CS 414 – Multimedia Systems Design

Lecture 24 – Multimedia Session Protocols (Layer 4-5)

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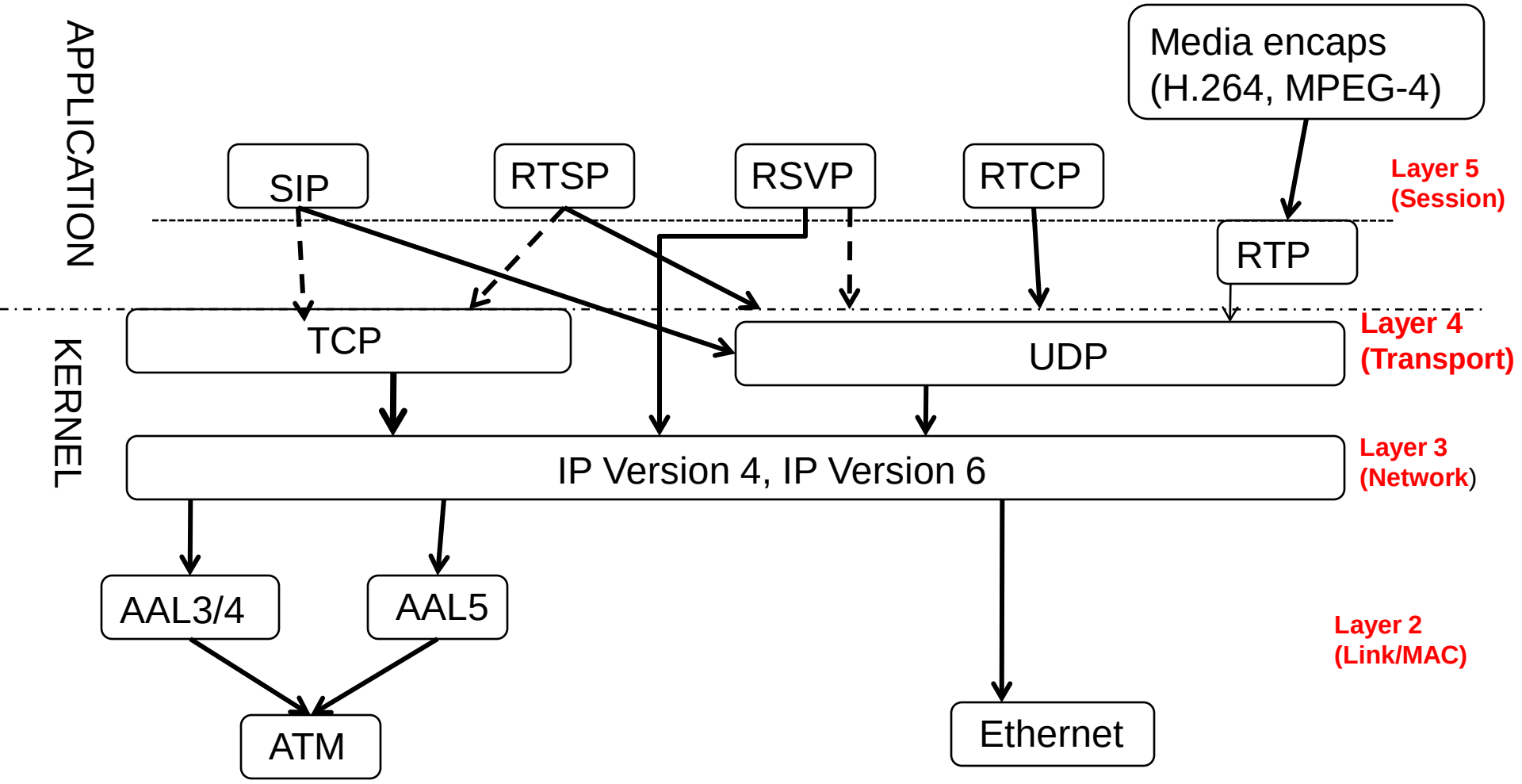
Administrative

- MP2 demonstrations 5-7pm in 216 SC, March 2
- HW1 is out, deadline March 6, midnight
  - Individual effort!!! (take it as a midterm preparation)
- Midterm, March 9 11-11:50am in class
  - All topics/lectures until February 27, i.e., the material covered this week March 2-9 will not be on the midterm
  - You can bring calculator and 1 page of cheat-sheet (otherwise, exam is closed book, closed notes)

