ATLAS-D Meeting 2013 - Würzburg GRID Introduction M. Böhler

September $24^{\rm th}$ 2013

Albert-Ludwigs-Universität Freiburg



Outline

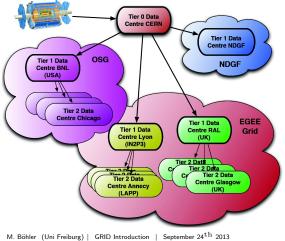
- ATLAS Computing Grid
 - A brief overview of the whole thing
- Distributed Data Management
 - How's data distributed in the Grid?
- Distributed Analysis Interfaces
 - how are analyses scheduled in the Grid?
- GRID and my Analysis?
 - Which tools do I need in order to perform a complete ATLAS analysis?





The ATLAS Computing GRID

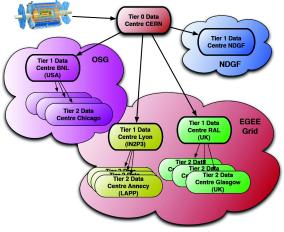
- In fact ATLAS uses three grids:
 - EGI in Europe, Asia and Canada
 - OSG in USA
 - NorduGrid in Nordic countries
- All badged as Worldwide LHC Computing Grid compatible
- However, this is a fact which we mostly try and hide from you





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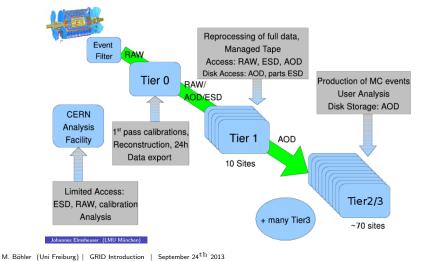


- ▶ 1 Tier-0: CERN
- 10 Tier-1: National Computing Centres (BNL, RAL, IN2P3, ..., FZK)
- ► ~ 40 Tier-2: Regional Computing Centres (CSCS, CYF, DESY-HH,...)
- Composed of multiple individual sites for local User Anlaysis (NAF2.0,...)
- ~100 Analysis queues in PanDA



ATLAS GRID Data Flow

- prompt reconstruction and several data formats are directly processed at CERN
- reprocessing campaigns (e.g. new SW releases, new calibrations) are processed on the GRID (mainly Tier1s)
- MC production and user analysis (Tier1s and Tier2s)





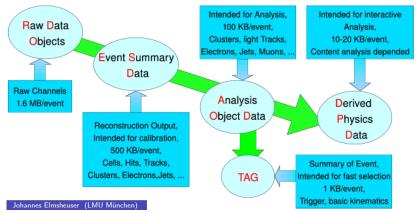
ATLAS	Computing	Grid

Distributed Data Management

Distributed Analysis Interfaces

GRID and my Analysis?

Data Formats



Missing here: dESD and dAOD (Distribution similar to DPD/AOD)

- from most detailed data format RDO to final Derived Physics Data
 - data is combined into higher level objects
 - data is slimmed, skimmed, and thinned





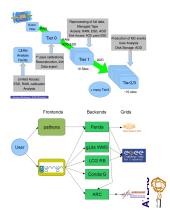
ATLAS GRID Architecture

- Production System (prodsys + Panda) : centralized MC simulation and Data reconstruction
 - Useful Tool: ATLAS Metadata Interface (AMI)
 - AMI knows about all datasets, their dependencies and their metadata http://atlas-ami.cern.ch:8080/AMI/servlet/

 Distributed Data Management (DDM/DQ2) : centralized data movement and catalog system

 Distributed User Analysis : de-centralized individual analysis (ganga + pathena)

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Distributed Data Management (DDM)

Data management is at the core of all ATLAS GRID activities

- All data organised as datasets
 - Which contain multiple files

```
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data12_8TeV.00203454.physics_Egamma.merge.NTUP_TAU.r4065_p1278_p1443/
[] NTUP_TAU.01224072._000001.root.1 56a2c1530-5602-49ef-8063-55309a886a0b6 ad:575182f9 4826841984
[] NTUP_TAU.01224072._000002.root.1 55202f3-cbe4-41fa-94d46-9b4a0tf665a ad:99f361cc 3700907305
[] NTUP_TAU.01224072._000004.root.1 65402f15-cbe4-41fa-94d46-9b4a0tf665a ad:99f361cc 3700907305
[] NTUP_TAU.01224072._000005.root.1 7bd5f2f7-ad33-4fe3-9dtb-44464bbe75e4 ad:8b1f4745 3809997412
...
[] NTUP_TAU.01224072._000015.root.1 fbc35582-6a09-4d26-a8db-9be15473e800 ad:f60637f9 4369755635
total files: 15
local files: 0
total size: 64453708501
date: 2013-03-25 20:09:46
```

- Datasets are the units of replication on the GRID
 - So the DDM central catalog records the location of complete datasets on the GRID, as well as the content of each dataset
 - Datasets can be grouped in containers https://twiki.cern.ch/twiki/bin/viewauth/AtlasProtected/PhysicsContainers
 - Datasets are also the basic input to an analysis
- DDM also moves data between sites on the GRID



Datasets

Dataset can have different states

- Open: new files can be attached to the dataset
- Closed: no new files can be attached to the current dataset version. But a new version can be created and new files added to it
- Frozen: no new files can be added to the datasets not possible to create a new version

► The datasets/containers can be subscribed (copied) from one site to another site.

- Official datasets (e.g. AOD, ESD, DESD) are placed centrally on different sites and have many replicas on some official area
- Datasets produced by groups (e.g. D2PD) are managed by group managers and placed on some group area
- User can request some of the official datasets, group or user datasets to be moved to some user areas
- The different areas are identified by Space Tokens



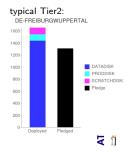
DATADISK DATATAPE

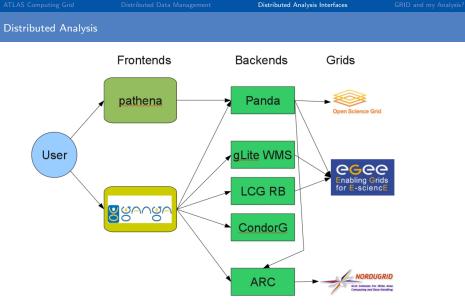
SCRATCHDISK

Space tokens



- - transient space, with a lifetime of less than 30 days
 - default space where Distributed Analysis tools write
 - data needs to be stored permanently somewhere else
 - 1. download them using DQ2 tools
 - 2. move them on a permanent storage e.g. using DATRI
- ATLASLOCALGROUPDISK : (DESY-HH_LOCALGROUPDISK)
 - this is permanent storage
 - available on all German sites included in DQ2
 - Only people with group /atlas/de in VOMS can request replication to this space
 - no space limitation per user BUT if you are using too much space $O(5 \text{ TB}) \rightarrow \text{you might be contacted...}$





- Data is centrally being distributed by DQ2
- Jobs go to data

PanDA Client Tools

- PanDA is the main ATLAS Production and Distributed Analysis system
- PanDA Client Tools consists of several tools for job execution on the grid and bookkeeping
 - pathena for submitting Athena jobs to PanDA
 - prun for general jobs (e.g. ROOT and Python scripts) to PanDA
 - psequencer allows for a sequence of different tasks to be submitted (e.g. an analysis job followed by the transfer of the output back to the local machine)
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 - 1. Run Athena on AOD/ESD to produce DPD (pathena)
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- 1. pAthena: Client tool for PanDA to submit user-defined jobs from the command line
 - Works on the Athena runtime environment
 - A consistent user-interface to Athena

When you run Athena locally with *athena jobOptions.py* all you need to do to submit a job to the grid is

```
pathena jobOptions.py [--inDS inputDataset] --outDS outputDataset
```

for more instructions see:

pathena -h



Monitoring PanDA jobs (1)

```
2. prun: submit a simple (e.g. plotting) job:
```

```
prun --outDS user.boehlerm.pruntest_Hello --exec HelloWorld.py
```

...you can directly follow your job with the PandalD, here: PandalD=1903903212 Go to: http://panda.cern.ch and enter your PanDA id in job field in the left column



Monitoring PanDA jobs (2)

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- job finished correctly (green field)
- Most common grid failures: stage-in or stage-out
- \blacktriangleright For less obvious failures, check log files \rightarrow Find and view log files

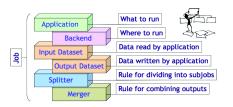


Ganga

- Ganga combines components to provide a front-end client for interacting with Grid infrastructures
- Ganga allows simple switching between testing on a local batch system and large-scale data processing on Grid distributed resources
- Jobs look the same whether they run locally or on the Grid
 - \rightarrow Configure once, run anywhere

GANGA offers three ways of user interaction:

- Shell command line (example on this page)
- Interactive IPython shell
- Graphical User Interface



ganga athena AnalysisSkeleton_topOptions.py --panda --inDS fdr08_run2.0052283.physics_Muon .merge.AOD.o3_f8_m10 --outputdata AnalysisSkeleton.aan.root --split 3



Monitoring Ganga Jobs

- Interactive IPython shell:
 - just setup and start ganga:

setupATLAS localSetupGanga ganga

More Ganga features:

- resubmit functionality
- submit more jobs when others are completed

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 Graphical Web Interface (not Ganga specific, but you can use it to monitor your jobs): https://dashb-atlas-task.cern.ch/templates/task-analysis/

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M. Böhler (Uni Freiburg) | GRID Introduction | September 24th 2013

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- 4. You found a couple of interesting/problematic events
 - check the event by eye make your own event display (last session of the day)



More Help:

- Distributed Data Management
 - DDM Twiki:

https://twiki.cern.ch/twiki/bin/viewauth/AtlasComputing/DistributedDataManagement

- Panda
 - Where to get help when you need it! hn-atlas-dist-analysis-help@cern.ch (Distributed Analysis Help)
 - CERN Tutorial: https://twiki.cern.ch/twiki/bin/viewauth/AtlasComputing/SoftwareTutorialUsingTheGrid
 - Distributed Analysis with Panda (with FAQ) https://twiki.cern.ch/twiki/bin/view/Atlas/DAonPanda
 - Find your jobs in the PanDA monitor http://panda.cern.ch
 - Panda wiki page https://twiki.cern.ch/twiki/bin/view/AtlasComputing/Panda
- Ganga:
 - All analysis-tools related problems → The Distributed Analysis List hn-atlas-dist-analysis-help@cern.ch
 - The General Ganga Manual http://ganga.web.cern.ch/ganga/
 - The Full GangaAtlas Tutorial https://twiki.cern.ch/twiki/bin/viewauth/AtlasComputing/FullGangaAtlasTutorial
 - A GangaAtlas Quick Start Guide https://twiki.cern.ch/twiki/bin/viewauth/AtlasComputing/GangaAtlasQuickReferenceGuide
 - GangaAtlas FAQ https://twiki.cern.ch/twiki/bin/viewauth/AtlasComputing/DAGangaFAQ