Hardware: Old, New, Future

Dan Werthimer and Casper Collaborators
Existing Multi-purpose Hardware

- **BEE2** (5 2VP70-7, 20 GB, 18 CX4)
- **iBOB** (1 2VP50-7, 8 MB, 2 CX4)
- **iADC** (Atmel/E2V, 2 Gsps or 2*1Gsps, 8bit)
- **National ADC** (3 Gsps, >2.5 GHz bandwidth)
  (can ping pong for 6 Gsps, can use dual 1.5 Gsps)
- **DAC Board, Dual DAC Board** (10 bits (9 usable), 1.5 Gsps)
- **SERENDIP 5** (2V6000, 2V1000, 4 ADC’s 128 Msps)
- **10 Gbe Switches** (HP, Foundry, Fujitsu....)
- **10 Gbe cables** (Gore....)
**Compute Module Diagram**

- **IB4/CX4**: 40Gbps
- **5 FPGAas**: 2V70FF1704
- **138 bits 300MHz DDR**: 41.4Gbps/s
- **100BT Ethernet**: 20Gbps
- **4GB DDR2 DRAM**: 12.8GB/s (400DDR)
- **Memory Controller**
- **FPGA Fabric**
- **MGT**
Multi-Purpose Spectrometer – Low Bandwidth
Aaron Parsons

Xilinx Virtex-II 6000 FPGA

200 Aux. I/O

Pol. 1
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  I
  Q
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200 Mhz ADC

Pol. 2
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200 Mhz ADC

256 MB DRAM

Xilinx Virtex-II 1000 FPGA

Compact PCI Backplane

Software
Agilent ADC-FGPA-CX4 board - ??

20 Gsps 8 bit Agilent ADC

XC5VSX240T

6 CX4 ports

120 Gbps xauui
100 Gbps infiniband
60 Gbps 10 Gbe
BEE3

- Chen Chang (designer of Bee1, Bee2 (PhD))
- Microsoft, Celestica, Berkeley
- available from BeeCube
- not open source
ROACH (virtex 5)
Reconfigurable Open Architecture Compute Hardware

- Mini-Roach – Henry Chen, Rick Raffanti
- Roach:
  - Francois Kapp (lead), Alan Langman... -- KAT
  - George Peck, Mike Revnell, Steve Durand -- NRAO
  - Henry Chen – UCB CASPER
  - Hayden So – Univ. Hong Kong

Next gen correlators, beam formers, spectrometers, VLBI
Roach Mechanical

- 1 U ATX Enclosure $150
- ATX power supply $50
ATA quad digitizer, packetizer (planned - 2009)
New FPGA Boards

- MiniRoach (V5 test board, spectrometer)
- Roach (MeerKat, NRAO, Hong Kong, UCB)
  (V5, CX4, DRAM, SRAM)
- Bee3 (4*V5, CX4, DRAM, Microsoft, BeeCube)
- Roach II – XC5VSX240T, 6*CX4, 2DDR2, 3 QDR
ADC Boards – Current

- Atmel: dual 1 Gsps, single 2 Gsps, 8 bit, 1.5 GHz

- National: 3 Gsps, 8 bit, 2.5 GHz bandwidth
  
  two can be interleaved to get 6 Gsps

  can also install dual 1.5 Gsps (ADC08D1500)

  need Roach or Miniroach to get full sample rate

- 64 channel ADC board – 12 bit, 65 Msps (2wide)
ADC Boards - Planned

- Quad ADC (200 Msps, 8 bit), PCB Layed Out, Henry MeerKat ADC — single 3 Gsps, or dual 1.5 Gsps, 8bit
  programmable attenuation, gain, sample clock, Oct. 2008

- ATA – ADC and FPGA, quad 1.5 Gsps, 8 bit
  with programmable attenuation, gain

- Agilent 20Gsps, 8 bit (unfunded)

- JPL optically isolated ADC (Robert Navarro)

- E2V ADC? (5 Gsps, 2 * 2.5 Gsps, 4 * 1.25 Gsps)
Misc. Boards

- Programmable Attenuator/Gain (RAL, Oren)
  
  4 GHz BW, -16 to +16 dB in 0.5 dB step, Notch Filter

  (or minicircuits, $50, programable atten/gain)

- 1 PPS distribution (RAL- Oren Milgrome)

- VSI connector (converts ZDOC to VSI)

- DAC board, 9 bits, ~1.5 Gsps

- Dual Dac Board, 9 bits, ~1.5 Gsps
Board Interconnect - Upgradable

- **Problem:** Backplanes are short lived
  
  (S100, Multibus, VME, ISA, EISA, PCI, PCIX, PCIe, compactPCI, compactPCIe, ATCA...)

- **Solution:** Use 10Gbit Ethernet
  
  (10Gbe, Infiniband, Myrinet, Xaui, Aurora)

  Copper CX4 (40 meters max) or Optical
CX4 cables

- Gore CX4 10Gbe cables (1, 2, 3, 15 meter...)
  
  about $75 each

  (not infiniband cables)

(see cable length memo for V2Pro

  1-3 Meter max)

Active CX4 Cables – 45 meter max

Optical CX4 Cables – Matt Dexter tests ~$300
10 Gbit Ethernet Switches, NIC’s

- HP – Procurve 6 to 8 ports CX4, 24-48 1Gbe
- Foundry – 16 XFP ports
- Fujitsu – XG700 (12 CX4 ports)
- Fujitsu – XG2000C (20 ports, 16 CX4, 4 XFP)
- Myricom – 10 Gbe NIC boards (PCIe)
Where to get tested boards

- Build and test them yourself (cheapest for large Q))
- iBOB, iADC, 5 volt cables, Digicom Electronics
  Mo Ohady, mo@digicom.org
- Bee2, enclosure and power supply, SAE Materials
  Mario Salazar, marios@saemtl.com
  coordinate with Ken Lutz, BWRC, lutz@eecs.berkeley.edu
- iBOB mounting plates, front panels – make or buy – NRAO?
- Other Vendors?? Rakesh Mehta, MTE India?
Logistics – Presentations

• Get your PPT, .PDF to Jason Manley
• Install on Presentation Laptop
• DO NOT USE YOUR OWN LAPTOP
• Please wear microphone (see Jason)
• We are posting video and ppt to web site
• Let Jason know if you don’t want your presentation posted
Logistics – Location

- Saturday, Sunday at BWRC,
  BWRC doors locked – buzz or call
- Sunday Night Pizza/Beer at Dan’s – all invited
- Monday, Tuesday at Space Sciences Lab
  Take Bus to SSL: $1, 12 mins, see program
  Monday Tuesday Lunch will be provided
- Tours of BWRC lab, SSL in the afternoons
Logistics: Suggested Donation

$ 50 ( $ 25 for students )

covers morning refreshments, two lunches...

$ \rightarrow \text{Andrew Siemion}
Casper Advisory Board
Matthew Bailes, John Ford, Yashwant Gupta, Glen Jones, Alan Langman, Jonathan Weintroub

Brainstorming Session – Open Mic – Tuesday AM

Constructive Criticism

Ideas for Future Directions, Long Term Strategy

How best to collaborate

Organizational Structure

Anything else ➔ REPORT
Thanks to Workshop Organizers

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