SLA Delivery over RPR

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Coriolis NETWORKS

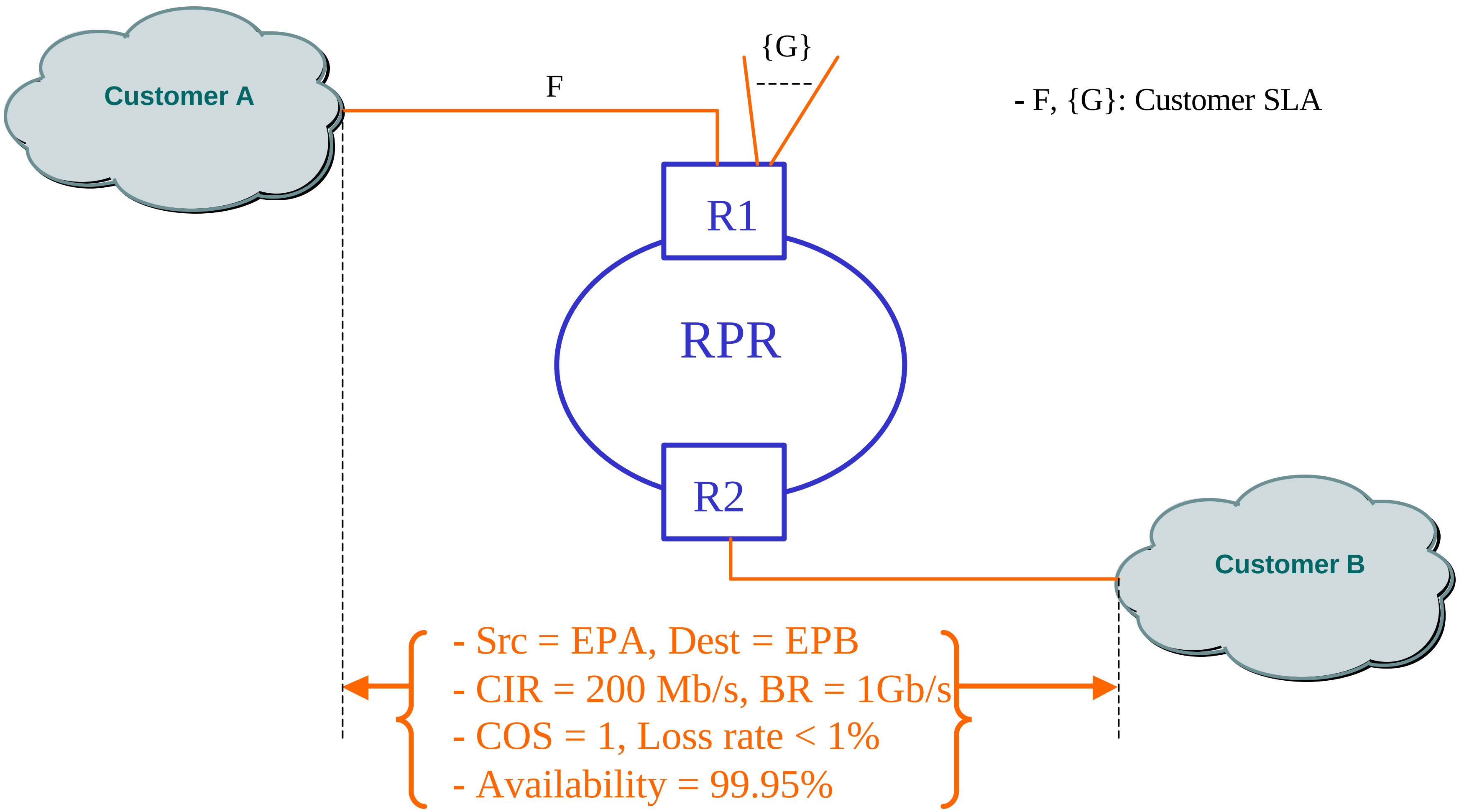
SLAs: Carrier Perspective

- Billable and enforceable services
- Better control of network resources and usage
- Challenge:
  - Adhere to the SLAs in a stat-muxed network

What are SLAs?

