



# The State of SDN & NFV: 5 Years In

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A photograph of a large, powerful blue wave crashing over a surfer. The surfer is visible in the lower right, riding the wave. The sky is bright blue with scattered white clouds. A black semi-transparent banner with a fine grid pattern is overlaid across the middle of the image, containing white text.

**There is a Wave Sweeping the IT Industry**

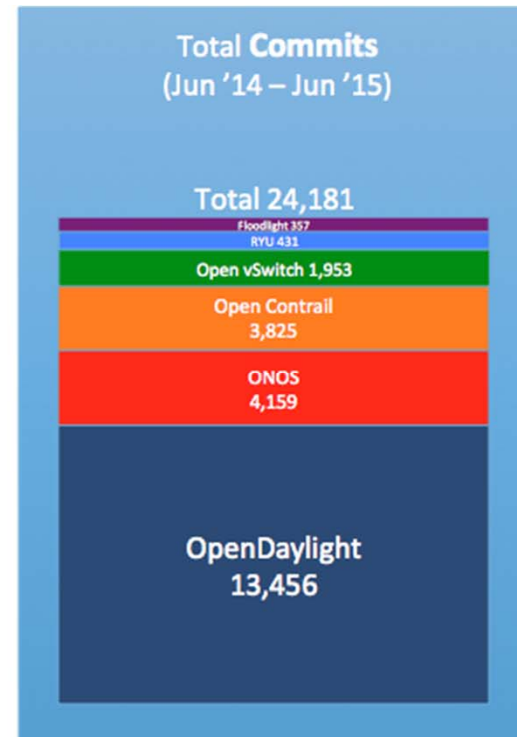
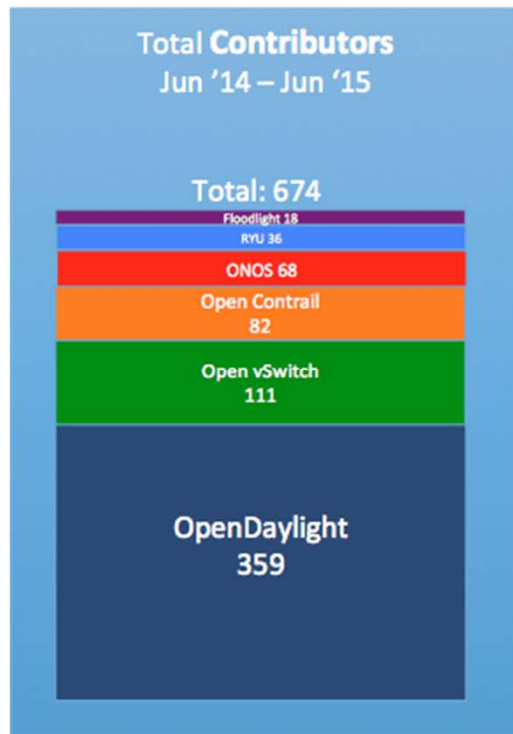


**The Era of Standards Wars is Over**



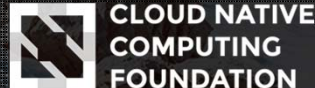
**Collaboration**  
With your team ...but also with your competitors!

