

# Router for Academia Research Education

RARE/freeRtr in a nutshell



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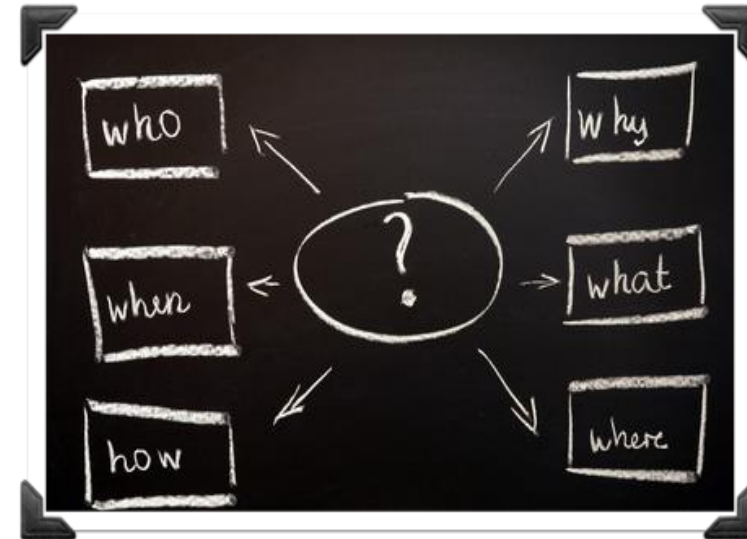
[www.geant.org](http://www.geant.org)



**WHY are we doing  
all of this ?**

# Problems statements

- Needs of **network aware** applications
- Traditional procurement life cycle workload related to network equipment acquisition
- Reduce vendor lock-in
- Ability to implement ADHOC features
- Reduce digital divide affordable network solution without functionality trade off.



## RARE/freeRtr mission statement

- One unified & Opensource routing platform
  - Multiple solutions (=dataplanes)
  - That fit R&E use case

**At TREMENDOUS line rate !**



# 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



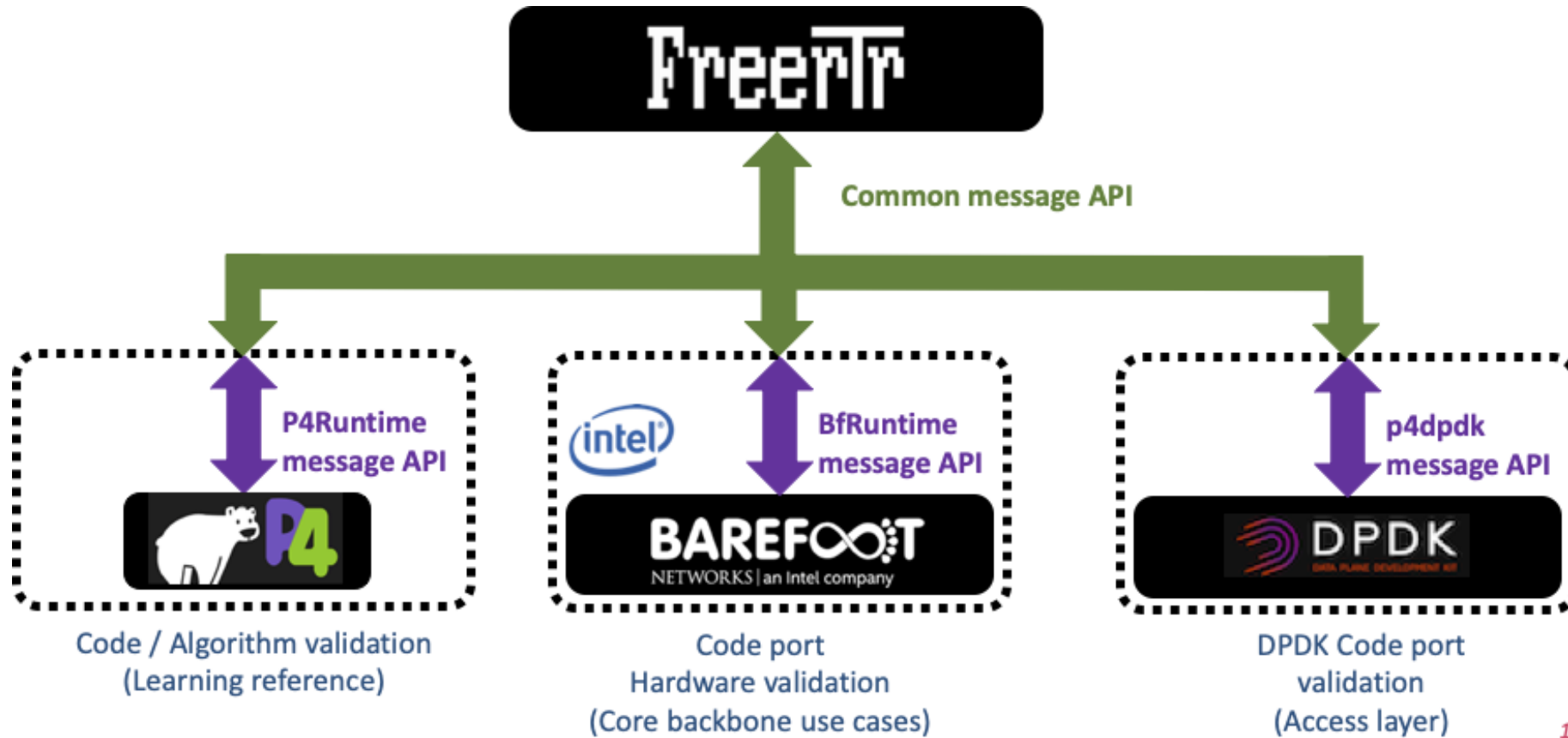
- Hypervisor Technology convergence
  - openstack.
  - kubernetes



