Layer 2 subscription protocol considerations

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Layer 2 subscription protocol in ResE

- ResE can guarantee a deterministic low latency and jitter isochronous transportation service only if the network resources are available along the entire transportation path.

- Currently GARP/GMRP is a most related L2 protocol for subscription function, but:
  - A flooding style scheme.
    - In GMRP the multicast group membership information will be disseminates across all the bridges in the network, which cause inefficiency
  - The bridges only get the reachability information of multicast listeners but without the subscription indication since talker and path-specific information are not disseminated.
    - For the subscription, a protocol whose session runs directly along the stream path will be preferred.

Desirable ResE subscription protocol functions

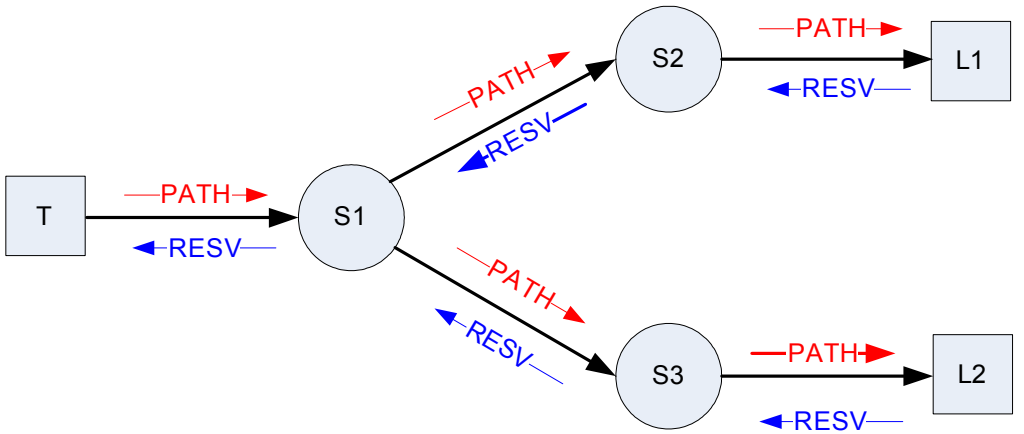
Feature	Preference
Specify resource subscription information	*Necessary*
Support unicast and one-to-many multicast	*Necessary*
Merge flow for multicast session	*Necessary*
Be adaptable to routing changes	*Necessary*
Be adaptable to listener membership changes	*Necessary*
Support CBR flow spec	*Necessary*
Be robust to certain signaling packet deficiency	*Necessary*
Control the signaling overhead	*Necessary*
Support many-to-many multicast	*Optional*
Adapt to dynamic changing of flow spec during one session	*Optional*
Support heterogeneous listeners environment	*Optional*
Support VBR and other flow spec	*Optional*

RSVP basics

- RSVP is primarily a vehicle used by applications to communicate their requirements to the network in a robust and efficient way
- It is a signalling protocol that installs and maintains reservation state information at each routers along the path of a stream.

Basic operation

- Listeners join multicast group via IGMP (For L2 applications, this can be GMRP)
- Talker sends PATH messages to listeners (unicast or multicast)
- Listeners send RESV messages back to talker
- Message types:
  - Path, Resv
  - PathErr, ResvErr
  - PathTear, ResvTear
  - ResvConf



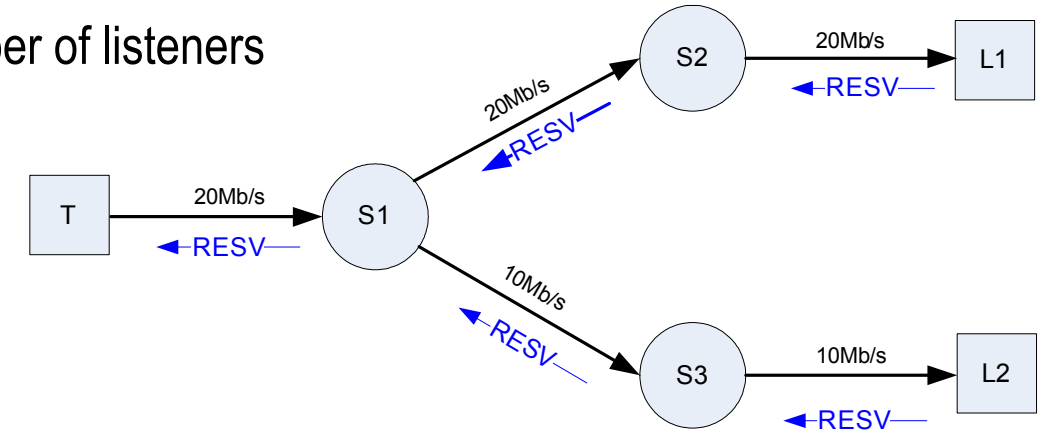
RSVP main features

❑Receiver-initiated

- Support both unicast and many-to-many multicast well
- Support heterogeneous receiver environment where each receiver is responsible for choosing its own requirement of reserved resources, initiating the reservation and keeping it.

❑Flow merging

- Reservations are merged at the intermediate nodes. The “largest” flowspec will be forwarded
- Scale well for large number of listeners



❑Soft-state

- Robust and simple
- Providing graceful support for dynamic membership changes, routing changes and reservation changes

RSVP main features (cont.)

- Several reservation styles
  - Wildcard-Filter, Fixed-Filter, Shared-Explicit
  - Fit a variety of application requirements in multipoint-to-multipoint environment
- Interoperability
  - RSVP is designed to operate correctly through a non-RSVP cloud. This feature may be employed for non-ResE Clouds
- Separation of reservation from routing
  - In Layer 2, RSTP can provide necessary interaction
- Unidirectional data flows

Possible simplification points

- Support only unicast and one-to-many multicast
  - No need for different reservation styles in ResE
- Support only CBR streams
  - flowspec can be simplified
- Homogeneous listener environment
  - Assuming in each session all listeners have the same reservation requirement
    - Then “killer reservation” problem is alleviated, therefore blockade state is not necessary
  - But at the cost of not supporting heterogeneous receivers
- Omit optional objects
- Fix the number, length and order of objects

RSVP implementation example

- Low-end 68040 processor with bus speed of 32MHz:
  - Trigger message: 0.73 ms for PATH, 0.37 ms for RESV
    - approximately 900 flow setups/s
  - Refresh message: 0.33 ms for PATH, 0.29ms for RESV
- 2400 flows with a refresh interval of 30s
  - Requires about 230 kb/s of bandwidth (when PATH: 208 bytes, RESV: 148 bytes)
  - In ResE the refresh interval should be shorter

(Source: Ping Pan and Henning Schulzrinne, ACM Computer Communication Review, 1999)

Correspondence between L3 and L2

	Layer 3	Layer 2
Routing	*RIP, OSPF, MOSPF…*	*RSTP, MSTP*
Group membership maintenance	*IGMP*	*GMRP*
Resource reservation (subscription)	*RSVP*	*RSVP L2 variant*

Summary

- RSVP concepts might be a good reference for designing a subscription protocol in ResE
  - Similar design goals, all necessary function provided
  - Well documented and accepted
  - Helpful for seamlessly integration with IP QoS schemes
  - Simplification is easier than extension

- Works to do:
  - Message formats adaptation
  - Simplification choice

Thank you!