RPR MAC Transit Path Design

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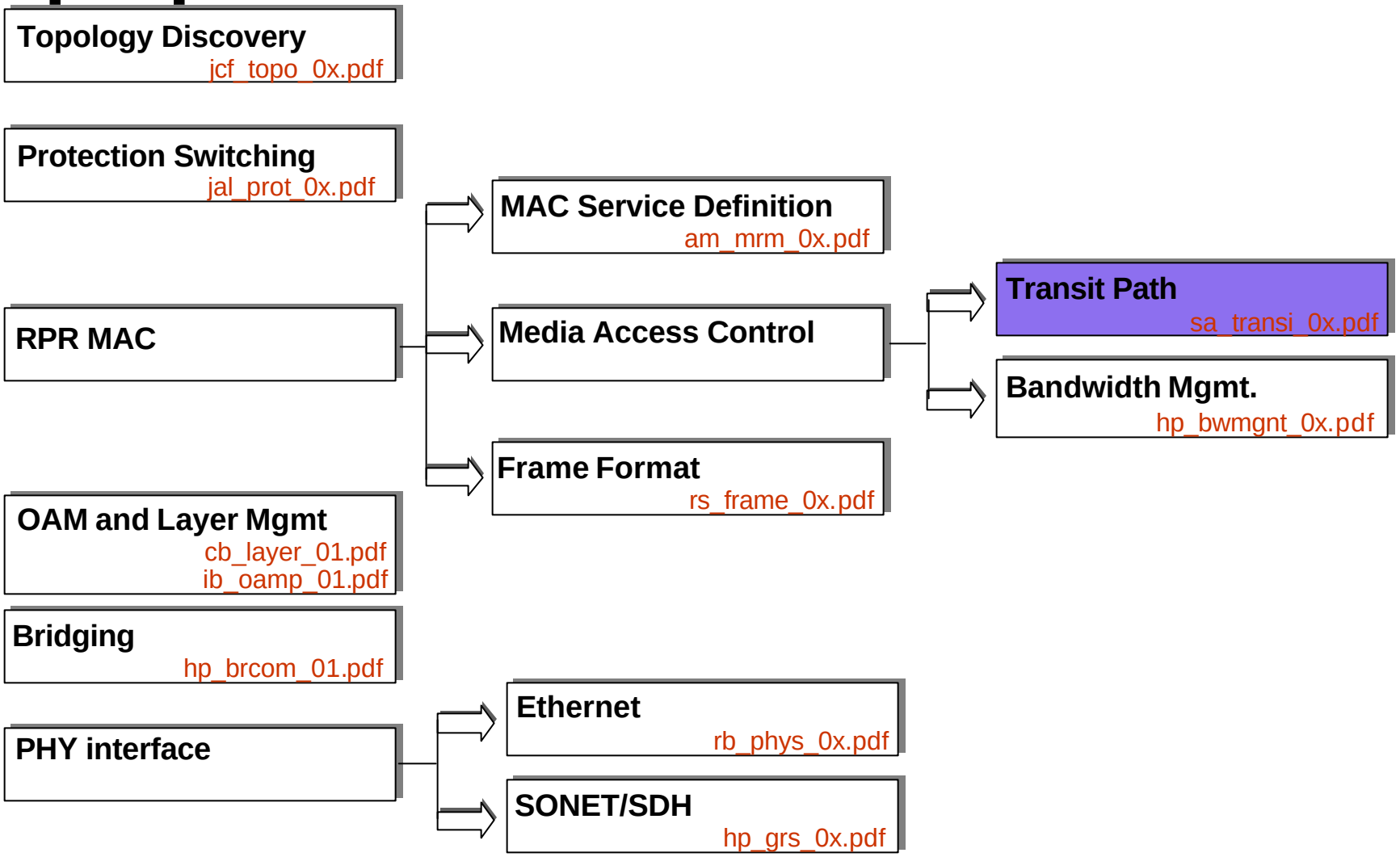
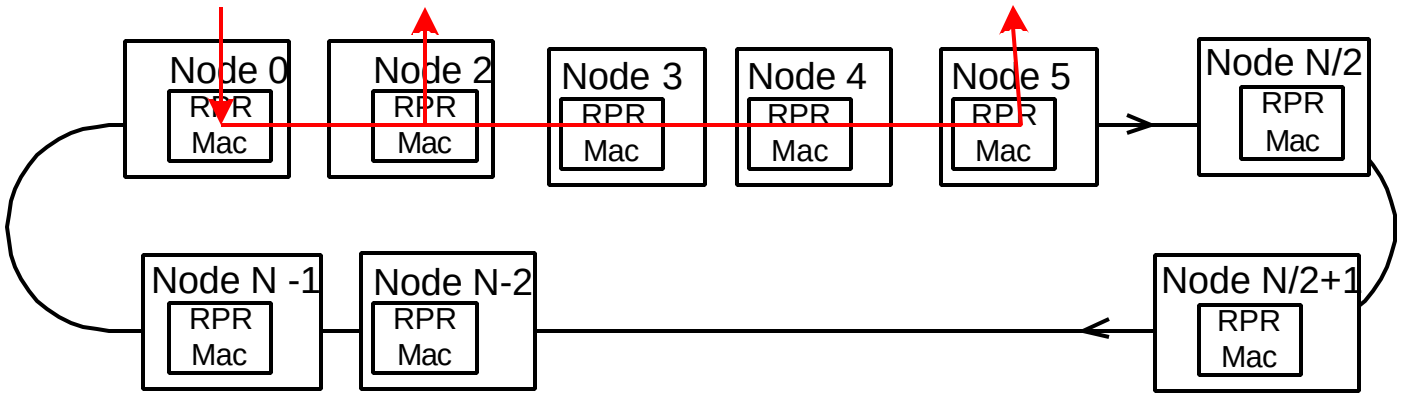
Components of a complete RPR proposal



