Router for Academia Research Education

RARE/freeRtr in a nutshell

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Public

www.geant.org

RARE project : Group focus

funded project

Control plane software

~~P4~~ (**not only P4**) **Programmable** data plane

Interface them and the result is …

Feature rich routing platform

running at **various** hardware line rate

Flexible, DIY “hackable/extensible” router

Control plane independence

➔that suits R&E use case

One familiar platform

⬇

Multiple solutions

⬇

Each solution addresses

⬇

R&E

use case

Why RARE now ?

Starting from early 2010:

Several valuable Open Source control plane usage besides well know commercial vendor

Starting from 2020:

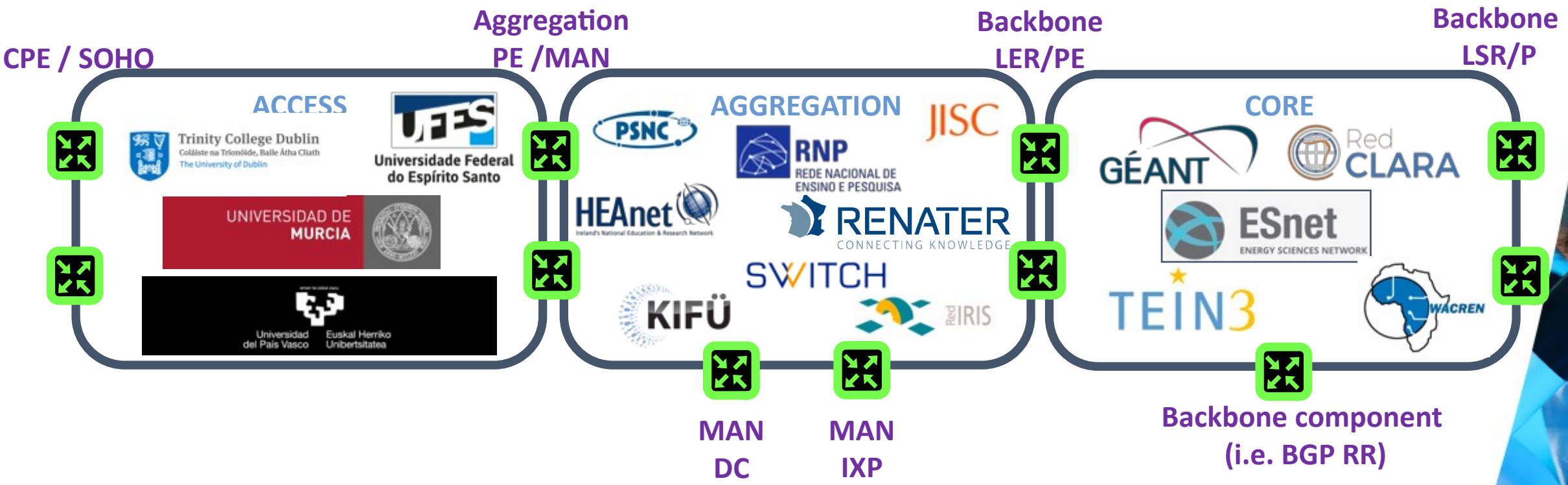
Dataplane solution reached maturity ready to implement production grade use case

NOS emergence

Technology convergence (Hypervisor/VM, K8s/Container, kernel bypass …)

It’s a good time to tie Control Plane and Dataplane !

RARE use cases



IPv4 and IPv6 compliant !

RARE for everyone in R&E

Routing (CP+DP) platform solution for the R&E context
- Open Platform
- Programmable

RARE for Research and Education connectivity
- Emerging NREN
- Or not …

RARE for R&E content provider
- IaaS owned by NREN
- IaaS owned by International Global Research project

RARE for R&E end user institution
- Primary/Secondary schools
- University campus
- MAN network for Regional network

RARE for International Global research project connectivity
- **Network research**
- **Science research**

Positive societal consequences !

