

SDN & Cloud Related Activities & Research

Affan Basalamah & Eueung Mulyana
Institut Teknologi Bandung



About the Presenter

- **Affan Basalamah**
 - Head of Development, ICT Directorate
 - affan@itb.ac.id
- **Dr.-Ing. Eueung Mulyana**
 - Faculty, Telecommunication Engineering
 - eueung@stei.itb.ac.id

tl;dr

- SDN & Cloud Computing adalah topik yang multidisiplin
- Tidak ada satu entitas yang bisa menguasai seluruhnya
- Perlunya sinergi antar:
 - **Akademik:** Dosen dan Mahasiswa
 - **Operator:** ISP dan Networkers secara umum
 - **Vendor:** Principal dan System Integrator

About ITB

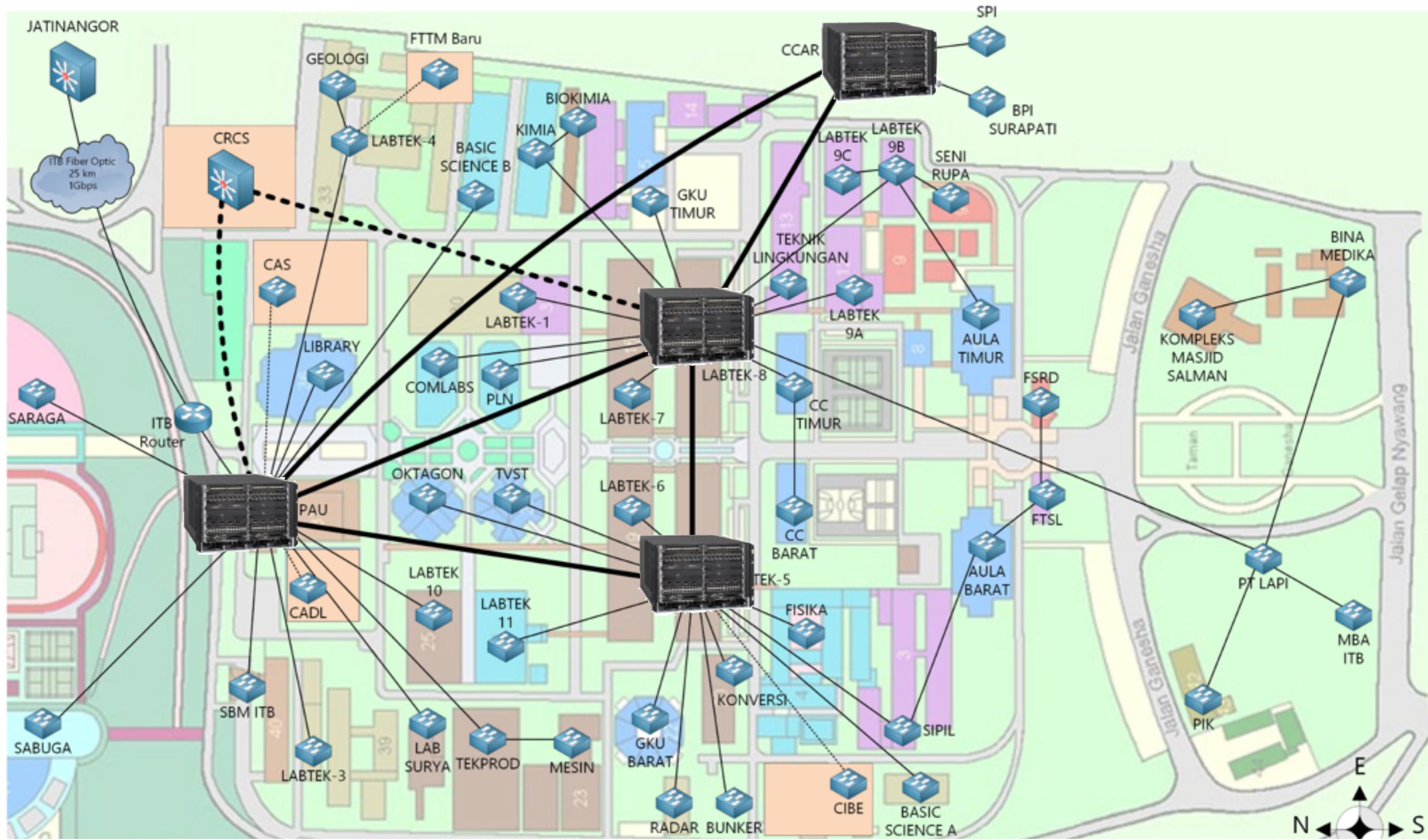


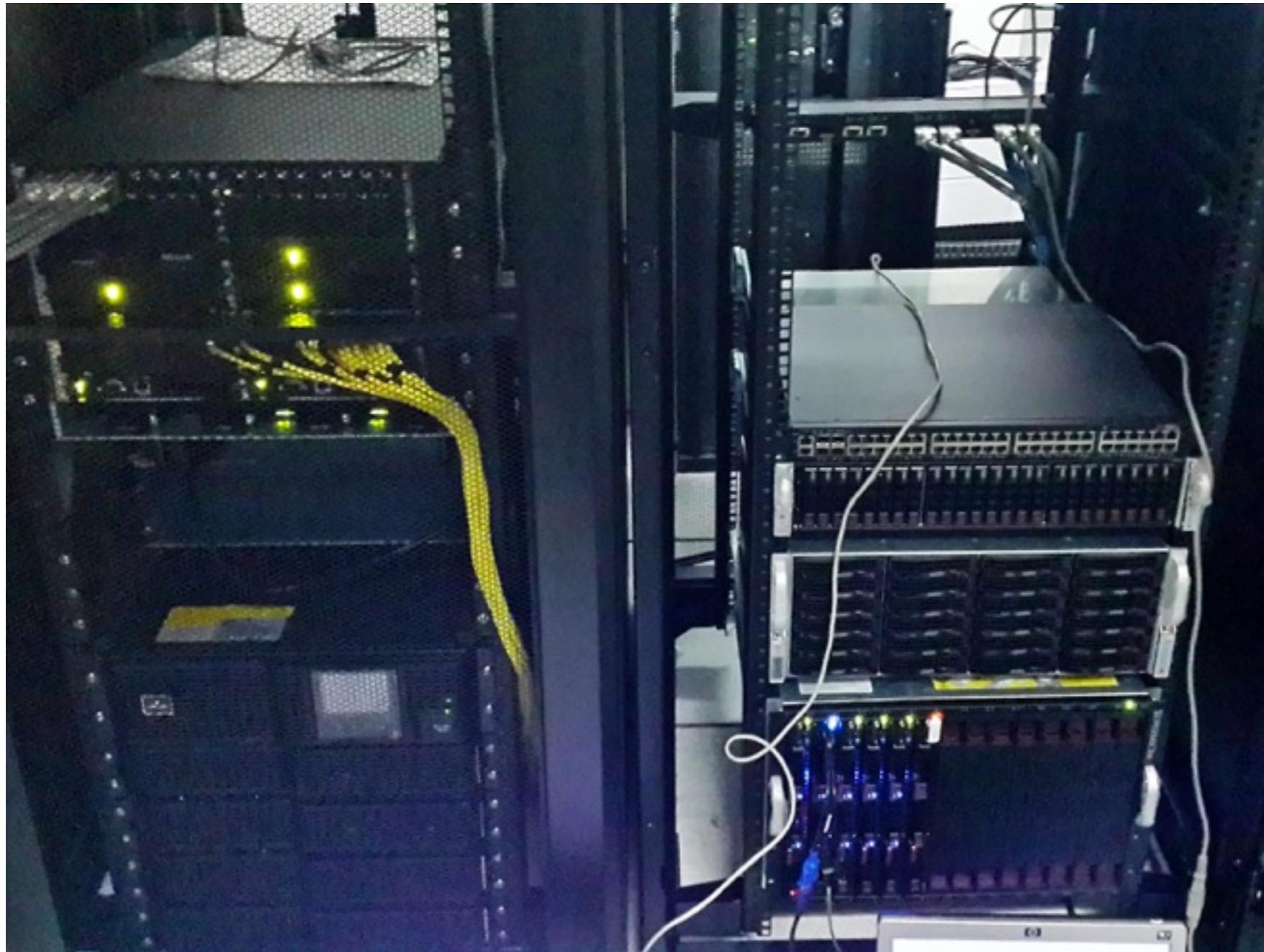


Institut Teknologi Bandung

Aula Barat ITB

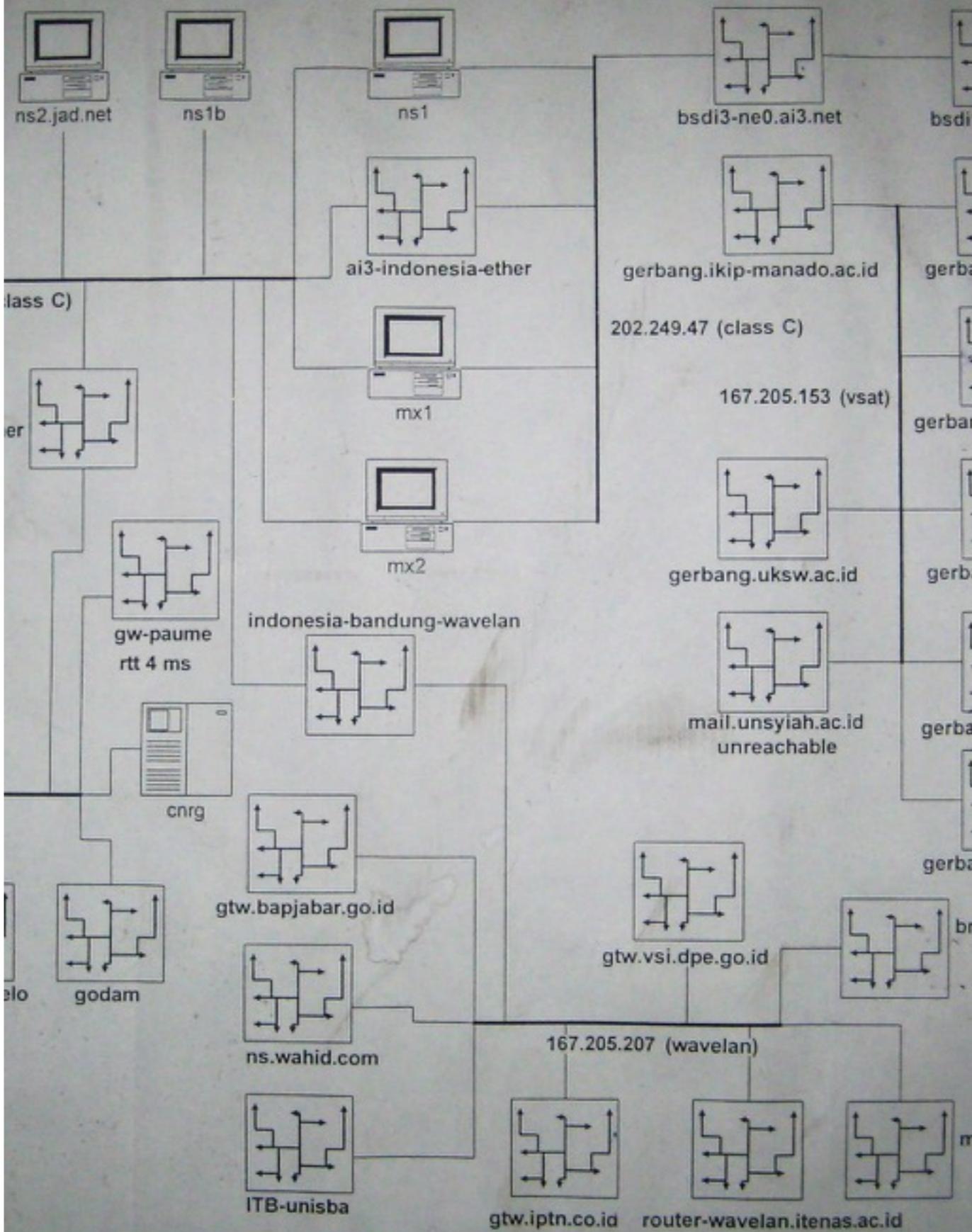
Campus Core Network





Brocade MLXe-8 Core Network

SDN & Cloud in 5 minutes

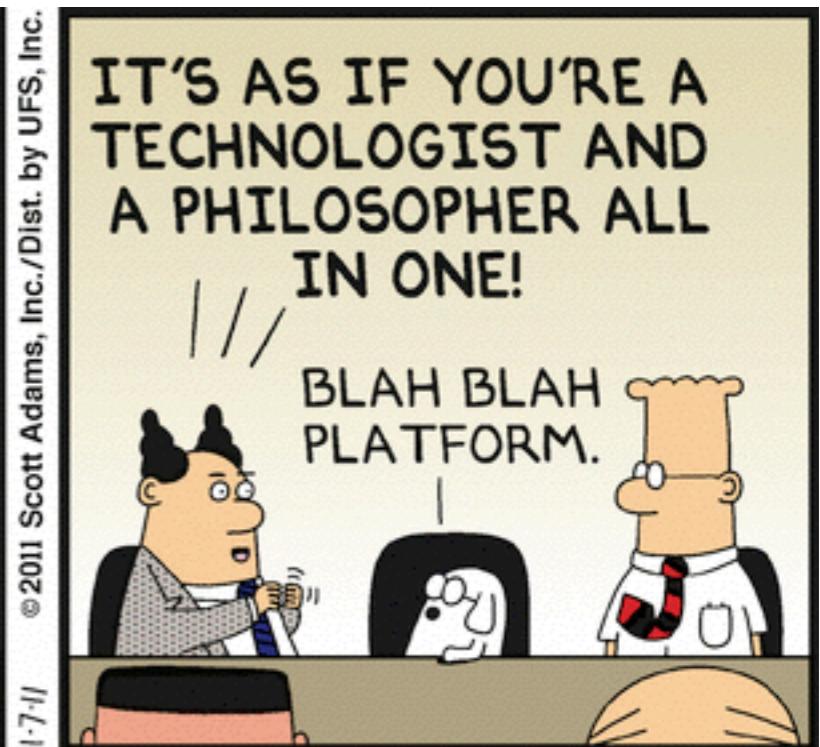
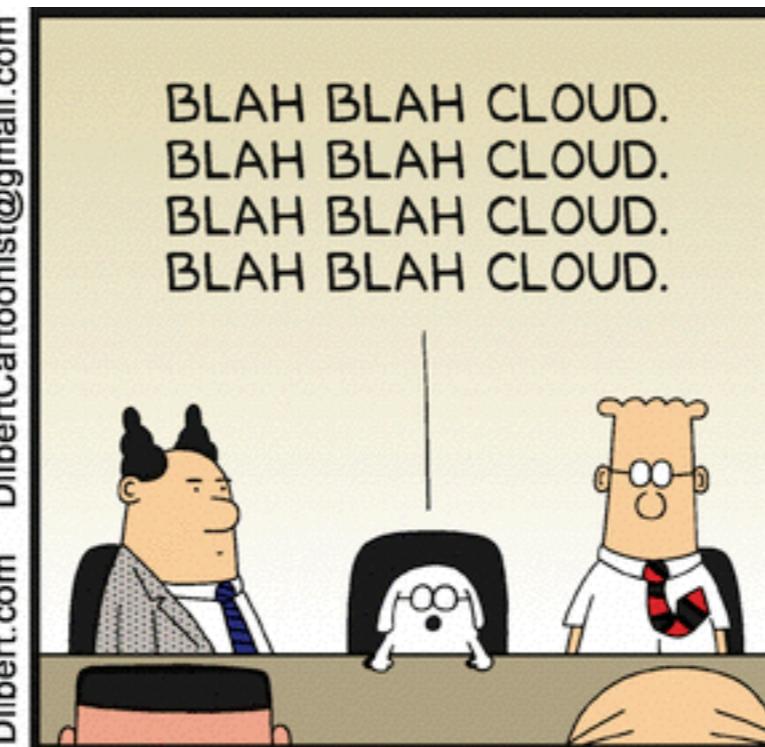


Future Internet

- Rapid Innovation
- Rapid Deployment
- Flexible & Robust Underlying Networking Infrastructure

Cloud

- Virtualize Everything!
- Scalability, Virtual Assets Flexibility, Ease of Management, and Provisioning



<http://dilbert.com/strip/2011-01-07>

DevOps (Simplified – Finch)

- It is **not** my job to build and manage servers.
 - It **is** my job to build and maintain a **system** that builds and manages servers.
- It is **not** my job to build and manage switches.
 - It **is** my job to build and maintain a **system** that builds and manages switches.
- **Humans** are **good** at strategy, but **bad** at repetitive tasks
 - **Computers** are **good** at repetitive tasks
- <https://speakerdeck.com/cfinch/sdn-devops-for-networks>

What is Software Defined Networking?

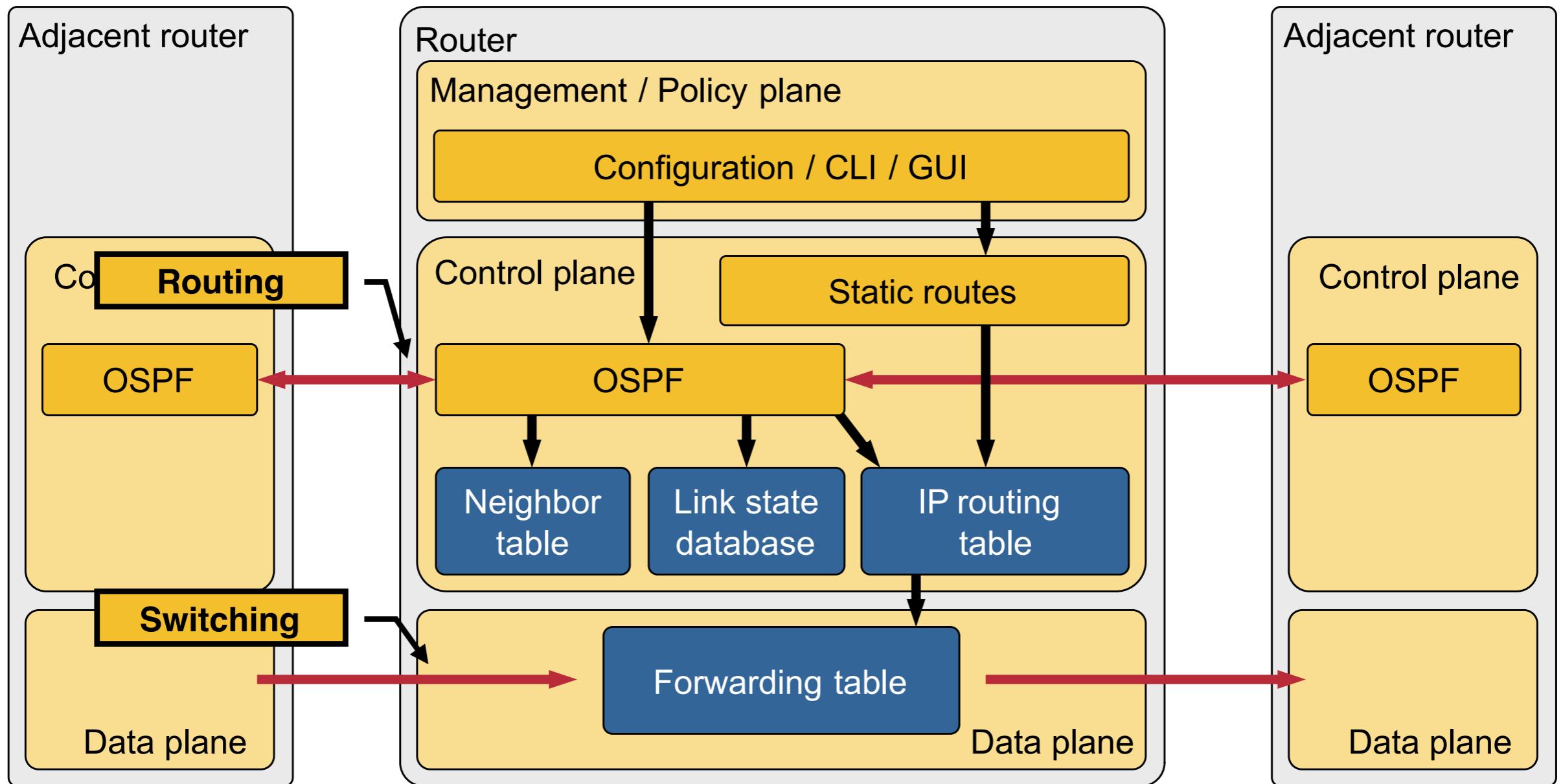
Software-defined networks (SDN): an architectural approach that ***optimizes and simplifies network operations*** by more closely binding the interaction (i.e., provisioning, messaging, and alarming) among applications and network services and devices, whether they be real or virtualized.

Thomas D. Nadeau & Ken Gray,
SDN - Software Defined Networking, O'Reilly Media, 2013

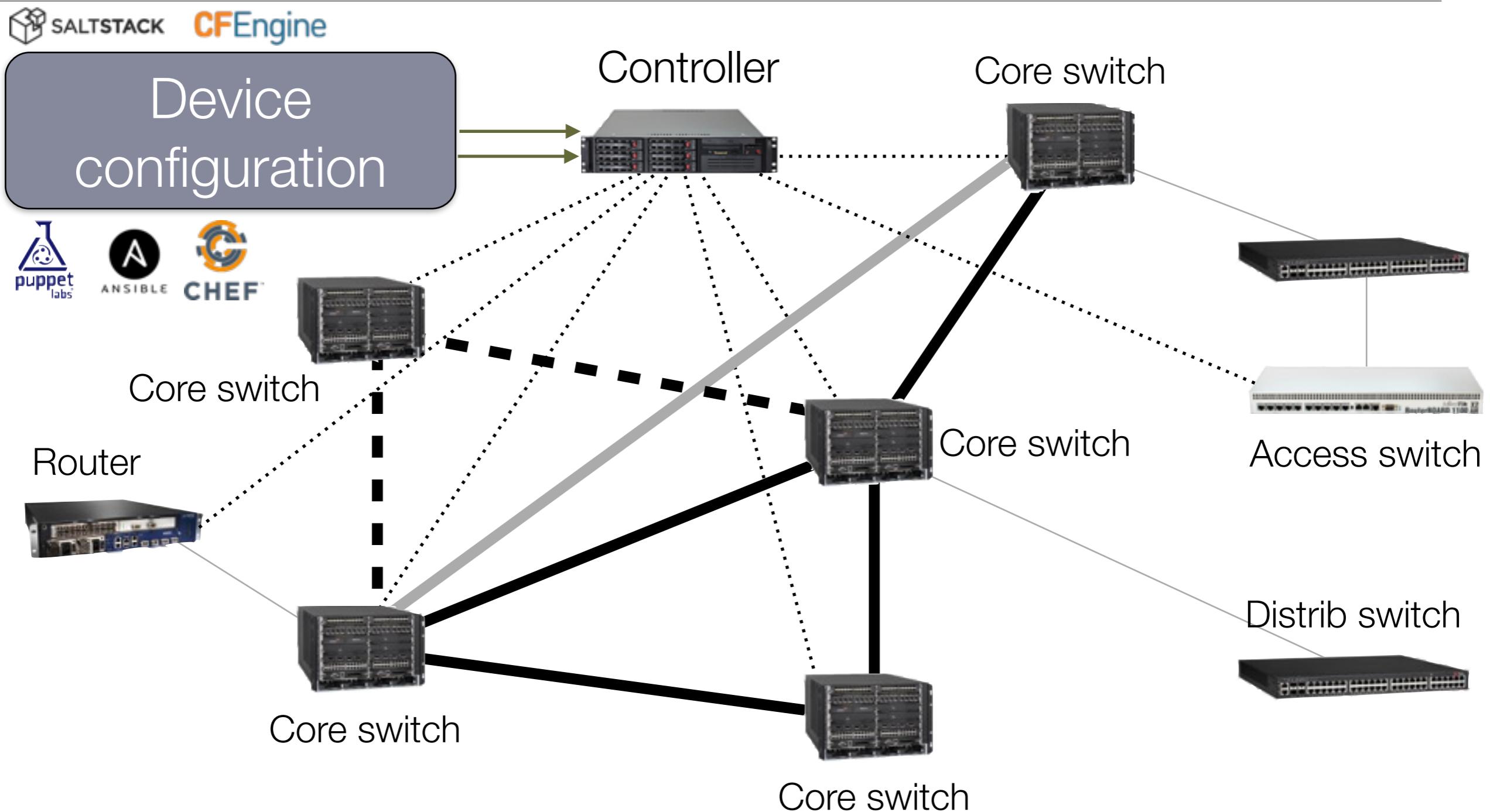
SDN Architectures

- Device Provisioning Systems
- Service Provisioning Systems
- Routing & Forwarding Adjustment Controllers
- Centralized Control Plane (e.g. OpenFlow)

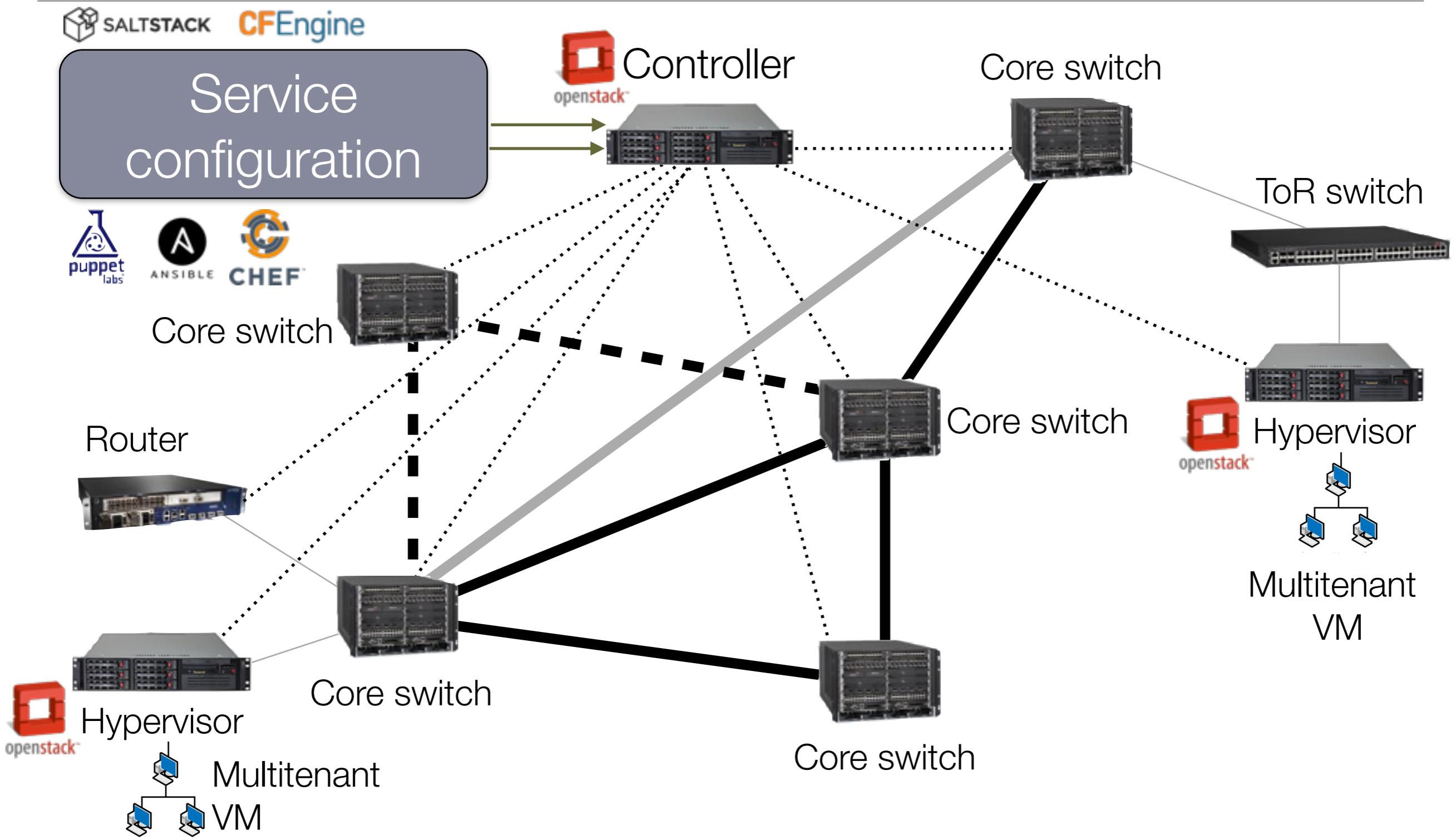
Management, Control & Data Planes



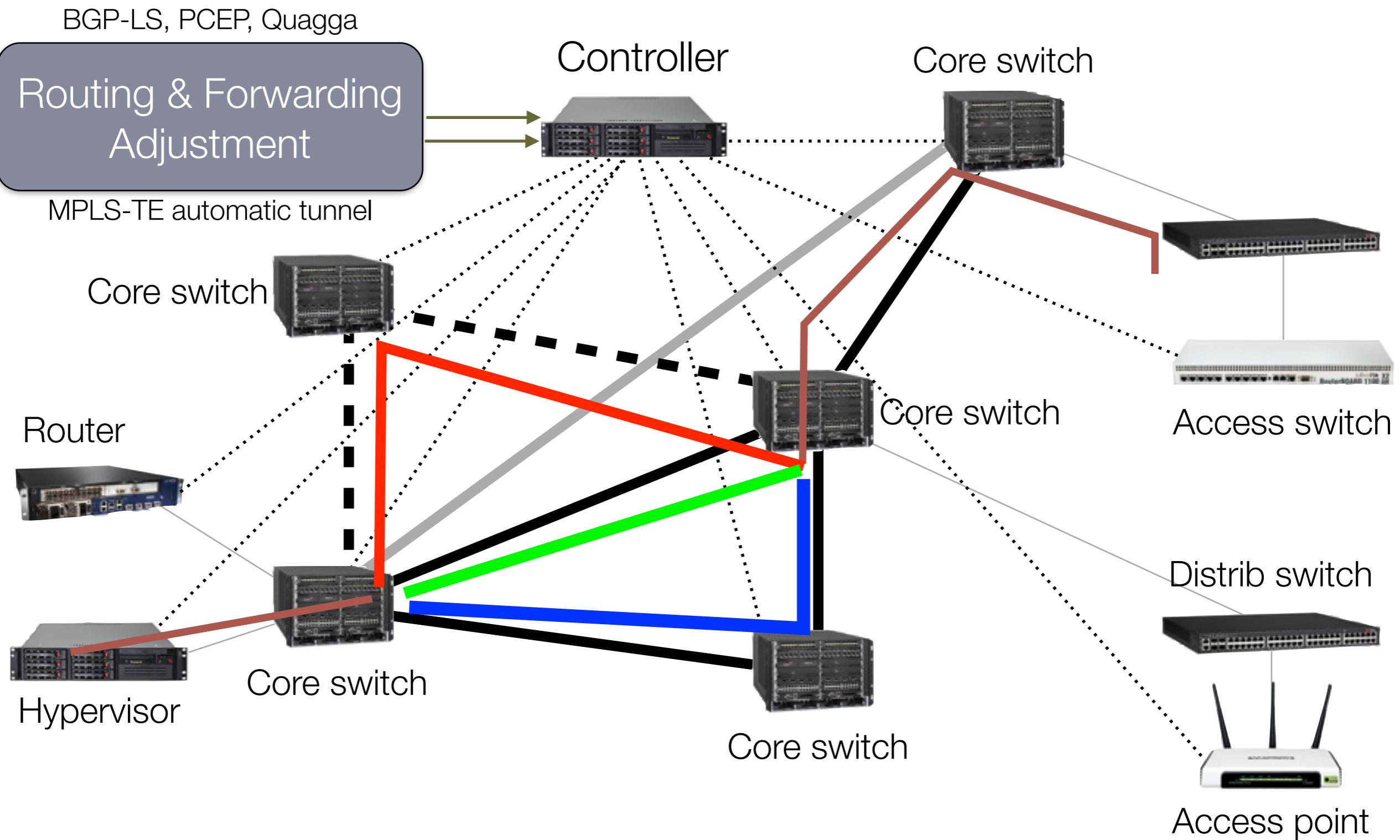
SDN for Device Configuration



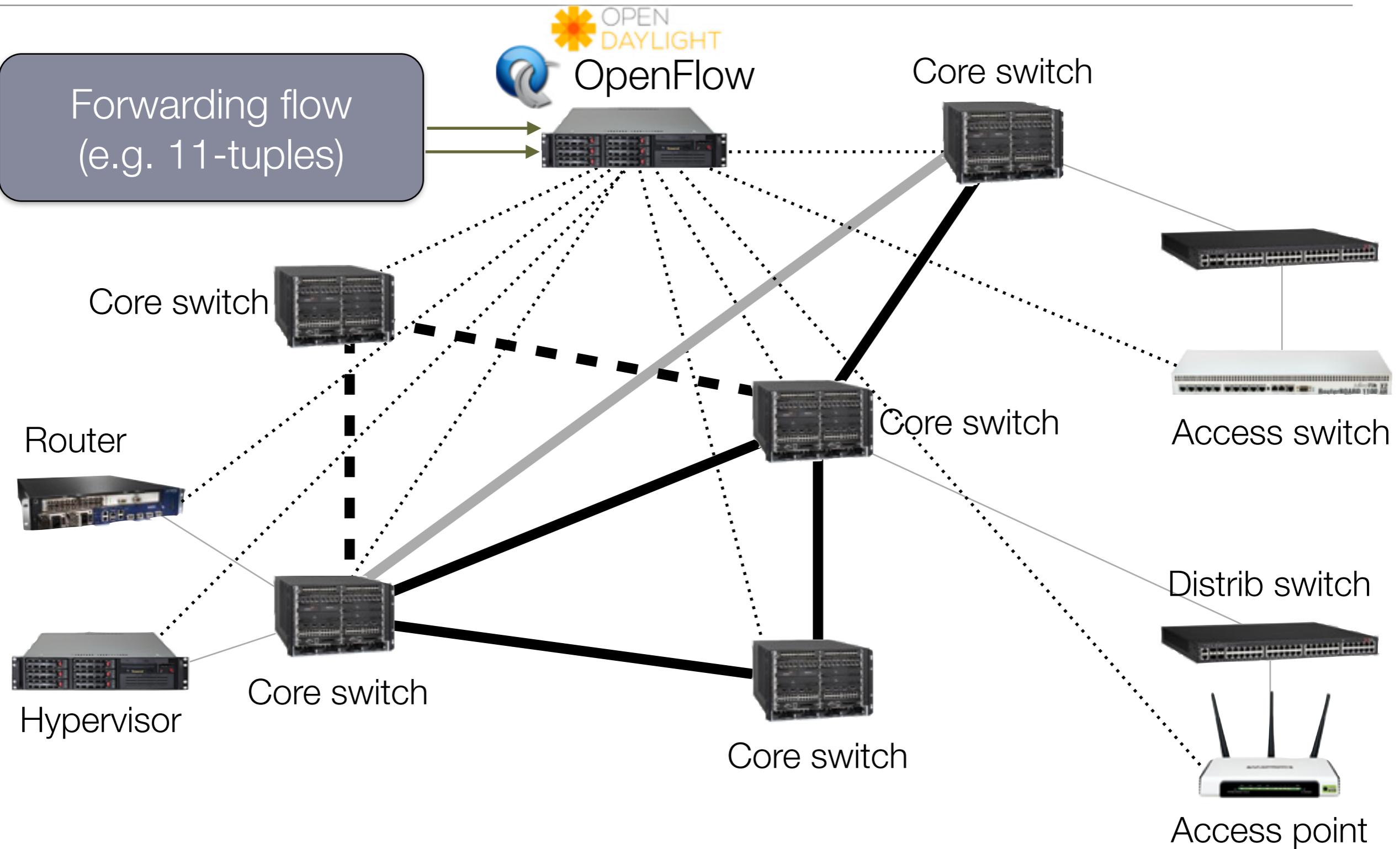
SDN for Service Configuration



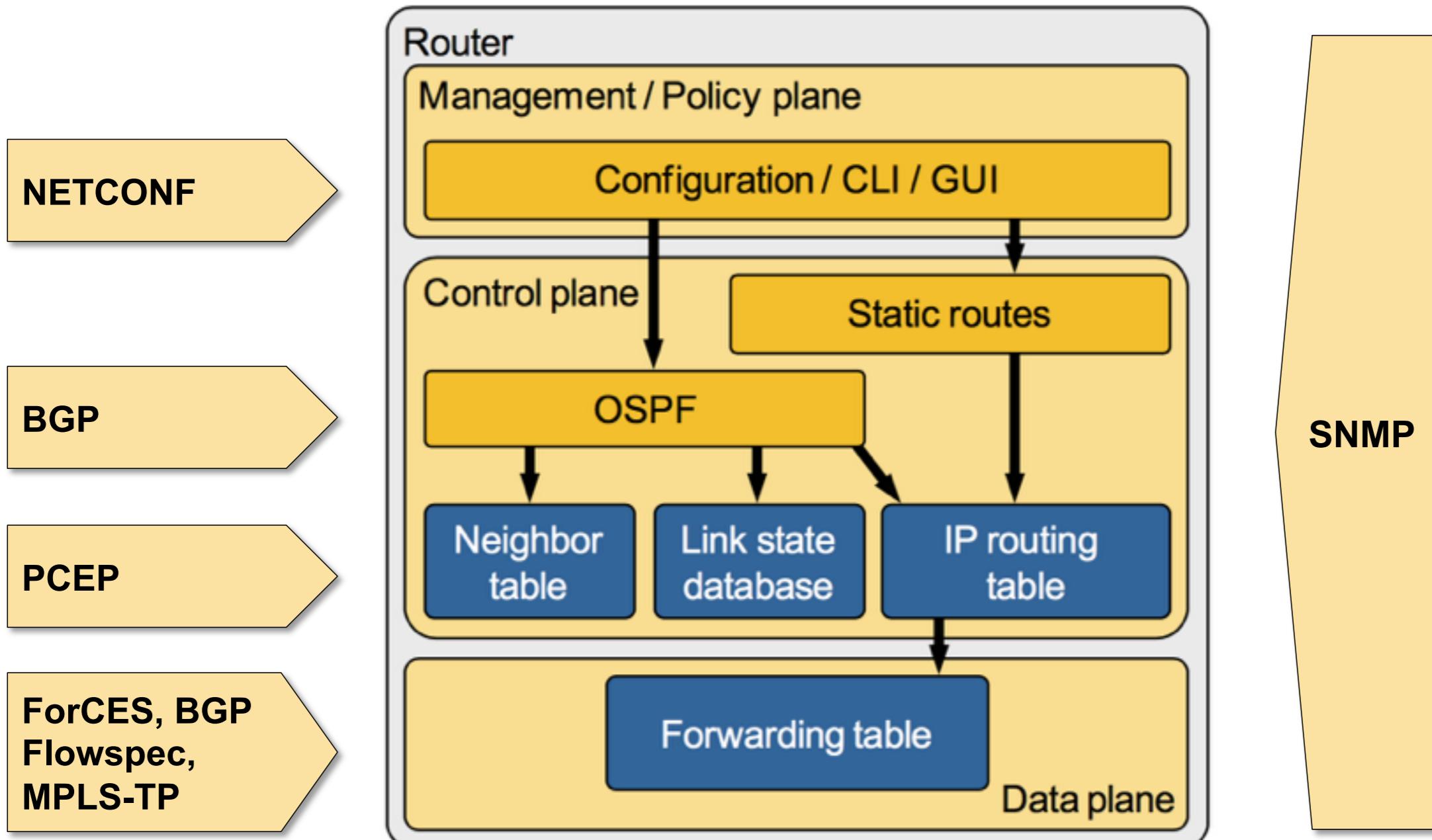
SDN for RIB/FIB Adjustments



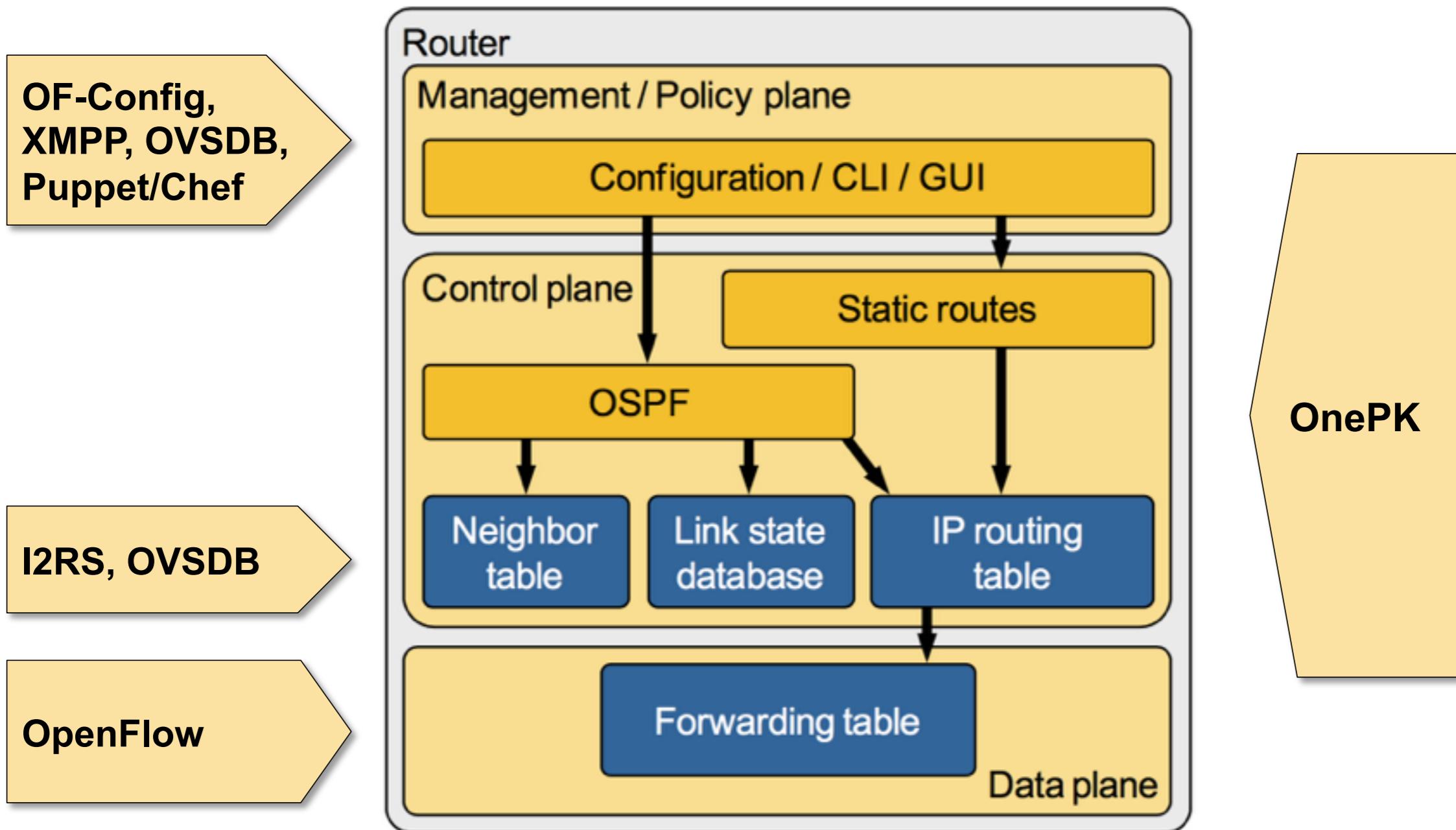
Centralized Control Plane - OpenFlow



Existing toolbox for SDN



Emerging toolbox for SDN

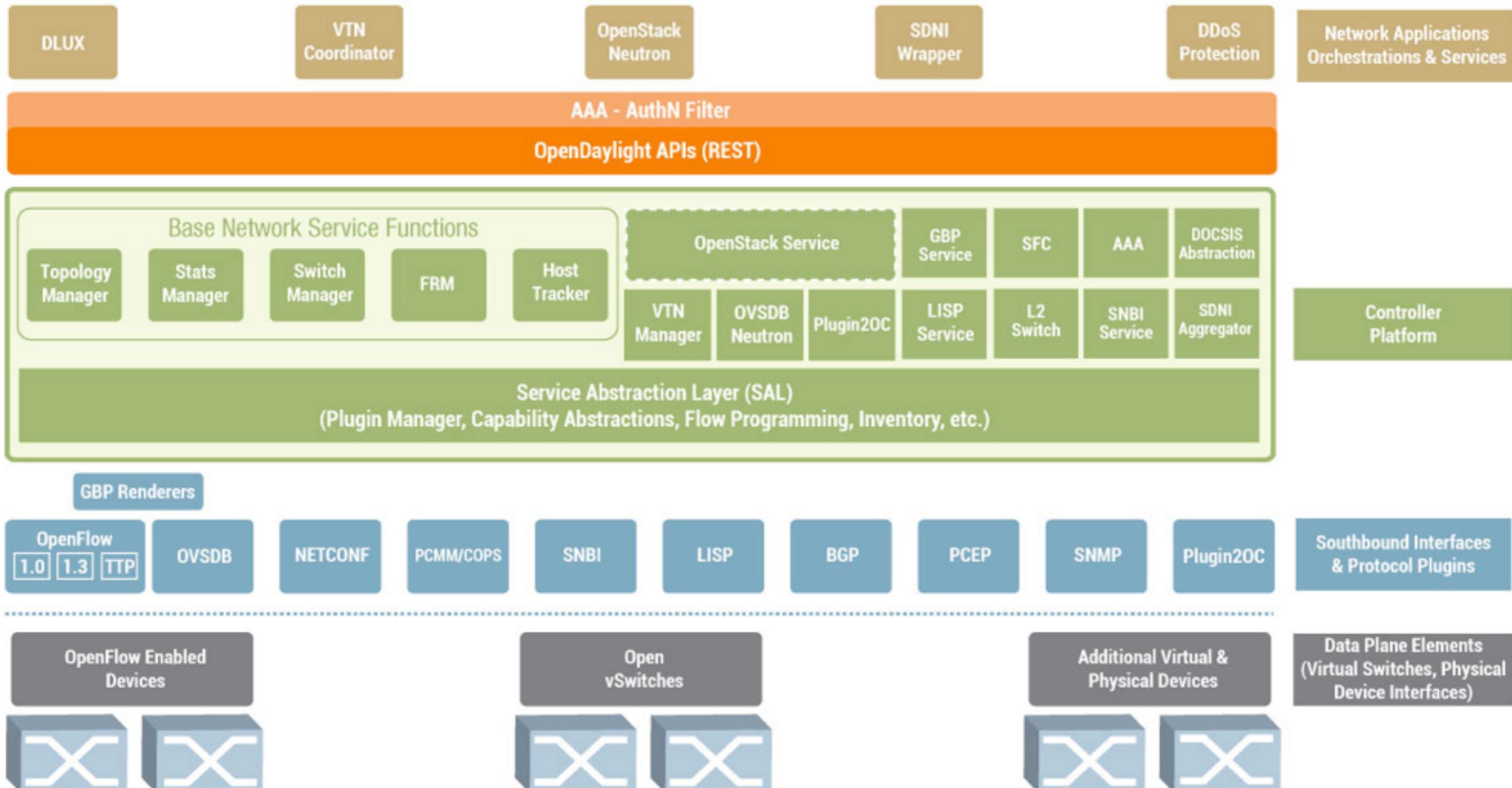




OPEN DAYLIGHT

“HELIUM”

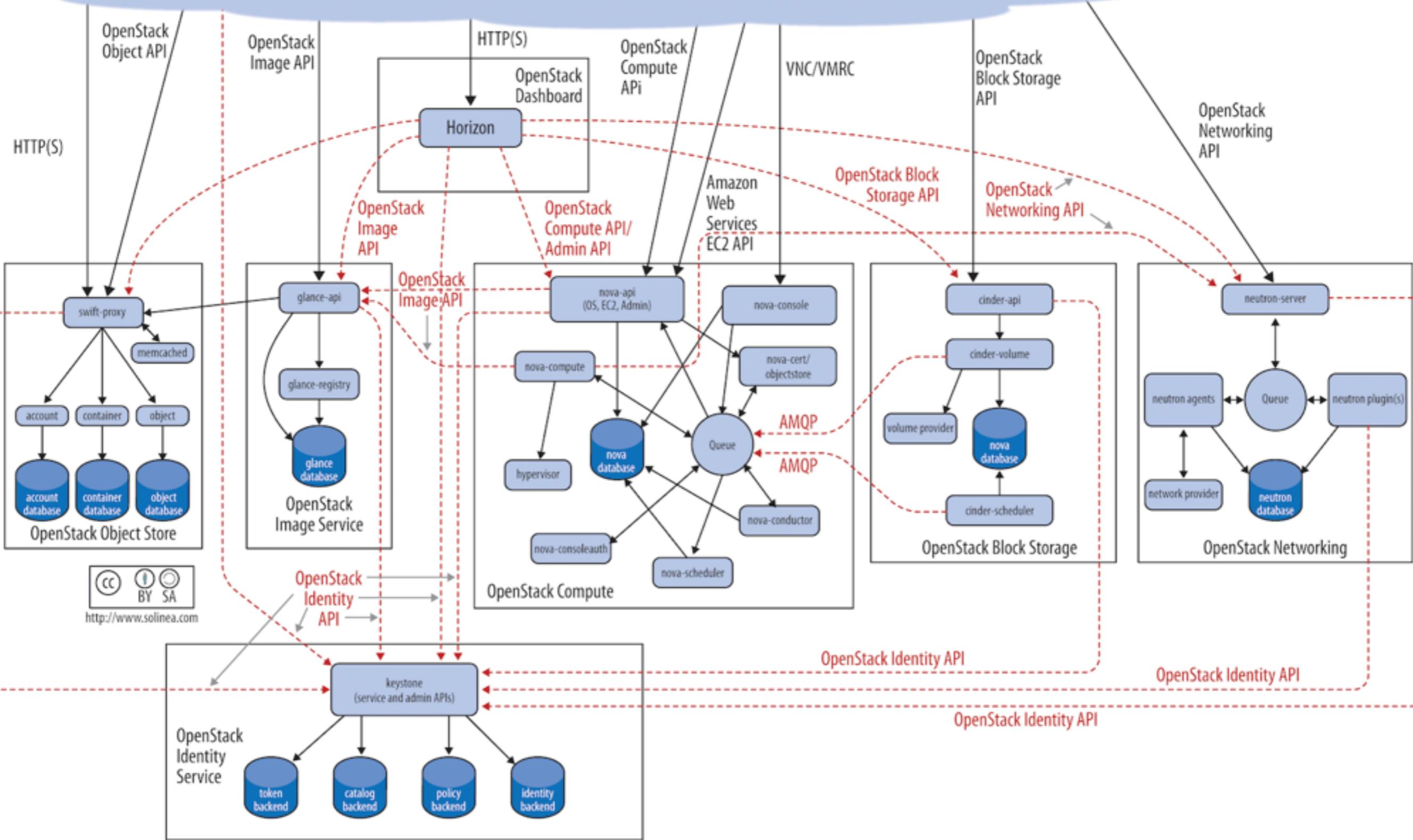
AAA: Authentication, Authorization & Accounting	OVSDB: Open vSwitch DataBase Protocol
AuthN: Authentication	PCEP: Path Computation Element Communication Protocol
BGP: Border Gateway Protocol	PCMM: Packet Cable MultiMedia
COPS: Common Open Policy Service	Plugin2OC: Plugin To OpenContrail
DLUX: OpenDaylight User Experience	SDNI: SDN Interface (Cross-Controller Federation)
DDoS: Distributed Denial Of Service	SFC: Service Function Chaining
DOCSIS: Data Over Cable Service Interface Specification	SNBI: Secure Network Bootstrapping Infrastructure
FRM: Forwarding Rules Manager	SNMP: Simple Network Management Protocol
GBP: Group Based Policy	TTP: Table Type Patterns
LISP: Locator/Identifier Separation Protocol	VTN: Virtual Tenant Network



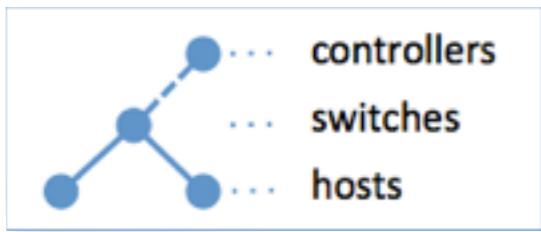


- Command-line interfaces (nova, neutron, swift, etc)
- Cloud Management Tools (Rackspace, Enstratus, etc)
- GUI tools (Dashboard, Cyberduck, iPhone client, etc)

Internet



SDN, Cloud & DevOps Tools



Mininet



OPEN NETWORKING
FOUNDATION



ONOS
Open Network Operating System



OPEN
NETWORKING
FOUNDATION



CFEngine



openstack™



OpenNebula

apachecloudstack™

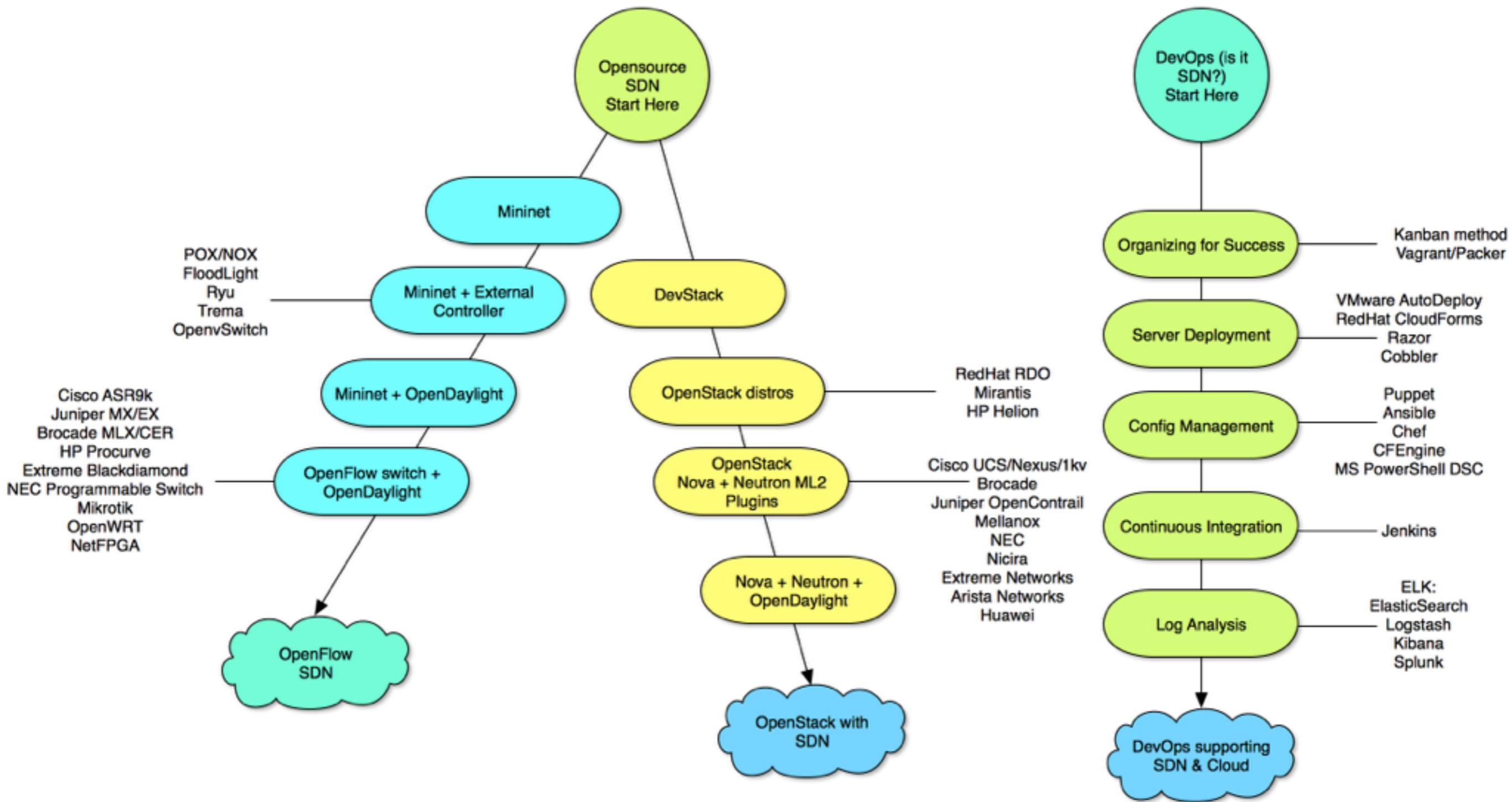


logstash



Jenkins

Opensource SDN Process Simplified



Impact for Networkers



Impact - New Ways of Doing Things

- Campus Network
- Datacenter Network
- Service Provider Network

Campus Network

- Old Way
 - Manually provisioning network config to equipment
 - Provision services via manually configuring equipment
- New Way
 - Push configs to standardized equipment
 - Simplified Network Access Control (NAC)
 - Simplified DDoS mitigation

Datacenter Network

- Old Way
 - Manually provisioning network config to equipment
 - Provision services via manually configuring equipment
- New Way
 - DevOps - automatic config/service provisioning
 - OpenStack with SDN - multitenant private cloud

Service Provider Network

- Old Way
 - Manually provisioning network config to equipment
 - Provision services via manually configuring equipment
- New Way
 - Automatic TE tunnels via PCEP
 - Large-scale DDoS mitigation via BGP FlowSpec
 - NFV - SP service chaining

Tiga Pertanyaan

1. Apakah Netadmin mengkonfigur device atau “network”?
2. Apakah Netadmin musti mengerti server dan aplikasi?
3. Apakah Netadmin bakal disuruh coding?

Tiga Pertanyaan - Jawaban

1. Apakah Netadmin mengkonfigur device atau “network”?

Ia harus memiliki device view dan network view

2. Apakah Netadmin musti mengerti server dan aplikasi?

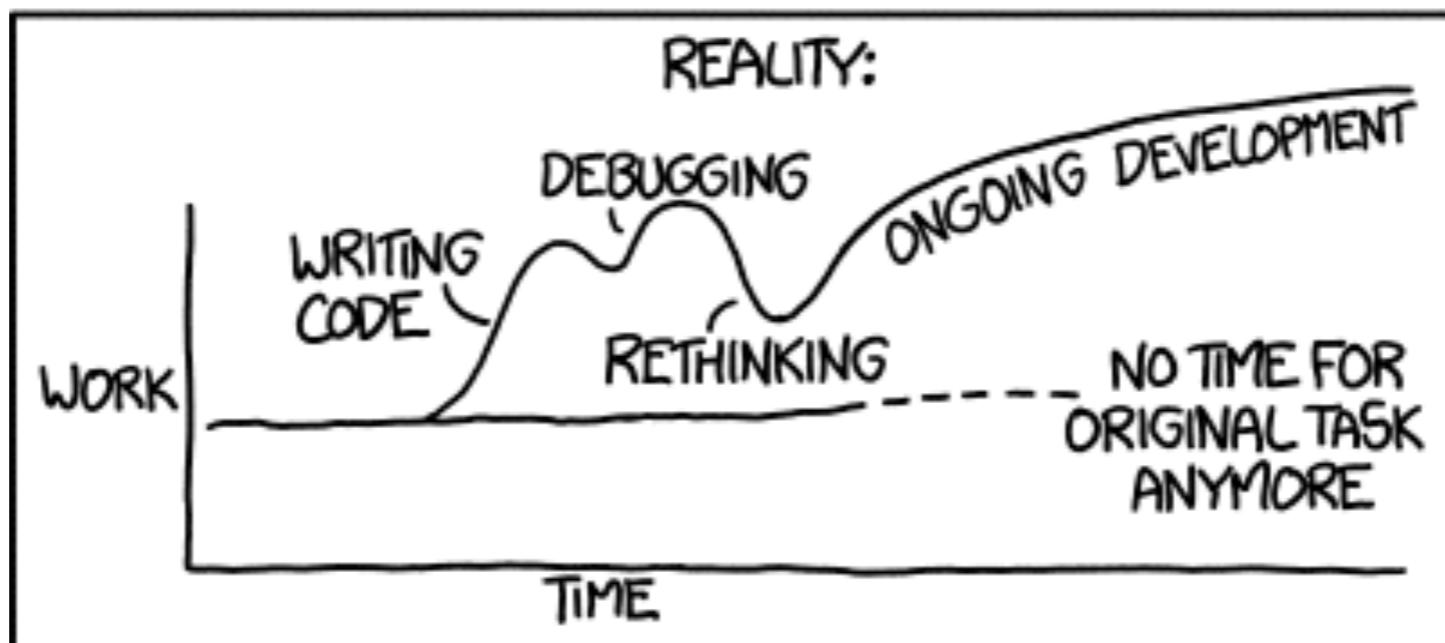
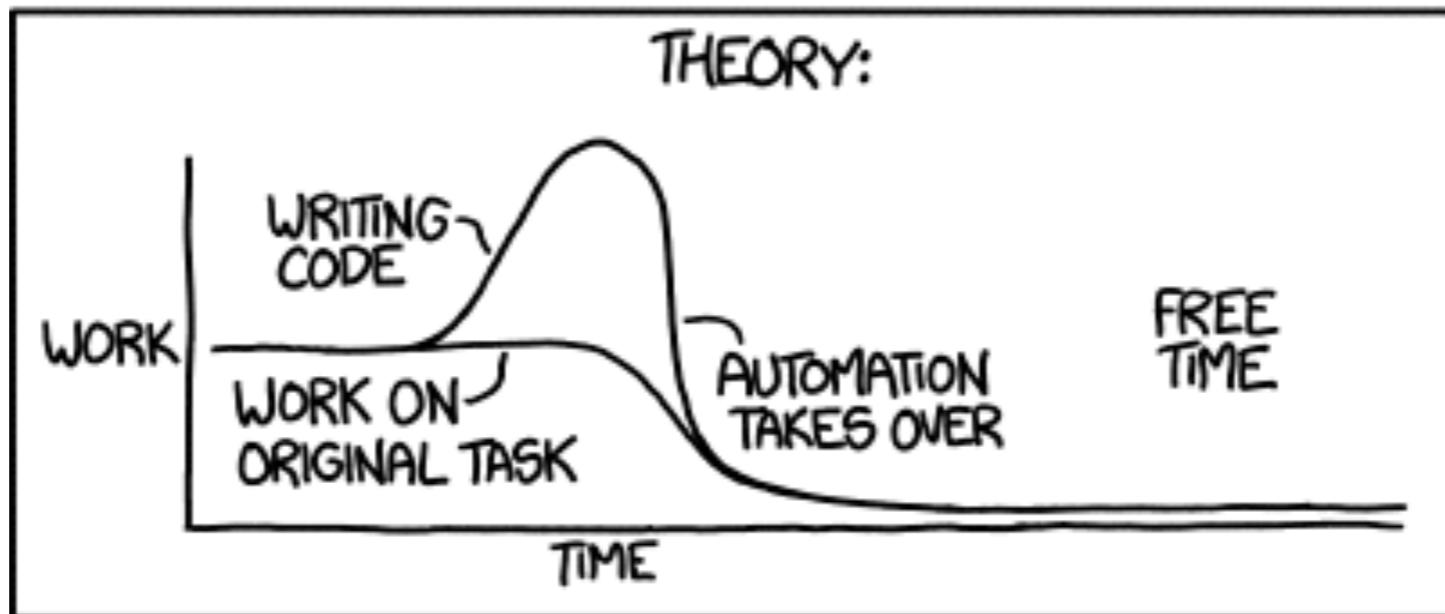
Tidak perlu, tapi sebaiknya ia mengetahui dasar UNIX/Linux

3. Apakah Netadmin bakal disuruh coding?

Tidak, Netadmin hanya pengguna aplikasi, tapi sebaiknya ia mengetahui hal dasar (web services & API)

Challenges

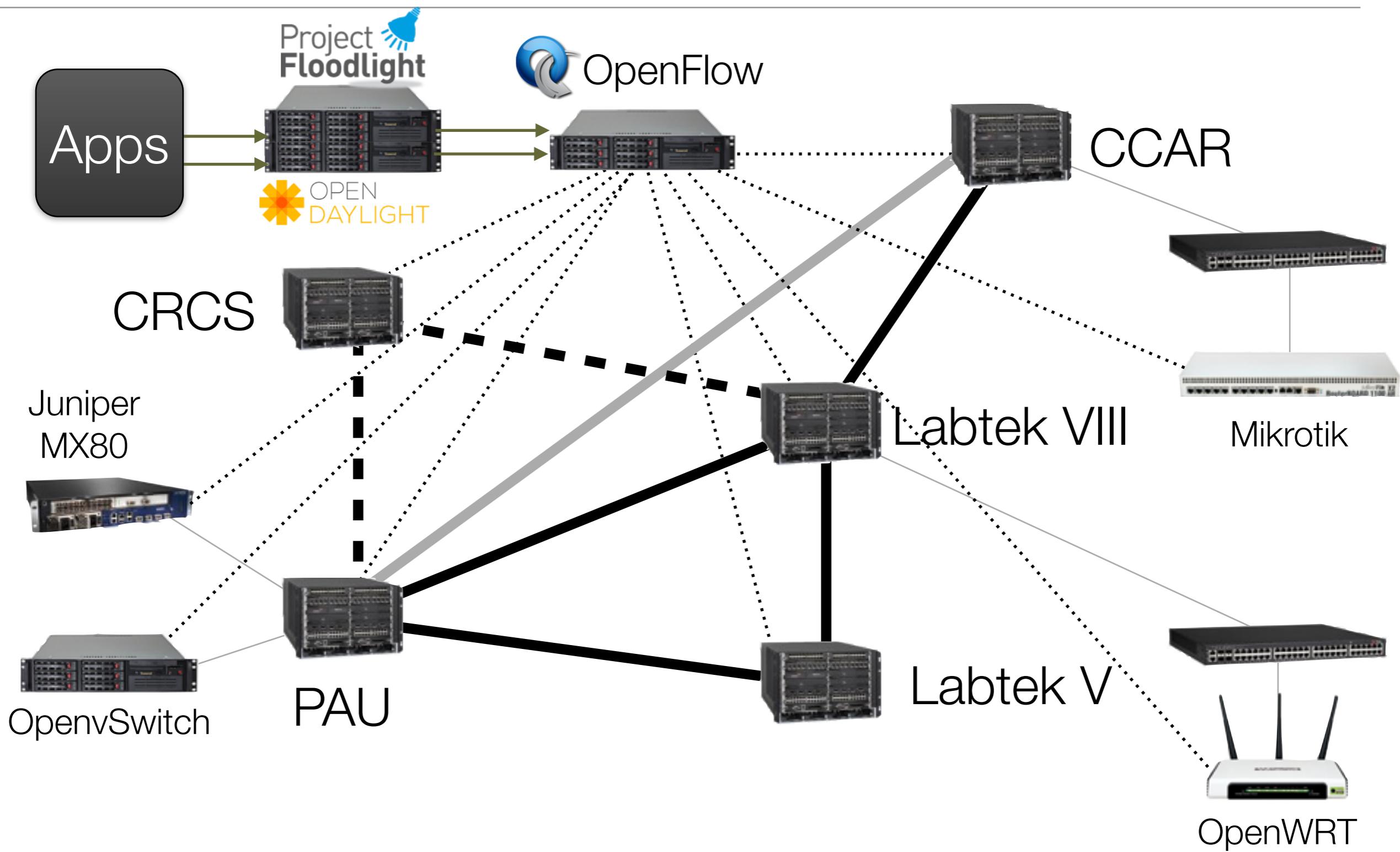
"I SPEND A LOT OF TIME ON THIS TASK.
I SHOULD WRITE A PROGRAM AUTOMATING IT!"



Activities & Research



SDN-ready Network in ITB



Implementing OpenFlow SDN

- Core network support OpenFlow v1.0
- Hybrid Port Mode with Protected & Unprotected VLANs
 - Protected VLANs is not subject to defined OpenFlow flows
 - Regular network can coexist with OpenFlow
 - VPLS support on VLAN on OpenFlow Hybrid Mode
- L2 mode & L3 mode
- SDN Controller using OpenDaylight
- Ongoing

SDN Course in ITB

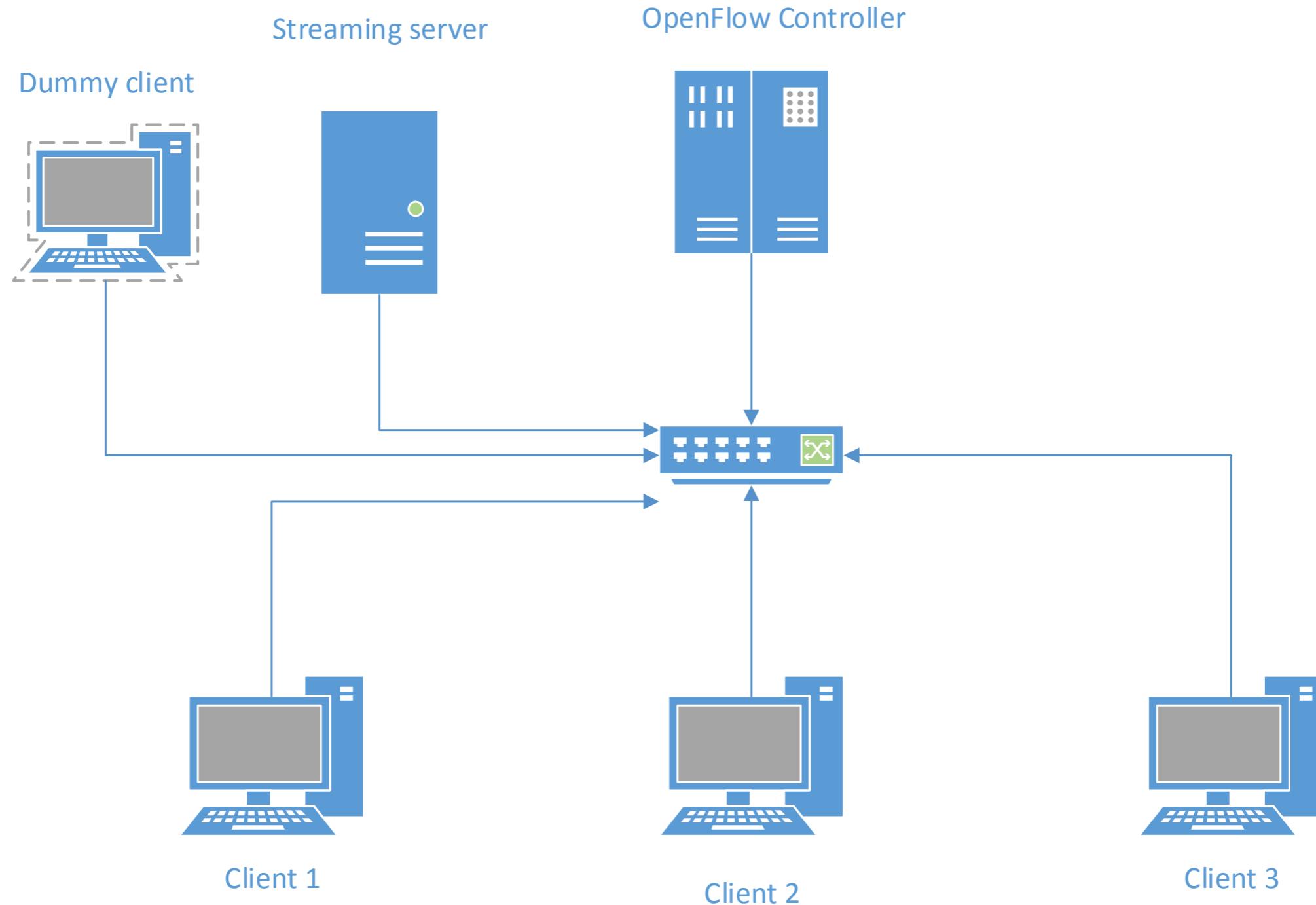
Telecommunication Engineering : EL5244 - Software Defined Networking

- Lectured by Dr.-Ing. Eueung Mulyana

Thesis/Final Projects:

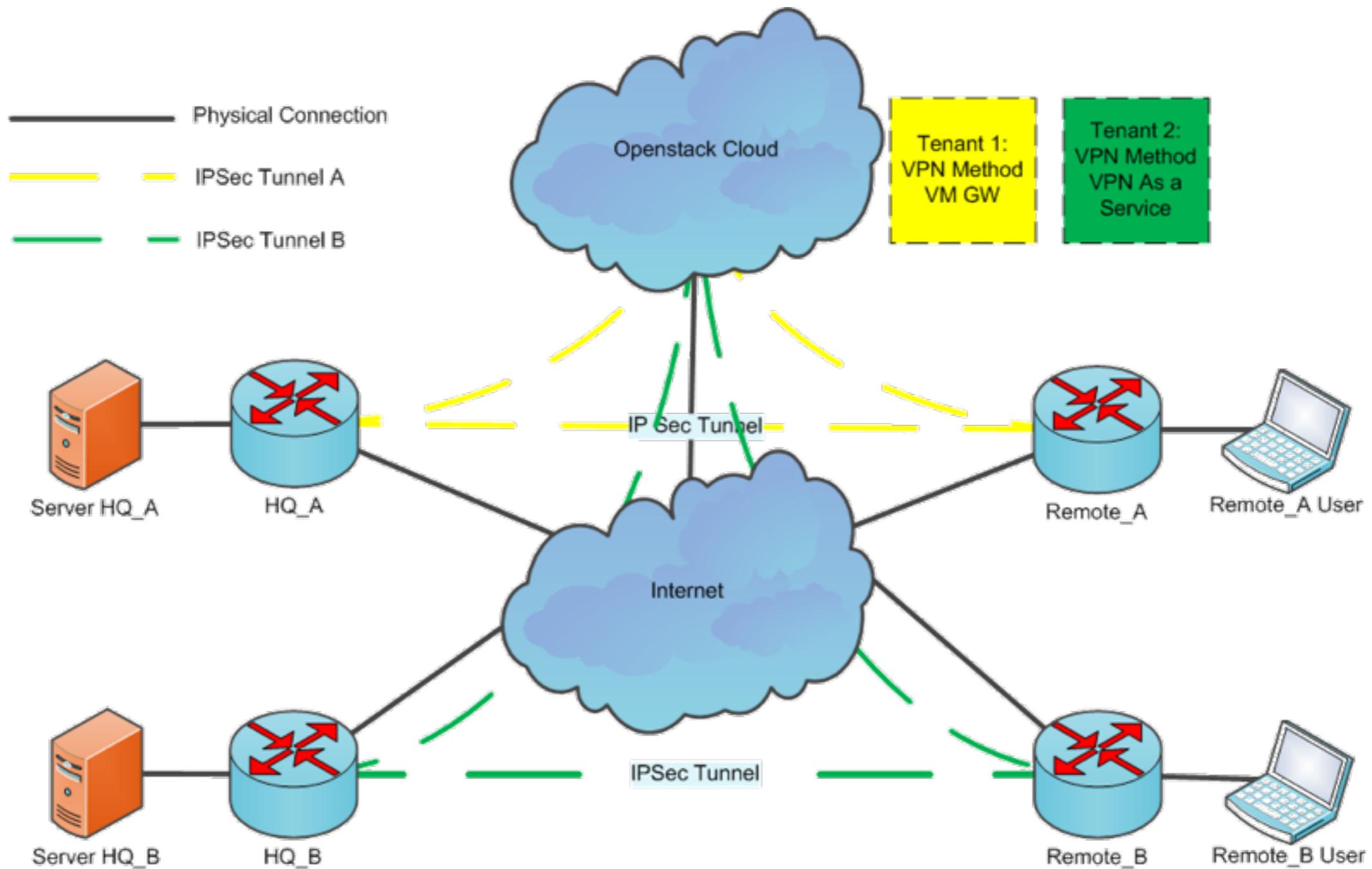
- Design & Implementation of Multicast Streaming Application on A Local OpenFlow Network
- Design & Implementation of MPLS Service on OpenFlow Network with Open vSwitch
- Implementation & Analysis of Elastic Load Balancing for DNS Service on OpenStack Cloud
- Sustainable Campus-Scale OpenFlow Testbed at ITB
- Design & Implementation Site-to-Site IPsec VPN on OpenStack

Design & Implementation of Multicast Streaming Application on A Local OpenFlow Network



Design Multicast Video Streaming Application on Unicast Network Using Floodlight (OF1.0)

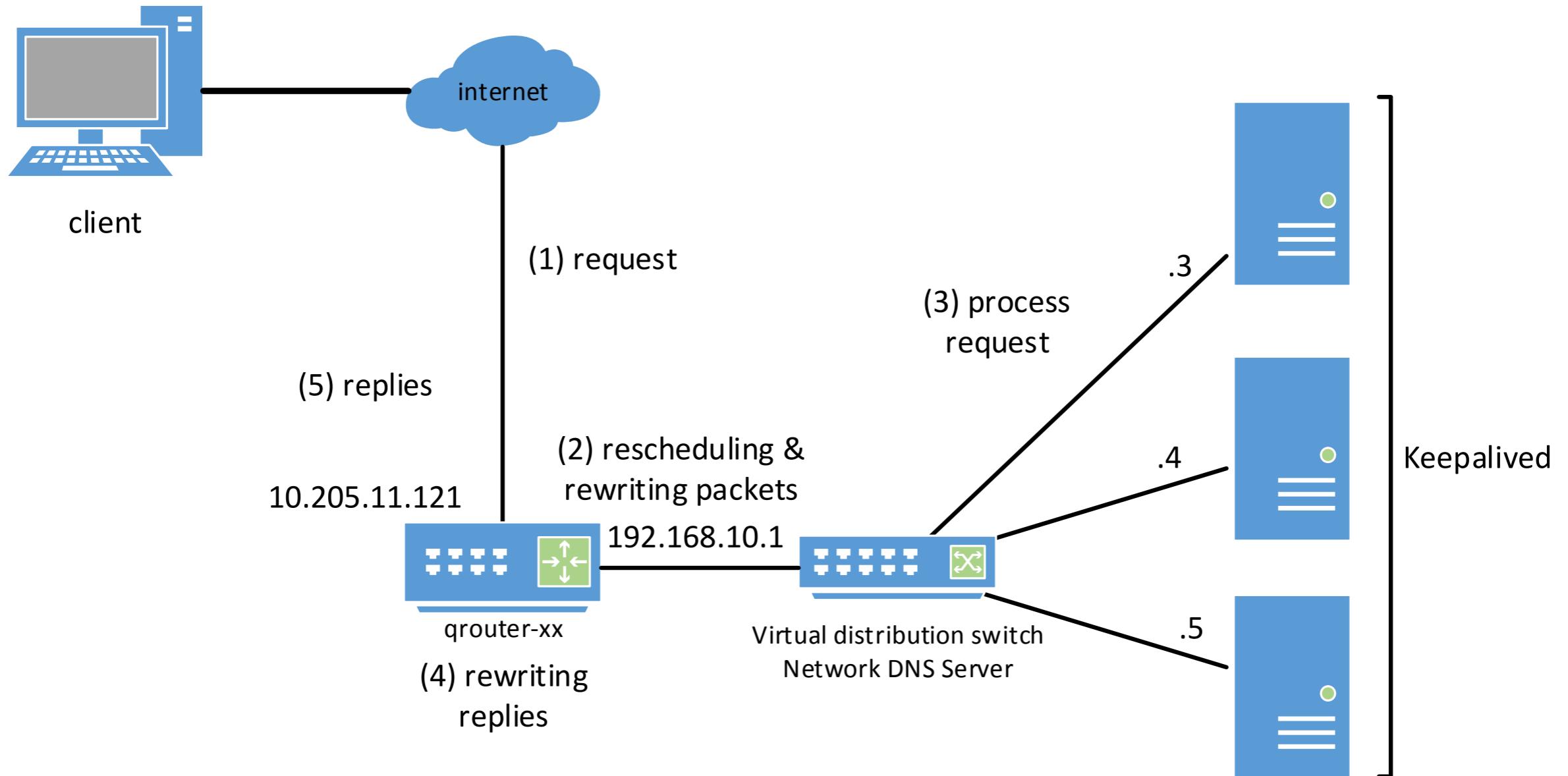
Design & Implementation Site-to-Site IPsec VPN on Openstack



Design & Implementation Site-to-Site IPsec VPN on Openstack

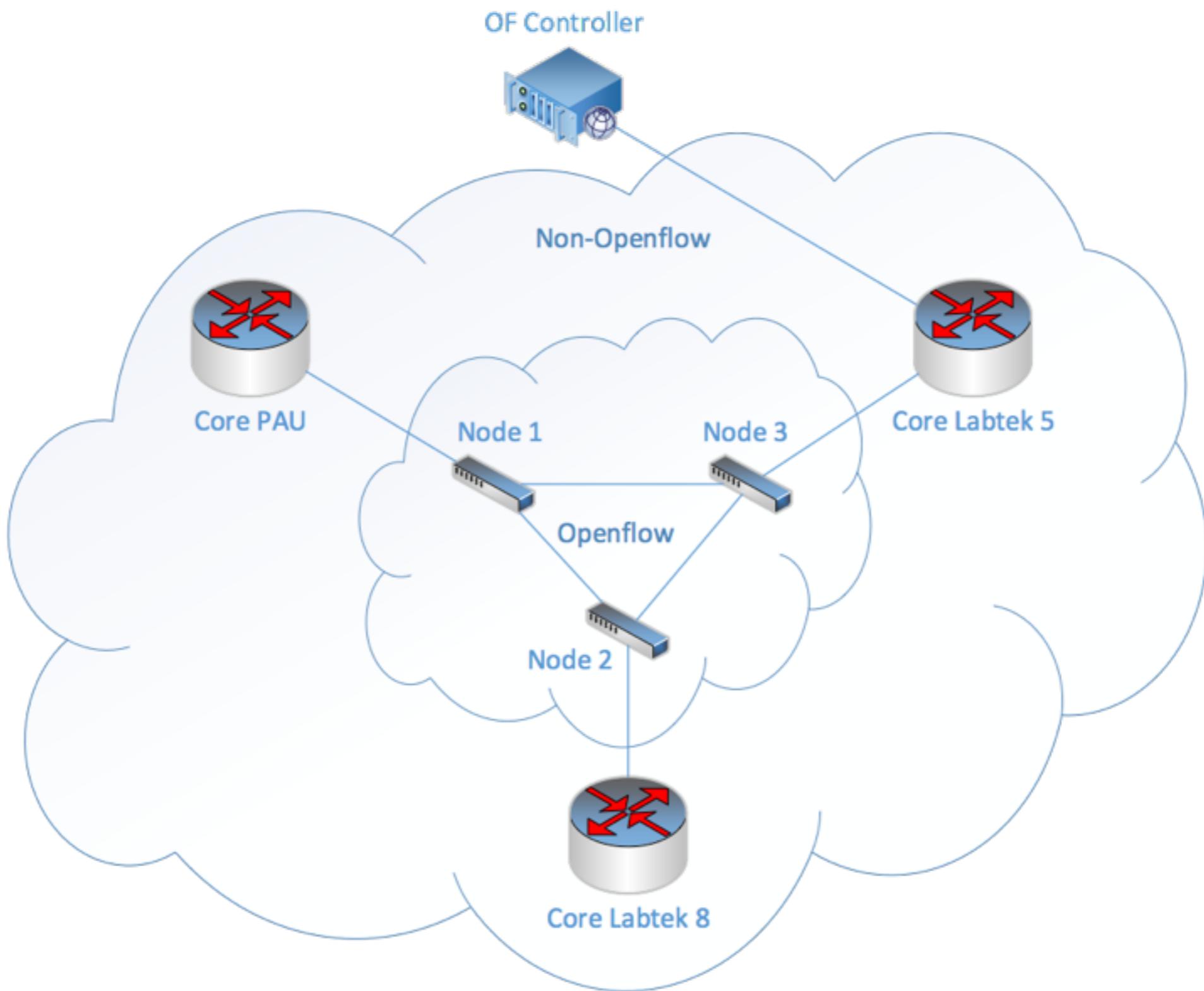
- Implement Site-to-Site IPsec VPN on OpenStack
- Performance evaluation :
 - s2s IPsec VPN @Cisco routers
 - s2s IPSec VPN @Openstack using Openswan in Fedora Instance as VPN Gateway
 - s2s IPSec VPN @Openstack using VPN as a Service (Neutron)

Implementation of Elastic Load Balancing in DNS Service on Openstack Cloud

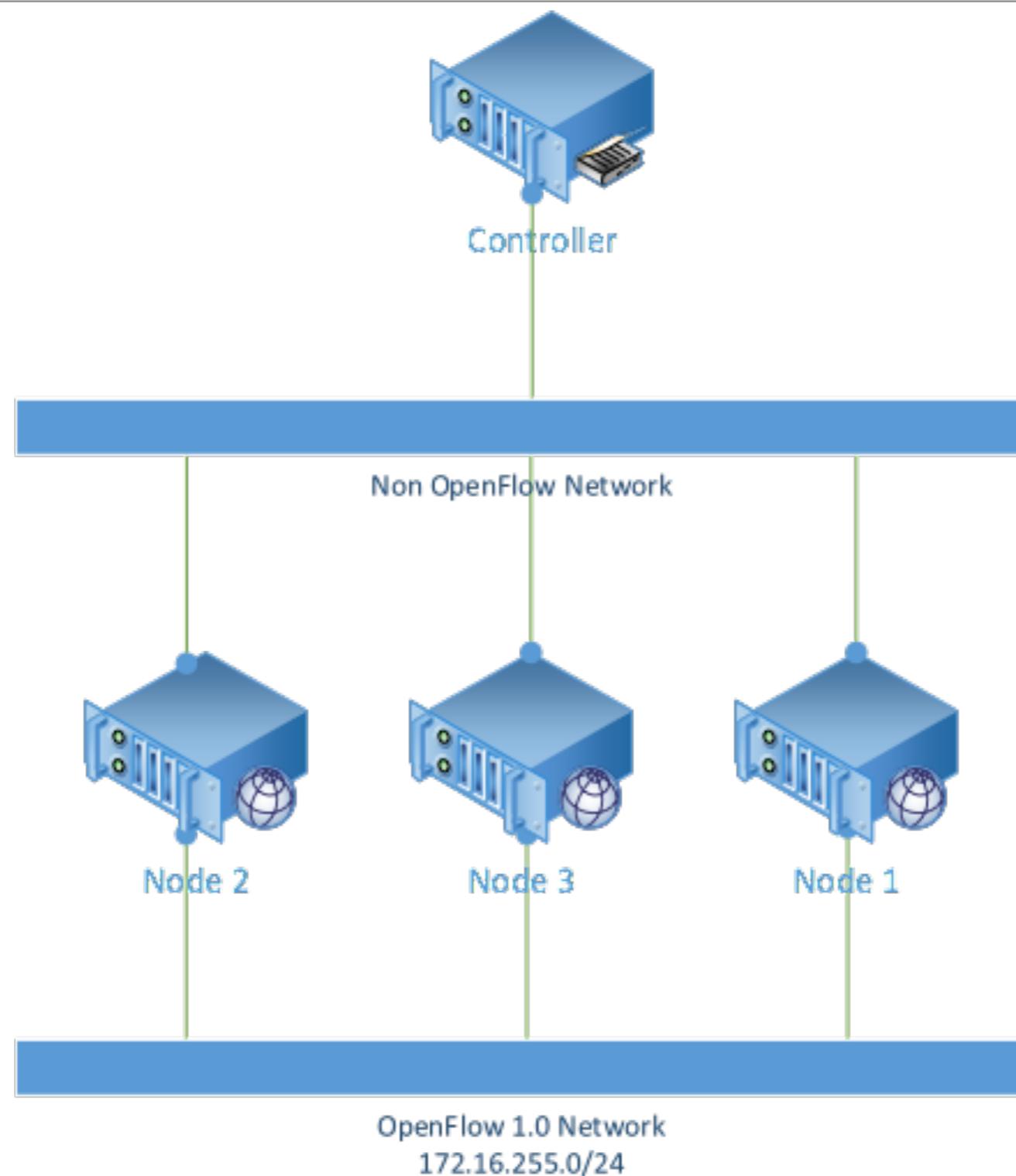


Integrating LVS+Keepalived to load balance DNS request (UDP Traffic)
Implement elastic resource allocation based using Openstack Heat

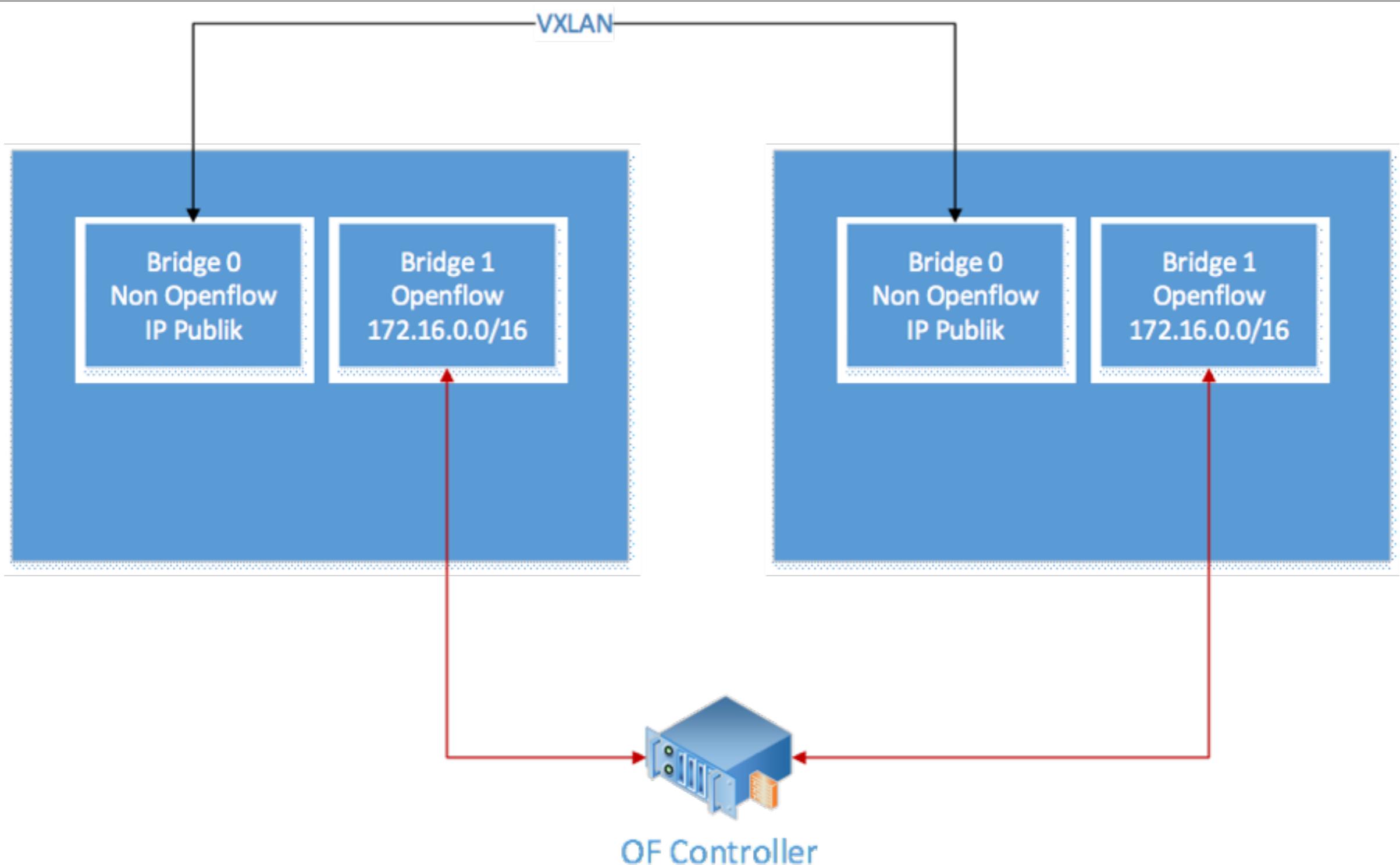
Campus-Scale OpenFlow Testbed



Campus-Scale OpenFlow Testbed



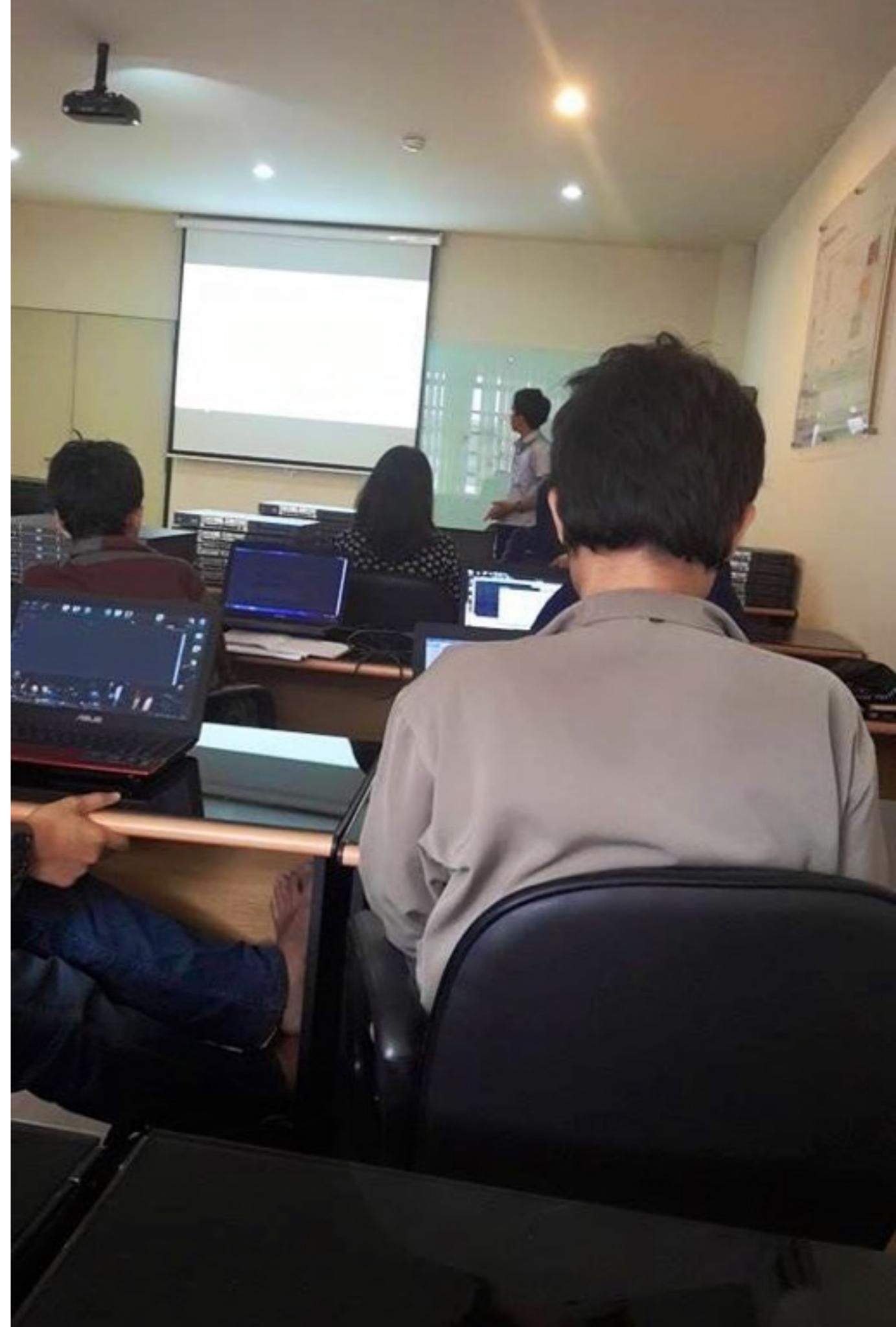
Campus-Scale OpenFlow Testbed



Final Project Work In-Progress

- BGP over OpenFlow Network
- Dynamic Routing on OpenStack Neutron
- Implement VPN as a Service between Cloud & Existing IP Network
- File Sharing Service over OpenStack Swift

What's Next: Collaboration



SDNRG ITB

- SDN Research Group at ITB
 - <http://sdnrg.itb.ac.id>
 - sdnrg@itb.ac.id
 - twitter.com/sdnrgitb
 - facebook.com/sdnrgitb
- Special Interest Groups on Networking and Connected Services (e.g. OpenStack, Internet of Thing)

But why?

- SDN & Cloud Computing adalah topik yang multidisiplin
- Tidak ada satu entitas yang bisa menguasai seluruhnya
- Academic, Operator & Vendor saling memerlukan
 - Academics need real use case for their research
 - Operators need help for their problems
 - Vendors need customers to propose their solutions

SDNRG ITB can bridge the gaps

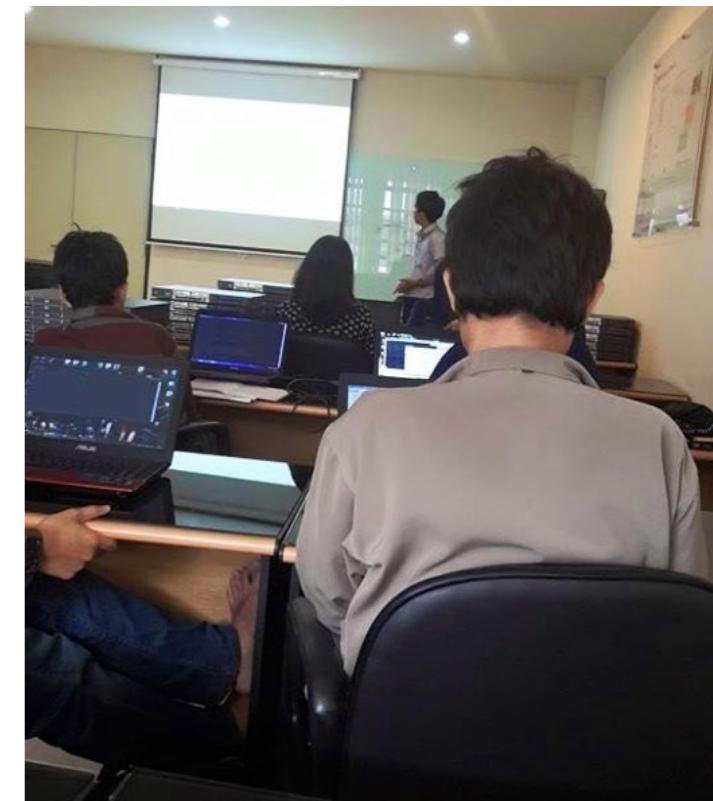
- Academic can get real use case from practitioners
- Networkers can get help understanding SDN tech
- Vendors can promote SDN tech to educated community

After the gaps is small, whats next?

- Educated researchers can build SDN tech solutions for practitioners that fit to the real use case
- Educated networkers can architect better SDN solutions that leads to better network, with help from researchers & vendors
- Educated vendors can propose SDN solutions to the right customers



SDNRG 1st Meetup, Bandung 2014



OpenStack Mini Workshop, Bandung 2015

SDNRG ITB

- SDN Research Group at ITB
 - <http://sdnrg.itb.ac.id>
 - sdnrg@itb.ac.id
 - twitter.com/sdnrgitb
 - facebook.com/sdnrgitb

**Let's make it
happen!**

Terima kasih!

