

**Aether community meeting -  
CPqD**

Daniel Lazkani Feferman, Nov/2022



**Conecte-se ao novo**



## Agenda

- Who we are?
- Our projects
  - OpenRAN @Brasil
  - PLAT5GBR
- Lessons learned
- Demo



# 897

COLLABORATORS

# 352

NATIONAL  
PATENT  
PROCESSES

# 172

INTERNATIONAL  
PATENT  
PROCESSES

### 2 SPIN-OFFS

TRÓPICO (WIRELESS AND DATA NETWORKS)  
PADTEC (OPTICAL COMMUNICATIONS)

- **Founded in 1976** as the R&D branch of Telebrás (public national telecom operator)
- After the **privatization process in 1998** it became a **private not-for-profit foundation**
- Largest ICT R&D Program in Latin America
- Revenues of R\$ 229 mi (~ €37 mi) in 2019
- Presence in all telecom operators in Brazil and some in Latin America (OSS Suite)
- Certified labs for compliance testing according to local regulations
- Host of a TIP Community Lab
- Brazilian branch of the BRICS Institute for Future Networks Initiative
- Deep knowledge of the local regulatory framework and market structure





### Areas of knowledge

- Cognitive Computing
- Advanced Computing
- Wireless Communications
- Optical Communications
- Data Networks
- Sensor Systems
- Power Systems
- Embedded Electronics
- Information and Communication Security



Our projects



Plataforma  
5G BR



ORGANIZAÇÃO SOCIAL DO MCTI



# Brazilian National Research and Education Network

## Who we are

We are an advanced national network for higher education, research and innovation. In 1992, we helped bringing the internet to Brazil and we continue promoting innovative use of Information and Communication Technologies, driving science and education for all.



## Global connectivity

We are connected to other international academic networks by direct connections with South America, North America and Europe.

**800**  
connected organizations

**+ than 4 million**  
users

**+ than 100 GB/s**  
connection speed

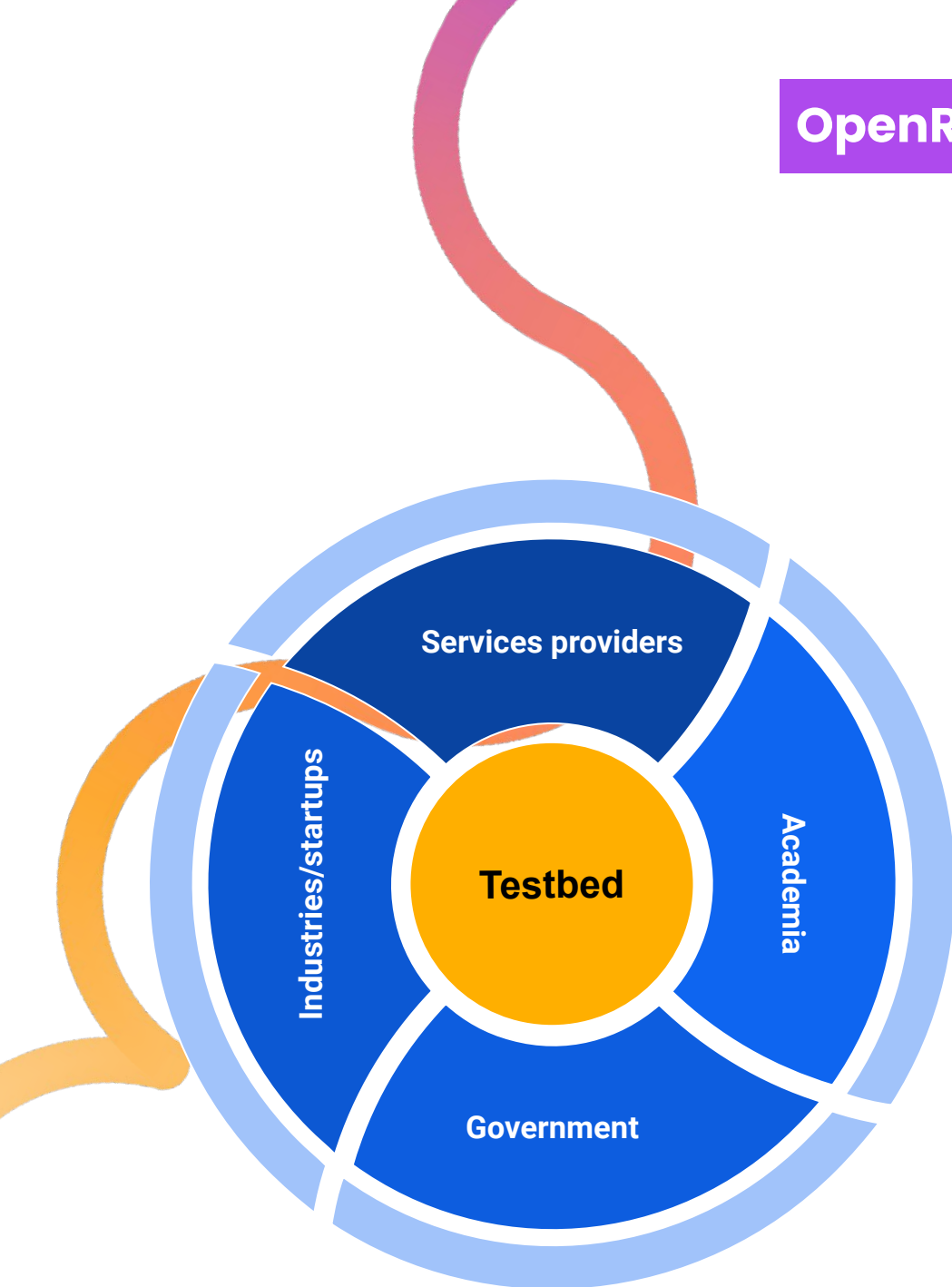
## Points of Presence

The infrastructure of Rede Ipê encompasses 27 Points of Presence (PoPs), one in each state, in addition to branches to serve 1522 campuses and units of education, research and health institutions throughout the country, benefiting millions of users.





# openRAN BRASIL



- A platform to research, develop and test new technologies and use cases
  - ex: 5G applications
- **State-of-the-art** technologies
  - ex: Open RAN, SDN, 5G, etc
- **Learning** environment
  - ex: how to operate new cloud paradigm and automate telco world
- **Lab** used for new technologies validation
  - ex: multi-domain orchestration, *xAPPs (RIC), applications, etc*
- Space to **promote** the development of Open RAN solutions through 5G applications



Development of end-to-end 5G network technologies, targeting private network markets, and small and medium providers.



A 5G system considering different technologies. Examples: virtualization, automation, orchestration, MEC, RIC, OSS/BSS, etc



We are currently in the first phase of 5G deployment, focused only on increasing data rates (eMBB). There are many challenges and opportunities for the effective rollout of 5G in massive IoT (mMTC) and critical communications (URLLC).



## PLAT5GBR



Development of 5G core and RAN through virtualization and disaggregation. Integration with an RU (Radio Unit) compatible with open architectures (TIP, O-RAN Alliance)



Development of the services and infrastructure automation platform aimed at, among other objectives, the creation, control and monitoring of network slices in 5G networks.



Integration into a Proof of Concept (PoC) for private networks and ISP's markets, integrating all developed functionalities (vRAN, Core, NFV, SDN, MEC, OSS/BSS)



