

UHD installation

UHD-3.15-LTS version is required work with USRP N310 and USRP B210

```
sudo apt-get install libboost-all-dev libusb-1.0-0-dev doxygen python3-docutils python3-mako  
python3-numpy python3-requests python3-ruamel.yaml python3-setuptools cmake  
build-essential
```

```
git clone https://github.com/EttusResearch/uhd.git  
cd uhd  
git checkout -f UHD-3.15-LTS  
cd host  
mkdir build  
cd build  
cmake ../  
make  
make test  
sudo make install  
sudo ldconfig
```

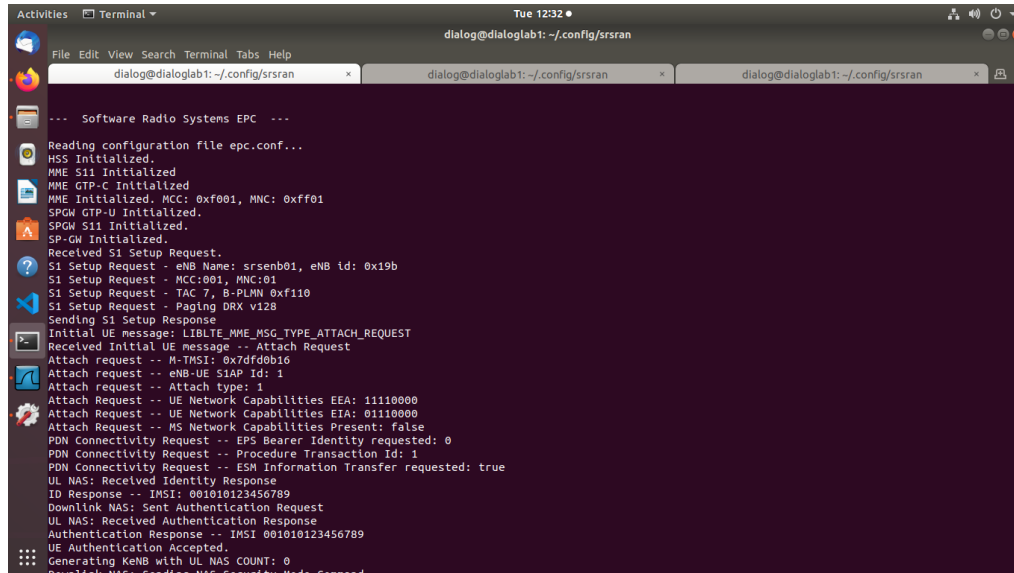
SRRAN Installation from Source

Refer section [3.1.3 Installation from Source](#) to install latest version of SRRAN from source.

