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Technical Analysis of Early PCs and DOS




Overview

- Analysis of the PC:
 - Hardware
 - Analysis of DOS:
 - Software
 - Impacts on Modern Technology:
 - Operating Systems
 - Computer Hardware
- 

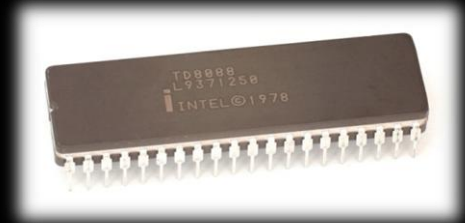


The PC:

- IBM PC, Low Cost
 - PC - 1981
 - XT - 1983
 - AT - 1984
 - Compatible Clones
 - Helped establish popularity
 - Open Standards, Popularity:
 - Third Party Devices
 - Third Party Software
- 

PC Hardware: Processors

- 8088
 - Same as 8086 but 8 bit data bus
 - Used in IBM PC and XT
 - 8087 optional FPU
- 80286
 - Used in IBM AT
 - Faster, memory management, access more memory
 - Features not used like expected



PC Hardware: Memory

- IBM PC [5150]
 - 16KB – 256KB, Expansion cards
 - BIOS used 8KB
- IBM XT [5160]
 - 64KB – 1MB, Expansion cards
 - BIOS used 384 KB
- IBM AT [5170]
 - Up to 16MB, 80286 address space



PC Hardware: Drives

- Low Budget
 - Tape drives
 - Floppy drive
- Floppy Drives Very Popular
- IBM PC
 - Up to 2 5.25" single sided floppy drives
- IBM XT
 - Up to 2 5.25" double sided floppy drives
 - 10MB hard drive
- IBM AT
 - Up to 2 5.25" high density floppy drives
 - 20MB hard drive



PC Hardware: IO

- Keyboard
 - Very good keyboard -> popularity
- Monitor
 - MDA - Text mode only
 - CGA - Text and graphics
 - EGA - Text and higher resolution graphics
- Serial and Printer Ports
 - Modems
 - Mice
 - Printers
- Expansion Cards:
 - Joysticks
 - Cash Drawers
 - Special Machinery



PC: Limitations

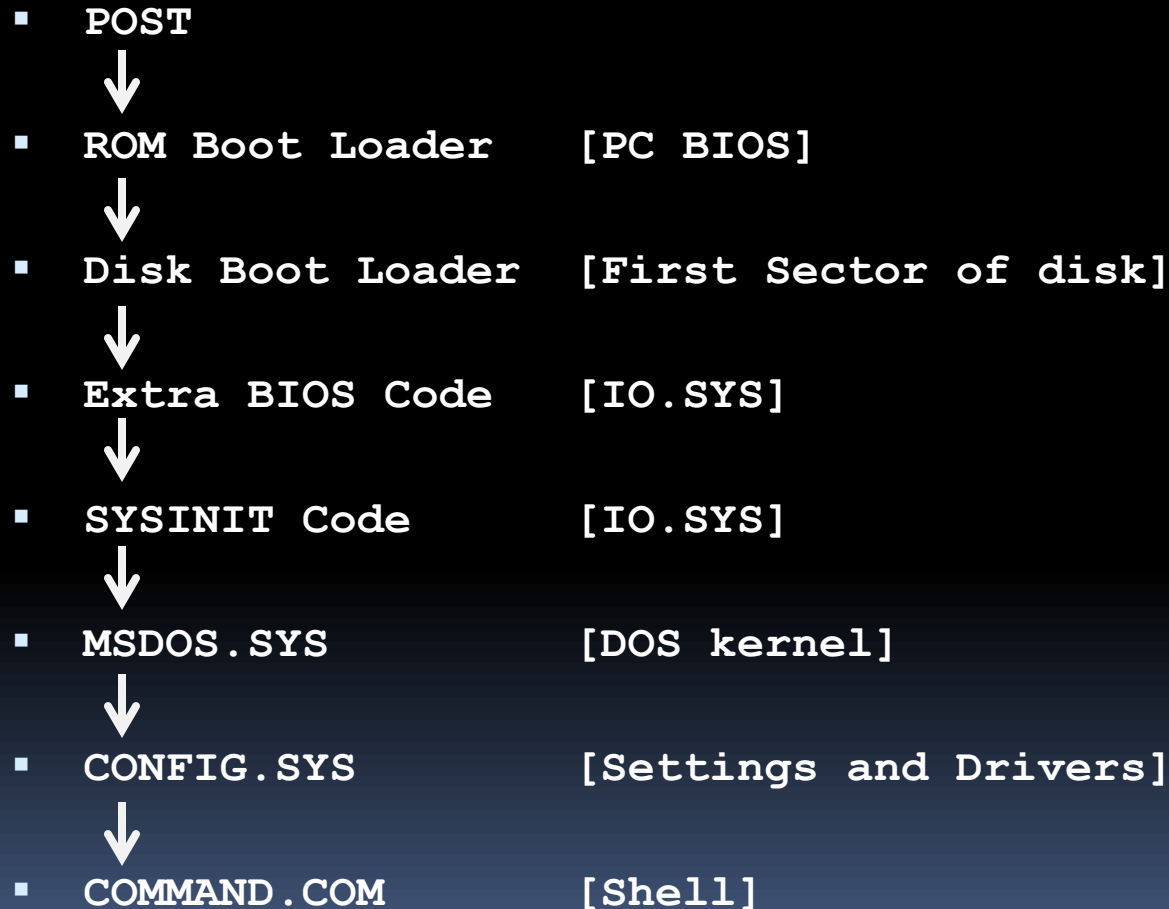
- **Memory**
 - Little available to programmer
 - Cost and address space
 - Fixed with expansion cards and 80286
- **Storage Capacity**
 - Hard drives quite expensive
 - Fixed with IBM XT
- **Graphics:**
 - Limited Resolutions
- **Multi-Tasking & Memory Management**
 - 8088 – No Support
 - 80286 – Added support, not backwards compatible -> not used

The Disk Operating System

- Root is CP/M
- Lightweight Single-Task Single-User Program Loader
- IBM asked Microsoft for OS
- Microsoft sourced 86-DOS from Tim Patterson
- Modified into MS-DOS
- Licensed PCDOS to IBM

```
Starting MS-DOS...  
C:\>_
```