# Significant Industry Investment in Open SDN





# Open Collaboration



# Vibrant Advisory Group





# Balancing Innovation and Standardization

Exploration vs. Rationalization



# Strong Desire for One Common Platform

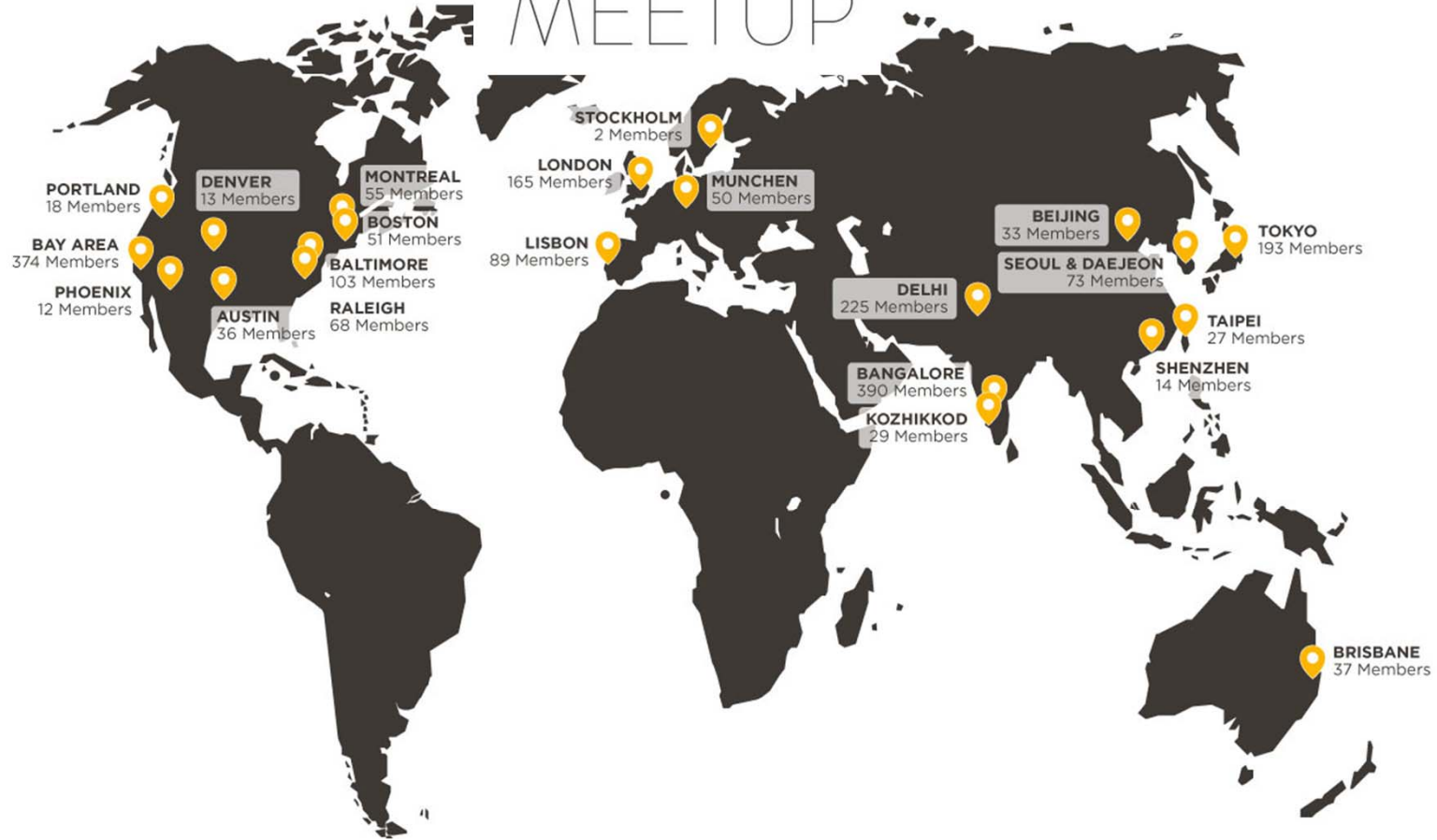
## “Open Programmable Network”

- Supports a wide range of use cases (similar to Linux’s reach)
- Takes a modular/approach to architecture (deploy only what you need)
- Supports the full range of operator hardware (multiple southbound interfaces)
- Provides easy way to write once, work everywhere (service abstraction layer)





