Router for Academia Research Education
RARE/freeRtr in a nutshell

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RARE project: Group focus

- Control plane software
  - *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 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!
RARE use cases

IPv4 and IPv6 compliant!
Anatomy of a typical R&E worldwide research project #1

- Research project’s Instruments
- High speed Research & Education Network
- Eyeballs
- Data processing computing center
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
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
### Complete feature list

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</table>

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)

More API/Agents are available!
Monitoring at node level! (Grafana dashboard)

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

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

- Work in progress production deployment
Let’s get practical ... and present you actual real life use cases!
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!
Key take-away – 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
Key take-away – 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 dataplanes: 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

Join the RARE project!
Thank you

Any questions?

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