F2E

Convert On Demand

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Outline

- Background
- Problem
- Design Requirements
- Current Status of Art
- Solution Approach
- Implementation
- Project Management
- Conclusions & Questions

Background

- Modern radar systems utilize digital signal processing. The radar receivers contain high speed A/D converters at the end of the analog signal path. The digital data is transmitted by fiber to the signal processor. Data rates on these signal paths are extremely high (6+ Gb/sec).
- For example, today Northrop Grumman uses expensive MIL-SPEC hardware simply to test their receivers in the factory.

Problem

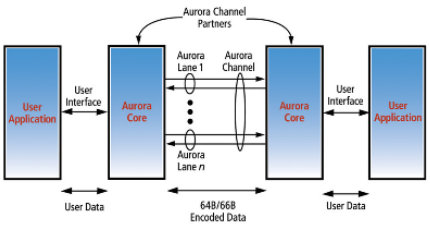
- We need to build a test receiver system that can handle data at high rates but is more cost effective than the expensive MIL-SPEC hardware that is in use.
- In a nutshell, we need to build a cost effective system that will help Northrop Grumman test receivers in the factory.
- The main question asked is:
  - How can we design and test an on demand converter

Design Requirements

- The unit should acquire data, buffer it in memory and upon request transfer the block over a LAN interface to a requesting computer.
- Real time conversion from fiber to LAN is not required.
- The data comes in as serial data encoded in the Xilinx Aurora protocol.

Aurora Interface

- Aurora is a scalable, lightweight, link-layer protocol that is used to move data across point-to-point serial links.
- It is an open protocol and is free of charge.



Why use the Aurora?

- Very efficient low-latency protocol that uses the least possible amount of logic
- Aurora increases bandwidth through bonded lanes.
- It is intended for use in high speed connections internally in a computer or in an embedded system.

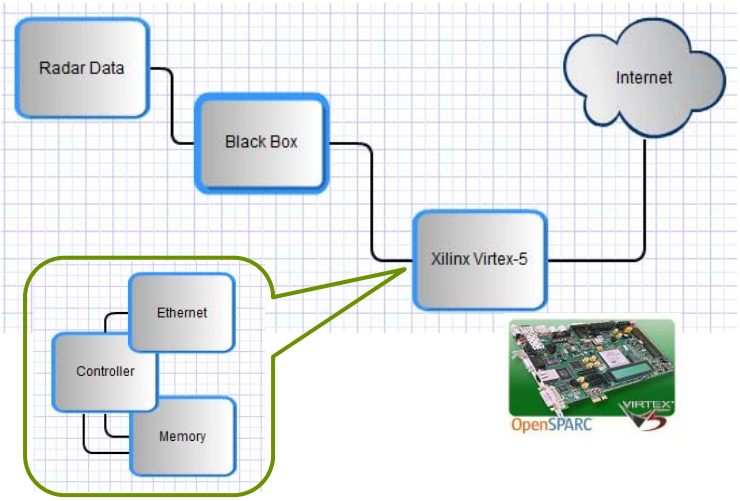
Basic Operational Concept

1. Our system is intended to acquire data on a fiber interface and buffer it in memory.
2. Completion is reported through LED.
3. A controller requests data acquired be transferred over LAN.
4. Our system then transfers the data and awaits next command.

Current Status of Art

- Currently there are no commercial products that have the ability to do on demand conversations at the speeds required for this project.
- The only products available are MIL-SPEC hardware. This hardware is very expensive and is not for commercial sale.

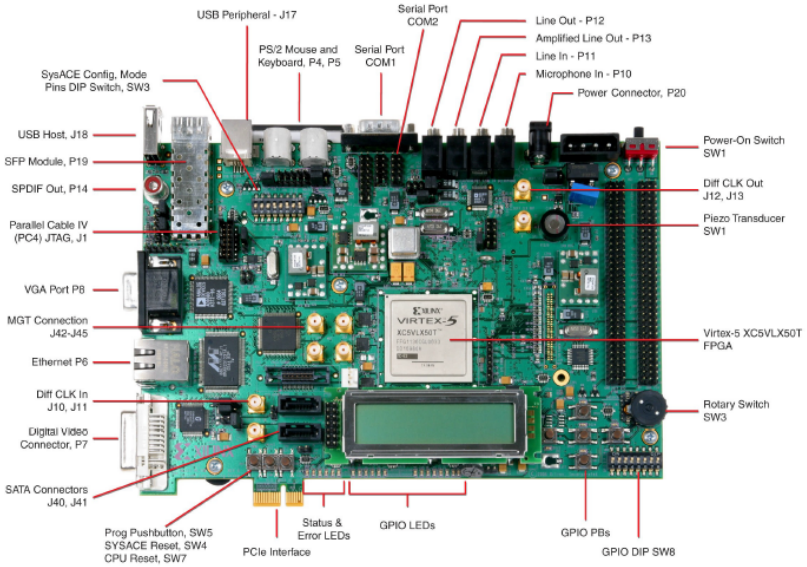
Solution Hardware diagram



Solution Pros and Cons

- Pros
  - The Aurora protocol is supported by the Virtex-5 FPGA.
  - The Virtex-5 is the only component needed to meet our requirements.
- Cons
  - The Virtex-5 is very expensive
  - Programming this FPGA is a challenge

Virtex 5 FPGA



Contingency Plans

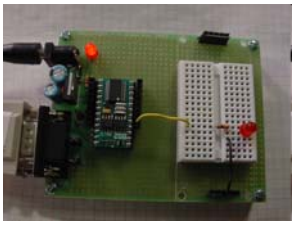
BASIC Stamp 2 (BS2) Board:
• A microcontroller which runs the Parallax PBASIC language.