RARE value proposition:
Implement a solution to each R&E use case

RARE for R&E connectivity (nx100GE, Tbps)

- **Core** backbone node
- **Edge** backbone node

RARE for R&E content provider (1,10,25,40,50,100GE)

- **ToR** node
- **Spine** node
- **Edge** node

RARE for R&E organization end user

- **CPE** for SOHO primary schools
- **MAN Router** for regional network

RARE latest news (Month 27 of 48)

RARE p4 targets

bmv2 software switch

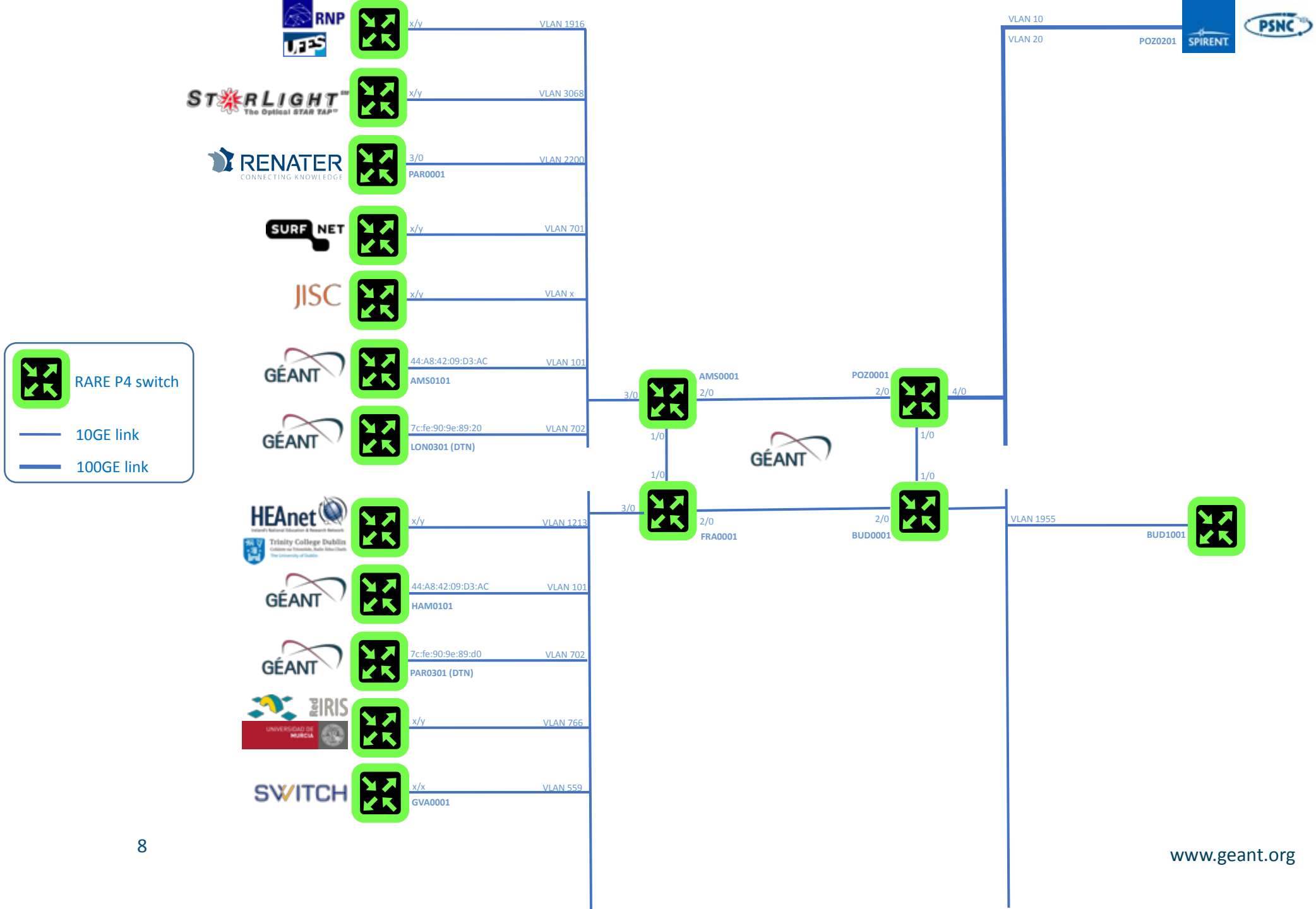
Programmable Ethernet ASIC on WEDGE-BF100-32X

