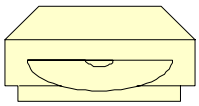


Compact Discs

Optical Discs

Media based on optical discs

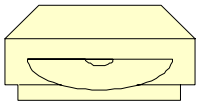
- [WORM not following the CD standards]
- **CD-DA(digital audio)**
- **CD-ROM**
- [CD-i], [CDTV]
- Photo-CD
- **CD-ROM**
  CD-R = CD-Recordable
  or CD-RW = CD-Rewritable
- **DVD…**

Optical discs: categories / groups

- **analogue versus digital**
  - »analogue data storage: laserdisc, videodisks,...
  - »digital data storage: CD-ROM, Photo-CD, CD-R,...
- **reading / writing**
  - »read-only memories
  - »write once, read many times memories
  - »erasable memories
  - »...

Optical Read-Only-Memory discs

- **The information is recorded once, industrially, for distribution.**
- **The user cannot change the contents. Examples:**
  - videodisks
  - Most CD-ROM Discs
  - CD-i Discs
  - Photo-CD when used as a publication medium
  - ...



Compact Discs

Compact Disc = CD

Compact Disc = CD: properties

- **The dimensions are standardised:**
  the diameter is 120 mm,
  and the hole in the centre is 15 mm
- **Applied in CD-DA, CD-ROM, CD-XA, CD-i, Photo-CD,...**
- **Constant Linear Velocity (= CLV) while reading data**
- **Data stored on 1 side in a spiral**
  of valleys (named “pits”)
  and plains (named “lands”)

Compact Discs: reading the data

- Data are read in a drive with a laser beam which converts transitions pit-land to bits.
- The reader head does not touch the surface of the disc, so that there is no friction and thus no wear or risk of disc crashes.
- This medium offers random access to data like other disks for computers.
  Thus access is fast in comparison with media that have to be read sequentially like tapes.

?? Question ??

What is the capacity of a CD-ROM disk?
1. expressed quantitatively,
and
2. compared with printed sheets of paper.

Compact Discs: storage capacity (Part 1)

- 1 CD can store about 600 to 700 MB = 600 000 to 700 000 KB
- For comparison, we should realise that a common A4 sheet of paper can store an amount of information in the form of printed characters that would require about 2 kB of space on a computer.
- So one CD can store about the same amount of text information equivalent as 300 000 of such A4 sheets.

Compact Discs: storage capacity (Part 2)

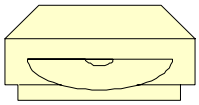
- 1000 paper sheets together make a pile of about 10 cm.
- So one CD corresponds in this view to a pile of about 30 m of paper sheets, which is a pile of paper as high as a 10-floor building.

Compact Discs: relevant journals

- **Computers in Libraries**
- **Information World Review**
- **Online Review**
- **PC Magazine (USA, UK,...)**
- **PC World (USA, UK,...)**
- **The Electronic Library**
- **...**

Compact Discs: relevant online information sources

- **Usenet newsgroups:**
  - »bit.listserv.cdromlan
  - »bit.listserv.pacs



Compact Discs

Formats and standards

Compact Discs: physical format and standard

- **diameter + thickness + center hole dimension**
- **recording density + layout of tracks**
- **the arrangement of pits in the tracks**
- **rotational speed**
- **blocks to segment data on the disc**
- **error detection and correction schemes**

The physical format standard allows the disc to be (physically) read by any drive / player.

Compact Discs: logical format and standard

- **how information is conceptually or logically represented/organised on the media**
- **how the volumes, files, records are organised**
- **how the data can be accessed by the computer operating system.**

An ISO standard exists.

