

# RARE Router: Opportunities and Use Cases for Research and Education Networks

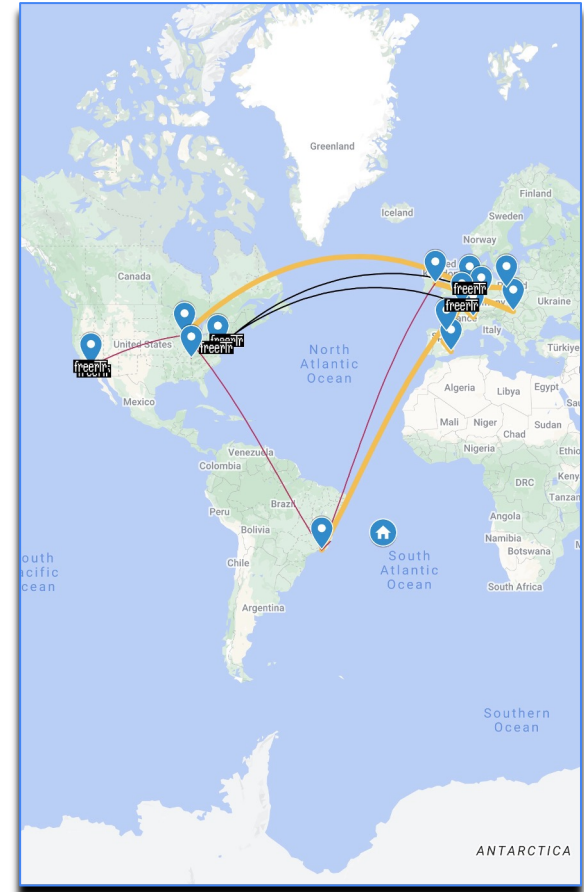
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# RARE/FreeRTR

## Project members



## GÉANT P4 lab participants



## Why RARE?

One platform that provides multiple solutions. Each solution is able to address a specific Research and Education use case or need.



# RARE Features

- **Forwarding:** ipv4, ipv6, ipx, mpls, layer2, atom, eompls, vpls, evpn
- **Routing:** ospf, is-is, bgp, static, rip, eigrp, babel, bfd, msdp, pim ssm, igmp
- **LSP support:** p2p, p2mp, mp2mp built by bgp, ldp, rsvp-te, sr, sr-te
- **Crypto:** macsec, ipsec, ikev1, ikev2, tls, dtls, ssh, openvpn, wireguard, sgt
- **Tunneling:** gre, ipip, l2tp, pptp, gtp, nvgre, vxlan, geneve, mplsip, mplsudp, erspan, etherip, icmptun, pimtun, ipcompress, ipencap, minenc, nos, tmux, l2f, uti, etc
- **Encapsulation:** Ethernet, vlan, ppp, Framereelay, pwether, virtppp, hairpin
- **Misc:** acl, qos, nat, pbr, srv6, vrrp, hsrp, inspect, 6to4, rpl, tunnel, vpdn, pcep
- **Servers:** telnet, ssh, socks, http(s), ftp(s), tftp, pop3(s), smtp(s), gopher, irc, dcpp, sip, dns, ntp, syslog, lpd, radius, tacacs, etc

# NREN Survey

- A survey was carried out to gain insights into NREN backbones.
  - Most of the NRENs operate multivendor backbones
  - A few NRENs lack their own network equipment and instead rely on infrastructure of local operators
  - Twelve out of thirteen NRENs operate dual stack backbones, supporting both IPv4 and IPv6
  - Three out of thirteen NRENs offer MPLS services including L2VPNs and L2VPNs.
  - Two NRENs run PIM

## Architecture

- Star
- Partial Mesh

## Infrastructure Security

- TACACs+
- OOB
- BGPFlowSpec

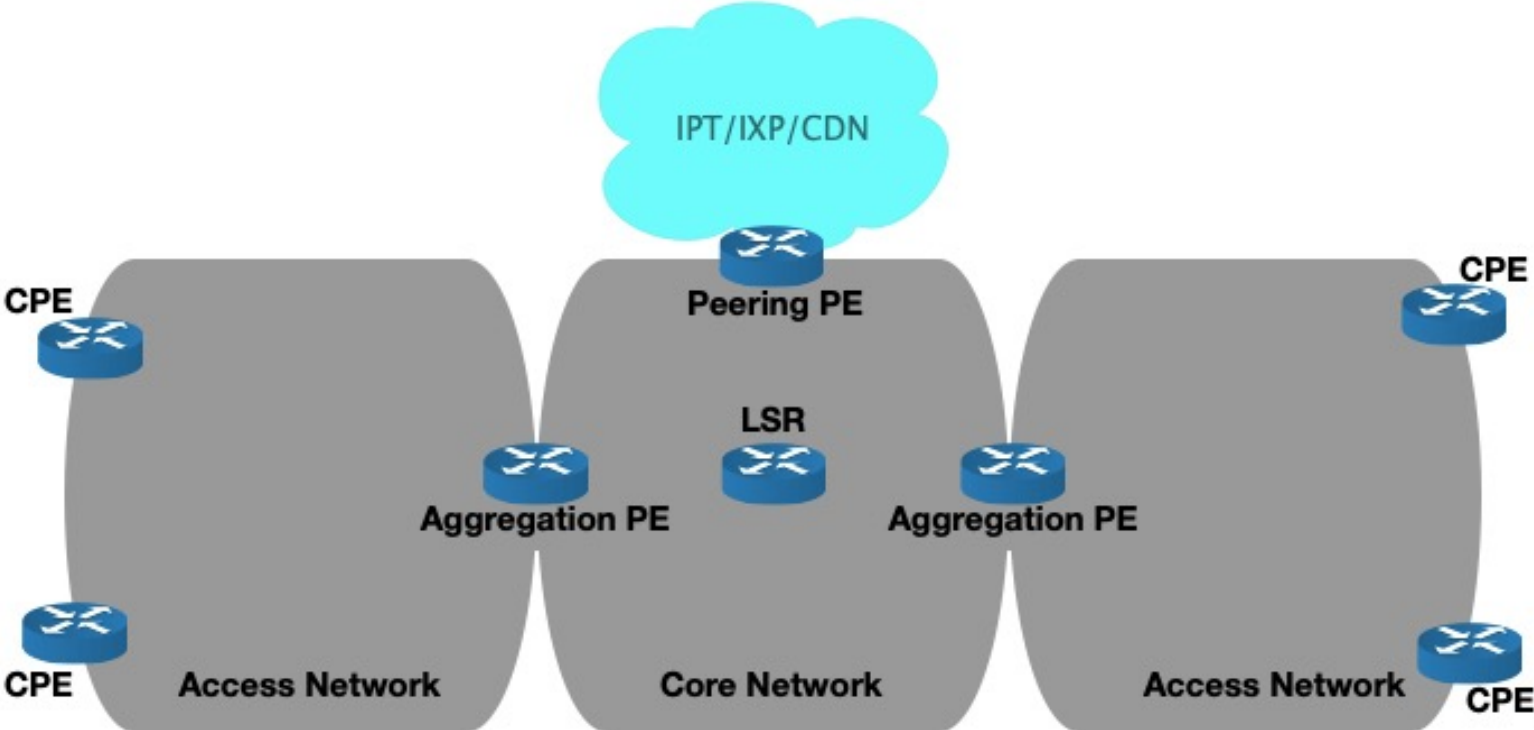
## Connectivity Services

- IP Transit
- Layer 2 VPNs
- Layer 3 VPNs

## Routing Security

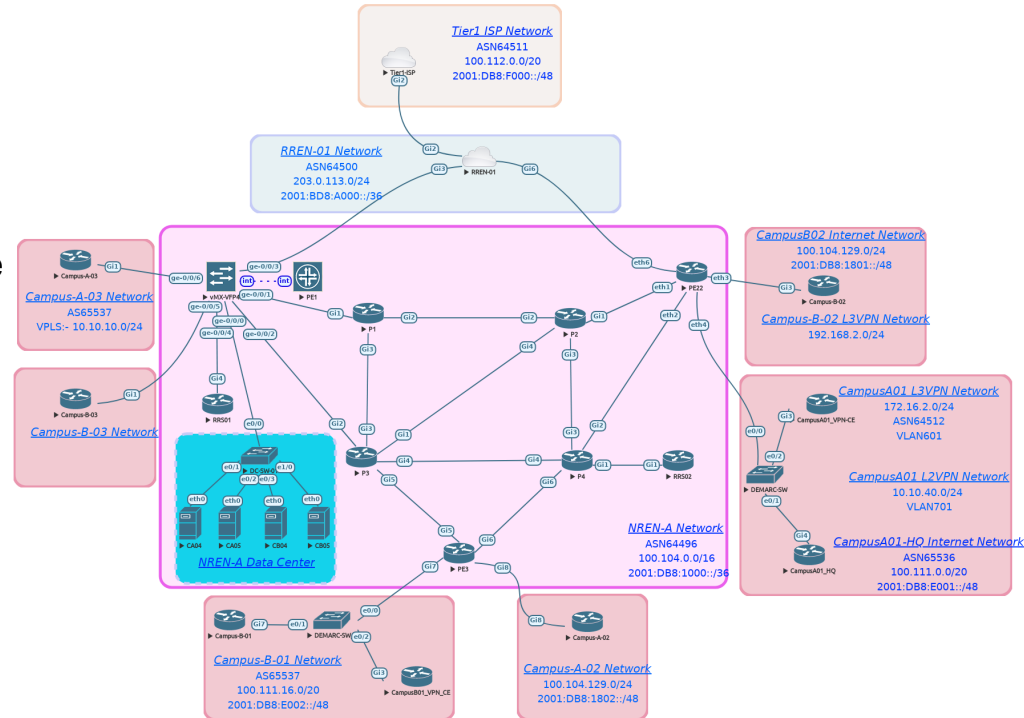
- Antispoofing
- RPKI
- Bogon Filtering

# Use Cases



# Validation Lab

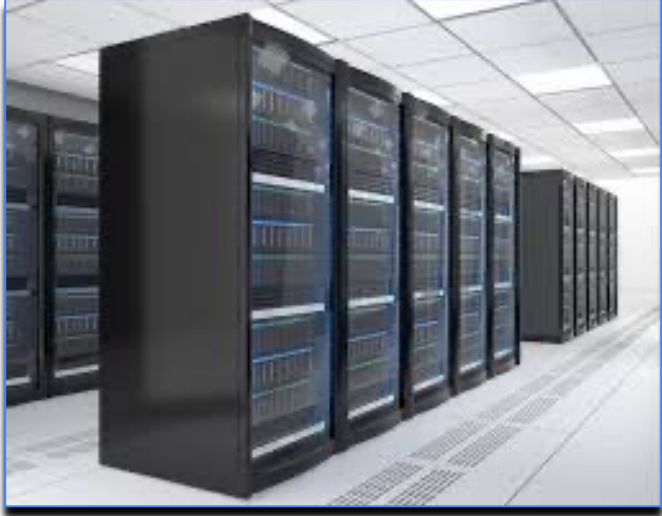
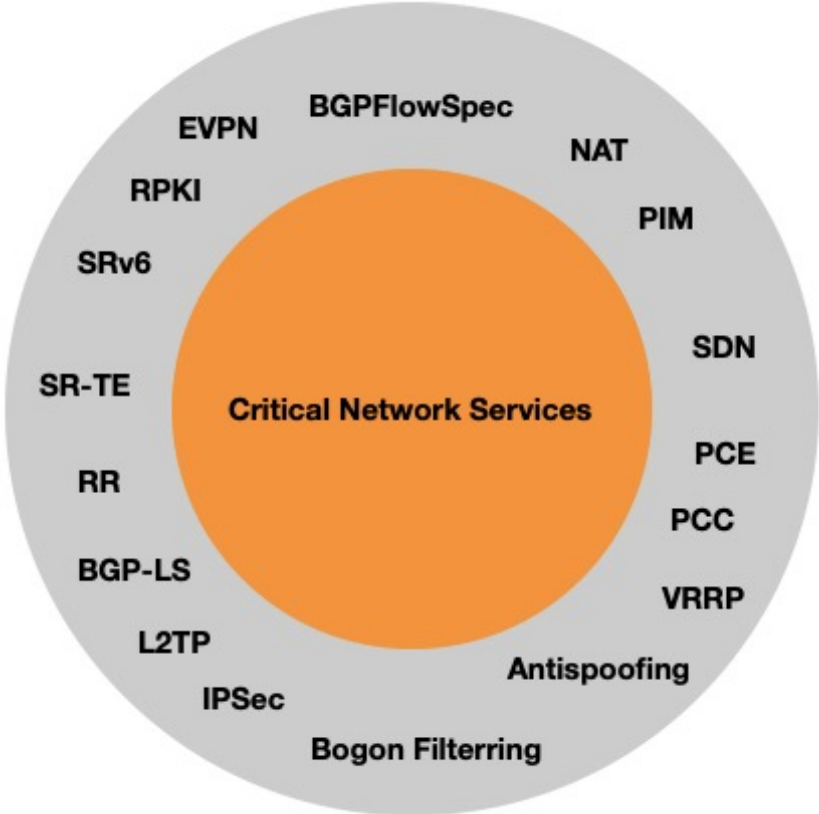
- Juniper, Cisco IOS-XE and RARE/Freertr
- Routing Protocols
  - Intermediate System to Intermediate System (IS-IS)
  - Border Gateway Protocol (BGP)
- BGP Scaling Techniques
  - Peer groups (Templates), Route Reflectors
- Multiprotocol Label Switching (MPLS) Applications
  - VPNs and RSVP-TE



# Value Proposition

- As an open source software, RARE does not require any license
- For NRENs that are yet to deploy their own network equipment, you can
  - recycle old servers to act as 1Gbps CPEs for primary and secondary schools, OOB servers, route reflectors etc or
  - procure commodity hardware at lower price points to serve as
    - 10Gbps CPEs for end-user institutions such as university campuses, research centres
    - Nx10,25,40,100Gbps Internet transit gateways or core nodes
    - Nx10,25,40,100Gbps Data Centre spine or edge
    - Nx10,25,40,100Gbps IXP or PNI peering node

# Future Tests



# Thank you!

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