Running EPC

`sudo srsepc ~/.config/srsran/epc.conf`

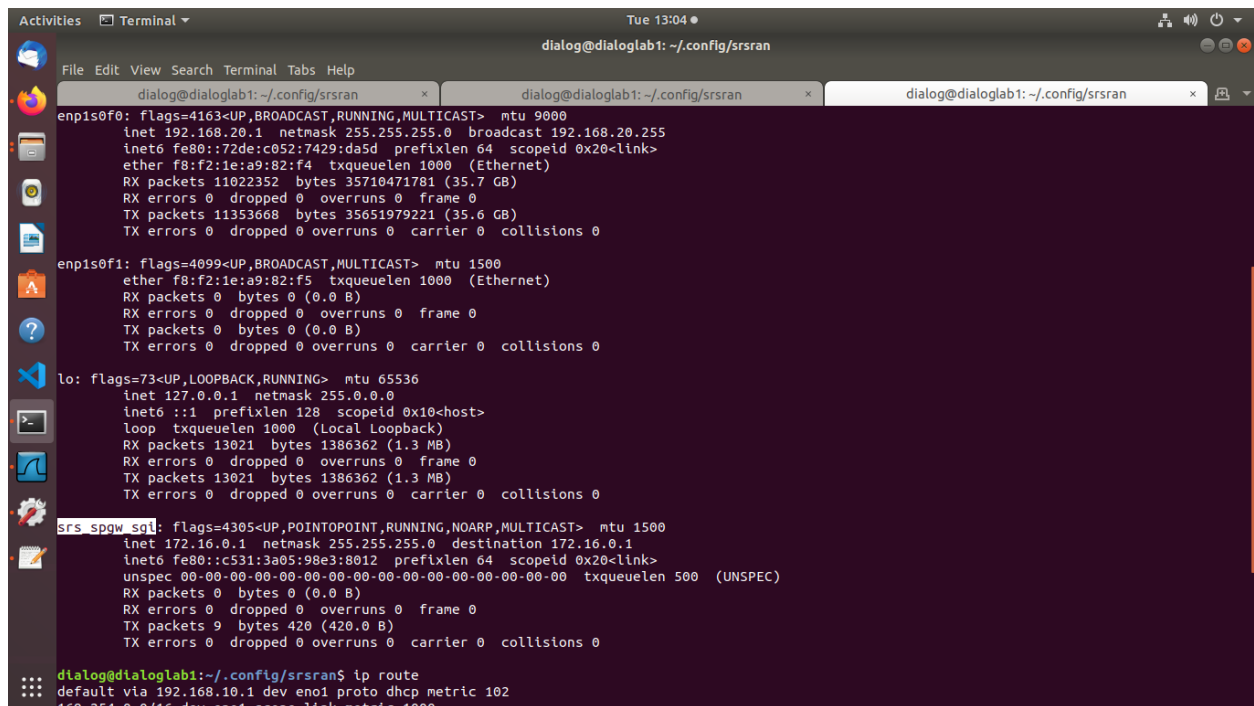
After running this command, the output of the terminal should be as follows.



```
Activities Terminal Tue 12:32
dialog@dialoglab1: ~/.config/srsran

dialog@dialoglab1: ~/.config/srsran
--- Software Radio Systems EPC ---
Reading configuration file epc.conf...
HSS Initialized.
MME S11 Initialized.
MME GTP-C Initialized.
MME Initialized, MCC: 0xf001, MNC: 0xff01
SPGW GTP-U Initialized.
SPGW S11 Initialized.
SP-GW Initialized.
Received S1 Setup Request.
S1 Setup Request - eNB Name: srsenb01, eNB Id: 0x19b
S1 Setup Request - MCC: 001, MNC: 01
S1 Setup Request - TAC 7, B-PLMN 0xf110
S1 Setup Request - Paging DRX v128
Sending S1 Setup Response
Initial UE message: L1BLTE_MME_MSG_TYPE_ATTACH_REQUEST
Received Initial UE message -- Attach Request
Attach request -- M-TMSI: 0x7df00b16
Attach request -- eNB-UE S1AP Id: 1
Attach request -- Attach type: 1
Attach Request -- UE Network Capabilities EEA: 11110000
Attach Request -- UE Network Capabilities EIA: 01110000
Attach Request -- MS Network Capabilities Present: false
PDN Connectivity Request -- EPS Bearer Identity requested: 0
PDN Connectivity Request -- Procedure Transaction Id: 1
PDN Connectivity Request -- ESM Information Transfer requested: true
UL NAS: Received Identity Response
ID Response -- IMSI: 001010123456789
Downlink NAS: Sent Authentication Request
UL NAS: Received Authentication Response
Authentication Response -- IMSI 001010123456789
UE Authentication Accepted.
Generating KeNB with UL NAS COUNT: 0
Downlink NAS: Sending NAS Security Mode Command
```

