



ONOS Multiple Instance Installation

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❖ Prepare a Second VM

- Install or import CentOS 7.x image
- Follow the previous tutorial to perform pre-installation and basic setup
 - Make sure Java 8 is installed
 - Note that no need to install maven
 - Try to avoid using 192.168.56.101, as this IP has been used by VM1
 - In this case, we will use 192.168.56.102 as the private IP address
- Type in following command to check Java has been correctly installed

```
# java -version  
java version "1.8.0_131"  
Java(TM) SE Runtime Environment (build 1.8.0_131-b11)  
Java HotSpot(TM) 64-Bit Server VM (build 25.131-b11, mixed mode)
```

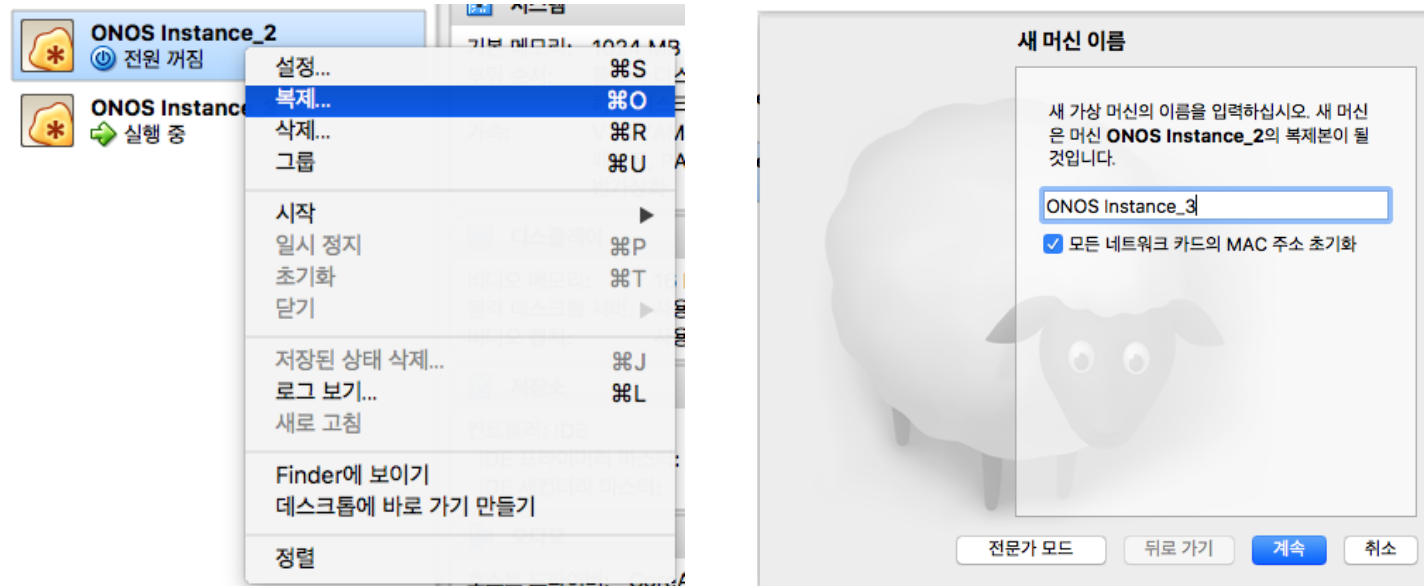
- Copy generated RSA key to VM1

```
$ ssh-copy-id 192.168.56.101  
...  
  
Now try logging into the machine, with: "ssh 'localhost'"  
and check to make sure that only the key(s) you wanted were added.  
  
$ ssh sdn@192.168.56.101
```

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❖ Prepare a Third VM

- Simply clone the second VM to spawn a third VM



- Change IP address of VM3 to 192.168.56.103

```
# ip a
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP qlen 1000
    link/ether 08:00:27:75:21:b6 brd ff:ff:ff:ff:ff:ff
    inet 192.168.56.103/24 brd 192.168.56.255 scope global enp0s8
        valid_lft forever preferred_lft forever
    inet6 fe80::a00:27ff:fe75:21b6/64 scope link
        valid_lft forever preferred_lft forever
```

❖ Inter-connect VM1, VM2 and VM3

- Allow SSH login without entering password
 - In VM1, issue following commands to copy RSA key to VM2 and VM3

```
$ ssh-copy-id 192.168.56.102  
$ ssh-copy-id 192.168.56.103
```

- Run following commands in VM1 to make sure that **sdn** user can access each VM without password

```
$ ssh sdn@192.168.56.101  
$ ssh sdn@192.168.56.102  
$ ssh sdn@192.168.56.103
```

