Router for Academia Research Education

RARE/freeRtr in a nutshell

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Public

www.geant.org
GÉANT-4 programme

- 39 participants country
  - NREN participants
  - But also NREN staff members!

- GN4 phase 3 cooperation programme
  - 44 months
  - Budget 78 M€

- GN4-3 divided in “Work Package”
  - 9 WP divided in “Tasks”
  - Task 1 encompasses 6 Sub-tasks
  - RARE is one of these sub-task
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

• Software sovereignty?
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-known commercial vendor

- Starting from 2020:
  - Dataplane solution reached maturity ready to implement production grade use case

- NOS emergence

- Hypervisor Technology convergence

It’s a good time to tie Control Plane and Dataplane!
One control to rules all dataplanes
What about ISP and commercial use case?
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
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 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 ...
Useful links

• Project
  freeRtr control plane’s home: freertr.org
  more information on dataplanes: rare.freertr.org
  Project members’ journey: blog.freertr.org
  FreeRtr configuration guide: docs.freertr.org

• 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  @rare_freerouter
    IRC@DN42 #freertr
  RARE/freeRtr guild
RARE/freeRtr 1st release is out!

- CI/CD deployment: ~ 2500 tests automated weekly
- ONIE image: one liner installation

- TOFINO based switches
  - Wedge 100BF-32X
  - Wedge 100BF-32QS
  - Wedge 100BF-64X
  - APS6064X
  - APS2556X1T

- An extensive list of specific tailored profile. RARE/freeRtr can act as P/PE,BNG,BRAS, CGNAT, traffic cleaner and more!

- An innovative software life cycle management leveraging Nix package manager paradigm.

  ➔ it is possible to upgrade and rollback without any hitch at the software distribution level (think of an "apt upgrade" with the possibility to "apt downgrade #n » at the router level)

- And more!

For those who wants to start their journey:

http://docs.freertr.org/guides/installation/
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*
- GitHub organisation: https://github.org/rare-freertr
Looking ahead: Finalize transition to production

Extend HCL:
new TOFINO based hardware support
new DPDK release

New target:
TOFINO2
NVIDIA DPU
P4 SmartNIC
FPGA

New idea:
Polka / mPolka
Leverage Nix paradigm

And more ...

Join the RARE project !
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):

  \[ \text{portID} = \langle \text{routeID} >_{\text{nodeID}} \]
GP4L Topology rendering via BGP-LS\cite{1}

\[1\] http://gp4l.geant.org/
GP4L AMT relay / AMT gateway / Unicast → Multicast


AN INNOVATIVE MULTICAST STREAMING SERVICE!
AMT relay / AMT gateway / Unicast → Multicast
http://mcast-menu.par.geant.org/
http://mcast-menu.pra.geant.org/

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