Implementation of software router cluster

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3 Evolution of ISP infrastructure
4 Routing cluster features
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Introduction

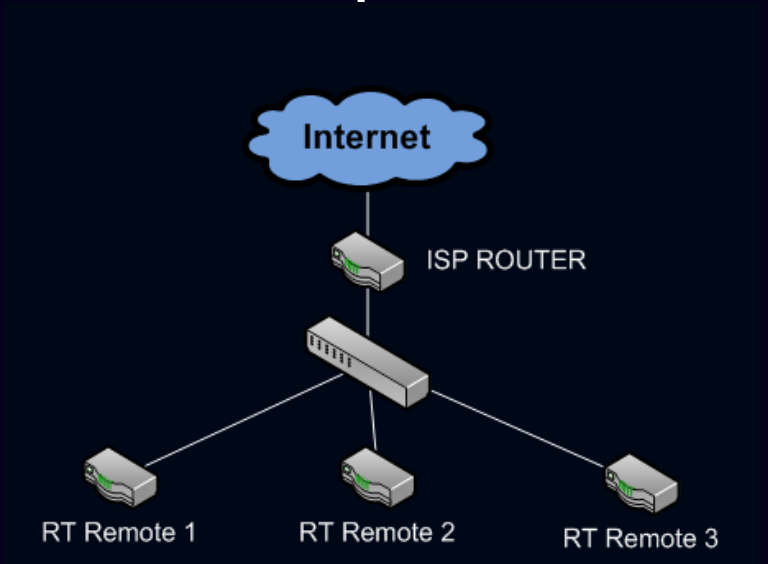
- “There is no cloud - it is always somebody's computer”
- “Cloud implementation” is the buzzword of the decade
- Cloud storage
- Cloud processing
- Cloud services
- Cloud network control (“SDN controller in the cloud”)
- Is there a use-case for “centralized routing control” ?
- Is there a use-case for a “cloud routing” ?
- Unfortunately “easier said then done”

2 Software router

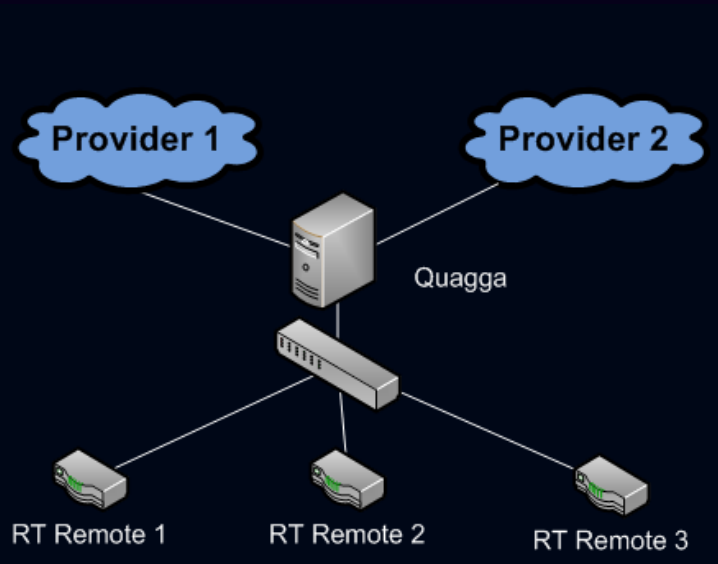
- Software router (SW-RTR) is not a new thing
- Several presentations on RIPE NCC SEE conferences
- Server with Linux + routing software
- Cheap “full global BGP table” routing
- Software: Quagga / Bird / OpenBGP / FRRouting
- Ability to process several full BGP tables
- Ability to process 3 Mpps ~ 20-30Gbps
- “Empty CPU” benefit
- Problems with limited bandwidth
- Problems with modifications needed to kernel
- Not a universal solution !

