RSVP Over Tunnels

- Several IP-in-IP tunneling mechanisms exist today
- Both RSVP messages and reserved data flows are invisible to intermediate tunnel routers
- Current tunneling mechanisms do not contain enough information to identify flows inside

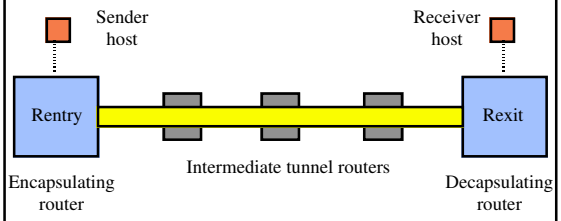
Goals for RSVP over Tunnels

- Try to limit changes to tunnel endpoints
- Allow multiple flows per tunnel
- Co-exist with most, if not all, current tunneling schemes
- Interoperate with RSVP routers that do not support the new mechanism

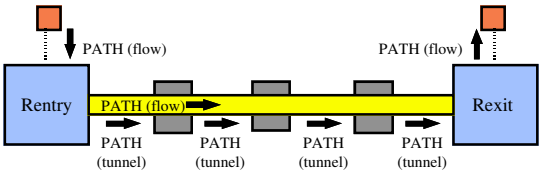
UDP Encapsulation

- Encapsulate payload (including IP header) by prepending IP and UDP headers
- Use RSVP to reserve resources for encapsulated packets
- Could use different (new) protoID that has ports in the same positions as UDP (more on this later)

Example Topology



PATH messages



PATH messages

- Rentry receives a PATH; the tunnel to Rexit is an outgoing interface for SESSION
- Rentry generates a new “tunnel” PATH message
  - Session dest = Rexit, sender = Rentry
  - select UDP ports
  - Tspec accounts for flow and tunnel overhead

PATH messages

- Alternatively, an existing UDP encapsulation can be used: update Tspec and refresh tunnel PATH
- Flow PATH sent via original tunnel?
- Rexit acts as a receiving RSVP host for the tunnel PATH messages

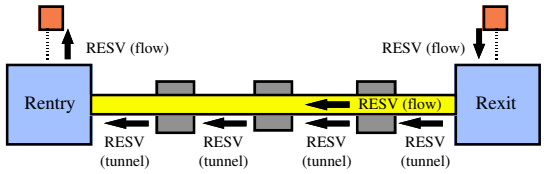
PATH messages

- At Rexit, a method is needed to associate flow PATHs with the tunnel PATH / UDP ports
  - send flow PATHs with UDP encapsulation
  - define a new RSVP "association" message
  - define a new "ignore-and-forward-if-unknown" TUNNELED_FLOWS object to piggyback the flow PATHs on the tunnel PATH

PATH messages

- At Rexit, tunnel PATH information has to be incorporated into forwarded flow PATH
  - non-RSVP bit
  - ADSPEC
- At Rexit, if there is no matching tunnel PATH state for flow PATH: set non-RSVP bit (ADSPEC?)

RESV messages



RESV messages

- Rexit receives RESV; Rentry is a PHOP
- Rexit looks for PATH states:
  - session dest = Rexit, source = Rentry, UDP
  - search for flow PATH / encapsulation association
  - If not found: forward flow RESV to PHOP via tunnel (Rentry doesn't support RSVP tunneling mechanism)

RESV messages

- If PATH states are found: Rexit generates a FF tunnel RESV message
  - flowspec accounts for flow & tunneling
- Flow RESV sent via tunnel?

RESV messages

- RESV association / admission control
  - reservation for a flow is a portion of the tunnel reservation
  - Rentry needs to know both:
    - association between tunnel & flow RESVs
    - whether or not tunnel reservation is enough to support an individual flow reservation
  - Could do all admission control at Rentry
  - Rexit could help

RESV messages

- Rexit admission control mechanism
  - FF RESV for tunnel asks for RESV_CONFIRM (will go all the way to Rentry - single receiver)
  - Only forward flow RESV upon confirmation
  - Admission control failure for flow if tunnel RESV_ERR received or timeout occurs
    - Flow RESV not forwarded
    - RESV_ERR sent downstream for flow

RESV messages

- When Rentry gets flow RESV, it does not need to do admission control (still needs to update classifier)
- flow RESV / tunnel RESV association still needed

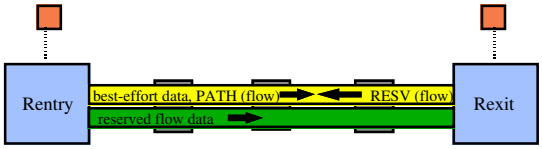
RESV messages

- If reservation exists for encapsulation (multiple flows): Rexit updates tunnel flowspec and refreshes tunnel RESV
- If flowspec is modified hop-by-hop, Rentry uses tunnel flowspec to update flow flowspec for forwarding

Data Flows

- Best-effort traffic uses original tunnel encapsulation
  - Includes PATH messages for flow?
  - RSVP messages may need “help” through the best-effort tunnel - not trivial
- Packets classified as part of the flow(s) by Rentry get UDP wrapper

Data flows



Details, details...

- Selecting UDP port numbers
  - Rentry can select; Rexit can reject and suggest a new one
  - Reserve/configure ports per tunnel neighbor
  - New protoID: demux of dest port can include IP source address
- Mechanisms to associate flow RSVP messages with UDP encapsulation

Details, details...

- Security issues
  - Spoofing encapsulation header
- Flow fragmentation / MTU discovery
- Making RSVP tunnel-aware (LIH)
- Determining Tspec and flowspec parameters for tunnel
- Rentry and/or Rexit could be hosts

Details, details...

- Admission control