The CampusGrid Test Bed at Forschungszentrum Karlsruhe

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Abstract. A central idea of Grid Computing is the virtualization of heterogeneous resources. To meet this challenge the Institute for Scientific Computing (IWR), has started the project CampusGrid. Its medium term goal is to provide a seamless IT environment supporting the on-site research activities in Physics, Bioinformatics, Nanotechnology and Meteorology. The environment will include all kinds of HPC resources: vector computers, shared memory SMP servers and clusters of commodity components, InfiniBand-Clusters as well as a shared high-performance SAN storage solution and a global file system. The paper shows the ideas, the test-bed and informs about the current project status and scheduled development tasks. This is associated with reports on other activities in the fields of Grid computing and high performance computing at IWR and D-Grid.

1 Introduction

It is a medium term goal to realize the project CampusGrid at FZK to support the on-site research activities in physics, bioinformatics, nanotechnology and meteorology. We cooperate with industrial partners and international institutions to test and discuss the functionality, robustness and scalability of such a seamless IT environment. The CampusGrid project aims at building a virtual computer with

- CPUs of various types, running different operating systems
- distributed and shared memory
- a global high performance file system

The environment will be based on a middleware layer which uses Grid technologies to implement secure single sign-on, job management and allocation of resources. This middleware layer may be assembled from the wide range of existing or currently developed Grid middleware solutions which will be adapted and improved in order to match our specific requirements. For instance, the middleware needed on each resource of the CampusGrid must support our heterogeneous hardware and should be as light-weight as possible. For compatibility, all resources of the CampusGrid should be accessible as OGSA compliant Grid services. Our close cooperation with international Grid projects as well as industrial partners – hardware manufacturers and software developers – guarantees a progressive and competitive solution.

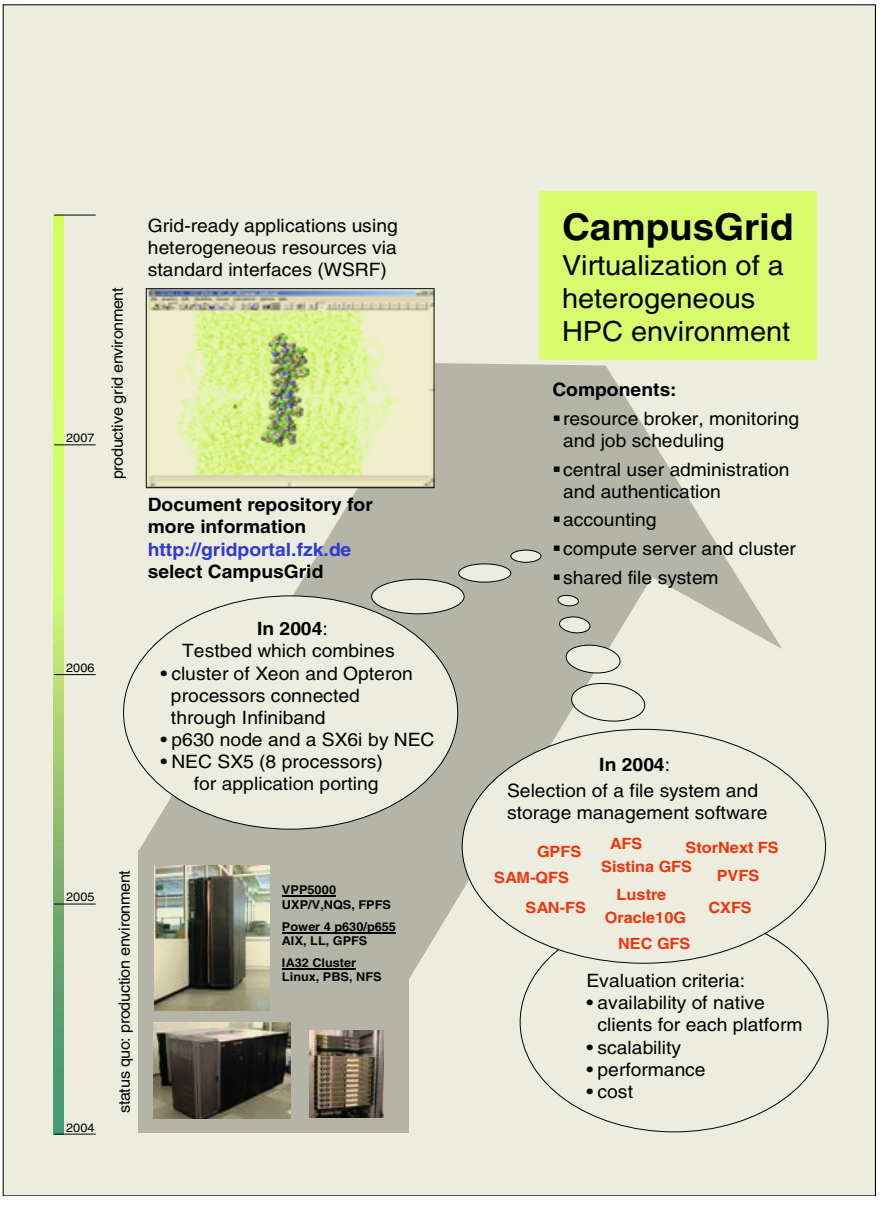
P.M.A. Sloot et al. (Eds.): EGC 2005, LNCS 3470, pp. 1139 – 1142, 2005.

