Bidirectional Forwarding Detection (BFD)

Introduction, Update and Applications

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Juniper™ NETWORKS

Overview

- Goals
- Protocol Overview
- Applications
- Adoption Status
- Conclusion

Detecting Forwarding Failures

- In IP, historically a function of the routing protocol
  - Because formerly, routing = forwarding
  - Fault resolution in perhaps tens of seconds
  - This is too slow for anything but best-effort IP
  - Sometimes there is no routing protocol!

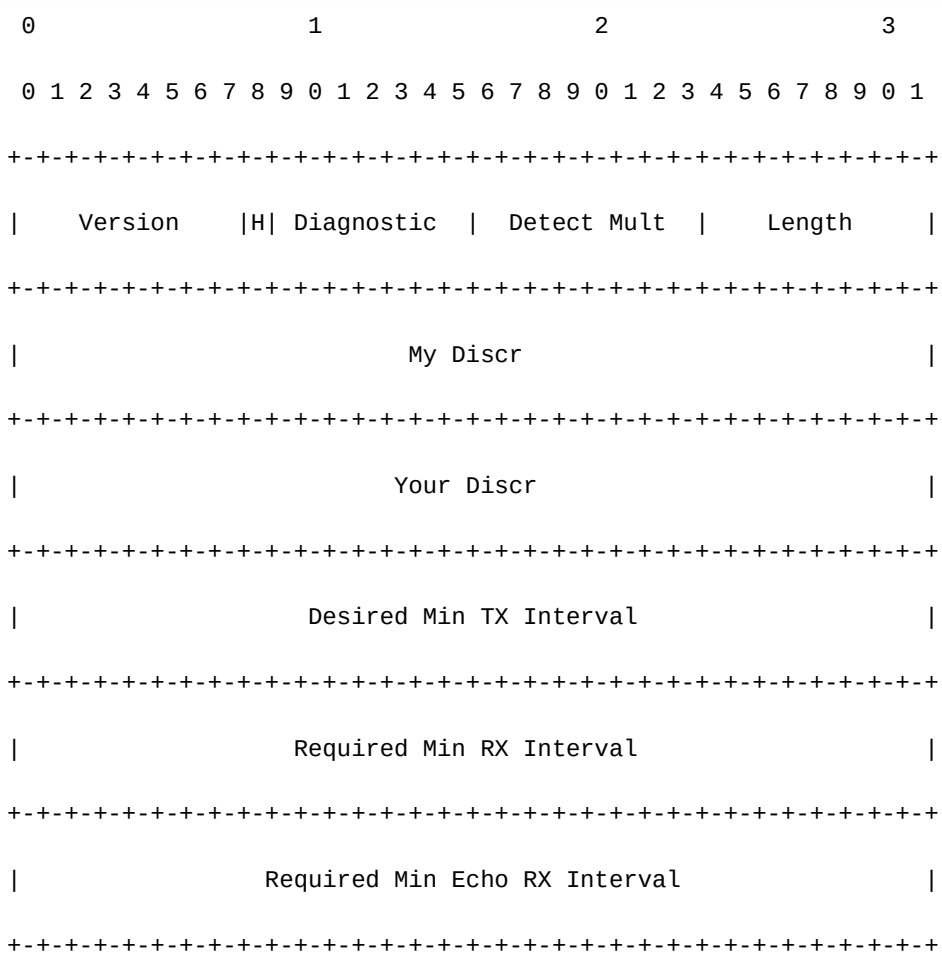
Goals of BFD

- Faster **convergence** of routing protocols, particularly on shared media (Ethernet)
- Semantic **separation** of forwarding plane connectivity and control plane connectivity
- **Detection** of forwarding plane-to-forwarding plane connectivity (including links, interfaces, tunnels etc.)
- A **single** mechanism that is independent of media, routing protocol, and data protocol
- Requiring **no changes** to existing protocols

BFD Protocol Overview

- At its heart, Yet Another Hello Protocol
- Packets sent at intervals; neighbor failure detected when packets stop arriving
- Intended to be implemented in the forwarding plane where possible
- Context defined by encapsulating protocol
- Always unicast, even on shared media

