



# Data Handling



ANDREW NORMAN

# Talk Overview

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- Infrastructure & Tools
- Data Transport
- Monitoring
- Operations

# The Problem

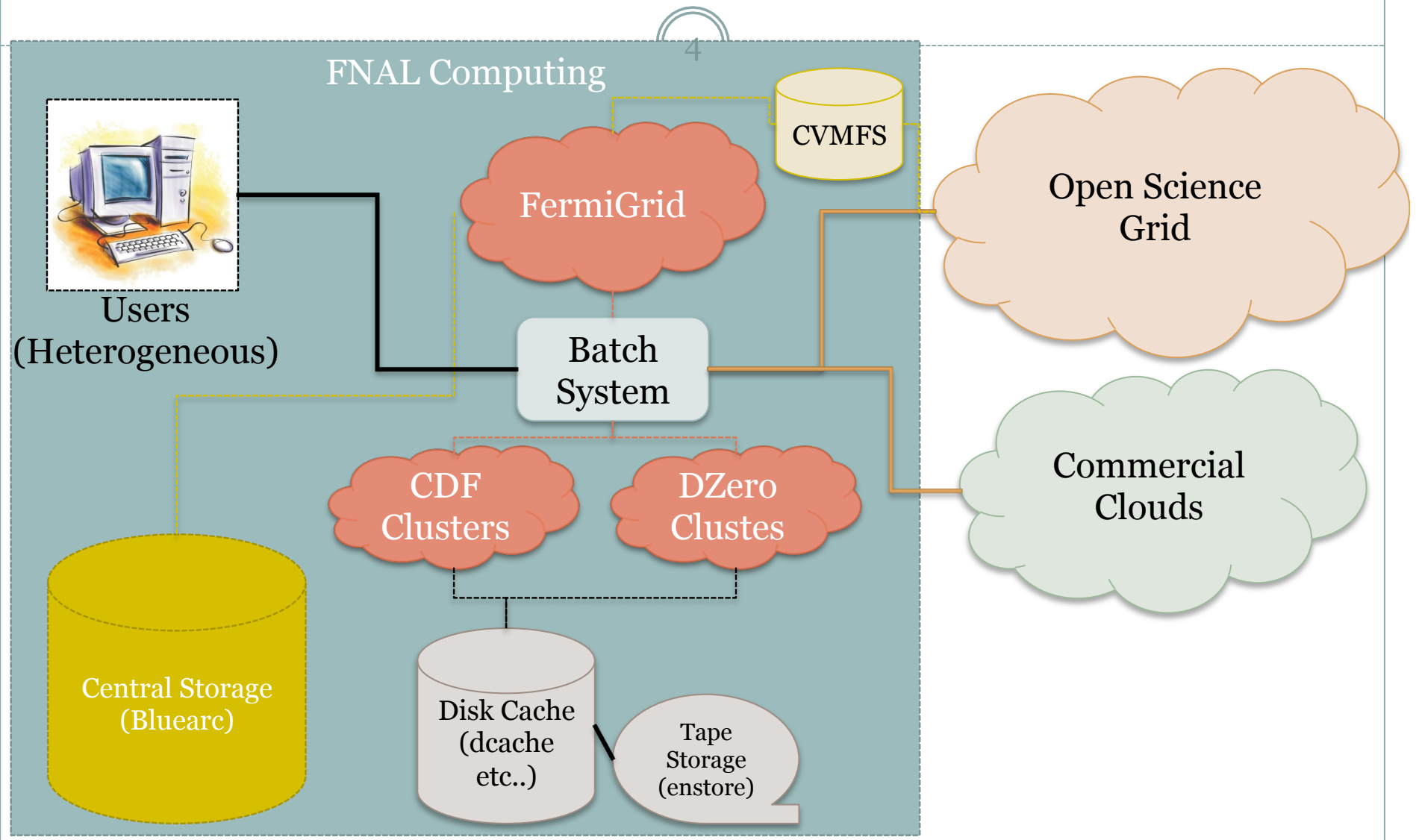
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Moving data  
is hard



