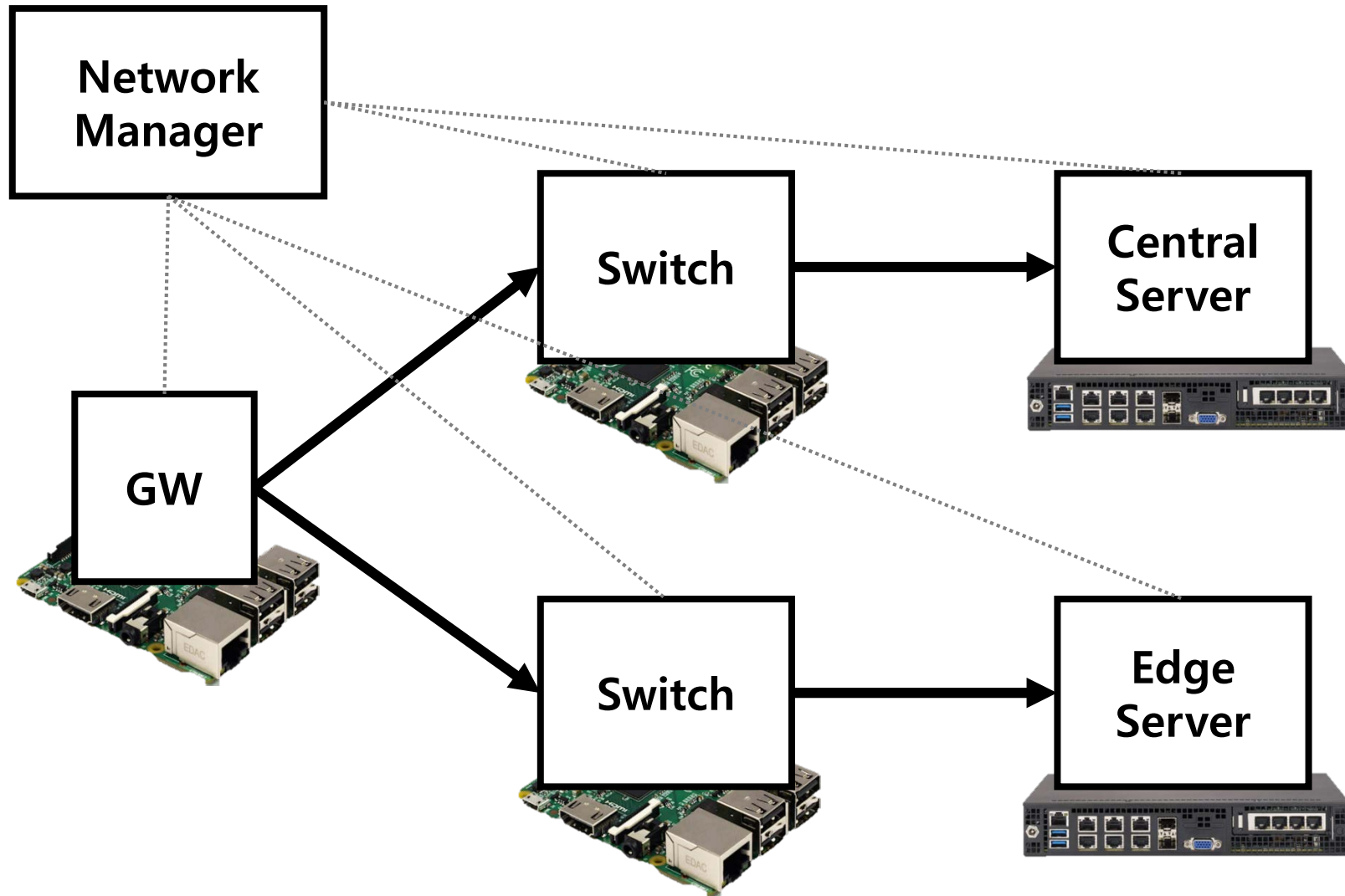


# **iCPS Simulation - Network**

**Division 4. – Korea University**

# Simulation Environment



# **1. Network Manager**

Division 4. – Korea University

# Install SDN Controller (OPENDaylight)

- `cd iCPS_Network_Manager`
- `mvn clean install -DskipTests -o`

```
mnc@mnc-VirtualBox: ~/iCPS_Network_Manager
mnc@mnc-VirtualBox:~/iCPS_Network_Manager$ mvn clean install -DskipTests -o
```



```
[INFO] sfc-vmm-socket ..... SUCCESS [ 0.540 s]
[INFO] sfc-bootstrap ..... SUCCESS [ 7.408 s]
[INFO] features-sfc ..... SUCCESS [ 9.807 s]
[INFO] sfc-karaf ..... SUCCESS [01:19 min]
[INFO] BUILD SUCCESS
[INFO] Total time: 05:42 min
[INFO] Finished at: 2018-05-08T17:31:30+09:00
[INFO] Final Memory: 155M/239M
[INFO] -----
```

