# Testbed Presentation

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# Agenda

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2. Network Devices and Computational Resources
3. Architecture
4. Testbed Usage Scenarios
5. Testbed Simulation
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   ii. Preliminaries Results
   iii. SC’16 Kytos Demo
6. OpenStack and SDN
7. Huawei and Openflow
8. Current Status
9. Next Steps

SPRACE

# Introduction

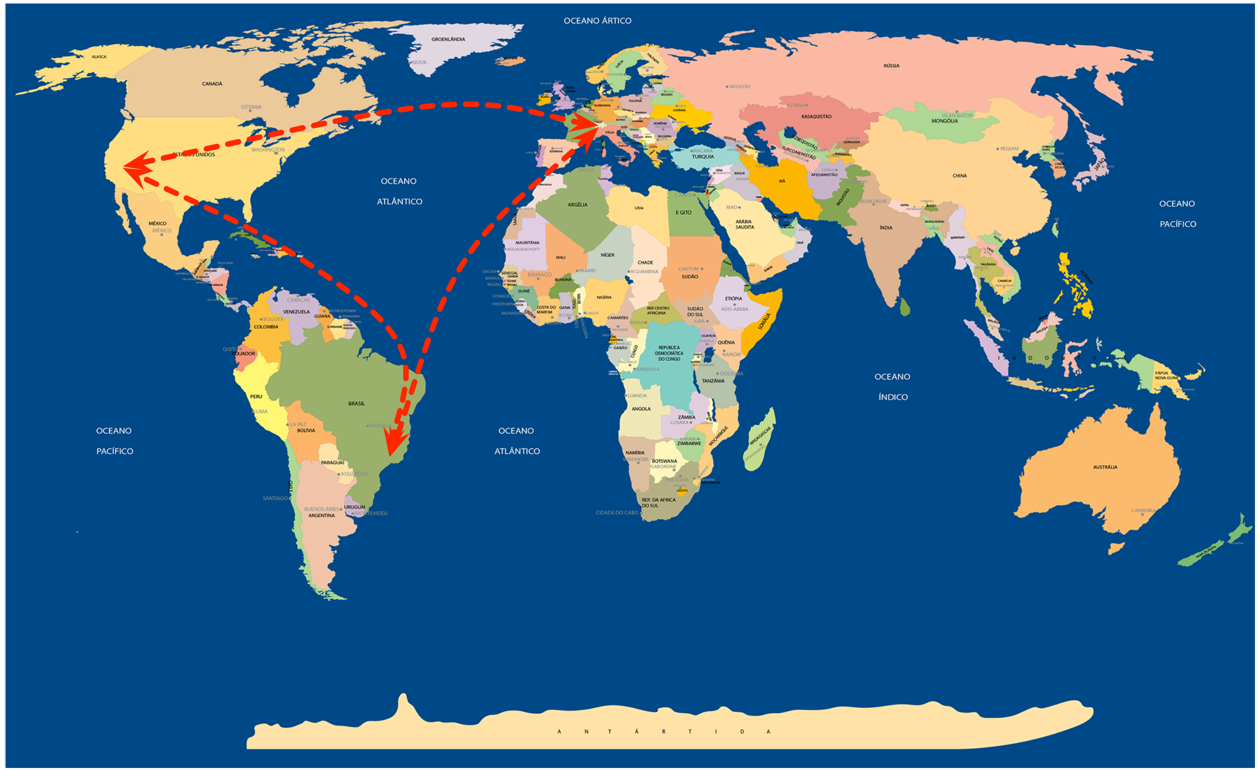
Geographically Distributed Environment to:

- Perform scientific research
- Proof of Concept (POC)
- Deploy and Evaluate new technologies (hardware and software)

# Introduction

Three sites

- North America: Caltech
- Europe: CERN
- South America: NCC (main site)



# Introduction

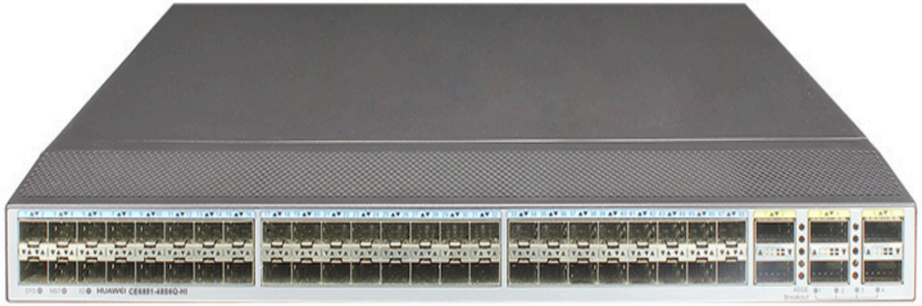
## Who is supporting us?

# Network Devices

## Huawei Switches

- Model: CE8860
  - 2x 100GbE
  - 24x 10G or 25GbE
  - 16x 40GbE
  - Total: 42 Ports
  - Supports SDN (OpenFlow > 1.3)

- Model: CE6851
  - 48x 10GbE
  - 5x 40GbE
  - Total: 53 Ports
  - Supports SDN (Openflow > 1.3)



# Computational Resources

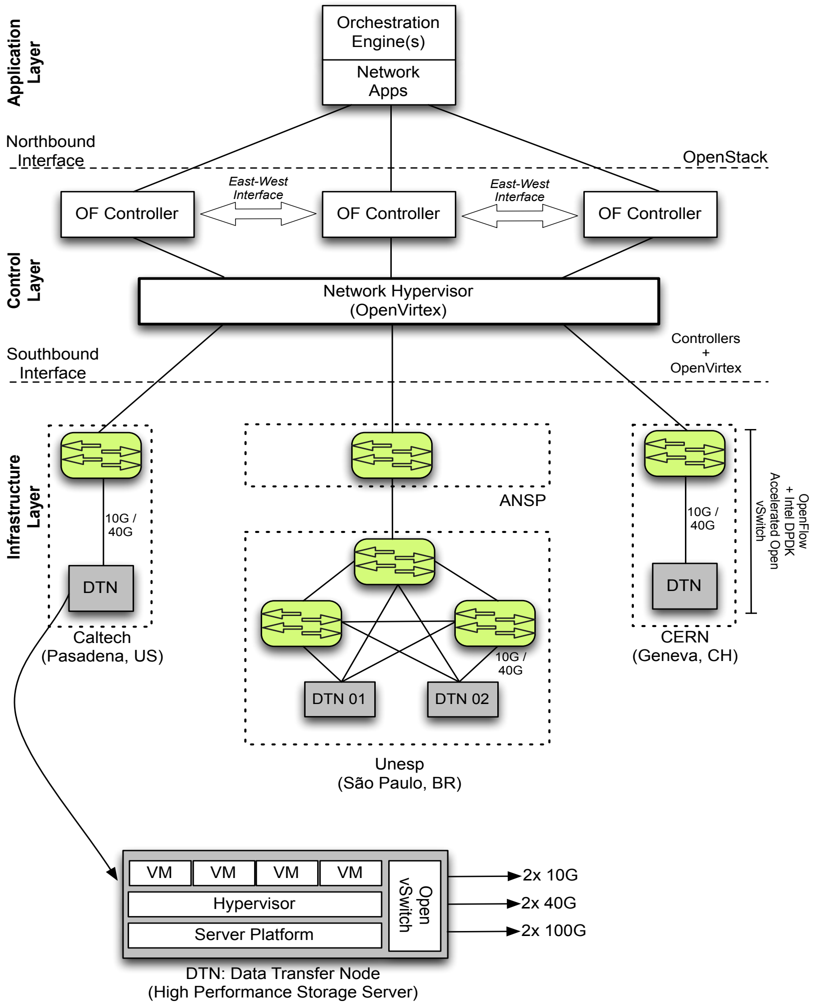
Huawei Servers (Data Transfer Nodes)