- Endpoint specification
- Traffic descriptor
  - CIR, BR, etc
- QOS/COS
  - Latency, loss ratio, etc
- Availability
  - Protection class, etc

SLA Example

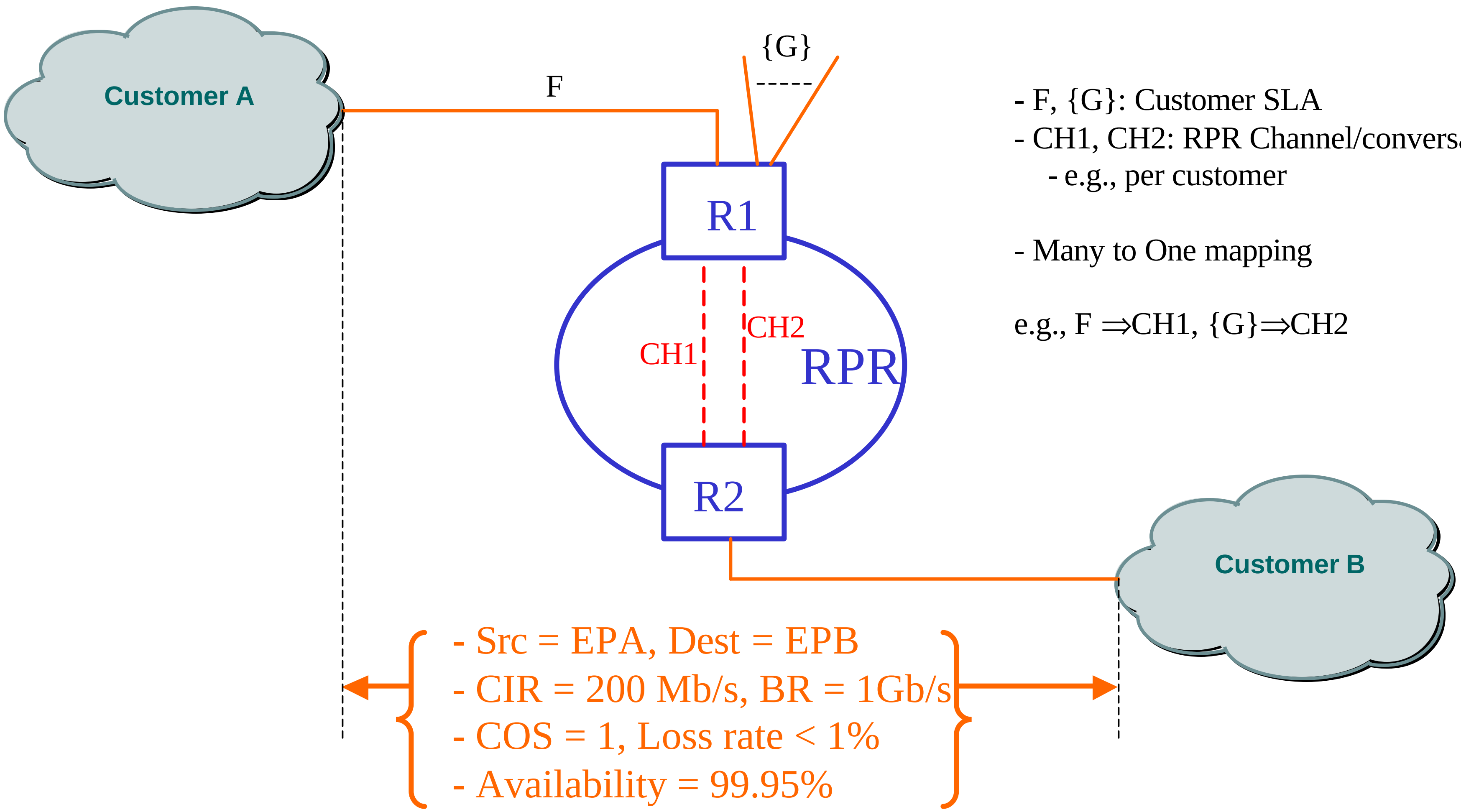

Customer A
F
{G}
- F, {G}: Customer SLA
R1
RPR
R2
Customer B
- Src = EPA, Dest = EPB
- CIR = 200 Mb/s, BR = 1Gb/s
- COS = 1, Loss rate < 1%
- Availability = 99.95%

