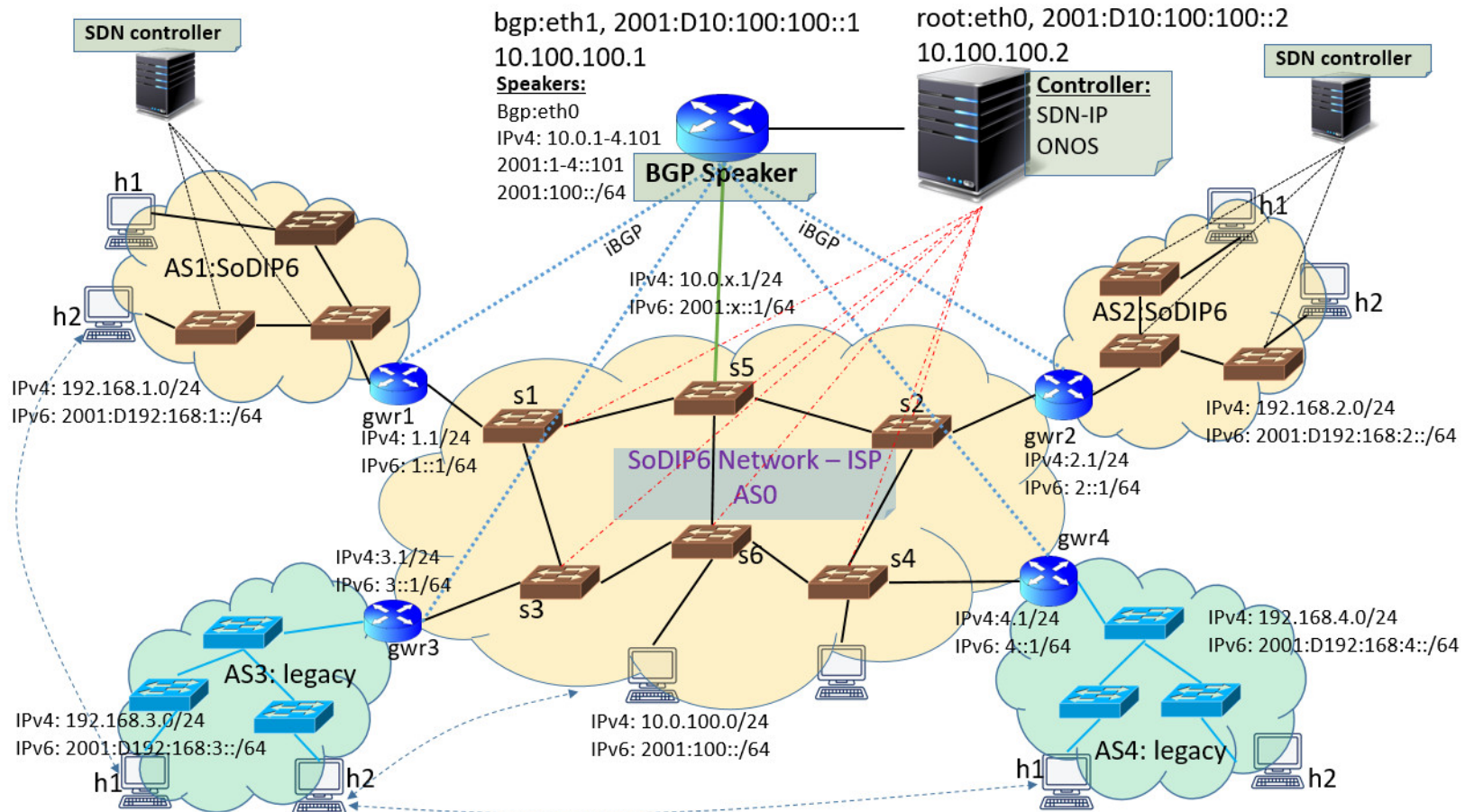# Some glimpses of ongoing ONOS/SDN-IP tests/implementation for SoDIP6 networks (use-case)

Authors: Babu R Dawadi, Danda B Rawat, Shashidhar R Joshi, and Pietro Manzoni

SDN controller

bgp:eth1, 2001:D10:100:100::1
10.100.100.1
Speakers:
Bgp:eth0
IPv4: 10.0.1-4.101
2001:1-4::101
2001:100::/64