- Model: RH2288H V3
- 2x Intel(R) Xeon(R) CPU E5-2690 v3 @ 2.60GHz
- Memory: 128Gb
- 2xSSD Disks in RAID 0 (240GB) and 4xDisks in RAID 1 (7.3TB)

Huawei Servers (Controllers)

- Model: RH2288 V3
- 2x Intel(R) Xeon(R) CPU E5-2695 v3 @ 2.30GHz
- Memory: 64Gb
- 2xSSD Disks in RAID 0 (240GB)

# Architecture



# Testbed Simulation

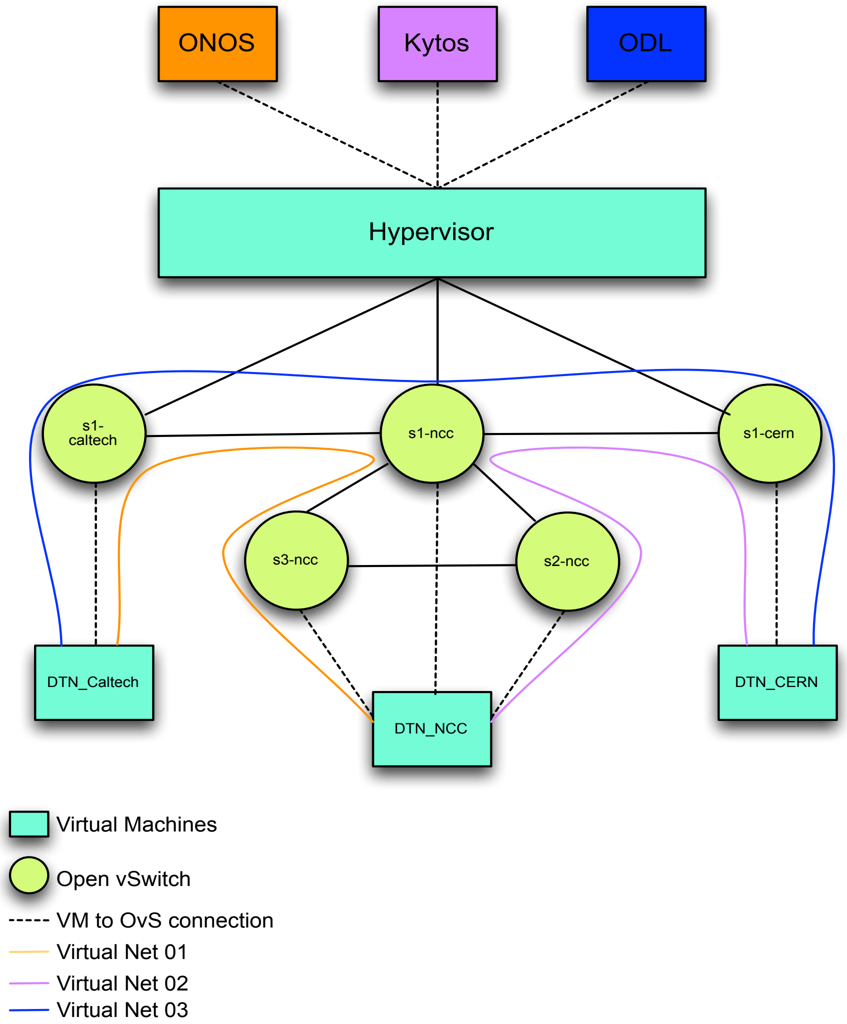
- What is it?
  - Reduction of our testbed that mimics our testbed architecture and topology

- How?
  - Using virtual machines (KVM) and Open vSwitch (Accelerated by Intel DDPK)

- Why?
  - Several usage scenarios, such as:

    - ❑ QA Environment
    - ❑ SW Evaluation
    - ❑ Topology Evaluation
    - ❑ POC
    - ❑ ETC…

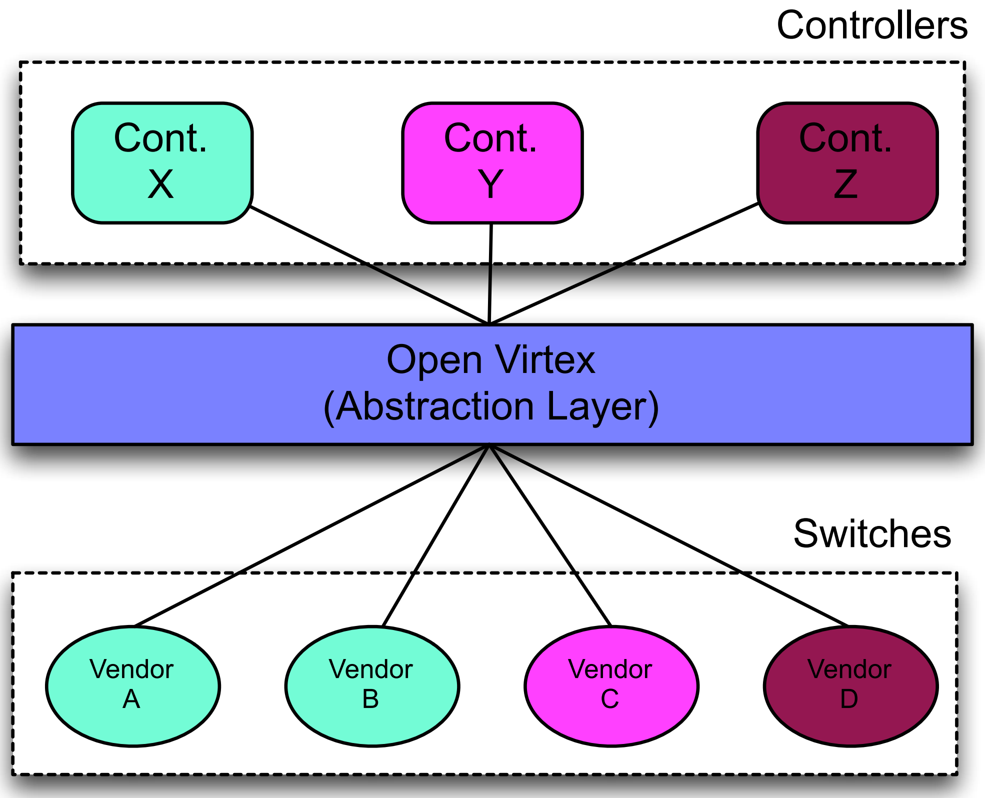
# Testbed Simulation



VM's Configuration:

- DTNs:
  - 4 vCPU
  - Memory: 10GB
- Controllers:
  - 1 vCPU
  - Memory: 2GB
- Hypervisor:
  - 2 vCPU
  - Memory: 5GB

