Advanced QOS for MPLS Based Metro Networks

MPLS Japan 2005

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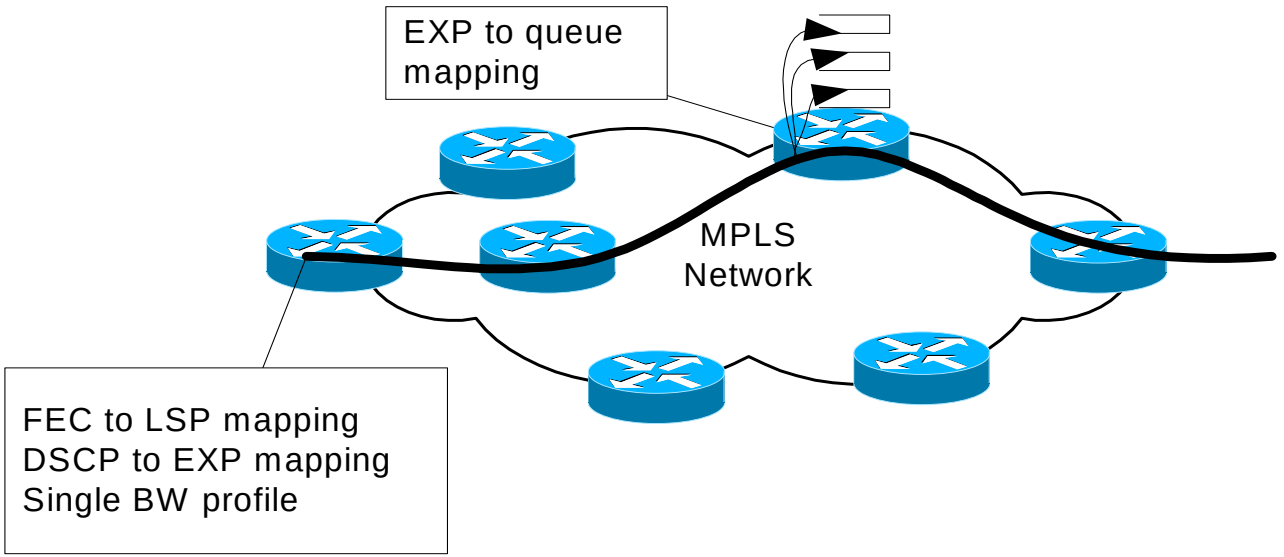
- Metro QOS req.
- QOS building blocks
- Fitting MPLS for the metro req.
- Interoperability between the approaches

MPLS QOS Today

- MPLS-TE is widely used in core networks
  - Rough congestion hot-spot avoidance
  - VoIP bypass
  - Tunnel is a virtual pipe
- QOS based on DiffServ model
  - Connectivity and QOS handling are treated as independent entities:
    - Queue configuration seperated from tunnel set-up
    - Complicated and manual queue tuning
- E-LSP is widely used for priority queuing between applications

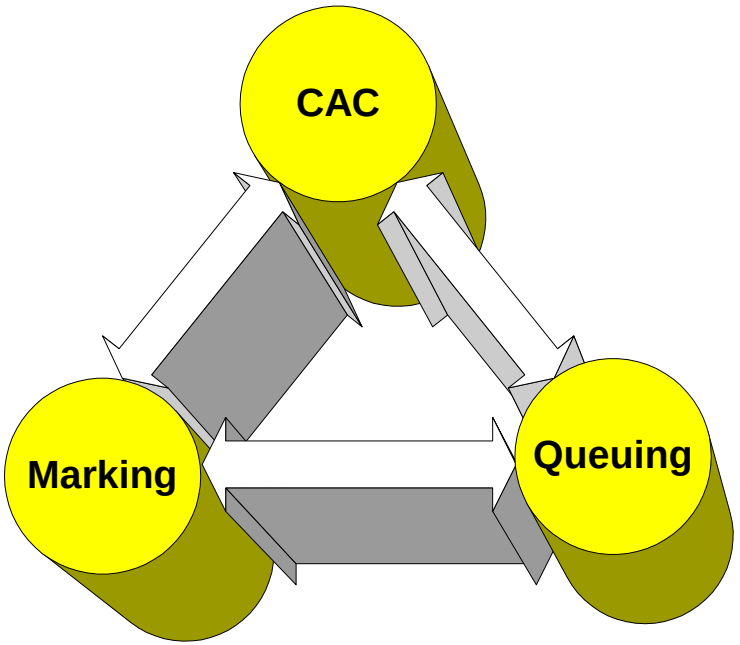
The E-LSP model



Metro QOS Requirements

- High number of individually guaranteed services
  - Should be operationally manageable
- Optimize network cost by migrating to over-subscribed networks instead of over-engineered networks
- PIR is important
  - The access market principle
  - Low pricing of PIR services, but user experience should be good
- Guaranteed services under network failure scenarios

