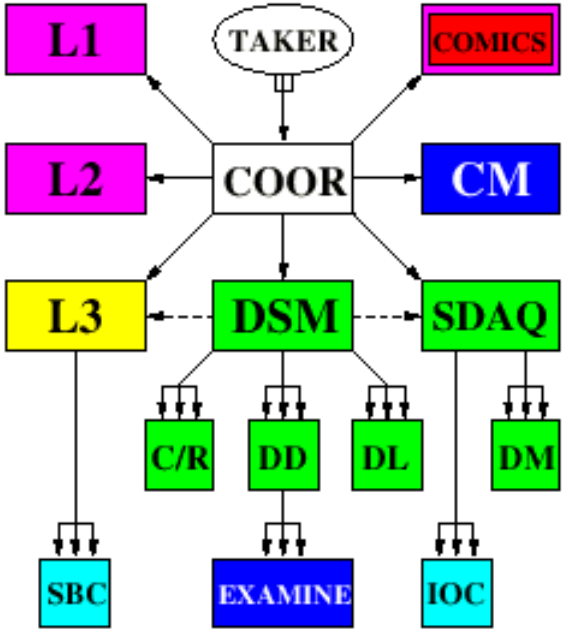
DAQ Back End Tutorial

- The players
  - Data and flow control diagrams
  - Brief description of each application
- Configuration and log files
- Starting and stopping applications
- Monitoring
  - Status web page
- How to reach the experts
- Summary

