Lecture 7 – Computer Technology & Multimedia Operating System (MOS)

- Communication Architecture
  - Hybrid and digital system
- Multimedia Workstation
- Introduction to MOS
- Real time and Multimedia
- Resource Management
- Process Management
- File System

Introduction

- A multimedia system is comprised **of both hardware and software components.** (the hardware being the major force behind the multimedia development)

- e.g. Increased storage space, higher graphic resolution visual display cards, full duplex sound system, etc.

- A multimedia communication system was the outcome of multimedia hardware systems integrated with the communication system. The starting point being the **hybrid system**, where digital and analog components were integrated.

Communication Architecture

- Local communication system frequently includes a network interface card through which they can communicate with each other. The problem with conventional system is that the **audio and video cannot be carried out with the conventional communication infrastructure and network adapters.**

- The solution to this problem was that continuous and discreet media have been considered in different environments, independently of each other.

  e.g. The analog telephone system provides the audio transmission services using its original dial devices connected by copper wires to the telephone companies nearest end office

Communication Architecture cont…

- On the other hand, digital computer networks provide data transmission services at lower data rates using network adapters connected by the copper wires to the switches and routers.

*Analog and Digital Environment without interaction*
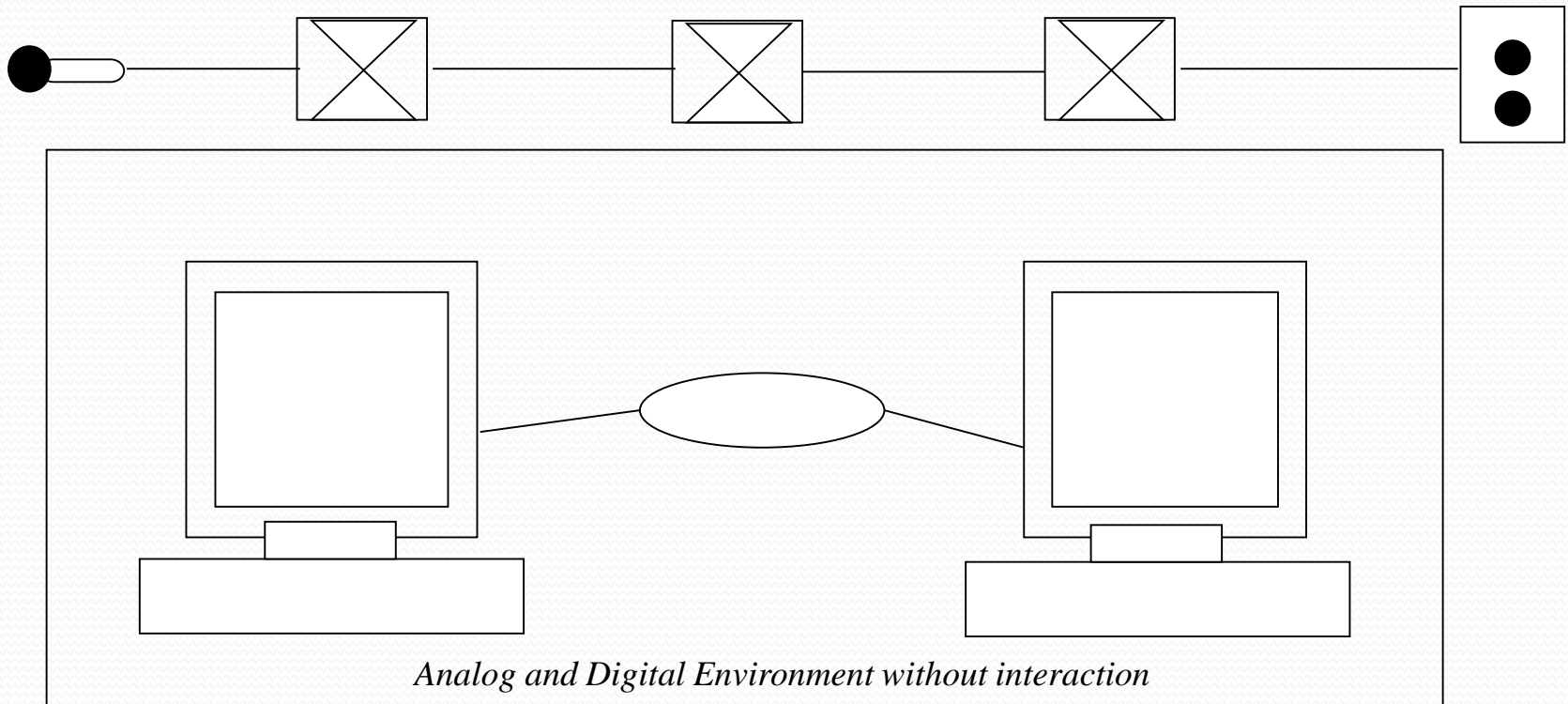
Hybrid Systems