- Construct a cluster using VM2 and VM3
 - Generate a cell file named “multi” under tools/test/cells

```
# Local VirtualBox-based ONOS instances 1,2 & ONOS mininet box  
  
export ONOS_NIC=192.168.56.*  
export OC1="192.168.56.102"  
export OC2="192.168.56.103"  
export OCN="192.168.56.101"  
export ONOS_USER=sdn  
export ONOS_APPS="drivers,openflow,fwd,proxyarp,mobility"
```

❖ Inter-connect VM1, VM2 and VM3

- Apply the clustering configuration
 - OCI: default cluster node, typically same as OC1
 - OC2 ~ OCX: other cluster nodes
 - OCN: represents a mininet node

```
$ cell multi
ONOS_CELL=multi
OCI=192.168.56.102
OC1=192.168.56.102
OC2=192.168.56.103
OCN=192.168.56.101
ONOS_APPS=drivers,openflow,fwd,proxyarp,mobility
ONOS_GROUP=sdn
ONOS_NIC=192.168.56.*
ONOS_SCENARIOS=/home/sdn/onos/tools/test/scenarios
ONOS_TOPO=default
ONOS_USER=sdn
ONOS_WEB_PASS=rocks
ONOS_WEB_USER=onos
```

- Package ONOS binary

```
$ onos-package
```

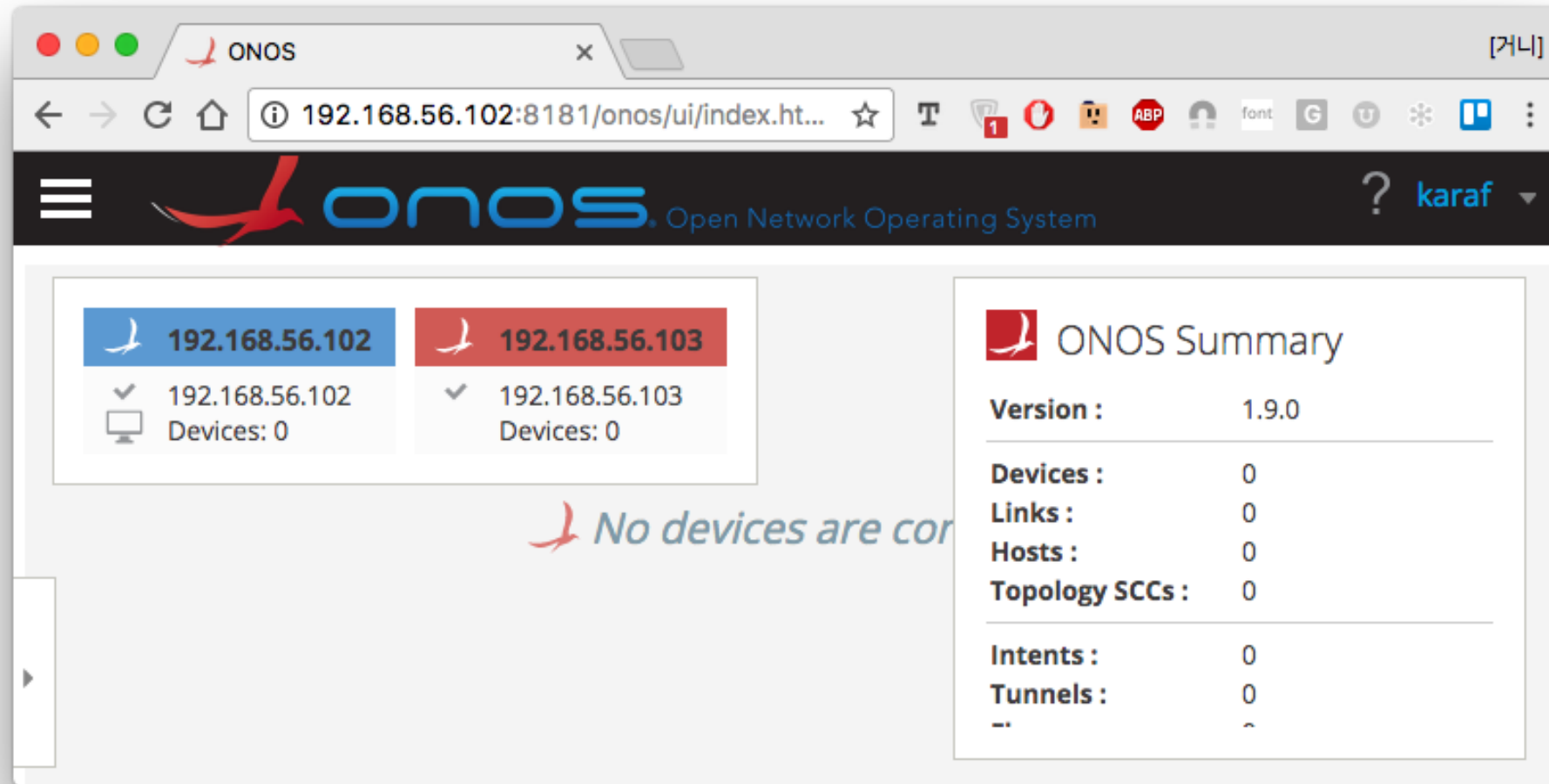
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❖ Launch Two ONOS Nodes with One Mininet Node

```
$ stc setup
Downloading STC binary...Done.
2017-04-22 14:14:07 Setup started
2017-04-22 14:14:07 Push-Bits-2 started -- onos-push-bits 192.168.56.103
2017-04-22 14:14:07 Uninstall-2 started -- onos-uninstall 192.168.56.103
2017-04-22 14:14:07 Push-Bits-1 started -- onos-push-bits 192.168.56.102
2017-04-22 14:14:07 Uninstall-1 started -- onos-uninstall 192.168.56.102
...
2017-04-22 14:14:16 Kill-1 started -- onos-kill 192.168.56.102
2017-04-22 14:14:16 Install-1 started -- onos-install 192.168.56.102
2017-04-22 14:14:21 Kill-2 started -- onos-kill 192.168.56.103
2017-04-22 14:14:21 Install-2 started -- onos-install 192.168.56.103
...
2017-04-22 14:14:25 Secure-SSH-1 started -- onos-secure-ssh -u
                        onos -p rocks 192.168.56.102
2017-04-22 14:14:33 Secure-SSH-2 started -- onos-secure-ssh -u
                        onos -p rocks 192.168.56.103
...
2017-04-22 14:15:01 Wait-for-Start-1 started -- onos-wait-for-start 192.168.56.102
2017-04-22 14:15:15 Wait-for-Start-2 started -- onos-wait-for-start 192.168.56.103
...
2017-04-22 14:18:15 Check-Nodes-1 started -- onos-check-nodes 192.168.56.102
2017-04-22 14:18:15 Check-Components-1 started -- onos-check-components 192.168.56.102
...
2017-04-22 14:18:21 Check-Logs-1 started -- onos-check-logs 192.168.56.102
2017-04-22 14:18:21 Check-Apps-1 started -- onos-check-apps 192.168.56.102
drivers,openflow,fwd,proxyarp,mobility includes
```

