An Introduction
A Quick Glance

- The DZero DAQ
- L3DAQ components
- L3DAQ communication
- An in depth look at monitoring
Dzero DAQ

- 63 readout crates in DAQ
- 0-20 kb/crate/event
- Maximum events size ~250kb

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The Players.... L3DAQ Components

L3 is comprised of both hardware and software components

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L3DAQ - Overview

All ethernet, except for TFW communication
L3DAQ – Communication Flow
SBC – Single Board Computer

• 2 main functions
  • Readout controller for event data (many instances)
  • Routing master (1 instance)
• PIII 933Mhz, 128Mb RAM, 128Mb flash, 2 100 Mb/s Ethernet ports
• Tundra Universe II chip as VME-PCI interface
  • Programmable DMA controller
• PMC expansion slot
  • Holds BVM DIO module responsible for VME readout over J3 backplane
SBC – Logic & Operation

• Event fragment thrown out after 1s if still waiting for route tag
• Route tags thrown out after several seconds if no event fragment
• If evt# in event fragment > evt# in route tag, throw out route tag
• If evt# in event fragment < evt# in route tag, throw out fragment
SBC – How a Crate Reads Out
SBC – Routing Master Basics

• Receives crate list per bit and list of farm nodes from Supervisor
• Receives bits fired, event number from TFW
• Chooses which nodes to send event for filtering
• Sends routing info to SBCs based on event #
• Sends crate info to nodes based on event#
• Receives number of available buffers from nodes
• If number of available buffers in the farm becomes to low, RM can disable triggers allowing farm can catch up
SBC – Routing Master Comm. Flow
Ethernet Switches

- **2984G switch**
  - Concentrates signal from up to 10 100Mb/s connections to 1Gb/s optical line
  - Limits number of 100Mb/s connections to prevent network congestion

- **6509 switch**
  - Receives the Gigabit links and connects to the L3 nodes
L3 Farm Nodes

- 48 Dual PIII 1GHz, 1GB RAM
- 34 Dual AMD Athlon 2GHz, 1GB RAM
- Dual Ethernet ports
  - One dedicated to online system
  - One dedicated to L3DAQ
- Runs several processes
  - Event builder (EVB)
  - Filtershell process (actually 2 running instances)
Node – Event Builder

- Always connected to all SBCs (including RM)
- In-progress has a 1s timeout, resulting in incomplete event
- Max of 3 buffers advertised to RM to limit data flow into 6509
Supervisor

• Primary function is L3 interface to COOR
• Communicates with ScriptRunner and RM
  – No communication with SBCs or EVB
• Sends RM crate list per bit and node info
  – RM complains if nodes/SBCs not connected
• Sends trigger programming to ScriptRunner when a trigger download is performed
uMon – Front End Crates

- uMon monitors from the Routing Masters perspective!
- When crate color is….
  - Red: At least one event fragment from the crate did not reach the farm. Included in a run.
  - Yellow: Monitoring information is not available for the crate. Included in a run.
  - White: Included in a run and experiencing no problems.
  - Grey: Crate not included in a run.
uMon – Front End Crates, Part 2

• “Inc%: XX” monitors the percentage of events from a crate that have been missing.
  • This is a running total. Hitting the “Reset Inc Counters” button will reset this total to zero. To go back to the running total simply hit the “Unreset Inc Counters”

• Live SBC connections to the farm nodes are shown as beige boxes, otherwise black. The uppermost left box is node 0 (which does not exist and is therefore always black), next is node 1 and so forth. The lowermost right box is the SBCs connection to the Routing Master (beige connected, black not).
  • The strip chart is the rate which the SBC is reading from crate electronics.

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uMon – Front End Crates, Part 3

- Yellow block on the strip chart indicates no monitoring info from SBC
- Route Q bar chart:
  - Fractional use of route Q
- Event Q bar chart:
  - Fractional use of event Q
- Both charts utilize yellow on black background
- Route Q should be nearly empty and event Q should be < 2/3
uMon – L3 Input/Inc. Event Rate

- Strip chart shows the rate at which the RM is receiving/sending event tags
- The “L3 Input Rate” is just the instantaneous rate
- Pull down list allows the vertical scale of the chart to be changed
- A yellow bar at the top of the strip chart indicates that there is not monitoring information available.
uMon – L3 Input Rate By Bit

- Blocks, going from left to right, correspond to L1/L2 trigger bits 0 to 127
- The grayscale of each block represents the rate of the particular trigger with black being 0 Hz and white maximum rate.
- Clicking on a block will display the corresponding bit and its current rate
- Scale may be selected from drop down menu
uMon – Route Fifo Depth

- “Global L3 Disable” gives the fraction of time since the last update that the Routing Master has disabled triggers.
- “Route FIFO Depth” histogram shows the number of events in the TFW FIFO as determined by polls from RM conducted every 10ms.
- “RM-Farm conn” shows the RM connections to the farm nodes.
uMon – EVB Rates

• “EVB Rates” shows the EVB input rate into each individual node. Missing event rate as fraction of the total for a node will show as a red bar chart on top of the bin.

• “Node” strip chart shows the EVB rate of the chosen node over a period of ~20 minutes.

• “Total EVB Rate” shows the input rate into all EVB processes on L3 farm.

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uMon – Routing Groups

- Selecting a routing group will highlight all crates associated with that group.
- Input is given for each group
- Disable fraction is given for each group
fuMon v0.1.13

Node 48 Details

Run: 176305
CPU: 29%
Linc 3.4Hz: IP: 0, AD: 3
Out 0.6Hz: COM: 0, EB: 20
<175kHz: FO: 0, FS: 11
Total: 101499, 110920
Failed: 89498, 97882
Passed: 12000, 13035
Sent: 12000, 13035
Stops/Reqs: 0, 0
Restarts: 12, 14
Exits: 1, 3
State: WAIT, WAIT

Out/Pass Reject: 41Hz/14% (7.2)

CPU Utilization

L3DAQ Farm Uber Monitor

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fuMon – Output/Pass Rate

• fuMon monitors from the nodes perspective!
• Main strip chart shows total output rate of the farm
• Smaller chart shows pass fraction as grayscale bars
• Scale may be changed by drop down menu
• Reject is the ratio of input_events/sent_events over entire farm

Out/Pass (Reject) 100Hz
41Hz/14% (7.2)
fuMon - Nodes

• When the color is...
  • Orange: 10 or more complete EVB buffers waiting for processing by FS
  • Red: One or more events were incomplete and dropped by EVB
  • White: In a run and experiencing no problems
  • Grey: Not in a run.

• Three black dots represent # of advertised free buffers to RM
• First bar chart represents in process EVB buffers
• Second bar chart represents complete EVB buffers
fuMon – Nodes, Part 2

- 2 beige boxes in the middle represent the state of the two filtershell processes running on the node.
  - 1\textsuperscript{st} (highest) position: WAIT
  - 2\textsuperscript{nd} position: FILTER
  - 3\textsuperscript{rd} position: FLATTEN
  - 4\textsuperscript{th} position: SEND
- Top strip chart shows the event rate into the filtershell processes
- Bottom strip chart shows the pass fraction for the filtershell processes
- A yellow bar on the top of the strip chart indicates there is no monitoring info
fuMon – Node Details

• Clicking on a particular node will give you detailed instantaneous information about that node.
fuMon – Node CPU Usage

• “CPU Utilization” shows what fraction of the nodes total processing power is being consumed.

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DAQ Dialog
Typical Problems

- Not enough nodes in run
  - Symptom: L3 disables, nodes in FILTERING
  - SMT/CFT/CAL in full-readout mode?
- Collector Router backed up
  - Farmnodes orange (SENDING) in fuMon
  - L3 output rate too high or event size too large
  - Farmnodes wont respond to Super when SENDING
    - Supervisor appears hung
    - Must PAUSE and wait OR restart farmnodes and Super
- Crate 100% missing
  - Almost always a component problem
  - Check Route and Event queue state in uMon
Some Useful Scripts

- **Supervisor**
  - `start_daq l3supervisor`
- **Nodes**
  - `l3xreset <node>`, or `l3xreset` to reset entire farm
- **Monitor server**
  - `l3xdaq_monitor_server`
- **SBC**
  - `l3xdaq_reset <sbc>`
- **SBC scripts**
  - `is_crate_requesting_readout.sh` (SlaveReady asserted?)
  - `getInfo.sh` (sbc driver stats and status)
  - `sbc_config_rdwr` (VME targets and modes)
  - `reset_all.sh` (restarts processes)
Website

- [http://www-d0online.fnal.gov/www/groups/l3daq/default.html](http://www-d0online.fnal.gov/www/groups/l3daq/default.html)
  - Documentation for all monitoring packages
  - This and previous Level 3 talks and papers
  - “What to do when” page for troubleshooting L3 problems
  - Log files for the SBCs, Supervisor, Monitor Server, & daqAI
  - On call expert list
Missing Node Info