FPGA Design - the Making of an Intel 8086 Microprocessor with Modern Technology

***Abstract*—The Intel 8086 microprocessor was first introduced in 1978. Since then the semiconductor industry has changed vastly from the old chip manufacturing techniques of the time. Today we can fit thousands of Intel 8086 microprocessors in the same size package with use of modern semiconductor techniques such as the abilty to design with 22nm feature size and better yield from improved wafer quality. This paper examines how we can still learn from ancient technology but with a new more modern twist. By utilizing field programmable gate arrays, we can easily implement the same technology from the past and learn about architectures that are still in use today.**

I. Introduction

It was in the mid 1970s when Intel announced their latest project, the Intel 8086 - a 16-bit microprocessor capable of supporting up to a revolutionary 1 mega*byte* of address space and 64 kilo*bytes* of I/O. Gone were the days of simple computing in only 8-bits of freedom, this was the 70's and 16-bits was here to take over. Along with the increases in accessable memory and larger bit ALU computations, Intel introduced a new type of archetecture and instruction set known as x86, this newmethod of computing revolved around the use of registers that stored input/output data which could then have computations performed on them. This improvement has since paved the way for future computing by setting a standard on how to recieve data and how data would be processed in a regular clock cycle. The 8086 supported 80 assembly instructions which gave software developers of the time more way to write better code that performed better with the new hardware.

The field-programmable gate array (FPGA) has been around since the 1980's, its purpose was to be able to easily create custom hardware without the need to buy large quantities of logic chips and instead use one chip that could be customized after manufacturing to act as the hardware needed at the time, essentially the perfect prototyping device. The FPGA accomplishes this by using "logic blocks" which is typically a circuit consisting of multiplexers and low level logic gates that can be configured in such a way as to create custom complex logic such as adders or even be used for more simple XOR and NAND gates a basic structure of a logic block can be found in Figure 1. The blocks are most often configured as a matrix with interconnects for inputs, outputs and configuration paths in between, latest improvements in silicon technologies have allowed companies to greatly increase the number of logic blocks on a chip into the hundreds of thousands and beyond.

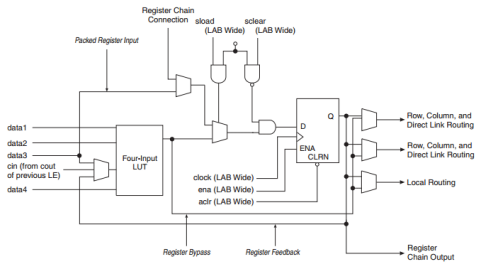

Fig. 1. Cyclone III Device Family LEs in Normal Mode [1]

II.

III. Procedure

IV. Results

V. Problems Faced & Troubleshooting

VI. Conclusion

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References

[1] Altera Corporation. (2012, Aug.) Cyclone iii device handbook. [Online]. Available: http://www.altera.com/literature/hb/cyc3/cyclone3_handbook.pdf