Compact Discs: applications formats

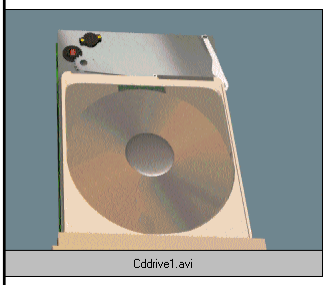
- **how the information contents (text, graphics, sound, program code,...) are stored / represented in computer data /files on disc, within the physical and logical standard formats**
- **how the data on the disc should be interpreted by an applications program**

Applications formats have not been standardised; de facto standards exist.

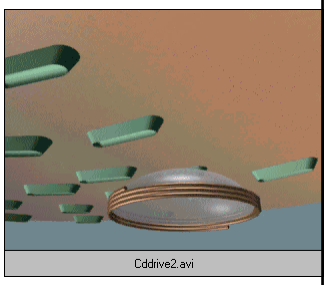
Compact Discs: some standard specifications

Red Book	CD-DA	Digital Audio	1982
Yellow Book	CD-ROM	ROM	1983
	CD-ROM XA		1986
Green Book	CD-i	Interactive	1986
Orange Book	CD-R	Recordable	
	Photo CD		1990
White Book	Video CD		
	CD-E, CD-RW	Erasable Rewritable	
...			

Compact Discs



CD-ROM



CD-ROM = Yellow Book standard

- The basic technology of CD-ROM remains the same as that for CD audio, but CD-ROM requires greater data integrity, because a corrupt bit that is not noticeable during audio playback becomes intolerable with computer data.
- So CD-ROM (Yellow Book) dedicates more bits to error detection and correction than CD audio (Red Book).
- Data is laid out in a format known as ISO 960.

CD-ROM XA: description

- CD-ROM XA = CD-ROM extended architecture, is an extension of the CD-ROM Yellow Book format.
- Uses compressed audio + pictures and interleaving, so that text as well as sound, static and moving pictures can appear simultaneously.
  (Interleaving = mixing of data for text, sound and pictures on the disc-track)
- Introduced by *Philips*, *Sony* and *Microsoft* in 1986.

CD-ROM workstation - hardware required

Input device(s) + Display + Printer

⇕

Microcomputer

⇕

SCSI or IDE-ATAPI or USB (or Sound Card or Parallel or...)

⇕

CD-ROM drive

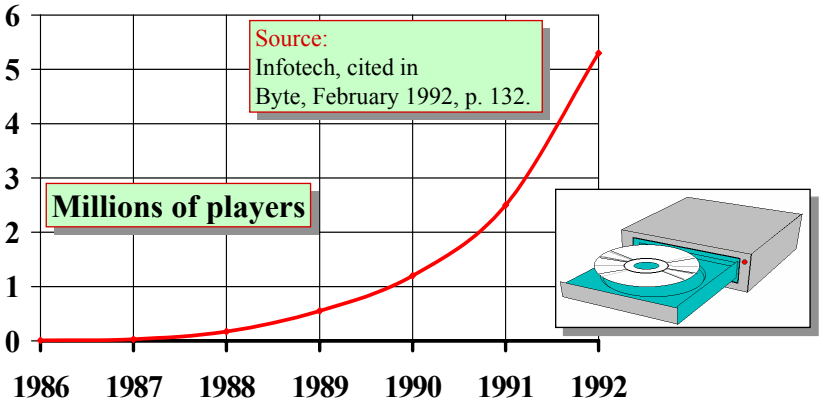
CD-ROM workstation - CD software required

- **Device driver: (here: device = CD-ROM drive)**
  - » specific for the CD-ROM hardware used, or
  - » SCSI (= Small Computer System Interface)
- **CD-ROM utilities and application software:**
  - » Dearchiving / Decompression
  - » Retrieval of information
  - » Image visualisation
  - » Sound generation
  - » ...

CD-ROM drives / players: various types

- **stand-alone drives, which come with their own housing and power supply**
  - »Single-disc (and single-head) drive
  - »Multi-disc single-head drive = Juke-box
  - »CD-ROM multidrives or “towers” = several single-disc drives working together
- **disc drives that can be built in the microcomputer, like hard and floppy disk drives**

CD-ROM drives / players installed base



?? Question ??

Which advantages offers
CD-ROM as an information carrier?

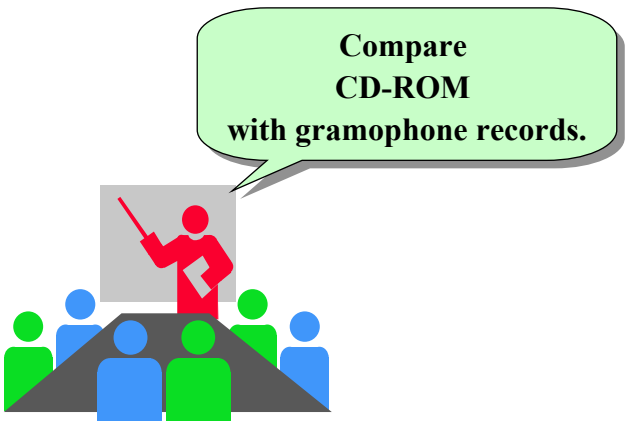
CD-ROM: advantages in comparison with other information carriers (1)

- The formats are well standardised and the technology is stable; this ensures a high degree of compatibility.
- The information density is high.
- The cost of information storage per information unit is low.
- The disks are easy to store, to transport and to mail .

CD-ROM: advantages in comparison with other information carriers (2)

- Crashes with the reader head do not occur in normal use, and the disks resist well to wear.
- Random access to information is possible.
- CD-ROM systems are easy to use.

?? Question ??



CD-ROM applications

- to publish information
- to distribute information on a limited scale
- to store information for personal use
- ...

CD-ROM as publication medium

- Thousands of titles have been published on this medium.
- How to find a published CD-ROM with relevant information? Directories are available for this purpose.

CD-ROM titles: online accessible directory

- ***Gale Directory of Databases*, USA**
  semi-annual in print + on CD-ROM

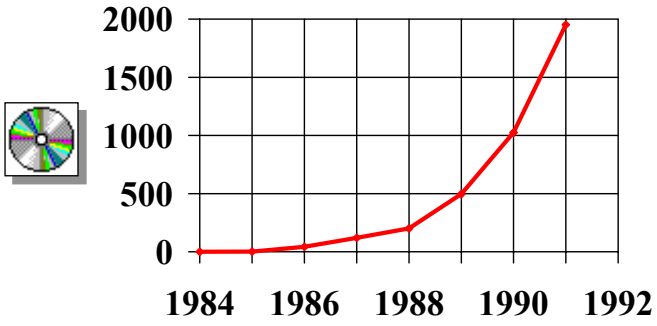
CD-ROM titles: some published directories

- **Multimedia and CD-ROM Directory, published by *Waterlow New Media* (earlier by TFPL), UK**
  in print + on CD-ROM

- ***Swets E-Media Catalogue*, NL**
  in print

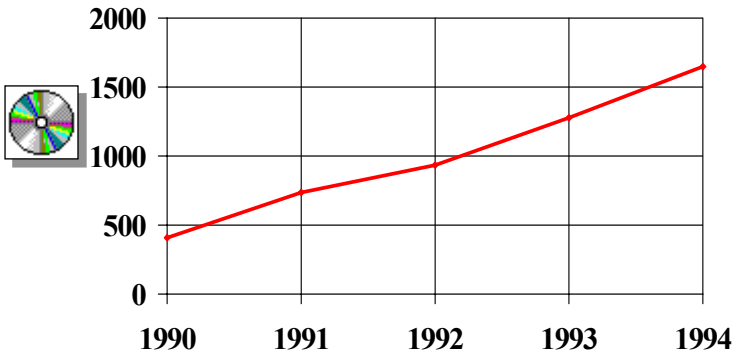
- **...**

CD-ROM titles published (Ref.: Nicholls and Sutherland)



