Lecture 9 Multimedia Communication Systems

- Application Subsystem
- Transport Subsystem
- Quality of Service And Resource Management

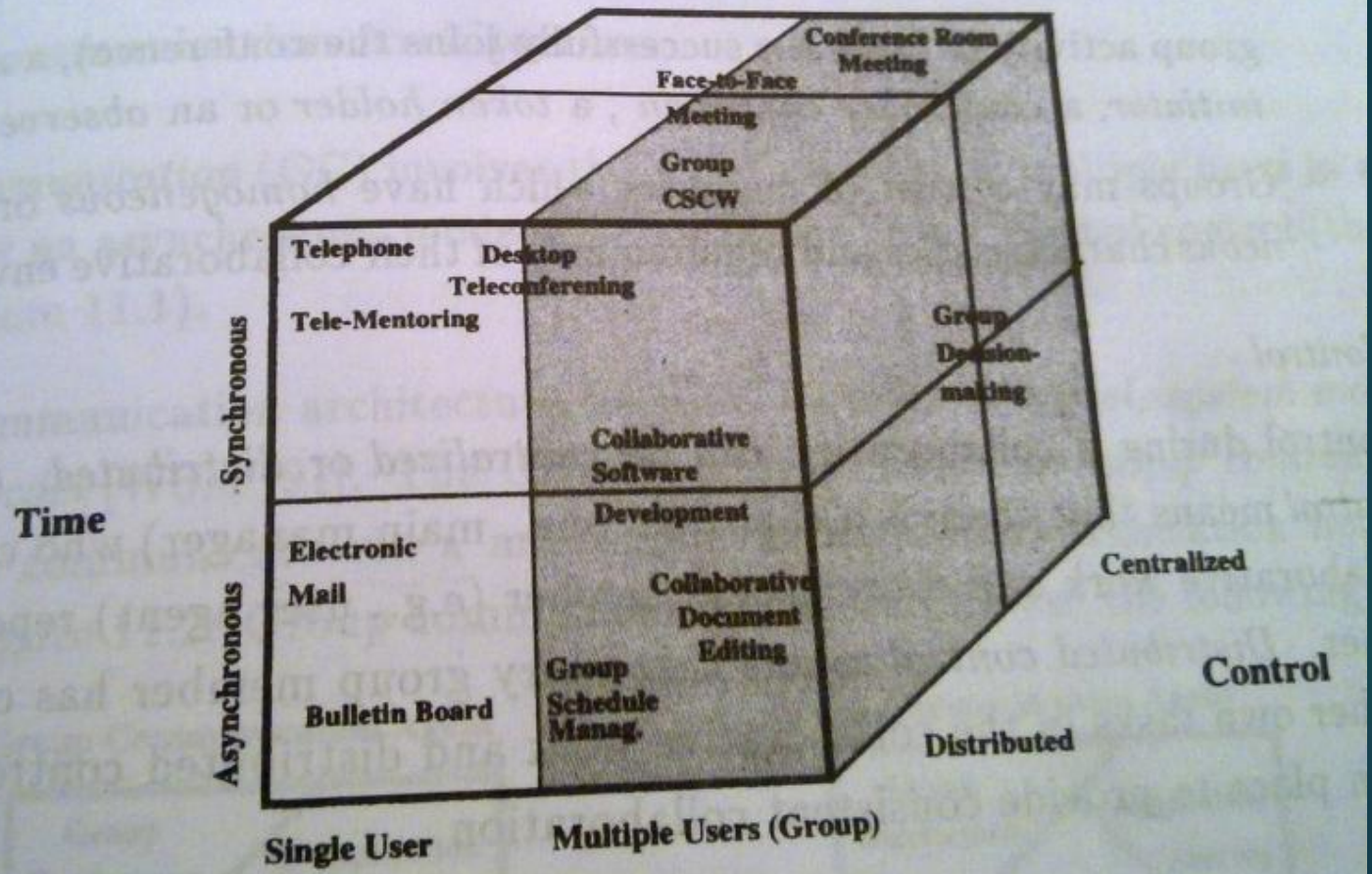
Application Subsystem

- Collaborative Computing
  - CSCW (Computer Supported Cooperative Work)
  - E.g. Electronic mail, bulletin boards, social networking, chat engine, conference systems, screen sharing tools

