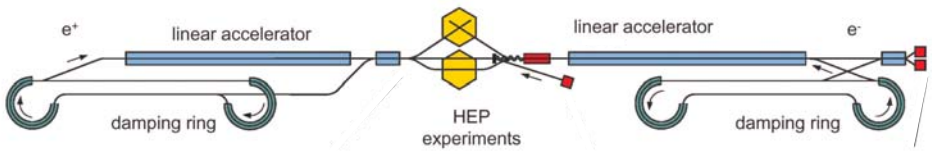
Global Networks and Collaboration

GAN: Global Accelerator Network

Building and operating future large facilities for high energy physics represent unprecedented challenges which might best be approached via the framework of an international collaboration.



ICFA Task Force

In March 2000 ICFA set up a task force to study the approach of a Global Accelerator Network (GAN) for high energy physics. Three international workshops followed – in March 2002 in Cornell, in September 2002 in Shelter Island, and in October 2003 in Trieste. Additionally a working group on Remote Experiments in Accelerator Physics has been formed within the ICFA Beam Dynamics Panel.

The discussions led to the broad agreement that a collaboration for a major accelerator facility must meet at least the following challenges:

- maintain and nurture the scientific culture of the participating laboratories
- maintain the visibility and vitality of each partner.

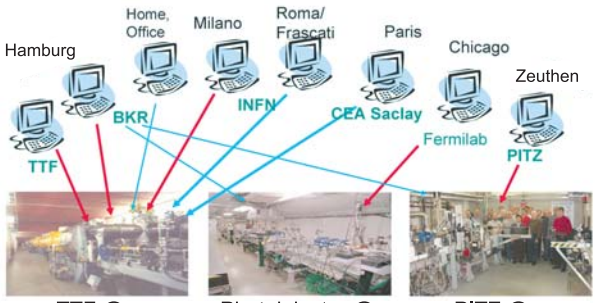
Furthermore, all participating countries must be willing to invest and to commit themselves through long-term agreements.

To achieve this goal all partners must have the possibility to contribute in

- building the accelerator
- commissioning the accelerator

and must take responsibility in

- conducting studies
- operations
- maintenance
- and trouble shooting



Overview of remote operation around TESLA Test Facility

Remote Operation of Accelerators

One of the technical aspects is how to build and operate major components on one continent while providing access for experts from another continent. This not only involves remote access and remote communication, but also collaboration on various scales. The technical side of remote operation and communication seems solvable. In fact right now there already exist accelerators and experimental facilities with active or planned remote operation including:

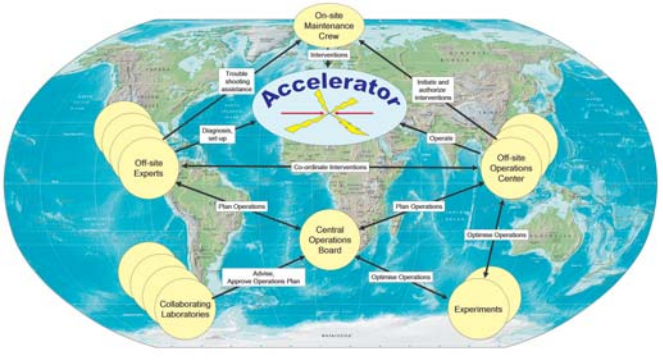
- CMS experiment (CERN)
- Photoinjector (FNAL)
- RHIC operations (BNL)
- SNS accelerator (ORNL)
- TTF accelerator (DESY)

In addition to these there are numerous scientific (e.g. in large scale astrophysics facilities) and industrial projects of direct value for GAN.

For the ICFA-Task force report see http://www.fnal.gov/directorate/icfa/icfa_tforce_reports.html
The chairman of the ICFA beam dynamics subpanel is Dave Rice (Cornell) dhr1@cornell.edu
The homepages of the GAN workshops are www.lns.cornell.edu/public/GAN, www.agsrhichome.bnl.gov/RemOp and www.elettra.it/cotogan2003

DESY GAN Working Group

At DESY a GAN working group has been established, which consists of members of various DESY groups. The group will evaluate the relevance of DESY-specific GAN aspects, prepares GAN relevant information for DESY and develops a proposal for the future co-ordination of GAN activities at DESY. The corresponding sociological and organisational aspects of collaboration are addressed by interdisciplinary working groups and workshops.



The German government approved the construction of a new Free Electron Laser (XFEL in TESLA Technology) for DESY in a decision in February 2003 emphasizing the European co-operation under which this project will be realised.
DESY will continue its research work on the TESLA Linear Collider in the existing international framework, to facilitate German participation in a future global project.

DESY already participates in various GAN related activities. Among those are:

- a proposal to create a Multipurpose Virtual Laboratory (MVL) as part of the European Design Study Towards a Global TeV Linear Collider EUROTeV
- development and usage of collaboration tools (electronic logbook)
- TTF (Tesla Test Facility) remote shifts from INFN, Milano, Cornell, as well as remote control of PITZ (Photon Injector Test facility Zeuthen)
- development of the TTF2 data acquisition system

For information on EUROTeV see http://www-flc.desy.de/eurotev/

Grid Developments and Services at DESY

Grid Computing at DESY

For the HERA experiments DESY operates a computing infrastructure with elaborated data management and analysis functionality. Computing resources at participating remote institutes play a vital role for Monte Carlo production and as analysis station for scientists. Integrating these resources for the various aspects of HEP analysis has been key to the success of HERA analysis. Now Grid technologies are successively replacing and extending the existing solutions.

