Leveraging CS Software Skills in the Digital Design Process

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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