Grid Computing for Calice

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The Grid Dream

Mobile Access

Desktop

Visualizing

Supercomputer, PC-Cluster

Data Storage, Sensors, Experiments

Internet, Networks
Grid Computing

- Grid Computing is about *virtualization* of resources

- The Grid is there – pioneered by LCG

- (Almost) all HEP resources have been moved to the Grid

- Grid tools become the *de facto* standard for computing (local batch system globally accessible) and data access (GridFTP, SRM, Catalog Services)

- User management done within *Virtual Organizations* (VO)

- Certificates for authentication rather than local site accounts

- Embedded in the EU project *Enabling Grids for E-sciencE* (EGEE)
The LHC Computing Model

- **Online System**
  - ~1 TIPS
  - ~100 MBytes/sec

- **Offline Farm**
  - ~20 TIPS
  - ~100 MBytes/sec

- **Tier 0**
  - CERN Computer Centre
  - >20 TIPS
  - ~Gbits/sec or Air Freight

- **Tier 1**
  - US Regional Centre
  - Italian Regional Centre
  - French Regional Centre
  - RAL Regional Centre
  - ~Gbits/sec
  - 1 TIPS = 25,000 SpecInt95
  - PC (1999) = ~15 SpecInt95

- **Tier 2**
  - ScotGRID++
  - ~1 TIPS
  - ~Gbits/sec

- **Tier 3**
  - Institute
  - ~0.25TIPS
  - 100 - 1000 Mbits/sec

**Workstations**

**Physics data cache**

- **Physicists work on analysis “channels”**

- Each institute has ~10 physicists working on one or more channels

- Data for these channels should be cached by the institute server
Building Blocks

• A Virtual Organization (VO) is a *dynamic collection of individuals, institutions, and resources* which is defined by certain sharing rules.
  
  ➢ A VO represents a collaboration
  ➢ Users are members of a certain VO *(Authorization)*
  ➢ Users authenticate themselves with a certificate *(Authentication)*
  ➢ Certificates are issued by a national *Certification Authority (CA)*

• Grid Infrastructure
  
  ➢ Core Services (mandatory per VO)
    ➢ VO Membership Services
    ➢ Grid Information Services
    ➢ Resources Broker
    ➢ Workload Management System
  ➢ Resources (brought in by partners) *(Grid sites)*
DESY Grid activities were initially driven by the demand for resources for MC production of H1 and ZEUS

The International Lattice Data Grid (ILDG) and the International Linear Collider Community (ILC) joined the Grid activities

DESY participates in EGEE (since 2004) and D-GRID (since 2005)

DESY is a Tier-2 centers for ATLAS (in federation w/ U Freiburg) and CMS (in federation w/ RWTH Aachen)

DESY participated in the Service Challenges SC3/4 and the Pre-Production Service PPS for EGEE

DESY operates a complete Grid infrastructure, incl. all services
Overview
... Grid @ DESY ...

- Quattor (SL 3.08 for all nodes; complete installation for WNs)
- GLITE-3_0, Yaim (for all service nodes)

- Central VO Services: *(unique per VO)*
  - VO Members (VOMS) [grid-voms.desy.de]
  - Catalogue Services (LFC) [grid-lfc.desy.de]

- Distributed VO Services: *(mandatory per VO)*
  - Resource Broker (RB) [grid-rb1/2.desy.de]
  - Workload Management (WMS) [grid-wms0.desy.de]
  - Information Index (BDII) [grid-bdii.desy.de]
  - MyProxy (PXY) [grid-pxy.desy.de]
… Grid @ DESY

* Site Resources:
  - **GIIS:** DESY-HH  [grid-giis.desy.de]
  - **CE:** 166 * Opteron/2.4  [grid-ce0.desy.de]
  - **CE:** 324 * Opteron/2.2 Woodcrest/3.0  [grid-ce1.desy.de]
  - **CE:** 90 * XEON/3.0  [grid-ce2.desy.de]
  - **SE:** dCache-based w/ access to DESY data space

* Grid (Tier-2) Resource Planning:
  - 2005: 200 kSpecINT2k  30 TB
  - **Now:** 800 kSpecINT2k  (200) TB
  - 2008: 1600 kSpecINT2k  600 TB
  - 2009: 1800 kSpecINT2k  800 TB
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VO Support @ DESY

- **VOs hosted at DESY:**
  - Global: ‘hone’, ‘ilc’, ‘zeus’
  - Regional: ‘calice’, ‘dcms’, ‘ildg’

- **VOs supported at DESY:**
  - Regional: ‘dech’

- **H1 Experiment at HERA (‘hone’)**
  - desy, uni-dortmund, cscs, gridpp, bham, ucl, lancs, ox, marseille, cyf-kr, saske

- **ILC Community (‘ilc’, ‘calice’) (registration: http://grid-voms.desy.de:8443/vomses/)**
  - desy, ifh, ciemat, lal, polgrid, cclcgeli, cam, ic, manchester, ucl

