Introduction of the Hungarian Supercomputing Grid experiments

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• Explanation the main goal of the project

• Short description of the Hungarian Supercomputing Grid (H-SuperGrid) infrastructure

• Hardware and middleware constructions

• Summarize the result of the project and the execution possibilities for sequential, MPI (Message Passing Interface) and PVM (Parallel Virtual Machine) applications

• Testing possibilities
Aims of the project

- Establish the Hungarian Supercomputing Grid testbed, based on the current Hungarian and international results of cluster and Grid computing
- Integrating the Hungarian supercomputers and large capacity clusters into a supercomputing Grid infrastructure
- Using the Grid middlewares and job-managers with good efficiency in the determined testbed
- Determination of the execution possibilities for the applications which have high computation requirements
Co-ordinator

Office for National Information Infrastructure Development (NIIFI)

Consortium members

- Computer and Automation Research Institute Hungarian Academy of Sciences (MTA SZTAKI)
- BUTE Dept. Control Engineering and Information Technology
- ELTE Network Service Center
- BUTE Center of Information Systems
- BUTE Institute of Nuclear Technics
- HP Computer Hungary Ltd.

- The SuperGrid includes heterogeneous resources

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**Actual structure of the SuperGrid**

- **GRID application**
- **Web based GRID access**
  - GRID portal
  - P-GRADE portal
- **High-level parallel development layer**
  - P-GRADE
- **Low-level parallel development**
  - PVM
  - MW
  - MPI
- **Grid level job management**
  - Condor-G
- **Grid middleware**
  - Globus
- **Grid fabric**
  - Condor, Sun Grid Engine (SGE)
  - Fork
  - SUN HPC
  - Compaq Alpha Server
  - Clusters

**P-GRADE**: Parallel Grid Run-time and Application Development Environment.

**Condor-G**: Marriage of Condor and Globus. Uses the Globus Toolkit to start the job on the remote machine.

**Globus**: Grid middleware system.

**Local job-managers**: Condor, Sun Grid Engine (SGE), Fork.
TESTING POSSIBILITY: The MCNPX

- Fortran90 Monte Carlo radiation transport computer code
- It transports all particles at all energies
- A special application modelling the lifetime of the reactor shells of the Hungarian nuclear power station at Paks
- Time consuming computation of the particles trajectories (neutrons, protons, electrons, etc.)
- Reduced computational time with PVM and MPI versions
- Execution on the SuperGrid was the final requirements of the project
- The simulation results are accepted by the Nuclear authorities
• The Hungarian nuclear power station had a critical breakdown in a fuel assemblies cleaning storage tank (2003. April)
• The Institute of Nuclear Technics calculated more than 100 scenarios about the risks of critical consequences
• For the calculations the Nuclear Institute used the SuperGrid testbed
• The whole calculations time claimed 4 weeks
• If the testbed had been completely available, than the required computational time were significant less
• Furthermore, Grid enabled MPI (MPICH-G2) version of the code was created by our laboratory (first time in the world)
• Tested between two clusters
Fuel assemblies

Horizontal profile

Vertical profile

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Result: the execution time is longer than in the case of one cluster. The processes intercommunications are time-consuming.
Application executing possibilities at the consortium members

First scenario

Condor

UNIVERSE

Vanilla Standard PVM MPI

Second scenario

Globus

Jobmanager

Fork Condor SGE

SEQ SEQ SEQ

MPI MPI MPI

MPI PVM

Third scenario

Condor-G

Jobmanager

Globus

Fork Condor SGE

SEQ SEQ SEQ

MPI PVM

MPI

:Ok

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• The created tesbed has great importance
• Heterogeneous, supports the joint of different types of clusters and supercomputers
• Gives a high-performance and high-throughput Grid for the parallel applications
• The connection to the European Grid infrastructure is easily achievable
• The integration of the P-GRADE with Condor and Globus is provide a high-level program development environment for the Grid
Thank you for your attention!