

ECE 471 – Embedded Systems

Lecture 2

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Misc Course Notes

- Class notes will be posted on the website.
- Read chapter 1 of the book
- We will do some hands-on embedded work this semester.
Still finalizing the hardware.



Common Embedded Architectures

- Somewhat dated list, from EE Times 2003. Multiple answers so doesn't necessarily sum up to 100%
- 8-bit processors
 - Microchip PIC – 43%
 - AVR, etc. 8051 – 55%
 - Motorola 68xx – 36%
 - Zilog Z80 – 15%
- 16-bit processors



- 8086/80186/80286 – 41%
- 68HC12 – 21%

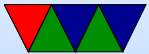


Key Features of Embedded Micro-controllers

- Parallel and Serial I/O
- A/D converters
- GPIO pins
- i2c, CAN, USB busses
- FPGA?



- Low-power



For Comparison, Freescale 68HC11

- Introduced in 1985
- 8-bits
- 2MHz
- Internal RAM 1-768Bytes, External 64kB



Brief Computer Architecture Review – Continued

Previously went over

- Code Density
- Processor Type (In/Out-of-order)
- Bit-width
- Caches



Memory Hierarchy



Virtual Memory

- TLBs
- page-size
- memory protection
- Linear Address Space



Branch Prediction

- Strange as it may sound, your computer often “guesses” (computer architects prefer the term “speculates”) about which direction a conditional branch will go
- This is to hide performance issues where the processor would have to stall or wait around to find out the results of calculations needed to know the branch direction
- What to do if it guesses wrong? Throw everything out from the wrong path and execute again



- It may be hard to believe, but in many cases you can get 99% and above accuracy
- Data prediction has been tried too, less successfully
- Good branch predictor designs are closely held secrets by chip companies



End of Computer Architecture Review

- Just wanted to emphasize on modern systems one has to be aware of underlying hardware
- Most performance issues are due to Caches, VM/TLB (also a type of cache) and Branch Prediction
- Until recently most embedded systems didn't have to worry about these issues, but due to Moore's law advanced features are appearing in embedded CPUs



System-on-a-Chip

- Discrete Chips: CPU, GPU, Northbridge, Southbridge, (and older days, FPU, MMU, etc)
- System-on-a-Chip (SoC): All parts of a computer on-chip
CPU, DSP, memory, timers, USB, voltage regulators, memory controllers
- System-in-Package (SiP): various chips in one package

