

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
- ◆ Online operation – starting, stopping, and status



Purpose

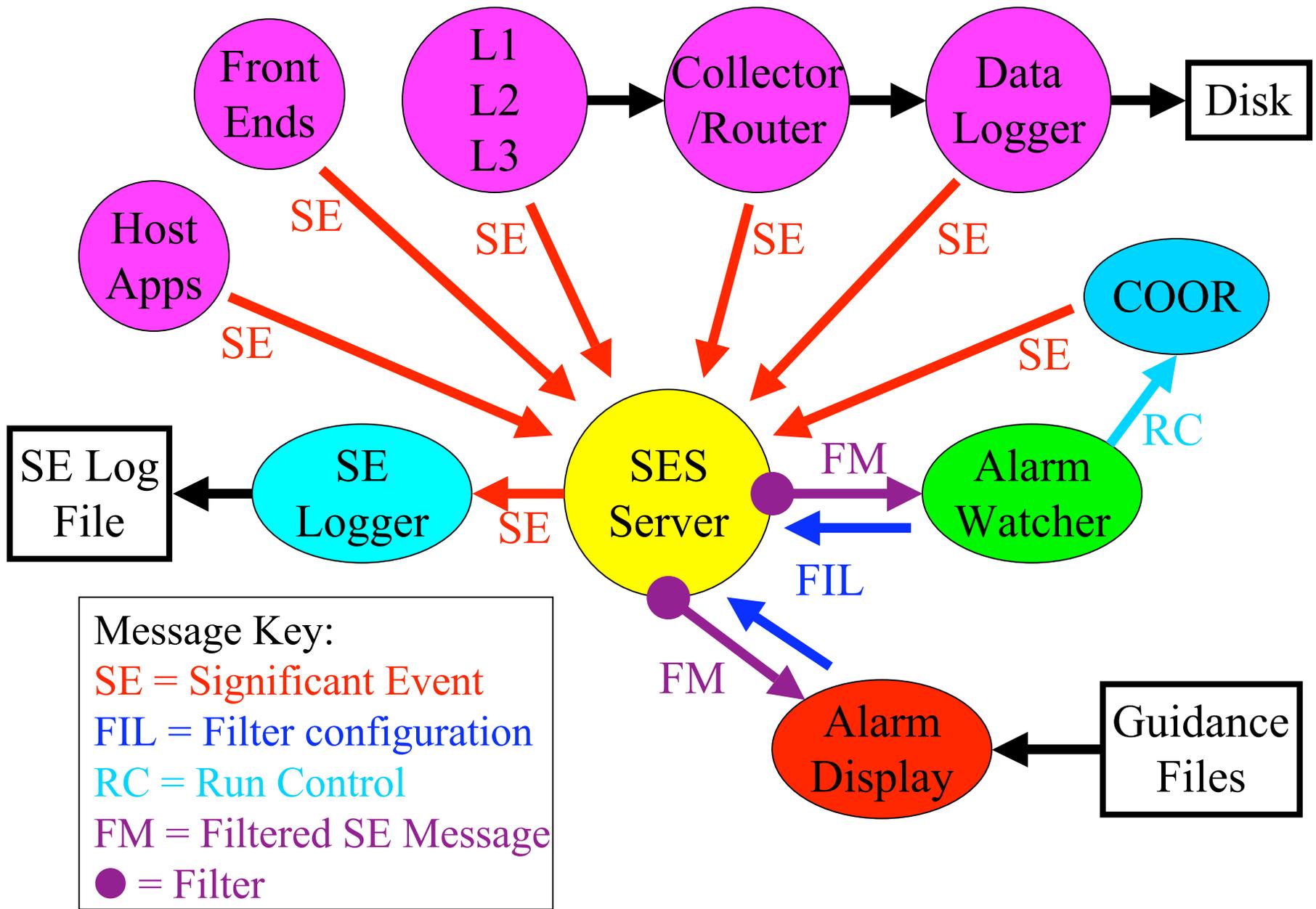
- ◆ Monitor the health of the DZero online system
- ◆ During detector operations produce, distribute, and display events which are significant to the experiment
 - Alarm conditions
 - DAQ state transitions from COOR
- ◆ Archive SE messages for later review
 - Look for trends when diagnosing equipment 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



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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