OPEN  
DAYLIGHT  
MEETUP

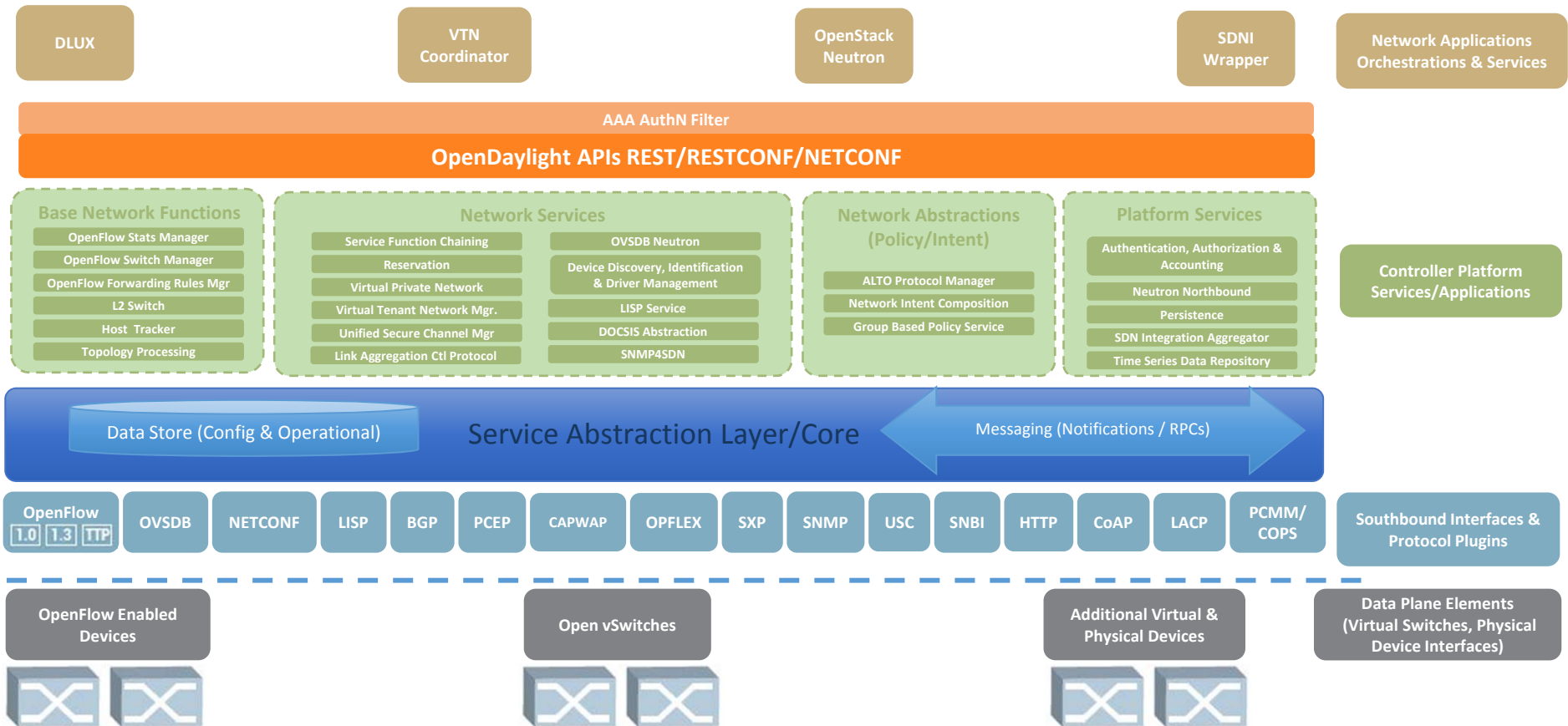


# Solutions Based on OpenDaylight



#odsummit

# OPEN DAYLIGHT *001k1xp*



# Standardizing the SDN Platform

## Some Questions Have Been Addressed...

- Need to support multiple protocols
- YANG models

## While Others Still Remain:

- The role of policy / intent
- How to scale out logically centralized control
- Evolving role of OpenFlow
- How to measure end-to-end controller performance