We have a  
**LOT** of data

# IF Computing Infrastructure



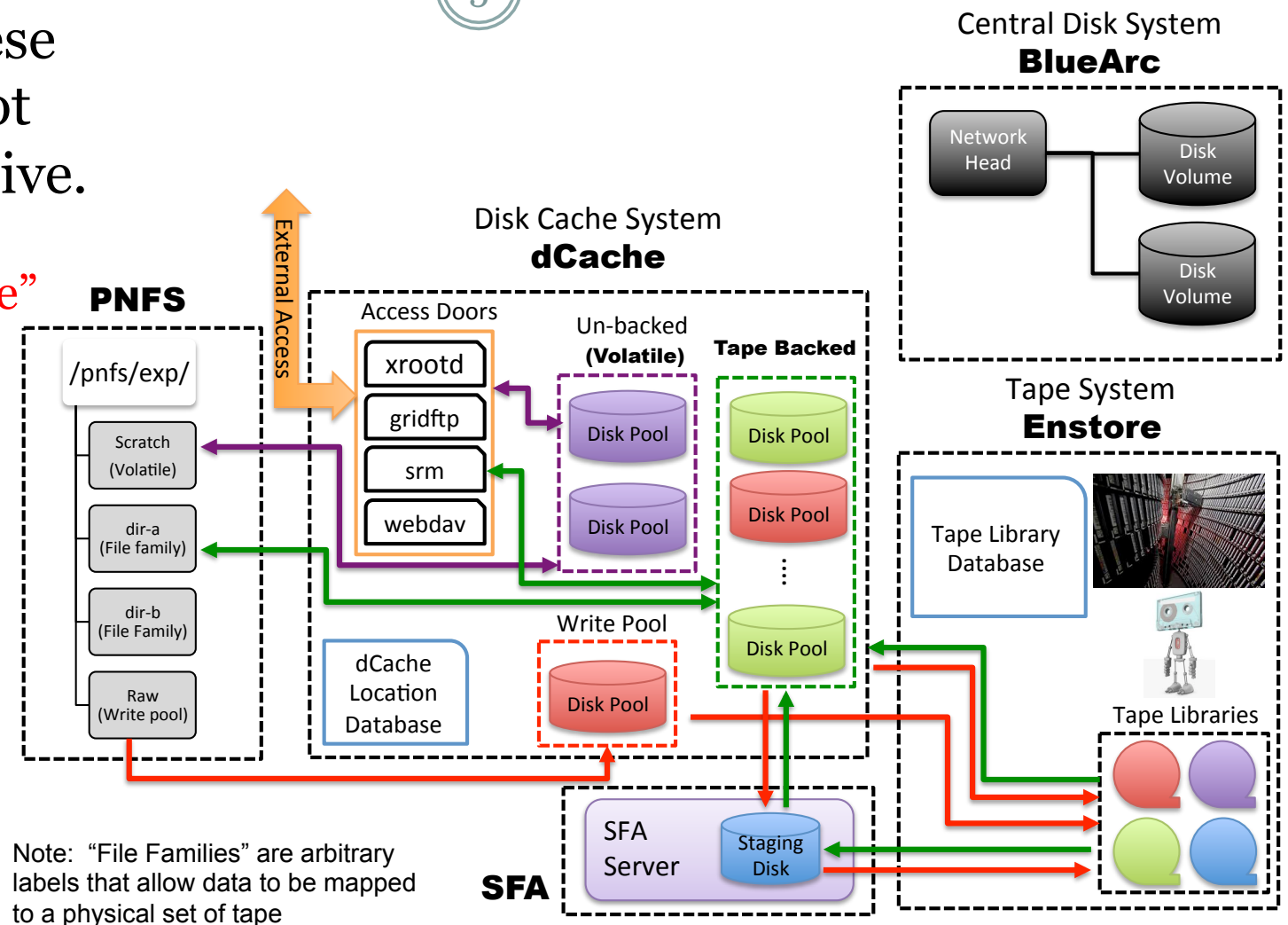
# FNAL Storage

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Access to these systems is not always intuitive.