The network interface of SPGW will appear as `srs_spgw_sgi`



```
Activities Terminal Tue 13:04
dialog@dialoglab1: ~/.config/srsran

dialog@dialoglab1: ~/.config/srsran
enp1s0f0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 9000
inet 192.168.20.1 netmask 255.255.255.0 broadcast 192.168.20.255
inet6 fe80::72de:c052:7429:da5d prefixlen 64 scopeid 0x20<link>
ether f8:f2:1e:a9:82:f4 txqueuelen 1000 (Ethernet)
RX packets 11022352 bytes 35710471781 (35.7 GB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 11353668 bytes 35651979221 (35.6 GB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

enp1s0f1: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
ether f8:f2:1e:a9:82:f5 txqueuelen 1000 (Ethernet)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
inet 127.0.0.1 netmask 255.0.0.0
inet6 ::1 prefixlen 128 scopeid 0x10<host>
loop txqueuelen 1000 (Local Loopback)
RX packets 13021 bytes 1386362 (1.3 MB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 13021 bytes 1386362 (1.3 MB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

srs_spgw_sgi: flags=4305<UP,POINTOPOINT,RUNNING,NOARP,MULTICAST> mtu 1500
inet 172.16.0.1 netmask 255.255.255.0 destination 172.16.0.1
inet6 fe80::c531:3a05:98e3:8012 prefixlen 64 scopeid 0x20<link>
unspec 00:00:00:00:00:00:00:00:00:00:00:00:00:00:00:00 txqueuelen 500 (UNSPEC)
RX packets 0 bytes 0 (0.0 B)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 9 bytes 420 (420.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

dialog@dialoglab1: ~/.config/srsran$ ip route
default via 192.168.10.1 dev eno1 proto dhcp metric 102
169.254.0.0/16 dev eno1 scope link metric 1000
```

Then we have to share the internet access to the interface. For that copy the following script to a sh file.

```
#!/bin/bash
```

```
IPTABLES=/sbin/iptables
```

```
WANIF='eno1'
```

```
LANIF='srs_spgw_sgi'
```

```
# enable ip forwarding in the kernel  
echo 'Enabling Kernel IP forwarding...'  
/bin/echo 1 > /proc/sys/net/ipv4/ip_forward
```

```
# flush rules and delete chains  
echo 'Flushing rules and deleting existing chains...'  
$IPTABLES -F  
$IPTABLES -X
```

```
# enable masquerading to allow LAN internet access  
echo 'Enabling IP Masquerading and other rules...'  
$IPTABLES -t nat -A POSTROUTING -o $LANIF -j MASQUERADE  
$IPTABLES -A FORWARD -i $LANIF -o $WANIF -m state --state RELATED,ESTABLISHED -j  
ACCEPT  
$IPTABLES -A FORWARD -i $WANIF -o $LANIF -j ACCEPT
```

```
$IPTABLES -t nat -A POSTROUTING -o $WANIF -j MASQUERADE  
$IPTABLES -A FORWARD -i $WANIF -o $LANIF -m state --state RELATED,ESTABLISHED -j  
ACCEPT  
$IPTABLES -A FORWARD -i $LANIF -o $WANIF -j ACCEPT
```

```
echo 'Done.'
```

Running ENB

```
sudo sysctl -w net.core.wmem_max=62500000
```

```
sudo sysctl -w net.core.rmem_max=62500000
```

Since we are using USRP N310 as the ENB, we have to change enb.conf as follows.

```
[enb_files]
```

```
sib_config = sib.conf
```

```
rr_config = rr.conf
```

```
rb_config = rb.conf
```

```
[rf]
```

```
#dl_earfcn = 3350
```

```
tx_gain = 80
```

