Differentiated Services for IP Networks

Thoughts on early DiffServ implementations…..

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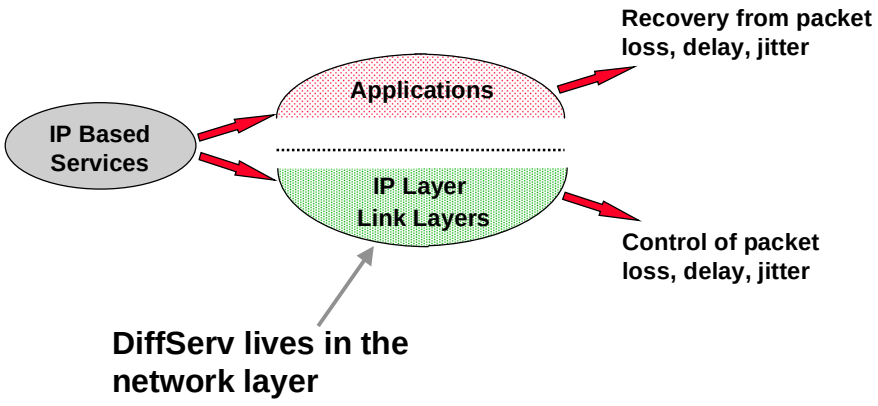
We make the things that make communications work

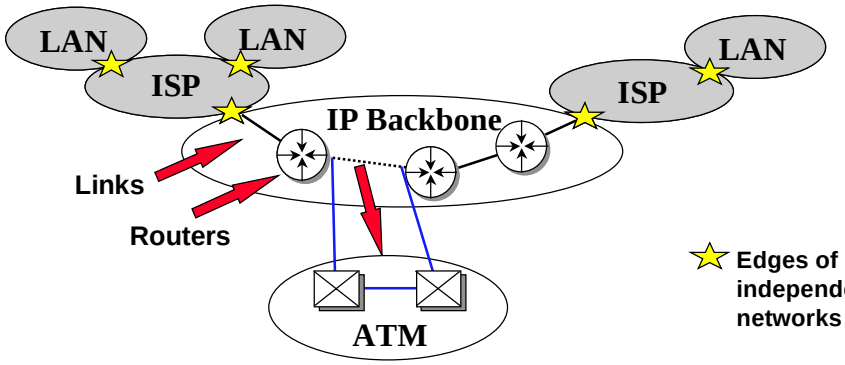
Where does DiffServ fit?

- **Quality of Service has two components**

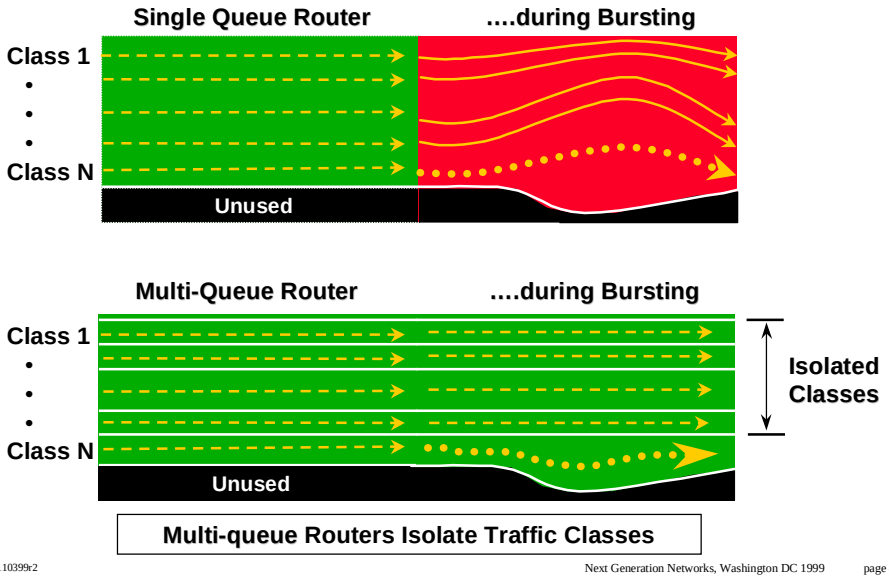


End to end QoS: Edges, Routers, Links

- End to End QoS depends on
  - Edge to Edge QoS
  - Router capabilities (e.g. DiffServ)
  - Link capabilities (e.g. ATM, MPLS/POS, Ethernet...)



