December '94 IETF

Routing Support for Resource Reservations

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Acknowledgements: Bob Braden, Van Jacobson, Lixia Zhang, ISIP and E2E

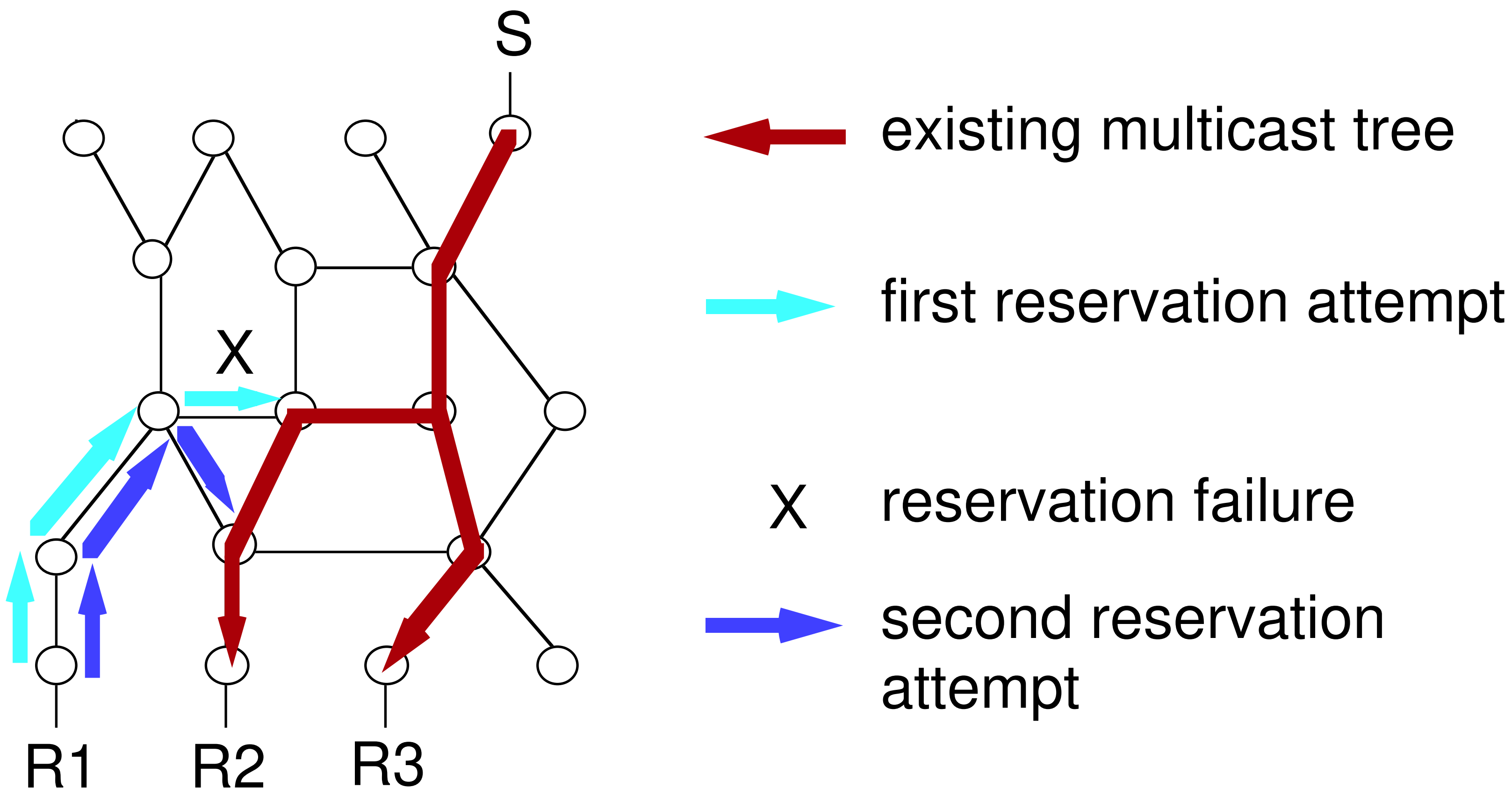
Routing Assumptions

- Each subflow uses a separate multicast group
- Future unicast routing uses Quality of Route (QoR) to classify routes according to static link capabilities
- Applications coordinate use of single QoR per group
- Receiver puts QoR in Join to indicate its general requirements
- Routing builds multicast trees using unicast QoR routes
- Multicast trees are shared among receivers with relatively homogeneous requirements