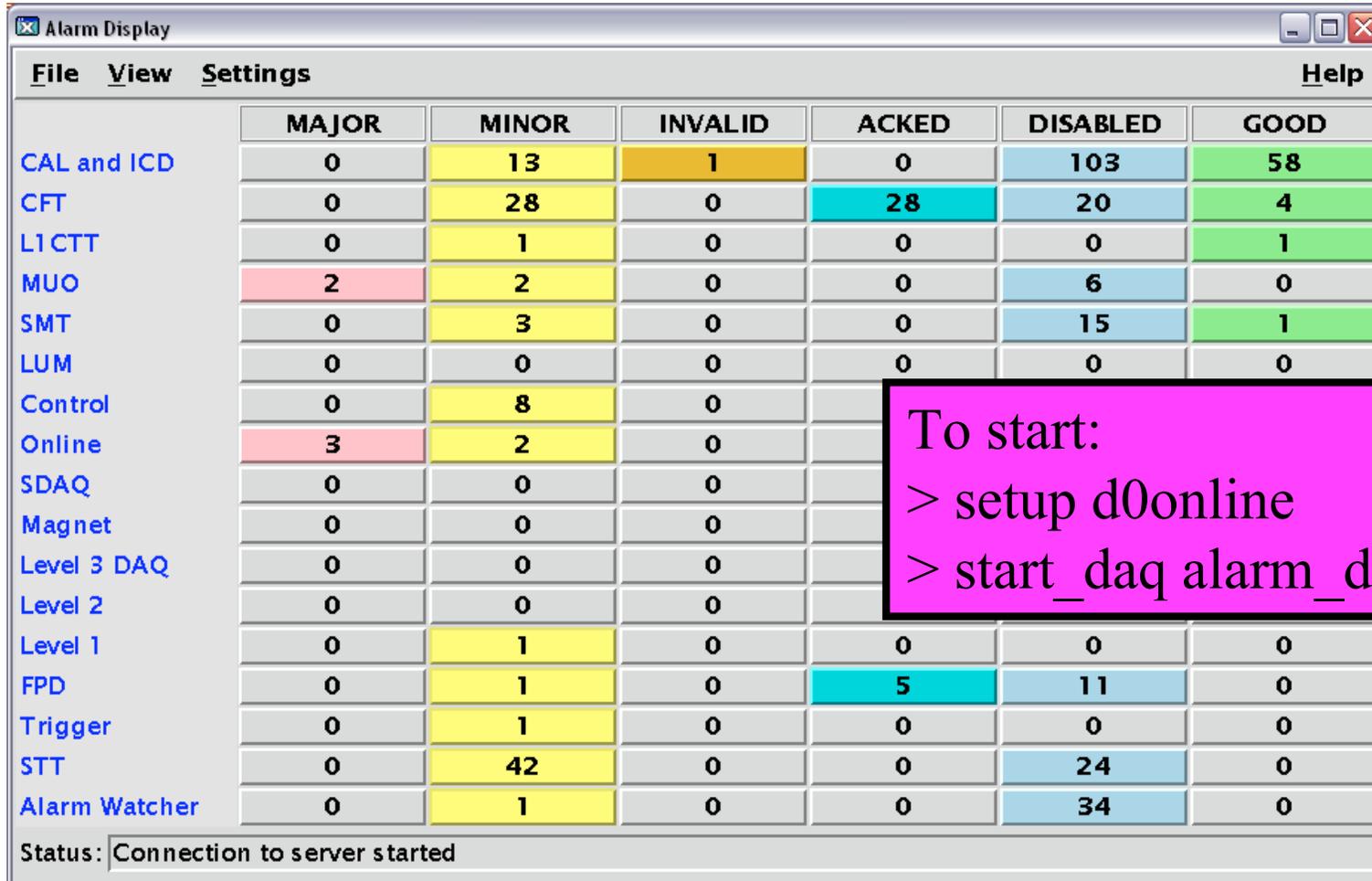


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Alarm Display



The screenshot shows a window titled "Alarm Display" with a menu bar (File, View, Settings, Help) and a table of alarm counts. The table has columns for MAJOR, MINOR, INVALID, ACKED, DISABLED, and GOOD. The rows list various components and their corresponding alarm counts. A status bar at the bottom indicates "Connection to server started".

	MAJOR	MINOR	INVALID	ACKED	DISABLED	GOOD
CAL and ICD	0	13	1	0	103	58
CFT	0	28	0	28	20	4
L1CTT	0	1	0	0	0	1
MUO	2	2	0	0	6	0
SMT	0	3	0	0	15	1
LUM	0	0	0	0	0	0
Control	0	8	0			
Online	3	2	0			
SDAQ	0	0	0			
Magnet	0	0	0			
Level 3 DAQ	0	0	0			
Level 2	0	0	0			
Level 1	0	1	0	0	0	0
FPD	0	1	0	5	11	0
Trigger	0	1	0	0	0	0
STT	0	42	0	0	24	0
Alarm Watcher	0	1	0	0	34	0

Status: Connection to server started

To start:

> setup d0online

> start_daq alarm_display



	MAJOR	MINOR	INVALID	ACKED	DISABLED	GOOD
CAL and ICD	0	12	0	0	102	52
CFT	0	28	0	0	0	0
LI CTT	0	1	0	0	0	0
MUO	2	2	0	0	0	0
SMT	0	3	0	0	0	0
LUM	0	0	0	0	0	0
Control	0	8	0	0	0	0
Online	3	2	0	0	0	0
SDAQ	0	0	0	0	0	0
Magnet	0	0	0	0	0	0
Level 3 DAQ	0	0	0	0	0	0
Level 2	0	0	0	0	0	0
Level 1	0	1	0	0	0	0
FPD	0	1	0	5	11	0
Trigger	0	1	0	0	0	0
STT	0	42	0	0	24	0
Alarm Watcher	0	1	0	0	34	0

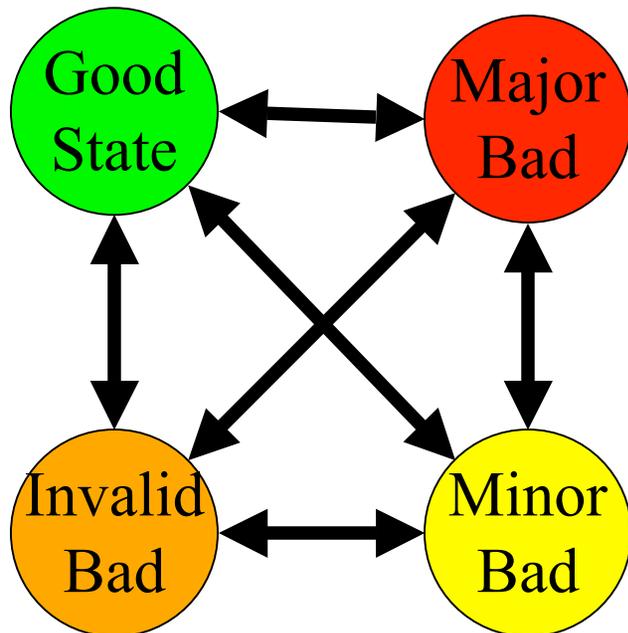
Four alarm severity levels:

- Major – fix the problem
- Minor – monitor the situation
- Invalid – read or write error
- Good – problem repaired

- 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



	MAJOR	MINOR	INVALID	ACKED	DISABLED	GOOD
CAL and ICD	0	13	1	0	103	58
CFT	0	28	0	28	20	4
LICTT	0	1	0	0	0	1
MUO	2	2	0	0	6	0
SMT	0	3	0	0	15	1
LUM	0	0	0	0	0	0
Control	0	8	0	0	0	0
Online	3	2	0	0	14	0



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



Default configuration file, /online/config/ses/ad.config

```
addRow('CAL and ICD', "(contains(det, 'CAL') or contains(det, 'ICD')) ...")
addRow('CFT', "contains(det, 'CFT')")
addRow('L1CTT', "contains(det, 'CTT')")
addRow('MUO', "contains(det, 'MUO')")
addRow('SMT', "contains(det, 'SMT')")
addRow('LUM', "contains(det, 'LUM')")
addRow('Control', "contains(det, 'CTL')")
addRow('Online', "contains(det, 'ONL') and not contains(devtype, 'SDAQ')")
addRow('SDAQ', "contains(devtype, 'SDAQ')")
addRow('Magnet', "contains(devtype, 'MAG')")
addRow('Level 3 DAQ', "contains(name, 'L3DAQ')")
addRow('Level 2', "contains(det, 'L2')")
addRow('Level 1', "contains(det, 'L1') and not contains(det, 'FPD')")
addRow('FPD', "contains(det, 'FPD')")
addRow('Trigger', "contains(det, 'TRG') or contains(det, 'TFW')")
addRow('STT', "contains(det, 'STT')")
addRow('Alarm Watcher', "contains(mtype, 'alarm') and (priority > 100)")
```

File View Settings

- CAL and ICD
- CFT
- L1CTT
- MUO
- SMT
- LUM
- Control
- Online
- SDAQ
- Magnet
- Level 3 DAQ
- Level 2
- Level 1
- FPD
- Trigger
- STT
- Alarm Watcher

Status: Connection to

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.

