RPR MAC: Data Path Objectives

Harry Peng: hpeng@nortelnetworks.com

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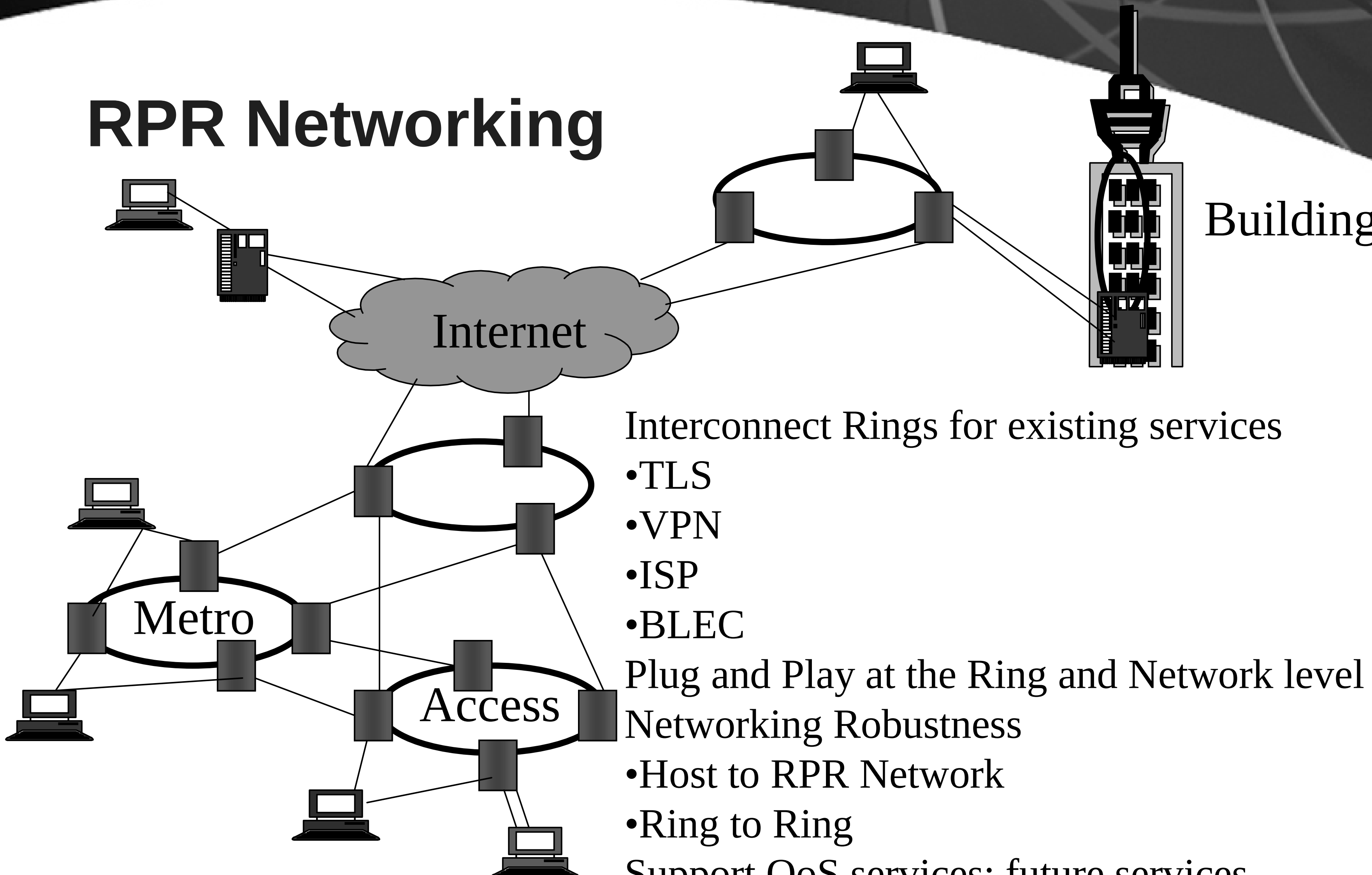
- MAC In Perspective
- MAC Components

RPR Networking



Interconnect Rings for existing services

- TLS
- VPN
- ISP
- BLEC

Plug and Play at the Ring and Network level

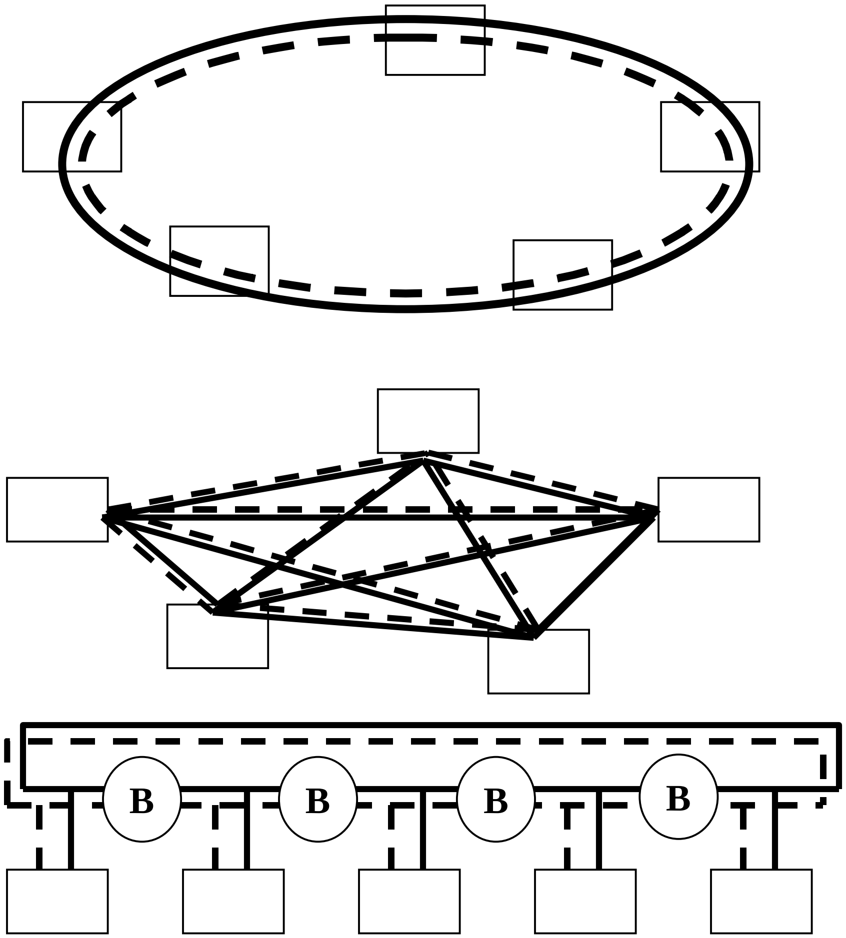
Networking Robustness

- Host to RPR Network
- Ring to Ring

Support QoS services: future services

Provide Services with LOWEST cost per MANAGED bit
Design to provide maximum BW available

RPR has a dual nature



Physical View
•Two counter rotating rings

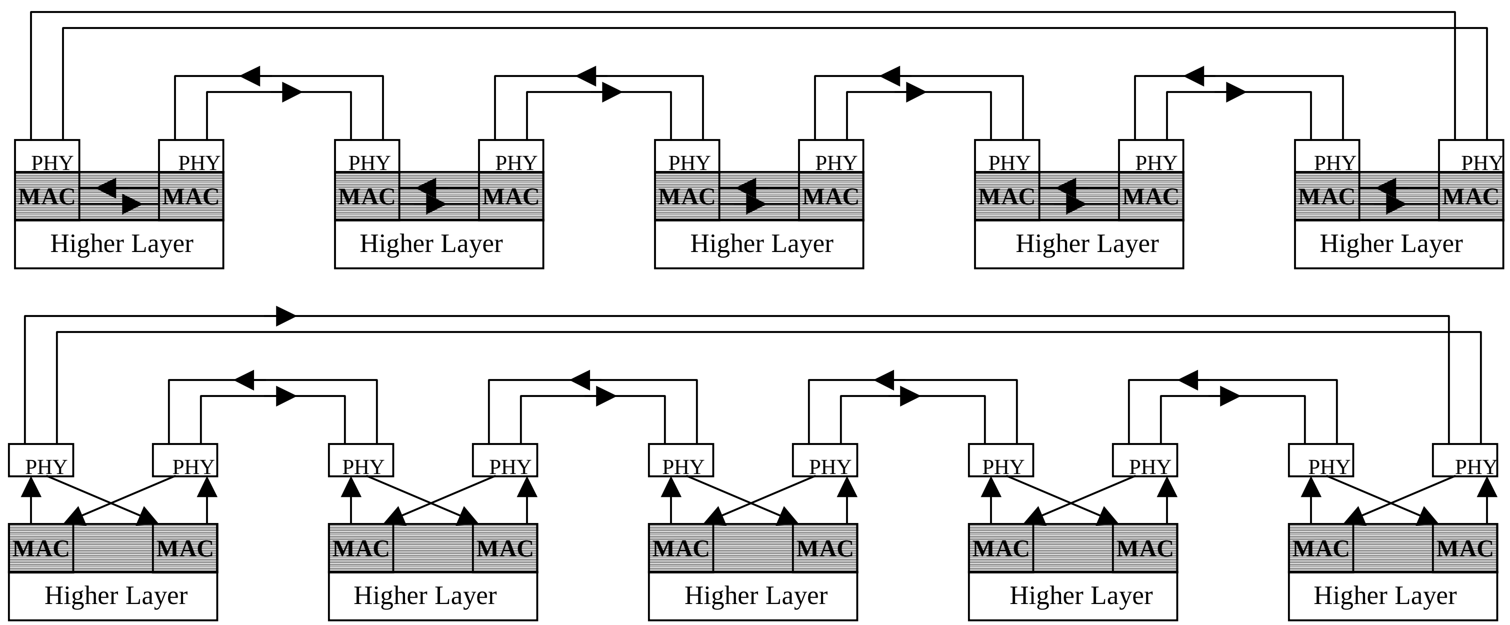
Data Plane Logical View
•Two fully mesh network