# 4 Emerging Use Cases for SDN



Centralized  
Network  
Monitoring,  
Management  
&  
Orchestration



Pro-active  
Network  
Management  
and Traffic  
Engineering



Network  
Functions  
Virtualization



Cloud  
Networking

# OpenDaylight in the WAN

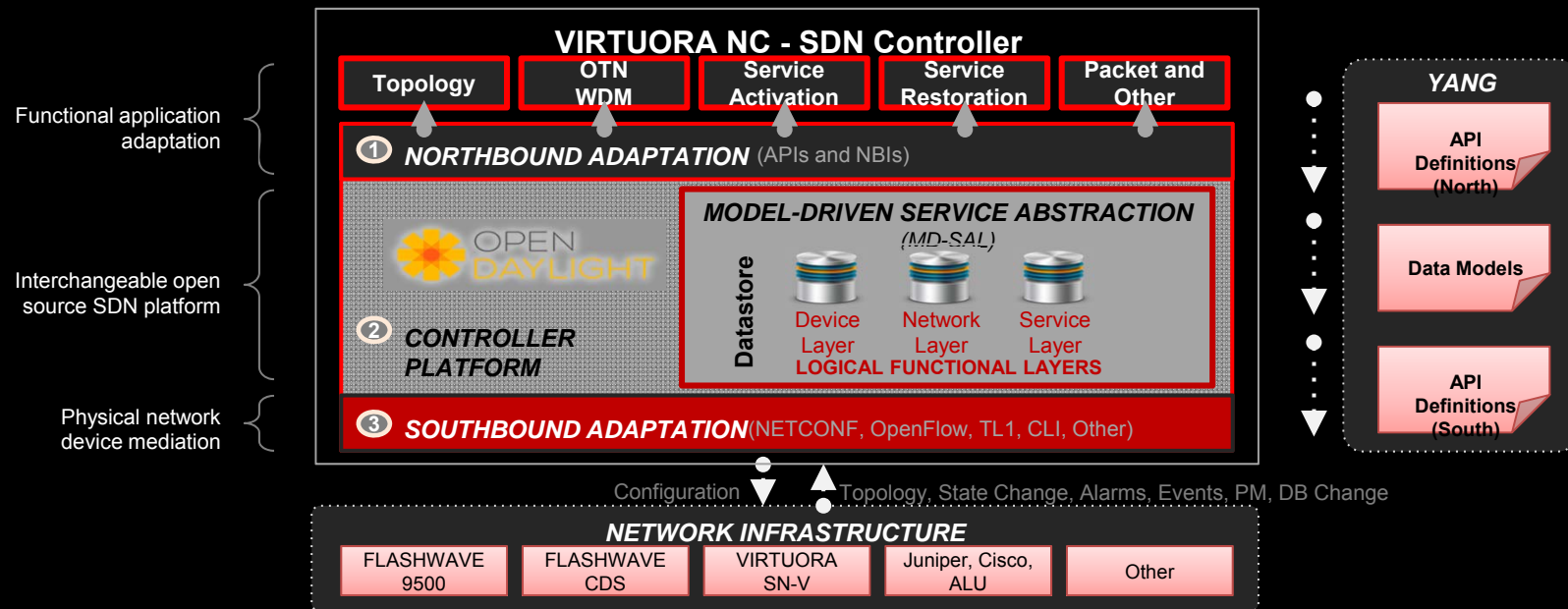


- **Objective:** Self-provisioned dynamic network services
- **What:** Telstra PEN Platform - Layer 2 Ethernet virtual cross connect (VXC) forwards frames between any 2 endpoints on the network
- **How:** MD-SAL application, leveraging OpenFlow protocol
- **Reach:** 25 POPs and growing



# Virtuora SDN Controller

Modular Architecture, Multi Layer, Multi Vendor





## Value to Customers

*“Open Plus”: Open Source advantages, Plus vendor-added value*

### ■ Open Source advantages

- Cross-vendor involvement improves multi-vendor device support
- Community development increases speed of feature and bug fixes

### ■ Fujitsu functionality

- Optical network provisioning and service restoration
- Adding SDN automation to a historically manual and static realm
- Domain-specific GUI and high-level APIs

### ■ Easy modularity

- All Open Source APIs and features are available
- User can add additional Fujitsu or Open Source apps onto platform

### ■ Turn-key vendor solution

- Pre-packaged to reduce installation & configuration
- Commercial support for immediate help

# Value to Fujitsu

*Leveraging the value provided by the community*



## ■ Easier to get started

- Building on existing specialized platform
- Allows focus on core competency

## ■ Easier to add value

- Community is open to helping other developers
- YANG models enable multivendor support like never before

## ■ Easier to maintain

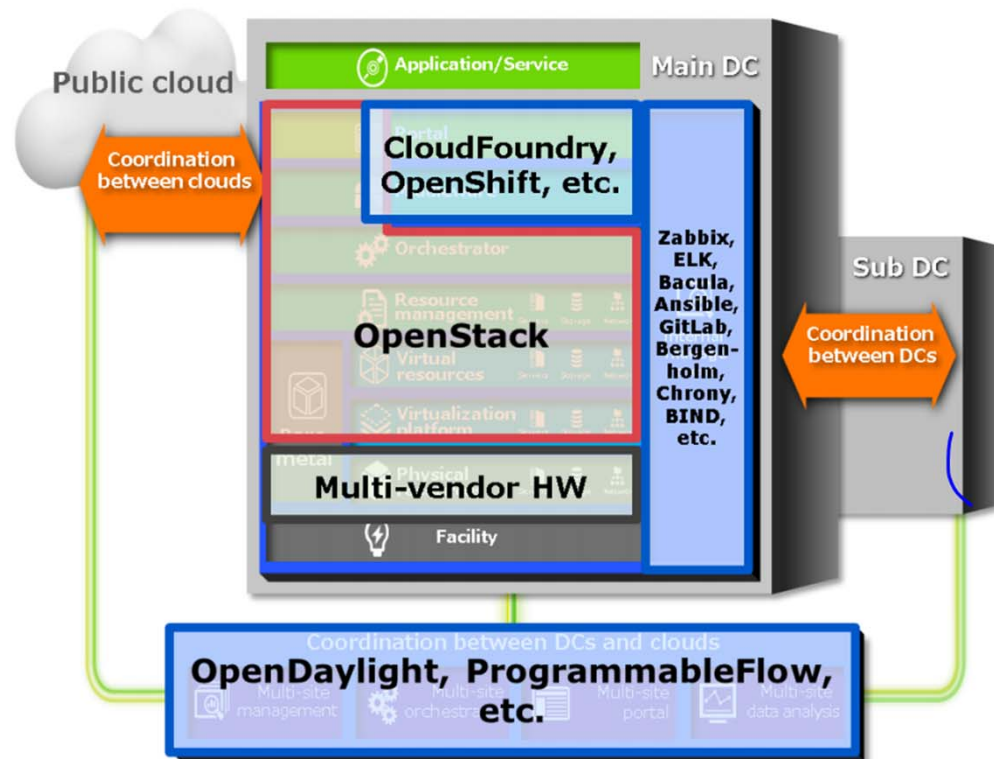
- Upstream bug fixes and features
- Strong value in Formal Release / Service Release strategy
  - Easier to go from Li-SR1 to Li-SR2 than from He to Li

