GN4-3 STF#19
Frédéric LOUI, GÉANT
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 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
RARE project: Group focus

- 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
RARE project: Partner

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
Jordi ORTIZ /ONOS SME
Alexander GALL
Simon LEINEN
An open programming language

**P4:** Programming Protocol-independent Packet Processors

«*P4 is a domain-specific programming language for specifying the behaviour of the dataplanes of network-forwarding elements.*»\(^1\)

⇒ 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](http://p4.org)
P4 packet forwarding workflow

my_program.p4

Payload
Header

Payload
Header

Compilation

Payload
Header
• 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 latest news (M15)

• 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 latest news (M15)

• 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

- JISC
- AMSTERDAM
- FRANKFURT
- PARIS
- LYON
- SLOUGH
- POZNAN
- BUDAPEST
- MADRID
- MURCIA
- GENEVA

Diagram shows a network of cities connected by 10GE links, with GÉANT as the central hub.
RARE validation designs: P4 Testbed network management via NMaaS!

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)
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
• 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
Key take away 4/4

- 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
Useful links

• RARE-FreeRTR documentation web site
  • https://rare-freertr.mp.ls/

• 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

Looking ahead … Let’s build a RARE NREN community
Thank you

Any questions?

frederic.loui@renater.fr

As part of the GÉANT 2020 Framework Partnership Agreement (FPA), the project receives funding from the European Union’s Horizon 2020 research and innovation programme under Grant Agreement No. 856726 (GN4-3).