Implementation in production of CPE based on white box with RARE/FreeRtr at University of Murcia

Subtitle (if applicable)

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Context

- Gaia (https://ants.inf.um.es/en/gaialab) is Department of Information and Communications Engineering's laboratory.
- It has been historically intended for network research and provides virtualization resources to the research group. As such, the laboratory has some networking decision freedom and hardware independence from University's NOC network.
- As such, the laboratory manages 2 IPv4 /24 ranges and 5 IPv6 /64 ranges.
- On the latest years new technologies, such as SDN, NFV, IoT and lately 5G, have introduced new philosophies and requirements to the network.

Some projects currently relying on Gaia

- INSPIRE-5GPlus
- 5GASP
- Phoenix
- CyberSec4Europe
- Just to name the more relevant

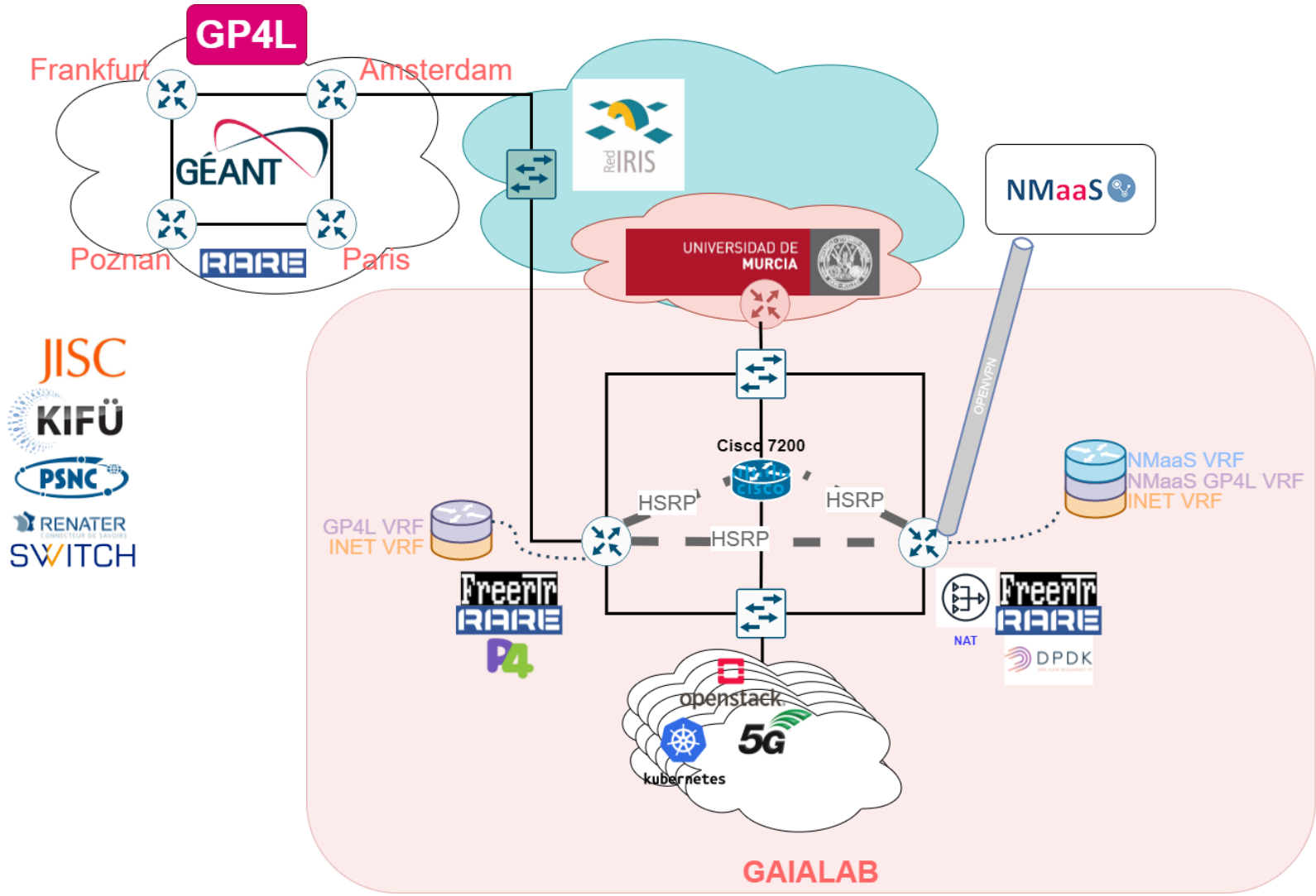
Motivations and Requirements

- Increase internal bandwidth: from 1G to several 10G, at least 10G.
- Replace the obsoleted routing hardwareAvoid vendor lock-in, preferable open approach
- Each experiment requires isolation and connectivity
  - Until now, heavy VLAN usage with ACLs
  - NAT4
- Services
  - VPN client/server
  - DHCP/SLAAC
  - Enhanced monitoring
- Safe migration with fast rollback procedure

Initial Approach

- Cisco 7200 left to rollback
- A DELL R510 server with two Xeon E5640 processors with 32GB RAM was available
  - Upgrade with Intel XXV710 10G network card
  - Use RARE/FreeRtr DPDK version
- 1 Link towards University NOC (2 vlan), 1 Link connected with internal switching (19 vlan - NAT)
- HSRPv2 with Cisco7200 (v3 supporting IPv6 not supported by the Cisco.
- In production since November 2020

Initial Approach



EdgeCore Wedge 100BF-

RARE/freeRouter - interfaces bytes

Last 7 days | 5s

	min	max	avg	current
tx	0 b/s	0 b/s	0 b/s	0 b/s
rx	0 b/s	0 b/s	0 b/s	0 b/s

	min	max	avg	current
tx	0 b/s	0 b/s	0 b/s	0 b/s
rx	0 b/s	0 b/s	0 b/s	0 b/s

	min	max	avg	current
tx	0 b/s	0 b/s	0 b/s	0 b/s
rx	0 b/s	0 b/s	0 b/s	0 b/s

hw:sdn10

140 Gib/s
93 Gib/s
47 Gib/s
0 b/s
04/15 04/16 04/17 04/18 04/19 04/20 04/21

	min	max	avg	current
tx	85.3 Gib/s	117.0 Gib/s	89.1 Gib/s	85.6 Gib/s
rx	180 Mib/s	291 Mib/s	210 Mib/s	203 Mib/s

hw:sdn11

140 Gib/s
93 Gib/s
47 Gib/s
0 b/s
04/15 04/16 04/17 04/18 04/19 04/20 04/21

	min	max	avg	current
tx	85.3 Gib/s	117.3 Gib/s	89.0 Gib/s	85.6 Gib/s
rx	180 Mib/s	291 Mib/s	209 Mib/s	203 Mib/s

hw:sdn12

140 Gib/s
93 Gib/s
47 Gib/s
0 b/s
04/15 04/16 04/17 04/18 04/19 04/20 04/21

	min	max	avg	current
tx	206 Mib/s	334 Mib/s	240 Mib/s	232 Mib/s
rx	84.7 Gib/s	116.5 Gib/s	88.3 Gib/s	85.0 Gib/s

hw:sdn13

140 Gib/s
93 Gib/s
47 Gib/s
0 b/s
04/15 04/16 04/17 04/18 04/19 04/20 04/21

	min	max	avg	current
tx	206 Mib/s	334 Mib/s	240 Mib/s	232 Mib/s
rx	84.7 Gib/s	116.5 Gib/s	88.4 Gib/s	85.0 Gib/s

hw:sdn14

140 Gib/s
93 Gib/s
47 Gib/s
0 b/s
04/15 04/16 04/17 04/18 04/19 04/20 04/21

	min	max	avg	current
tx	85.3 Gib/s	117.3 Gib/s	89.1 Gib/s	85.6 Gib/s
rx	180 Mib/s	291 Mib/s	210 Mib/s	203 Mib/s

hw:sdn15

140 Gib/s
93 Gib/s
47 Gib/s
0 b/s
04/15 04/16 04/17 04/18 04/19 04/20 04/21

	min	max	avg	current
tx	85.3 Gib/s	116.8 Gib/s	89.2 Gib/s	85.6 Gib/s
rx	180 Mib/s	294 Mib/s	210 Mib/s	203 Mib/s