“Common sense” tasks can have unintended consequences

Need optimized brokers to understand the infrastructure and guard it



# Tools

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- SAM and SAMWeb
- SAM Catalog Browsers
- File Transfer Service
- IFDH

# Sequential Access w/ Metadata (SAM)

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- SAM is a combination of brokers and databases which *OPTIMIZE* access to large sets of data
  - Replica catalogs
  - Managed [site] caches
  - Storage media specific optimizations
    - ✦ Pre-staging mechanisms
    - ✦ Minimize TAPE mounts
- Data catalog services
  - Dataset definition
  - Production level accounting and recovery
  - Data processing project management

# SAMWeb

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- Modern http based Client/Server tools
- Simplifies client access to SAM functionality
  - Eliminates the need for dedicated SAM stations at sites
  - Allows experiments universal access to SAM resources from non-FNAL locations
  - Allows cross platform access to the SAM toolset (Linux/Unix, OSX, anything that can run Python or talk http)
- Improves upon the functions/tasks people really use
  - Simplified function calls
  - Optimizations to common tasks (i.e. multi-file and bulk operations)



# File Transfer Service

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- Handles large scale organization & migration of files
  - Robust/Paranoid mode for Online/DAQ environments
  - High throughput/Permissive mode for Offline environments
- Simplifies “how” files are register w/ data catalogs
  - Operates with the concept of “drop boxes” and rule sets
  - Simplifies managed file replication and hierarchical organization
- Designed to scale to “*production*” levels

# IFDH

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- Swiss army knife of file delivery
- Designed to be a lightweight toolkit to handle the last leg of file delivery
  - “Smart” broker with location awareness
  - Integrated with SAM data catalogs
  - Modular system for transfer protocols
    - ✦ Provides single end user interface and syntax
    - ✦ Allows for workflows with “mixed” transport requirements
  - Handles authentication and certificate generation for FNAL users
  - Bidirectional operation (i.e. copy-in and copy-out)
    - ✦ Includes bulk copy operations
- Most end users only need IFDH



# What's New

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- SAM
  - Easier deployment
  - New streamlined scheme
  - New user level documentation
  - Optimizations to servers/stations
    - ✦ dCache/Enstore + SFA
  - Integration with postgres databases
- SAMWeb
  - Registered locations ➡ “access schema” translation
    - ✦ dCache, xrootd
  - New Authentication and Administration interfaces
  - Integration with dCache
    - ✦ Many functions optimized for dCache access methods
  - New dataset management options (deletes, renames, etc...)

# What's New

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- FTS
  - Simplified Configuration
  - Integrated with dCache
    - ✦ Permits use of “volatile” pool for intermediate copyback
    - ✦ Optimized for dCache specific access methods
  - “Standard” recipes now provided for common uses
    - ✦ ART framework files designed to work transparently
    - ✦ Auxiliary tools, modules and services included in toolkit
- IFDH
  - Expanded support for access methods (dCache, xroot, etc...)
  - Bulk transfer methods
  - Background transfer services
  - Simplified “smart” Authentication

# SAM & SAMWeb: Tricks

# Basic Data Sets

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- Define a dataset based on some “tier” and metadata selection criteria

```
# Setup SAMWeb – It’s a UPS product
export PRODUCTS=/grid/fermiapp/products/common/db/:$PRODUCTS
setup sam_web_client <version>
# Get a certificate
kx509
```

Selection Criteria

```
samweb count-files “data_tier raw”
1641854
```

Additional Selection Criteria

```
samweb count-files “data_tier raw and online.detector fardet”
1415308
```

# Basic Data Sets

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- With enough criteria select just the data you want:

```
samweb count-files "data_tier raw and online.detector fardet and  
start_time > '2014-06-15T23:59:59' "  
5257
```

- Create “name” for the selected

```
Samweb create-definition fardet_data_today "data_tier raw and  
online.detector fardet and start_time > '2014-06-15T23:59:59' "
```

