40m DAQS

Status and Role as LIGO DAQS Prototype

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Outline

- Brief overview of DAQS hardware and software
- Current status
- Various prototyping efforts
  - >> Test bed for Frame development AND enhancement
  - >> Different network transfer strategies
  - >> Data distribution
  - >> Feeding DAS
  - >> Diagnostics early prototyping
  - >> NDCU development

DAQS Overview

- Input
  - >>32 fast data channels (16384 Hz)
  - >>128 slow data channels (16 Hz)
- Anti-Aliasing Filter
- ADC
  - >>32 Channel, 16-bit, with 64 KB local FIFO
  - >>Receive 1 Hz trigger and a 4 MHz clock from GPS
  - >>16 Hz generate Buff-Half-Full interrupt on VME backplane
- DCU
  - >>MIPS 4700 processor, 175 MHz, 32 MB of RAM
  - >>Handle interrupt and copy data to RM
  - >>1Hz checks overrange and write summary stat in RM
  - >>1Hz FB CPU is interrupted

LIGO

Overview (cont)

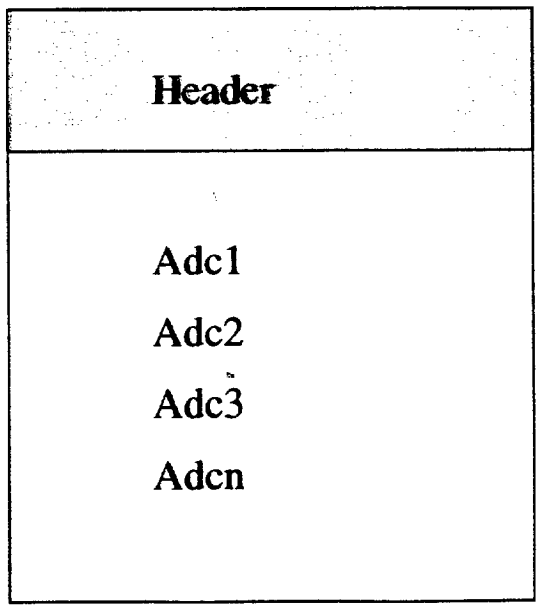
- FB
  - ››Task waits on semaphore released by ISR
  - ››Copy data from RM to local RAM
  - ››Build Frame
  - ››Write Frame to DAQS server via an NFS mount
- DAQS Server
  - ››Arrival of a new Frame file is broadcast with EPICS
  - ››Data clients listen to this channel with EPICS' ezca

Current Status

- Real-time OS: vxWorks 5.2
- Frame Library: v3.42
- GPS Board in
- Data Rate at 800 KB/sec
- Monitoring and Visualization
  - ››Time series, FFT, Real-time and Playback mode
  - ››xmgr viewing package
  - ››Triana trial

Prototyping Efforts
Test bed for Frame Development

- Unique environment, long term reliability
- Debugging, memory leaks
- Driving enhancements to Frame library
  - ››Static nature of Frames on a per run basis
  - ››Unique opportunity to huge gains in efficiency



Prototyping Efforts TCP/IP Socket

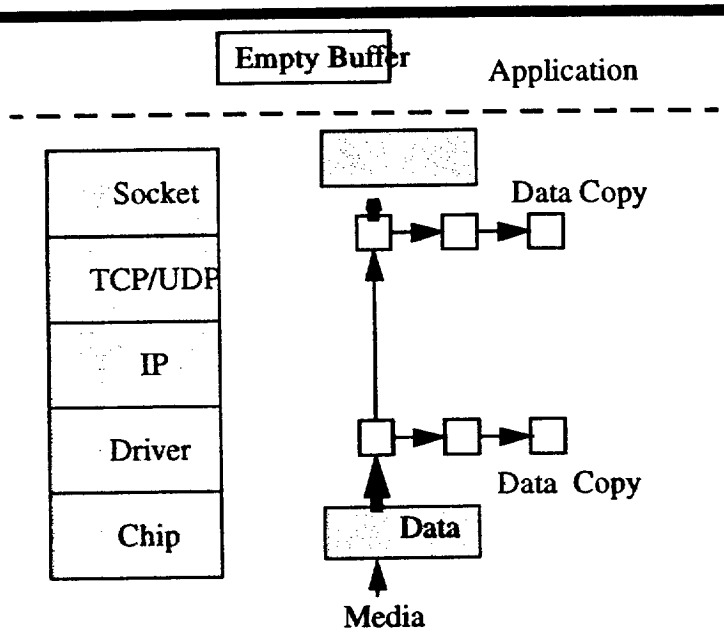
- TCP/IP socket facility more efficient
- After tuning parameters
  - ››Achieve 6 MB/sec transfer rate over FastEthernet link
- Implement in FB, replacing NFS writes
  - ››Transfer Frames
  - ››Poor performance under vxWorks
    - — Unix to vxWorks with (Fast) Ethernet link < 200 KB/s
  - ››Need to tune parameters
  - ››Significant improvement in performance
    - — Unix to vxWorks with Ethernet link 1.1 MB/s
    - — Unix to vxWorks with Fast Ethernet link 5.9 MB/s

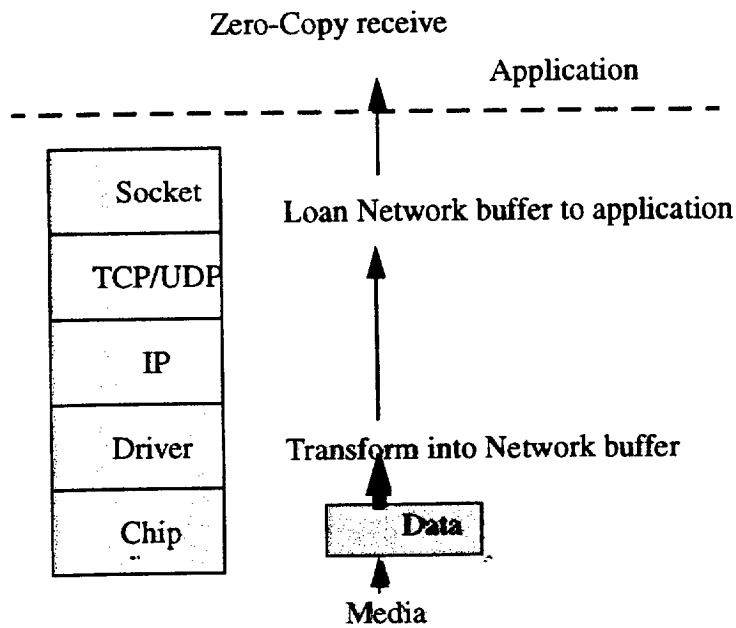
Prototyping Efforts
Zero Buffer Copy

- vxWorks supports this protocol

Achieved 7.2 MB/sec transfer rate

Prototyping Efforts
Zero Buffer Copy (cont)





Prototyping Efforts Frame Building on Ultra

- RM board on SBUS
- Systran's board benchmarks
  - >>3 MB/sec on reads and 6-7 MB/sec on writes
- Test reliability
- Test performance
  - >>Use interrupt generating and handling features

Prototyping Efforts
Data Distribution Software

- DAQ Event Services class library
  - ››Serves data off shared memory and/or disc
  - ››Thread pools
  - ››Event scheduling capability
  - ››Priority handling
- DAQ Daemon
  - ››Serves data off disc
  - ››Listener and worker threads
- Client API Calls

Prototyping Efforts Feeding DAS

- Exercising client API
- Reliability and Performance studies
- Interaction with CACR

Prototyping Efforts
Diagnostics Effort

- Monitoring and Visualization
  - >>xmgr, DaDisp
  - >>Real-time and playback modes
  - >>FFT engine and basic spectral analysis

40 Meter Diagnostics

- **Add diagnostic tools to monitor the realtime behavior of the apparatus.**
  - Tools do not impede flow of data to tape
  - Tools are based on Frame formats so that they can be readily implemented for LIGO as appropriate
- **Requires some changes to the data collection architecture in the 40 Meter:**
  - Frame builder software modified to accept slow monitoring data from PSL and Reference Source and put into reflective memory.
  - Slow monitoring data from pre-stabilized laser and Reference Source added to data acquisition display list.
  - Server software modified to disburse data so that computationally intensive analysis code (like spectral analysis) can be done on other machines.

Software Development Plans

- **Diagnostic software tasks**
  - Set high and low alarm limits on slow data already in data acquisition system.
  - Create trend frames for slow data (visibility, power, status, DC offset drifts, etc.)
  - Develop realtime correlation of two signals.
  - Waterfall plots of time vs frequency
  - Develop oscillation monitors for known problems at 3 Hz, 31 Hz, 2 KHz.) Also - violin and power line resonance monitors
  - Create list of lock and out of lock segments so that these data can be easily and quickly referenced. Serap, Bruce Allen
  - Add state indicators - Lisa's states 1-4 - to operator display
  - Automated interferometer calibration
  - Noise performance monitor - use calibrations and current power spectrum to indicate overall system health.
  - Sideband monitor from Tropel on APD.

