

## GN4-3 STF#19

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### RARE latest news

Network Technology Evolution

Router for Academia Research and Education (aka RARE)

Zagreb, Croatia

3-4 March 2020



# Agenda

## RARE project

Group focus

Partner

## P4 in a in a nutshell

An open programming language: P4

P4 packet forwarding

## RARE latest news

RARE features

P4 testbed status

RARE validation designs & related use case

## Key take away

## Looking ahead



- WP6-T1 sub-task: RARE
  - Control plane software
  - P4 data plane compliant hardware
  - Interface them and the result is ...
- Fully functional router
  - running at hardware line rate
  - DIY “hackable/extensible” router
  - Control plane independence



Ivana GOLUB /Activity Leader



Tim CHOWN /Activity Leader



Xavier JEANNIN /Task Leader  
Frederic LOUI /Technical coordinator  
Maxime WISSLE /White Box SME



Janos MOHACSI /White Box SME  
Csaba MATE /FreeRouter lead developer

UNIVERSIDAD DE  
MURCIA



Jordi ORTIZ /ONOS SME



Alexander GALL  
Simon LEINEN

*«P4 is a domain-specific programming language for specifying the behaviour of the dataplanes of network-forwarding elements. »<sup>1</sup>*

➔ It allows you to program:

« how a packet that comes into your system, goes out »

- Behavioural programming language
  - Language with constraints
  - Limited number of variable types
  - With fixed size
- P4 is not a general purpose language
  - You cannot program any software
  - Like C, C++ or Java

(1) <http://p4.org>



- RARE p4 targets
  - Bmv2 p4 software switch developed by p4.org
  - TOFINO NPU developed by BAREFOOT/INTEL (WEDGE-BF100-32X)
  - **FPGA under study**
    - (cooperation with Pavel BENACEK/CESNET WP6-T1 DPP group)

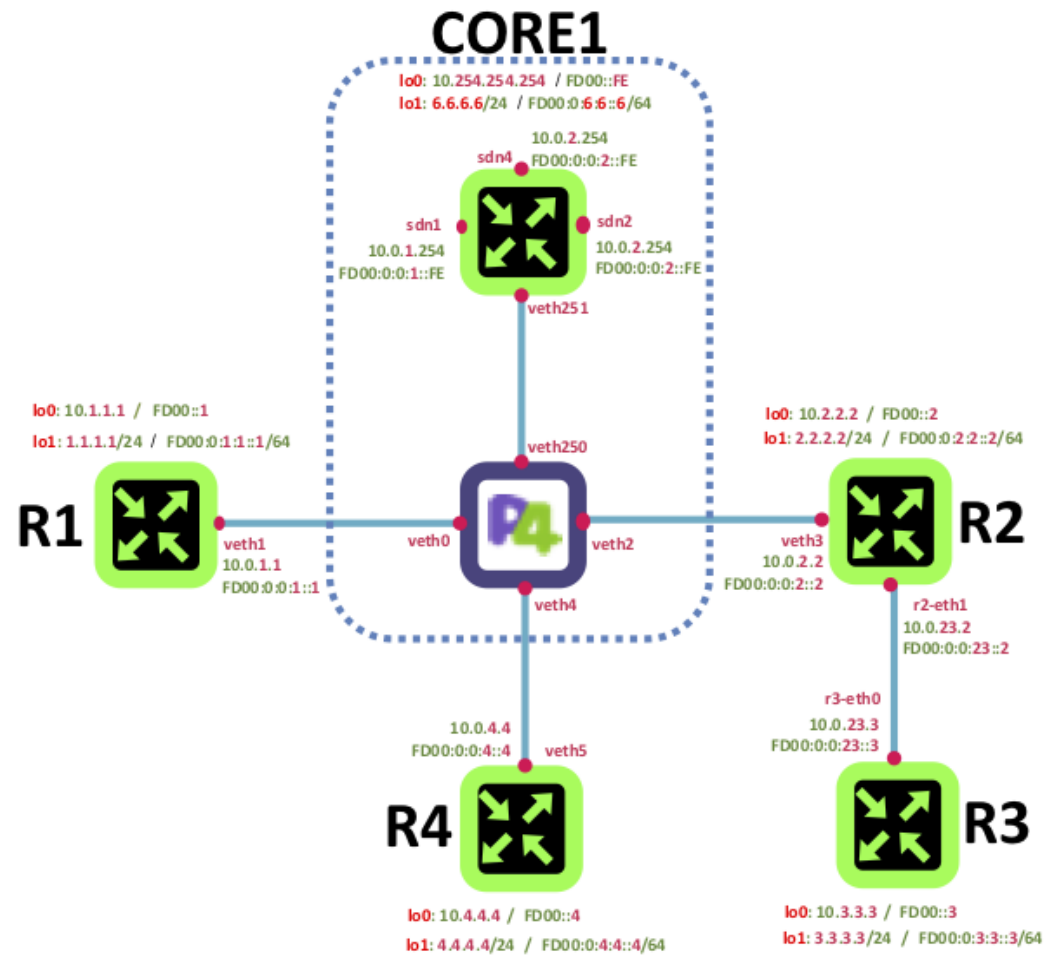
- RARE network core features
  - Routing: ISIS, OSPF
  - Label based forwarding: IS-IS-SR, OSPF-SR
  - **SRv6**
  - Network service signalling: BGP
- RARE network service edge features
  - L3VPN
  - P2P L2VPN
  - P2MP L2VPN (VPLS, EVPN)