Collaborative Dimensions

- Can be categorized according to: time, user scale, control
  - Time : asynchronous (processing activities that do not happen at the same time e.g email) and synchronous (cooperative work that happens at the same time (e.g conferencing)
  - User scale: specifies whether a single user collaborates with another user or a group of more than two users collaborate together.
    - Groups can be further classified as
      i. Static (pre-determined participating members and membership does not change during the activity) or dynamic (group members can join or leave the activity at any time)
      ii. Group members may have different roles in CSCW like a conference initiator, conference chairman, token holder, an observer, member of a group etc
      iii. Group members may have homogeneous or heterogeneous characteristics
  - Control: Centralized (there is a chairman who controls the collaborative work and every group member reports to him or Decentralized (every group member has control over his/her own tasks and distributed control protocols are in place to provide consistent collaboration

11.1. APPLICATION SUBSYSTEM



Group communication (GC) Architecture

- GC involves the communication of multiple users in a synchronous or an asynchronous mode with centralized or distributed control
- GC architecture consists of a support model, system model and interface model
- GC support model includes group communication agents that communicate via a multicast communication network
- Group communication agents use Group Rendezvous, Shared Applications, and Conferencing for their collaboration

shown in Figure 11.2. Group communication agents may use the following f

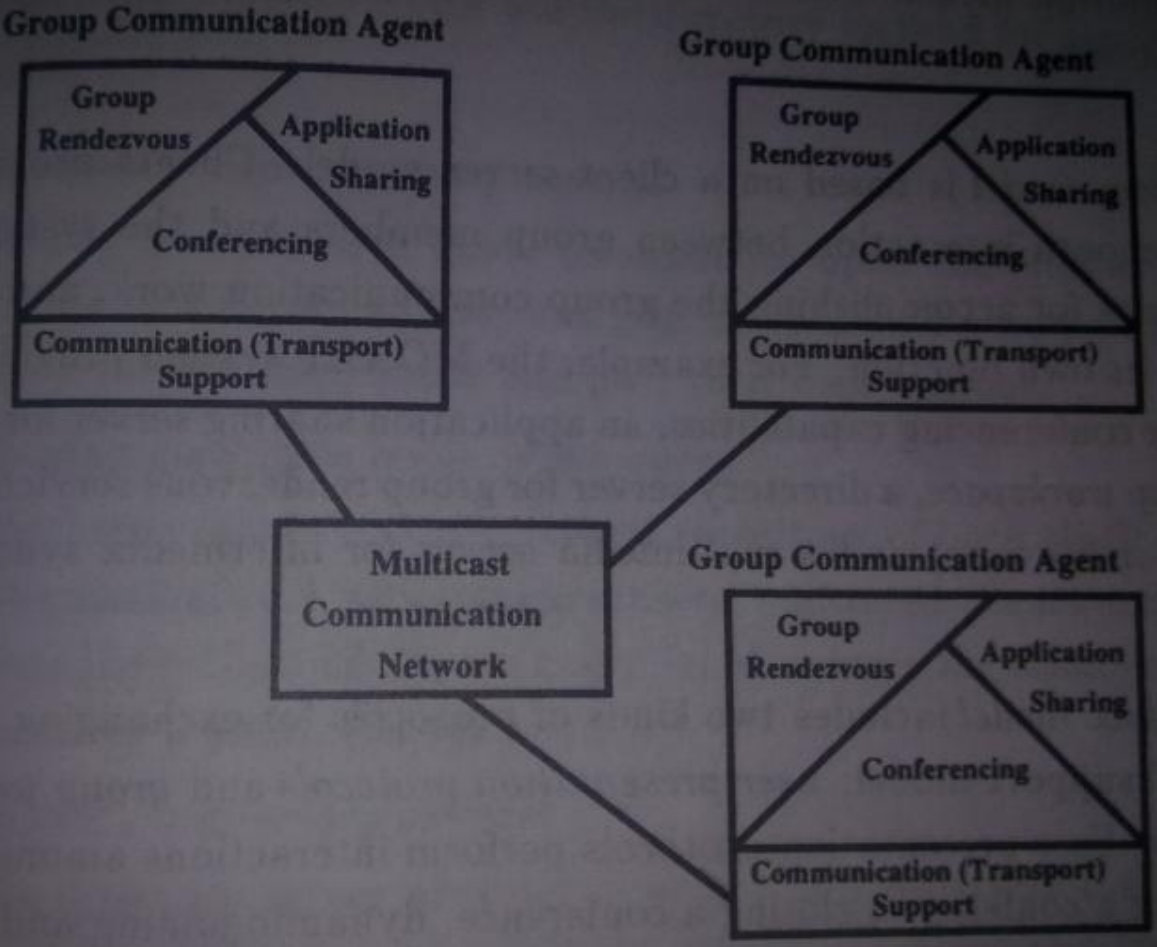


Figure 11.2: *Group communication support model.*

- Group Rendezvous – denotes a method which allows one to organize meetings, and to get information about group, ongoing meetings and other static and dynamic information

