RPR MAC Model
(Contention Resolution and Fairness Issue)

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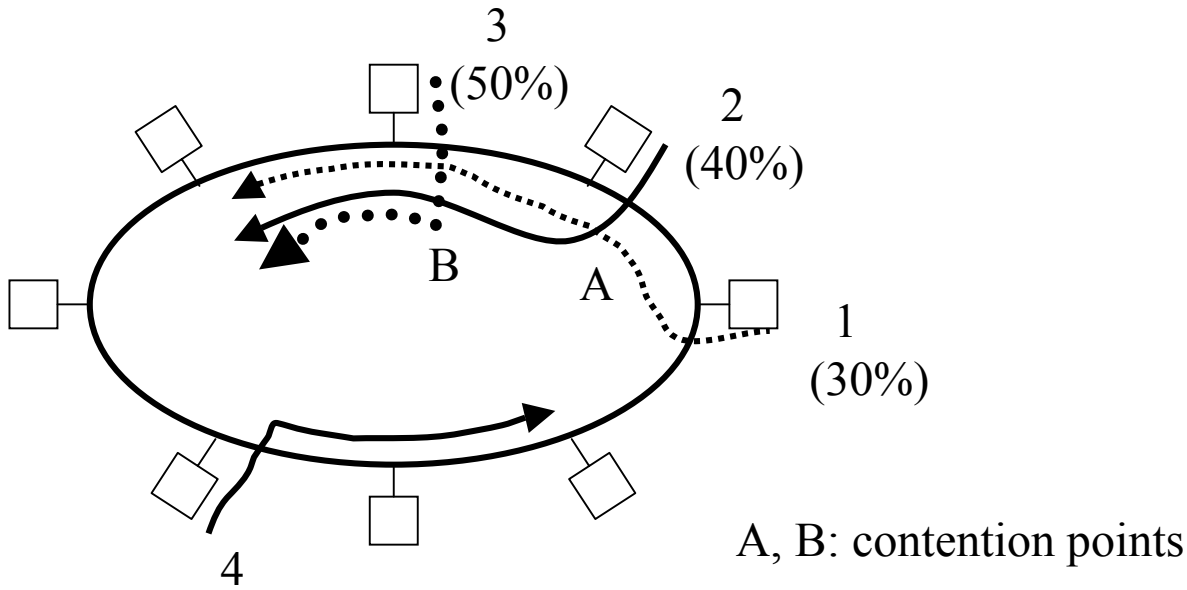
What is the Issue?

- Fair (or unfair) allocation of ring bandwidth under congestion is a complex problem.
  - Potential for lengthy standardization effort.
  - Also likely have implication on scalability w.r.t. geographical coverage, link speed, and # of nodes.
- Is it an indispensible part of MAC definition, or a system issue which belongs to a vendor differentiation area?

