



>> RPR Media Access Control and Client Design

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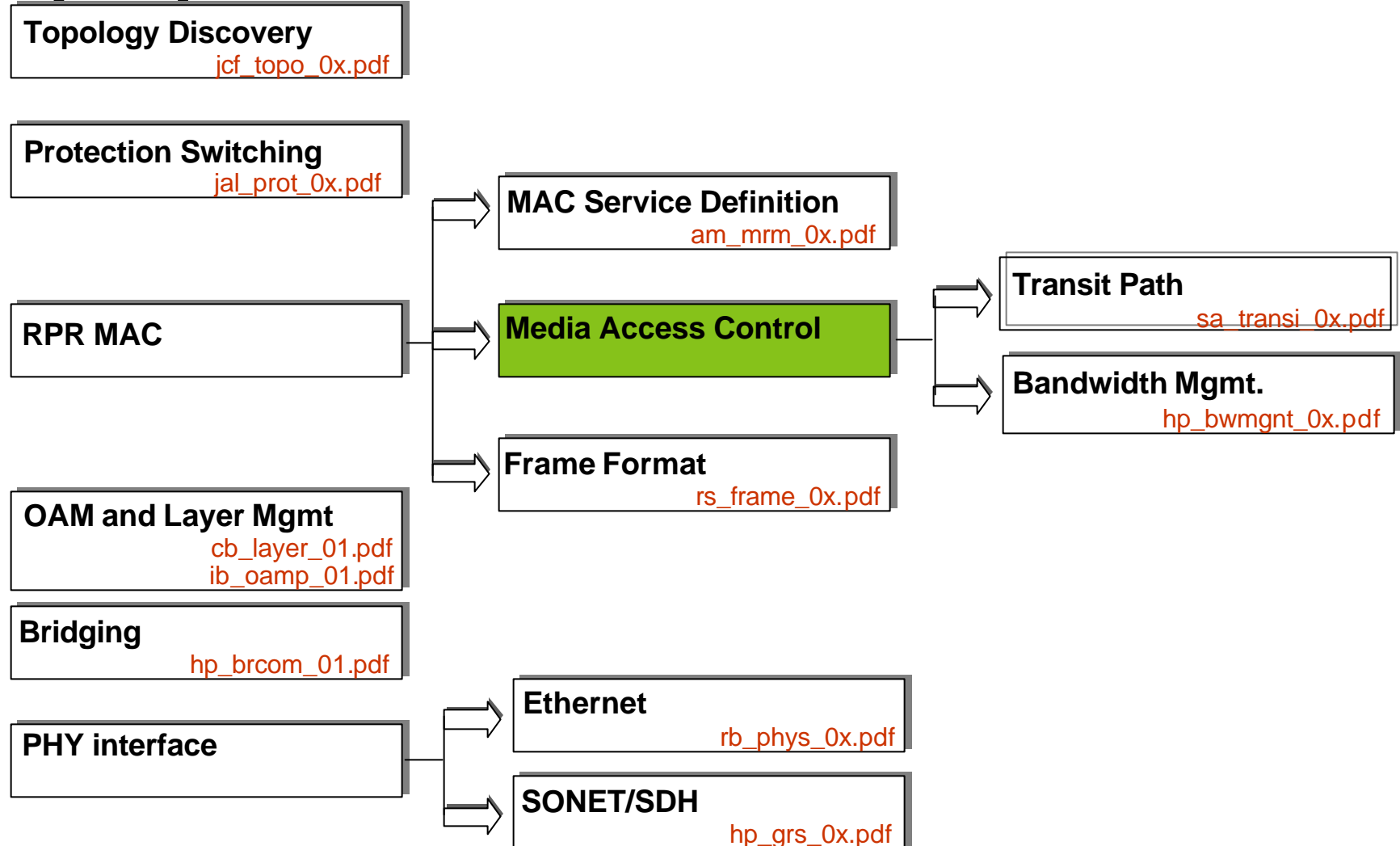
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Components of a complete RPR proposal





Outline



- ✍ Introduction
- ✍ Objectives and requirements
- ✍ Issues meeting the requirements
- ✍ RPR Framework Proposal
- ✍ RPR MAC Media Access Rate control
- ✍ RPR MAC Client Interface Requirements
- ✍ RPR MAC Client Options
- ✍ Conclusion



Introduction



Discuss the MAC behavior and interfaces with other blocks that address

- ✍ Approved Objectives.
- ✍ Service requirements.
- ✍ Implementation flexibility, under interoperability constraints.



RPR MAC relevant voted objectives



- ✍ The MAC shall support multiple types of service
- ✍ The 802.17 standard shall provide support for services that require bounded delay and jitter, and guaranteed bandwidth.
- ✍ The 802.17 standard shall support dynamic weighted bandwidth distribution



MAC Functionality Requirements

- ✍ MAC should support
 - ✍ Multiple type of services
 - ✍ Committed bandwidth services endorsed by carrier SLAs
 - ✍ Overcommitted bandwidth services
 - ✍ MAC should provide services with bounded delay.
- ✍ Support arbitrary source destination traffic flows into the RPR shared medium.
- ✍ Committed bandwidth services should be never penalized in all circumstances.
- ✍ Carrier network services for metro and core
- ✍ Maximum link utilization
- ✍ Maximum spatial reuse



Bandwidth management Issue

- ✍ If MAC architecture allows lower class services interfering or even blocking the committed data services as a result of congestion,
 - ✍ carrier SLA can be violated.



Support for Virtual Output Queuing

- ✍ Problems if MAC proposal has no VoQ support:
 - ✍ Bandwidth management: MAC sets the access rate low to satisfy the bandwidth allocated by one congested destination
 - ✍ Severely limits the access rates to other uncongested destinations.
 - ✍ MAC client: (HoL) blocking problem occurs in a single queue access.
 - ✍ Frame destined to uncongested destination waits behind an frame congested destinations.
 - ✍ Low priority streams can congest a destination, as a result committed bandwidth to all destination can suffer.(violation of SLA's)