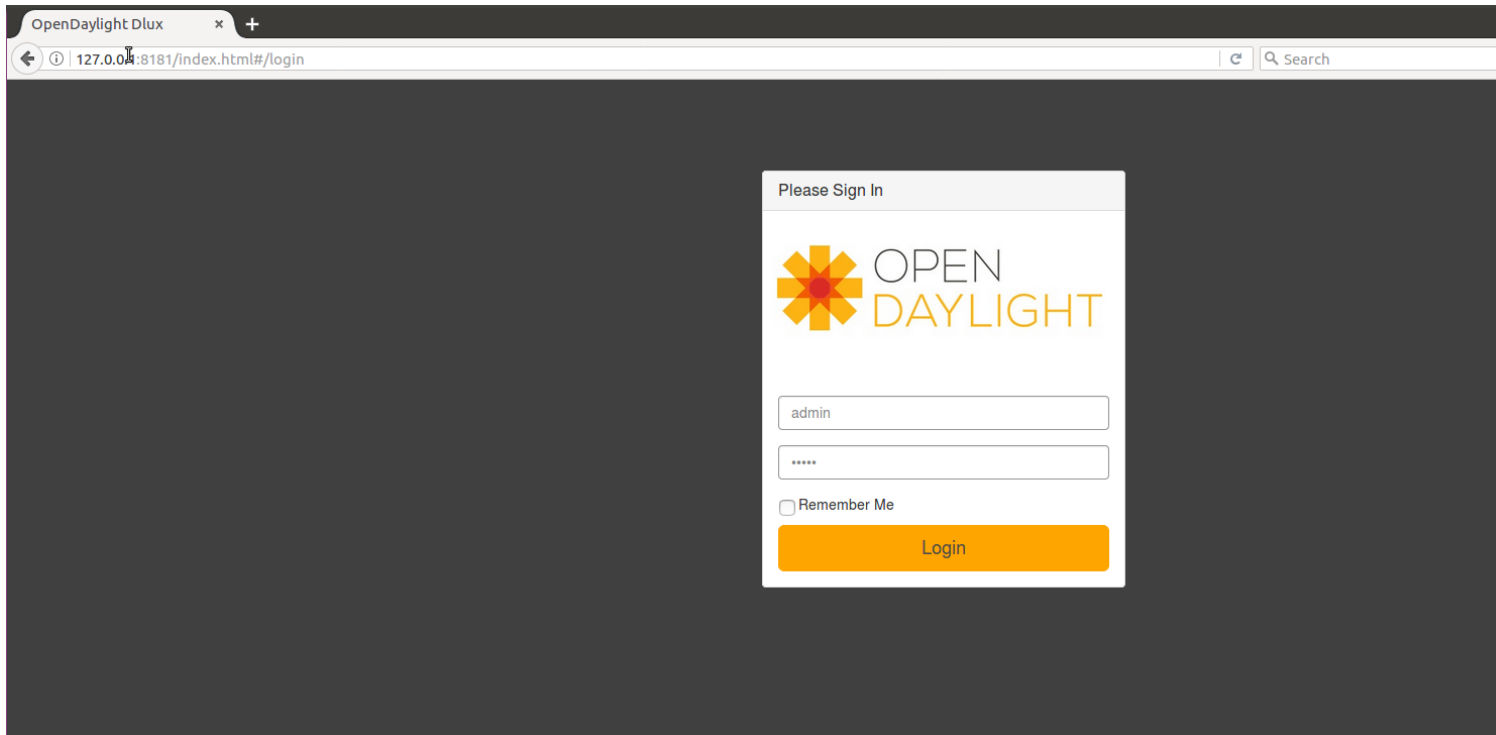
# Start SDN Controller (OPENDaylight)

- `cd iCPS_Network_Manager/sfc-karaf/target/assembly/bin`
- `./karaf`

[illegible]

# OPENDAYLIGHT UI

- (Browser) 127.0.0.1:8181/index.html
- ID : admin / pass : admin



# OPENDAYLIGHT - Config

- Paste script then, Apply

Service Nodes

Service Function Forwarders

Service Functions

Service Function Chains

Service Function Paths

Access Lists/Classifiers

NSH Metadata

IPFIX APPID

System Info

Config

Json config content

```
{
  },
  {
    "name": "FW-Edge-MCI",
    "sff-sf-data-plane-locator": {
      "sf-dpl-name": "fw-edge-mcl-dpl",
      "sff-dpl-name": "edge-cloud-switch-dpl"
    }
  }
],
"ip-mgmt-address": "192.168.100.111",
"service-function-forwarder-ovs:ovs-bridge": {
  "bridge-name": "br-2"
},
"service-node": ""
}
}
;
```

Apply

Export

☐ Validate to sfc-rev-2014-07-01 before apply

File

Browse...

