



memory

Disks, sectors, tracks, cylinders
and partitions



The architecture of a PC

- Donald Knuth, “The Art of Computer Programming” – 1960s

- **CPU memory** – registers

- Volatile
- Fast
- Limited quantity

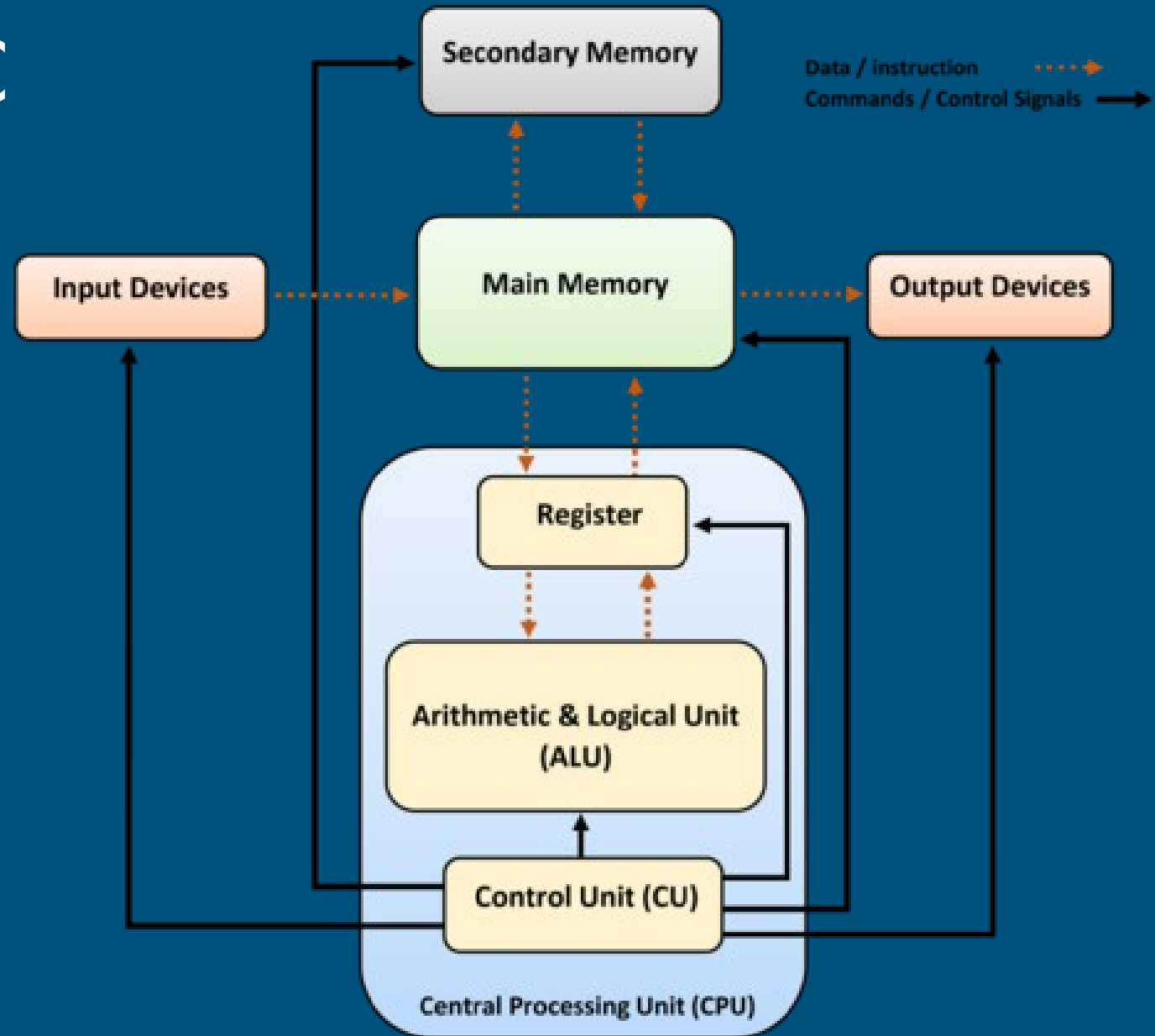


- **Addressable storage** – “main memory”

