Significant Event System Tutorial: DAQ Operations

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SES Tutorial Outline

- Purpose – the role of the SES
- Overview – SES system architecture
- Shift operations – alarm display
- Core applications – server, alarm watcher, logger
- Operation – starting, stopping, and status
Purpose

- Monitor the health of the DZero online system
- During detector operations produce, distribute, and display events which are significant to the experiment
  - Alarm conditions
  - DAQ state transitions from COOR
- Archive SE messages for later review
  - Look for trends when diagnosing equipment issues
  - In run I the detectors state was checked for all top event candidates to insure the events were not artifacts of a detector problem
Message Key:
SE = Significant Event
FIL = Filter configuration
RC = Run Control
FM = Filtered SE Message
● = Filter
Functionality
(Comments on the previous slide)

- **Sender Clients**
  - Identify bad states
  - Send alarms

- **Server**
  - Maintains the current state
  - Supplies the state to clients on request

- **Logger**
  - Writes all SE messages to files

- **Alarm watcher**
  - Detects alarms that should pause runs
  - Sends run pause commands to COOR

- **Alarm display**
  - Shows the current state to the user
  - Access guidance to assist in resolving an alarm condition
Alarm Display

To start:
> setup d0online
> start_daq alarm_display
Each button is labeled with a value that reflects the number of alarms of a severity that pass the filter for that row.

Each row has a different filter.

Alarms that pass multiple filters appear in multiple rows.

Four alarm severity levels:
- Major – fix the problem
- Minor – monitor the situation
- Invalid – read or write error
- Good – problem repaired
Alarm severity transitions

- A device starts in the good state (not listed on the display)
- A bad alarm is in one of the three severity levels
- Transitions from the bad severities to good can occur at any point
- As can transitions between severities
an alarm display configuration file contains the filter for each row.

Identical to the alarm watcher filter.

Detector groups can generate a customized alarm display by creating a detector specific configuration file.
Left click a button to see the names of all alarms in that category.

```
<table>
<thead>
<tr>
<th>Category</th>
<th>MAJOR</th>
<th>MINOR</th>
<th>INVALID</th>
<th>ACKED</th>
<th>DISABLED</th>
<th>GOOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAL and ICD</td>
<td>0</td>
<td>13</td>
<td>1</td>
<td>0</td>
<td>103</td>
<td>58</td>
</tr>
<tr>
<td>CFT</td>
<td>0</td>
<td>28</td>
<td>0</td>
<td>28</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>L1CTT</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>MUO</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>SMT</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>LUM</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Control</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
```

CFT: Minor Alarms

```
CFTA_AFE_4B2/VPUD6
CFTA_AFE_4B4/VPUD4
CFTA_AFE_4B4/VPUD7
CFTA_AFE_4B4/VPUD8
CFTA_AFE_8A2/VPUD1
CFTA_AFE_8A2/VPUD2
CFTA_AFE_8A2/VPUD5
CFTA_AFE_8A2/VPUD6
CFTA_AFE_8B6/VPUD2
CFTA_AFE_8B6/VPUD3
CFTA_AFE_8B6/VPUD4
CFTA_AFE_9A2/VPUD7
CFTC_AFE_4A6/AFET
CFTC_AFE_AA7/AFET
CFTF_AFE_1A2/AFET
```

CFT: Acknowledged Alarms

```
CFTA_VRB_500A/VTMSD0:R
CFTA_VRB_500A/VTMSD1:R
CFTA_VRB_500A/VTMSD2:R
CFTA_VRB_500A/VTMSD3:R
CFTA_VRB_500B/VTMSD0:R
CFTA_VRB_500B/VTMSD1:R
CFTA_VRB_500B/VTMSD2:R
CFTA_VRB_500B/VTMSD3:R
CFTA_VRB_500C/VTMSD0:R
CFTA_VRB_500C/VTMSD1:R
CFTA_VRB_500C/VTMSD2:R
CFTA_VRB_500C/VTMSD3:R
CFTA_VRB_500D/VTMSD0:R
CFTA_VRB_500D/VTMSD1:R
CFTA_VRB_500D/VTMSD2:R
```

Buttons:
- SHOW
- GUIDANCE
- CONTROL
- ACK
- ACK ALL
- DISABLE
- DISABLE ALL
- CLOSE
Left click a name then click the show button or double click a name to see the single alarm display.

Get more information on the alarm

Alarms can be disabled or acknowledged from here.

- Alarm names identify the source of the alarm and must be unique.
- Alarms must follow the official DZero naming convention: `<detector>_<device type>_<location>/<attribute>`
Alarms in the good, acked, and disabled columns behave differently than alarms in bad columns.

- Acked indicates that a bad alarm has been seen by the shifter.
- A state transition causes the alarm to appear in the major, minor, invalid, or good column.

- There is a persistence mechanism for disabled alarms.
- The last alarm message sent will be stored in the disabled column independent of the alarms severity.
- Disabled alarms will not pause runs!!!

- An alarm transition from bad to good is stored for five minutes.
- Multiple alarms can be listed under one name.
### Single Alarm Display

- **The name identifies the device in alarm.**
- **Explains the cause of the alarm.**
- **Shows the contents of the alarm message.**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>message type: alarm</td>
<td>name: CTL_PROC_11/MEM</td>
<td>priority: 0</td>
</tr>
<tr>
<td></td>
<td>host: d00ctl11</td>
<td>db entry: none</td>
<td>parent: none</td>
</tr>
<tr>
<td></td>
<td>children: none</td>
<td>transition: bad</td>
<td>severity: minor</td>
</tr>
<tr>
<td></td>
<td>alarm type: analog</td>
<td>parameters: ai 4 86.465053 90.0000000 60.0000000 0.0000000 0.0000000</td>
<td></td>
</tr>
</tbody>
</table>

**Alarm cause:** High alarm
**Alarm value:** 86.465053
**HiHi limit:** 90.000000
**High limit:** 60.000000
**Low limit:** 0.000000
**LoLo limit:** 0.000000

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### Acknowledging and Resolving Alarm Conditions

- **Acknowledge this alarm**
- **Unack for an alarm in the acked column**

### Displaying Alarm Information

- Issue a command stored in the hardware database.
- Display information on resolving the alarm condition.

### Alarm Details

- **Alarm cause:** High alarm
- **Alarm value:** 86.465053
- **HIHI limit:** 90.000000
- **High limit:** 60.000000
- **Low limit:** 0.000000
- **LoLo limit:** 0.000000

### Message Contents

- **Version:** v4
- **Utility:** ef(6)
- **Timestamp:** Thu Jan 29 10:23:42 2004

### Alarm Parameters

- **Parent:** none
- **Children:** none
- **Transition:** bad
- **Severity:** minor
- **Alarm type:** analog
- **Parameters:** ai 4 86.465053 90.000000 60.000000 0.000000 0.000000

### Control Panel

- **Buttons:**
  - Close
  - Ack
  - Disable
  - Control
  - Guidance
  - Command

**Legend:**

- **Enable this alarm.**
- **Look at the current values.**
Current Control Values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Alarm limits</th>
<th>Severity for each limit</th>
<th>Current alarm state</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTL_PROC_11/MEM.VAL</td>
<td>86.467081</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTL_PROC_11/MEM.SCAN</td>
<td>I/O Intr</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTL_PROC_11/MEM.ASND</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTL_PROC_11/MEM.HIHI</td>
<td>90.000000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTL_PROC_11/MEM.HIGH</td>
<td>60.000000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTL_PROC_11/MEM.LOW</td>
<td>0.000000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTL_PROC_11/MEM.LOLO</td>
<td>0.000000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTL_PROC_11/MEM.HHSV</td>
<td>MAJOR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTL_PROC_11/MEM.HSV</td>
<td>MINOR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTL_PROC_11/MEM.LSV</td>
<td>NO_ALARM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTL_PROC_11/MEM.LLSV</td>
<td>NO_ALARM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTL_PROC_11/MEM.SEVER</td>
<td>MINOR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTL_PROC_11/MEM.STAT</td>
<td>HIGH</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• Making guidance available for all alarms is a point of emphasis for DZero operations.
• Any assistance in encouraging detector groups to add this information is much appreciated.
Transient Alarms

- No good message is expected from the sender client.
- The server automatically clears the alarm after 15 minutes.
- This is useful for software applications (examines, coor, ...) sending alarms. The difficulty is determining the bad and good transitions.

A run pausing transient alarm can be cleared immediately with the clear transient button.
Online Operations

- Senders
- Server
- Logger
- Alarm Display
- COOR
- Alarm Watcher
- L3 Filter Senders
- L3 Filter Server
- L3 Filter Logger
- File
Why are there two servers in the SES?

- Errors in level 3 filters are fixed without outside intervention.
- The SES framework was a simple way to get level 3 filter errors written to a file for later review.
- There is a special level 3 message that is simply passed through the server to attached clients.

The alarm display and watcher serve no purpose connected to the level 3 filter server.
• The two servers, two loggers, and alarm watcher all run as daemons.
• They sit in the background waiting to receive messages.
• When a message is received they spring into action.
• Each daemon process writes an error file.

• Start all daemons: start_daq ses
• Stop all daemons: stop_daq ses
Each daemon can be stopped and started individually.

- **Start server:**
  `start_daq ses_server`
- **Stop server:**
  `stop_daq ses_server`

- **Start L3 filter server:**
  `start_daq ses_l3_server`
- **Stop L3 filter server:**
  `stop_daq ses_l3_server`

- **Start alarm watcher:**
  `start_daq alarm_watcher`
- **Stop alarm watcher:**
  `stop_daq alarm_watcher`

  *Listen for the notification.*

- **Start logger:**
  `start_daq ses_logger`
- **Stop logger:**
  `stop_daq ses_logger`

- **Start L3 filter logger:**
  `start_daq ses_l3_logger`
- **Stop L3 filter logger:**
  `stop_daq ses_l3_logger`
Start the user interfaces with the start_daq script and stop them with the File->Exit menu item.