	MAJOR	MINOR	INVALID	ACKED	DISABLED	GOOD
CAL and ICD	0	13	1	0	103	58
CFT	0	28	0	28	20	4
LI CTT	0	1	0	0	0	1
MUO	2	2	0	0	6	0
SMT	0	3	0	0	15	1
LUM	0	0	0	0	0	0
Control	0	8	0	0	0	0

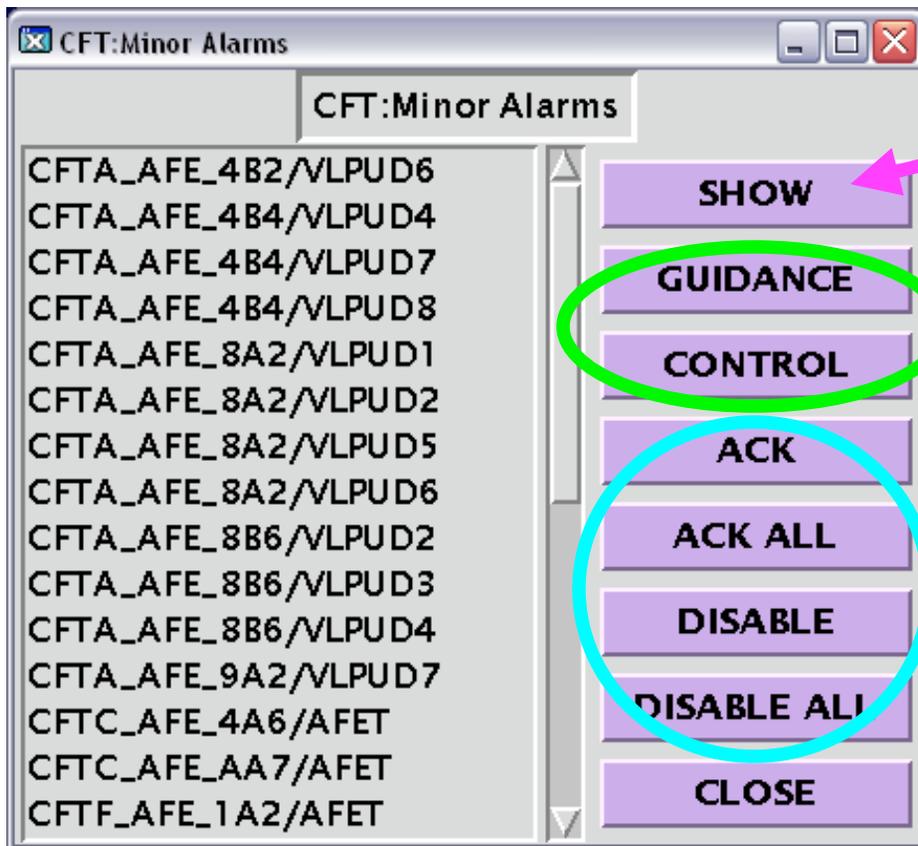
CFT:Minor Alarms

- CFTA_AFE_4B2/VLPUD6
- CFTA_AFE_4B4/VLPUD4
- CFTA_AFE_4B4/VLPUD7
- CFTA_AFE_4B4/VLPUD8
- CFTA_AFE_8A2/VLPUD1
- CFTA_AFE_8A2/VLPUD2
- CFTA_AFE_8A2/VLPUD5
- CFTA_AFE_8A2/VLPUD6
- CFTA_AFE_8B6/VLPUD2
- CFTA_AFE_8B6/VLPUD3
- CFTA_AFE_8B6/VLPUD4
- CFTA_AFE_9A2/VLPUD7
- 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





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.



The screenshot shows a window titled 'Help' containing a table with four columns: INVALID, ACKED, DISABLED, and GOOD. The table has 15 rows. Arrows point from the text boxes to the following cells: the 'INVALID' cell in the first row (value 1), the 'ACKED' cell in the second row (value 28), the 'DISABLED' cell in the first row (value 103), and the 'GOOD' cell in the first row (value 58).

INVALID	ACKED	DISABLED	GOOD
1	0	103	58
0	28	20	4
	0	0	1
	0	6	0
	0	15	1
	0	0	0
	0	0	0
	0	14	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0
	0	0	0



Single Alarm Display

CTL_PROC_11/MEM:Control:Minor Alarms

***** CTL_PROC_11/MEM *****

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
message type: alarm
name: CTL_PROC_11/MEM
priority: 0
host: d0olct11
db entry: 0
parent: none
children: none
transition: bad
severity: minor
alarm type: analog
parameters: ai 4 86.465053 90.000000 60.000000 0.000000 0.000000

CLOSE ACK DISABLE CONTROL GUIDANCE COMMAND



CTL_PROC_11/MEM:Control:Minor Alarms

```

***** CTL_PROC_11/MEM *****
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
  parent:      none
  children:    none
  transition:  bad
  severity:    minor
  alarm type:  analog
  parameters:  ai 4 86.465053 90.000000 60.000000 0.000000 0.000000
  
```

Issue a command stored in the hardware database.

Display information on resolving the alarm condition.

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

parent: none
children: none
transition: bad
severity: minor
alarm type: analog
parameters: ai 4 86.465053 90.000000 60.000000 0.000000 0.000000

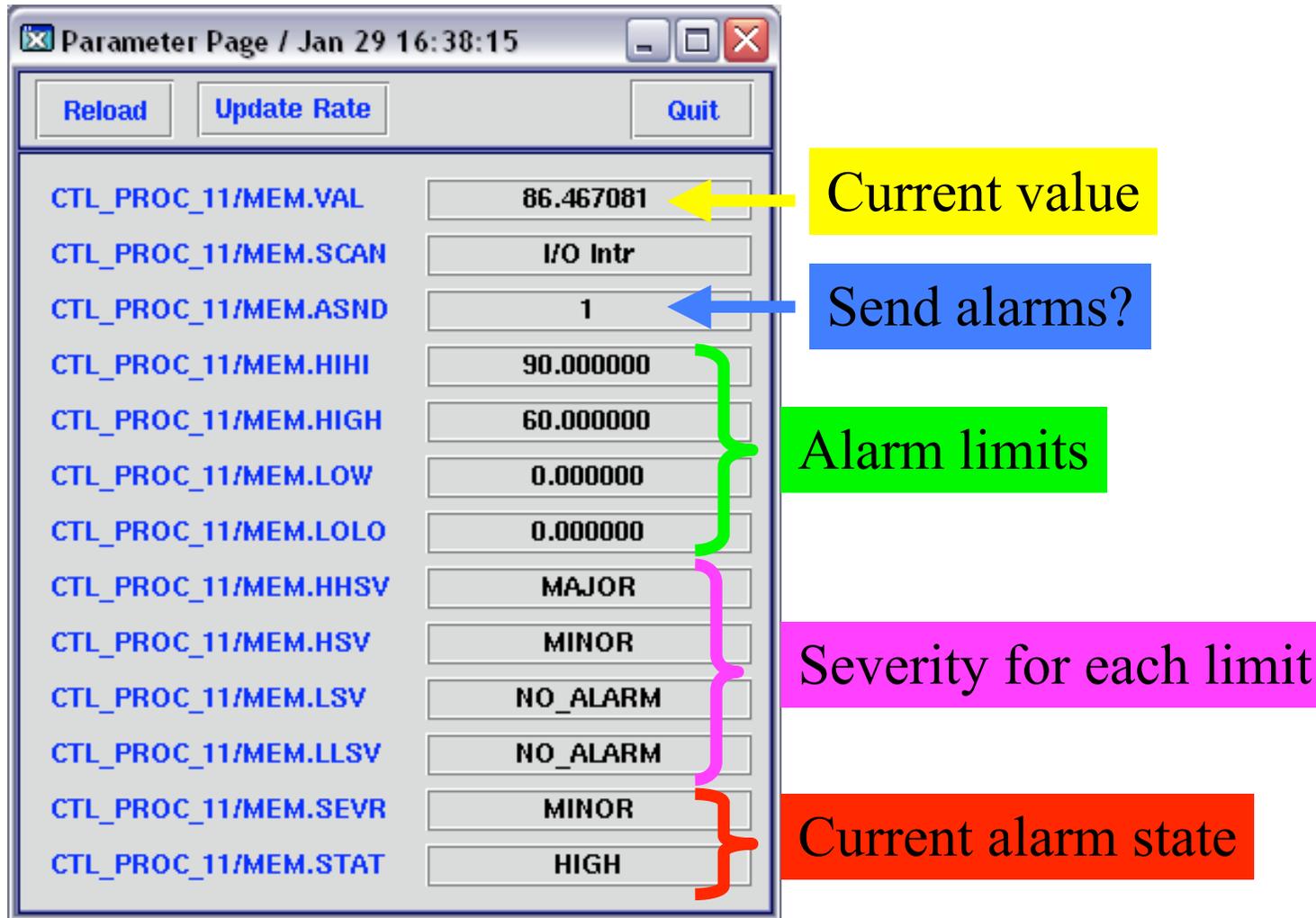
CLOSE ACK DISABLE CONTROL **GUIDANCE** COMMAND

