SDN based Network Management in Emulated Environment

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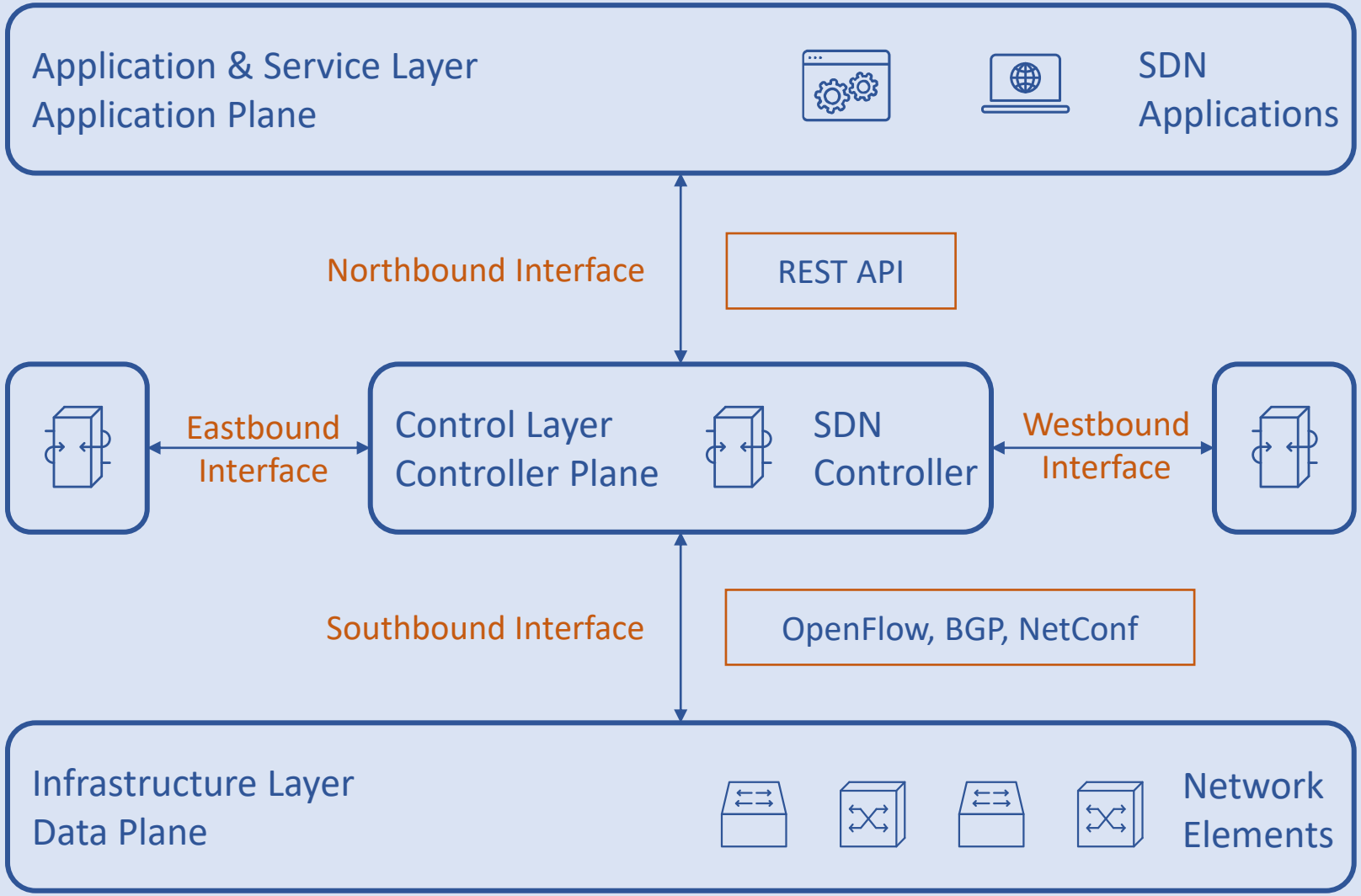
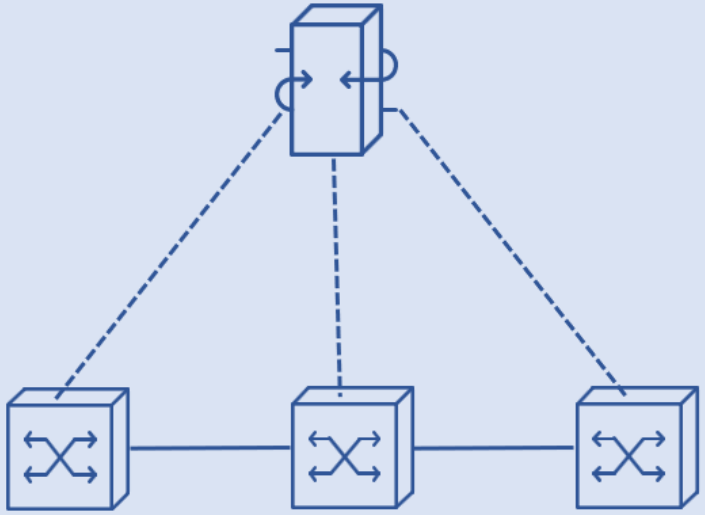
Agenda

1. SDN Architecture
2. Different SDN Architectures
3. Open-source SDN Controllers
4. Open vSwitch
5. OpenFlow
6. Creation of Flow rules
7. Creations of Intents
8. Use-cases

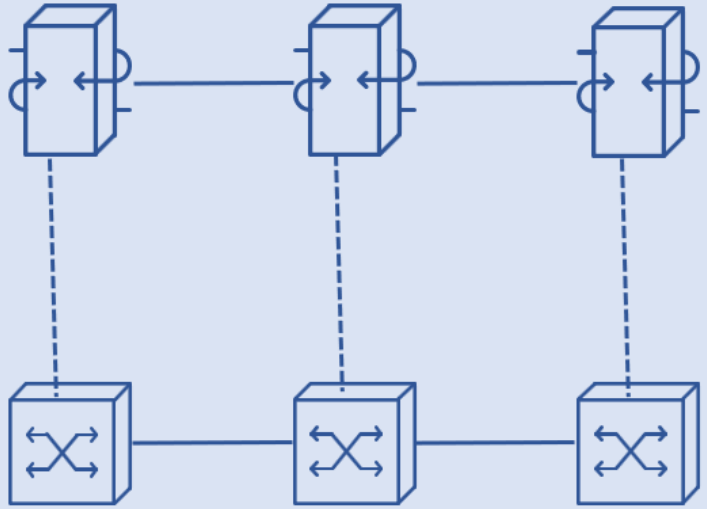
SDN Architecture



Different SDN Architectures (1/3)

