



كلية المأمون الجامعة
قسم هندسة تقنيات الحاسوب
المرحلة الثانية

[MICROPROCESSORS ARCITECTURE]

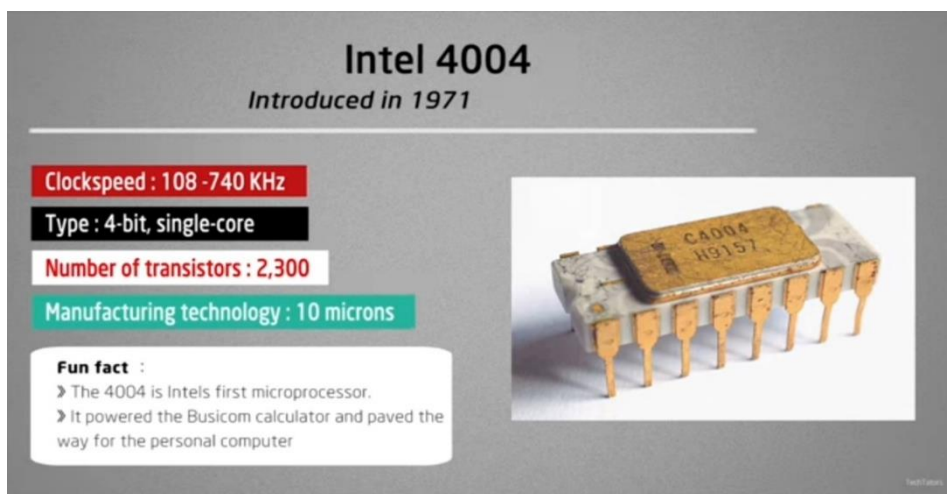
Lecture2

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Brief History of the CPU

1. The 4004 Microprocessor

- The world's first microprocessor the Intel 4004.
- A 4-bit microprocessor-programmable controller on a Chip
- Addressed 4096, 4-bit-wide memory locations.
- The 4004-instruction set contained 45 instructions.
- Main problems with early microprocessor were:
 - speed(slow)
 - word width(4bits)
 - and memory size(4KB).



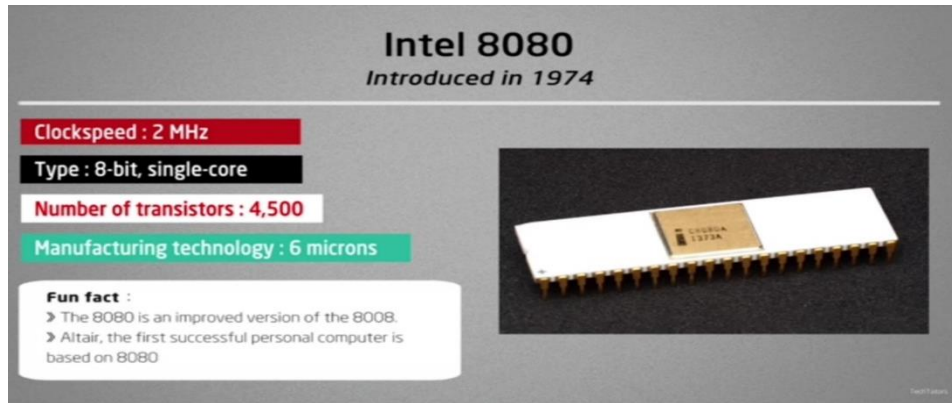
2. The 8008 Microprocessor

- Intel released 8008 in 1971.
- extended 8-bit version of 4004 microprocessor.
- Addressed expanded memory of 16K bytes.

3. The 8080 Microprocessor

- Intel introduced 8080 microprocessors in 1973.

- first of the 8-bit general purpose microprocessor
- 8080 addressed four times more memory. 64K bytes.



4. The 8085 Microprocessor

- In 1977 Intel Corporation introduced 8085 (an updated version of the 8080)
- Last 8-bit, general-purpose microprocessor developed by Intel.
- Main advantages of 8085 were its:
 - internal clock generator
 - higher clock frequency

5. The 8086 and 8088 Microprocessor

- In 1978 Intel released the 8086; a year or so later, it released the 8088.
- Both devices are 16-bit microprocessors.
- 8086 & 8088 addressed 1M byte of memory.
- The number of instructions increased.
- Another feature was a 4- or 6-byte instruction cache or queue that prefetched instructions before they were executed.

Intel 8086

Introduced in 1978

Clockspeed : 5 MHz

Type : 16-bit, single-core

Number of transistors : 29,000

Manufacturing technology : 3 microns

Fun fact :

- » The 8086 is the first 16-bit processor.
- » The 8086 gave rise to the x86 architecture, which eventually became Intel's most successful line of processors



The image shows a black integrated circuit (IC) package for the Intel 8086 microprocessor. It is a Pin Grid Array (PGA) package with numerous pins visible along the bottom edge. The top of the package is labeled with "INTEL 8086" and "INTEL 778 774".

6. The 80286 Microprocessor

- Intel introduced the 80286 in 1983 (an updated 8086)
- Almost identical to the 8086 and 8088.
- Addressed 16M-byte memory system instead of a 1M-byte system.

Intel 286

Introduced in 1982

Clockspeed : 6 MHz

Type : 16-bit, single-core

Number of transistors : 134,000

Manufacturing technology : 1.5 microns

Fun fact :

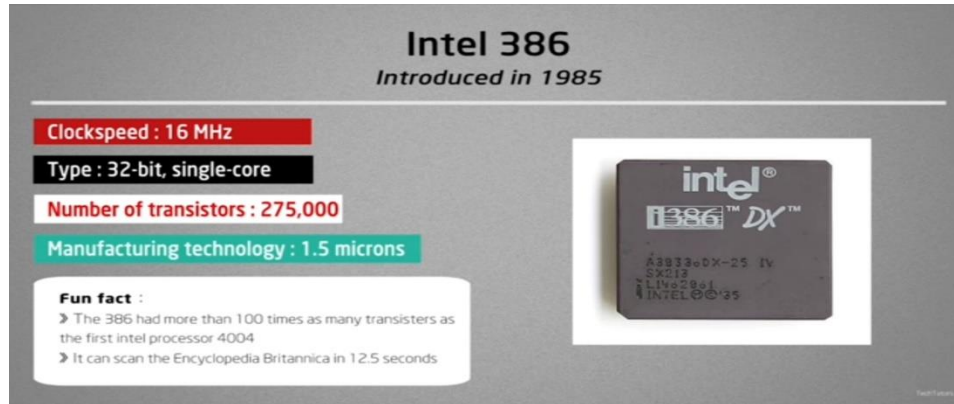
- » Bill Gates famously dubbed the 286 as a "brain dead chip," since it wasn't able to run multiple MS-DOS applications in windows environment.



The image shows a square integrated circuit (IC) package for the Intel 80286 microprocessor. The package is black with gold-colored pins. The top of the package is labeled with "intel 80286" and "N80286 © INTEL".

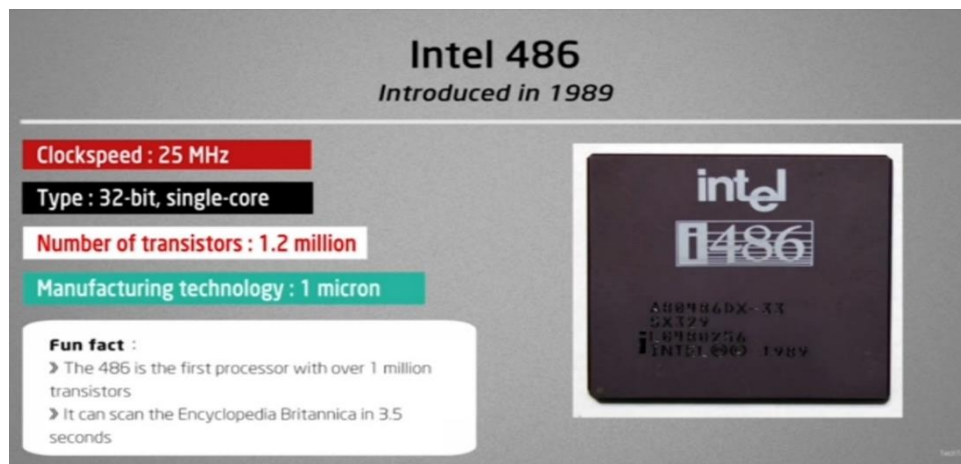
7. The 80386 Microprocessor

- Applications demanded faster microprocessor speeds, more memory, and wider data paths. Led to the 80386 in 1986 by Intel.
- major overhaul of 16-bit 8086–80286 architecture
- Intel's first practical microprocessor to contain a 32-bit data bus and 32-bit memory address



8. The 80486 Microprocessor

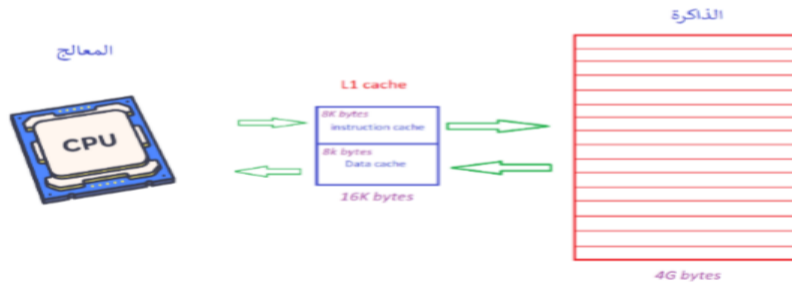
- In 1989 Intel released the 80486.
- 80386-like microprocessor.
- 8K-byte cache memory system.



9. The Pentium Microprocessor

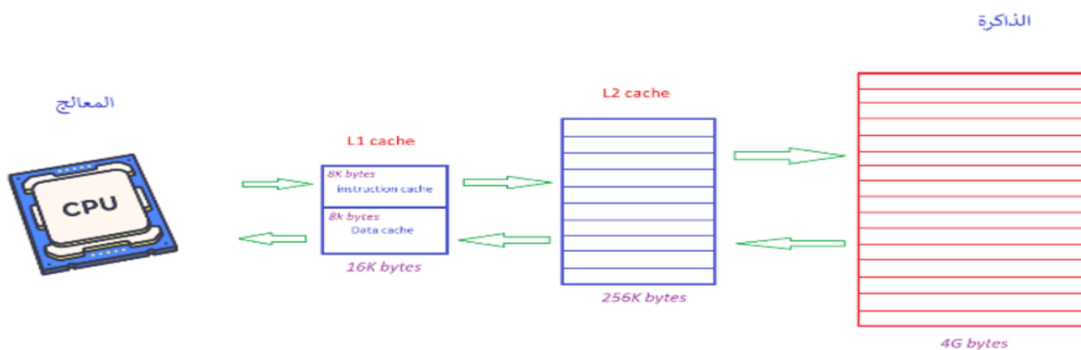
- Originally labeled the P5 or 80586.

- Cache size was increased to 16K bytes from the 8K cache found in 80486.
 - 8K-byte instruction cache
 - 8K-byte data cache.
- Memory system up to 4G bytes.
- Data bus width increased to a full 64 bits.



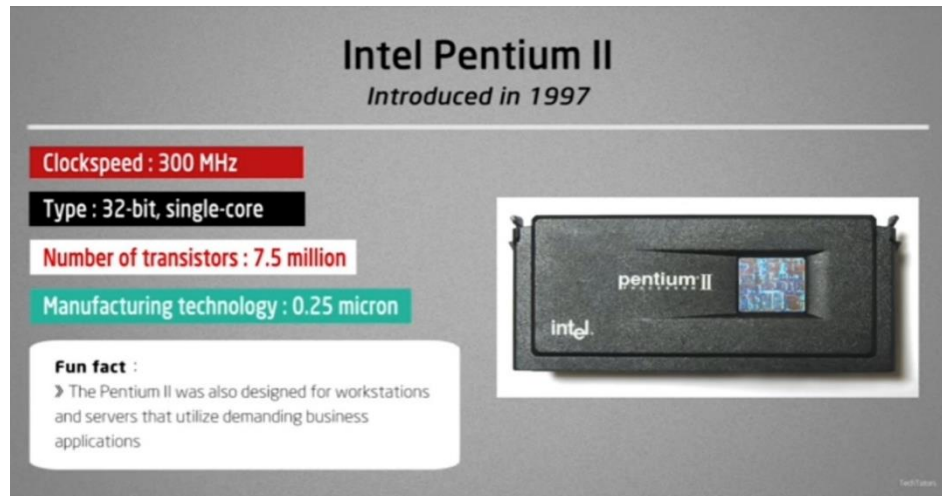
10. The Pentium Pro Microprocessor

- A recent entry, formerly named the P6.
- Pentium Pro contains 2 levels of cache.
 - Internal 16K level-one (L1) cache. 8K data, 8K for instructions
 - 256K level-two (L2) cache
 - Pentium Pro uses three execution engines, to execute up to three instructions at a time
 - Pentium Pro can address 4G-byte or a 64G-byte memory system.



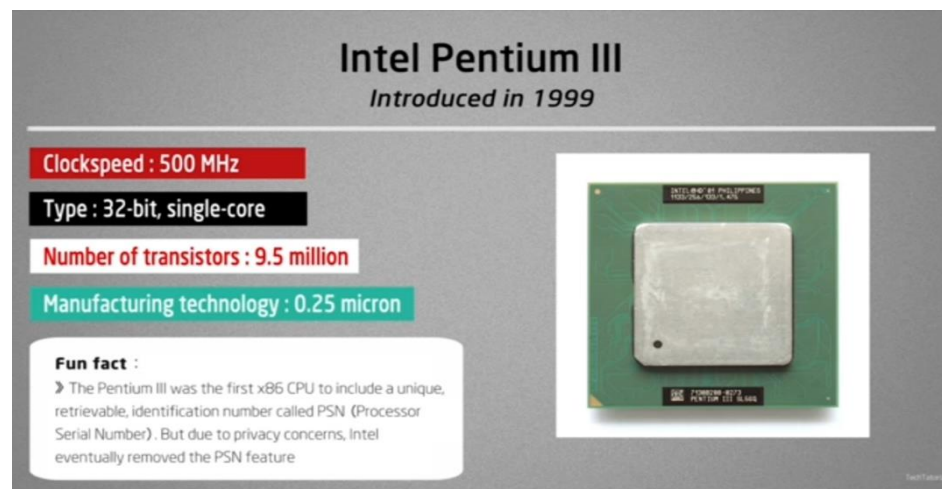
11. The Pentium II Microprocessor

- Pentium II, released 1997.
- L2 cache on main circuit board of not fast enough to function properly with Pentium II
- The Pentium II incorporated Intel technology.



12. The Pentium III Microprocessor

- Faster core than Pentium II
- Additional FP instructions to support 3D graphics.



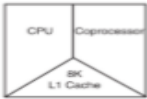
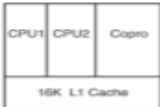
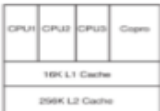
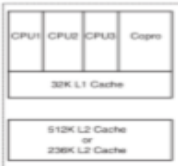
13. The Pentium 4 Microprocessor

- most recent version of Pentium called Core2.
- uses Intel P6 architecture.
- Pentium 4 available to 3.2 GHz and faster.

14. The Future Microprocessor (Itanium)

- This new generation of Intel processor makes use of a 64-bit organization with the IA-64 architecture.
- The Itanium architecture allows greater parallelism than traditional architectures.
- 128 general-purpose integer and 128 floating-point registers; 64 predicate registers.
- Many execution units to ensure enough hardware resources for software.

The Multi-core microprocessors

Microprocessor	Block Diagram
80486	
Pentium	
Pentium Pro	
▪ Pentium II ▪ Pentium III ▪ Pentium 4, or Core2	

Year	CPU	Properties	Bus width	Address bus	Memory Size
1971	4004	- World's first microprocessor - The 4004-instruction set contained 45 instructions. - Main problems with early microprocessor were: ➤ speed (slow) ➤ word width (4bits) ➤ memory size (4K bytes)	4 bits		4 KBytes
1972	8008	extended 8-bit version of 4004 microprocessor	8-bit		16K bytes
1973	8080	The world's first 8-bit general-purpose microprocessor.	8-bit	16	64K bytes
1977	8085	- In 1977 Intel Corporation introduced 8085 (an updated version of the 8080) - Last 8-bit, general-purpose microprocessor developed by Intel. - Main advantages of 8085 were its: ➤ internal clock generator ➤ higher clock frequency	8-bit	16	64K bytes
1978	8086	16-bit general-purpose microprocessor. 6-byte instruction cache	16-bit	20	1M byte of memory
1979	8088	16-bit general-purpose microprocessor. 4-byte instruction cache	16-bit	20	1M byte of memory
1983	80286	- This extension of the 8086 with memory 16-MByte. - Almost identical to the 8086 and 8088.	16-bit	24	16 MB
1986	80386	- Applications demanded faster microprocessor speeds, more memory, and wider data paths. Led to the 80386 in 1986 by Intel. - major overhaul of 16-bit architecture.	32-bit	32	

1989	80486	- Full cache technology - instruction pipelining.	32-bit	32	8K-byte cache memory
1993	Pentium	- Originally labeled the P5 or 80586. 32 bit machine - Single core - Data bus width increased to a full 64 bits.	32-bit	32	16K-byte cache 4G bytes memory
Year	CPU	Properties	Bus width	Address bus	Memory Size
	Pentium Pro	A recent entry, formerly named the P6 32 bit machine - Single core - Pentium Pro uses three execution engines, to execute up to three instructions at a time. - Pentium Pro can address 4G-byte or a 64G-byte memory system.	32-bit	32 or 36	- Internal 16 K level1 (L1) cache 256K level-two (L2) cache 4GB or 64GB memory size
1997	Pentium II	32-bit machine - Single core - The Pentium II incorporated Intel MMX technology	32-bit		
1999	Pentium III	32-bit machine - Single core - Additional FP instructions to support 3D graphics	32-bit		
2000	Pentium 4	32-bit machine ▪ Single core ▪ Additional FP and other enhancements for multimedia	32-bit		
Future	Itanium	- The new generation of Intel processors makes use of a 64-bit organization with the IA-64 architecture. - The Itanium architecture allows greater parallelism than traditional architectures. 128 general-purpose integer and 128 floating-point registers, 64 predicate registers. - Many execution units to ensure enough hardware resources for software.	64-bit		