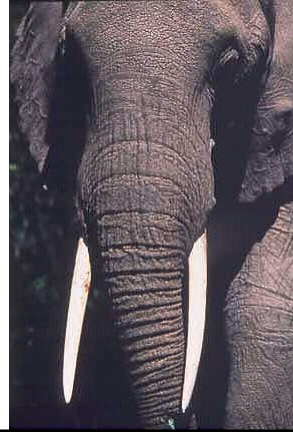


Disks

Introduction



Disks: summary / overview / abstract

- The following gives an introduction to external memory for computers, focusing mainly on disks.
- This presentation is preceded by a more general introduction to computer technology.
- A separate but related presentation discusses optical disks like CD's and DVD.

!! Task - Assignment !!

**Read: Recording history.
(Methods of storing data
have evolved from ink and paper
to technology such as magnetic tape and compact disk.)**

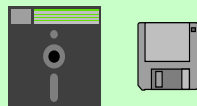
Personal Computer World (U.K.),
November 2001, pp. 234-234



Disks: overview of various types

Magnetic disks

Floppy disks



Hard disks

Optical disks

- *Laserdisc*
- *WORM*
- *CD*
- *DVD*
- ...

Disks: comparison of types

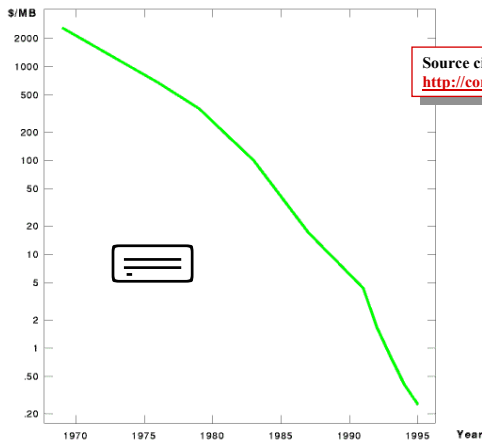


Failure rate
Disk capacity
Storage cost per bit
Speed of data access and transfer
Exchangeability
Transportability
Risk of disk crashes

| <u>Floppy</u> | <u>Hard</u> | <u>Optical</u> | <u>Other</u> |
|---------------|-------------|----------------|--------------|
| ☹ High | ☺ Low | ☺ Low | |
| ☹ Low | ☺ High | ☺ High | ☺ High |
| ☹ High | ☹ High | ☺ Low | ☺ Low |
| ☹ Lowest | ☺ High | ☹ Low | |
| ☺ + | ☹ - | ☺ + | ☹ - |
| ☺ + | ☹ - | ☺ + | ☺ + |
| ☺ Low | ☹ High | ☺ Low | |

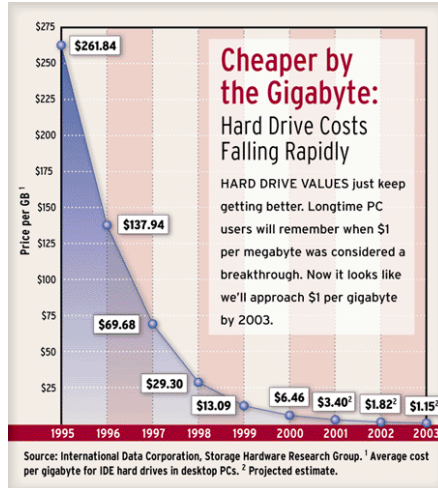
Disks: decreasing prices: 1970-1995

Disk prices



Source cited in 1997:
<http://community.bellcore.com/lesk/ages/ages.html>

Disks: decreasing prices: 1995-...

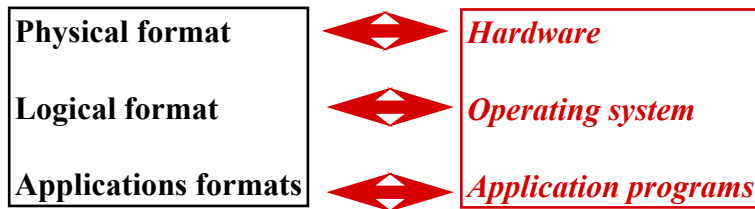
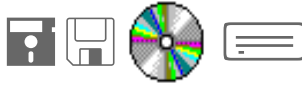


?? Question ??

What are the consequences of the decreasing disk prices?

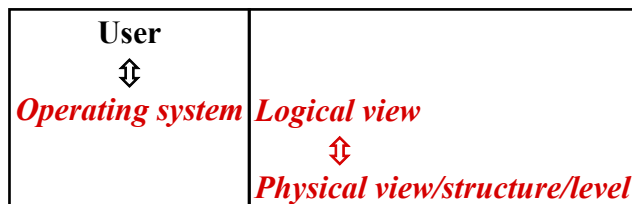


Disks: formats



Physical and logical organization of disk files

The logical view of the user is translated by the operating system to the physical level.



Data storage on disk: concentrically on tracks versus 1 spiral

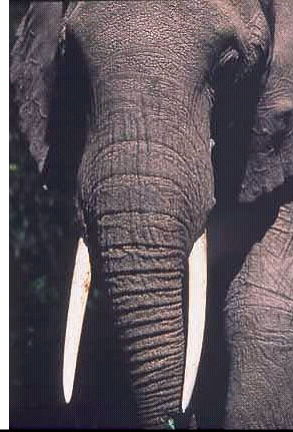
| <u>Storage method</u> | <u>Usage</u> | <u>Access</u> | <u>Capacity</u> |
|---------------------------------|----------------|---------------|-----------------|
| Concentrically on tracks | Magnetic disks | + Fast | - Low |
| One continuous spiral | CDs | - Slow | + High |

Constant Angular Velocity versus Constant Linear Velocity

| | <u>Disk rotation velocity</u> | <u>Usage</u> |
|------------|---|---|
| CAV | Constant | Magnetic disks drives (and newer, faster CD players) |
| CLV | Changes as head moves along the spiral | CD players |

Disks

Disk access time
and
data transfer rate



Disk access time: definition

- **Access time**
 - »= the time to locate a particular piece of information on a disk
 - »= seek time + settling time + rotational delay

Disk access time: various causes

Seek time =

the time required to position the head assembly at the desired radius

Settling time =

the time required for the head to settle into position at the desired radius

Rotational delay =

the time the disk must rotate to get the desired sector under the read head

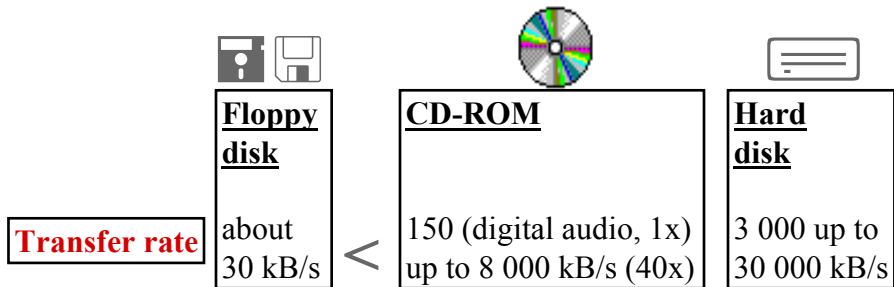
Disk access times of various types of disks



Disks: data transfer rate

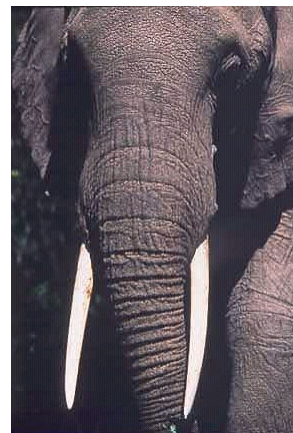
Transfer rate

= the speed at which the computer reads data from a disk once the data is found (kB/s)