BS2 > I/O explorer > Atom Board > LAN

Virtex 5 (Extended Solution):
• Virtex 5 > I/O Explorer > Atom Board > LAN

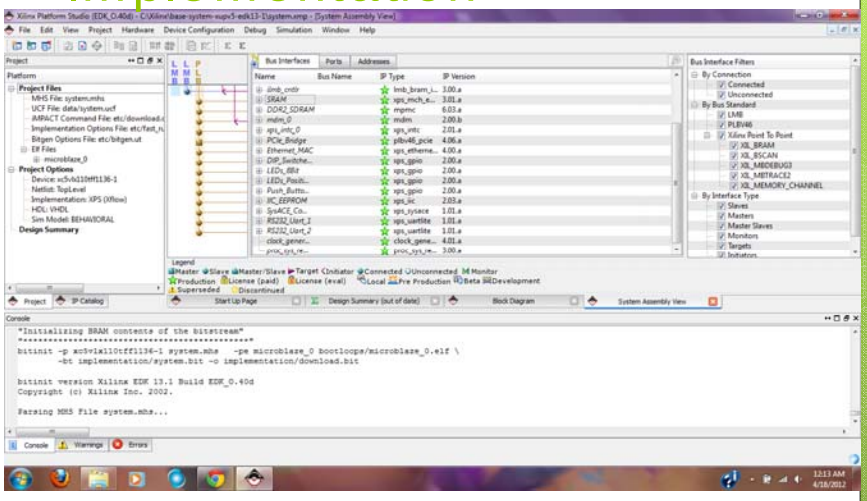
I/O Explorer

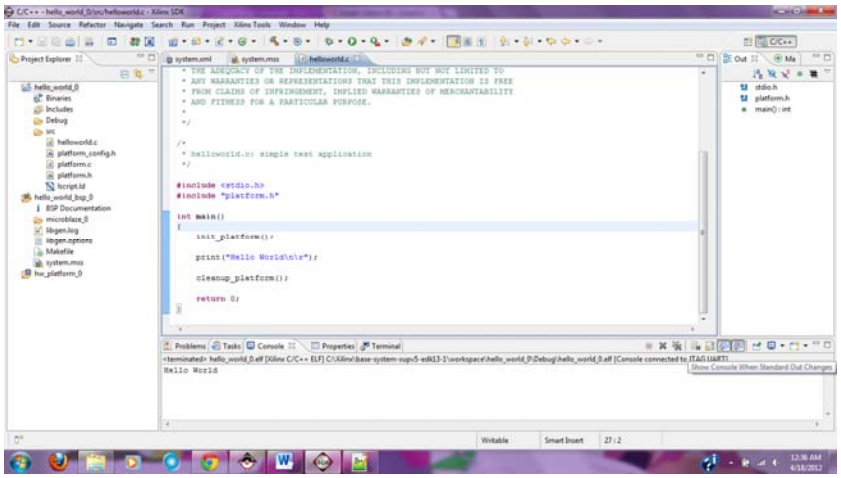
Atom Board

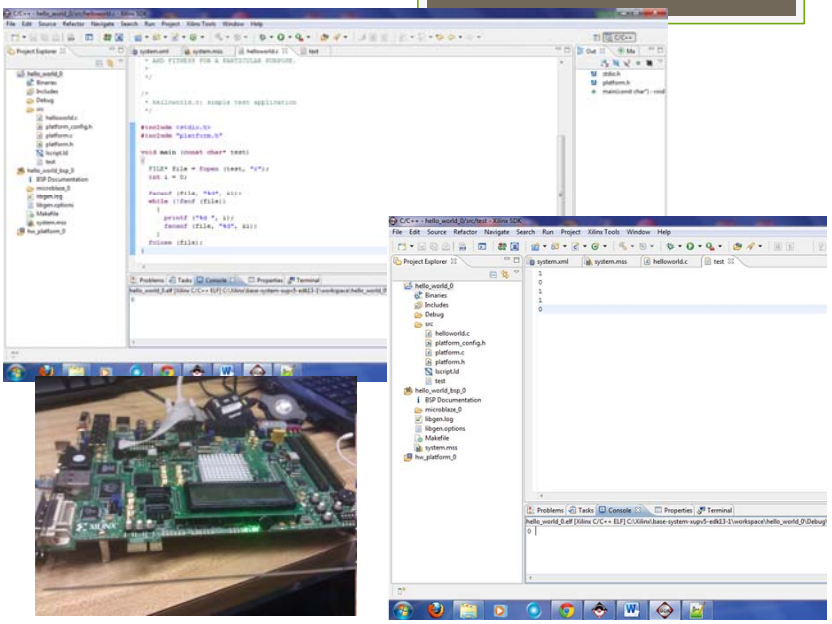


BASIC STAMP 2

Implementation




Hello World



Design Matrix

		BS2/ Atom Board		Atom Board/ I/O Explorer		Virtex-5	
Criteria	Weight	Rating	Score	Rating	Score	Rating	Score
Aesthetics	10 %	1	.1	2	.2	3	.3
Sustainability	15 %	1	.15	2	.3	3	.45
Software (user- friendly)	15 %	3	.45	1	.15	2	.3
Price	25 %	2	.5	3	.75	1	.25
Memory	35 %	1	.35	2	.7	3	1.05
Total		8	**1.55**	11	**2.1**	11	**2.35**

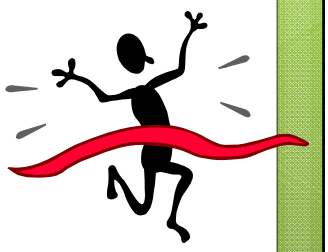
Score = Weight * Rating

Budget

Item	Unit Cost ($)	Discount Price ($)	Quantity	Cost ($)
Xilinx Virtex®-5 XC5VLX110T	2000	750	1	750
Miscellaneous	100	0		0
Total Cost				750

Conclusion

- Creating a receiver system that is cost effective and can handle high-speed data rates is a daunting task
- Given the chance to work with the Virtex 5 again, we would like to continue on this project, perfecting the system until it is industry worthy.
- Great learning experience!



Future Work

- In the future we would like to:
  - Implement two Virtex-5 boards into the system
  - Make real time conversion from fiber to LAN possible
  - Incorporate the use of two buttons into our system

Acknowledgements

- Department of Electrical and Computer Engineering, Howard University
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Questions

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