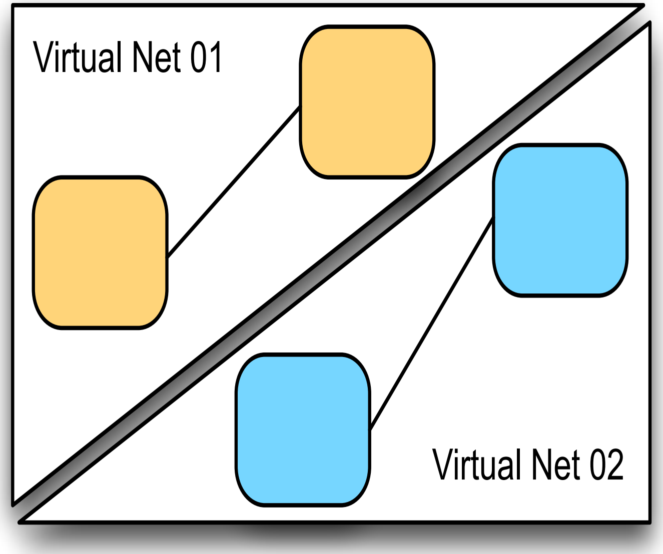
# Testbed Simulation



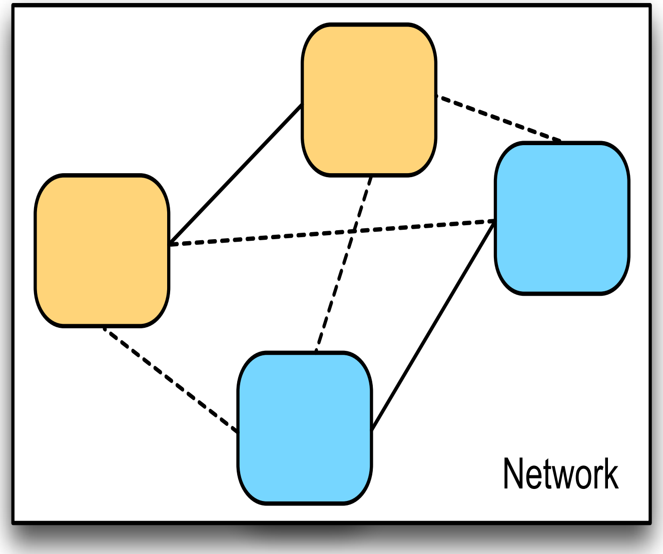
- Controller’s Point of View:
  - There are only switches of a kind

- Switch’s Point of View:
  - There is only one switch available

# OpenVirtex Vs FlowVisor



OpenVirtex



FlowVisor

- Network completely segmented (by sw port)
- Hosts inside VN01 can not reach VN02

- Network is segmented by packet type or protocol
- Hosts can reach each other

# Testbed Simulation

**Cria a rede, dizendo qual Controller será usado:**

```
  ovxctl.py -n createNetwork tcp:10.10.0.20:6633 10.0.0.0 16
```

**Cria os switches virtuais:**

```
  ovxctl.py -n createSwitch 1 00008664b7c93d40
  ovxctl.py -n createSwitch 1 0000ca63a25d5c41
  ovxctl.py -n createSwitch 1 00007a1088f88a46
```

**Cria as portas virtuais dos Switches:**

```
  ovxctl.py -n createPort 1 00008664b7c93d40 6
  ovxctl.py -n createPort 1 00008664b7c93d40 7
  ovxctl.py -n createPort 1 00:00:ca:63:a2:5d:5c:41 12
  ovxctl.py -n createPort 1 00:00:ca:63:a2:5d:5c:41 8
  ovxctl.py -n createPort 1 00:00:7a:10:88:f8:8a:46 13
  ovxctl.py -n createPort 1 00:00:7a:10:88:f8:8a:46 9
```

**Cria os links:**

```
 ovxctl.py -n connectLink 1 00:a4:23:05:00:00:00:01 2 00:a4:23:05:00:00:00:03 1 spf 1
  ovxctl.py -n connectLink 1 00:a4:23:05:00:00:00:03 2 00:a4:23:05:00:00:00:02 2 spf 1
```

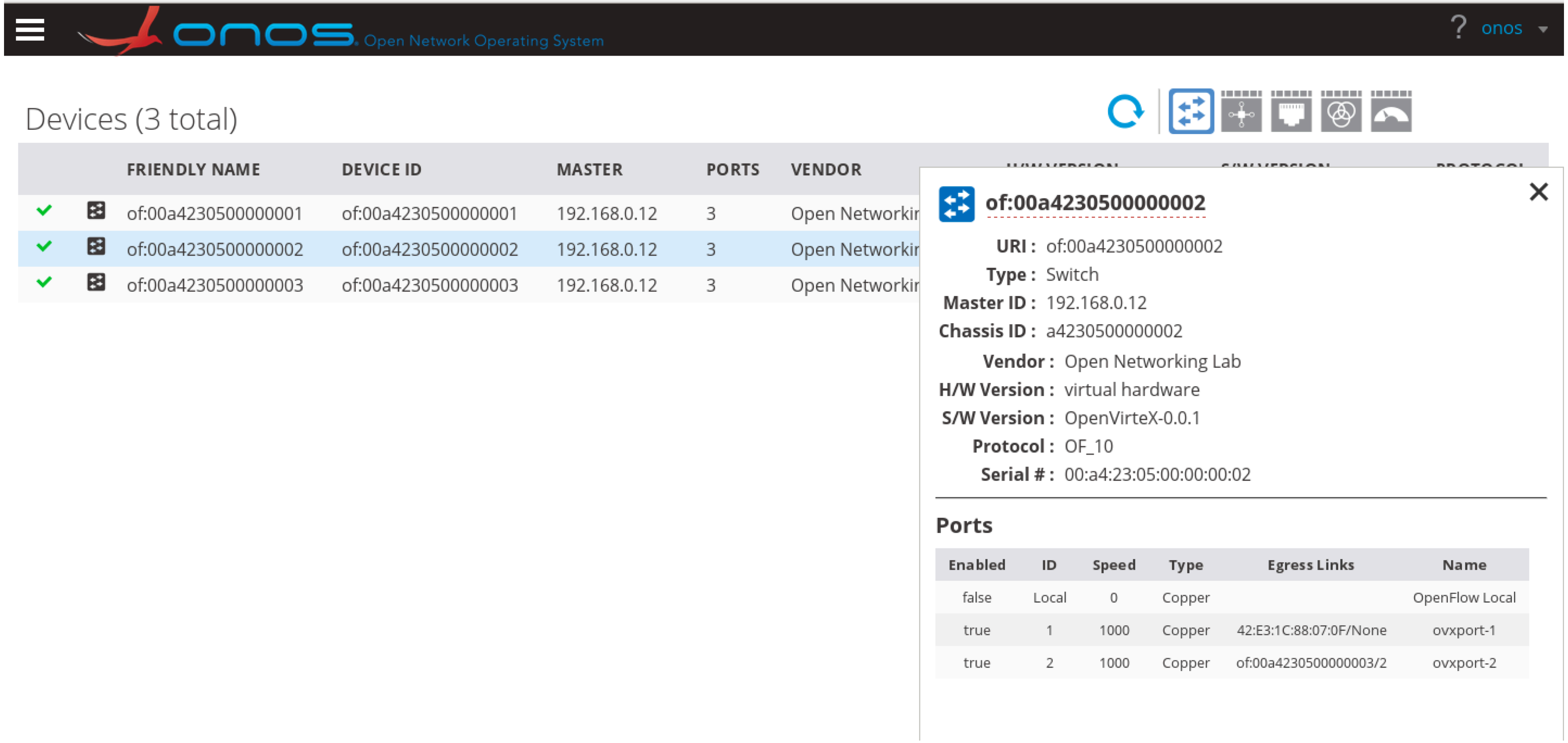
**Cria os hosts:**

```
  ovxctl.py -n connectHost 1 00:a4:23:05:00:00:00:01 1 36:CD:3F:36:71:92
  ovxctl.py -n connectHost 1 00:a4:23:05:00:00:00:02 1 42:e3:1c:88:07:0f
```

**Sobre a rede virtual:**

```
  ovxctl.py -n startNetwork 1
```

# Testbed Simulation



Devices (3 total)

|  |  | FRIENDLY NAME | DEVICE ID | MASTER | PORTS | VENDOR |
|---|---|---|---|---|---|---|
| ✓ |  | of:00a4230500000001 | of:00a4230500000001 | 192.168.0.12 | 3 | Open Networkin |
| ✓ |  | of:00a4230500000002 | of:00a4230500000002 | 192.168.0.12 | 3 | Open Networkin |
| ✓ |  | of:00a4230500000003 | of:00a4230500000003 | 192.168.0.12 | 3 | Open Networkin |

