



High Performance Computing at NIIF

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The mission of NIIF/Hungarnet

“The goal is to provide leading-edge (IT) infrastructure for research and higher education organizations and public collections.”

Source: Government decision about NIIF/Hungarnet



NIIF/Hungarnet background

- Long history of research networking in Hungary: since 1986
- NIIF/Hungarnet is one of the oldest NRENs of Europe
- The figures today:
 - 10G backbone, ~600.000 users, ~750 institutions
 - all universities, high schools, research institutes, most of the public collections (libraries, museums)
- Being among the first 10 research network in Europe (by quality of infrastructure, size and services)
- NIIF/Hungarnet is under the authority of the Ministry of Informatics and Telecommunications

Key elements of NIIF's strategy



- State-of-the-art infrastructure for research and higher education
- Best of breed enabling technologies/services for the institutions
- Taking the advantage of being *equal partner* in Europe from 1st of May 2004
- Eliminating infrastructural bottlenecks and disparities
- Providing equal opportunities to all Hungarian scientists for participating in worldwide R&D cooperations
- Preserving the leading position among European NRENs



Architectural design of the NIIF „building”

**collaborative
infrastructure**

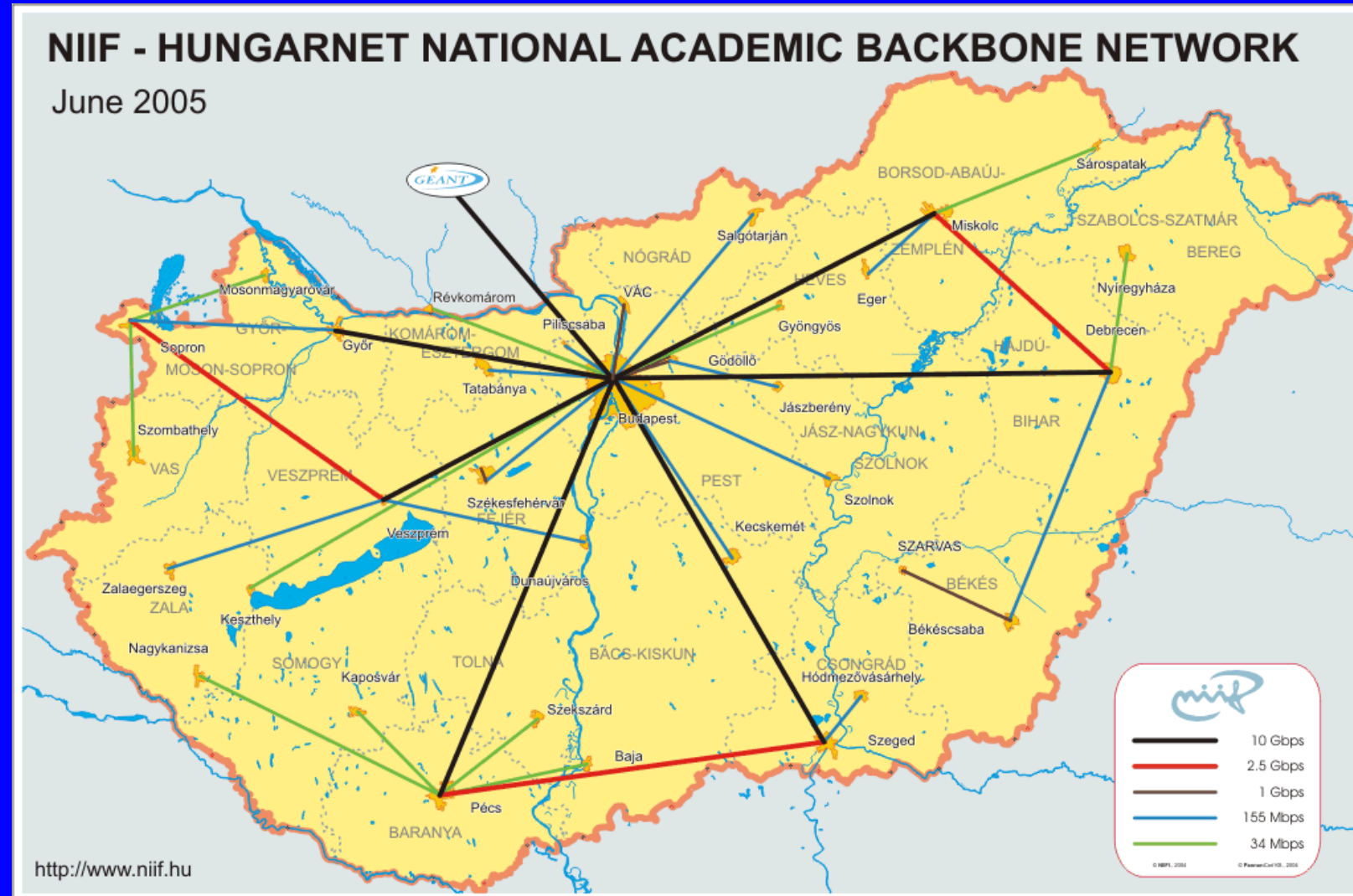
**computing
infrastructure**

middleware infrastructure

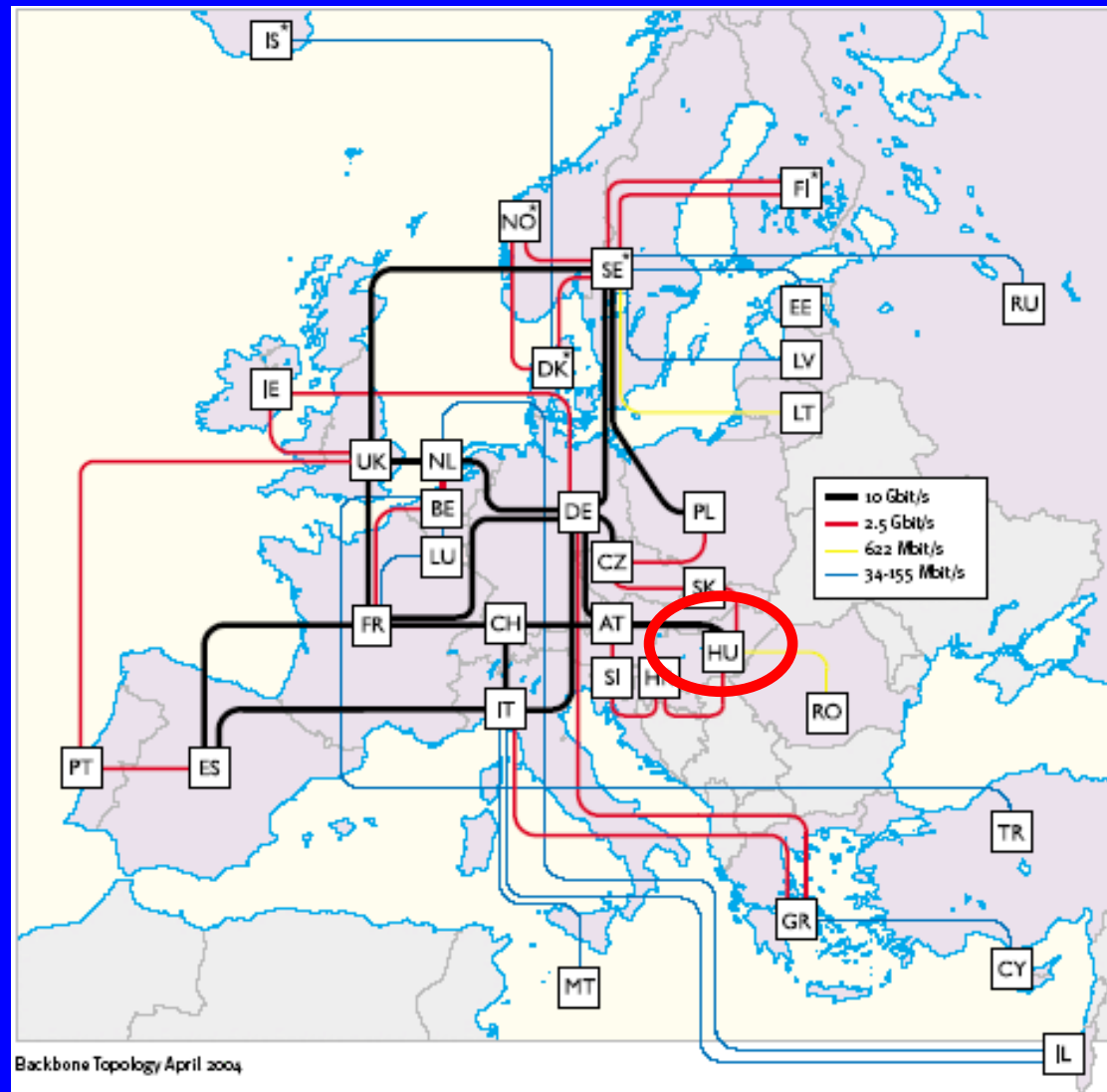
networking infrastructure

Each building block contains a number of NIIF projects

Networking infrastructure



GEANT topology





Computational infrastructure at NIIF/Hungarnet





NREN and HPC

- Supporting large scale, high performance scientific computing is one of the most important roles of research networks today
- Often, academic institutions cannot afford buying and operating expensive supercomputing facilities by themselves
- User demand for computing power is ever increasing at universities and research institutes



NREN and HPC

- NRENs may provide efficient solutions for satisfying the academic community's needs toward HPC infrastructure
- The NIIF/Hungarnet answer:
 - Centrally operated supercomputing facility (Supercomputer Center)
 - Distributed, countrywide HPC grid, based on institution owned PC labs (ClusterGrid)



NIIF and HPC

Mission:

- Supporting Hungarian research and science with very high power computing infrastructure
- Better and more efficient utilization of the already existing networking and computing elements
- Stimulating national and international scientific cooperation



NIIF supercomputer centre



- Established in 2001
- Initial configuration:
 - 2x SunE10k
 - 96 processors
 - 60 Gflops
 - TOP500 ranking!
- Regular, yearly update to keep pace with the increasing user demand



NIF supercomputer centre today

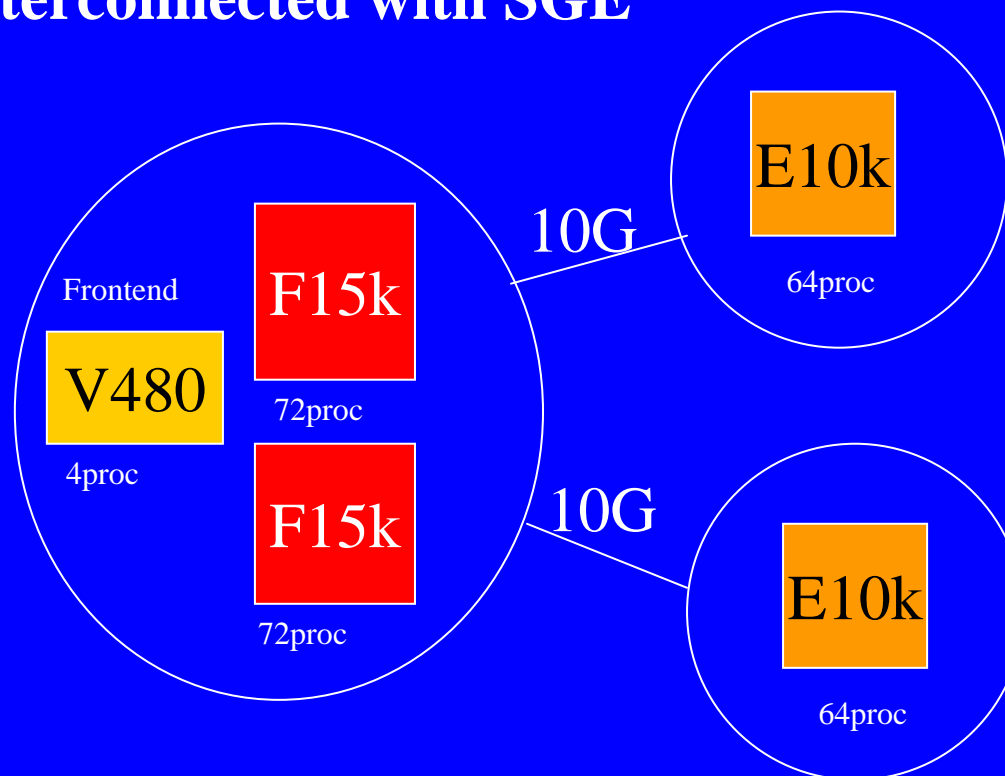


- 4 computing nodes
- SMP architecture
- 276 processors
- 356 Gbyte memory
- ~560 Gflops power
- 20 Tbyte storage
- 7x24 operation
- 180,000
CPUhour/month



The NIIF supercomputer nodes

Interconnected with SGE





The NIIF supercomputer

- MPI, PVM and OpenMP parallel environments are all supported
- Highly optimized parallel mathematical libraries
- Auto-parallel compilers
- High level fully graphical parallel development and debugging tools
- Popular applications installed (Gaussian, etc.)