Existing MACs and Fairness

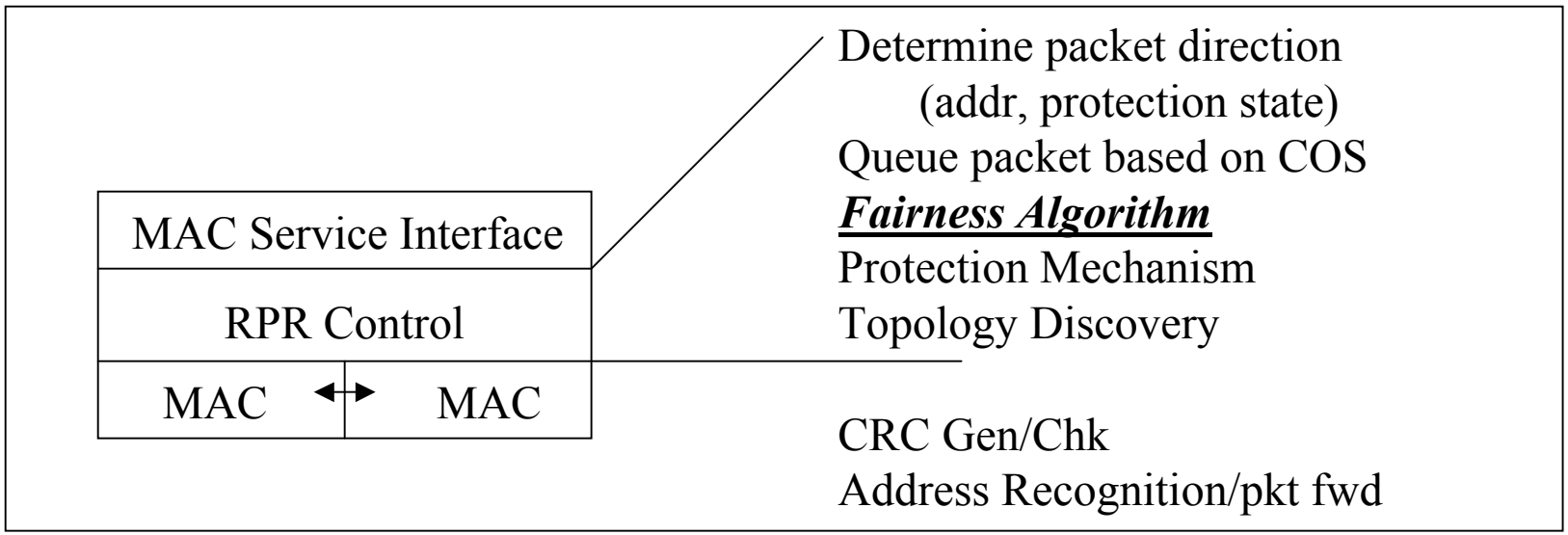
- Traditionally, MAC is to resolve access contention among multiple nodes sharing a common physical transmission medium, thus the name “Medium Access Control”
  - IEEE 802.3 Ethernet does it by CSMA/CD
  - IEEE 802.5 Token Ring by token passing
  - ANSI FDDI by timed token protocol
  - IEEE 802.6 DQDB by generating slots which carry busy/idle status, and distributed queueing with bandwidth balancing mechanism
- In all of the above, “fair” allocation of shared link bandwidth has been part of the MAC.

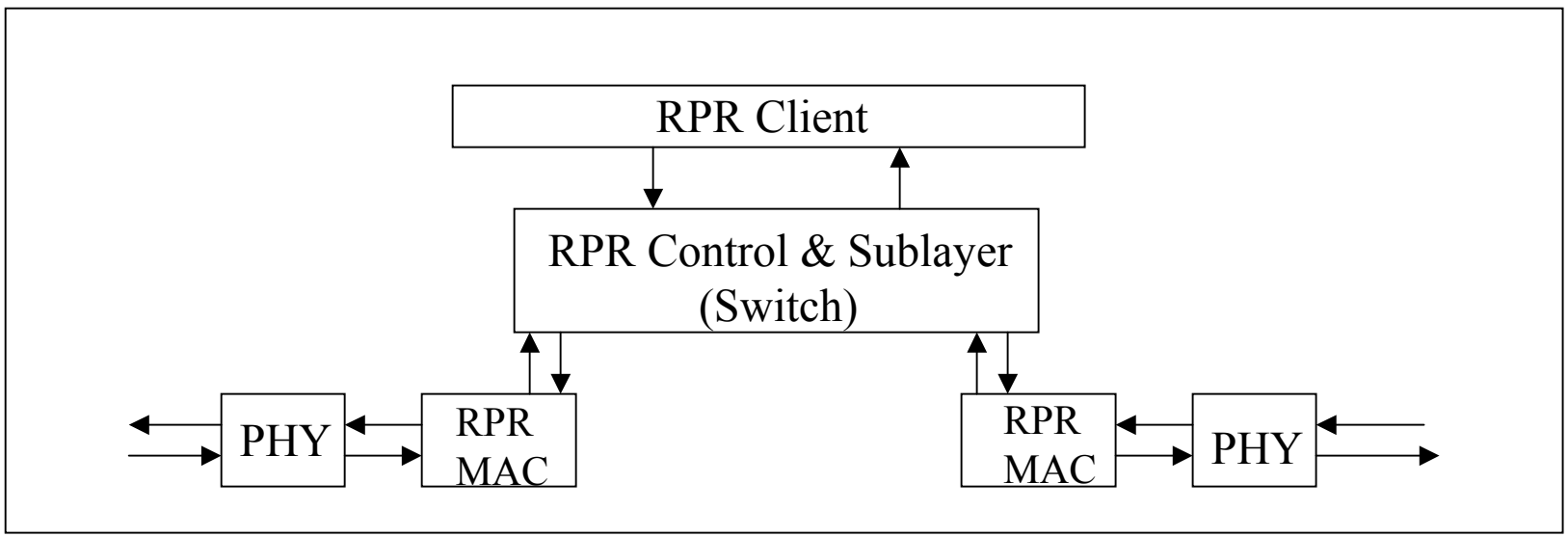
Contention Resolution and Fairness in RPR



