



Queens College Digital Design Laboratory

Dr. Christopher Vickery

Computer Science Department

Queens College of CUNY

vickery@qc.edu

March 11, 2004

Topics

- ◆ What's Happening in Digital Design
 - ◆ and why it matters to CS majors
- ◆ What's Happening at Queens College
- ◆ Celoxica RC200E Design Kits
- ◆ Laboratory Assignments
- ◆ Demonstrations

What's Happening in Digital Design

- ◆ *Application Specific Integrated Circuits (ASICs)*
 - ◆ Custom logic designed by engineers
 - ◆ High performance, high development cost, long turnaround cycles
 - ◆ Use Hardware Description Languages (HDLs)
 - ◆ Verilog, VHDL
- ◆ *Field Programmable Gate Arrays (FPGAs)*
 - ◆ Lower cost, but performance approaching ASICs – Now!
- ◆ Need for new development tools: *Hardware Implementation Languages (HILs)*
 - ◆ SystemC, System Verilog, Handel-C

... and Why It Matters to CS Majors

- ◆ More of the development cycle depends on software skills
 - ◆ Old (current) way
 - ◆ Partition hardware and software (two design teams)
 - ◆ Codesign – parallel development of hw/sw
 - ◆ Integrate, test, ship
 - ◆ New way
 - ◆ Design and develop in software (one design team)
 - ◆ Partition into hardware and software
 - ◆ Test, ship
 - ◆ Either the engineers become programmers ...
 - ◆ ... or the programmers learn the new languages

What's Happening at QC

- ◆ NSF Grant to S. Goodman and C. Vickery
 - ◆ Originally planned to introduce HDLs in Computer Organization course
- ◆ Spring/Summer 2003
 - ◆ Purchased IBM PCs (3.06 GHz, 1.25 GB)
 - ◆ Purchased Celoxica Hardware/Software
 - ◆ RC200E Design Kits
 - ◆ DK IDE for FPGA Development
- ◆ Logic Design Laboratory Course
 - ◆ This is the second semester
 - ◆ Initially challenging, ultimately rewarding

Celoxica RC200E Design Kits

- ◆ Xilinx Virtex II FPGA, RAM
- ◆ I/O Interfaces: Touchscreen, Audio, Video, Keyboard, Mouse, Serial, Parallel, Expansion, Ethernet, Bluetooth, SmartMedia
- ◆ Design Flow
 - ◆ Compile and Link Handel-C Code
 - ◆ Simulate (different levels)
 - ◆ Configure FPGA

Laboratory Assignments

- ◆ Familiarize with Language and IDE
- ◆ Use PAL with Switches, LEDs, Seven Segment Displays
 - ◆ Pipelined Accumulator
- ◆ Servomotor Controller
 - ◆ Simulate with Waveform Analyzer
 - ◆ View Waveform on Oscilloscope
 - ◆ Control Modified Servomotor
- ◆ Universal Asynchronous Receiver Transmitter
- ◆ Touchscreen/Memory Project

Demonstrations

- ◆ Celoxica's RC200E Demos
- ◆ Handel-C and the DK IDE
 - ◆ Simulation
 - ◆ FPGA Configuration