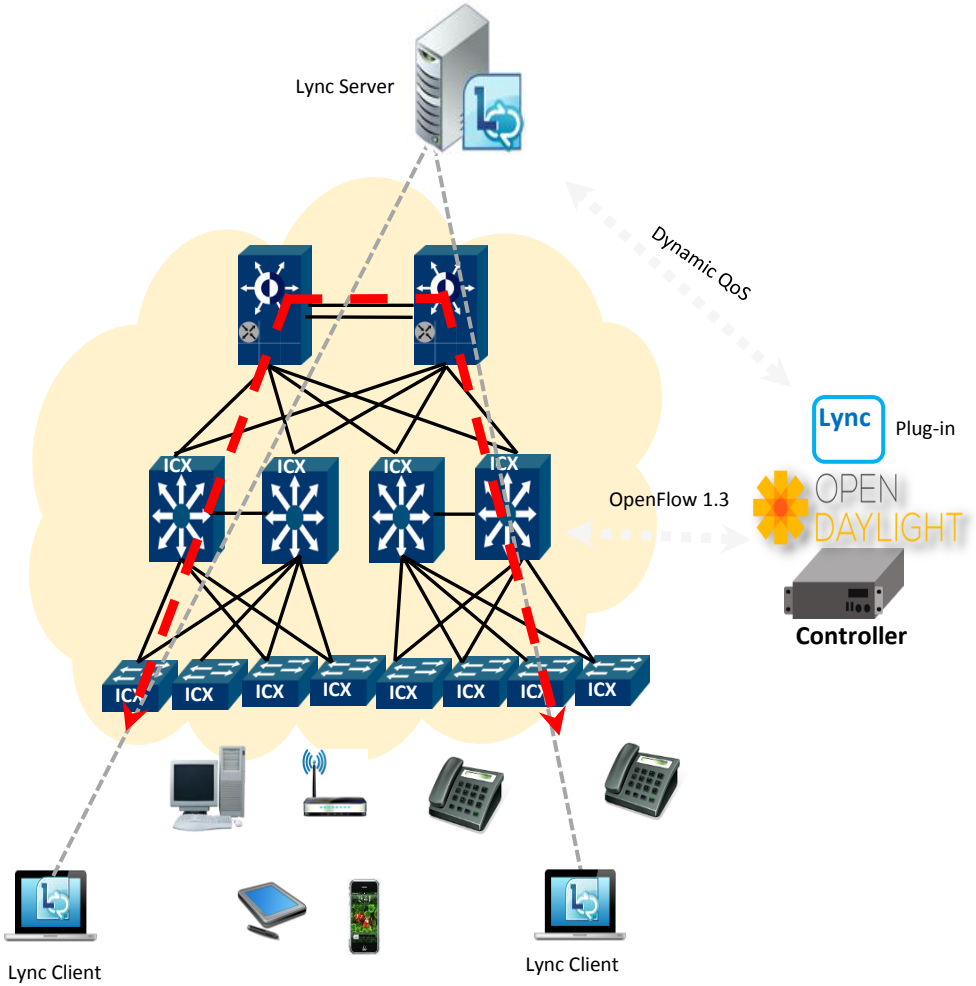
Applications

The OpenDaylight Controller is designed in a cluster for increased performance and reliability

vADX enhances SDN operations:
- OpenFlow load balancing
- Northbound API load balancing
- TLS offload for encrypted traffic

SDN-Based Adaptive and Automated QoS

Application detects voice/video delays, dynamically requests prioritization



Solution

- Fully automated and adaptive call admission and control
- Single trusted source of QoS management
- Eliminates the need to QoS tag at the switch port level
- Dynamic replacement of manual switch-by-switch provisioning of static QoS policies

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Thanks

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