B211 Internet Computing

Multimedia Transport over the Internet

Lecture Outline

- Special Requirements for Multimedia Content Transport
- Multicasting
- Real-Time Transport Protocol (RTP/RTCP)
- Resource Reservation Protocol (RSVP)

Multimedia Content

- Images, audio and video
  - Compared to text.
- Special properties:
  - Multicast
  - High bandwidth requirements
    - bigger in size
    - in real-time - audio/video packets must arrive within a certain time frame.
  - Priority over text-based messages
  - Basic Quality-of-Service (QoS) required from a network for the content to be transported from source to destination properly.

Streaming

- An important implementation for online video is *streaming,* where data is displayed while the download is happening.
- Streaming clients:
  - download an initial portion of the video and start displaying without waiting for everything.
  - have a continuous buffer of upcoming sounds/images, so that the display won't stop if there is a slight delay in traffic.

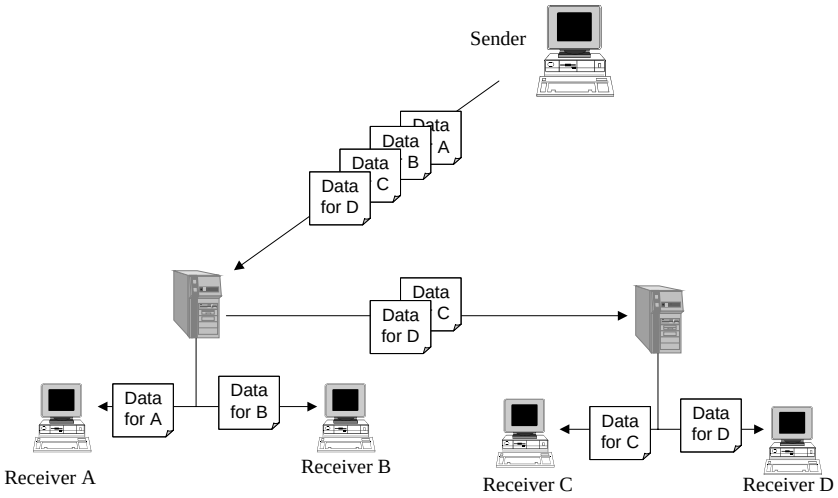
IPv6

- One of the design criteria for the new IPv6 was to support transport of multimedia content.
- Unlike IPv4, IPv6 packets can indicate:
  - high priorities
  - the fact that multiple packets belong in a single traffic “flow”
- Routers can use the information to route the packets appropriately.
  - Eg. process the higher priority packets first.

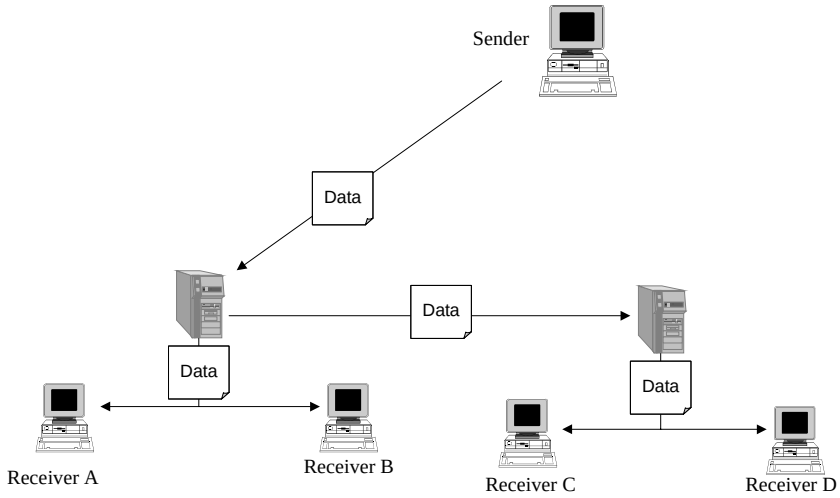
IP Multicasting

- Unlike e-mail or web communications, which is ***unicast*** (one sender, one receiver), more and more multimedia delivery is now ***multicast*** (one sender, multiple receivers).
- Eg.
  - Live event broadcasts.
  - Streaming movies.
  - Voice, video or text conferencing.