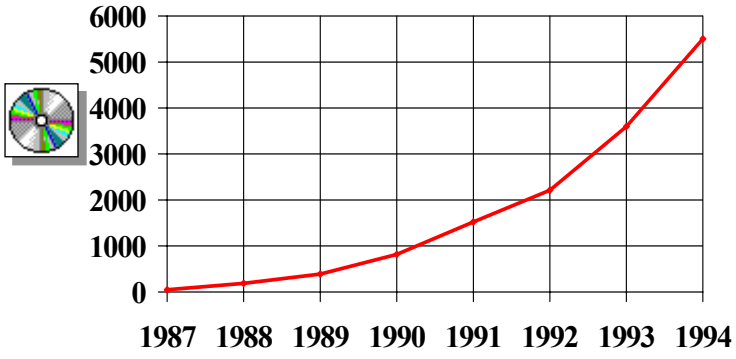
Source: Nicholls, Paul, and Sutherland, Trish
CD-ROM databases: a survey of commercial publishing activity.
Database, February 1992, p. 36-41.

CD-ROM titles published (Ref.: Gale Directory of Databases)



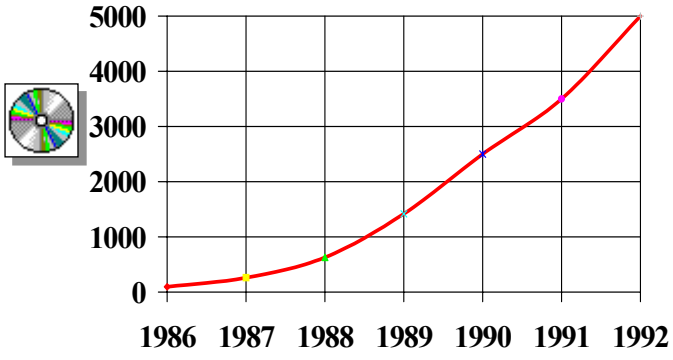
Source: Marcaccio, in: Gale Directory of Databases, 1994.

CD-ROM and multimedia CD titles (Ref.: TFPL CD-ROM Directory)



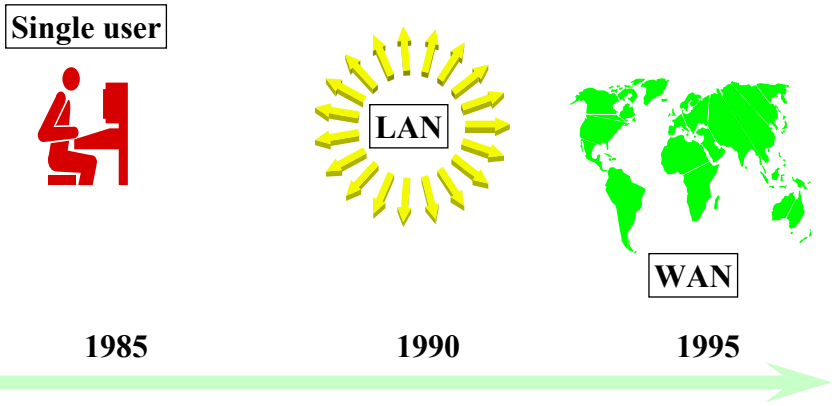
Source: TFPL Publishing, The CD-ROM Directory 1994.

CD-ROM titles (commercially available + in-house)