**of:00a4230500000002**

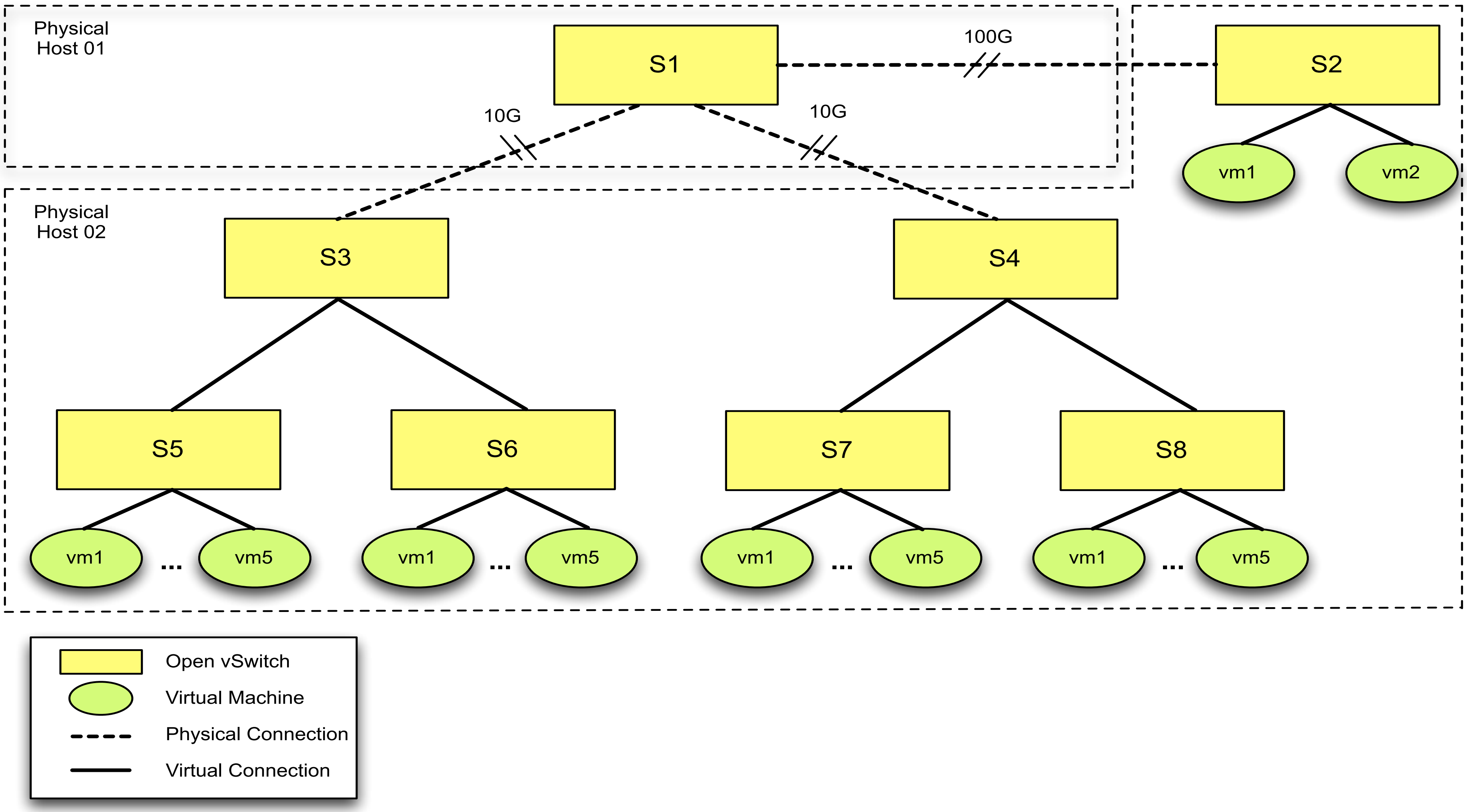
URI : of:00a4230500000002
Type : Switch
Master ID : 192.168.0.12
Chassis ID : a4230500000002
Vendor : Open Networking Lab
H/W Version : virtual hardware
S/W Version : OpenVirteX-0.0.1
Protocol : OF_10
Serial # : 00:a4:23:05:00:00:00:02

**Ports**

| Enabled | ID | Speed | Type | Egress Links | Name |
|---|---|---|---|---|---|
| false | Local | 0 | Copper |  | OpenFlow Local |
| true | 1 | 1000 | Copper | 42:E3:1C:88:07:0F/None | ovxport-1 |
| true | 2 | 1000 | Copper | of:00a4230500000003/2 | ovxport-2 |

Open Virtex GUI

# Kytos Controller Demo



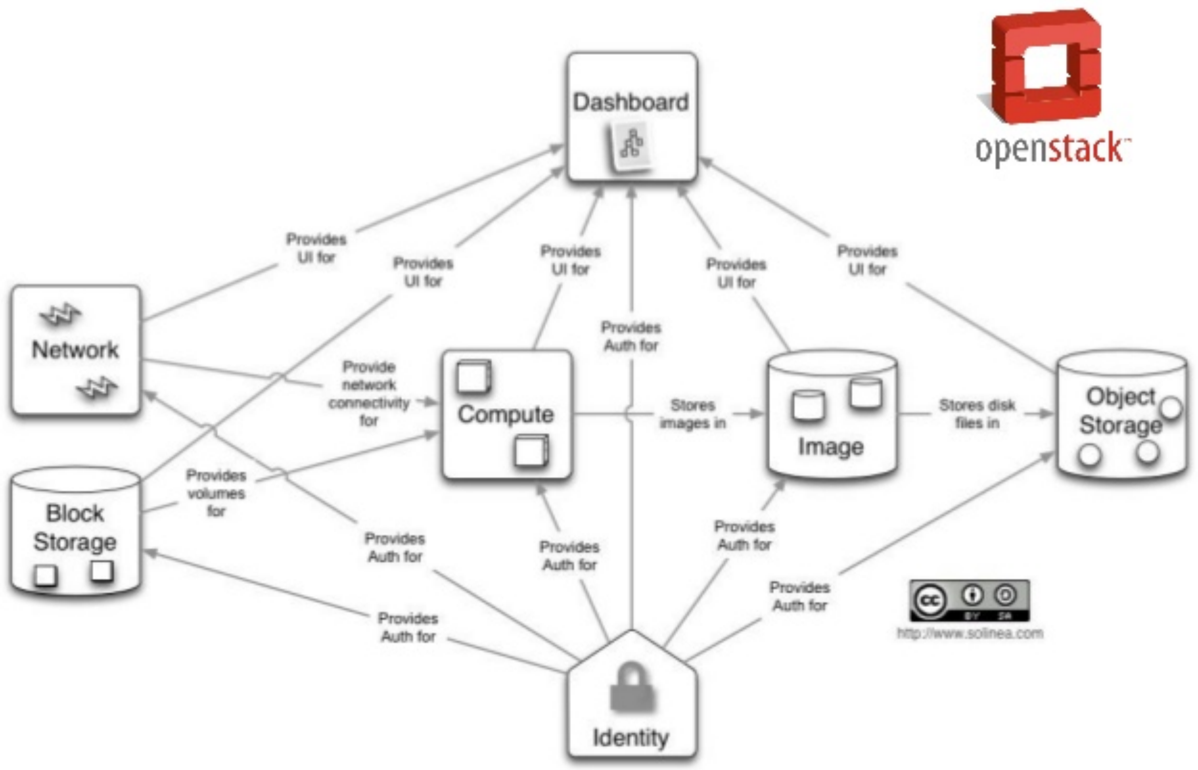
# OpenStack

Responsible for manage datacenter resources (compute nodes, storage and networking) to create a cloud environment.

