Requirements for Scalable Application Specific Processing in Commercial HPEC

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# The 3 Single-Paradigm Architectures

<table>
<thead>
<tr>
<th><strong>Scalar</strong></th>
<th><strong>Vector</strong></th>
<th><strong>App-Specific</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel Itanium</td>
<td>Cray X1</td>
<td>Graphics - GPU</td>
</tr>
<tr>
<td>SGI MIPS</td>
<td>NEC SX</td>
<td>Signals - DSP</td>
</tr>
<tr>
<td>IBM Power</td>
<td></td>
<td>Prog’ble - FPGA</td>
</tr>
<tr>
<td>Sun SPARC</td>
<td></td>
<td>Other ASICs</td>
</tr>
<tr>
<td>HP PA</td>
<td></td>
<td></td>
</tr>
</tbody>
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Paradigms to Applications

Diagram showing the relationship between compute intensity, data locality, and application-specific, vector, and scalar operations.
Microprocessors & Heat

Chip Maximum Power in watts/cm²

Thermal Density

- Not too long to reach Nuclear Reactor
- Itanium – 130 watts
- Pentium 4 – 75 watts
- Pentium III – 35 watts
- Pentium II – 35 watts
- Pentium Pro – 30 watts

Surpassed Heating Plate

- Pentium – 14 watts
- 1386 – 1 watt
- 1486 – 2 watts

Year

1985 1995 2001

1.5µ 1µ 0.7µ 0.5µ 0.35µ 0.25µ 0.18µ 0.13µ 0.1µ 0.07µ
Architectural Challenges

• **Ease of Use**
  – Languages
  – Compilers
  – Debuggers
  – APIs

• **Performance**
  – Bandwidth to/from System
  – Scalability