## PLAT5GBR – targets

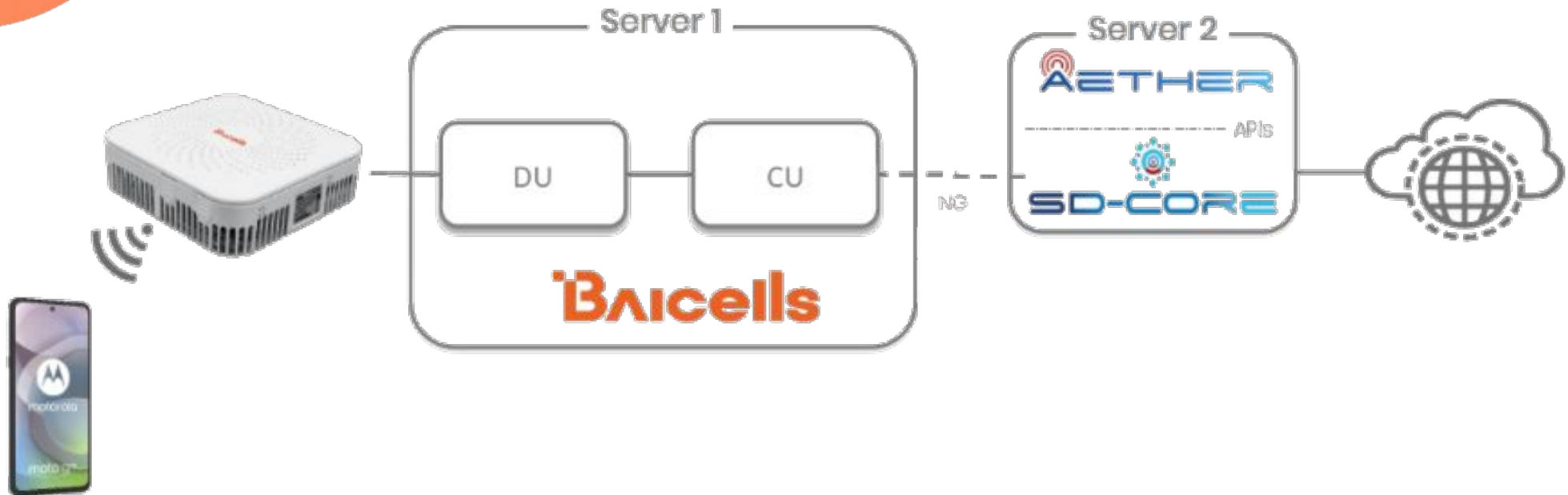


1. Open RAN: Virtualized and Disaggregated
2. Distributed cloud architecture
3. Multi-access Edge Computing (MEC)
4. IPv6 compatibility
5. SDN centralized data centers
6. Simple and scalable infrastructure
7. E2E infrastructure automation
8. Unified OSS/BSS

## PLAT5GBR – setup & achievements



- Virtualized Open RAN
- High performance 5G Core with DPDK supporting multiple slices
- Using Aether as the Orchestrator



# PLAT5GBR



- We have done 3 validations:
  - USRP B210 (using OAI)
  - Amarisoft gNB
  - Baicells:
    - iperf3

