# Examples of shared ATLAS Tier2 and Tier3 facilities

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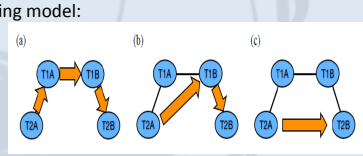
## Introduction

The ATLAS computing challenge consists of storing, processing and reprocessing, and accessing to those data from any institute of the collaboration. This task has been done thanks to the **Worldwide LHC Computing Grid project** (WLCG) which is a global collaboration linking GRID infrastructures. To achieve with this goal the WLCG has defined different type of computing **centres in Tiers**.

•**Tier0**: It is based at CERN and the raw data are recorded to tape and a first processing is done.
•**Tier1s**: There are 10 sites, which are storing the raw data on tapes; analysis/real data on disk and a reprocessing is carried out.
•**Tier2s**: There are 38 centres taking care of analysis data on disk, providing resources for user analysis and producing the Monte Carlo simulation events.
•**Tier3s**: Local computing resources for the user belonging to an institute or University.

## Evolution of the ATLAS data and Computing Model

The evolution of the data transfer routing model:
(a)The original model relied on the presumably efficient network between Tier1s and between associated Tier1 and Tier2 sites.
(b) Some Tier2s are well connected to many other Tier1s and can skip transfer routing via their associated Tier1.
(c) The transfer efficiencies between some Tier2s not associated to the same Tier1 are good enough to make direct transfers without routing via Tier1.

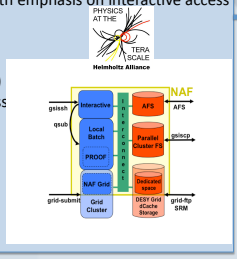



**Tier2Ds:**
The connectivity of each Tier2 with respect to each one of the Tier1s is reviewed. Those that fulfil a certain performance are then classified as Tier2D

## Tier2 & Tier3 activities in different institutes

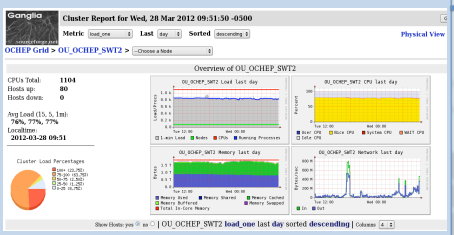
### Germany and the National Analysis Facility (NAF)

DESY is a Tier-2 for ATLAS and CMS experiments:
• Tier-2 resources integrated into a large Grid installation.
• gLite middleware is used to offer these resources to the worldwide community.
NAF offers additional Grid resources to physicists from German institutes:
• Located at DESY and profit from its infrastructure:
• CPU resources:
- Additional Grid CPU resources (integrated into Grid batch)
- Separate local Batch system with emphasis on interactive access (**like PROOF**)
• Storage resources:
- Additional **dCache** capacity (integrated into existing Grid-SE)
- **Lustre** file system for fast access in the local batch system
• User Support shared between:
- Experiment groups (specific software support)
-IT experts
(infrastructure support)




### University of Oklahoma (OUHEP)

OUHEP is operating a Tier2 with the storage based on **Lustre** for ATLAS and running a medium sized Tier3 desktop cluster for:
• Data analysis
• Monte Carlo production
• Interactive analysis (root/proof-lite)
• Testing, deployment and integration ATLAS software and **OSG** infrastructure.
• The Tier3 facility:
- 100 TB in the current **NFS** on top of **XFS** storage
- 170 CPU/cores with a fully operational **OSG CE**

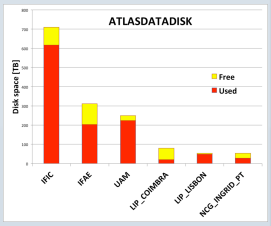


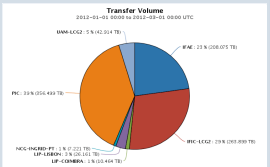

### UK ATLAS Cloud

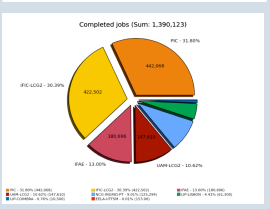
UK ATLAS cloud consists of 4 federated Tier-2 centres:
• Sharing pledges, expertise and resources
• Running Monte Carlo production
• Analysis activities
UK Tier3 resources are local (not-shared):
• Available tools for local users to easily run on their Tier2 resources
• Enable access of data hosted at the nearby Tier2 on local Tier3
•Manage its local grid storage resources (LOCALGROUPDISK) cloud-wide
• Mostly **DPM** Storage middleware solution
• **dCahe** and **Lustre/Storm** sites too
• Supporting other scientific applications
User support: Cloud support team
• To facilitate smooth operations
• Recent rapid deployment of **CVMFS** across the cloud


### Spain and Portugal, ATLAS ES Cloud

In Spain and Portugal there is a federated Tier2
• Data placement is organized in ATLAS using space token (ATLASDATADISK)
• Dynamic placement of dataset at Tier-2s based on usage as well as an on-demand replication system.
• Job distribution in order to optimize our physics output. Large part of the analysis and the MC production is done at Tier-2s.
Each of the ES Cloud sites has an associated Tier3:
• Sharing the infrastructure of the Tier2
• Using the same queuing system
A fair share queuing system was set up
Optimizing the occupation
• Additional resources for computing and storage (**Lustre/ dCache**)
• Using automatic tools for system management tasks
**QUATTOR** to install operating system
**CVMFS** to have the ATLAS software available
Database access trough **SQUID + FRONTIER**
• Two levels of monitoring:
from the global LHC Grid
Internal to the site (Nagios, Ganglia)
• Every site has a pre-production computing cluster where software updates are tested before.
• CPU usage is shared fairly between MC production & analysis jobs



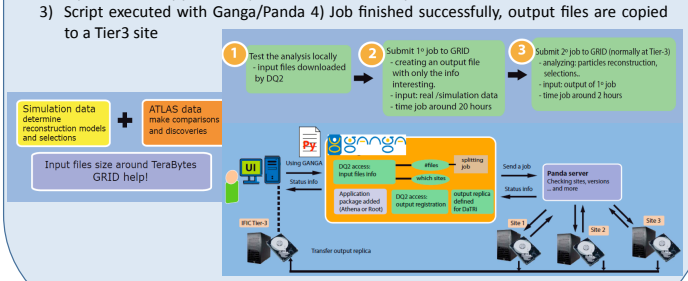




## An example of a Physics Analysis in this framework

For running GRID analysis jobs ATLAS has developed two tools where all ATLAS requirements has been included, the different GRID environments (**EGI-Glite, OSG, EGI-ARC**) has been unified and a practical job monitoring status web page has been deployed:

•**PanDA client**: PanDA is a specific system for production and distributed analysis for sending jobs to the GRID in an easy way for users.
•**Ganga** (Gaudi/Athena and Grid Alliance): A job management tool for local, batch systems and the GRID.

An **example of Distributed Analysis** in heavy exotic particles:
1) Input files, 2) A python script is created where requirements are defined
3) Script executed with Ganga/Panda 4) Job finished successfully, output files are copied to a Tier3 site

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