under study

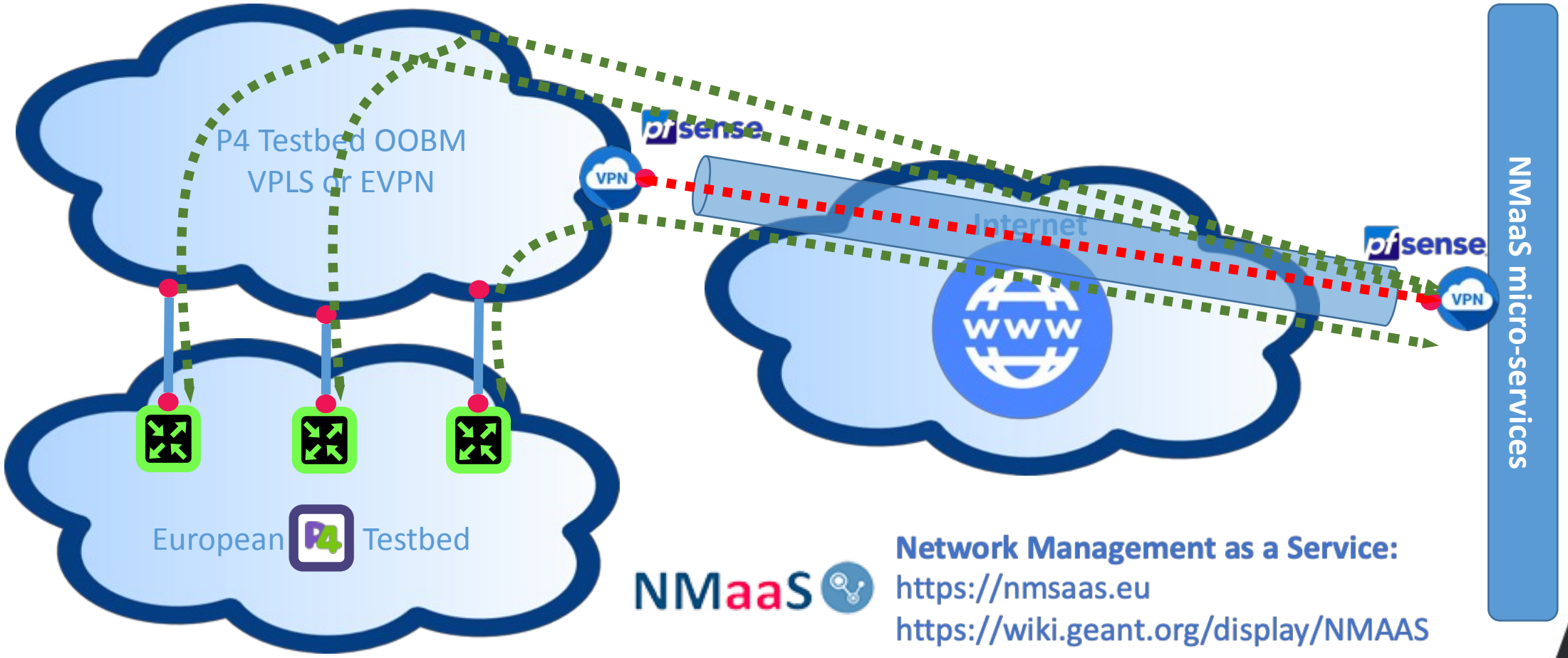
RARE p4 discussion emulation targets

RARE Network Programmable targets

Broadcom **under study**


RARE P4 switch
10GE link
100GE link
RNP
UPS
x/y
VLAN 1916
STARLIGHT
The Optical STAR TAP
x/y
VLAN 3068
RENATER
CONNECTING KNOWLEDGE
3/0
VLAN 2200
PAR0001
SURF NET
x/y
VLAN 701
JISC
x/y
VLAN x
GÉANT
44:A8:42:09:D3:AC
VLAN 101
AMS0101
GÉANT
7c:fe:90:9e:89:20
VLAN 702
LON0301 (DTN)
VLAN 10
VLAN 20
POZ0201
SPIRENT
PSNC
AMS0001
3/0
2/0
POZ0001
2/0
4/0
1/0
1/0
GÉANT
1/0
1/0
3/0
2/0
FRA0001
2/0
BUD0001
VLAN 1955
BUD1001
HEAnet
Trinity College Dublin
x/y
VLAN 1213
GÉANT
44:A8:42:09:D3:AC
VLAN 101
HAM0101
GÉANT
7c:fe:90:9e:89:d0
VLAN 702
PAR0301 (DTN)
RedIRIS
UNIVERSIDAD DE MURCIA
x/y
VLAN 766
SWITCH
x/x
VLAN 559
GVA0001

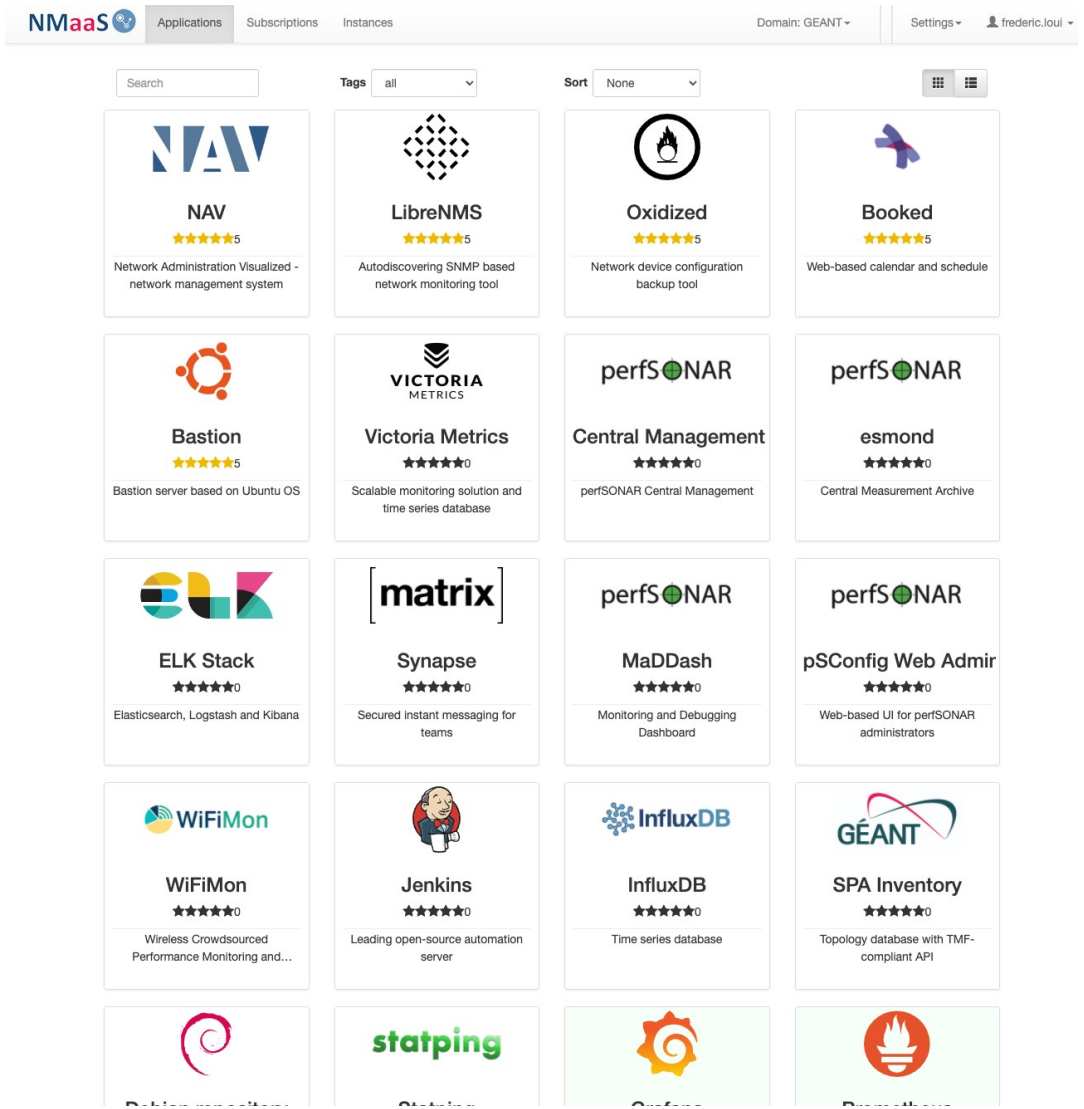
P4 LAB network management via NMaaS* !