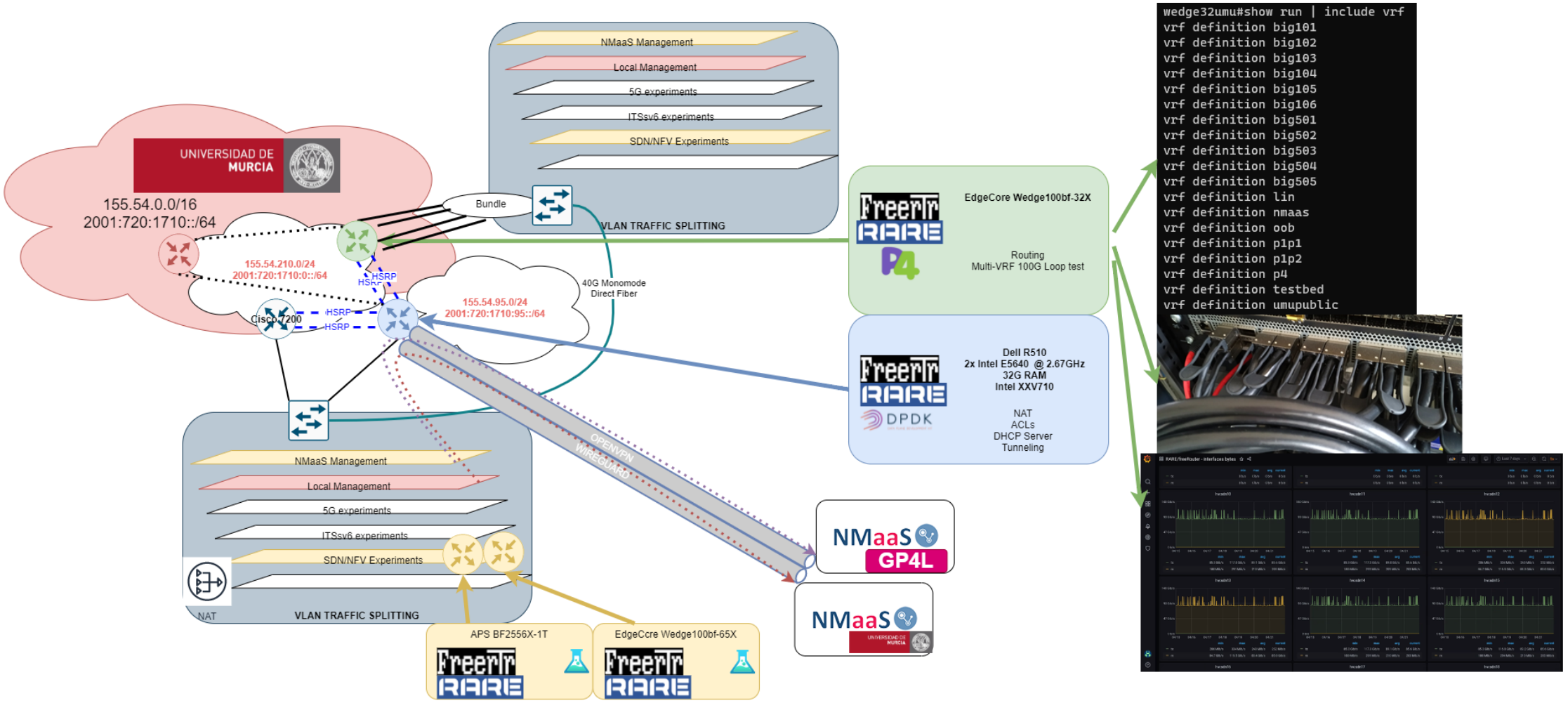
hw:sdn16

hw:sdn17

hw:sdn18

Current Approach

- Cisco as Failsafe just for NAT
- HSRP and VRRP adopted
- OpenVPN and Wireguard client/server on DPDK
- DHCP server on DPDK
- Metrics exposed to Prometheus and Grafana panels from DPDK and P4
- Wedge running pure Debian RARE-FreeRtr, APS-2556X-1T running NIX RARE-FreeRtr
- Moving from ACL isolation to VRFs


UNIVERSIDAD DE MURCIA
155.54.0.0/16
2001:720:1710::/64
155.54.210.0/24
2001:720:1710:0::/64
HSRP
HSRP
Cisco 7200
HSRP
HSRP
155.54.95.0/24
2001:720:1710:95::/64
Bundle
NMaaS Management
Local Management
5G experiments
ITSv6 experiments
SDN/NFV Experiments
VLAN TRAFFIC SPLITTING
40G Monomode
Direct Fiber
FreeRtr
RARE
P4
EdgeCore Wedge100bf-32X
Routing
Multi-VRF 100G Loop test
FreeRtr
RARE
DPDK
Dell R510
2x Intel E5640 @ 2.67GHz
32G RAM
Intel XXV710
NAT
ACLs
DHCP Server
Tunneling
OPENVPN
WIREGUARD
NMaaS
GP4L
NMaaS
UNIVERSIDAD DE MURCIA
NMaaS Management
Local Management
5G experiments
ITSv6 experiments
SDN/NFV Experiments
NAT
VLAN TRAFFIC SPLITTING
APS BF2556X-1T
FreeRtr
RARE
EdgeCcre Wedge100bf-65X
FreeRtr
RARE
wedge32umu#show run | include vrf
vrf definition big101
vrf definition big102
vrf definition big103
vrf definition big104
vrf definition big105
vrf definition big106
vrf definition big501
vrf definition big502
vrf definition big503
vrf definition big504
vrf definition big505
vrf definition lin
vrf definition nmaas
vrf definition oob
vrf definition p1p1
vrf definition p1p2
vrf definition p4
vrf definition testbed
vrf definition umupublic

Conclusions and Next Steps

- Willing to remove completely the old Cisco 7200. RARE – FreeRtR fulfilled the Lab requirements completely.
- Reliability is comparable to traditional solution while allowing us to continue with Network Research.
- Virtualized instances of DPDK RARE-freeRtr also desired.
- APS-2256X-1T has GearBox 1Gx16, 32x25G ports and 6x100G ports which is more on the scale of the laboratory than Wedge.
- If you are running IPv4 without NAT or IPv6 only, P4 is your choice.
- If you still need NAT, DPDK can be a really good solution.

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Thank you

Any questions?

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