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ABSTRACT

This report describes the process of porting a variant of the Unix kernel from the MIPS architecture to the Arm architecture. A heavily modified 2.11BSD version of the Unix kernel called RetroBSD is used as the basis for this development. The goal of this project is to run this ported kernel on both a simulator and on a physical embedded development board. An additional portion of this work is devoted to adapting the large-scale codebase of RetroBSD to more modern and sustainable development standards that will facilitate future ports to other platforms and architectures.

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1. Introduction

Porting the MIPS32® M4K® architecture to the Arm® Cortex®-M4 architecture.

2. Relevant History of BSD

RetroBSD is a semi-modernized version of 2.11BSD targeted to the PIC32MX7 MIPS-based microcontroller.[1] The early history of RetroBSD has been lost. It can only be concluded that RetroBSD was started some time in 2011, or perhaps some time even before that. The earliest post on the RetroBSD forum was from August 15, 2011. The project could have started much earlier than the creation of the forum.

2.11BSD has a long lineage going back to the first release of 2BSD on May 10, 1979.[2] The 2BSD line of software distributions for the DEC™ PDP-11 continued on until the most recent release of 2.11BSD in 1991.[3] This release was a celebration of the 20th anniversary of the PDP-11. It is the culmination of the efforts to port 4.3BSD features — which runs on the DEC VAX — to the PDP-11. Patches to 2.11BSD have been sporadically available since the initial release in 1991 from the long-time maintainer Steven Schultz. The most recent patch level is 469 and was released on April 14, 2020.[4] RetroBSD was started from patch level 431, which was released on April 21, 2000. It is from this version that all RetroBSD development began.

DiscoBSD derives from the most recent commit to the RetroBSD codebase, which is revision 506 from February 17, 2019.[5]

3. Hardware

The defining features of the target hardware for RetroBSD and DiscoBSD are that they are RAM-constrained, 32-bit, and do not have a memory management unit. The lack of an MMU rules out any possibility of virtual memory, which is a critical component in most major operating systems. A secondary feature of the target hardware is that their processors have the ability to protect kernel code from user code with a memory protection unit. This feature was not explored in this project, but is a viable focus of additional study.

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7.5. Getting to /sbin/init

8. Userland

9. Future Work

10. Conclusion

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