NMaaS

Network Management as a Service:
https://nmsaas.eu
https://wiki.geant.org/display/NMAAS

P4 LAB network management via NMaaS* !



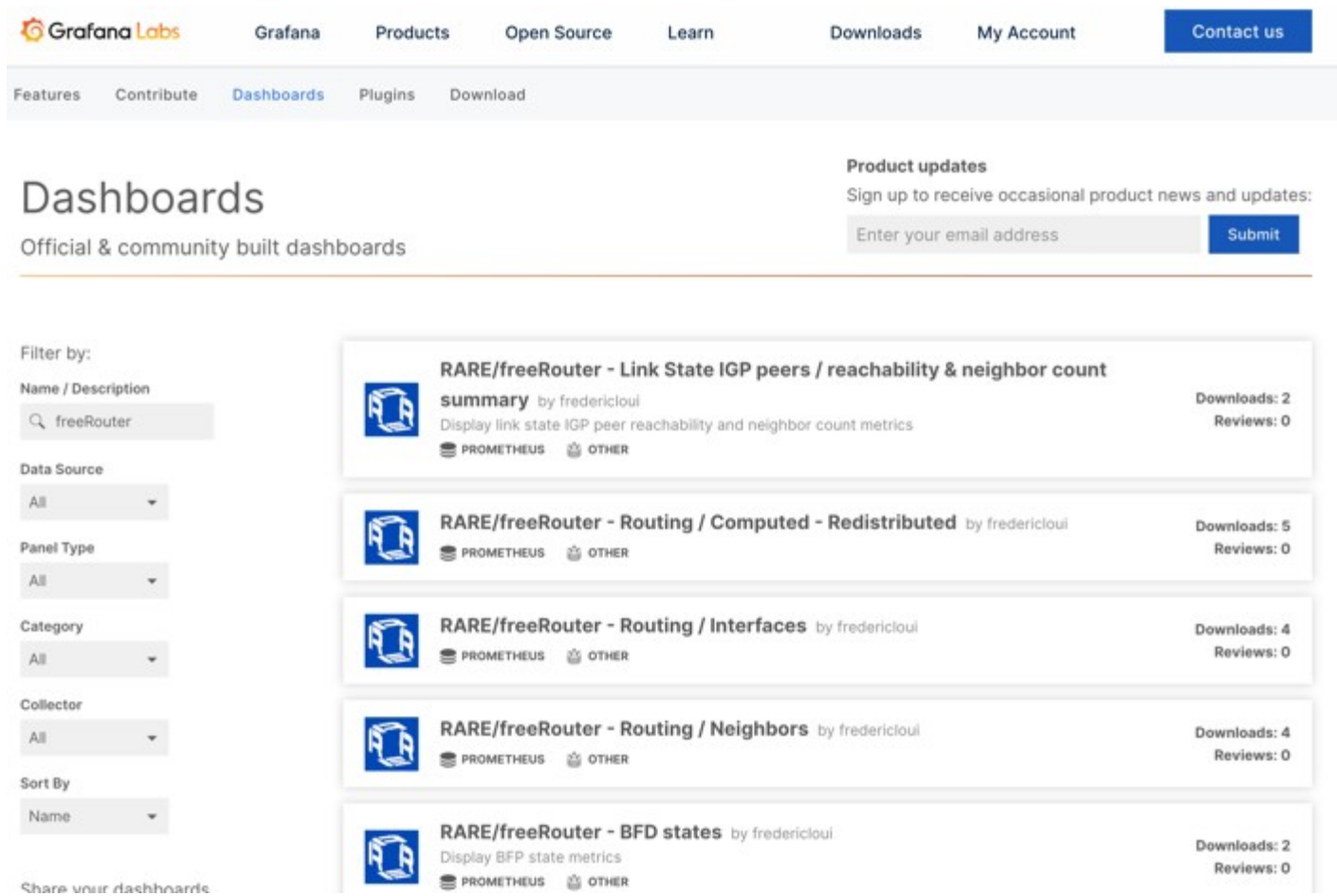
Network Management as a Service:
https://nmsaas.eu
https://wiki.geant.org/display/NMAAS

