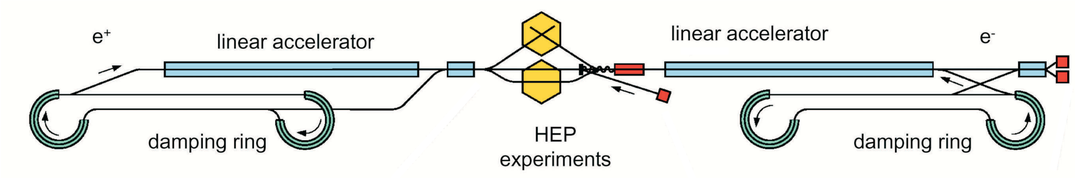
Global Networks

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. Two international workshops followed – the first in March 2002 in Cornell, the second in September 2002 in Shelter Island. 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.

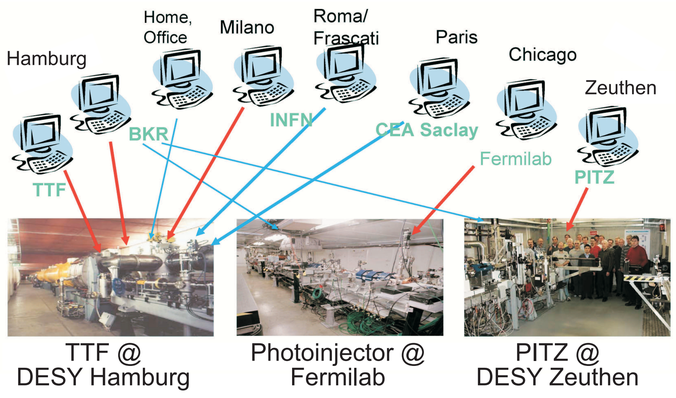
Furthermore, all participating countries must be willing to invest and to commit them-selves through long-term agreements.

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:

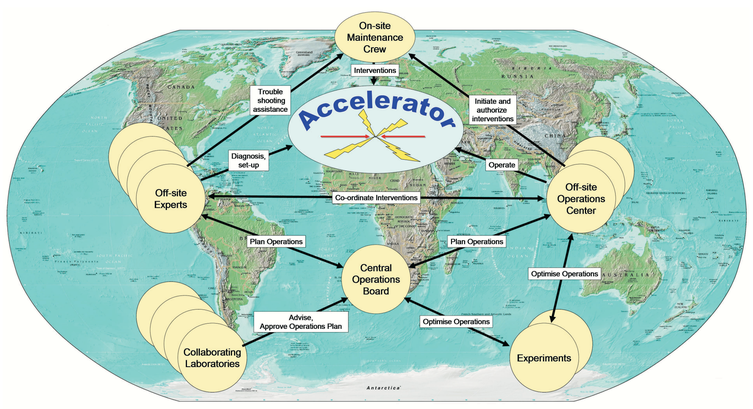
- CMS experiment (CERN)
- Photoinjector (FNAL)
- RHIC operations (BNL)
- SNS accelerator (ORNL)
- TTF accelerator (DESY)

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 homepage of the Cornell Workshop "Enabling the Global Accelerator Network" is http://www.lns.cornell.edu/public/GAN/
The homepage of the Shelter Island "Remote Operations Workshop" is http://www.agsrhichome.bnl.gov/RemOp/
For information on CARE see the ESGARD homepage http://esgard.lal.in2p3.fr

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 (TESLA XFEL) 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 TESLA 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:

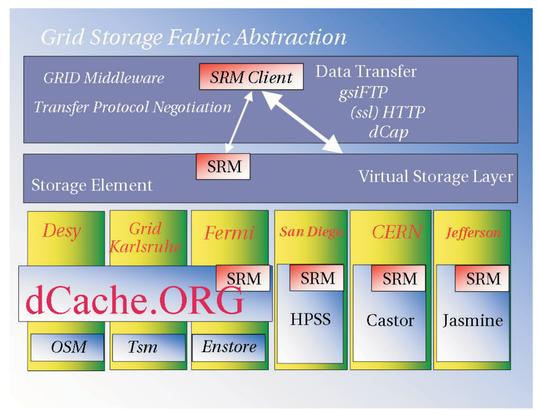
- a proposal to create a Multipurpose Virtual Laboratory (MVL) as part of the Coordinated Accelerator Research in Europe (CARE) initiative
- development and usage of collaboration tools (electronic logbook)
- TTF (Tesla Test Facility) remote shifts from INFN, Milano, Cornell, as well as remote control of PITZ (Photon Injector Test facility Zeuthen)
- development of the TTF2 data acquisition system

GRID Activities at DESY

dCache: Mass Storage GRID Fabric

In 2001, an international collaboration among EU-Data Grid (EDG WP2 and WP5), Fermilab, Jefferson Lab, and LBNL initiated the definition of an abstract interface to mass storage Grid Fabrics, the Storage Resource Manager (SRM). This approach should allow to negotiate data and transport attributes, like dataset catalogues and transfer protocols, among the Grid middleware layer and the underlying highly heterogeneous mass storage fabrics.

DESY in collaboration with Fermilab, has designed and implemented a generic data cache layer, the dCache, capable of storing hundreds of terabytes of data on cheap commodity hardware supporting a variety of hierarchical storage managers (HSM). One of the crucial components of the cache is the implementation of the SRM protocol. Hence the dCache as is, can be operated as a mass storage Grid Fabric and can be accessed by standard data transfer Grid middleware tools (e.g. globus-url-copy).



For the time being, the dCache is in production at DESY, Fermilab, and at various places around the world in conjunction with the US-CMS participation at CERN. The German Grid Tier I center at FZ Karlsruhe (GridKa) has substantial interest in adopting the dCache technology.

ILDG: International Lattice Data GRID

The lattice field theory community has started to develop the so-called International Lattice Data Grid (ILDG). It aims on providing a Data Grid to exchange data which are results of very resource consuming simulations.

This project was started by UKQCD and the US American SciDAC initiative and in the meantime incorporates the entire lattice QCD (LQCD) community, including theorists at DESY Hamburg and Zeuthen.

Two working groups have been set up to coordinate these developments:

- The Metadata Group aims on standardizing an XML Schema for Lattice Field Theory data.
- The Middleware Group aims on standardizing protocols for interconnecting existing Grids.

DESY is actively involved in both groups. It is planned to participate in a testbed to publish the data catalogue by means of a Storage Resource Manager (SRM). The SRM will be built using the dCache technology (see down).

Computing Grids for Monte Carlo production

The ZEUS Collaboration has implemented a worldwide distributed Monte Carlo Production with an early computing grid named FUNNEL. Started in 1996, the FUNNEL system runs currently on 15 sites in eight countries on four different operating system platforms. A sophisticated middleware allows to specify simulation requests and to retrieve the results. About 240 million events have been processed in 2002.

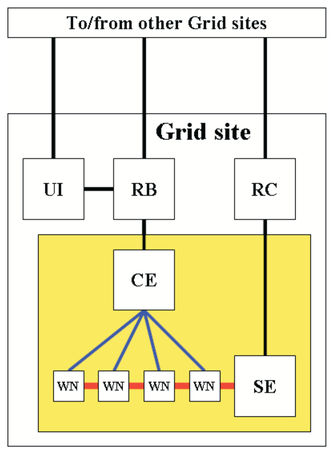
The H1 Collaboration together with the DESY IT group has recently initiated the H1GRID project: This project is carried out together with the Queen Mary University London (QMUL) which is already part of the UK Particle Physics Grid (GridPP) in the LHC Computing Grid and EU-DataGrid (EDG) context. Currently a testbed for Work Package (WP) 6 is being set up. The H1GRID project contains 3 phases:

The first phase is a testbed in which basic functionalities of the Globus Toolkit in conjunction with the EDG software are studied. The main building blocks of the Grid such as User Interface (UI), Computing Element (CE), Worker Node (WN), Storage Element (SE), Replica Catalogue (RB) and Resource Broker (RB) are installed on SuSE-based DESY Linux systems. DESY user, host, and service certificates are issued by GridKa at FZ Karlsruhe which serves as the Certification Authority (CA) for the German Grid. It is planned to complete the testbed and connect it to the QMUL systems by the end of summer. The Storage Element (SE) will be based on the dCache technology.

The testbed step is being carried out independently of any experiment specific software and saves as basis for further Grid activities at DESY.

In the prototype phase it is planned to bring H1 specific physics applications, e.g. Monte Carlo, generation and detector simulation, onto the Grid. This requires to envelope the application software in a framework which includes all necessary non-standard Linux libraries and provide access to data input, geometry and conditions databases.

In the final phase more resources of other institutes and universities will be included to set up a production system.



The diagram gives a rough overview of the main elements of an independent Grid site:
Job submission is done from a User Interface (UI) which contacts a local or a remote Resource Broker (RB). The RB knows about the computing resources in all connected Grid sites and routes the job to a suitable Computing Element (CE) at an appropriate site. The CE starts the job on a worker node (WN), usually by way of a batch system. The output information is routed back via the CE to the submitting UI. Data which are needed by the WNs are provided by a Storage Element (SE) which requests data via a Replica Catalogue (RC) in case they are not locally available.