- **Backing storage** – “disk space”

- Not volatile
- Relatively slow

A modern PC



Mercury delay lines

Acoustic

Developed for radar WWII
384 bits per 5' tube = 48
bytes

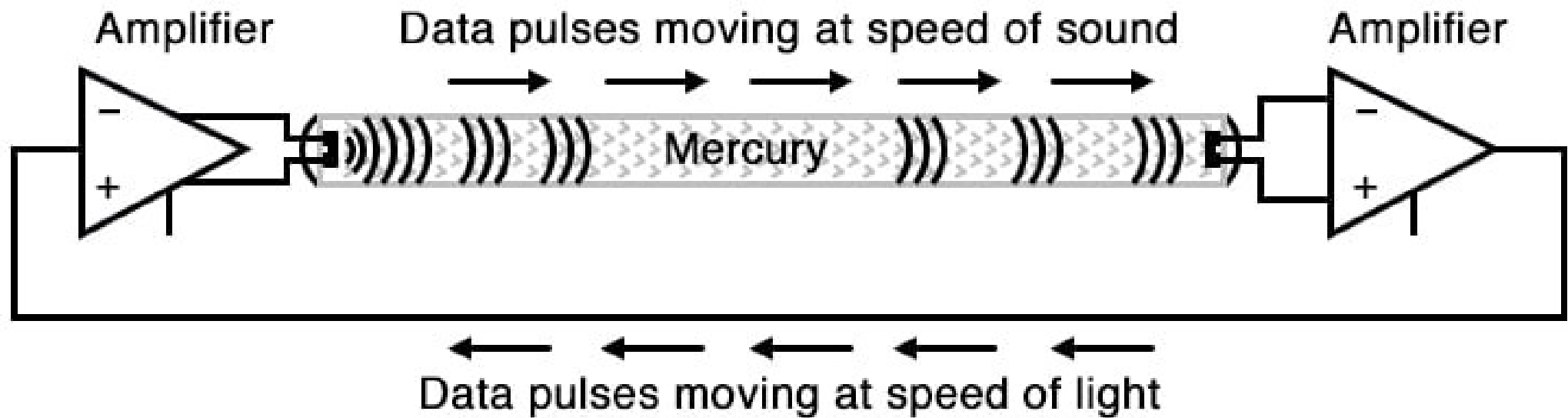
EDSAC ~ 1KB > 20 tubes

EDVAC 128 tubes ~6KB



Delay line

Mercury tube delay-line memory

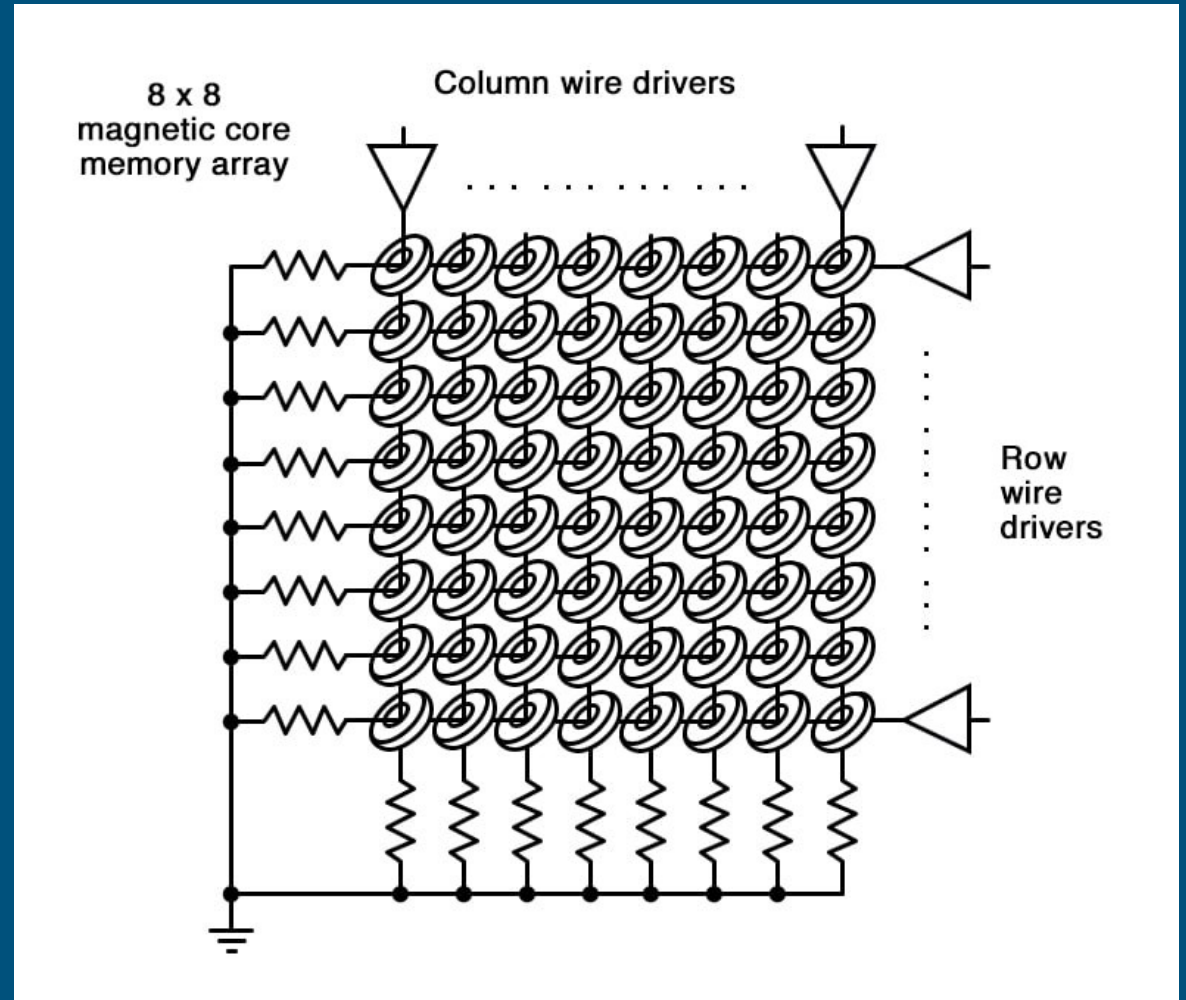


Magnetic core memory

Addressed by row/column

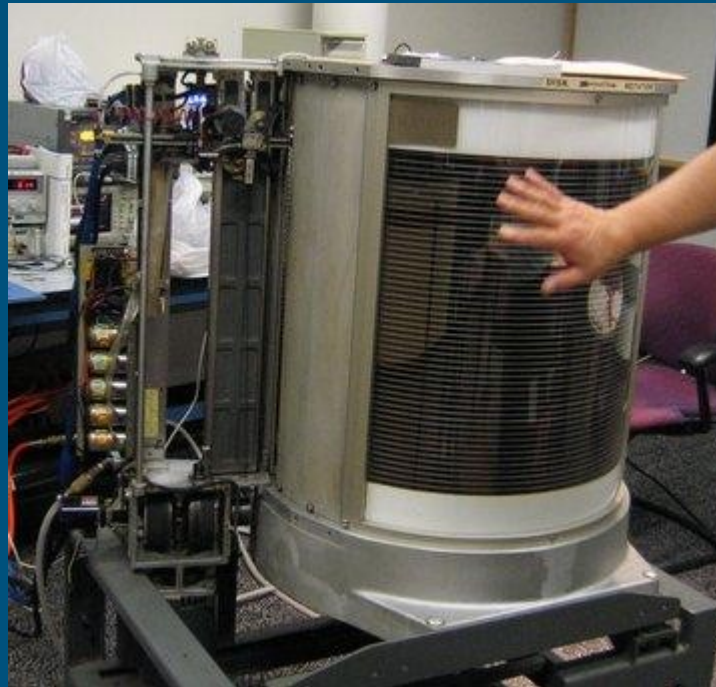
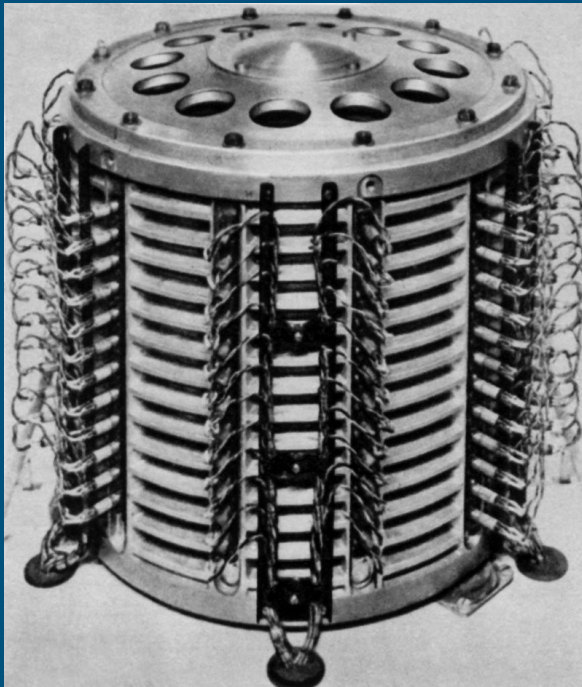
Random Access

RAM



Backing storage

- Drum storage
- E.g. paper tape, magnetic disks



“floppy” disks - kilobytes

8” floppy typically 80KB

5.25” floppy 360 KB



3.5 floppy disk

3.5" across

C late 1980

1.44MB when formatted

Less floppy than 5.25" / 8"



Storage evolves

- CDROM 600 MB
- DVD – 4.x GB – the ISO filetype
- Mercury Delay Lines → Cylinder → 8 inch Disk → 5.25" → 3.5" → stick...

KB → 1.44MB → ... → 5TB

-

navigating a disk

- The head needs to know where it is
- Physical entities (e.g. platter, track, sector, cylinder...) have to be marked
- Partitions (physical units) are made up of multiple sectors, linked together
- Partitions hold **directories** and **files** – logical units – & are made up of lists of sectors
- Formatting marks a plan for the logical units on the disk surface.
A **MAP**

fragmentation

v



Simplified example of directory

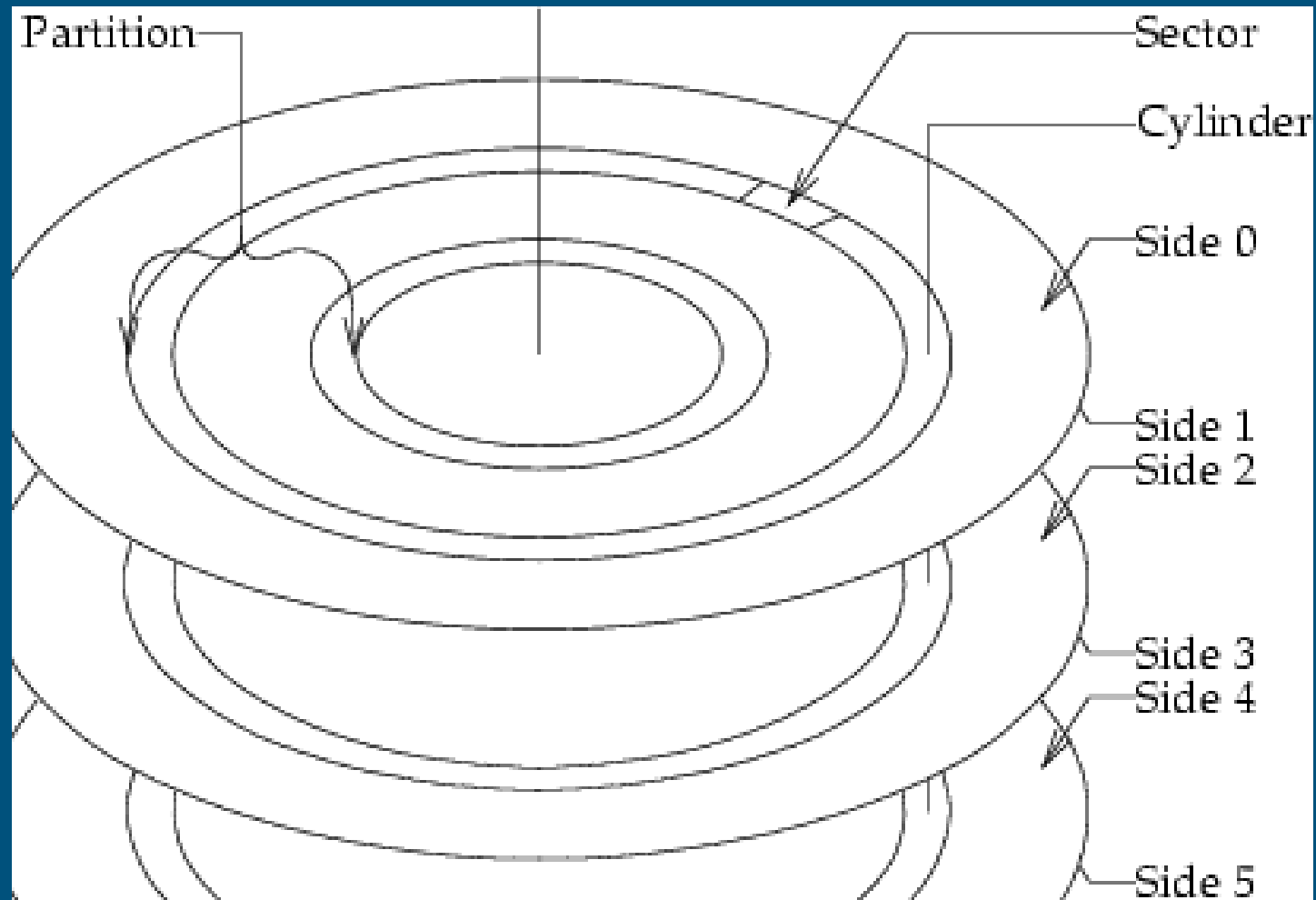
Entry	Track	Sector	Contents	Next	bootable
1	23	17	Essay.docx	314	0
2			Photo.jpg	3	0
...					
314	45	19	Essay.docx	-1	0
315	99	99	DIRECTORY	...	...

Files are stored in chunks, not as one contiguous lump, to mitigate **fragmentation**. Cylinders are quick

FAT/NTFS/FAT32/APFS/EXT/EXT2/reiserFS/SWAP/...

So-called “quick” formatting empties the filenames, nothing else
full formatting zaps everything

A “modern” Hard Disk



Types of hard disk drive

- IDE (< 1TB)
- SSD (just looks like one but has no moving parts) 1T / 2T
- SATA – Serial ATA

- Memory stick / pen drive GB

tools

- Partition editor – manages the partitions (!)
- Formatter

We have to write partitions, then format them to make them useable by an OS

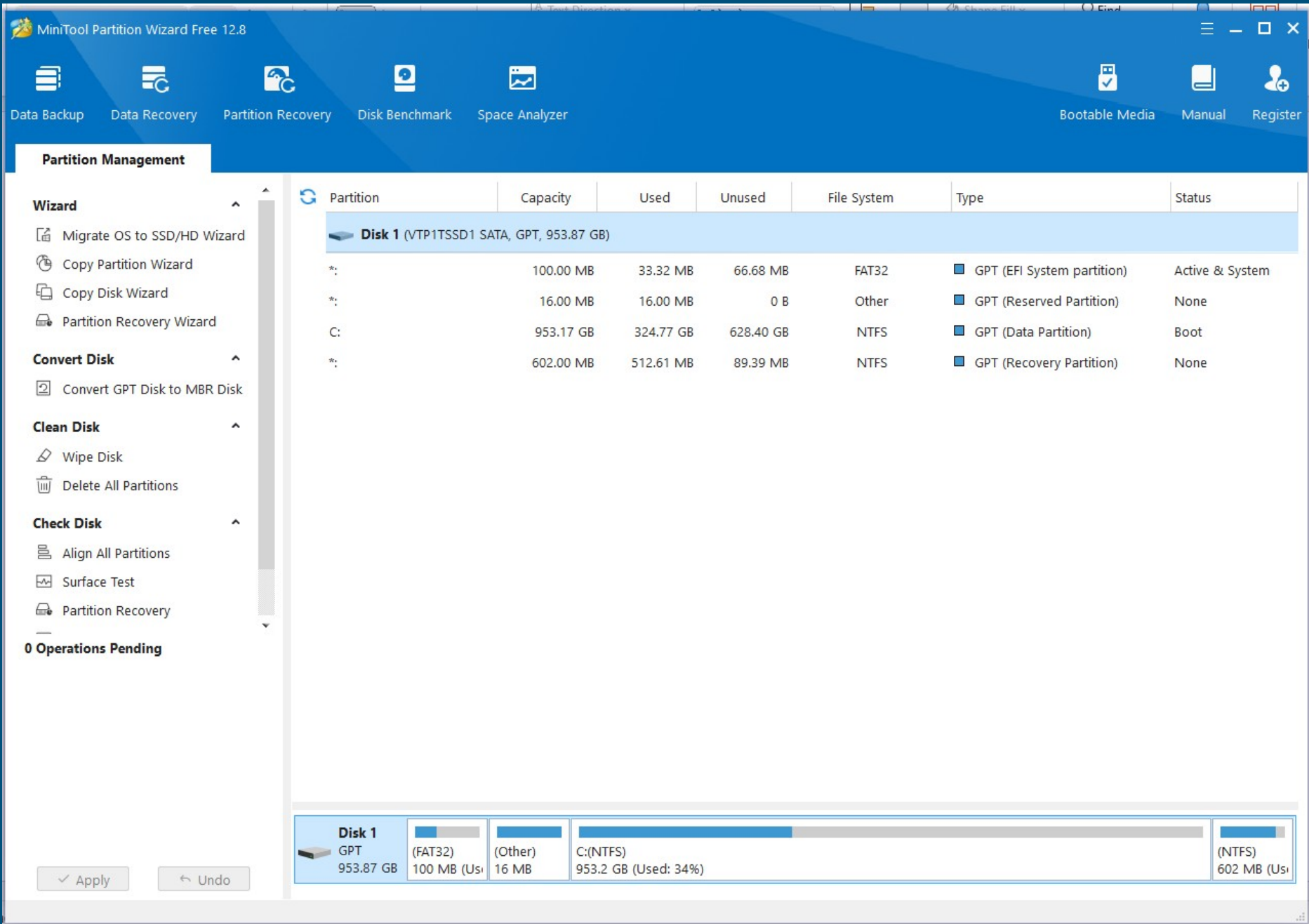
ONE partition marked as bootable

Bootable partition

- Bootstrap
- Special code in a partition to invoke the boot loader to pull the basics of an operating system off the partition
- BIOS
- Easy to break.



MiniTool
Partiti...



More jargon

- NAS
 - Network-attached storage
- RAID
 - Redundant array of inexpensive disks
- JBOD
- Raid levels

NAS

- Network-attached storage
- Raid array attached to network through samba module-the OS sees the partitions.

RAID

- Redundant Array of Inexpensive Disks

- RAID 0 – striping fast
- RAID 1 – mirroring safe
- RAID 5 – striping with parity safe but slow
- RAID 6 – striping with double parity
- RAID 10 – combining mirroring and striping

- Performance v reliability

- https://en.wikipedia.org/wiki/Standard_RAID_levels

- A sad tale

A sad tale ii

Bird records in database on BBC B

Database on 5.25" filing system

Filing system on partition

To read the data: