



# WORLDWIDE LHC COMPUTING GRID

JOSÉ MAURICIO PERDOMO, PERCCOM COHORT 5

[JOSEMPERDOMOZ@GMAIL.COM](mailto:JOSEMPERDOMOZ@GMAIL.COM)

COURSE: CLUSTERS, GRIDS, CLOUDS

COURSE MODERATOR: ANDREY SHEVEL

ITMO UNIVERSITY

2018

# WHAT IS WLCG ?

- The Worldwide LHC Computing Grid (**WLCG**) project is a global collaboration of more than 170 computing centres in 42 countries, linking up national and international grid infrastructures.

# MISSION OF WLCG PROJECT

- The mission of the WLCG project is to provide global computing resources to store, distribute and analyse the ~50 Petabytes of data expected in 2018, generated by the Large Hadron Collider (LHC) at CERN on the Franco-Swiss border.

# WHAT COMPRISES THE LHC COMPUTING GRID ?

1. Data is generated by 4 giant experiments of the LHC ring\*:  
LHCb, ATLAS, ALICE, CMS . Conjointly they produce 100 GB/s of data.
2. Data is aggregated to the Tier 0 CERN Data Centre.  
Permanent Long-Term Storage ( Tape Storage )

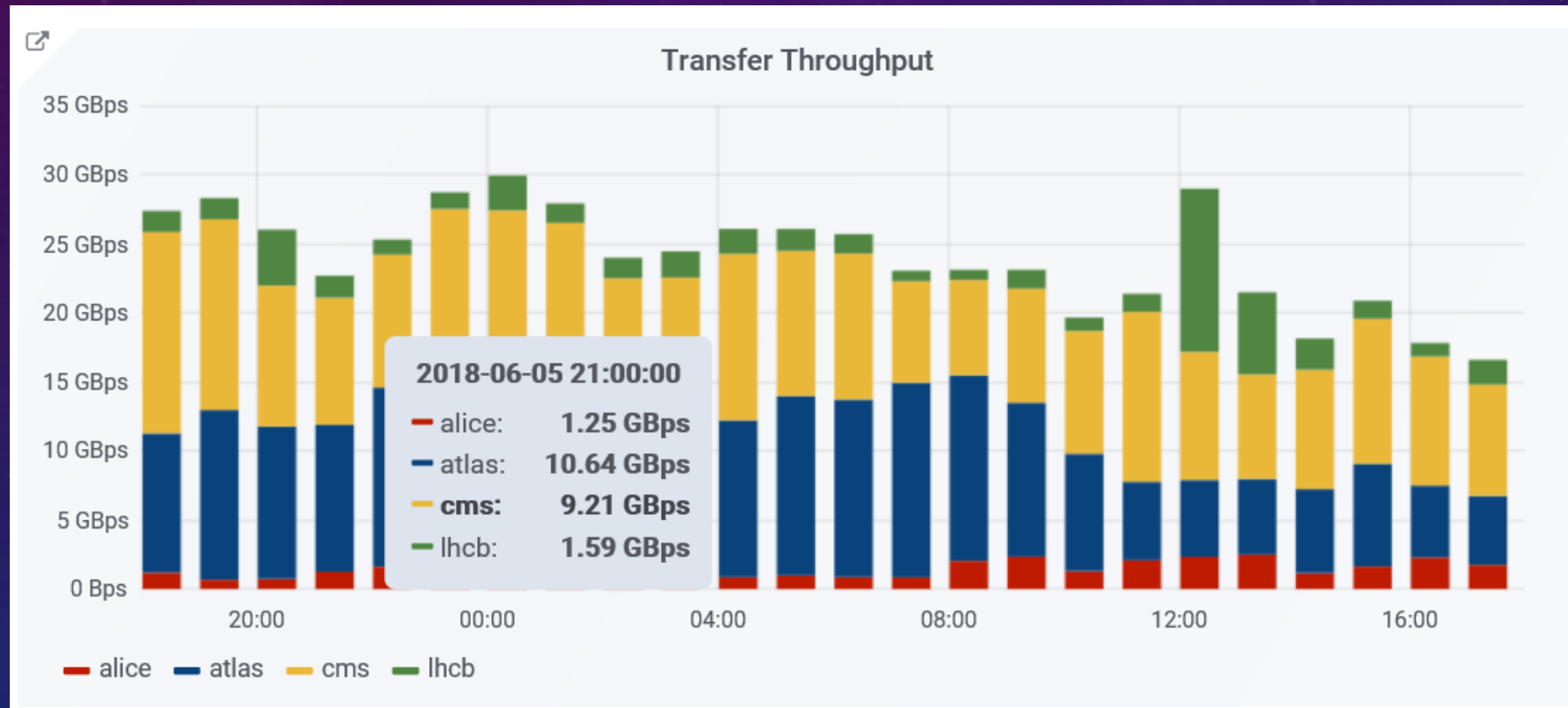
3. Data is distributed to 11 Tier 1 Data Centres ( More permanent Storage, re-processing, and analysis )

4. Data is received in 140 Tier 2 Data Centres disseminated around the world (Simulation, and end-user analysis)

5. Data is sent to TIER 3 universities around the world.

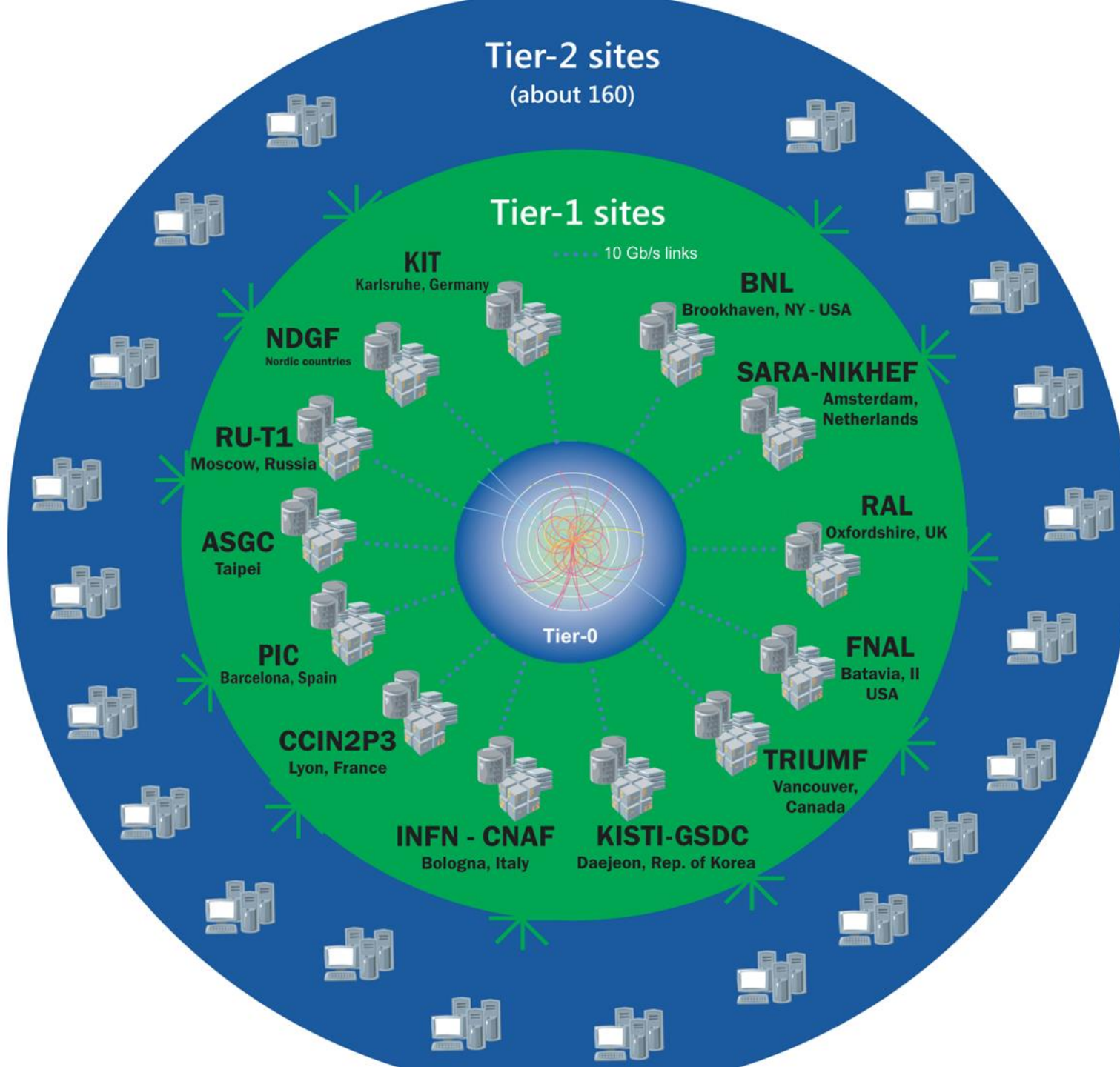
6. Finally, Tier 4 is comprised by end-user PCs.