The QOS Triangle

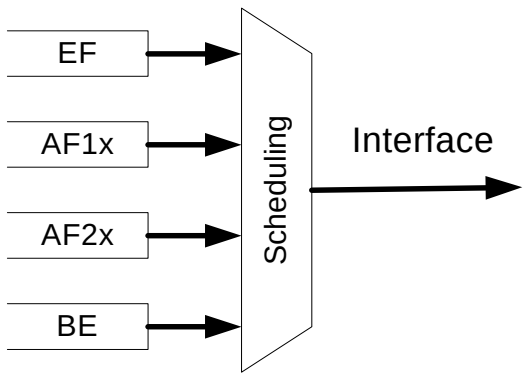


CAC – Call Admission Control

- CAC avoids creating services that would negatively impact existing services QoS
  - Local CAC verifies availability of resources in each node along the path
- Should be on a per COS basis
- In MPLS, CAC requests are propagated along the path by RSVP-TE, each node verifies its local resources
- Current MPLS implementations have various levels of COS awareness levels, from one level to multiple levels.

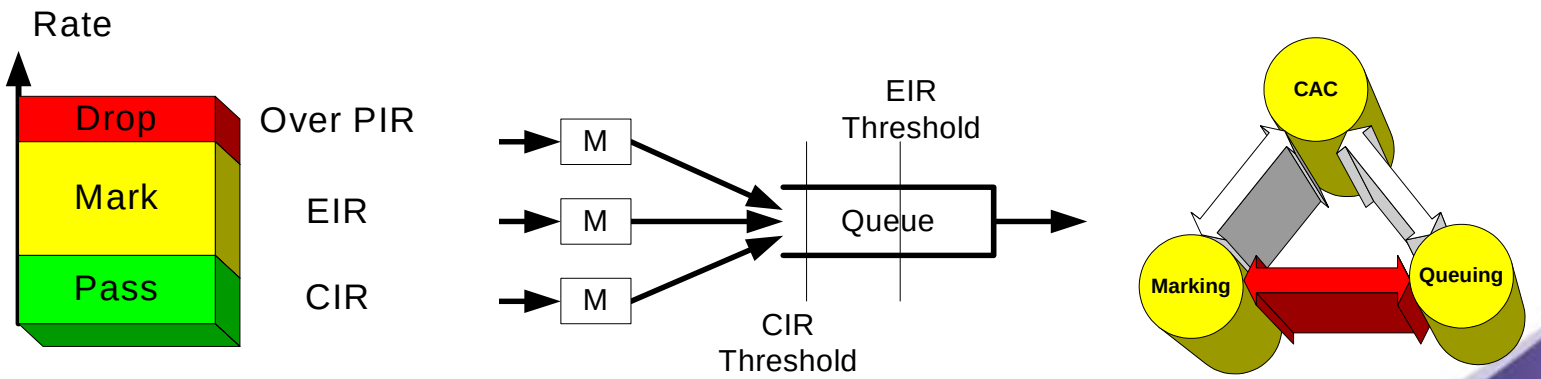
Queuing

- Enforce the relative priority of traffic on a per packet level
- Define the scheduling scheme between various COS
- Existing tools typically ensure strict priority and simple weighting between the queues, combined with WRED (Weighted Random Early Detection)



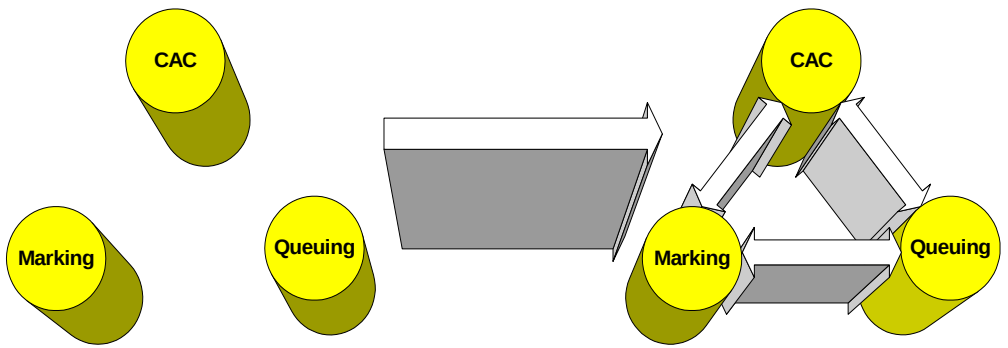
Marking

- Enforce the CIR to EIR partitioning on a per packet basis
- Since CIR is always taken into considerations in queue configuration, wrong marking can lead to violation of CIR for other services
- Marking is the key to enable sharing of a queue between different users



Fitting MPLS for the metro requirements

- MPLS **has the right building** blocks to meet the metro networks requirements
- However, the tools provided by MPLS should be better used in order to effectively built an economic and operational QOS scheme



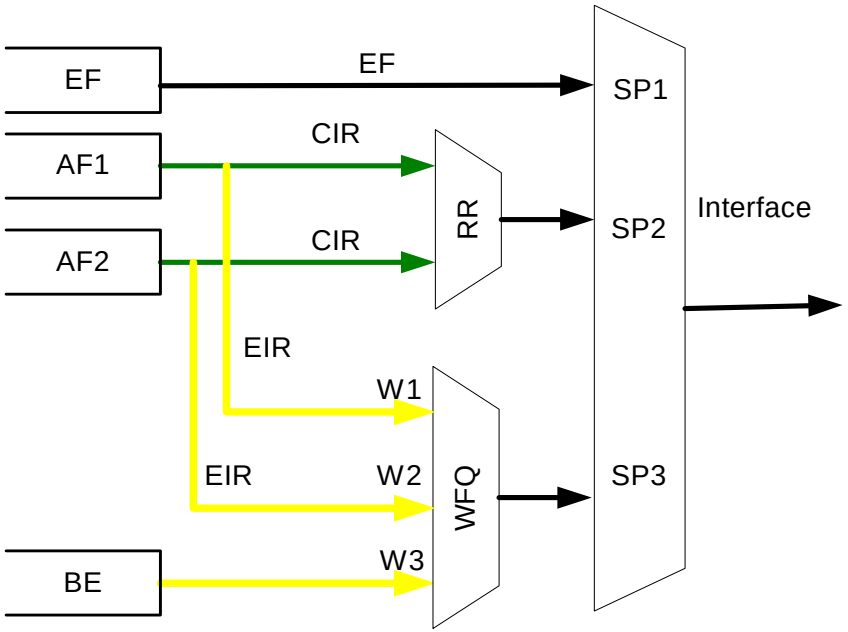
The Importance of PIR

- The residential access market relies today exclusively on “BE like” service
- However some guarantee is needed – user expects an “always on” service with reasonable throughput at any time
- This traffic is combined with true guaranteed traffic on the same network
  - Which has also it’s own EIR component in addition to CIR
- The evolution toward statistical multiplexing metro networks

The Importance of PIR

- Key components to enable this feature:
  - Always reserve network bandwidth for BE – **CAC guarantee for PIR share**
  - Fairness between BE users
    - Queuing and RPR
    - PIR signaling to gain fairness based on PIR ratio

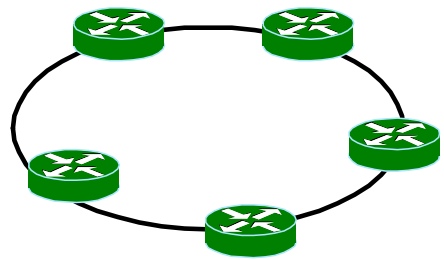
Queuing scheme for PIR guarantee and fairness



W3 = EIR(BE)/
[EIR(BE)+EIR(AF1)+EIR(AF2)]

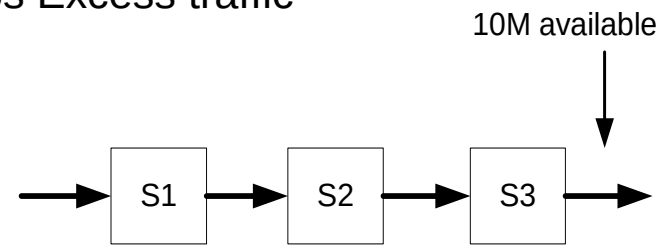
RPR - Fairness at the network level

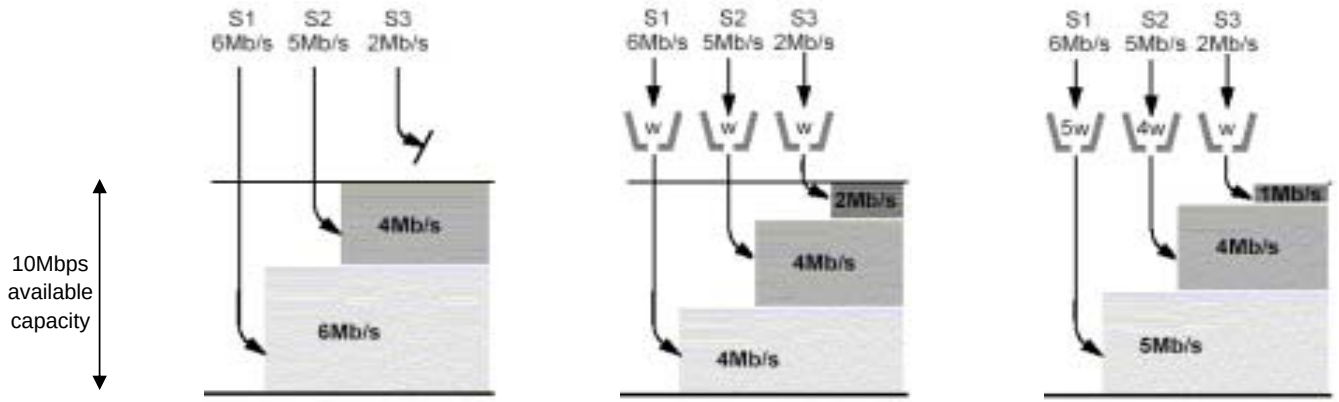
- RPR fairness enables sharing of ring excess bandwidth fairly by all stations
- Each station weight is proportional to it's services' EIR
- Ring-wide statistical multiplexing gains, compared to other approaches where it occurs locally
- This in addition to other RPR properties
  - Sub 50-msec protection at the MAC layer
  - Spatial reuse of BW
  - Native multicast support



Example of RPR fairness

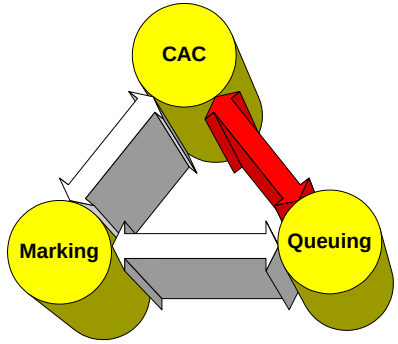
- Assume 3 stations competing on 10Mbps Excess traffic
  - S1 services EIR = 5M, sending 6M
  - S2 services EIR = 4M, sending 5M
  - S3 services EIR = 1M, sending 2M





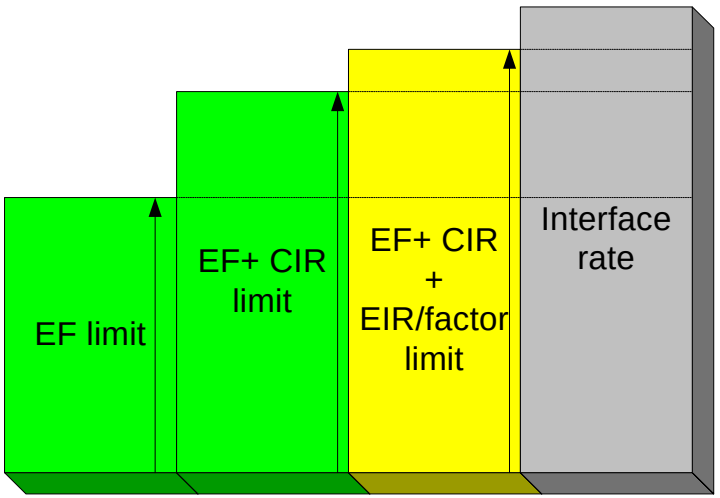
Operational Scalability

- Large number of circuits dictates automatic queue configurations
- Queuing cannot be a separate configuration domain, and should be tightly related to the MPLS connections that are established
- MPLS already carries CIR/PIR
  - Only CIR can be actually configured in existing implementations
  - Use both parameters to adjust the queues parameters on the fly
  - Automatically adjust at failures that affect the connection route



