History of Processors

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Processor

A device that takes in binary numbers, does some arithmetic or logical operation on those numbers and produces an output of more binary numbers

- 1960’s processors were built using discrete elements
- 1970’s microchip was invented (all components were placed on a single piece of silicon.
- Size was a lot smaller and speed was much faster
Prior to “micro”

- Vacuum tubes
  - Controls electric current between electrodes in a vacuum tube
  - Thermionic emission of electrons from the cathode
  - 1942-1960
- Electromechanical Relays
  - 1835 Joseph Henry
  - Essentially ON-OFF switches
- Semiconductor
  - 1833 Michael Faraday
  - Presence of an E changes the conductance
1968 - 1969
• Intel Corporation founded
• Advanced Micro Devices (AMD)

1971
• Intel 4004

1972
• Intel 8008
Timeline

1974 - 1979
- Intel
  - 8080
  - 8085
  - 8086
  - 8088

1979
- Motorola 68000

1982 & 1985
- Intel
  - 80286
  - 80386

1987
- SPARC processor
  - Sun

1988 - 1992
- Intel
  - 80386SX
  - 486SX
  - 486DX2
  - AMD386 family
Moore’s Law
## First Intel Processors

<table>
<thead>
<tr>
<th>Intel 4004</th>
<th>Intel 8008</th>
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</thead>
<tbody>
<tr>
<td>Intel’s first microprocessor</td>
<td>16 KB memory</td>
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<tr>
<td>Ted Hoff</td>
<td>Originally</td>
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<tr>
<td>740 kHz</td>
<td>Less instructions per second</td>
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<tr>
<td>4-bit data bus</td>
<td>8-bit data</td>
</tr>
<tr>
<td>8-bit instructions</td>
<td>14-bit addresses</td>
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<tr>
<td>12-bit addresses</td>
<td>7 “scratchpad” registers</td>
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</tbody>
</table>
Intel vs Motorola

Intel 8088
- 16-bit registers
- 8-bit data bus (16-bit architecture)
- 20-bit address bus (limits up to 1MB of memory)
- 4.77 MHz to 10 MHz
- Integer and floating-point instructions can be executed concurrently
- Found in: IBM PCs, Amstrad PPC-640
- 29,000 transistors, 3µm spacing
- Includes a 4 byte pre-fetch queue (8086 had 6byte)
- 0.33 to 1 million instructions per second

Motorola 68000 family
- 32-bit data and address registers
- 16-bit data bus
- 24-bit address bus (limits addressable memory to 16MB)
- Up to 16MHz
- 56 instructions
- Able to expand to support 32-bit data and address bus
- Still manufactured in 2007 at speeds up to 20MHz
- Found in: Apple Macintosh 128, Atari 520STfm, Sega arcade
- HP, Printronix and Adobe printers, Automotive engine controller, TI graphing calculators
References

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