Interoperability Testing of Broadband Network Technologies

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Overview

- The Meaning of Interoperability
- Interoperability Testing Experience
  - MPLS
  - GMPLS
  - IPv6

Interoperability Failures

- Pushes out market acceptance of new technologies
- Increases support cost
- Opens windows of opportunity for alternative solutions
- Does not enhance the reputation of a product

The meaning of Interoperability

- Plug and play operation independent of who provided the product
- Works in the users environment
- Works with the users applications

UNH InterOperability Lab (IOL)

- Operates as a non-profit lab as part of the University of New Hampshire – provide test services at cost
- 100% funded by the commercial communications industry and thus market driven
- Tests 17 different technologies
- Coordinates multiple interoperability efforts for industry
- Develops customized hardware and software test solutions
- Provides R&D testing and consulting services to reduce time to market

Select Technological Applications

- IPv6
- Ethernet Interface
  - 10Base-T
  - Fast Ethernet
  - Gigabit Ethernet
  - 10Gigabit Ethernet
  - Power over Ethernet
- ADSL and SHDSL
- Ethernet Bridging
  - Spanning Tree and VLANs
- Voice over X
- MPLS Services
- GMPLS/OIF UNI and NNI
- IPv4 Routing
  - OSPF, BGP and IS-IS
  - RIP and VRRP
  - Multicast Routing
- Storage Area Networks
  - Fibre Channel and iSCSI
  - Serial Attached SCSI
  - Serial Attached ATA
- 802.11 Wireless
- DOCSIS/Cable Modems
- FDDI and Token Ring

MPLS Testing Experiences

- MPLS Specifications are not very clear
- This required significant interoperability testing from the beginning of the signaling protocols (LDP and RSVP-TE)
- Many implementations had to fix bugs
- Order was constructed: MPLS Forum 2002 SUPERDemo
  - largest MPLS test event to date
  - careful testing revealed detailed issues
  - operational network built with 19 implementations

Additional MPLS Testing

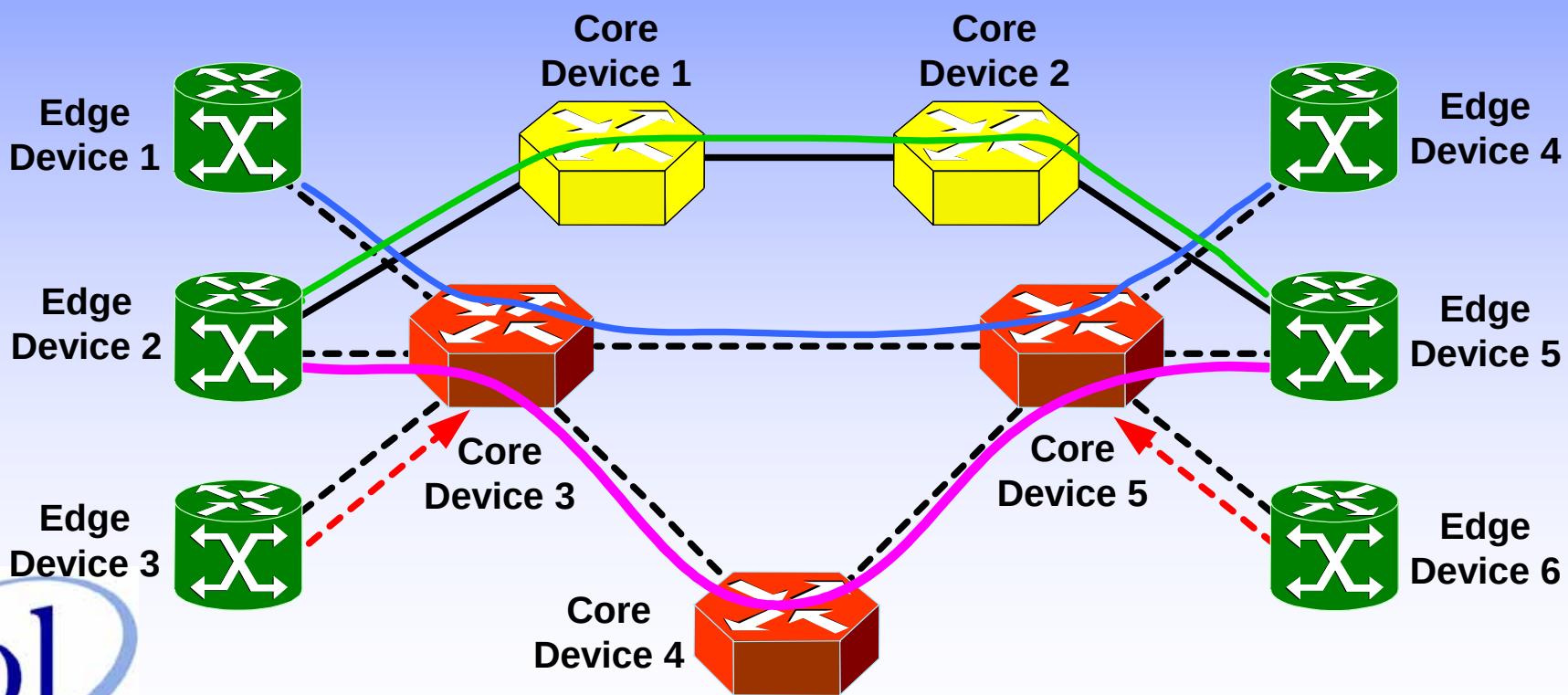
- MPLS World Congress in Paris (EANTC)
  - 2003 and 2004
- SUPERDemo 2003
- UNH-IOL MPLS Services Testing Consortium
- Additional testing of features including: Fast Reroute, Scalability, VPLS, 2547bis, Layer 2 encapsulation and simultaneous RSVP/LDP network architectures