Modern application packages often include parts well suited for cluster computing as well as serial components which require vector processors to achieve acceptable performance. The processing of experimental data typically results in a complex computational scheme where the user divides the job into subtasks and submits them to the available computing resources. By use of an intelligent brokerage and scheduling mechanism the CampusGrid software will choose the optimum computing platform for each subtask with respect to resource workload and user constraints. This will allow for the complementary use of high performance vector computers, large SMP systems and clusters built from commodity hardware (with or without high performance interconnect) in the same job. At the same time emphasis is put on the implementation of a unique working area with high performance access for all CampusGrid users. Access to online storage in an effective way and improved communication between hundreds or thousands of nodes in High Throughput Computing (HTC) clusters will benefit from technological standards like iSCSI and Infiniband. Both options will be studied in order to optimize the dataflow between the CampusGrid components. The results of these studies are of special interest also for the rapidly scaling storage area networks of the GridKa environment.

It is the overall long term vision to allow the seamless integration of all kind of resources in a Grid, CPUs and data archives as well as on-site experiments, measuring devices and facilities like the synchrotron radiation source ANKA (www.fzk.de/anka). Efficient use of such a computational environment will also require adaptations of the application software which will be demonstrated by selected packages of scientific and industrial partners who evaluate the CampusGrid under production conditions.

2 Status Quo and Project Progress

For many years, IWR has been operating a wide range of different computers which are optimally tailored to their respective use, like vector computers (VPP5000), clusters of SMP computers (IBM-SP Power3/Power4) and clusters of commodity processors. In its responsibility for the CampusGrid Project, IWR plans to harmonize heterogeneous hardware platforms by a software layer starting in 2004. For this purpose, the concept of grid computing will be applied to the existing installations. A mandatory first step is the administration of the users and access rights by a common user administration in the Windows based "active directory with services for Unix". Anther step is the implementation of global data storage, i.e. all data inventories may be accessed and changed in the same way by each computer connected. As an ad hoc solution the corresponding environment “Globale Datenhaltung und Benutzerverwaltung” has already been deployed. Now we are in the process of evaluating the hard- and software environment for the CampusGrid project.


2007
2006
2005
2004
productive grid environment
status quo: production environment
Grid-ready applications using heterogeneous resources via standard interfaces (WSRF)
Document repository for more information
http://gridportal.fzk.de
select CampusGrid
CampusGrid
Virtualization of a heterogeneous HPC environment
Components:
resource broker, monitoring and job scheduling
central user administration and authentication
accounting
compute server and cluster
shared file system
In 2004:
Testbed which combines
cluster of Xeon and Opteron processors connected through Infiniband
p630 node and a SX6i by NEC
NEC SX5 (8 processors) for application porting
In 2004:
Selection of a file system and storage management software
GPFS
AFS
StorNext FS
Sistina GFS
SAM-QFS
PVFS
Lustre
SAN-FS
Oracle10G
CXFS
NEC GFS
Evaluation criteria:
availability of native clients for each platform
scalability
performance
cost
VPP5000
UXP/V,NQS, FPFS
Power 4 p630/p655
AIX, LL, GPFS
IA32 Cluster
Linux, PBS, NFS

The active Testbed for SNFS looks like: