



Exploring OpenDaylight

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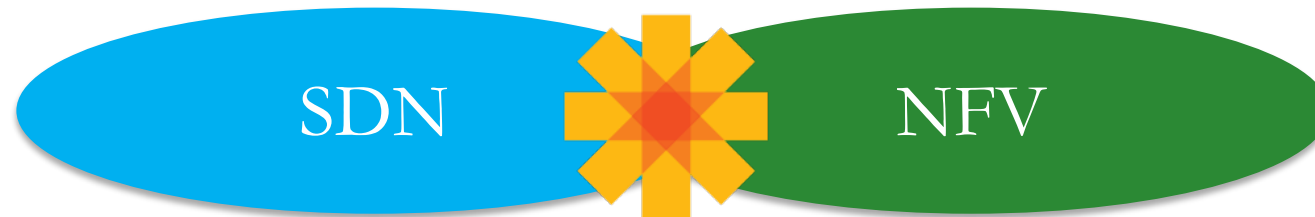
SDN, NFV and OpenDaylight

New Revenue

Open, Programmable APIs

Service Agility

Orchestration, Automation and MANO



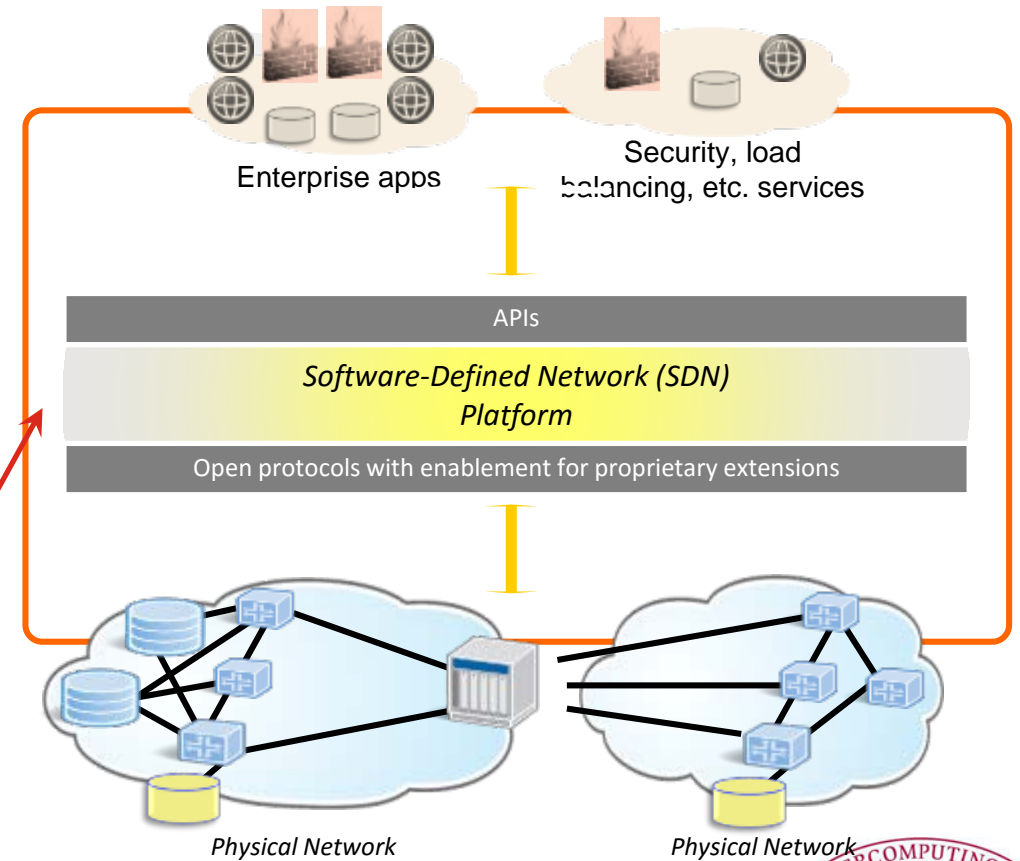
Virtualization and Abstraction Layer

Lower Cost

Why SDN?