- **ZEUS Experiment at HERA (‘zeus’)**
  - desy, uni-dortmund, gridpp, bham, ucl, lancs, ox, marseille, cyf-kr, saske, infn, utoronto, uam, scotgrid, weizmann, scai, bris, tau, ed
CALICE Data @ DESY …

- Data are stored in the DESY mass storage system which provides a HMS (tape) back-end
- Access to tape data via user-transparent dCache system
- Data in /pnfs/desy.de/calice/generated are NOT on tape
- In total 13 TB are currently stored in /pnfs/desy.de/calice

- Grid access
  - ‘ilc’ and ‘calice’ are official EGEE VOs
  - via Grid tools all around the work
  - dedicated pool nodes cache ~4 TB for reading/writing

- Local access within DESY
  - by way of the NFS-mounted pseudo-dir PNFS
  - by way of a the dcap protocol
  - dedicated pool nodes cache ~4 TB for reading
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… CALICE Data @ DESY …

> grid-proxy-init -debug
> export LFC_HOST=grid-lfc.desy.de
> lfc-ls -l /grid/calice
-rw-rw-r-- 1 44022 3145 836636348 Nov 01 21:24 /grid/calice/tb-cern/rec/rec_v0402/Run310070_rec.000.slcio

> lcg-cp -v --vo calice lfn:/grid/calice/tb-cern/rec/rec_v0402/Run310070_rec.000.slcio
  file:/tmp/Run310070_rec.000.slcio
Using grid catalog type: lfc
Using grid catalog : grid-lfc.desy.de
Source URL: lfn:/grid/calice/tb-cern/rec/rec_v0402/Run310070_rec.000.slcio
File size: 836636348
VO name: calice
Source URL for copy:
  gsiftp://dcache20.desy.de:2811//pnfs/desy.de/calice/tb-cern/rec/rec_v0402/Run310070_rec.000.slcio
Destination URL: file:/tmp/Run310070_rec.000.slcio
# streams: 1
# set timeout to 0 (seconds)
825229312 bytes 10603.78 KB/sec avg 9216.07 KB/sec inst
Transfer took 77070 ms

> ls -l /tmp/Run310070_rec.000.slcio
-rw-r--r-- 1 gellrich it 836636348 Feb 11 18:34 /tmp/Run310070_rec.000.slcio
> mount
...
pnfs:/pnfs on /pnfs/desy.de type nfs (rw,addr=131.169.40.37)
...

> ls -l /pnfs/desy.de/calice/tb-cern/rec/rec_v0402/Run310070_rec.000.slcio
-rw-r--r-- 1 caliceon calice 836636348 Nov 1 21:28 /pnfs/desy.de/calice/tb-cern/rec/rec_v0402/Run310070_rec.000.slcio

> which dccp
/opt/products/bin/dccp

> dccp /pnfs/desy.de/calice/tb-cern/rec/rec_v0402/Run310070_rec.000.slcio /tmp/Run310070_rec.000.slcio

> ls -l /tmp/Run310070_rec.000.slcio
-rw-r--r-- 1 gellrich it 836636348 Feb 11 18:51 /tmp/Run310070_rec.000.slcio
(Near) Future Aspects

- Scientific Linux 4 is coming (pushed by the LHC experiments)
  - Software must run on SL4 WNs
  - Is CALICE aware of SL4?

- Multiple VO membership has been a hot topic
  - VOMS is (still) being rolled-out

- Database access by many concurrent jobs
  - Caching technologies are under development

- DESY will distribute Grid resources among ALL VOs

- Typical fraction for ‘calice’ is ~ 10%
Conclusions

• Grid Computing is a strategic technology for the future

• (Significant) resources will be available in the Grid (only)

• The Grid requires global thinking!

• DESY maintains a Grid Infrastructure in production

• DESY is an LCG Tier-2 centre for ATLAS and CMS

• H1, ILC, and ZEUS heavily use the Grid for MC production

• VOs already exist for ILC and CALICE with international support
At Last

The Grid is ready for CALICE!

Testbeam data are exclusively on the Grid!

Get your certificate quick and start to use the Grid!
Grid @ Web

• DESY Grid Web Sites:
  ✓ http://grid.desy.de/
  ✓ http://grid.desy.de/certs/
  ✓ http://grid.desy.de/users/
  ✓ http://grid.desy.de/install/DESY-VO.html

• Grid Computing Web Sites:
  ➢ http://cic.in2p3.fr/
  ➢ http://cern.ch/lcg/
  ➢ http://www.eu-egee.org/
Grid Infrastructure

UI

ssh

certs

$HOME/.globus/

VO exclusive

LFC

RB

WMS

JDL

output

BDII

GRIS

CE

VOMS

/etc/grid-security/grid-mapfile

/./

WN

WN

WN

WN

R-GMA

HMS

DESY-HH

world

Site2

Site3