

# MICROPROCESSOR ARCHITECTURE

UOP S.E.COMP (SEM-I)

## MICROPROCESSOR HISTORY

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# History

## History

Fairchild Semiconductors (founded in 1957) invented the first IC in 1959.

In 1968, **Robert Noyce, Gordon Moore, Andrew Grove** resigned from Fairchild Semiconductors.

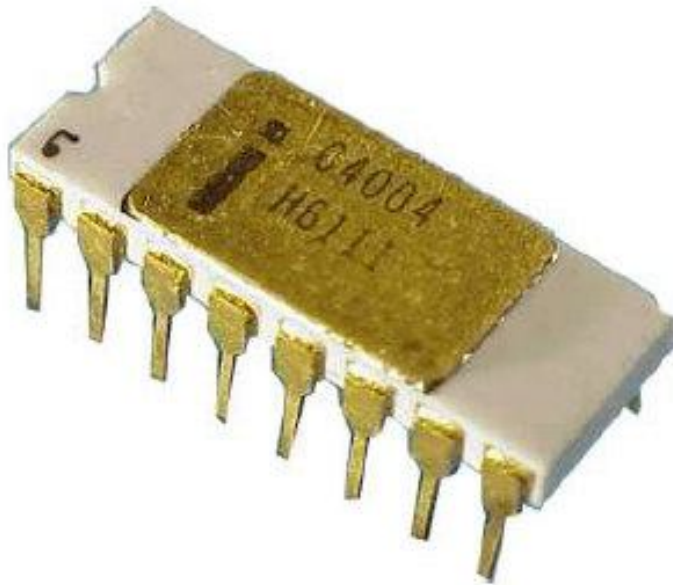
They founded their own company **Intel** (Integrated Electronics).

Intel grown from 3 man start-up in 1968 to industrial giant by 1981.



## History

### INTEL 4004



- Introduced in 1971.
- It was the first microprocessor by Intel.
- It was a 4-bit  $\mu$ P.
- Its clock speed was 740KHz.
- It had 2,300 transistors.
- It could execute around 60,000 instructions per second.

# History

## INTEL 4040

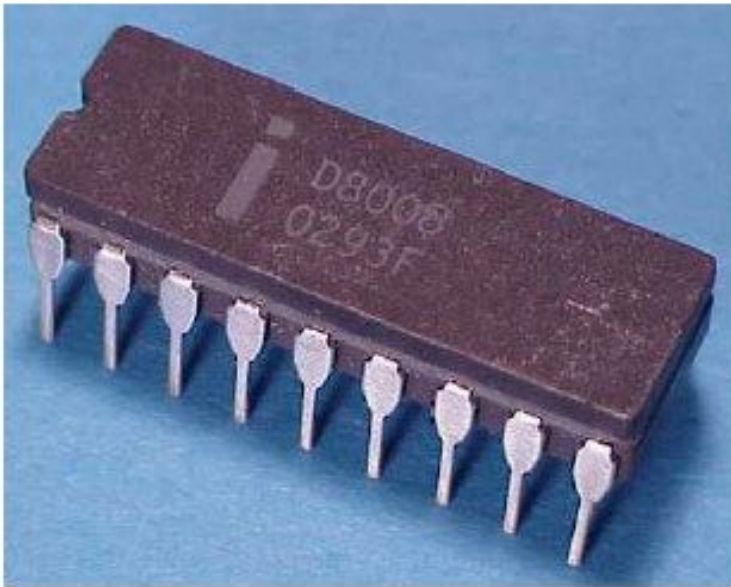


- Introduced in 1974.
- It was also 4-bit  $\mu$ P.



# History

## INTEL 8008



- Introduced in 1972.
- It was first 8-bit  $\mu$ P.
- Its clock speed was 500 KHz.
- Could execute 50,000 instructions per second.

# History

## INTEL 8080



- Introduced in 1974.
- It was also 8-bit  $\mu$ P.
- Its clock speed was 2 MHz.
- It had 6,000 transistors.
- Was 10 times faster than 8008.
- Could execute 5,00,000 instructions per second.