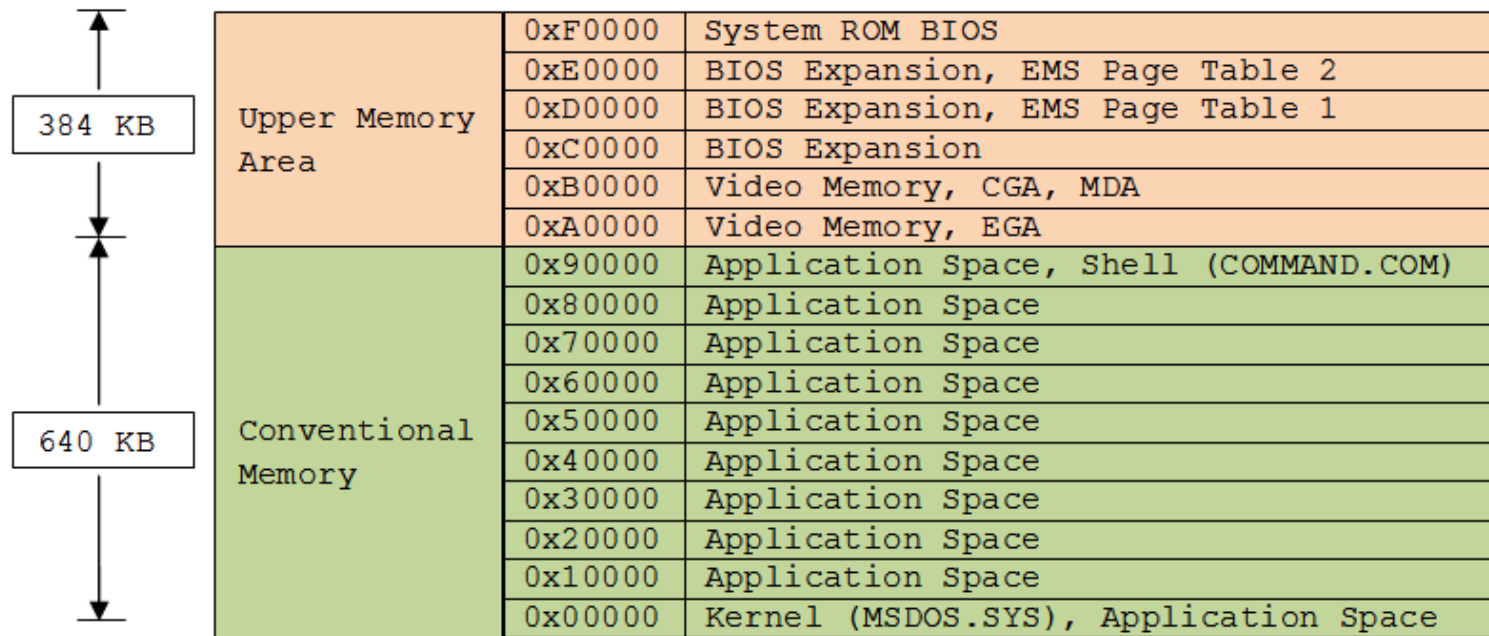
DOS: Boot Process



DOS: Memory Management

- Conventional Memory (640KB)
 - Kernel [MSDOS.SYS]
 - Applications
- Upper Memory Area (384KB)
 - Video Memory
 - BIOS Extensions
 - System ROM BIOS
- Loading High

DOS: Memory Management



DOS: Memory Management

- Free Memory - Arena Entries
 - Headers chained together for searching
 - Essentially Dynamic Partitioning
- .COM
 - Raw binary
 - Max memory given at start
- .EXE
 - Has header telling DOS how much memory is needed
- Memory Requests
 - DOS functions

DOS: File Management

- FCB
 - Legacy for CP/M programs
 - No Directories
- FAT
 - Clusters
 - Basic block of data
 - File Allocation Table
 - Index table for clusters
 - Cluster Chaining
 - Directory Tables
 - Cluster #s
 - Name, Attributes

DOS: IO

- Basic Devices – BIOS
 - Keyboard, Screen, Drives
 - Software Interrupts
 - Available to DOS and programs
- Additional Devices – CONFIG.SYS
 - Loaded at startup

DOS: API

- Basic functions:
 - File access
 - Starting another program
 - Memory allocation
- Similar to BIOS function calls
 - Software interrupts
- Very primitive compared to today:
 - Limited libraries - programmers wrote their own for every program

DOS: Limitations

- No Multi-Tasking
 - TSRs were closest functionality
- One User
 - Original design was simple program loader
- No Security
 - Files only protected by attributes
 - System
 - Hidden
 - Read Only
- Limited API
 - No Common Libraries

```
01:03:54
D:\KATHIR\SWF\TCSAMP~1>timer
Syntax: Timer -I (for Install)
Syntax: Timer -U (for Uninstall)

D:\KATHIR\SWF\TCSAMP~1>timer -i
Installing...
Done

D:\KATHIR\SWF\TCSAMP~1>_
```

Impacts: Windows

- PC
 - PC is only as good as its OS
 - PC grew out of DOS into Windows
 - PC popularity -> Windows popularity
- DOS
 - Early Windows built on MS-DOS
 - Early Windows were first graphic shells for DOS
 - Windows 3.x & 9x loaded with DOS

Impacts: FAT

- DOS and Windows made FAT very popular
- Floppy drives in PC
 - PCs made floppy disk popular
 - Removable drive implies inter-system data exchange
 - FAT was the answer to data sharing
- FAT now standard for camera storage
- FAT used in Flash Drives and SD cards
- Most OSs can read FAT drives

Impacts: x86 Architecture

- PC and DOS rose in popularity
 - More hardware and software targeted at PC
 - Intel created better processors with new features
- Backward compatibility is important
 - All x86 processors are backward compatible
 - Consumer can always run old software on new machine
 - Keeps consumers happy, thus reinforcing popularity

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