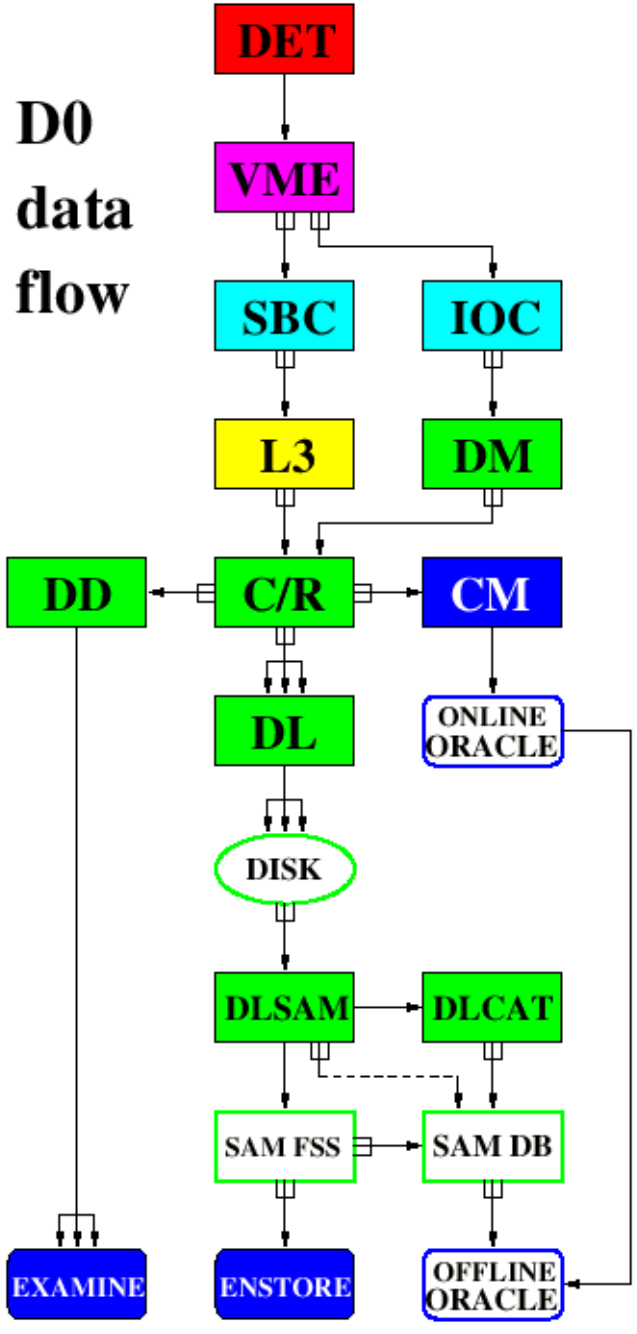
The Players

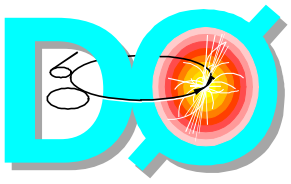


D0 control flow

This tutorial is about the green guys

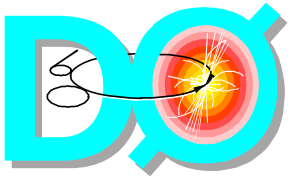
D0 data flow





C/R and DD

- **C/R = Collector/Router**
  - **Receives events from L3 nodes and SDAQ DMs**
  - **Routes an event according to the event's stream(s):**
    - Forwards calibration events to the CM
    - Forwards normal events to their DL(s) and as many as possible to the DD as well
    - Events w/o valid streams are dropped (with a warning)
      - **Log file contains their event header dumps**
      - **Recently observed probability $O(10^{-4})$, clustered in a few spikes**
- **DD = (Data) Distributor**
  - **Receives events from the C/R(s)**
  - **Serves them to connected Examines according to each Examine's stream and trigger wish lists**



The DL

- **DL = DataLogger**
  - **Receives events from C/R(s)**
  - **Saves them in files based on stream, run and partition ("{stream}_{run}_{partition}.raw"):**
    - Each covers an integral number of luminosity blocks
    - Each has an associated event catalog file
    - Late events go to partition 000
    - Events that arrive after their run has ended are dropped (with a warning)
      - **Log file contains their event header dumps**
      - **Recently observed probability $O(10^{-6})$, clustered in a few spikes**
  - **Is told by DLSAM when to move to the next disk**

SDAQ and DM

- **SDAQ = Secondary DAQ Supervisor**
  - **Controls IOC processes ("crates") participating in SDAQ runs (calibration, monitoring, tests)**
  - **Starts and controls corresponding DM processes**
- **DM = DataMerger**
  - **Receives SDAQ event fragments from IOC processes, merges them into complete events and sends those to a CR**
  - **Receives calibration and/or monitoring summaries from IOC processes and sends them to a CR, which will forward them to the CM**
    - Currently this is the main use of the SDAQ

The DSM

- **DSM = Data** (Flow) **State Manager**
  - **Controls all CR, DD and DL instances ("slaves") on behalf of COOR**
    - DD is non-vital → its replies are ignored
    - Puts any restarted "slave" into current DAQ state
  - **Instructs CRs to which DL or CM to route a stream**
  - **Balances load over DLs**
    - Currently there is only 1 DL
  - **Supplies L3 and SDAQ Supervisors with weighted list of CRs**
    - 2nd CR needed when > ~80 L3 nodes

DLSAM and DLCAT

- **DLSAM = DL-SAM interface**
  - **Tells DL when to move to the next buffer disk**
    - When occupancy or time limit is reached
    - Currently 2 TB available (30 disks)
      - **Enough for 2 days of continuous (!) data taking at 12.5 MB/s**
  - **Uses SAM FSS to transfer completed files to Enstore**
    - Checks PNFS before deleting any file
    - Lets DLCAT fix meta-data missing in the SAM DB
      - **When the FSS lost its connection to the DB server**
- **DLCAT = DL (event) Cataloguer**
  - **Checks and fixes meta-data missing in SAM DB**
  - **Stores and checks event catalogs in SAM DB**
    - SAM DB (Oracle) will detect duplicate events, if any

Configuration and Logs

- **/online/data/d0online/d0online_names.py**
  - **Shows on which host(s) an application runs**
- **/online/data/datapath/$host/$app.setup**
  - **Configuration file for application $app on $host**
    - $app can be collector, datalogger, distributor, dlcat, dlsam, dsm, sdaq
- **/online/log/$app/$year/$month**
  - **Holds formatted logfiles**
- **/online/log/$app**
  - **Holds stdout/stderr files (out.* and stop.*)**