- New architecture with separate Control and Data planes
- Open Programmable Networks and APIs
- New business models and revenue opportunities
- Efficiency in both capital and operational expenses

Focus Area
for OpenDaylight



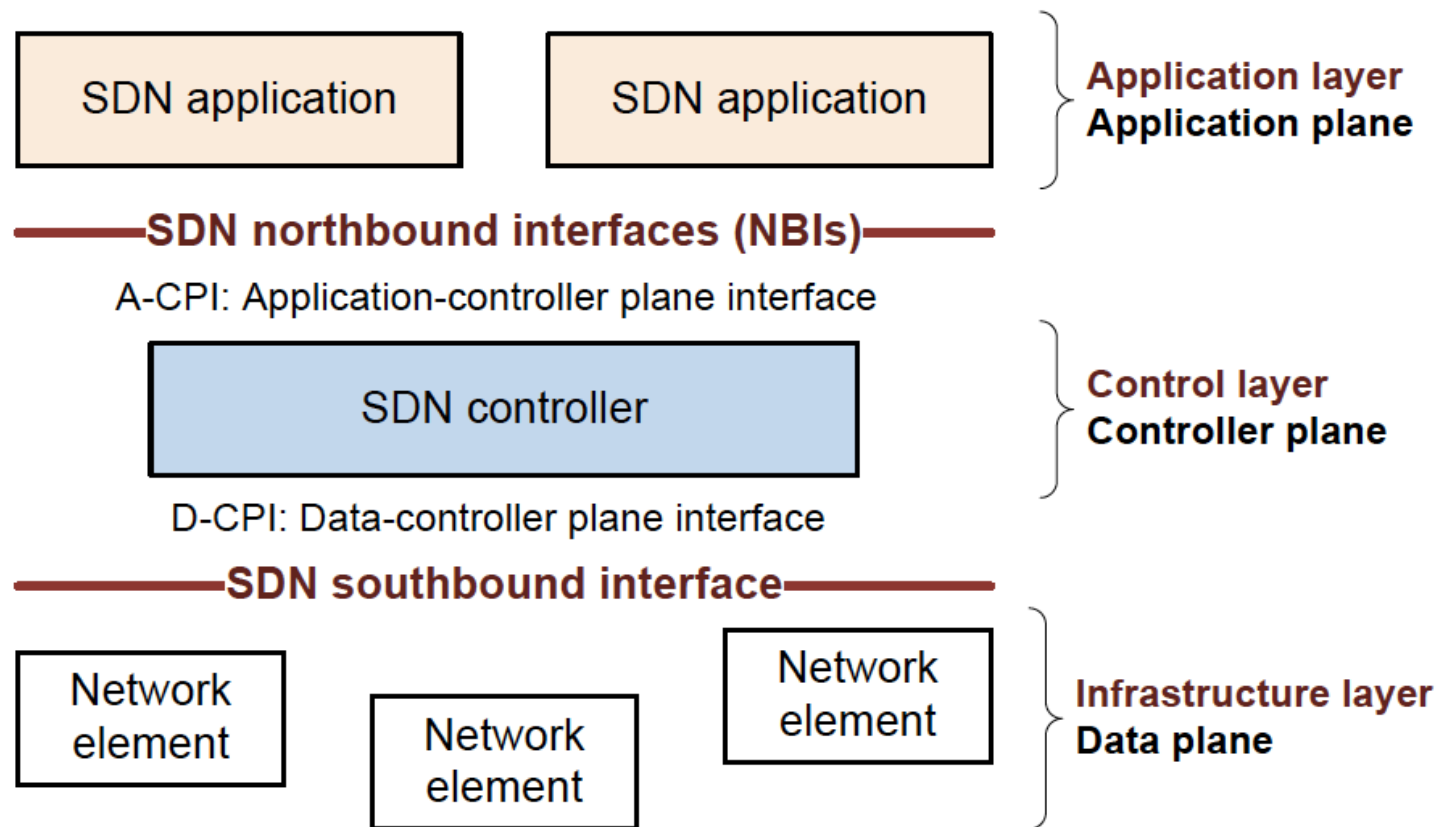


SDN Architecture Characteristics

- Directly programmable
- Agile
- Centrally managed
- Programmatically configure
- Open standards-based and vendor-neutral



SDN Overview



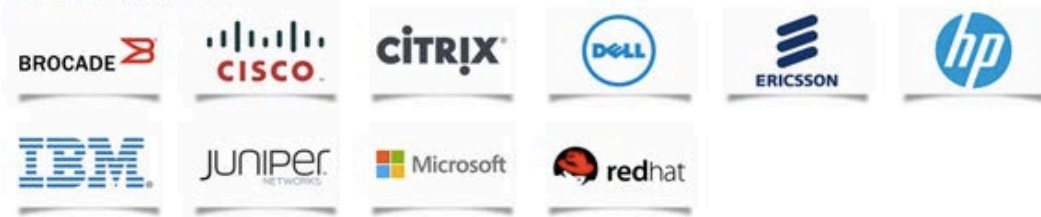
What is OpenDaylight?