No file selected.

Restconf URL

http://127.0.0.1:8181/restconf

Apply

Script is here !

Please double click the  
script-config.txt icon

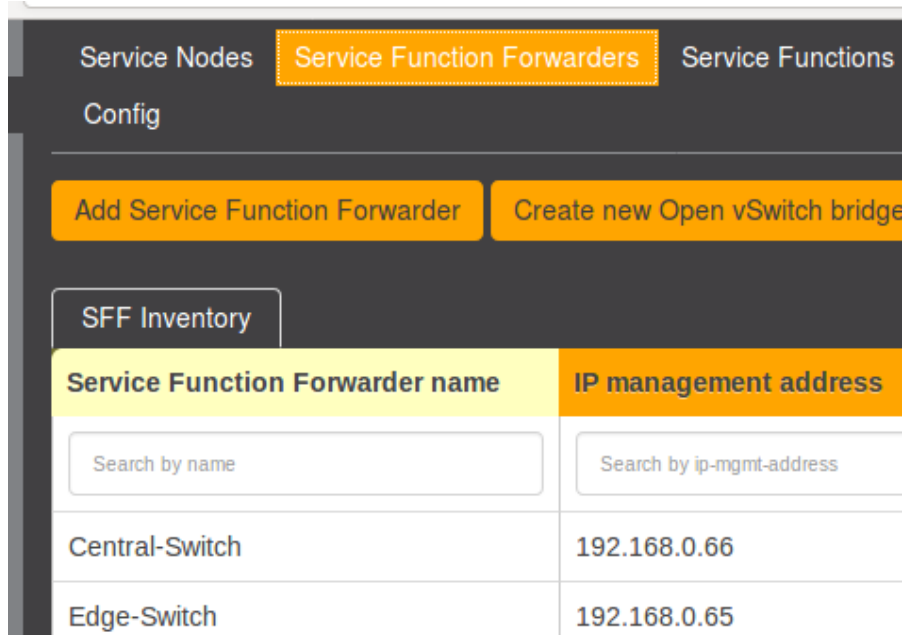
Then, you can find the  
Script



script-config.txt

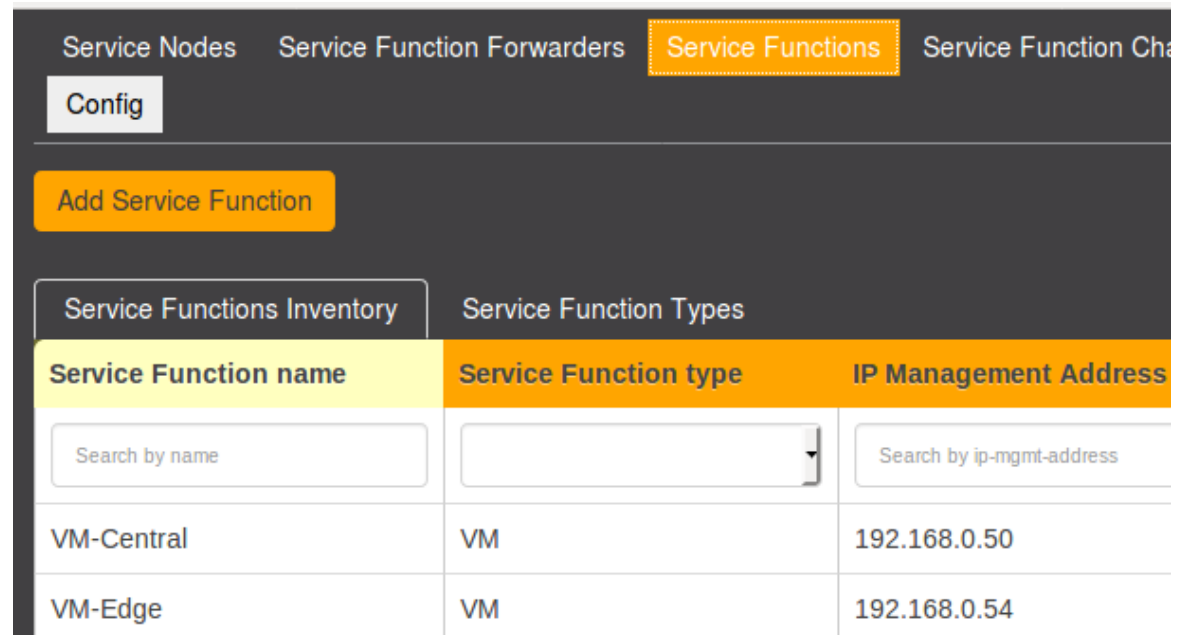
# OPENDAYLIGHT – Service Function

- Checking !
  - Service function forwarders
  - Service functions



The screenshot shows the 'Service Function Forwarders' tab in the OpenDaylight configuration interface. It includes a 'Config' button and two main action buttons: 'Add Service Function Forwarder' and 'Create new Open vSwitch bridge'. Below these is the 'SFF Inventory' section, which contains a table with two columns: 'Service Function Forwarder name' and 'IP management address'. The table lists two entries: 'Central-Switch' with IP '192.168.0.66' and 'Edge-Switch' with IP '192.168.0.65'. Search filters are provided for both columns.