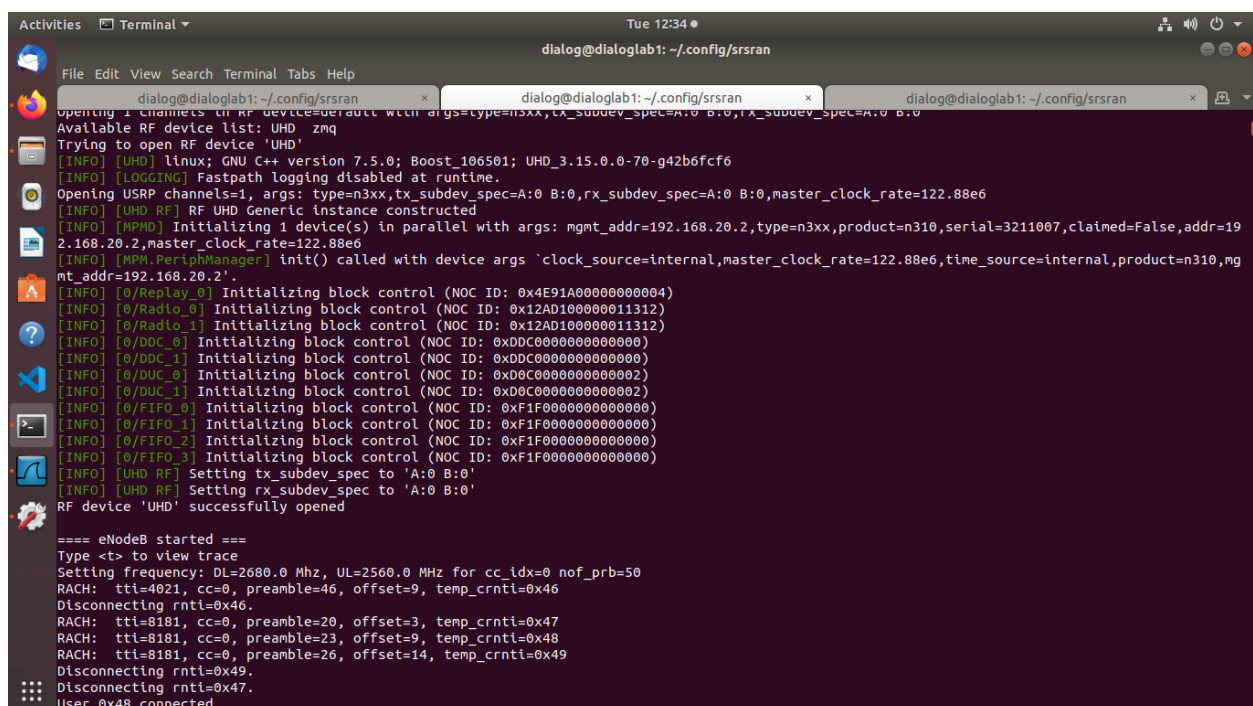
```
rx_gain = 40
```

```
device_args = type=n3xx,tx_subdev_spec=A:0 B:0,rx_subdev_spec=A:0 B:0
```

```
[expert]
```

```
lte_sample_rates = true
```

```
sudo srsenb ~/.config/srsran/enb.conf
```



```
dialog@dialoglab1: ~/.config/srsran
dialog@dialoglab1: ~/.config/srsran
dialog@dialoglab1: ~/.config/srsran
Opening 1 channels on RF device=usrp1 with args=type=n3xx,tx_subdev_spec=A:0 B:0,rx_subdev_spec=A:0 B:0
Available RF device list: UHD zmq
Trying to open RF device 'UHD'
[INFO] [UHD] linux; GNU C++ version 7.5.0; Boost_106501; UHD_3.15.0-70-g42b6fc6
[INFO] [LOGGING] Fastpath logging disabled at runtime.
Opening USRP channels=1, args: type=n3xx,tx_subdev_spec=A:0 B:0,rx_subdev_spec=A:0 B:0,master_clock_rate=122.88e6
[INFO] [UHD RF] RF UHD Generic instance constructed
[INFO] [MPMD] Initializing 1 device(s) in parallel with args: mgmt_addr=192.168.20.2,type=n3xx,product=n310,serial=3211007,claimed=False,addr=192.168.20.2,master_clock_rate=122.88e6
[INFO] [MPM.PeriphManager] init() called with device args 'clock_source=internal,master_clock_rate=122.88e6,time_source=internal,product=n310,mgmt_addr=192.168.20.2'
[INFO] [0/Replay_0] Initializing block control (NOC ID: 0x4E91A00000000004)
[INFO] [0/Radio_0] Initializing block control (NOC ID: 0x12AD100000011312)