3 Evolution of ISP infrastructure

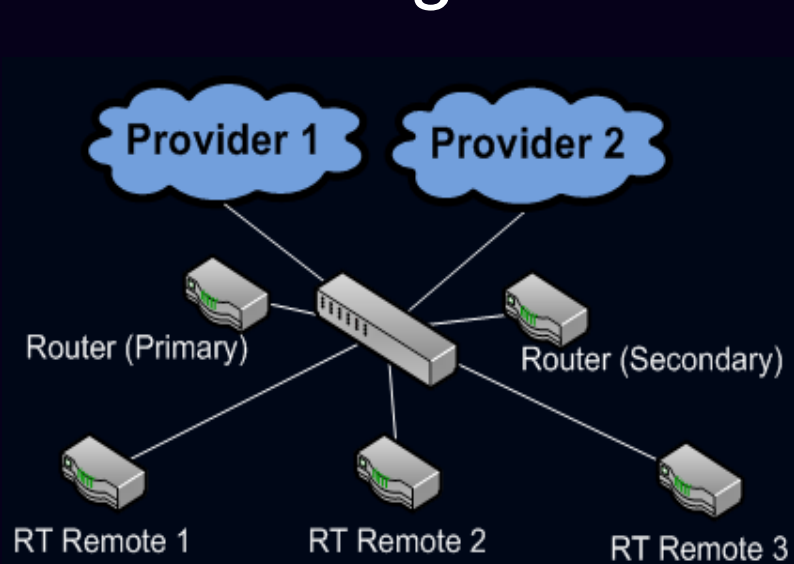
- Simple ISP



- Medium ISP

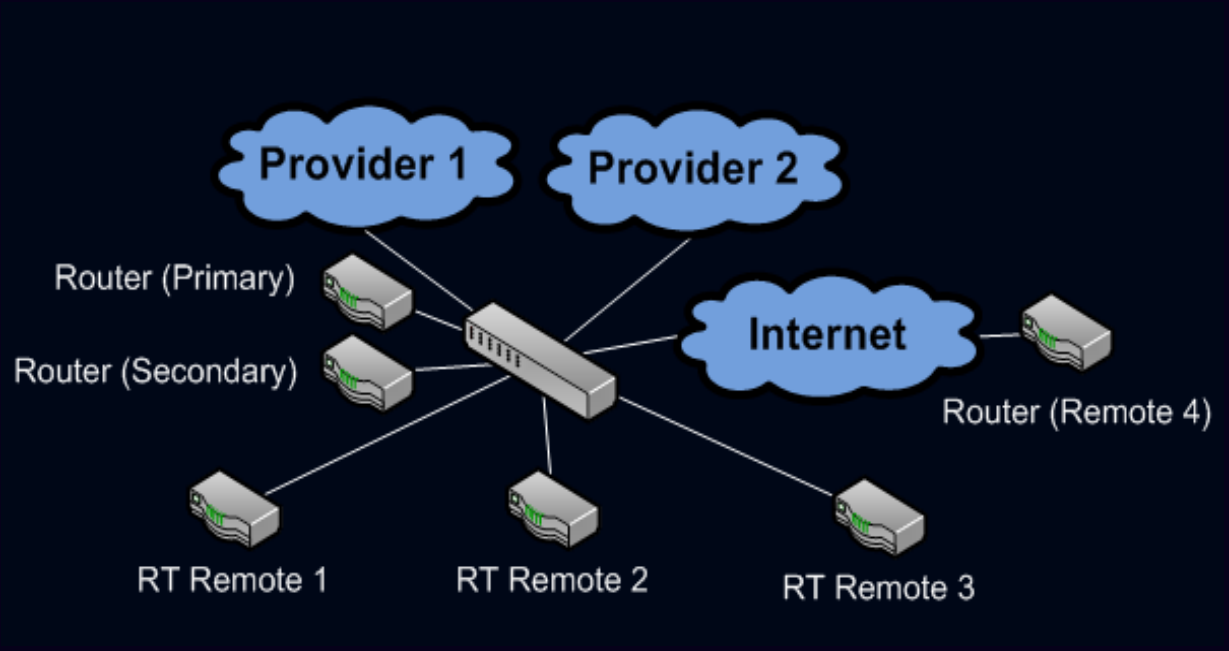


- Larger ISP

