

# Multimedia Communications

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(國立交通大學 電子工程系)

## Time/Date/Instructor

- 9:10am – 12:00pm, Thursday (Sept June 18 – Jan 14, 2010), 科技大樓 332
- Instructors: Hsueh-Ming Hang, 杭學鳴
- [hmhang@mail.nctu.edu.tw](mailto:hmhang@mail.nctu.edu.tw)
- Classnotes: <http://cwww.ee.nctu.edu.tw/>

## Grading

- 3 Homework Assigns: 35 % (including 2 computer assignments in C, 15% each)
- Examine: 30% (2 hours, open book)
- Final Project: 35% (select a topic from a given list; oral and written reports)

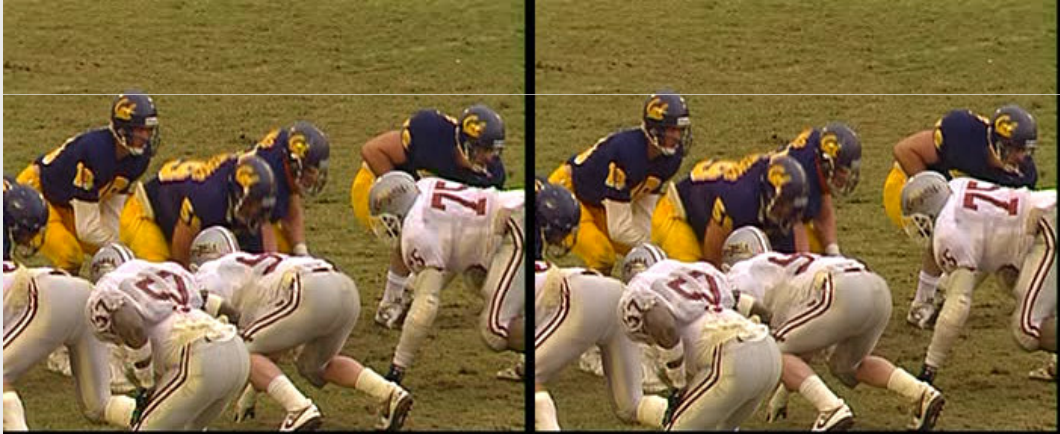
## Recommended Readings

- (1) H.-M. Hang and J.W. Woods ed., Handbook for Visual Communications, Academic Press, 1995.
- (2) Y. Q. Shi and H. Sun, Image and Video Compression for Multimedia Engineering, 2nd Ed., CRC Press, 2008. .
- (3) K.R. Rao, et al., Intr. to Multimedia Communications, John Wiley & Sons, 2006.
- (4) 戴顯權等, 多媒體通訊, 滄海書局, 2008.
- (5) J.-N. Hwang, Multimedia Networking: From Theory to Practice, Cambridge Univ. Press, 2009.

# Demo: AVC vs MPEG-2

- Test sequence: Football 8 secs

- Resolution: 352 x 240
- Frame rate: 30 frm/sec



hmhang, CSIE, NTUT

Sept. 2009

Comm Lab  
Communication Laboratory

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## Chap. 1 Introduction

# Multimedia

(S&N, Multimedia)

- Text
- Image: (2-D) spatial representation of objects – real (natural) and virtual (synthetic)
- Graphics: represented by graphics primitives (lines, rectangles, polyhedron etc) and their attributes
- Audio: vibration of matter – speech, music
- Video: motion pictures (natural)
- Animation: changes that have a visual effect. A computer-based animation is performed by a computer using graphical tools.

# Multimedia (cont.)

- Multimedia: more than one medium – text, pictures, sound, video, ...
- Continuous media
  - Audio, video, animation
  - A series of consecutive units of equal presentation of duration.
- Discrete media
  - Text, graphics, image
  - Displayed as one presentation unit

# Multimedia Information Systems

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- Multimedia information systems allow for
  - ◆ Creation
  - ◆ Processing
  - ◆ Storage
  - ◆ Management of multimedia information
  - ◆ Retrieval
  - ◆ Transfer
  - ◆ Presentation

# Multimedia System Applications

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- VCD, DVD
- Videophone, video conference
- Digital TV
- Video-on-Demand, interactive TV
- Web page
- Video games, computer game
- Digital libraries, digital museums
- Distance learning
- Electronic books