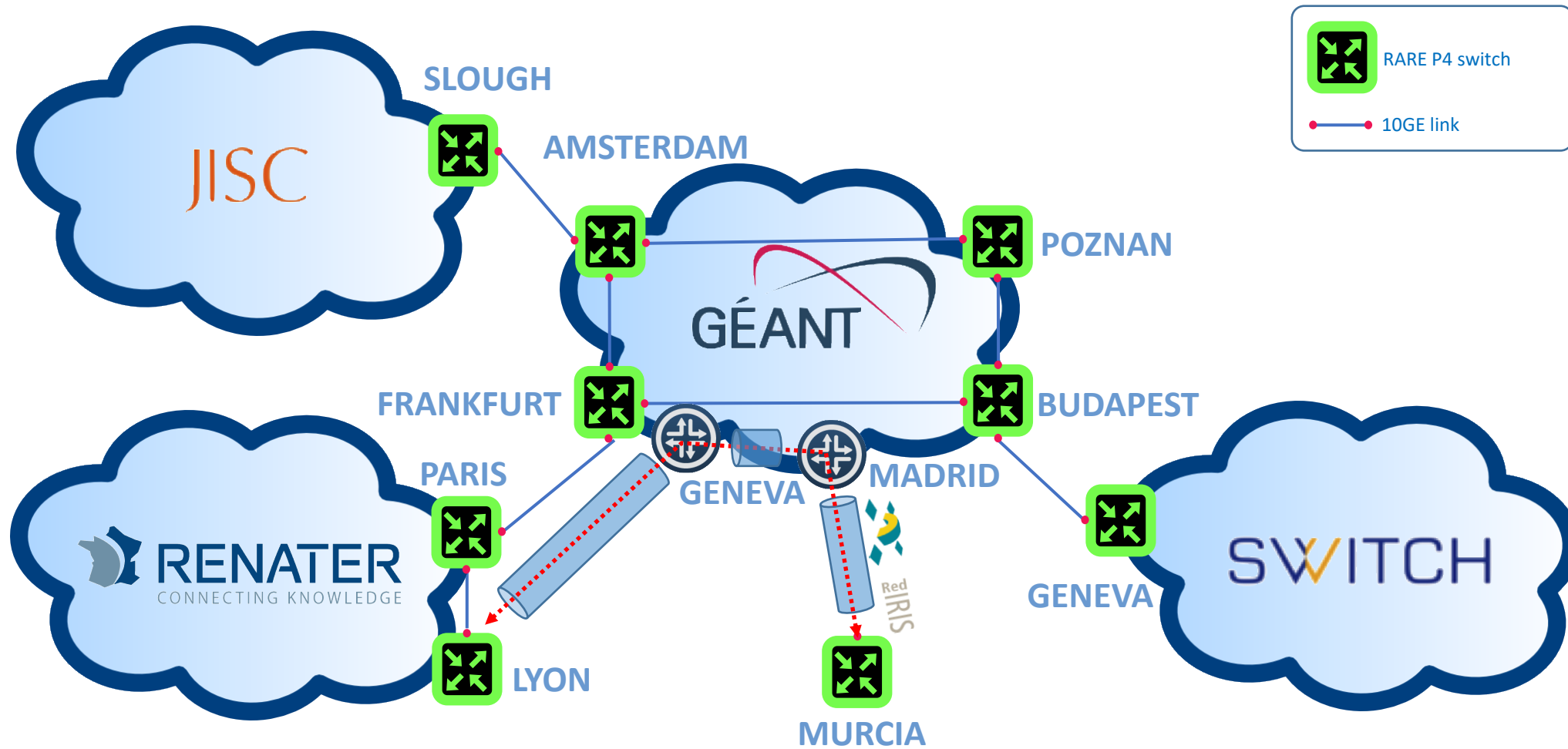
- RARE network security features
  - **Control Plane Policy**
- RARE network management features
  - TACACS/RADIUS
  - SSH/NTP/DHCP/DNS
  - **Accounting** ← On-going work

