Data Forwarding in RPR MAC

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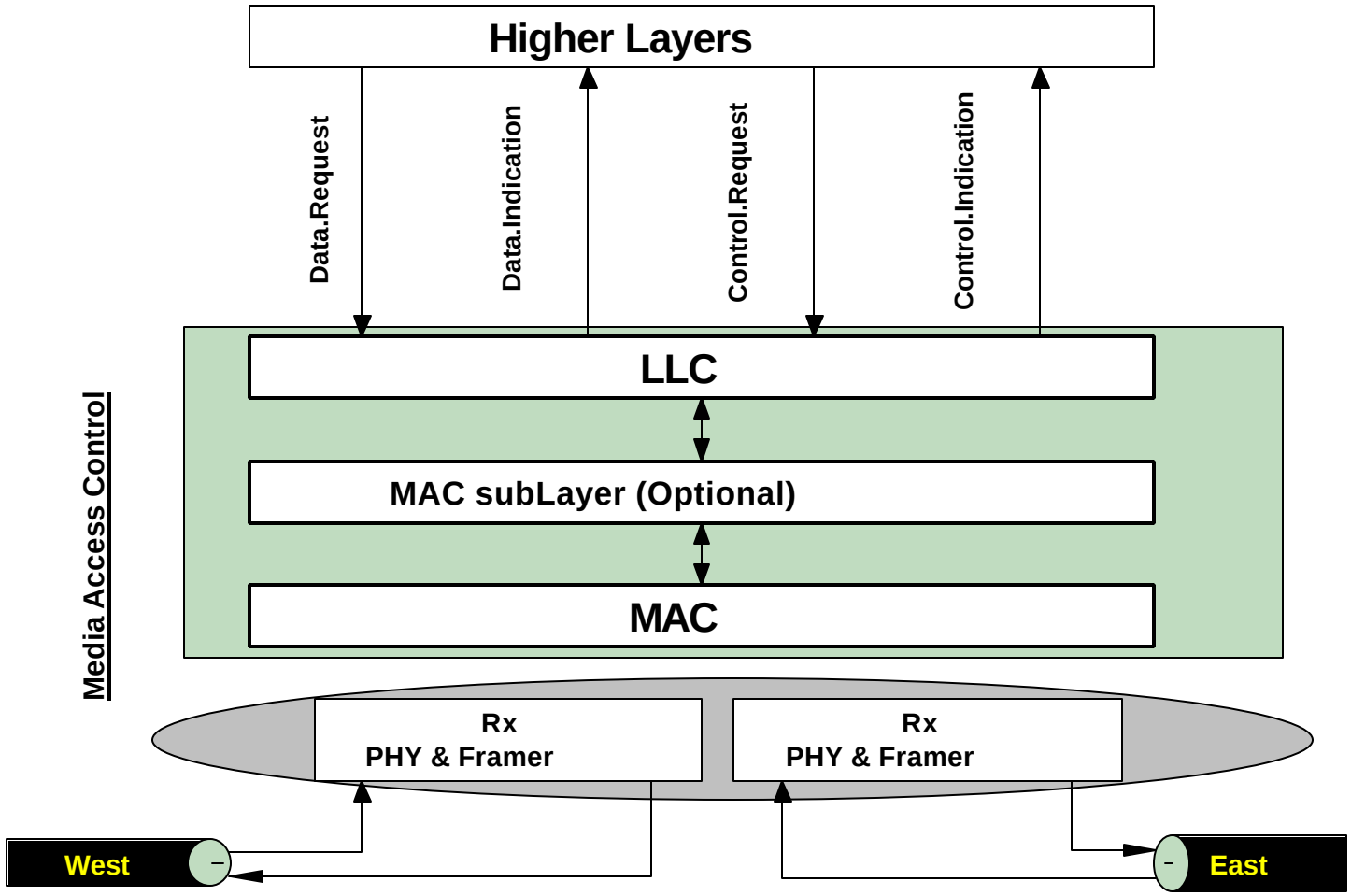
Data Forwarding in MAC

- Need for a Robust & Scalable MAC Reference Model
- MAC Functions:
  - Packet Switching across Ports
  - Traffic Engineering with CoS
  - Transit and Add Data Path Management, etc.
- Define Operations only at MAC Reference Points
- No specific device implementation details (such as buffers & queues)
- Interoperability among different vendor implementations
- Allows Future Expansions and Protocol Changes