Disks

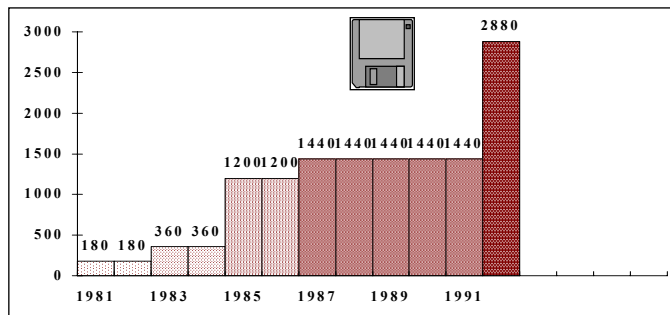
Capacity
of information carriers



Capacity of information carriers

| | |
|------------------------------------|-----------------------|
| <i>Paper sheet A4 storing text</i> | <i>2 Kbytes</i> |
| Floppy disks | |
| 5.25" ss-dd | 180 Kbytes |
| 5.25" ds-dd | 360 Kbytes |
| 5.25" ds-hd | 1 200 Kbytes |
| 3.5" ds-dd | 720 Kbytes |
| 3.5" ds-hd | 1 440 Kbytes |
| Hard disks on PCs | |
| from 10 000 to 80 000 000 Kbytes | |
| Compact Disc | 600 000 Kbytes |

Capacity of floppy disks: evolution



Evolution of disk capacities: advantages and disadvantages

- **Hard disks**

- ☺ Fast evolution: increasing capacity
- ☹ Not suitable for transfer to another computer

- **Compact disc**

- ☹ Stable from 1985: no increase of capacity
- ☺ High compatibility with CD and DVD drives

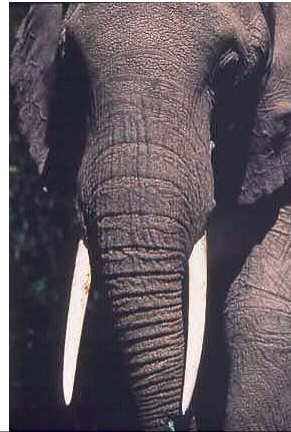
?? Question ??

**Compare
the storage capacity
of the hard disk in your microcomputer
with the storage capacity
of a CD and of a DVD.**



Disks

Disk backup technologies



Disk backup technologies: various systems

- Tape drives
- Removable drives
- Recordable CD (not rewritable)
Recordable and rewritable CD
- Extra hard disk
- DVD-RAM
- DVD-R, DVD+R
DVD-RW, DVD+RW
- Network drives

!! Task - Assignment !!

Read about computer file backup methods:

Rubenking, Neil J.

Backup nice and easy.

PC Magazine (USA), September 3, 2002, pp. 70-72.



Disk backup technologies: tape drives

- **+Pros:**
 - » inexpensive hardware
 - » low media cost
 - » large capacity

- **-Cons:**
 - » slow
 - » serial storage; no fast random access

Disk backup technologies: removable drives

+ Pros:

- + inexpensive hardware
- + random access storage

- Cons:

- very limited exchangeability of disks among various disk drives

Disk backup technologies: recordable CD (not rewritable)

- **Named CD-R**
- **The files are not erasable; not rewritable**

+ Pros:

- + inexpensive; low media cost
- + random access storage
- + disks can be read by most CD-ROM drives

- Cons:

- limited to 700 MB
- not erasable / rewritable / reusable

Disk backup technologies: recordable and rewritable CD

- **Named CD-RW**
- **The files are erasable; rewritable**

+ Pros:

- + inexpensive; low media cost
- + random access storage

- Cons:

- limited to 700 MB

Disk backup technologies: extra hard disk

+ Pros:

- + fast
- + random access storage

- Cons:

- expensive but prices come down
- not removable
inconvenient to keep off-site in a safe place

Disk backup technologies: DVD-RAM

+ Pros:

- + random access storage
- + large capacity

- Cons:

- drives are expensive
- not many drives are available

Disk backup technologies: DVD-RW and DVD+RW

+ Pros:

- + random access storage
- + large capacity
- + inexpensive

- Cons:

- fragile disks and low reliability in comparison with CD

!! Task - Assignment !!

Write up on maximum 1 page
a procedure to store and back-up
a personal digital information collection,
that includes

- written documents,
- e-mail messages,
- web sites,
- music files,
- a few thousand original/master and improved/edited photos...



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