Monitoring at Network Element Level ! (Prometheus agent)

Monitoring at EML ! (Grafana dashboard)

Prometheus

Grafana



https://grafana.com/grafana/dashboards?search=freeRouter

Key take-way – We are ready to roll into <u>production</u>

- Automated testing
- 3rd party testing via Spirent usage
  (thanks PSNC@WB team)
- P4 profile calibration
- DPDK currently in operation SOHO
- Production deployment

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KIFÜ

- Work in progress production deployment

RENATER
CONNECTING KNOWLEDGE

And what about ISP and commercial network use cases ?

Practical use case #001 SOHO router

DPDK flavor ideal for CPE

nx1GE

nx10GE small MAN ideal for small campus

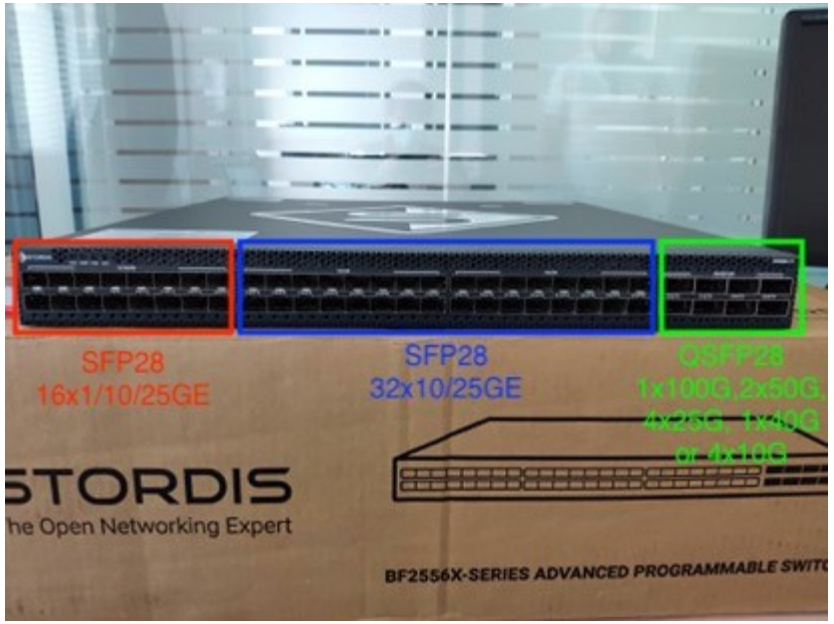
Couple of 100GE (Depending on server generation)

Practical use case #002 BRAS router

DPDK and P4 dataplane

➔suitable for CAMPUS / EDGE BACKBONE router

nx1GE, nx10GE, nx100GE



Practical use case #003 LSR router

P4 dataplane fits perfectly pure **LSR** core router

NNI: 4 directions with (8x100GE) bundle

Practical use case #004 LER router

P4 dataplane fits perfectly pure **LER** use case

NNI: EST/WEST direction @ (8x100GE) bundle

UNI: 16x100GE left for end user connection !

Practical use case #005 high performance BGP RR

Recycling old server ?

