Kuliah 4

Basic Multimedia

Indrabayu
Lab. Multimedia Signal Processing and Wireless

Teknologi Sistem Multimedia

- Multimedia berhubungan dengan fungsi:
  - Generation
  - Manipulation
  - Storage
  - Presentation
  - Communication of information

Flashback ke def multimedia

- Semua data harus dalam format digital
- Data bisa berupa format:
  - text,
  - graphics,
  - images,
  - audio,
  - video.

Sinkronisasi

- Kebanyakan data multimedia berukuran besar
- Kadang2 media tertentu membutuhkan sinkronisasi
  - The data will usually have temporal relationships as an integral property.

Media statik dan continous

- Statik atau media diskrit
  - Time independent
  - Teks, single image, grafik, dll
- Media continous
  - Time dependent
  - Video, animasi, dll

Analog Digital Converter

- Dunia yang kita rasakan (sense) adalah analog
- Sensor elektrik melakukan konversi dunia kita ke sinyal elektrik
  - **cth**. Transducers: microphones, speaker, fax, scanner, dll
  - (yg biasanya) **continuous** signals
- Analog signals must be converted or **digitised**
- *Digital*: discrete digital signals that computer can readily dealwith.
- Special hardware devices : **Analog-to-Digital** converters
- Playback – a converse operation: **Digital-to-Analog**.

Multimedia Data: Input and format

- **How to capture and store each Media format?**
  - Note that Text, Graphics and some images are generated directly by computer and *do not* require digitising:
- **they are generated directly in some binary format.**
  - Handwritten text would have to digitised either by electronic
  - pen sensing of scanning of paper based form.

Text and Static Data

- Source: keyboard, floppies, disks and tapes.
- Stored and input character by character:
  - Storage of text is 1 byte per character (text or format character).
  - For other forms of data *e.g.* Spreadsheet files some formats may store format as text (with formatting) others may use binary encoding.
- Format: Raw text or formatted text *e.g* HTML, Rich Text Format (RTF), Word or a program language source (C, Java,*etc.)*
- Not temporal — **BUT** may have natural implied sequence *e.g.* HTML format sequence, Sequence of C program statements.
- Size Not significant unlike other Multimedia.

Graphics

- Format: constructed by the composition of primitive objects such as lines, polygons, circles, curves and arcs.
- Input: Graphics are usually generated by a graphics editor program (*e.g.* Freehand) or automatically by a program (*e.g.*Postscript).
- Graphics are usually editable or revisable (unlike Images).
- Graphics input devices: keyboard (for text and cursor control), mouse, trackball or graphics tablet.
- graphics standards : GKS , PHIGS, OpenGL, Graphics files usually store the primitive assembly
- Do not take up a very high storage overhead.

Images

- Still pictures which (uncompressed) are represented as a bitmap (a grid of pixels).
- Input: Generated by programs similar to graphics or animation programs.
- Input: scanned for photographs or pictures using a digital scanner or from a digital camera.
- Analog sources will require digitising.
- Stored at 1 bit per pixel (Black and White), 8 Bits per pixel (Grey Scale, Colour Map) or 24 Bits per pixel (True Colour)
- Size: a 512x512 Grey scale image takes up 1/4 MB, a 512x512 of 24 bit image takes 3/4 MB with no compression.
- This overhead soon increases with image size
- Compression is commonly applied.

Images

- Each pixel is stored as a single to as binary image.
- Such an image is also called since it contains no color.
- shows a 1-bit monochrome image

Images 8-bit Gray-level Images

- Each pixel has a gray-value between 0 and 255. Each pixel is represented by a single byte; e.g., a dark pixel might have a value of 10, and a bright one might be 230.
- Bitmap: The two-dimensional array of pixel values that represents the graphics/image data.
- Image resolution refers to the number of pixels in a digital. image (higher resolution always yields better quality).

24-bit Color Images

- In a color 24-bit image, each pixel is represented by three bytes, usually representing RGB.
- This format supports 256x256x256 possible combined colors, or atotal of 16,777,216 possible colors.
- { However such flexibility does result in a storage penalty: A 640x480 24-bit color image would require 921.6 kB of storage without any compression.

Audio

- Audio signals are continuous analog signals.
- Input: microphones and then digitised and stored
- usually compressed.
- CD Quality Audio requires 16-bit sampling at 44.1 KHz
- 1 Minute of Mono CD quality audio requires 5 MB. How about stereo channel?

Video

- Input: Analog Video is usually captured by a video camera and then digitised.
- There are a variety of video (analog and digital) formats
- Raw video can be regarded as being a series of single images.There are typically 25, 30 or 50 frames per second.
- A 512x512 size monochrome video images take 25*0.25 = 6.25MB for a minute to store uncompressed.
- Digital video clearly needs to be compressed.

Output Devices

- The output devices for a basic multimedia system include
  - A High Resolution Colour Monitor
  - CD Quality Audio Output
  - Colour Printer
  - Video Output to save Multimedia presentations to (Analog)
  - Video Tape, CD-ROM DVD.
  - Audio Recorder (DAT, DVD, CD-ROM, (Analog) Cassette)
  - Storage Medium (Hard Disk, Removable Drives, CD-ROM)

Storage Media

- The major problems that affect storage media are:
  - Large volume of data
  - Real time delivery
  - Data format
  - Storage Medium
  - Retrieval mechanisms

High performance I/O

- There are four factors that influence I/O performance:
- **Data —**
  - high volume, continuous, contiguous vs distributed storage.
  - Direct relationship between size of data and how long it takes to handle.
  - Compression

Data Storage

- Depends of the storage hardware and
- The nature of the data.
- The following storage parameters affect how data is stored:
  - Storage Capacity
  - Read and Write Operations of hardware
  - Unit of transfer of Read and Write
  - Physical organisation of storage units
  - Read/Write heads, Cylinders per disk, Tracks per cylinder, Sectors per Track
  - Read time
  - Seek time

Data Transfer

- Depend how data generated andwritten to disk, and in what sequence it needs to retrieved.
- Writing/Generation of Multimedia data is usually sequential *e.g.* streaming digital audio/video direct to disk.
- Individual data (*e.g.* audio/video file) usually streamed.
- RAID architecture can be employed to accomplish high I/O rates (parallel disk access)

Operating System Support

- Scheduling of processes when I/O is initiated.
- Time critical operations can adopt special procedures.
- Direct disk transfer operations free up CPU/Operating system space.

Basic Storage

- Basic storage units have problems dealing with large multimedia data
- Single Hard Drives — SCSI/IDE Drives.
- *AV* (Audio-Visual) drives
  - avoid thermal recalibration between read/writes,
  - suitable for desktop multimedia.
- New drives are fast enough for direct to disk audio and video capture.
- **not** adequate for commercial/professional Multimedia.

Removable Media

- *Floppies* not adequate
- Jaz/Zip Drives,
- CD-ROM,
- DVD-ROM.

RAID — Redundant Array of Inexpensive Disks

Needed:

- To fulfill the needs of current multimedia and other data hungry application programs,
- Fault tolerance built into the storage device.
- Parallel processing exploits arrangement of hard disks.

Raid technology offers some **significant advantages** as a storage medium of multimedia data:

- Affordable alternative to mass storage
- High throughput and reliability

The key components of a RAID System are:

- Set of disk drives, disk arrays, viewed by user as one or more logical drives.
- Data may be distributed across drives
- Redundancy added in order to allow for disk failure
- Disk arrays:
  - store large amounts of data,
  - have high I/O rates and
  - take less power per megabyte (cf. high end disks)
  - **but** they have **very poor reliability** As more devices are added, reliability deteriorates
  - N devices generally have 1/N the reliability of a single device

Overcoming Reliability Problems

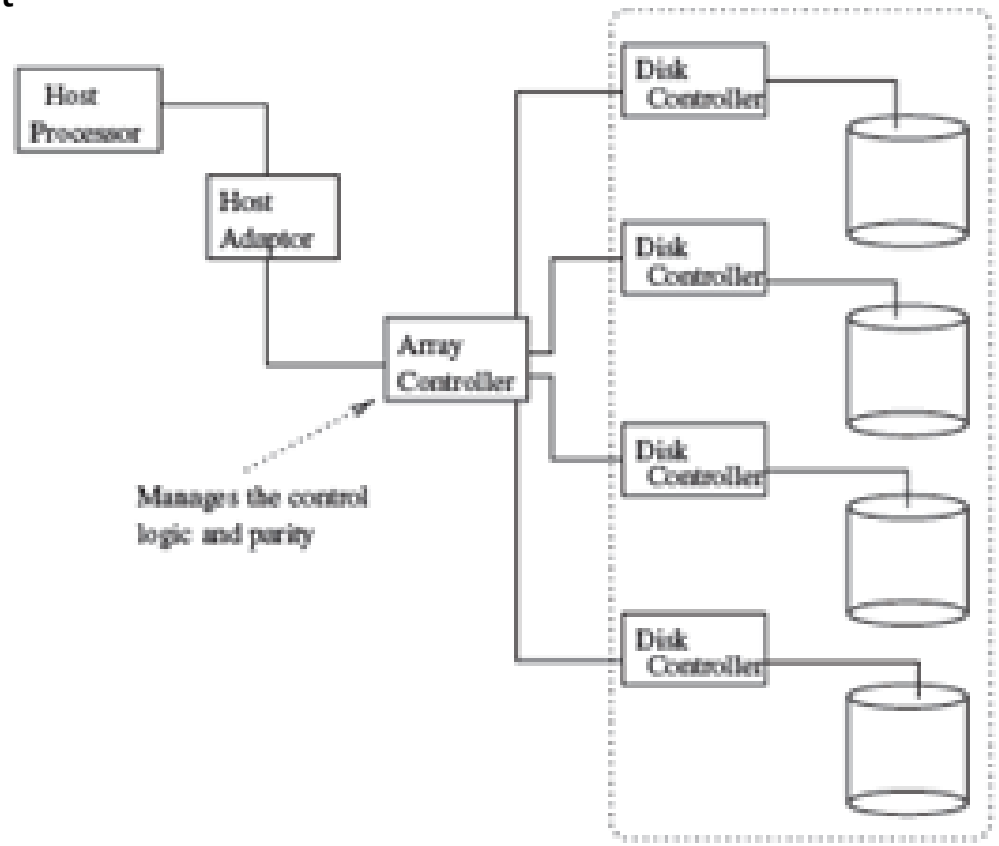
- **Redundancy** — Files stored on arrays may be striped across multiple disks.
- Four ways do to this.

Four ways of Overcoming Reliability Problems

- **Mirroring** or shadowing of the contents of disk, which can be a capacity kill approach to the problem.
  - write on two disks - a 100% capacity overhead.
  - Reads to disks may however be optimised.
- **Horizontal Hamming Codes**: A special means to reconstruct information using an error correction encoding technique.
- **Parity and Reed-Soloman Codes**: Also an error correction coding mechanism. Parity may be computed in a number of ways.
- **Failure Prediction**: There is no capacity overhead in this technique.

RAID Architecure

- Each disk within the array needs to have its own I/O controller,but interaction with a host compute may be mediated through an **array controller**



Optical Storage

- The most popular storage medium in the multimedia context
- compact size,
- High density recording,
- Easy handling and
- Low cost per MB.
- CD and recently DVD (ROM) the most common
- Laser disc — older format.

CD Storage

- There a now various formats of CD:
- CD-DA (Compact Disc-Digital Audio)
- CD-I (Compact Disc-Interactive)
- CD-ROM/XA (eXtended Architecture)
- Photo CD

The capacity of a CD-ROM is

- 620-700 Mbs depending on CD material,
- 650/700 Mb (74/80 Mins) is a typical write once CD-ROM size.
- Drives that read and write CD-ROMS (CD-RW) also similar.

CD Standards

- There are several CD standard for different types of media:
- **Red Book** — Digital Audio: Most Music CDs.
- **Yellow Book** — CD-ROM:
  - Model 1 – computer data,
  - Model 2 – compressed audio/video data.
- **Green Book** — CD-I
- **Orange Book** — Write once CDs
- **Blue Book** — LaserDisc

DVD

- The current best generation of optical disc storage technolog for Multimedia:
- DVD — **Digital Versatile Disc** (formal), **Digital Video Disc** (mistaken).
- Larger storage and faster than CD
  - over 2 Hours of Video / Single sided DVD-ROM 2.4 Gb
- Formats: DVD-Video and DVD-ROM (DVD-R and DVD-RAM)

What are the features of DVD-Video?

