Open5GS SCP Model C-UPF/SMF-UEs based on UERANSIM

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OVERVIEW

I. This project focuses on implementing and testing a **5G Core Network** using **Open5GS** and the **SCP Model C** approach.

II. **UERANSIM** is used to simulate user equipment (UEs) to validate network functionality.

III. Here is the github repository’s link: https://github.com/MobileComputingWiSe24-25/mobcom-teammblcp

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INTRODUCTION

I. Open5GS 5G SA Core Implementation - Showcases **performance, scalability, and resilience** through an open-source 5G core solution.

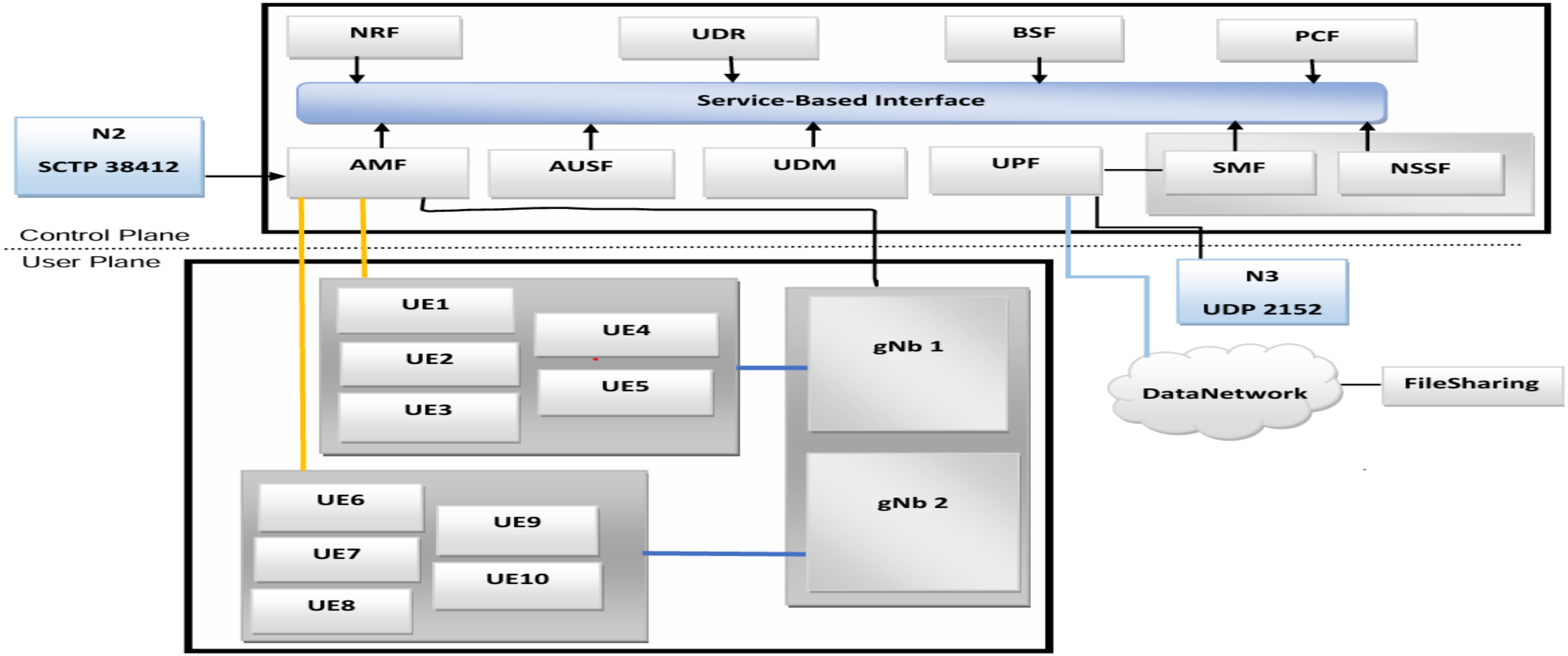
II. Significance of 5G Technology - Offers **ultra-high-speed data rates**, **low latency**, and **enhanced network capacity**.

III. Scope of This Project - **Deploy, Integrate services and test** a 5G SA network using **Open5GS**.

Project Goals

- Multiple control-plane (C-plane) and user-plane (U-plane) instances.
- RAN + multiple gNBs and simulated UEs via UERANSIM.
- Docker and Docker Compose-based setup (no Kubernetes).
- IPv4-only networking, no localhost IP addresses in the core data plane.
- Single PDU session per UE, using the 5G SA architecture.
- No TLS encryption in the 5GC (to enable traffic analysis).
- Automatic scaling/orchestration logic (AMF, UPF, SMF) after every 10 UEs register.

System Architecture



Configuration

Network ips:

❑ Set the correct IP addresses in the .env file.

❑ Ensure the correct Wi-Fi address is updated.

❑ .env file is used for building Docker images.

❑ Deploy using Docker Compose.

❑ No need to modify docker-bake.hcl for this project.

Environment

Version:

OPEN5GS_VERSION: v2.7.2

UBUNTU_VERSION: jammy

MONGODB_VERSION: 6.0

NODE_VERSION: 20

Using Methods:

Open 5GS 5g Core with SCP Model C,

Integration of RAN, gNBs, and Simulated UEs using UERANSIM,

Docker-Based Deployment of 5G core,

Traffic Analysis with iPerf3.

Automatic Scaling and Orchestration logic.

Docker Network Configuration

- Host IP: 192.168.2.35
- UPF advertise field modified in upf.yaml
- Exposes Docker container networks
- Special permissions needed for UERANSIM TUN interfaces

gNB & Core Network Interfaces

- N2 Control Plane (AMF) → SCTP Port: 38412
- N3 User Plane (UPF) → UDP Port: 2152
- Prepared for external gNB connectivity

Implementation

Build it with Bake

- Executing the command will generate all the images within Docker -   docker buildx bake

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Implementation

Build it with Docker Compose

- We will implement the 'docker-compose.yaml' files. It is situated in the 'compose-files' directory of our project. To deploy the 'docker-compose.yaml' files, we must utilize the specified command. Following the execution of the command, we can now observe that our containers are operating smoothly within Docker.

```
docker compose -f compose-files/scp/model-c/docker-compose.yaml --env-file .env up -d
```

Implementation

To shut down the deployment

- To conclude the project, you can simply terminate the container. To achieve it, you require the specified command:

```
docker compose -f compose-files/scp/model-c/docker-compose.yaml --env-file .env down
```