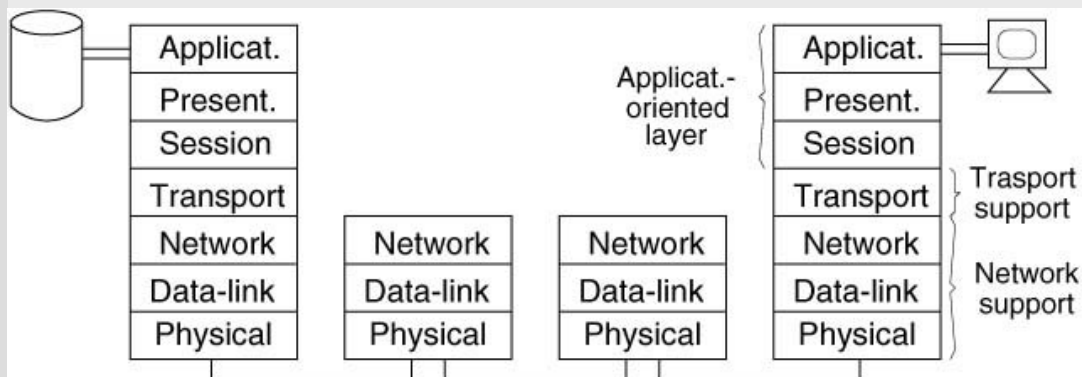
# Server-Client Structure



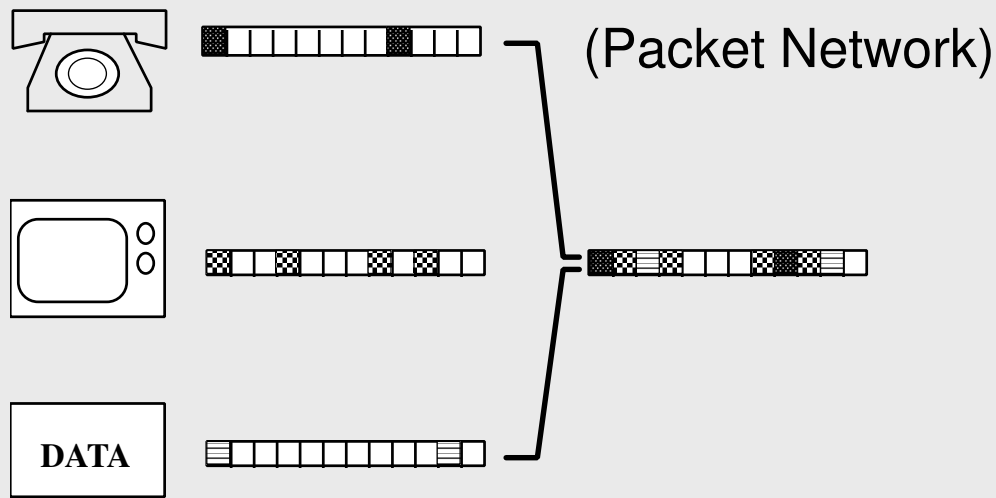
- One-to-one; One-to-many
- Constant bit rate (CBR); Variable bit rate (VBR)
- Symmetric (two way); Asymmetric (one way mostly); Broadcast (one way and one to many)
- Real-time encoding/decoding (videophone); Storage media (video library)