Conclusion and Future Plan

- 40m DAQS Operational
- Serving as Prototype for Hardware and Software
- Pushing Frame Building Downstream
- Data Serving Experience
- Diagnostics

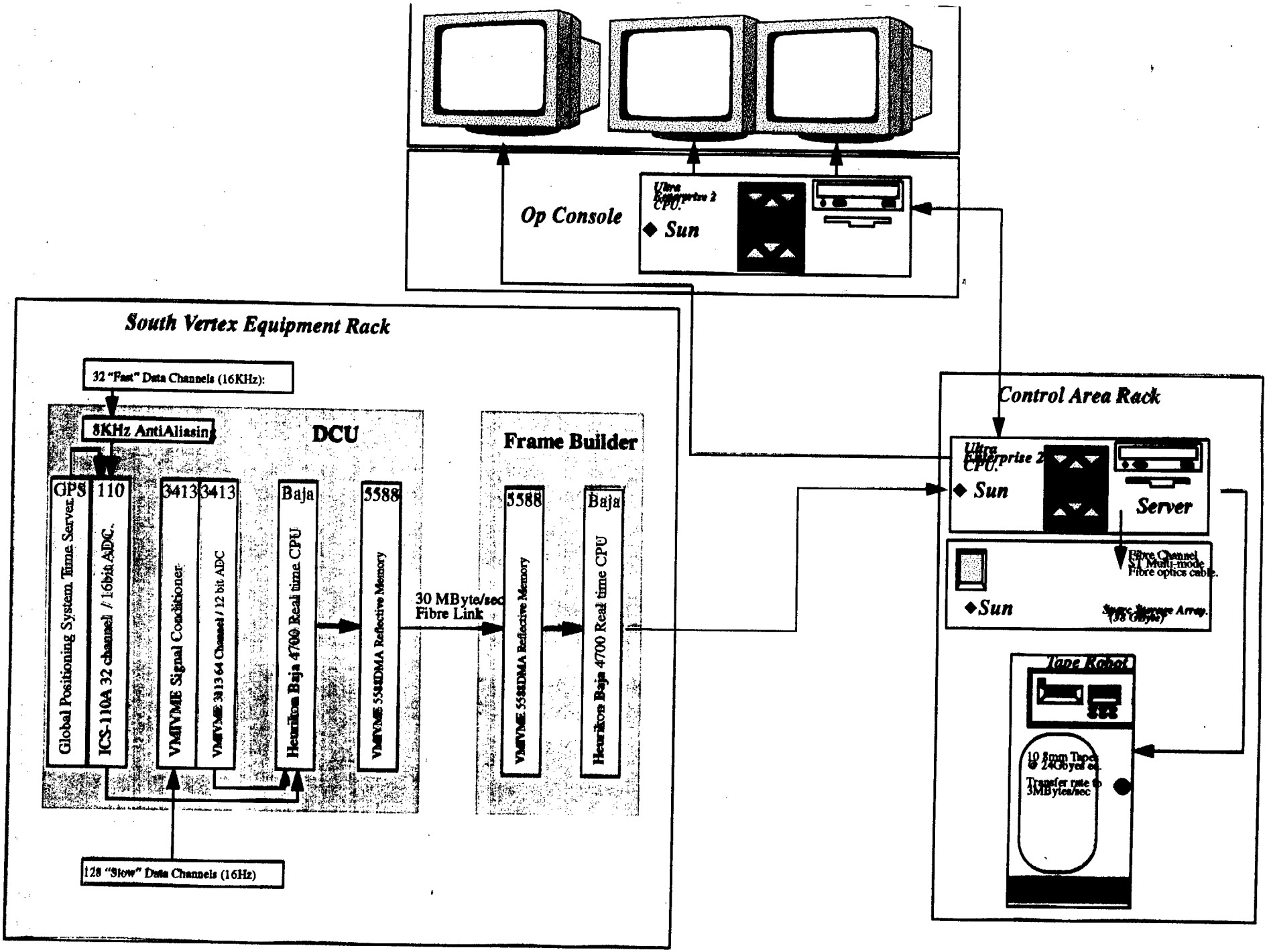


Figure 5: System Overview

Note 1, Linda Turner, 04/20/98 04:12:20 PM
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