

CMPE-310

Lecture-02: 8086 Architecture

Outline

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Bus Architecture

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Basic Architecture

Basic Components



DRAM

SRAM

Cache

ROM

Flash

EEPROM

8086 through pentium IV

Serial/USB

Keyboard

Mouse

Monitor

Hard Drive

printer

Bus Types

Address Bus : Computer bus (a series of lines/wires connecting two or more devices) that is used to specify a physical address.

Data Bus : Provides for transportation of data.

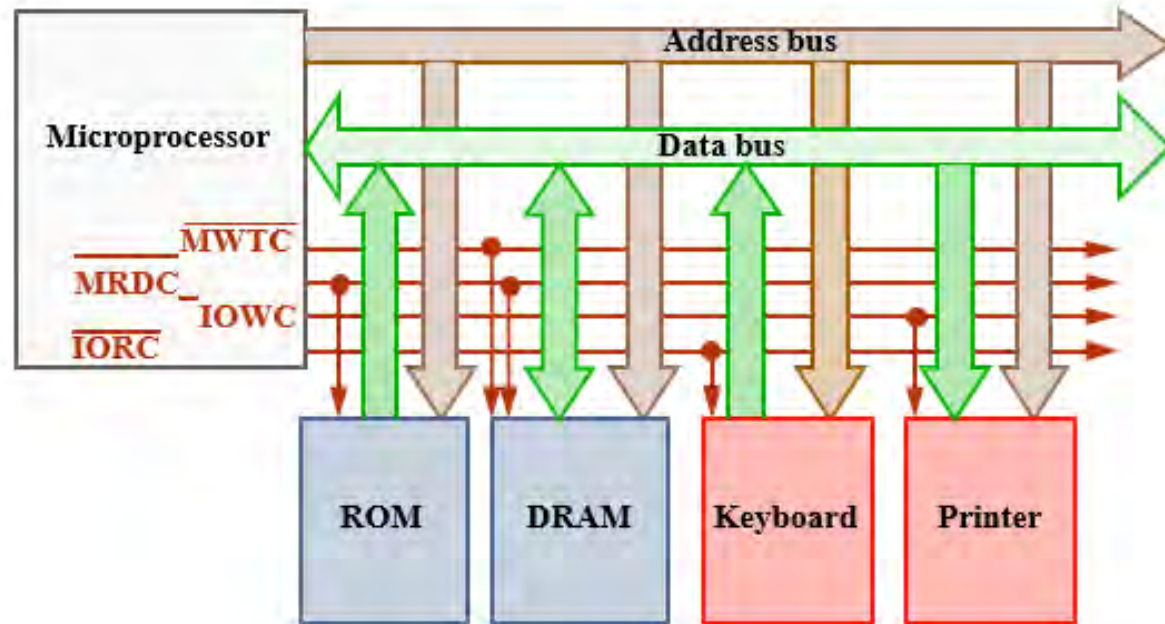
Control Bus : CPU transmits a variety of control signals to components and devices using the control bus. Most systems have at least 4 control bus connections (active low). **MRDC** (Memory Read Control), **MWRC**, **IORC** (I/O Read Control), **IOWC**.

2^0	1
2^1	2
2^2	4
2^3	8
2^4	16
2^5	32
2^6	64
2^7	128
2^8	256
2^9	512
2^{10}	1024~= 1K

Intel family of microprocessor bus and memory sizes

<i>Microprocessor</i>	<i>Data Bus Width</i>	<i>Address Bus Width</i>	<i>Memory Size</i>
8086	16	20	1M
8088	8	20	1M
80186	16	20	1M
80188	8	20	1M
80286	16	24	16M
80386SX	16	24	16M
80386DX	32	32	4G
80386EX	16	26	64M
80486	32	32	4G
Pentium	64	32	4G
Pentium Pro–Core2	64	32	4G
Pentium Pro–Core2 (if extended addressing is enabled)	64	36	64G
Pentium 4 and Core2 with 64-bit extensions enabled	64	40	1T
Itanium	128	40	1T

Bus Architecture



Bus Standards

ISA (Industry Standard Architecture): 8 MHz, 8-bit (8086/8088) 16-bit (80286-Pentium)

EISA (Enhanced Industry Standard Architecture): 8 MHz, 32-bit (older 386 and 486 machines).

