Many applications belong to the category of collaborative computing

- E-mail
- Bulletin board
- Text-based conferencing (MS Messenger)
- Desktop teleconferencing (NetMeeting)
- Video Teleconferencing
These applications can be classified using the following properties:

- **Time** – Asynchronous or synchronous
- **User scale** – two single users or a group users, the number of groups may or may not change, group member may or may not have the same role
- **Control** – centralized or distributed control
Group Communication Architecture
Group Communication Architecture

- **Group rendezvous**
  - Provide methods for setting up collaborative group meetings and providing static and dynamic information about groups and ongoing meetings

- **Shared applications**
  - Mechanism for supporting group communication application activities

- **Conferencing**
  - Synchronized tele-collaboration
  - Often involves transmission of videos and audio
Transport Subsystem for Multimedia Applications

- **Requirements**
  - Significant data throughput – Multimedia applications often involve large amount of video and audio data. High data throughput is often required
  - Fast data forwarding – Multimedia applications often impose constraints on maximum end-to-end delay
  - Multicasting – Multimedia data are sent to multiple destinations for data sharing

- We will examine existing transport protocols to see how they satisfy these constraints
Internet Transport Protocols

- Provide full-duplex end-to-end internet connection with reliable transmission. It is built on unreliable transmission protocols based on the following strategies
  - Sequencing numbering
  - Retransmission on timeout
  - Positive acknowledgement on reception of information

- For multimedia applications
  - The positive acknowledgement causes heavy overhead
  - Retransmission may cause the system to violate the deadlines
User Data Protocols

- An extension to IP that supports multiplexing and simple error detection (checksumming)
  - Fast because there is no acknowledgement
  - Unreliable when the bandwidth is low
  - No guarantee of the correctness of the transmission

- For multimedia applications
  - Pros – fast, low overhead
  - Cons – not reliable
Network Layer for Multimedia Applications

- Internet Protocol
  - IP with the following properties and services
    - Addressing and multicasting
    - Type of service
    - Internet group management Protocol
    - Routing
    - Some other internet services
IP Address and Multicasting

- Accommodate five classes of addresses: A, B, C, D, E.
- The address is represented by 32 bits
- Class A: 7 bits for network number
- Class B: 14 bits for network number
Multicasting

- Class E: for multicasting transmission
- The routing system should be aware which networks have hosts in the multicasting group
- Implemented by special routing algorithms (e.g. mrouted in Mbone) based on the Internet unicast assumption
Routing

- The Internet routing algorithm may transmit packets using different routes. This is an advantage when the link layer encounters some errors or delays.
- For multimedia applications, it is ideal to have a fixed path between two end points.
- This is a problem that needs to be addressed.
Internet Group Management Protocol (IGMP)

- A protocol for managing Internet multicasting groups
- Used for conferencing applications (join, leave, etc)
- Allows multimedia data to be sent all members of a multicast group
- The multicast routers periodically send out queries to detect the presence of group member on a particular network. This knowledge is used in multicast routing algorithms.
- Queries are sent infrequently to reduce overhead