SLA Example – RPR Context

- F, {G}: Customer SLA
- CH1, CH2: RPR Channel/conversation!!
    - e.g., per customer

- Many to One mapping

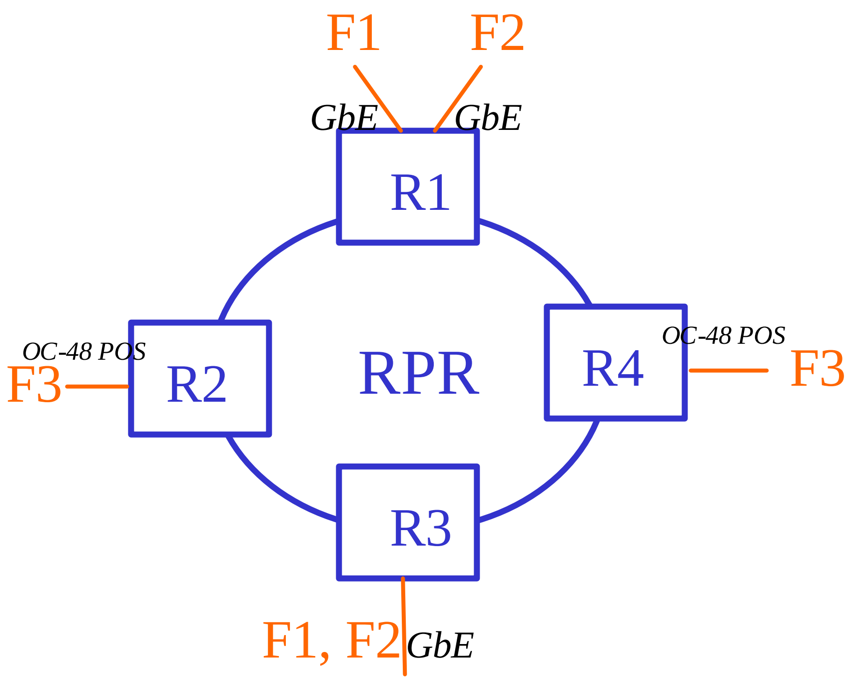
e.g., F ⇒CH1, {G}⇒CH2



SLA Enablers

- CAC or N/W Engg - NOT a MAC function
- Traffic policing – NOT a MAC function
  - E.g., Policer with a marker
- SLA-aware bandwidth management
  - Intelligent discard
  - SLA-aware media access
  - Intelligent congestion notification

Example



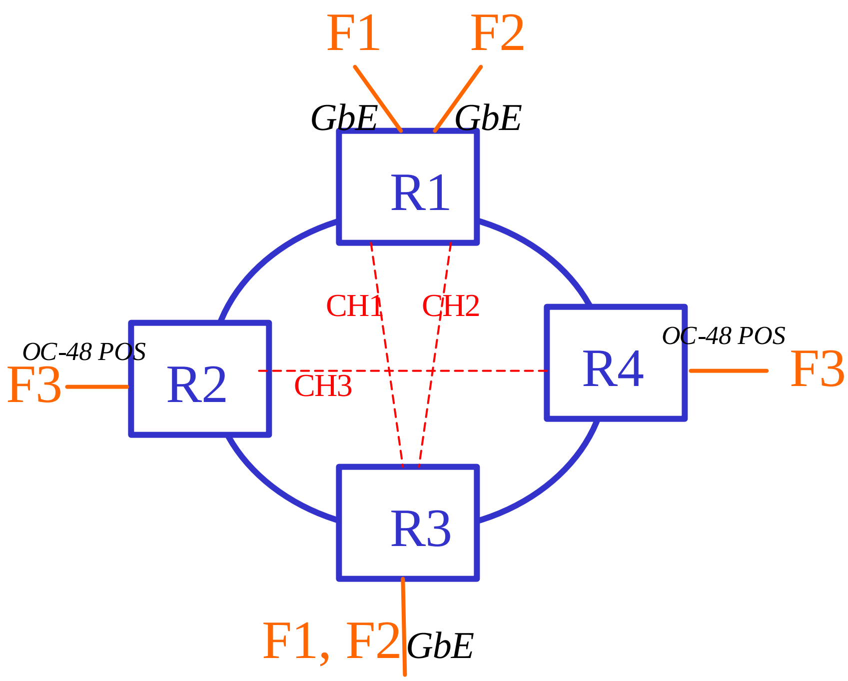
Stat-Mux example:
SUM (CIR) ≤ RBW
SUM (BR) = K*RBW, K ≥ 1