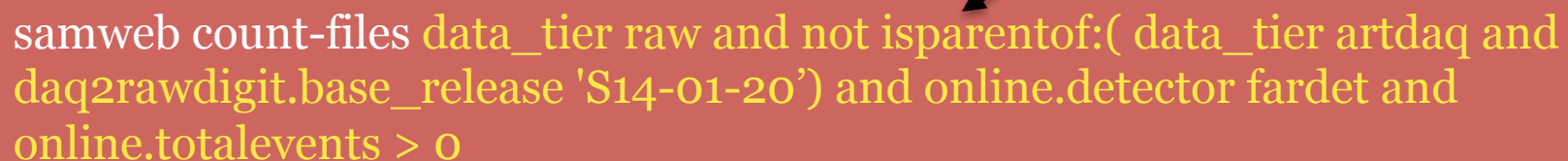
- Can now use this dataset for analysis/production

# Advanced Data Sets

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- Datasets are dynamic.
  - They are recalculated each time they are requested.
- Draining dataset pattern
  - Looks for children
  - Use with a job that makes children
  - Dataset size approaches zero as you run
  - Auto recovery

Shrinks as output is produced



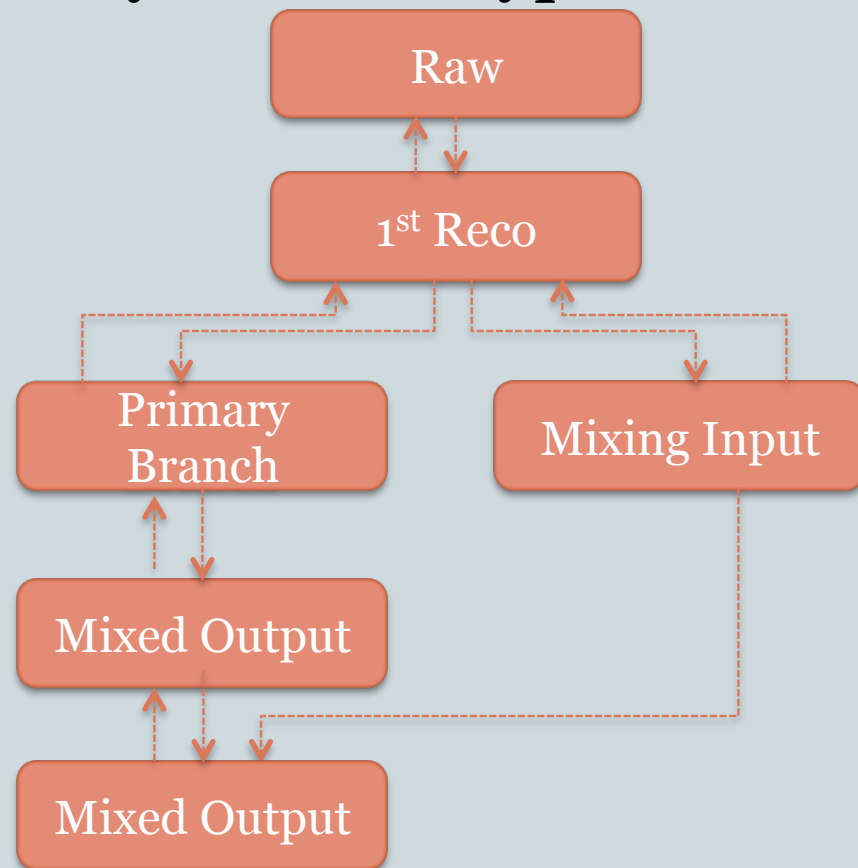
```
samweb count-files data_tier raw and not isparentof:( data_tier artdaq and  
daq2rawdigit.base_release 'S14-01-20') and online.detector fardet and  
online.totalevents > 0
```



# Advanced Data Sets

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- Can use parentage to specify different types of complex relationships
  - Can do peers, mixing etc...
- Preserves the full parentage of every file
  - Files inherit meta-info
  - Fully trackable



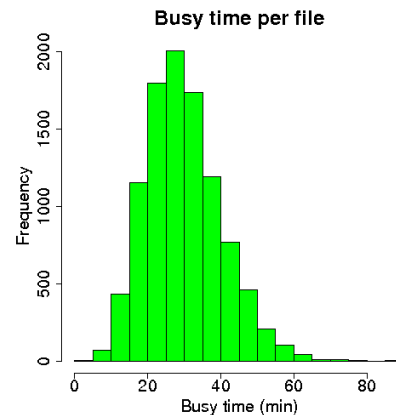
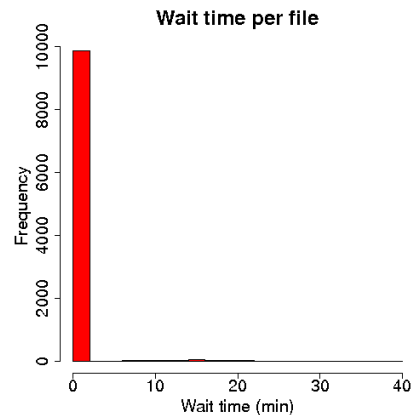
# Projects and Monitoring

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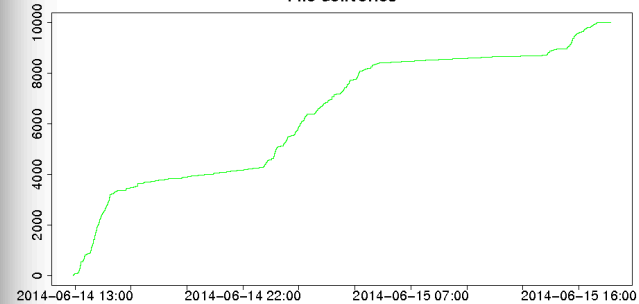
## Project ynitin-nitins\_job\_MC-20140614\_1225

Generated at 2014-06-16 13:26:47

Project Id	16751
Status	running
Owner	ynitin
Start time	2014-06-14 12:26:02
Dataset definition	prodreco_S14-03-25_FDCRY
Files in snapshot	10069
Files seen	10001
Processes	10001
Busy processes	0
Finished processes	9997
Waiting processes	0
Error processes	4
Mean wait time (per file)	19s
Mean busy time (per file)	29min 54s
Last activity	process ended at 2014-06-15 17:43:14



File deliveries



Plot of activity by consumer process

### Processes

Process Id	Node name	Status	Description	Files seen	Last change	Waiting for	Mean wait time (per file)	Mean busy time (per file)
735957	fnpc6026.fnal.gov	completed	16677126.5	1	2014-06-14 13:11:25 (process ended - completed)	-	0s	17min 59s
735958	fnpc6005.fnal.gov	completed	16677126.0	1	2014-06-14 13:13:34 (process ended - completed)	-	0s	20min 8s
735959	fnpc6027.fnal.gov	completed	16677126.2	1	2014-06-14 13:11:09 (process ended - completed)	-	0s	17min 43s
735960	fnpc6027.fnal.gov	completed	16677126.1	1	2014-06-14 13:06:49 (process ended - completed)	-	0s	13min 23s
735961	fnpc6000.fnal.gov	completed	16677126.6	1	2014-06-14 13:15:24 (process ended - completed)	-	0s	21min 58s
735962	fnpc6000.fnal.gov	completed	16677126.3	1	2014-06-14 13:03:35 (process ended - completed)	-	0s	10min 9s
735963	fnpc6023.fnal.gov	completed	16677126.8	1	2014-06-14 13:18:13 (process ended - completed)	-	0s	24min 47s
735964	fnpc6030.fnal.gov	completed	16677126.7	1	2014-06-14 13:12:07 (process ended - completed)	-	1s	18min 39s
735965	fnpc6030.fnal.gov	completed	16677126.4	1	2014-06-14 13:14:35 (process ended - completed)	-	1s	21min 7s
735966	fnpc6026.fnal.gov	completed	16677126.10	1	2014-06-14 13:13:59 (process ended - completed)	-	0s	18min 12s
735967	fnpc6030.fnal.gov	completed	16677126.15	1	2014-06-14 13:26:22 (process ended - completed)	-	0s	30min 32s
735968	fnpc6013.fnal.gov	completed	16677126.9	1	2014-06-14 13:23:31 (process ended - completed)	-	0s	27min 40s
735969	fnpc6022.fnal.gov	completed	16677126.16	1	2014-06-14 13:13:08 (process ended - completed)	-	0s	17min 16s
735970	fnpc6028.fnal.gov	completed	16677126.11	1	2014-06-14 13:16:43 (process ended - completed)	-	1s	20min 50s