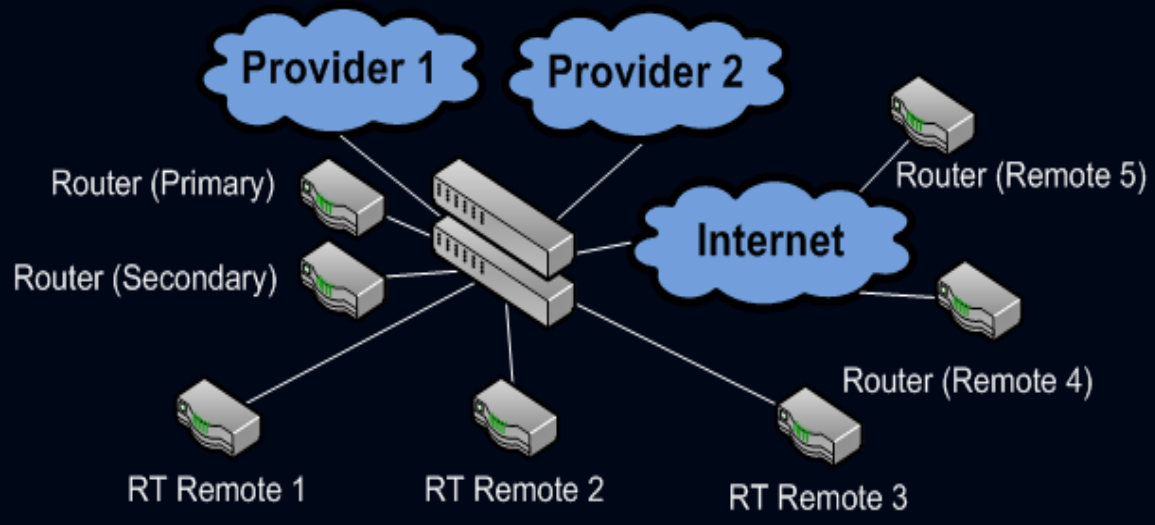


3 Evolution of ISP infrastructure

- Hybrid implementation

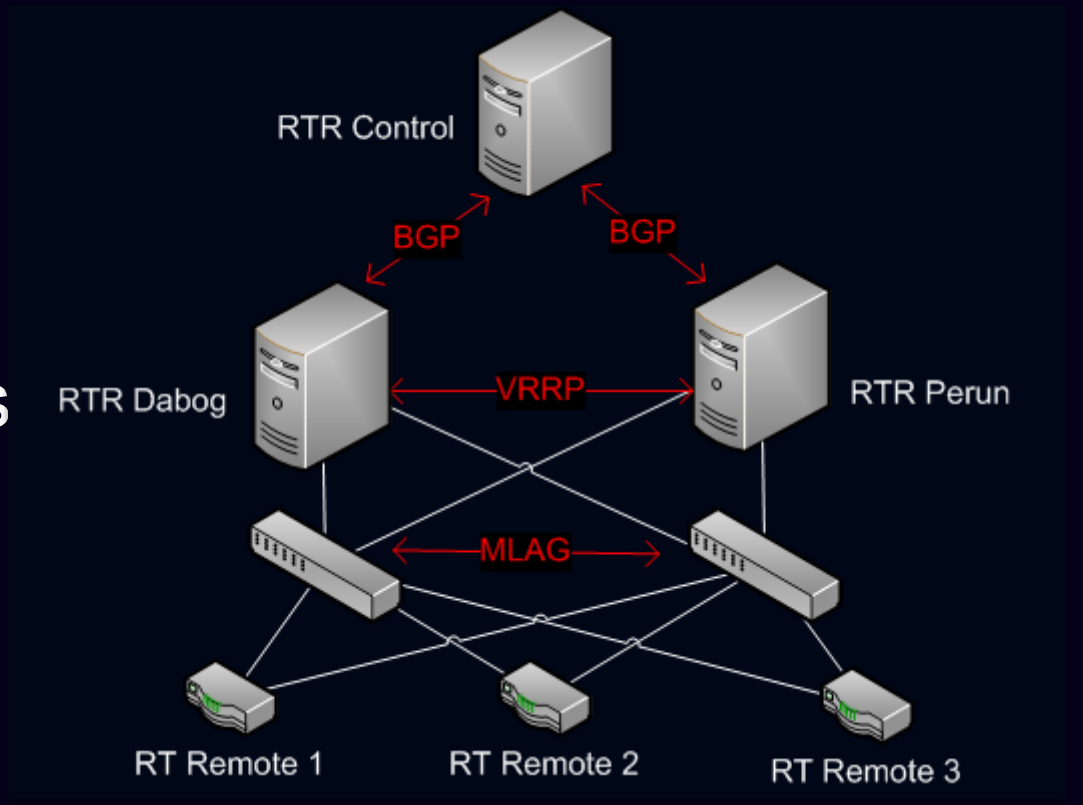


- “Nothing is more permanent …”