SFF Inventory	
Service Function Forwarder name	IP management address
<input type="text" value="Search by name"/>	<input type="text" value="Search by ip-mgmt-address"/>
Central-Switch	192.168.0.66
Edge-Switch	192.168.0.65



The screenshot shows the 'Service Functions' tab in the OpenDaylight configuration interface. It includes a 'Config' button and an 'Add Service Function' button. Below these is the 'Service Functions Inventory' section, which contains a table with three columns: 'Service Function name', 'Service Function type', and 'IP Management Address'. The table lists two entries: 'VM-Central' with type 'VM' and IP '192.168.0.50', and 'VM-Edge' with type 'VM' and IP '192.168.0.54'. Search filters are provided for all three columns.

Service Functions Inventory		
Service Function name	Service Function type	IP Management Address
<input type="text" value="Search by name"/>	<input type="text"/>	<input type="text" value="Search by ip-mgmt-address"/>
VM-Central	VM	192.168.0.50
VM-Edge	VM	192.168.0.54



# OPENDAYLIGHT – Service Function Chain

- Deploy all service function chains

The image shows a two-part interface for managing Service Function Chains in OpenDaylight.

**Left Panel: Service Function Chains List**

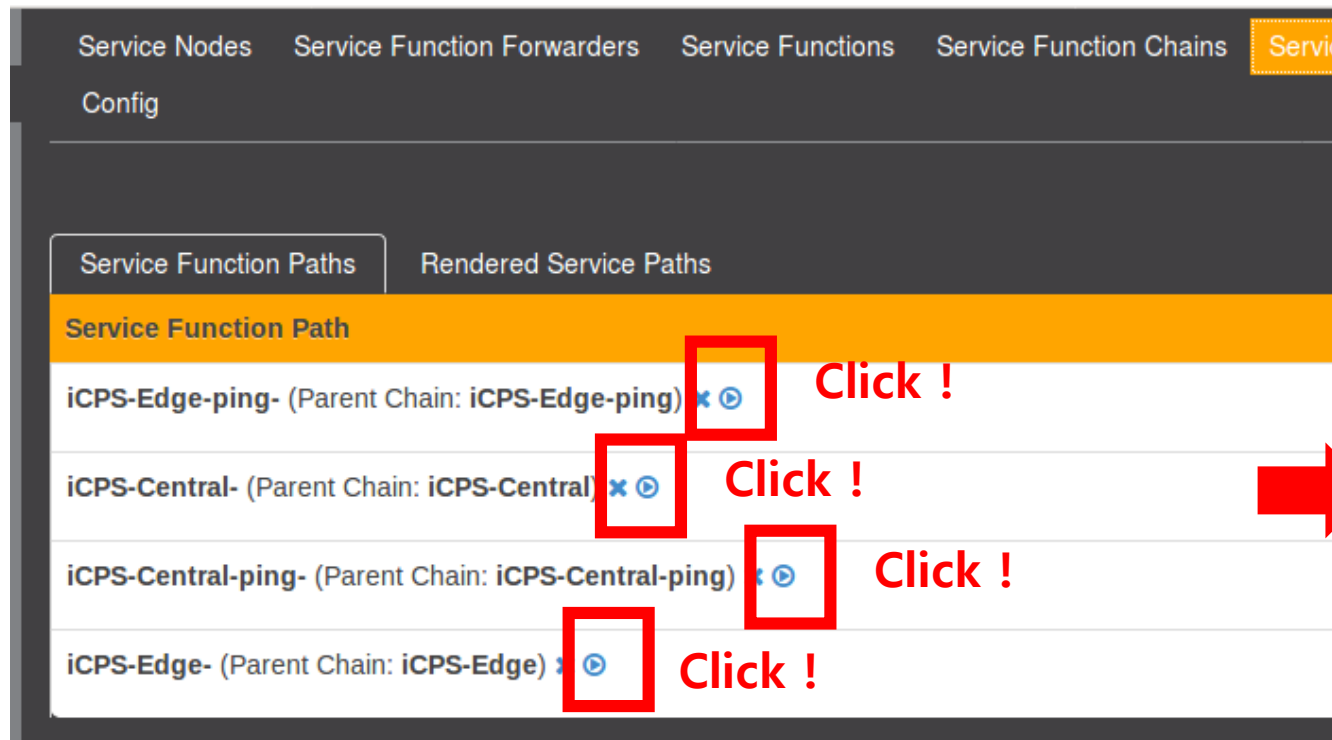
- Navigation tabs: Forwarders, Service Functions, **Service Function Chains** (highlighted in orange).
- Buttons: **Add Service Function Chain** (orange), **Service Function Chain** (orange header).
- Chain List:
  - iCPS-Edge**: Represented by a blue VM icon. A red box highlights the edit icon (a circle with a dot and an 'x'), with a red arrow pointing to the right panel and the text "Click !".
  - iCPS-Centra**: Represented by a blue VM icon. A red box highlights the edit icon, with the text "Click !".