Starting and Stopping

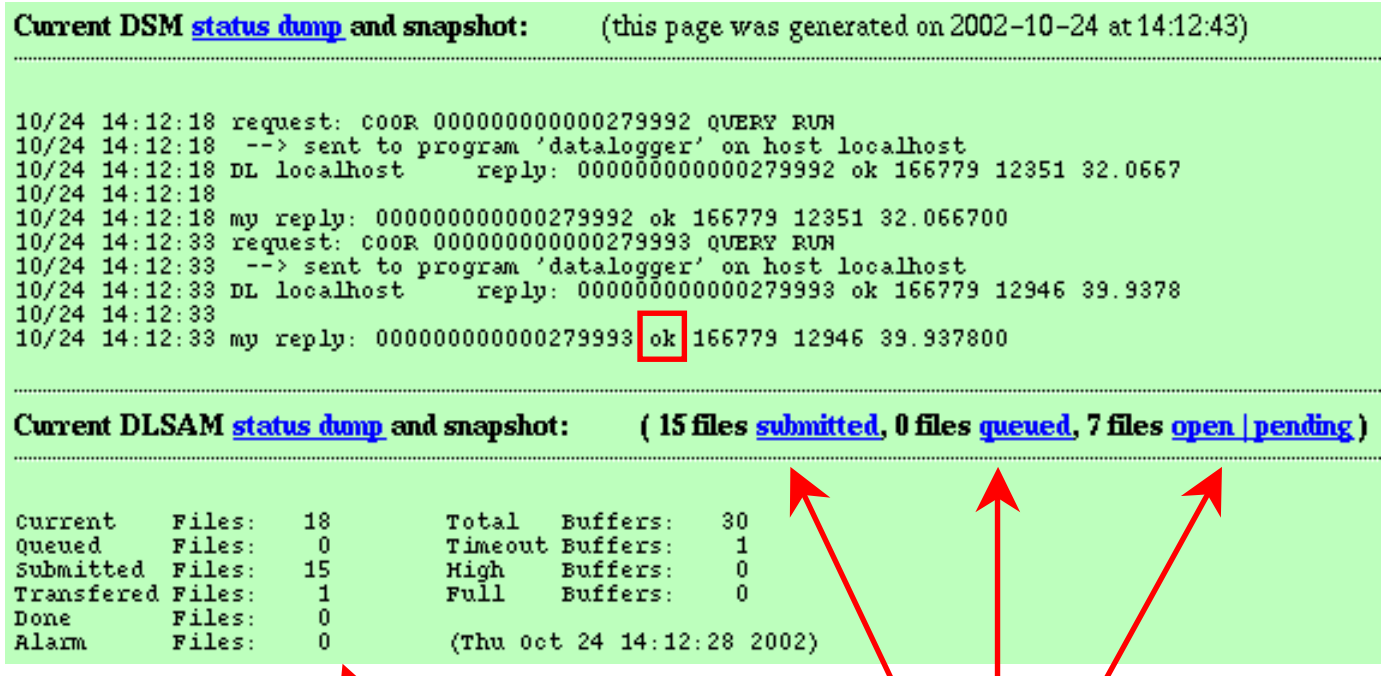
- **Start an application**
  - setup d0online
  - start_daq $app
- **Stop an application**
  - **First stop all ongoing runs!**
    - **Not needed for DLCAT (nor DLSAM, but see below)**
  - setup d0online
  - stop_daq $app
  - **DLSAM must run when the DL is recording a run**
    - It instructs the DL when to move to the next disk

Monitoring

- **Back end status web page**
  - **http://www-d0online.fnal.gov/www/daq/operations/status/onlstatus-auto.html**
  - **Updated every minute**
  - **Frequently checked by the experts**
  - **Usually sufficient to verify the status or to discover problems**

Example Status Page Top

Here the DSM reports all being OK for the ongoing run:



Current DSM status dump and snapshot: (this page was generated on 2002-10-24 at 14:12:43)

```
10/24 14:12:18 request: COOR 000000000000279992 QUERY RUN
10/24 14:12:18  --> sent to program 'datalogger' on host localhost
10/24 14:12:18 DL localhost     reply: 000000000000279992 ok 166779 12351 32.0667
10/24 14:12:18
10/24 14:12:18 my reply: 000000000000279992 ok 166779 12351 32.066700
10/24 14:12:33 request: COOR 000000000000279993 QUERY RUN
10/24 14:12:33  --> sent to program 'datalogger' on host localhost
10/24 14:12:33 DL localhost     reply: 000000000000279993 ok 166779 12946 39.9378
10/24 14:12:33
10/24 14:12:33 my reply: 000000000000279993 ok 166779 12946 39.937800
```

Current DLSAM status dump and snapshot: (15 files submitted, 0 files queued, 7 files open | pending)

```
Current     Files:   18        Total   Buffers:   30
Queued      Files:    0        Timeout Buffers:    1
Submitted   Files:   15        High    Buffers:    0
Transfered  Files:    1        Full    Buffers:    0
Done        Files:    0
Alarm       Files:    0        (Thu Oct 24 14:12:28 2002)
```

Buffer disk subdirectory contents.

DLSAM file state numbers are approximate.