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❖ Access Web GUI

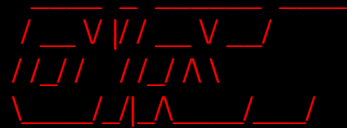


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❖ Access CLI

- Each node has its own index which can be represented using \$OC1~X
 - A typical way to command an ONOS node is “**COMMAND \$OCX**”

```
$ onos $OC1  
Welcome to Open Network Operating System (ONOS)!
```



```
Documentation: wiki.onosproject.org  
Tutorials:    tutorials.onosproject.org  
Mailing lists: lists.onosproject.org
```

```
Come help out! Find out how at: ...
```

```
Hit '<tab>' for a list of available commands  
and '[cmd] --help' for help on a specific command.  
Hit '<ctrl-d>' or type 'system:shutdown' or  
'logout' to shutdown ONOS.
```

```
onos>
```


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❖ Access CLI

- Summary:

```
onos> summary  
node=192.168.56.102, version=1.9.0nodes=2, devices=0, links=0,  
hosts=0, SCC(s)=0, flows=0, intents=0
```

- Masters: list up all nodes that have mastership

```
onos> masters  
192.168.56.102: 0 devices  
192.168.56.103: 0 devices
```

- Nodes: list up all ONOS instances

```
onos> nodes  
id=192.168.56.102, address=192.168.56.102:9876, state=ACTIVE, updated=1h ago *  
id=192.168.56.103, address=192.168.56.103:9876, state=ACTIVE, updated=1h ago
```

❖ Mininet Topologies

- Sample topology files are located under tools/test/topos directory
- List up all existing topologies

```
$ topos
default *      # Default US MPLS topology recipe
geant          # GEANT & Nordnet topology recipe
sdnip          # SDN-IP topology recipe
uk             # Simple UK topology recipe
vpls           # Default VPLS topology recipe
```

- Apply or show an existing topology
 - OTH: number of hosts
 - OTL: number of links
 - OTD: number devices

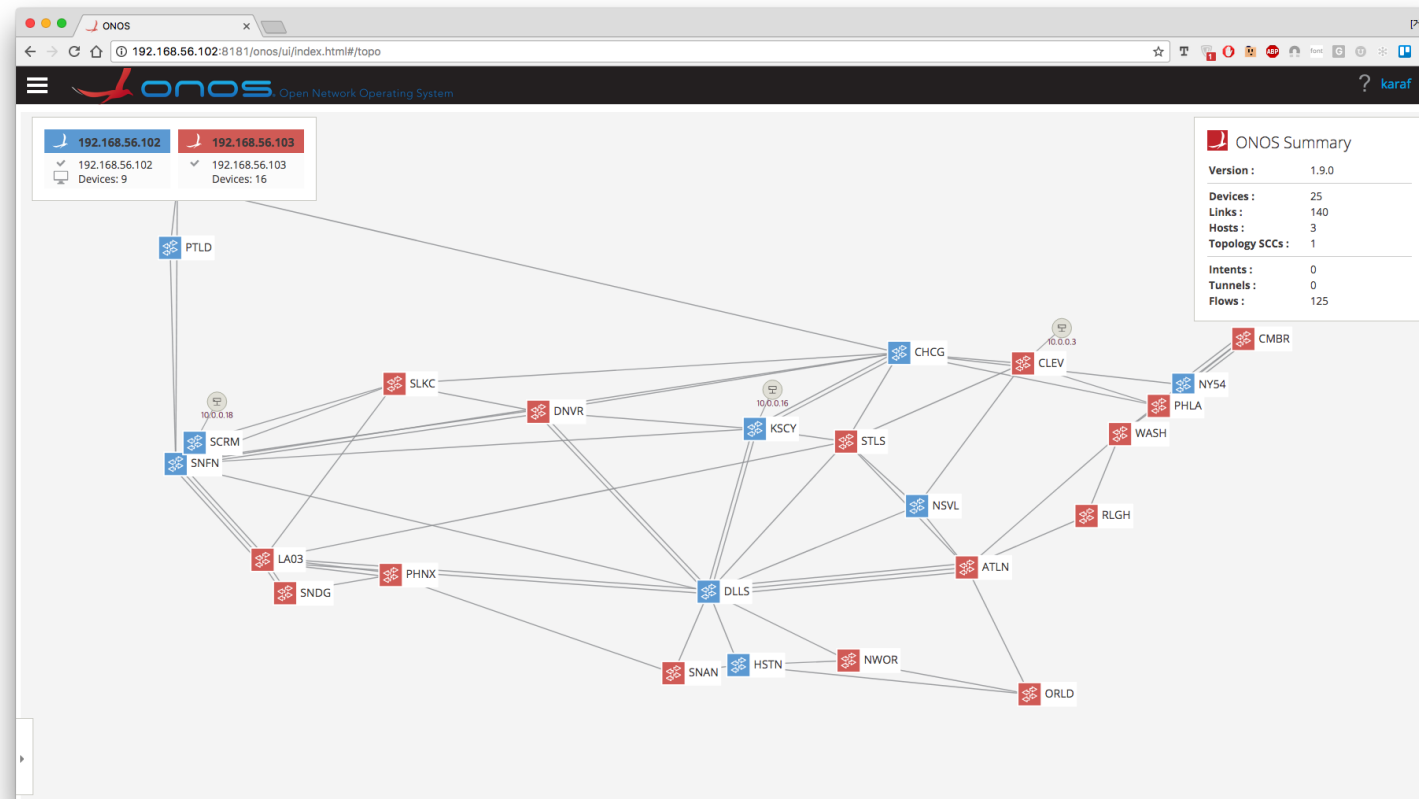
```
$ topo default
ONOS_TOPO=default
OTH=25
OTL=140
OTD=25
```

Test Multiple ONOS Instances (2/3)

❖ Construct a Data Plane using Topology File

- `./topo [topology file] [list of controllers' IP]`

```
$ cd tools/test/topos  
$ ./topo default.py $OC1 $OC2
```



❖ Clean Test Environment

- Shutdown data plane by exiting mininet
- Uninstall ONOS instances using stc teardown

```
mininet> exit

$ stc teardown
2017-04-23 02:10:37 Teardown started
2017-04-23 02:10:37 Uninstall-2 started -- onos-uninstall 192.168.56.103
2017-04-23 02:10:37 Uninstall-1 started -- onos-uninstall 192.168.56.102
2017-04-23 02:10:50 Uninstall-2 completed
2017-04-23 02:11:02 Uninstall-1 completed
2017-04-23 02:11:02 Teardown completed
0:24 Passed! 3 steps succeeded
```

```
[sdn@localhost onos]$
```



References

1. VirtualBox: <https://www.virtualbox.org/>
2. ONOS Install: <https://wiki.onosproject.org/display/ONOS/Installing+on+a+single+machine>
3. Forming a cluster: <https://wiki.onosproject.org/display/ONOS/Forming+a+cluster>
4. CLI and GUI: <https://wiki.onosproject.org/display/ONOS/Accessing+the+CLI+and+GUI>
5. Maven: <https://maven.apache.org/>
6. BUCK: <https://buckbuild.com/>
7. Mininet: <http://mininet.org/>