- It is the integration and interaction of analog and digital devices.

- The main advantage of this approach is that it has all the necessary devices for input, output, storage and transfer   with high quality audio and video.

Integrated Device Control

- It is an approach that provides the control of analog input/output audio and video components in digital environment.

- The computer only controls and manages the streams, but it does not process the streams, hence the existing quality and format of audio and video are not changed

  E.g. IMAL (Integrated Media Architecture Library)

- This project integrated a number of analog and digital networks.

Integrated Device Control cont…
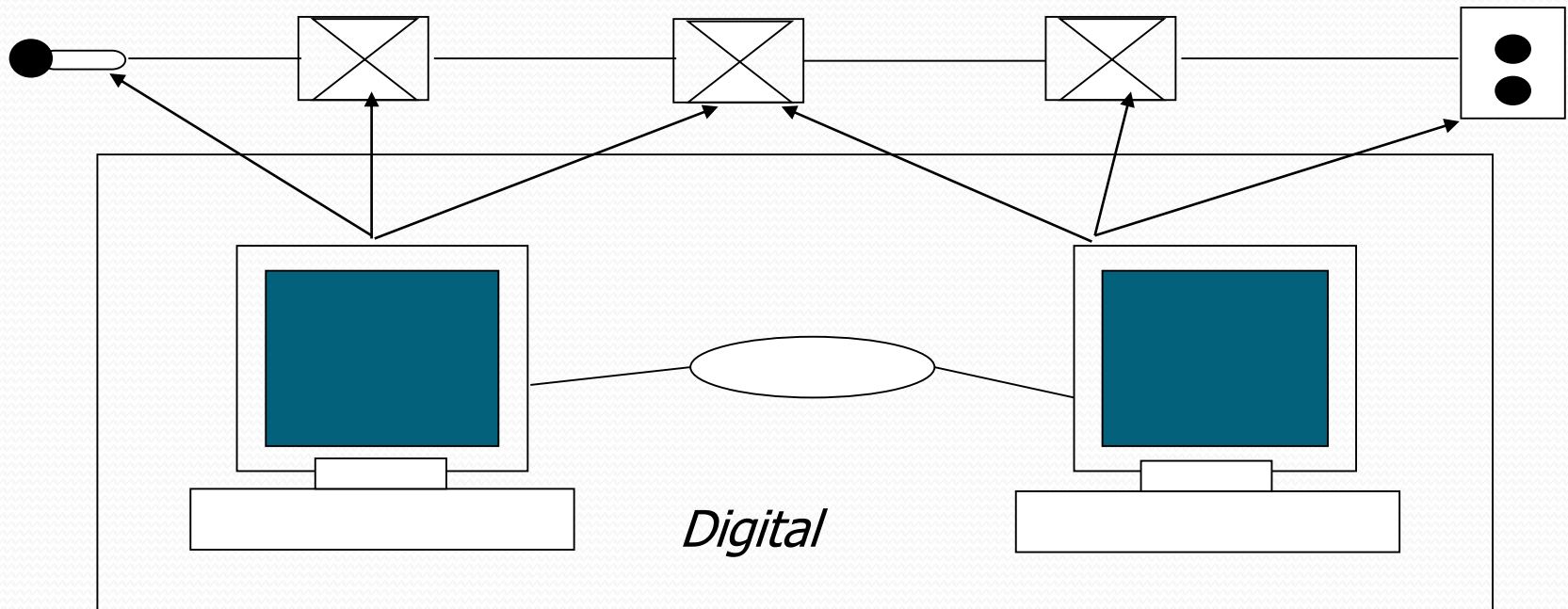
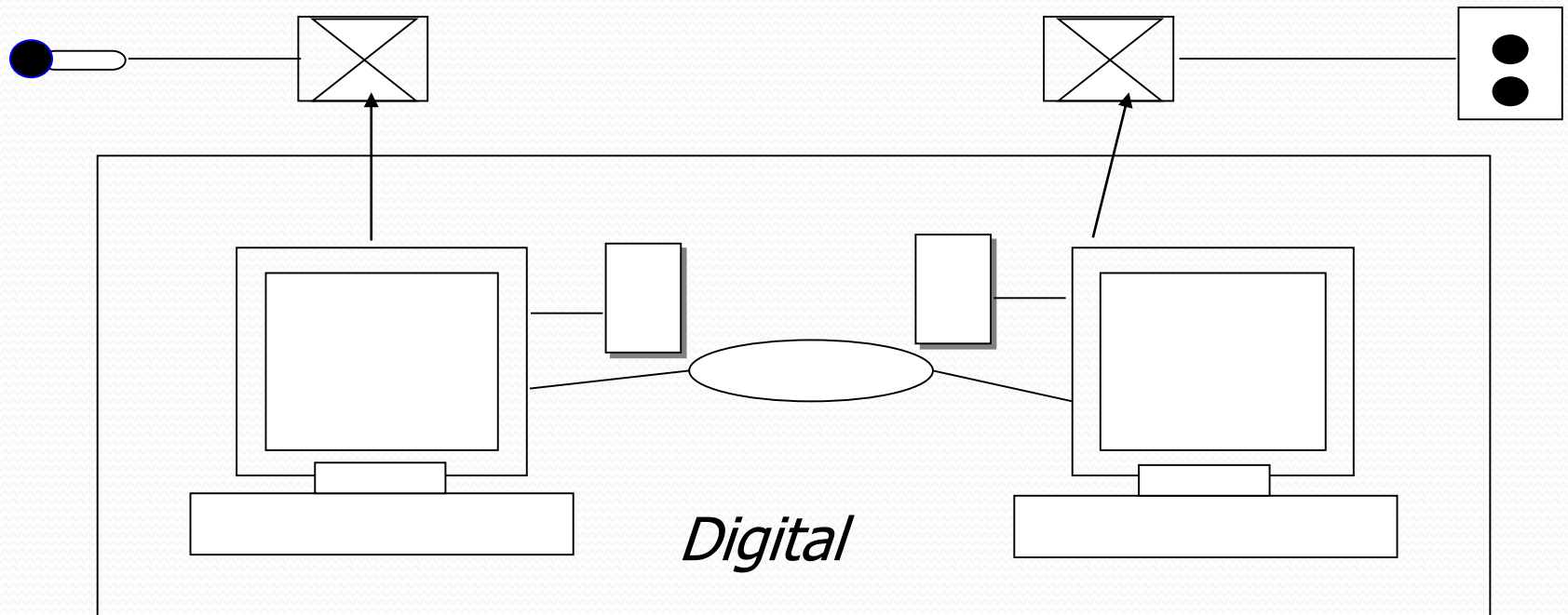*Computer control of all audio and video components*

Integrated Transmission

- In this approach the external analog audio and video devices are connected to the computers using A/D (D/A) converters outside of the computer, not only for control but also for processing purposes.

- This kind of structure implies several issues.

- Computer controls the external devices.

- The continuous data are processed externally as well as in the computer.

- The digitization of audio and video signals occurs before communication between computers.

- The next major issue is to synchronize the different media within a digital network.

Integrated Transmission Control

☐ This approach implies that analog audio and video sources and destinations are connected to the computers for control purpose to transmit continuous data over digital networks such as cable network.

☐ In the both approaches the computer only controls the devices for processing and transmitting audio and video data.