Repository Structure

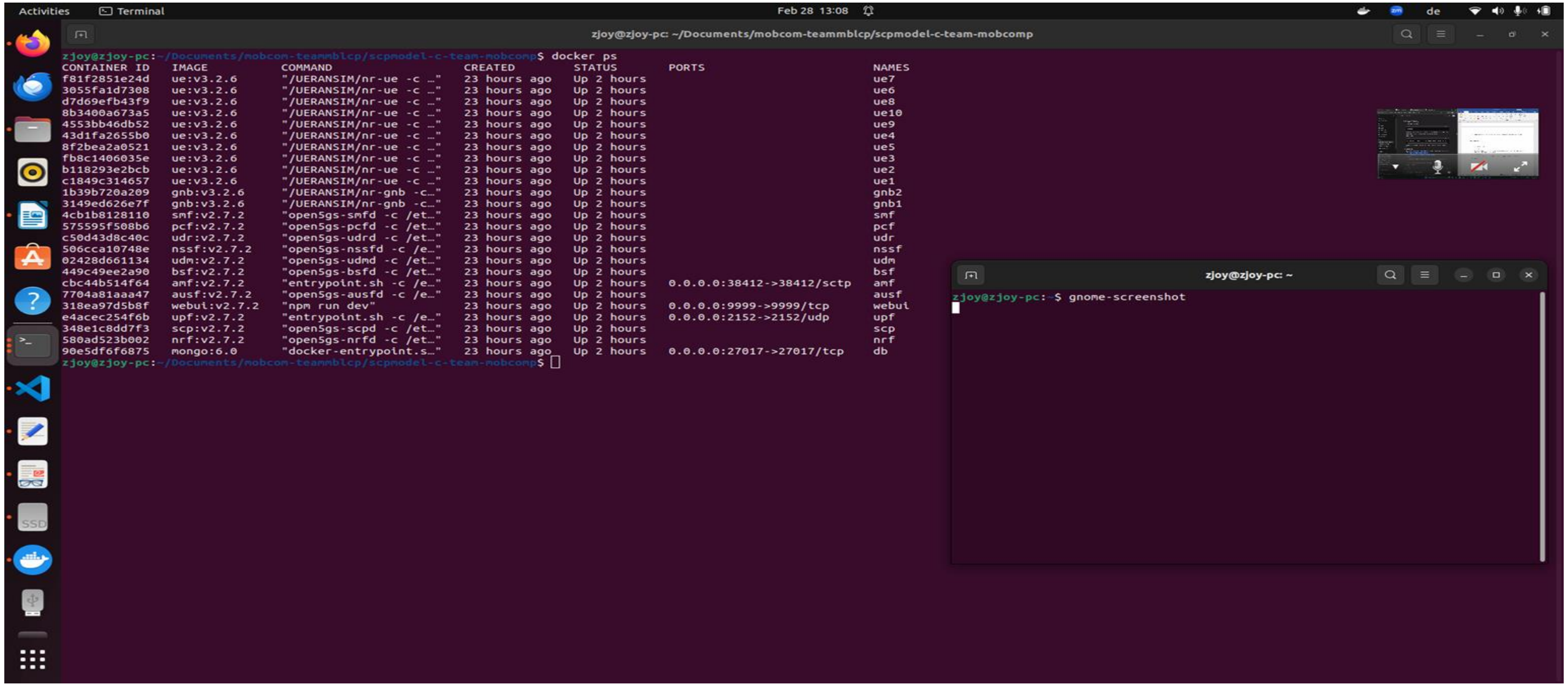
- scpmodel-c-team-mobcomp – This is our main project folder. Inside in this folder we have project files.
- compose-files/scp/model-c - In this folder we have docker-compose.yaml file.
- configs/scp/model-c - Config files for Open5GS (AMF, SMF, UPF, etc.)
- images – Docker files for building each network function (NF).
- env – Key environment variables for building and running the containers (e.g., IP addresses, base image versions, etc.).
- LICENSE
- Makefile
- docker-bake.hcl – Configuration for building images using docker buildx bake.

Services

- Internet
- Voice over internet protocol (VoIP)
- File sharing (Next Cloud)
- Video Streaming

Testing and Demo

Check Container Status:



Activities
Terminal
Feb 28 13:08
de
zjoy@zjoy-pc: ~/Documents/mobcom-teammblcp/scpmodel-c-team-mobcomp

```
zjoy@zjoy-pc:~/Documents/mobcom-teammblcp/scpmodel-c-team-mobcomp$ docker ps
CONTAINER ID   IMAGE         COMMAND                  CREATED        STATUS       PORTS                           NAMES
f81f2851e24d   ue:v3.2.6     "/UERANSIM/nr-ue -c …"   23 hours ago   Up 2 hours                                   ue7
3055fa1d7308   ue:v3.2.6     "/UERANSIM/nr-ue -c …"   23 hours ago   Up 2 hours                                   ue6
d7d69efb43f9   ue:v3.2.6     "/UERANSIM/nr-ue -c …"   23 hours ago   Up 2 hours                                   ue8
8b3400a673a5   ue:v3.2.6     "/UERANSIM/nr-ue -c …"   23 hours ago   Up 2 hours                                   ue10
4553bb46db52   ue:v3.2.6     "/UERANSIM/nr-ue -c …"   23 hours ago   Up 2 hours                                   ue9
43d1fa2655b0   ue:v3.2.6     "/UERANSIM/nr-ue -c …"   23 hours ago   Up 2 hours                                   ue4
8f2bea2a0521   ue:v3.2.6     "/UERANSIM/nr-ue -c …"   23 hours ago   Up 2 hours                                   ue5
fb8c1406035e   ue:v3.2.6     "/UERANSIM/nr-ue -c …"   23 hours ago   Up 2 hours                                   ue3
b118293e2bcb   ue:v3.2.6     "/UERANSIM/nr-ue -c …"   23 hours ago   Up 2 hours                                   ue2
c1849c314657   ue:v3.2.6     "/UERANSIM/nr-ue -c …"   23 hours ago   Up 2 hours                                   ue1
1b39b720a209   gnb:v3.2.6    "/UERANSIM/nr-gnb -c…"   23 hours ago   Up 2 hours                                   gnb2
3149ed626e7f   gnb:v3.2.6    "/UERANSIM/nr-gnb -c…"   23 hours ago   Up 2 hours                                   gnb1
4cb1b8128110   smf:v2.7.2    "open5gs-smfd -c /et…"   23 hours ago   Up 2 hours                                   smf
575595f508b6   pcf:v2.7.2    "open5gs-pcfd -c /et…"   23 hours ago   Up 2 hours                                   pcf
c50d43d8c40c   udr:v2.7.2    "open5gs-udrd -c /et…"   23 hours ago   Up 2 hours                                   udr
506cca10748e   nssf:v2.7.2   "open5gs-nssfd -c /e…"   23 hours ago   Up 2 hours                                   nssf
02428d661134   udm:v2.7.2    "open5gs-udmd -c /et…"   23 hours ago   Up 2 hours                                   udm
449c49ee2a90   bsf:v2.7.2    "open5gs-bsfd -c /et…"   23 hours ago   Up 2 hours                                   bsf
cbc44b514f64   amf:v2.7.2    "entrypoint.sh -c /e…"   23 hours ago   Up 2 hours   0.0.0.0:38412->38412/sctp       amf
7704a81aaa47   ausf:v2.7.2   "open5gs-ausfd -c /e…"   23 hours ago   Up 2 hours                                   ausf
318ea97d5b8f   webui:v2.7.2  "npm run dev"            23 hours ago   Up 2 hours   0.0.0.0:9999->9999/tcp          webui
e4acec254f6b   upf:v2.7.2    "entrypoint.sh -c /e…"   23 hours ago   Up 2 hours   0.0.0.0:2152->2152/udp          upf
348e1c8dd7f3   scp:v2.7.2    "open5gs-scpd -c /et…"   23 hours ago   Up 2 hours                                   scp
580ad523b002   nrf:v2.7.2    "open5gs-nrfd -c /et…"   23 hours ago   Up 2 hours                                   nrf
90e5df6f6875   mongo:6.0     "docker-entrypoint.s…"   23 hours ago   Up 2 hours   0.0.0.0:27017->27017/tcp        db
zjoy@zjoy-pc:~/Documents/mobcom-teammblcp/scpmodel-c-team-mobcomp$
```

```
zjoy@zjoy-pc:~$ gnome-screenshot
```

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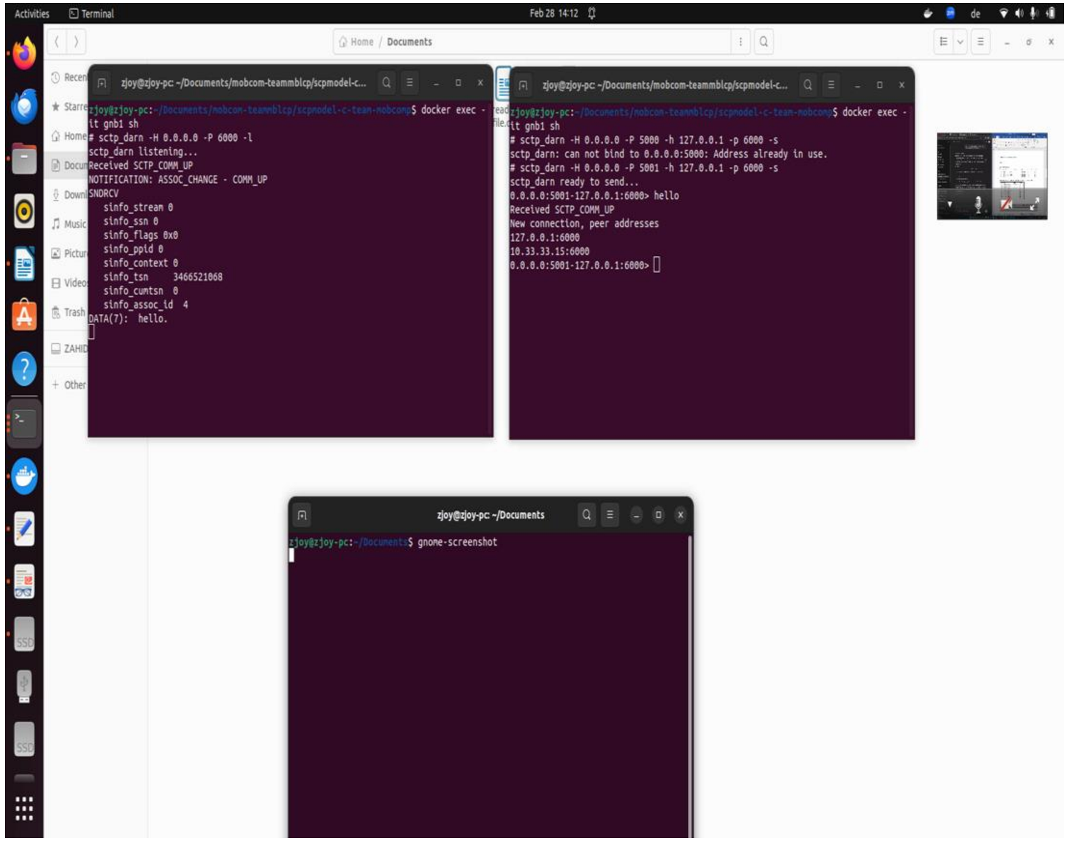
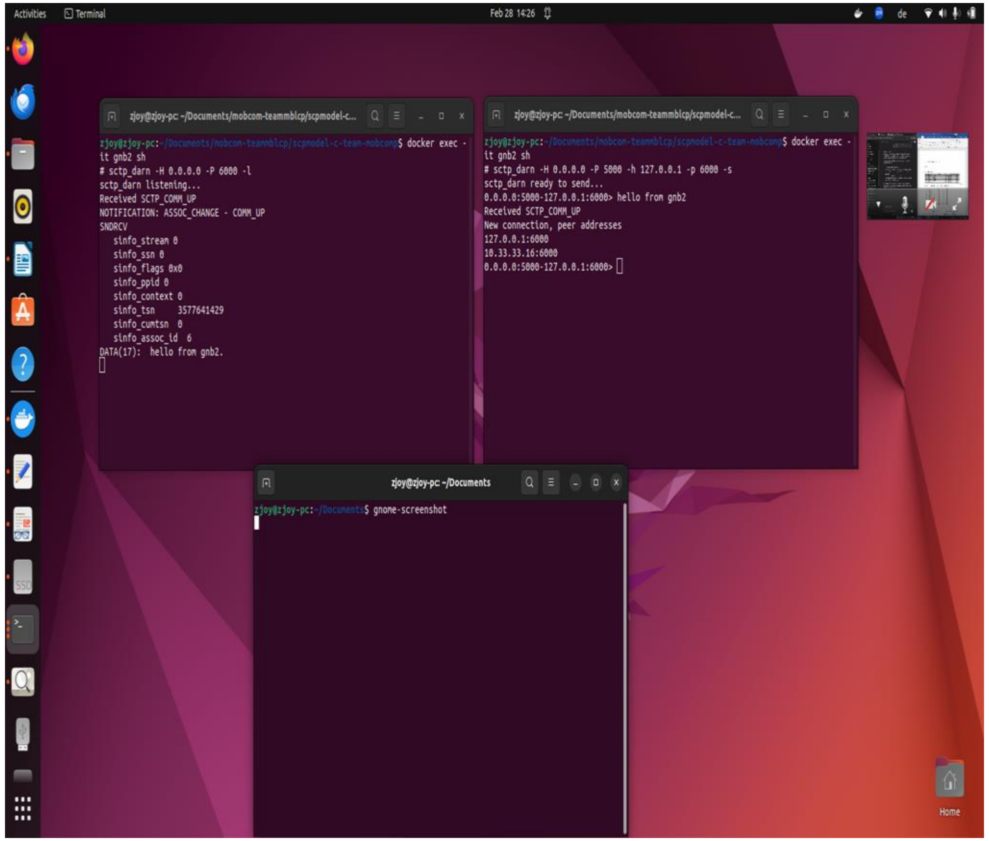
gNb 1 and gNb 2 SCTP connection establishment and data passes:



```
zjoy@zjoy-pc:~/Documents/mobcom-teammblcp/scpmodel-c-team-mobcomp$ docker exec -
it gnb1 sh
# sctp_darn -H 0.0.0.0 -P 6000 -l
sctp_darn listening...
Received SCTP_COMM_UP
NOTIFICATION: ASSOC_CHANGE - COMM_UP
SNDRCV
   sinfo_stream 0
   sinfo_ssn 0
   sinfo_flags 0x0
   sinfo_ppid 0
   sinfo_context 0
   sinfo_tsn     3466521068
   sinfo_cumtsn  0
   sinfo_assoc_id  4
DATA(7):  hello.
```

```
zjoy@zjoy-pc:~/Documents/mobcom-teammblcp/scpmodel-c-team-mobcomp$ docker exec -
it gnb1 sh
# sctp_darn -H 0.0.0.0 -P 5000 -h 127.0.0.1 -p 6000 -s
sctp_darn: can not bind to 0.0.0.0:5000: Address already in use.
# sctp_darn -H 0.0.0.0 -P 5001 -h 127.0.0.1 -p 6000 -s
sctp_darn ready to send...
0.0.0.0:5001-127.0.0.1:6000> hello
Received SCTP_COMM_UP
New connection, peer addresses
127.0.0.1:6000
10.33.33.15:6000
0.0.0.0:5001-127.0.0.1:6000> 
```

```
zjoy@zjoy-pc:~/Documents$ gnome-screenshot
```

