Integrated and Differentiated Services

Multimedia Systems(Module 5 Lesson 4)

Summary:

- Intserv Architecture
  RSVP signaling protocol
- Diffserv Architecture
  - Traffic Classification and Conditioning
  - Per-Hop Behavior

Sources:

- Chapter 6 from
  "Computer Networking: A Top-Down Approach Featuring the Internet", by Kurose and Ross

Integrated Services

Intserv is a framework developed by the IETF to provide individualized QoS guarantees to individual application sessions.

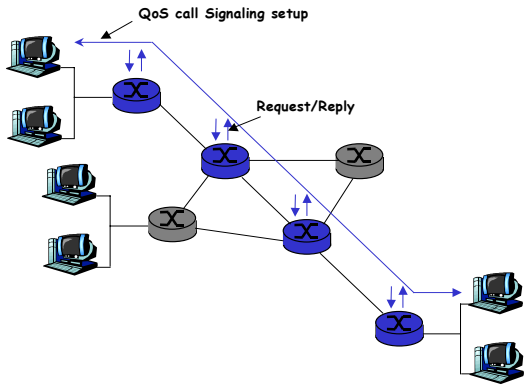
Two key features lie at the heart of Intserv:

- *Reserved resources* : A router is supposed to know what amounts of its resources (buffers, link b/w) are already reserved for ongoing sessions
- *Call setup* : A session requiring QoS guarantees must first be able to reserve sufficient resources at each network router on its source-to-destination path to ensure that its end-to-end QoS requirement is met.

Call Setup Process

- *Traffic characterization and specification of the desired QoS:*
  - **Tspec** : Characterizes the traffic the sender will be sending into the network. (RFC 2215)
  - **Rspec** : Characterizes the QoS being requested by the connection. (RFC 2210)
- *Signaling for Call Setup* : A session's Tspec and Rspec must be carried to the intermediate routers: RSVP
- *Per-element call admission* : Once a router receives the Tspec and Rspec for a session, it determines whether or not it can admit the call.

Call Setup Process



Service Classes

The Intserv architecture defines two major service classes:

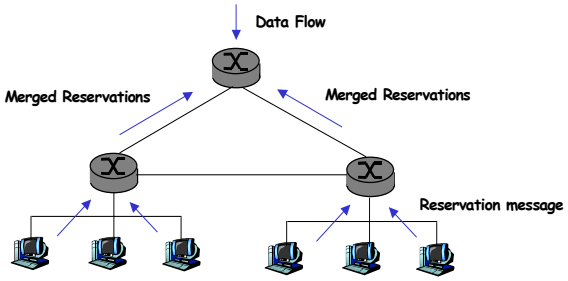
- *Guaranteed QoS* : [RFC 2212] Provides firm (mathematically provable) bounds on queuing delays that a pkt will experience in a router. The source's traffic characterization is given by a leaky bucket (r,b) and the requested service is characterized by a transmission rate R bps.
- *Controlled-load Network Service* : [RFC 2211] Provides a service closely approximating the QoS that same flow would receive from an unloaded network element. No quantitative guarantees are made, therefore the word "closely approximate" is non-quantifiable.

RSVP : Resource Reservation Protocol

The RSVP protocol allows applications to reserve bandwidth for their data flows. To implement RSVP the RSVP software must be present on the receivers, senders and routers.

Principle characteristics:

- Provides reservations for bandwidth in multicast trees (unicast is handled as a degenerate case of multicast)
- Is receiver-oriented, that is, the receiver of the data flow initiates and maintains the resource reservation used for that flow.



Some Clarifications

Session : A session can consist of multiple data flows; Each sender in a session is a source of one or more data flows. Each data flow in a session has the same multicast addr. The specific data flow is identified by a flow identifier field (IPv6).

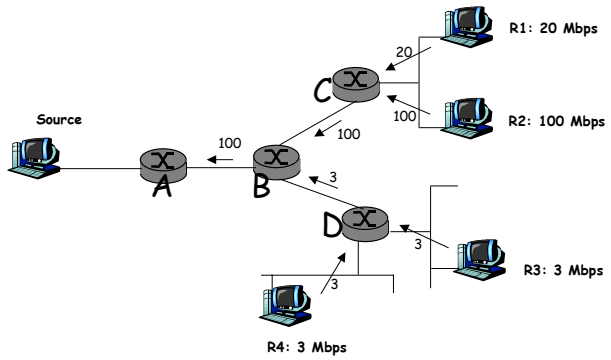
What RSVP [RFC 2205] does not do :

- It does not specify *how* the network provides the reserved b/w to the data flows. It is merely a protocol that allows the apps to reserve the necessary link b/w.
- It is not a routing protocol. It does not determine the links in which reservations are to be made. It depends on the underlying routing protocol (unicast or multicast).

RSVP is sometimes referred to as a *signaling protocol,* meaning that is allows hosts to establish a tear down reservations for data flows.

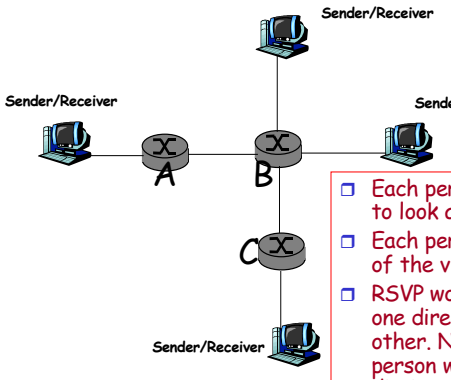
RSVP lays special emphasis on heterogeneous receivers

Example Scenario for RSVP



- Source is transmitting a sporting event (video and audio).
- Use layered-coding to handle heterogeneous receivers.
- Receiver-oriented reservation protocol.

Example 2 for RSVP: Video Conferencing



- Each person has 3 windows open to look at 3 others.
- Each person wants to see each of the video at 3 Mbps.
- RSVP would reserve 9 Mbps in one direction and 3 Mbps in the other. No merging, because each person wants to receive 3 distinct streams

- Consider audio only: Suppose *b* bps are needed for each stream. Because it is rare for two persons to talk at the same time, it is not necessary to reserve 3x*b* bps into each receiver; 2x*b* would suffice.

Differentiated Services

Difficulties associated with the Intserv model of per-flow reservation of resources:

- *Scalability.* Intermediate routers have to maintain per-flow state; E.g., It was observed that a backbone router using OC-3 speed link sees approximately 256,000 source-destination pairs in one minute. Does not scale.
- *Flexible service models.* Intserv provides small number of pre-specified service classes. Need for *qualitative* or *relative definitions* of service classes.

Diffserv is a architecture for providing *scalable* and *flexible* service differentiation – that is the ability to handle different "classes" of traffic in different ways within the Internet.

Diffserv arch. Has two sets of functional elements:

- *Edge functions: Packet Classification and traffic conditioning*
- *Core function: Forwarding*