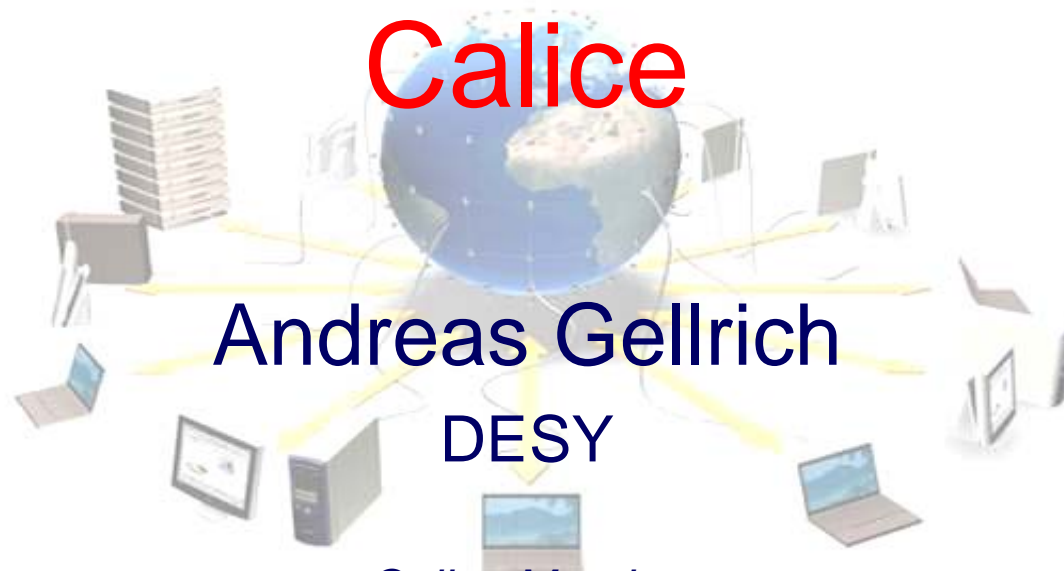


Grid Computing for Calice



Andreas Gellrich

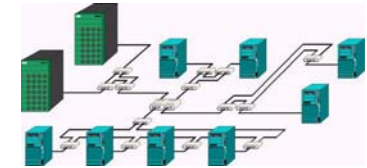
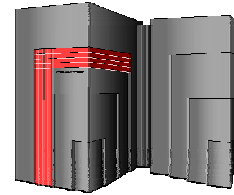
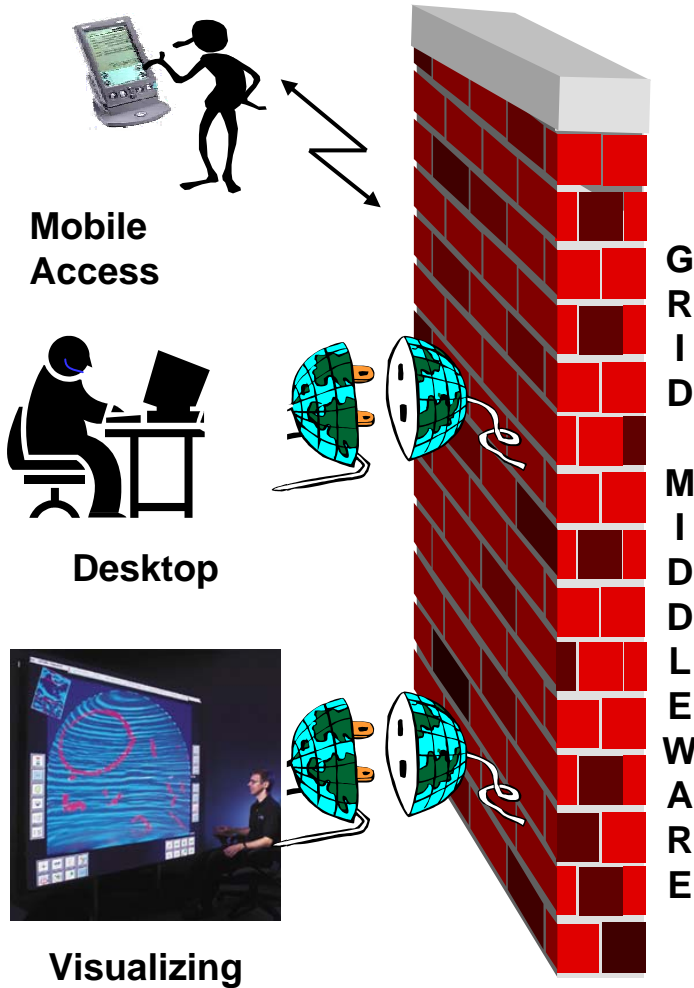
DESY

*Calice Meeting
DESY, 12.02.2007*

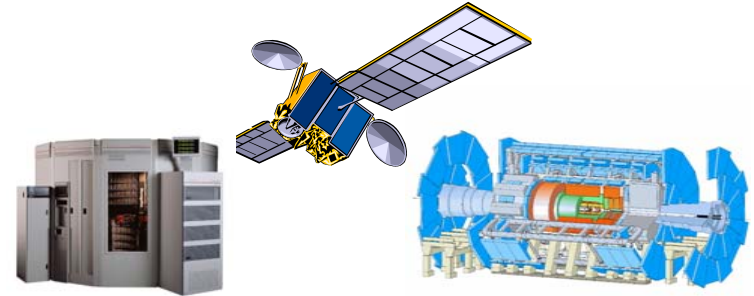


The Grid Dream

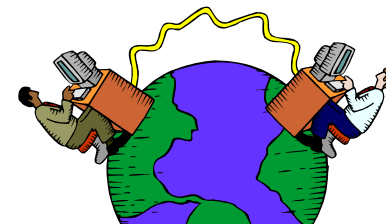
<http://grid.desy.de/>



Supercomputer, PC-Cluster



Data Storage, Sensors, Experiments



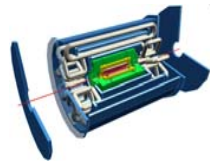
Internet, Networks



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



~PBytes/sec

Online System

~100 MBytes/sec

1 TIPS = 25,000 SpecInt95

PC (1999) = ~15 SpecInt95

- One bunch crossing per 25 ns
- 100 triggers per second
- Each event is ~1 Mbyte

Offline Farm
~20 TIPS

~100 MBytes/sec

CERN Computer Centre
>20 TIPS

~ Gbits/sec
or Air Freight

Tier 0

Tier 1

US Regional Centre

Italian Regional Centre

French Regional Centre

RAL Regional Centre

Tier 2

ScotGRID++
~1 TIPS

Tier2 Centre
~1 TIPS

Centre
~1 TIPS

Centre
~1 TIPS

Tier 3

Institute
~0.25TIPS

Institute

Institute

Institute

Physics data cache

Workstations

100 - 1000
Mbits/sec

Physicists work on analysis “channels”

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

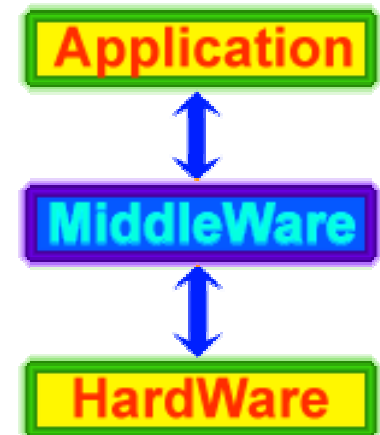
Data for these channels should be cached by the institute server



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*)





<http://grid.desy.de/>

Grid @ DESY ...

- 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



... 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

<http://grid.desy.de/>

- 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



VO Support @ DESY

- VOs hosted at DESY:
 - Global: '*hone*', '*ilc*', '*zeus*'
 - Regional: '*calice*', '*dcms*', '*ildg*'
 - Local: '*baikal*', '*desy*', '*herab*', '*hermes*', '*icecube*'
- VOs supported at DESY:
 - Global: '*atlas*', '*cms*', '*dteam*'
 - 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



EGEE

... CALICE Data @ DESY ...

<http://grid.desy.de/>

```
> 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/tbcern/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
```



... CALICE Data @ DESY

<http://grid.desy.de/>

```
> 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

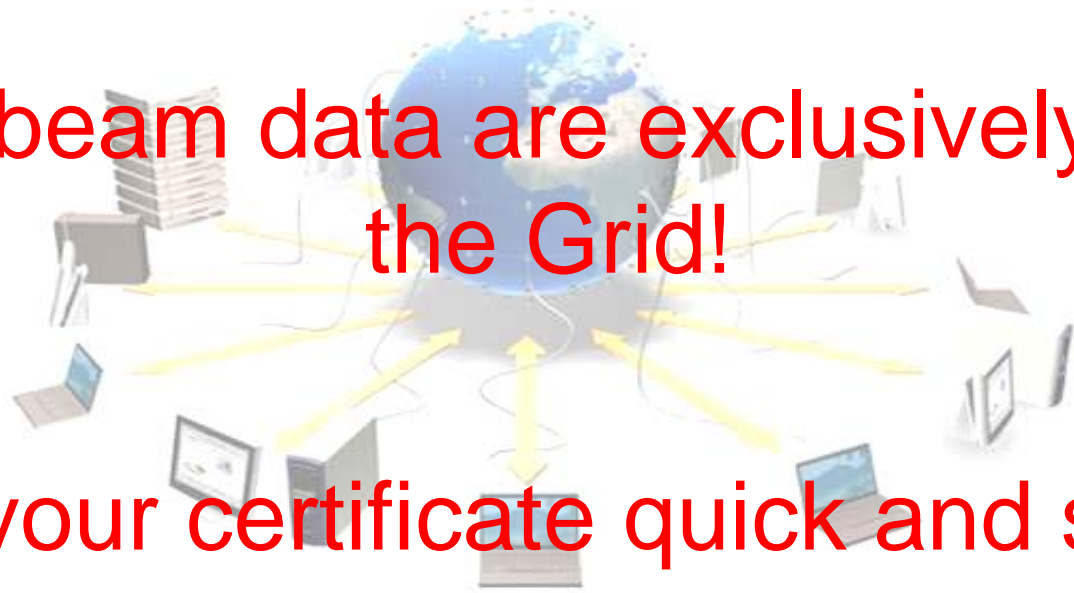
- Grid Computing is a **strategic** technology for the future
- (Significant) **resources** will be available in the Grid (only)
- The Grid requires **global** thinking!
- DESY maintains a Grid Infrastructure *in production*
- DESY is an LCG **Tier-2** centre for **ATLAS** and **CMS**
- **H1**, **ILC**, 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

<http://grid.desy.de/>