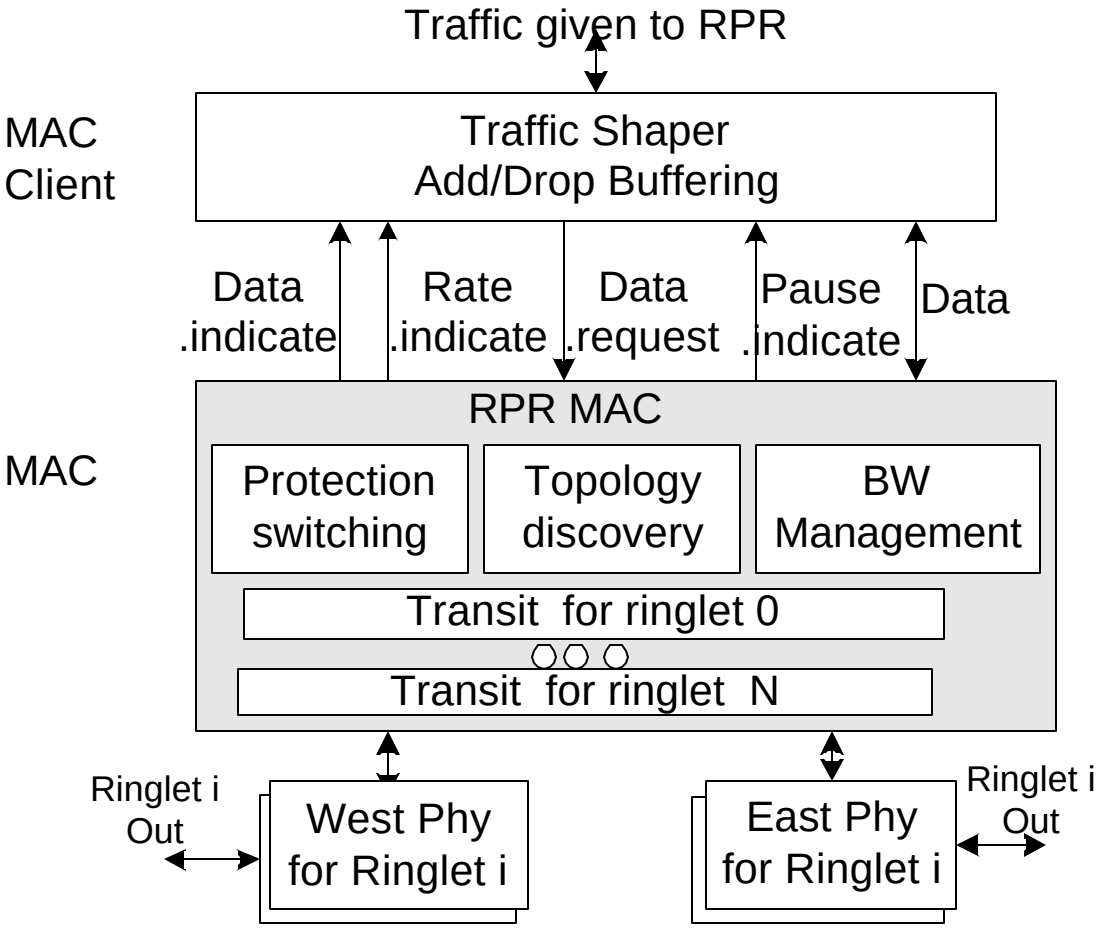
Outline

- RPR System Architecture
- RPR MAC Requirements and Objectives
- RPR MAC Framework Proposal
- RPR MAC Transit Path Design
- Optional Modes of Operation
- RPR MAC Client Add/Drop Path Design
- Conclusion

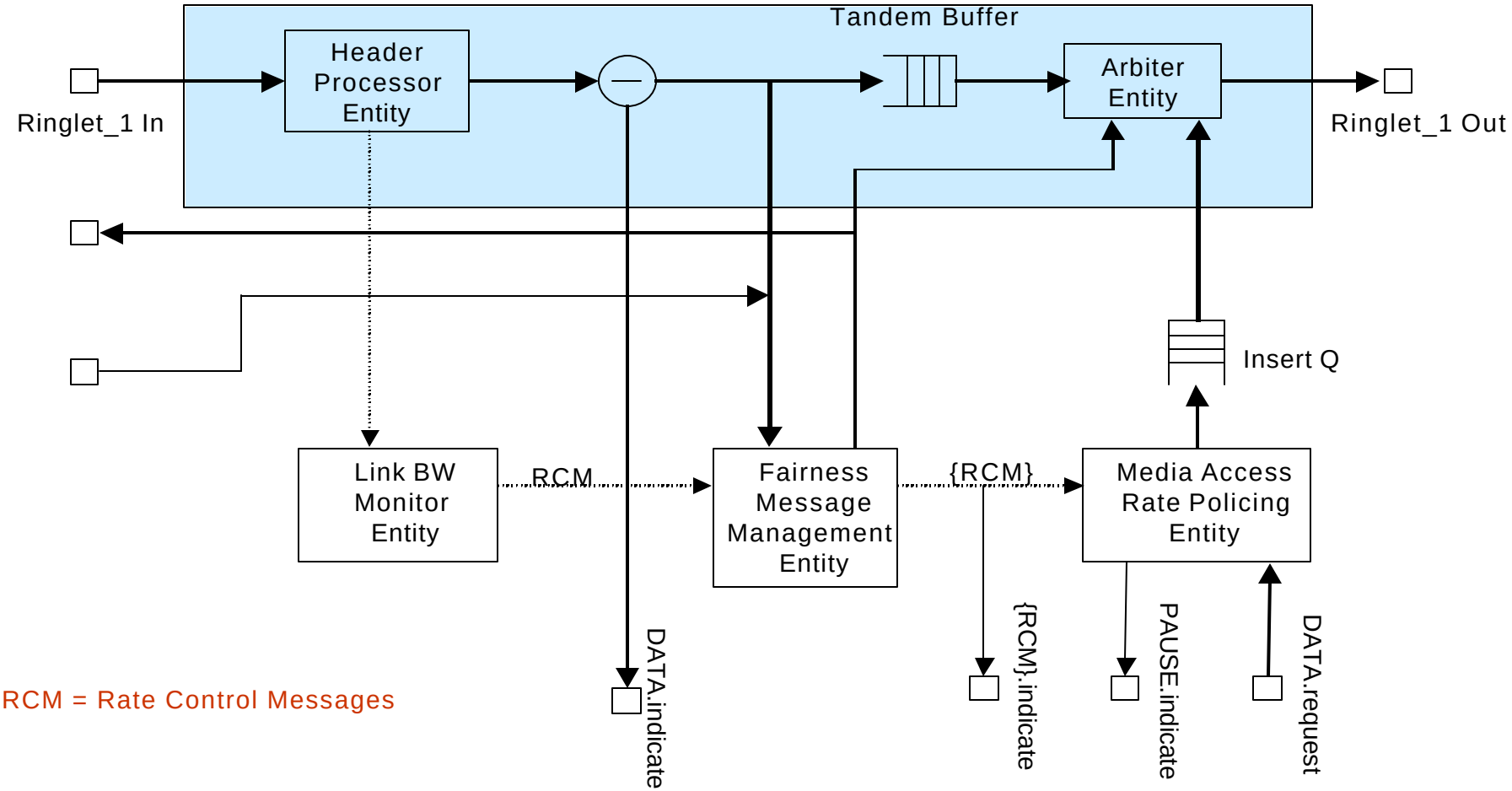
RPR Network


Node 0
RPR Mac
Node 2
RPR Mac
Node 3
RPR Mac
Node 4
RPR Mac
Node 5
RPR Mac
Node N/2
RPR Mac
Node N -1
RPR Mac
Node N-2
RPR Mac
Node N/2+1
RPR Mac