Multicasting in a Unicast Network



Efficient Multicasting



Protocols to Support Multimedia Transport

- A few protocols exists which were defined to support efficient multimedia transport.
- Examples:
  - Real Time Transport Protocol (RTP) and Real Time Control Protocol (RTCP)
  - Resource Reservation Protocol (RSVP)
- Besides multicasting, the example protocols also has other features to support better delivery.

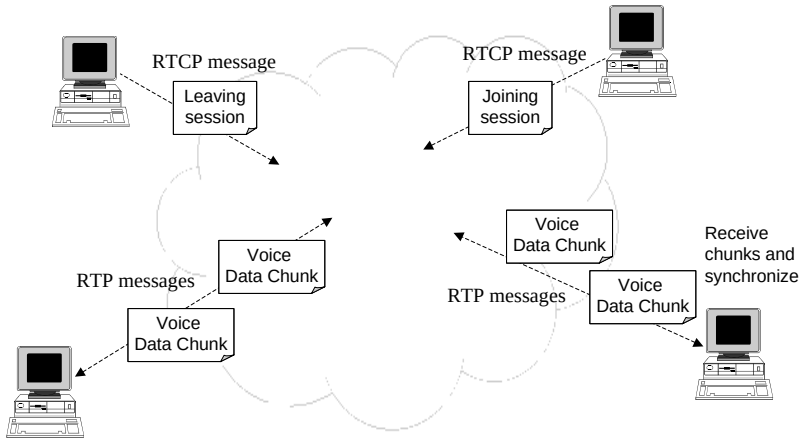
Real Time Transport Protocol (RTP)

- Designed to support real-time traffic,
  - Mainly audio and video conferencing,
  - But can be used for any real-time multicasting.

Real Time Control Protocol (RTCP)

- The control information sent by the various senders to coordinate the multicasting session is defined by the Real Time Control Protocol (RTCP).
  - All participant periodically send RTCP messages to the others to convey information (eg. changes in congestions, a new receiver in the multicast, a receiver leaving the session, etc).

Example Audio Conference



Mixed Audio and Video in RTP

- In sessions involving both audio and video, the two media are transmitted as separate RTP sessions.
    - RTCP packets are transmitted for each medium using different ports and different addresses.
    - To allow some participants to receive only one medium if they choose

Mixers and Translators

- Not all sites may want to receive media data in the same format.
- Eg. participants in one area are connected through a low-speed link while others have a high-speed network access.
    - An RTP-level mixer may be placed near the low-bandwidth area.
    - This mixer mixes the incoming audio streams into a single stream, translates the audio encoding to a lower-bandwidth one and forwards the lower- bandwidth packet stream across the low-speed link.

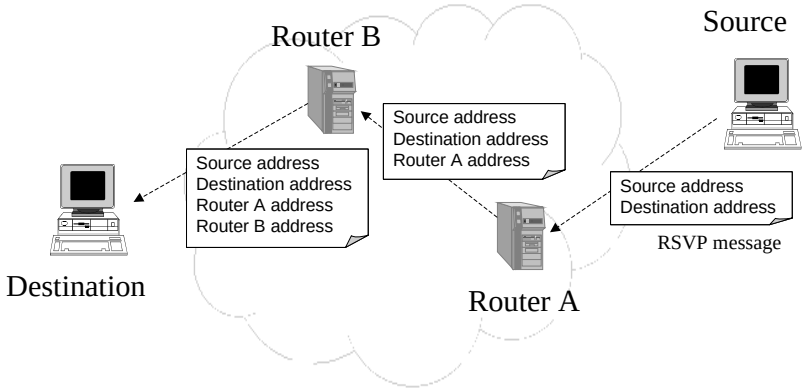
Limitations of RTP

- RTP does not handle:
    - timely delivery - how long it takes to get to the receivers.
    - Guarantees that packets will reach receivers.
- It depends on lower layer software to handle them.