Modular software concept – each module manages an specific kind of resource

- Keystone – identity
- Glance – image repository
- Nova – compute management
- Neutron – networking management
- Horizon – system dashboard
- Cinder – Block Storage provider
- and others…

# OpenStack Modules



Font: openstack.org

Management of network resources

Creation of network objects

- Network
- subnets
- switches
- routers
- Firewalls
- VPNs
- Load Balancers

Networking provided by agent plugins

- Native Linux networking mechanisms
- External devices
- SDN Controllers

# OpenStack – Neutron (Service and Components)

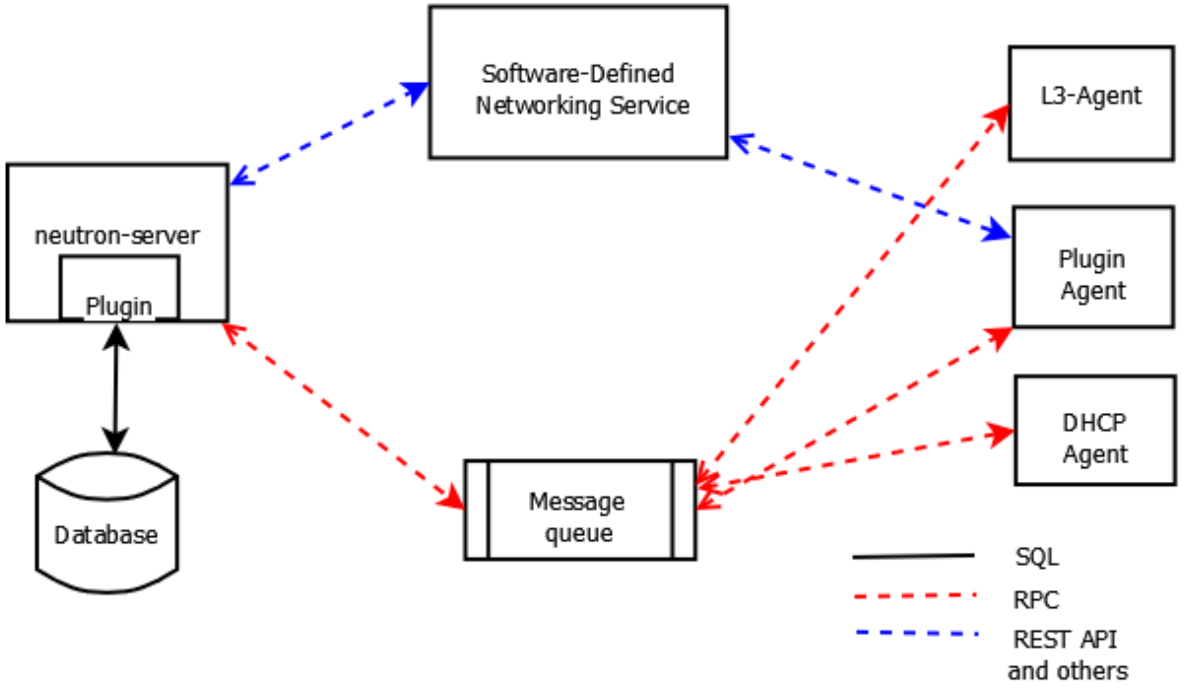
Neutron Server

- Plugins
- Agents
  - Layer 2 (Ethernet and Switching)
  - Layer 3 (IP and routing)
- Services
  - Routing services
  - VPNaaS
  - LBaaS
  - FWaaS

# OpenStack – Neutron

Integrate networking services with SDN controllers to provide virtual networking to the cloud infrastructure

- Integration between Neutron and SDN controller software through REST API

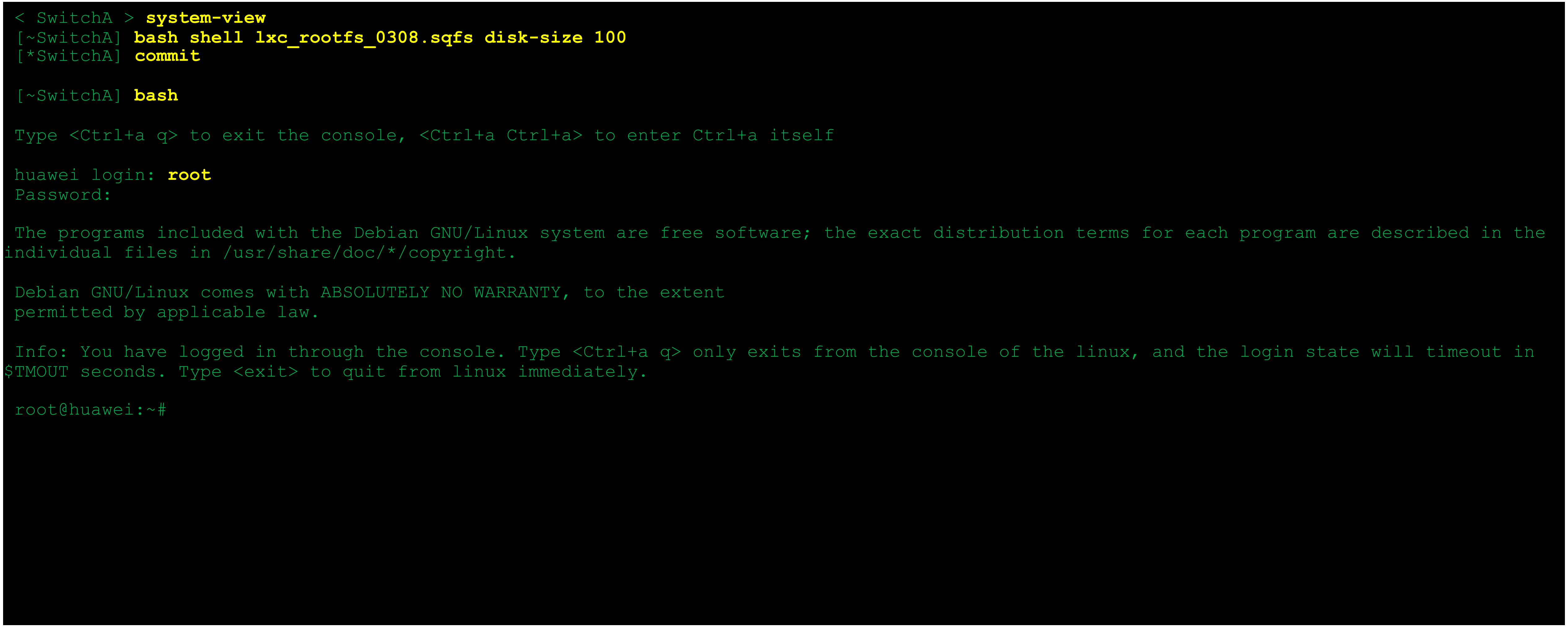


# Huawei and Openflow

Considerations:

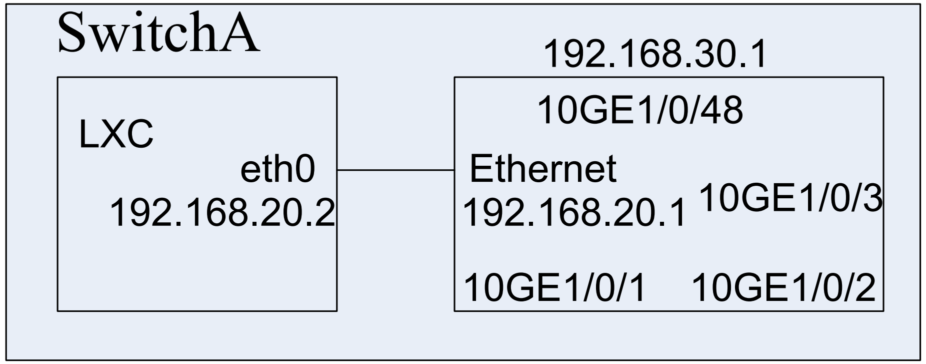
- Huawei Switches support version 1.3
- Necessary to create a *docker* inside the Switch to support controllers
- When using Huawei’s controller (Agile) *docker* is not necessary

