

Assignment 9 - 5G NR Simulation in NS-3

MPA-KPM

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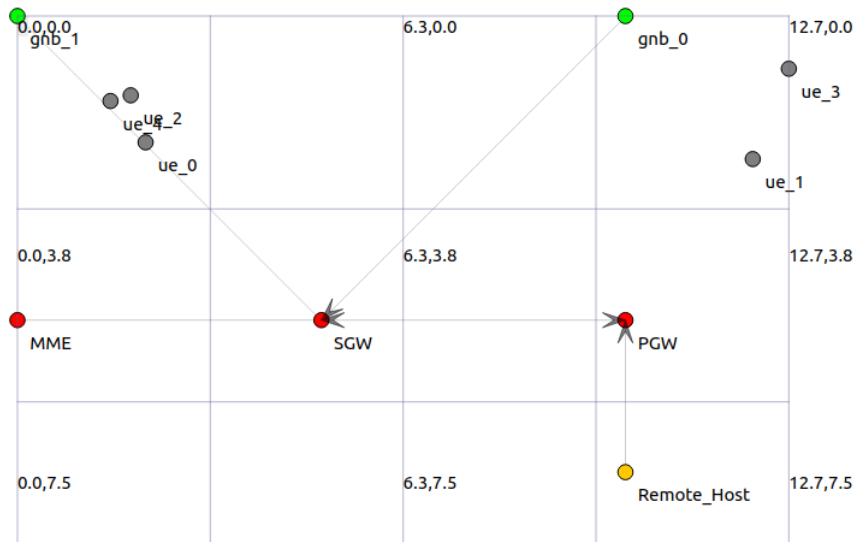
Ústav telekomunikací, FEKT

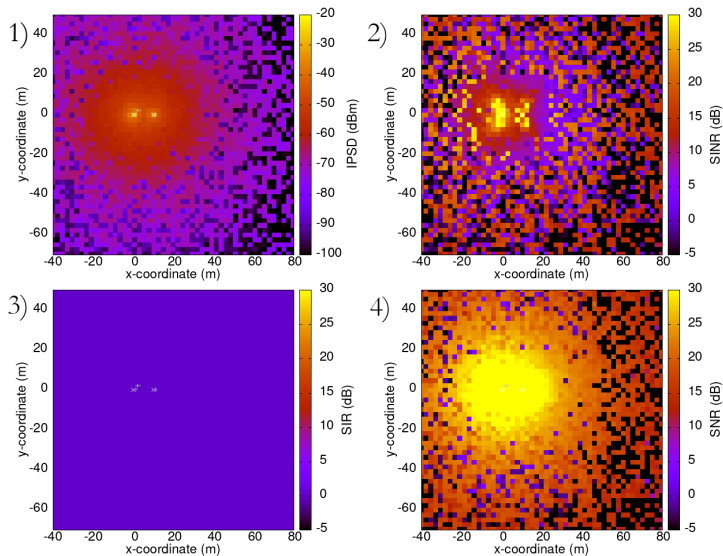
2024/25

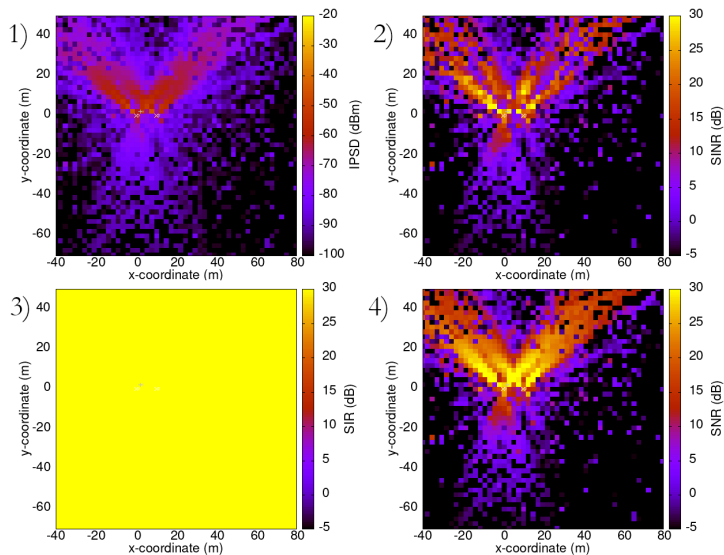
- Number of gNodeBs: 2
- Number of UEs: 5
- Number of servers: 1
- Number of PGWs: 1
- Number of MMEs: 1
- Number of SGWs: 1
- Simulation duration: 1000 ms
- AppStartTime: 400 ms
- Frequency bands:
 - Band 1: 26.5 GHz
 - Band 2: 27 GHz
- Used numerology: 2 and 4
- Bandwidth: 100 MHz