RBW = 2.48 Gb/s
F1: {0.38 Gb/s, 1.0 Gb/s}
F2: {0.2 Gb/s, 1.0 Gb/s}
F3: {1.0 Gb/s, 2.48 Gb/s}

K = 4.48/2.48 = 1.8

Remaining capacity for burst = 0.9Gb/s

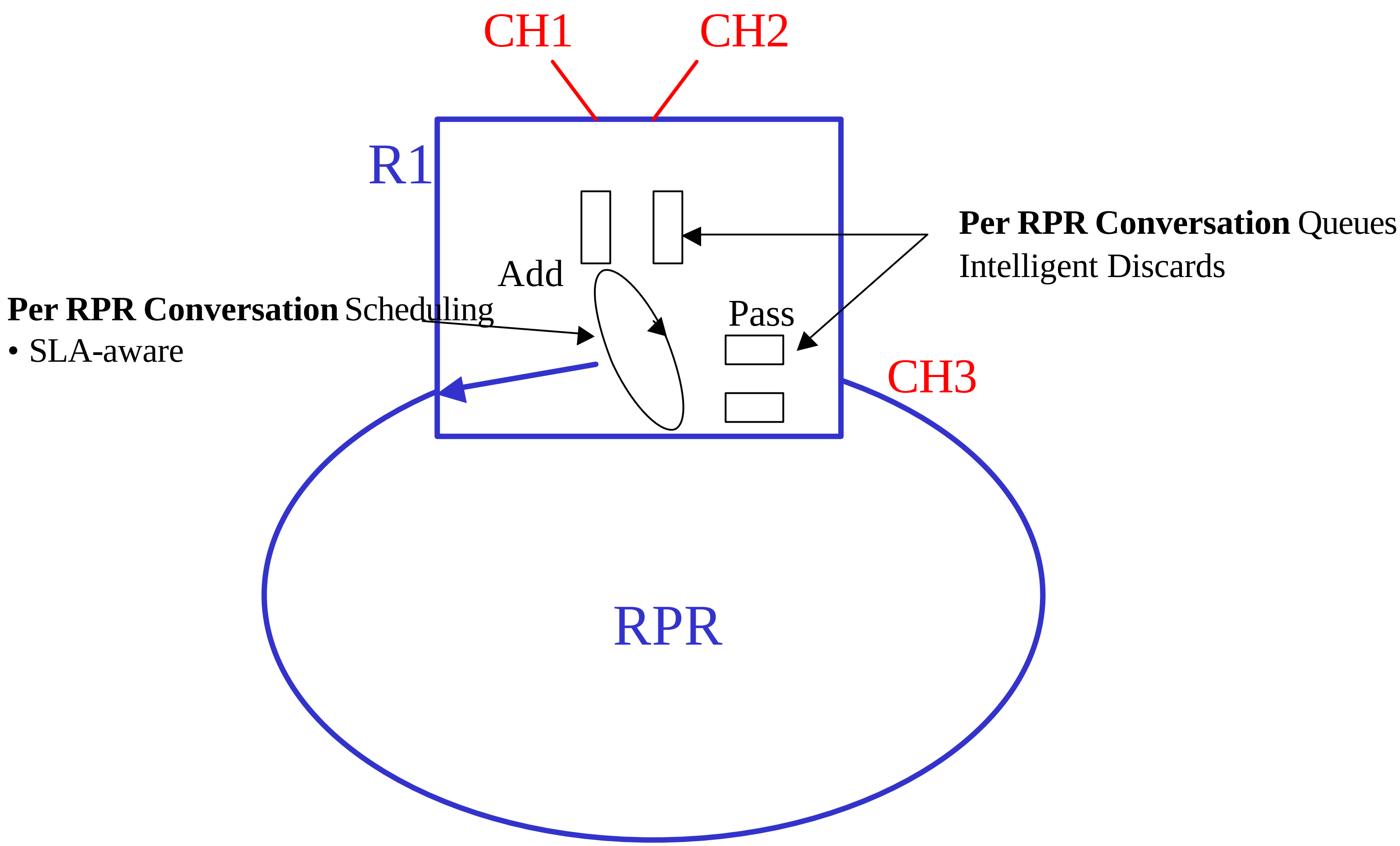
Example



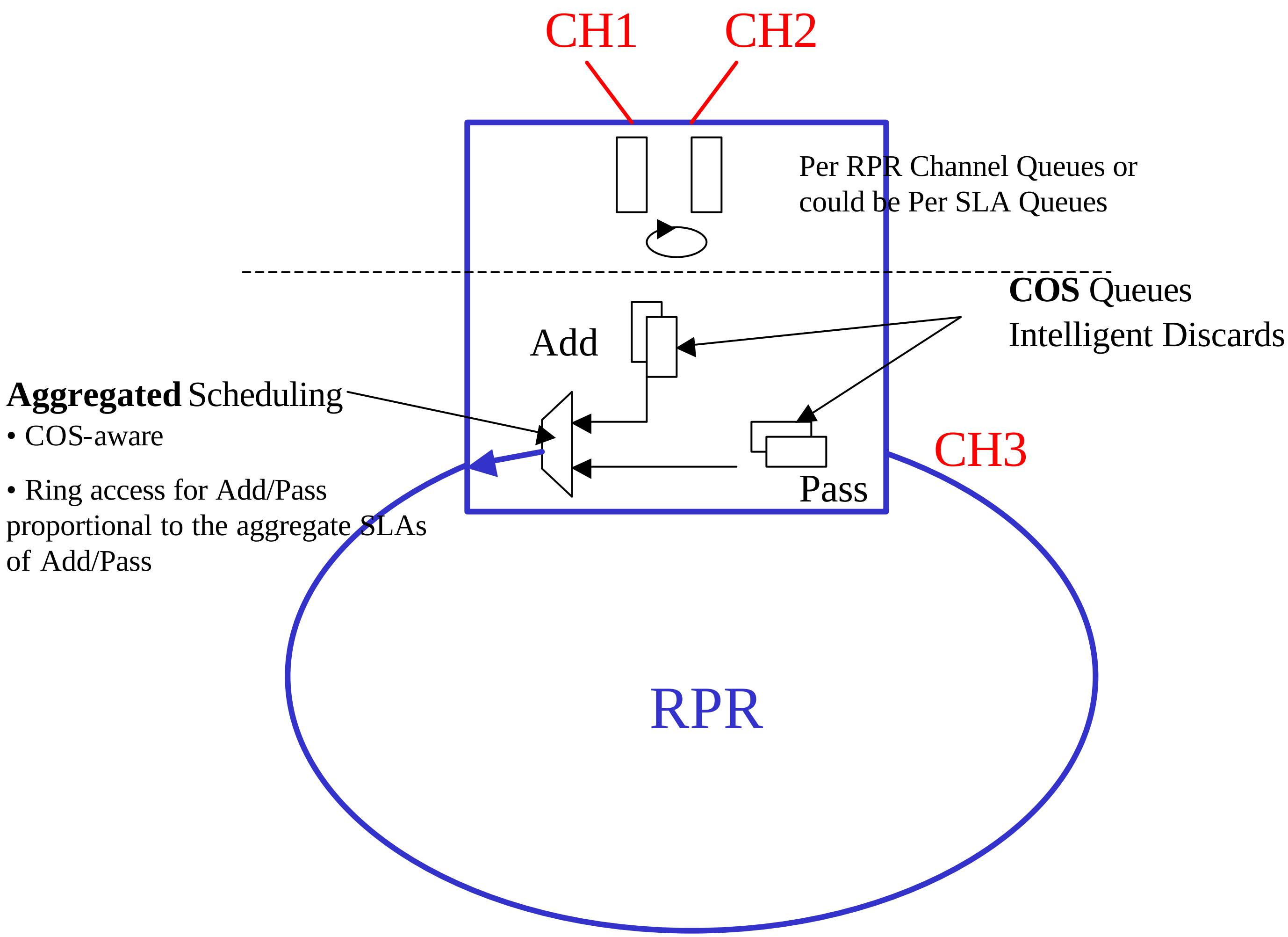
F1, F2, F3: SLAs

CH1, CH2, CH3: RPR Channels/Conversations