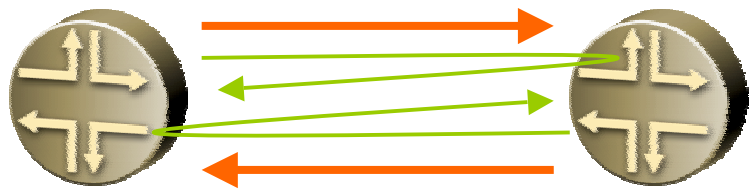
BFD Operation



Two BFD Modes

- Asynchronous Mode
  - Control packets flow in each direction

- Echo Mode
  - Slower control packets, echo packets loop through remote system



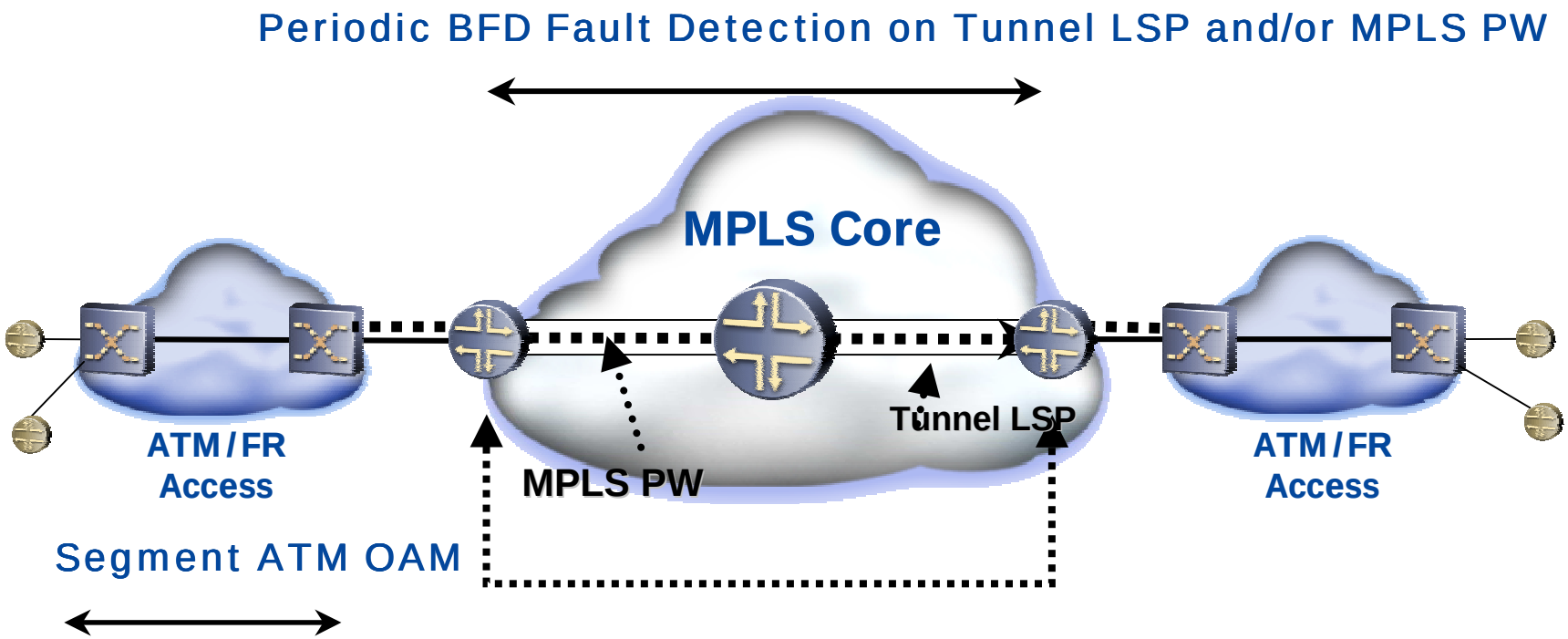
BFD Applications

- IGP liveliness detection
- Tunnel liveliness detection
  - MPLS LSPs
  - IP-in-IP/GRE tunnels
- Edge network availability
- Liveness of static routes
- Host reachability (e.g media gateways)
- Switched Ethernet integrity