Disable this alarm.

Look at the current values.



Current Control Values



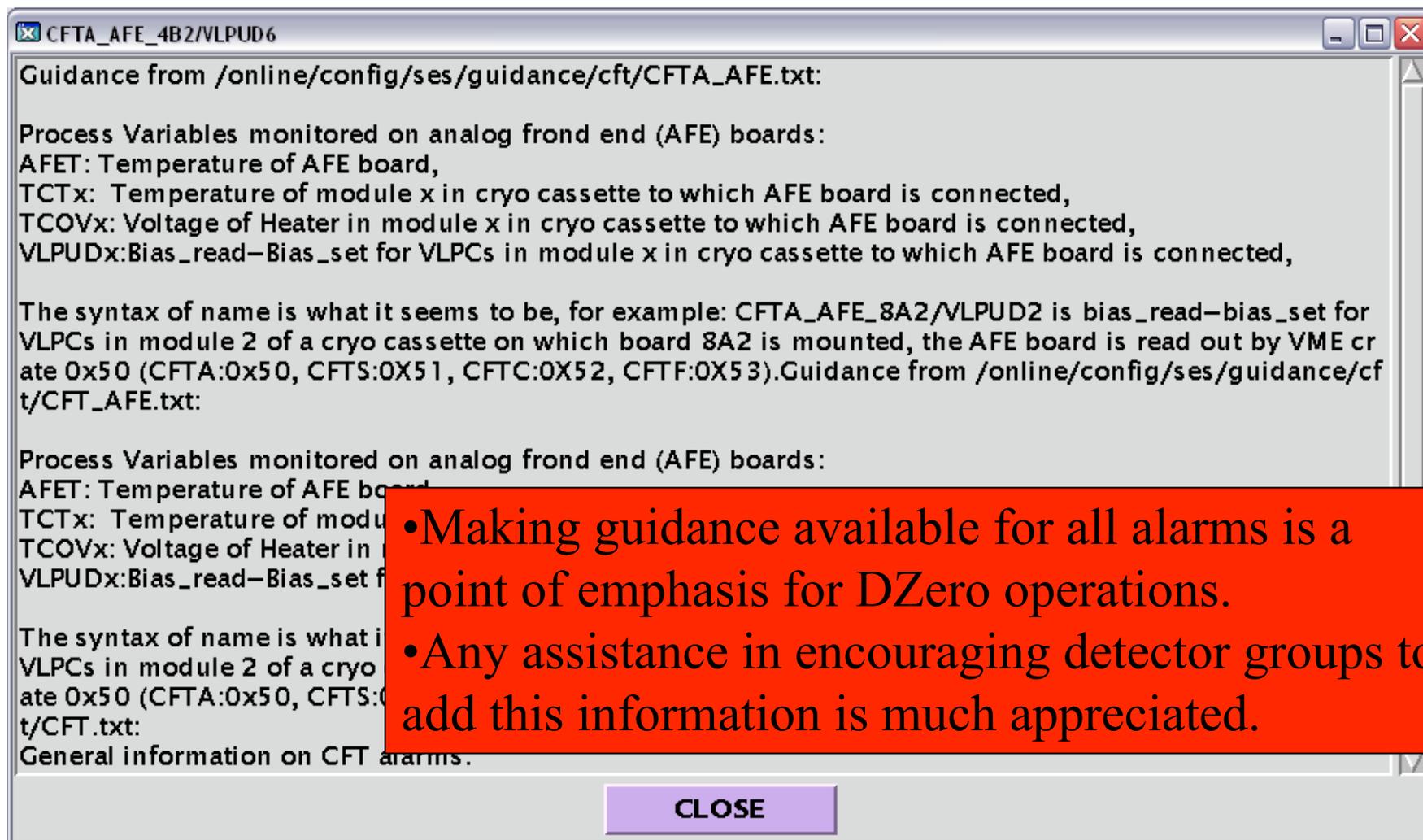
Parameter	Value
CTL_PROC_11/MEM.VAL	86.467081
CTL_PROC_11/MEM.SCAN	I/O Intr
CTL_PROC_11/MEM.ASND	1
CTL_PROC_11/MEM.HIHI	90.000000
CTL_PROC_11/MEM.HIGH	60.000000
CTL_PROC_11/MEM.LOW	0.000000
CTL_PROC_11/MEM.LOLO	0.000000
CTL_PROC_11/MEM.HHSV	MAJOR
CTL_PROC_11/MEM.HSV	MINOR
CTL_PROC_11/MEM.LSV	NO_ALARM
CTL_PROC_11/MEM.LLSV	NO_ALARM
CTL_PROC_11/MEM.SEVR	MINOR
CTL_PROC_11/MEM.STAT	HIGH

Annotations:

- Current value (yellow arrow pointing to 86.467081)
- Send alarms? (blue arrow pointing to 1)
- Alarm limits (green bracket grouping MEM.HIHI, MEM.HIGH, MEM.LOW, MEM.LOLO)
- Severity for each limit (magenta bracket grouping MEM.HHSV, MEM.HSV, MEM.LSV, MEM.LLSV)
- Current alarm state (red bracket grouping MEM.SEVR, MEM.STAT)



Guidance



CFTA_AFE_4B2/VLPUD6

Guidance from /online/config/ses/guidance/cft/CFTA_AFE.txt:

Process Variables monitored on analog frond end (AFE) boards:
AFET: Temperature of AFE board,
TCTx: Temperature of module x in cryo cassette to which AFE board is connected,
TCOVx: Voltage of Heater in module x in cryo cassette to which AFE board is connected,
VLPUDx: Bias_read-Bias_set for VLPCs in module x in cryo cassette to which AFE board is connected,

