Design alternatives of Simple Reservation Protocol

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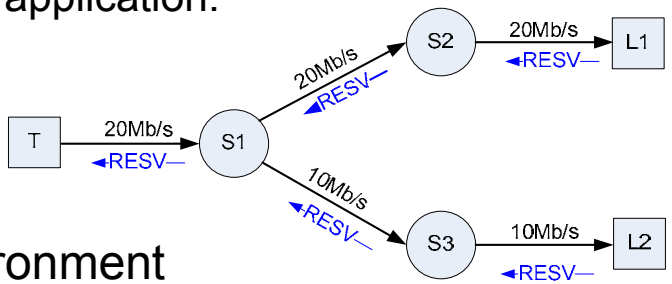
Design Choice: Number of Signaling Pass

- Two-pass signaling in RSVP
  - An important function of PATH messages is to set up the reverse path for forwarding RESV messages, since in IP networks the routing can be asymmetric.
  - Other functions of PATH messages include non-RSVP cloud marking and gathering end-to-end QoS information.
- ResE
  - In ResE, all nodes share a same view of spanning tree. The routing is symmetric.
  - However, one-pass scheme has deficiency:
    - A reservation message will be flooded if its DA aren't existing in bridge's FDB.
      - –Flooding will cause inefficient resource usage and misleading reservation results.
  - Three-pass scheme
    - Listener would "ping" the talker before reservation.
    - Talker responses to listener ping messages.
    - Bridges along the path will learn the talker's address.
    - This scheme incurs additional round-trip delay

Design Choice: Reservation Initiator

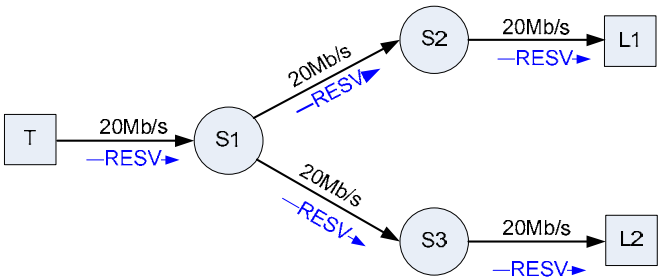
❑Listener imitated

- ▪Essential for heterogeneous listener environment
  - •However, heterogeneous reservation is not useful unless the switches can intelligently discard frames for each specific application.



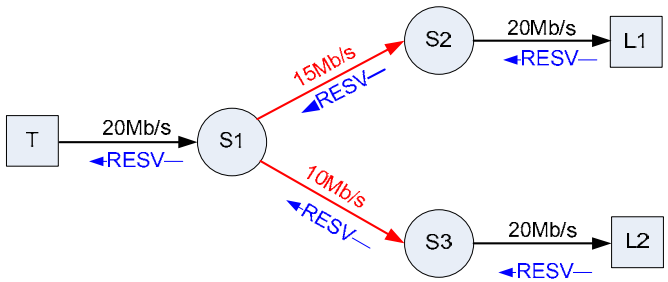
❑Talker initiated

- ▪Applicable for homogeneous listener environment
  - •It would significantly reduce the complexity in signaling
    - –Messages follow the data path
      - »But routing for the data path should exist before reservation.
    - –No need for merge of reservation messages from different receivers



Design Choice: Reservation Policy

- Strictly guaranteed reservation
  - If the admission control failed with a receiver's resource requirement somewhere, then the request will be denied. The receiver should retry his reservation.
- Flexible reservation
  - Even the admission control failed with a receiver's resource requirement somewhere, SRP would first reserve the maximum allowable resource locally, and then continue with
    - the original resource requirement (Greedy style)
      - Signaling is simple, but may incur more wasted resources
    - updated resource requirement (Tight style)
      - With receiver initiated scheme, this scheme will cause "virtually heterogeneous" reservation.



  - Data frames with flexible reservation should be marked with special flag. Intermediate bridges use this flag to discard frames that exceed the committed bandwidth.
  - Flexible reservations may be updated to strictly guaranteed reservations upon reservation refreshing.
  - Should provide notifications to related receivers about their flexible reservations.

Example 1: Three-Pass Listener Initiated SRP

- Three-pass signaling
  - Receiver first sends a “ping” message to desirable talker.
  - Talker responds to listener ping message
    - Talker address will be learnt by intermediate bridges
  - Listener sends reservation message to talker upon receiving talker ping response
  - Listener sends teardown message to talker to release reservation
- Listener initiated reservation
  - Listener sends reservation message to talker upon receiving talker ping response.
    - Reservation messages should never be flooded
    - Reservation messages are merged in the intermediate nodes. A reservation request message travels only as far as the first bridge at which another receiver's reservation already exists for the same session.

Example 1: Three-Pass Listener Initiated SRP (cont.)

- Bridges execute admission control on the port receiving reservation messages
  - Set up reservation state if the admission control is successful
  - Send back Error message if the admission control is failed
- Each node periodically refreshes its reservation.
  - Otherwise, reservation states will age out and send Error messages downstream

Implicit ACK and explicit NACK

- Application data frames are used as implicit acknowledgement
- Error messages are used as explicit negative acknowledgement

Flexible reservation

- Can be achieved using greedy reservation scheme

Example 2: Two-Pass Talker Initiated SRP

- Two-pass signaling: use GMRP as the first pass
  - Listeners use GMRP registration to join the isochronous multicast group.
  - Listeners use GMRP deregistration to leave the isochronous multicast group. There is no need for dedicate teardown messages.
    - Upon a GID_Leave.indication event for an isochronous group address on a given port, corresponding reservation states and reserved resources (if any) will be released.
- Talker initiated reservation: only one type of message is needed
  - Talker sends reservation message towards listeners in the isochronous group.
    - Carry a flag to indicate whether the resource reservation is successful upstream.
  - Reservation messages traverse end-to-end even admission control is failed.
- For each incoming reservation message, intermediate bridge will:
  - Get the outbound ports list for this message from group registration entries
  - Execute admission control on each outbound port, and update the reservation states in bridge
    - Update the flag according to the execution result of admission control

Example 2: Two-Pass Talker Initiated SRP (cont.)

- Upon a GID_join.indication event for an isochronous group address on a given port, intermediate bridge will send a reservation message out of this port if corresponding reservation state has been set up in this bridge.
  - This will disassociate the set-up delay from the talkers' refresh timer value
- Talker periodically refreshes its reservation.
  - Otherwise, reservation states will age out and reservation messages with failure flag will be sent downstream

Explicit ACK and NACK

- When a listener receives the reservation message, it knows whether the reservation is successful according the corresponding flag.

Flexible reservation

- Reservation messages carry the "bottlenecked" bandwidth instead of requested bandwidth.
- Reservation messages serve as a notification to receivers about the flexible reservation.

Comparison

- Example 1: Three-Pass Listener Initiated SRP
  - Pros:
    - Admission control would be done on Resv message receiving port. No need for FDB retrieval.
    - Error messages clean up unnecessary reservation automatically.
    - Extendable for heterogeneous reservation scenarios
  - Cons:
    - No explicit ACK
    - Three-pass signaling incurs additional set-up delay
    - Several new messages and processing method should be defined:
      - –Ping, PingResponse, Resv, Error, Teardown; Most are new to Ethernet.

Comparison (cont.)

- Example 2: Two-Pass Talker Initiated SRP
  - Pros:
    - Explicit ACK/NACK
    - Only one new message will be defined. Signaling processing is simpler.
      - –Resv; GMRP is reutilized.
    - Listeners can be non-ResE devices in some simplified scenarios.
    - Be natural for realizing flexible reservation.
  - Cons:
    - Admission control should be done on Resv message outbound port.
    - Upon failed reservation, listeners should explicit deregister to avoid possible wasted reservation.

Thank you!