ARM based SD Card to FPGA Data Transfer Optimization

Company

Bold Circuits LLC is a full service electronic design firm founded in 2015 to serve the commercial, military, and research markets. Our client's businesses cover a wide variety of fields including neuroscience, performance athletics, biomedical, military, and consumer products. Bold Circuits' primary specialties are hardware design, PCB layout, and FPGA development.

Background

Many embedded platforms today include Secure Digital (SD) card memory capabilities. In typical applications, SD cards are used for bulk storage, where performance is not of primary concern, or for data capture where maximum write performance is desired. One area or research that remains under-evaluated is the optimization of sustained read performance of SD cards. Of particular interest to Bold Circuits is the use of ARM processors to maximize the transfer of data from SD cards to FPGA fabric for further use and processing.

Project Details

The primary goal of this project is to characterize the achievable sustained data transfer performance from various SD cards to FPGA fabric using an ARM processor as the intermediary. Identification of the limiting factors and data bottlenecks, whether the SD cards themselves, the ARM processor(s), or the ARM-FPGA interface, is also desired. Two different architectures will be investigated: a standalone ARM processor with a generic interface to an FPGA and an integrated System on Chip (SoC) where the ARM core and FPGA fabric are contained within the same physical device.

To achieve this goal, the Capstone team will acquire off the shelf evaluation hardware for the two architectures based on market research and consultation with the technical contact. End to end testing from an SD Card to a logic analyzer connected to an FPGA will be performed. Once baseline performance is established, optimization techniques will be explored. An architecture comparison, highlighting strengths and weaknesses, will also be performed.

Deliverables

- Integrated off the shelf hardware capable of demonstrating the two architectures
- ARM Software for each architecture, maximizing code reuse/common software for both
- VHDL for targeted FPGAs, again maximizing reuse/common features for each architecture
- Baseline and Optimized Test Results

Team

An appropriate team for this project would consist of 1-2 Computer Engineering students to write the software for the ARM processor(s) and 1 Electrical Engineering student to develop the data interface on the FPGA(s). All students would be involved in the hardware selection, integration, characterization and performance testing, and report generation.

Technical Contact

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