# REAL-TIME DATA TRAFFIC



# DATA JOURNEY

- 600 million collisions every second – Only 1 in a million collisions is of interest – Electronic preselection passes 1 out of 10,000 events and stores them in computer memory– 15 000 processor cores select 1 out of 100 of the remaining events . (100 GB/s) Then sent CERN data Centre



# WLCG RESOURCE HIERARCHY

More facts:

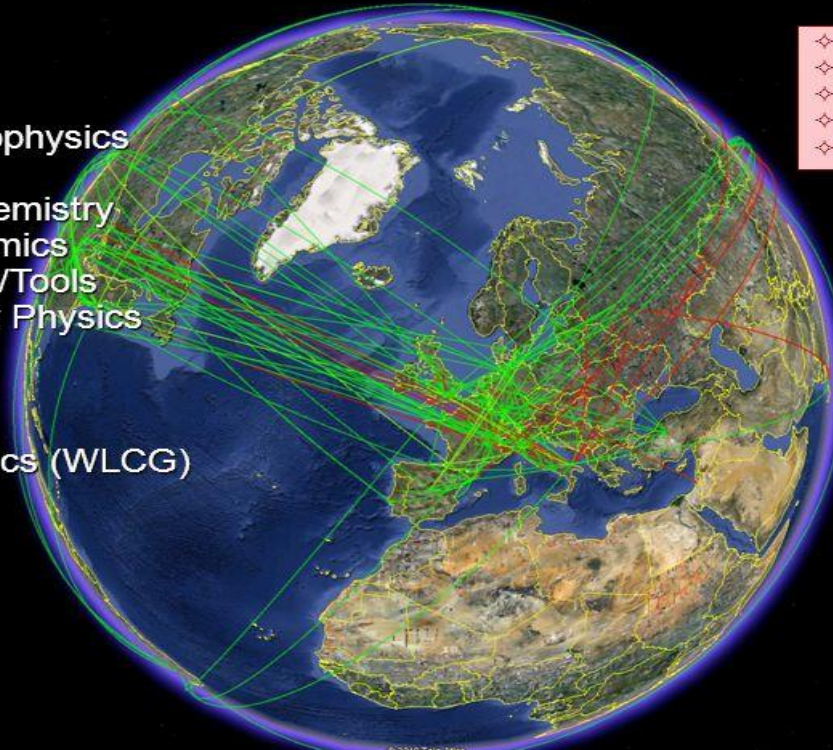
- 10 GB/s global transfer rate
- 1.5 million jobs running every day
- 30 Petabytes generated in 2012



# Grid Computing and CERN

Oct 26, 2010, 4:50:00 pm

Astronomy & Astrophysics  
Civil Protection  
Computational Chemistry  
Comp. Fluid Dynamics  
Computer Science/Tools  
Condensed Matter Physics  
Earth Sciences  
Finance  
Fusion  
High Energy Physics (WLCG)  
Humanities  
Life Sciences  
Material Sciences  
Social Sciences



Running jobs: 117948.0  
Transfer rate: 4.94 GiB/sec

- ◇ 285 sites in 48 countries
- ◇ ~250k CPU cores
- ◇ ~100 PB disk
- ◇ Large number of users
- ◇ 1M jobs/day



EGEE-III INFOS-RI-222667



©2010 Teig Atlas  
©2010 Europe Technologies  
US Dept of State Geographer  
©2010 Google  
47°21'40.40" N 32°01'11.50" W elev -3524 m

Eye alt 15441.40 km

# MIDDLEWARE USED IN WLCG

Computing resources are allocated to each experiment, so that scientists have the right amount of computing power they need for conducting their research.

