

CSCI 460 OS Final Project

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1 Introduction

The purpose of this document is to propose the implementation of a Linux distribution onto a Microblaze soft-core processor, run on a Xilinx Artix-7 FPGA, as a final project to meet the course requirements of CSCI 460. Upon completion, this project should demonstrate a basic understanding of the hardware and software interfaces of an operating system applied to a single-processor system.

2 Device

The device to be used is a Basys 3 development board, provided by Digilent and shown in Figure 1, below. This board uses a Xilinx Artix-7 XC7A35T FPGA and is programmed using the Vivado suite. We have chosen this board as we already have access to one, are familiar with the hardware supplied, and have created several projects already using the development environment.

A single-core processor can be constructed within Vivado's block system tools, complete with memory management, debugging, and peripheral devices. C code can be written directly to the processor using the Xilinx SDK, causing the system to behave more like a customized micro-controller. Basic tests may be conducted using the SDK; however, the final demonstration will rely on additional tools for the implementation of a Linux distribution and execution of code.

3 Linux Distribution

The Linux distribution to be used is Yocto, available freely and with a history of implementation on various FPGA devices. Though many developers prefer System on Chip (SoC) FPGAs for Linux development, Yocto has been confirmed by Xilinx to work on Microblaze soft-core systems and therefore will be implemented on the Basys board.

Yocto is often used in embedded systems design and is supported by Xilinx through their PetaLinux tools. Documentation is provided to help developers implement Yocto on any FPGA device capable of supporting a Microblaze, and

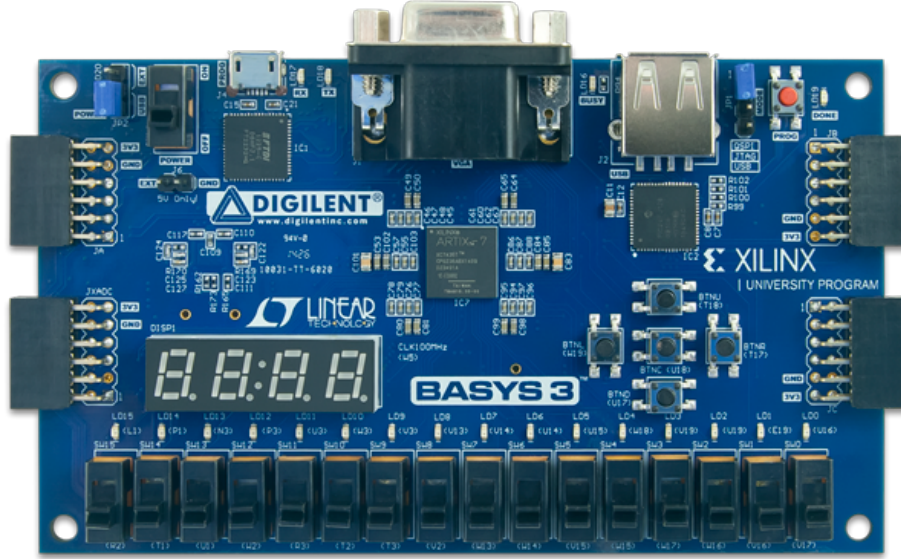


Figure 1: The Basys 3 development board

several YouTube tutorials help to describe the workflow necessary to implement Yocto through the Vivado suite. As no tutorials or resources related to the Basys board currently exist, modifications specific to our platform are necessary to ensure a working system.

In the event that the project does not work sufficiently on the Basys board, the option of switching to the Arty Artix-7 board remains - as several tutorials and resources exist to aid in the implementation of Yocto and PetaLinux on this device. This will be considered as a last resort as the Arty's functionality is not nearly as robust as the Basys.

4 Software Demonstration

To demonstrate successful implementation of the Linux platform, test programs regarding processes, threads, and/or scheduling will be constructed on the device and run. These will be accessed via SSH to a PC, ensuring any code written can be accessed and edited easily.

5 Conclusion

By the deadline for the CSCI 460 final project, we aim to demonstrate the implementation of a Linux distribution on a soft-core processor within an FPGA device. By using Xilinx's PetaLinux tools to aid in putting Yocto onto an Artix-7 FPGA, within a Basys board, we hope to show an understanding of the

materials presented in the Operating Systems course and potential applications of the discussed topics.