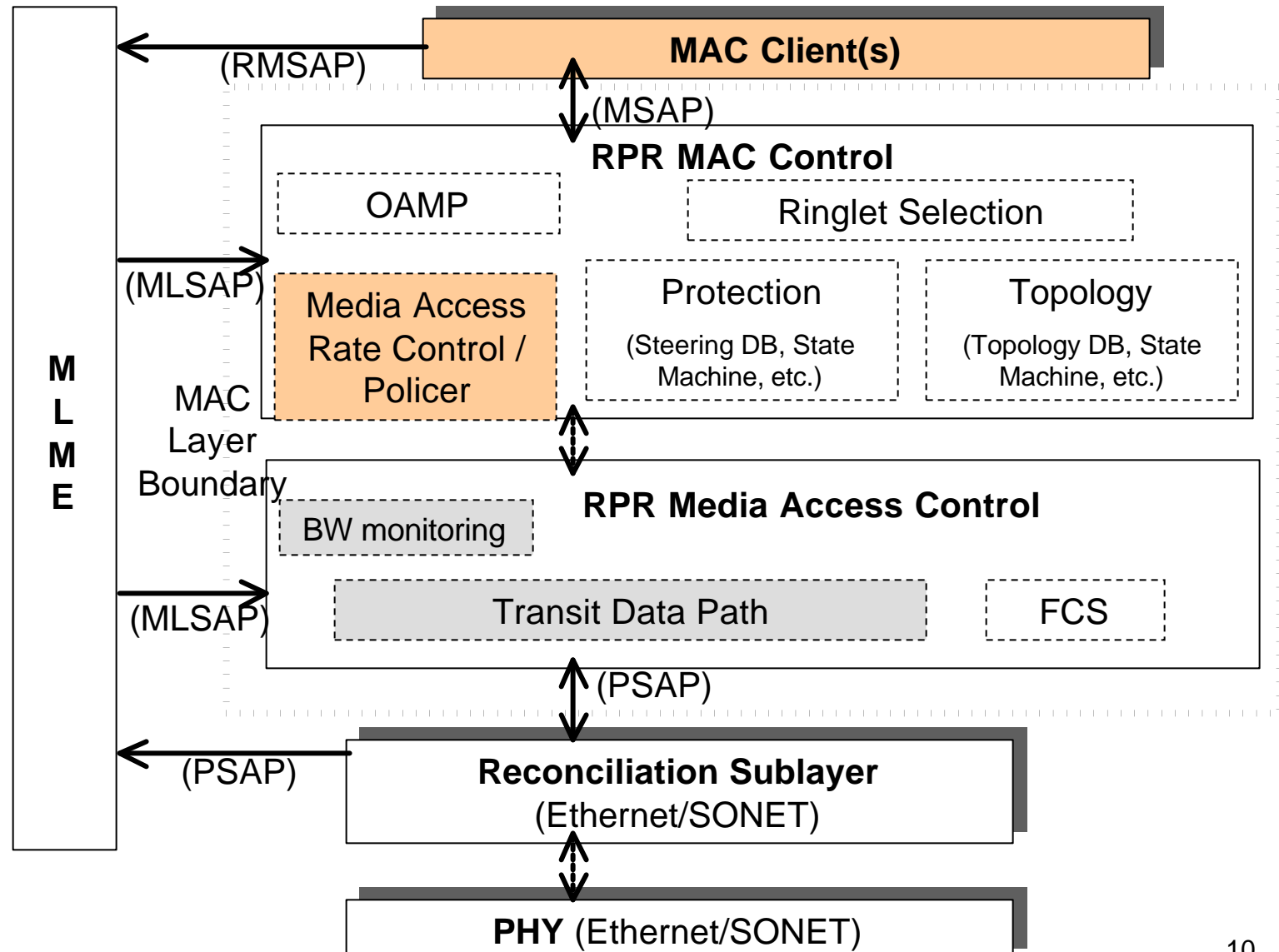


Proposed Solution

- ✍ Bandwidth management propagates independent media access rate control for each ring segment in the RPR MAC.
 - ✍ Monitors committed and overcommitted bandwidth separately.
- ✍ Media Access control controls the access of overcommitted traffic into the media, such that congestion is avoided.
- ✍ Support for Virtual Output Queuing (VoQ) in the MAC client.



RPR MAC Framework and Relevant QoS Components





Media Access Rate Control

- ✍ Bandwidth management block monitors the transit bandwidth and advertises link availability as RCM message.
- ✍ Every node in a distributed fashion determines the weighted fair share:
 - ✍ Maximum bandwidth contribution of a given source node for every link segment in a ringlet is determined.
- ✍ At every node, RPR MAC controls bandwidth access from the MAC client into the media on per link segment basis to avoid congestion.

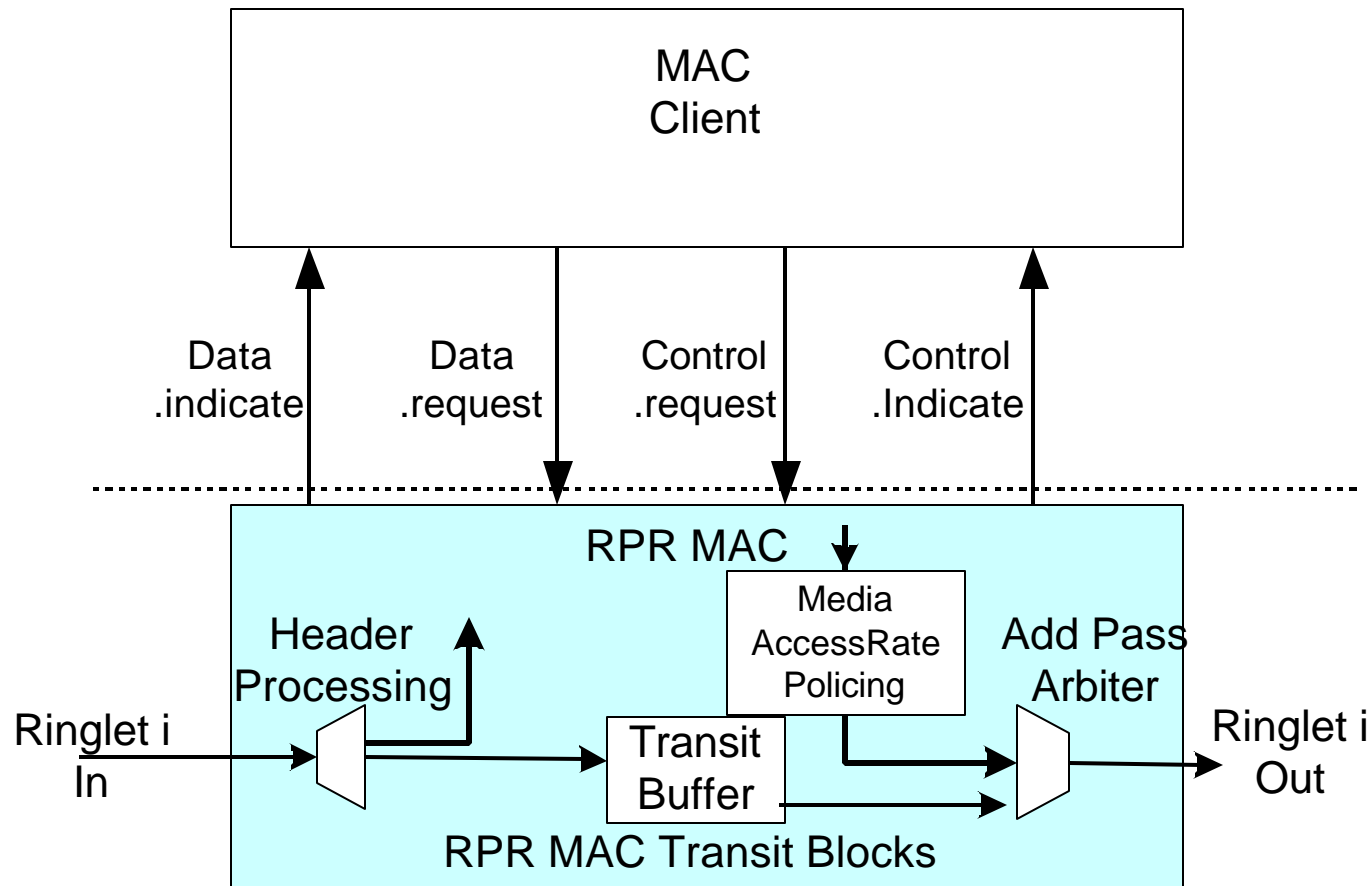


Support for RPR VoQ MAC client

- ✍ Enhanced client implement Virtual Output Queuing functionality to avoid Head of Line (HoL) blocking.
- ✍ Traditional Clients: do not implement virtual output queuing:
 - ✍ LLC client
 - ✍ Bridging client
 - ✍ Routing client
 - ✍ Other clients
- ✍ Need to serve multiple types of clients
 - ✍ Traditional services with no VoQ.
 - ✍ Traditional services with VoQ.
 - ✍ New services with VoQ.

Compatibility to traditional clients while supporting the new clients very important.

RPR MAC and Client Interaction





Media access control signals

There are two type of MAC_control.indication RPR MAC conveys to the MAC clients:

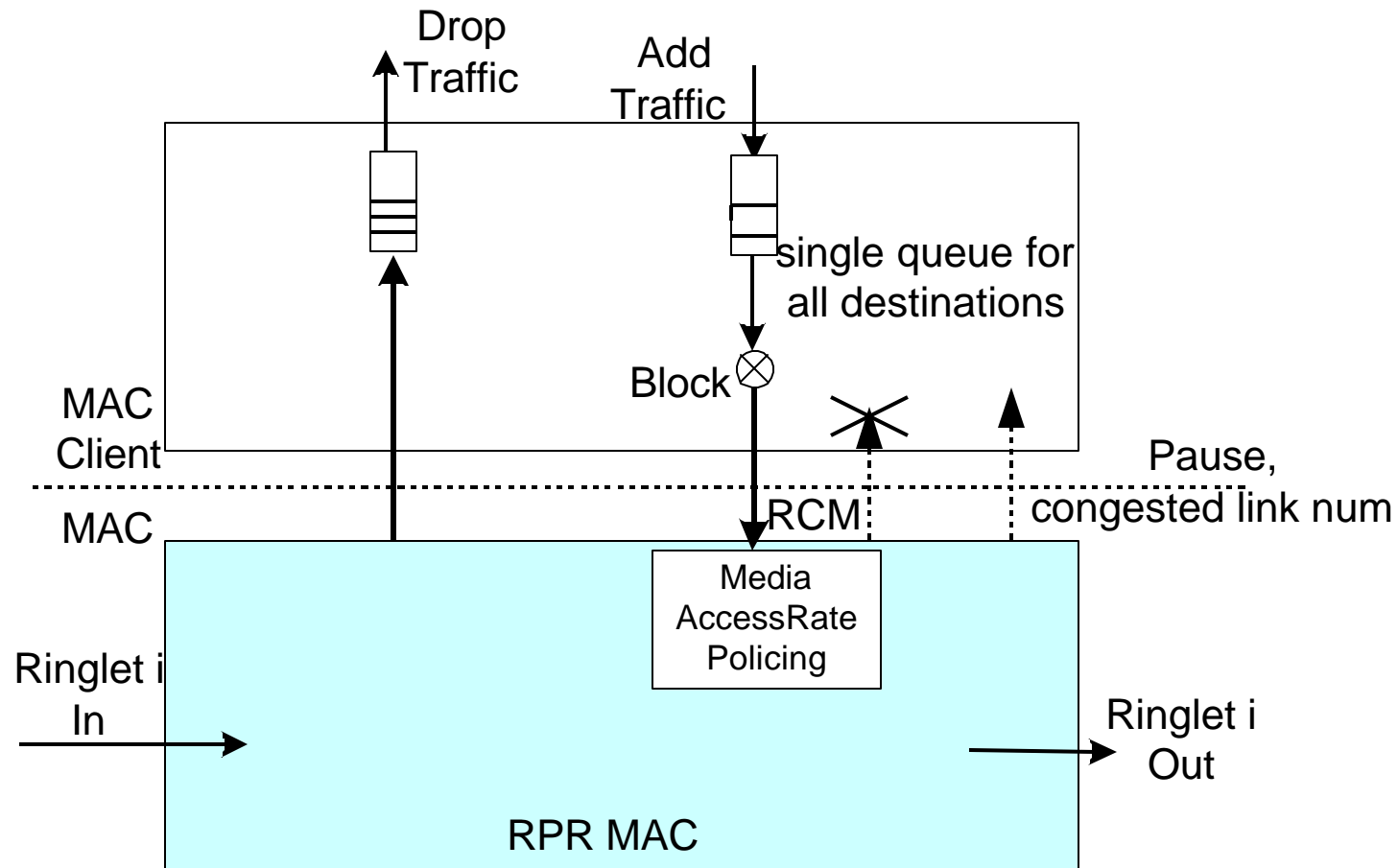
- ✍ **Pause signal:** The pause signal indicates:
 - ✍ One of the link segment bandwidth is violated.
 - ✍ Link segment number.
- ✍ **RCM signal:** The RCM message indicates to the MAC:
 - ✍ Bandwidth available on per link segment basis.
 - ✍ MAC client has a choice of using the RCM information to shape the traffic before sending it into the RPR MAC.
 - ✍ Avoids pause signals.