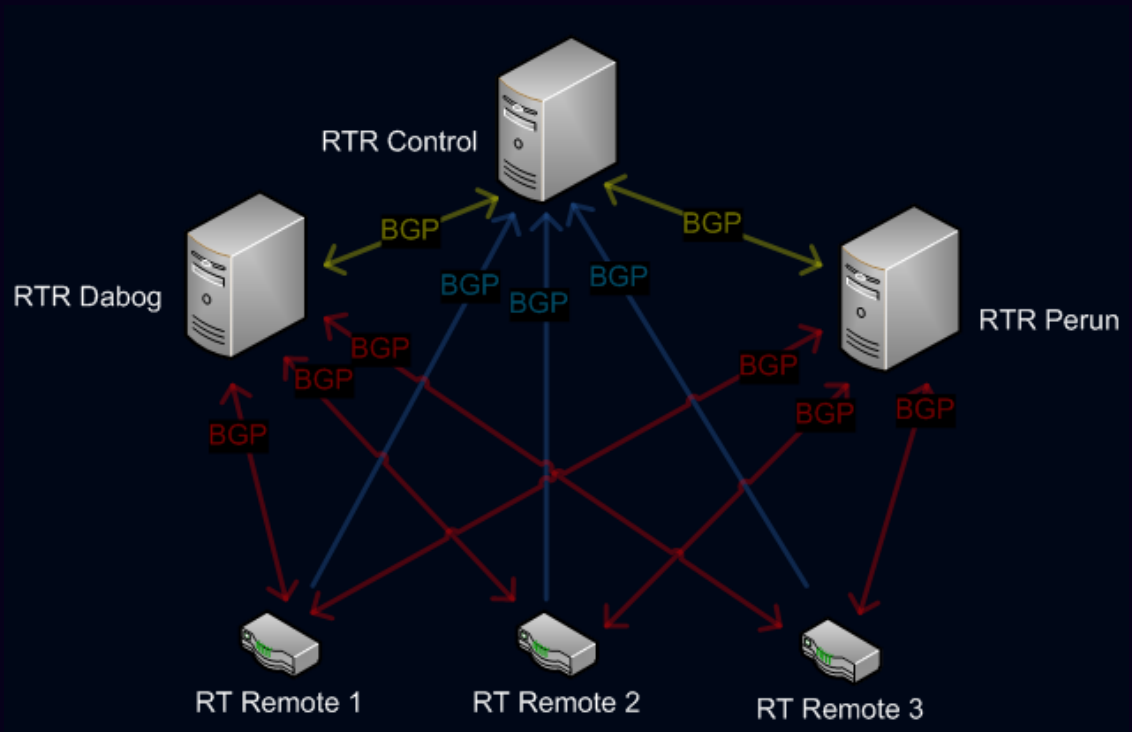
4 Routing cluster features

- Routers in the same VLAN
- VRRP for gateway address
- BGP to interface addresses
- Route reflector features
- Command server analysis
- Router connects to both switches
- MLAG between switches
- LACP on the sw-router side
- sw-routers with identical conf.