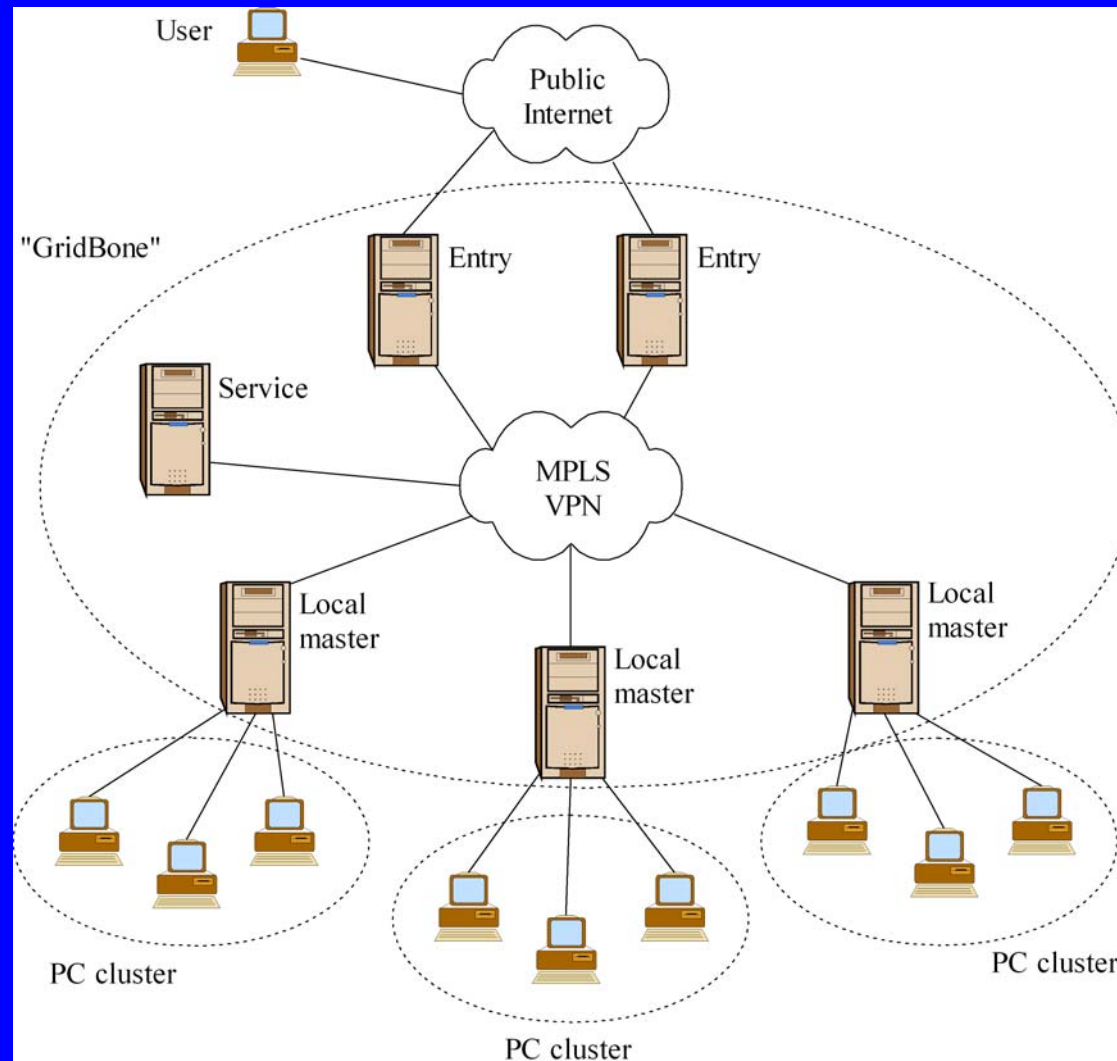
The Hungarian ClusterGrid Infrastructure Project



daily production use since 2003

www.clustergrid.niif.hu

General architecture





System features

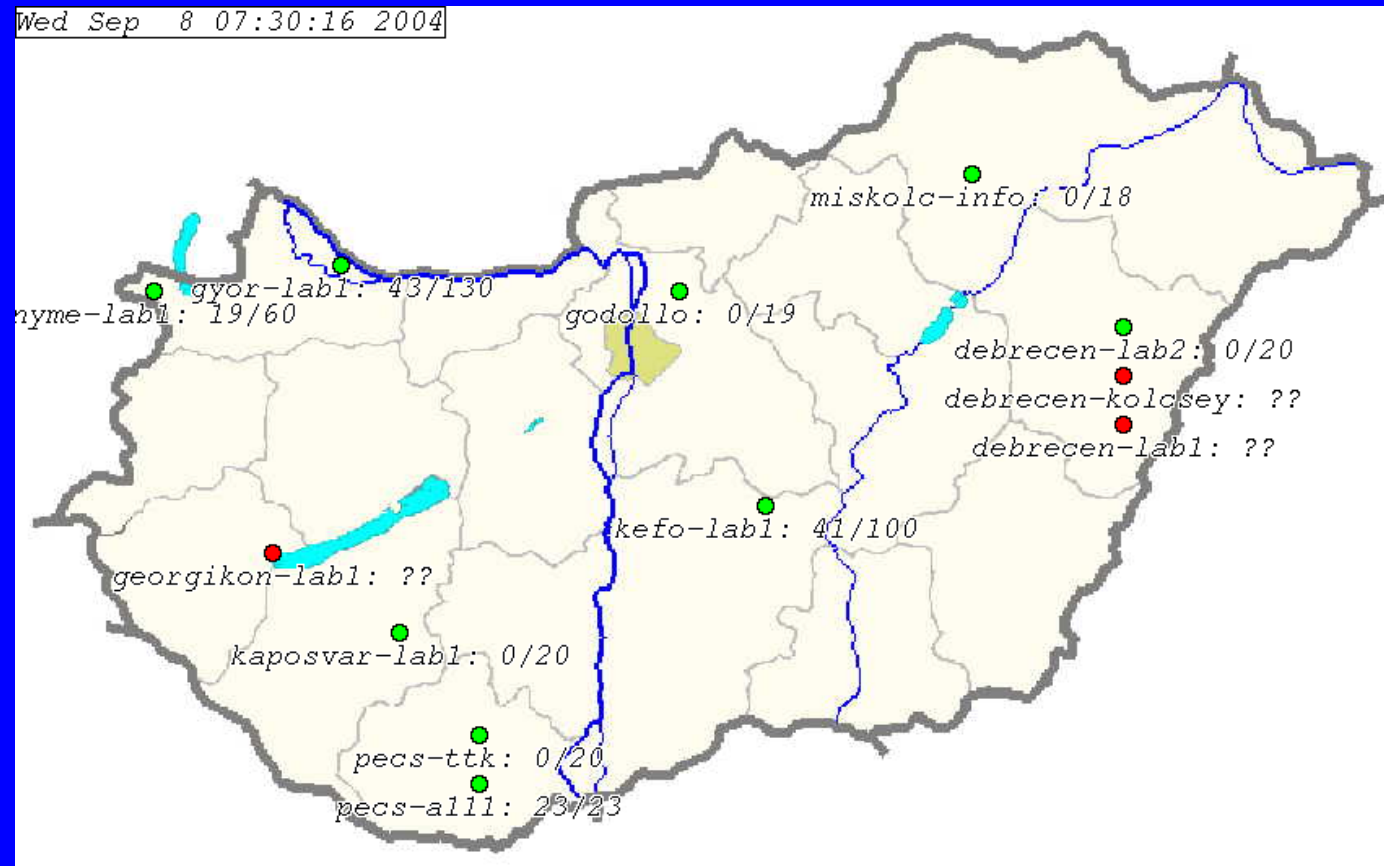
- Intel processors, Linux environment
- Currently 1600 execution nodes at 24 institutions are connected
- The cummulated grid peak performance is measured to be 1.4 Tflops
- More than 16 scientific projects are using it
- In production, since July 2003