The pause signal and RCM signal overlap in terms of functionality

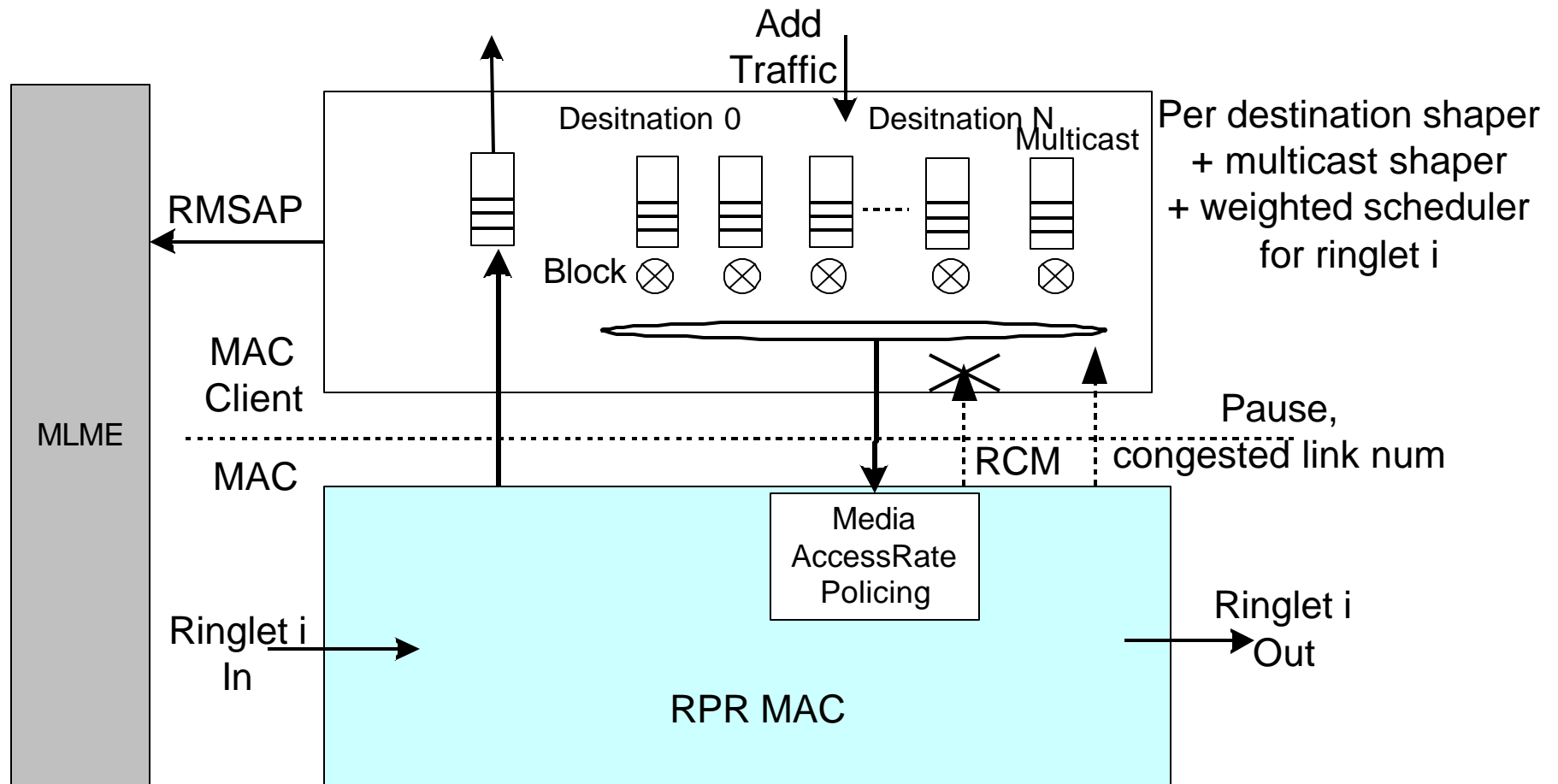
- ✍ Both necessary to serve traditional and the new clients.



