Merits of Open Loop

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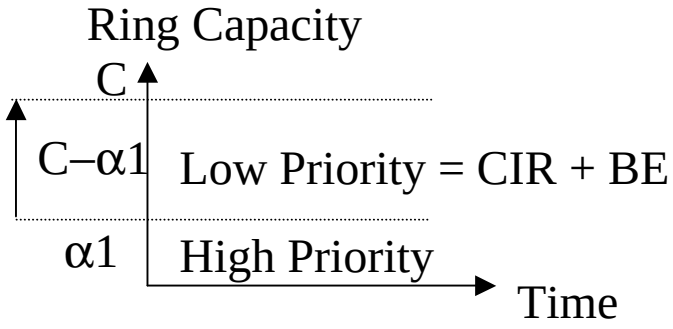
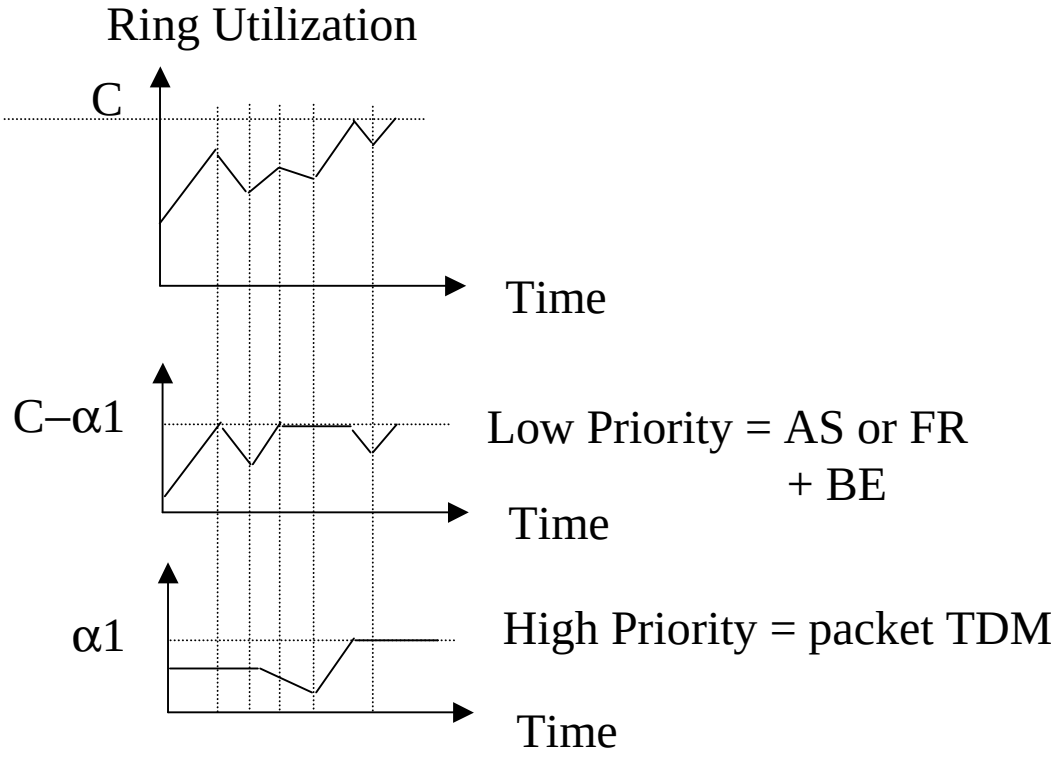
Merits of Open Loop

- Allows for dynamic partitioning between the High and Low priority traffic
- No HOL blocking issues
- Comparable performance to CA
- Relatively low configuration and operational complexity
- Not prone to getting out of tune, or link aggregation issues

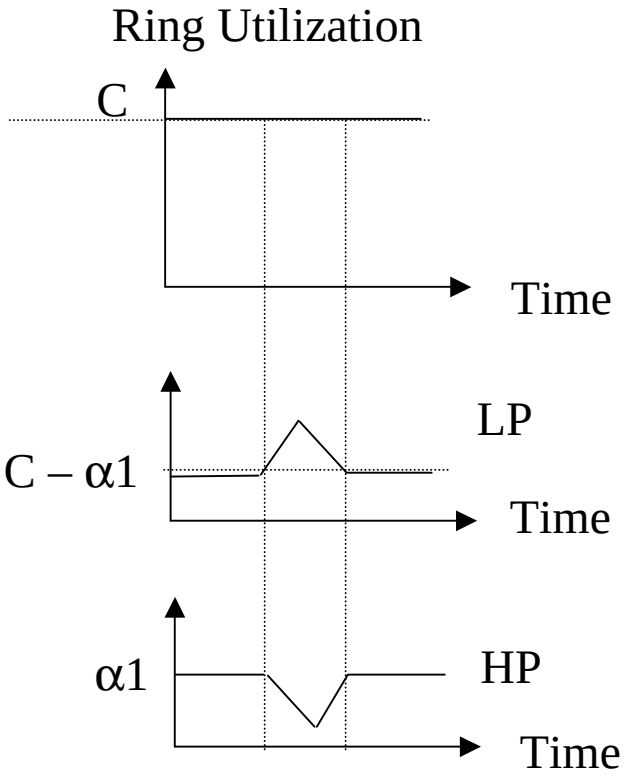
Stat-muxing High & Low Priority Traffic

Static Partitioning = no stat-muxing





Dynamic Partitioning



It is inconceivable to have:
- Close to 100% ring utilization
- Consistent bounded delay for HP
- & small Transit Buffers with no loss on the ring

Can't have our cake and it it too

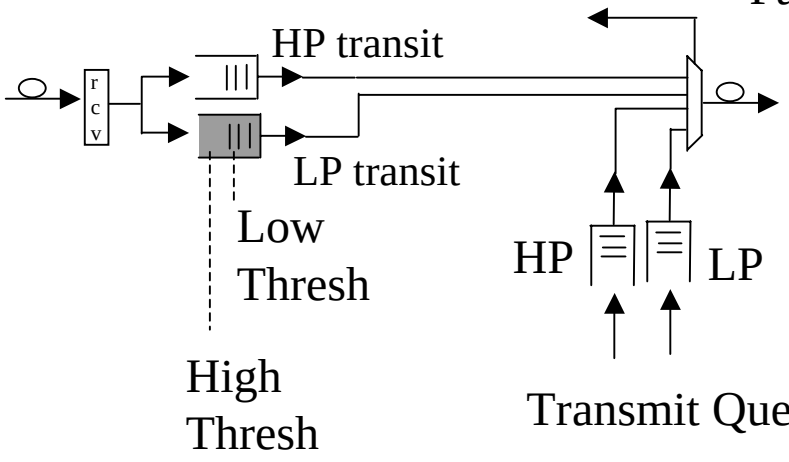
Open loop caters to dynamic partitioning, CA may not

3 examples of congestion avoidance

References

- SRP-fa, Spatial Re-use Protocol
  - rfc2892
  - Conexant SRP MAC overview
  - SRP-fa performance evaluation 3/14/01
- iPT-CAP, Inter WAN Packet Transfer
  - iPT
  - iPT-CAP 07/11/00
  - iPT fairness CAP simulation report
- VOQ-aware MAC
  - Proposed VOQ-aware MAC 05/01
  - Simulation Results 03/12/01

SRP-fa



Fairness signal = If (congested)

{ rev_usage = MIN (lp_my_usage, rcvd_usage) }

// fair_usage = min(my_usage_on_ring)

Table of SRP Scheduling Order

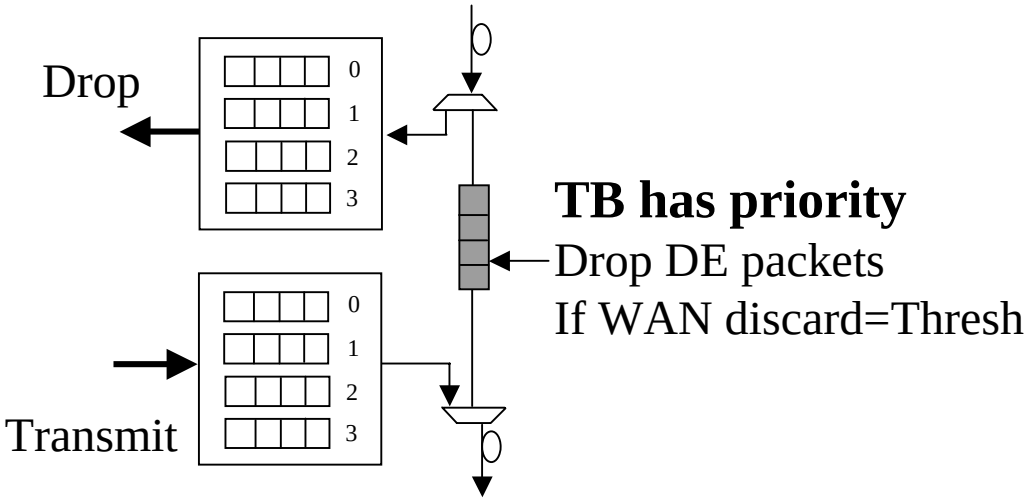
! congested && (my_usage < allow_usage)	congested || {(lo_tb_depth>0) && (my_usage > fwd_rate)}	(lo_tb_depth> TB_HI_THRESH)
HP transit HP host	HP transit HP host	HP transit
LP host LP transit	LP transit	LP transit

SRP-fa Engineering Parameters

2 options

- (LP_HI_thresh – LP_Low_thresh/2) >= bytes in transit (i.e. large enough TB allows dynamic partitioning)
- (LP_HI_thresh – LP_Low_thresh/2) < bytes in transit (i.e. Host HP ring access delay is un-bounded)

iPT-CAP




```
If (!congested)
  { target_rate = C';
    advertise (target_rate);
  }
else
  { detect (#active_stations);
    target_rate = C'/#active_stations;
    advertise (target_rate);
  };
```

- C' = C – α1 leads to static partitioning
- Seems to be the only way to bound high priority delay
  - Even then it is not clear how High Priority access delay is not impacted by LP traffic

VOQ-aware MAC

- Again the fairness control block is not intended to apply to High Priority traffic
- $$f_i = r_i + w_i \frac{\left(C' - \sum_{active} r_i \right)}{\sum_{active} w_i}$$

- Where f_i is the BW station-i receives & is sum of it's committed rate (r_i) + share of excess ring bandwidth
- C' = C – α1
- Clearly a case of static partitioning, similar issue to iPT

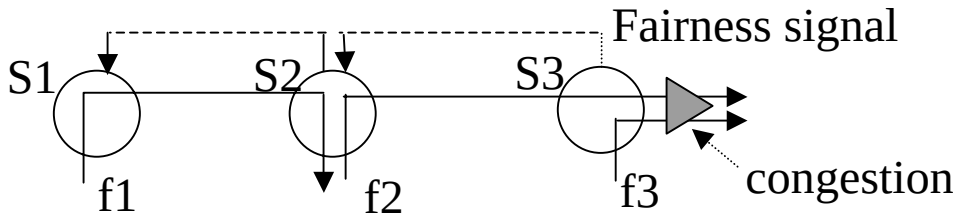
Conclusion 1

- High priority traffic ring access delay may not be bounded when using congestion avoidance
  - Low priority transit gets through first
- Avoidance algorithms/weighted fairness operate on low priority traffic only
  - Leads to static partitioning of ring bandwidth between high and low priority traffic

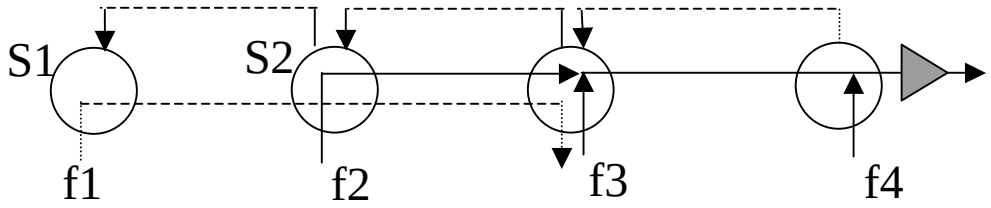
No HOL Blocking

- With open loop only connections which cross the congested link are throttled
- Congestion avoidance on the other hand exhibits HOL blocking in one or two flavors
  - Un-intended throttling of stations
  - Un-intended throttling of add/host traffic (Adisak's quiz 05/01)

HOLB: Station Throttling

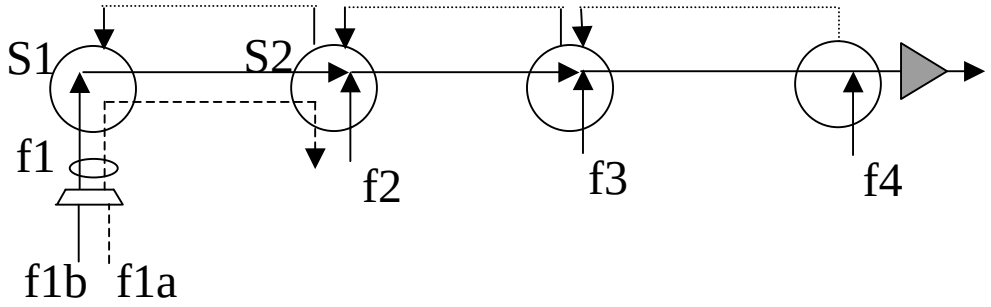


- SRP has mechanism to allow for spatial re-use i.e. if at S2 (allow_usage>fwd_rate); f1 is not throttled



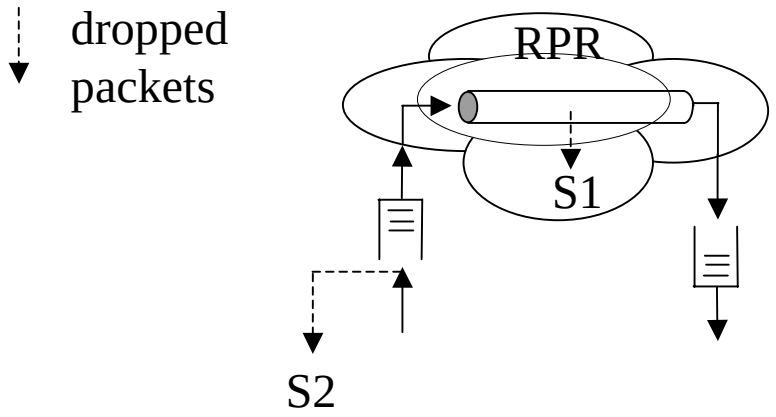
- f1 however is throttled to bottleneck rate (1/3 vs. ½) as (fwd_rate>allow_usage) at station-2

HOLB: Host Throttling



- f1 host is rate shape limited based on bottleneck rate which is due to f1b + f2 + f3 + f4 + …
- f1a is therefore denied full access to the ring while resources are available on S1-S2 span

Comparable Performance



Performance not likely to be a differentiator

- Suitable metric for comparing open loop & CA is client good-put
- TCP would drop 6-8% of it's traffic irrespective
- With open loop it gets dropped at the congested link S1
- With CA it gets dropped at the RPR MAC upper layers S2

Lower Configuration & Operational Complexity

- Weighted fairness by definition requires global knowledge of two parameters per station
  - committed bandwidth per station (r_i)
  - weight of station (w_i)
- Global knowledge requires identical copies of two tables at every station $\{r_0 \ldots r_n\}$ & $\{w_i \ldots w_n\}$
- A change in r or w has to be communicated to all stations

Open Loop Fairness

- Open loop offers “fairness” as controlled by TCP in the face of congestion
- If it’s good enough for the rest of the network, it’s good enough for RPR
- No need for global knowledge of weights or rates
- Provisioning is weighted, while allocation of excess bandwidth is weighted by the number of contending TCP connections
  - Remember, excess bandwidth is allocated on a best effort basis
  - Weighted best effort offered by CA is contradiction in terms

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