CERN
openlab for DataGrid applications
Developing Solutions for the Data-Intensive Science of the Large Hadron Collider

How to make resources be part of the LCG infrastructure

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The mission of the the LHC Computing Grid (LCG) is to build and maintain a data storage and analysis infrastructure for the entire high-energy physics community that will use the Large Hadron Collider.

Projected requirements for 2008 (taken from TDR):

- **140 million SPECint2000 (P4 ~ 1700 SPECint2000)**
- **50 PB mass storage**
- **60 PB disk storage**

Current status:
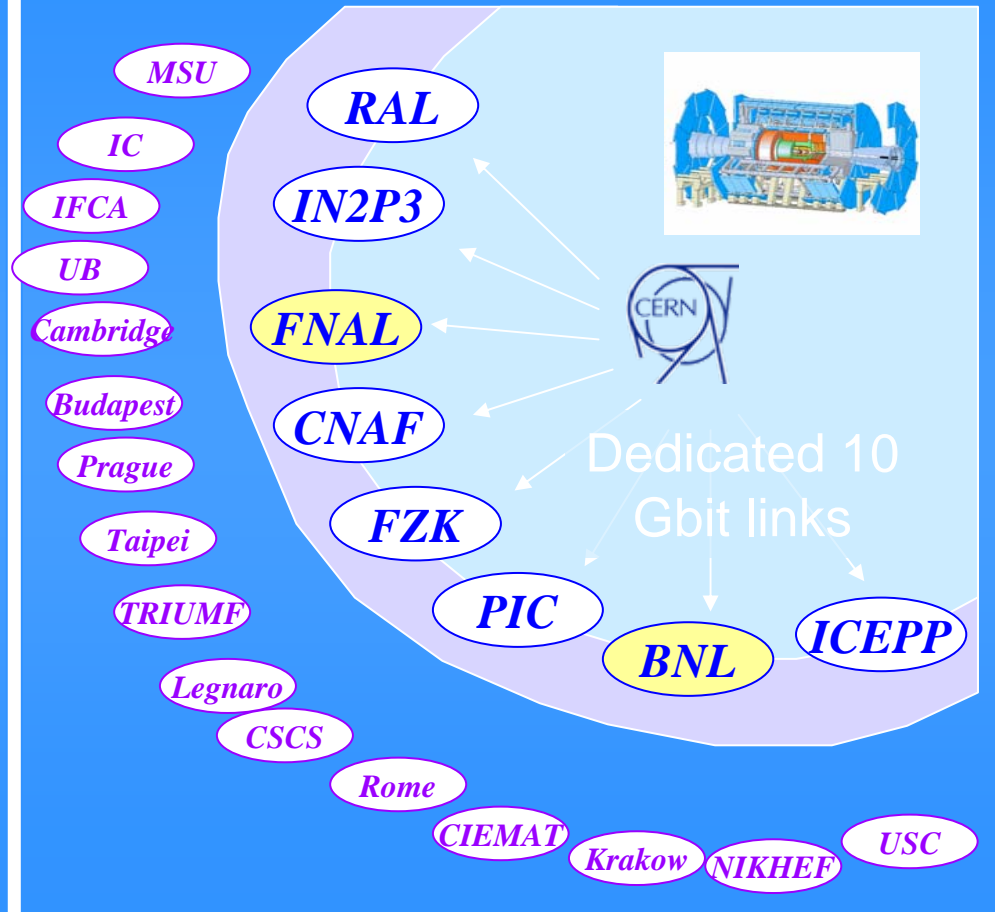
187 sites, 15321 CPUs, 5PB

LCG Layout

Tier 0: CERN, raw data storage & reconstruction

Tier 1: mass storage, 24/7 operation, long-term commitment, data-heavy analysis

Tier 2: Monte Carlo & end user analysis, well managed grid-enabled disk storage

Tier 3: local clusters at universities

Where does my site fit in ?

MSU
RAL
IC
IFCA
IN2P3
UB
Cambridge
FNAL
Budapest
CNAF
Prague
FZK
Taipei
PIC
TRIUMF
BNL
ICEPP
Legnaro
CSCS
Rome
CIEMAT
Krakow
NIKHEF
USC

Dedicated 10 Gbit links

Operations Management Center (OMC) (http://lcg.web.cern.ch)

At CERN, management coordination, middleware deployment.

Core Infrastructure Centers (CIC) (http://cic.in2p3.fr)

Essential core Grid services: catalogues, VO management, resource brokers, monitoring, recovery,…

Currently: CERN, CNAF, RAL, CCIN2P3, Russia.

Grid Operations Centre (GOC) (http://goc.grid-support.ac.uk)

Coordinates and monitors the operation of the Grid Infrastructure (more LCG specific). Accounting, monitoring, Wiki. (http://goc.grid.sinica.edu.tw/gocwiki)

Regional Operations Centers (ROC)

Front line support in geographical regions. Located at Tier 1 sites.

Grid User Support Center (GGUS) (http://gus.fzk.de)

Central portal for support and documentation.

