RPR MAC Address-Station ID Binding and Fairness Algorithm

Chip Engines

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Chip Engines & RPR

- Company Facts
  - Headquartered Sunnyvale, CA
  - Fabless Semiconductor Company
  - Started October 2000, VC Funded
  - 83 Employees
- Product Focus
  - IP Based WAN Chipsets
  - Semiconductor Products for Metropolitan Networks

Proposed RPR Features

- MAC Address and Station Id Binding
- Priority of Control Packets
- Provisioning Bandwidth Partitioning
  - Pass-Through
  - Insert
- Fairness Algorithm

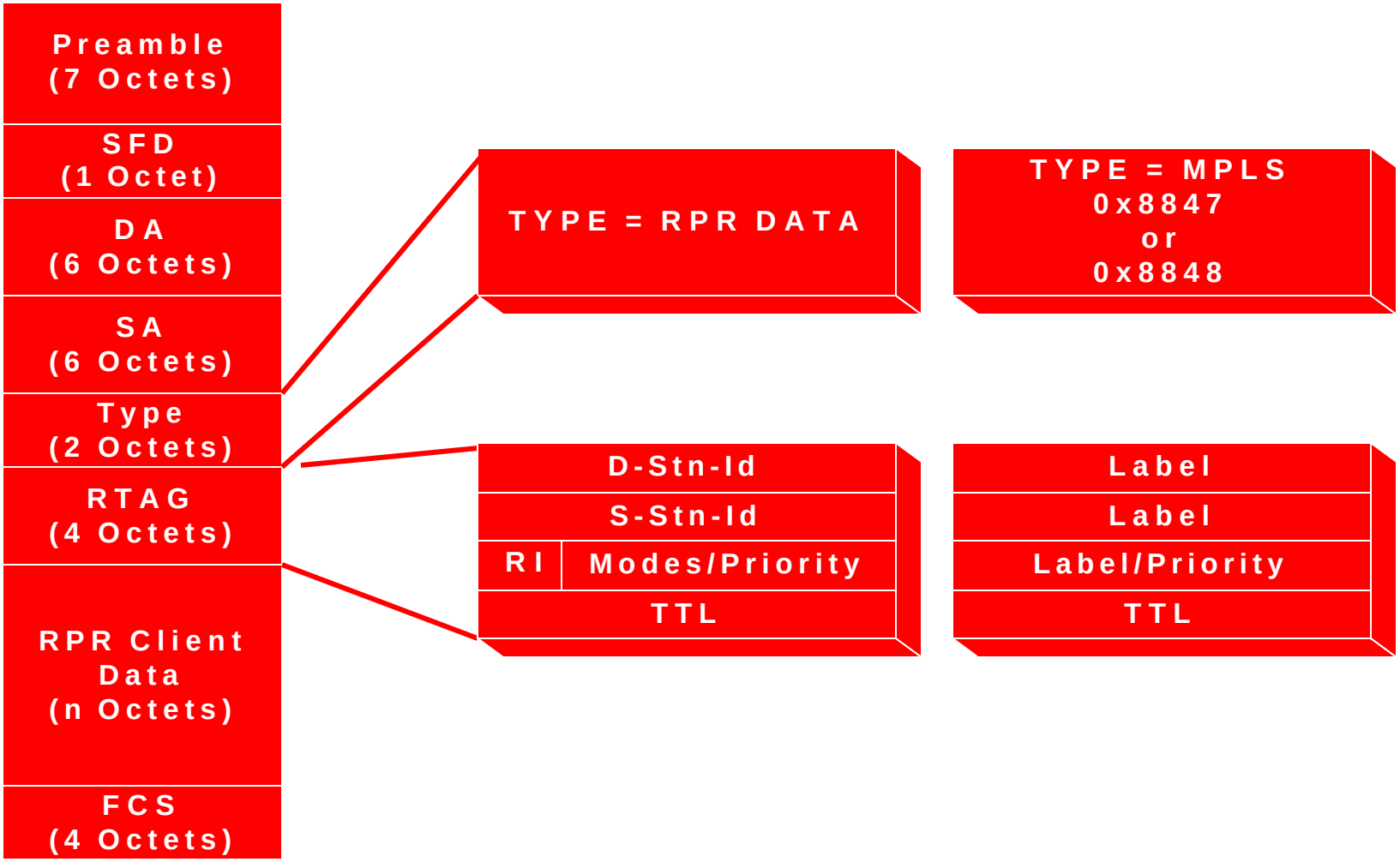
MAC Address & Station Ids

- Explicit Station Id
  - Station Id Part of the RPR Header
  - Source (1 Byte) and Destination (1 Byte)
  - No Station Id for Multicast MAC Addresses
  - Negotiated When a Station Enters the Ring
    - Use Control Packets
- Implicit Station Id
  - Implied Bits in 48-bit MAC Address Field
  - For Example, Lower 8-bits
  - Can Scale Up to Support > 256 stations
  - Negotiation Protocol to Determine Implied Bits

Station Id Advantages

- Simplifies Look-Up
  - Eliminates or Reduces the need for CAM Look-Up
    - Except for Multicast MAC Addresses
- Fast Processing of Per Station Statistics
  - Efficient Structures to
    - Police Pass-Through Traffic
    - Provision Bandwidth & Apply Fairness Algorithm
  - Enables Finer Granularity of Ring Flows
    - (Source Station Id)
    - (Source Station Id, Destination Station Id)
    - (Ringlet Id, Source Station Id, Destination Station Id)
- Simplifies Topology Determination
  - Ring Topology Built With Station Ids

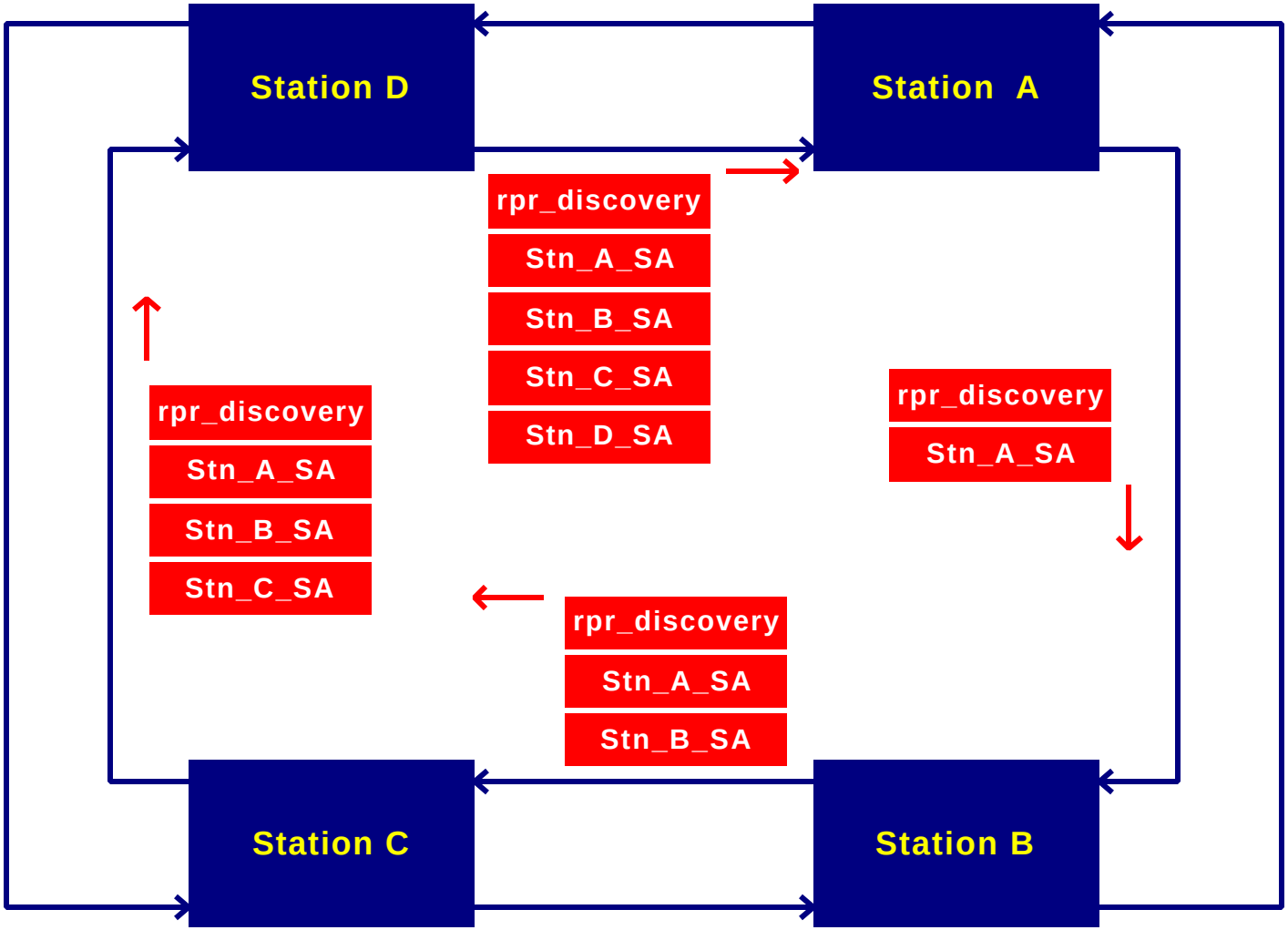
Proposed RPR Frame Format



Station Ids

- Statically Assigned
  - Pre-assigned Before Station Activation
  - Similar to the Pre-assignment of 6-Byte MAC Addresses
  - Unlike 6-Byte MAC Addresses
    - Global Uniqueness Not Required
    - Local Uniqueness Required Around the Ring
- Dynamically Assigned
  - Centralized Algorithm
    - Needs A Station-ID Server for Unique Id Assignment
    - Concept Similar to DHCP in IP
    - Station-ID Server May Need A Back Up for Protection
  - Distributed Algorithm
    - Stations Acquire Ids Upon Activation
      - Topology Learning & Reaching Consensus

Distributed Station Id Selection



Station Id Selection Algorithm Sketch

- All Stations Upon Activation Send A Control Packet
  - Using A Default Ringlet
- Receiving Stations Append in Order
  - Source Address, Status, Station ID to the Control Packet
  - Update the Packet Length
  - Forward the Control Packet to the Next Station
- Control Packets Returning to Source Stations Have
  - Full Ring Topology Information
  - Station ID Status for Every Station on the Ring
- Source Station with Lowest MAC Address
  - Selects Station Id and Updates Status
  - Re-circulates Control Packet with Updated Information
  - Other Source Stations Take Turn in Selecting Station Id

Control Packet Priority

- Priority 0 (Control Packets)
  - Effect Rapid Protection Switch-Over
  - Effect Rapid Learning of Topology
  - In-Band Provisioning
  - Congestion Control Feedback Messages
- Priority 1
  - Committed Bandwidth & Latency
- Priorities 2 through 4
  - Committed Bandwidth to Best-Effort

Bandwidth Partitioning

- Provisioning
  - Pass-Through Traffic
    - Source Station to Destination Station
  - Insert Traffic
    - Generated by Local Station
  - Ingress Shaping & Policing Criteria
    - Timing Interval
    - Committed Burst, Excess Burst
    - RED/WRED Congestion Control Algorithms
- Control Packet In-Band Provisioning Information
  - (Source Station Id)
  - (Source Station Id, Destination Station Id)
  - (Ringlet Id, Source Station Id, Destination Id)

Fairness Algorithm

- Per Flow Policing for Cut-Through Traffic
  - Policing Interval
  - Committed & Excess Burst
- Per-Flow WRED and Rate Control for Queued Traffic
  - Minimum and Maximum Thresholds
  - Committed Bandwidth
- Control Packet Feedback Control
  - Source Based Statistics
  - (Source, Destination) Based Statistics
  - Messages to Throttle Offending Stations