Control Plane
•Dual buses with
•Logical bridges for fairness control

Key RPR challenges

- **Value of the Ring**
  - Inherent resilient: redundant path (R)
  - Existing network topology
  - Full logical Mesh
  - Inherent multicast/broadcast
  - Port Consolidation
  - No standing issue, finer granularity control
- **Technical Challenges need solution**
  - High BW efficientcy
    - Destination removal
    - No reserved protection BW
  - Shared medium: Collision Handling
    - Connectionless vs connection oriented
    - No stranding granularity: dedicated channels
    - Dynamic Fairness BW reservation
  - Fairness
    - Parking lot problem
    - BW utilization
    - Response time vs stability
    - Unfairness: QoS
- **Market Acceptance**

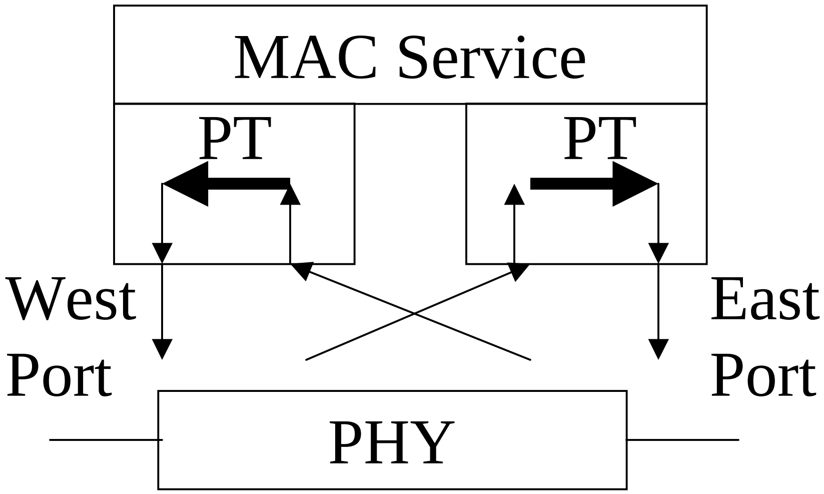
Where is the RPR MAC?



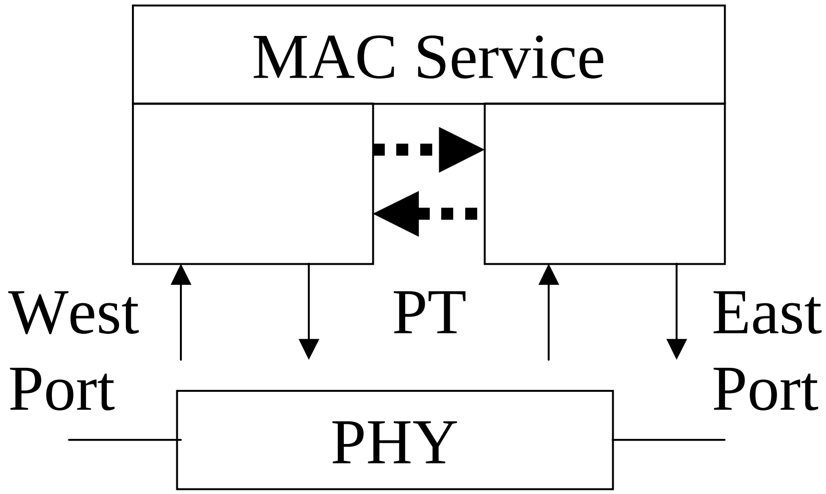
- Keep the ring View in Mind. Ring is only part of the network
- Must solve collision domain
  - maximum ring performance
  - minimum design complexity

MAC Design

Method 1

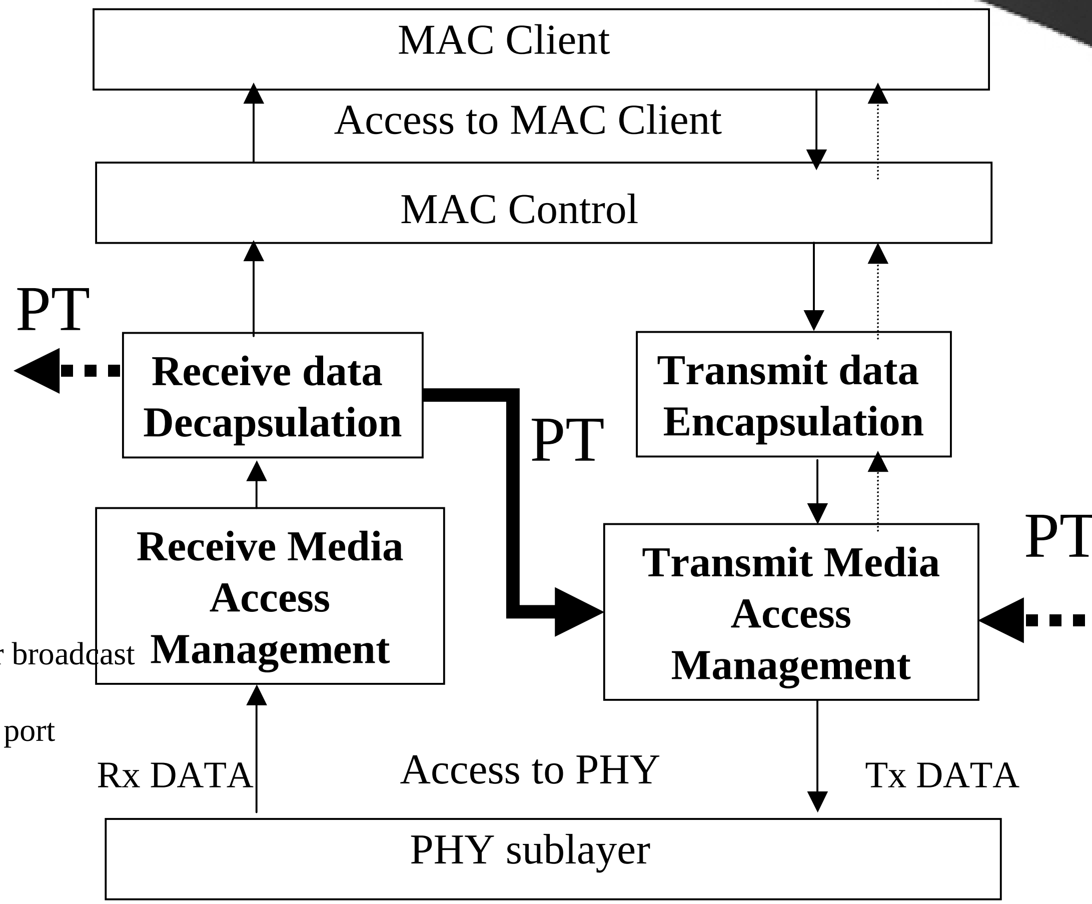


Method 2



•RPR MAC an extension to point to point MAC

Components of a MAC



- PLS layer required for PHY status signaling
- A transmit media access management secondary port
- Receive data not address to this station is not discarded but send to the TMAM or to a PT port
- The transmit data header modification block process TTL
- Transmit Media access management has the tandem buffer

For Frame Reception
1)Receives a bit-serial data stream from the Physical Layer
2)Presents to the MAC client sublayer frames that are either broadcast frames or directly addressed to the local station
3)PT all frames not addressed to the receiving station to PT port
4) passes control messages to Management /Cotrol
5)Header processing on PT

For Frame Transmission
1)Accepts data from the MAC client or Pass though port and constructs a frame
3)select which PHY to transmit
4)Presents a bit-serial data stream to the Physical Layer for transmission on the medium

Collision management

- **Use buffer insertion in Transmit Media Access Management (TMAM)**
  – NO SAR function
  – No large internal buffering, simpler to design
  – Scalable to Terabits,
  – Perform even at low ring rate
- **Support cut through in Tandem Path**
  – Minimizes locality dependent delay unfairness
  – Minimize latency
  – Provide “one hop” to destination node

What else is needed to Complete multi-station System

- **Need a Fair Access Control Protocol (TMAM)**
  - Collision is handled locally
  - Source does not re-transmit
- **Need a Congestion Management Protocol for all the stations**
  - Local versus Global
  - High link utilization

Summary

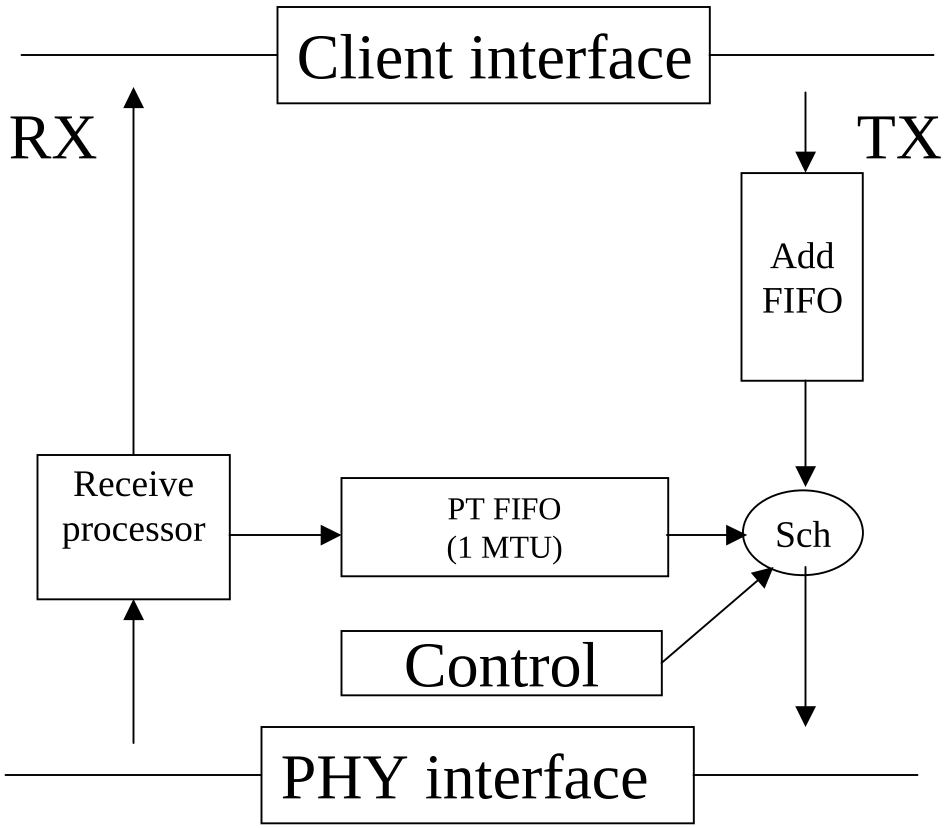
RPR MAC:

- **Support Shared Media Access**
  - Handle local collision by buffer no SAR
- **Support PassThrough (PT): Buffer Insertion Ring**
  - Very Scalable design
  - Best ring delay/jitter performance
- **Support a Fair Congestion Management Protocol**
  - Multi-station shared medium
  - All equal stations have equal performance: goodput and delay
- **Support Tandem performance monitoring**
  - Shared medium not channelized

Questions and Answer

Back Ups

What is a Buffer Insertion Ring



Scheduler:
if (control_packet)
    send_control ()
else if (PT_packet)
    send PT_packet ()
else if (Add_packet)
    send Add_packet ()

Receive Processor:
- DA address check: receive
- SA address check: discard
- TTL check
- TTL process
- HEC

- **Enhanced original BIR with control message buffer**
- **OPE-RPR dual BIR with Congestion management+ perform monitor, node discovery, L2 protection**

Buffer Insertion Ring's Attractiveness

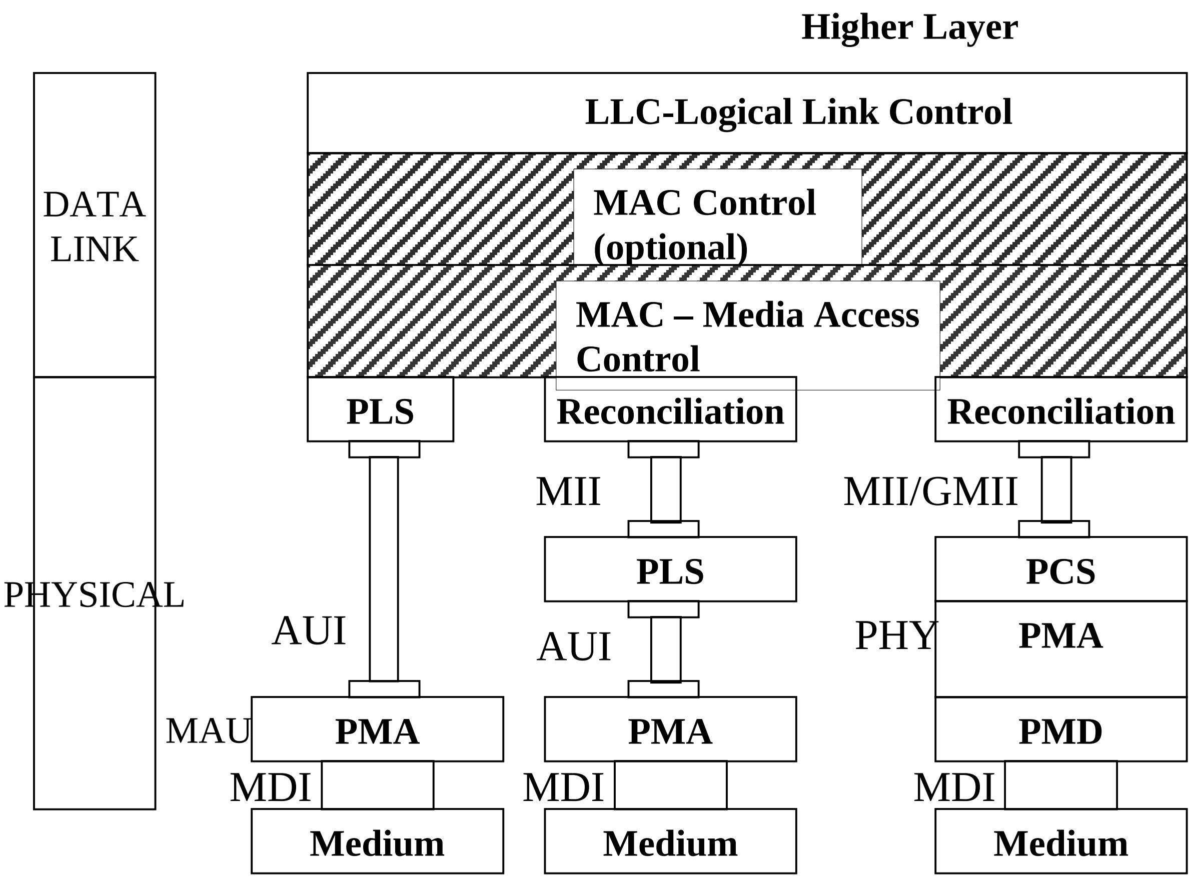
- **Enabled by high link rate**
  - Low Transit delay
  - No need for SAR
- **Scalable**
  - Low silicon cost
  - Not concern with memory technology
  - Lower cost/bit
- **No segmentation**
- **bounded Ring delay**
- **Supports Loss less media**
- **Shared media**
  - Congestion Management required
  - starvation

Need Fairness Access Control for ring "Congestion"

Fairness

- **Per SLA BW weighted fairness**
- **Per class per customer fairness**
  - Regardless of traffic pattern
  - Regardless of position on the ring
  - Fairness: goodput and delay
- **Support types Service Level Agreement**
  - ? What is the customer SLA today: BW
  - ? What is the SLA of tomorrow: BW + QoS

OSI Reference Model/ LAN CSMA/CD Layers



AUI= Attachment unit interface
MDI= Medium dependent interface
MII= Media independent interface
GMII= Gigabit Media independent interface
MAU= Medium Attachment Unit
PLS= Physical Layer Signaling
PCS = Physical Coding sublayer
PMA= Physical Medium Attachment
PHY= Physical Layer Device
PMD= Physical Medium Dependent