The innovative features



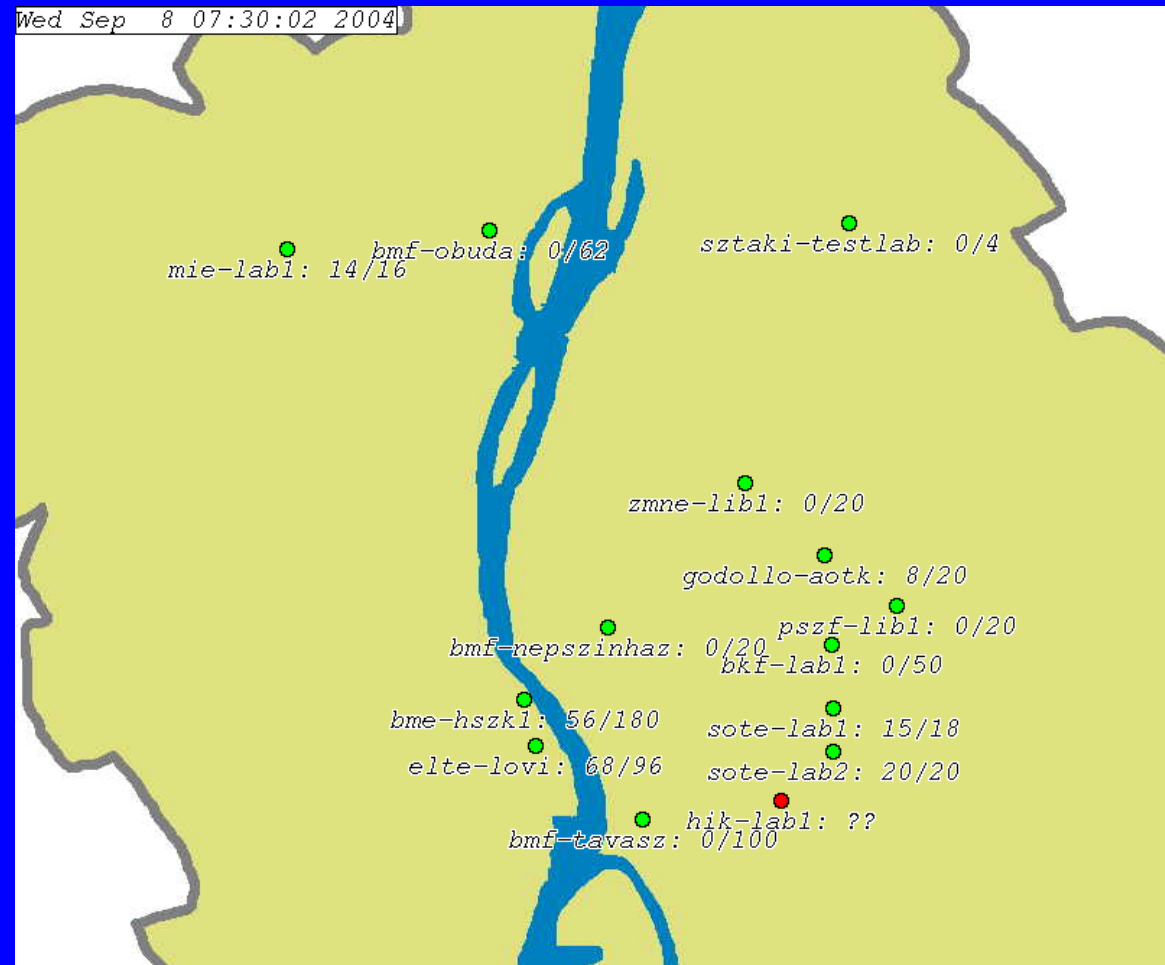
- Use of virtual private networking (VPN)
- Ease of management (NFS root “thin” clients, network boot solution)
- Intelligent, web-service and web-transaction based grid resource brokering
- A “one job – one directory structure” execution layout
- LDAP based, integrated and uniform user and job authentication and authorization

The Provincial Map





Budapest map



Grid projects with NIIF participation



- SuperGrid (Hungarian, NIIF coordinator)
- ClusterGrid (Hungarian, NIIF coordinator)
- EGEE (EU, NIIF contractor)
- SEEGRID (EU, NIIF subcontractor)
- Resource Grid (Hungarian, NIIF contractor)
- NIIF is founding member of the Hungarian Grid Competence Center (MGKK)



Cooperation with NorduGrid

- NorduGrid currently has ~6000 processors
- NIIF ClusterGrid - NorduGrid interconnection is being developed
- Joint FP6 proposal is submitted
- Switzerland and Slovakia are also partners



Other important grid projects in Hungary

- EGEE(2) - MTA SZTAKI, NIIF, MTA KFKI, Technical Univ. of Budapest
- HunGrid - MTA SZTAKI, MTA KFKI, MTA KKKI
 - PC clusters, ~200 processors
 - Virtual Organization within EGEE