RPR System Architecture



MAC Architecture

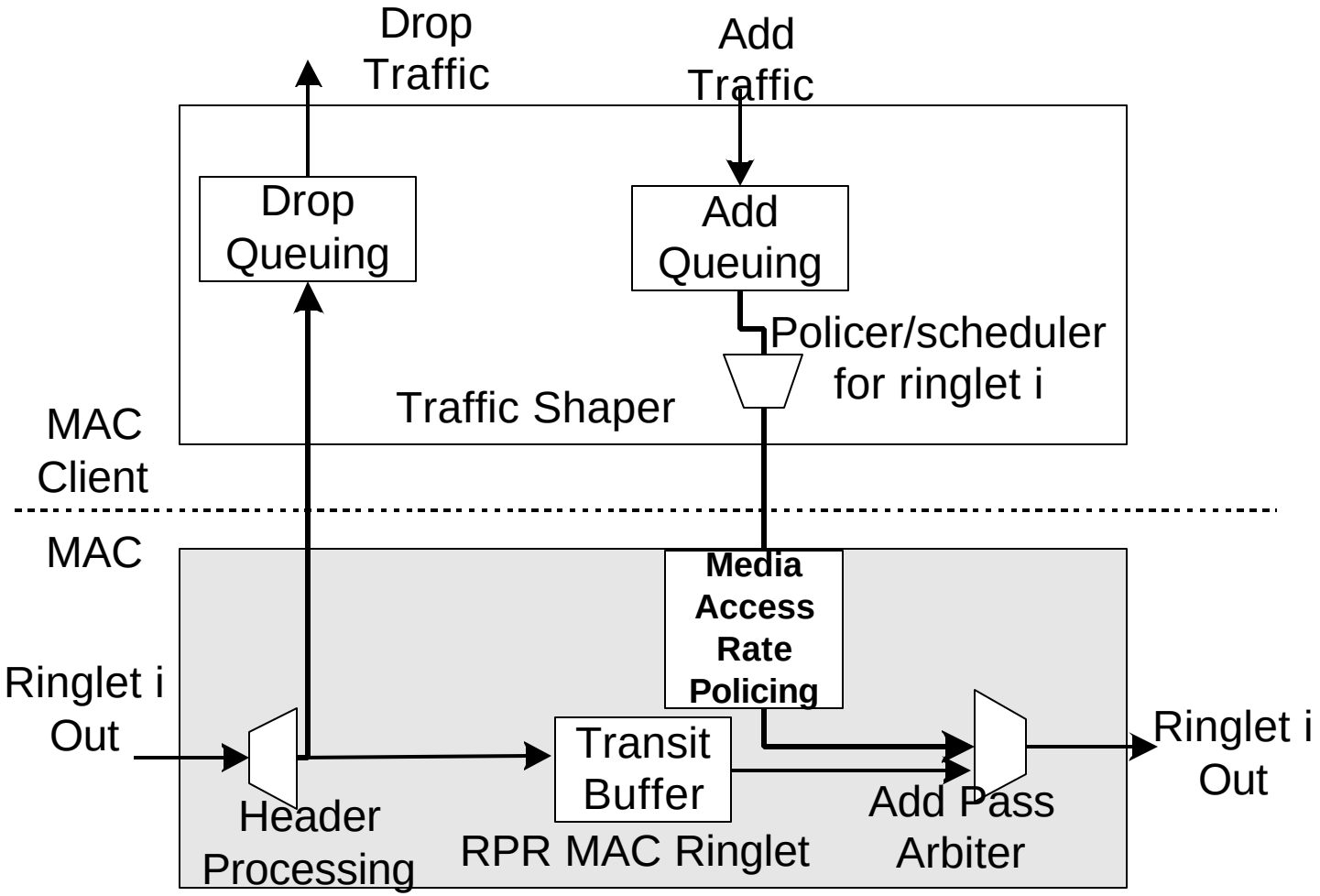


RCM = Rate Control Messages

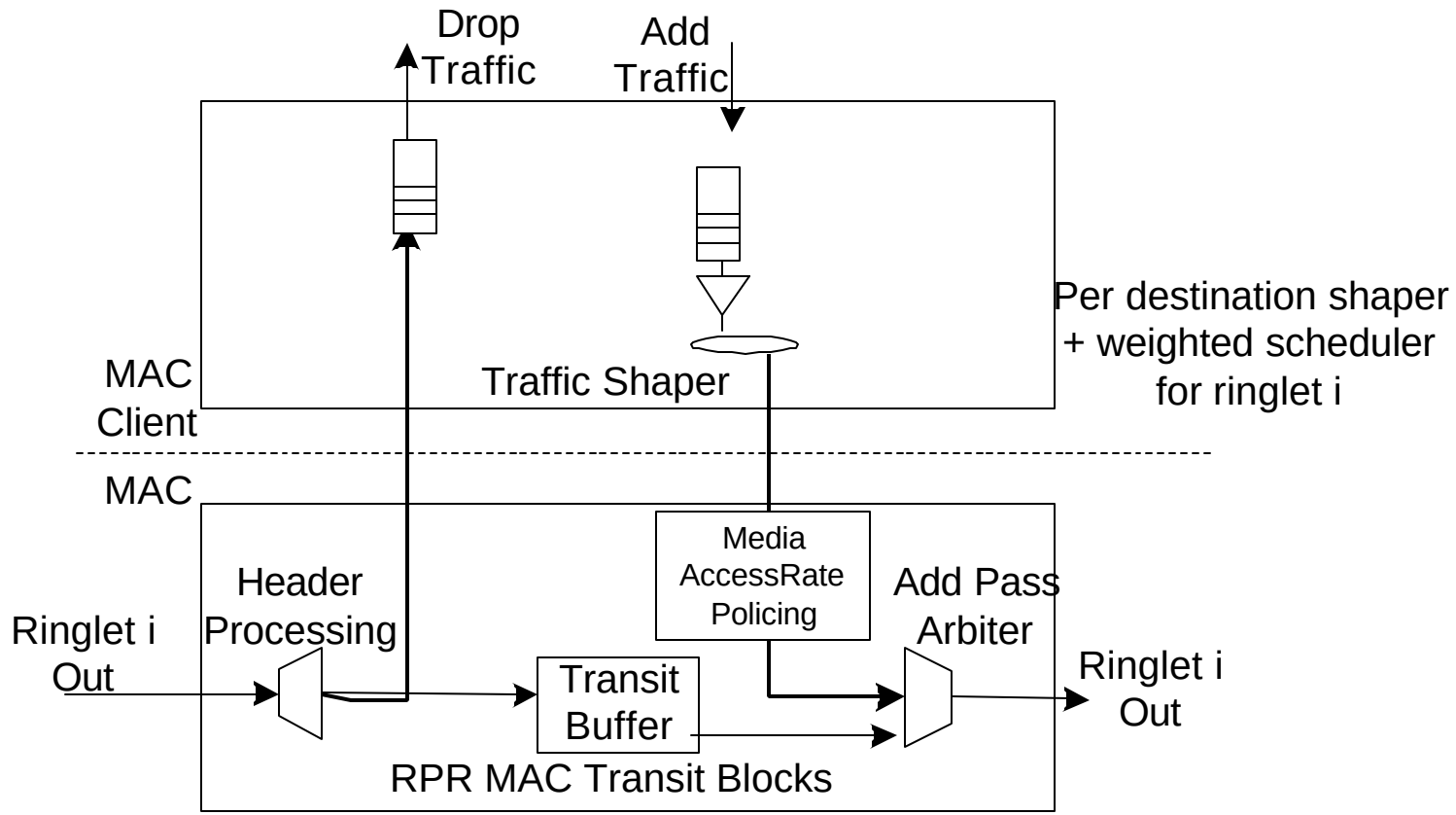
Objectives and Requirements for the Transit Path

- The transit path is part of the shared medium
- The transit path is lossless.
- The transit path implements destination and source stripping.
- The transit path implements broadcasting and multicasting: drop and pass
- Minimal buffering in the transit path
  - Minimize the cost of the standard RPR MAC chip saving memory cost
  - Minimize delay in the transit path
  - Maximize scalability as RPR MAC chip scales at higher-speed and multiple ringlets.

RPR MAC: Transit Data Path



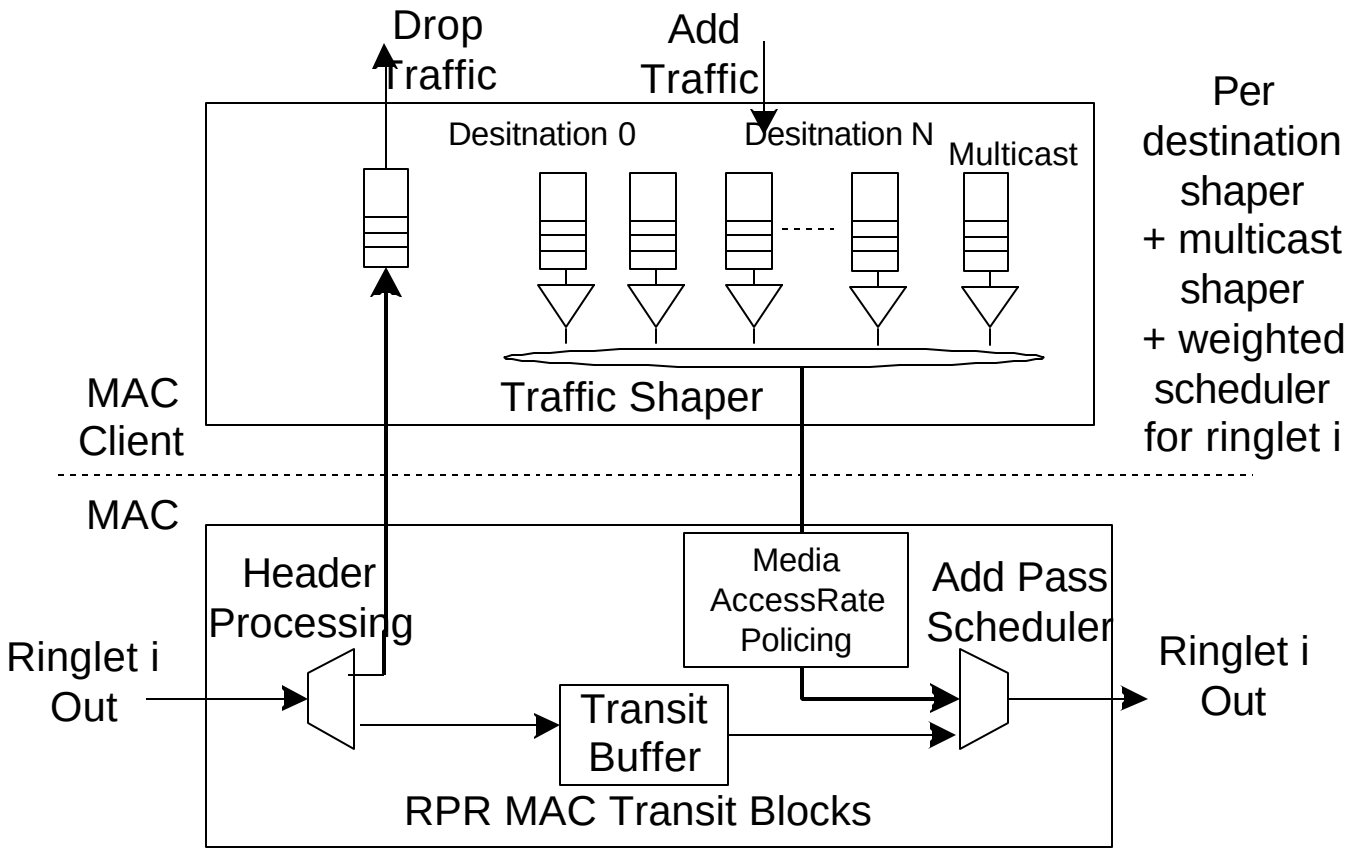
MAC Client Add/Drop Path Options



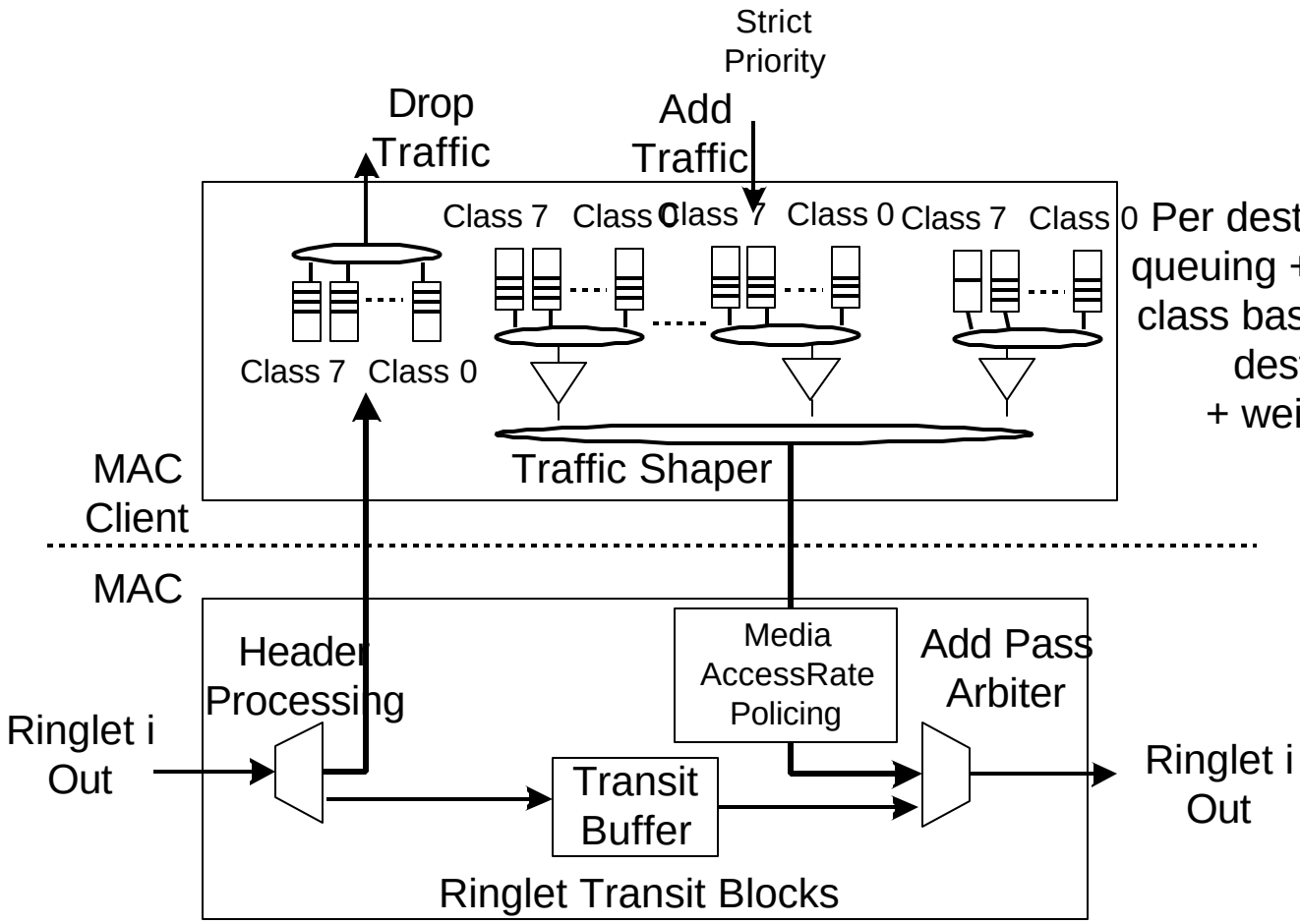
Support for Virtual Output Queuing

- Objective: maximize the spatial reuse and the link utilization for frame flows with arbitrary (source, destination) pairs.
- Problems if MAC proposal has no VOQ support:
  - MAC sets the access rate low to satisfy the bandwidth allocated by one congested destination
    - Severely limits the access rates to other uncongested destinations.
  - (HoL) blocking problem occurs in a single queue access.
    - Frame destined to uncongested destination waits behind an frame congested destinations.
- Proposed Solution
  - Signaling messages propagates independent media access rate control for each ring segment in the RPR MAC.
  - Virtual Output Queuing (VoQ) in the MAC client

MAC Client Add/Drop Path Options: Virtual Output Queuing



MAC Client Add/Drop Path Options: Class of service based queuing per destination



Per destination class based queuing +multicast queueing, class based scheduling + per destination shaper + weighted scheduler for ringlet i

Optional modes of operation and transit buffer considerations

- Cut-through Mode:
  - Frame transmission can begin before it is entirely received.
  - RPR header should be received entirely before beginning transmission out of the outgoing ringlet, since the header has to be processed.
    - Reduces the delay that frames experience in the transit path.
- Store & forward mode:
  - Frame is entirely received before it is considered for transmission.
  - This mode of operation allows FCS errored frames to be stripped and transit error counter incremented.
    - Eliminates degraded frames in the transit path at instance of FCS error.

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
```

Mac Transit Path

This Proposal:

- Conforms to the 802 shared MAC medium.
- Scalable for high-link speeds.
- Cost effective solution that minimizes the cost of silicon implementation.
- Vendor differentiated RPR system architecture.

Other Proposals:

Summary: