CYPRESS

RPR

Topology Discovery, Fault Recovery and Restoration in RPR

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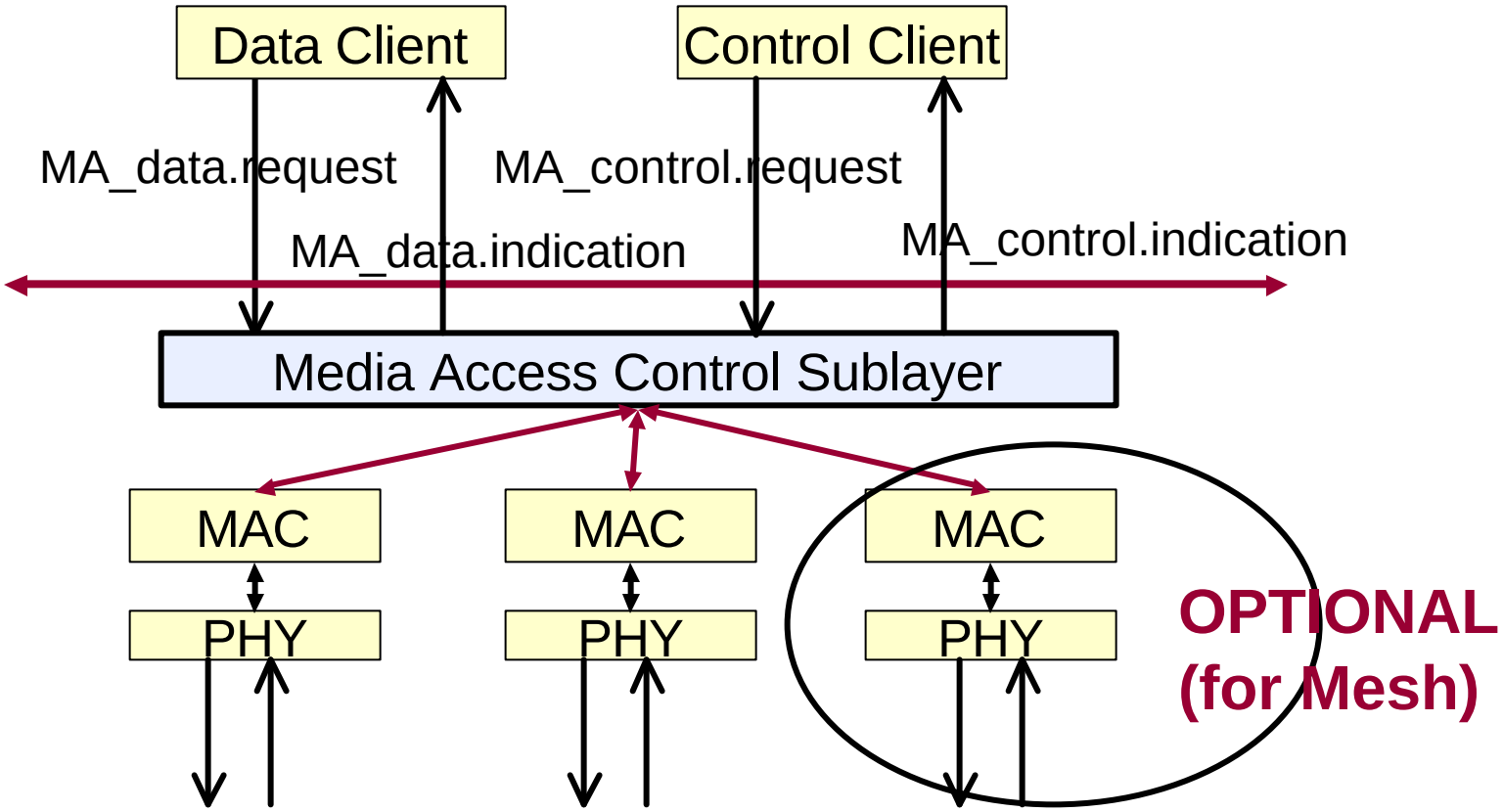
Topology Discovery

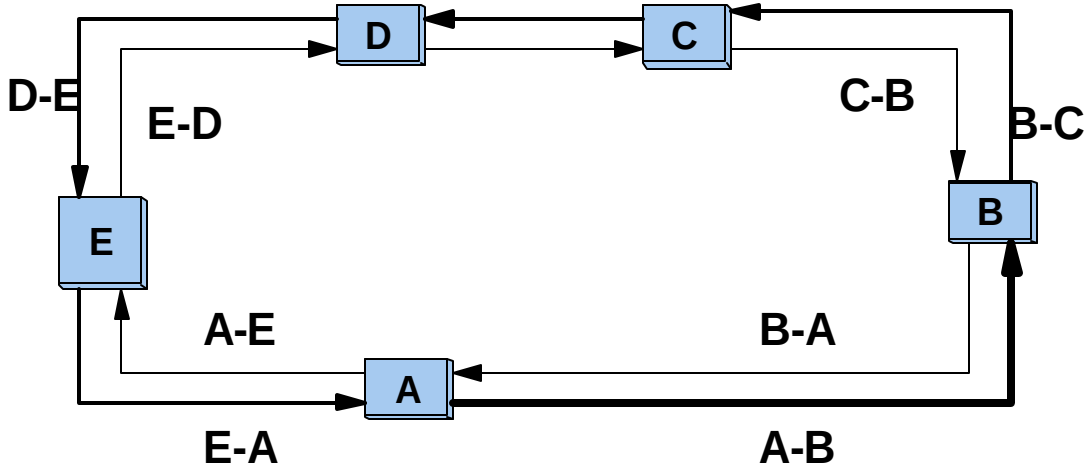
- Topology discovery supports ring, multiple rings, and ring/mesh networks
- L2 Topology discovery in RPR results in an efficient connectivity map for nodes
- Cost of a link is determined by - hop count, link rate, and any user-administered cost for the link
- Once discovery is over, each node knows where to forward a packet, based on the destination MAC address.

RPR MAC Model



- **A unified MAC interface to MAC clients.**
- **Network Topology Transparent to MAC clients**

L2 Discovery



- Each node sends out a topology discovery packet on a link
- The packet contains following parameters (among others):
  - Source (node) MAC address
  - Hop (= 0), Cost
  - TTL
- The receiving node records MAC, hop, cost (+ any admin costs), and port # where the packet came from
- It sends the packet on every outgoing port (except the source) with hop+1, cost, original MAC address.

Topology Discovery (contd.)

- **Topology discovery packets can be sent**
  - Periodically
  - On demand - by a newly inserted node
  - When a node/link failure occurs
- **At the end of topology discovery, a forwarding entry at a node contains:**
  - Destination MAC address
  - Output port #, cost, hop count - for primary link
  - Similar information for backup link
- **Topology for ring is simple - a subset of General Topology**

Topology Discovery (contd.)

- Topology discovery packets go around until sinked by source node, or TTL expired
- If a node receives a topology discovery packet more than once (for mesh), it may replace its previous link/cost with a better one.
- Reachability link(s) other than primary link are recorded as backup link
- Must allow flexibility in L2 Topology discovery protocol implementation for future improvements

Fault Recovery

- L2 Topology Discovery also establishes fault backup paths for primary links
- For a ring network, a backup path usually is the other ring
- For mesh networks, backup path could be links along ring/mesh
- Each Link has its Fault Recovery Link established

Fault Restoration

- Node detecting fault sends packets on backup link (Wrapping)
- The node marks packet with Fault Identification (FI) in packet MAC header
- If source node sees the packet with FI set , it doesn't sink it.
- Further packets from source node re-routed (Steering) according to topology
- Upon fault clearing new topology messages are sent by the node near fault.

Summary

- Topology discovery for RPR ring networks should support mesh networks
- Fault recovery using Wrapping at fault, followed by source re-routing - results in quick recovery
- Fault restoration using source re-routing
- Fault restoration should allow alternative routes (in case of mesh networks)