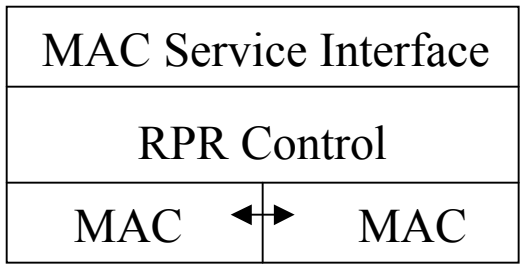
- Is RPR a shared medium?
  - Yes and No, depending on traffic pattern due to spatial reuse
  - Flows 1,2, and 3 form a contention domain, while flow 4 is contention-free
- Consider a case where flows 1, 2, and 3 try to transmit 30, 40, and 50% of the ring bandwidth, respectively.
  - Contention resolution is needed between the ring and host traffic at ‘A’
  - Contention resolution also takes the form of fair/unfair bandwidth allocation problem under congestion at ‘B’

Revisiting RPR MAC Models Suggested So Far

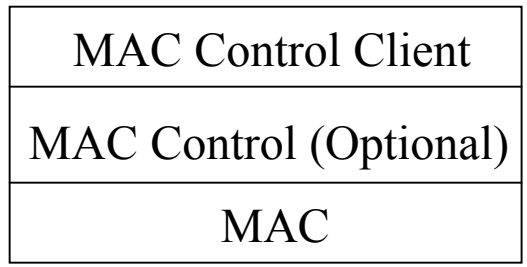




Comparison with 802.3x MAC Control Layer



802.17



802.3x

- In 802.3x, the MAC control sub-layer defines simple flow control for full-duplex operation.
  - Not a shared medium network any more, thus no CSMA/CD.
    - "MAC" is a misnomer, except for the frame format.
    - Each node becomes a bridge.

Comparison with 802.3x MAC Control Layer
(cont'd)

- The architecture also allows specifications of alternative flow control mechanisms.
    - Since it "is" effectively a bridge.
- Topology discovery and protection mechanisms optimized for Ethernet switched ring can also be part of MAC control sub-layer in 802.3x?
    - New frame format is required to include ring ID, TTL, etc.
- Since RPR ring segments can be considered as pt-to-pt full-duplex links, similar approach also deserves a hard look.

Summary

- Fair (or unfair) allocation of ring bandwidth under congestion is a complex problem.
  - Potential risk for lengthy standardization effort.
- Architectural approach of 802.3x MAC control sub-layer may provide flexibility, in that the fairness mechanism under congestion can be left as an option?
  - Unlike in the full-duplex switched networks, however, RPR MAC still need contention resolution between the add and ring traffic, at the minimum.
- Efforts need be focused to specify only a minimum set of common functionalities for in-time standard.
  - However, the specification of fairness mechanism should also be sufficiently detailed enough to allow interoperability.