[INFO] [0/Radio_1] Initializing block control (NOC ID: 0x12AD100000011312)
[INFO] [0/DDC_0] Initializing block control (NOC ID: 0xDDC0000000000000)
[INFO] [0/DDC_1] Initializing block control (NOC ID: 0xDDC0000000000000)
[INFO] [0/DUC_0] Initializing block control (NOC ID: 0xD0C0000000000002)
[INFO] [0/DUC_1] Initializing block control (NOC ID: 0xD0C0000000000002)
[INFO] [0/FIFO_0] Initializing block control (NOC ID: 0xF1F0000000000000)
[INFO] [0/FIFO_1] Initializing block control (NOC ID: 0xF1F0000000000000)
[INFO] [0/FIFO_2] Initializing block control (NOC ID: 0xF1F0000000000000)
[INFO] [0/FIFO_3] Initializing block control (NOC ID: 0xF1F0000000000000)
[INFO] [UHD RF] Setting tx_subdev_spec to 'A:0 B:0'
[INFO] [UHD RF] Setting rx_subdev_spec to 'A:0 B:0'
RF device 'UHD' successfully opened

==== eNodeB started ====
Type <t> to view trace
Setting frequency: DL=2680.0 Mhz, UL=2560.0 Mhz for cc_idx=0 nof_prb=50
RACH: tti=4021, cc=0, preamble=46, offset=9, temp_crnti=0x46
Disconnecting rnti=0x46.
RACH: tti=8181, cc=0, preamble=20, offset=3, temp_crnti=0x47
RACH: tti=8181, cc=0, preamble=23, offset=9, temp_crnti=0x48
RACH: tti=8181, cc=0, preamble=26, offset=14, temp_crnti=0x49
Disconnecting rnti=0x49.
Disconnecting rnti=0x47.
User 0x48 connected
```