Example Status Page Bottom

Here DLCAT is busy storing 3 event catalogs, another is waiting to be checked against the DB, and another has just arrived:

Last known transfers: (DLCAT: 1 in stage, 0 in meta-check, 3 in store, 1 in cat-check, 0 in cleanup)

```
10/24 14:07:45 all_0000166778_002.raw --> /pnfs/sam/dzero/copy1/datalogger/run160000/datalogger/all/all
10/24 14:08:17 all_0000166778_003.raw --> /pnfs/sam/dzero/copy1/datalogger/run160000/datalogger/all/all
10/24 14:08:48 all_0000166778_004.raw --> /pnfs/sam/dzero/copy1/datalogger/run160000/datalogger/all/all
10/24 14:09:19 all_0000166778_005.raw --> /pnfs/sam/dzero/copy1/datalogger/run160000/datalogger/all/all
10/24 14:09:50 all_0000166778_006.raw --> /pnfs/sam/dzero/copy1/datalogger/run160000/datalogger/all/all
10/24 14:10:21 all_0000166778_007.raw --> /pnfs/sam/dzero/copy1/datalogger/run160000/datalogger/all/all
10/24 14:10:53 all_0000166778_008.raw --> /pnfs/sam/dzero/copy1/datalogger/run160000/datalogger/all/all
10/24 14:11:24 all_0000166778_009.raw --> /pnfs/sam/dzero/copy1/datalogger/run160000/datalogger/all/all
10/24 14:11:55 all_0000166778_010.raw --> /pnfs/sam/dzero/copy1/datalogger/run160000/datalogger/all/all
10/24 14:12:26 all_0000166778_011.raw --> /pnfs/sam/dzero/copy1/datalogger/run160000/datalogger/all/all
```

Application:	CR	DD	DL	DLCAT	DLSAM	DM	DSM	SDAQ
Snapshot:	d0ol31	d0ol34	d0olc	d0olc	d0olc	d0olc	d0olc	d0olc
Episode:	d0ol31	d0ol34	d0olc	d0olc	d0olc	d0olc	d0olc	d0olc

Last N files to Enstore + SAM: 10 100 1k 2k /online: **85%** full, **5624248** kB free

Sorted on run, stream, partition: 10 100 1k 2k Trouble shooting instructions.

The last 100 and 1000+ lines in an application's log file, per host.

Statistics for the last N files transferred. Trouble shooting hints.

DSM Status Snapshot

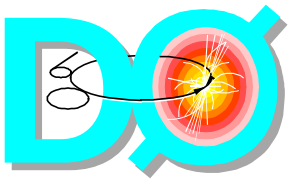
- **Usually shows messages pertaining to the most recent COOR commands**
  - **Click on the DSM log file snapshot or episode link to see more details**
- **Shows if the DSM is “ok” or “bad”**
  - **DSM is “ok” when all its required “slaves” are “ok”**
    - The DD is not required
  - **Click on the DSM status dump link to see more details**
    - Compare the lists of required and connected slaves
    - Absent/misbehaving slaves can be (stopped and) restarted
      - **First stop all ongoing runs**

DLSAM Status Snapshot

- **Shows status of buffer disks and files to be transferred**
  - **"timeout" → DL should move to another disk**
- **Symptoms of SAM or Enstore problems:**
  - **Files staying "Queued" or "Submitted" > 1 hour**
    - DLSAM may recover automatically
    - Stopping and restarting DLSAM rarely helps
      - **The same applies to DLCAT**
  - **Files in "Alarm" state**
    - Expert intervention needed

How to reach the experts

- **The ODS D0 Online Support group has a primary:**
  - Send e-mail to helpdesk@fnal.gov
  - Call the HelpDesk at x2345, or the Computing Services Operators at x2746 after hours, when the problem is urgent
  - **In all cases mention the application that has problems (e.g. "dsm") and its host ("d0olc" will do)**
    - The HelpDesk/Operator needs that information to figure out whom to contact/page
- **Questions and comments about the DAQ Back End can be sent to:**
  - **d0online-support@fnal.gov**



Summary

- **The D0 DAQ back end is an integrated system comprising:**
  - **CR, DD, DL, DLCAT, DLSAM, DM, DSM, SDAQ**
    - Their interactions/dependencies are not trivial
    - Contact the experts for configuration changes
- **DAQ shifters can stop and (re)start the applications**
  - **Following guidelines e.g. found in this tutorial**
  - **Please inform the experts of any problems**
- **The status web page is handy for monitoring and trouble shooting**