- Technology scouting and feature testing
  - Technology scouting
    - Knowledge gathering / Training
    - Liaison with P4 organization and main P4 vendor
  - Nightly integrated P4Lang repository
    - Launchpad for ubuntu 18.04
    - Open Build Service for Debian stable (BUSTER)
    - NixOS P4 software integration
  - Dissemination
    - RARE GitHub
    - RARE-FreeRTR documentation site

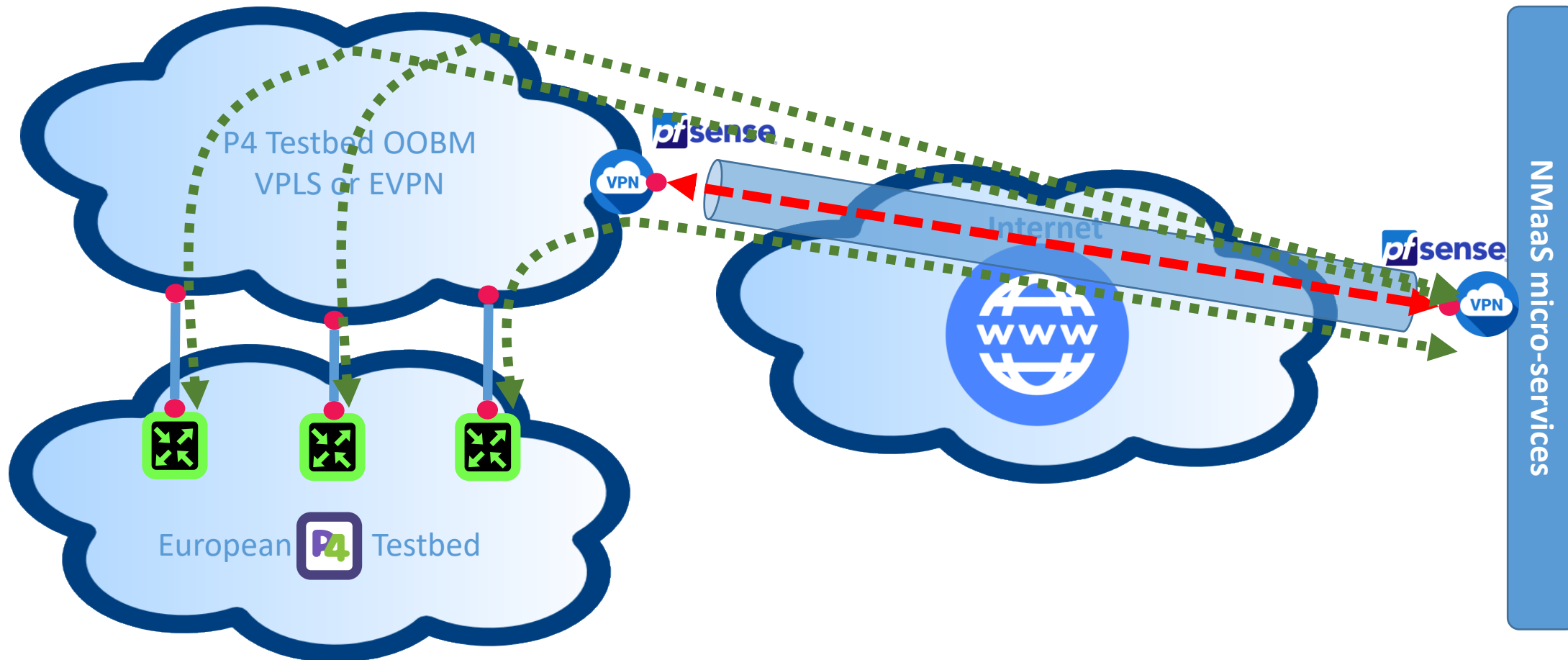
# RARE validation designs: RARE reference design