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



# One control to rules all dataplanes



12

## 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)

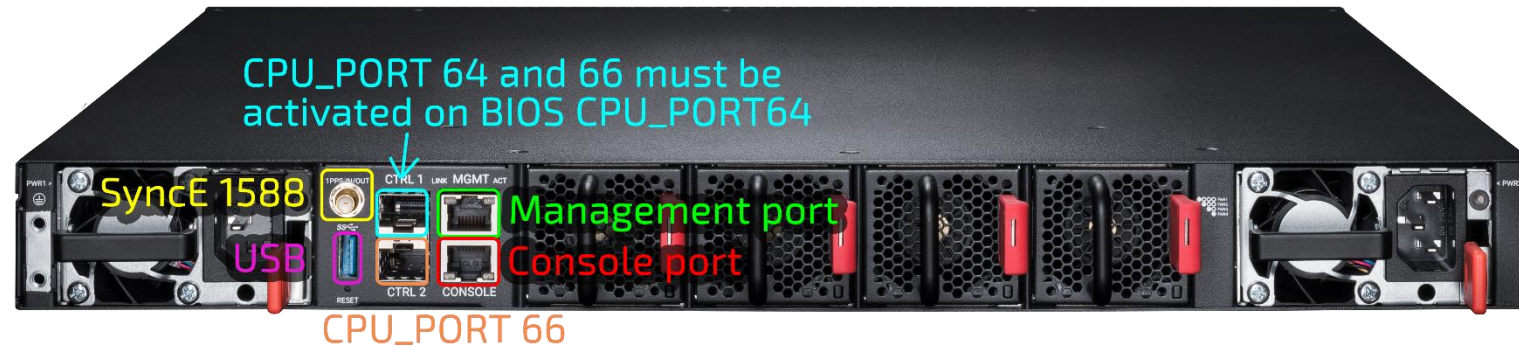
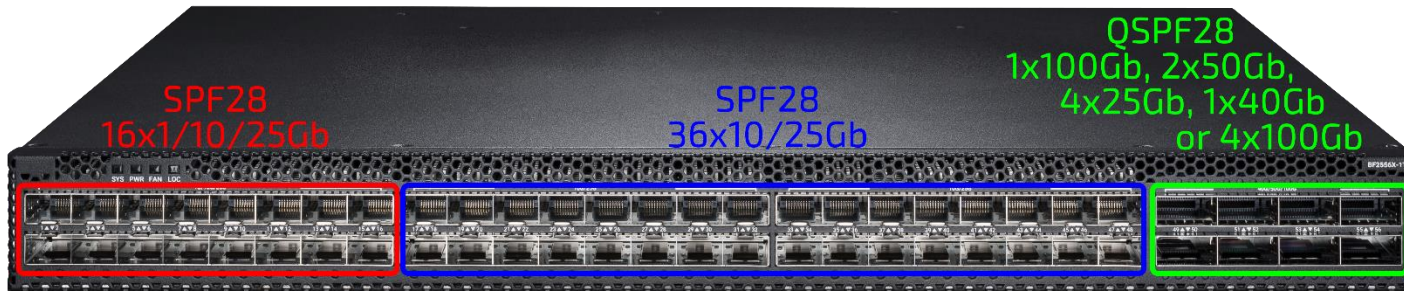


# Practical use case #002 BRAS-BNG/LNS router

- DPDK and P4 dataplane
  - ➔ suitable for CAMPUS / EDGE BACKBONE router
- nx1GE, nx10GE, nx100GE



BF-2556X-1T





## Practical use case #003 LSR router

- P4 dataplane fits perfectly pure **LSR** core router
- NNI: 4 directions with (8x100GE) bundle



**Edge-core**  
NETWORKS

**WEDGE-100BF-32X**





# 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!

**Edge-core**  
NETWORKS

**WEDGE-100BF-32X**





## Practical use case #005 high performance BGP RR

- Recycling new 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 » Practical