# Video over Computer Networks

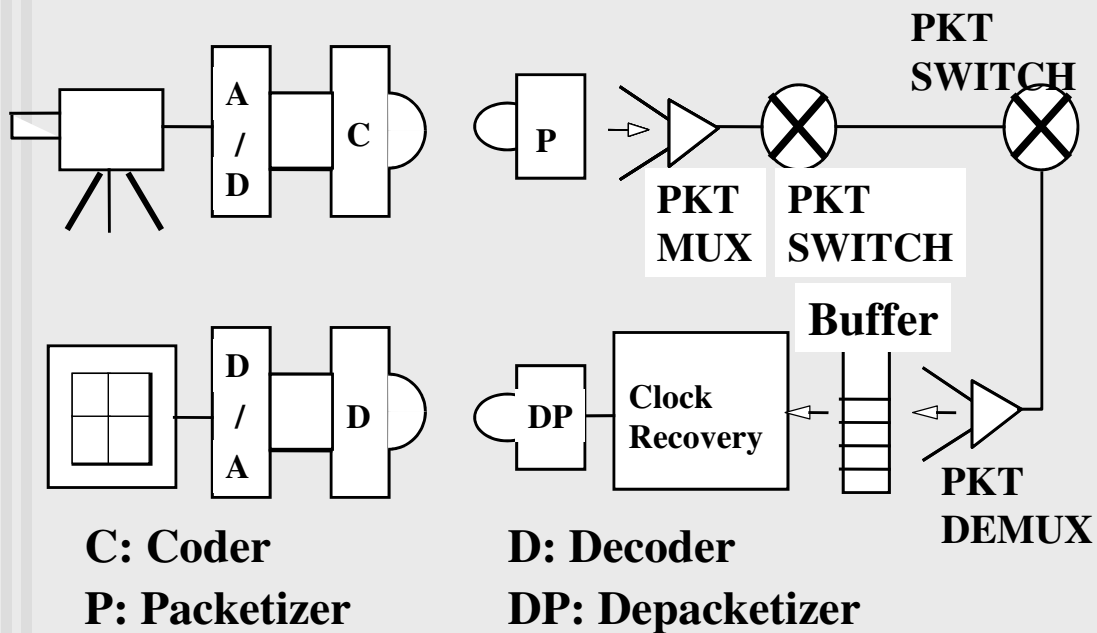
-- OSI (Open Systems Interconnection) Reference Model