BGP Speaker

root:eth0, 2001:D10:100:100::2
10.100.100.2
Controller:
SDN-IP
ONOS

SDN controller

h1

AS1:SoDIP6

h2

IPv4: 192.168.1.0/24
IPv6: 2001:D192:168:1::/64

gwr1
IPv4: 1.1/24
IPv6: 1::1/64

iBGP

IPv4: 10.0.x.1/24
IPv6: 2001:x::1/64

iBGP

s5

s1

s2

SoDIP6 Network – ISP
AS0

h1

AS2:SoDIP6

h2

IPv4: 192.168.2.0/24
IPv6: 2001:D192:168:2::/64

gwr2
IPv4:2.1/24
IPv6: 2::1/64

IPv4:3.1/24
IPv6: 3::1/64

s6

s4

s3

gwr4

IPv4:4.1/24
IPv6: 4::1/64

IPv4: 192.168.4.0/24
IPv6: 2001:D192:168:4::/64

gwr3

AS3: legacy

IPv4: 192.168.3.0/24
IPv6: 2001:D192:168:3::/64

h1

h2

IPv4: 10.0.100.0/24
IPv6: 2001:100::/64

h1

AS4: legacy

h2

The output snapshots are captured in different moments. ONOS web interface sometimes has peculiar display like appearing and disappearing of the labels/status of the IPv4 and IPv6 address/devices/hosts etc..

ONOS - Chromium
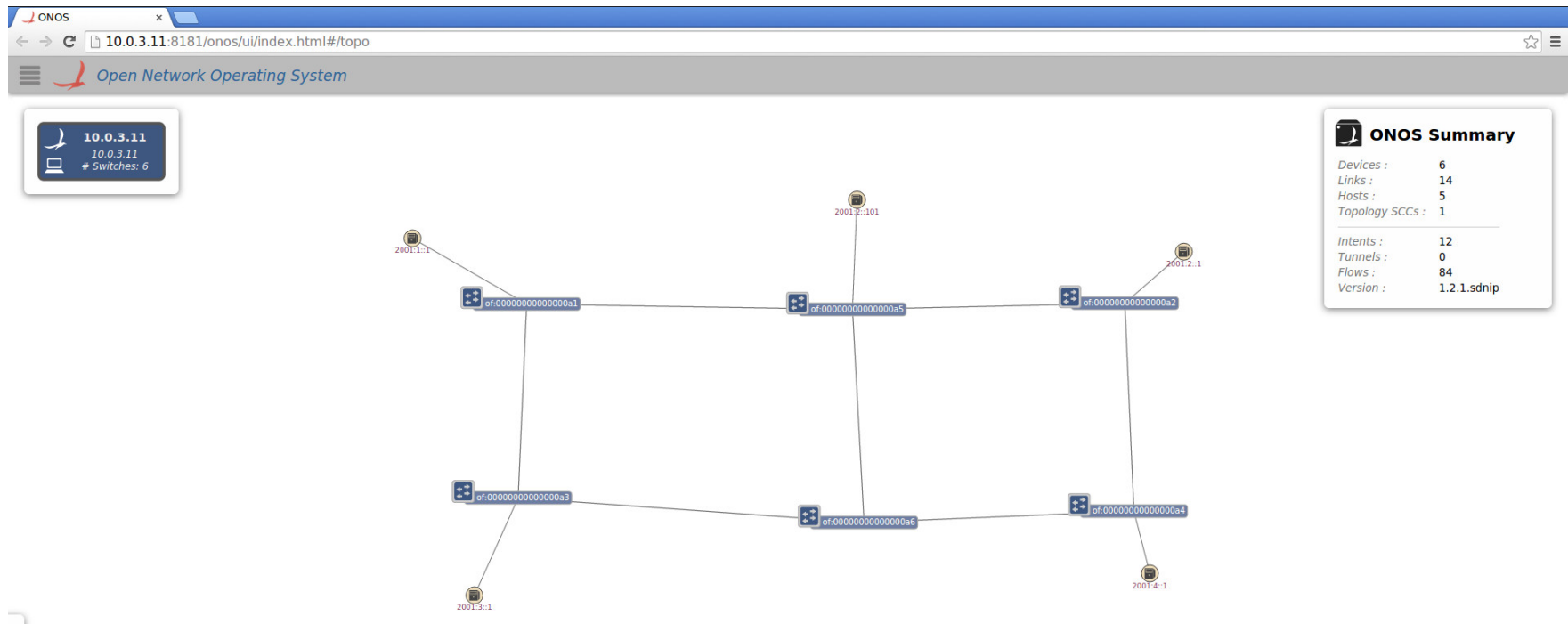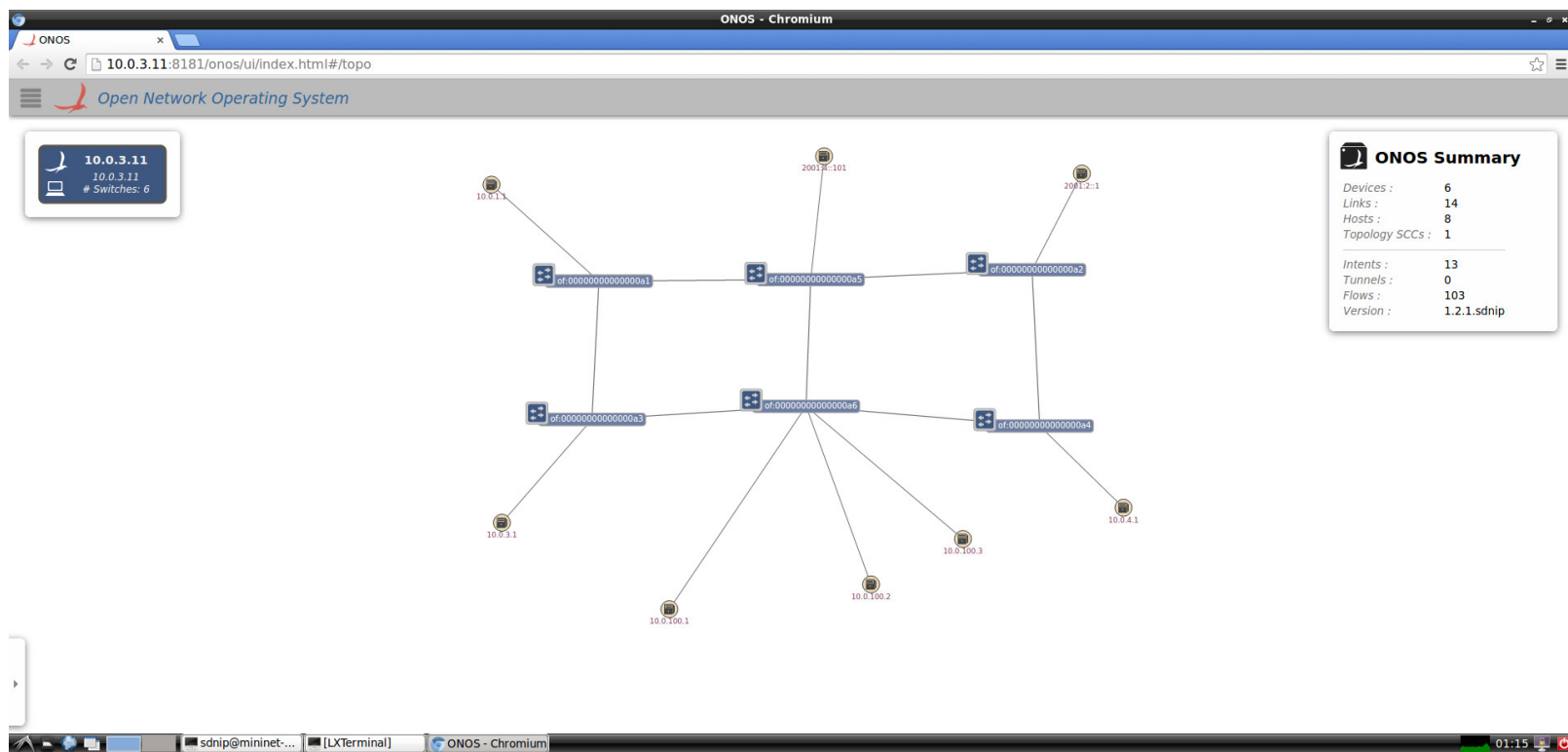
ONOS