- Shared Applications – denotes techniques which allows one to replicate information to multiple users simultaneously. The remote users may point to interesting aspects (via telepointing) of the information and modify it so that all users can immediately see the update information (e.g joint editing)

- Conferencing – simple form of collaborative computing, provides the management of multiple users for communicating with each other using multiple media

Session Management

- An important (core) part of the multimedia communication architecture which separates the control, needed during the transport, from the actual transport
- Architecture – built around an entity – session manager

Session Control Architecture

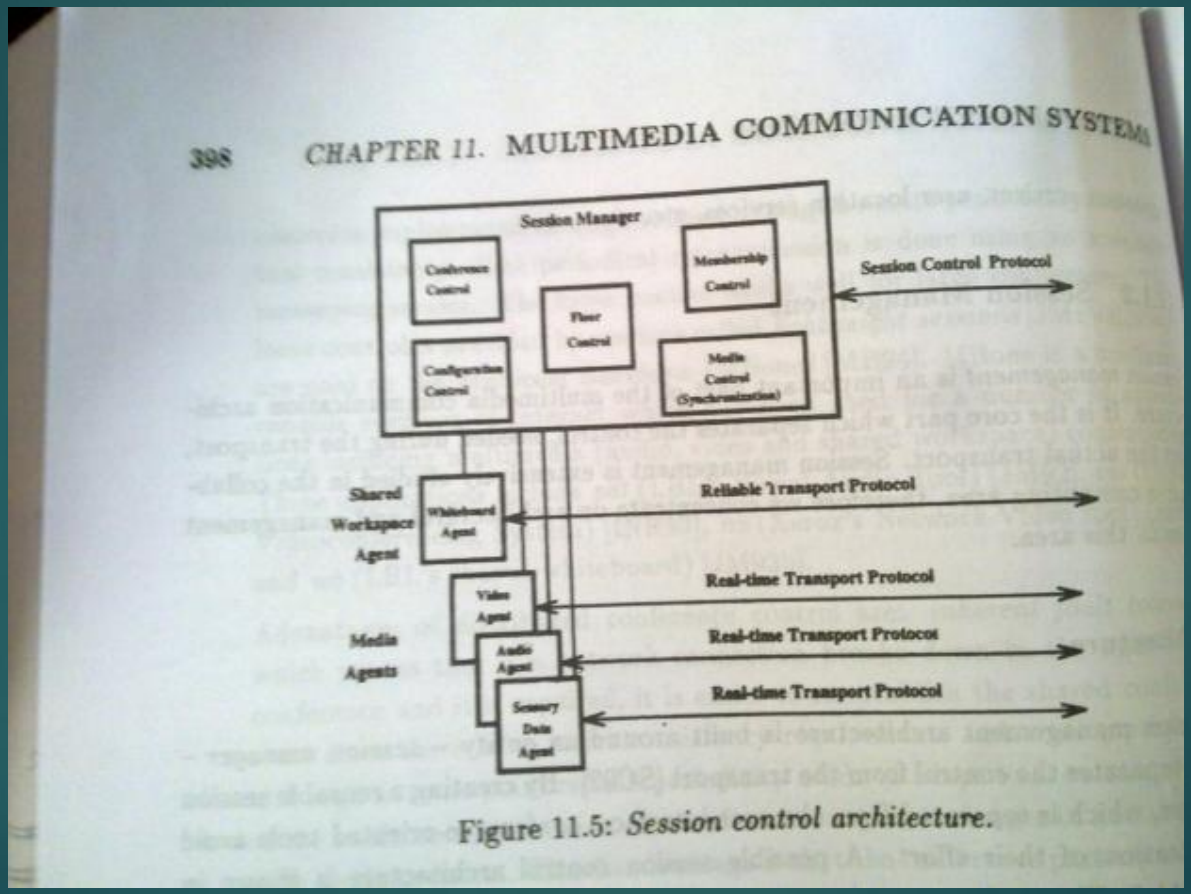


Figure 11.5: *Session control architecture.*

Session Control Architecture

- Session manager – includes local and remote functionalities
  - Local functionalities – includes membership control (participant authentication, presentation of coordinated user interface), control management for shared workspace (floor control), media control management (interconnection among media agents – synchronization), configuration management (exchange of interrelated QoS parameters or selection of appropriate according to QoS, Conference Control Management (establishment, modification and a closing of a conference)
  - Remote functionalities – communication with other session managers to exchange session state information which may include the floor information, configuration information etc
- Media Agents – responsible for decisions specific to each type of media
  - Allows a replacement of agents, each agent performs its own control mechanism over the particular medium like mute, unmute, change video quality, start sending, stop sending etc.
- Shared Workspace Agent – transmits shared objects (telepointer coordinate, graphical ot textual object) among the shared applications

Control

- Floor Control – is employed to provide access to the shared workspace
  - To maintain data consistency
  - To enforce access control – floor passing mechanism (only one participant has the floor at any time)
  - Floor handed off to another participant when requested, to obtain floor the participant must explicitly take action to signal a floor change
- Conference Control
- Media Control – includes a functionality synchronization of media streams
- Configuration Control – includes a control of mdeia quality, QoS handling, resource availability and other system components to provide a session according to user requirements
  - May embed services (negotiation and renegotiation of media quality)

Transport Subsystem – brief overview of transport and network protocols and their functionalities

- Requirements – User and Application
  - Data throughput – especially audio and video data
  - Fast Data forwarding
  - Service Guarantees
  - Multicasting

Transport Layer

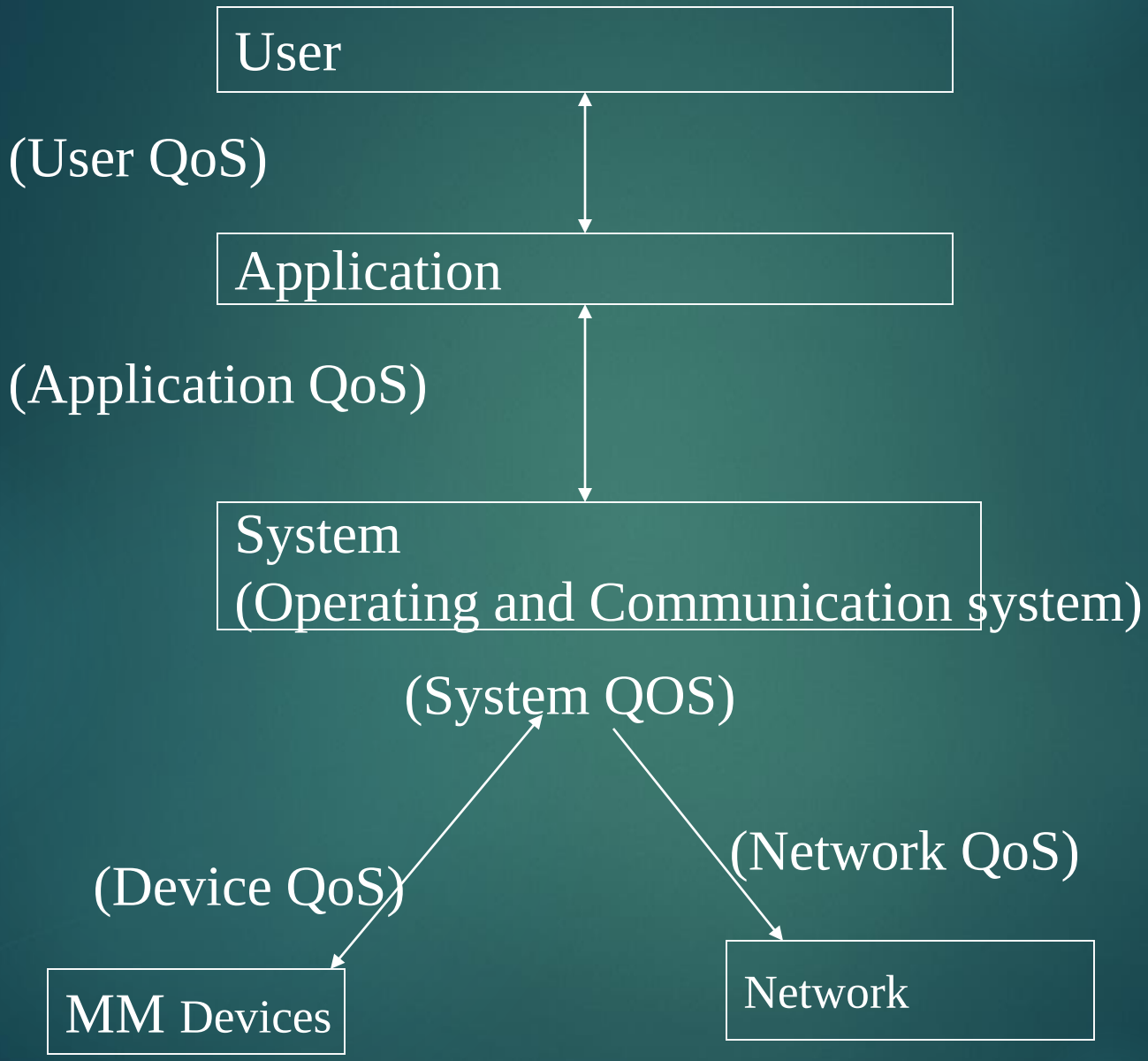
- TCP (Transmission Control Protocol)
- UDP (User Datagram Protocol)
- RTP (Real-time Transport Protocol)
  - Suitable for applications transmitting real time data or simulation data over multicast or unicast network services
  - Primarily designed to satisfy the needs of multiparty multimedia conferences, but not limited to that particular application
  - Does not address resource reservation and does not guarantee QoS for real-time serivces
- XTP (eXpress Transport Protocol)