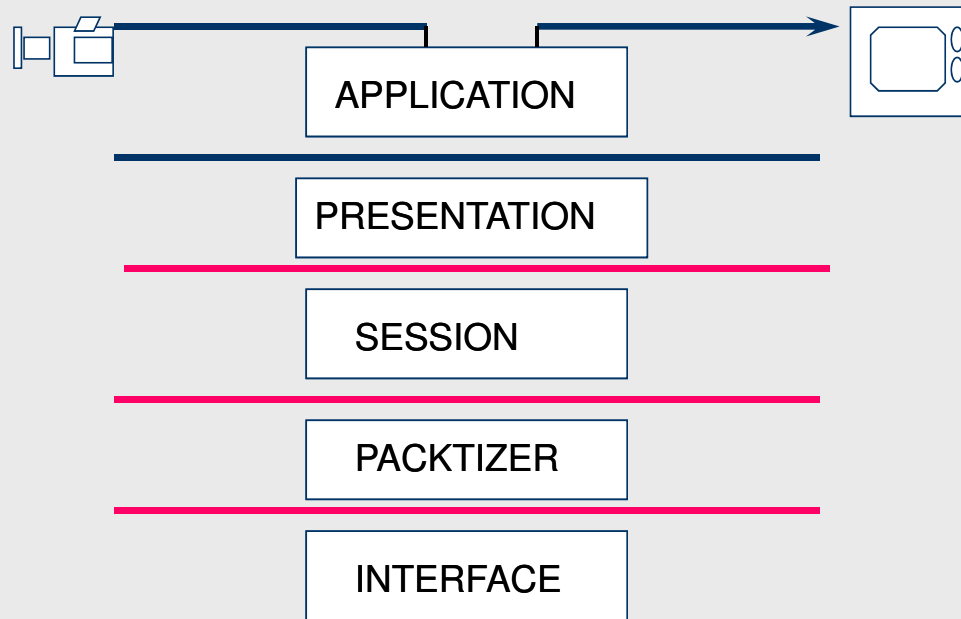
# Multimedia over Packet Network



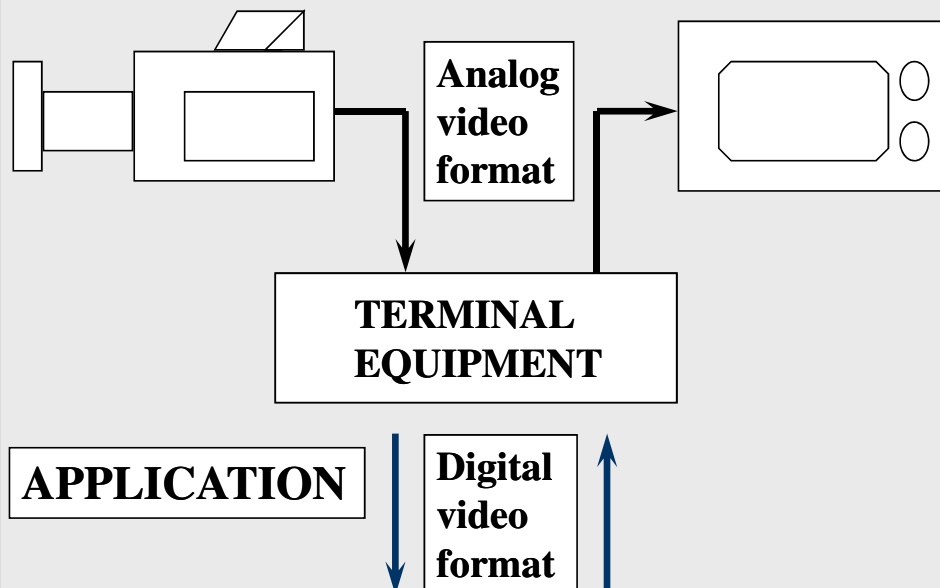
# Video over Packet Network



# Packet Video System Layers

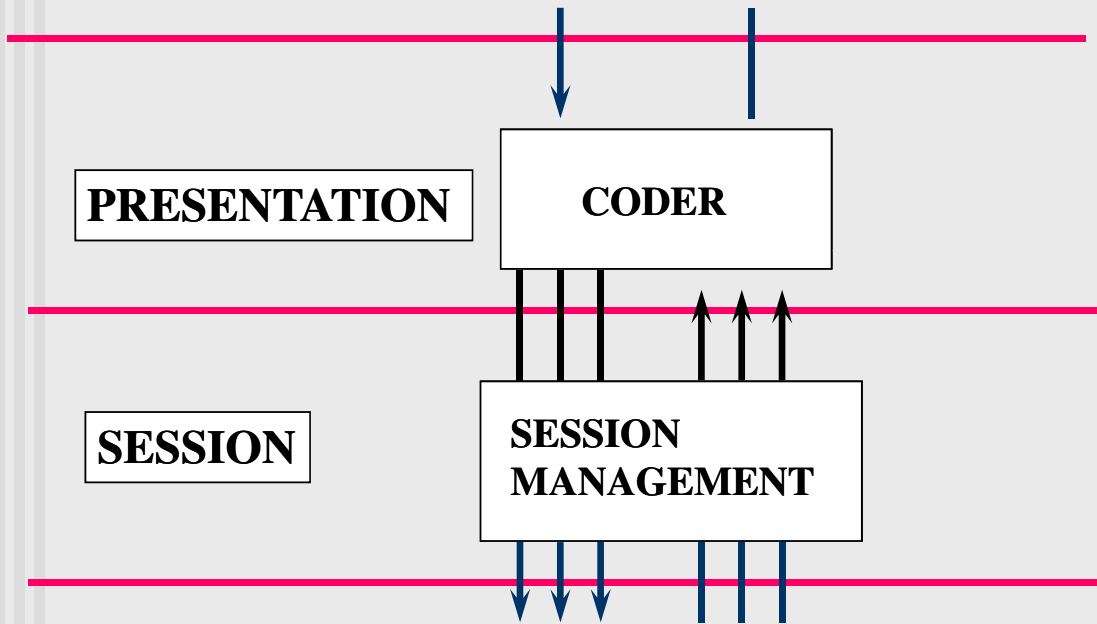


# Packet Video – Application Layer

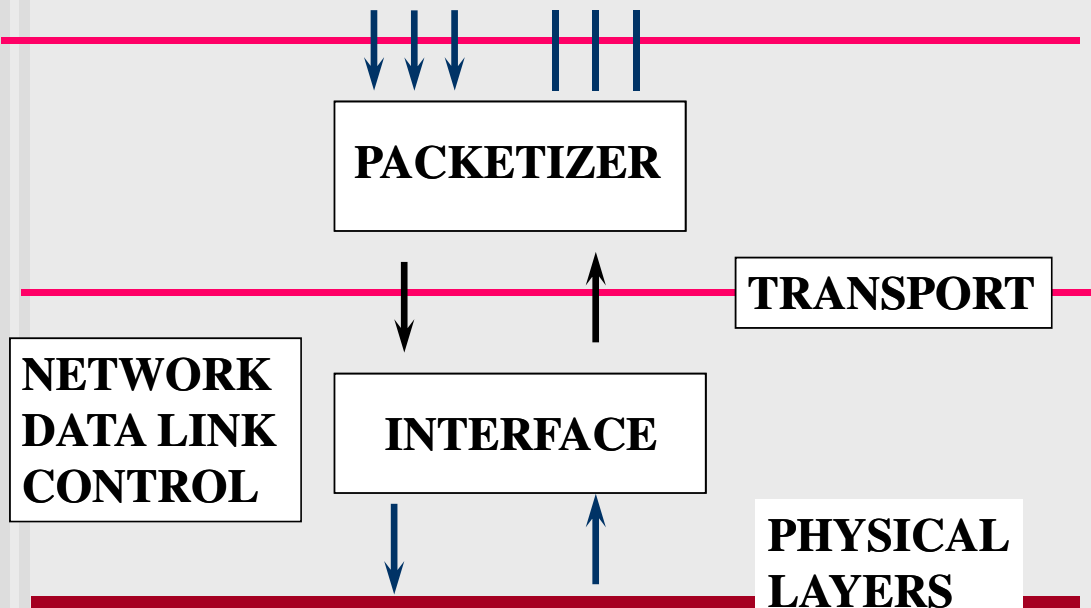




# Packet Video – Middle Layers



# Packet Video – Lower Layers



# Technologies in Multimedia Systems

*Problems: (1) Huge amount of data; (2) Real-time processing/transmission; and (3) Quality of Service (QoS)*

- Image/video/audio/speech compression: JPEG image, MPEG video, ...
- Data stream multiplexing and synchronization: H.320, MPEG system, ...
- Hypermedia presentation: HTML, MHEG, ...
- Multimedia operating system (real-time OS)
- Digital transmission: modulation, error control coding, ...
- Security: encryption, watermark, ...

# Technologies in Multimedia (cont.)

- Network architecture and interface: Ethernet, FDDI, ...
  - Network protocol and management: TCP/IP, ATM, RSVP, ...
  - Video server -- resource/process management (scheduling, ...)
  - Hypermedia database -- digital image/video/audio library
  - Authoring: multimedia editing, creation, ...
  - Hardware, VLSI, and system integration
  - Various peripheral devices: digital camera, display, DVD...