Internet Multimedia Protocol Stack

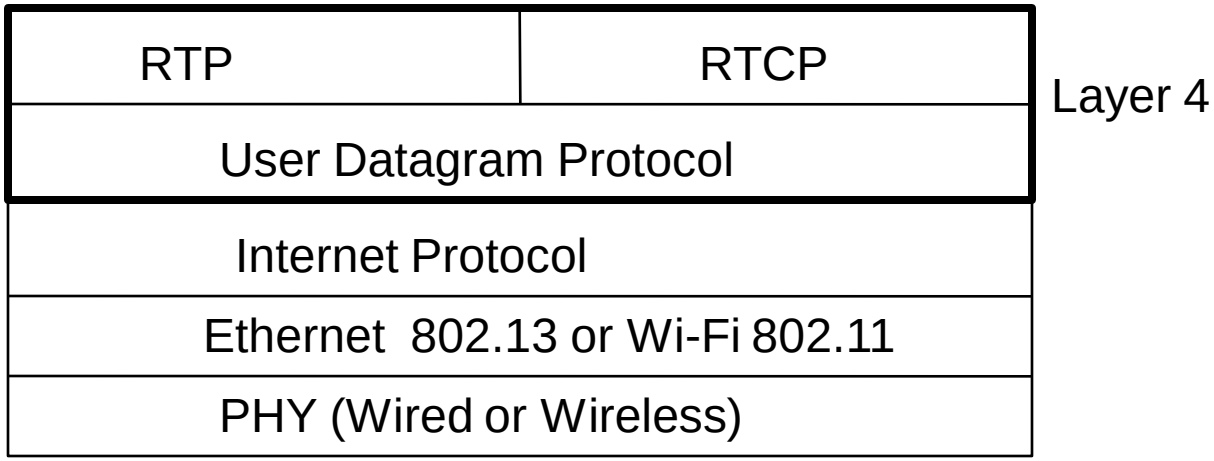


Service Requirements for Real-time Flows (Voice/Video)

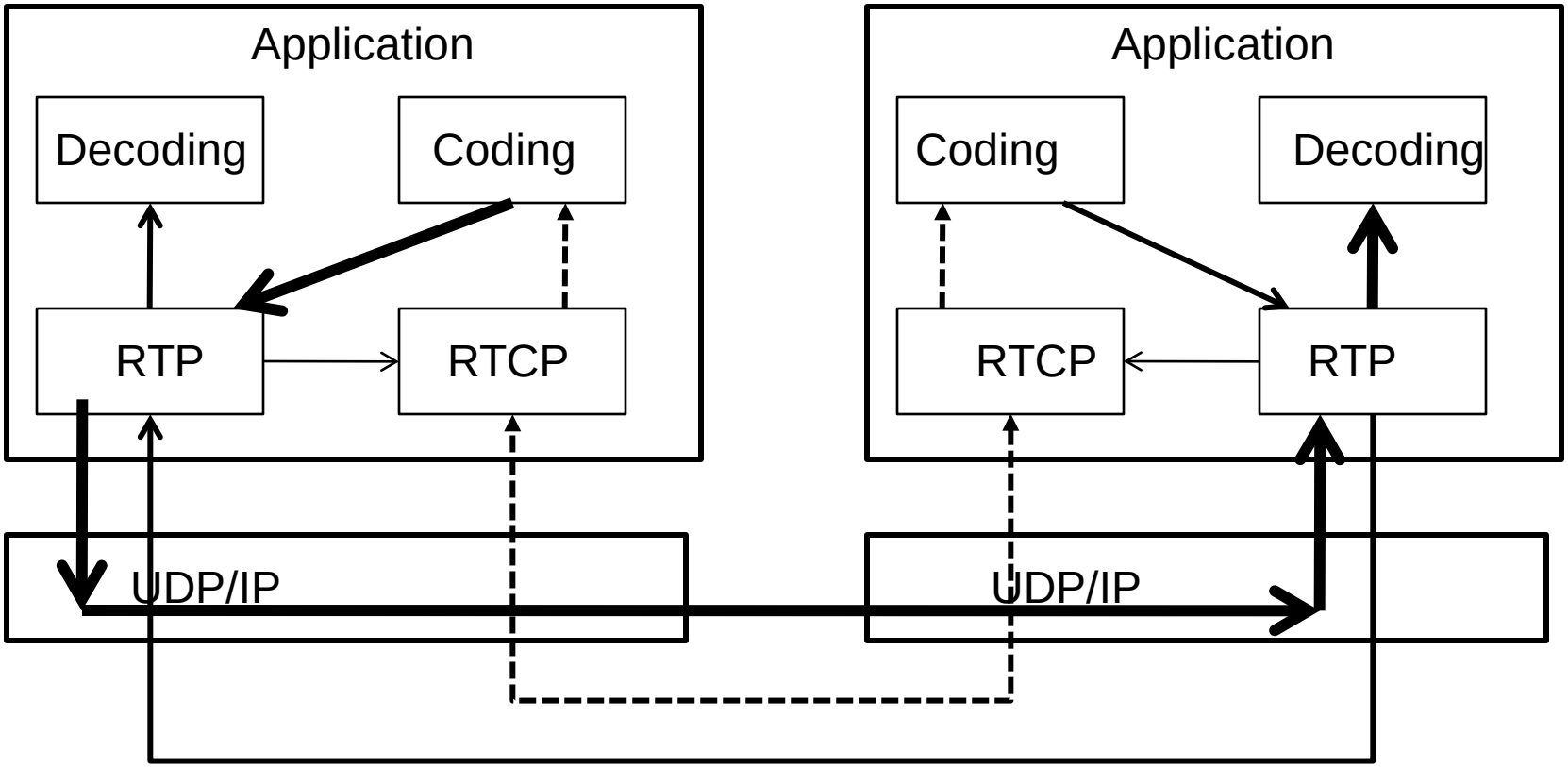
- Sequencing
- Intra-media synchronization
- Inter-media synchronization
- Payload identification
- Frame indication