Ideal for aggregation

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







# Practical use case #007 100GE Private Peering node

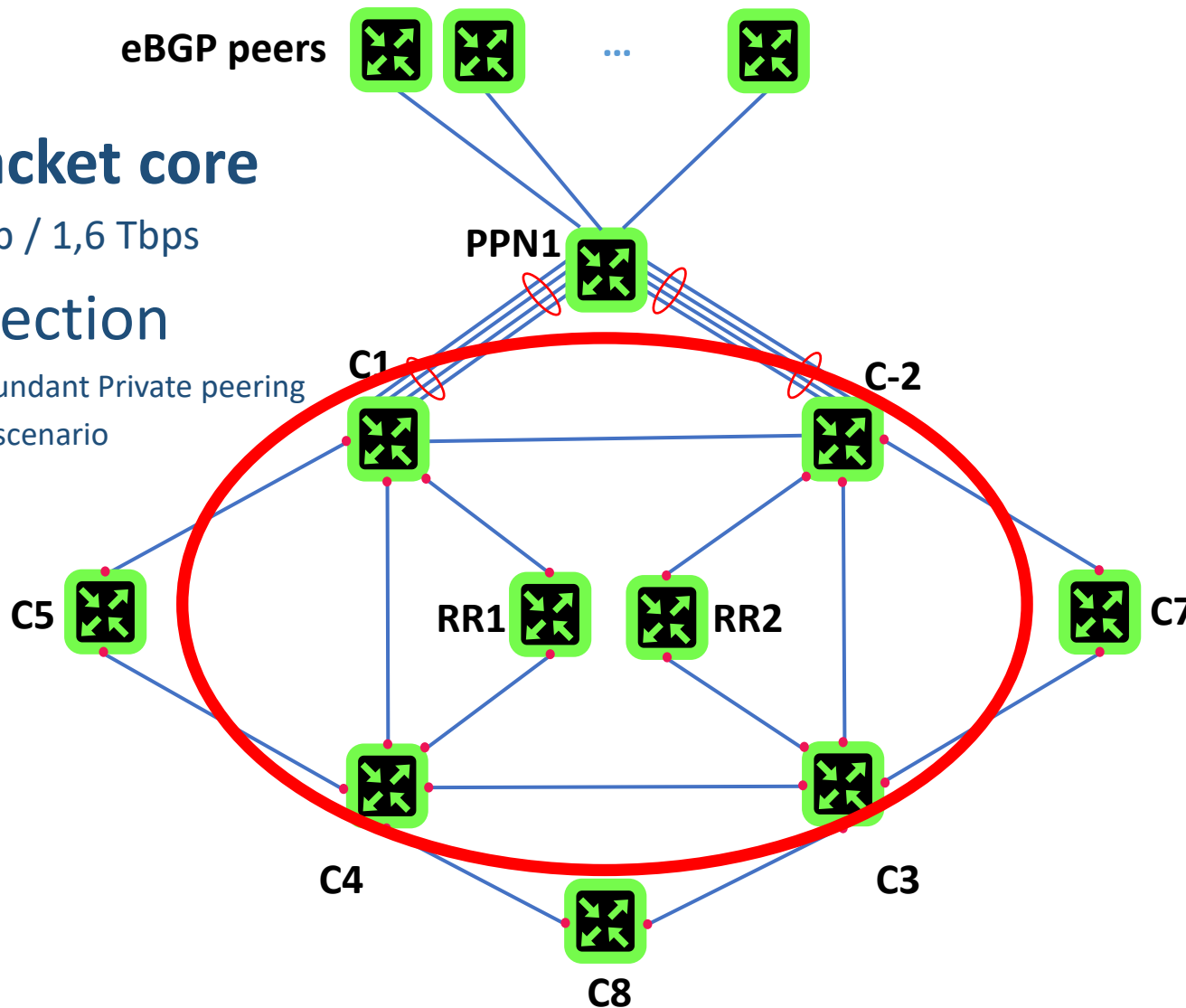


- High resilient **Packet core**

- 2 direction @ 400Gb / 1,6 Tbps

- User ports connection

- 24 ports left for 2x12 redundant Private peering
- 1:3 ratio with redundant scenario





## 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!**



# Acknowledgements ...



APS Networks



## Useful links

- Project

freeRtr control plane's home: [freertr.net](http://freertr.net)

more information on dataplanes: [rare.freertr.net](http://rare.freertr.net)

Project members' journey: [blog.freertr.net](http://blog.freertr.net)

FreeRtr configuration guide: [docs.freertr.net](http://docs.freertr.net)

- Contact

For daring RARE/freeRtr users: [rare-users@lists.geant.org](mailto:rare-users@lists.geant.org)

For RARE/freeRtr JEDI developer wanabee: [rare-dev@lists.geant.org](mailto:rare-dev@lists.geant.org)

For RARE/freeRtr supporters  [@rare\\_freerouter](https://twitter.com/rare_freerouter)



IRC@DN42 #freertr





## Useful links: Source code!!!!



freeRtr core: [sources.nop.hu/src/](https://sources.nop.hu/src/)



TOFINO ASIC: [sources.nop.hu/misc/p4bf/](https://sources.nop.hu/misc/p4bf/)



P4Lang bmv2: [sources.nop.hu/misc/p4lang/](https://sources.nop.hu/misc/p4lang/)



p4emu: [sources.nop.hu/misc/native/p4\\*](https://sources.nop.hu/misc/native/p4*)



p4dpk: [sources.nop.hu/misc/native/p4\\*](https://sources.nop.hu/misc/native/p4*)

## Looking ahead: Finalize transition to production



**Join the RARE project !**

### **Extend HCL:**

new TOFINO based hardware support  
new DPDK release

### **New target:**

TOFINO2  
NVIDIA DPU  
P4 SmartNIC  
FPGA

### **New idea:**

Polka  
Leverage Nix paradigm

And more ...