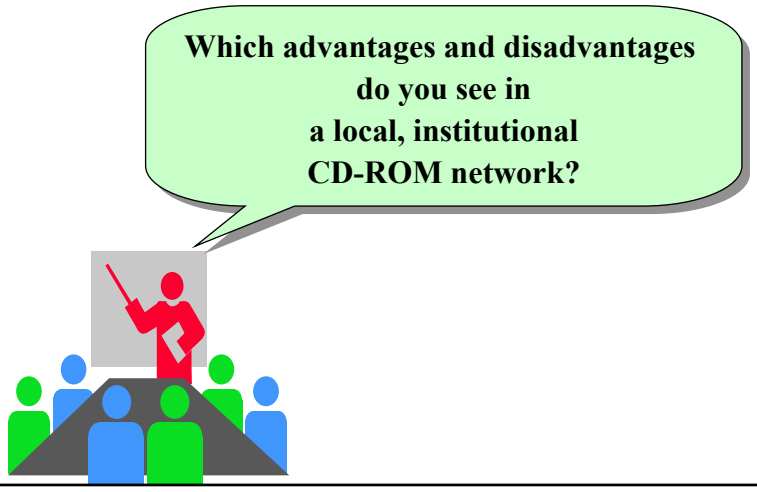


Source: Infotech, cited in Byte, February 1992, p. 132.

CD-ROM:
methods of access to discs



?? Question ??



CD-ROM in local networks: possible advantages

- Easier access to a range of CD-ROMs.
- Ideally, access from the user's own workstation in the office or at home.
- Simultaneous access by several users to the same data.
- Better security avoids damage to discs and equipment.
- Less personnel time needed to provide disks to users.
- Automated, detailed registration of usage statistics to support the management.
- ...

CD-ROM in local networks: possible disadvantages (Part 1)

- Costs of the network software and computer hardware.
- Increased charges imposed by the information suppliers.
- Need for expensive, technical expertise to select, set up, manage, and maintain the network system.
- Technical problems when the CD-ROM product is not designed for use in the network.
- The network software component for the workstation-side must be installed on each microcomputer before this can be applied to access the CD-ROM's.

CD-ROM in local networks: possible disadvantages (Part 2)

- **Technical and support problems when the user's workstation is not suited for use of the CD-ROM:**
  - » insufficient RAM or free RAM;
  - » insufficient free disk space;
  - » variations in operating systems;
  - » fonts required for display, but not present on the workstation;
  - » ...

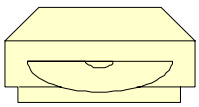
CD-ROM in local networks: methods used

Client requests are directed to

- **another microcomputer on the LAN with CD drives and server software (= "Peer-to-peer")**
- **a LAN server computer which is extended with CD drives**
- **a dedicated CD-ROM server in the LAN**
- **a LAN server computer, and CDs were copied to the hard disk(s) of that computer (for instance using the software package *Ultra*net*)**
- **...**

CD-ROM in networks: external alternatives

An increasing number of external, commercial, accessible servers (online hosts), outside the local LAN, offer many of the data available on CD-ROM,
with the same or a similar user-friendly user interface.



Compact Discs

CD-ROM versus CD-i

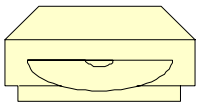
CD-i: description

- CD-i = Compact Disc interactive
  was developed by a grouping of 3 electronics multi-nationals (Philips, Sony, Matsushita).
- Hardware for playback + disc contents
  are consumer / mass market oriented.
- Uses a dedicated, standalone machine for playback, like a CD audio player, with a television.
- Uses MPEG compression / decompression algorithms for digital video.

CD-ROM versus CD-i equipment

CD-ROM disc ⇔ CD-ROM player ⇔ PC + operating system ⇔ computer display

CD-i disc ⇔ *CD-i player, including Motorola chip + RTOS operating system* ⇔ *television display*

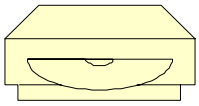


Compact Discs

CD-ROM multi-session technology

CD-ROM
multi-session technology

- **Refers to the ability of some CD-ROM discs to have additional data written up to the capacity of the disc.**
- **Is applied with Kodak Photo-CD.**
- **(Old CD-ROM drives can only read the first session.)**



Compact Discs

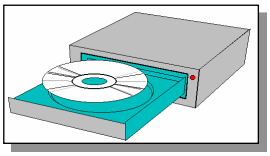
CD-R

CD-R: description

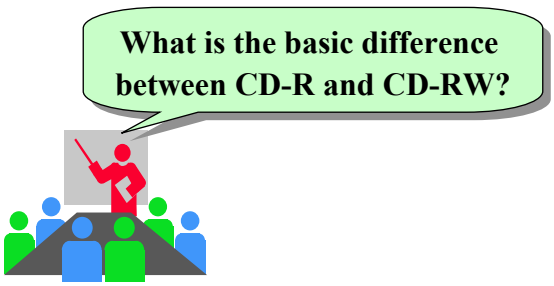
- **Includes a provision for appending information to a disc that already has information written on it.**
- **Uses discs consisting of the same polycarbonate substrate as other CDs, but instead of having an aluminium coating, the groove is covered with an organic-dye recording layer, followed by a layer of gold and a lacquer coating.**
- **Follows the Orange Book specification.**
- **Has been developed by *Philips* and *Sony*.**

CD-R: applications

- prototyping titles destined for conventional CD pressing
- final production of discs for limited distribution
- archiving on computer readable information carrier
- ...



?? Question ??



!! Task - Assignment !!

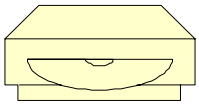
Read
Harris, Tom
How CD burners work. [online]
Available from:
http://computer.howstuffworks.com/cd-burner.htm
[cited 2005]

!! Task - Assignment !!

Read the chapter on
CD-R and CD-RW drives
by Thompson and Thompson,
In: PC hardware in a nutshell: a desktop quick reference.
Cambridge : O'Reilly, 2000, 501 pp.

CD-R:
online information sources

- **See for instance the FAQ available free of charge through the WWW:**
  - »http://www.cdrfaq.org/



Compact Discs

Kodak Photo CD

Kodak Photo CD: description

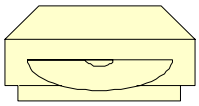
- **Specifies a file format for high resolution photographic images.**
- **Usually stores 5 copies of each image in different resolutions.**
- **Supports multiple writing sessions, so that the user can append images to a CD.**
- **For information, see http://www.kodak.com/**

Kodak Photo CD: drives

- **The photographic images can be played back on**
  - »CD-i players,
  - »Kodak's PhotoCD readers,
  - »CD-ROM XA devices,
  - »but not on an old standard CD-ROM drive.
- **Using a PC and proper software, the user can edit and print images.**

?? Question ??

Talking about CD recordable,
what is the difference between
“write once” and ‘write many times”?

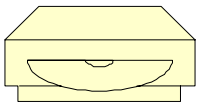


Compact Discs

Video Compact Disc

Video Compact Disc: description

- Aims at a large impact on the domestic video market.
- A standard developed by *Philips, Sony, JVC, Matsushita* and labelled White Book.
- Can store up to 74 minutes of VHS-quality digital video with stereo audio.
- Uses the MPEG data compression and decompression standard.



Compact Discs

DVD

DVD: description

- **DVD is the official name ; stood for Digital Video (or Versatile) Disc**
- **Standard for storing data on optical disc with a *higher capacity* than in the case of the older CD.**
- **First DVD discs and drives/players available in 1997.**
- **DVD drives/players read CD-ROM also.**

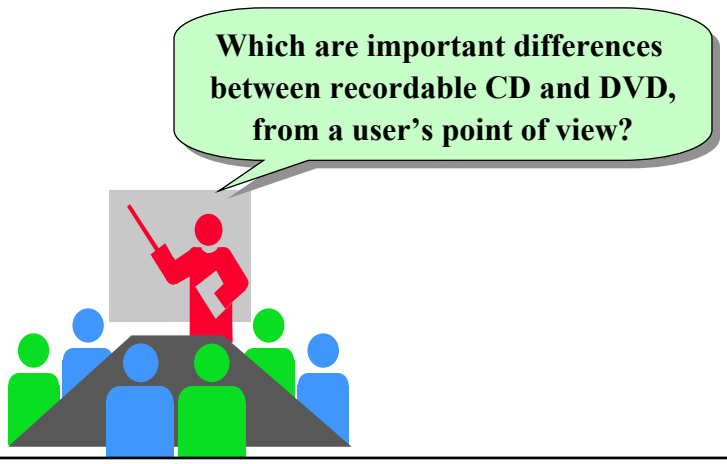
DVD-ROM: comparison of design with CD-ROM