- ARC

The Advanced Resource Connector (ARC) middleware integrates computing resources (usually, computing clusters managed by a batch system or standalone workstations) and storage facilities, making them available via a secure common Grid layer.

- Virtual Data Toolkit

The Virtual Data Toolkit (VDT) is an ensemble of distributed computing software that can be easily installed and configured. The goal is to make it as easy as possible for users to deploy, maintain and use distributed computing software. The VDT is a product of the Open Science Grid (OSG), which uses the VDT as its software distribution.

- Globus Toolkit

The Globus Toolkit is a fundamental enabling technology for building grids that allow distributed computing power, storage resources, scientific instruments, and other tools to be shared securely across corporate, institutional, and geographic boundaries.


- EMI - European Middleware Initiative

EMI is a collaboration of the three major middleware providers in Europe, ARC, gLite and UNICORE, and other consortia. It aims to deliver a consolidated set of middleware components for deployment in EGI, PRACE and other DCIs; extend the interoperability between grids and other computing infrastructures; strengthen the reliability of the services; and establish a sustainable model to maintain and evolve the middleware, fulfilling the requirements of the user communities.

# LHC HOME

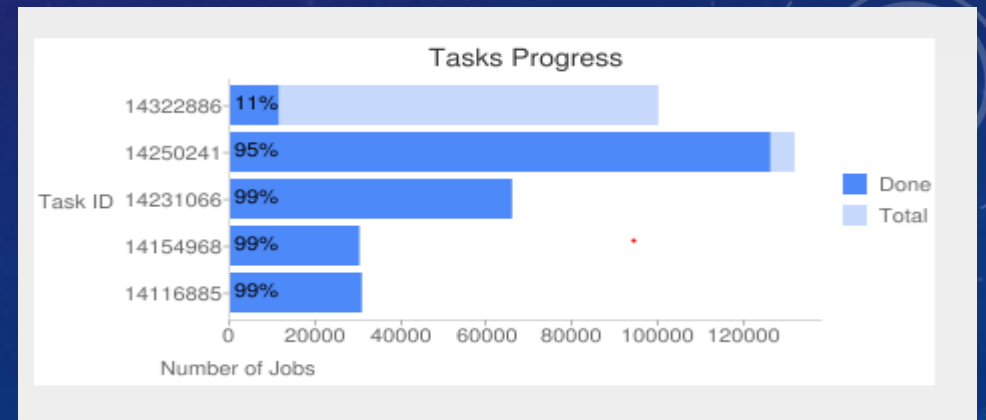


Project ATLAS ( focused on the search for new particles )



The screenshot shows the BOINC Manager window with the following details:

- Tareas:** SixTrack
- De:** LHC@home
- CERN (Organización Europea para la Investigación Nuclear):** Física
- Descripción:** El Gran Colisionador de Hadrones (LHC, por sus siglas en inglés) es un acelerador de partículas del CERN, la Organización Europea para la Investigación Nuclear, el mayor laboratorio de física de partículas del mundo.
- Transcurrido:** 00:35:04
- Restante (estimado):** 00:14:18
- Progreso:** 60.622% (indicated by a green progress bar)
- Estado:** Suspendido - con baterías
- Proyectos:** LHC@home
- Trabajo realizado para este proyecto:** 0
- Botones:** Avisos, Suspender, Ayuda