New Routing Requirements

- ***Recommended***
  - Use alternate, explicit routes when reservation rejected
  - Pin routes for reserved flows that require stability
- ***Optional***
  - Use inactive routing state to support channel selection
  - Use explicit routes to bundle related flows (route them together)

Use alternate, explicit route when reservation rejected



- Requires careful protocol design to avoid deadlocks and maintain tree integrity

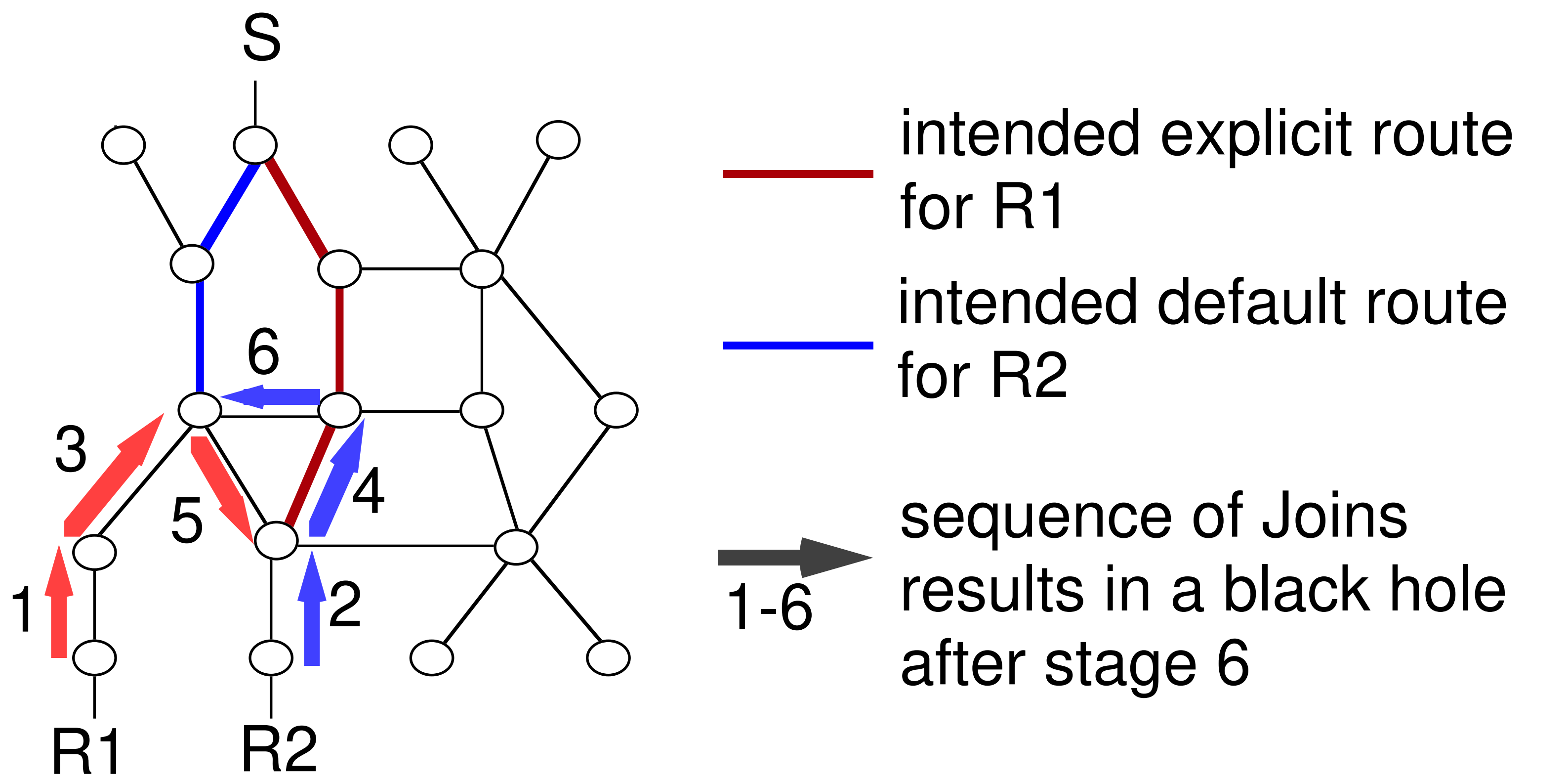
Alternate Route Interfaces

- ***Application->RSVP***
  - no change
- ***RSVP->Routing (at the host)***
  - request for alternate route
- ***RSVP->Routing (at each node)***
  - reservation status on upstream link (reserved/unreserved)