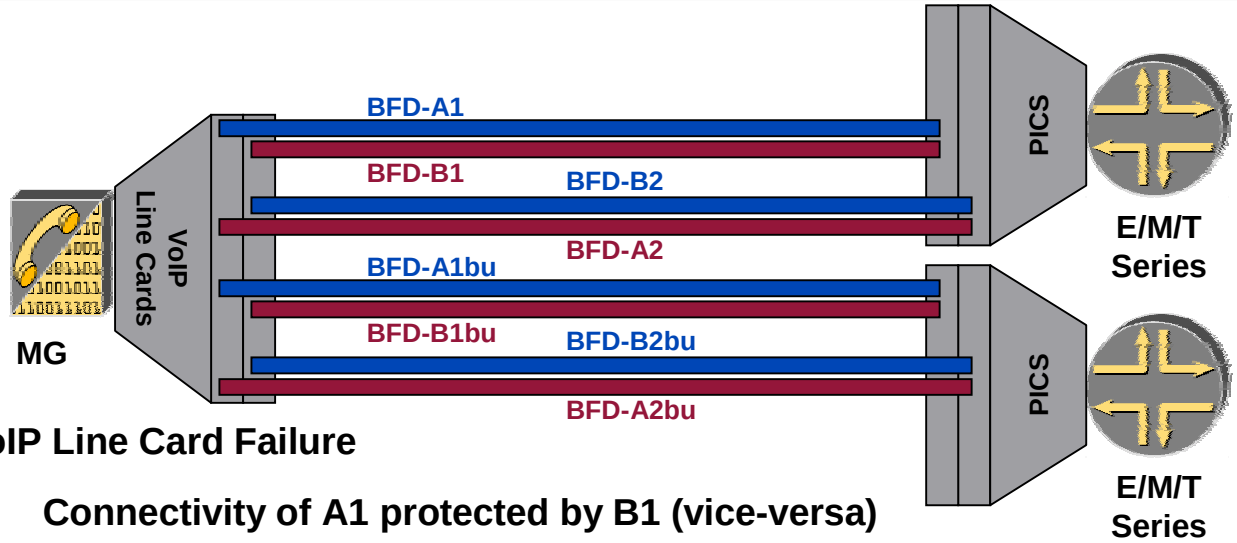
BFD for IGP Liveliness Detection

- One of the first motivations for BFD
- Faster convergence particularly on shared media
  - Sub-second IGP adjacency failure detection
- IGP hellos can be set to higher intervals
  - Can improve IGP adjacency scaling

BFD for MPLS LSPs
Layer 2 Transport over MPLS

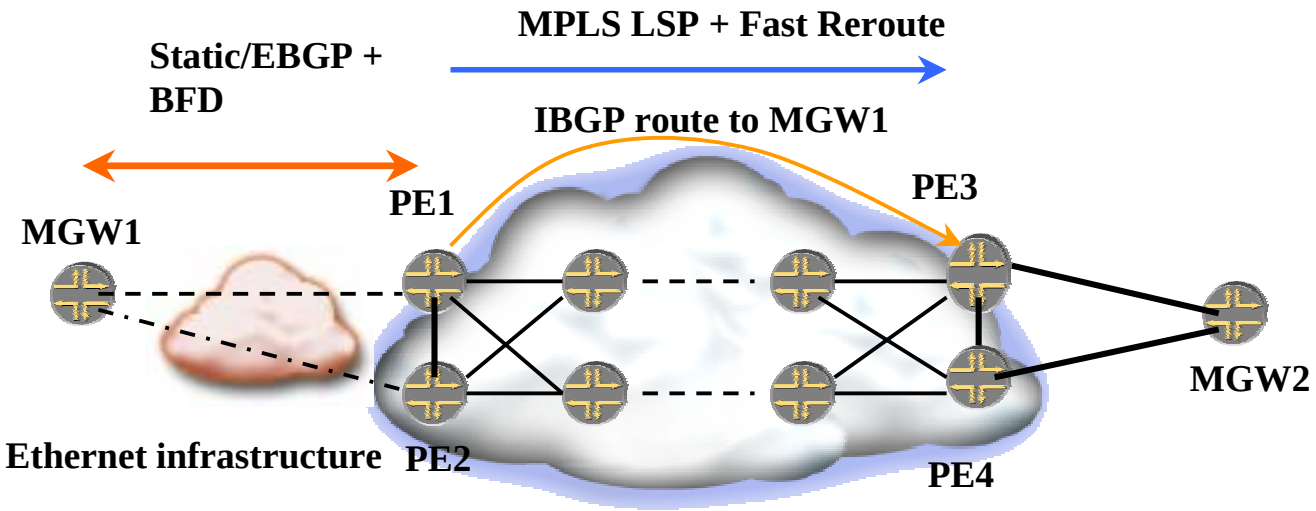


MG to Router Connection with BFD



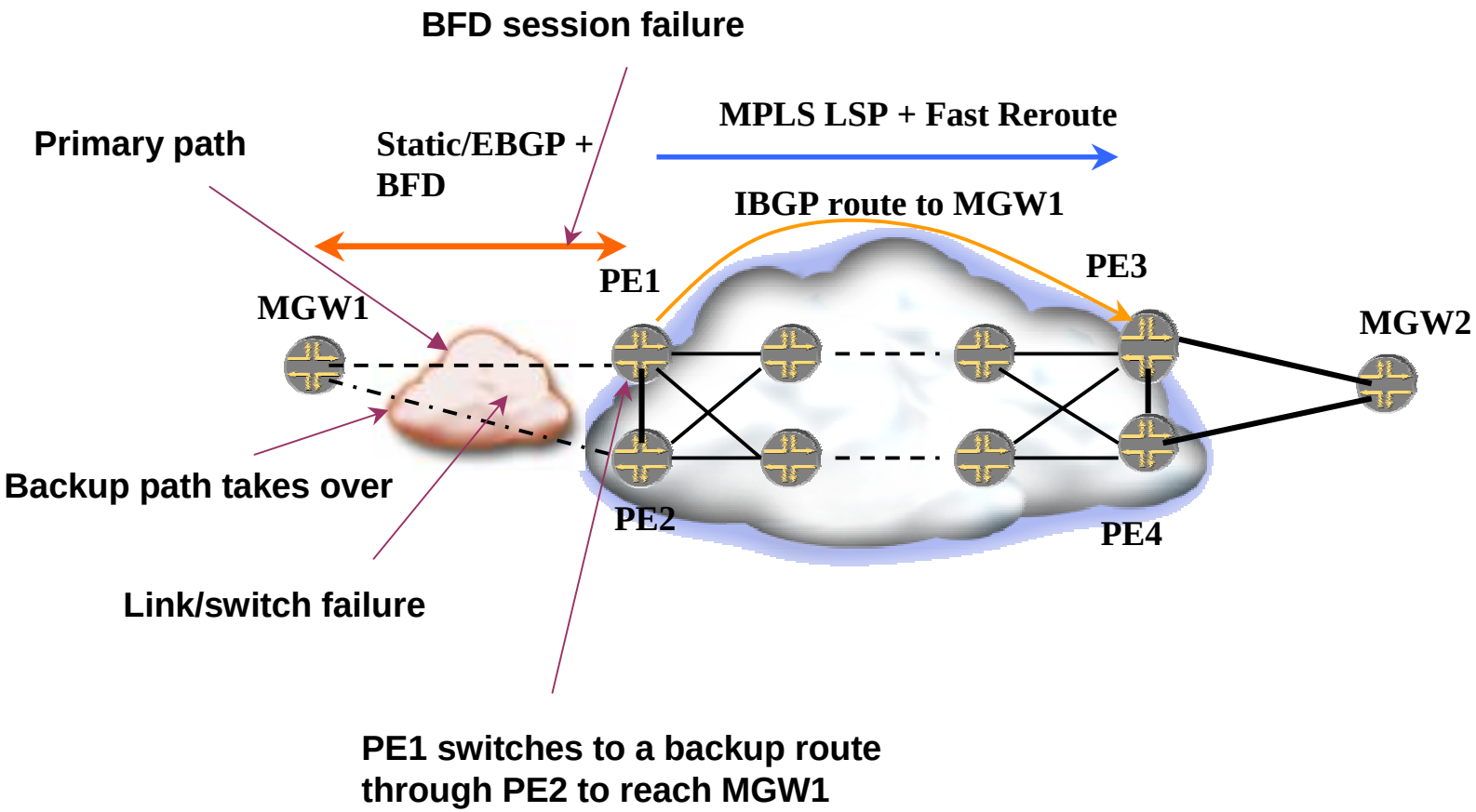
- **VoIP Line Card Failure**
  - **Connectivity of A1 protected by B1 (vice-versa)**
    - **Call preserved only under specific MG application control**
- **Router PIC Failure**
  - **Connectivity of A1 and B1 protected by A2 and B2 respectively (vice-versa)**
    - **Call preserved with packet-loss period (dependant on detection and re-route times)**
- **Router System Failure**
  - **Connectivity of A and B protected by Abu and Bbu respectively (vice-versa)**

BFD for Edge Availability
Voice over IP



- MGW Media Gateway
- BFD between MGW and PEs
- Enables fast detection/failover

BFD for Edge Availability
Voice over IP



BFD IETF Status

- Protocol jointly developed by Juniper and Cisco
- Base spec: draft-katz-ward-bfd-03.txt
- Over IP: draft-katz-ipv4-ipv6-01.txt
- Over MPLS: draft-raggarwa-mpls-bfd-00.txt
- Much enthusiasm and citation in other drafts
- A BFD WG has been formed

Conclusion

- BFD solves some problems that IP networks need to move beyond best-effort
- It’s simple and lightweight
- Increasing interest in the service provider and development communities
- Shipping in router code for over a year
- Many vendors committed to support

Thank You

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