# RARE validation designs: P4 european testbed design

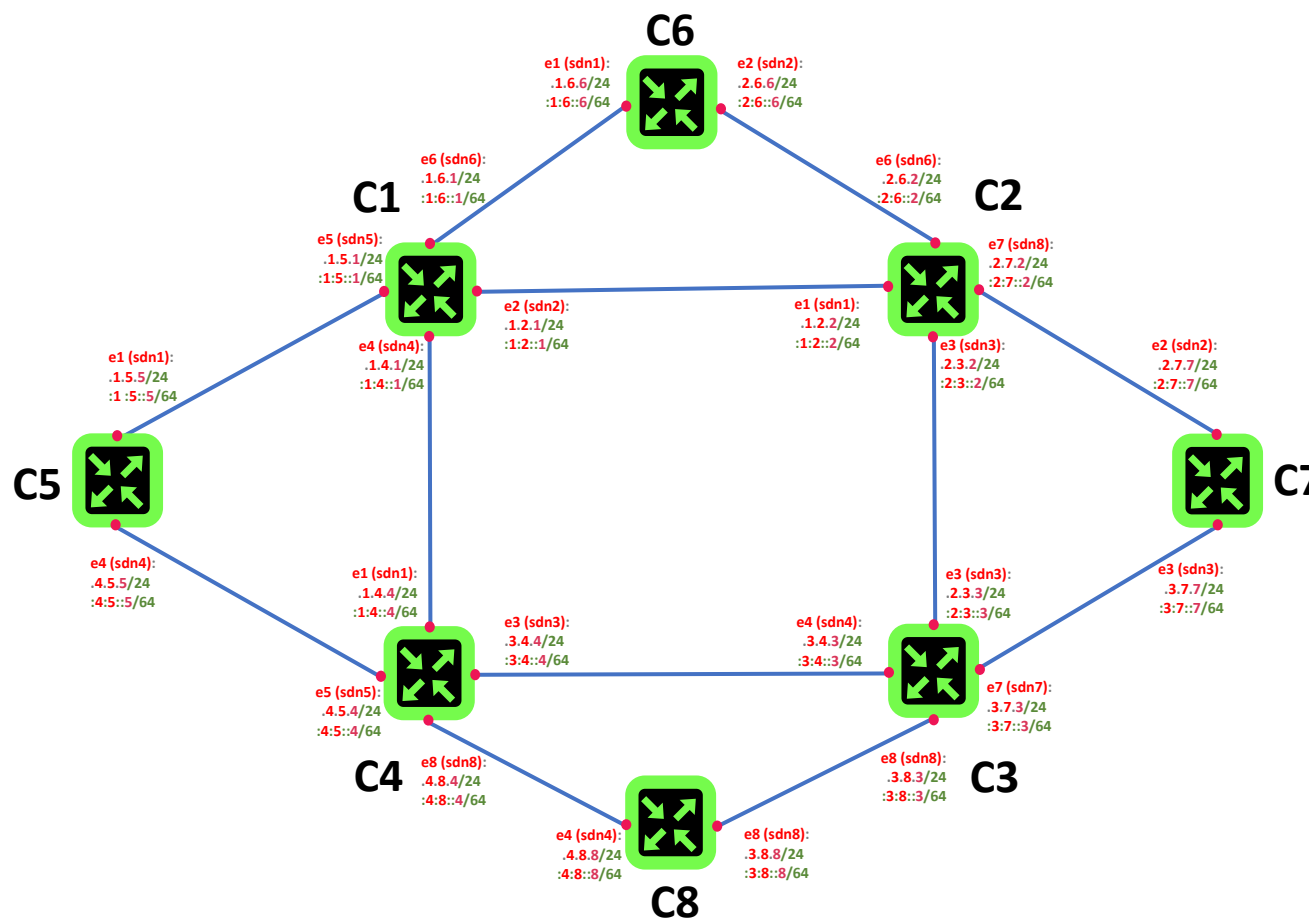