The syntax of name is what it seems to be, for example: CFTA_AFE_8A2/VLPUD2 is bias_read-bias_set for VLPCs in module 2 of a cryo cassette on which board 8A2 is mounted, the AFE board is read out by VME crate 0x50 (CFTA:0x50, CFTS:0x51, CFTC:0x52, CFTF:0x53). Guidance from /online/config/ses/guidance/cft/CFTA_AFE.txt:

Process Variables monitored on analog frond end (AFE) boards:
AFET: Temperature of AFE board,
TCTx: Temperature of module x in cryo cassette to which AFE board is connected,
TCOVx: Voltage of Heater in module x in cryo cassette to which AFE board is connected,
VLPUDx: Bias_read-Bias_set for VLPCs in module x in cryo cassette to which AFE board is connected,

The syntax of name is what it seems to be, for example: CFTA_AFE_8A2/VLPUD2 is bias_read-bias_set for VLPCs in module 2 of a cryo cassette on which board 8A2 is mounted, the AFE board is read out by VME crate 0x50 (CFTA:0x50, CFTS:0x51, CFTC:0x52, CFTF:0x53). Guidance from /online/config/ses/guidance/cft/CFTA_AFE.txt:

General information on CFT alarms.

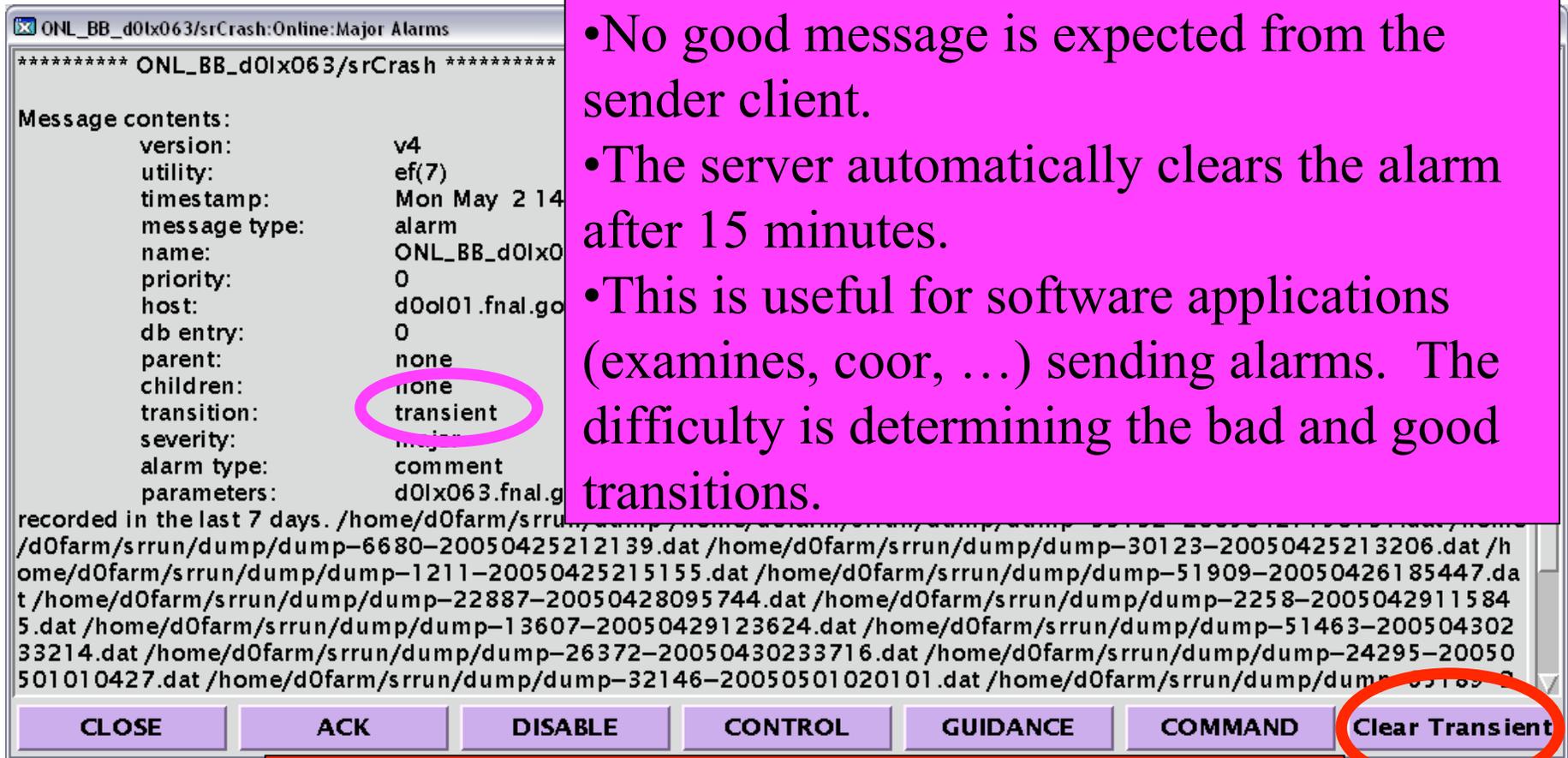
• Making guidance available for all alarms is a point of emphasis for DZero operations.

• Any assistance in encouraging detector groups to add this information is much appreciated.

CLOSE



Transient Alarms



The screenshot shows a window titled "ONL_BB_d0lx063/srCrash:Online:Major Alarms". The message contents are as follows:

```
***** ONL_BB_d0lx063/srCrash *****  
Message contents:  
  version:          v4  
  utility:          ef(7)  
  timestamp:       Mon May 2 14  
  message type:    alarm  
  name:            ONL_BB_d0lx0  
  priority:        0  
  host:            d0ol01.fnal.go  
  db entry:        0  
  parent:          none  
  children:        none  
  transition:      transient  
  severity:        major  
  alarm type:      comment  
  parameters:      d0lx063.fnal.g
```

Below the message, there is a list of files recorded in the last 7 days. At the bottom of the window, there are several buttons: CLOSE, ACK, DISABLE, CONTROL, GUIDANCE, COMMAND, and Clear Transient. The "Clear Transient" button is circled in red.

•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.