Feature	CD-ROM	DVD-ROM
• Disc diameter	120 mm	120 (or 80) mm
• *Data sides*	*1*	*1 or 2*
• *Data layers*	*1*	*1 or 2*
• Tracks per inch	16 000	34 000
• *Laser wavelength*	*780 nm (infrared)*	*635 to 650 nm (red)*

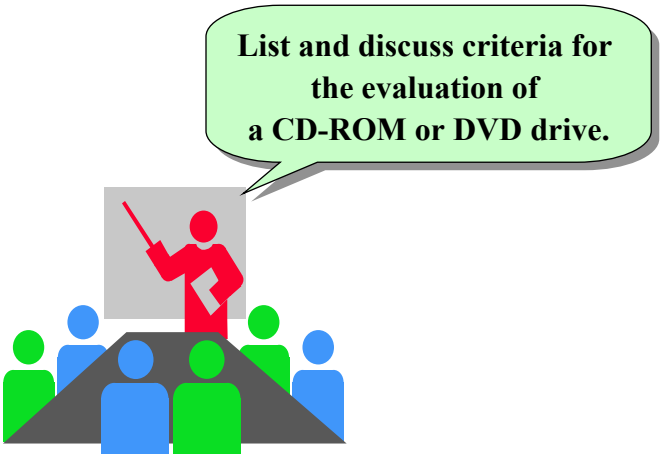
DVD-ROM: comparison of performance with CD-ROM

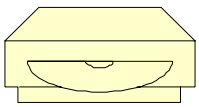
Feature	CD-ROM	DVD-ROM
• *Capacity*	0.68 Gbyte	4.5 to 17 Gbyte
• *Data transfer rate*	1.2 (up to 12) Mbit/s	> 11 Mbit/s

!! Task - Assignment !!



!! Task - Assignment !!

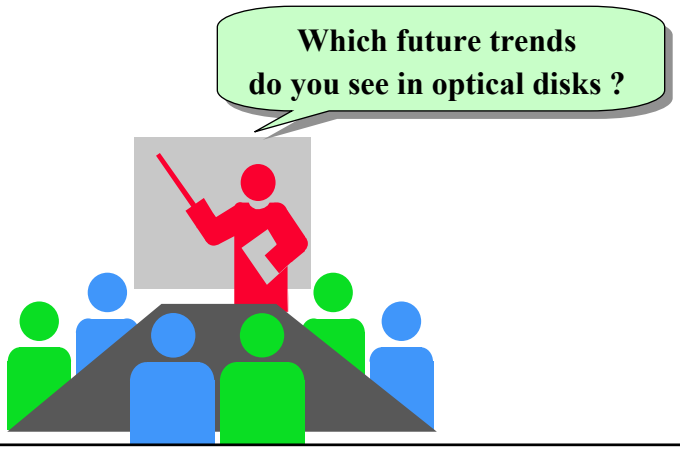




Compact Discs

Future trends

?? Question ??



Optical discs: future trends (Part 1)

We see an

- increasing number of published disks
- increasing power of the software to read and use the stored data and to interact with CDs
- increasing access and transfer speeds of drives (readers, players)
- increasing quality to price ratio for the required hardware
- increasing disk capacity (from CD to DVD)

Optical discs: future trends (Part 2)

- increasing number of titles that offer not only pure, simple text, but also multimedia content
- in-house production of disks for use in an organisation or as a personal information storage medium
- increasing number of CD-ROM producers that provide also online, public access to their databases
- increasing number of applications that use a client-server software architecture for databases on disk

?? Question ??