

ComS / CprE 583 – Reconfigurable Computing

Project Proposals

Assigned: Week 7

Due: Week 9

The goal of this project is for you to gain an in-depth understanding of some aspect of reconfigurable computing. Students will work in groups of 2-3 people, and will be expected to deliver a detailed proposal and final report, along with a presentation summarizing the project to the rest of the class. Each project *must* contain an element of design and experimentation; proposals that do not meet this criterion will be rejected.

1) Topic Selection. For the project proposal, first work with your team to settle on an appropriate general topic. Post your project topic on Blackboard in the “In-Class Discussions” forum – topic selection will be first-come, first-served. Topics are also subject to instructor approval. Below is a general list of reasonable topics, note that you are free to be creative and come up with something that doesn’t cleanly fall into this list:

- Design and implementation of X
 - Pick any application or application domain
 - Identify whatever objectives need to be optimized (power, performance, area, etc.)
 - Design and implement X targeting an FPGA
 - Compare to traditional microprocessor-based implementation
- Network processing
 - Explore the use of an FPGA as a network processor that can support flexibility in functionality through reconfiguration
 - Flexibility could be with respect to optimization
 - Could provide additional processing to packets / connections
- Implementation of a full-fledged FPGA-based embedded system
 - From block diagram to physical hardware
 - Examples:
 - Image / video processor
 - Digital picture frame
 - Digital clock (w/video)
 - Sound effects processor
 - Any old-school video game ☺
 - Voice-over-IP
- Prototype some micro-architectural concept using FPGA technology
 - See proceedings of MICRO/ISCA/HPCA/ASPLOS from last 5 years
 - Survey some recurring topic
 - Compare results from simulation (e.g., using PIN) to FPGA prototype results
- Anything else that interests you!

A list of some previously selected topics is available at the end of this document.

2) Expectations and Deliverables. It is expected that your project will revolve around a current topic in reconfigurable computing, with your efforts culminating in a working hardware/software system that improves upon existing state-of-the-art in some fashion. The project proposal is due during Week 9, after which there will be a mid-project review deadline at Week 13, followed by a final deadline at the end of the semester.

For the Week 9 deadline, there are two main deliverables:

- A. The Project Proposal Document should be written in a professional style, and should include an introduction, a discussion of related work, and a discussion of your proposed approach. It should also detail specific design and experimentation methodologies where appropriate.
- B. The Project Proposal Presentation should include a description of the project team, with names and responsibilities, followed by an overview of the project concept. Do not simply rehash the project proposal document – instead, provide an overview of the motivation (why is this project interesting and useful), a description of the end result, and a system diagram of the final product. Also, break down your project plan into 1-week milestones, with an aggressive initial schedule that would have your project essentially complete by Week 13. The presentation should be approximately 10 minutes long.

For tips on how to prepare a technical paper, peruse an online LaTeX tutorial and download the IEEE template. Do not copy/paste other content (including figures) for your project proposal – both the project concept and the motivation should be entirely your own work. In the IEEE template a project proposal should be approximately 5 pages long, including any figures and list of references.

The literature review (discussion of related work) should include on the order of 10-12 references. One method of organization that is appropriate is for your selected topic, first identify 2-3 core problems / issues through a literature search. For each core problem, next identify 2-3 approaches for addressing the problem. Finally, for each approach, identify 1-2 papers that implement this approach.

Appropriate venues to search include IEEE and ACM affiliated conferences and journals, specifically the FCCM, FPGA, FPL, FPT, conferences and the ACM TSETS and IEEE Transactions on Computing journals. A word of warning – a blind Google search for keywords related to your project idea will not likely lead to high-quality papers, ultimately limiting the potential value of your project. Sticking to the above publication venues (and other similar IEEE and ACM venues) will serve your team better.

4) Previous Year's Topics.

- Delta-Sigma Modulation Digital to Analog Converter [Fall 2011]
- Ring Oscillator-based Physical Unclonable Function (PUF) [Fall 2011]
- Reconfigurable Processor for a Simultaneous Localization and Mapping (SLAM) System [Fall 2011]
- A Radix-8/4/2 FFT Processor for OFDM Systems [Fall 2011]
- FPGA-based Hardware Emulation of Image Morphing [Fall 2011]
- Configurable Ethernet Frame Generator [Fall 2011]

- Twitter Frenzy (FPGA Data Stream Processing) [Fall 2010]
- CAPTCHA Processing [Fall 2010]
- Blowfish (Hardware Accelerated Encryption Cracking) [Fall 2010]
- Sparse Matrix Vector Multiplication [Fall 2010]
- Reconfigurable Hardware Scheduler for Real-Time Systems [Fall 2010]
- Architecture Support for Software Fault Tolerance [Fall 2010]
- AES Encryption/Decryption HW Accelerator for Linux [Fall 2009]
- Simply Gaming (HW Game Engine for Tic-Tac-Toe) [Fall 2009]
- Noise Cancellation using Two Microphones [Fall 2009]
- Parallel Prefix Algorithm Accelerator [Fall 2009]
- Face Detection Accelerator [Fall 2009]
- Remote Sensing Image Processing [Fall 2009]

Papers and presentations for these previously completed projects are available upon request.