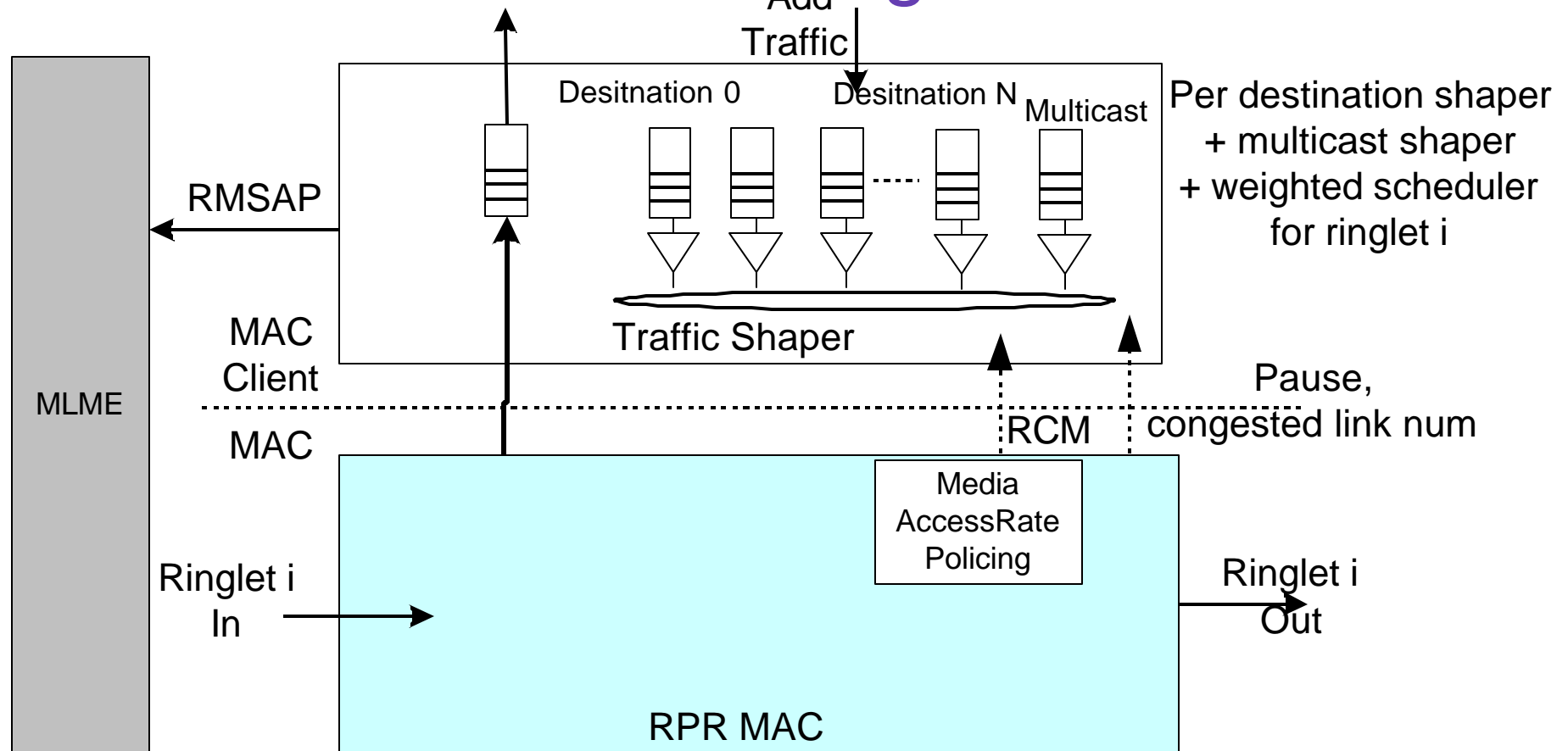
RPR MAC Client: Traditional Clients



New MAC Client : Virtual Output Queuing

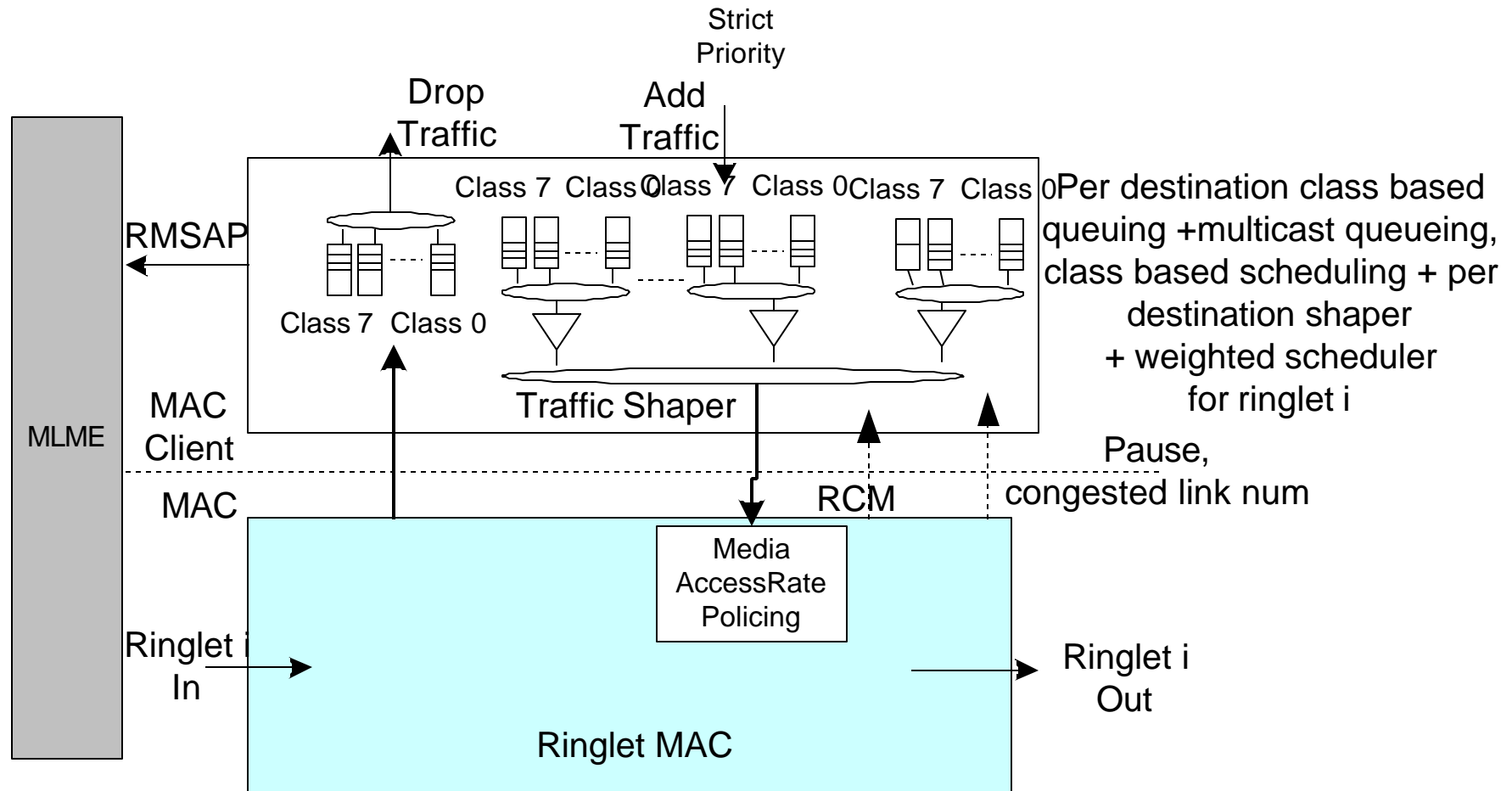


New MAC Client : Virtual Output Queuing



✍ Sharing target available link segment bandwidth in the ring between multiple destination flows traversing that link.

New MAC Client Class of Service based queuing per destination





Conclusion



- ✍ Conforms to the 802 shared MAC architecture.
- ✍ Supports carrier class services.
- ✍ Virtual Output Queuing to avoid HOL blocking.
- ✍ Supports traditional simple clients: LLC, Bridging, Routing as well as new client that avoid HoL blocking.
- ✍ Scalable for high-link speeds and cost effective.



Media Access Rate Control

At each 10usec interval

for each link segment

calculate the node (for this MAC) allowed BW, fj.

$$fj = rj + wj * RCF$$

give credit for each segment

if (segment_credit) < 15,000,000

segment_credit += fj

if (segment_credit) < 0 // client BW exceeds limit

assert PAUSE.indicate

end FOR

At each DATA.request

if no PAUSE.indicate asserted, accept DATA.request

for each segment between this and the dest nodes

deduct segment credit

*segment_credit -= frame_length*10,000*

end FOR

RPR Network