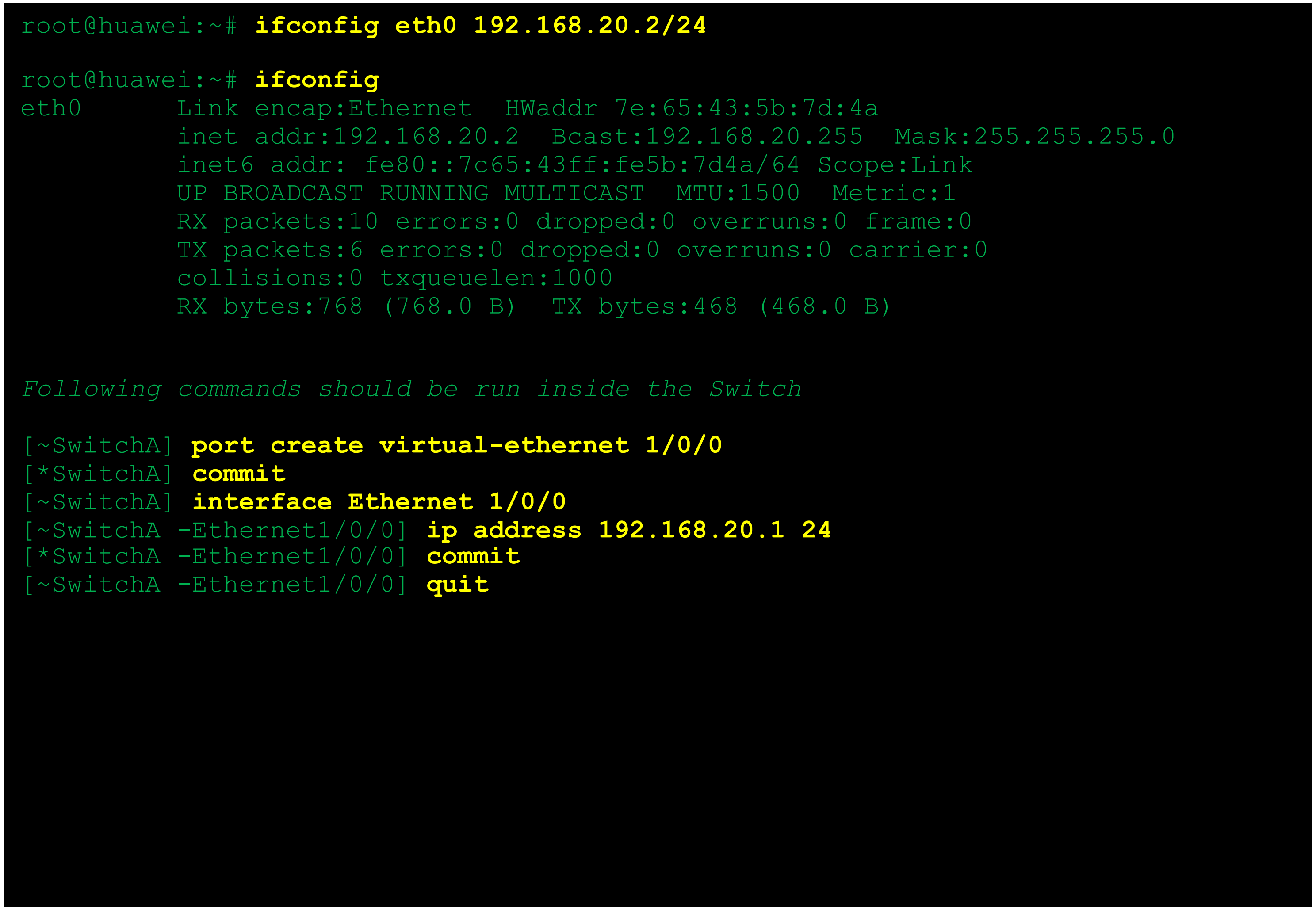
# Huawei and Openflow



```
< SwitchA > system-view
[~SwitchA] bash shell lxc_rootfs_0308.sqfs disk-size 100
[*SwitchA] commit

[~SwitchA] bash

Type <Ctrl+a q> to exit the console, <Ctrl+a Ctrl+a> to enter Ctrl+a itself

huawei login: root
Password:

The programs included with the Debian GNU/Linux system are free software; the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.

Info: You have logged in through the console. Type <Ctrl+a q> only exits from the console of the linux, and the login state will timeout in
$TMOUT seconds. Type <exit> to quit from linux immediately.

root@huawei:~#
```