Alternate Routing Mechanism

- Join using explicit route may form black hole when merging with a branch that is not yet connected
- Use connected/unconnected flag per link to avoid violating tree structure
  - status of new branch is "unconnected"
  - when Join reaches sender or merges with a connected branch, status of new branch changed to "connected"
  - two unconnected Joins can merge only if they both use default routes; otherwise one must backoff

Join using explicit route can lead to a black hole

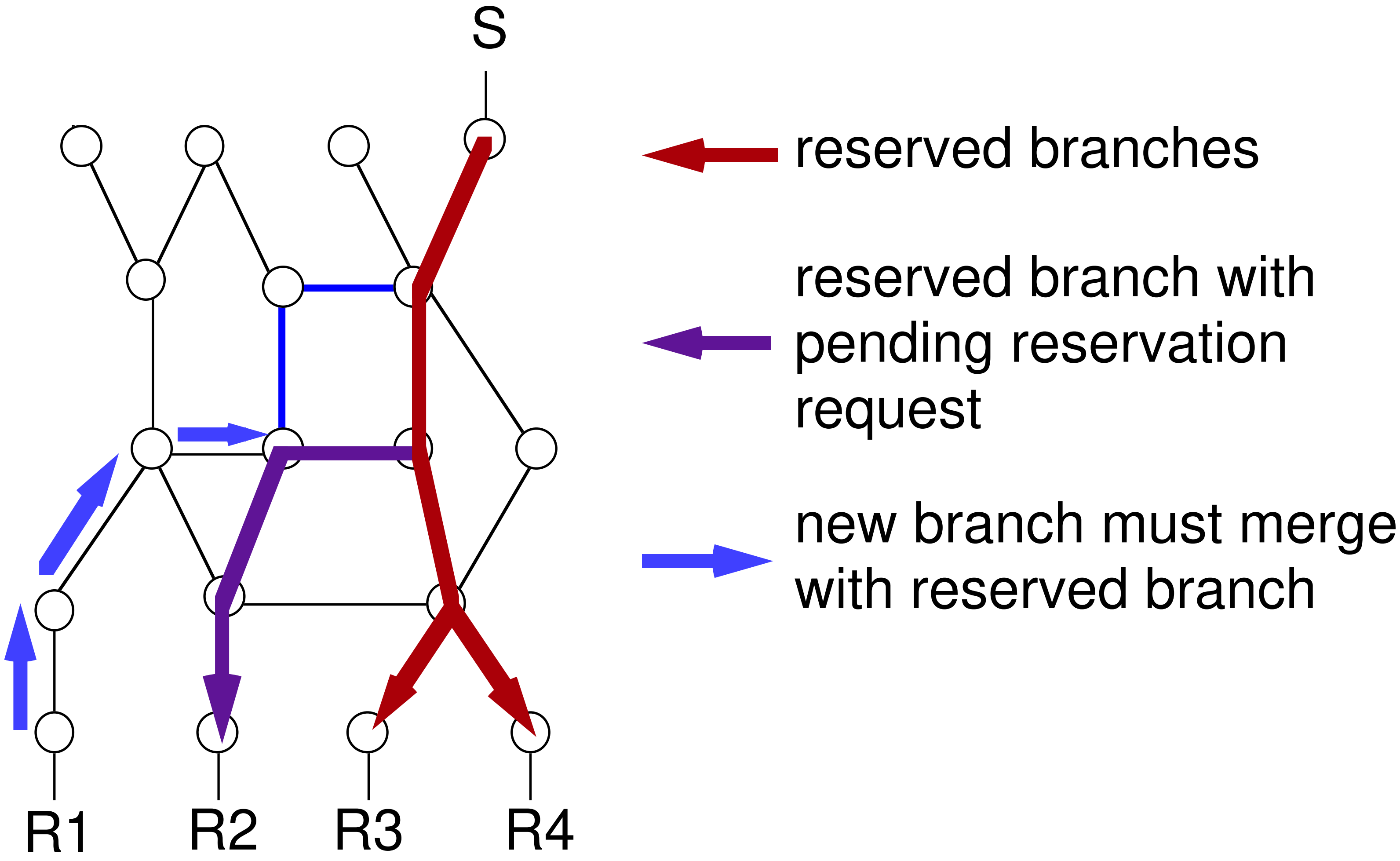


- Use per-link "connected" flag to indicate Join has merged with tree
- Two "unconnected" Joins can merge only if they both use default routes; otherwise one must backoff

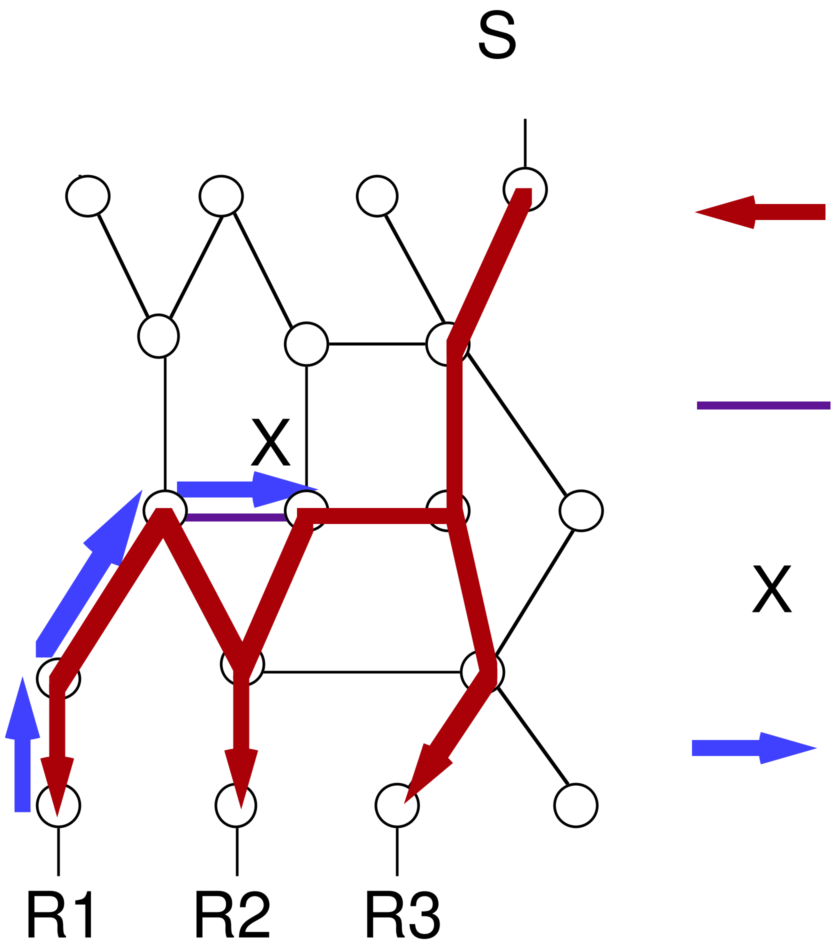
Alternate Routing Mechanism (continued)

- Receiver using explicit route may disrupt service to existing members if it re-routes a reserved branch
- Use reserved/unreserved flag per link to avoid rerouting existing reservations
  - RSVP sets links to reserved when it sends a request upstream
  - if request fails, RSVP may set links to unreserved
  - a Join with an explicit route may prune conflicting branches only if they are unreserved

Avoid rerouting existing reservations using per-link reservation status



Service disruption if routes not stable



- Ask unicast routing to provide stability; adapt only upon link/node failure or smoothly transition