- Start alarm display: start_daq alarm_display.
- Any number can be running simultaneously.

- Message board: start_daq message_board
- L3 filter message board: start_daq l3_message_board
- The message board is a debugging tool that displays the last 1,000 messages sent to a server.
System configuration is handled in /online/data/d0online/d0online_names.py.

- **SES_SERVER_ADDR**="d0ol-svc-ses.fnal.gov:52150"
- **SES_DISABLE_FILE**="/online/config/ses/ses.disable"
- The disable file keeps a record of disabled alarms for persistence.
- **SES_L3_SERVER**="d0ol-svc-ses.fnal.gov:52245"
- **SES_ALARM_WATCHER_ADDR**="d0ol-svc-ses.fnal.gov:52153"
- **SES_AW_CONFIG_FILE**="/online/config/ses/aw.config"
- **SES_LOGGER_ADDR**="d0ol-svc-ses.fnal.gov:52151"
- **SES_L3_LOGGER_ADDR**="d0ol-svc-ses.fnal.gov:52246"
- Each logger occupies a port to prevent multiple instances from running.
New log files are opened when:
• The logger starts
• At midnight
• The server is restarted

Date when the file was opened:
• YYYYMMDD-DDMMSSSTZ

Log files written by the logger are located in /online/log/ses/logs.
Log files written by the l3 logger are located in /online/log/ses/l3logs.
A cron job zips log files more than a few days old.

Log files:
-rw-r--r-- 1 d0run d0_prod 2688616 Jan 29 10:22 se_log.20040129-000000CST.gz
-rw-r--r-- 1 d0run d0_prod 3796569 Jan 30 00:00 se_log.20040129-102321CST.gz
-rw-r--r-- 1 d0run d0_prod 97396837 Jan 31 00:00 se_log.20040130-000000CST
-rw-r--r-- 1 d0run d0_prod 201863729 Jan 31 23:59 se_log.20040131-000000CST
-rw-r--r-- 1 d0run d0_prod 87175211 Feb  1 23:59 se_log.20040131-235959CST
-rw-r--r-- 1 d0run d0_prod 79317890 Feb  2 23:59 se_log.20040202-000000CST
-rw-r--r-- 1 d0run d0_prod 47788150 Feb  3 14:42 se_log.20040203-000000CST
• All the daemons write information about their internal state to files to aid in debugging
• A new file is created each time the daemon is started.

```
/online/log/ses/server/out.*
/online/log/ses/server/l3out.*
/online/log/ses/logger/out.*
/online/log/ses/logger/l3out.*
/online/log/ses/aw/out.*
```
Manually Checking the Daemons

- Log into the computer specified in d0online_names.py
  - setup d0online
  - d0ssh d0ol-svc-ses
- View the process status with the ps command
  - ps www

- When starting each daemon all the data is passed via command line arguments
  - -r = port on which a server listens for connection requests
  - -c = configuration file
  - -h = server host
  - -p = server port
  - -l = log directory
  - --coor = COOR host and port
<d0olj> ps auxwww | grep seserver | grep 52150
  d0run    19015  0.0  0.7 1395628 28764 ?  S   Apr18  0:00 python
  /online/products/SigEvtSys/onl04-09-00/NULL/py/seserver.py
  -r 52150 -c /online/config/ses/ses.disable

<d0olj> ps auxwww | grep seserver | grep 52245
  d0run    19228  0.0  0.6 1270076 25064 ?  S   Apr18  0:00 python
  /online/products/SigEvtSys/onl04-09-00/NULL/py/seserver.py
  -r 52245

<d0olj> ps auxwww | grep watcher
  d0run    20398  0.0  0.1 30012 5896 ?  S   Apr18  0:00 python
  /online/products/SigEvtSys/onl04-09-00/NULL/py/sealarmwatcher.py
  -p 52150 -h d0ol-svc-ses.fnal.gov -r 52153
  -c /online/config/ses/aw.config --coor=d0olf.fnal.gov:52127 --online
<d0olj> ps auxwww | grep selogger | grep 52150
  d0run  20156  0.0  0.1 23812 7072 ?   S  Apr18  0:00 python
  /online/products/SigEvtSys/onl04-09-00/NULL/py/selogger.py
  -p 52150 -h d0ol-svc-ses.fnal.gov -l /mnt/ses/logs -r 52151

<d0olj> ps auxwww | grep selogger | grep 52245
  d0run  20277  0.0  0.1 22928 7484 ?   S  Apr18  0:00 python
  /online/products/SigEvtSys/onl04-09-00/NULL/py/selogger.py
  -p 52245 -h d0ol-svc-ses.fnal.gov -l /mnt/ses/l3logs -r 52246