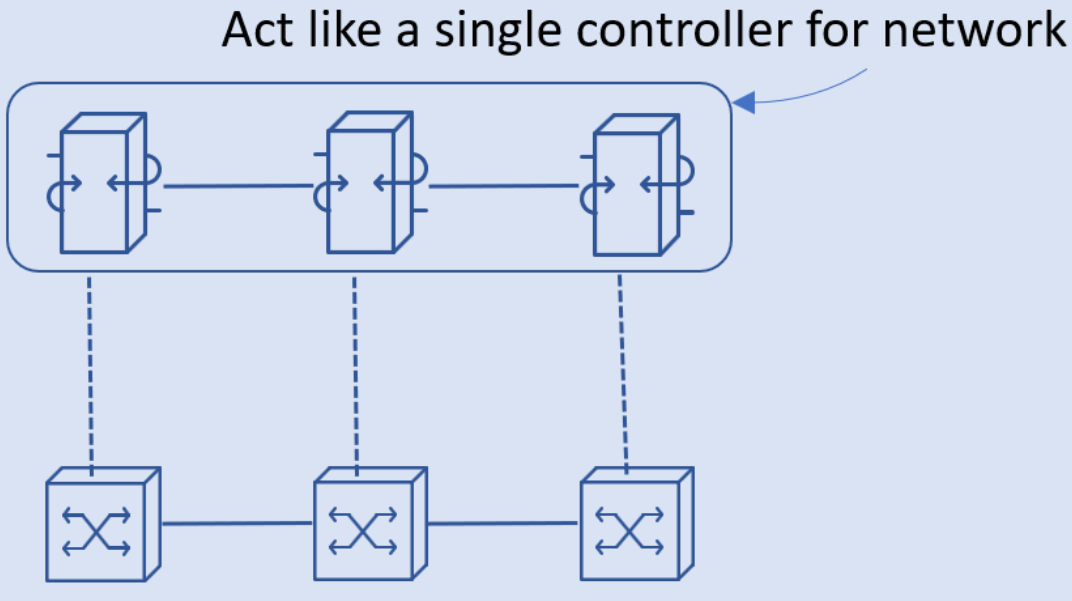


a. Physically-centralised architecture

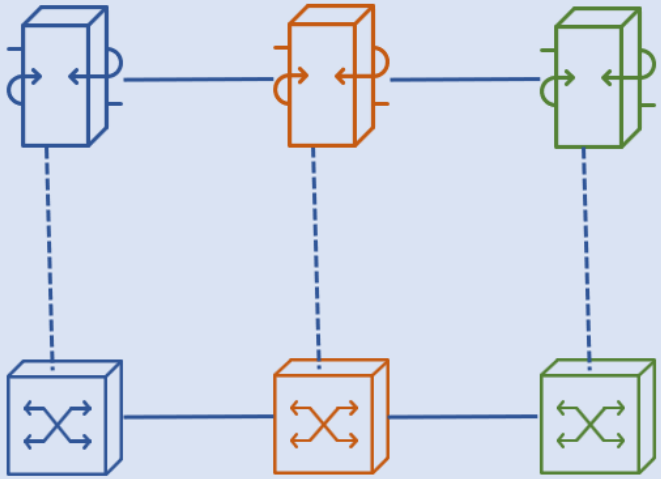


b. Physically-distributed architecture

Different SDN Architectures (2/3)

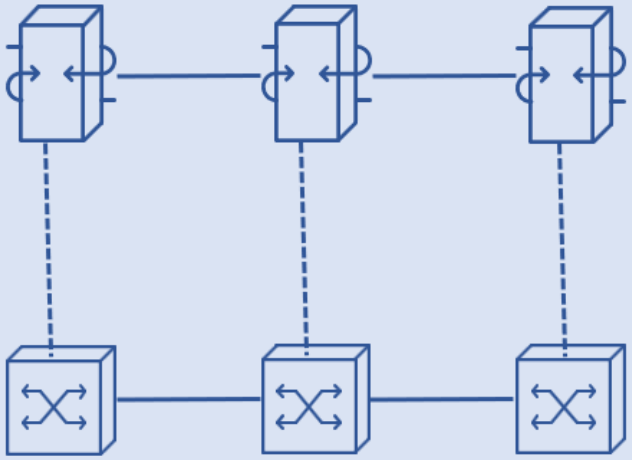


c. Physically-distributed & Logically-centralised architecture

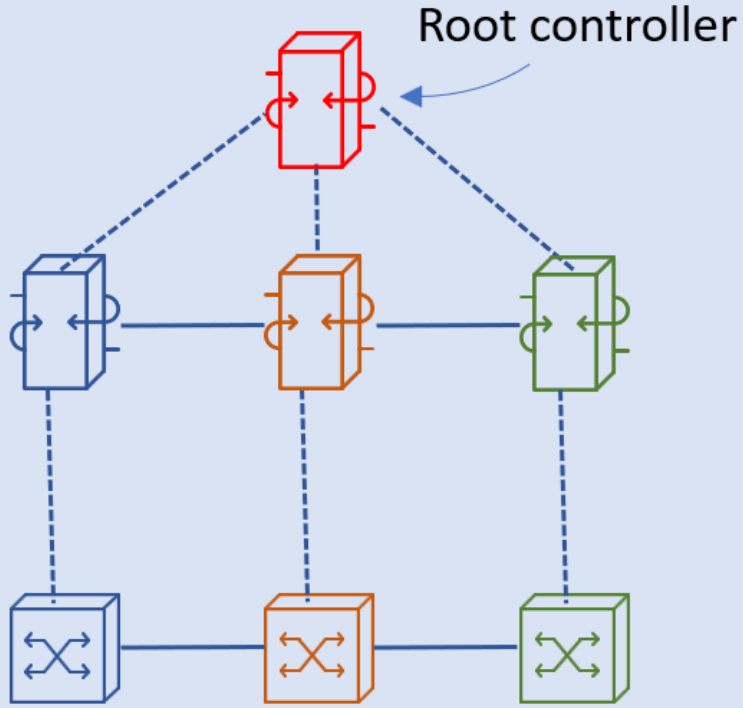


d. Physically-distributed & Logically-distributed architecture

Different SDN Architectures (3/3)