Bandwidth Management at each Node during Media Access (Ideal)



Bandwidth Management at each Node during Media Access(Approximate)



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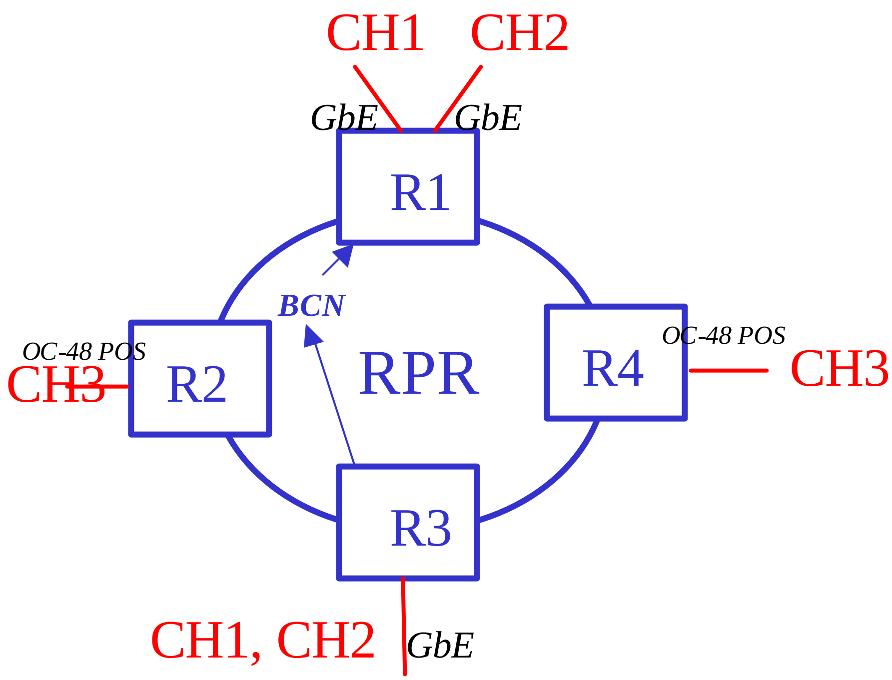
Example



Remaining capacity for burst = 0.9Gb/s

Example “fairness” policy under saturation:
Each node distributes the burst capacity equally.

Locally optimal decision @ R1 will yield:
CH1 = 0.68 Gb/s,
CH2 = 0.5 Gb/s,
CH3 = 1.3 Gb/s

This causes congestion at node R3!!!
- Backward congestion notification (BCN)

What is required?