Exclude Device-specific Details

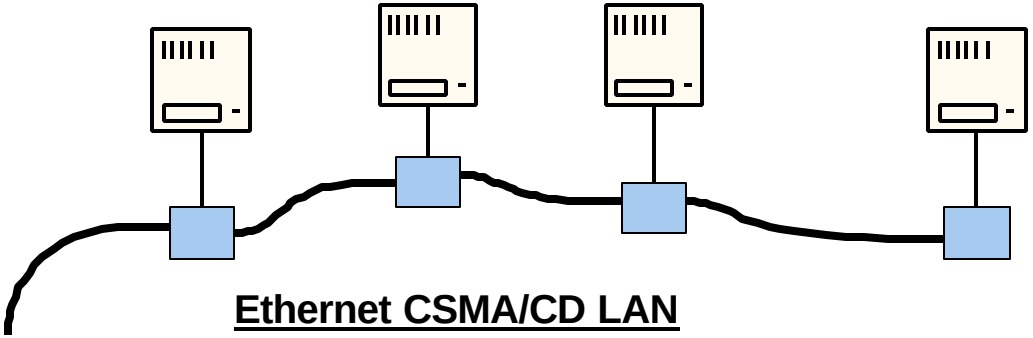
- **Existing IEEE 802.3 MACs never specify internal device details**
- **No one needs to know internals of Ethernet MACs**
- **Define Operations only at MAC Reference Points**
- **Current RPR Proposals get down to defining Buffers, Queues, and Schedulers as part of RPR MAC Standard**
  - Impossible to check Devices for MAC Standards Compliance
  - Interoperability among different vendor implementations
- **All MACs should interoperate as long as Frame Structure, Frame Processing, and Node Access are standardized.**
- **Device vendors can add more features while keeping basic functionality intact.**

MAC Reference Model

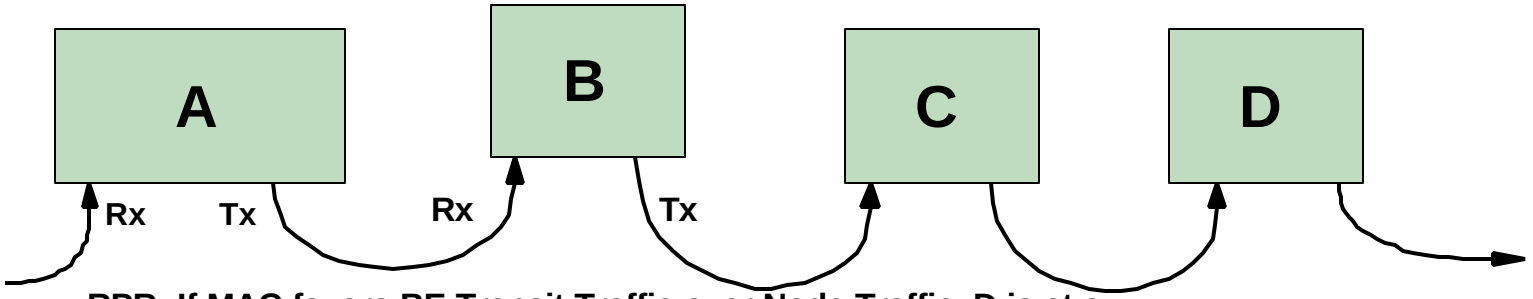


Data Forwarding Issues

RPR vis-à-vis Ethernet - LAN with CSMA/CD-like Features ?



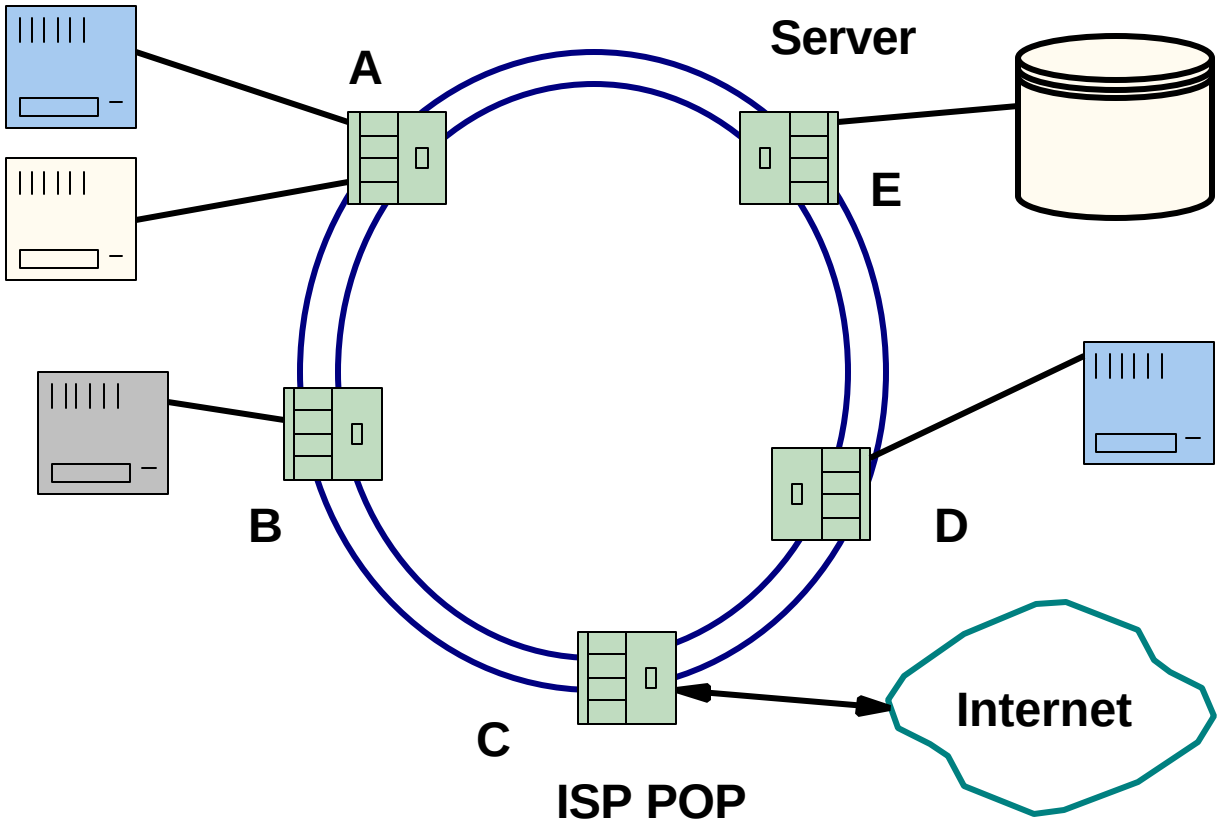
Ethernet CSMA/CD LAN



RPR: If MAC favors BE Transit Traffic over Node Traffic, D is at a severe disadvantage over A - No CSMA/CD Operation

If a node is allowed access over Transit, choke points can occur
Can't have a pure CSMA/CD in an NBMA environment

MAN Configuration Example



Nodes C and E need more than fair access to network

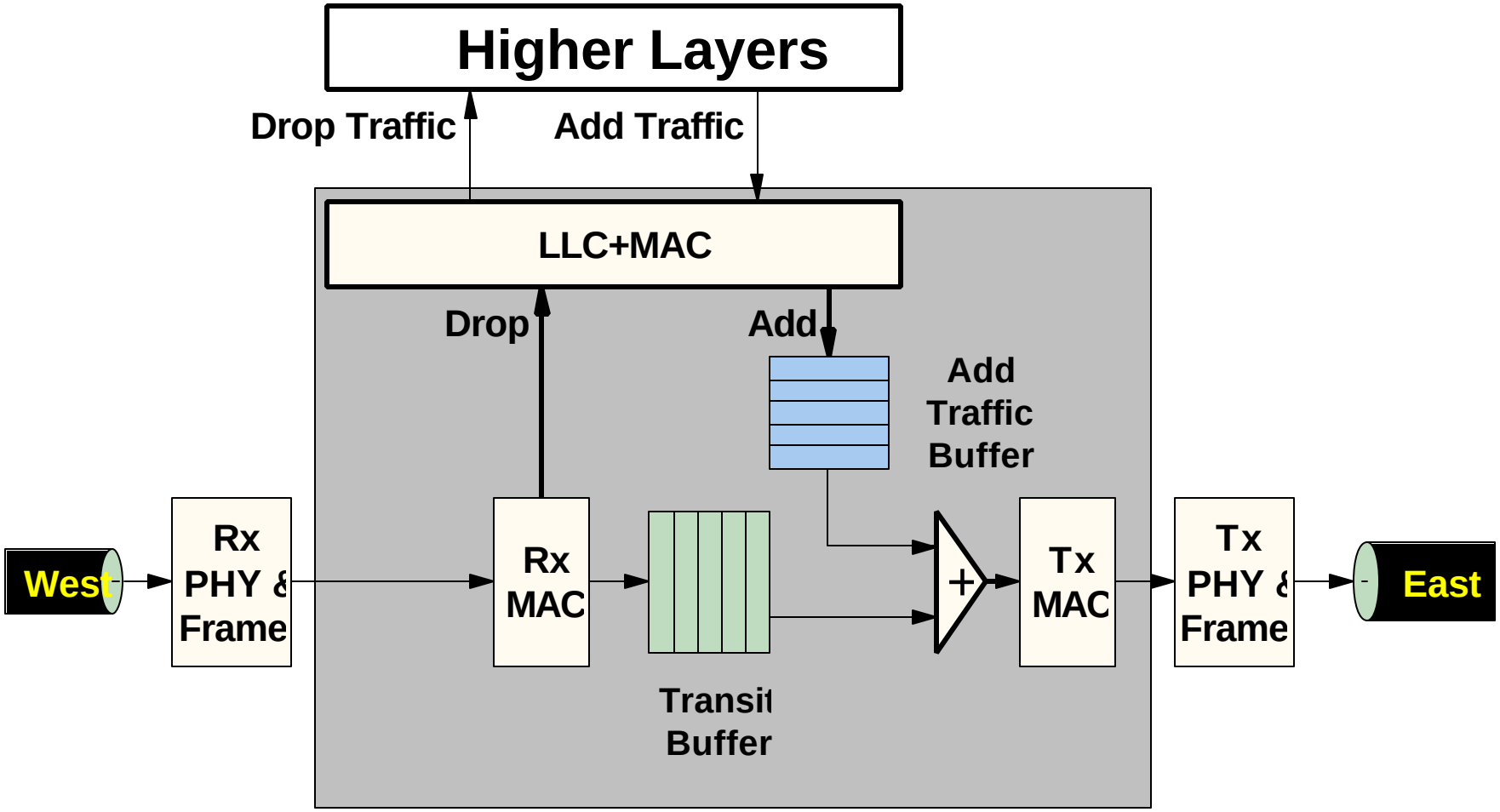
LAN Operation with Fair Access

- **CSMA/CD operation gives a per-packet Access for Ethernet Networks**
- **Best-achievable granularity – per-packet access for RPR Nodes**
- **Over-subscription over RPR networks likely in high ratios**
- **NBMA nature RPR mandates Fair Access Methods**
- **Fair Access doesn't mean diving Bandwidth equally**
  - Some nodes need more access than other nodes in MAN
  - Transit and Node Traffic access would differ at different nodes
- **Statistical Multiplexing with Permissible Bursting at different Nodes**

Transit & Add Data Path Design

- Provisioned Traffic doesn't require any special design
- Giving preference to Transit Traffic gives unfair advantage to upstream nodes
- For Data Packets, it's not necessary to always deliver very quickly.
- Nodes on the way need access to network under allowable limits
- Temporary Buffering of Transit Packets may be needed to give way to Node Packets
- Otherwise, performance at downstream nodes would greatly suffer
- Nodes farthest from Servers wouldn't get good service