# RARE/freeRrt GÉANT

## P4 lab use cases

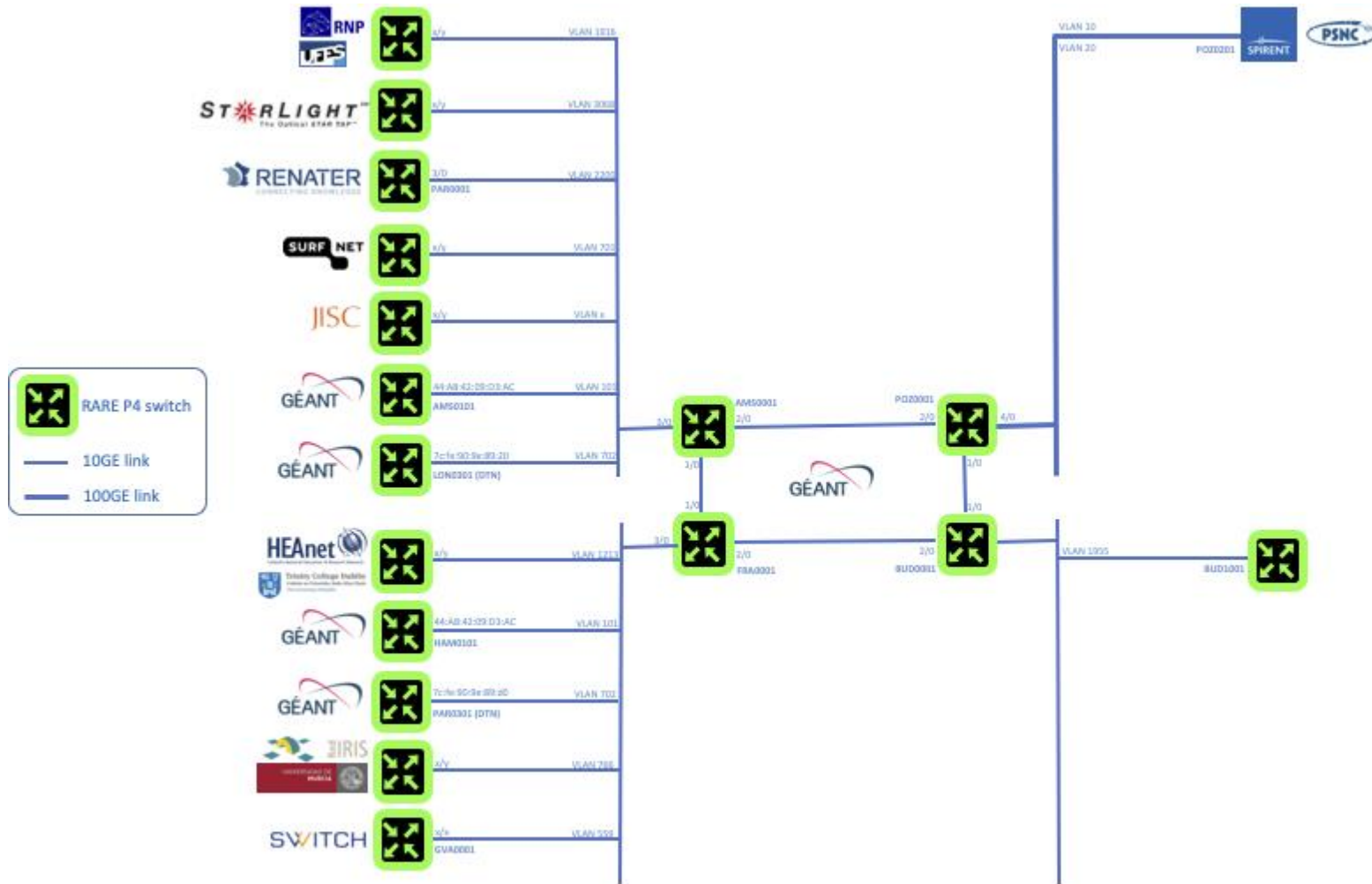


# GP4L – GÉANT P4 LAB

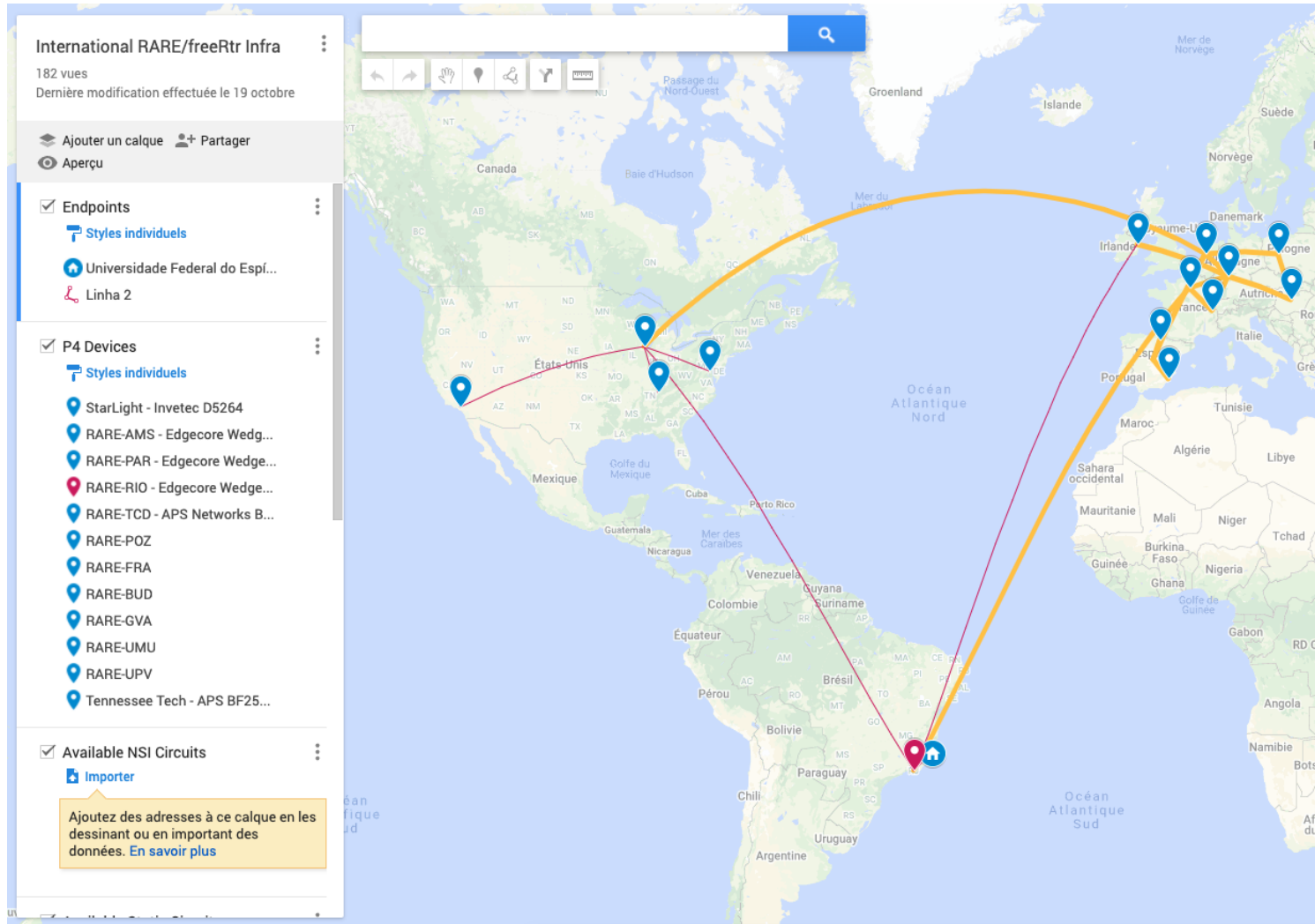




# GP4L – GÉANT P4 LAB



# GP4L – GÉANT P4 LAB



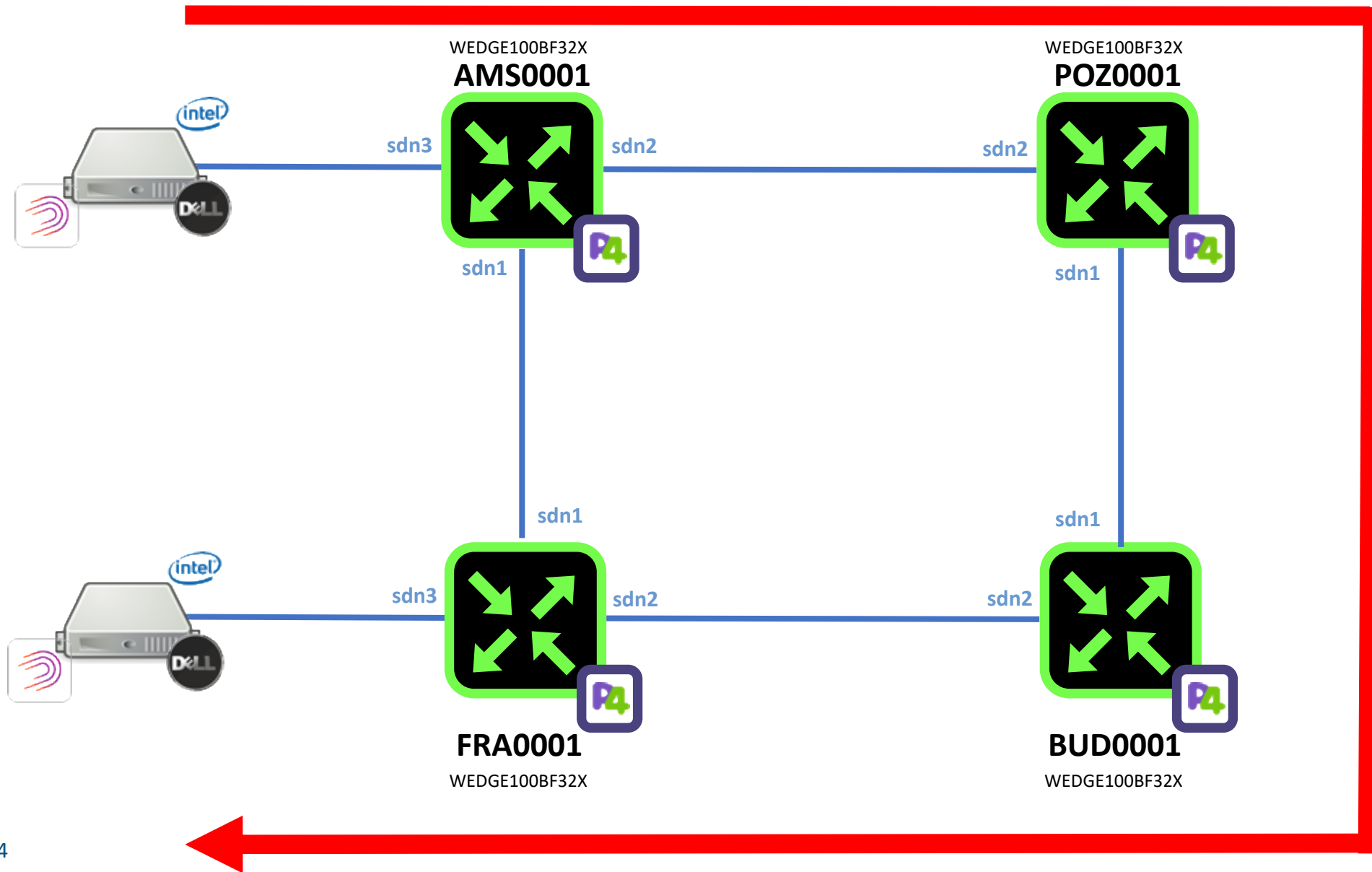
## PolKA: [1]