Network Layer

- IP (Internet Protocol)
- IGMP (Internet Group Management Protocol)
- RSVP (Resource reSerVation Protocol)

Quality of Service (Qos)

- A CONCEPT FOR SPECIFYING HOW GOOD THE OFFERED NETWORKING SERVICES ARE
- CAN BE CATEGORIZED BY A NUMBER OF SPECIFIC PARAMETERS
- QOS LAYERED MODEL FOR THE MCS (IN THE NEXT SLIDE)


User
(User QoS)
Application
(Application QoS)
System
(Operating and Communication system)
(System QOS)
(Device QoS)
(Network QoS)
MM Devices
Network

QoS parameters

- The set of chosen parameters for the particular service determines what will be measured as QoS
- Most of the current QoS parameters differ from the parameters described in ISO because the variety of applications, media sent and the quality of the networks and end systems
- Hence many different parameters are

QoS parameters (Contd.)

- Possible set of QoS parameters for each layer

1. Application QoS Parameters – describe requirements for the application services possibly specified in terms of

   a. Media quality – which includes the media characteristics and their transmission characteristics, such as end to end delay

   b. Media relations – which specify the relations among media, such as media conversion or inter/intra stream synchronization

QoS parameters (Contd.)

2. System QoS parameters- describe requirements on the communication services and OS services resulting from the application QoS, specified in terms of quantitative and qualitative criteria

a. Quantitative criteria – those which can be evaluated in terms of certain measures, such as **bps (bits per second), no. of errors, task processing time, PDU size** etc.
b. Qualitative criteria – specify the expected services needed for provision of QoS, such as **interstream synchronization, ordered delivery of data, error recovery mechanism, scheduling mechanism** etc.

- Can be used by the coordination control to invoke proper services for particular applications

QoS parameters (Contd.)

3. Network QoS parameters – describe requirements on network services, specified in terms of

   a. Network load – describing the ongoing network traffic and characterized through average/minimal inter arrival time on the network connection, packet/cell size, and service time in the mode for the connection's packet cell.

   b. Network performance – describing the requirements which the network services must guarantee

      performance might be expressed through a source to destination delay bound for the connection's packet and

QoS parameters (Contd.)

4. Device QoS parameters – specify timimg and thtoughput demands for media data units

QoS parameter values and types of service

1. Guaranteed services – provide QoS guarantees, as specified through the QoS parameter values either in deterministic statistical representation

- Deterministic bounds can be given through a single value(e.g. average value, contractual value, threshold value, target value), a pair of values (e.g. min and average value, lowest quality and target quality) or an interval of values (lower bound is the min value and upper bound is the max. value)

- statistical bounds on error rate etc

QoS parameter values and types of service (Contd.)

2. Predictable services (historical services) – based on past network behavior
   - Hence the QoS parameters are estimates of past behavior which the service tries to match
3. Best effort services – services based on either no guarantees or no partial guarantees
   - There is either no specification of QoS parameters required, or some bound in deterministic or statistical forms are given
   - Most of the current network protocols have best effort services