Lab Notes for RIV MOOC

1. SDN with ONOS

ONOS and mininet are the most stable solution for testing SDN in the Lab VM.

- Installing ONOS via docker is straighforward

```
sudo apt-get update
sudo apt-get install     apt-transport-https     ca-certificates    gnupg-
agent     software-properties-common
wget https://download.docker.com/linux/ubuntu/gpg
apt-key add gpg
sudo apt-key fingerprint 0EBFCD88
sudo add-apt-repository    "deb [arch=amd64]
https://download.docker.com/linux/ubuntu \
   $(lsb_release -cs) \
   stable"
apt update
sudo apt-get install docker-ce docker-ce-cli containerd.io
docker pull onosproject/onos
```

- Start mininet (only OpenFlow10 seems to work)

```
sudo mn --topo tree,2 --mac --switch ovsk,protocols=OpenFlow10 --controller
remote,ip=172.17.0.2
```

- Start ONOS as specified in https://wiki.onosproject.org/display/ONOS/Single+Instance+Docker+deployment and make sure to activate the following apps:

```
*   8 org.onosproject.drivers              2.4.0.SNAPSHOT Default Drivers
*  26 org.onosproject.optical-model        2.4.0.SNAPSHOT Optical Network
Model
*  27 org.onosproject.openflow-base        2.4.0.SNAPSHOT OpenFlow Base
Provider
*  57 org.onosproject.netcfghostprovider   2.4.0.SNAPSHOT Network Config
Host Provider
*  60 org.onosproject.lldpprovider         2.4.0.SNAPSHOT LLDP Link Provider
*  61 org.onosproject.hostprovider         2.4.0.SNAPSHOT Host Location
Provider
*  75 org.onosproject.openflow             2.4.0.SNAPSHOT OpenFlow Provider
Suite
* 107 org.onosproject.gui2                 2.4.0.SNAPSHOT ONOS GUI2
* 136 org.onosproject.proxyarp             2.4.0.SNAPSHOT Proxy ARP/NDP
* 158 org.onosproject.fwd                  2.4.0.SNAPSHOT Reactive
Forwarding
```

- For example use: (password karaf)

```
docker run -t -d -p 8181:8181 -p 8101:8101 -p 5005:5005 -p 830:830 --name
onos onosproject/onos
docker exec -it onos /bin/bash
apt update
apt install openssh-server
ssh -p 8101 -o StrictHostKeyChecking=no karaf@localhost
```

- Check the GUI (login: onos, password: rocks) at http://172.17.0.2:8181/onos/ui/#/topo2
- Activate reactive forwarding:

```
app activate org.onosproject.fwd
```

- Or play with intents https://wiki.onosproject.org/display/ONOS/Basic+ONOS+Tutorial:

```
add-host-intent 00:00:00:00:00:01/None 00:00:00:00:00:04/None
```



- Play with ONOS and mininet
- Explore openflow or openvswitch
- Study intents and reactive routing
- Interconnect with iBGP speaker (sdn-ip)
- Explore VPLS or VxLAN

2. Routing with FRR

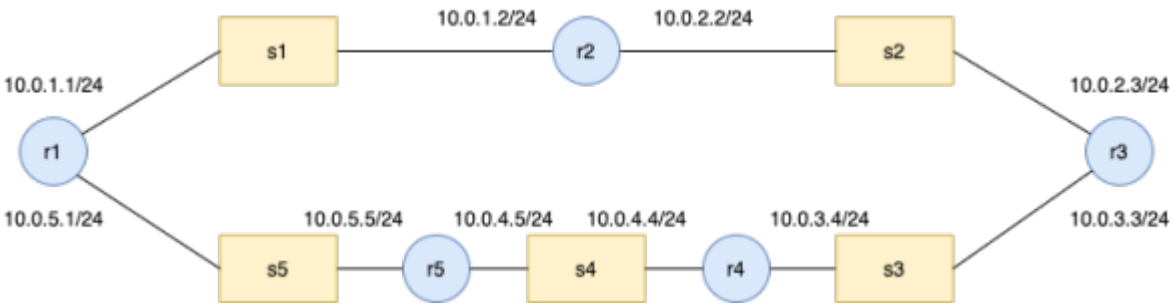
The lab environment is based on http://docs.frrouting.org/projects/dev-guide/en/latest/topotests.html. Topotests is a suite of topology tests for FRR built on top of Mininet.

```
cd /home/user/frr/tests/topotests
sudo pytest -s --topology-only mooc-lab1/mooc-lab1.py
```

- Examples of adding MPLS encapsulation:

```
on r1
ip route add 3.3.3.3/32 encap mpls 50000/8300 via 10.0.5.5 dev r1-eth1

on r3
ip route add 1.1.1.1/32 encap mpls 50000/8100 via 10.0.3.4 dev r3-eth1
```



- `mooc-lab2` implements Segment Routing http://docs.frrouting.org/projects/dev-guide/en/latest/ospf-sr.html.

What works in the current platform:

- IPv4 and IPv6 [tested]
- OSPF and BGP [tested]
- MPLS and LDP [tested] (with linux kernel, all features are accessible)
- Segment Routing! [tested with node-sid et OSPF opaque LSA]



- Think about updating FRR to get latest Segment routing features http://docs.frrouting.org/en/latest/pathd.html. PATH is a daemon that handles the installation and deletion of Segment Routing (SR) Policies.

3. Docker Containers

Update the apt package index and install packages to allow apt to use a repository over HTTPS:

```
$ sudo apt-get update

$ sudo apt-get install \
    apt-transport-https \
    ca-certificates \
    gnupg \
    lsb-release
```

Add Docker's official GPG key:

```
$ wget https://download.docker.com/linux/ubuntu/gpg -O key.txt
$ sudo gpg --dearmor -o /usr/share/keyrings/docker-archive-keyring.gpg
key.txt
```

Use the following command to set up the stable repository

```
echo \
  "deb [arch=amd64 signed-by=/usr/share/keyrings/docker-archive-keyring.gpg]
https://download.docker.com/linux/ubuntu \
  $(lsb_release -cs) stable" | sudo tee /etc/apt/sources.list.d/docker.list
> /dev/null
```

In order to solve the `containered.io` dependency problem, add the following line to the source file `/etc/apt/sources.list`:

```
deb http://security.ubuntu.com/ubuntu xenial-security main
```

Update and install.

```
$ sudo apt-get update
$ sudo apt-get install containerd.io
$ sudo apt-get install docker-ce docker-ce-cli
```

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