100G TRILL Backbone

Marian Ďurkovič
Network Architect
About SANET

- National research & education network in Slovakia
- Established as non-profit association in 1991
- Connecting universities, schools, research institutes, etc. to pan-European GÉANT network and global Internet
- Based on dark-fibre infrastructure since 2002
- 37 POPs in Slovakia
- Cross-border fibres to neighbour NRENs
  - ACONET, CESNET, PIONIER
100G Backbone Objectives

- Researchers need 10 Gb/s for several applications
- Overprovisioned backbone is clearly the best solution
- Start with 2 x 100 Gb/s today
- Provide clear path towards terabit speeds in the future
- Use state-of-the-art technology
- Create robust and resilient network
- **Keep It Simple & Straightforward!**
Backbone Technology

• Based on cloud-scale equipment
• Specialized hardware with optimized functionality
  – Ethernet everywhere
  – No legacy interfaces or protocols
• Building blocks:
  – PtP DWDM system supporting 500 Gb/s superchannels
  – TRILL switches (3.2 Tb/s forwarding capacity)
• Compact size, green IT solution
Network POP Design

Westbound Cloud Xpress

1. Wave mux separates individual super-channels
2. 500G super-channel enters Cloud Xpress
3. Cloud Xpress extracts a specific 100GbE stream
4. 100GbE enters TRILL Switch
5. TRILL switch will forward packet data to client port(s)
CloudXpress Advantage

• Extremely easy to setup & bring live
  – Much less optical patching needed
  – Link up in just a few minutes

• QSFP28 tributary ports
  – DAC cables could be used for 100GE connections

• Management via CLI, SSH, SNMP and NETCONF
  – The same UIs that routers & switches use
  – Easy integration into fully automated environment

• Instant bandwidth
  – HW ready for future demands
Protocol Innovation

- Ethernet networks typically use Spanning-tree protocol
  - Forms a simple tree by blocking all redundant links
  - Protocol failure leads to network meltdown
  - Legacy approach, hardly usable in backbone today
Protocol Innovation (2)

• We decided to use TRILL instead:
  – Brings well-known IP routing principles to ethernet
  – Natively uses all available links (including parallel paths)
  – Dynamic routing via shortest path by IS-IS protocol
  – Much less complexity and lower costs than MPLS
  – External devices just see a huge ethernet switch
Our Terabit POP

- This is 22RU high rack
  - 6RU for network equipment
  - 6RU for UPS + batteries
  - 10RU still free

- Power consumption ~1 kW
Network Performance

- Test performed on virtual path spanning Slovakia 4-times via:
  - 36 TRILL switches
  - 28 PtP DWDM spans
  - during full production
Overall Experience

• Clear separation of tasks between devices
  – No task duplicated at multiple OSI layers
• Much simpler configuration at all levels
  – Large portion of former router config was deleted
• Easy to understand for people operating the network
• Fast reconvergence in case of e.g. fibre cut
• Network in production & stable for ~1.5 years
Future Plans

• Extend coverage of 100G backbone to more POPs
  – Deliver 100G services to additional users
  – Improve network resilience
• Activate more 100 Gb/s channels as needed
  – Done by SW licenses (not necessary to install new HW)
• Replace legacy routers by cloud-scale devices
  – 48 x 10GE + 6 x 100GE in 1U pizza box
Conclusions

• Innovation driven by the cloud sector brings disruptive change to traditional network design
• Cost of 100GE coming down to levels acceptable for massive deployment
• Very good environment for new ideas & concepts
• Remember the KISS principle