- The main features of DVD include:
- Over 2 hours of high-quality digital video (over 8 on a doublesided, dual-layer disc).
- Support for widescreen movies on standard or widescreen TVs (4:3 and 16:9 aspect ratios).
- Up to 8 tracks of digital audio (for multiple languages), each with as many as 8 channels.
- Up to 32 subtitle/karaoke tracks.
- Automatic *seamless* branching of video (for multiple story lines or ratings on one disc).
- Up to 9 camera angles (different viewpoints can be selected during playback).

Main features of DVD

- Menus and simple interactive features (for games, quizzes, etc.).
- Multilingual identifying text for title name, album name, song name, cast, crew, etc.
- *Instant* rewind and fast forward, including search to title, chapter, track, and timecode.
- Durability (no wear from playing, only from physical damage).
- Not susceptible to magnetic fields. Resistant to heat.
- Compact size (easy to handle and store, players can be
- portable, replication is cheaper).

What are the disadvantages of DVD?

- Despite several positive attributes mentioned above there are some potential disadvantages of DVD:
- It has built-in copy protection and regional lockout.
- It uses digital compression. Poorly compressed audio or video may be blocky, fuzzy, harsh, or vague.
- The audio downmix process for stereo/Dolby Surround can reduce dynamic range.
- It doesn’t fully support HDTV.
- Some DVD players and drives may not be able to read CDRs.
- Dispute of some DVD-R formats

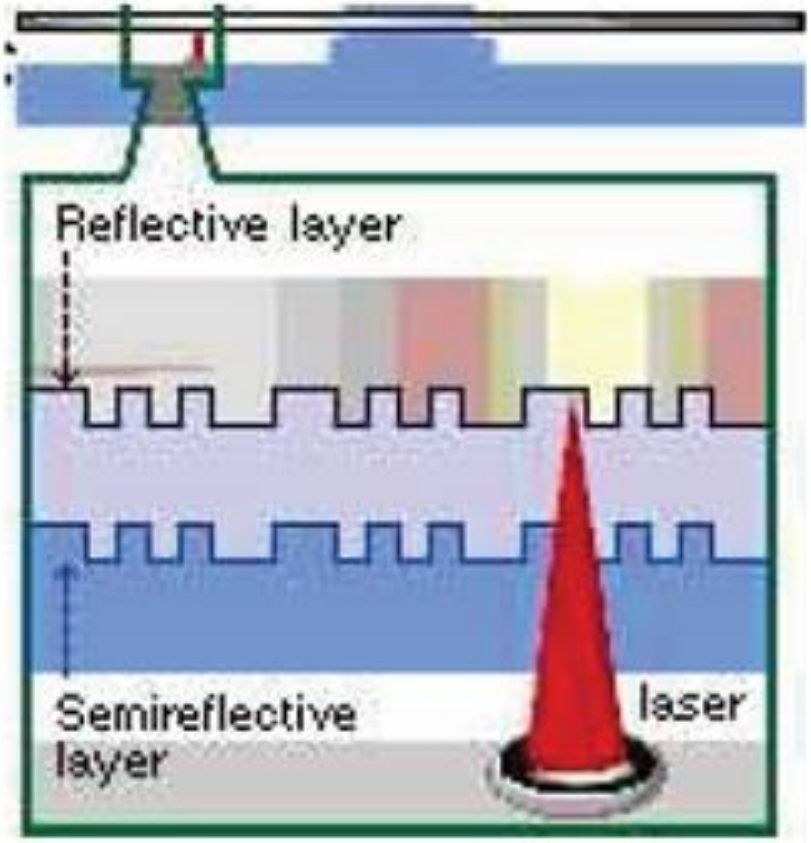
Comparision of DVD and CD-ROM

The increase in capacity in DVD-ROM (from CD-ROM) is due to:

- smaller pit length (~2.08x),
- tighter tracks (~2.16x),
- slightly larger data area (~1.02x),
- discs single or double sided

Comparision of DVD and CD-ROM (Cont.)

- another data layer added to each side creating a potential for four layers of data per disc
- more efficient channel bit modulation (~1.06x),
- more efficient error correction (~1.32x),
- less sector overhead (1.06x).
- capacity of a dual-layer disc is slightly less than double that of a single-layer disc.



End of lecture