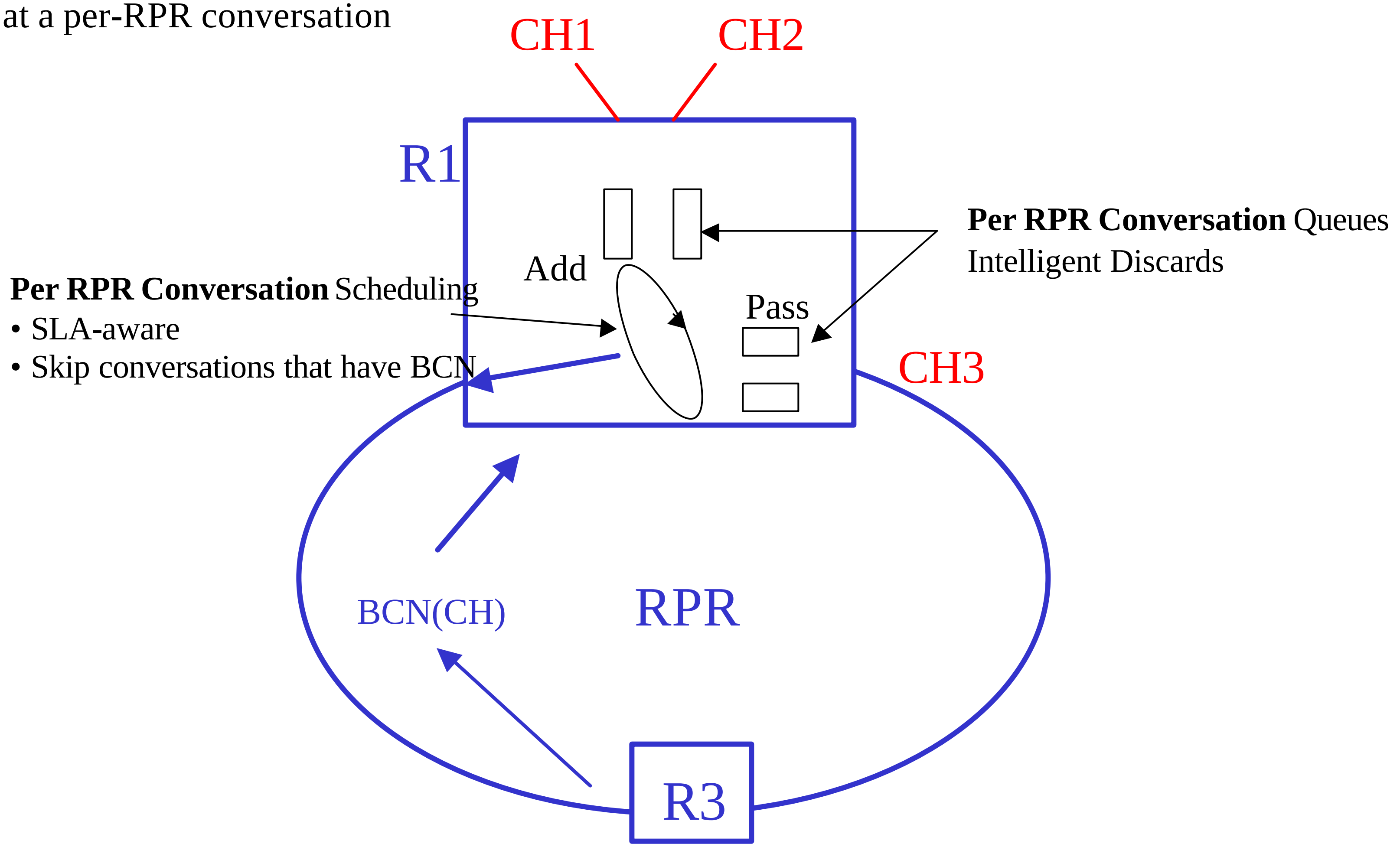
– Knowledge of congestion at connection endpoints important

– Aggregated scheduling with aggregated BCN (hop-by-hop) can potentially violate individual SLAs
  - HOL Blocking

Ideal Distributed Solution

- Per-RPR conversation scheduling at each node's MAC

–BCN at a per-RPR conversation level



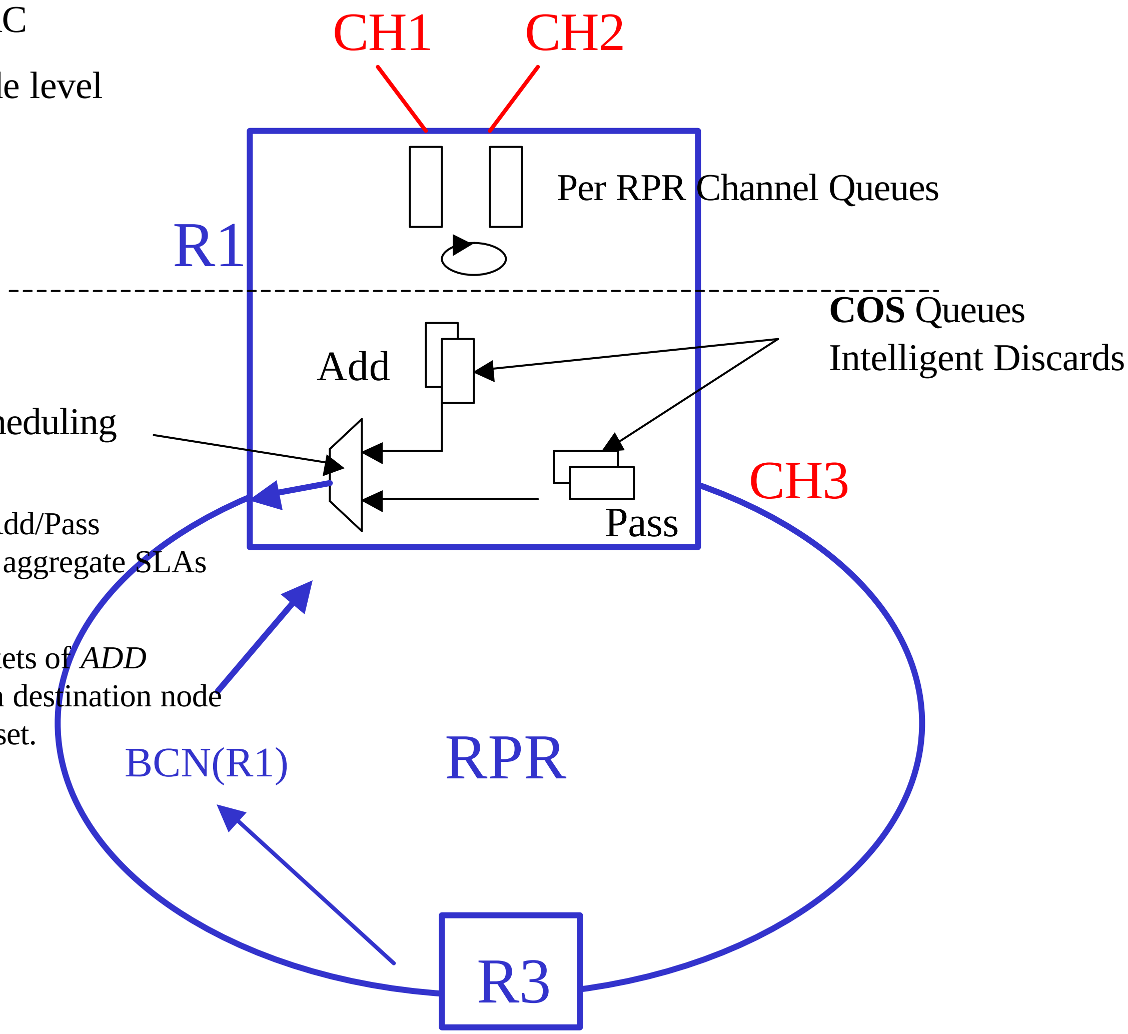
Approximate Distributed Solution

–Aggregated scheduling (based on aggregated SLAs) at each node's MAC

–BCN at a per-source node level

Aggregated Scheduling

- COS-aware
- Ring access for Add/Pass proportional to the aggregate SLAs of Add/Pass
- Skip or drop packets of *ADD* channels going to a destination node that has BCN(R1) set.



Hooks in the MAC

- Input hooks to the MAC that indicates the proportion of the ring that corresponds to ADD traffic
  - PASS_BW = RBW – ADD_BW
  - Proportion determined such that the SLAs are adhered to, and fairness is achieved for the remainder of BW.
- Intelligent Congestion notification from the destination MAC
  - At least at a per source node level
    - Just affects the ADD traffic at the source node for this destination
    - Doesn’t affect the PASS traffic at the intermediate nodes

Conclusions

- Key ingredient for ease of SLA delivery
  - SLA-aware media access
    - SLA-aware scheduling at each source node
    - Intelligent congestion notification from destination nodes