CAC Enhancements

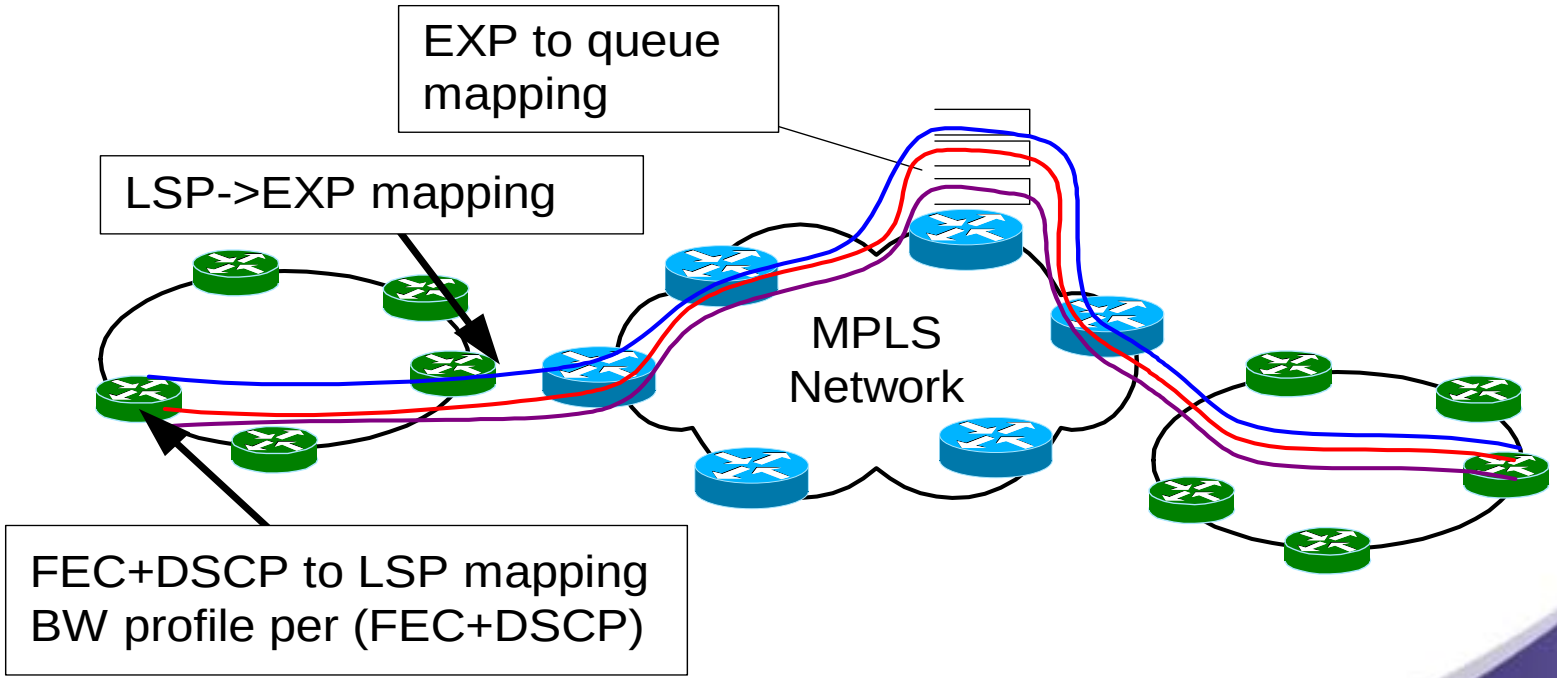
- PIR is part of the queue configurations
- If the PIR portion has to be guaranteed, it should be taken into consideration as part of the CAC



The need for L-LSP

- L-LSP has a single COS (Ordered Aggregate) per tunnel
- It is the key to enable the automatic per connection CAC and queues setting
- However, L-LSP is not widely supported in packet based platform
- The solution:
  - Use a single tunnel per COS
  - Each COS will be assigned the applicable EXP Bits

L-LSP and the co-existence with E-LSP core



Summary

- The metro QOS scheme should negotiate between two engineering tradeoffs: scalability and capacity management
- The solution:
  - Bind all QOS building blocks together
  - Automate the relationship between the blocks
- Co-existence with MPLS core DiffServ networks is possible

Thank You

Questions?