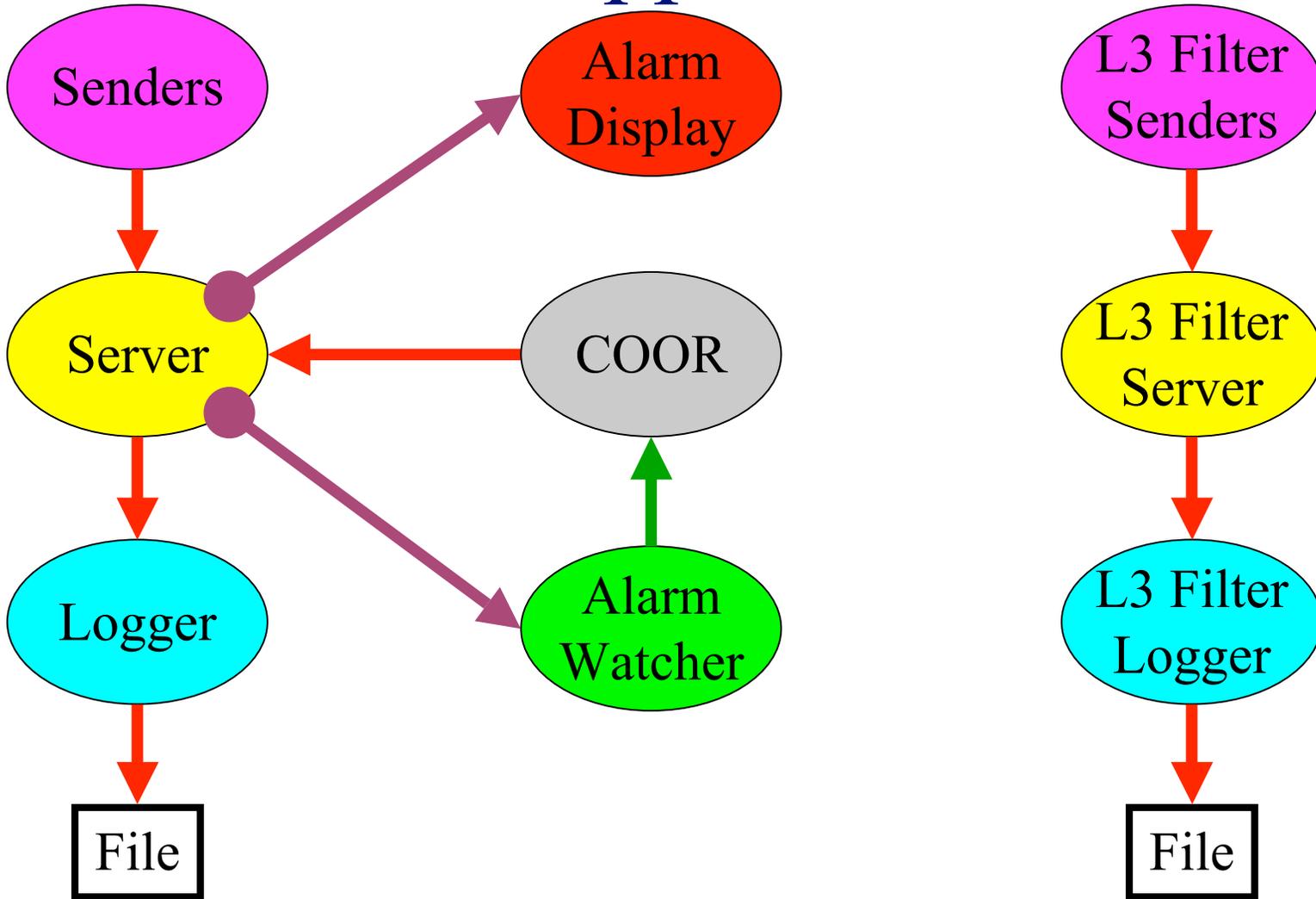


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Core Applications



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.

Alarm Display

COOR

Alarm Watcher

L3 Filter Senders

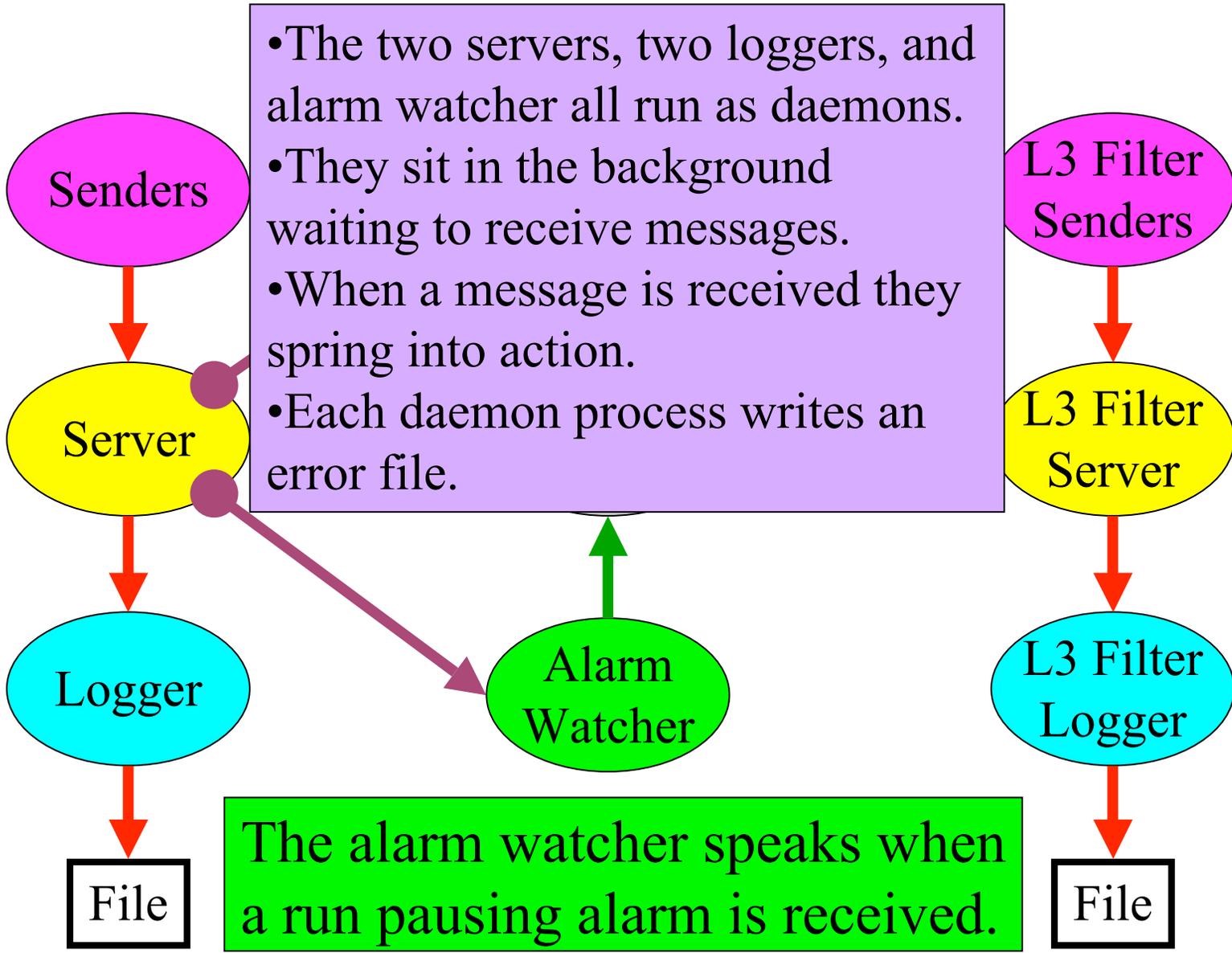
L3 Filter Server

L3 Filter Logger

File

The alarm display and watcher serve no purpose connected to the level 3 filter server.



