Leveraging CS Software Skills in the Digital Design Process

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Outline

- Thesis: It's time to change the "hardware" component of the CS major.
- CS *vs.* EE or CE
- Conventional Digital Design Methodologies
- Current Trends
- Opportunities and Necessities
- The FPGA Laboratory at Queens

Time to Change the CS Major

- Digital design has been and engineering discipline
- CS students have needed only a conceptual model of digital systems
- Hardware and software components have been developed by separate groups
- But software development, the CS student's area of expertise, now dominates the digital design process

CS *vs.* EE or CE

- DSI: the dynamic-static interface (Yale Patt)
- Engineers traditionally approach the DSI from below (the hardware side)
- Computer scientists approach it from above (the software side)
- Current invasion of ASIC turf by FPGAS is being accompanied by CS-EE turf war

Conventional Digital Design

- Schematic capture went out with Large Scale Integration
- Hardware Description Languages
  - VHDL
  - Verilog
- Simulations and Testbeds are integral
- ASICs for high volume, high performance
- FPGAs for lower volume and performance

Current Trends

- ◆ Moore's Law
- ◆ FPGAs now invading ASIC domain
  - ■ Xilinx Virtex II Pro
    - ◆ 4 PPC CPUs
    - ◆ 10 M gates
    - ◆ 3 GBps I/O
- ◆ HDLs can't keep up
- ◆ Hardware Implementation Languages Emerging

Opportunities and Necessities

- Opportunity for CS departments to prepare students for the immediate future
- Necessity to provide knowledgeable students to industry
- Need to learn to interact with engineers

The FPGA Lab at Queens

- Funded by NSF ILI grant to S. Goodman and C. Vickery
  - Fall 2003 is the first semester
- Based on the Handel-C Hardware Implementation Language
  - There are pros and cons.
- Uses the RC200E Design Kit from Celoxica Ltd.
  - Xilinx Virtex II FPGA
  - Many I/O devices
  - Supported by IDE-like DK product from Celoxica

Demo

- ◆ RC200E
  - FPGA
  - SmartMedia, Parallel Port
  - Audio I/O, Video I/O
  - Touchscreen, VGA, PS2 mouse and keyboard
  - RS-232, Ethernet, Bluetooth
  - Expansion Header
- ◆ DK Software
  - Handel C compiler
  - Configurable for simulation and hardware targets
  - Software debugging environment during simulation