Harvey Mudd College
Computer Science Department

Computer Science Clinic
Overview

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Professor & Director

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History of Computer Science Clinic

- 1992: Computer Science Major Established
- 1993: Computer Science Clinic Established
- 1993-1994: 4 Projects (1 joint with Math, Bio, Engrg.)
- 1994-1995: 3 Projects
- 1995-1996: 3 Projects
- 1996-1997: 7 Projects (1 joint with Engineering)
- 1997-1998: 5 Projects
- 1998-1999: 7 Projects
- 1999-2000: 9 Projects
- 2000-2001: 11 Projects + 1 summer project
- 2001-2002: 11 Projects (1 joint with Engineering) + 1 summer
- 2002-2003: 10 Projects
New Clients:
- Green Media Toolshed
- Kofax Image Products
- LaserFiche
- Magulandia Studio
- Northrop Grumman
- Sandia National Laboratories

Repeat Clients:
- The Aerospace Corporation
- Auditude
- Boeing
- Teradyne
2002-2003 Project Areas

- Network Management and Security
  - Aerospace
- Hand-Held Mobile Application
  - Boeing
- Artificial Intelligence/Pattern Recognition
  - Auditude, Kofax, LaserFiche, Sandia
- Graphics/Animation
  - Magulandia Studio
- Fault-Tolerance
  - Northrop Grumman
- Web Enterprise Application
  - Teradyne
- Database Application
  - Green Media Toolshed
Faculty Areas

- Zachary Dodds  Robotics, Vision
- Mike Erlinger  Network Management, Security
- Ran Libeskind-Hadas  Distributed Computing Algorithms
- Robert Keller  Languages, Parallel Processing
- Geoff Kuenning  Networking and Operating Systems
- Melissa O’Neill  HCI, Distributed computing
- Chris Stone  Programming Languages
- Elizabeth Sweedyk  Graphics, Animation
- Belinda Thom  Machine Learning, Music
Components of the CS Major

- Principles of Computer Science
- Kernel Courses (6)
- Technical Electives (3 minimum)
- CS Clinic (1 year)
- Colloquium (2 years)
- Research projects (optional)
Kernel CS Courses

- Data Structures and Program Development
- Computability and Logic
- Algorithms
- Computer Systems
- Software Development
- Programming Languages
Computer Science Electives

- Advanced Computer Architecture
- Advanced Operating Systems
- Artificial Intelligence
- Compiler Design
- Computer Graphics
- Computer Networks
- Computer Vision
- Databases
- Neural Networks
- Parallel and Real-Time Computation
- Performance Analysis
- Robotic
- Theory of Computation
What “Typical” Clinic Projects Entail

- Nuera produces switches that route telephone calls.
- Designed and built software simulator for networks for algorithm testing, and
- Software for automatically generate efficient routing tables.
Typical Projects (cont’d)

• Optivus Technology develops radiation treatment systems based on Proton beams.

• Developed a registration tool for radiographic images to speed the patient alignment process while enhancing accuracy.
“Typical” Projects (cont’d)

- IBM Austin Research Center is interested in high-performance processors based on asynchronous logic.
- Developed a suite of tools for verifying hardware transformations, including a VHDL compiler and visualization capabilities.
“Typical” Projects (cont’d)

- Octel Communications needed to translate a large set of voice-mail prompts into many different languages

- Developed an interactive tool used by human translators that provides phrase structure and contextual information
“Typical” Projects (cont’d)

• Microsoft wanted the ability to display Sidewalk web-sites on hand-held devices.

• Developed display and down-load software for several popular platforms (Pilot, Windows CE)
Design Goals from Microsoft Project

- Provide the user as much information as possible on the device *without consuming unreasonable resources*
- Display the data *in a way familiar to the user*
- Make the process of maintaining current information *nearly invisible to the user*
Project Implementation Overview

- **Download data:**
  Internet Linkage

- **Parse data:**
  Client-Side HTML Parsing

- **Transfer data:**
  PC Dock to Handheld Computer

- **Display data:**
  User Interface Design
Deliverables

- **Sidewalk for Pilot 1.0**
  - PC application, conduit dynamic link library,
  - Pilot browser, installer

- **Sidewalk for Windows CE 1.0**
  - PC application, installer

- **Source code and documentation**
Conclusion

- Computer Science Clinic projects address
  - Technical Requirements
  - Performance Requirements
  - Ergonomic Requirements

- ranging from current practice to advanced research

- in a manner cost-effective to clients.
Unsolicited Assessment Letter

“I've received the final report and read it this morning. I believe the clinic team has done a most wonderful job. The first problem that was tackled, finding a good VHDL compiler for asynchronous design, turned out to be a lot more work than I had anticipated (having been lucky in trying things only on the one compiler that seems to work before I asked the team to look at asynchronous VHDL). I think it is absolutely amazing that the team managed to overcome the problems with finding a good compiler in such a short time, and still carry out most of the (aggressive) goals that were set at the start of the project.
The VHDLemu system that was developed is a very decisive way to deal with compiler problems indeed, and that system by itself would have made for a great clinic end result. I think it puts some very expensive academic and industry VHDL development effort to shame, by achieving higher functionality and correctness rather than tons of whistles and bells on a faulty core.

I am also very impressed with the mechanized proof that deadlock is avoided in the MIPS decomposition. I see this as a major achievement. I know that the underlying theory is difficult to communicate, and yet the team understood it so well they could turn it into a tool. I also appreciate the completeness of that effort. My challenge to the team had been to verify some transformations, and I had certainly not anticipated to see the complete decomposition analyzed. If you look a little in the formal methods and mechanized proof literature, you will see that this work is on the cutting edge!
Finally, the visualization tool very nicely ties the whole thing together. Adding concurrency and knowing that you have not sacrificed correctness is one thing, but convincing yourself that the added concurrency gives added performance is another, and a visualization tool is a great way to give insight into what has been achieved, or where the bottlenecks are.”
CS Clinic Sponsors
1993-2003

- Accel Technologies, Inc.
- The Aerospace Corporation (5)
- Beckman Instruments
- GTE
- HRL Laboratories
- IBM (3)
- Jet Propulsion Laboratories (2)
- Legato Systems, Inc.
- Microsoft Corporation (2)

- Nuera Communications
- Octel Communications Corp. (2)
- Optivus Technology, Inc. (4)
- Paracel, Inc.
- Rockwell Science Center
- Teradyne, Inc.
- WebTV Networks, Inc.
- Worldport, Inc.