Running UE

```
sudo srsue ~/.config/srsran/ue.conf
```

```
sudo ip route del default
```

```
sudo ip route del 172.16.0.0/24
```

```
sudo ip route add default via {ue tunnel ip} dev tun_srsue proto dhcp metric 100
```

```
sudo ip route add 172.16.0.0/24 dev tun_srsue proto kernel scope link src {ue tunnel ip} metric 100
```

```
ping 8.8.8.8
```

```
Sudo cp /etc/resolv.conf /etc/resolv.orig
```

```
Sudo rm /etc/resolv.conf
```

```
Sudo nano /etc/resolv.conf
```

```
Add following line,
```

```
nameserver 8.8.8.8
```

```
cat /etc/resolv.conf
```

```
Ping www.google.com
```
















```
Activities Terminal Thu 14:56
dialog@dialoglab2: ~/.config/srsran

File Edit View Search Terminal Tabs Help
dialog@dialoglab2: ~/.config/srsran x dialog@dialoglab2: ~/.config/srsran x

dialog@dialoglab2:~/.config/srsran$ ping 172.16.0.2
PING 172.16.0.2 (172.16.0.2) 56(84) bytes of data.
^C
--- 172.16.0.2 ping statistics ---
4 packets transmitted, 0 received, 100% packet loss, time 3066ms

dialog@dialoglab2:~/.config/srsran$ ping 172.16.0.3
PING 172.16.0.3 (172.16.0.3) 56(84) bytes of data.
64 bytes from 172.16.0.3: icmp_seq=1 ttl=64 time=0.014 ms
64 bytes from 172.16.0.3: icmp_seq=2 ttl=64 time=0.015 ms
64 bytes from 172.16.0.3: icmp_seq=3 ttl=64 time=0.029 ms
64 bytes from 172.16.0.3: icmp_seq=4 ttl=64 time=0.015 ms
64 bytes from 172.16.0.3: icmp_seq=5 ttl=64 time=0.014 ms
64 bytes from 172.16.0.3: icmp_seq=6 ttl=64 time=0.013 ms
64 bytes from 172.16.0.3: icmp_seq=7 ttl=64 time=0.014 ms
64 bytes from 172.16.0.3: icmp_seq=8 ttl=64 time=0.014 ms
^C
--- 172.16.0.3 ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7145ms
rtt min/avg/max/mdev = 0.013/0.016/0.029/0.005 ms
dialog@dialoglab2:~/.config/srsran$ ping 172.16.0.1
PING 172.16.0.1 (172.16.0.1) 56(84) bytes of data.
64 bytes from 172.16.0.1: icmp_seq=1 ttl=64 time=112 ms
64 bytes from 172.16.0.1: icmp_seq=2 ttl=64 time=37.8 ms
64 bytes from 172.16.0.1: icmp_seq=3 ttl=64 time=36.0 ms
64 bytes from 172.16.0.1: icmp_seq=4 ttl=64 time=34.9 ms
64 bytes from 172.16.0.1: icmp_seq=5 ttl=64 time=33.0 ms
64 bytes from 172.16.0.1: icmp_seq=6 ttl=64 time=32.2 ms
64 bytes from 172.16.0.1: icmp_seq=7 ttl=64 time=31.0 ms
64 bytes from 172.16.0.1: icmp_seq=8 ttl=64 time=30.0 ms
64 bytes from 172.16.0.1: icmp_seq=9 ttl=64 time=28.9 ms
^C
--- 172.16.0.1 ping statistics ---
9 packets transmitted, 9 received, 0% packet loss, time 8008ms
rtt min/avg/max/mdev = 28.987/41.883/112.731/25.194 ms
dialog@dialoglab2:~/.config/srsran$
```