## ■ Easier to support

- Even vendors get value from being able to see the source code

# How NEC is Leveraging OpenDaylight

OSS-Based Open Cloud Infrastructure



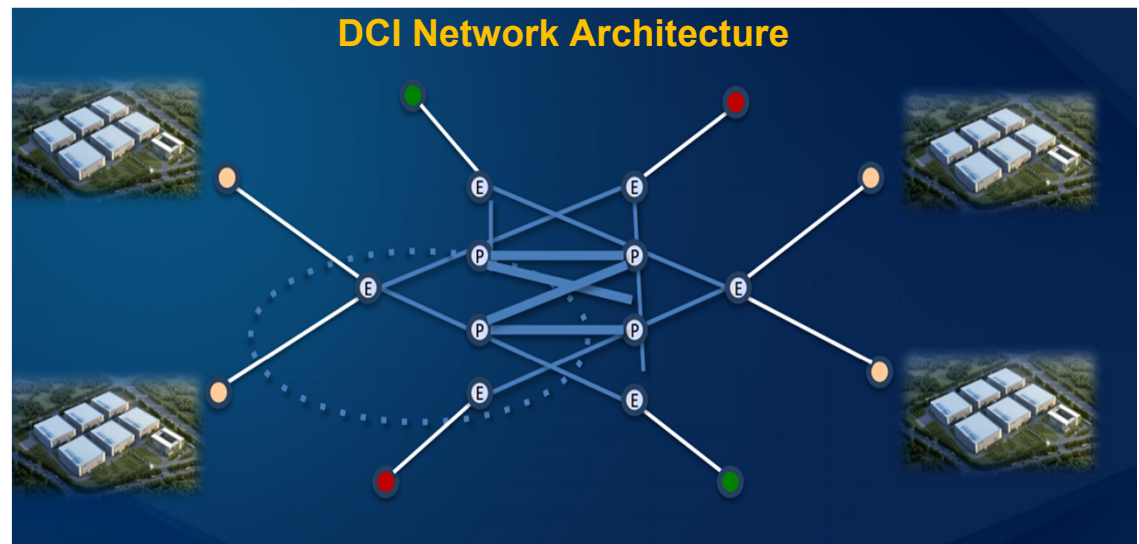
# How Tencent is Leveraging OpenDaylight

## CHALLENGE

One of the largest web-scale companies in the world experienced low bandwidth usage of expensive WAN connections, low service redundancy scheduling efficiency

## SOLUTION

Built DCI controller based on ODL and achieved real bandwidth usage improvement + network service quality enhancement



# How Tencent is Leveraging OpenDaylight

## Why OpenDaylight:

Great scalability of the architecture and extensible with rich southbound protocols / healthy ecosystem, resilient architecture, increasingly rich features and southbound protocols, clear version evolution rhythm and its reputation in the open source community



“We request all our partners to be OpenDaylight compatible by end of 2015”

*Marty Ma,  
Chief Architect*

# Korea Telecom: T-SDN



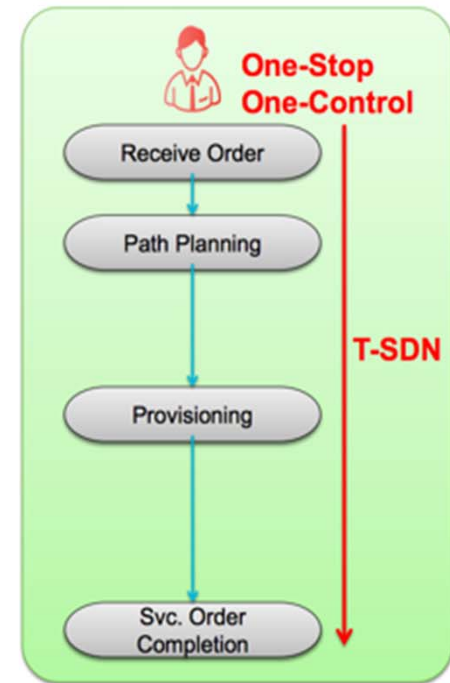
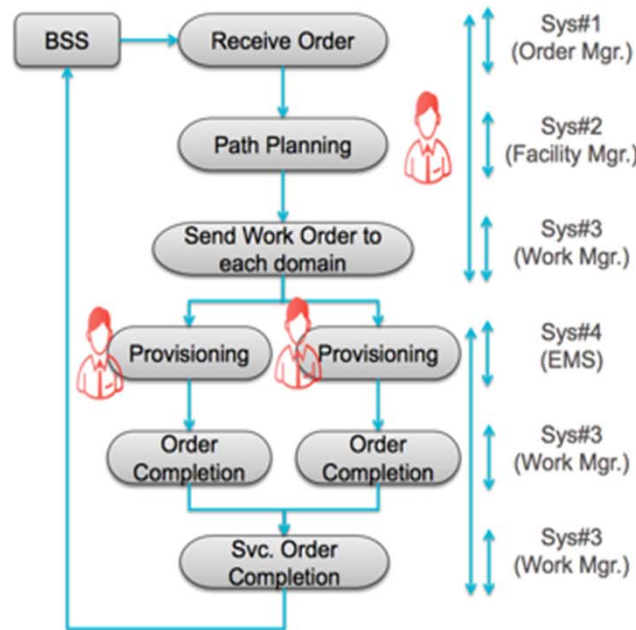
## CHALLENGE:

OPEX increase by segmented operations

- For E2E Service Configuration, many domain operators should participate
- Delayed service deployment because of manual planning and provisioning

## SOLUTION:

Simplify and automate provisioning processes using T-SDN



95% Time reduction

# Korea Telecom:T-SDN



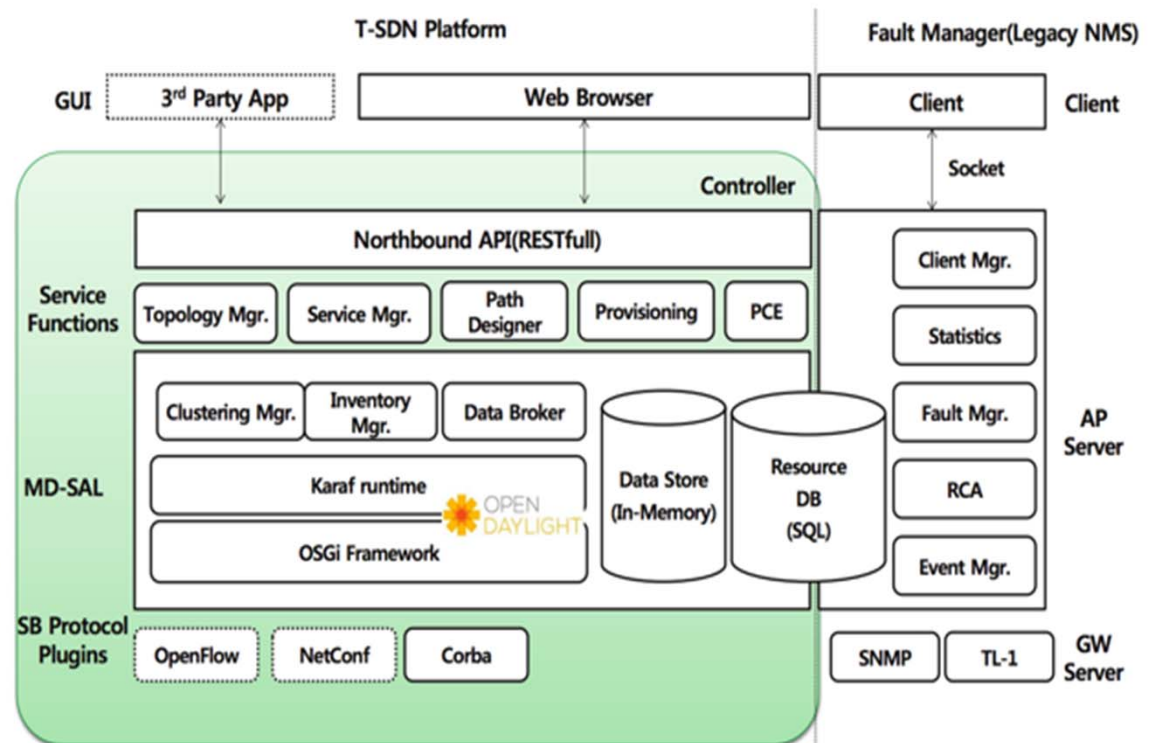
## KT Architecture

Adopted open source SDN controller (OpenDaylight Helium release)