# Kudo to James BURNETT@GÉANT !



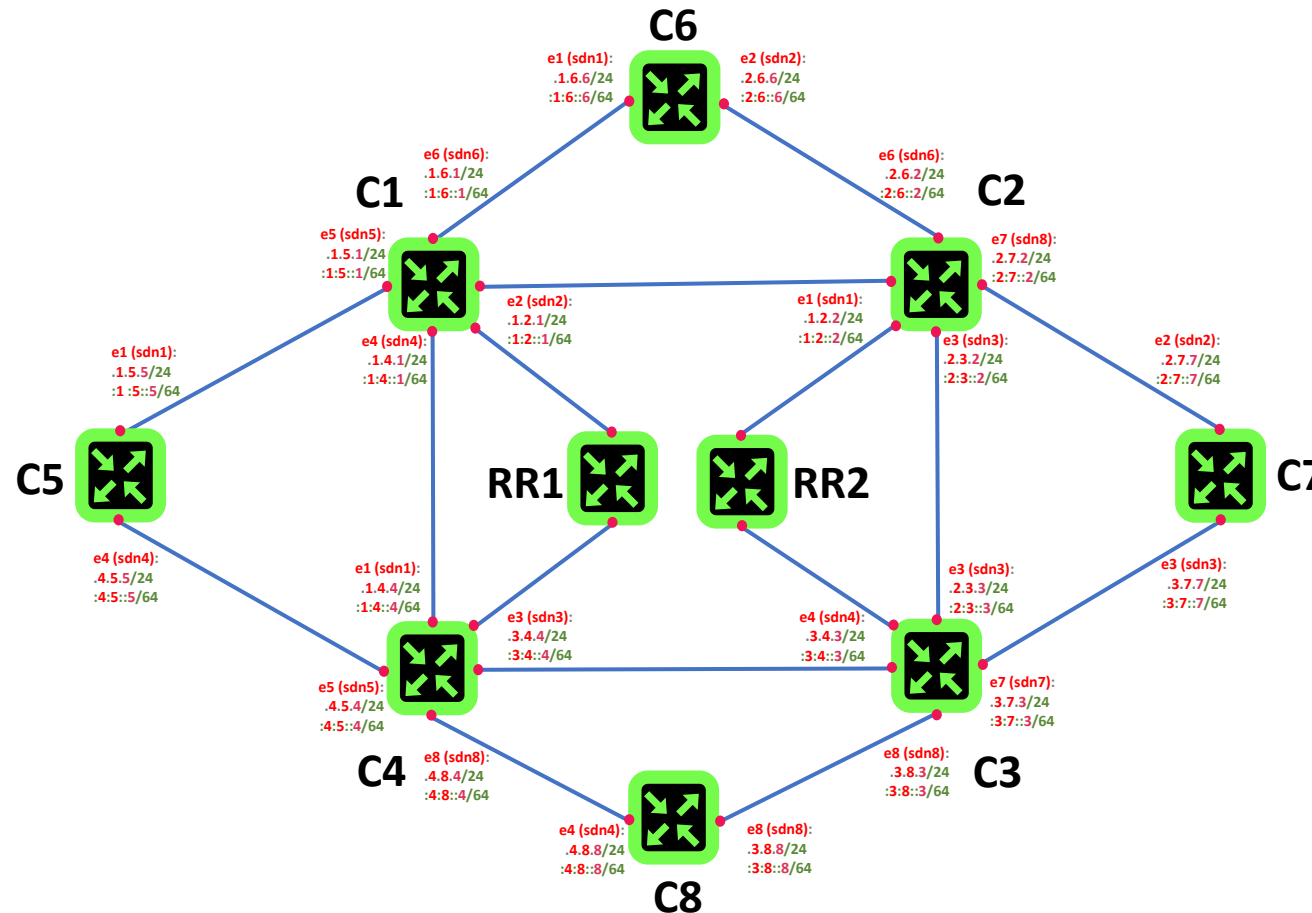
## RARE relevant use cases:

- RARE as a core P router



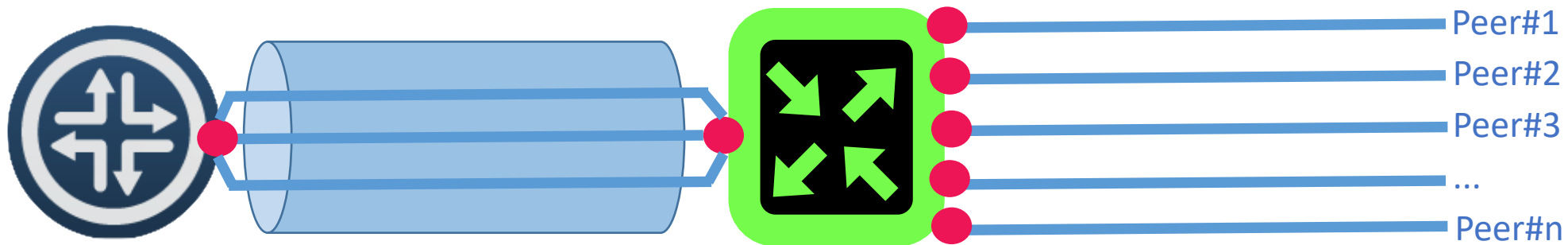
## RARE relevant use cases:

- RARE as a core PE router



## RARE relevant use cases:

- Applicable use cases
  - RARE as a 100GE internet peering (For 100GE peer aggregation)





## RARE relevant use cases:

- On going discussion
  - Inter DCI service
  - IXP use case
  - RARE used as SPINE/LEAF/TOR router inside Datacenter
- Cooperation
  - Use P4 node as a TCP SYN proxy/cookie mitigation box
    - (WP8 - Jochen Schoenfelder)

## Key take away 1/4

RARE project objective is to assess the possibility:

- To couple a control plane to a P4 data plane
- Qualify the missing (if any) components in order to have a complete Network OS
- Apply RARE outcomes to R&E use case defined by other GN4-3 subtasks



### Open networking programming language such as P4

- Is not a complex language due to its behavioural nature
- A P4 program applies to any NPU that support P4 open specification

### Open networking provides an opportunity to elaborate an R&E router:

- Technical and economic context are favourable
- Bring networking innovation into the R&E world
  - NREN
  - Global research projects
- High bandwidth end to end network service
- Unlock digital divide situation
  - Emerging NREN
  - Emerging PAN-EUROPEAN network



## Key take away 3/4

- **In M24 RARE project will reach TRL5-6**
  - **Usable LSR in operational environment**
    - ISIS/OSPF MPLS-LDP
    - MPLS-SR with ISIS/OSPF Segment Routing extension
  - **Usable LER in operational environment**
    - IPv4 L3VPN, 6VPE
    - Pseudowire, VPLS, EVPN
  
- **Additional use cases development**
  - Internet Private peering use case
  - Datacenter SPINE/LEAF use case
  - IXP use case



- **Raise R&E community RARE project awareness**
  - Connect additional NREN in the GÉANT P4 European testbed
  - Propose connectivity service to Global Research project as pilot test
  - **Propose RARE training workshop**
- **More work needed in order to reach a full fledge Network Operating System**
  - Network Management/Telemetry
  - Operational procedure
  - Life Cycle Management model

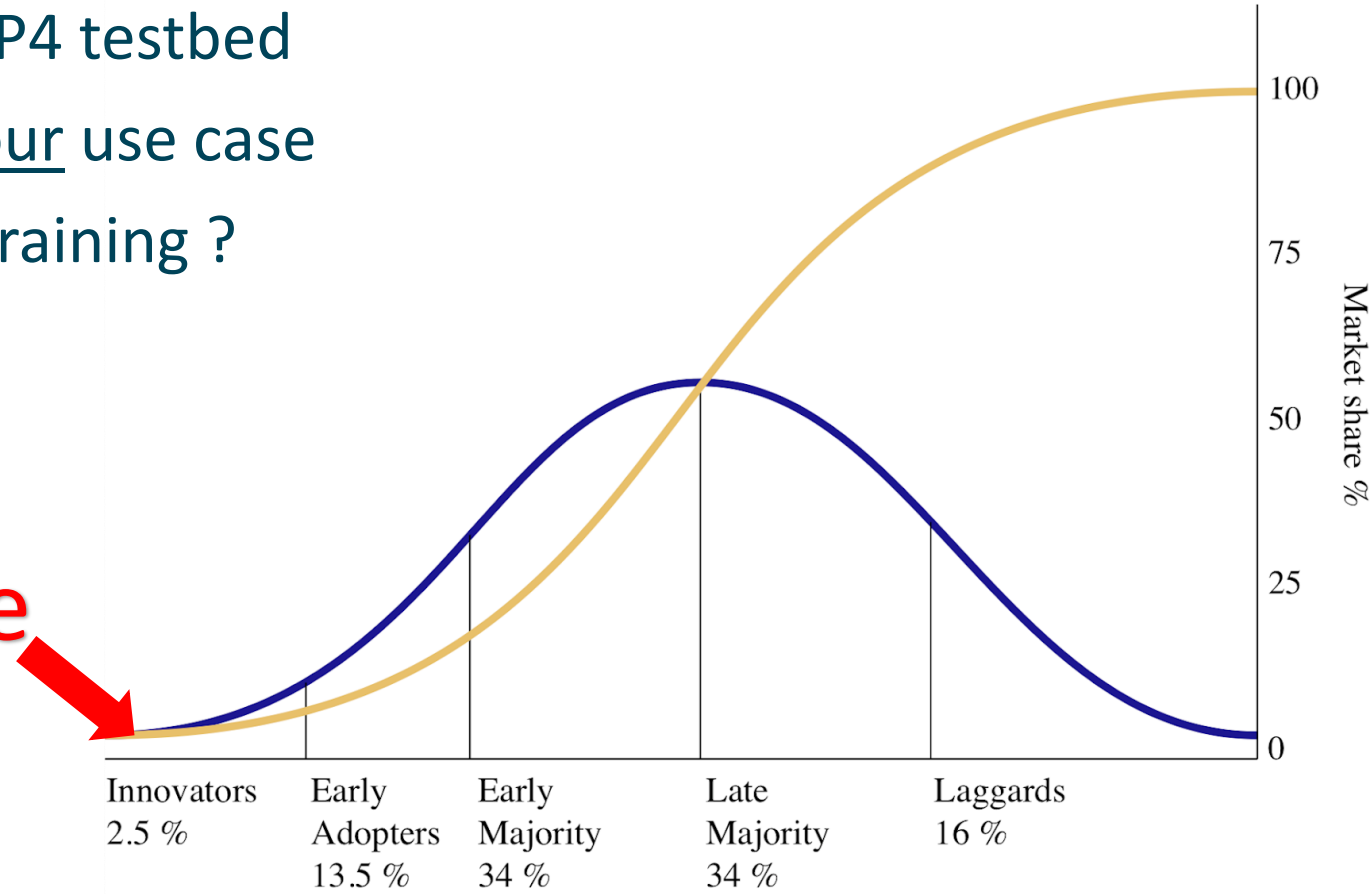


- RARE-FreeRTR documentation web site
  - <https://rare-freertr.mp.lis/>
- Ubuntu P4Lang repository at Launchpad
  - <https://launchpad.net/~frederic-loui>
- Debian stable P4Lang repository at Open Build System
  - <https://build.opensuse.org/project/subprojects/home:frederic-loui:p4lang>
- RARE public github repository
  - <https://github.com/frederic-loui/RARE>
- RARE private Bitbucket git (GN4-3 Community access only)
  - TOFINO code subject to NDA.
- FreeRTR web site
  - <http://freerouter.nop.hu/>

## Let's create a P4 NREN community

- Share RARE P4 testbed
- Elaborate your use case
- Workshop/Training ?

We are here



Diffusion of Innovation: [https://en.wikipedia.org/wiki/Diffusion\\_of\\_innovations](https://en.wikipedia.org/wiki/Diffusion_of_innovations)

# Looking ahead ... Let's build a RARE NREN community





# Thank you

## Any questions?

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