Integrated Transmission Control cont…

Digital

Continuous data input into a digital network under computer control

Digital Systems

- **Connection to Workstations**
  - **In this system the audio and video devices can be connected directly to the computers. And digitized audio and video data are transmitted over the shared data networks .**
  - **The devices in this case can be either analog or digital.**
  - **e.g. Voice Chat, Video conferencing**

Digital Systems cont…
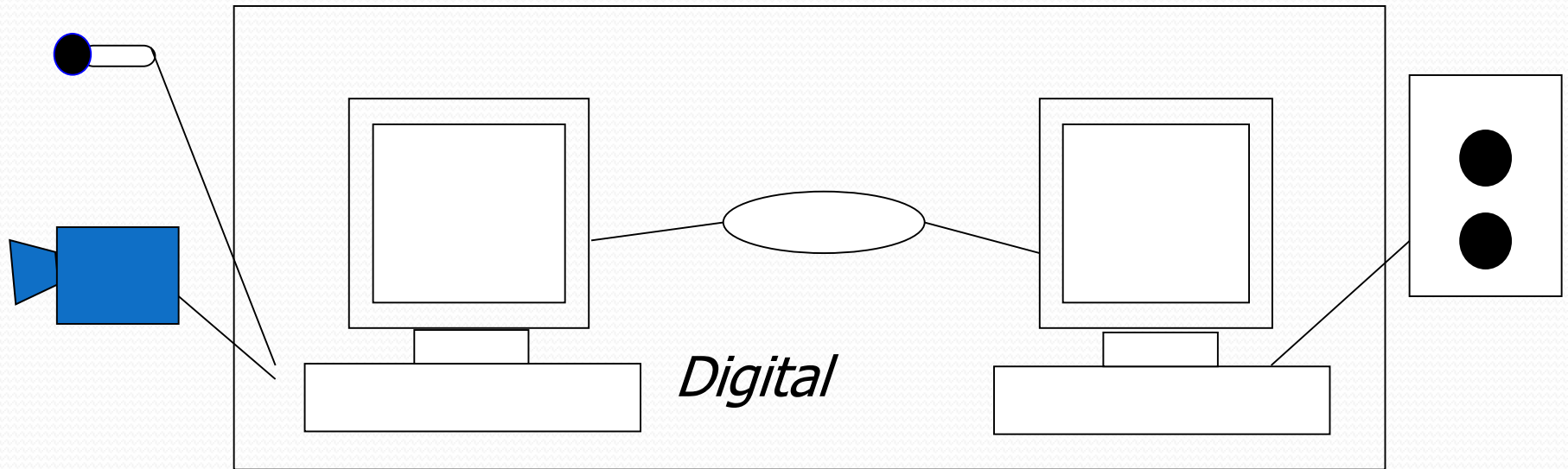
Digital

Integrated system structure with analog end system devices

and A/D and D/A interface

Digital Systems cont…

- **Connection to switches**
  - **Switches are devices that are similar to bridge but they are often used to connect individual computers with working principle as that of bridge.**
  - **(Which works by extracting the destination header from the frame header and looks it up in the table to see where to send the frame.)**
  - **The audio and video devices are directly connected to the network switches in a digital network**