- Open source project
- Modular, pluggable, and flexible controller at its core
- Implemented strictly in software
 - Contained within its own Java Virtual Machine (JVM)
- Deployable on any hardware and OS that supports Java



Who is in OpenDaylight Project?

PLATINUM MEMBERS



GOLD MEMBERS



SILVER MEMBERS



Continuous Growth to 41 Members



Who makes products based on Open Daylight?



Graphical User Interface Application and Toolkit (DLUX / NeXT UI)

AAA AuthN Filter

OpenDaylight APIs REST/RESTCONF/NETCONF/AMQP

Base Network

- Host Tracker
- L2 Switch
- OpenFlow Forwarding Rules Mgr
- OpenFlow Stats Manager
- OpenFlow Switch Manager
- Topology Processing

Enhanced Network Services

- | | | |
|--------------------------------|----------------------------|-----------------------------|
| AAA | Messaging 4Transport | SNMP4SDN |
| Centinel – Streaming Data Hdlr | NetIDE | Time Series Data Repository |
| Controller Shield | Neutron Northbound | Unified Secure Channel Mgr |
| Dev Discovery, ID & Drvr Mgmt | OVSDB Neutron | User Network Interface Mgr |
| DOCSIS Abstraction | SDN Integration Aggregator | Virtual Private Network |
| Link Aggregation Ctl Protocol | Service Function Chaining | Virtual Tenant Network Mgr. |
| LISP Service | | |

Network Abstractions (Policy/Intent)

- ALTO Protocol Manager
- Fabric as a Service
- Group Based Policy Service
- NEMO
- Network Intent Composition

Controller Platform Services/Applications

Data Store (Config & Operational)

Service Abstraction Layer/Core

Messaging (Notifications / RPCs)

- | | | | | | | | | | | | | | | | |
|----------------------|-----------|--------|----------|-------|-----|-------|---------|---------|-----|-------|-----|-------|----------------|-------|------------|
| OpenFlow 1.0 1.3 TTP | OF-Config | OVSD B | NETCO NF | LIS P | BGP | PCE P | CAPWA P | OPFLE X | SXP | SNM P | USC | SNB I | IoT Http/CoA P | LAC P | PCMM/ COPS |
|----------------------|-----------|--------|----------|-------|-----|-------|---------|---------|-----|-------|-----|-------|----------------|-------|------------|

Southbound Interfaces & Protocol Plugins

OpenFlow Enabled Devices



Open vSwitches



Additional Virtual & Physical Devices



Data Plane Elements (Virtual Switches, Physical Device Interfaces)



Is Opendaylight the only Open Source SDN Controller Available?

Use-Cases \ Controllers	Trema	Nox/Pox	RYU	Floodlight	ODL	ONOS***
Network Virtualization by Virtual Overlays	YES	YES	YES	PARTIAL	YES	NO
Hop-by-hop Network Virtualization	NO	NO	NO	YES	YES	YES
OpenStack Neutron Support	NO	NO	YES	YES	YES	NO
Legacy Network Interoperability	NO	NO	NO	NO	YES	PARTIAL
Service Insertion and Chaining	NO	NO	PARTIAL	NO	YES	PARTIAL
Network Monitoring	PARTIAL	PARTIAL	YES	YES	YES	YES
Policy Enforcement	NO	NO	NO	PARTIAL	YES	PARTIAL
Load Balancing	NO	NO	NO	NO	YES	NO
Traffic Engineering	PARTIAL	PARTIAL	PARTIAL	PARTIAL	YES	PARTIAL
Dynamic Network Taps	NO	NO	YES	YES	YES	NO
Multi-Layer Network Optimization	NO	NO	NO	NO	PARTIAL	PARTIAL
Transport Networks - NV, Traffic-Rerouting, Interconnecting DCs, etc.	NO	NO	PARTIAL	NO	PARTIAL	PARTIAL
Campus Networks	PARTIAL	PARTIAL	PARTIAL	PARTIAL	PARTIAL	NO
Routing	YES	NO	YES	YES	YES	YES





