Integrated QoS Architecture for IP Switching

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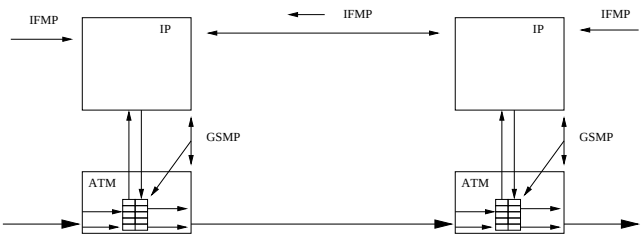
Summary

- IP Switching
- Integrated QoS Architecture
- Guaranteed Service
- BR Service
- Simulation Model
- Simulation Results
- Conclusion

IP Switching

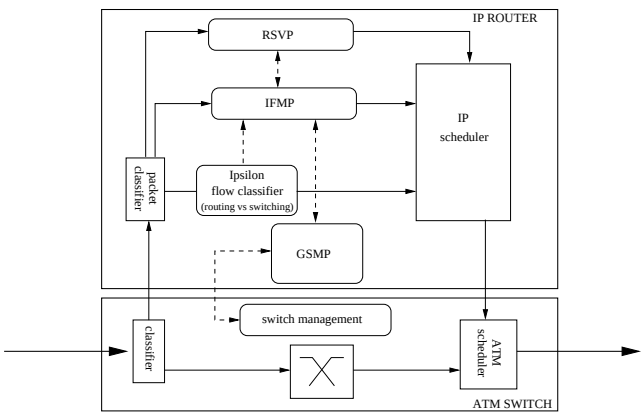
- IP + ATM
- IP switching = IP control path + ATM data path
- switching decision is made based on the expected length of the flow
- GSMP controls the switching table
- IFMP manages redirection information



- IFMP uses the concept of "soft state"

Integrated QoS Architecture

- IP QoS means IntServ framework and RSVP
- QoS-demanding flows have to be switched
- IFMP labels can be integrated into RSVP



Guaranteed Service

- GS = strict delay bounds
- approximation of a "fluid model"
- flow (b,r,p) + L
- each node caracterized by C_j and D_j

$$Delay = \frac{(b-L)}{R}\frac{(p-R)}{(p-r)} + \frac{L}{R} + \sum_{j=1}^{i}\left[\frac{C_j}{R} + D_j\right]$$

- $R > r$, especially with bursty traffic
- $\sum R - \sum r$ is reserved but not used
- "wasted" bandwidth that can be guaranteed at a larger scale

BR Service

- definition of a $bandwidth\ recovery$ service [Georgiadis96]
- designed to be associated with GS
- provide long term bandwidth guarantees
- application : web, ftp...

Implementation in a WFQ

we use per-flow queueing

CAC for GS $\quad \sum_{i=1}^{M} R_i \leq C_l - \Delta_{\mathrm{BR}}$

CAC for BR $\quad \sum_{i=1}^{M} r_i + \sum_{i=1}^{M'} r'_i \leq C_l$

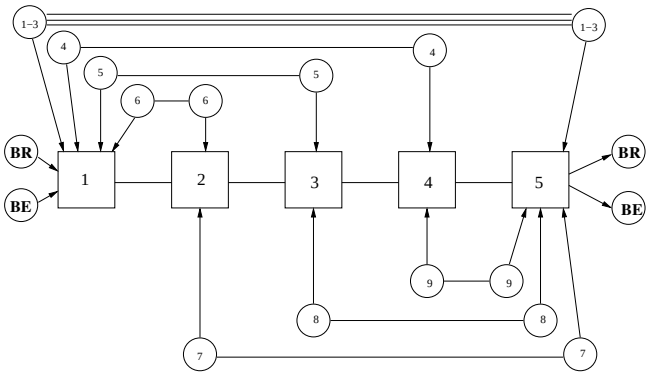
A clearing rate $R(\Delta_{\mathrm{BR}})$ is computed for all BR flows. Each one is affected a weighted share of this rate.

$$weight(BR_i) = \alpha_i \times R(\Delta_{\mathrm{BR}})$$

Simulation Model

5 IP-Switches network

In each switch, WFQ with per flow queueing



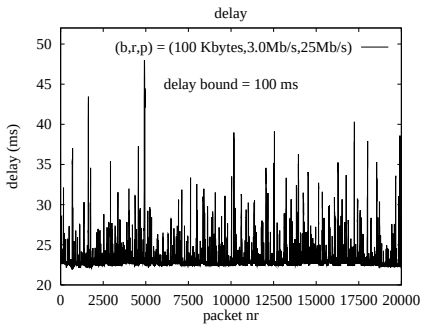
Each GS flow is : $b = 100Kbytes, r = 3.0Mb/s, p = 25Mb/s$

Required end-to-end delay bound is 100 ms

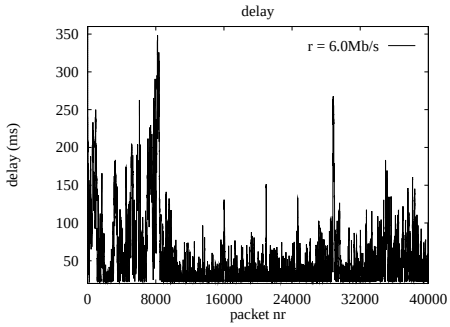
BR flows and BE traffic cross all switches

Simulation Results - Delays

GS

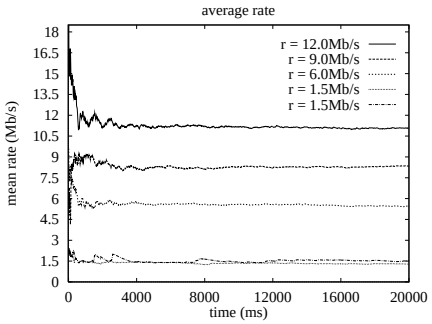


BR

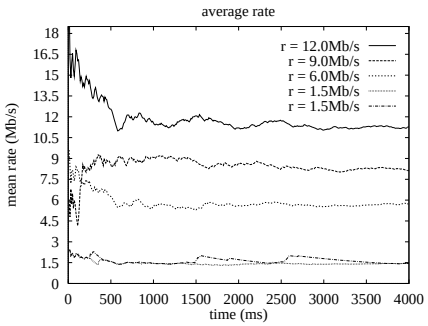


Simulation Results - BR service

long term



short term



Conclusions - Prospects

Our contribution :

- QoS architecture for IP switching
- simulation of an implementation of the BR service

Problems (?) : scalability (in a backbone)

Prospects : providing scalability by using flow agregation