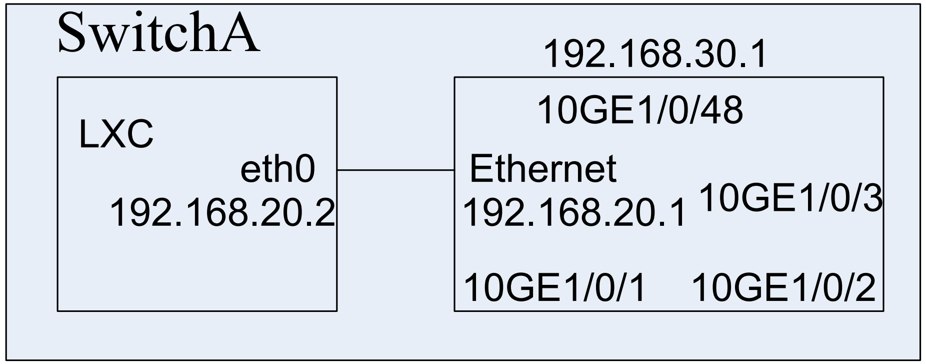
# Huawei and Openflow

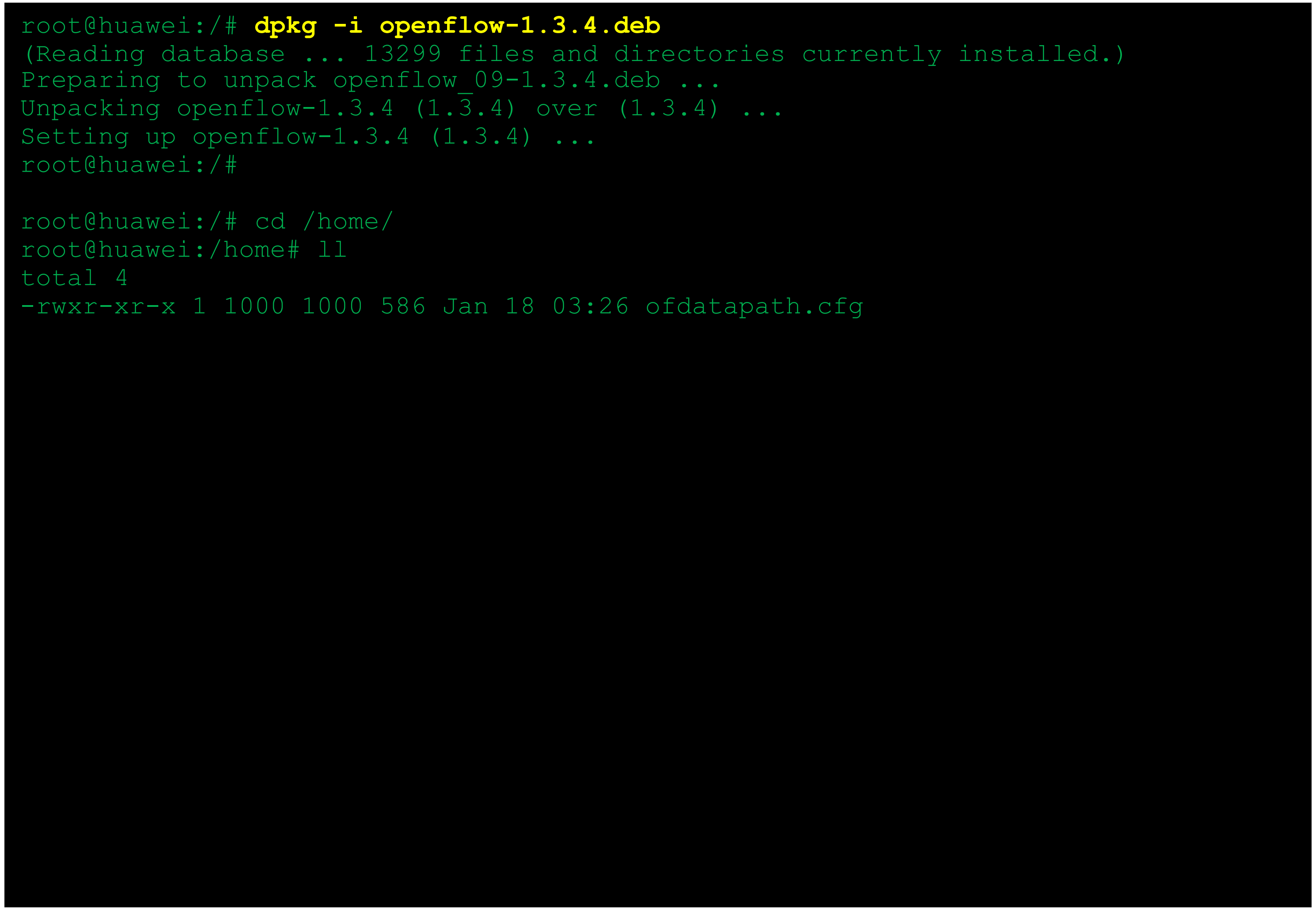




```
root@huawei:~# ifconfig eth0 192.168.20.2/24

root@huawei:~# ifconfig
eth0      Link encap:Ethernet  HWaddr 7e:65:43:5b:7d:4a
          inet addr:192.168.20.2  Bcast:192.168.20.255  Mask:255.255.255.0
          inet6 addr: fe80::7c65:43ff:fe5b:7d4a/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:10 errors:0 dropped:0 overruns:0 frame:0
          TX packets:6 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:768 (768.0 B)  TX bytes:468 (468.0 B)


Following commands should be run inside the Switch

[~SwitchA] port create virtual-ethernet 1/0/0
[*SwitchA] commit
[~SwitchA] interface Ethernet 1/0/0
[~SwitchA -Ethernet1/0/0] ip address 192.168.20.1 24
[*SwitchA -Ethernet1/0/0] commit
[~SwitchA -Ethernet1/0/0] quit
```

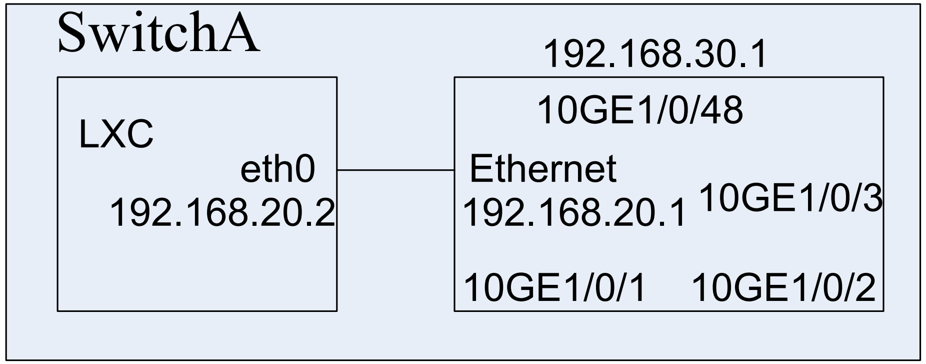
# Huawei and Openflow

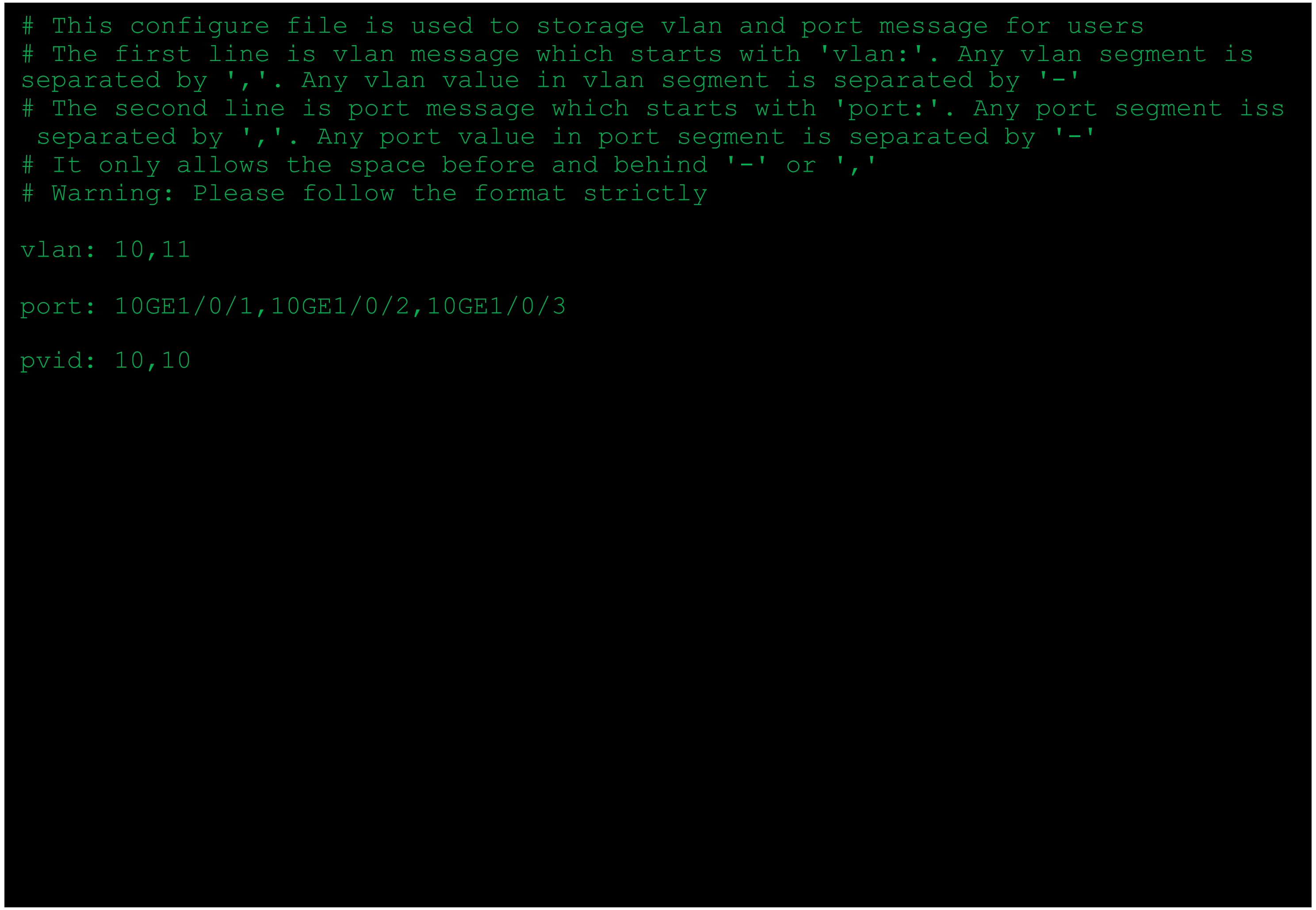




```
root@huawei:/# dpkg -i openflow-1.3.4.deb
(Reading database ... 13299 files and directories currently installed.)
Preparing to unpack openflow_09-1.3.4.deb ...
Unpacking openflow-1.3.4 (1.3.4) over (1.3.4) ...
Setting up openflow-1.3.4 (1.3.4) ...
root@huawei:/#

root@huawei:/# cd /home/
root@huawei:/home# ll
total 4
-rwxr-xr-x 1 1000 1000 586 Jan 18 03:26 ofdatapath.cfg
```

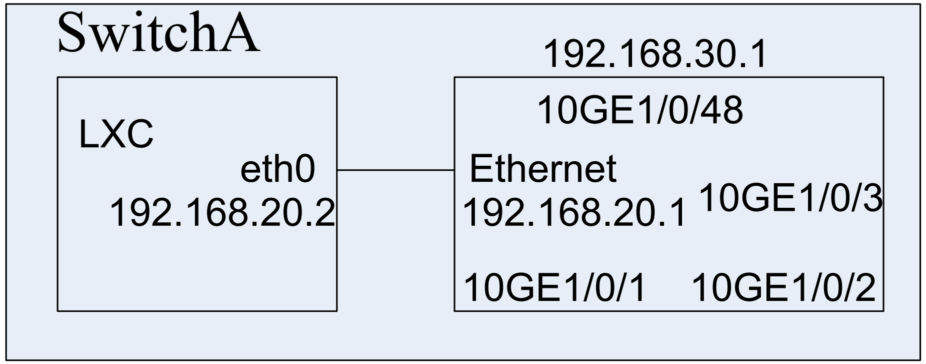
# Huawei and Openflow

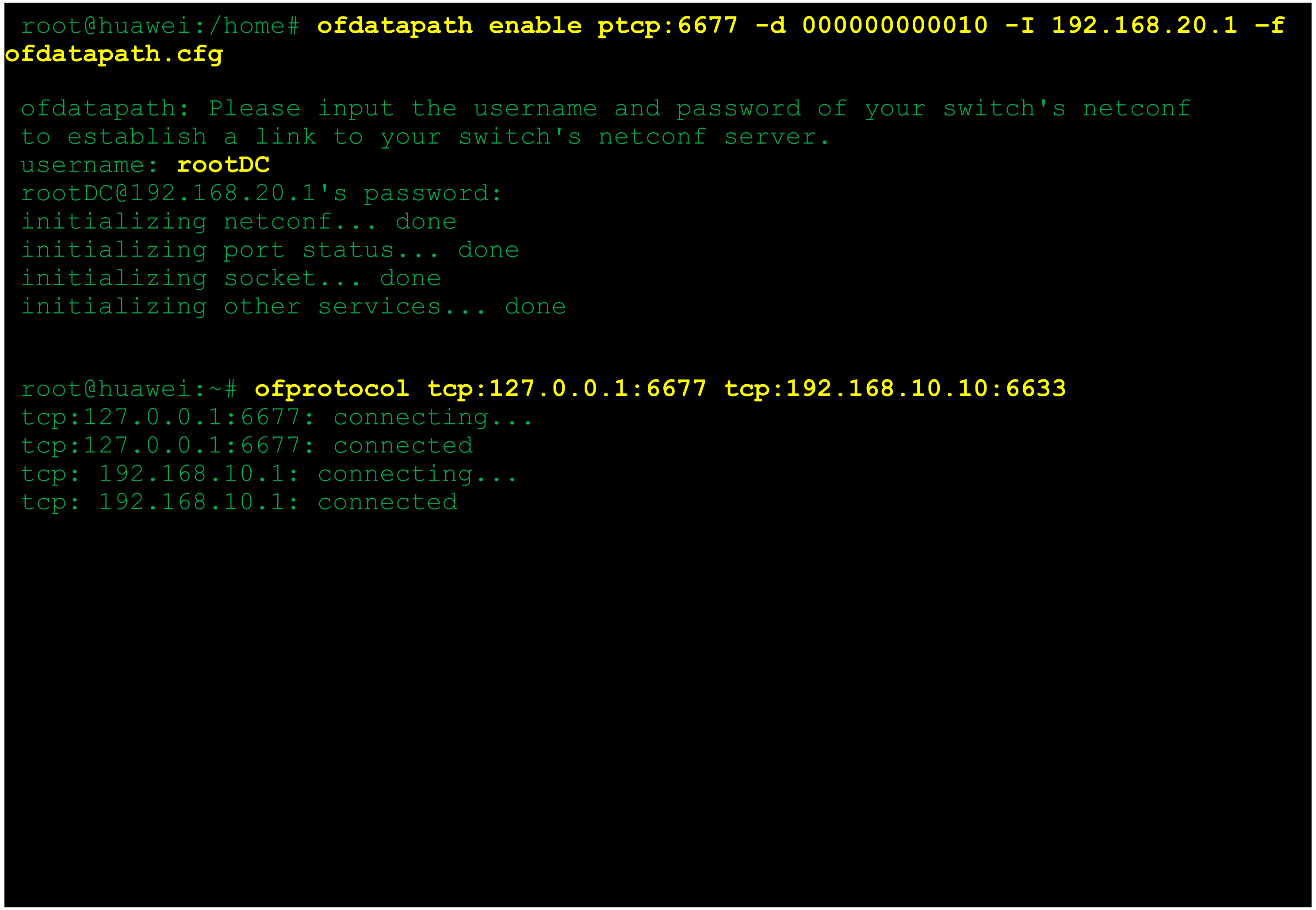




```
# This configure file is used to storage vlan and port message for users
# The first line is vlan message which starts with 'vlan:'. Any vlan segment is
separated by ','. Any vlan value in vlan segment is separated by '-'
# The second line is port message which starts with 'port:'. Any port segment iss
 separated by ','. Any port value in port segment is separated by '-'
# It only allows the space before and behind '-' or ','
# Warning: Please follow the format strictly

vlan: 10,11

port: 10GE1/0/1,10GE1/0/2,10GE1/0/3

pvid: 10,10
```

# Huawei and Openflow





```
root@huawei:/home# ofdatapath enable ptcp:6677 -d 000000000010 -I 192.168.20.1 -f
ofdatapath.cfg

ofdatapath: Please input the username and password of your switch's netconf
to establish a link to your switch's netconf server.
username: rootDC
rootDC@192.168.20.1's password:
initializing netconf... done
initializing port status... done
initializing socket... done
initializing other services... done


root@huawei:~# ofprotocol tcp:127.0.0.1:6677 tcp:192.168.10.10:6633
tcp:127.0.0.1:6677: connecting...
tcp:127.0.0.1:6677: connected
tcp: 192.168.10.1: connecting...
tcp: 192.168.10.1: connected
```

# Current Status

❑ NCC Side machines are already deployed (using CentOS 7)

❑Switches are installed and updated (used during SC’16)

❑ Image installation and scripts are ready

❑ Software and tools are under test in our testbed

# Next Steps

- ❑ Deploy CERN and CALTECH equipment
- ❑ Send equipment to US and Europe
- ❑ Define final architecture (OpenStack + OpenVirtex + XOS)
- ❑ Write and evaluate some scenarios to run in our Testbed

# Questions and Answers