← Network selection

Wash Hands - Dialog 4G	
Dialog 3G	
Dialog 2G	
41304 4G	
Mobitel 4G	
00101 4G	
Airtel 4G	
41311 4G	
Mobitel 3G	
Airtel 3G	
Hutch 3G	
Hutch 2G	
Mobitel 2G	
Airtel 2G	
41312 4G	

```
Activities Terminal Thu 14:56
dialog@dialoglab2: ~/.config/srsran

File Edit View Search Terminal Tabs Help

dialog@dialoglab2: ~/.config/srsran x dialog@dialoglab2: ~/.config/srsran x

dialog@dialoglab2:~/.config/srsran$ ping 172.16.0.2
PING 172.16.0.2 (172.16.0.2) 56(84) bytes of data.
^C
--- 172.16.0.2 ping statistics ---
4 packets transmitted, 0 received, 100% packet loss, time 3066ms

dialog@dialoglab2:~/.config/srsran$ ping 172.16.0.3
PING 172.16.0.3 (172.16.0.3) 56(84) bytes of data.
64 bytes from 172.16.0.3: icmp_seq=1 ttl=64 time=0.014 ms
64 bytes from 172.16.0.3: icmp_seq=2 ttl=64 time=0.015 ms
64 bytes from 172.16.0.3: icmp_seq=3 ttl=64 time=0.029 ms
64 bytes from 172.16.0.3: icmp_seq=4 ttl=64 time=0.015 ms
64 bytes from 172.16.0.3: icmp_seq=5 ttl=64 time=0.014 ms
64 bytes from 172.16.0.3: icmp_seq=6 ttl=64 time=0.013 ms
64 bytes from 172.16.0.3: icmp_seq=7 ttl=64 time=0.014 ms
64 bytes from 172.16.0.3: icmp_seq=8 ttl=64 time=0.014 ms
^C
--- 172.16.0.3 ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7145ms
rtt min/avg/max/mdev = 0.013/0.016/0.029/0.005 ms
dialog@dialoglab2:~/.config/srsran$ ping 172.16.0.1
PING 172.16.0.1 (172.16.0.1) 56(84) bytes of data.
64 bytes from 172.16.0.1: icmp_seq=1 ttl=64 time=112 ms
64 bytes from 172.16.0.1: icmp_seq=2 ttl=64 time=37.8 ms
64 bytes from 172.16.0.1: icmp_seq=3 ttl=64 time=36.0 ms
64 bytes from 172.16.0.1: icmp_seq=4 ttl=64 time=34.9 ms
64 bytes from 172.16.0.1: icmp_seq=5 ttl=64 time=33.0 ms
64 bytes from 172.16.0.1: icmp_seq=6 ttl=64 time=32.2 ms
64 bytes from 172.16.0.1: icmp_seq=7 ttl=64 time=31.0 ms
64 bytes from 172.16.0.1: icmp_seq=8 ttl=64 time=30.0 ms
64 bytes from 172.16.0.1: icmp_seq=9 ttl=64 time=28.9 ms
^C
--- 172.16.0.1 ping statistics ---
9 packets transmitted, 9 received, 0% packet loss, time 8008ms
rtt min/avg/max/mdev = 28.987/41.883/112.731/25.194 ms
dialog@dialoglab2:~/.config/srsran$
```



```
Activities  Terminal  Thu 15:06
dialog@dialoglab2: ~/.config/srsran

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dialog@dialoglab2: ~/.config/srsran x dialog@dialoglab2: ~/.config/srsran x
64 bytes from 8.8.8.8: icmp_seq=7 ttl=55 time=75.1 ms
64 bytes from 8.8.8.8: icmp_seq=8 ttl=55 time=58.9 ms
64 bytes from 8.8.8.8: icmp_seq=9 ttl=55 time=50.9 ms
^C
--- 8.8.8.8 ping statistics ---
9 packets transmitted, 9 received, 0% packet loss, time 8010ms
rtt min/avg/max/mdev = 50.965/77.393/145.999/27.528 ms
dialog@dialoglab2:~/.config/srsran$ ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=55 time=69.1 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=55 time=68.0 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=55 time=111 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=55 time=65.1 ms
^C
--- 8.8.8.8 ping statistics ---
5 packets transmitted, 4 received, 20% packet loss, time 4005ms
rtt min/avg/max/mdev = 65.161/78.577/111.948/19.325 ms
dialog@dialoglab2:~/.config/srsran$ ping -I tun_srsue 8.8.8.8
PING 8.8.8.8 (8.8.8.8) from 172.16.0.3 tun_srsue: 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=55 time=77.3 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=55 time=45.8 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=55 time=58.0 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=55 time=48.9 ms
64 bytes from 8.8.8.8: icmp_seq=5 ttl=55 time=47.0 ms
64 bytes from 8.8.8.8: icmp_seq=6 ttl=55 time=54.2 ms
64 bytes from 8.8.8.8: icmp_seq=7 ttl=55 time=53.6 ms
64 bytes from 8.8.8.8: icmp_seq=8 ttl=55 time=63.8 ms
64 bytes from 8.8.8.8: icmp_seq=9 ttl=55 time=70.2 ms
64 bytes from 8.8.8.8: icmp_seq=10 ttl=55 time=69.0 ms
64 bytes from 8.8.8.8: icmp_seq=11 ttl=55 time=68.0 ms
64 bytes from 8.8.8.8: icmp_seq=12 ttl=55 time=67.0 ms
^C
--- 8.8.8.8 ping statistics ---
12 packets transmitted, 12 received, 0% packet loss, time 11014ms
rtt min/avg/max/mdev = 45.815/60.274/77.354/9.937 ms
dialog@dialoglab2:~/.config/srsran$
```

```
Activities Terminal Thu 15:08
dialog@dialoglab2: ~/.config/srsran

File Edit View Search Terminal Tabs Help

dialog@dialoglab2: ~/.config/srsran x dialog@dialoglab2: ~/.config/srsran x
dialog@dialoglab2:~/.config/srsran$ sudo rm /etc/resolv.conf
dialog@dialoglab2:~/.config/srsran$ sudo nano /etc/resolv.conf
dialog@dialoglab2:~/.config/srsran$ ping www.google.com
PING www.google.com (142.251.42.4) 56(84) bytes of data.
64 bytes from bom12s19-in-f4.1e100.net (142.251.42.4): icmp_seq=1 ttl=55 time=64.8 ms
64 bytes from bom12s19-in-f4.1e100.net (142.251.42.4): icmp_seq=2 ttl=55 time=66.0 ms
64 bytes from bom12s19-in-f4.1e100.net (142.251.42.4): icmp_seq=3 ttl=55 time=65.0 ms
64 bytes from bom12s19-in-f4.1e100.net (142.251.42.4): icmp_seq=4 ttl=55 time=116 ms
64 bytes from bom12s19-in-f4.1e100.net (142.251.42.4): icmp_seq=5 ttl=55 time=54.9 ms
64 bytes from bom12s19-in-f4.1e100.net (142.251.42.4): icmp_seq=6 ttl=55 time=76.0 ms
64 bytes from bom12s19-in-f4.1e100.net (142.251.42.4): icmp_seq=7 ttl=55 time=53.0 ms
64 bytes from bom12s19-in-f4.1e100.net (142.251.42.4): icmp_seq=8 ttl=55 time=59.8 ms
64 bytes from bom12s19-in-f4.1e100.net (142.251.42.4): icmp_seq=9 ttl=55 time=50.0 ms
64 bytes from bom12s19-in-f4.1e100.net (142.251.42.4): icmp_seq=10 ttl=55 time=38.8 ms
64 bytes from bom12s19-in-f4.1e100.net (142.251.42.4): icmp_seq=11 ttl=55 time=77.0 ms
64 bytes from bom12s19-in-f4.1e100.net (142.251.42.4): icmp_seq=12 ttl=55 time=46.9 ms
^C
--- www.google.com ping statistics ---
12 packets transmitted, 12 received, 0% packet loss, time 11012ms
rtt min/avg/max/mdev = 38.836/64.057/116.003/19.061 ms
dialog@dialoglab2:~/.config/srsran$ ping -I tun_srsue www.google.com
PING www.google.com (142.250.192.68) from 172.16.0.3 tun_srsue: 56(84) bytes of data.
64 bytes from bom12s16-in-f4.1e100.net (142.250.192.68): icmp_seq=1 ttl=55 time=65.6 ms
64 bytes from bom12s16-in-f4.1e100.net (142.250.192.68): icmp_seq=2 ttl=55 time=64.0 ms
64 bytes from bom12s16-in-f4.1e100.net (142.250.192.68): icmp_seq=3 ttl=55 time=54.9 ms
64 bytes from bom12s16-in-f4.1e100.net (142.250.192.68): icmp_seq=4 ttl=55 time=98.9 ms
64 bytes from bom12s16-in-f4.1e100.net (142.250.192.68): icmp_seq=5 ttl=55 time=52.0 ms
64 bytes from bom12s16-in-f4.1e100.net (142.250.192.68): icmp_seq=6 ttl=55 time=51.9 ms
64 bytes from bom12s16-in-f4.1e100.net (142.250.192.68): icmp_seq=7 ttl=55 time=49.9 ms
64 bytes from bom12s16-in-f4.1e100.net (142.250.192.68): icmp_seq=8 ttl=55 time=88.0 ms
64 bytes from bom12s16-in-f4.1e100.net (142.250.192.68): icmp_seq=9 ttl=55 time=47.7 ms
^C
--- www.google.com ping statistics ---
9 packets transmitted, 9 received, 0% packet loss, time 8009ms
rtt min/avg/max/mdev = 47.789/63.712/98.934/17.107 ms
dialog@dialoglab2:~/.config/srsran$
```