Digital Systems cont…

Video Server

Connection to switches an example: VuNet

Switch — **Switch**

Switch
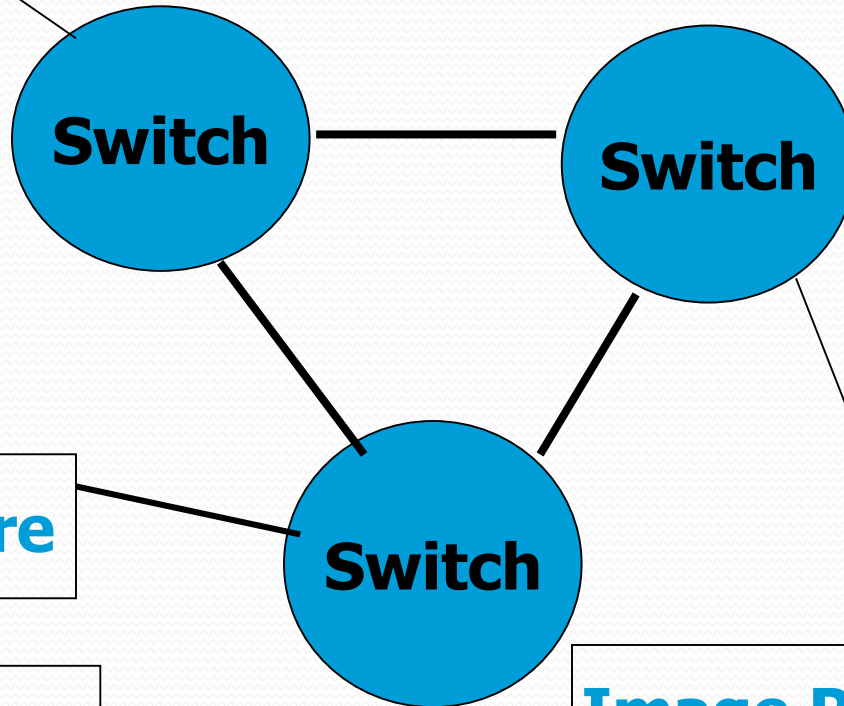
Video Capture

Analog TV Source

Image Processing System

Multimedia Workstation

- **A multimedia workstation is designed for the simultaneous manipulation of discreet and continuous media information.**

- **Components of Multimedia workstation**
  - **Standard Processor (Processing discreet media information)**
  - **Main memory and Secondary storage**
  - **Universal processors (Signal processor for processing data in real time)**
  - **Special purpose processors (graphics audio and video media processors)**
  - **Graphic video adapters (VGA, SVGA, EGA)**
  - **Communication adapters (Asynchronous Transfer Mode Host Interface)**
  - **Special purpose adapters**

- **e.g. Silicon Graphic workstation running IRIX with REACT TM (refer to figure 8.8 of page 220)**

BUS

- In current workstations, data are transmitted over the traditional asynchronous bus, which provides low and unpredictable time guarantee.

- The multimedia workstation in addition to this bus also require second bus, to transmit data, which can keep the time guarantee. (multi bus system)

MULTI MEDIA DEVICES

- This includes the input and output multimedia devices. (microphones, headphones, as well speakers)
- The video interface in a computer must accommodate the most commonly used video techniques/standards NTSC, PAL, SECAM, etc.
- A monitor serves for video output, which must have color, high resolution and flat and large shapes.

Primary Storage

- **Multimedia systems requires a high degree of memory management. Besides ROM'S PROM'S, EPROM', static memory elements, low cost dynamic memory modules are needed.**

Secondary Storage

- **A secondary storage device should high storage density and low access time.**

- **The other requirements include a high capacity at low price and a storage of discreet and continuous media together.**

Processor

- In multimedia workstation the necessary work is distributed among different processors.

- Like A dedicated signal processor allows the compression and decompression of audio in real time.

- A future development can see a multi-universal processor, which would have DSP properties unified with the CPU properties.

CHARACERISTICS OF REAL TIME SYSTEM

- Real time systems should show deterministic and predictable behaviour, which is achieved by processing **time-critical task in guaranteed time.**

  This guarantee cannot be assured for task that occurs at random intervals with unknown arrival times, processing requirements or deadlines.

- The another factor to take into consideration is that **no processing machine collapses** during the run time of a real time process.

Features of a Real Time System:

- Predictably fast response to time critical events and accurate timing information. Eg: Response to malfunction in a nuclear power plant must occur within a well defined period.

- High degree schedulability (the degrees of resource utilization) e.g. CPU and processes.

- Stability under transient load.

- The processing of critical task must be ensured even if the system is overloaded.

- Computer conferencing and multimedia are the new application areas in Real Time Systems

Real Time and Multimedia:

- An audio and video data stream consists of single, periodically changing values of continuous media data.

  E.g. Audio samples, video frames

- Each Logical Data Unit (LDU) must be presented by a well determined deadline.

- Eg. A piece of music must be played back at a constant speed.

- To fulfill this timing requirement the OS must use the real time scheduling techniques.

- These techniques must be applied to all system resources involved in continuous media data processing (CUP, main memory, storage, I/O)