Integrated QoS Architecture for IP Switching

Simon Pietro Romano
Universitá di Napoli Federico II
Naples - Italy

Christophe Deleuze
José Rezende
Serge Fdida
Laboratoire d'Informatique de Paris 6
Université Pierre et Marie Curie
Paris - France

`sprom@grid.grid.unina.it`
`{Christophe.Deleuze;Jose...}@lip6.fr`

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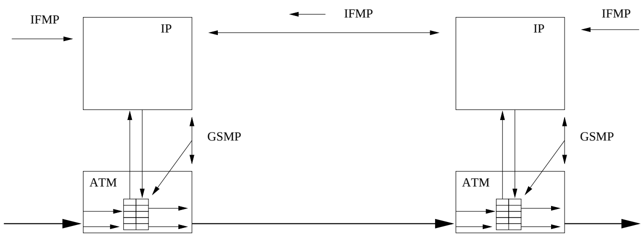
Summary

- IP Switching
- Integrated QoS Architecture
- Service classes
- Scheduling
- Simulations
- Conclusion

IP Switching

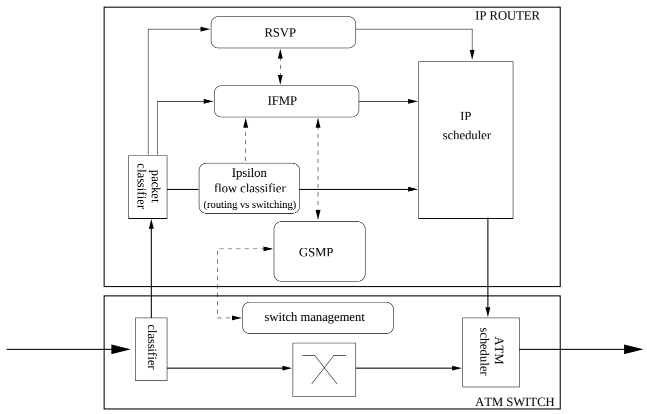
- IP + ATM
- IP switching = IP control path + ATM data path
- switching decision is made based on the expected length of the flow
- GSMP controls the switching table
- IFMP manages redirection information



- IFMP uses a "soft state" mechanism

Integrated QoS Architecture

- IP QoS $\rightarrow$ IntServ/RSVP framework
- 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"
- each node caracterized by C_j and D_j
- flow (b,r,p) + L

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

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

BR Service

- definition of a *bandwidth recovery* service [Georgiadis96]
- designed to be associated with GS
- uses "wasted" bandwidth $\sum R - \sum r$
- provides average bandwidth guarantees
- for applications that need "human-scale-interactivity"
- examples : web, ftp...
- possible implementation of the "Controlled-Load" service

Implementation in a WFQ

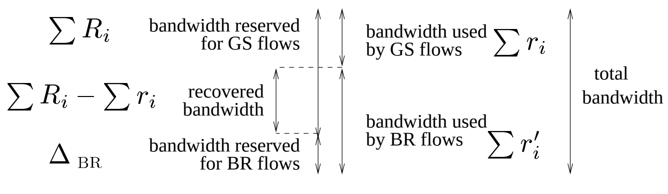
we use per-flow queueing

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

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

Each BR flow is affected a weighted share of Δ_{BR}

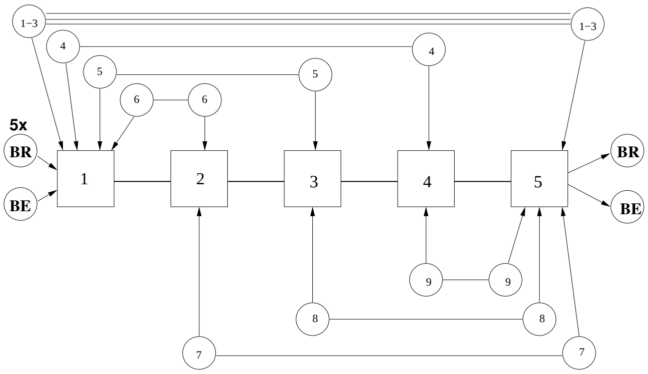
$$weight(BR_i) = \alpha_i \times \Delta_{\mathrm{BR}}$$



Simulation Model

5 IP-Switches network

In each switch, WFQ with per flow queueing



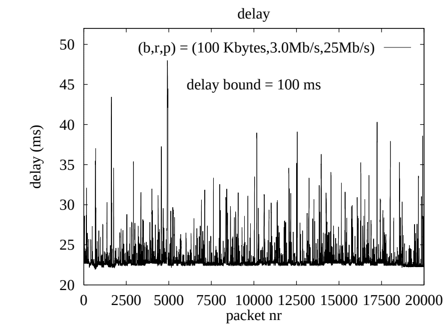
Each GS flow is : $b = 100Kbytes, r = 3.0Mb/s, p = 25Mb/s$

Required end-to-end delay bound is 100 ms

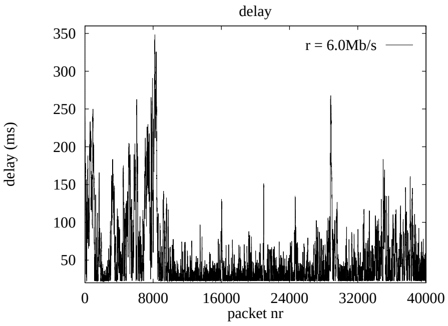
BR flows and BE traffic cross all switches

Simulation Results - Delays

GS

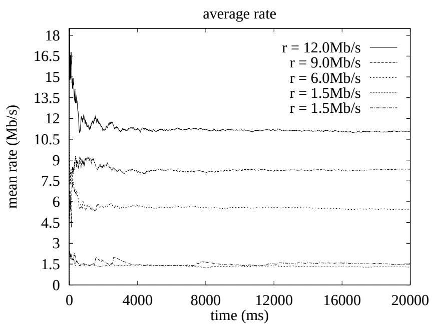


BR

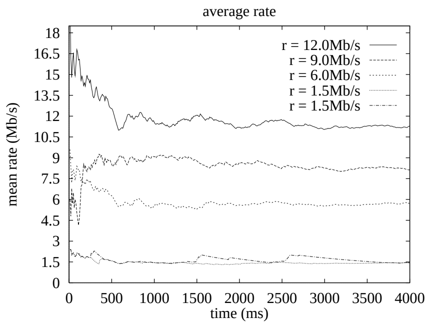


Simulation Results - BR service

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