Ideal for **K8s** cluster using **BGP** as **CNI** network plugin

Taking advantage of server « huge » amount of RAM

No need specific high performance dataplane

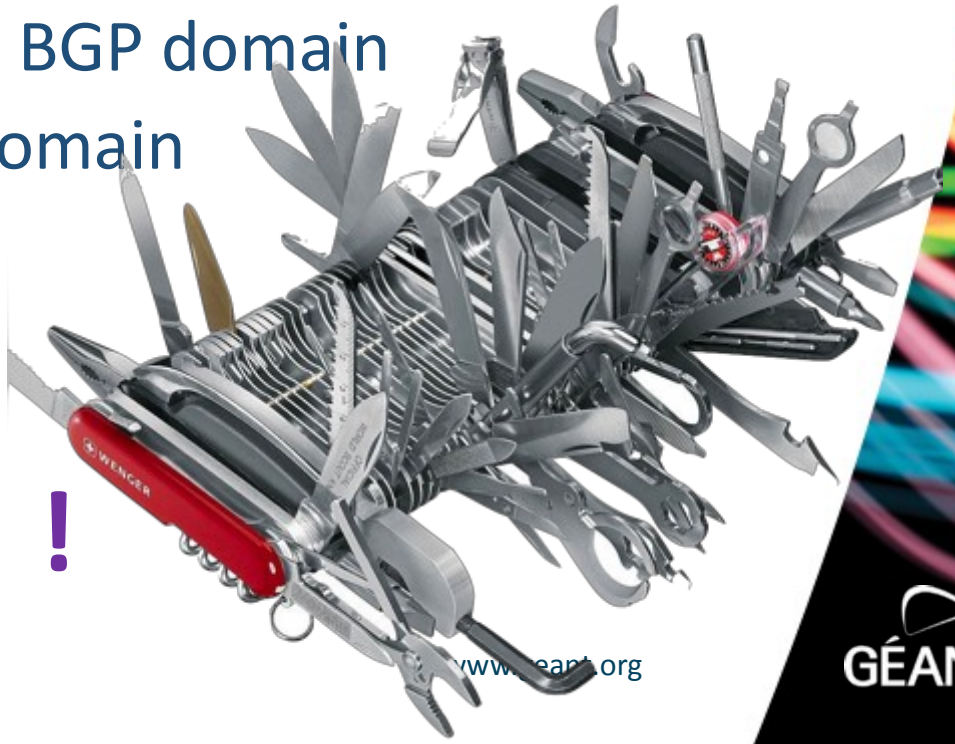
Practical use case #006 « small » PE

Ideal for aggregation

- 2x10GE or 2x100GE NIC server side
- 2x10g+48x1g or 1x100g+48x1/10g switch

Practical use case #xxx The sky is the limit

- Automation integration
- IXP with MPLS core
- ToR router combined to BGP aware network plugin
- Spine/Leaf DC router
- Global BGP monitoring for your entire BGP domain
- Global IGP guard for your entire IGP domain
- BGP flowspec aware anti DDOS
- AAA servers (TACACS, RADIUS)
- …



We need YOUR creativity !

Key take-way – Room for improvement

Network Management

- Node monitoring
- Flow Monitoring

New Network Management Paradigm

- Streaming Telemetry
- **INT**

➔ **It is a good opportunity to rethink how Network Management is handled**

« Closing the dots » with **automation existing project**

Key take-way – Final words – RARE vision

Open Network programming opportunity

- R&E small institution
- R&E global project (100GE is real, 400GE just landed)

Opportunity to define NGN NMS

- Scaling new NMS (horizontal scaling with K8s)
- Streaming Telemetry
- **INT**

➔ **It is a good opportunity to rethink how Network Management is handled**

Opportunity to integrate **existing automation initiatives**

Instantaneous & Flexible

Network Services for the users !

Key take-way – Private Peering Node

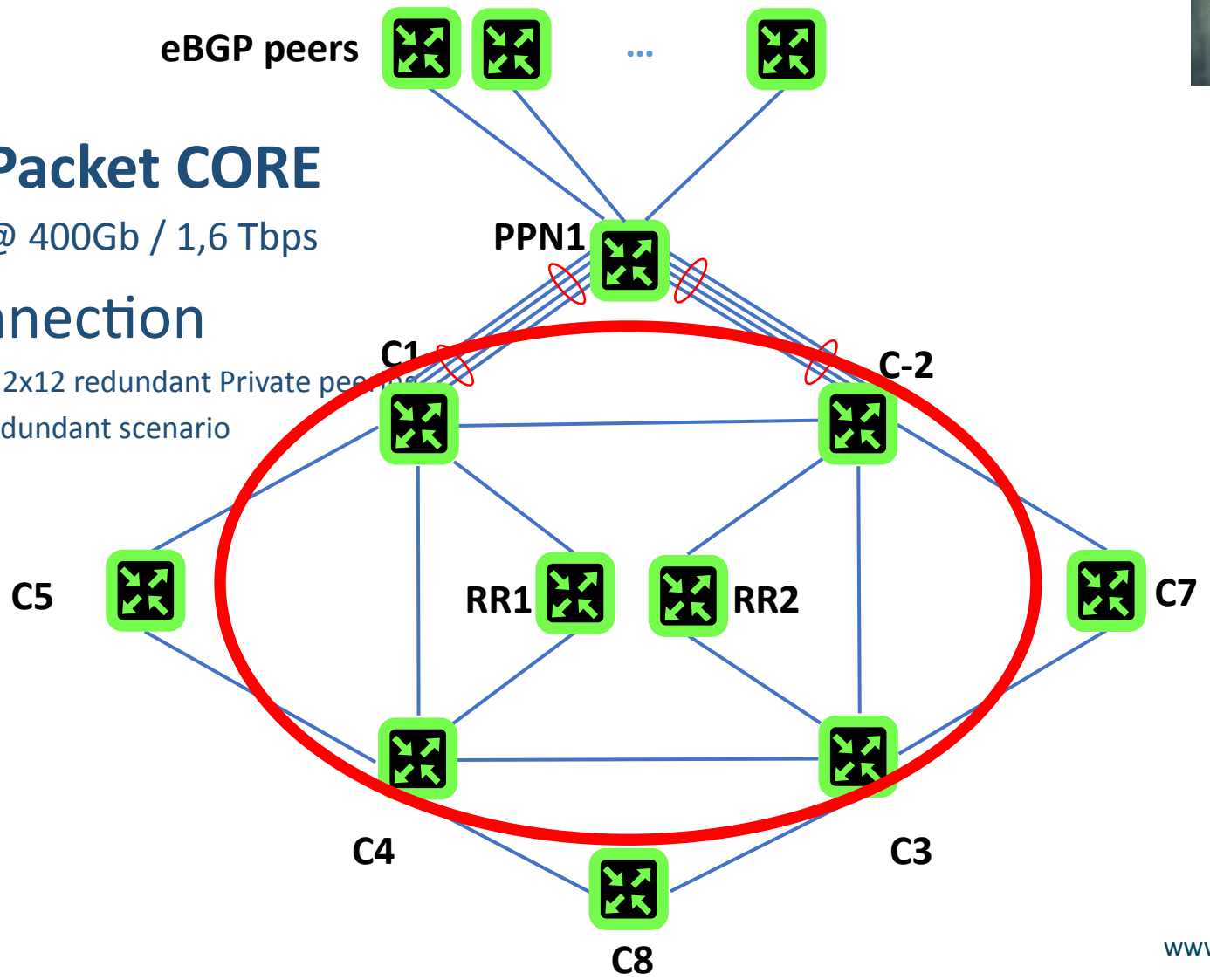
High resilient **Packet CORE**

2 direction @ 400Gb / 1,6 Tbps

User ports connection

24 ports left for 2x12 redundant Private peering

1:3 ratio with redundant scenario



Useful links

Project

- **freeRtr control plane's home:** freertr.net
- **more information on dataplanes:** rare.freertr.net
- **Project members' journey:** blog.freertr.net
- **FreeRtr configuration guide:** docs.freertr.net

Contact

- **For daring RARE/freeRtr users:** rare-users@lists.geant.org
- **For RARE/freeRtr JEDI developer wanabee:** rare-dev@lists.geant.org
- **For RARE/freeRtr supporters !** https://twitter.com/rare_freerouter

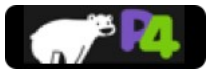
We are interested to work with industry and ISPs !
Please get in touch if you are interested (contact above)

Useful links

Source code !!!!

freeRtr core: sources.nop.hu/src/

TOFINO ASIC: sources.nop.hu/misc/p4bf/



P4Lang bmv2: sources.nop.hu/misc/p4lang/

p4emu: sources.nop.hu/misc/native/p4*

p4dpk: sources.nop.hu/misc/native/p4*

Special thanks ...

And others ...
Who make this possible !

Thank you

Any questions?

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