

Ch 3.5 Example CPU Chips

3 examples: Intel's Big Daddy, TI mobile chip, and a tiny Atmel microcontroller

Intel Core i7

- "...a direct descendant of the 8088 CPU used in the original IBM PC" and even more incredibly... "it is fully backward compatible with the 8088 and can run unmodified 8088 binary programs"
- CISC architecture, in part to accommodate this
- Transistor size 32 nanometers. Human hair is 20K-100K nanometers
- 3 caches: L1 32KB instr cache, L2 256 unified cache (data+instr), L3 4-15MB unified cache
- Power consumed between 17-150 watts. Internal heat sensors. Thermal throttling - slow down if hot
- 1155 pins! More than half for power/ground

TI OMAP4430 system-on-a-chip

- ❖ ARM (Advanced RISC Machine) instr set for mobile and embedded applications, RISC architecture
- ❖ Power efficiency is the design driver. Consumes 1/250th the power of the Intel i7
- ❖ Multi-purpose: multiple CPUs, graphics processors, video processor, image processor. Separate components only consume power when used

Atmel ATmega168 microcontroller

- ➔ Tiny! 8-bit processor. Standard 28 pin package. Low cost, about \$1
- ➔ All memory on chip. So, no memory address or data lines
- ➔ I/O ports communicate with devices and sensors
- ➔ AVR instr set with 131 instrs, each 16 bits in length

Ch 3.6 Example Buses

3 examples: PCI the PC standard, a speedup PCI Express, and user-friendly USB

PCI bus

- ❑ Peripheral Component Interconnect (PCI) bus. Standard peripheral bus in PC's. Peripherals include monitors, external memory, etc.
- ❑ PCI too slow for memory, so separate bus for that data
- ❑ Synchronous (clocked) with master-slave.
- ❑ Pin count reduced by multiplexing data and address lines. 32 bits.
- ❑ Uses a centralized bus arbiter to control access

PCI Express

- Necessary speed-up of PCI for today's higher bandwidth peripherals
- De-centralized packet-switching approach, ala local networking. Packet contains header and data

Universal Serial Bus (USB)

- Lower-speed, ease of use is the goal
- USB root hub plugs into the main bus, handles multiple USB connections
- Keyboard example: not an interrupt, just polled every 50 milliseconds
- Speed 12Mbps (mega bits per second). USB 2.0 = 480 Mbps, USB 3.0 = 5Gbps max speeds
- All new versions are backward compatible