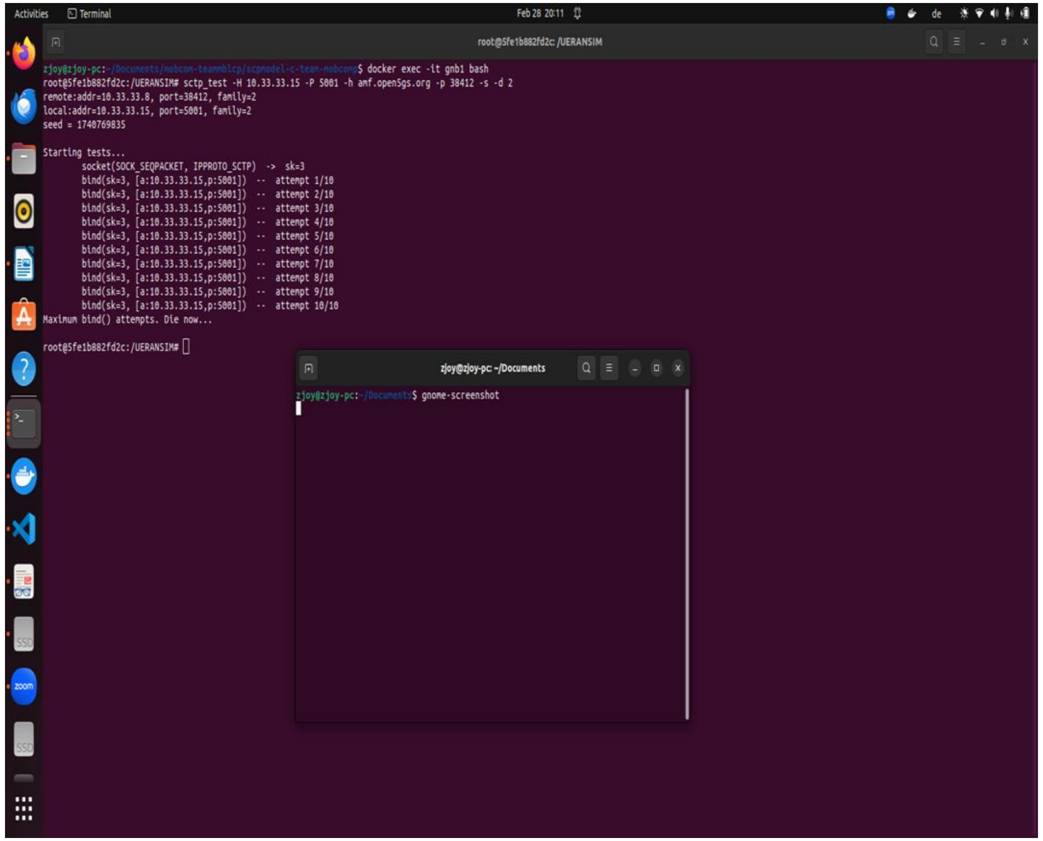

Activities
Terminal
Feb 28 14:26
de
zjoy@zjoy-pc: ~/Documents/mobcom-teammblcp/scpmodel-c...
zjoy@zjoy-pc: ~/Documents
Home

```
zjoy@zjoy-pc:~/Documents/mobcom-teammblcp/scpmodel-c-team-mobcomp$ docker exec -
it gnb2 sh
# sctp_darn -H 0.0.0.0 -P 6000 -l
sctp_darn listening...
Received SCTP_COMM_UP
NOTIFICATION: ASSOC_CHANGE - COMM_UP
SNDRCV
   sinfo_stream 0
   sinfo_ssn 0
   sinfo_flags 0x0
   sinfo_ppid 0
   sinfo_context 0
   sinfo_tsn     3577641429
   sinfo_cumtsn  0
   sinfo_assoc_id  6
DATA(17):  hello from gnb2.
```

```
zjoy@zjoy-pc:~/Documents/mobcom-teammblcp/scpmodel-c-team-mobcomp$ docker exec -
it gnb2 sh
# sctp_darn -H 0.0.0.0 -P 5000 -h 127.0.0.1 -p 6000 -s
sctp_darn ready to send...
0.0.0.0:5000-127.0.0.1:6000> hello from gnb2
Received SCTP_COMM_UP
New connection, peer addresses
127.0.0.1:6000
10.33.33.16:6000
0.0.0.0:5000-127.0.0.1:6000> 
```

```
zjoy@zjoy-pc:~/Documents$ gnome-screenshot
```

SCTP connection and packets transfer with amf:

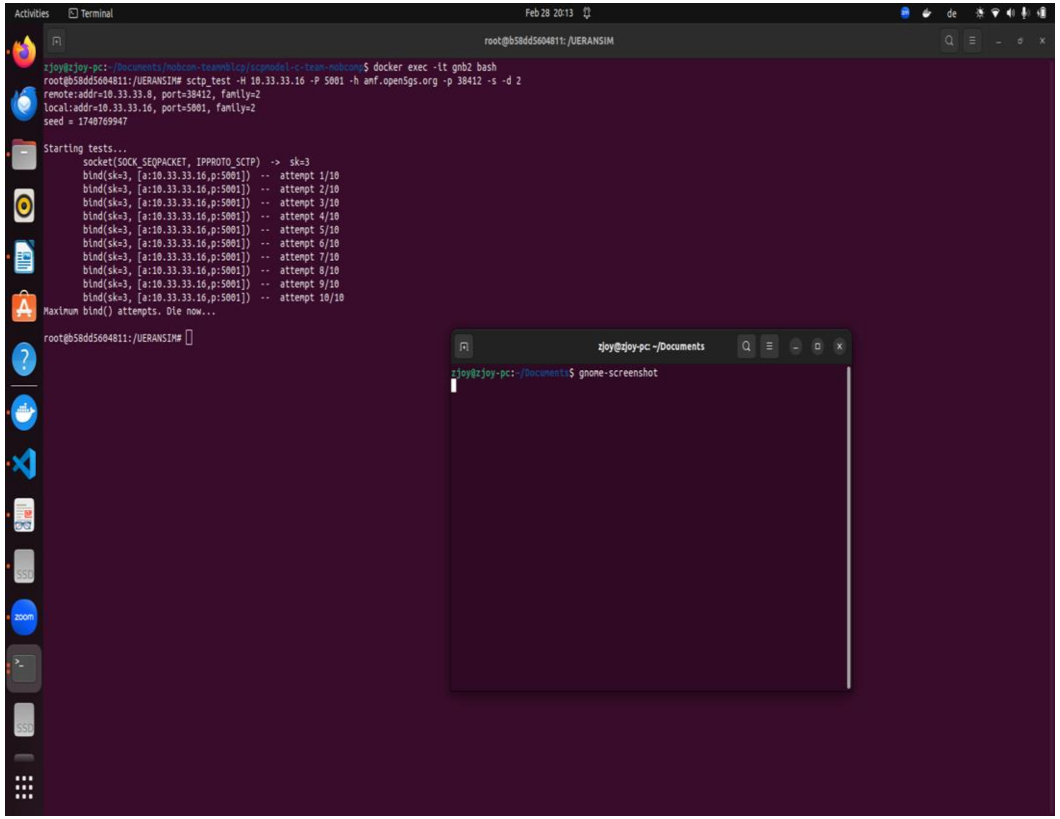


```
zjoy@zjoy-pc:~/Documents/mobcom-teamblcp/scpmodel-c-team-mobcomp$ docker exec -it gnb1 bash
root@5fe1b882fd2c:/UERANSIM# sctp_test -H 10.33.33.15 -P 5001 -h amf.open5gs.org -p 38412 -s -d 2
remote:addr=10.33.33.8, port=38412, family=2
local:addr=10.33.33.15, port=5001, family=2
seed = 1740769835

Starting tests...
        socket(SOCK_SEQPACKET, IPPROTO_SCTP)  ->  sk=3
        bind(sk=3, [a:10.33.33.15,p:5001])  --  attempt 1/10
        bind(sk=3, [a:10.33.33.15,p:5001])  --  attempt 2/10
        bind(sk=3, [a:10.33.33.15,p:5001])  --  attempt 3/10
        bind(sk=3, [a:10.33.33.15,p:5001])  --  attempt 4/10
        bind(sk=3, [a:10.33.33.15,p:5001])  --  attempt 5/10
        bind(sk=3, [a:10.33.33.15,p:5001])  --  attempt 6/10
        bind(sk=3, [a:10.33.33.15,p:5001])  --  attempt 7/10
        bind(sk=3, [a:10.33.33.15,p:5001])  --  attempt 8/10
        bind(sk=3, [a:10.33.33.15,p:5001])  --  attempt 9/10
        bind(sk=3, [a:10.33.33.15,p:5001])  --  attempt 10/10
Maximum bind() attempts. Die now...

root@5fe1b882fd2c:/UERANSIM# 
```

```
zjoy@zjoy-pc:~/Documents$ gnome-screenshot
```



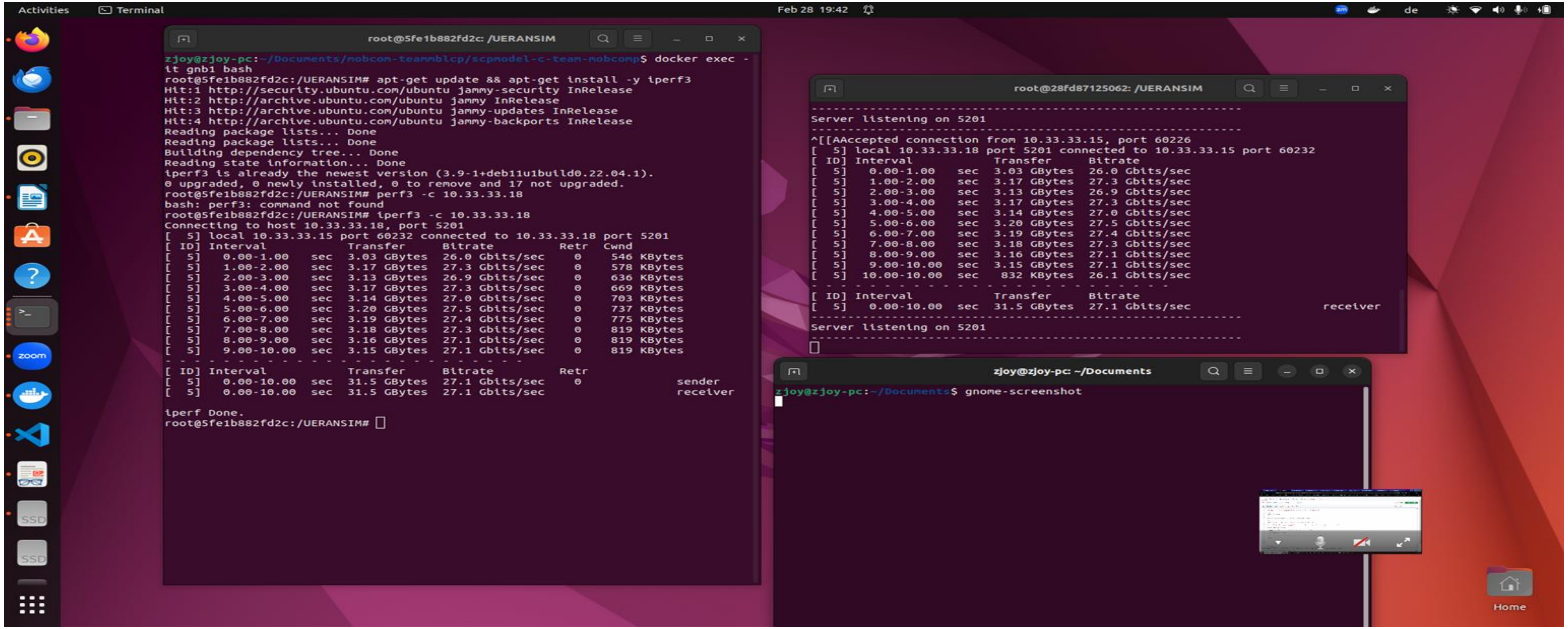
```
zjoy@zjoy-pc:~/Documents/mobcom-teamblcp/scpmodel-c-team-mobcomp$ docker exec -it gnb2 bash
root@b58dd5604811:/UERANSIM# sctp_test -H 10.33.33.16 -P 5001 -h amf.open5gs.org -p 38412 -s -d 2
remote:addr=10.33.33.8, port=38412, family=2
local:addr=10.33.33.16, port=5001, family=2
seed = 1740769947

Starting tests...
        socket(SOCK_SEQPACKET, IPPROTO_SCTP)  ->  sk=3
        bind(sk=3, [a:10.33.33.16,p:5001])  --  attempt 1/10
        bind(sk=3, [a:10.33.33.16,p:5001])  --  attempt 2/10
        bind(sk=3, [a:10.33.33.16,p:5001])  --  attempt 3/10
        bind(sk=3, [a:10.33.33.16,p:5001])  --  attempt 4/10
        bind(sk=3, [a:10.33.33.16,p:5001])  --  attempt 5/10
        bind(sk=3, [a:10.33.33.16,p:5001])  --  attempt 6/10
        bind(sk=3, [a:10.33.33.16,p:5001])  --  attempt 7/10
        bind(sk=3, [a:10.33.33.16,p:5001])  --  attempt 8/10
        bind(sk=3, [a:10.33.33.16,p:5001])  --  attempt 9/10
        bind(sk=3, [a:10.33.33.16,p:5001])  --  attempt 10/10
Maximum bind() attempts. Die now...

root@b58dd5604811:/UERANSIM# 
```

```
zjoy@zjoy-pc:~/Documents$ gnome-screenshot
```

Running iPerf3 in a 5G Network Setup:


Activities
Terminal
Feb 28 19:42
de
root@5fe1b882fd2c: /UERANSIM
root@28fd87125062: /UERANSIM
zjoy@zjoy-pc: ~/Documents
SSD
SSD
Home

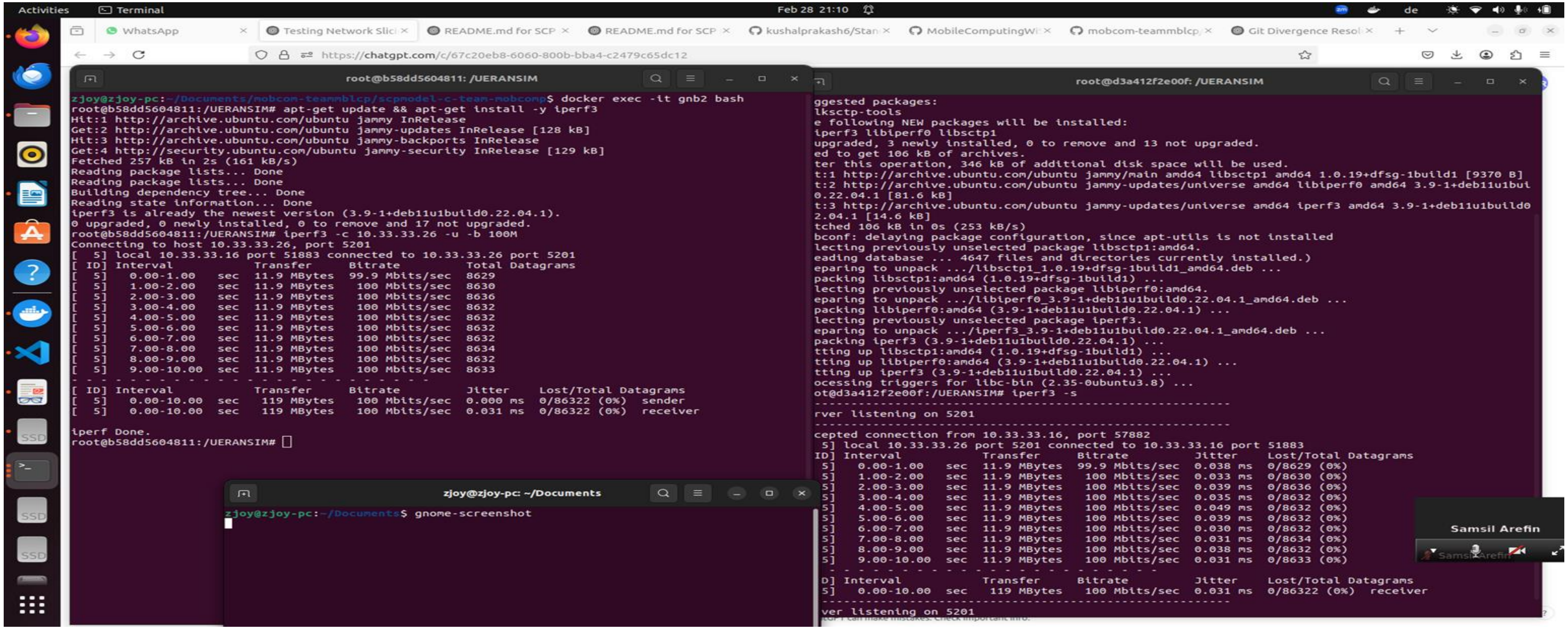
```
zjoy@zjoy-pc:~/Documents/mobcom-teammblcp/scpmodel-c-team-mobcomp$ docker exec -
it gnb1 bash
root@5fe1b882fd2c:/UERANSIM# apt-get update && apt-get install -y iperf3
Hit:1 http://security.ubuntu.com/ubuntu jammy-security InRelease
Hit:2 http://archive.ubuntu.com/ubuntu jammy InRelease
Hit:3 http://archive.ubuntu.com/ubuntu jammy-updates InRelease
Hit:4 http://archive.ubuntu.com/ubuntu jammy-backports InRelease
Reading package lists... Done
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
iperf3 is already the newest version (3.9-1+deb11u1build0.22.04.1).
0 upgraded, 0 newly installed, 0 to remove and 17 not upgraded.
root@5fe1b882fd2c:/UERANSIM# perf3 -c 10.33.33.18
bash: perf3: command not found
root@5fe1b882fd2c:/UERANSIM# iperf3 -c 10.33.33.18
Connecting to host 10.33.33.18, port 5201
[  5] local 10.33.33.15 port 60232 connected to 10.33.33.18 port 5201
[ ID] Interval           Transfer     Bitrate         Retr  Cwnd
[  5]   0.00-1.00   sec  3.03 GBytes  26.0 Gbits/sec    0    546 KBytes
[  5]   1.00-2.00   sec  3.17 GBytes  27.3 Gbits/sec    0    578 KBytes
[  5]   2.00-3.00   sec  3.13 GBytes  26.9 Gbits/sec    0    636 KBytes
[  5]   3.00-4.00   sec  3.17 GBytes  27.3 Gbits/sec    0    669 KBytes
[  5]   4.00-5.00   sec  3.14 GBytes  27.0 Gbits/sec    0    703 KBytes
[  5]   5.00-6.00   sec  3.20 GBytes  27.5 Gbits/sec    0    737 KBytes
[  5]   6.00-7.00   sec  3.19 GBytes  27.4 Gbits/sec    0    775 KBytes
[  5]   7.00-8.00   sec  3.18 GBytes  27.3 Gbits/sec    0    819 KBytes
[  5]   8.00-9.00   sec  3.16 GBytes  27.1 Gbits/sec    0    819 KBytes
[  5]   9.00-10.00  sec  3.15 GBytes  27.1 Gbits/sec    0    819 KBytes
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Retr
[  5]   0.00-10.00  sec  31.5 GBytes  27.1 Gbits/sec    0             sender
[  5]   0.00-10.00  sec  31.5 GBytes  27.1 Gbits/sec                  receiver

iperf Done.
root@5fe1b882fd2c:/UERANSIM# 
```

```
-----------------------------------------------------------
Server listening on 5201
-----------------------------------------------------------
^[[AAccepted connection from 10.33.33.15, port 60226
[  5] local 10.33.33.18 port 5201 connected to 10.33.33.15 port 60232
[ ID] Interval           Transfer     Bitrate
[  5]   0.00-1.00   sec  3.03 GBytes  26.0 Gbits/sec
[  5]   1.00-2.00   sec  3.17 GBytes  27.3 Gbits/sec
[  5]   2.00-3.00   sec  3.13 GBytes  26.9 Gbits/sec
[  5]   3.00-4.00   sec  3.17 GBytes  27.3 Gbits/sec
[  5]   4.00-5.00   sec  3.14 GBytes  27.0 Gbits/sec
[  5]   5.00-6.00   sec  3.20 GBytes  27.5 Gbits/sec
[  5]   6.00-7.00   sec  3.19 GBytes  27.4 Gbits/sec
[  5]   7.00-8.00   sec  3.18 GBytes  27.3 Gbits/sec
[  5]   8.00-9.00   sec  3.16 GBytes  27.1 Gbits/sec
[  5]   9.00-10.00  sec  3.15 GBytes  27.1 Gbits/sec
[  5]  10.00-10.00  sec   832 KBytes  26.1 Gbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  5]   0.00-10.00  sec  31.5 GBytes  27.1 Gbits/sec                  receiver
-----------------------------------------------------------
Server listening on 5201
-----------------------------------------------------------
```

```
zjoy@zjoy-pc:~/Documents$ gnome-screenshot
```

UDP Testing with iPerf3:



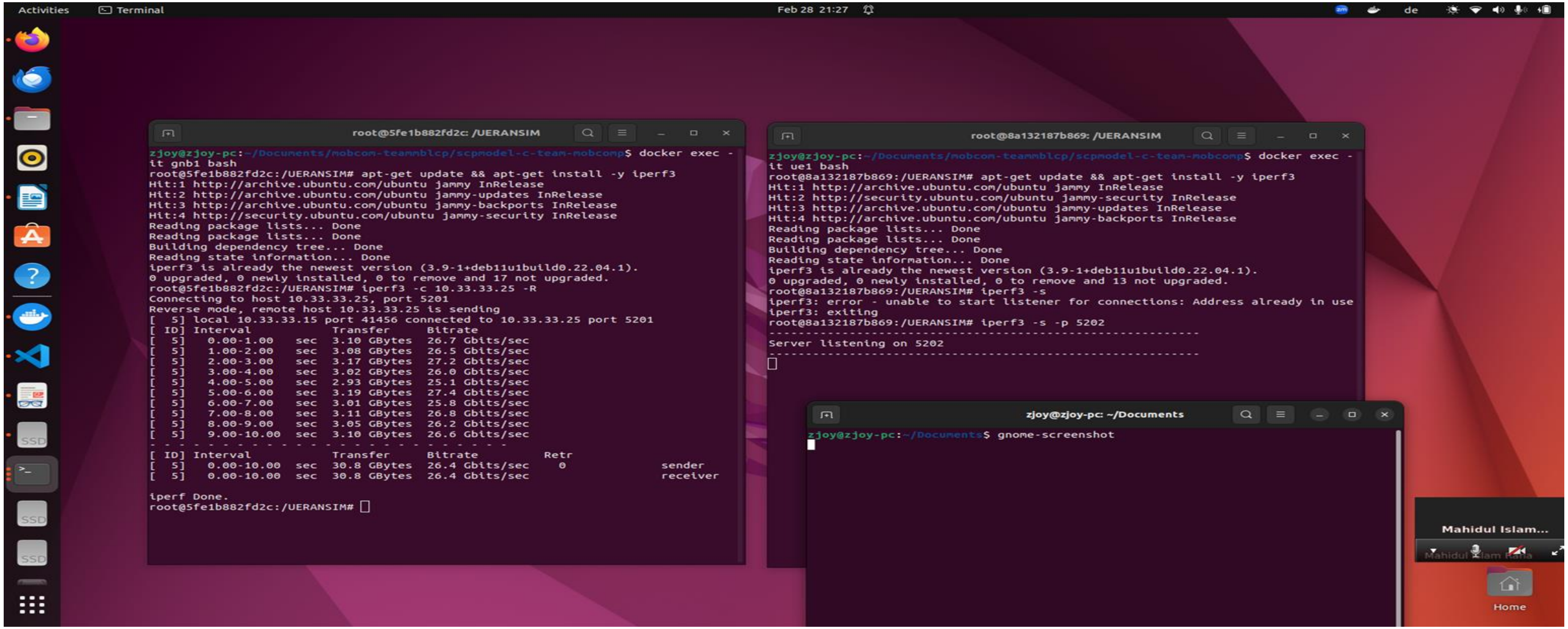
```
zjoy@zjoy-pc:~/Documents/mobcom-teammblcp/scpmodel-c-team-mobcomp$ docker exec -it gnb2 bash
root@b58dd5604811:/UERANSIM# apt-get update && apt-get install -y iperf3
Hit:1 http://archive.ubuntu.com/ubuntu jammy InRelease
Get:2 http://archive.ubuntu.com/ubuntu jammy-updates InRelease [128 kB]
Hit:3 http://archive.ubuntu.com/ubuntu jammy-backports InRelease
Get:4 http://security.ubuntu.com/ubuntu jammy-security InRelease [129 kB]
Fetched 257 kB in 2s (161 kB/s)
Reading package lists... Done
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
iperf3 is already the newest version (3.9-1+deb11u1build0.22.04.1).
0 upgraded, 0 newly installed, 0 to remove and 17 not upgraded.
root@b58dd5604811:/UERANSIM# iperf3 -c 10.33.33.26 -u -b 100M
Connecting to host 10.33.33.26, port 5201
[  5] local 10.33.33.16 port 51883 connected to 10.33.33.26 port 5201
[ ID] Interval           Transfer     Bitrate         Total Datagrams
[  5]   0.00-1.00   sec  11.9 MBytes  99.9 Mbits/sec  8629
[  5]   1.00-2.00   sec  11.9 MBytes   100 Mbits/sec  8630
[  5]   2.00-3.00   sec  11.9 MBytes   100 Mbits/sec  8636
[  5]   3.00-4.00   sec  11.9 MBytes   100 Mbits/sec  8632
[  5]   4.00-5.00   sec  11.9 MBytes   100 Mbits/sec  8632
[  5]   5.00-6.00   sec  11.9 MBytes   100 Mbits/sec  8632
[  5]   6.00-7.00   sec  11.9 MBytes   100 Mbits/sec  8632
[  5]   7.00-8.00   sec  11.9 MBytes   100 Mbits/sec  8634
[  5]   8.00-9.00   sec  11.9 MBytes   100 Mbits/sec  8632
[  5]   9.00-10.00  sec  11.9 MBytes   100 Mbits/sec  8633
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Jitter    Lost/Total Datagrams
[  5]   0.00-10.00  sec   119 MBytes   100 Mbits/sec  0.000 ms  0/86322 (0%)  sender
[  5]   0.00-10.00  sec   119 MBytes   100 Mbits/sec  0.031 ms  0/86322 (0%)  receiver

iperf Done.
root@b58dd5604811:/UERANSIM# 
```

```
zjoy@zjoy-pc:~/Documents$ gnome-screenshot
```

```
ggested packages:
lksctp-tools
e following NEW packages will be installed:
iperf3 libiperf0 libsctp1
upgraded, 3 newly installed, 0 to remove and 13 not upgraded.
ed to get 106 kB of archives.
ter this operation, 346 kB of additional disk space will be used.
t:1 http://archive.ubuntu.com/ubuntu jammy/main amd64 libsctp1 amd64 1.0.19+dfsg-1build1 [9370 B]
t:2 http://archive.ubuntu.com/ubuntu jammy-updates/universe amd64 libiperf0 amd64 3.9-1+deb11u1bui
0.22.04.1 [81.6 kB]
t:3 http://archive.ubuntu.com/ubuntu jammy-updates/universe amd64 iperf3 amd64 3.9-1+deb11u1build0
2.04.1 [14.6 kB]
tched 106 kB in 0s (253 kB/s)
bconf: delaying package configuration, since apt-utils is not installed
lecting previously unselected package libsctp1:amd64.
eading database ... 4647 files and directories currently installed.)
eparing to unpack .../libsctp1_1.0.19+dfsg-1build1_amd64.deb ...
packing libsctp1:amd64 (1.0.19+dfsg-1build1) ...
lecting previously unselected package libiperf0:amd64.
eparing to unpack .../libiperf0_3.9-1+deb11u1build0.22.04.1_amd64.deb ...
packing libiperf0:amd64 (3.9-1+deb11u1build0.22.04.1) ...
lecting previously unselected package iperf3.
eparing to unpack .../iperf3_3.9-1+deb11u1build0.22.04.1_amd64.deb ...
packing iperf3 (3.9-1+deb11u1build0.22.04.1) ...
tting up libsctp1:amd64 (1.0.19+dfsg-1build1) ...
tting up libiperf0:amd64 (3.9-1+deb11u1build0.22.04.1) ...
tting up iperf3 (3.9-1+deb11u1build0.22.04.1) ...
ocessing triggers for libc-bin (2.35-0ubuntu3.8) ...
ot@d3a412f2e00f:/UERANSIM# iperf3 -s
-----------------------------------------------------------
rver listening on 5201
-----------------------------------------------------------
cepted connection from 10.33.33.16, port 57882
 5] local 10.33.33.26 port 5201 connected to 10.33.33.16 port 51883
ID] Interval           Transfer     Bitrate         Jitter    Lost/Total Datagrams
 5]   0.00-1.00   sec  11.9 MBytes  99.9 Mbits/sec  0.038 ms  0/8629 (0%)
 5]   1.00-2.00   sec  11.9 MBytes   100 Mbits/sec  0.033 ms  0/8630 (0%)
 5]   2.00-3.00   sec  11.9 MBytes   100 Mbits/sec  0.039 ms  0/8636 (0%)
 5]   3.00-4.00   sec  11.9 MBytes   100 Mbits/sec  0.035 ms  0/8632 (0%)
 5]   4.00-5.00   sec  11.9 MBytes   100 Mbits/sec  0.049 ms  0/8632 (0%)
 5]   5.00-6.00   sec  11.9 MBytes   100 Mbits/sec  0.039 ms  0/8632 (0%)
 5]   6.00-7.00   sec  11.9 MBytes   100 Mbits/sec  0.030 ms  0/8632 (0%)
 5]   7.00-8.00   sec  11.9 MBytes   100 Mbits/sec  0.031 ms  0/8634 (0%)
 5]   8.00-9.00   sec  11.9 MBytes   100 Mbits/sec  0.038 ms  0/8632 (0%)
 5]   9.00-10.00  sec  11.9 MBytes   100 Mbits/sec  0.031 ms  0/8633 (0%)
 - - - - - - - - - - - - - - - - - - - - - - - - -
D] Interval           Transfer     Bitrate         Jitter    Lost/Total Datagrams
 5]   0.00-10.00  sec   119 MBytes   100 Mbits/sec  0.031 ms  0/86322 (0%)  receiver
-----------------------------------------------------------
ver listening on 5201
```