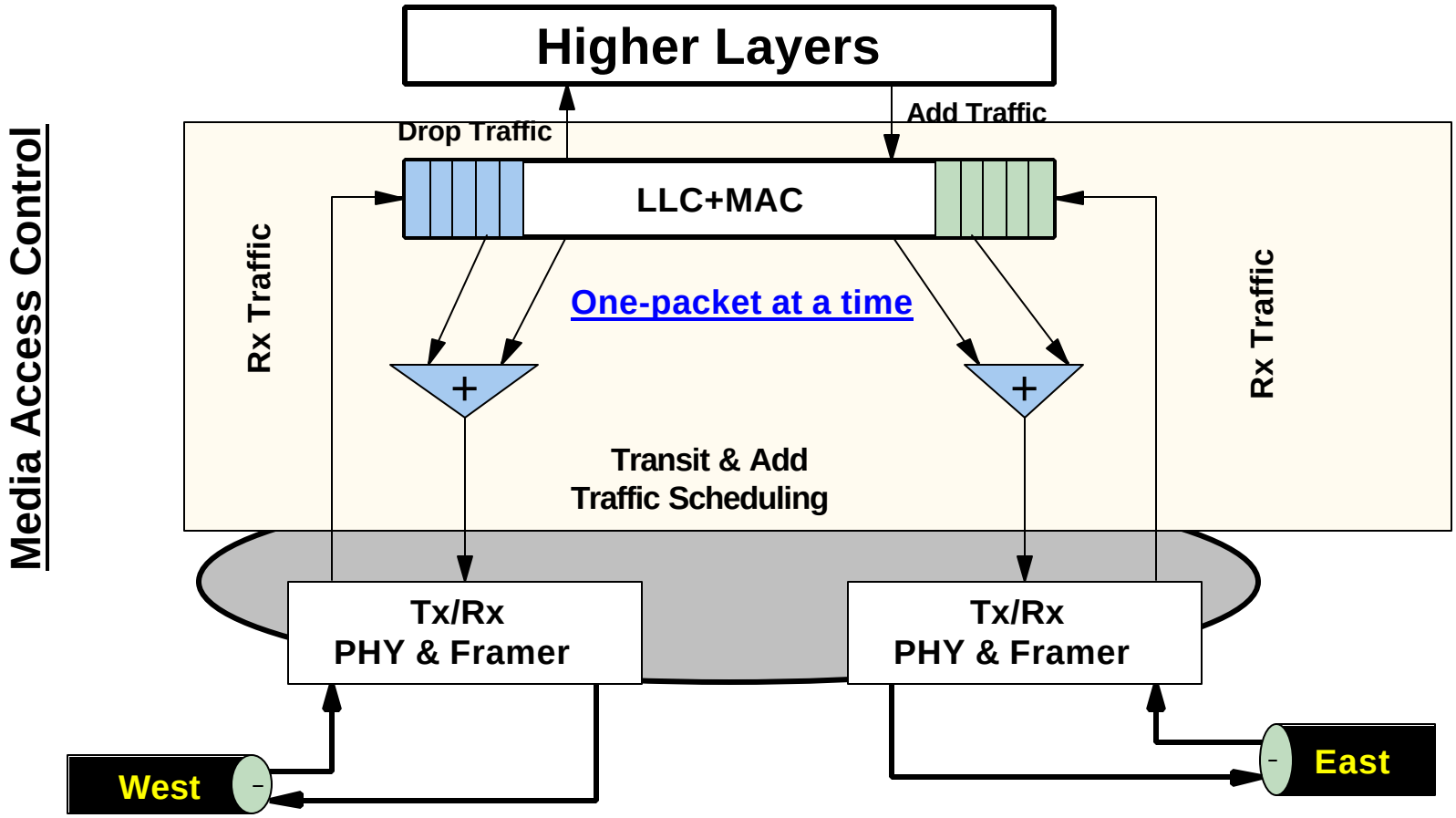
Transit Buffer Design Issues



Transit & Add Data Path Design

- A MAC device could have any size Transit Buffer
- Scheduler in the MAC would always pick and schedule add/transit one packet at a time.
- Therefore, all MACs behave same regardless of Transit Buffer size
- On server nodes, client layers may temporarily store Transit packets to allow Node Traffic
- Congestion declaration at a node is decided by node, depending on node traffic requirements
- RPR MAC standard would specify an upper limit on Latency
- Congestion declaration independent of how deep the Transit Buffer is.

Transit & Add Paths



MAC Internal Buffer Design Issues

- Nodes don't need to advertise how deep their buffer size is
- Clients can always extend transit buffer and take up all queuing for local queuing and scheduling
- Efficient Queuing Methods and Fast Switching Logic ongoing Areas of Research
- Traffic Engineering methods evolving under continuous Research
- Wouldn't be prudent to fix a particular design into RPR Standard for all times to come
- Internal Buffer Design Implementation should NOT be standardized. May be provided as Guidelines/Examples ONLY.
- RPR MAC should specify Transit Packet Treatments & Processing Requirements with Latency, Jitter Bounds, etc.

Conclusion

Requirements for RPR MAC Standard

- Clear Reference Points for MAC
- Rx/Tx Port Management & Association with
  - Traffic Engineering
  - Topology
  - User Configuration
  - Allow other Parameter(s) based on Future Protocol Developments
- Basic RPR MAC should only perform Core Packet Handling
- Internal Buffer Design Implementation should NOT be specified
- RPR MAC Standard should ONLY specify Behaviors at different Reference Points, like other standards do.