Join LCG as a user

Every user must be affiliated with one Virtual Organization (VO):

LHC affiliation

1. **ALICE**
2. **ATLAS**
3. **CMS**
4. **DTEAM**
5. **LHCB**
6. **SixTrack**

Non LHC affiliation

1. **BaBar**
2. **D0**
3. **H1**
4. **Zeus**
5. **ILC**
6. **Biomed**
7. **ESR (earth science)**
8. **EGEODE (geo sciences)**
9. **PhenoGrid**

1. **Obtain a certificate from a certification authority (CA)**
2. **Contact LCG registrar to get affiliated with a VO.**

http://lcg-registrar.cern.ch

Use LCG

Get an account on a User Interface (UI) machine or install a UI. Put the user certificate on the UI. The UI allows you to

- Submit jobs.
- List all the resources suitable to execute a given job.
- Cancel jobs.
- Retrieve the output of finished jobs.
- Show the status of a job.
- Retrieve logging and bookkeeping information.
- Copy, replicate and delete files from the grid.
- Use LCG APIs.

At CERN all lxplus machines are UIs.

```
source /afs/cern.ch/project/gd/LCG-share/sl3/etc/profile.d/grid_env.[c]sh
```

LCG software

- **Distributed as a set of rpms per node type.**
- **Configuration via shell scripts (YAIM).**
- **Supported architectures: x86, IA64, Opteron only in 32 bit mode.**
- **Supported OS: Scientific Linux 3 (SL3).**

http://lcg.web.cern.ch/lcg/Sites/releases.html

Ports to other OS and architectures are mainly driven by the experiments' needs.
There are some partial ports available for various Linux flavors as well as IRIX, AIX and MacOS (provided by Grid-Ireland).
http://cagraidsvr06.cs.tcd.ie/autobuild

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What's in LCG ?

VDT Globus (globus 2.4 + patches)

MyProxy

Condor & Condor G

EDG Workload Management

EDG Logging and bookkeeping

VOMS (virtual organization membership service)

EDG Java security

EDG Replica Manager and Replica Location Service

gLite Information Service (R-GMA)

GridICE

LCAS (Local Center Authorization Service)

LCMAPS (Local Credential Mapping Service)

LCG Data Management Tools

OpenPBS/Torque (batch system)

CASTOR (hierachical storage management system)

dCache disk pool manager

LCG disk pool manager (DPM)

MySQL v4

Several PERL modules

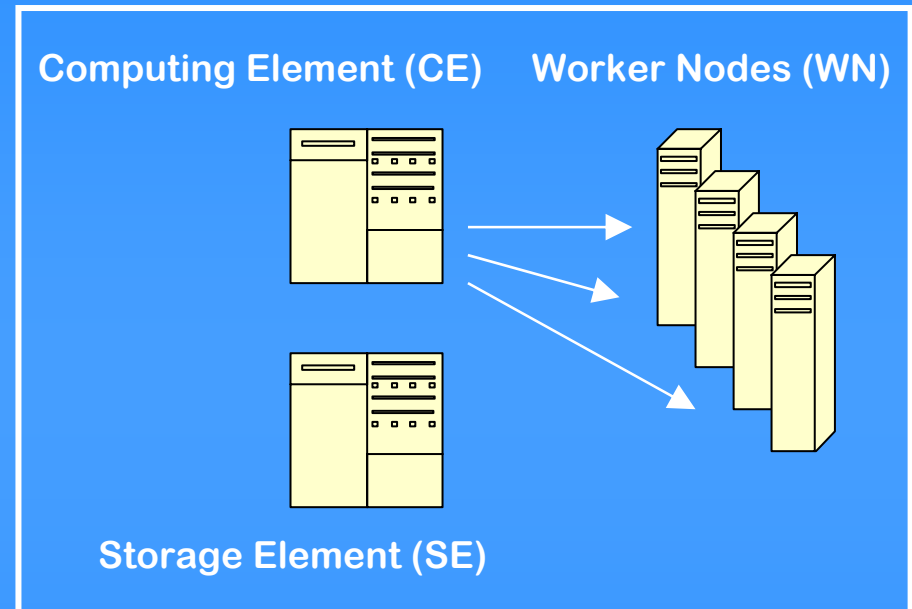Several Java modules

Minimal LCG site

Computing Element:
Gate Node, head of a local resource management system (PBS, LSF, Condor)

Worker Node:
Compute Node

Storage Element:
Provides Grid interfaces to site storage

Computing Element (CE)   Worker Nodes (WN)

Storage Element (SE)

Further LCG nodes

Resource Broker (RB)

Runs workload management system, i.e. acceptance of submitted jobs and sending them to appropiate CEs. Also runs the logging and bookkeeping services.

LCG File Catalog (LFC)

Maps logical file names to physical files. Oracle or MySQL.

Storage Element flavors

Classic, dCache, dpm (disk, Oracle or MySQL).

Further LCG nodes

BDII

Information system. A site may use its own top level BDII.

MyProxy

To store proxy certificates for a longer time.

VO-Box

New in LCG-2_6_0. Allows VOs to run their own user level agents.

How to join

- **First contact with LCG deployment manager.**
- **Contact your Regional Operations Center (ROC).**
- **Enter your site in the GOC database.**
- **Subscribe to the lcg-rollout list.** http://listserv.rl.ac.uk/archives/lcg-rollout.html

Site appears in monitor and is being tested every 24 hours. http://goc.grid.sinica.edu.tw/gstat

Site decides which VOs it wants to support.