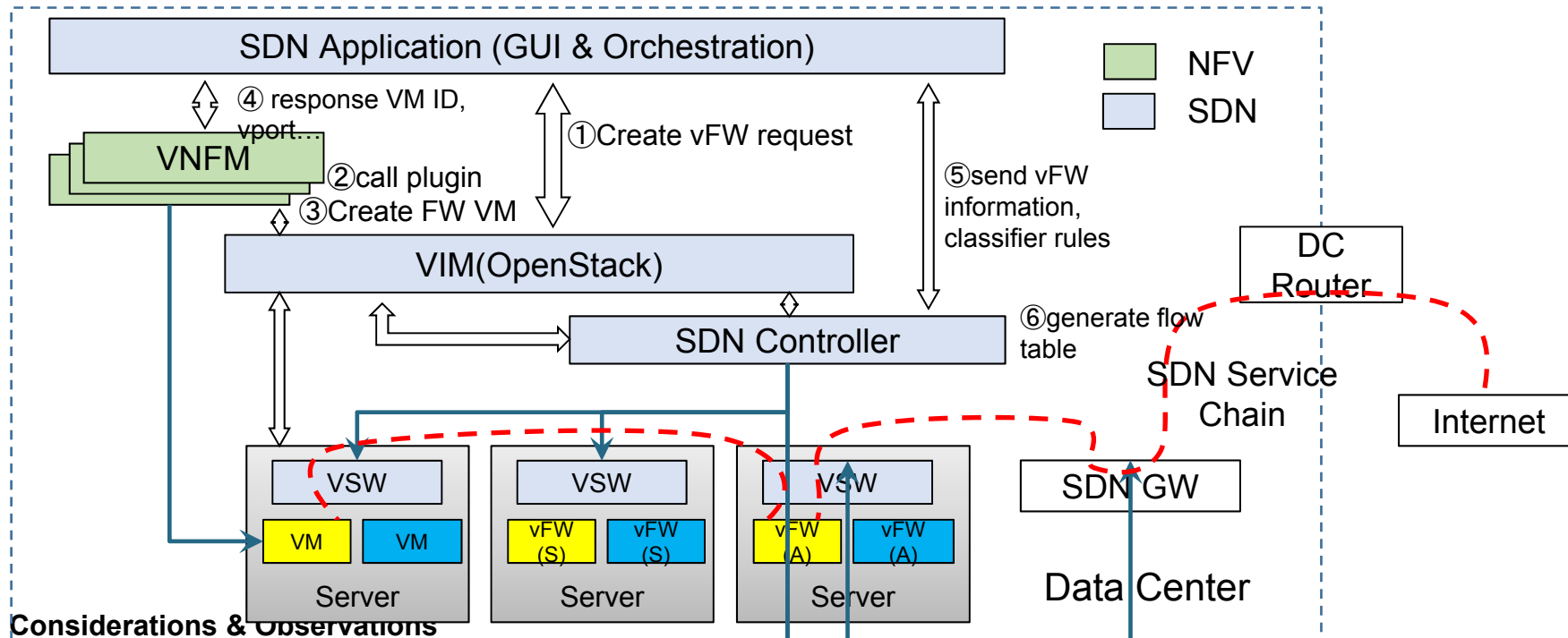
- To reduce time and cost for development

Integrated with legacy transport NMS

- Share inventory, topology and fault information
- Define YANG-model use in memory data store for fast path computation
- Real-time synchronization for resource changes
- Adopted MSPP, OXC, and PRN plugins



# NovoDC: An Example in Public/Private Cloud



- VPC+Service Chain are the basic services in both Public/Private Cloud
- Openstack is the integral part
- vSwitch performance improved; vFW, vLB ready for certain deployments
- Service Chaining: multiple technologies including VxLAN extended/Openflow/NSH/other tags



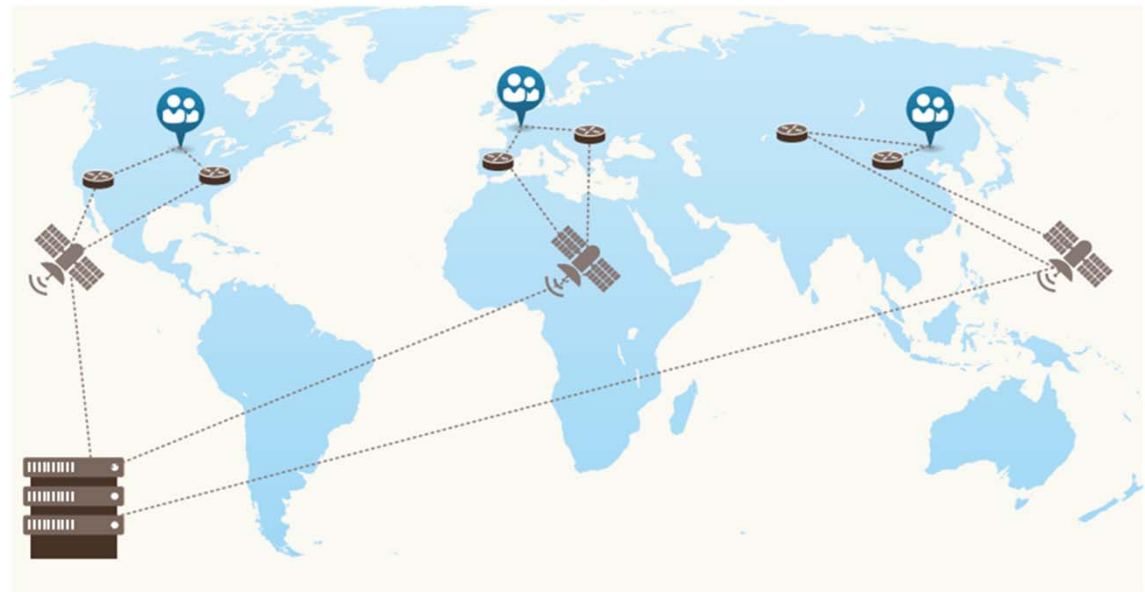
# How SERRO is Leveraging OpenDaylight

## CHALLENGE:

Atypical customer data flows:  
weather, finance, airlines,  
government, energy --mapping  
packet switch infrastructure to optical  
transport networks