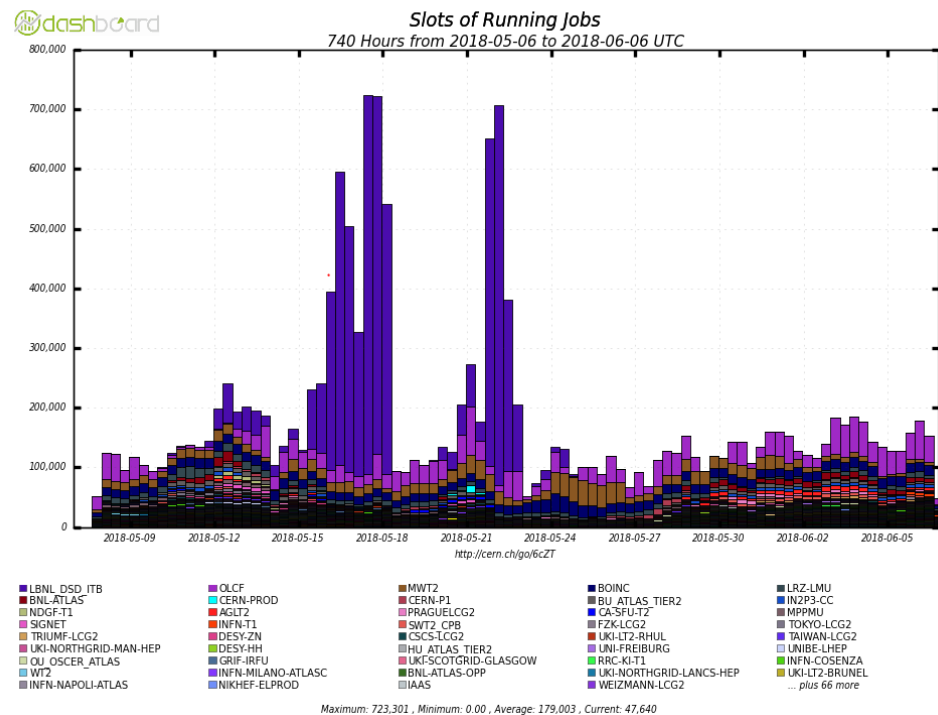


# HOW DOES LHC HOME WORKS ?

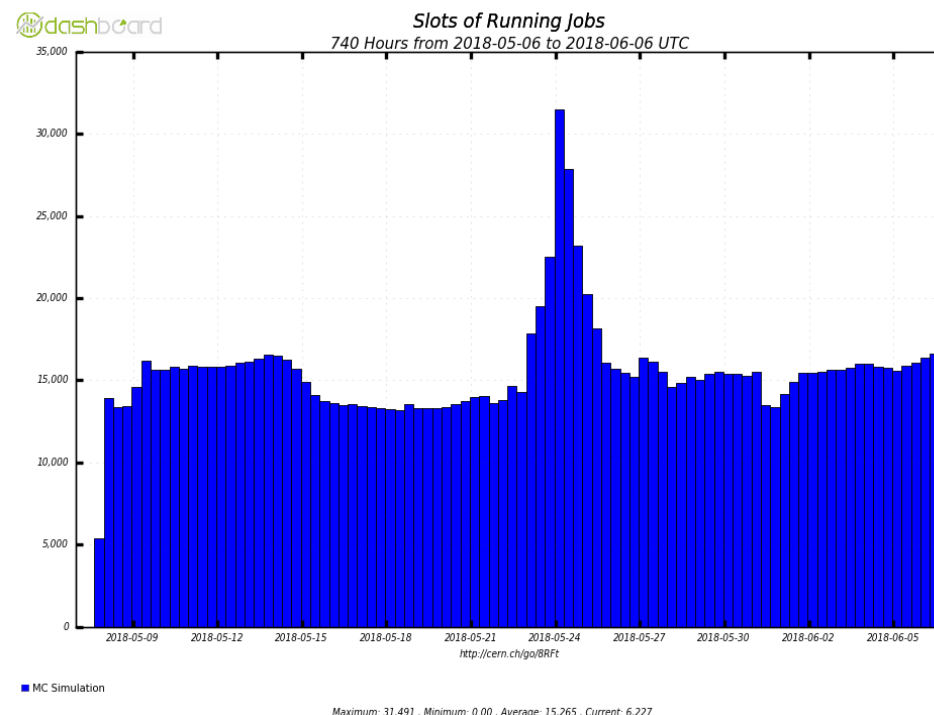
- All of the LHC home projects run using BOINC ( Berkeley Open Infrastructure for Network Computing) - a long-established platform which is used by the vast majority of volunteer-computing projects around the world.
- Some require extra software like Virtualbox, CERNVM or Vboxwrapper to compute more complex tasks.

# ATLAS JOBS IN REAL TIME

### ATLAS Simulation Jobs



### ATLAS jobs running on BOINC site



<http://lhathome.web.cern.ch/projects/atlas>