



# RPR QoS Requirements

Understanding the issues of QoS related motions

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## Operator requirements and Trade-off's



- ❖ RPR should support new revenue-generating services.
- ❖ Fiber in the Metro is expensive! Operators want a high bandwidth utilization.
  - ◆ QoS is always difficult to combine with high bandwidth utilization.
- ❖ The needs of the Metro Networks are very diverse! Operators want flexibility.
- ❖ Operators want a cheap and easy-to-manage solution
  - ◆ RPR needs to find a balance between flexibility and simplicity

## QoS in a packet based Metro Network



What is the SLA a packet-based Metropolitan Network should support ?

- ◆ Delay & jitter guaranteed services
  - ◆ Bandwidth guaranteed services
  - ◆ Packet loss guaranteed services
  - ◆ Protection guaranteed services
- ↑ Operators make money from guaranteed services!

## How does this translate at the RPR MAC layer?



- ❖ The RPR MAC layer supports QoS by mapping the traffic in different priority classes.
- ❖ The RPR MAC layer supports delay, bandwidth, and packet loss guaranteed services, by ensuring a *fair* access of the traffic to the ring.
- ❖ Bandwidth reservation and policing shall be done at the ingress of the ring. Reservation signalling should be recognized by the Standard RPR MAC.

## How does this translate at the RPR MAC layer?



- ❖ The RPR MAC layer supports Protection guaranteed services by
  - ◆ Layer 2 fast protection switching and rerouting (50 ms)
  - ◆ class-based protection levels
  - ◆ sharing of protection bandwidth: in case of bandwidth shortage, some classes of traffic may be dropped
- ↑ **Requirement:** The Standard RPR MAC shall support class-based protection.

## Multiple classes of service and *fair* access to the ring

### ❖ For real-time traffic,

- ♦ privileged access to the ring
- ♦ minimizing the impact on end-to-end delay & jitter of the position in the ring

⤴ **Requirement:** The Standard RPR MAC shall allow at least one class of traffic with minimum delay and jitter.

### ❖ For bandwidth guaranteed traffic,

- ♦ packet loss guarantees

⤴ **Requirement:** The Standard RPR MAC shall allow at least one class of traffic with minimum packet loss

## Multiple classes of service and *fair* access to the ring

### ❖ For best-effort traffic,

- ◆ a fair (equal or weighted) access to the available bandwidth for all the nodes of the ring

↑ **Requirement:** The Standard RPR MAC shall allow at least one class of traffic with per node, equal or weighted, access to the ring.

**CONCLUSION:** The Standard RPR MAC must support multiple classes of service.

- ◆ Following the vendor's choice or the operator's market, some classes may be merged, but the Standard RPR MAC shall allow for flexible combinations of the different guaranteed services (protection, delay & jitter, bandwidth and packet loss)

# Scheduling



- ❖ The scheduling can be based on cut-through, on store and forward, or on any combination of both depending on the classes.
- ❖ The actual scheduling solution for the different classes is an implementation choice, and should never become a requirement for the Standard RPR MAC.
  - ◆ Withdraw implementation oriented motions:
    - ◆ 43: The RPR MAC will support a cut-through transit buffer on the ring
    - ◆ 51: The fairness mechanism shall prevent upstream and downstream advantage or disadvantage in terms of bandwidth and delay allocation.



## Congestion control at the MAC layer

- ❖ To guarantee at the same time high bandwidth utilization and fairness for best-effort traffic, one needs congestion control at the MAC layer:

- ◆ Efficient bandwidth utilization means source 1 will take all the available bandwidth



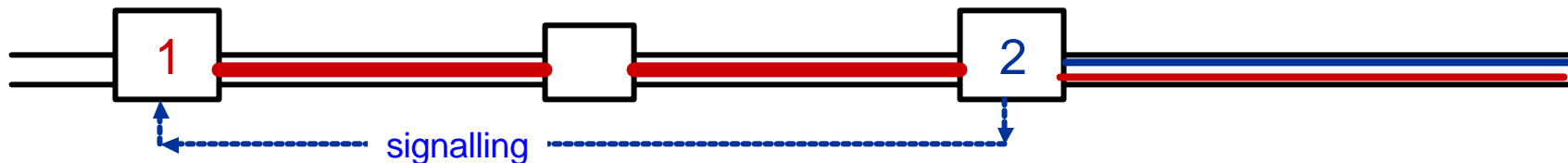
- ◆ If source 2 also wants to send, it has to throttle source 1.

## Congestion control at the MAC layer

- ❖ At the MAC layer, there are two ways to control the flow of source 1:
  - ❖ Packet drop in the congested node



- ❖ Throttling of other nodes on the ring by internode signalling



## Congestion control at the MAC layer



- ❖ The actual mechanism for congestion control is an implementation choice and should never become a requirement for the Standard RPR MAC.
  - ◆ Withdraw implementation-oriented motions:
    - ◆ 12: minimal packet loss on the ring except during protection events
    - ◆ 13: No packet loss on ring except during protection events
    - ◆ 44: The RPR MAC will provide for better than 90% link utilization for any span on the ring

## Conclusions



- ❖ The RPR MAC layer supports QoS by mapping the traffic in different priority classes
  - ⤴ **Motion:** The Standard RPR MAC shall support multiple classes of service for delay & jitter, bandwidth and packet loss guarantees.
  - ⤴ **Motion:** The Standard RPR MAC shall support class-based protection
- ❖ Following the vendor's choice or the operator's market, some classes may be merged, but the Standard RPR MAC shall allow for flexible combinations of the different guaranteed services.

## Conclusions



- ❖ The actual scheduling for the different classes is an implementation choice, and should never become a requirement for the Standard RPR MAC.

⬆ **Motion:** withdraw motions: 43, 51

- ❖ The actual mechanism for congestion control is an implementation choice and should never become a requirement for the Standard RPR MAC.

⬆ **Motion:** withdraw motions 12, 13, 44