**Right Panel: Creating Service Function Path based on chain 'iCPS-Edge'**

- Header: **Creating Service Function Path based on chain 'iCPS-Edge'** (blue bar).
- Form Fields:
  - Enter unique path name:** Text input containing "iCPS-Edge-".
  - Select a schedule type:** Dropdown menu.
- Schedule Type Selection:** A dropdown menu is open, showing a search bar and a list of options:
  - Select a type
  - iCPS-D4** (highlighted with a red box and "Click !")
  - Random
  - Round Robin
  - Load Balance
  - Shortest Path
  - Weighted SP
  - User Defined

# OPENDAYLIGHT – Service Function Paths

- Deploy all service function paths



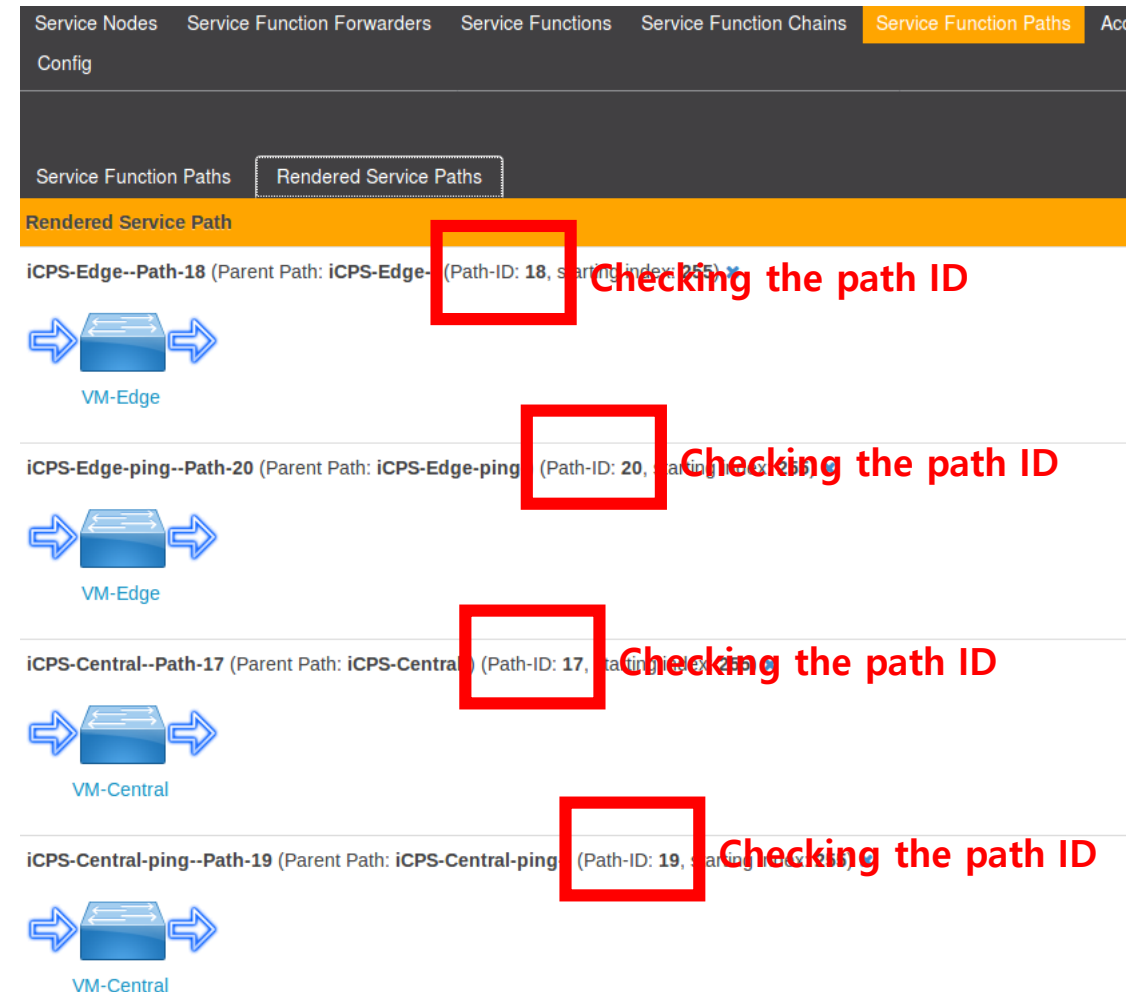
Service Nodes Service Function Forwarders Service Functions Service Function Chains **Service Function Paths**

Config

Service Function Paths Rendered Service Paths

Service Function Path

- iCPS-Edge-ping- (Parent Chain: iCPS-Edge-ping) **Click !**
- iCPS-Central- (Parent Chain: iCPS-Central-) **Click !**
- iCPS-Central-ping- (Parent Chain: iCPS-Central-ping) **Click !**
- iCPS-Edge- (Parent Chain: iCPS-Edge-) **Click !**



Service Nodes Service Function Forwarders Service Functions Service Function Chains **Service Function Paths**

Config

Service Function Paths **Rendered Service Paths**

Rendered Service Path

- iCPS-Edge--Path-18 (Parent Path: iCPS-Edge- (Path-ID: 18, starting index: 255)) **Checking the path ID**
- iCPS-Edge-ping--Path-20 (Parent Path: iCPS-Edge-ping- (Path-ID: 20, starting index: 255)) **Checking the path ID**
- iCPS-Central--Path-17 (Parent Path: iCPS-Central- (Path-ID: 17, starting index: 255)) **Checking the path ID**
- iCPS-Central-ping--Path-19 (Parent Path: iCPS-Central-ping- (Path-ID: 19, starting index: 255)) **Checking the path ID**

# 2. Switch

Division 4. – Korea University

# Install OVS

- cd iCPS\_Network\_Switch
- (Remove the previous OVS related files)
- sudo ./setup\_iCPS\_network\_switch.sh

```
mnc@mnc-VirtualBox:~/iCPS_Network_Switch$ ./setup_iCPS_network_switch.sh
Hit http://kr.archive.ubuntu.com precise Release.gpg
Hit http://kr.archive.ubuntu.com precise-updates Release.gpg
Hit http://kr.archive.ubuntu.com precise-backports Release.gpg
Hit http://kr.archive.ubuntu.com precise Release
Hit http://kr.archive.ubuntu.com precise-updates Release
```



```
* nsh-v8 e38f9ea nsh: fix install script to add ovs to boot startup
Removing old ovs configuration.
Checking Build Dependencies.
Creating Debian Packages.
Installing kernel module using dkms.
Installing openvswitch userland packages.
f60437a1-afa8-4be0-9a34-172c50eb85f6
  ovs_version: "2.3.00"
Install Complete!
```

# Connecting the SDN Controller

- `sudo ovs-vsctl set-manager tcp:(controller IP):6640`

```
mnc@mnc-VirtualBox: ~/iCPS_Network_Switch
mnc@mnc-VirtualBox:~/iCPS_Network_Switch$ sudo ovs-vsctl set-manager tcp:192.168.0.64:6640
```

- `sudo ovs-vsctl show`

```
mnc@mnc-VirtualBox:~/iCPS_Network_Switch$ sudo ovs-vsctl show
f60437a1-afa8-4be0-9a34-172c50eb85f6
    Manager "tcp:192.168.0.64:6640"
        is_connected: true
    ovs_version: "2.3.90"
```

# **3. Central / Edge Cloud**

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# Start Service Function

- cd ICP\_EDGE (or ICPS\_Central)
- sudo ./start\_agent.sh

```
bubuntu@bubuntu-VirtualBox: ~/sfc-py
[sudo] password for bubuntu:
INFO:sfc/sfc_agent.py:ODL locator: 192.168.100.101:8181
INFO:sfc/sfc_agent.py:

===== STARTING SFC AGENT =====
INFO:sfc/sfc_agent.py:

SFC Agent will listen to Opendaylight REST Messages and take any
appropriate action such as creating, deleting, updating SFs, SFFs,
or classifier.

INFO:/home/bubuntu/sfc-py/sfc/common/odl_api.py:Getting SFFs configured in ODL .
.
WARNING:/home/bubuntu/sfc-py/sfc/common/odl_api.py:

Could not determine SFF name. This means ODL is not running
or there is no SFF with a data plane locator IP that matches
one where the SFC agent is running. SFC Agent will retry later...

INFO:werkzeug: * Running on http://0.0.0.0:5000/ (Press CTRL+C to quit)
```

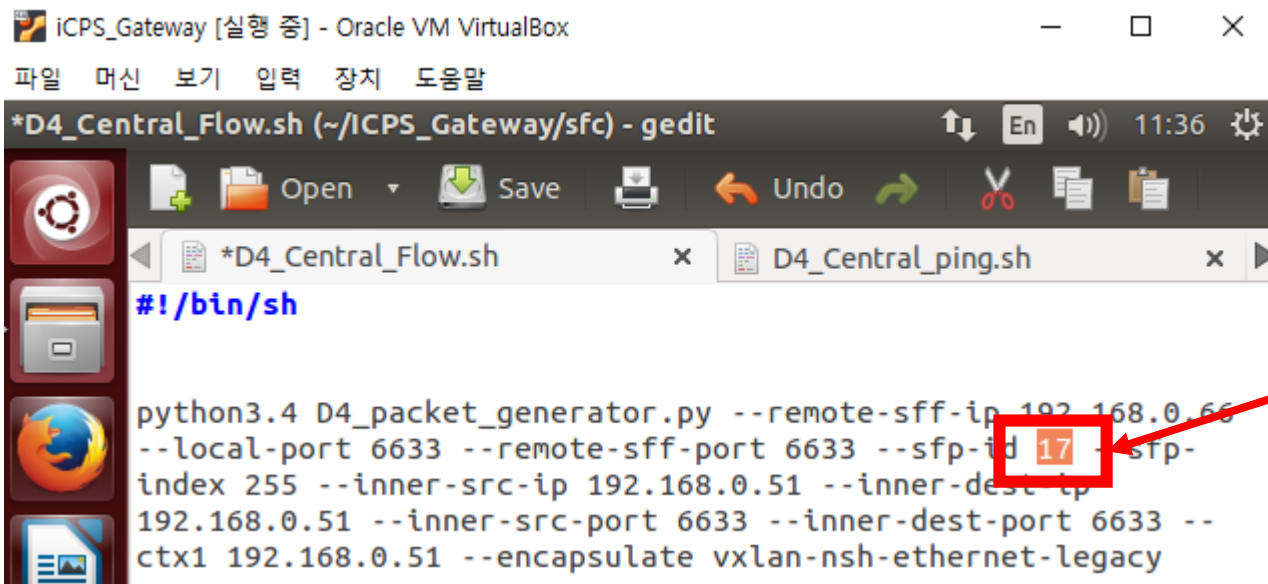
# **4. Gateway**

**Division 4. – Korea University**



# Change sfd id

- Change sfd id at files as follows
  - D4\_Central\_Flow.sh
  - D4\_Central\_ping.sh
  - D4\_Edge\_Flow.sh
  - D4\_Edge\_ping.sh



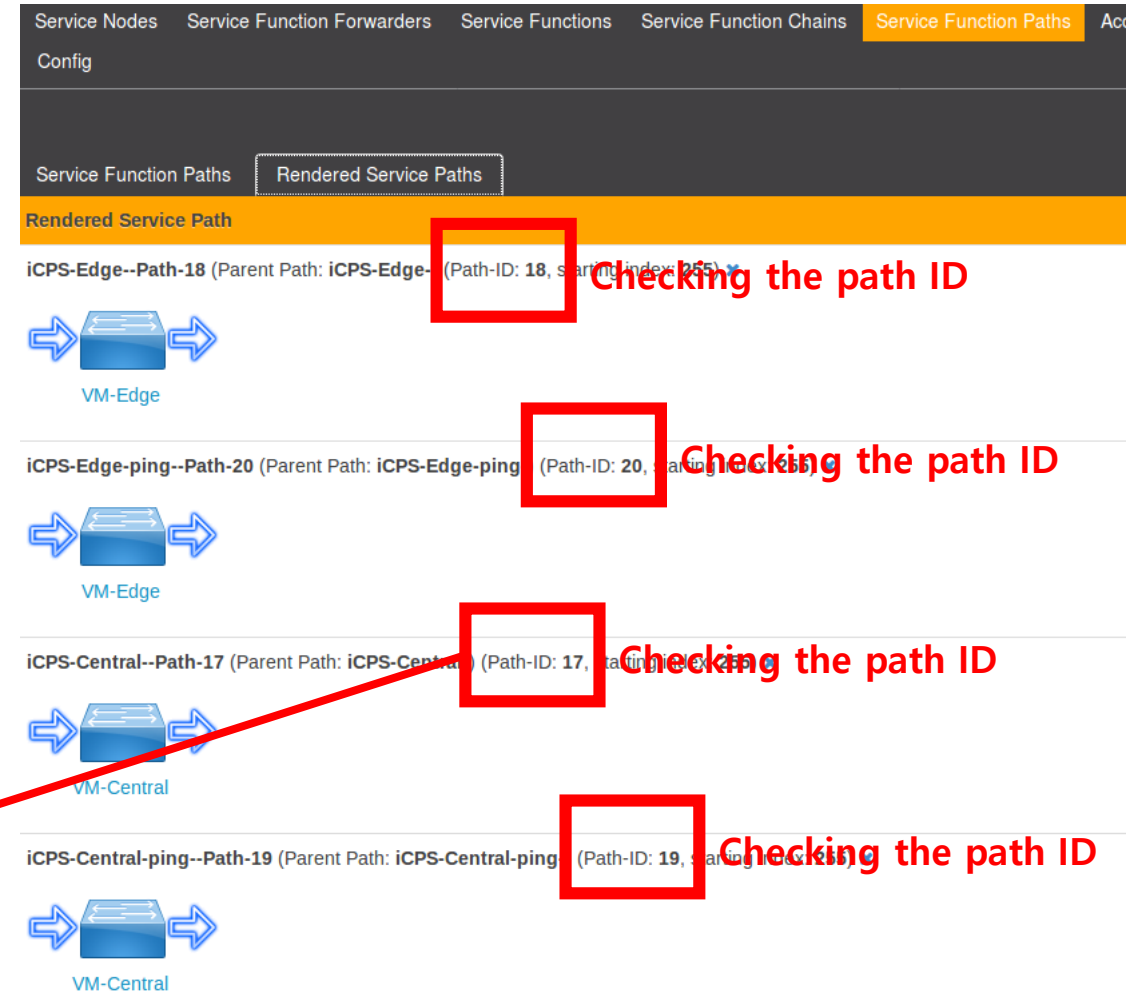
```
iCPS_Gateway [실행 중] - Oracle VM VirtualBox
파일  머신  보기  입력  장치  도움말

*D4_Central_Flow.sh (~/.ICPS_Gateway/sfc) - gedit
#!/bin/sh

python3.4 D4_packet_generator.py --remote-sff-ip 192.168.0.66
--local-port 6633 --remote-sff-port 6633 --sfp-id 17 --sfp-
index 255 --inner-src-ip 192.168.0.51 --inner-dest-ip
192.168.0.51 --inner-src-port 6633 --inner-dest-port 6633 --
ctx1 192.168.0.51 --encapsulate vxlan-nsh-ethernet-legacy
```

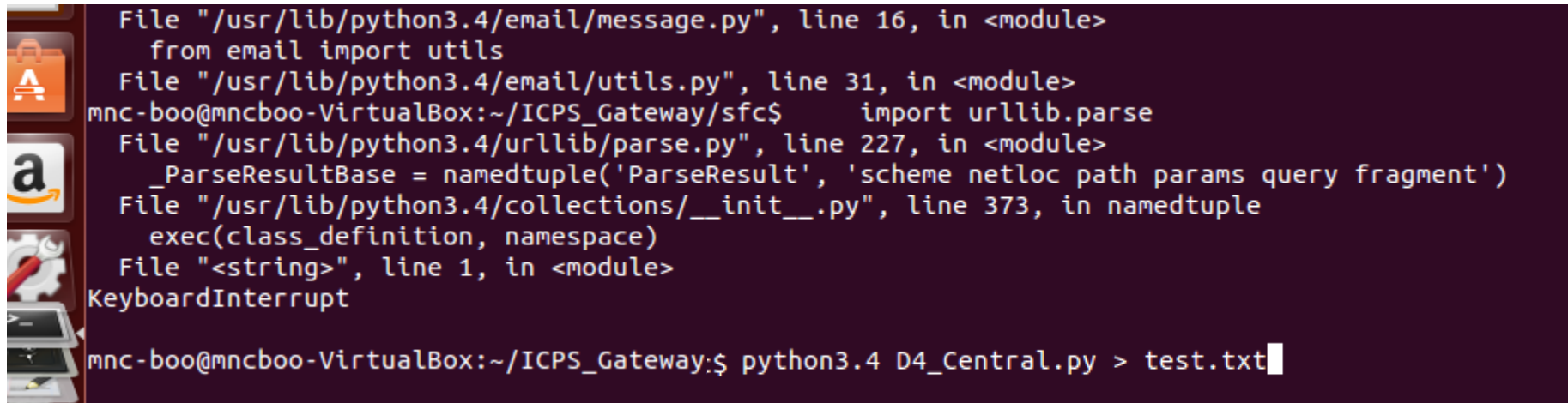
Checking the  
page 10

## < OPENDAYLIGHT – Service Function Paths >



# Send Packets

- cd ICPS\_Gateway
- python3.4 D4\_Central.py

A terminal window with a dark purple background and a vertical sidebar on the left containing icons for a folder, Amazon, a gear, and a laptop. The terminal text shows a series of Python error messages from the email and urllib libraries, followed by a keyboard interrupt, and ends with a command prompt where the user has entered a command to run a script and redirect output to a file.

```
File "/usr/lib/python3.4/email/message.py", line 16, in <module>
    from email import utils
File "/usr/lib/python3.4/email/utils.py", line 31, in <module>
mnc-boo@mncboo-VirtualBox:~/ICPS_Gateway/sfc$     import urllib.parse
File "/usr/lib/python3.4/urllib/parse.py", line 227, in <module>
    _ParseResultBase = namedtuple('ParseResult', 'scheme netloc path params query fragment')
File "/usr/lib/python3.4/collections/__init__.py", line 373, in namedtuple
    exec(class_definition, namespace)
File "<string>", line 1, in <module>
KeyboardInterrupt
mnc-boo@mncboo-VirtualBox:~/ICPS_Gateway:$ python3.4 D4_Central.py > test.txt
```