















## Applications of multicast

- videoconferencing
- collaborative workgroups

   group editing
- file downloads
- IP TV
- distributed games
- distributed databases or computation

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## Multicast: Bandwidth Reduction

- applications
  - IP TV, file distribution
- · but some caveats
  - reliability? worried about ACK implosions
  - different users with different start times? what happens to what you already sent?
  - bandwidth glut? if you have lots of spare bandwidth, why bother with multicast?
  - other approaches? peer-to-peer

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Multicast: Naturally Many-to-Many Apps

- some apps may be *inherently* many-to-many
  - examples: on-line gaming, collaborative apps like teleconfering or shared editing
- if so, is it easier to build them as
  - client/server
  - many-to-many (peer-to-peer?) using unicast
  - many-to-many using multi-cast

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- mcast groups identified by IP addr
- sending: anyone can send to meast grp - don't need to be a member
- receiving: hosts *join* and *leave* groups via IGMP
- network builds multicast *distribution tree* to send data
  - responsibility of *designated router* on same LAN as host (and other rtrs in the network)

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- uses normal IP-Send operation, with an IP multicast address specified as the destination
- must provide sending application a way to: -specify outgoing network interface, if >1
  - available -specify IP time-to-live (TTL) on outgoing packet
- -enable/disable loopback if the sending host is a member of the destination group on the outgoing interface 13b multic 45



Why not do things at the app? today mostly happen at application ex: instant messaging, gaming, content distribution networks why not do this? (digression) why multicast? save bandwidth: avoid sending same pkt on same link twice
anonymous addressing: find anyone in the group, don't have to know who they all are what info do we have at the application? only have limited topology information => harder to save bandwidth because it's harder to tell when you have shared links
 anon addressing is harder too... you end up keeping lists of at least some group members (version discrepancies... people could run different software): [not really network vs. app difference]

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• occupies similar position and role as ICMP in the TCP/IP protocol stack

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## **Multicast Status**

• MBone exists

- moderately widely used in research
- but not always stable
  - multi-domain routing is hard—everyone has to talk, and often people don't talk about experimental services :-(
- Some commercial use (apps)
- but very little ISP support
  - concerned about how to charge, and potential overuse
- Multicast widely used on LANs
   Casela Internitives it for load balance
- ex. Google. Inktomi use it for load balancing 13b\_multicast\_overview: Sci551 SP2006 ⊕ John Heidemann 72