Computer Hardware History

Miniaturization and the Increase in Computing Power Over Time

Miniaturization
• The trend to manufacture ever smaller mechanical, optical and electronic products and devices.
  – Computers get smaller, and/or cheaper, and/or more powerful over time.
  – The changes are fast!

Early Computers
• Earliest electronic computers were built using vacuum tubes.

Problems with Vacuum Tubes
• Used a lot of power
• Generated a lot of heat
• Took up a lot of space
• Not very powerful
• Needed a lot of maintenance

• Rack of vacuum tubes

Eniac
Another Rack of Tubes

Enter the Transistor

- A transistor is a device used to amplify or switch electronic signals and electrical power.
- Performs the same function as a vacuum tube
- MUCH smaller
- Uses MUCH less power
- Generates MUCH less heat
- Cheaper to make
- Faster

Transistors

Integrated Circuit

- Electronic circuit containing multiple components
- Performs the same function as a circuit made from individual components.
- MUCH smaller
- Uses MUCH less power
- Generates MUCH less heat
- Cheaper to make
- Faster
- Does any of this sound familiar?? 😊
**Intergrated Circuits**

- An integrated circuit that contains all the functions of a central processing unit (CPU) of a computer.
- This is the “brain” of the computer; more on this later
- CPUs have shrunk from room size (vacuum tubes) to cabinet size (transistors) to fingernail size (integrated circuits)

**Transistor counts on IC CPUs**

<table>
<thead>
<tr>
<th>Year</th>
<th>CPU</th>
<th>Transistor Count</th>
<th>Used in</th>
</tr>
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<tbody>
<tr>
<td>1974</td>
<td>Intel 8080</td>
<td>4,500</td>
<td>Altair 8800</td>
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<tr>
<td>1975</td>
<td>MOS Technology 6502</td>
<td>3,510</td>
<td>Apple II</td>
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<td>1976</td>
<td>Zilog Z80</td>
<td>8,500</td>
<td>TRS-80 Model 1</td>
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<tr>
<td>1978</td>
<td>Intel 8086/8088</td>
<td>29,000</td>
<td>IBM PC</td>
</tr>
<tr>
<td>1982</td>
<td>Intel 80286</td>
<td>134,000</td>
<td>IBM PC/AT</td>
</tr>
<tr>
<td>1985</td>
<td>Intel 80386</td>
<td>275,000</td>
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<tr>
<td>1989</td>
<td>Intel 80486</td>
<td>1,180,235</td>
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<tr>
<td>1993</td>
<td>Pentium</td>
<td>3,100,000</td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>Pentium II Deschutes</td>
<td>7,500,000</td>
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<tr>
<td>2001</td>
<td>Pentium III Tualatin</td>
<td>45,000,000</td>
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<tr>
<td>2005</td>
<td>Pentium 4 Prescott-2M</td>
<td>169,000,000</td>
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<tr>
<td>2008</td>
<td>Core i7 (Quad)</td>
<td>731,000,000</td>
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<td>2012</td>
<td>8-core Itanium</td>
<td>3,100,000,000</td>
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<tr>
<td>2015</td>
<td>SPARC M7</td>
<td>10,000,000,000</td>
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</table>

**Moore’s Law**

The observation made in 1965 by Gordon Moore, co-founder of Intel, that the number of transistors per square inch on integrated circuits had doubled every year since the integrated circuit was invented. Moore predicted that this trend would continue for the foreseeable future.

**Altair 8080 (1974) – First consumer PC that had any real success. 8080 CPU.**
Apple II (1977) – 6502 CPU.

TRS 80 Model 1 (1977) – Z80 CPU

Today: Microsoft Surface Pro 4 – Intel i5 or i7 CPU. PC / Tablet / Laptop