Router for Academia Research Education

RARE/freeRtr in a nutshell

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RARE project: Group focus

- Funded project
- Control plane software
  - P4 (not only P4) Programmable dataplane
  - Interface them and the result is ...
- Feature rich routing platform
  - Various hardware line rate
  - Flexible, DIY “hackable/extensible” router
  - Control plane independence

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!
Anatomy of a typical R&E worldwide research project #1

High speed Research & Education Network

Data processing computing center

Research project’s Instruments

Eyeballs
Anatomy of a typical R&E worldwide research project #2
RARE is for everyone

- **Routing (CP+DP) platform solution**
  - Open Platform
  - Programmable
- **RARE for Research and Education connectivity**
  - Emerging NREN
  - Or not …
- **RARE for content provider DCI**
  - IaaS owned by NREN
  - IaaS owned by International Global Research project
- **RARE for 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 latest news (Month 29 of 48)

• RARE p4 targets
  bmv2 software switch
  Programmable Ethernet ASIC on WEDGE-BF100-32X under study

• RARE p4 discussion emulation targets
  TCPDUMP & Libpcap
  DPDK
RARE “target” development

- Code / Algorithm validation (Learning reference)
- Code port Hardware validation (Core backbone use cases)
- DPDK Code port validation (Access layer)
RARE testing framework: ~ 2300 features = 2300 tests
**RARE testing framework: Dataplane tests ~300 tests**

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And more features!

**Please come @IRC #freertr and submit your idea!**
RARE validation designs:
P4 LAB network management via NMaaS!
(Network Management as a Service)

Network Management as a Service:
https://nmaas.eu
https://wiki.geant.org/display/NMAAS
P4 LAB network management via (Network Management as a Service)

Network Management as a Service:
https://nmaas.eu
https://wiki.geant.org/display/NMAAS
Monitoring at node level! (Prometheus agent)
Monitoring at node level! (Grafana dashboard)

https://grafana.com/grafana/dashboards?search=freeRouter
Key take-way – We are ready to roll into production

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

• Work in progress production deployment
Practicale 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 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!
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

Why not joining the effort?
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
    ➔ Rethink how Network Management is handled

• Opportunity to integrate existing automation initiatives

Instantaneous & Flexible
Network Services for the users!
Acknowledgements ...
Useful links

• Project
  freeRtr control plane’s home: freertr.net
  more information on dataplances: 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  @rare_freerouter
  IRC@DN42 #freertr
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*
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
P42VPP
T4P4S ELTE
Leverage Nix paradigm

And more ...
Thank you

Any questions?

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