DL: 989Mbps

UL: 138Mbps

```
01:09 Magic iPerf
iPerf3 Stopped
-c 10.20.1.42 -R -u -b 700M -l 1100 -P 4 -t 99
[ 0] 8.00-9.00 sec 28.7 MBytes 240 Mbits/sec 0.013 ms
19363/46700 (41%)
[ 8] 8.00-9.00 sec 28.4 MBytes 238 Mbits/sec 0.012 ms
19153/46253 (41%)
[10] 8.00-9.00 sec 28.8 MBytes 242 Mbits/sec 0.014 ms
19224/46694 (41%)
[SUM] 8.00-9.00 sec 115 MBytes 960 Mbits/sec 0.013 ms
76745/185904 (41%)
-----
[ 4] 9.00-10.01 sec 29.9 MBytes 249 Mbits/sec 0.705 ms
15889/44379 (36%)
[ 6] 9.00-10.01 sec 29.6 MBytes 246 Mbits/sec 0.714 ms
16183/44376 (36%)
[ 8] 9.00-10.01 sec 29.7 MBytes 247 Mbits/sec 0.705 ms
16094/44373 (36%)
[10] 9.00-10.01 sec 29.6 MBytes 246 Mbits/sec 0.715 ms
16190/44370 (36%)
[SUM] 9.00-10.01 sec 119 MBytes 989 Mbits/sec 0.710 ms
64356/177498 (36%)
-----
[ 4] 10.01-11.00 sec 26.1 MBytes 221 Mbits/sec 0.047 ms
22737/47617 (48%)
[ 6] 10.01-11.00 sec 26.8 MBytes 227 Mbits/sec 0.045 ms
22072/47629 (46%)
[ 8] 10.01-11.00 sec 26.0 MBytes 219 Mbits/sec 0.044 ms
22870/47618 (48%)
[10] 10.01-11.00 sec 26.8 MBytes 226 Mbits/sec 0.045 ms
22114/47631 (46%)
[SUM] 10.01-11.00 sec 106 MBytes 893 Mbits/sec 0.045 ms
89793/190495 (47%)
-----
[ 4] 11.00-12.01 sec 28.7 MBytes 238 Mbits/sec 0.937 ms
20057/47371 (42%)
[ 6] 11.00-12.01 sec 28.9 MBytes 240 Mbits/sec 0.935 ms
19809/47359 (42%)
[ 8] 11.00-12.01 sec 28.2 MBytes 234 Mbits/sec 0.938 ms
20444/47370 (43%)
```

```
20:05 Magic iPerf
iPerf3 Stopped
-c 10.20.1.42 -u -b 500M -l 1100 -P 6 -t 99
Connecting to host 10.20.1.42, port 5201
[ 4] local 172.250.0.10 port 44990 connected to 10.20.1.42 port 5201
[ 6] local 172.250.0.10 port 44906 connected to 10.20.1.42 port 5201
[ 8] local 172.250.0.10 port 45886 connected to 10.20.1.42 port 5201
[10] local 172.250.0.10 port 46251 connected to 10.20.1.42 port 5201
[12] local 172.250.0.10 port 38799 connected to 10.20.1.42 port 5201
[14] local 172.250.0.10 port 43815 connected to 10.20.1.42 port 5201
-----
[ID] Interval Transfer Bandwidth Total Datagrams
[ 4] 0.00-1.00 sec 2.75 MBytes 23.1 Mbits/sec 2062
[ 6] 0.00-1.00 sec 2.75 MBytes 23.1 Mbits/sec 2060
[ 8] 0.00-1.00 sec 2.74 MBytes 23.0 Mbits/sec 2055
[10] 0.00-1.00 sec 2.73 MBytes 22.9 Mbits/sec 2048
[12] 0.00-1.00 sec 2.73 MBytes 22.9 Mbits/sec 2046
[14] 0.00-1.00 sec 2.72 MBytes 22.8 Mbits/sec 2039
[SUM] 0.00-1.00 sec 16.4 MBytes 138 Mbits/sec 12310
-----
[ 4] 1.00-2.00 sec 2.73 MBytes 22.9 Mbits/sec 2048
[ 6] 1.00-2.00 sec 2.73 MBytes 22.9 Mbits/sec 2044
[ 8] 1.00-2.00 sec 2.72 MBytes 22.8 Mbits/sec 2039
[10] 1.00-2.00 sec 2.71 MBytes 22.8 Mbits/sec 2032
[12] 1.00-2.00 sec 2.71 MBytes 22.7 Mbits/sec 2027
[14] 1.00-2.00 sec 2.70 MBytes 22.7 Mbits/sec 2024
[SUM] 1.00-2.00 sec 16.3 MBytes 137 Mbits/sec 12214
-----
[ 4] 2.00-3.01 sec 2.69 MBytes 22.4 Mbits/sec 2018
[ 6] 2.00-3.01 sec 2.69 MBytes 22.4 Mbits/sec 2015
[ 8] 2.00-3.01 sec 2.68 MBytes 22.3 Mbits/sec 2010
[10] 2.00-3.01 sec 2.67 MBytes 22.3 Mbits/sec 2002
[12] 2.00-3.01 sec 2.67 MBytes 22.2 Mbits/sec 1999
[14] 2.00-3.01 sec 2.66 MBytes 22.1 Mbits/sec 1991
[SUM] 2.00-3.01 sec 16.1 MBytes 134 Mbits/sec 12025
```