# Polynomial Key-based Architecture for Source Routing in Network Fabrics

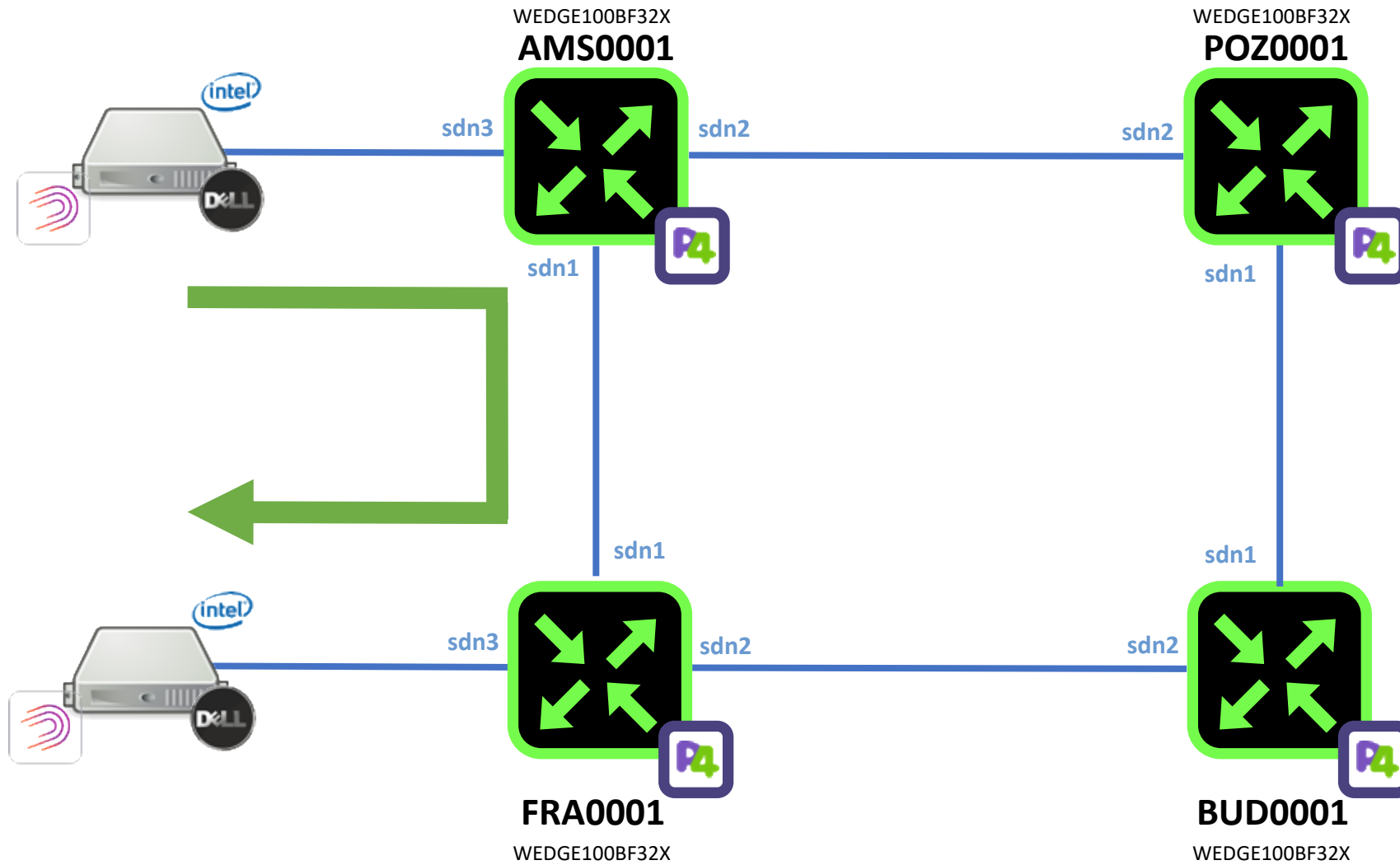
## How does PolKA work?