- ➔ *Hardware, Software, Networks, and Standards*

## International Standards

- ISDN Videophone (H.320, H.261, ...) (H.324, H.263, ...)
- MPEG-1 (ISO 11172) and Video CD
- MPEG-2 (ISO 13818/ H.222) and DVD
- MPEG-4 (ISO)
- MPEG-7, MPEG-21 (ISO)
- Grand Alliance HDTV (ATSC)
- European Digital Video Broadcasting (DVB)
- DAVIC
- ATM
- Internet: Mbone, RTP, RSVP, ...

## Example: ATSC Digital TV

-- *Advanced Television Systems Committee (ATSC) Digital Television Standard*

- ATSC: 1995
- For digital HDTV (terrestrial) broadcasting
- A: Video (MPEG2 Video)
- B: Audio (Dolby AC3)
- C: Transport Systems (MPEG Systems + ...)
- D: RF/Transmission Systems
- (E: Receiver)

# Topics in Multimedia

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-- *Wide variations. These topics are to be covered in this course*

- Multimedia Representation
- Data and Image Compression (LZ, JPEG)
- Speech, Audio, and Video Compression (H.261/263, MPEG1/2/4)
- MPEG-2 Systems and Optical Storage
- Digital TV and Multimedia Home Platform

# Topics in Multimedia (cont.)

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- MPEG-4 Systems and MPEG-21
- Database and Information Retrieval Technologies
- Content-based Multimedia Indexing and Retrieval (MPEG-7)
- Internet Search Engines
- Video-on-demand Systems