GMPLS Testing

- Test events in October, 2002 and January, 2004
- Test items included:
  - LSP Generation/Termination with OSPF-TE
  - Control Channel and Control Plane Fault
  - Multi-path LSP setup and selection (FSC and LSC LSPs)
  - Resiliency testing

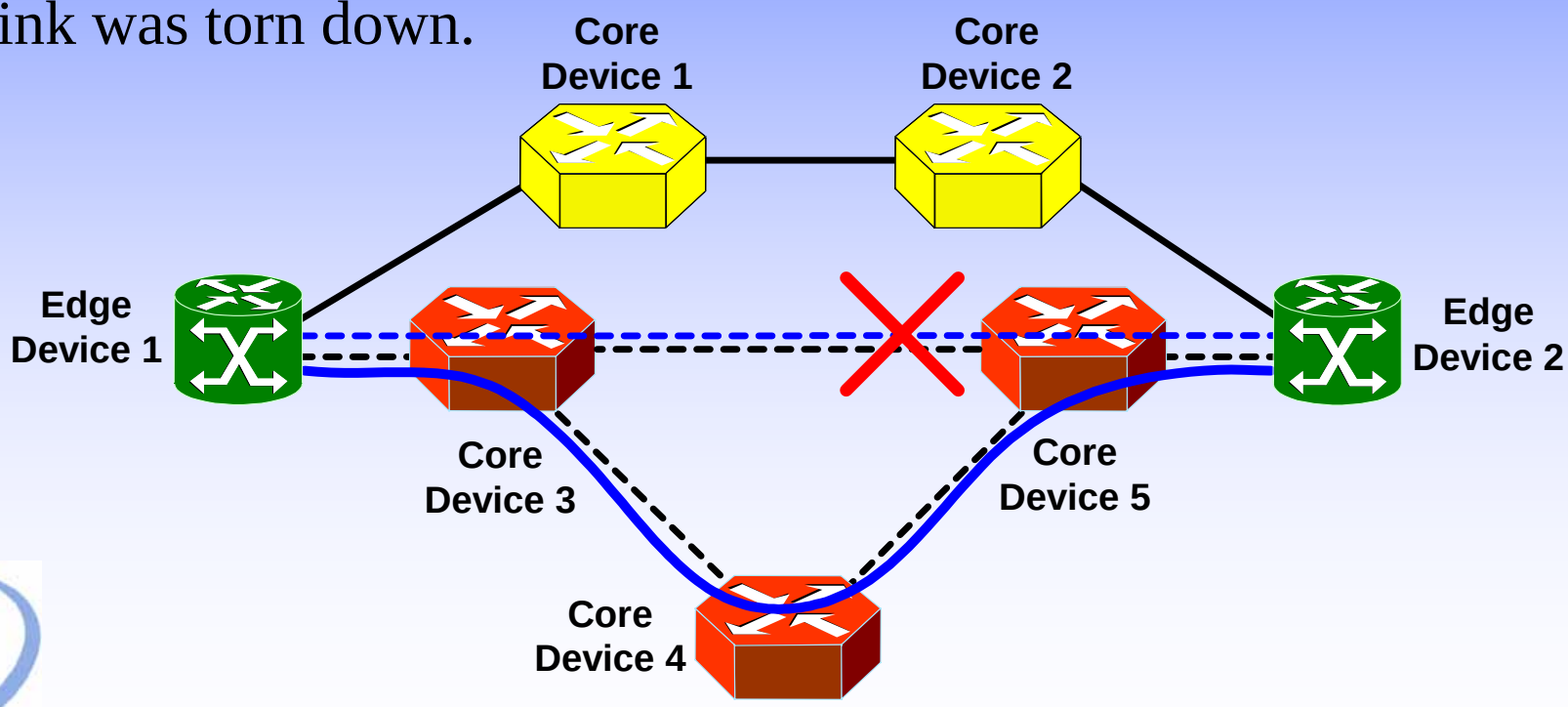
Multi-path LSP setup and selection (FSC and LSC LSPs)

- After a simple point-to-point topology was verified, a multi-path topology was built and path selection with OSPF-TE was tested



Control Channel Control Plane Fault and Restoration

- Proved that Data Channel remained provisioned when
  - Control Channel was disconnected
  - Control Plane was reset
- Proved that LSP could be re-established when primary TE link was torn down.



Additional Issues

- ERO sub-object types
- Control Channel tunneling
  - Numbered or Unnumbered; GRE, IP-in-IP or Point-to-point
- Control Plane link information advertising at edge nodes
- Hierarchical LSP implementation

IPv6 Testing

- Moonv6 Network Project
  - An international project to execute deployment testing of IPv6 technology
  - A cooperative effort between the North American IPv6 Task Force, UNH-IOL, the US Dept. of Defense and commercial service providers
  - Test items are determined by the US Dept. of Defense requirements and commercial service provider requirements
- IPv6 Ready Logo Program
  - Phase I testing already deployed with TAHI self-test or Moonv6 participation
  - Phase II test plan written as a collaborative effort between UNH-IOL and TAHI to create a unified IPv6 test plan

In Conclusion

- Doing basic interoperability testing can be easy, but working to build a true interoperable solution is a long-term detailed process
- True interoperability requires industry-wide commitment, and can result in a reduction of unknown issues in deployments
- Poor interoperability hurts a technology
  - Marketing focus obscures the technical reality