e. Flat architecture

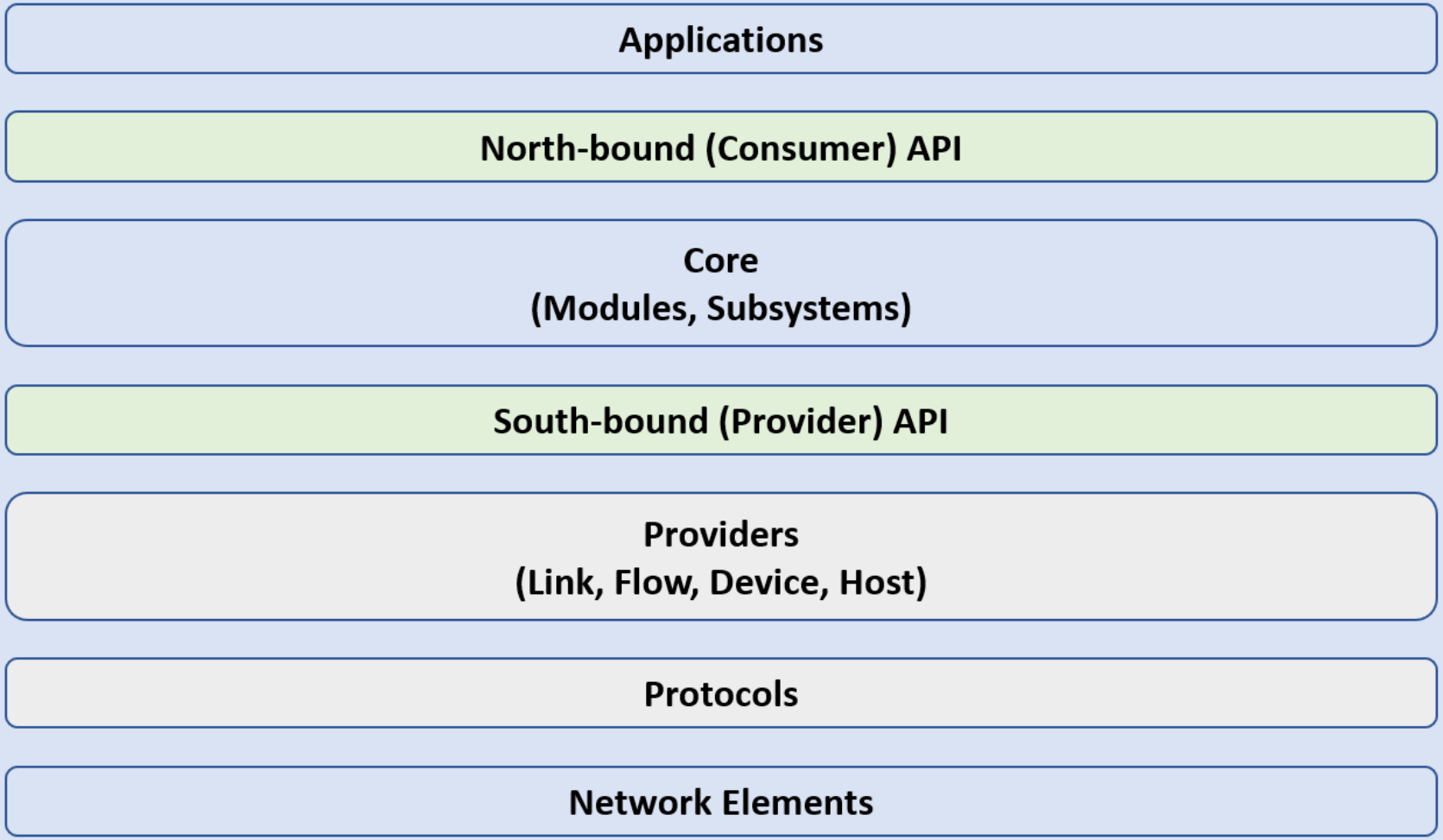


f. Hierarchical architecture

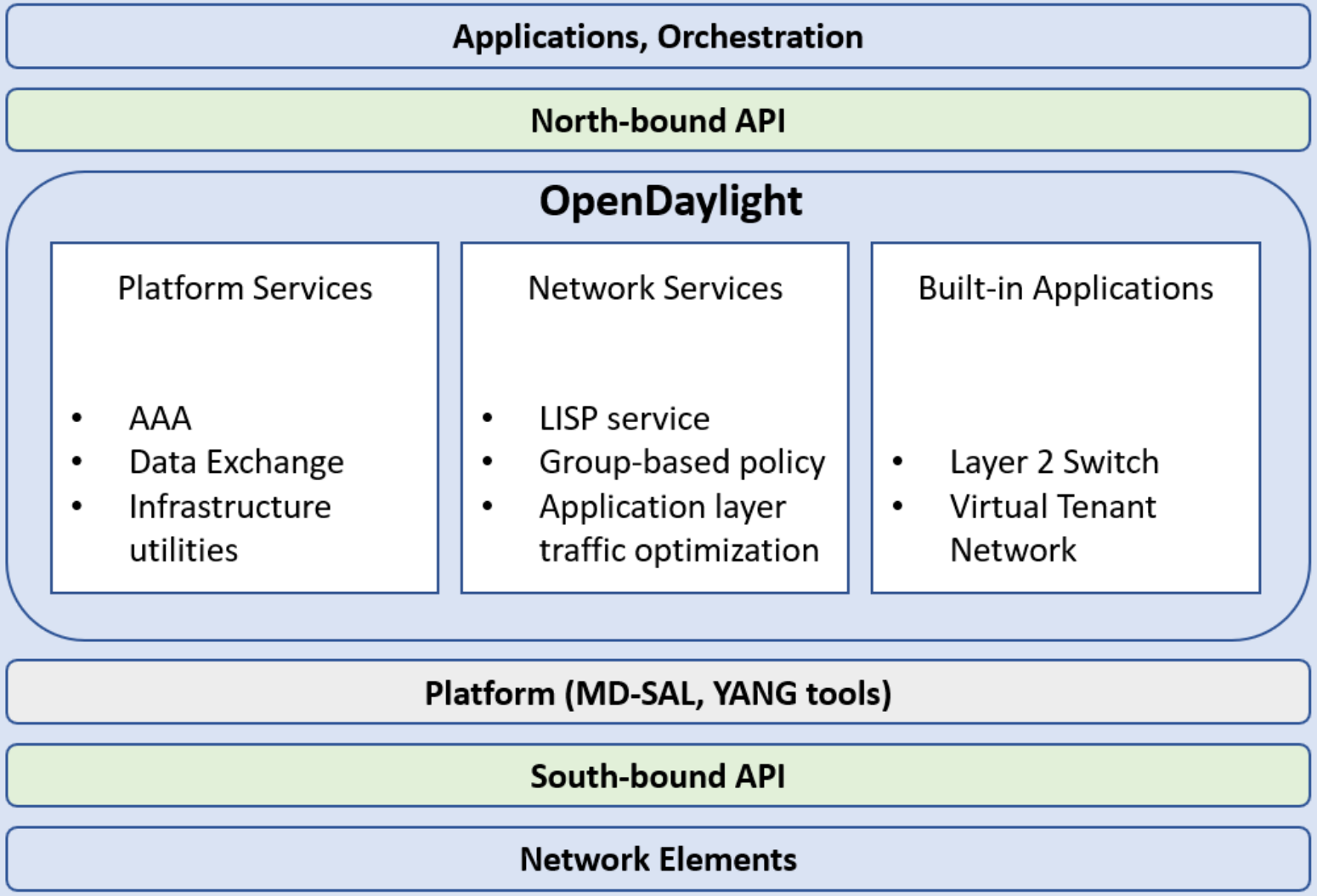
SDN Network Components

- Different components by different communities
- SDN Controllers
    1. ONOS
    2. OpenDaylight
    3. Ryu
- Open vSwitch
- OpenFlow protocol
- Emulated environments

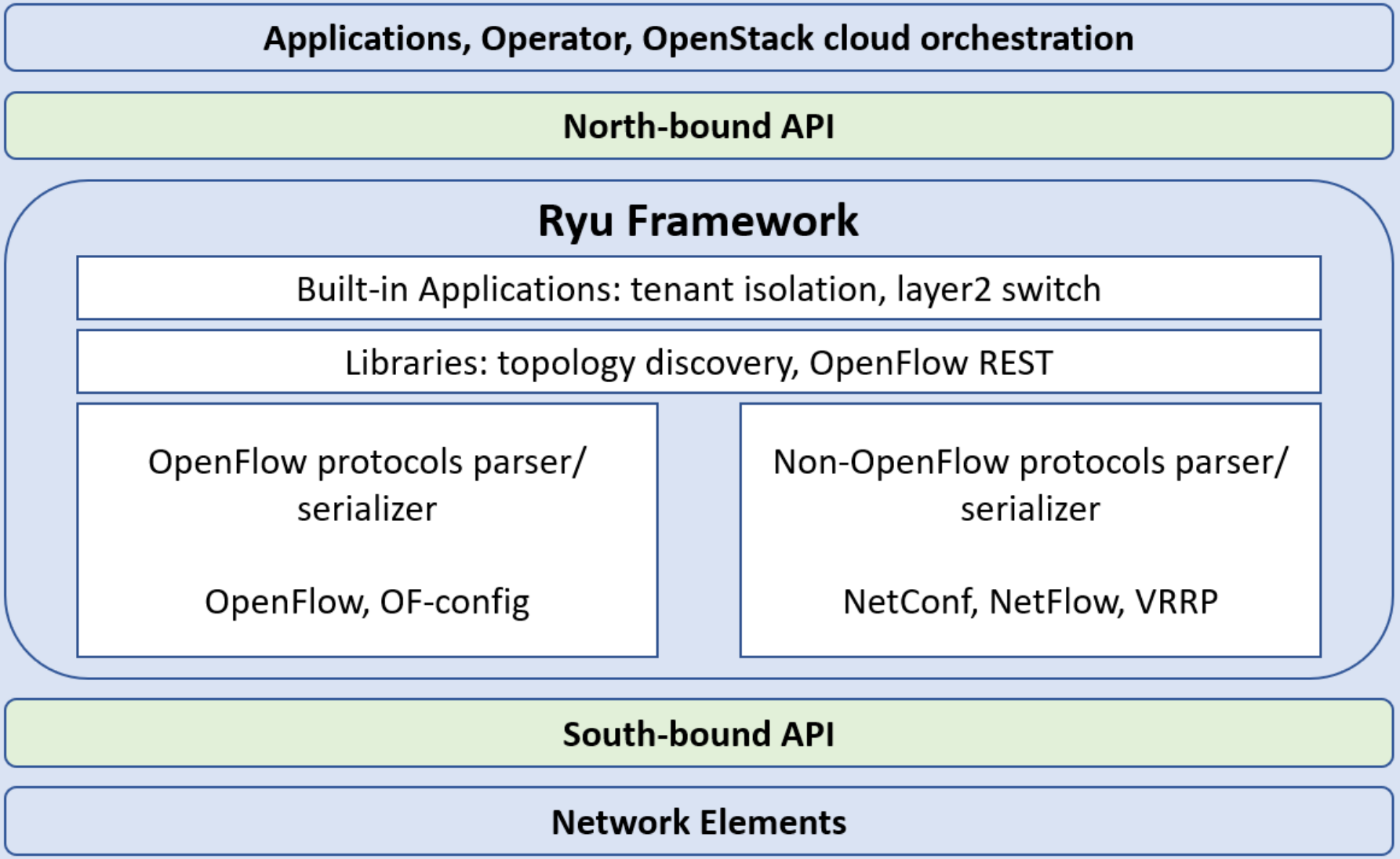
ONOS Controller



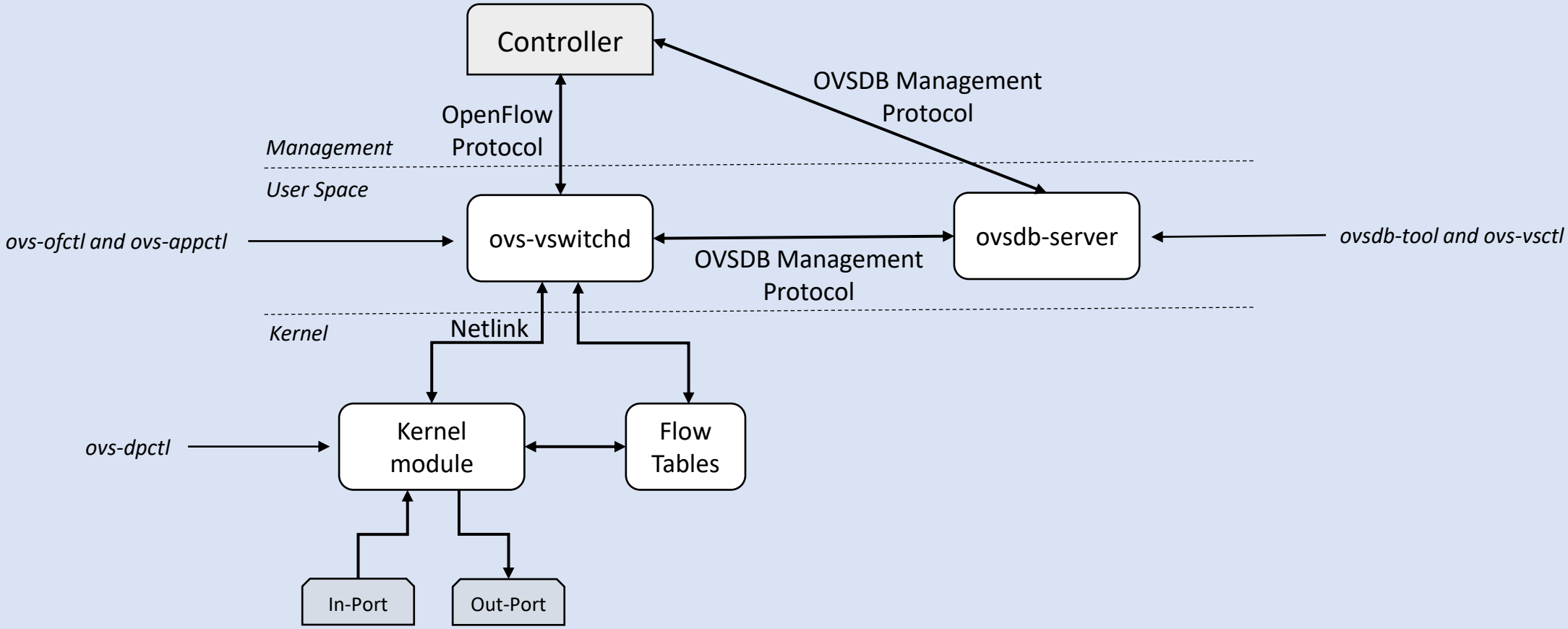
OpenDaylight Controller



Ryu Controller

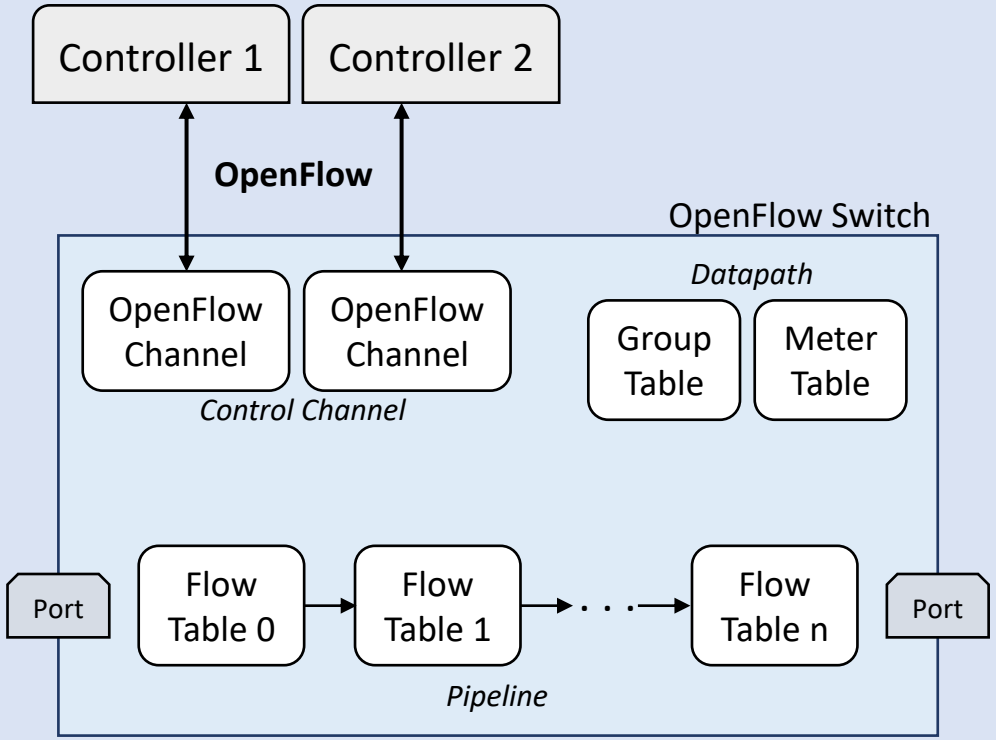


Open vSwitch



OpenFlow Protocol

- SBI protocol
- 6 major releases
- Main components
  - Flow table
  - Group table
  - Meter table
  - Control channel
- Three Message types:
  1. Controller-to-switch
  2. Asynchronous
  3. Symmetric



SDN network emulators

❖ GNS3

1. Client part: The GNS3-all-in-one software (GUI)
2. Server part: The GNS3 virtual machine (GNS3 VM)

➢ Advantages of GNS3:

- Implements easy to access network topology.
- Pre-configured and optimised appliances available to simplify deployment.
- Availability of in-built software packages such as Wireshark and Putty.
- Supports sharing of implemented network including the device configuration.

➢ Disadvantages of GNS3:

- Limitation of CPU and memory resources provided by the host machine.
- The software images of the network devices are required to be purchased and downloaded by the user.

❖ Mininet

➢ Advantages of Mininet:

- It is very fast and takes very little time for booting.
- It is easy to install and use.
- It saves money because the emulators are cost-effective instead of testing with hardware devices.
- It is also very easy to connect with other network devices.

➢ Disadvantages of Mininet:

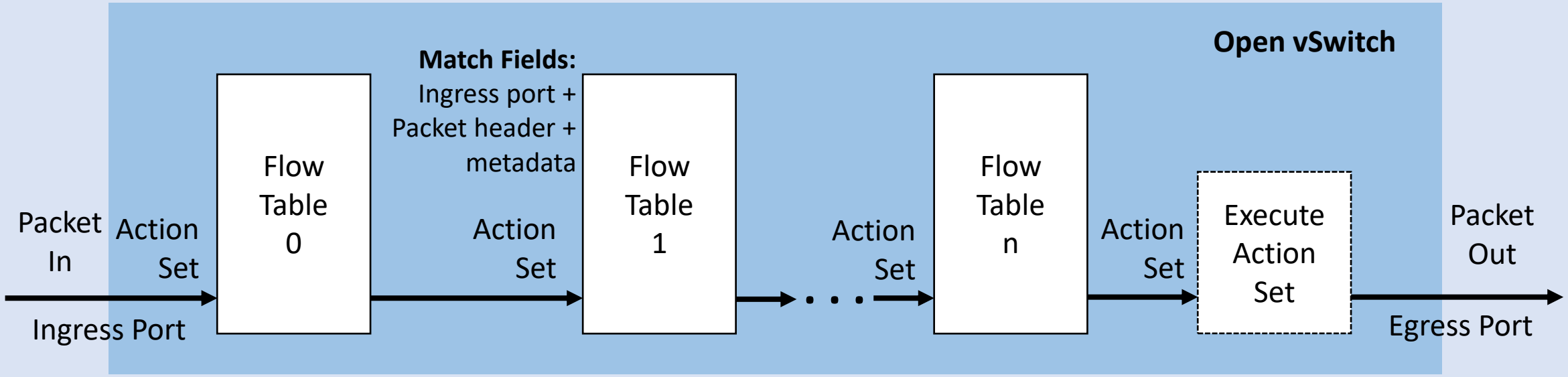
- Deployed network elements cannot exceed the CPU and bandwidth available on host machine.
- Single server implementation gave rise to the performance problems.
- All Mininet hosts share the host file system and PID space, a careful assessment of running daemons is required for process of debugging.

Flow Rules

- Forwarding flow rules
- Application commands >> Flow rules
- Creation & Installation
    1. Open vSwitch CLI
    2. ONOS REST API
    3. ONOS CLI

Demo

Packet transmission through flow tables within an Open vSwitch

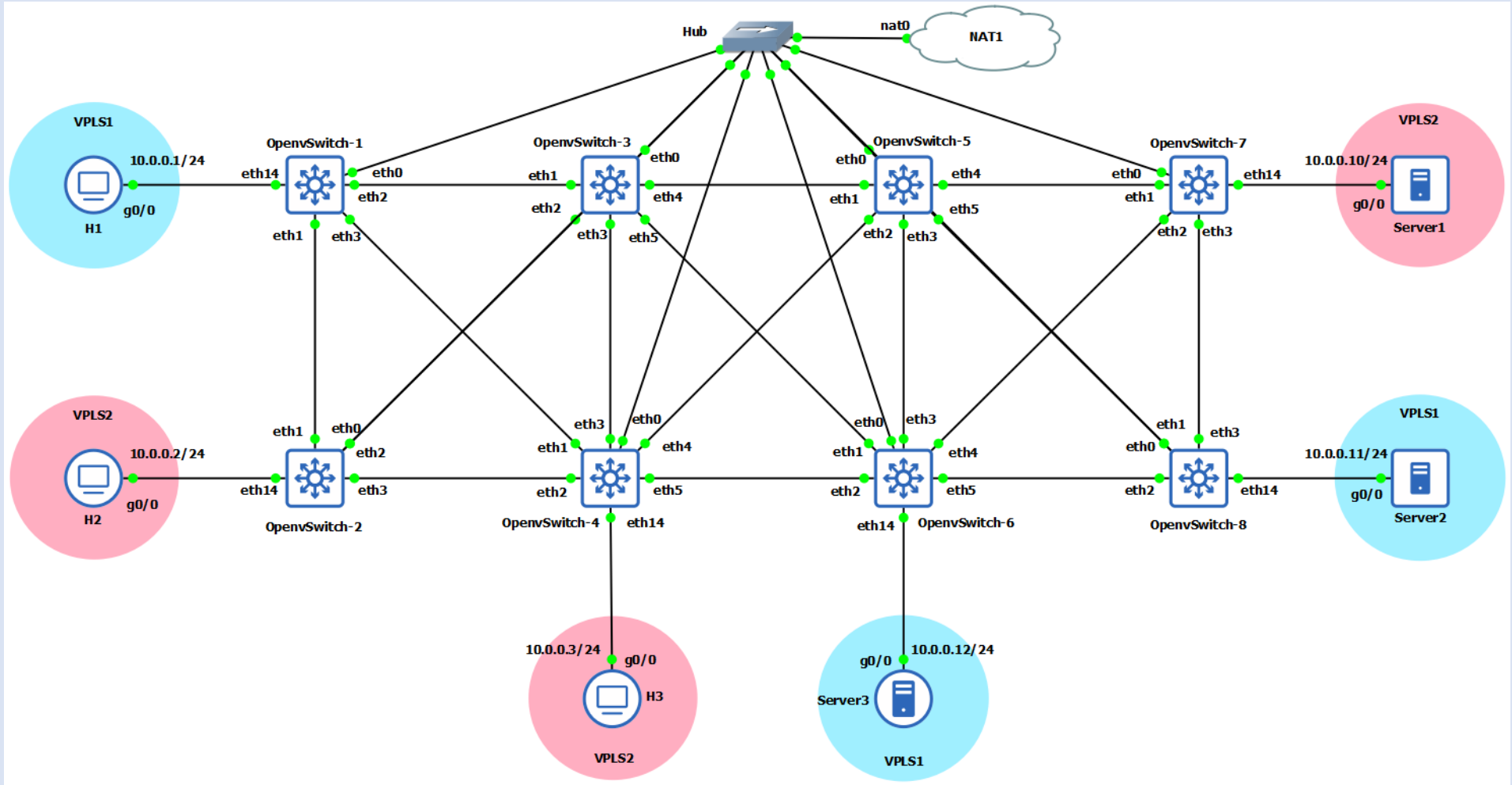


Creation of Intents

- Policy-based directives
- Intent Framework is a subsystem
- Application commands >> Flow rules
- Creation & Installation
    1. ONOS CLI
    2. ONOS GUI
    3. ONOS REST API

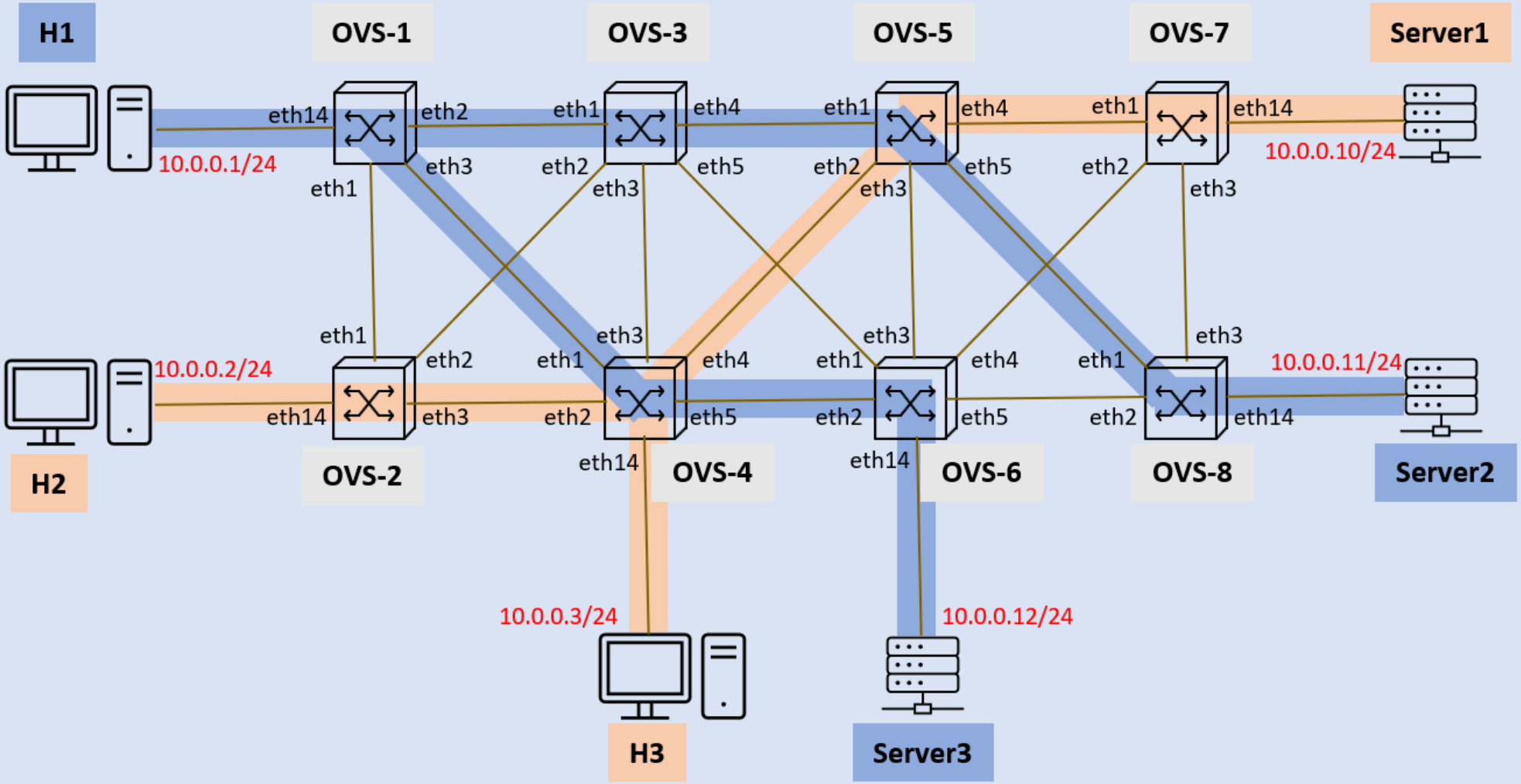
Demo

Use Case-1: Testing the ONOS Controller with Isolated Layer 2 Overlay Networks

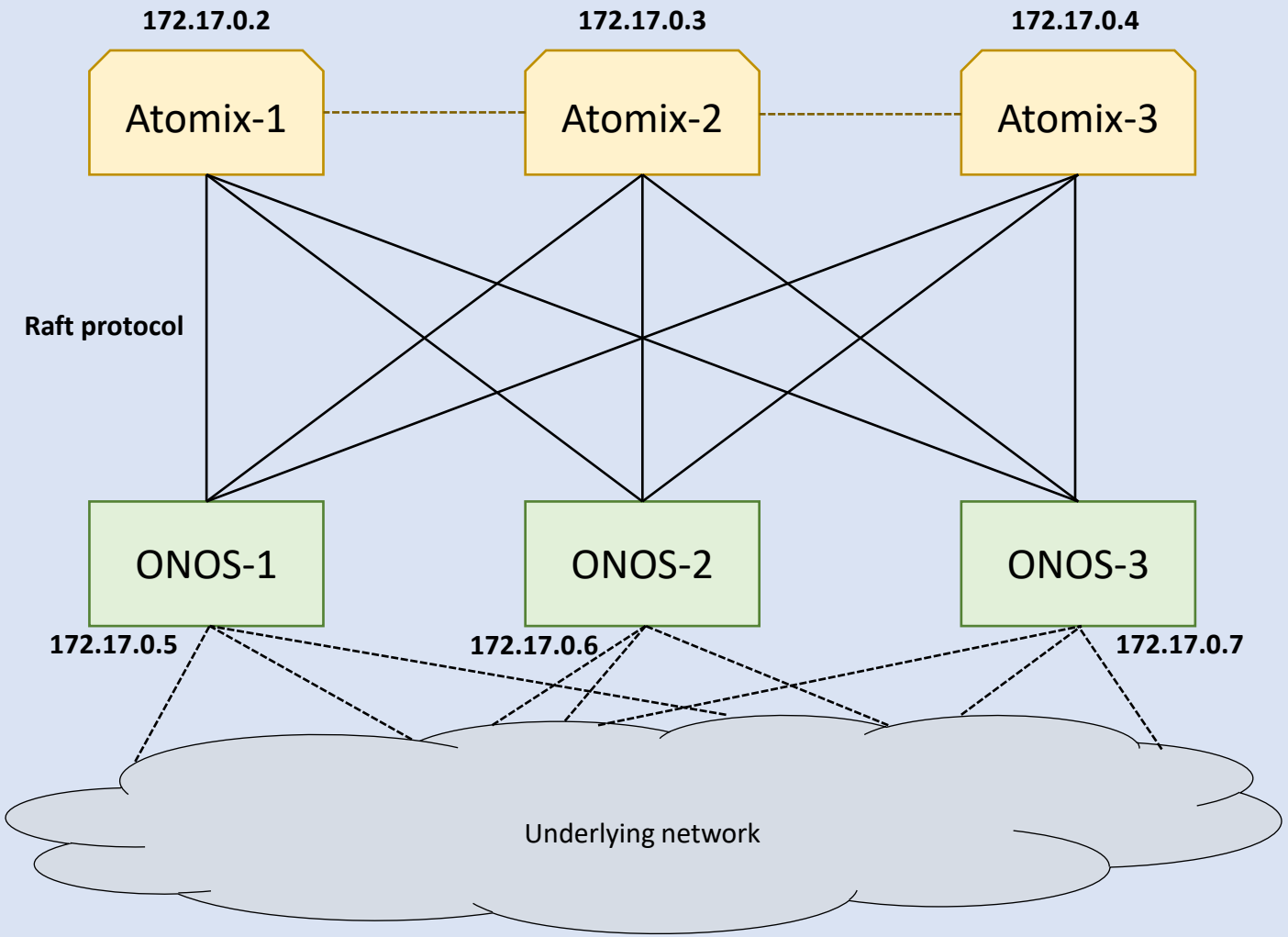


Demo

Created Layer 2 Overlay Networks

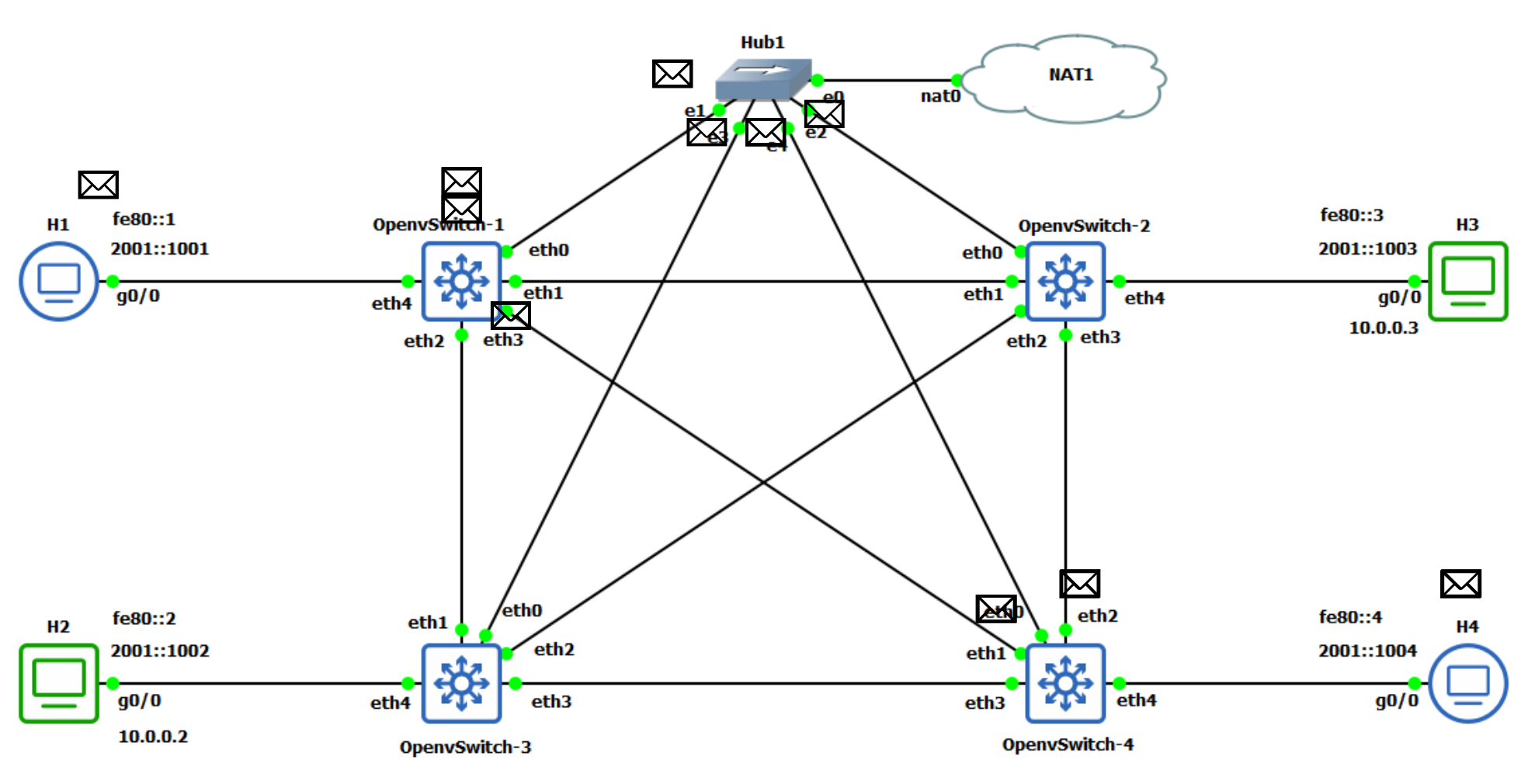


Use Case-2: Testing the Network with Multiple ONOS Controllers



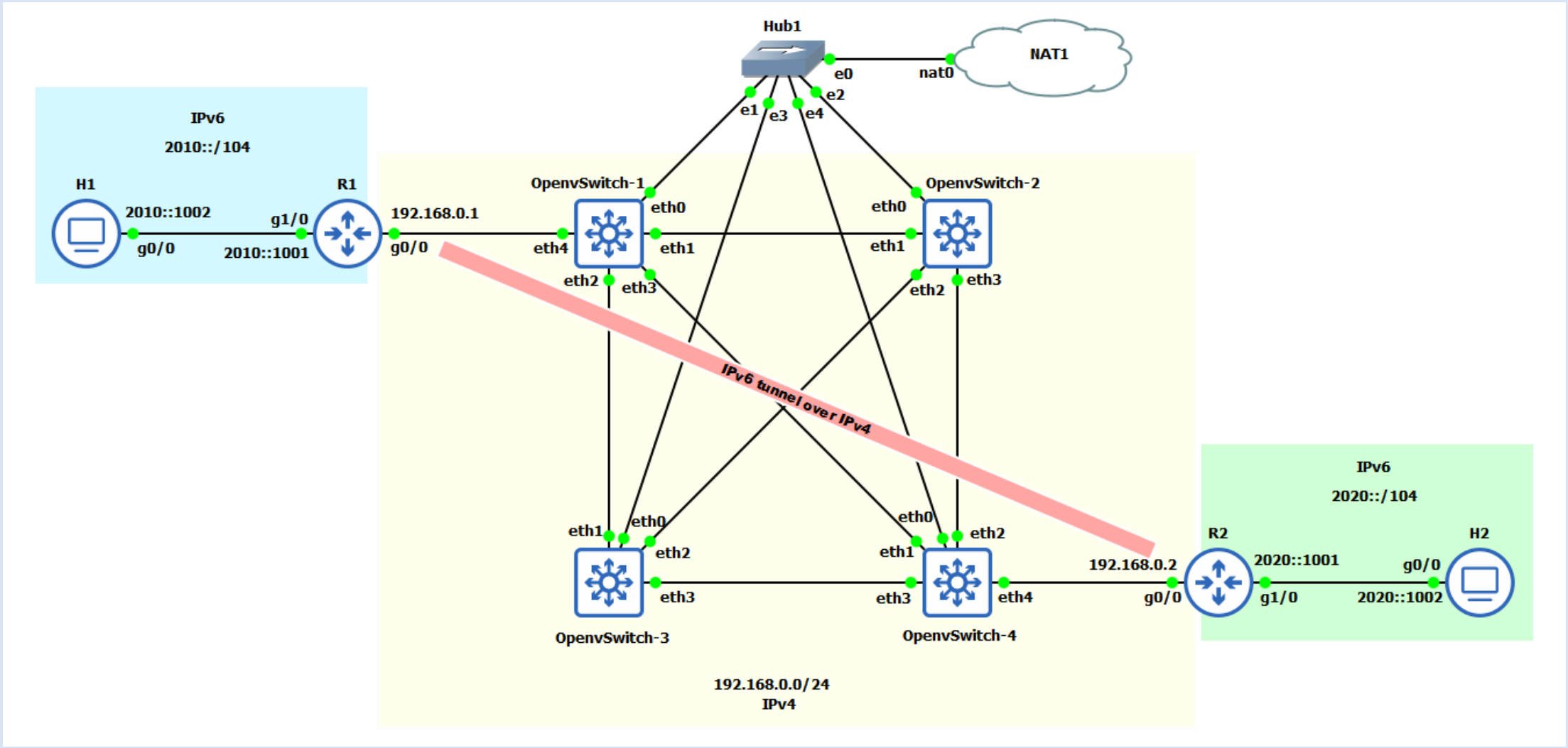
Demo

Use Case-3: Testing the ONOS Controller with IPv6 Addressing

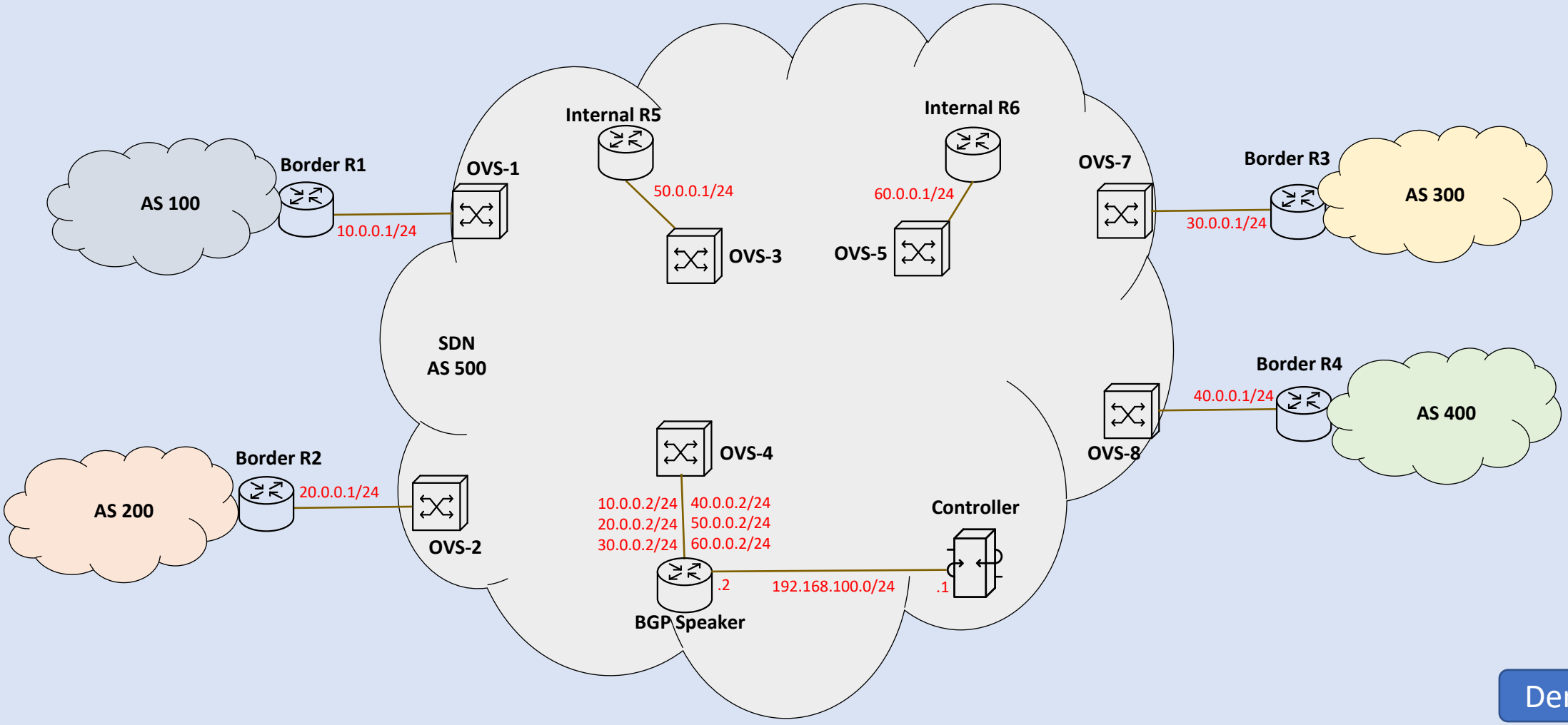


Demo

IPv6 tunneling over IPv4 network



Use Case-4: Integrating Software-defined Network with the Legacy Networks



Demo

Questions?

Thank you!