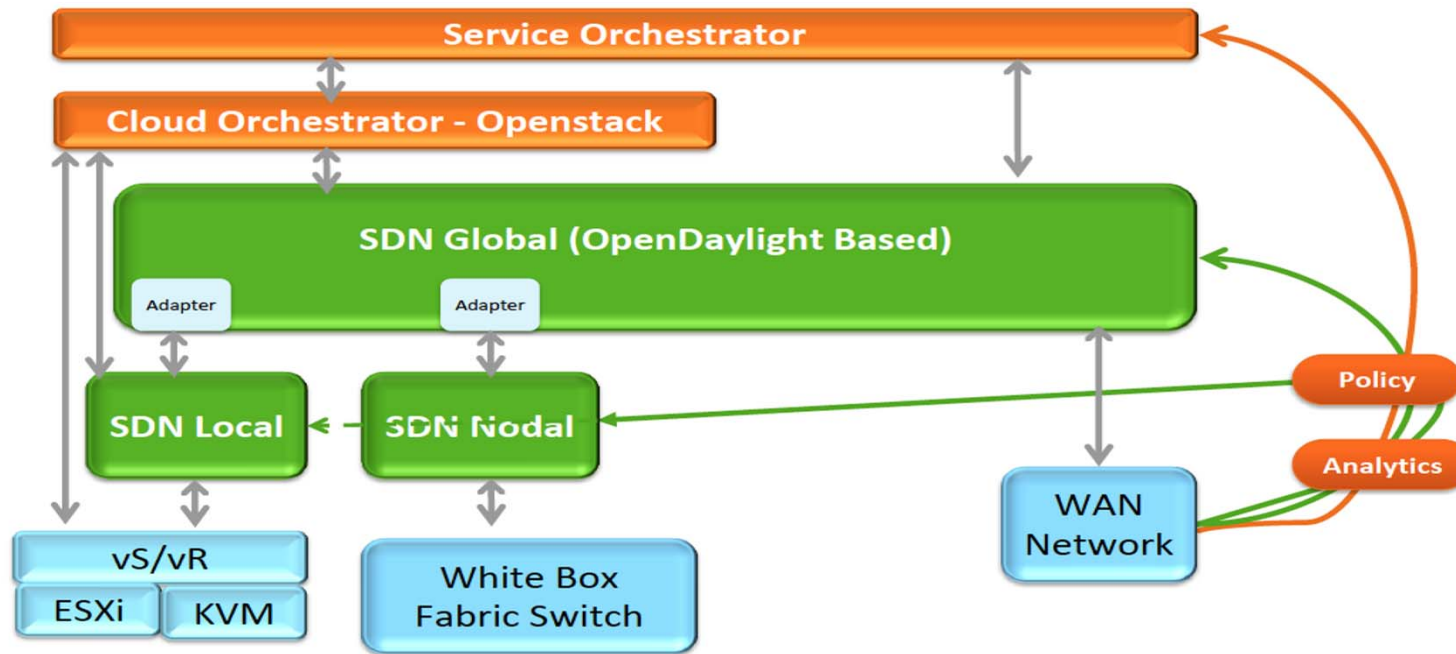
## SOLUTION:

Leverage ODL as a global controller  
to enable SDN on MEO satellite  
network, which provides consistent  
and on-demand connection



# How AT&T is Leveraging OpenDaylight

## How Do They Interact?



# How AT&T is Leveraging OpenDaylight

- “AT&T open source is 5% of our code; our goal is to move to >50% by 2020.”—*John Donovan, Senior Executive Vice President, AT&T Technology and Operations*
- OpenDaylight powers AT&T’s Network on Demand Enterprise L2 Service in over 100 markets
- The company is leveraging OpenDaylight for its global SDN controller
- AT&T is contributing to a new ODL project to support YANG models:

*“We configure devices in our software-based network using a tool built on a data modeling language called YANG. We’ll submit our customized YANG design tool into open source through the OpenDaylight Community. Innovators will be able to create services that plug into our software-defined framework.” –John Donovan, AT&T*

# How Caltech is Leveraging OpenDaylight

- **Who:** CalTech – Large Hadron Collider team
- **What:** Distribute 200+ TB data beyond 13 Tier 1 sites to 160 Tier 2 research sites and 300 Tier 3 sites
- **How:** Controller based on ODL leveraging OpenFlow to setup up flow rules for data distribution. First based on Hydrogen, then Helium, soon to be on Lithium
- **Quote:** “ODL has become the De-Facto Standard Controller”



#odsummit



**Who:** Bristol, England is building a fully programmable, citywide network using ODL

**What:** Developing an open programmable city region

**How:** An OpenDaylight-based SDN controller will integrate traffic across Bristol's fiber optic network, LTE and experimental 5G wireless networks, and a mesh network of 1,500 connected lamp posts. NEC will provide equipment and support for the network's radio elements



**Thank You**

Neela Jacques, Executive Director, OpenDaylight

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