Mobile Processors

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Introduction

• While the **wireless** technology advances, the necessity and demand for more functional mobile devices that can work together with the available wireless technology have increased.

• Vendors have had to design mobile chips to minimize power consumption, both to make batteries to last longer and to prevent heat buildup in devices that lack space for fans and other cooling systems.

• In the past mobile processor could afford to run at no more than 30 MHz for PalmOS PDAs, 80 MHz for cellular phones, and 200MHz for devices that run Microsoft's Pocket PC OS
Mobile Processor Challenges

- Processor designers have to increase the processing power of the microprocessors, increase the speed to cope with the high volume of data, while keeping low the heat generation and minimizing the power consumption.
- The big problem here is that we want our mobile devices to run all day without require a recharge, but we also want performance. And performance requires power, which drains the mobile batteries.
Lowering Power Consumption

- Designers can reduce the power consumption and heat generation by lowering the operating voltage at which the chips run, minimizing capacitance, and using sophisticated software and hardware power schemes designed to limit the power consumption for the execution of an instruction strictly to the electronic components (gates) that contribute to the execution of the instruction.
Important companies in the mobile processor marketing such as ARM, IBM, Intel, or Texas Instruments are integrating many system functions on a single chip.

SoC designs can lower processor prices, increase reliability by reducing the number of system components, lower power consumption, and increase performance by reducing the distance over which data must travel.
PDA, Smart Phones and Entertainment Devices
ARM

- ARM develops instruction sets and processor core architectures that have begun to dominate the market for PDA, smart phones and entertainment devices
- ARM implements optimized instructions, clock gating among other techniques to make ARM's chips energy efficient.
- As an example the ARM11 micro architecture is suited for networking and wireless consumer applications because of its media processing capability, low power characteristics, high data bandwidth, and high performance core
ARM (2)

- ARM11 has an **optimized 8-stage pipeline** using extensive operator forwarding between pipeline stages and **branch prediction** to anticipate the flow of instructions.
- Other features that the ARM11 includes are **pipeline parallelism** and support **completion of out-of-order instructions**.
Intel StrongARM

- Intel's StrongARM chips are based on ARM's v4 instructions set and run at up to 200MHz on about 0.5 W of power
- Next generation of Intel's StrongARM processors are expected to be smaller in size and deliver up to 600MHz and 750MIPS while using 40 to 450mW.
Intel XScale

- XScale mobile processors which uses ARM's v5 instruction set, Thumb (translate code to expand 16-bit instructions to a 32-bit format in real time), digital signal processor and Java extensions which is well suited for multimedia applications.
- Intel uses a dynamic voltage management technique that adjusts processing power and power usage to application and operation demands.
- XScale is supposed to clock at 600MHz and consume no more than 0.5W.
Motorola MX1

- The MX1 based on the ARM9 core will run at up to 200MHz.
- MX1 will include universal serial bus and liquid crystal display controllers.
- The chip will also include a Bluetooth device-connectivity interface, an MPEG-4 codec that will accelerate multimedia capabilities.
Current Laptops Mobile Processors
Intel Centrino

- Centrino technology comprise a **Pentium M** processor, **Intel 855 chipset family** to control functions as graphics and I/O, and a small card for wireless access plugged into the system board.
- The most important Centrino feature is the improvement in battery life and performance. Power consumption is less than 60 percent than the mobile version of Intel's Pentium IV, while performance is better by 15 percent.
Centrino Speed Step

- **Speed Step technology** saves power by stepping the operating voltage and frequency up or down to match the processing demands of the application running on the processor.
- Centrino technology also saves power by turning off clocks and circuits when they are not needed and running the secondary on chip cache more slowly than the processor.
Transmeta Efficeon

- Efficeon includes the **256-bit Very Long Instruction Word (VLIW)** hardware engine that can issue up to 8 instructions per clock cycle; and a new **Code Morphing software (CMS)** which dynamically optimizes and translate x86 instructions into VLIW native code that the VLIW hardware engine can process.
- Low power consumption is possible with the reduced switching logic and small die size of the VLIW architecture.
- Transmeta Efficeon power usage ranges from 75mW to 2.0 W
This technology uses the **AMD64** processor which can run 32-bit and 64-bit applications.

The AMD Turion64 uses the **AMD Power Now!** technology to optimize battery life through performance on demand, when required by the applications.

The Power Now technology allows the processor to **dissipate less heat** under normal operating conditions.

AMD Turion64 provides a **wireless network card** that supports the **802.11(a,b,g)** protocols and **Bluetooth** technology.
# Laptop Processors Frequency Table

<table>
<thead>
<tr>
<th>Processor</th>
<th>Frequencies</th>
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</thead>
<tbody>
<tr>
<td>Pentium M</td>
<td>2GHz, 1.80 GHz and 1.70GHz</td>
</tr>
<tr>
<td>Transmeta Efficieon</td>
<td>667MHz to 1.0GHz</td>
</tr>
<tr>
<td>AMD64</td>
<td>1.6 GHz to 2.0 GHz</td>
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</tbody>
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Conclusions

- Mobile computing is a very important field to work on now that the wireless networking is being so widely available in every part of the world.
- We want our mobile devices batteries to last all the day of work; we also want features that require high performance, and smaller and lighter devices to carry with us.
- Better Energy generation batteries and low power devices consumptions would have to be developed in order to increase performance in our mobiles with a battery life of at least one day.