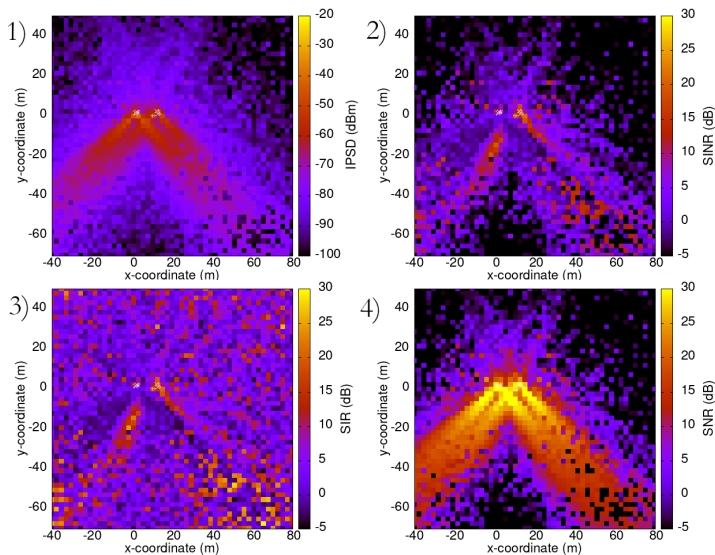
Device	IP Address Range	Assigned IPs
Remote Host	1.0.0.0/8	1.0.0.2
Packet Gateway (PGW)	1.0.0.0/8	1.0.0.1 Additional: 14.0.0.5, 7.0.0.1 (multiple interfaces)
User Equipment (UE)	7.0.0.0/8	- UE 0: 7.0.0.2 - UE 1: 7.0.0.3 - UE 2: 7.0.0.4 - UE 3: 7.0.0.5 - UE 4: 7.0.0.6
Base Stations (gNB)	10.0.0.0/8	- gNB 0: 10.0.0.5 - gNB 1: 10.0.0.9
Mobility Management Entity (MME)	Not assigned	Integrated into EPC (control plane only)

Numerology (n)	Subcarrier Spacing (Δf)	Typical Use Cases	Suitable Frequency Range
0	15 kHz	Voice, broadband, IoT	< 6 GHz
1	30 kHz	eMBB, IoT	< 6 GHz
2	60 kHz	URLLC, high-data-rate eMBB	< 6 GHz, mmWave
3	120 kHz	High-speed, mmWave (short latency)	mmWave
4	240 kHz	Future ultra-low-latency applications	mmWave









Flow 8 (7.0.0.6:1235 -> 7.0.0.5:49153) proto TCP

Tx Packets: 5142

Tx Bytes: 267388

TxOffered: 3.565173 Mbps

Rx Bytes: 263748

Throughput: 3.516640 Mbps

Mean delay: 7.799842 ms

Mean jitter: 0.072110 ms

Lost Packets: 70

Packet loss: 1.361338%

Rx Packets: 5072

Mean flow throughput: 66.905840

Mean flow delay: 5.206680

Mean flow packet loss: 0.955458%

Flow 8 (7.0.0.6:1235 -> 7.0.0.5:49153) proto TCP

Tx Packets: 14728

Tx Bytes: 765860

TxOffered: 3.829300 Mbps

Rx Bytes: 762948

Throughput: 3.814740 Mbps

Mean delay: 7.796296 ms

Mean jitter: 0.071970 ms

Lost Packets: 56

Packet loss: 0.380228%

Rx Packets: 14672

Mean flow throughput: 68.647990

Mean flow delay: 5.221326

Mean flow packet loss: 0.338203%

Flow 7 (7.0.0.6:1235 -> 7.0.0.5:49153) proto TCP

Tx Packets: 1

Tx Bytes: 56

TxOffered: 0.000747 Mbps

Rx Bytes: 0

Throughput: 0 Mbps

Mean delay: 0 ms

Mean jitter: 0 ms

Lost Packets: 0 Packet loss: 0 Rx Packets: 0

Mean flow throughput: 25.042149

Mean flow delay: 4.048864

Mean flow packet loss: 0.656385%

Flow 8 (7.0.0.6:1235 -> 7.0.0.5:49153) proto TCP

Tx Packets: 1302

Tx Bytes: 68476

TxOffered: 0.913013 Mbps

Rx Bytes: 67332

Throughput: 0.897760 Mbps

Mean delay: 8.349678 ms

Mean jitter: 0.092557 ms

Lost Packets: 22

Packet loss: 1.689708%

Rx Packets: 1280

Mean flow throughput: 28.841807

Mean flow delay: 5.640958

Mean flow packet loss: 1.576700%

- NS3 tool - lack of documentation in some parts of the project
- VMware box - unexpected behavior