# History

## Moore's Law

The image is a composite. On the left, a portrait of Gordon Moore, co-founder of Intel, is shown. To his right is a graph with 'Performance' on the vertical axis and 'Time' on the horizontal axis. A blue arrow curves upwards and to the right, indicating exponential growth. Overlaid on the graph is a black box with white text: "... the number of transistors on a chip approximately doubles every 24 months ...". Below this, the name 'Gordon Moore' is written in yellow, followed by 'Circa 1975' in white. In the bottom left corner of the composite is the Intel logo. Overlaid on the bottom right is a tilted newspaper clipping. The headline reads: 'Cramming more components onto integrated circuits'. The sub-headline reads: 'The experts look ahead'. The main text of the clipping reads: 'With unit cost falling as the number of components per circuit rises, by 1975 economics may dictate squeezing as many as 65,000 components on a single silicon chip'. The byline reads: 'By Gordon E. Moore, Director, Research and Development Laboratories, Fairchild Semiconductor Division of Fairchild Camera and Instrument Corp.'.

Performance

Time

“... the number of transistors on a chip approximately doubles every 24 months ...”

Gordon Moore  
Circa 1975

The experts look ahead

**Cramming more components onto integrated circuits**

With unit cost falling as the number of components per circuit rises, by 1975 economics may dictate squeezing as many as 65,000 components on a single silicon chip

By Gordon E. Moore  
Director, Research and Development Laboratories, Fairchild Semiconductor Division of Fairchild Camera and Instrument Corp.

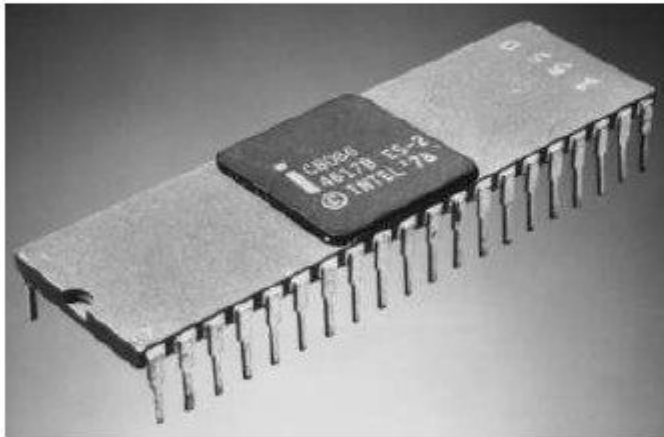
The future of integrated electronics is the development of new devices. The trend towards smaller components will bring about a proliferation of applications, pushing their volume into many new areas.

Integrated circuits will find their way into a wide range of products—automobiles, homes, schools, hospitals, and many other areas.



# History

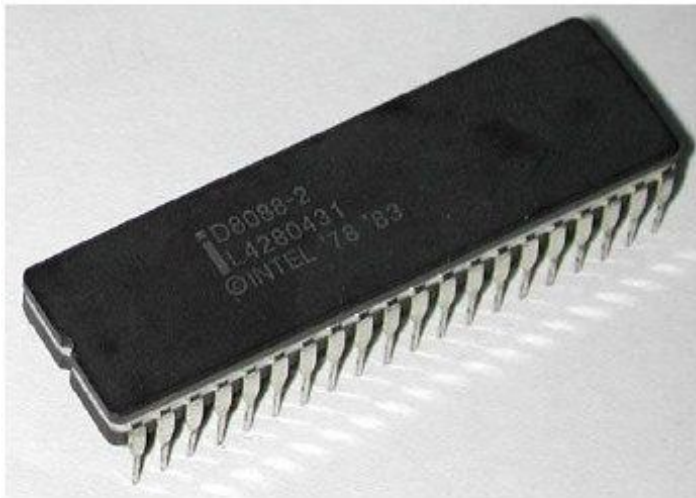
## INTEL 8086



- Introduced in 1978.
- It was first 16-bit  $\mu$ P.
- Its clock speed is 4.77 MHz, 8 MHz and 10 MHz, depending on the version.
- Its data bus is 16-bit and address bus is 20-bit.
- It had 29,000 transistors.
- Could execute 2.5 million instructions per second.
- It could access 1 MB of memory.
- It had 22,000 instructions.
- It had **Multiply** and **Divide** instructions.

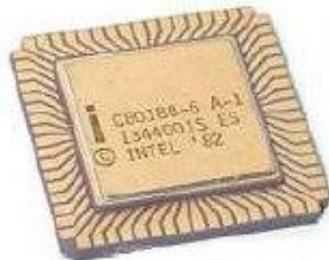
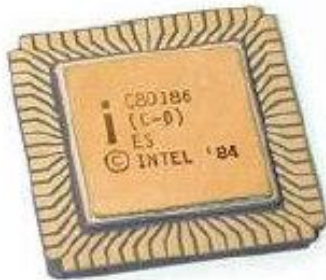
# History

## INTEL 8088



- Introduced in 1979.
- It was also 16-bit  $\mu$ P.
- It was created as a cheaper version of Intel's 8086.
- It was a 16-bit processor with an 8-bit external bus.
- Could execute 2.5 million instructions per second.
- This chip became the most popular in the computer industry when IBM used it for its first PC.

## INTEL 80186 & 80188



- Introduced in 1982.
- They were 16-bit  $\mu$ Ps.
- Clock speed was 6 MHz.
- 80188 was a cheaper version of 80186 with an 8-bit external data bus.
- They had additional components like:
  - Interrupt Controller
  - Clock Generator
  - Local Bus Controller
  - Counters



# History

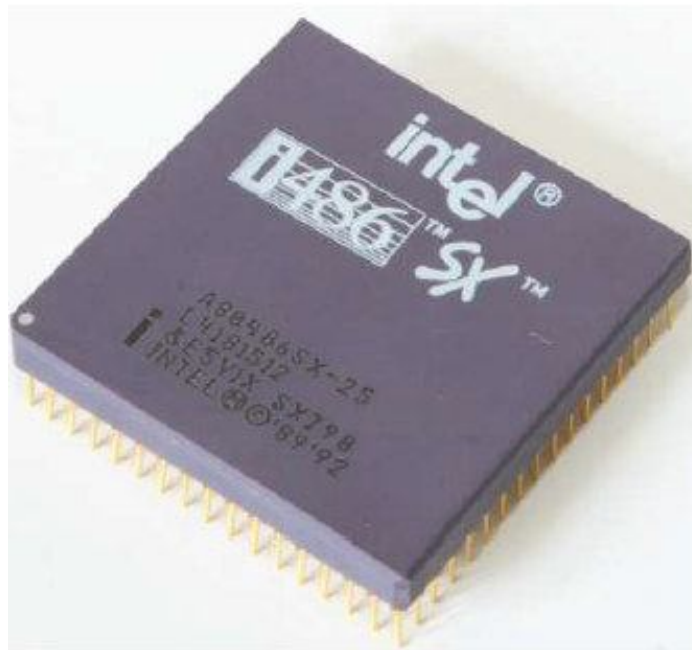
## INTEL 80386



- Introduced in 1986.
- It was first 32-bit  $\mu$ P.
- Its data bus is 32-bit and address bus is 32-bit.
- It could address 4 GB of memory.
- It had 2,75,000 transistors.
- Its clock speed varied from 16 MHz to 33 MHz depending upon the various versions.
- Different versions:
  - 80386 DX
  - 80386 SX
  - 80386 SL
- Intel 80386 became the best selling microprocessor in history.



## INTEL 80486



- Introduced in 1989.
- It was also 32-bit  $\mu$ P.
- It had 1.2 million transistors.
- Its clock speed varied from 16 MHz to 100 MHz depending upon the various versions.
- It had five different versions:
  - 80486 DX
  - 80486 SX
  - 80486 DX2
  - 80486 SL
  - 80486 DX4
- 8 KB of cache memory was introduced.

# History

## INTEL PENTIUM



- Introduced in 1993.
- It was also 32-bit  $\mu$ P.
- It was originally named 80586
- Its clock speed was 66 MHz.
- Its data bus is 32-bit and address bus is 32-bit.
- It could address 4 GB of memory.
- Could execute 110 million instructions per second.
- Cache memory:
  - 8 KB for instructions.
  - 8 KB for data.

## History

### INTEL PENTIUM PRO



- Introduced in 1995.
- It was also 32-bit  $\mu$ P.
- It had L2 cache of 256 KB.
- It had 21 million transistors.
- It was primarily used in server systems.
- Cache memory:
  - 8 KB for instructions.
  - 8 KB for data.
- It had L2 cache of 256 KB.



# INTEL PENTIUM II



- Introduced in 1997.
- It was also 32-bit  $\mu$ P.
- Its clock speed was 233 MHz to 500 MHz.
- Could execute 333 million instructions per second.
- MMX technology was supported.
- L2 cache & processor were on one circuit.



# INTEL PENTIUM II XEON



- Introduced in 1998.
- It was also 32-bit  $\mu$ P.
- It was designed for servers.
- Its clock speed was 400 MHz to 450 MHz.
- L1 cache of 32 KB & L2 cache of 512 KB, 1MB or 2 MB.
- It could work with 4 Xeons in same system.

# INTEL PENTIUM III



- Introduced in 1999.
- It was also 32-bit  $\mu$ P.
- Its clock speed varied from 500 MHz to 1.4 GHz.
- It had 9.5 million transistors.

## History

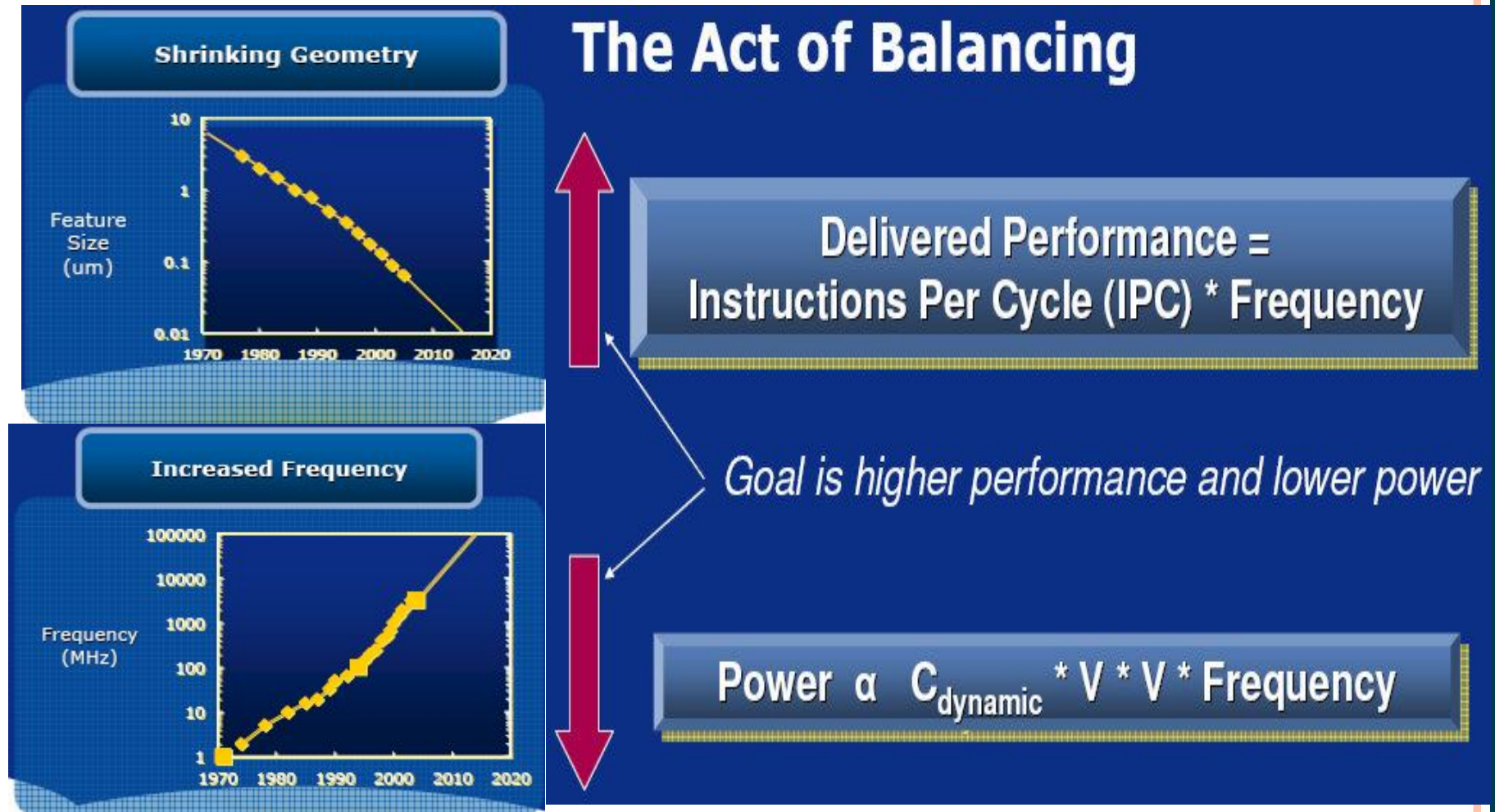
### INTEL PENTIUM IV



- Introduced in 2000.
- It was also 32-bit  $\mu$ P.
- Its clock speed was from 1.3 GHz to 3.8 GHz.
- L1 cache was of 32 KB & L2 cache of 256 KB.
- It had 42 million transistors.
- All internal connections were made from aluminium to copper.



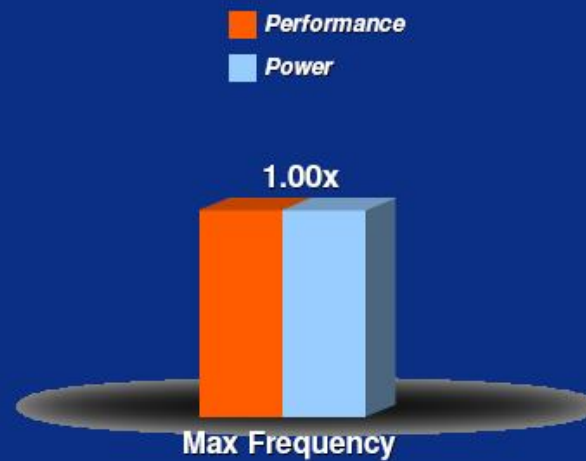
# History



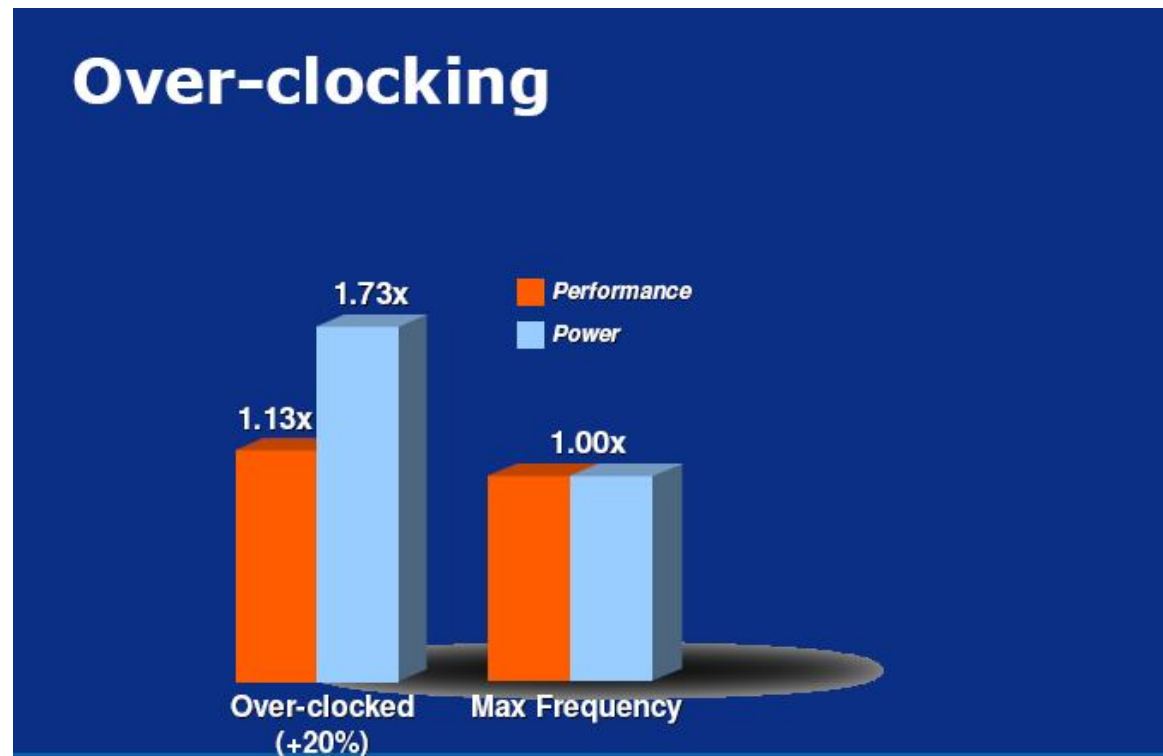


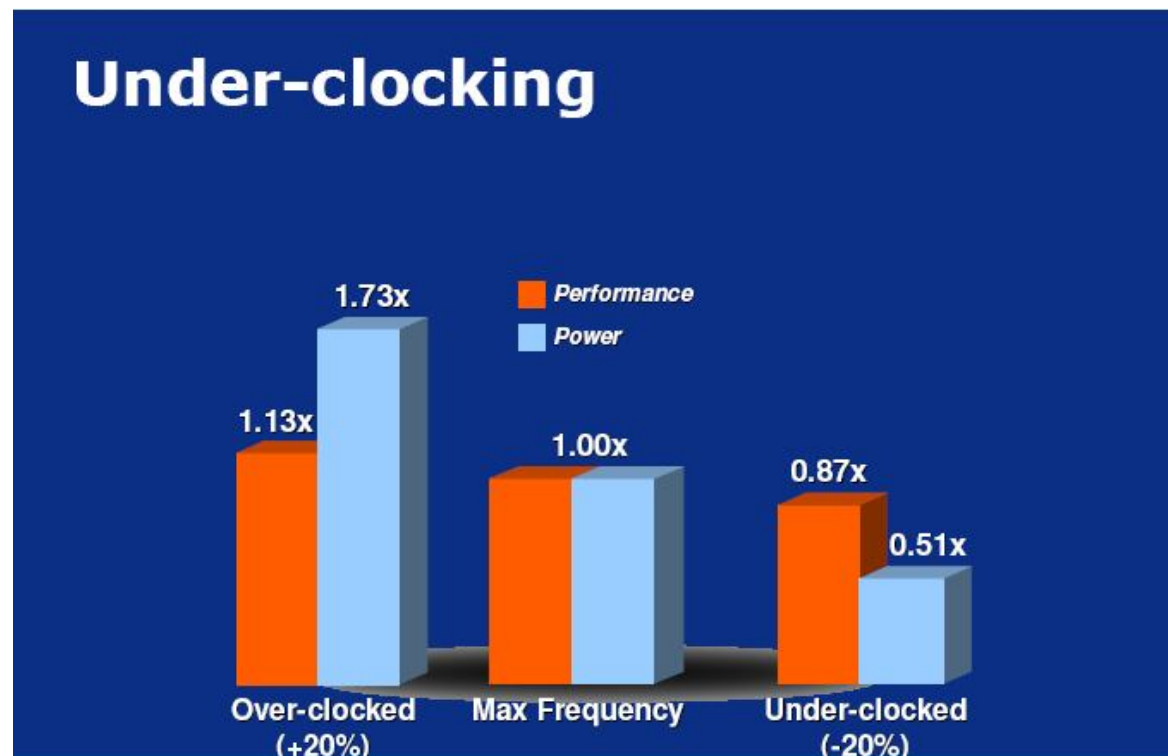
# History

## What then?

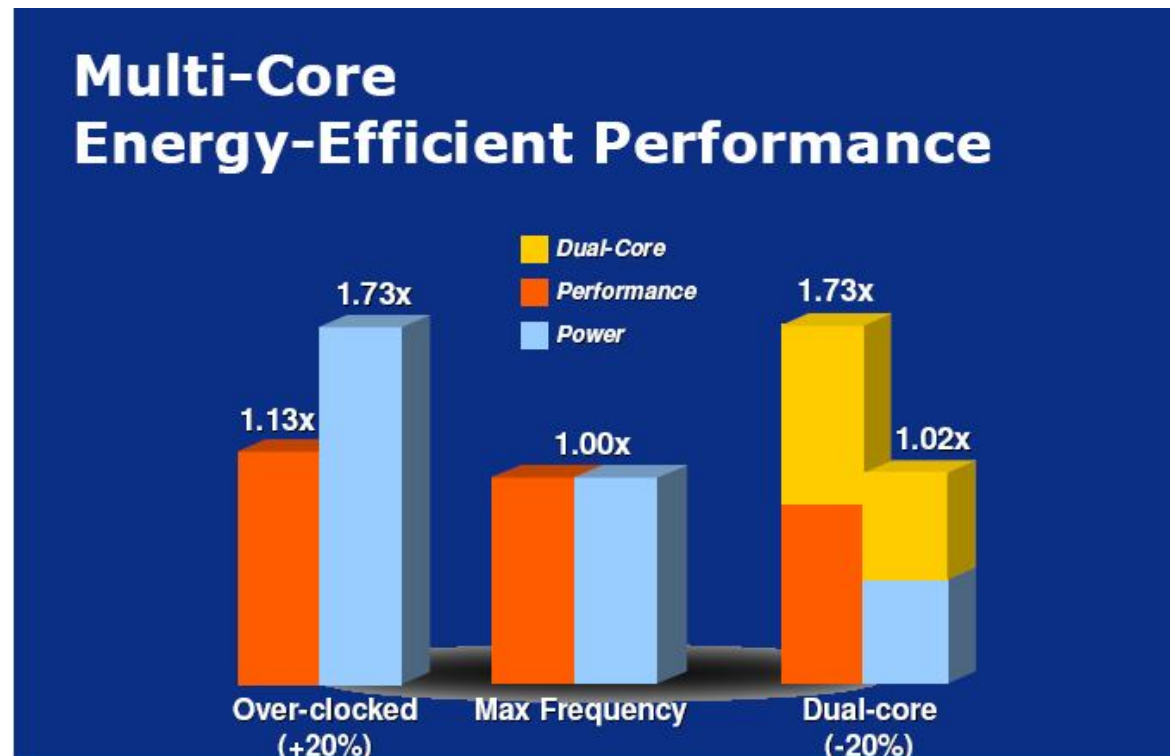


# History





# History

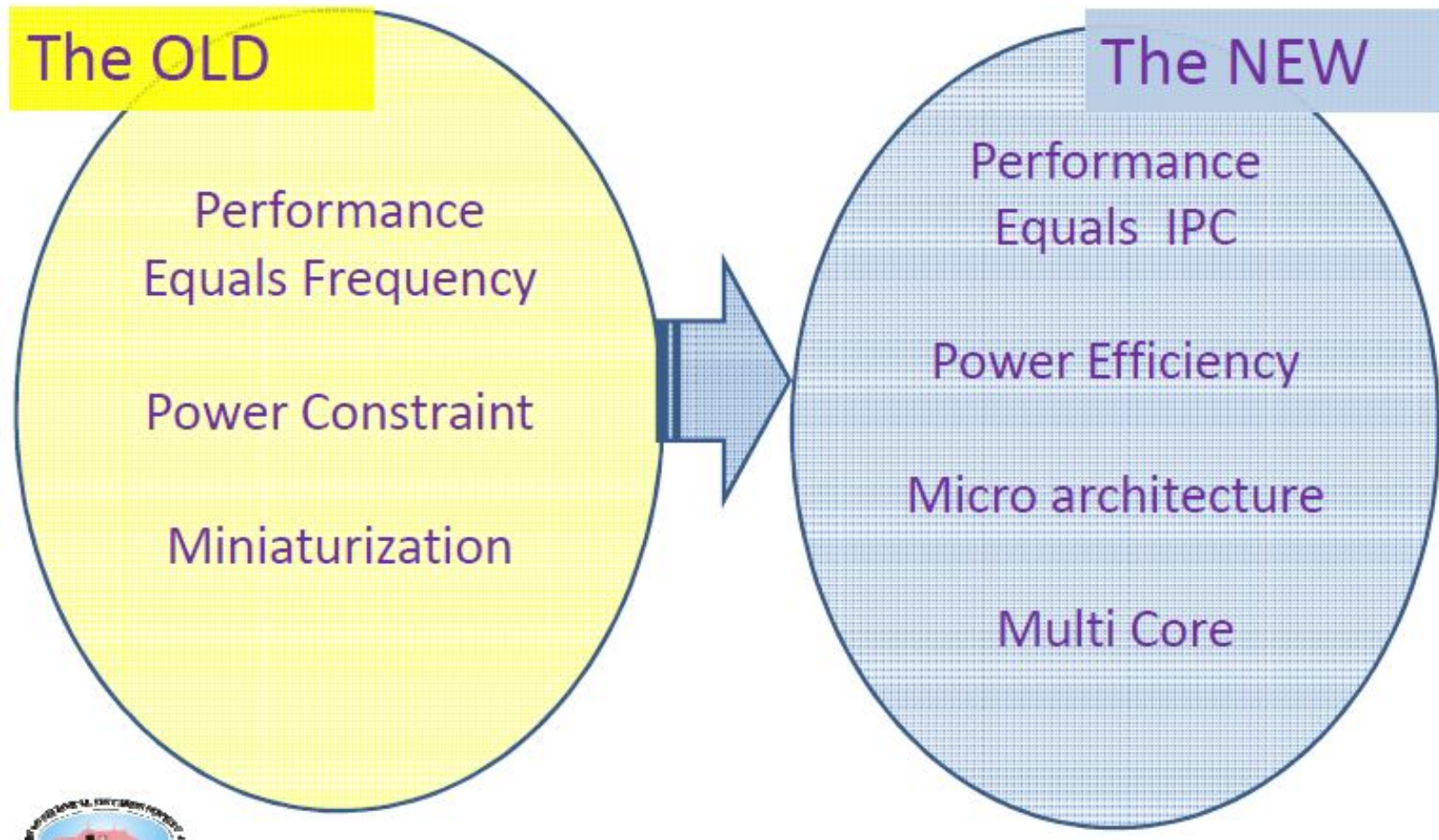




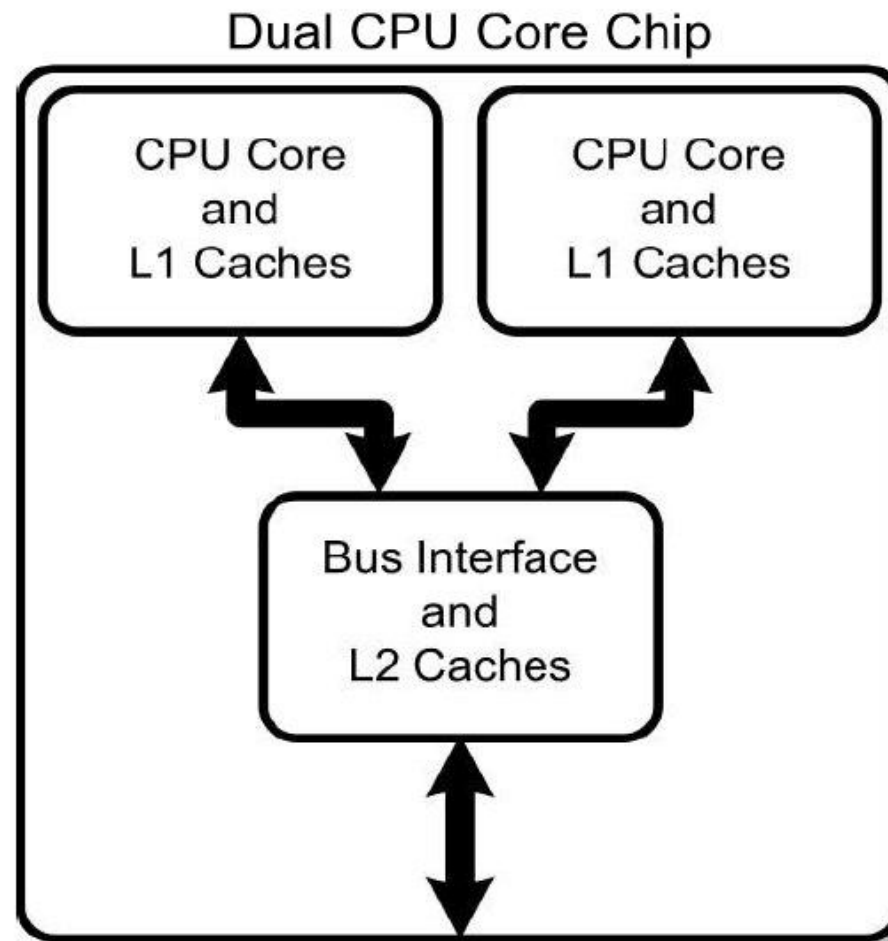
# History.....A new Era



## A New Era..



## A New Era..



## A New Era..

### INTEL DUAL CORE



- Introduced in 2006.
- It is 32-bit or 64-bit  $\mu$ P.
- It has two cores.
- Both the cores have their own internal bus and L1 cache, but share the external bus and L2 cache (*Next Slide*).
- It supported SMT technology.
- SMT: Simultaneously Multi-Threading
- E.g.: Adobe Photoshop supported SMT.



A New Era..

## INTEL CORE 2



- Introduced in 2006.
- It is a 64-bit  $\mu$ P.
- Its clock speed is from 1.2 GHz to 3 GHz.
- It has 291 million transistors.
- It has 64 KB of L1 cache per core and 4 MB of L2 cache.
- It is launched in three different versions:
  - Intel Core 2 Duo
  - Intel Core 2 Quad
  - Intel Core 2 Extreme

A New Era..

## INTEL CORE I3



- Introduced in 2010.
- It is a 64-bit  $\mu$ P.
- It has 2 physical cores.
- Its clock speed is from 2.93 GHz to 3.33 GHz.
- It has 781 million transistors.
- It has 64 KB of L1 cache per core, 512 KB of L2 cache and 4 MB of L3 cache.

A New Era..

## INTEL CORE I5



- Introduced in 2009.
- It is a 64-bit  $\mu$ P.
- It has 4 physical cores.
- Its clock speed is from 2.40 GHz to 3.60 GHz.
- It has 781 million transistors.
- It has 64 KB of L1 cache per core, 256 KB of L2 cache and 8 MB of L3 cache.



A New Era..

## INTEL CORE I7



- Introduced in 2008.
- It is a 64-bit  $\mu$ P.
- It has 4 physical cores.
- Its clock speed is from 2.66 GHz to 3.33 GHz.
- It has 781 million transistors.
- It has 64 KB of L1 cache per core, 256 KB of L2 cache and 8 MB of L3 cache.