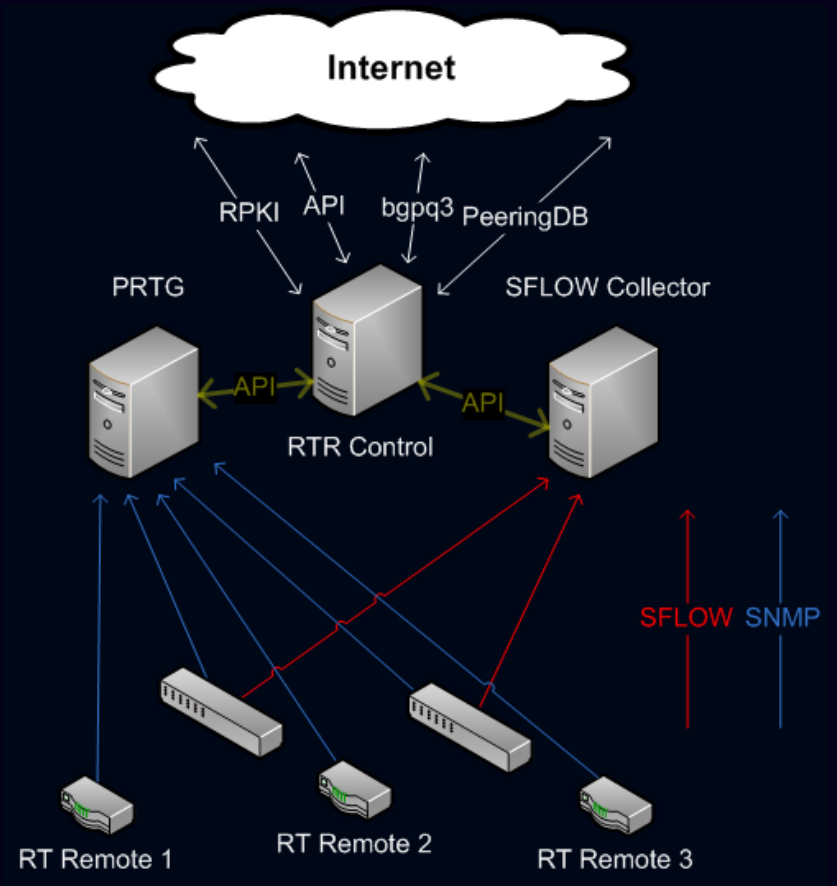
4 Routing cluster features

- 3 Types of BGP sessions
  - Informational
  - Routing
  - Command
- RTR Dabog: IPv6 Primary
- RTR Dabog: IPv4 Secondary
- RTR Perun: IPv4 Primary
- RTR Perun: IPv6 Secondary
- Route reflector functionality
- RTR Routers announce prefixes of AS (“source” announcement)



5 Routing cluster monitoring

- Done on “RTR Control” server / SW-RTR
- Communicates with “data sources”
  - RIPE DB
  - PeeringDB
  - GeoLoc
  - RPKI
  - SNMP / xFLOW collectors
- Ability to verify prefixes
- Ability to monitor traffic
- Ability to analyze BGP changes
- Ability to generate configurations



6 Routing cluster command server

- Prefix analyses and filtering
- Delivering up-to-date filters to SW-RTR constantly
- Ability to re-route traffic on the SW-RTR of the cluster
- Ability to re-route traffic on remote routers (physical ones)
- Ability analyze network traffic (SFLOW / SNMP)
- Ability to generate configurations of SW-RTR
- Ability to change / push configurations to equipment
- Ability to route / reroute traffic to itself (next-hop change)
- Analyses of re-routed traffic (tcpdump)

7 Routing cluster benefits

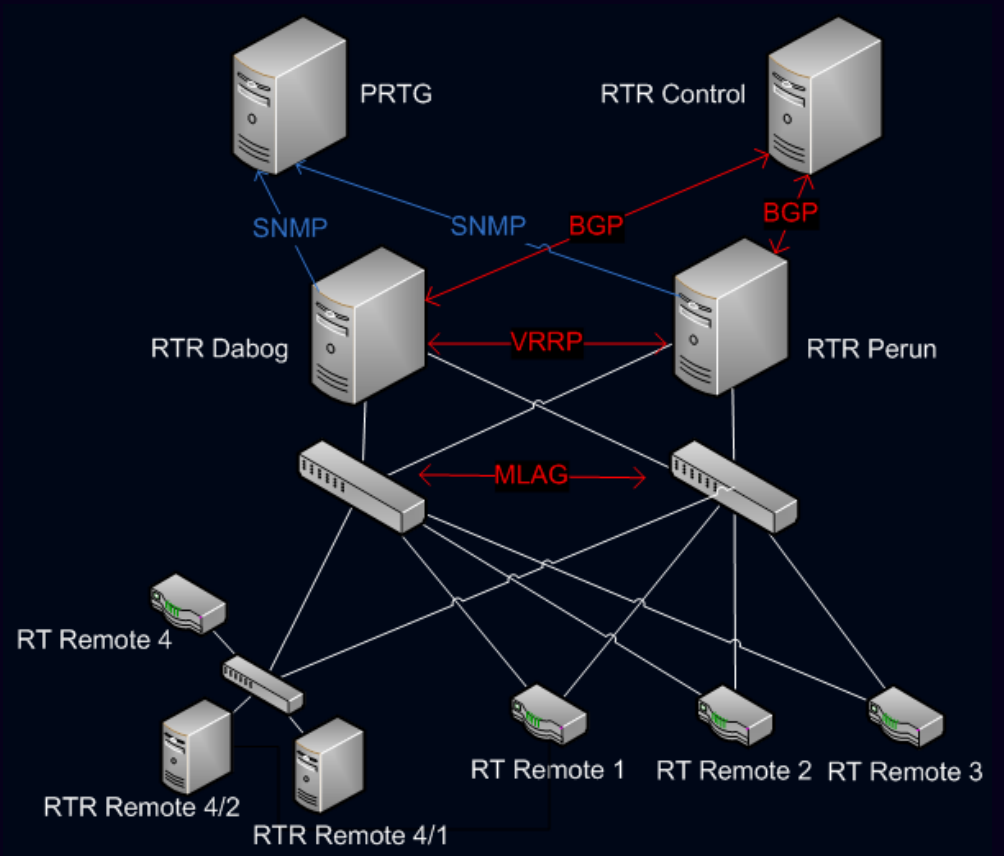
- Ability to control whole cluster from single location
- Load balancing between SW-RTR
- Changes can be done by non-technical staff (changes are done in Excel tables)
- GUI interface (*in the future*)
- Python scripts that control / generate new configurations
- Automatic update of all router-maps, prefix filters, firewall settings on all relevant equipment
- IPv4 / IPv6 synchronization
- High reliability of the cluster configuration
- SW-RTR are Linux servers - new features can be added

