

RPR Topology Discovery Proposal

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Goals

- Scalable from 1 to 100's of stations
- Determine/validate connectivity and ordering of stations on the ring
- Ensure all stations on the ring have a uniform and current image of the topology
- Immediate reaction to changes
- Tolerant of message loss
- Operate without any master station on the ring
- Operate independently of and in the absence of any management systems

Goals, continued

- Usable with all supported topologies: ring, linear (broken ring), and “star” (single station)
- Support dynamic addition and removal of stations to/from the ring
- Detect mis-cabling between stations
- Provide means of sharing additional information between stations
- Cause minimal overhead
- Provides dynamic information needed to initiate protection

Non Goals

- RPR Topology Discovery is not tightly integrated with the protection algorithm
 - The RPR Topology image is used by the steering algorithm
 - Protection can be triggered by changes reported by the topology protocol
- RPR Topology Discovery is not integrated with the congestion avoidance algorithm
 - The RPR Topology image is used by the congestion avoidance algorithm
 - Dynamic changes in congestion avoidance are triggered by other mechanism(s)

Features

- Discovery occurs only as needed
- Distributed algorithm
 - No master station is used
- All available fiber links can be discovered
- Topology validation eliminates need for acknowledgements and periodic broadcasts
- Works in linear topology without needing wrap-arounds

Control Messages

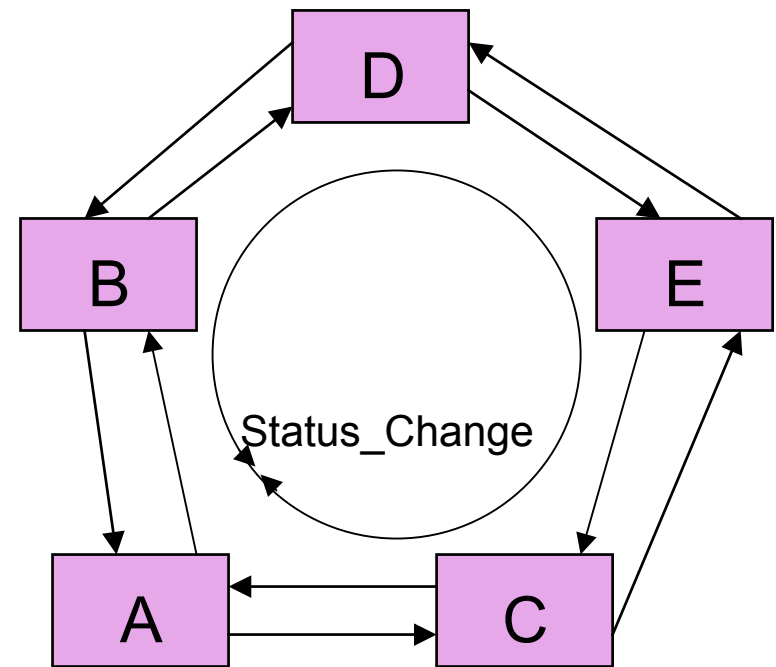
- Control messages indicated by value in RPR header
- Control messages contain priority and/or type indicators
- Control messages contain version indicator

Topology Discovery Triggers

- Neighbor change at any station
 - Addition or deletion of neighbor
 - Change in link status
- Detection of validation failure at any station
 - Station lacking topology image
 - Station with outdated or corrupted topology image

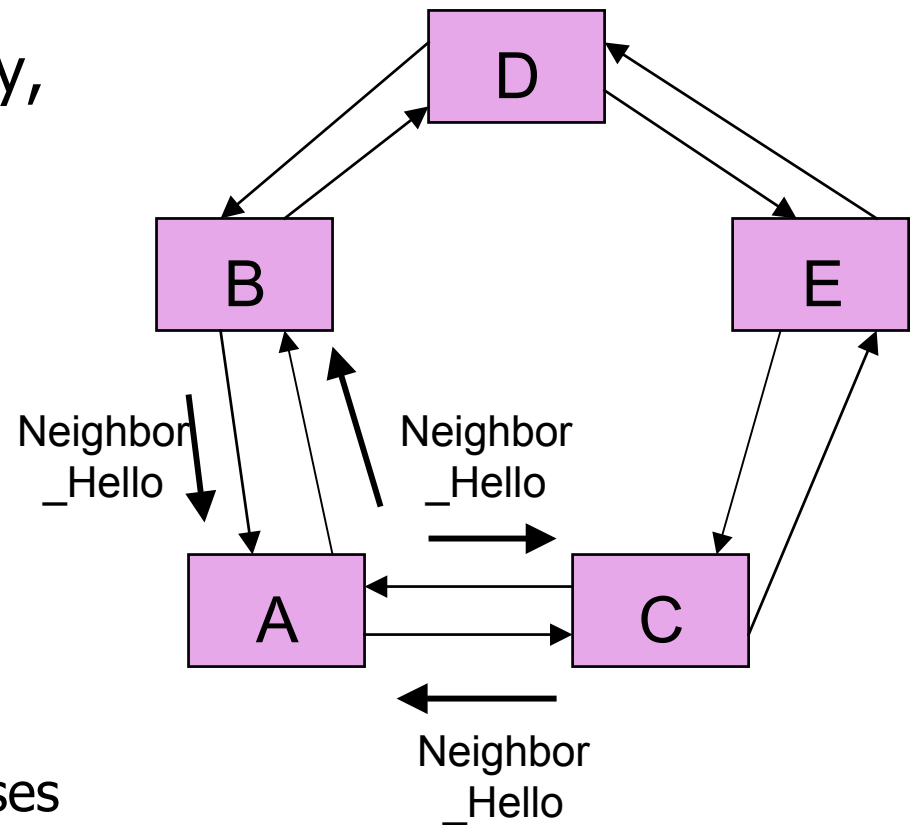
Status_Change Control Message

- Reports changes in neighbor identity or link status
- Contains
 - Source MAC address
 - Source station image version
 - Neighbor MAC addresses
 - Neighbor link statuses
 - Ring ID
- Broadcast with TTL = Max_Ring_Size
 - Removed by source
 - Sent to All_Stations broadcast MAC address



Neighbor_Hello Control Message

- Reports presence, identity, and topology version of neighbor station
- Contains
 - Source MAC address
 - Ring image version
 - Ring ID
- Unicast with TTL = 1
 - Removed by neighbor
 - Sent to Station_Left and Station_Right MAC addresses



Configurable Parameters

- Neighbor_Hello message period
- Topology_Stabilization time
- Number of failed topology discovery attempts before event generated for management system

Image Versions

- Station_Image_Version
 - Starts at 0 (indicating no valid image)
 - Incremented upon each change in local status
 - Independent value for each station
- Ring_Image_Version
 - Checksum of all Station_Image_Versions for all known stations (including self)
 - Common value for each station

Topology Discovery Process

1. If neighbor identity or link status changes
 1. Increment local Station_Image_Version
 2. Broadcast Status_Change message
 3. Replace station information in topology image
 4. Update local Ring_Image_Version
2. Else if higher Station_Image_Version received in Status_Change message
 1. Replace remote station information in topology image
 2. Update remote Station_Image_Version
 3. Update local Ring_Image_Version

Topology Discovery Process (2)

3. Else if validation failure detected due to incorrect Ring_Image_Version (including lack of topology image)
 1. Set local copies of local and remote Station_Image_Versions = 0
 2. Send Status_Change message
 3. (Note: Follow previous steps for higher Station_Image_Version for all Status_Change messages received as a result of this)
4. Else if Station_Change message received with Station_Image_Version == 0
 1. Update remote Station_Image_Version to 0
 2. Broadcast Status_Change message
 3. Update local Ring_Image_Version

Topology Discovery Process (3)

5. Upon setting Station_Image_Version to 0 or updating Ring_Image_Version
 1. Start Topology_Stabilization timer
 2. While Topology_Stabilization timer is running, do not compare, and indicate to neighbor not to compare Ring_Image_Versions