The role of DESY for the HERA experiments is as Tier0 and Tier1 centre for data recording and production and as analysis centre. For the HERA II program it is essential to use Grid resources at remote sites, starting with Monte Carlo Production, where the applications are ready to use the Grid infrastructure. For the University of Hamburg we are footprint in the LHC Grid for CMS analysis.

The Grid infrastructure at DESY is aligned with the HEP emerging standard, based on EDG software and supported and maintained by the LCG project.

Snapshot of HEP Grid Sites in Europe

With the experience in HEP data management and analysis DESY is a strong partner in various Grid projects and initiatives:

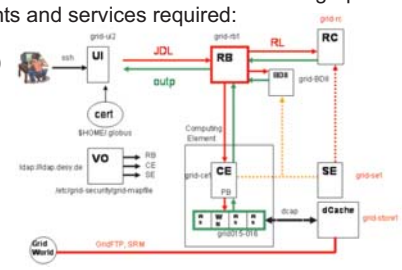
- Enabling Grids for E-science in Europe (EGEE) (see http://public.eu-egee.org/)
- e-Science in Germany (see http://d-grid.de/)
- German Grid for HEP (GHEP)
- International Lattice Data Grid (LIDG) (see: www.lqcd.org/ildg/)

At DESY we contribute to the development and support of Grid software:

- We are developing key components for data management (dCache) together with Fermilab
- We are extending standard Grid Middleware be the necessary functionality for the HERA experiments
- We integrate the Middleware building blocks into the DESY infrastructure
- We support the participating institutes to setup and operate the Grid for HERA analysis

After the experience with EDG middleware on a DESY test infrastructure we are now setting up the production infrastructure. This consists of all Grid components and services required:

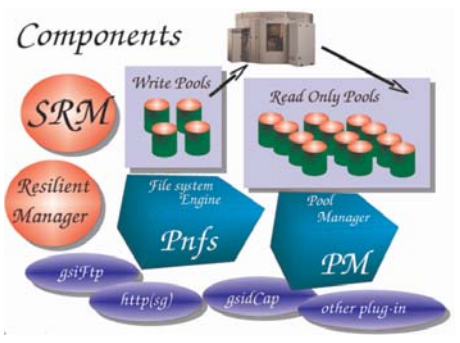
- Compute Elements (CE) with many Worker Nodes (WN)
- Resource Broker (RB)
- User Interface (UI)
- Virtual Organisation (VO) Management
- Storage Elements (SE), on the basis of dCache
- Meta Data and Replica Catalogue
- Data Replication service
- Monitoring and Information Systems (BDII)



Architecture of Grid Components at DESY

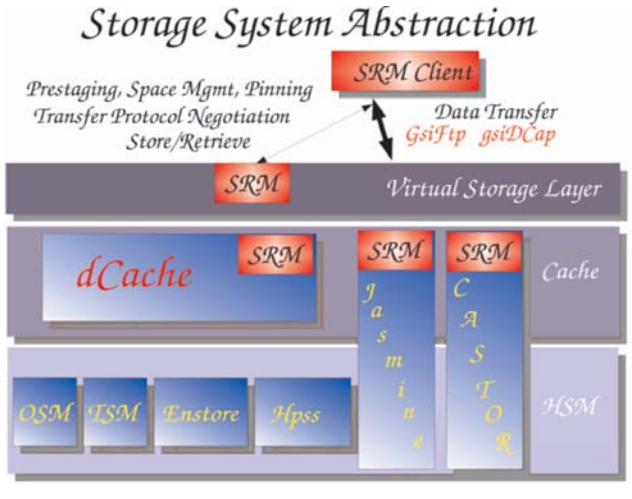
dCache: A Mass Storage GRID Fabric

The dCache product provides a system for storing and retrieving huge amounts of data, distributed among a large number of heterogeneous server nodes, under a single virtual filesystem tree with a variety of standard access methods. Depending on the Persistency Model, dCache provides methods for exchanging data with backend (tertiary) Storage Systems as well as space management, pool attraction, dataset replication, hot spot determination and recovery from disk or node failures. Connected to a tertiary storage system, the cache simulates unlimited direct access storage space. Data exchanges to and from the underlying Hierachical Storage Managers are performed automatically and invisibly to the user. Filesystem namespace operations may be performed through a standard nfs(2) interface.



dCache is a joint venture between the Deutsches Elektronen-Synchrotron, DESY and the Fermi National Accelerator Laboratory, FERMI.

Since end of 2001 the dCache full production release is in use at an increasing number of sites worldwide and is delivering TBytes of data from over hundreds of distributed server nodes. It is also part of the LCG Middleware for LHC computing as a certified Storage Element.



dCache is installed at many Grid sites. Large installations exist for CDF at Fermilab, Batavia, USA with 150 TBytes of disk storage, 50 TBytes delivered per day and at DESY, Hamburg, Germany with 70 TBytes fo disk storage, where 20 TBytes are delivered each day.

Many other sites connected to the Grid are using dCache, like the LHC Tier1 centre in Karlsruhe, Germany, as well as the US-CMS prototype Tier II centres at San Diego, Caltech, University of Florida and University of Madison, Wisconsin.