

INF5050 - Protocols and routing in internet

Multiprotocol Label Switching (MPLS) /
Generalized Multiprotocol Label Switching (GMPLS)

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Outline

- ▶ Background
- ▶ MPLS Fundamentals and Terminology
- ▶ GMPLS
- ▶ GMPLS Recovery techniques
- ▶ Summary
- ▶ Resources

Background

- ▶ What is MPLS?
 - ▶ Mechanism that directs data from one network node to the next based on on path labels rather than network addresses.
 - ▶ with such mechanism, we avoid lookups in a routing table
 - ▶ MPLS switches packets (IP packets) instead of routing packets to transport the data
- ▶ Why MPLS?
 - ▶ Provide a highly scalable mechanism that was topology driven rather than flow driven
 - ▶ Load balance traffic to utilize network bandwidth efficiently
 - ▶ Allow core routers/networking devices to switch packets based on a simplified header
 - ▶ Remove the complexity and overhead of network managements (Assemble and reassemble IP packets)

MPLS was conceived, why?

- ▶ The shortest path routing protocols like IS-IS and OSPF
 - ▶ Did not take capacity characteristics into account while making the routing decisions
 - ▶ The outcome is, segmentation over the network which leads to congestion, while others remain under-utilized.
- ▶ MPLS reduces the complexity and redundancies by adding new network functionalities.

MPLS Fundamentals and Terminology

- ▶ Main idea:
 - ▶ attach a short fixed-length label to packets at the ingress to an MPLS domain
 - ▶ the labels are used to make the forwarding decisions.
- ▶

Control Plane and Forwarding Plane

Terminology

- ▶ FEC (Forwarding Equivalence Class)
 - ▶ Group of IP packets which are forwarded in the same manner (e.g. over the same path, with the same priority and the same label)
- ▶ Label
 - ▶ Short fixed length identifier which is used to identify a FEC
- ▶ Label Swapping
 - ▶ Looking up the oncoming label to determine the outgoing label, encapsulation and port
- ▶ Label switched path (LSP)
 - ▶ Path through one or more LSR for a particular FEC
- ▶ Label switching router (LSR)
 - ▶ an MPLS capable router

- ▶ What is GMPLS?
 - ▶ a protocol suite extending MPLS to manage further classes of interfaces and switching technologies other than packet interfaces and switching, such as time division multiplex, layer-2 switch, wavelength switch and fiber-switch.

GMPLS

- ▶ GMPLS is an extended form of MPLS and some of these improvements are:
 - ▶ RSVP-TE
 - ▶ OSPF and IS-IS
 - ▶ New link-management protocol
 - ▶ Bi-directional LSP setup
 - ▶ Reduce latency
 - ▶ Less control overhead
 - ▶ Route selection is simpler
 - ▶ Cleaner interface
- ▶ MPLS emphasizes the separation of control plane and network plane
- ▶ GMPLS extends this separation and allows the control plane to be physically diverse from the associated data plane

GMPLS: Hierarchical LSP



Summary

- ▶ MPLS
- ▶ GMPLS

Resources

- ▶ Generalized Multiprotocol Label Switching: An Overview of Signaling Enhancements and Recovery Techniques
IEEE Communication Magazine, July 2001. A. Banerjee et. al.
- ▶ Internet Traffic Engineering Using Multi-Protocol Label Switching (MPLS). Computer Networks 40, Elsevier, 2002 D.O. Awduche and B. Jabbari.