10.0.3.11:8181/onos/ui/index.html#/topo

Open Network Operating System

10.0.3.11
10.0.3.11
Switches: 6

2001:4::101

10.0.1.1

2001:2::1

of:0000000000000a1

of:0000000000000a5

of:0000000000000a2

of:0000000000000a3

of:0000000000000a6

of:0000000000000a4

10.0.3.1

10.0.100.1

10.0.100.2

10.0.100.3

10.0.4.1

ONOS Summary

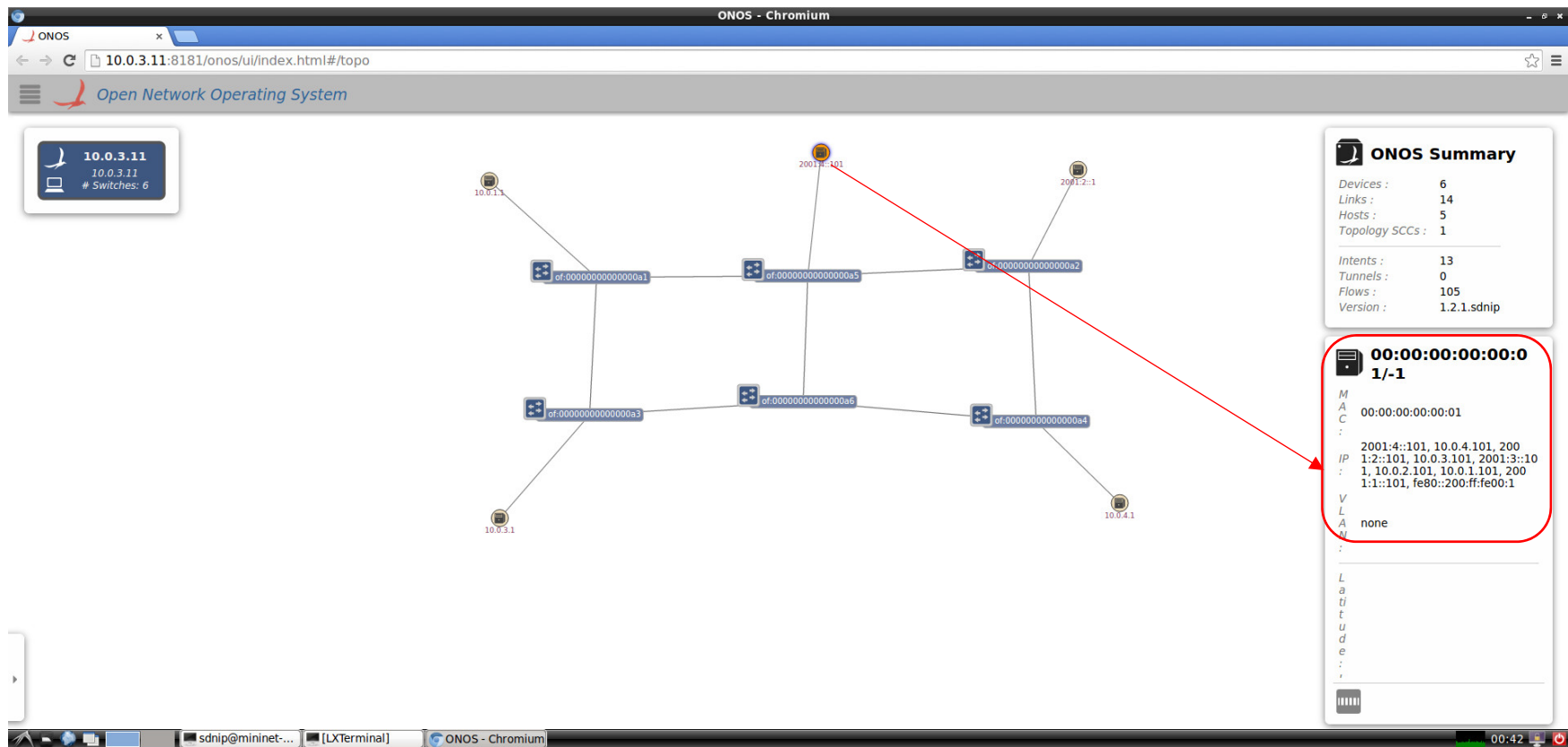|	
Devices :	6
Links :	14
Hosts :	8
Topology SCCs :	1
Intents :	13
Tunnels :	0
Flows :	103
Version :	1.2.1.sdnip

