CSCI operating systems proposal Team 9

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1 Introduction

This document will outline a high level concept and end goal for the final project in CSCI 460 (fall 2020). The basic idea is to put Linux on a FPGA device, run C code, and compare the speed said code to comparable microcontrollers that rely on C programming. The main goal of this project is to see if there is a noticeable overhead to running C on a Linux system on a FPGA compared to running this C code on a microcontroller, which should be more of a bare metal approach to executing C code.

2 Hardware & Software

The hardware that team 9 will use will consist of FPGA devices and microcontrollers with a AVR architecture. The FPGA device will be using Xilinx's Artix 7 FPGA devices, most likely a Basys 3 board due to the availability of IO available to the device. The microcontrollers that will be used are the Arduino Uno, Mega boards while being programmed in an environment like Atmel Studios or platformio to allow for more efficient c code. This last statement is due to the fact that the normal Arduino IDE's C++ flavor is overloaded with edge cases to create a very versatile code while suffering performance loss due to complexity. To avoid this, bare metal programming using the processors data-sheet will be used to speed up execution of the said C/C++ code.

This project has been designed to be inclusive to the whole team and make sure that everyone on the team feels like they are a important part of the end result.

3 End goal of this project

Team 9 will strive to reach a few end goals. These are detailed in the list below. The code generated will incorporate some concepts learned in CSCI 460 to make sure the scope doesn't diverge from the class. These concepts will be designed as the project progresses through the next few weeks.

1. Soft core processor + Linux system (Due 10/31)

2. Compile and run C/C++ on 1. (Due 11/3)
3. benchmark performance of code and soft core processor (Due 11/6)
4. replicate code for microcontroller (11/10)
5. benchmark performance on microcontroller as counterpoint to 1. (11/12)
6. build technical report on findings (Due 11/14)

4 Division of Labor

The FPGA parts will primarily be worked on by Rainey Anson. The C/C++ coding will be split between Hong Chuan and Skylar) This should more or less equally split the project between the members.

5 Conclusion

By the end of this project the group members of team 9 will demonstrate some of the capabilities of a linux system on a pure FPGA while comparing against easy to access microcontrollers. As well as making a technical report detailing the performance specs of each system tested. Overall, this project is a mix of proof of concept and research track due to the nature of it's tasks.

6 P.S.

Due to the constraint of 1 page for this proposal, there might be some questions on where we plan on going with some of the previous sections. Feel free to contact Team 9 via Slack to ask any questions/concerns.