QoS: Protect some traffic from others

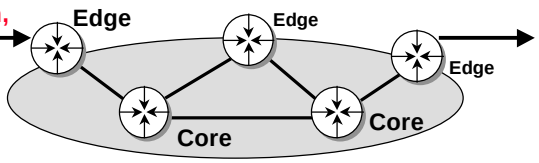


Multi-queue Routers Isolate Traffic Classes

How does DiffServ work?

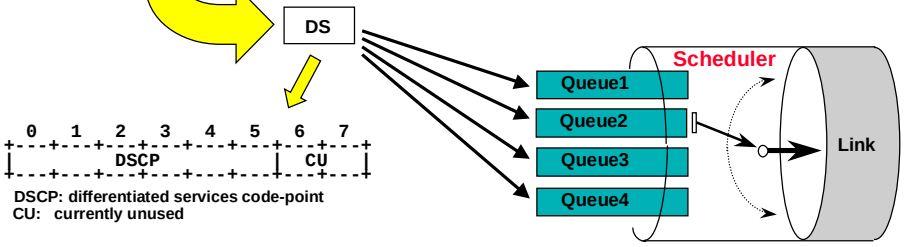
- Simplify, simplify, simplify….

Edge: Multi-field classification, policing, marking



ToS/ DS	Proto Type	Src Addr	Dst Addr	Src/Dst Ports

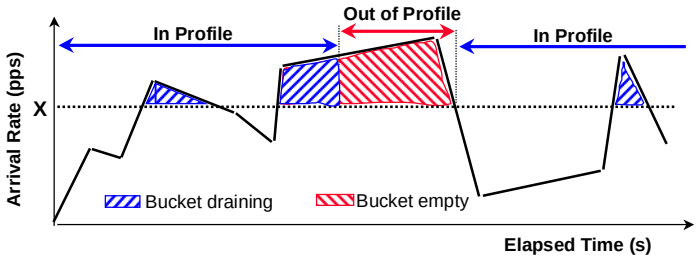
Core: DS field classification, policing, marking, queuing, scheduling



DSCP: differentiated services code-point
CU: currently unused

Distributed behavior

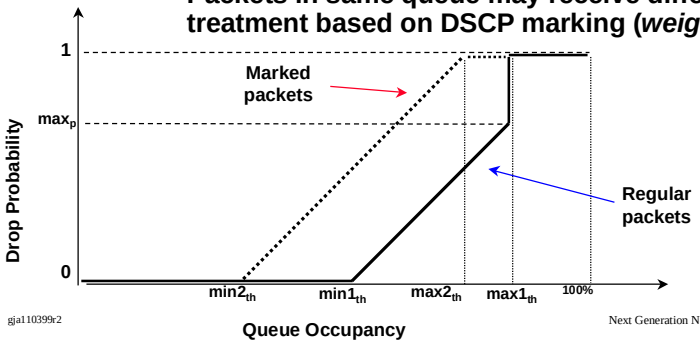
- Policing
  - Ensure aggregate load on core routers stays within limits
- Marking
  - Allows distributed burst tolerance



Token Bucket Metering

Queue Management: Better RED than Dead?

- Random Early Detection (RED)
  - Statistical targeting of congestion-causing flows, without requiring multi-field classifier
  - Keeps average queue occupancy low
    - Assuming predominantly TCP-like traffic
  - Makes the most of limited per-packet context
  - Packets in same queue may receive different RED treatment based on DSCP marking (*weighting*)



Is DiffServ worth it?

- Sure, for a time
- It is part of evolution
  - Ease of core router implementation
  - Simple core router management
  - End to end QoS requires co-ordinated management of Edge router behaviors
- Better than Best Effort!
- Some providers aiming for trials and customers in 2000

Will DiffServ be the only choice?

- No
- Service providers have options
  - New gigabit multi-field classifiers and schedulers can be deployed in core too
  - Core routers with < 10 queues giving way to routers with thousands of queues
- Service offerings may be mixed
  - DS behaviors for some flow aggregates
  - Flow-specific service guarantees using end to end per-flow queues for other traffic
- MPLS may provide additional method for selecting per-hop behaviors
  - Use Label instead of DSCP

DiffServ and VPNs

- Virtual Private Networks require isolation
- Topological isolation - private routing
  - Do it now with IP tunnels
  - Do it soon with MPLS
- Temporal isolation?
  - Use any QoS mechanism on tunneling packet
- DiffServ can be applied to tunnel itself
  - Tunnel appears as link layer with predictable QoS characteristics
  - DS network doesn't 'see' traffic being tunneled
  - Critical for private Service Level Agreements

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Last minute opinions….

Stuff I couldn't put in print….