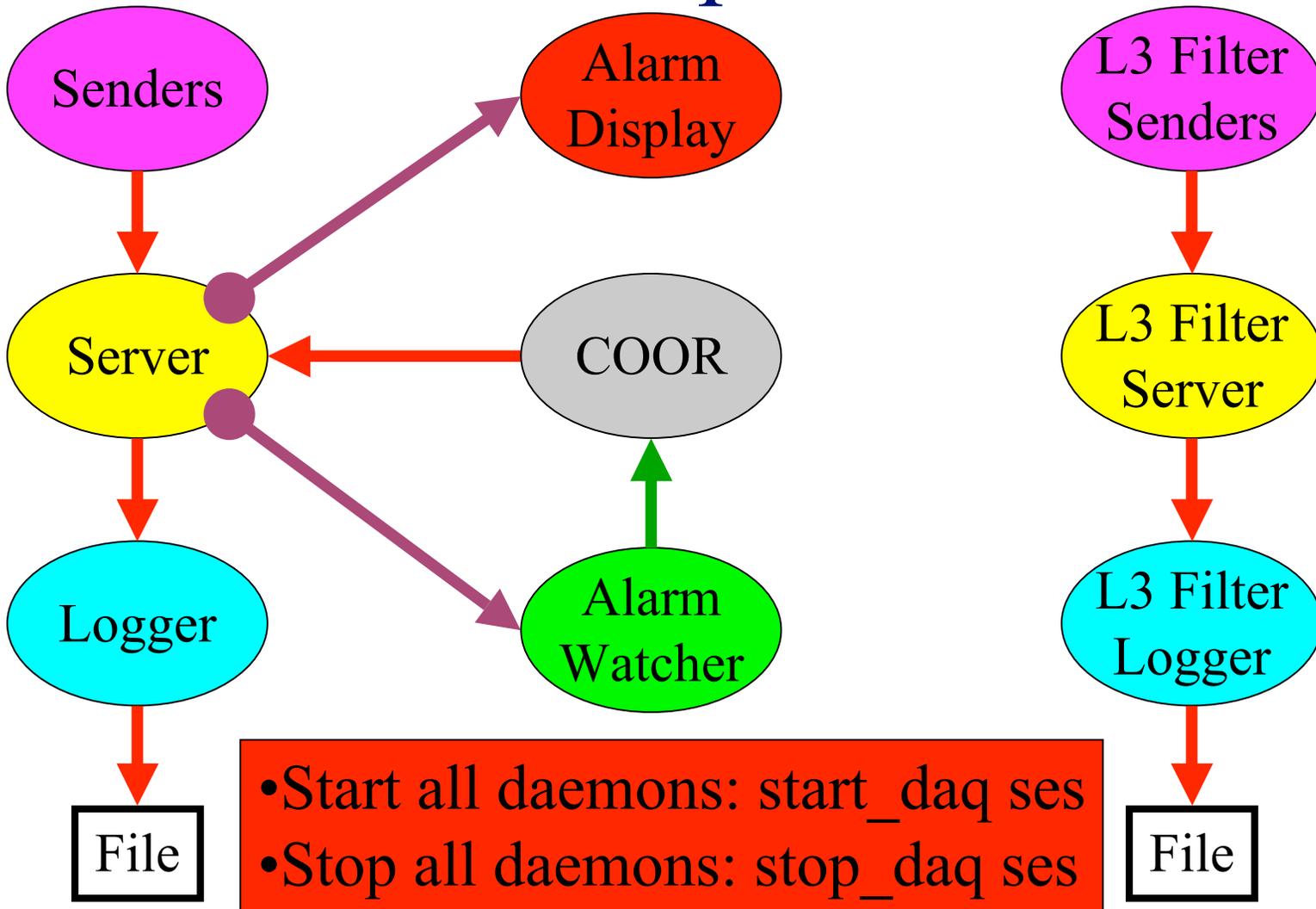


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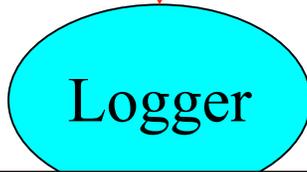


Online Operation



Each daemon can be stopped and started individually.

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



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



- Start alarm watcher:
start_daq alarm_watcher
- Stop alarm watcher:
stop_daq alarm_watcher
- Listen for the notification.