OpenDaylight Tools and Paradigms

- Java interfaces
 - for event listening, specifications and forming patterns
- Maven -
 - Build and dependency management
- OSGi -
 - Backend container framework that allows dynamically loading bundles
- Karaf -
 - OSGi based runtime



What is an Application Programming Interface (API)?

- set of rules ('code') and specifications that software programs can follow to communicate with each other.





What is a Representational State Transfer (REST) API?

- A REST API is an API in a specific architectural style
 - originally communicated by Roy Fielding in his doctoral dissertation
 - http://www.ics.uci.edu/~fielding/pubs/dissertation/rest_arch_style.htm





What defines a 'RESTful' API?

- Six constraints
 - Start with Null Style
 - Client-Server
 - Stateless (Server)
 - Cache
 - Uniform Interface
 - Layered System





What distinguishes REST?

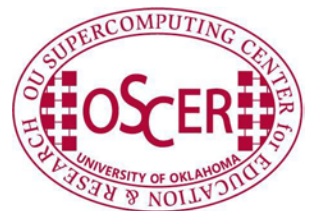
- Emphasis on uniform interface between components
 - Four constraints
 - identification of resources
 - manipulation of resources through representations
 - self-descriptive messages
 - hypermedia as the engine of application state.





Why a 'RESTful' API

- Principle of generality
 - Simplifies overall system architecture
 - Visibility of interactions improved



Questions? Thoughts?

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Extra Slides





OPEN DAYLIGHT “HELIUM”

Legend

AAA: Authentication, Authorization & Accounting

AuthN: Authentication

BGP: Border Gateway Protocol

COPS: Common Open Policy Service

DLUX: OpenDaylight User Experience

DDoS: Distributed Denial Of Service

DOCSIS: Data Over Cable Service Interface Specification

FRM: Forwarding Rules Manager

GBP: Group Based Policy

LISP: Locator/Identifier Separation Protocol

OVSDb: Open vSwitch DataBase Protocol

PCEP: Path Computation Element Communication Protocol

PCMM: Packet Cable MultiMedia

Plugin2OC: Plugin To OpenContrail

SDNI: SDN Interface (Cross-Controller Federation)

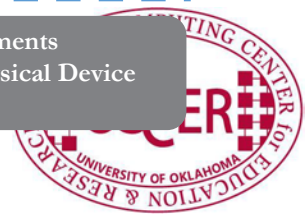
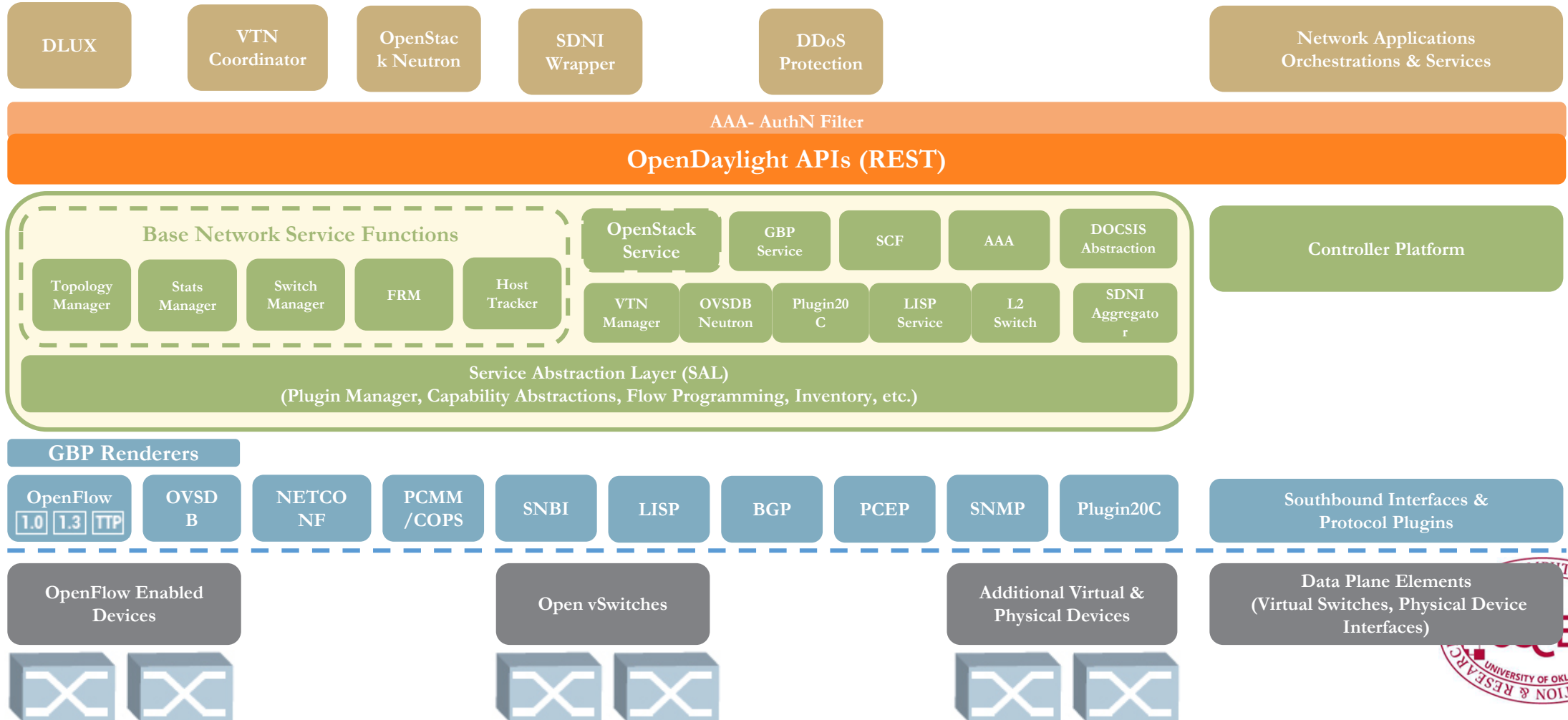
SFC: Service Function Chaining

SNBI: Secure Network Bootstrapping Infrastructure

SNMP: Simple Network Management Protocol

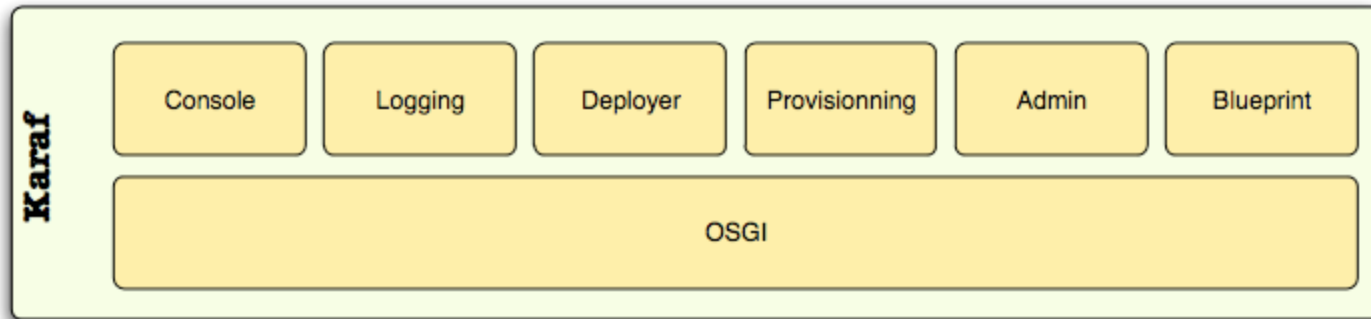
TTP: Table Type Patterns

VTN: Virtual Tenant Network



What is Karaf?

- Small OSGi based runtime
- Lightweight container
 - various components and applications can be deployed





What is OSGi (Open Service Gateway Initiative)?

- Java framework for developing and deploying modular software programs and libraries
- Two components
 - Specification for modular components called bundles
 - Java Virtual Machine (JVM)-level service registry





What are the drawbacks of REST?

- Uniform interface degrades efficiency
 - information transferred in a standardized form rather than form specific to an application's needs