Reverse Testing with iPerf3:


Activities
Terminal
Feb 28 21:27
de
root@5fe1b882fd2c: /UERANSIM
root@8a132187b869: /UERANSIM
zjoy@zjoy-pc: ~/Documents
Mahidul Islam...
Home

```
zjoy@zjoy-pc:~/Documents/mobcom-teammblcp/scpmodel-c-team-mobcomp$ docker exec -
it gnb1 bash
root@5fe1b882fd2c:/UERANSIM# apt-get update && apt-get install -y iperf3
Hit:1 http://archive.ubuntu.com/ubuntu jammy InRelease
Hit:2 http://archive.ubuntu.com/ubuntu jammy-updates InRelease
Hit:3 http://archive.ubuntu.com/ubuntu jammy-backports InRelease
Hit:4 http://security.ubuntu.com/ubuntu jammy-security InRelease
Reading package lists... Done
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
iperf3 is already the newest version (3.9-1+deb11u1build0.22.04.1).
0 upgraded, 0 newly installed, 0 to remove and 17 not upgraded.
root@5fe1b882fd2c:/UERANSIM# iperf3 -c 10.33.33.25 -R
Connecting to host 10.33.33.25, port 5201
Reverse mode, remote host 10.33.33.25 is sending
[  5] local 10.33.33.15 port 41456 connected to 10.33.33.25 port 5201
[ ID] Interval           Transfer     Bitrate
[  5]   0.00-1.00   sec  3.10 GBytes  26.7 Gbits/sec
[  5]   1.00-2.00   sec  3.08 GBytes  26.5 Gbits/sec
[  5]   2.00-3.00   sec  3.17 GBytes  27.2 Gbits/sec
[  5]   3.00-4.00   sec  3.02 GBytes  26.0 Gbits/sec
[  5]   4.00-5.00   sec  2.93 GBytes  25.1 Gbits/sec
[  5]   5.00-6.00   sec  3.19 GBytes  27.4 Gbits/sec
[  5]   6.00-7.00   sec  3.01 GBytes  25.8 Gbits/sec
[  5]   7.00-8.00   sec  3.11 GBytes  26.8 Gbits/sec
[  5]   8.00-9.00   sec  3.05 GBytes  26.2 Gbits/sec
[  5]   9.00-10.00  sec  3.10 GBytes  26.6 Gbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Retr
[  5]   0.00-10.00  sec  30.8 GBytes  26.4 Gbits/sec    0             sender
[  5]   0.00-10.00  sec  30.8 GBytes  26.4 Gbits/sec                  receiver

iperf Done.
root@5fe1b882fd2c:/UERANSIM# 
```

```
zjoy@zjoy-pc:~/Documents/mobcom-teammblcp/scpmodel-c-team-mobcomp$ docker exec -
it ue1 bash
root@8a132187b869:/UERANSIM# apt-get update && apt-get install -y iperf3
Hit:1 http://archive.ubuntu.com/ubuntu jammy InRelease
Hit:2 http://security.ubuntu.com/ubuntu jammy-security InRelease
Hit:3 http://archive.ubuntu.com/ubuntu jammy-updates InRelease
Hit:4 http://archive.ubuntu.com/ubuntu jammy-backports InRelease
Reading package lists... Done
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
iperf3 is already the newest version (3.9-1+deb11u1build0.22.04.1).
0 upgraded, 0 newly installed, 0 to remove and 13 not upgraded.
root@8a132187b869:/UERANSIM# iperf3 -s
iperf3: error - unable to start listener for connections: Address already in use
iperf3: exiting
root@8a132187b869:/UERANSIM# iperf3 -s -p 5202
-----------------------------------------------------------
Server listening on 5202
-----------------------------------------------------------
```

```
zjoy@zjoy-pc:~/Documents$ gnome-screenshot
```

CONCLUSION

The project successfully simulates a 5G Core network using Open5GS and UERANSIM, creating a functional 5G standalone environment. Docker Compose containerizes network functions, while UERANSIM authentically models RANs and UEs. This project provides practical insights into network orchestration and real-time traffic management.

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Thank you

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