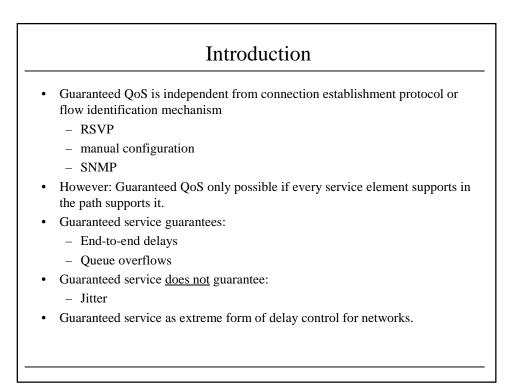
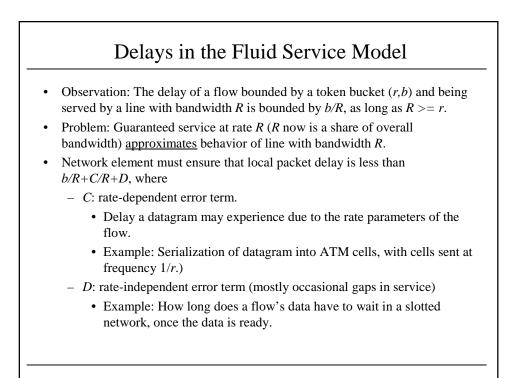


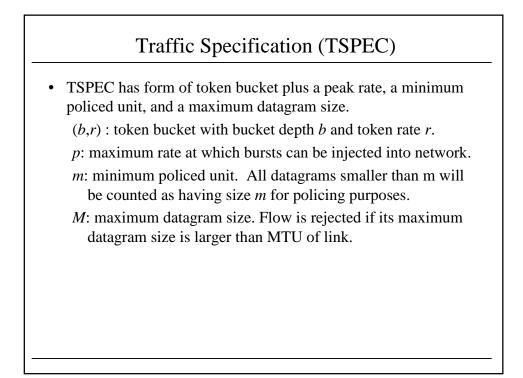
Specification of Guaranteed Quality of Service (RFC 2212)

- The "fluid model" of service
- The traffic specification (TSPEC)
- The desired service specification (RSPEC)
- Specifying a service module (subnet, switch, trunk, ...)
- Policing vs.reshaping



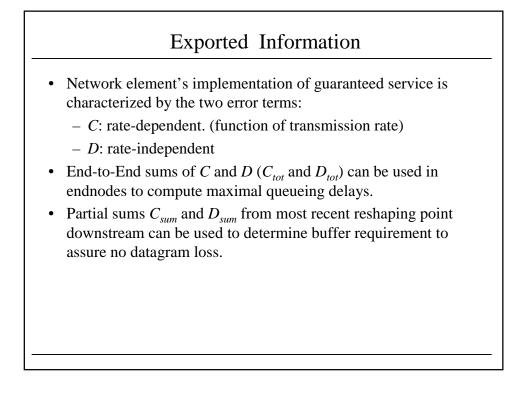
 Definition: The fluid model at service rate <i>R</i> is the service that would be provided by a dedicated wire of bandwidth <i>R</i> between the source and the receiver. Note: In the fluid model, the flow's service is completely independend of that of any other flow! Algorithms and implementations: Weighted Fair Queueing (WFQ) [Demers, Keshav, Shenker] Jitter EDD [Verma, Zhang, Ferrari]
 that of any other flow! Algorithms and implementations: Weighted Fair Queueing (WFQ) [Demers, Keshav, Shenker]
- Weighted Fair Queueing (WFQ) [Demers, Keshav, Shenker]
– Jitter EDD [Verma, Zhang, Ferrari]
 Virtual Clock [L. Zhang]
• General Definition [Goyal, Lam, Vin, NOSSDAV'95] :
$GRC^i(p_f^0) = 0$
$CRC^{i}(p_{f}^{j}) = \max\left\{A^{i}(p_{f}^{j}), GRC^{i}(p_{f}^{j-1})\right\} + \frac{l_{f}^{j}}{r_{f}} \qquad j \ge 1$
$d_f^j \leq GRC^K(p_f^j) + \alpha^K - A^1(p_f^j)$

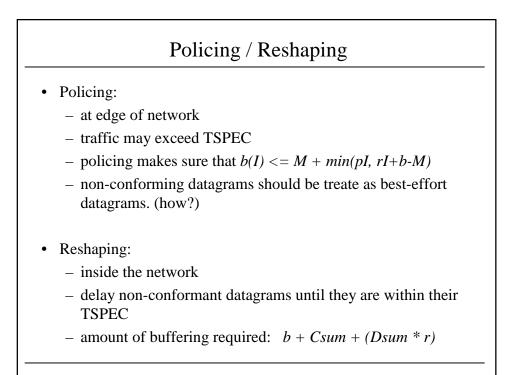


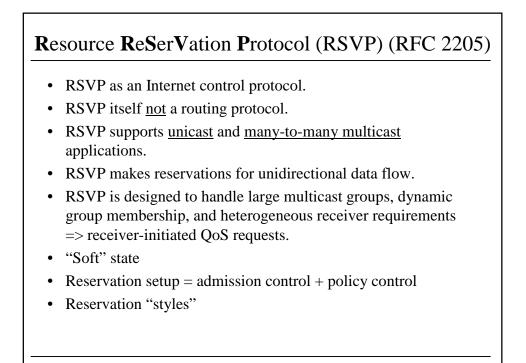


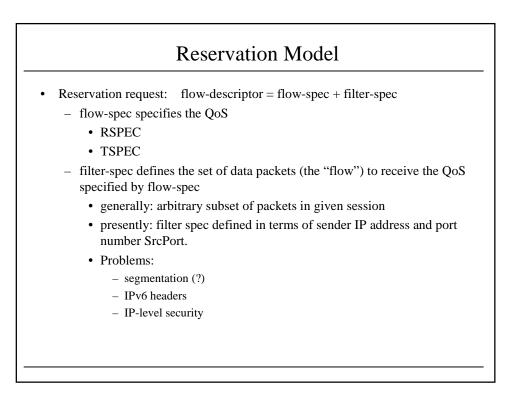
Desired Service Spec (RSPEC)

- *R*: rate
 - R must be greater or equal r
 - larger *R* reduces queueing delays
- S: slack term
 - Difference between the desired delay and the delay obtained by using a reservation level *R*.
 - Can be used by network element to reduce resource reservation.

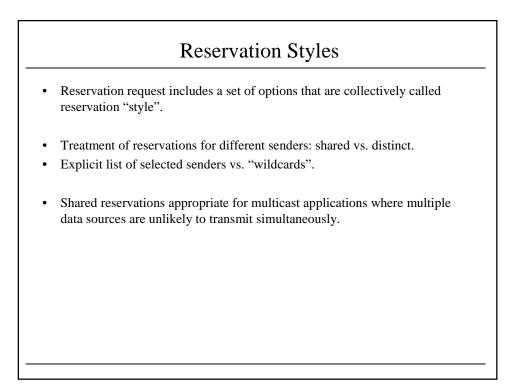


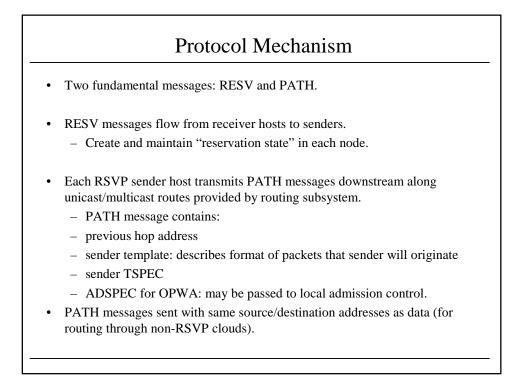


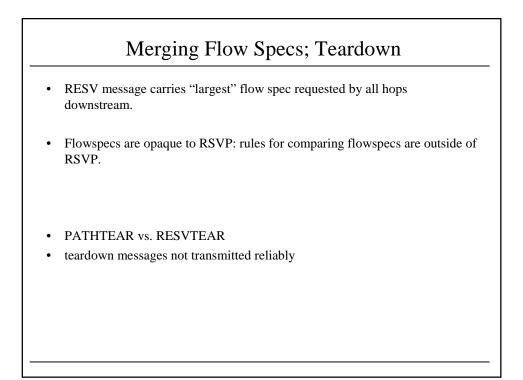




RSVP Requests
RSVP request messages originate at receivers and are passed to senders.
Each intermediate node performs the following two operations:
1. Make a reservation on link. (admission control and policy control)
- if fails, return error message to appropriate receiver.
- details of admission control are link-layer technology specific.
2. Forward the request upstream.
- Propagate request to appropriate senders.
- Requests may be merged (remember heterogeneous requirements!)
Basic reservation model is "one-pass"
 Receiver sends request upstream, and each node in path either accepts or rejects.
- Problem: no easy way for a receiver to find out the resulting end-to-end service.
Solution: One-Pass-With-Advertising (OPWA)







Soft State	
• RSVP maintains "soft state" in routers and hosts.	
 Soft state is created and periodically refreshed by PATH and RESV messages. 	
- State is deleted if no new matchin refresh messages arrive.	
 State can also be deleted with "teardown" messages. 	
• PATH and RESV messages are idempotent.	
• Route change: PATH message will initialize state on new route, and future RESV messages will initialize reservation state there.	ure
 State on old route will eventually time out. 	
• Periodic retransmission to offset non-reliability of IP.	
• Propagation of retransmitted control messages only if modify state.	