# Detailed FTS Monitoring

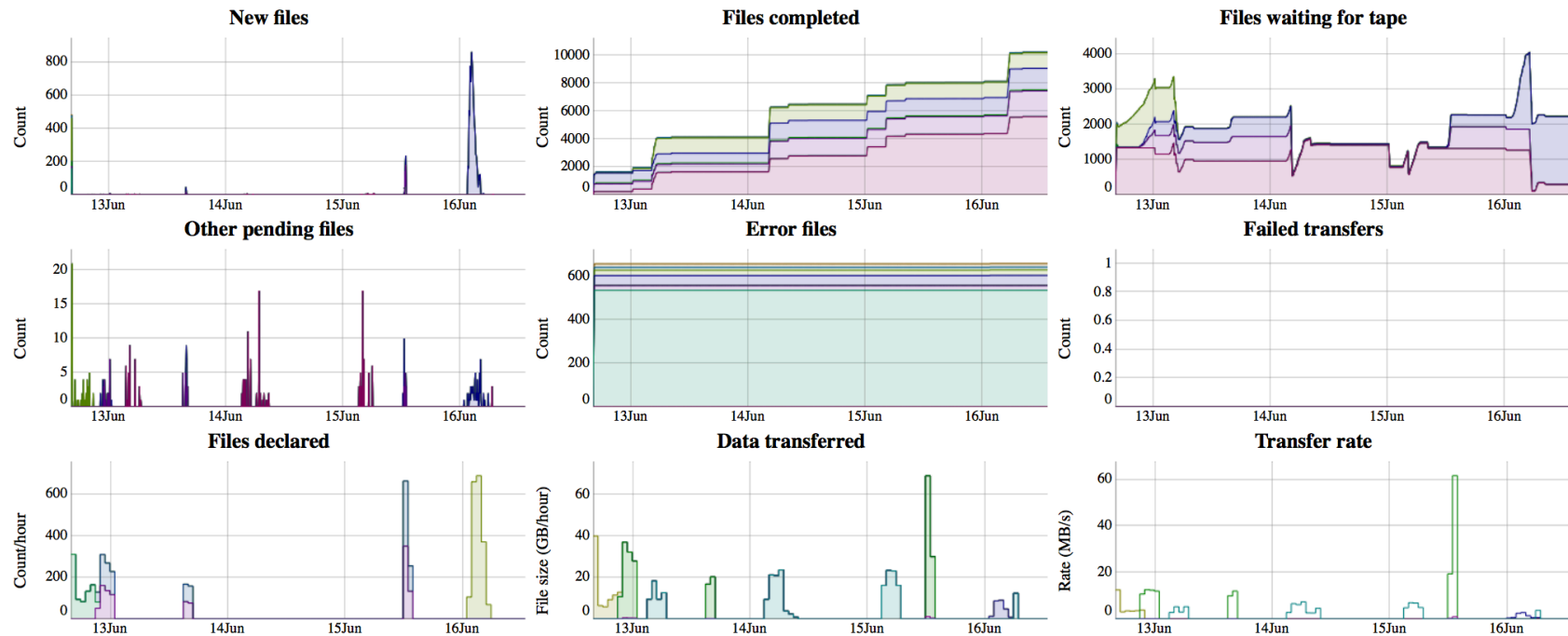
## FTS status for novasamgpvm02.fnal.gov

Generated at 2014-06-16 13:32:45 CDT ([refresh](#))

### Summary

FTS: OK FSS: OK Stager: OK

Completed files:	10273
Failed transfers:	0
All error files:	659
Waiting on tape:	2238
Other pending files:	0
New files:	0



# Tailored Web Interfaces

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- Web Interfaces are tailored to the experiment's data catalogs
  - Data tiers
  - Specific metadata
- Provides the “novice” interface for new users

## NOvA Monte Carlo Dataset Definition Editor

This page is designed to allow you to define your own custom data sets based on the current NOvA Monte Carlo data files that have been generated. To access the raw data or processed data set pages follow these links:  
[Raw Data Files and Sets](#)  
[Processed \(Reco\) Data Files and Sets](#)  
For more information on creating and using custom data sets see:  
[SAM Data Sets Wiki](#)

### Monte Carlo Selection Criteria

Previously Defined Data Sets:

Group/User:

(To start with a previously defined dataset)

<input type="button" value="raw"/>	<input type="button" value="Add Data Tier"/>
<input type="button" value="Run Start Time"/>	<input type="button" value="Add Date Range"/>
<input type="button" value="Run Number"/>	<input type="button" value="Run/Subrun Selection"/>
<input type="button" value="Trigger Stream"/>	<input type="button" value="Trigger Selection"/>
<input type="button" value="Detector"/>	<input type="button" value="Detector Selection"/>
<input type="button" value="Generator"/>	<input type="button" value="Generator Selection"/>
<input type="button" value="Horn Polarity"/>	<input type="button" value="Horn Selection"/>
<input type="button" value="v Type"/>	<input type="button" value="Horn Selection"/>
<input type="button" value="v Interaction"/>	<input type="button" value="Int. Selection"/>
<input type="button" value="No. Spills"/>	<input type="button" value="Add Event Selection"/>
<input type="button" value="GDML Geom File"/>	<input type="button" value="Geometry Selection"/> (Example: 'Geometry/gdml/ndos.gdml')
<input type="button" value="Job FHCL File"/>	<input type="button" value="FHCL Selection"/> (Example: cosomics_ndos_10000_r1_99.fcl)
<input type="button" value="GLOBAL"/>	<input type="button" value="GLOBAL.requestid"/>
<input type="button" value="Clear Query"/>	<input type="button" value="Add Selection"/>

(Date format: 2011-05-09 or Date/Time format: 2011-05-09T23:46:04)

### Logical Operators

Use these operators to join your criteria together.

### Data Set Definition (Dimensions query):

(you may also edit this query string directly to add custom fields to your query)

(SAM Translate)

Name your dataset:  user:  group:   
Datasets can have an arbitrary name but should not include spaces or special characters (underscores and dashes are permitted)

# Data Handling Service

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**ONLINE PRODUCTION OPERATIONS GROUP**

# Offline Production Operations Group (OPOG)

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- New group formed to address production needs of Fermilab experiments
- Designed to assist and/or run the large scale experiment workflows (simulation, reconstruction, etc...)
- Based on requests from Minos, Nova, Minerva
- Starting Operations Now
  - Marek Z. (MINOS)
  - Jenny T. and Paola B. start July 14<sup>th</sup>

## Offline Prod Ops Group (OPOG)

Physicist  
(New Hire)

Marek  
ZIELINSKI  
(Minos)

Jenny  
Teheran  
(Operator)

Paola  
Buitrago  
(Operator)

Data Handling

# Scope

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- The group is patterned off the CMS operations group
- Provides skilled “operators” who are able to:
  - submit, monitor, validate, triage the large scale experiment “production” work.
- Targeted at experiment’s needs for dedicated personnel who can:
  - Understand the grid processing infrastructure and successfully:
    - ✦ Run “keep up” processing of detector data
    - ✦ Submit large scale simulation jobs
    - ✦ Submit large scale reconstruction passes
    - ✦ etc...
- **Augments** the experiments own offline groups with additional operators

# Scope (cont.)

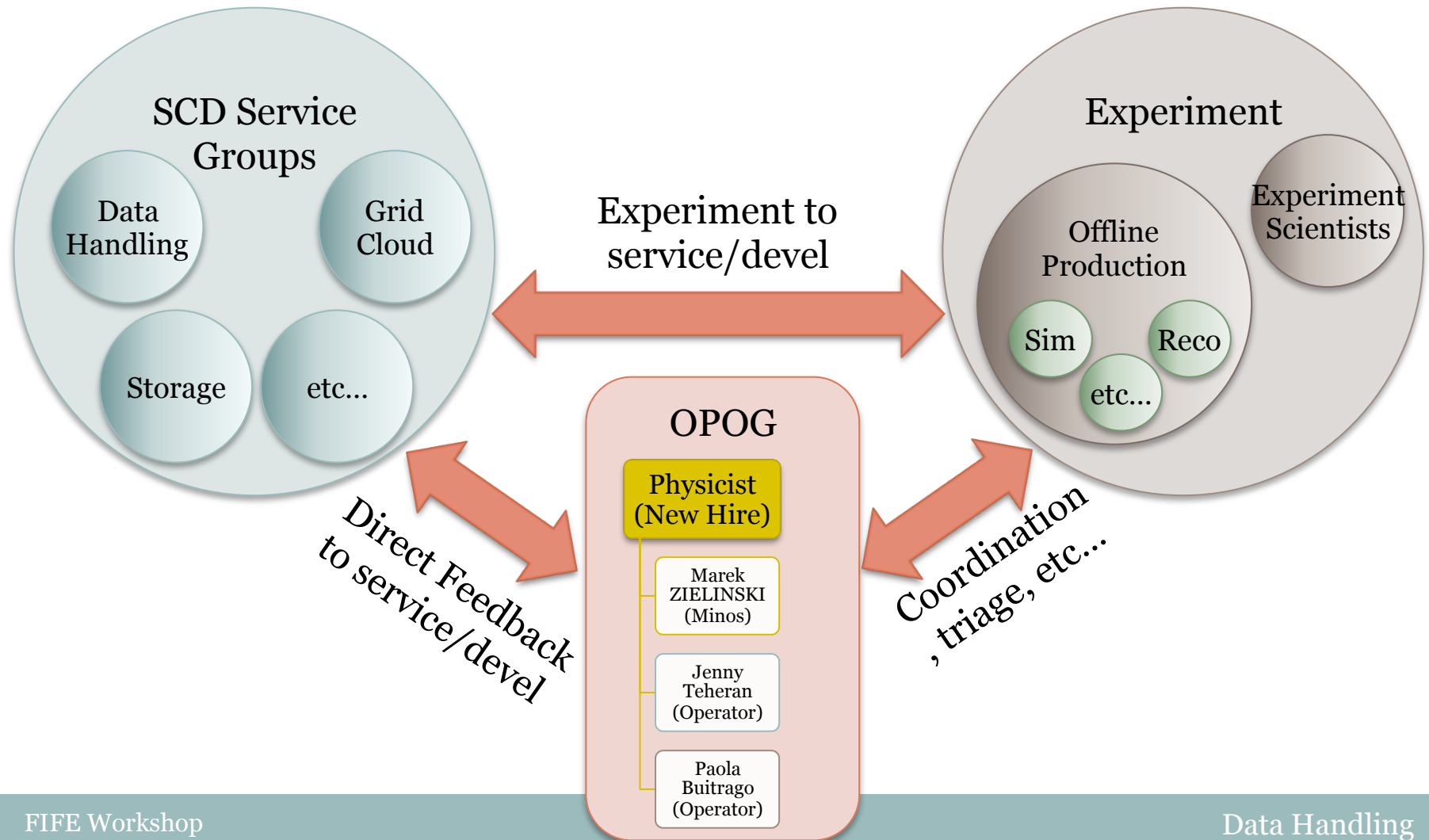
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- The group is not technically “developers”
  - They will understand the general workflows but are not the programmers who work with the experiment on their scripts/code
  - However....
    - ✦ Jenny and Paola are actually computer scientists with extensive development work in workflow management and cloud computing
- They provide feedback to the experiments and to SCD service groups (i.e. diagnose/report problems)
  - They coordinate across multiple requests from the experiments to get the work done (i.e. balance the “keep up” with the latest “sim” request)
  - They can provide feedback to Liaisons about activities outside their experiment



# OPOG

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# OPOG Time Scale

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- First operator hired (M. Zielinski)
  - Assigned to Minos
- Remaining Operators start July 14<sup>th</sup>
  - Preliminary Assignments:
    - ✦ Nova
    - ✦ Minerva
- Interviews have started for group leader  
(Acting Group Leader: A.Norman)
- Goal is to have full group operational by late July