8 Routing cluster drawbacks

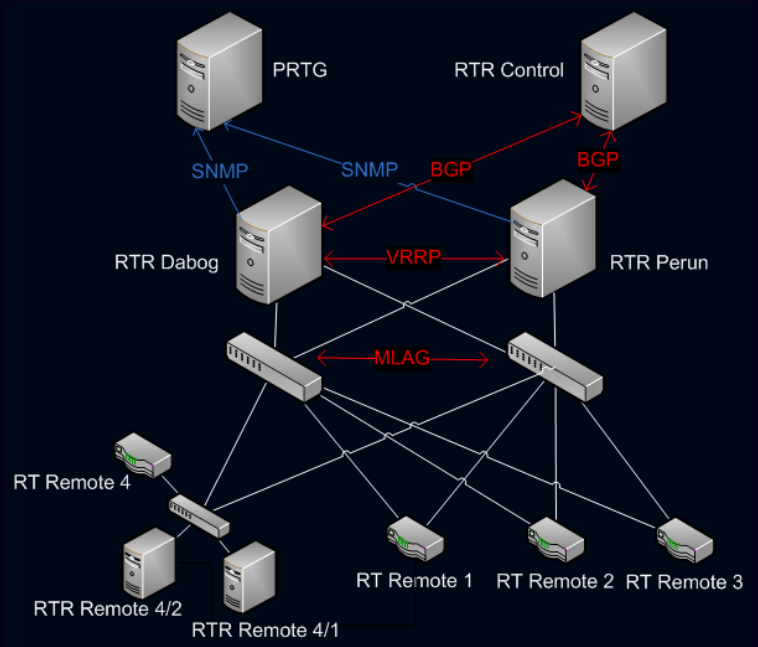
- Inability to route more than a 3 Mpps / 30 Gbps
- Setup is challenging even for experienced technical staff (bird implementation especially)
- “Mistake propagation” is instant (need for input correction)
- Software routers are controlled differently than regular routers
- Management can place an overwhelming burden on system

9 Implemented solution

- Semi-automatic solution
- Automatic filter generation
- Automatic filter distribution
- Automatic conf. generation
- Semi-automatic conf. distribution
- PRTG data collection
- PRTG event triggering
- System configuration in Excel
- Command line interface
- Automatic blackhole propagation
- Anti-DDoS prefix announcement control



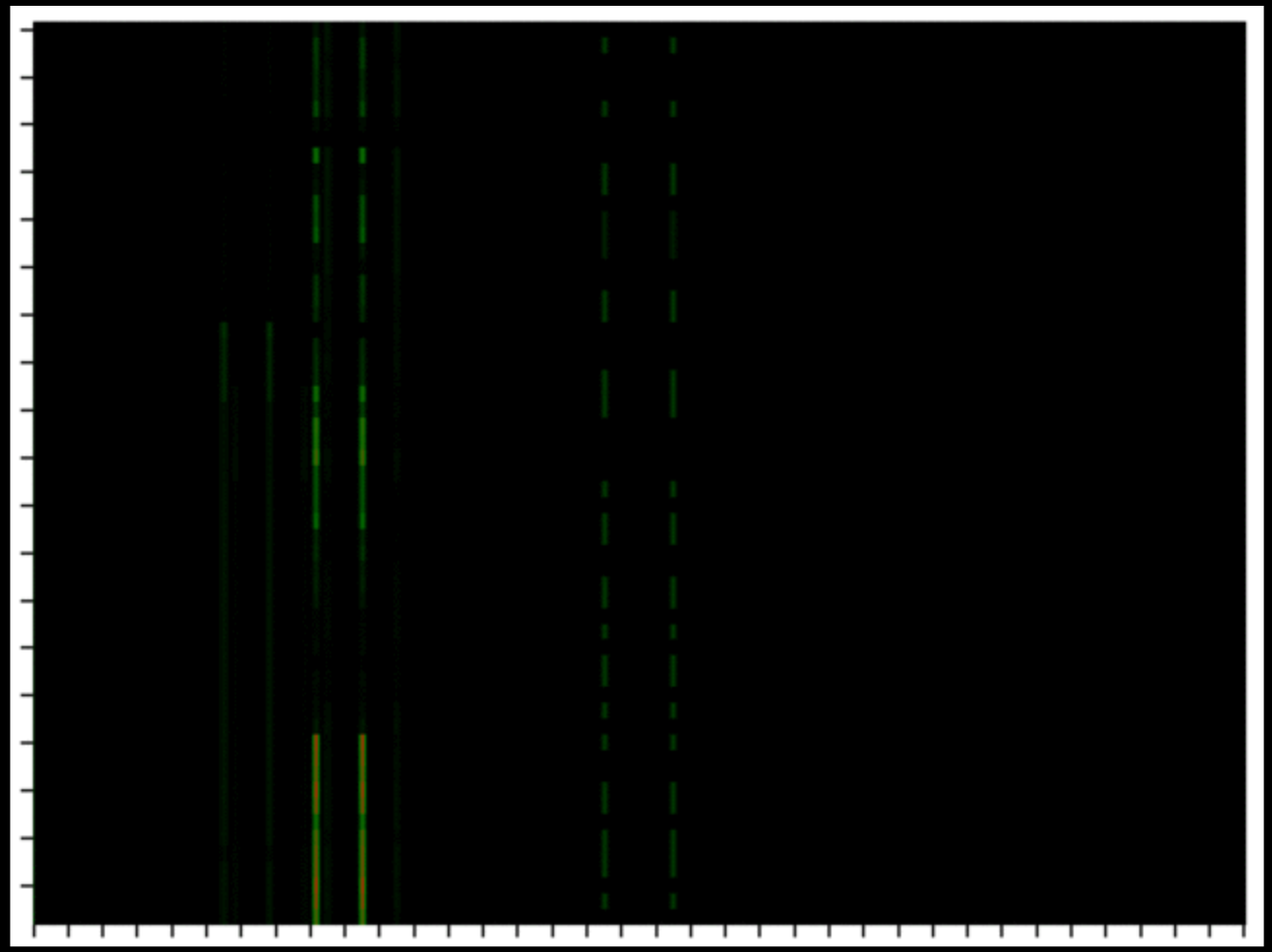
9 Implemented solution



- Firewall sub-system is problematic
- Firewall generates CPU load
- Need to generate SFLOW on switches
- Load-balance problem with MLAG
- Semi-automatic conf. distribution
- Slow response time (more autonomation needed)
- System only generates config for SW-RTR
- Need for a better control of non-SW-RTR equipment
- Need for development of GUI Interface for control and monitoring of the system.
- Need for a migration to Bird 2.x (currently Bird 1.6.4)

10 Conclusion

- Control / analyses mechanism works without problems.
- Ability to generate route/prefix reports and analyses
- Excellent response control in Anti-DDoS measures
- Ability to redirect and analyze traffic on the control server
- Lack of bandwidth of the SW-RTR
- Problem with firewall features / traffic filtering
- Problem with implementing MANRS directives
- While the results are promising – much work is needed.



Thank you.