- Three polynomials:
  - **routeID**: a route identifier calculated using the CRT.
  - **nodeID**: to identify each core node.
    - Irreducible polynomial
  - **portID**: to identify the ports of each core node.
- The forwarding uses a **mod** operation (remainder of division):

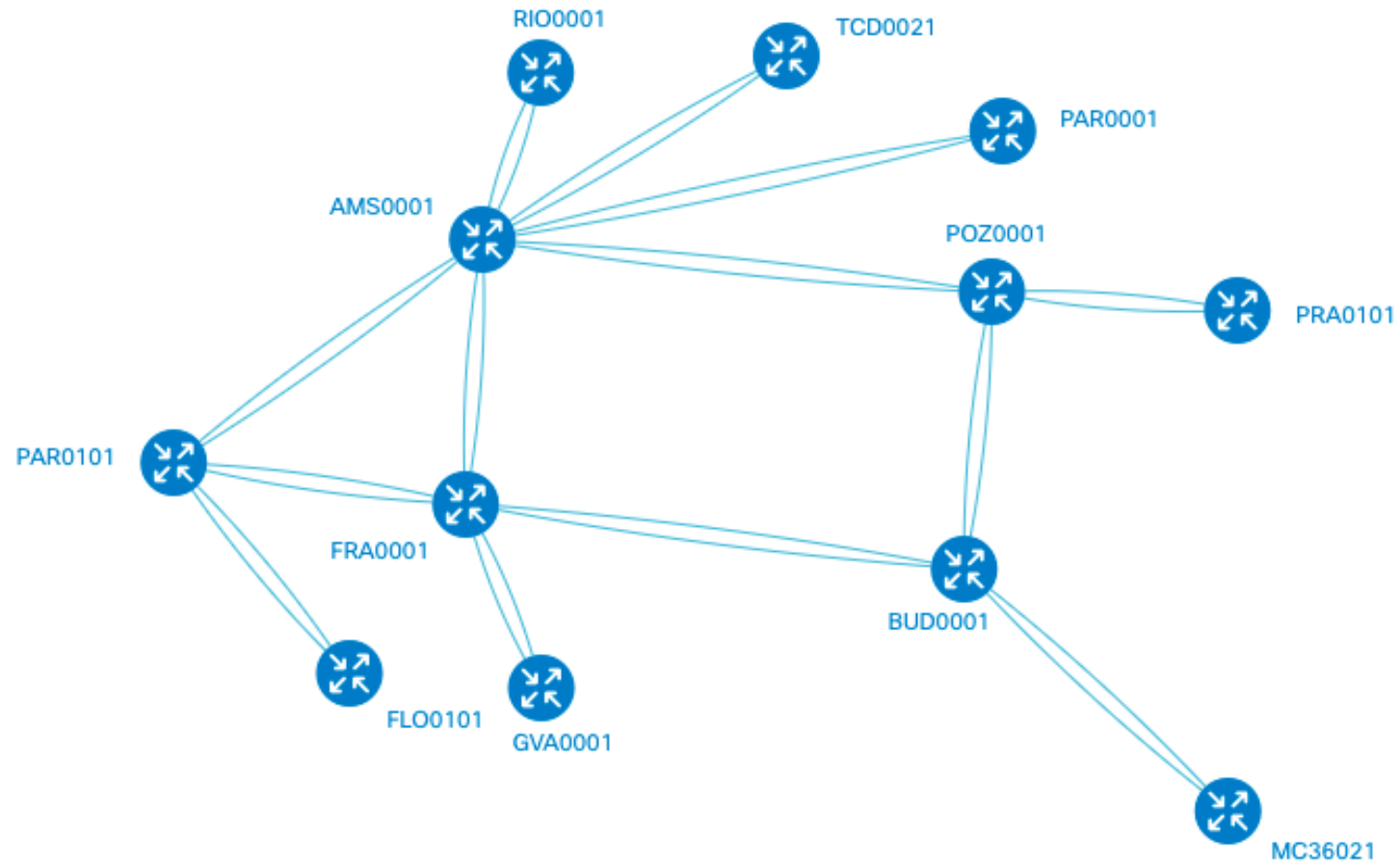
$$\text{portID} = \langle \text{routeID} \rangle_{\text{nodeID}}$$