PCI (Peripheral Component Interconnect): 33 MHz, 32-bit or 64-bit (Pentiums), New: PCI Express and PCI-X 533 MTS

VESA (Video Electronic Standards Association): Runs at processor speed (32-bit or 64-bit Pentiums)

Only disk and video.

Competes with the PCI but is not popular.

Bus Standards

USB (*Universal Serial Bus*): 1.5 Mbps, 12 Mbps, USB 2.0 - 480 Mbps and USB 3.2 upto 20 Gb/s.

E.g. keyboards, mouse, modems and sound cards.

Introduced to reduce system cost through fewer wires

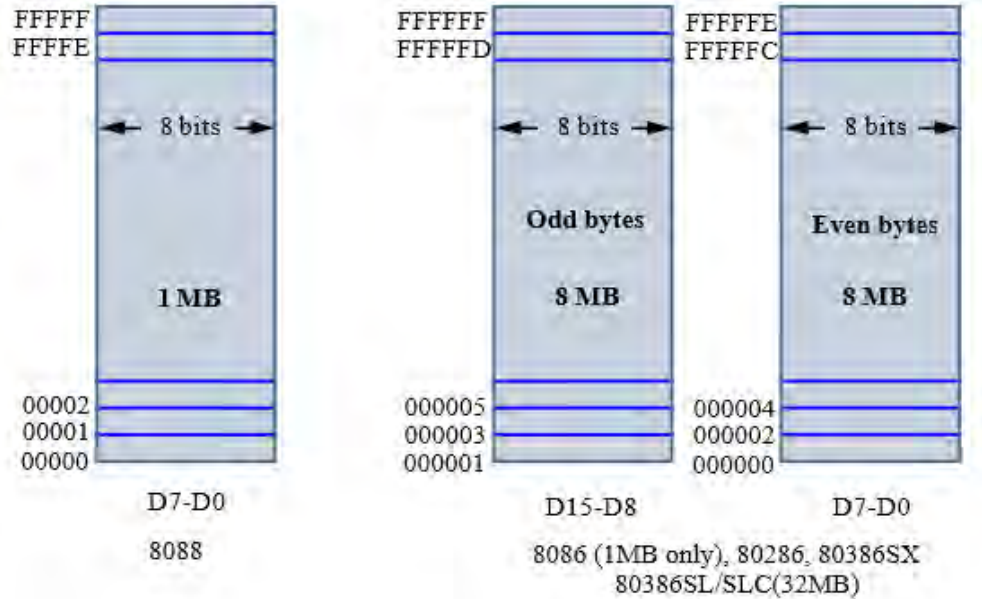
AGP (*Advanced Graphics Port*): 66MHz. (PCIe v6.0 is current standard – 128 GB/s)

Fast parallel connection: Across 64-bits for 533 MB/sec.

E.g. video cards.

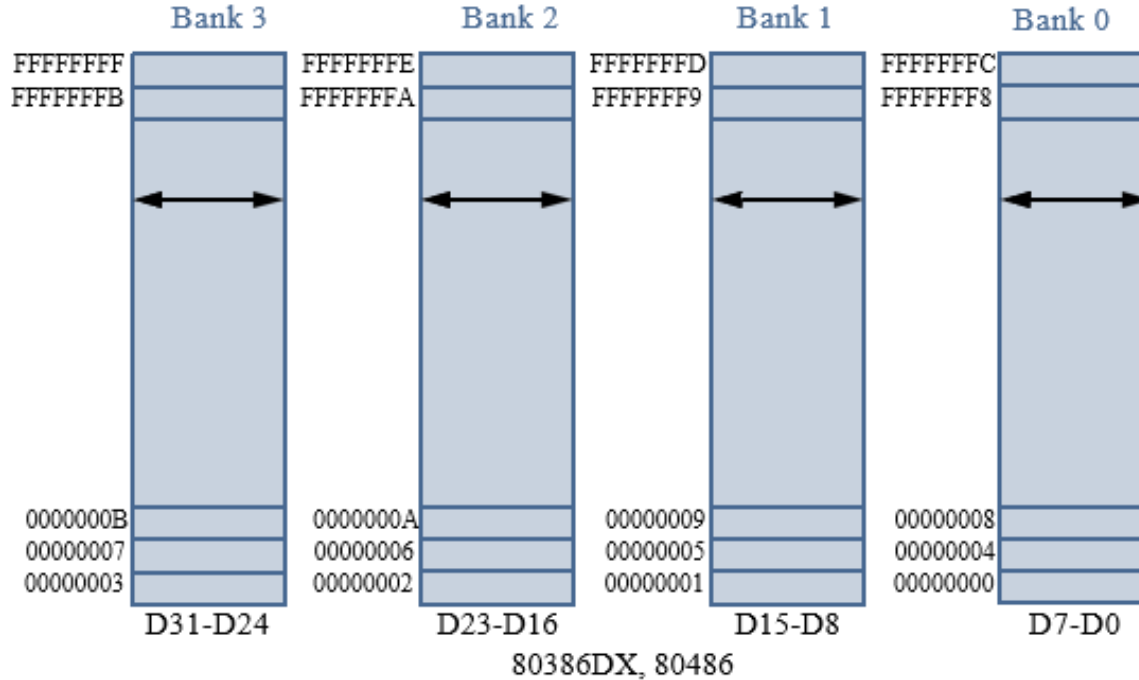
To accommodate DVD (Digital Versatile Disk) players. AGP 3.5 had peak bandwidth of 2.1GB/s.

Memory bank layout

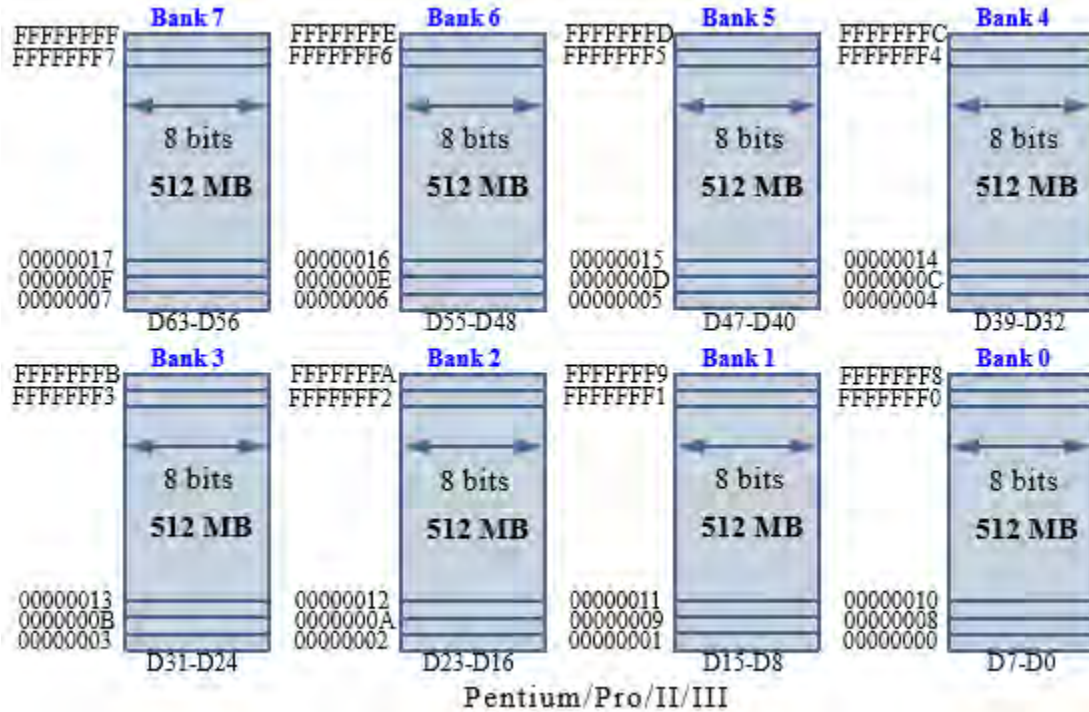


BHE-active low (odd bank)	A0 (even bank)	Selection
0	0	16 bit address
0	1	8 bit odd address
1	0	8 bit even address
1	1	none

Memory bank layout



Memory bank layout



Memory bank layout

8086 processor

20-bit addressing model.

Natural word size – 2 bytes.

Two banks (physically separate chips/modules) allow simultaneous access to two bytes.

No need for separate memory controller.

Why not use a single chip?

Modern processors access memory in chunks.

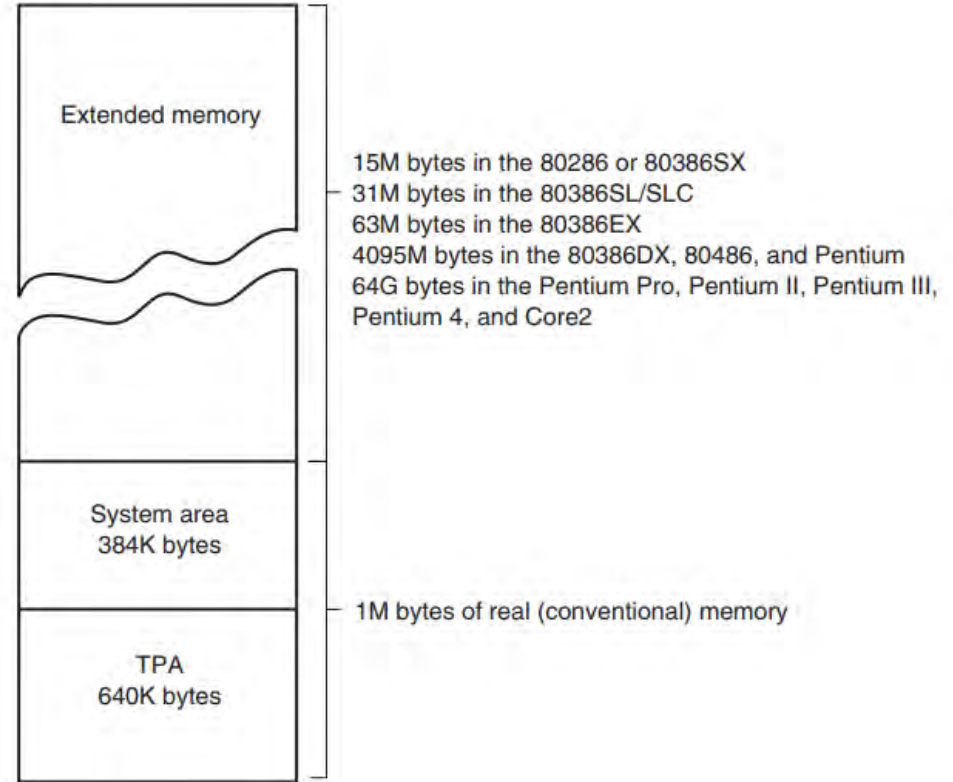
Memory latency didn't matter back in the 1970s.

CPU was too slow and memory modules were manufactured 8-bit wide.

Memory Map

Transient program area (TPA) holds the DOS (disk operating system) operating system and other programs that control the computer system.

System area contains programs for system communication (peripherals).



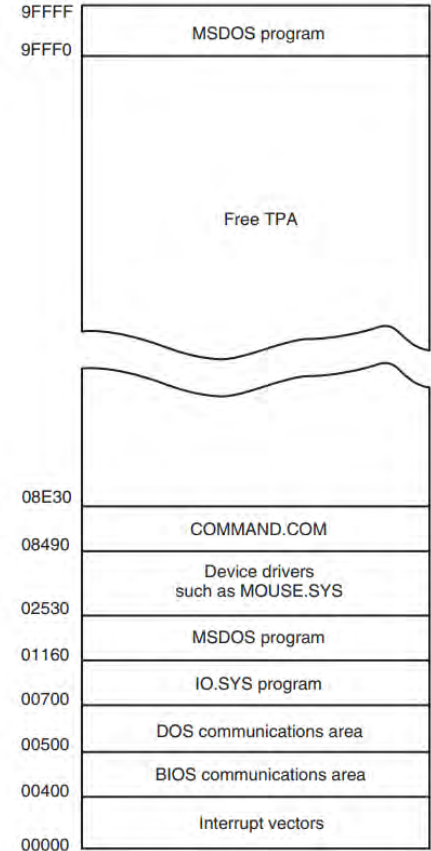
Inside the TPA

Interrupt vectors access various features of the DOS, BIOS (basic I/O system), and applications.

BIOS is a collection of programs stored in either a read-only (ROM) or flash memory that operates many of the I/O devices connected to your computer system.

BIOS and DOS communications areas contain transient data used by programs to access I/O devices and the internal features of the computer system.

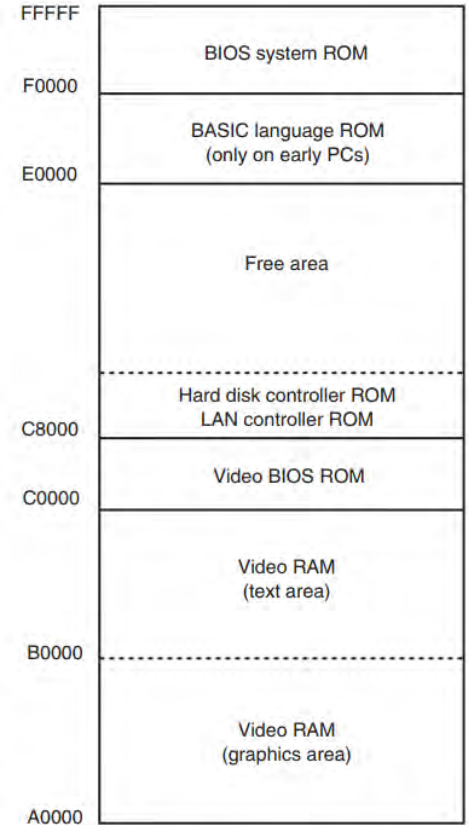
IO.SYS is a program that loads into the TPA from the disk whenever an MSDOS system starts up.



Inside the System Area

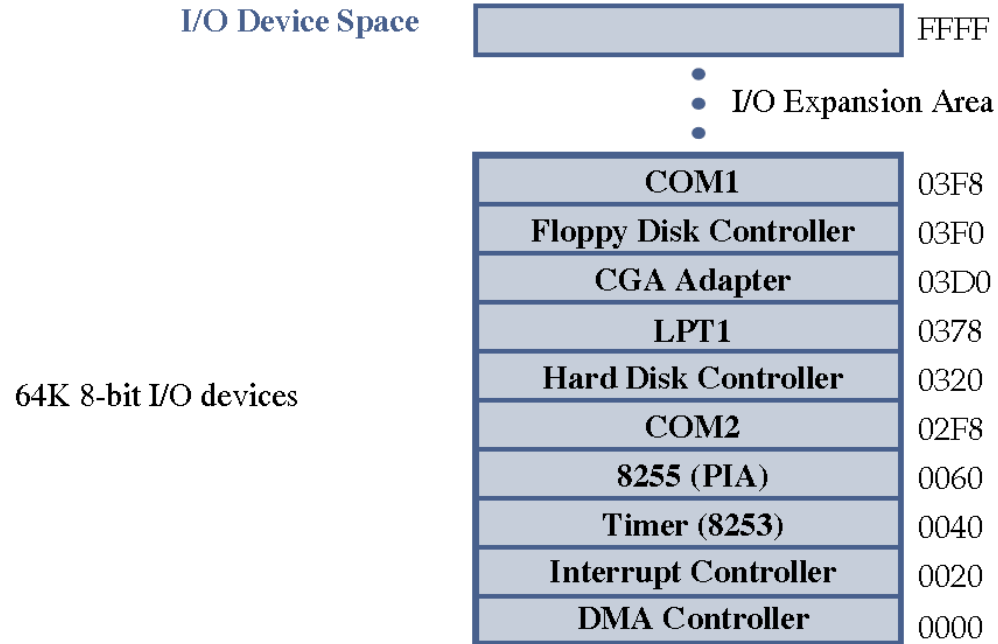
Contains programs on either a read-only memory (ROM) or flash memory, and areas of read/write (RAM) memory for data storage.

Video, LAN BIOS, Hard disk controller drivers and other programs.



I/O Space

NOT memory mapped on 80x86



Special instructions, IN/OUT to communicate with I/O devices