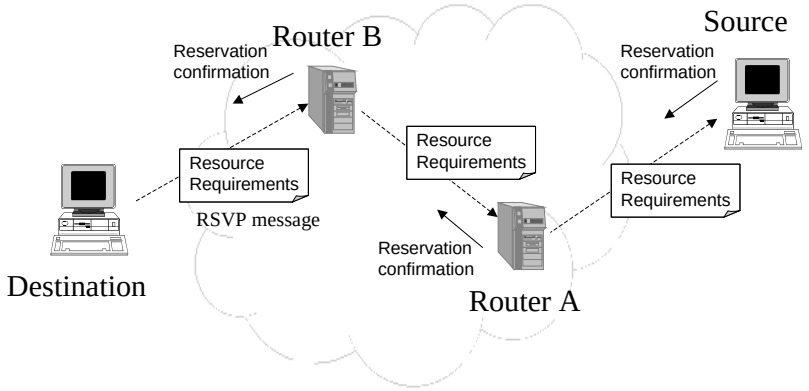
Resource Reservation Protocol (RSVP)

- Defines a procedures for packet recipients to tell sender and routers what it's capacities and limitations are.
    - Reserves resources, eg. bandwidth.
- Works on the assumption that a receiver knows what its requirements are.

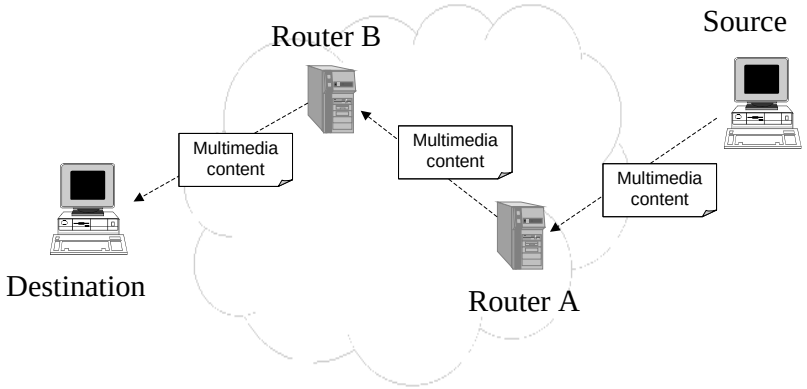
RSVP Path Determination



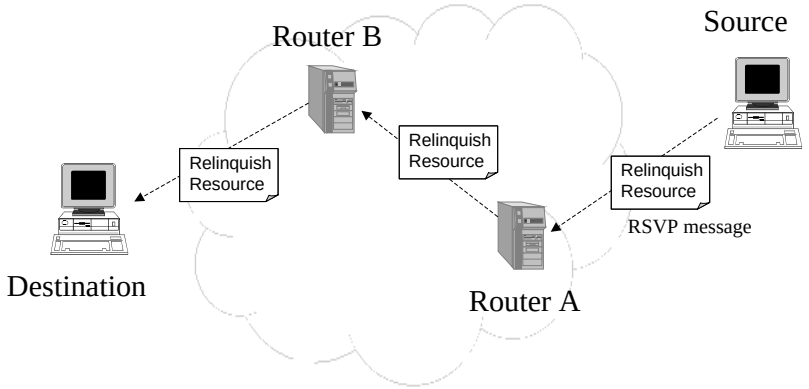
RSVP Resource Reservation



Content Transport through path fixed by RSVP



RSVP Path Teardown



Further Reading

- IPv6
  - http://playground.sun.com/pub/ipng/html/ipng-main.html
- RTP/RTCP
  - http://www.cs.columbia.edu/~hgs/rtp/
- RSVP
  - http://www.isi.edu/div7/rsvp/rsvp.html

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