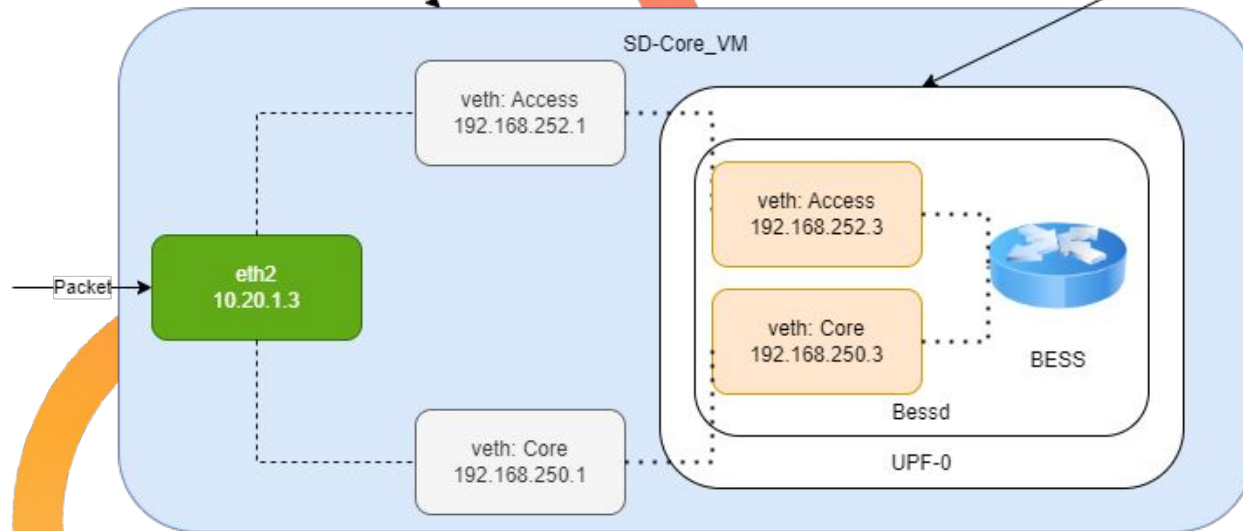




## Lessons learned

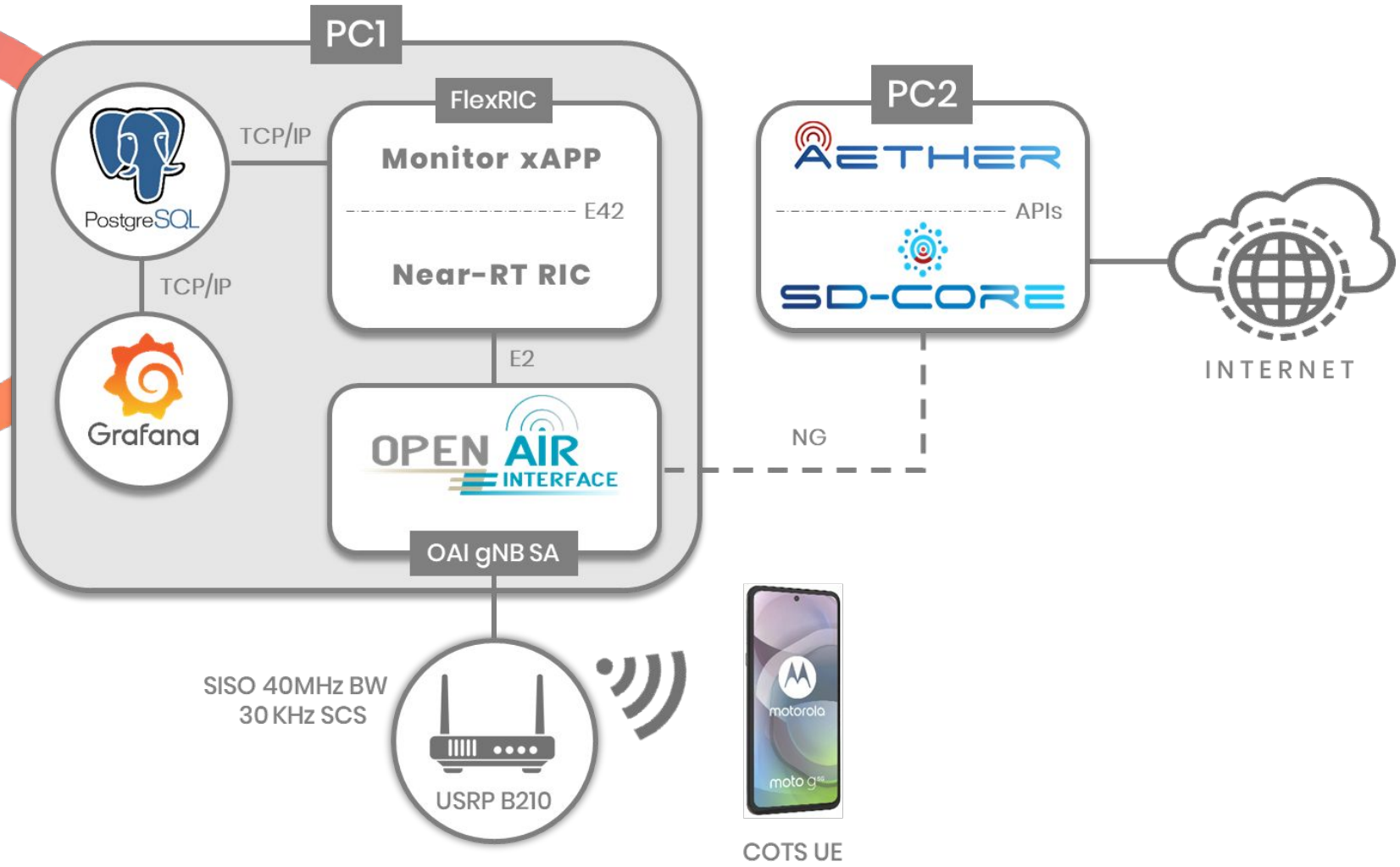
```
c2n@c2n:~$ route
Destination Gateway Genmask Flags Metric Ref Use Iface
192.168.250.0 0.0.0.0 255.255.255.0 U 0 0 0 core
192.168.252.0 0.0.0.0 255.255.255.0 U 0 0 0 access
```

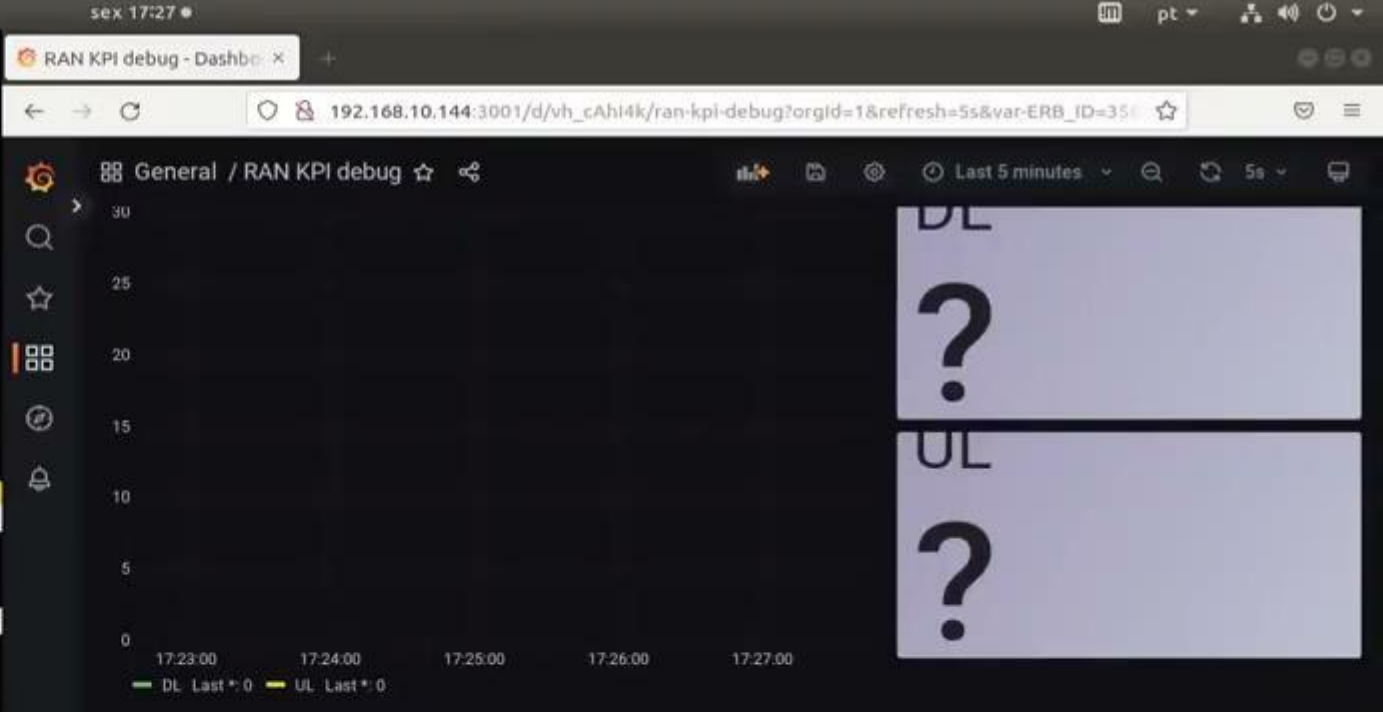
```
Inside bessd:
root@upf-0:/opt/bess/bessctl# ip route
192.168.250.0/24 dev core proto kernel scope link src 192.168.250.3
192.168.252.0/24 dev access proto kernel scope link src 192.168.252.3
```



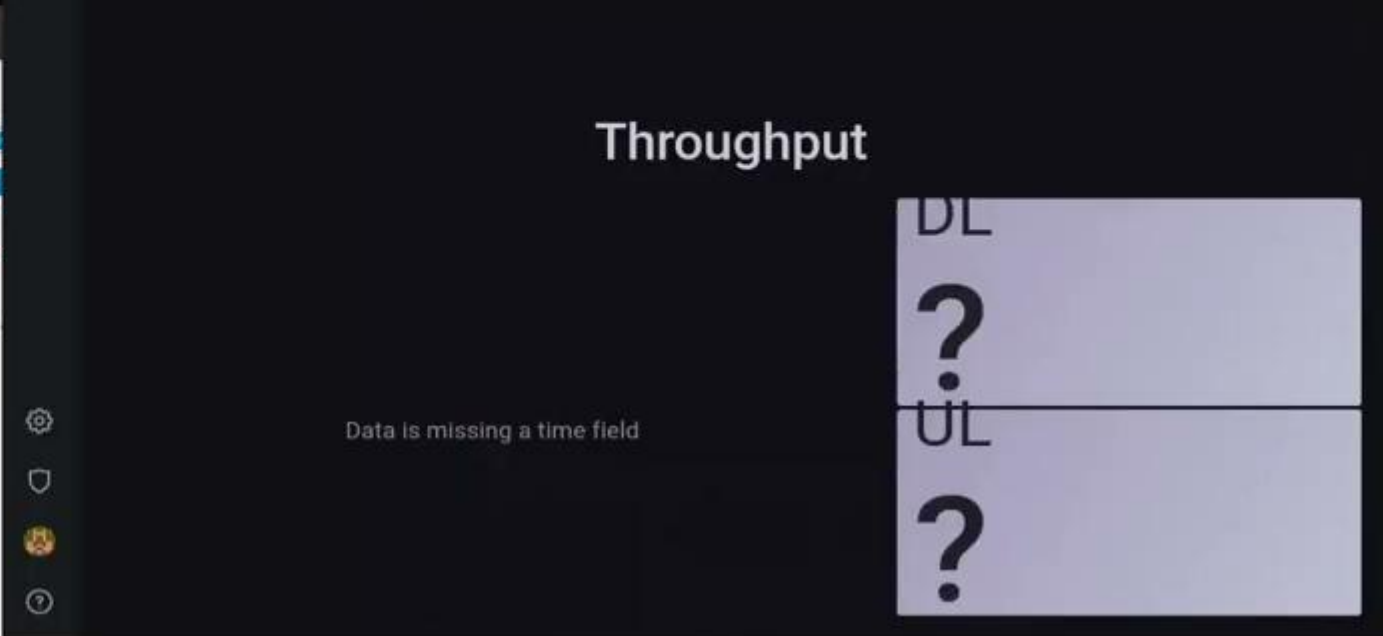
- Aether-in-a-box uses access (N3) and core (N6) macvlan interfaces
- BESS contains a GUI which can help troubleshoot connectivity issues
- We have been contributing back to the community by Identifying bugs and documentation issues

# Setup E2E Architecture





Name (ID)	Description	Enterprise	Site	Filter	Default Behavior	CS	MBR	Device Group	SD	SST	UFF	Edit
AiaB Slice (aiaB-vcf)		aiaB-enterprise	aiaB-site	ALLOW ALL		5g	↑ 1000000000 ↓ 500000000	aiaB-device-group	10203	1	aiaB-upf	



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CPqD**

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Support:



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