Ring Topology Discovery with Traffic Engineering

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- **Topology Discovery should provide an efficient connectivity route for nodes:**
  – Meets Traffic Engineering (TE) Requirements
  – Fastest route to a Node under Circumstances

- **Topology discovery is dynamic with:**
  – Link Parameters
  – Fault Conditions
  – Changing TE Requirements
  – User overrides for a path selection

- **Support for Node Local Reservations** at L2/L3

Node Packets

Node Packets

| Client i/f |
| L3 Node Reservations (RSVP) |
| User reservations |
| Link Bandwidth (\|East - West\|) Differences |

Data

Control

LLC

MAC subLayer

MAC subLayer

Rx **Tx**

Rx **Tx**

West -

- **East**

Transit Packets

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Every Node is a multiport device,
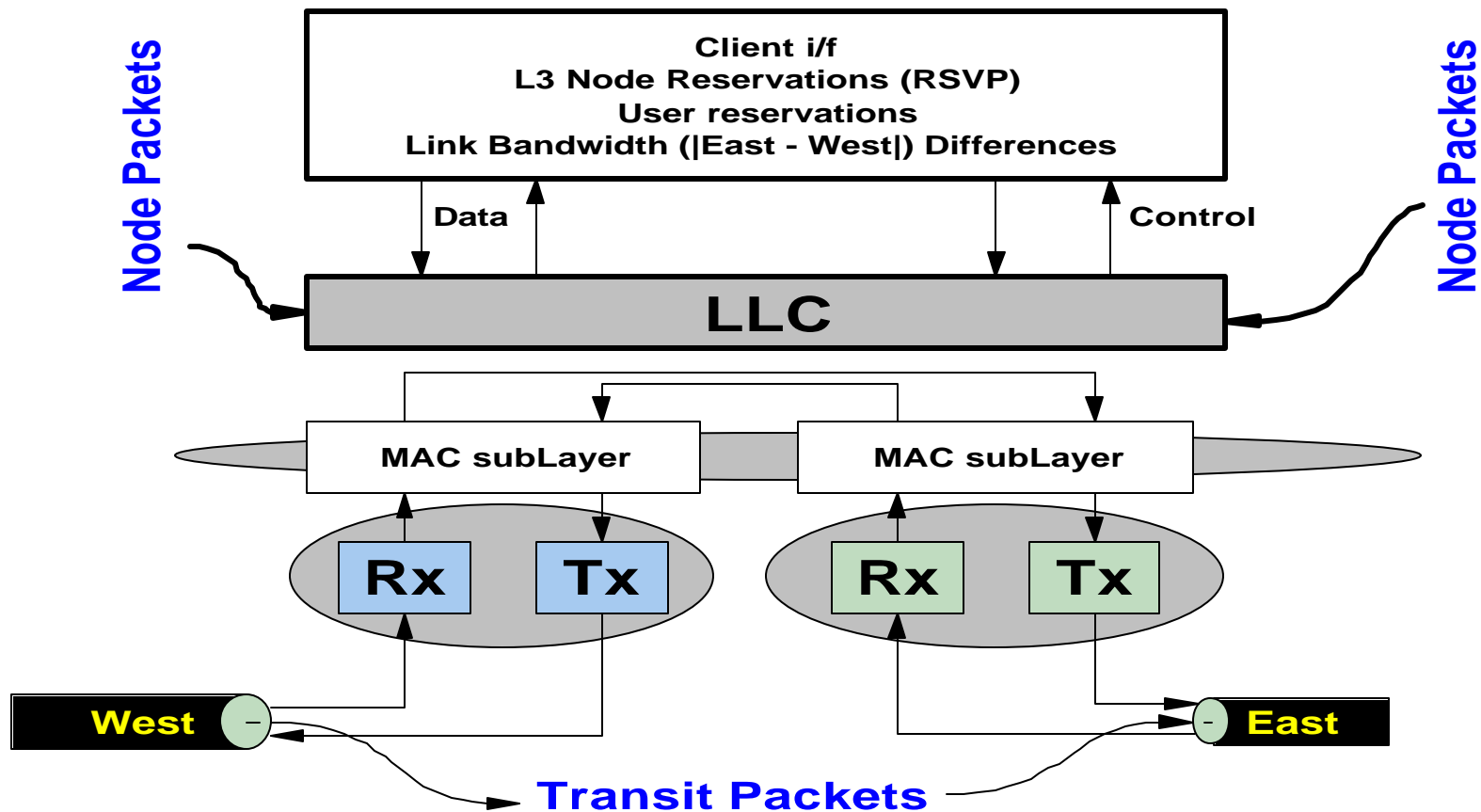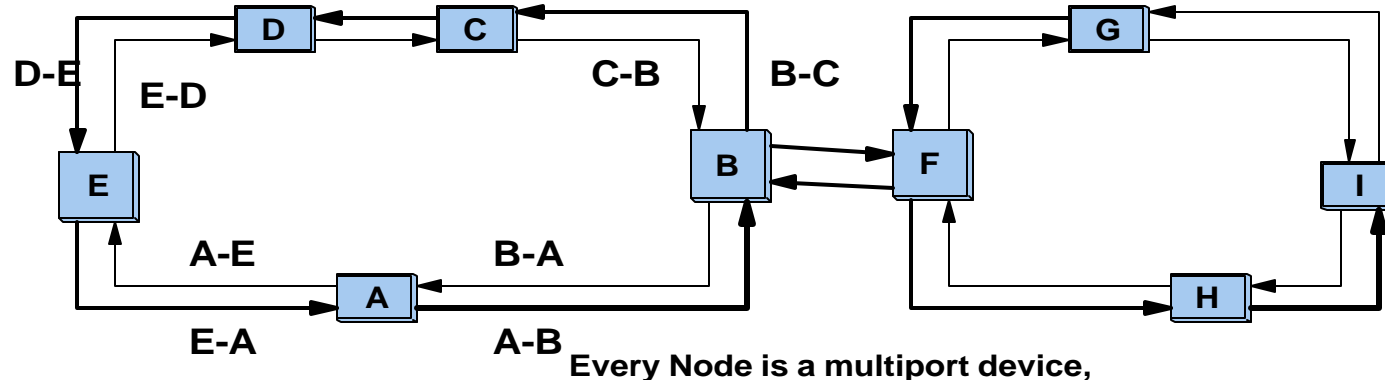
- **Each node sends out a topology discovery packet on a link**
- **The packet contains following parameters (among others):**
  - **Node MAC address**
  - **Hop (= 0), Cost, TTL**
  - **Link Rate (Physical)**
  - **Node L3 reservations for the link**
- **Rx Node can determine how much Bandwidth is Available towards the Tx Node**
- **An end-to-end path takes lowest bandwidth en route as available BW**