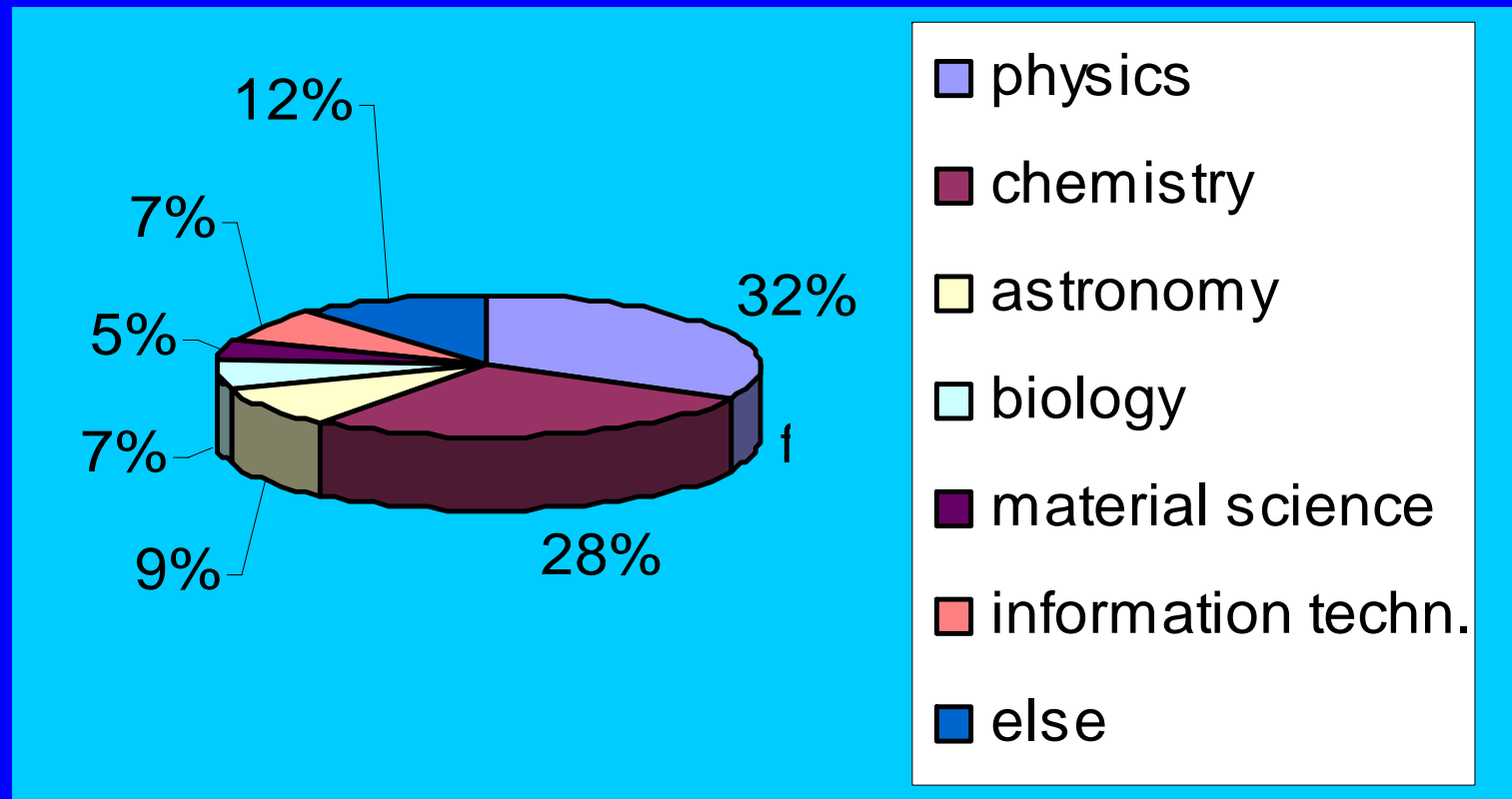
NIIF HPC applications, usage



- Many different scientific areas are represented, mainly natural sciences
- There are sequential applications to be run on large data sets million times
- There are real parallel applications (mainly message passing: PVM, MPI)
- Nearly 70 different scientific projects
- Very high utilization rate of resources (365 days average is above 90% !)



Scientific disciplines represented





Thank you!

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