Real-time Transmission Protocol (RTP)

- RTP provides end-to-end transport functions suitable for real-time audio/video applications over multicast and unicast network services
- RTP companion protocol – Real-time Transport Control Protocol (RTCP)



Relation between RTP and RTCP



RTCP: Control and Management

- Out-of-band control information for RTP flow.
  - Monitors QoS for RTP in the delivery and packaging of multimedia data
  - Used periodically to transmit control packets to participants in a streaming multimedia session.
  - Provides feedback on the **quality of service** being provided by RTP.
  - Gathers statistics on media connection
    - Bytes sent, packets sent, lost packets, **jitter**, feedback and **round trip delay**.
    - Application may use this information to increase the quality of service, perhaps by limiting flow or using a different codec.

RTCP Functions

- There are several type of RTCP packets:
  - Sender report packet,
  - Receiver report packet,
  - Source Description RTCP Packet,
  - Goodbye RTCP Packet and
  - Application Specific RTCP packets.
- RTCP itself does not provide any flow encryption or authentication means. SRTCP protocol can be used for that purpose.

RTP Services

- Payload Type Identification
  - Determination of media coding
  - Source identification
  - RTP works with Profiles
    - Profile defines a set of payload type codes and their mappings to payload formats
- Sequence numbering
  - Error detection
- Time-stamping
  - Time monitoring, synchronization, jitter calculation
- Delivery monitoring

RTP Message

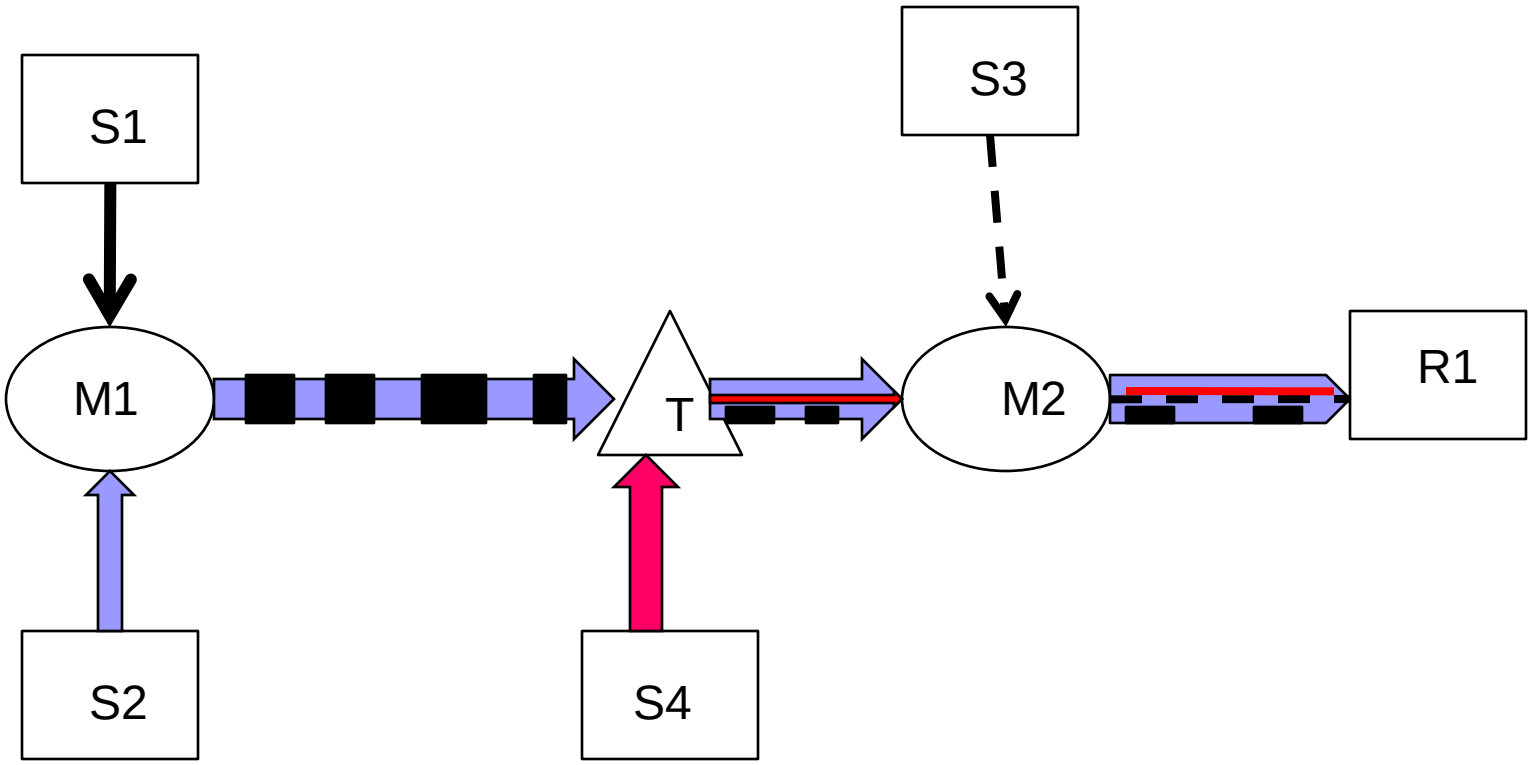

```
0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 3 3
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1

Ver   P  X  CC        M  PT          Sequence Number

Timestamp

SSRC

CSRC [0..15] :::
```

Ver – Version 2
P – Padding
X – Extension, if set, the fixed head is followed by exactly one header extension
CC – CSRC count
M – Marker – intended to allow significant events such as frame boundaries to be marked (defined by profile)
PT – Payload type
SSRS – synchronization source, CSRC – contribution source

RTP Services – Support of Heterogeneity

- Mixer service
  - Allows for resynchronization of incoming audio packets
  - Reconstructs constant 20 ms spacing generated by sender
  - Mixes reconstructed audio streams into single stream
  - Translates audio encoding to lower bandwidth
  - Forwards lower bandwidth packet streams
- Translator service
  - Allows for translation between IP and other high speed protocols
  - May change encoding data

Difference between Mixers and Translators

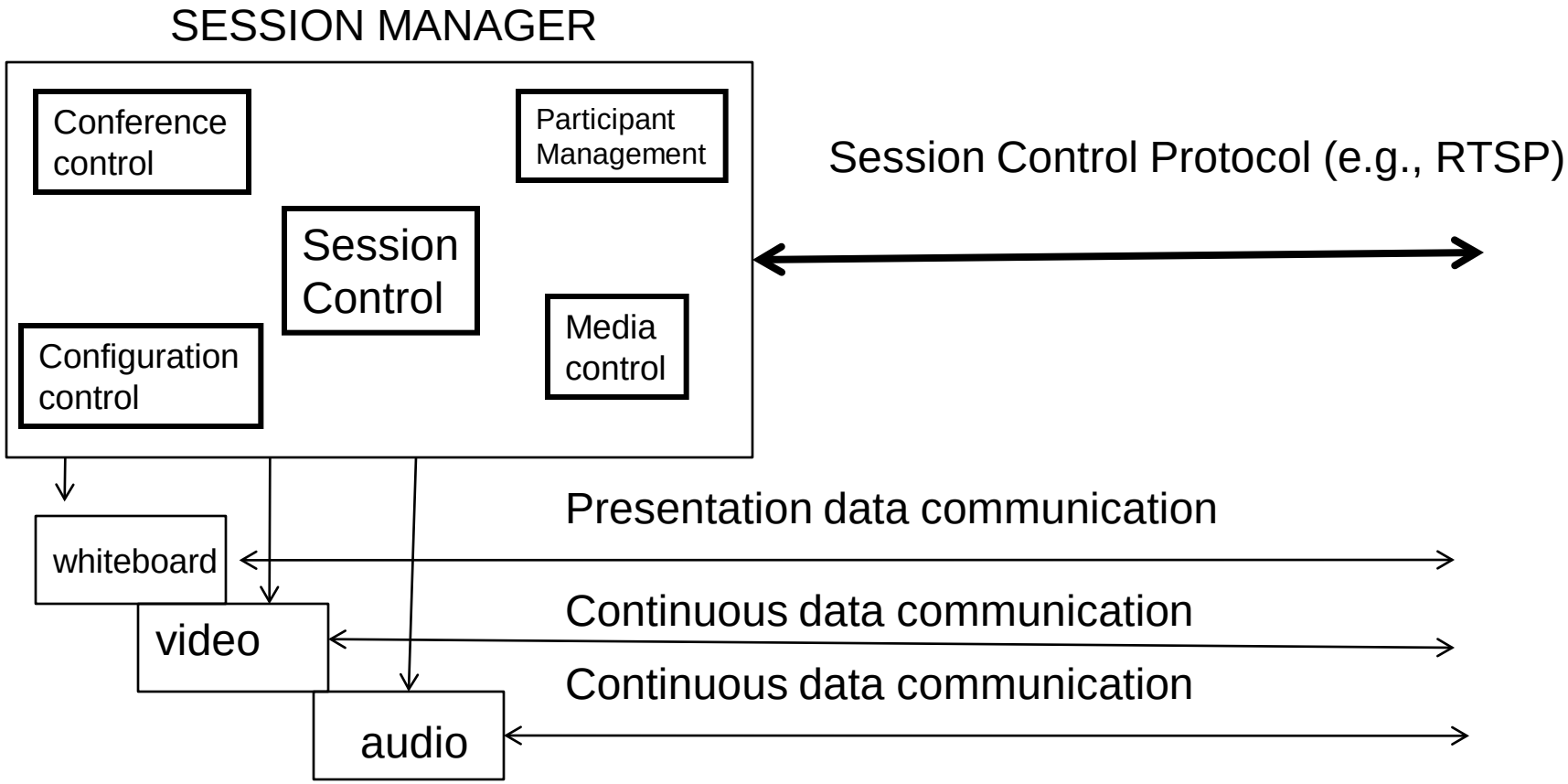


Payload Formats

- Static Payload formats
  - Established in RTP Profile
  - Payload type 0 := μ-law audio codec
- Dynamic Payload formats
  - Applications agree per session on payload format
  - H.263, JPEG, MPEG

Session Management (Layer 5)

- Important part of multimedia communication
- Separates control aspects from transport aspects



Session Manager

- Tasks:
  - Membership control
  - Monitoring of shared workspace
  - Coordination of Media control management
  - Exchange of QoS parameters
  - Conference control management – establishment, modification, termination

Session Control

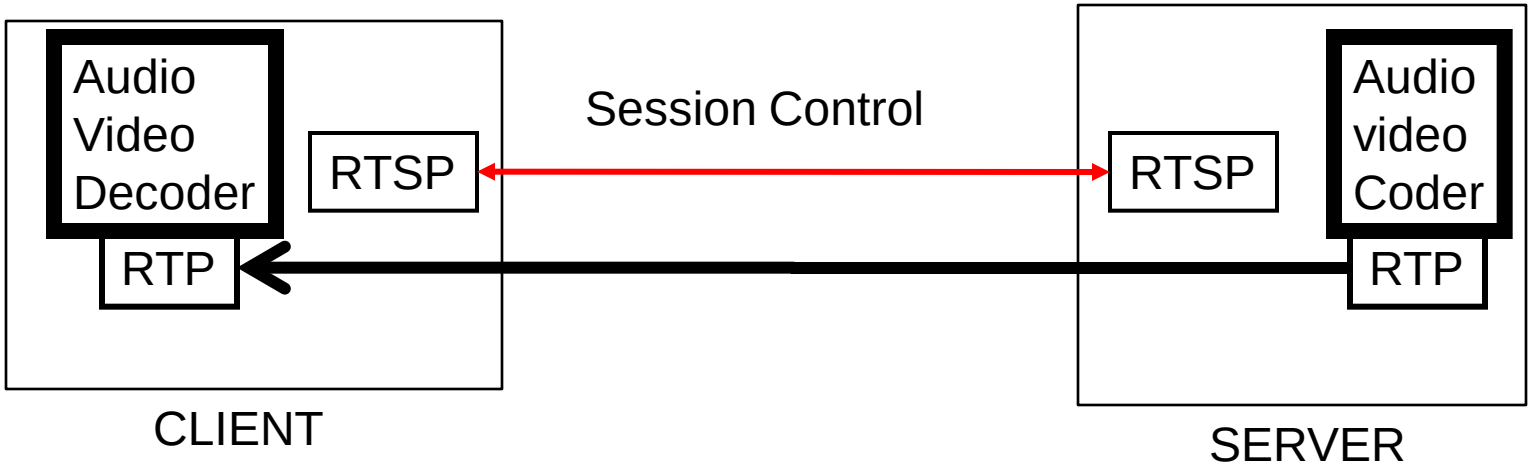
- Session Described by
  - Session state
    - Name of session, start, valid policies
- Session management – two steps for state processing
  - Establishment of session
  - Modification of session

Session Control

- Conference Control
  - Centralized or distributed approach
- Media Control
  - Synchronization
- Configuration Control
  - Negotiation of QoS parameters, admission control and reservation/allocation of resources
- Membership Control
  - Invitation of users; registration of users, change of membership

Real-Time Streaming Protocol (RTSP)

- Application Protocol for Control of multimedia streams
- This is **not** an application data transmission protocol, just **remote control protocol** between client and server



RTSP

- Approved as Internet Draft, February 2, 1998, authors H. Schulzrinne, A. Rao, R. Lanphier
- Enables controlled, on-demand delivery of real-time data such as audio and video
- Intends to control multiple data delivery sessions
- Provides means for choosing delivery channels
  - UDP
  - Multicast UDP,
  - TCP

RTSP Methods

Request	Direction	Description
OPTIONS	S <-> C	Determine capabilities of server (S) or client (C)
DESCRIBE	C -> S	Get description of media stream
ANNOUNCE	S <-> C	Announce new session description
SETUP	C -> S	Create media session
RECORD	C -> S	Start media recording
PLAY	C -> S	Start media delivery
PAUSE	C -> S	Pause media delivery
REDIRECT	S -> C	Use other server
TEARDOWN	C -> S	Destroy media session
SET_PARAMETER	S <-> C	Set server or client parameter
GET_PARAMETER	S <-> C	Read server or client parameter

RTSP Extensions

- Timing
  - RTSP needs to hide latency variations
  - PLAY request may contain information about when request is to be executed
- Three types of timestamps
  - SMPTE (the same as in TV production)
    - Format: hours:minutes:seconds:frames
  - Normal play time
    - Measured relative to beginning of stream and expressed in ours, minutes, seconds and fractions of second
  - Absolute time
    - Wall clock

Conclusion

- RTP usage – in several application audio and video tools (vat, vic)
- RTP follows the principle of application level framing and integrated layer processing
- RTP/UDP/IP is being used by the current streaming session protocols such as RTSP
- Session protocols are actually negotiation/session establishment protocols that assist multimedia applications
- Multimedia applications such as QuickTime, Real Player and others use them