- **Transit Packets aren't necessarily Highest Priority**
  - High Priority to Upstream Packets gives unfair advantage
  - Local Node's L3 reservations (using RSVP, etc.) must hold
  - RPR MAC can't be unfair to its own Node
  - If RPR MACs give Transit highest priority, every node is fair to its upstream node, but not fair to its own L3 needs.

- **Node Reservation Parameters:**
  - Amount of Bandwidth
  - Direction of reservation(outgoing port #). Only one side may need reservation
  - Reservation fixed: no bursting by upstream even if unused (or link BW different on two sides)
  - Reservation with bursting by upstream. Upstream can burst and take a chance

- **Topology discovery packets can be sent**
  - Periodically
  - On demand - by a newly inserted node
  - When a node/link failure occurs
  - In-band, along with data packets
- **After Topology determination, a node entry contains (at LLC):**
  - Destination MAC address
  - Output port #, cost, hop count
  - Topology type: dynamic (network parameters), or user-defined
- **LLC Algorithms determine which path to choose.**
- **Data Forwarding: MAC looks at {MAC, outport} to see where to send the packet**

- **Topology discovery for RPR ring networks should support Local Node TE Requirements**

- **Transit Packets shouldn't always get high priority just because they came from upstream**

- **LLC layer should include BW and TE parameters to determine permissible Transit Traffic**

- **MAC is not just for Equal Distribution of BW across all Nodes**

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- **For different span bandwidths, all we need to allow different rates on different MACs below MAC sub-layer**

- **Opaque nature of RPR networks (O-E-O) could easily support multiple rate spans**

- **This feature allows customers same flexibility they have with LAN (mixes of 100M/1G/10G in different network segments)**

- **Flexible upgrade path for providers and subscribers**