Computing for LHC in Germany

Günter Quast
Universität Karlsruhe (TH)
Meeting with RECFA
Berlin, October 5th 2007

- WLCG Tier1 & Tier2
- Additional resources for data analysis
  - HGF "Physics at the Terascale"
  - D-Grid
- Grid Computing for HEP in Germany
Mastering the LHC Data volume ...

... Grid Computing in Germany
Together building
a performant Grid Structure
for LHC Data Analysis

- Tier1 / Tier2 / Tier3 (=Institute clusters)
- embedded within the international LHC-Grid
- Participation in data and service challenges
- Grid sites: FZK, DESY, GSI, MPI and
  installations at (so far) 7 universities
- very active user communities
- frequent training and schools
- analysis facilities are emerging
  (funded by universities, BMBF & HGF)

LHC grid is largest Grid in Germany

Particle physics groups are important partners in the German D-Grid initiative

October ’07
list is growing!
GridKa, the German T1

- inaugurated in 2002
- well established Tier1
- Supports
  - ALICE
  - ATLAS
  - CMS
  - LHCb
- & 4 non-LHC experiments
- Global Grid User support ("GGUS")
- Certification Authority ("CA") for Germany
GridKa, the German T1

Presently, GridKa has
~2500 job slots
all are permanently in use!
Will rise by a factor of ~4 in 2008

Successful participation in WLCG and experimental Service Challenges

GridKa Resources
as pledged in WLCG MOU;
funding already approved until 2009

~1 average T1 for ALICE, ATLAS, LHCb
~10% of CMS T1 computing (< 1 average T1)

Collection of resource requests 2010-2012 started; reviewed by GridKa Technical advisory board and later by Overview Board, will lead to funding request to FZK/HGF
GridKa associated T2s

GridKa supports >20 T2s in 6 countries

+ successful data transfers from/to all CMS T1 & >20 CMS T2 world-wide

Alice T2 sites in Russia

Most complex “T2 cloud” of any T1 in WLCG

Coordinated by frequent T2 meetings
3 average ATLAS T2 distributed over 5 sites; 6th partner (Göttingen) being discussed
(see Appendix for numbers on T2 sizes)

Federated CMS T2 Aachen-DESY
1.5 average CMS T2

GSI Darmstadt is ALICE T2

Planned:
DESY/Dortmund/MPI Heidelberg
as future LHCb T2 for MC production
Before July 2007:
Funding only for 1 ATLAS & 1 CMS T2 @ DESY (Hamburg & Zeuthen)
· ½ ATLAS T2 @ MPI Munich
· ~¼ CMS T2 @ RWTH Aachen in 2008
· 1 ALICE T2 @ GSI Darmstadt

Since July 2007: Alliance of HGF Institutes and German Universities
„Physics at the Terascale“ approved and active.

Provides additional funding over a period of five years for
- T2 hardware at universities (~3M€ over 5 years)
  3 · ½ T2s for ATLAS @ Freiburg, Munich & Wuppertal
  ½ T2 for CMS @ RWTH Aachen
- hardware operation and grid services secured by universities
  (cost exceeds HGF funding!)
- funding of personnel for experiment-specific tasks
  by BMBF (~8 FTE for ATLAS & CMS T2s)

- WLCG MOU resources pledged by all sites;
- participation in WLCG and experimental challenges with prototypes
End-user Analysis Facilities

Also need dedicated user analysis facilities
- institute clusters @ universities
- National Analysis Facility („NAF“) @ DESY)
- D-Grid resources dedicated to HEP @ D-Grid sites

Required size approximately equals T2 capacity, services are complementary!

Requirements specified by ATLAS and CMS, presently under review by DESY IT
Long-term goal: „Virtual IT centre“ for LHC analysis

Funding for development work within Helmholtz Alliance
Funding by Helmholtz Alliance for Grid projects: 

6.7 M€ over five years (hardware & personnel!!)

Contributions by partners
(personnel, operation and maintenance of hardware):
15.3 M€ over five years

Projects

Hardware: - Tier2 at DESY and three Universities 
- National Analysis Facility

Network: Virtual private network among HEP sites

Workpackages:
WP1: Establishing a virtual computing centre
WP2: Development of GRID tools and optimization of GRID components
WP3: Training, workshops and schools
Goals of HEP project:

- distributed and dynamic data management, job scheduling, accounting and monitoring of data resource utilization
- automated user support tasks, monitoring of jobs, error identification and enabling direct access to executing jobs for early control and steering
- Grid technologies for individual scientific data analysis.

9 partners from HEP and computer science

Additionally, D-Grid initiative provided extra funding for Hardware share of HEP and Hadrons&Nuclei in 2007: ~4.0 M€
(will be integrated in national grid and analysis infrastructure @ T1 and T2 sites and some universities)
Tier3 & Analysis centres funded by:

- Universities: clusters with 50-100 CPU cores, several 10 TB storage
- HGF Alliance: CPU & Storage resources & Personnel
  volume: ~1M€ over five years for NAF@DESY
  ~40 FTE years of personnel
- D-Grid: additional resources, mainly at T1 / T2 sites, for German HEP
  ~4.0 M€ for HEP and Hadrons&Nuclei (approved two weeks ago, details being negotiated)
- BMBF extra initial funding for NAF @ DESY
  aim: have sufficient analysis capacity available for LHC data
  (details still being negotiated)

Projects of HGF Alliance in the area of T2/T3/NAF:
- virtualisation of resources
- application-driven monitoring
- improved data access management
- training, schools and workshops
- Grid-based storage systems
- High-performance network between HEP sites: Virtual Computer Centre
Since 2002: GridKa School
with large participation from HEP

Lectures and hands-on sessions:
- in Grid middleware
  (usage and installation & administration)
- Grid and HEP applications
- developments in science and industry

Complemented by training sessions of experimental communities during national workshops

HGF Alliance also committed to training and education

140 participants from 14 Countries

Grid computing and efficient usage of WLCG resources well established in German HEP!
Organisational Structure

HGF, BMBF, Experiments
GridKa overview board

GridKa T1

WLCG

T2s

T3s/Analysis

HGF Alliance
Management Board

GridKa Technical advisory Board

HGF Alliance
Grid Project Board

German T1/T2 well represented in WLCG committees

C-RRB  CB  OB  MB  GDB

Large personal overlap

Experimental communities
GridKa is well established T1 within WLCG
- supports ALICE, ATLAS, CMS and LHCb

T2 structure being built up for all 4 LHC experiments
- funding secured recently by HGF Alliance “Physics at the Terascale”
- all sites involved showed working prototypes already

T3 and analysis infrastructure evolving
- complicated funding
- development of tools and grid integration of end-user analysis facilities
  depends strongly on personnel funded by HGF Alliance
- HEP community projects within German Grid initiative important

Very tight situation concerning personnel
- difficult to find qualified people for development and operation
- lack of positions with long-term prospects
Appendix

- Pledged WLCG Tier2 resources in Germany
- Program of HFG Alliance “Physics at the Tera Scale”
## Tier2 in Germany

<table>
<thead>
<tr>
<th>Region, Federation, Institutions</th>
<th>Tier2 Status</th>
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<tbody>
<tr>
<td>Germany, DESY, Hamburg</td>
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<tr>
<td>Germany, GSI, Darmstadt</td>
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<td>Germany, ATLAS Federation FR/W</td>
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<td>- Bergische Universität, Wuppertal</td>
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<td>Germany, ATLAS Federation, Munich</td>
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<td>- RWTH, Aachen</td>
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WLCG MoU, August 2007
## Tier2 Resources

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<tr>
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### ALICE

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ATLAS