sdnip@mininet-... [LXTerminal] ONOS - Chromium

01:15

```
onos> intents
id=0x2, state=INSTALLED, key=0x2, type=PointToPointIntent, appId=org.onosproject.sdnip
    selector=[IP_PROTO{protocol=6}, TCP_DST{tcpPort=179}, IPV4_SRC{ip=10.0.2.1/32}, ETH_TYPE{ethType=800}, IPV4_DST{ip=10.0.2.101/32}]
    ingress=ConnectPoint{elementId=of:00000000000000a2, portNumber=1}, egress=ConnectPoint{elementId=of:00000000000000a3, portNumber=1}
id=0x8, state=INSTALLED, key=0x8, type=PointToPointIntent, appId=org.onosproject.sdnip
    selector=[IP_PROTO{protocol=6}, TCP_DST{tcpPort=179}, IPV4_SRC{ip=10.0.1.1/32}, ETH_TYPE{ethType=800}, IPV4_DST{ip=10.0.1.101/32}]
    ingress=ConnectPoint{elementId=of:00000000000000a1, portNumber=1}, egress=ConnectPoint{elementId=of:00000000000000a3, portNumber=1}
id=0x0, state=INSTALLED, key=0x0, type=PointToPointIntent, appId=org.onosproject.sdnip
    selector=[IP_PROTO{protocol=6}, TCP_DST{tcpPort=179}, IPV4_SRC{ip=10.0.2.101/32}, ETH_TYPE{ethType=800}, IPV4_DST{ip=10.0.2.1/32}]
    ingress=ConnectPoint{elementId=of:00000000000000a3, portNumber=1}, egress=ConnectPoint{elementId=of:00000000000000a2, portNumber=1}
id=0x7, state=INSTALLED, key=0x7, type=PointToPointIntent, appId=org.onosproject.sdnip
    selector=[IP_PROTO{protocol=6}, IPV4_SRC{ip=10.0.1.101/32}, TCP_SRC{tcpPort=179}, ETH_TYPE{ethType=800}, IPV4_DST{ip=10.0.1.1/32}]
    ingress=ConnectPoint{elementId=of:00000000000000a3, portNumber=1}, egress=ConnectPoint{elementId=of:00000000000000a1, portNumber=1}
id=0x81, state=WITHDRAWN, key=192.168.1.0/24, type=MultiPointToSinglePointIntent, appId=org.onosproject.sdnip
    selector=[ETH_TYPE{ethType=800}, IPV4_DST{ip=192.168.1.0/24}]
    treatment=[ETH_DST{mac=00:00:00:00:01:01}]
    ingress=[ConnectPoint{elementId=of:00000000000000a4, portNumber=1}, ConnectPoint{elementId=of:00000000000000a3, portNumber=1}, ConnectPoint{e
0a1, portNumber=1}
id=0x5, state=INSTALLED, key=0x5, type=PointToPointIntent, appId=org.onosproject.sdnip
    selector=[IP_PROTO{protocol=1}, IPV4_SRC{ip=10.0.2.1/32}, ETH_TYPE{ethType=800}, IPV4_DST{ip=10.0.2.101/32}]
    ingress=ConnectPoint{elementId=of:00000000000000a2, portNumber=1}, egress=ConnectPoint{elementId=of:00000000000000a3, portNumber=1}
id=0x9, state=INSTALLED, key=0x9, type=PointToPointIntent, appId=org.onosproject.sdnip
    selector=[IP_PROTO{protocol=6}, IPV4_SRC{ip=10.0.1.1/32}, TCP_SRC{tcpPort=179}, ETH_TYPE{ethType=800}, IPV4_DST{ip=10.0.1.101/32}]
    ingress=ConnectPoint{elementId=of:00000000000000a1, portNumber=1}, egress=ConnectPoint{elementId=of:00000000000000a3, portNumber=1}
id=0xa, state=INSTALLED, key=0xa, type=PointToPointIntent, appId=org.onosproject.sdnip
    selector=[IP_PROTO{protocol=1}, IPV4_SRC{ip=10.0.1.101/32}, ETH_TYPE{ethType=800}, IPV4_DST{ip=10.0.1.1/32}]
    ingress=ConnectPoint{elementId=of:00000000000000a3, portNumber=1}, egress=ConnectPoint{elementId=of:00000000000000a1, portNumber=1}
id=0x6, state=INSTALLED, key=0x6, type=PointToPointIntent, appId=org.onosproject.sdnip
    selector=[IP_PROTO{protocol=6}, TCP_DST{tcpPort=179}, IPV4_SRC{ip=10.0.1.101/32}, ETH_TYPE{ethType=800}, IPV4_DST{ip=10.0.1.1/32}]
    ingress=ConnectPoint{elementId=of:00000000000000a3, portNumber=1}, egress=ConnectPoint{elementId=of:00000000000000a1, portNumber=1}
id=0x3, state=INSTALLED, key=0x3, type=PointToPointIntent, appId=org.onosproject.sdnip
    selector=[IP_PROTO{protocol=6}, IPV4_SRC{ip=10.0.2.1/32}, TCP_SRC{tcpPort=179}, ETH_TYPE{ethType=800}, IPV4_DST{ip=10.0.2.101/32}]
    ingress=ConnectPoint{elementId=of:00000000000000a2, portNumber=1}, egress=ConnectPoint{elementId=of:00000000000000a3, portNumber=1}
id=0x4, state=INSTALLED, key=0x4, type=PointToPointIntent, appId=org.onosproject.sdnip
    selector=[IP_PROTO{protocol=1}, IPV4_SRC{ip=10.0.2.101/32}, ETH_TYPE{ethType=800}, IPV4_DST{ip=10.0.2.1/32}]
    ingress=ConnectPoint{elementId=of:00000000000000a3, portNumber=1}, egress=ConnectPoint{elementId=of:00000000000000a2, portNumber=1}
id=0x1, state=INSTALLED, key=0x1, type=PointToPointIntent, appId=org.onosproject.sdnip
    selector=[IP_PROTO{protocol=6}, IPV4_SRC{ip=10.0.2.101/32}, TCP_SRC{tcpPort=179}, ETH_TYPE{ethType=800}, IPV4_DST{ip=10.0.2.1/32}]
    ingress=ConnectPoint{elementId=of:00000000000000a3, portNumber=1}, egress=ConnectPoint{elementId=of:00000000000000a2, portNumber=1}
id=0xb, state=INSTALLED, key=0xb, type=PointToPointIntent, appId=org.onosproject.sdnip
    selector=[IP_PROTO{protocol=1}, IPV4_SRC{ip=10.0.1.1/32}, ETH_TYPE{ethType=800}, IPV4_DST{ip=10.0.1.101/32}]
    ingress=ConnectPoint{elementId=of:00000000000000a1, portNumber=1}, egress=ConnectPoint{elementId=of:00000000000000a3, portNumber=1}
onos>
```

sdnip@mininet-...   LXTerminal   ONOS - Chromium

```
onos> devices
id=of:00000000000000a1, available=true, role=MASTER, type=SWITCH, mfr=Nicira, Inc., hw=Open vSwitch, sw=2.1.3, serial=None, protocol=OF_13, channelId=10.0.3.1:50021
id=of:00000000000000a2, available=true, role=MASTER, type=SWITCH, mfr=Nicira, Inc., hw=Open vSwitch, sw=2.1.3, serial=None, protocol=OF_13, channelId=10.0.3.1:50022
id=of:00000000000000a3, available=true, role=MASTER, type=SWITCH, mfr=Nicira, Inc., hw=Open vSwitch, sw=2.1.3, serial=None, protocol=OF_13, channelId=10.0.3.1:50023
id=of:00000000000000a4, available=true, role=MASTER, type=SWITCH, mfr=Nicira, Inc., hw=Open vSwitch, sw=2.1.3, serial=None, protocol=OF_13, channelId=10.0.3.1:49992
id=of:00000000000000a5, available=true, role=MASTER, type=SWITCH, mfr=Nicira, Inc., hw=Open vSwitch, sw=2.1.3, serial=None, protocol=OF_13, channelId=10.0.3.1:50024
id=of:00000000000000a6, available=true, role=MASTER, type=SWITCH, mfr=Nicira, Inc., hw=Open vSwitch, sw=2.1.3, serial=None, protocol=OF_13, channelId=10.0.3.1:50025
onos>

onos> flows
deviceId=of:00000000000000a1, flowRuleCount=19
    id=100008507e769, state=ADDED, bytes=2442, packets=33, duration=2000, priority=5, tableId=0 appId=org.onosproject.core, payLoad=null
        selector=[ETH_TYPE{ethType=800}]
        treatment=DefaultTrafficTreatment{immediate=[OUTPUT{port=CONTROLLER}], deferred=[], transition=None, cleared=false, metadata=null}
    id=100008507fdef, state=ADDED, bytes=1764, packets=42, duration=2000, priority=40000, tableId=0 appId=org.onosproject.core, payLoad=null
        selector=[ETH_TYPE{ethType=806}]
        treatment=DefaultTrafficTreatment{immediate=[OUTPUT{port=CONTROLLER}], deferred=[], transition=None, cleared=false, metadata=null}
    id=100008507fdef, state=ADDED, bytes=0, packets=0, duration=2000, priority=5, tableId=0 appId=org.onosproject.core, payLoad=null
        selector=[ETH_TYPE{ethType=806}]
        treatment=DefaultTrafficTreatment{immediate=[OUTPUT{port=CONTROLLER}], deferred=[], transition=None, cleared=false, metadata=null}
    id=1000086e42306, state=ADDED, bytes=17560, packets=188, duration=2000, priority=5, tableId=0 appId=org.onosproject.core, payLoad=null
        selector=[ETH_TYPE{ethType=86dd}]
        treatment=DefaultTrafficTreatment{immediate=[OUTPUT{port=CONTROLLER}], deferred=[], transition=None, cleared=false, metadata=null}
    id=1000086eb6535, state=ADDED, bytes=104814, packets=1294, duration=2000, priority=40000, tableId=0 appId=org.onosproject.core, payLoad=null
        selector=[ETH_TYPE{ethType=88cc}]
        treatment=DefaultTrafficTreatment{immediate=[OUTPUT{port=CONTROLLER}], deferred=[], transition=None, cleared=false, metadata=null}
    id=1000086ed202b, state=ADDED, bytes=104814, packets=1294, duration=2000, priority=40000, tableId=0 appId=org.onosproject.core, payLoad=null
        selector=[ETH_TYPE{ethType=8942}]
        treatment=DefaultTrafficTreatment{immediate=[OUTPUT{port=CONTROLLER}], deferred=[], transition=None, cleared=false, metadata=null}
    id=100008714e102, state=FAILED, bytes=0, packets=0, duration=0, priority=40000, tableId=0 appId=org.onosproject.core, payLoad=null
        selector=[IP_PROTO{protocol=58}, ICMPV6_TYPE{icmpv6Type=135}, ETH_TYPE{ethType=86dd}]
        treatment=DefaultTrafficTreatment{immediate=[OUTPUT{port=CONTROLLER}], deferred=[], transition=None, cleared=false, metadata=null}
    id=100008714e4c3, state=FAILED, bytes=0, packets=0, duration=0, priority=40000, tableId=0 appId=org.onosproject.core, payLoad=null
        selector=[IP_PROTO{protocol=58}, ICMPV6_TYPE{icmpv6Type=136}, ETH_TYPE{ethType=86dd}]
        treatment=DefaultTrafficTreatment{immediate=[OUTPUT{port=CONTROLLER}], deferred=[], transition=None, cleared=false, metadata=null}
    id=1d000080b1524d, state=FAILED, bytes=0, packets=0, duration=0, priority=10, tableId=0 appId=org.onosproject.fwd, payLoad=null
        selector=[IPV6_SRC{ip=2001:1::101/128}, IN_PORT{port=3}, ETH_SRC{mac=00:00:00:00:00:01}, IPV6_DST{ip=2001:1::1/128}, ETH_DST{mac=00:00:00:00:01:01}, ETH_TYPE{ethType=86dd}]
        treatment=DefaultTrafficTreatment{immediate=[OUTPUT{port=1}], deferred=[], transition=None, cleared=false, metadata=null}
    id=1d000084fd27cc, state=PENDING_REMOVE, bytes=0, packets=0, duration=0, priority=10, tableId=0 appId=org.onosproject.fwd, payLoad=null
        selector=[IN_PORT{port=3}, ETH_SRC{mac=00:00:00:00:00:01}, ETH_DST{mac=00:00:00:00:01:01}]
        treatment=DefaultTrafficTreatment{immediate=[OUTPUT{port=1}], deferred=[], transition=None, cleared=false, metadata=null}
    id=23000019c173c1, state=ADDED, bytes=0, packets=0, duration=2000, priority=1000, tableId=0 appId=org.onosproject.net.intent, payLoad=null
        selector=[IP_PROTO{protocol=1}, IN_PORT{port=2}, IPV4_SRC{ip=10.0.1.101/32}, ETH_TYPE{ethType=800}, IPV4_DST{ip=10.0.1.1/32}]
        treatment=DefaultTrafficTreatment{immediate=[OUTPUT{port=1}], deferred=[], transition=None, cleared=false, metadata=null}
    id=23000019cf8781, state=ADDED, bytes=0, packets=0, duration=1003, priority=1000, tableId=0 appId=org.onosproject.net.intent, payLoad=null
```

File Edit Tabs Help

onos> hosts
id=00:00:00:00:00:01/-1, mac=00:00:00:00:00:01, location=of:00000000000000a5/1, vlan=-1, ip(s)=[10.0.1.101, 10.0.3.101, 10.0.2.101, 2001:4::101, 10.0.4.101, 2001:1::101]
id=00:00:00:00:01:01/-1, mac=00:00:00:00:01:01, location=of:00000000000000a1/1, vlan=-1, ip(s)=[2001:1::1, 10.0.1.1, fe80::200:ff:fe00:101]
id=00:00:00:00:02:01/-1, mac=00:00:00:00:02:01, location=of:00000000000000a2/1, vlan=-1, ip(s)=[10.0.2.1]
id=00:00:00:00:03:01/-1, mac=00:00:00:00:03:01, location=of:00000000000000a3/1, vlan=-1, ip(s)=[10.0.3.1]
id=00:00:00:00:04:01/-1, mac=00:00:00:00:04:01, location=of:00000000000000a4/1, vlan=-1, ip(s)=[2001:4::1, fe80::200:ff:fe00:401, 10.0.4.1]
onos>

```
mininet> isp_h1 ping isp_h2
PING 192.168.2.1 (192.168.2.1) 56(84) bytes of data.
64 bytes from 192.168.2.1: icmp_seq=1 ttl=61 time=3.40 ms
64 bytes from 192.168.2.1: icmp_seq=2 ttl=61 time=3.51 ms
64 bytes from 192.168.2.1: icmp_seq=3 ttl=61 time=1.07 ms
^CsendInt: writing chr(3)
--- 192.168.2.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 1.071/2.666/3.519/1.128 ms

mininet> isp_h1 ping isp_h3
 PING 192.168.3.1 (192.168.3.1) 56(84) bytes of data.
64 bytes from 192.168.3.1: icmp_seq=1 ttl=61 time=1.54 ms
64 bytes from 192.168.3.1: icmp_seq=2 ttl=61 time=2.42 ms
64 bytes from 192.168.3.1: icmp_seq=3 ttl=61 time=1.71 ms
^CsendInt: writing chr(3)
--- 192.168.3.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 3004ms
rtt min/avg/max/mdev = 1.547/3.064/6.569/2.050 ms
```

```
mininet> isp_h1 ping6 2001:4::1
0PING 2001:4::1 (2001:4::1) 56 data bytes
64 bytes from 2001:4::1: icmp_seq=1 ttl=61 time=2.12 ms
64 bytes from 2001:4::1: icmp_seq=2 ttl=61 time=1.06 ms
64 bytes from 2001:4::1: icmp_seq=3 ttl=61 time=4.41 ms
^CsendInt: writing chr(3)
--- 2001:4::1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2002ms
rtt min/avg/max/mdev = 1.064/2.532/4.411/1.397 ms

mininet> isp_h1 ping sdn_h1
PING 10.0.100.1 (10.0.100.1) 56(84) bytes of data.
64 bytes from 10.0.100.1: icmp_seq=1 ttl=62 time=21.5 ms
64 bytes from 10.0.100.1: icmp_seq=2 ttl=62 time=1.15 ms
^CsendInt: writing chr(3)
--- 10.0.100.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 1.157/11.336/21.515/10.179 ms
```

```
mininet> isp_h2 ping sdn_h1
PING 10.0.100.1 (10.0.100.1) 56(84) bytes of data.
64 bytes from 10.0.100.1: icmp_seq=1 ttl=62 time=17.0 ms
64 bytes from 10.0.100.1: icmp_seq=2 ttl=62 time=0.670 ms
64 bytes from 10.0.100.1: icmp_seq=3 ttl=62 time=0.087 ms
^CsendInt: writing chr(3)
--- 10.0.100.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2023ms
rtt min/avg/max/mdev = 0.087/5.919/17.001/7.839 ms

mininet> isp_h3 ping6 2001:100::1
PING 2001:100::1 (2001:100::1) 56 data bytes
64 bytes from 2001:100::1: icmp_seq=1 ttl=62 time=0.064 ms
64 bytes from 2001:100::1: icmp_seq=2 ttl=62 time=0.232 ms
^CsendInt: writing chr(3)
--- 2001:100::1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1011ms
rtt min/avg/max/mdev = 0.064/0.148/0.232/0.084 ms
```

D: Backup

Upload | Edit | Properties | New

D:\PhD-Study\Experimental\sdnip\configs\

Name	Size	Type	Changed
..		Parent directory	5/26/2020 7:20:32 PM
addresses.json	1 KB	JSON File	5/26/2020 7:16:19 PM
gui.json	1 KB	JSON File	5/26/2020 7:16:39 PM
network-config.cfg	4 KB	CFG File	5/26/2020 7:40:18 PM
quagga1.conf	1 KB	CONF File	5/25/2020 11:47:18 PM
quagga2.conf	1 KB	CONF File	5/25/2020 11:48:01 PM
quagga3.conf	1 KB	CONF File	5/25/2020 11:48:01 PM
quagga4.conf	1 KB	CONF File	5/25/2020 11:47:59 PM
quagga-sdn.conf	1 KB	CONF File	5/26/2020 7:17:29 PM
sdnip.json	3 KB	JSON File	5/26/2020 7:20:13 PM
zebra.conf	1 KB	CONF File	7/15/2015 6:20:35 AM

Ubnt18SDNIP [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities   Terminal   Tue 16:06

sdnip@sdnip-VirtualBox: ~/SoDIP6

File Edit View Search Terminal Help

```
 0PING 2001:100::2(2001:100::2) 56 data bytes
64 bytes from 2001:100::2: icmp_seq=1 ttl=64 time=15.7 ms
64 bytes from 2001:100::2: icmp_seq=2 ttl=64 time=2.10 ms
64 bytes from 2001:100::2: icmp_seq=3 ttl=64 time=0.156 ms
64 bytes from 2001:100::2: icmp_seq=4 ttl=64 time=0.111 ms
^CsendInt: writing chr(3)

--- 2001:100::2 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3046ms
rtt min/avg/max/mdev = 0.111/4.523/15.724/6.516 ms
mininet> sdn_h2 ping6 2001:100::1
*** errRun: ['stty', '-icanon', 'min', '1']
 0PING 2001:100::1(2001:100::1) 56 data bytes
64 bytes from 2001:100::1: icmp_seq=1 ttl=64 time=0.075 ms
64 bytes from 2001:100::1: icmp_seq=2 ttl=64 time=0.160 ms
64 bytes from 2001:100::1: icmp_seq=3 ttl=64 time=0.147 ms
64 bytes from 2001:100::1: icmp_seq=4 ttl=64 time=0.145 ms
64 bytes from 2001:100::1: icmp_seq=5 ttl=64 time=0.059 ms
64 bytes from 2001:100::1: icmp_seq=6 ttl=64 time=0.059 ms
64 bytes from 2001:100::1: icmp_seq=7 ttl=64 time=0.155 ms
64 bytes from 2001:100::1: icmp_seq=8 ttl=64 time=0.131 ms
64 bytes from 2001:100::1: icmp_seq=9 ttl=64 time=0.108 ms
^CsendInt: writing chr(3)

--- 2001:100::1 ping statistics ---
9 packets transmitted, 9 received, 0% packet loss, time 8174ms
rtt min/avg/max/mdev = 0.059/0.115/0.160/0.040 ms
mininet>
```

Right Ctrl