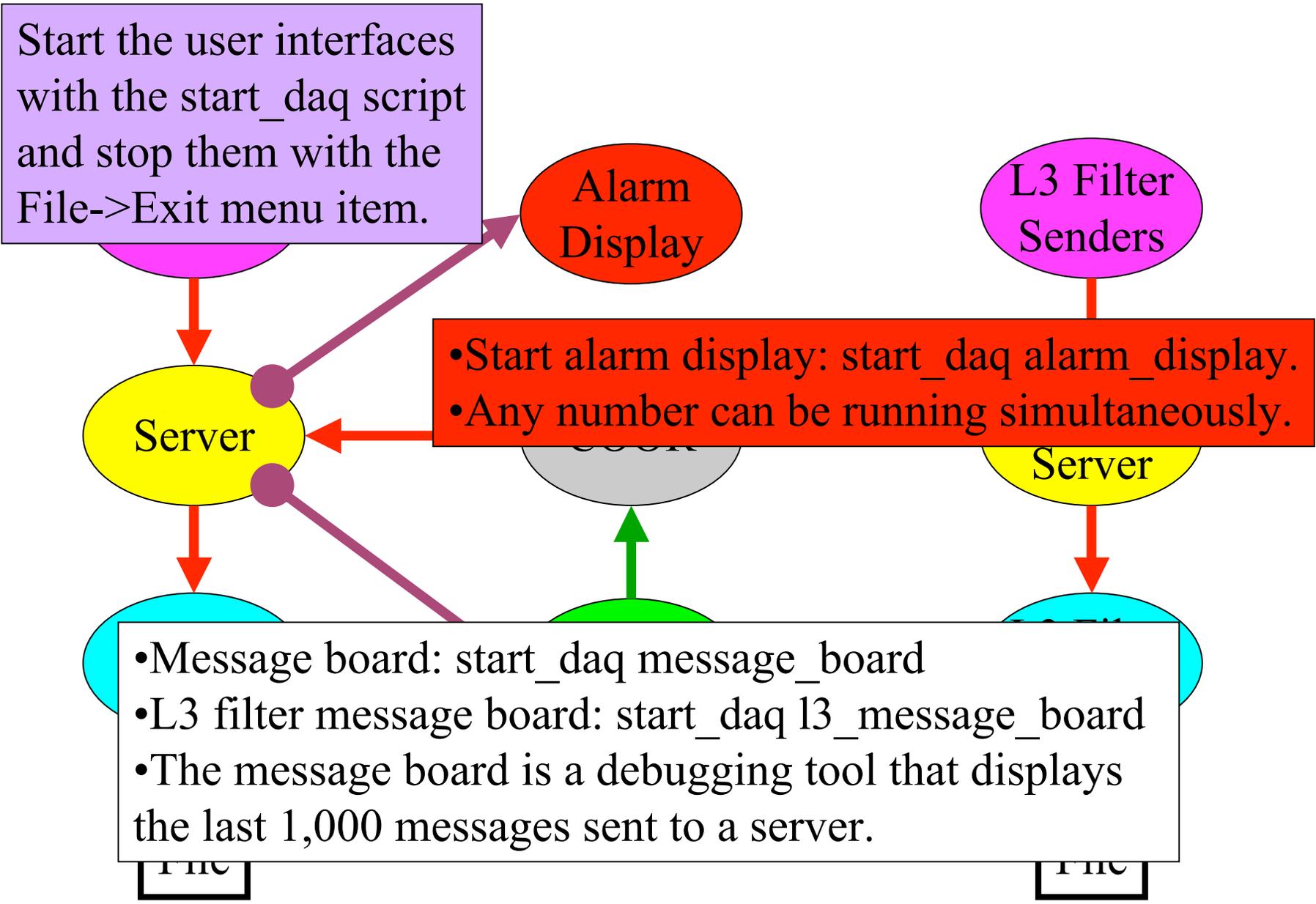


- Start L3 filter server:
start_daq ses_l3_server
- Stop L3 filter server:
stop_daq ses_l3_server



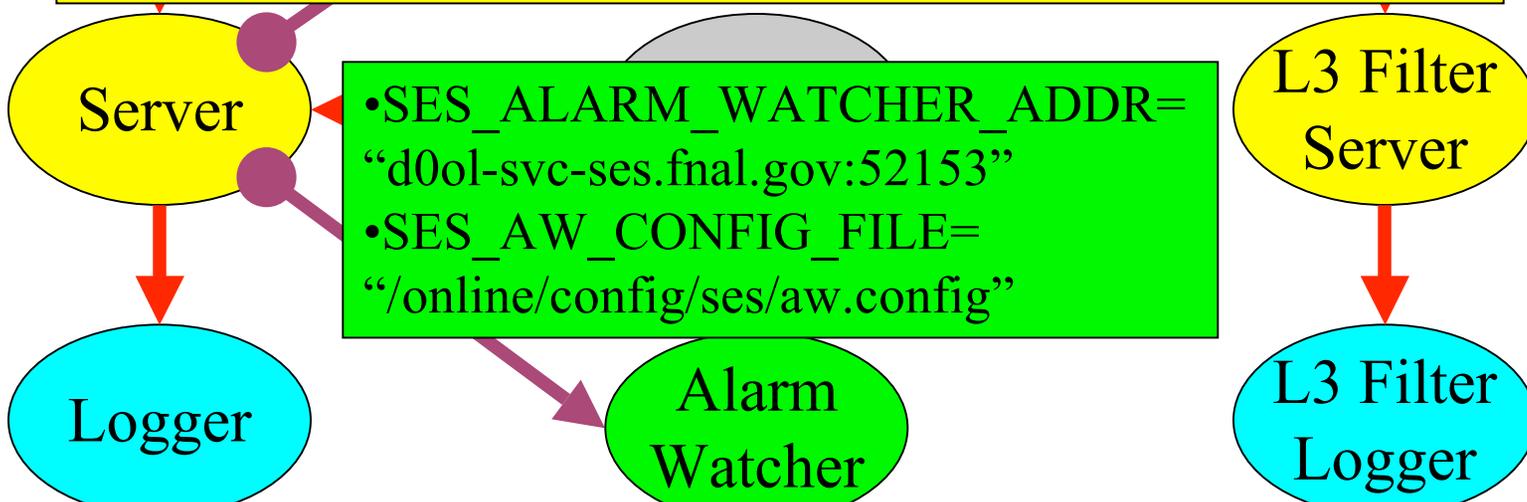
- Start L3 filter logger: start_daq ses_l3_logger
- Stop L3 filter logger: stop_daq ses_l3_logger





Online 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:

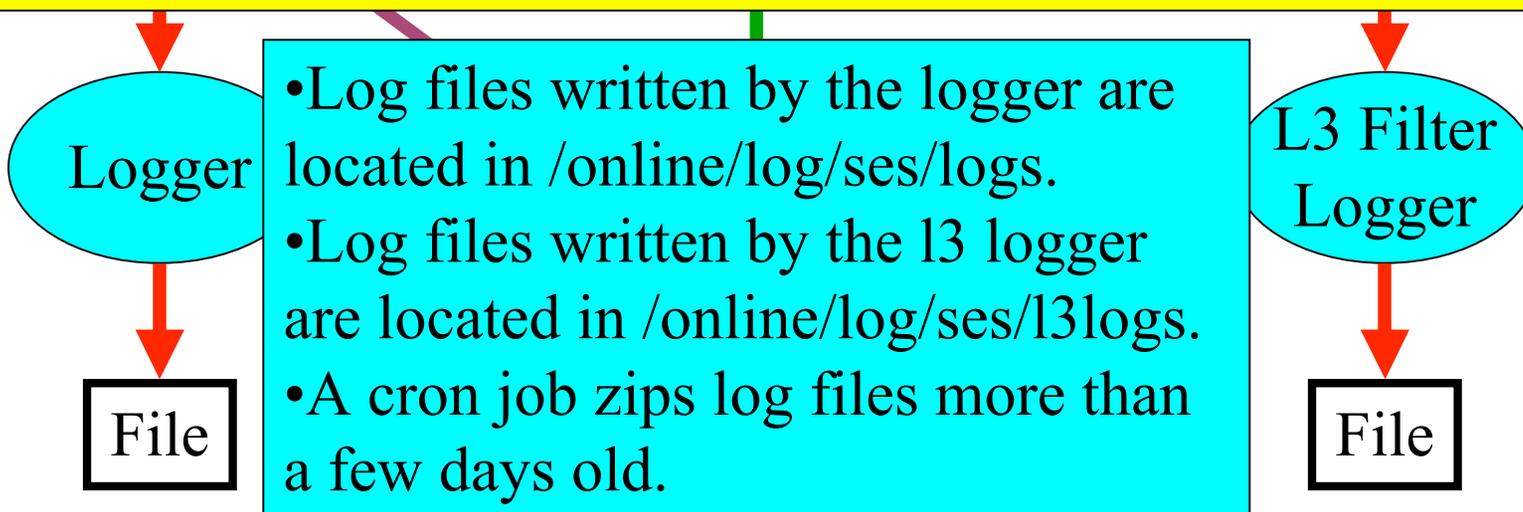
- The logger starts
- At midnight
- The server is restarted

- Date when the file was opened.
- YYYYMMDD-NNMMSSSTZ

arm

L3 Filter

```
Jan 28 23:59 se_log.20040128-000000CST.gz
-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
```



- 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.



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 auxwww`
- ◆ 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
```

Server

```
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
```

L3 Server

```
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
```

Alarm 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 --coord=d0olf.fnal.gov:52127 --online
```



```
<d0olj> ps auxwww | grep selogger | grep 52150
```

Logger

```
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
```

L3 Logger

```
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
```

