

## Hard Drives

SSDs, DVDs + Tape

## STORAGE for DATA

Throughput from disk may be 150 MB/s  
burst over bus 500 MB/s.

Modern drives have 8-128 MB RAM on board  
to buffer/cache. Sufficiently powerful processors  
that experimenters have loaded database  
software into an array and no other CPU  
required.....

Laptop drives 2.5" usually only 5400 rpm

mean time between failures theoretically 114 years  
but in use laptop failures with knocks and vibration

[youtube.com/watch?v=9eMWG3fwIEU](http://youtube.com/watch?v=9eMWG3fwIEU)

## Solid State Drives SSD

non volatile NAND logic (fast) or Flash based

expensive but fast access time  $\approx 0.1$  ms

'zero' latency compared to HDDs

sequential speed is 100-500 MB/s

Transactions/s (IOPS) often quoted (eg 90,000)

max 1-4 TBs (B+50...) better shock resistance, silent  
wk 6 that (low power)

SSDs have a wear rate - will spread the usage to even wear out. 'Overprovision' allows retirement of unreliable blocks. TRIM command to tell which blocks are no longer needed and can be erased.

## Optical Storage + CD-ROM

Designed for audio - audio is single speed.

5.27km track spiral length

Random access difficult due to spiral design, except if one long sequential file - such as 'tarball' or 'iso' file

Specialist optical cartridges created using mix of laser + magnetiz technology

Optical jukeboxes - as used by NASA etc.  
using many DVDs/Blue Ray

## Magnetic Tape

still effective as very cheap for backup and archive  
But slow. L.T.O. 'Linear Tape Open'

N.A.S. Network Attached Storage

Plugged onto network

iSCSI Internet Small Computer Systems Interface

## Hierarchical Filesystem

Automatically moves old files to slower storage media.  
see slide for reading!