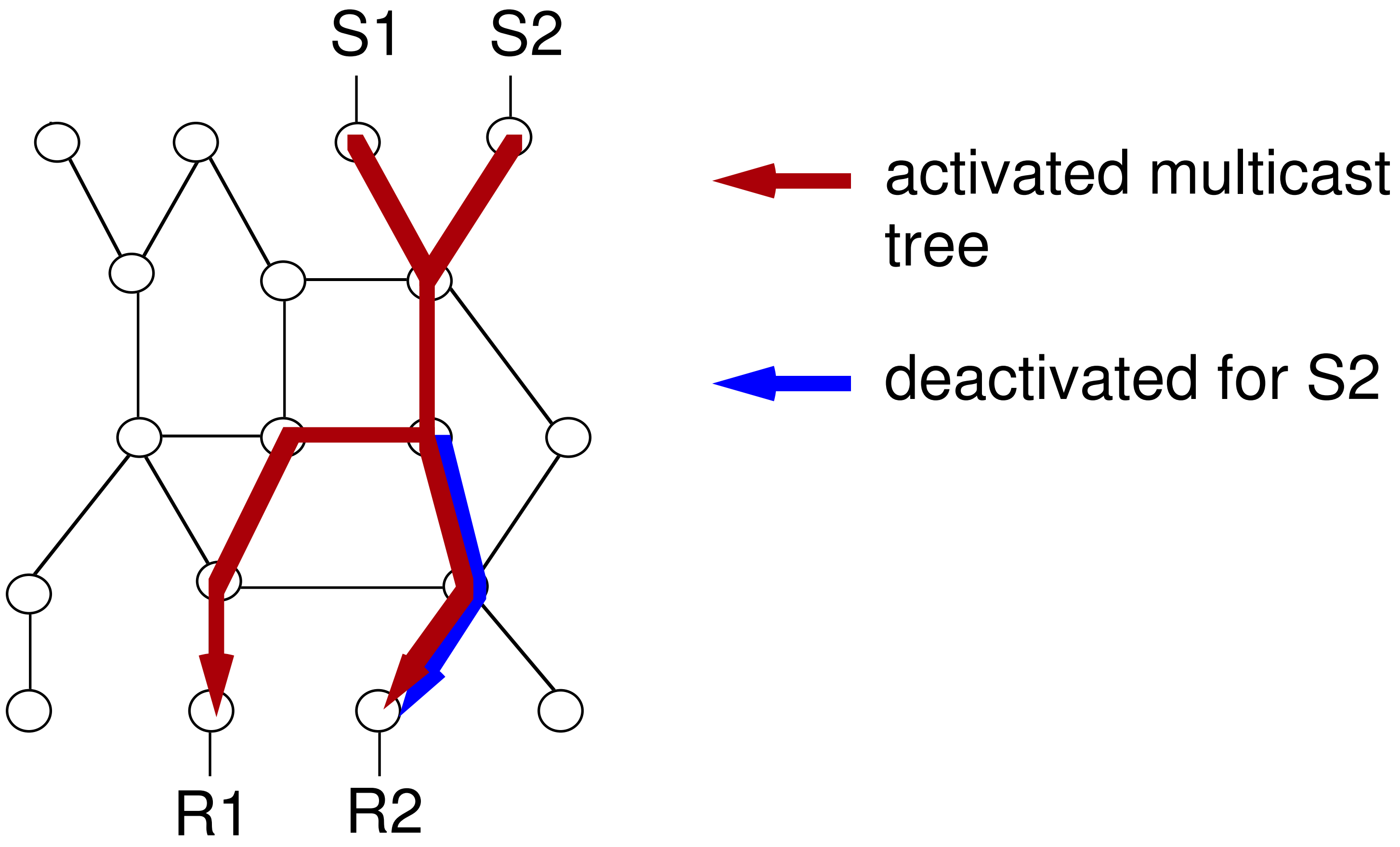
Route Pinning Interfaces (Exploratory)

- ***Application->RSVP***
  - stability flag: on asks routing to preserve service during unicast route changes; off allows service disruption
  - delegation flag: on gives routing liberty to provide stability any way it wants, e.g. smoothly transition; off means routing should provide stability by pinning
- ***RSVP->Routing (at the host)***
  - stability and delegation flags
- ***Routing->RSVP***
  - route failure notification

Route Pinning Mechanism

- stability off: update multicast tree to reflect unicast routing changes
- stability on, delegation off: update multicast tree only for unicast route failures
- stability on, delegation on: may provide stability any way it wants (e.g. smooth transition)
- Note: the hops in an explicit route are always pinned; stability and delegation flags apply to the path between hops

Channel selection supported by routing

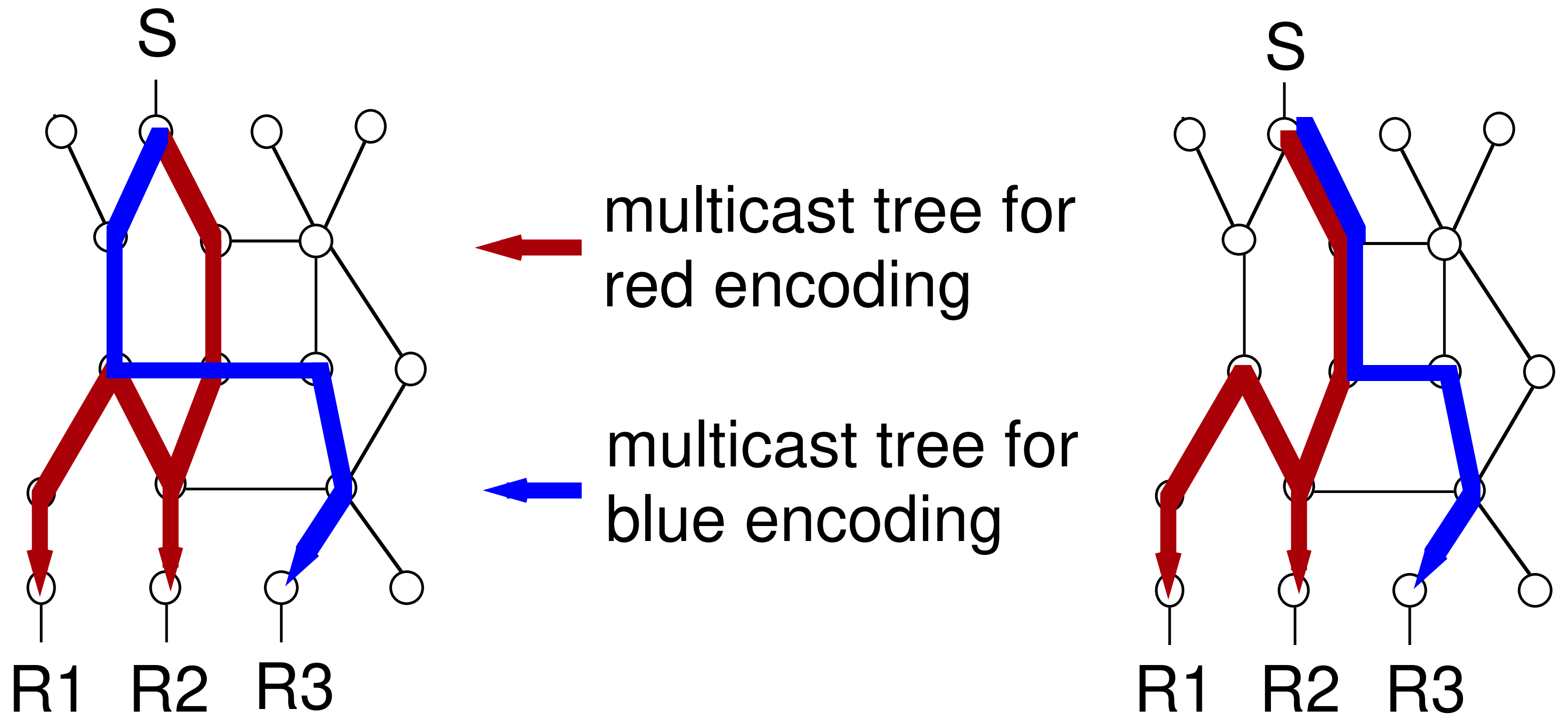


- R1 switches to S1

Optional Channel Selection

- If channel selection desired, may augment RSVP channel selection by giving routing the ability to turn off data forwarding without losing routing and reservation state
- ***Application->RSVP***
  - channel selection
- ***RSVP->routing***
  - source-specific deactivate/activate requests
- ***Routing Mechanism***
  - include deactivate/activate flag in Join to turn off/on data forwarding

Bundling Before and After



Optional Bundling

- ***Application->RSVP***
  - bundled groups
- ***RSVP->routing***
  - bundled groups
- ***Routing Mechanism***
  - best-effort not bundled and may be rerouted to satisfy bundling
  - with bundling preference, routing can just use explicit routes to bundle
  - routing needs more mechanism to do guaranteed bundling (not recommended)

Status

- Internet draft will be available from authors
- Daniel Zappala doing detailed design, implementation in DARTNET
  - will use RSVP, DVMRP, SDRP
  - using routing interface layer to allow upgrade to PIM/whatever
- Interested in other requirements
- Need to coordinate with IDMR and SDR