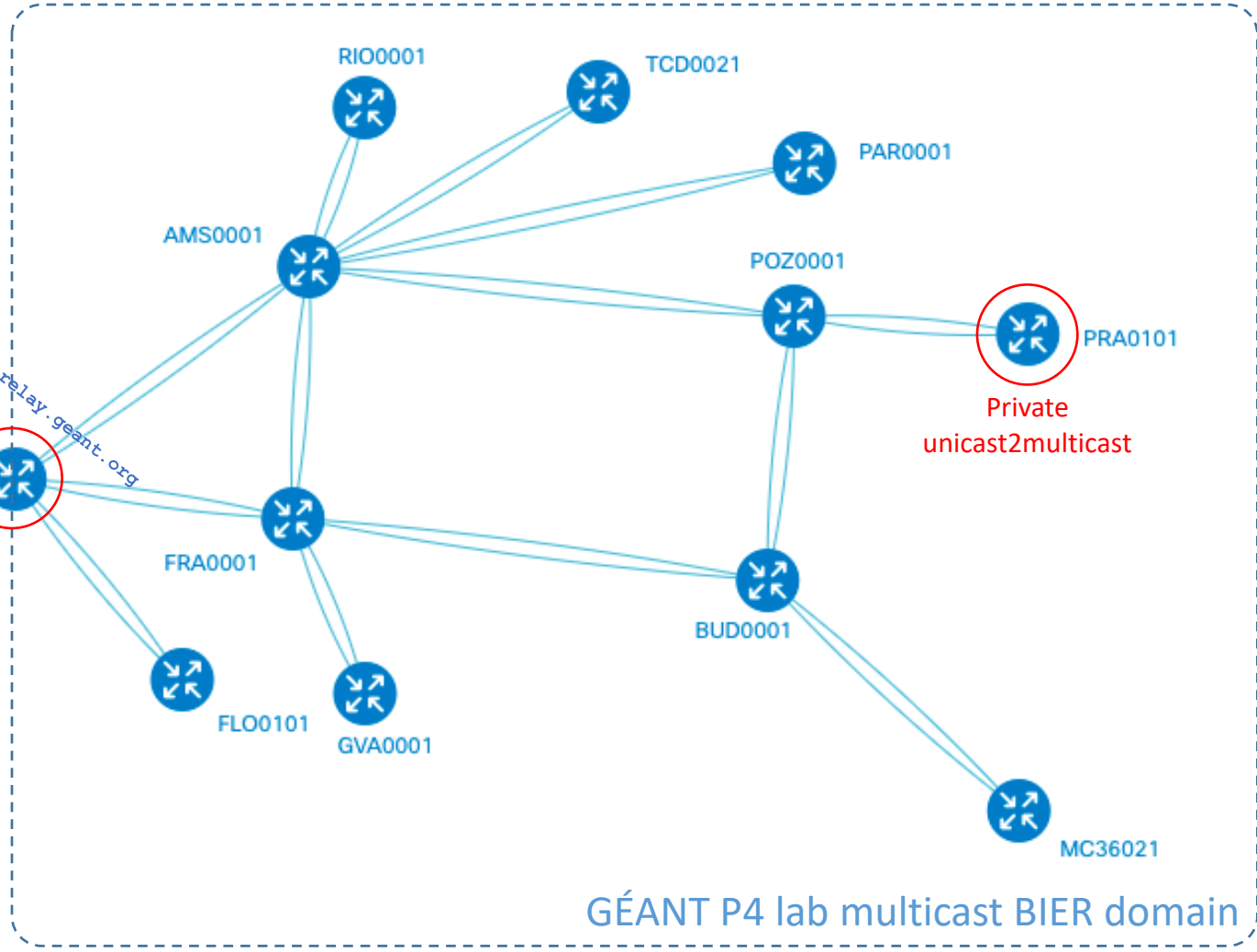
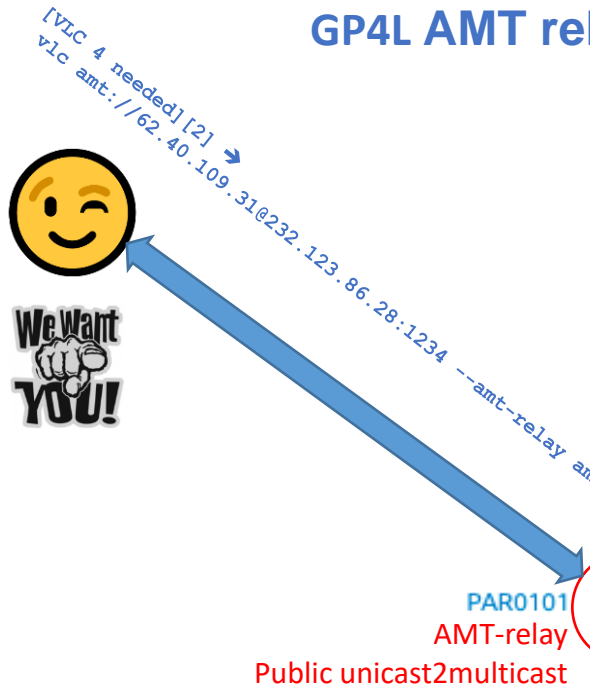




## GP4L Topology rendering via BGP-LS [1]



# GP4L AMT relay / AMT gateway / Unicast → Multicast



[1] <http://gp4l.geant.org/>  
[2] <https://nightlies.videolan.org/>

# AN INNOVATIVE MULTICAST STREAMING SERVICE !

AMT relay / AMT gateway / Unicast → Multicast

<http://mcast-menu.par.geant.org/>

<http://mcast-menu.pra.geant.org/>

**sho ipv4 nat CLEARNET trans**

	original		translated							
proto	source	target	source	target	age	last	timeout	pack	byte	
17	62.40.109.125 38337	62.40.109.31 2262	62.40.109.31 59487	232.123.86.28 1234	23:51:15	00:00:00	00:01:00	22711663	26527222384	
17	62.40.109.125 45392	62.40.109.31 2262	62.40.109.31 61222	232.123.45.36 1234	23:51:15	00:00:00	00:01:00	1850481	2161361808	
17	62.40.109.125 59210	62.40.109.31 2262	62.40.109.31 59051	232.123.33.114 1234	23:51:15	00:00:00	00:01:00	48333709	56453772112	

**sho ipv6 nat CLEARNET trans**

	original		translated							
proto	source	target	source	target	age	last	timeout	pack	byte	

**sho ipv4 mrou CLEARNET**

source	group	interface	upstream	targets	bytes
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**sho ipv6 mrou CLEARNET**

source	group	interface	upstream	targets	bytes
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**sho ipv4 mrou CORE**

source	group	interface	upstream	targets	bytes
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**sho ipv6 mrou CORE**

source	group	interface	upstream	targets	bytes
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- **INSTALL VLC 4**

<https://nightlies.videolan.org/>

- **Launch VLC AMT client**

`vlc amt://62.40.109.31@232.123.76.124:1234 --amt-relay amt-relay.geant.org`

# Thank you

Any questions?

[www.geant.org](http://www.geant.org)

