How to build an inexpensive production Grid infrastructure?

The Hungarian way

Péter Kacsuk

Hungarian Grid Competence Centre

Hungarian Grid Competence Centre MGKK

- **Goal:** To co-ordinate the Grid efforts of the Hungarian higher education and research institutions
- Virtual organization established in April 2003
- Founding members:
  - MTA SZTAKI (Computer science research institute)
  - NIIFI (National Infrastructure Dev. Office - HungarNet)
  - BME (Univ. of Technology, Budapest)
  - ELTE (Univ. of Science, Budapest)
- Two main Grid infrastructure projects:
  - **ClusterGrid** (to connect the Hungarian university clusters into a **high-throughput** Grid system)
  - **SuperGrid** (to connect the Hungarian supercomputers and high-end clusters into a **high-performance** Grid system)

Hungarian ClusterGrid Initiative

- **Goal:** To connect the 99 new clusters of the Hungarian higher education institutions into a production Grid

- Each cluster contains 20 PCs and a network server PC.
  - **Day-time**: the components of the clusters are used for education
  - **At night**: all the clusters are connected to the Hungarian Grid by the Hungarian Academic network (**2.5 Gbit/sec**)
  - Total Grid capacity by the end of 2003: **2079 PCs**

- **Basic concepts:**
  - To keep the system as simple as possible
  - To use existing production quality network and Grid middleware components
  - To develop only the missing components
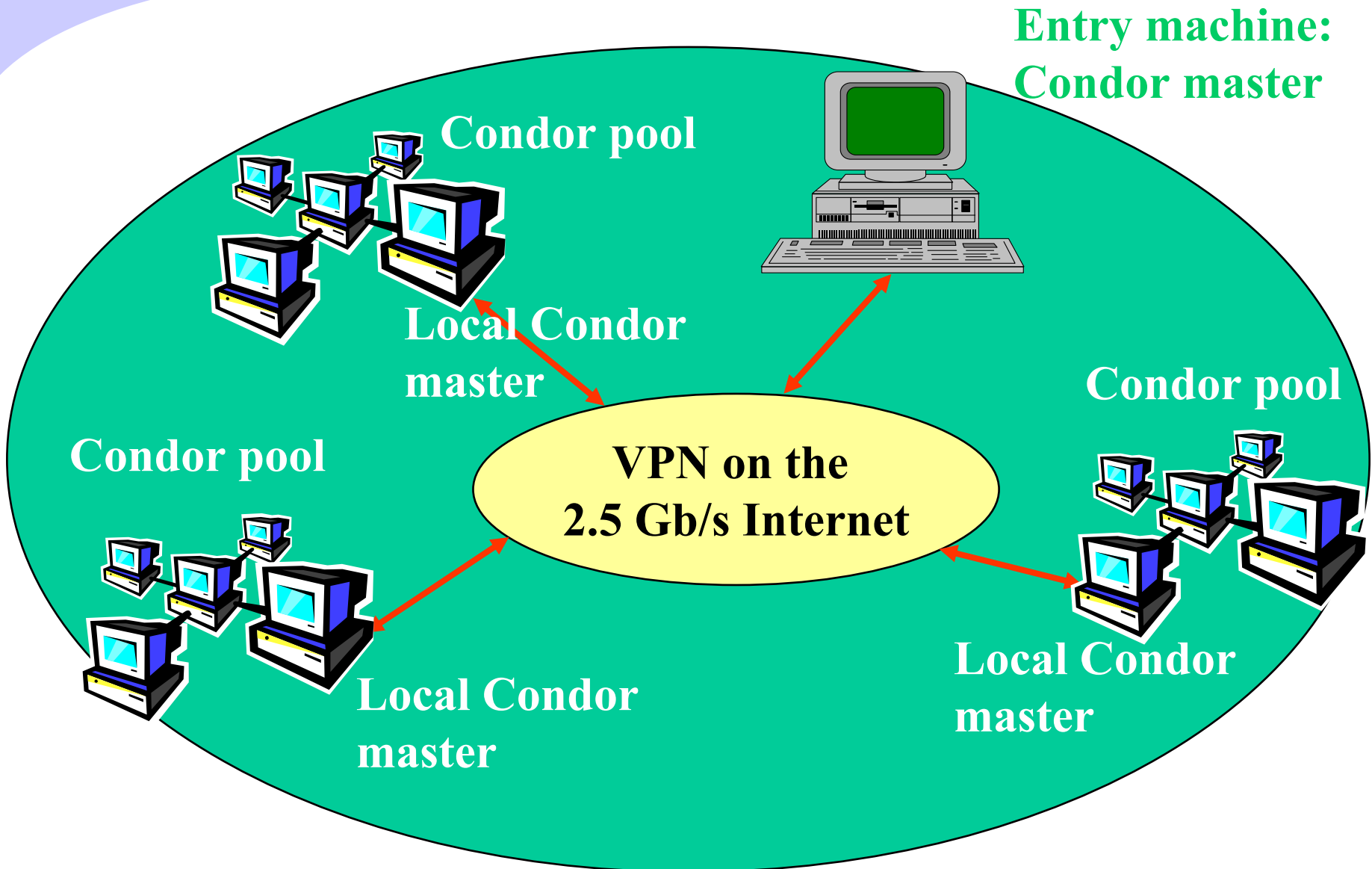 - One entry point to guarantee security
- **Existing components:**
  - Condor (flocking mode – brokering)
  - VPN technology (solving the firewall problem of Condor)
- **Own development:**
  - System boot for the Grid working mode

Structure of the Hungarian ClusterGrid

Entry machine:
Condor master

Condor pool

Local Condor master

Condor pool

Condor pool

VPN on the 2.5 Gb/s Internet

**Local Condor master**

Local Condor master

Own development: System boot for Grid mode

- The central machine and the local Condor masters operate continuously.

- Switching between different execution modes must be as automated as possible.

- The worker boot can be done from any kind of media, such as CD-ROM, floppy disk. The preferred is the network boot opportunity.
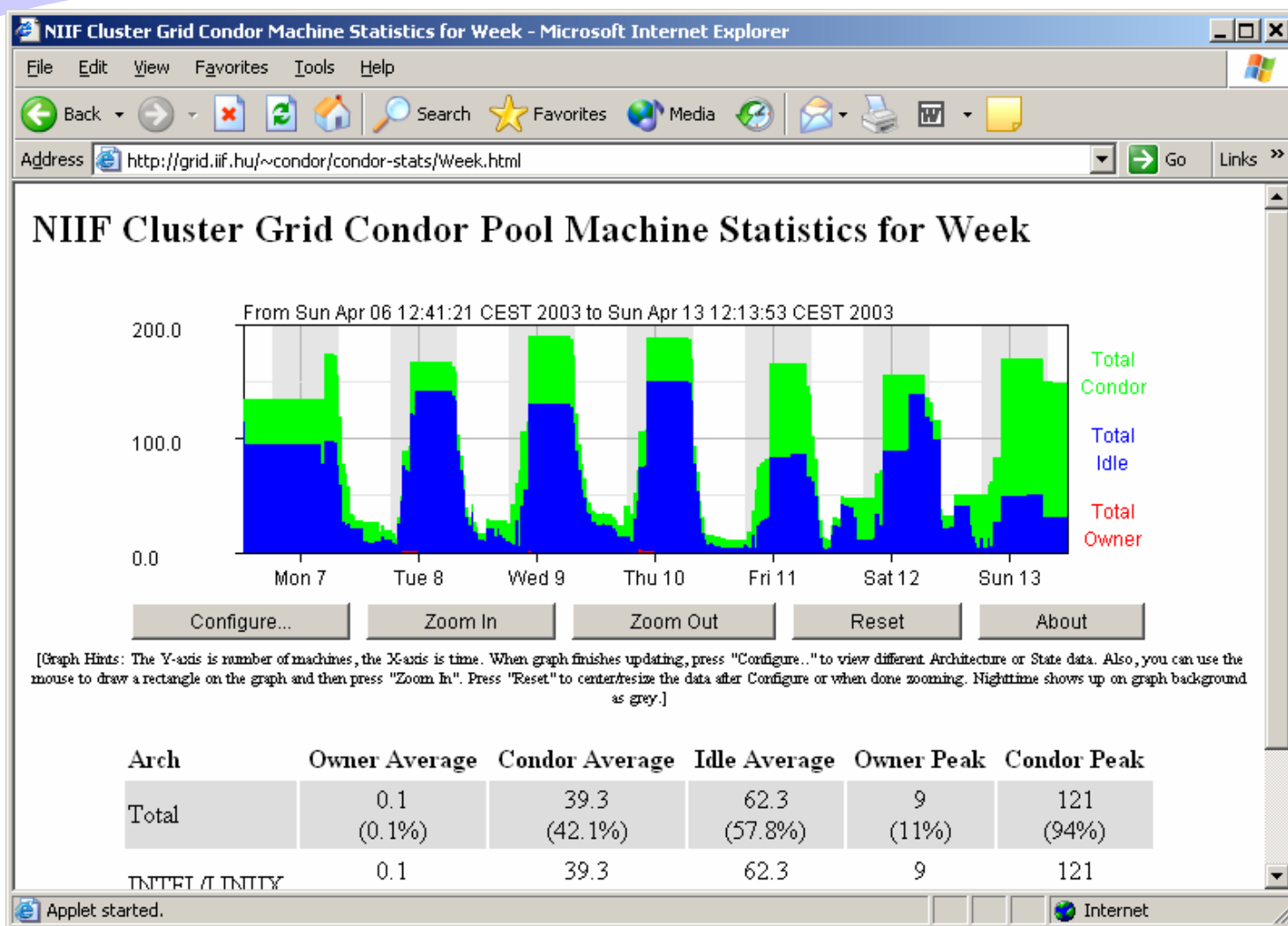
Current Implementation

- There are 8 Hungarian Institutes involved in the system (5 is outside of Budapest).
- 500 nodes are enabled for grid operation.
- It works as a **production Grid system**
- About 250 nodes in continuous (night and week-end) operation.
- The number of nodes is rapidly increasing.
- By the end of 2003 more than 2000 nodes are expected

Current structure of the ClusterGrid

Gödöllő 20

BME 160

Veszprém 20

ELTE 100

BGF 20

Dunaújváros 40

Pécs 20

Szeged 20
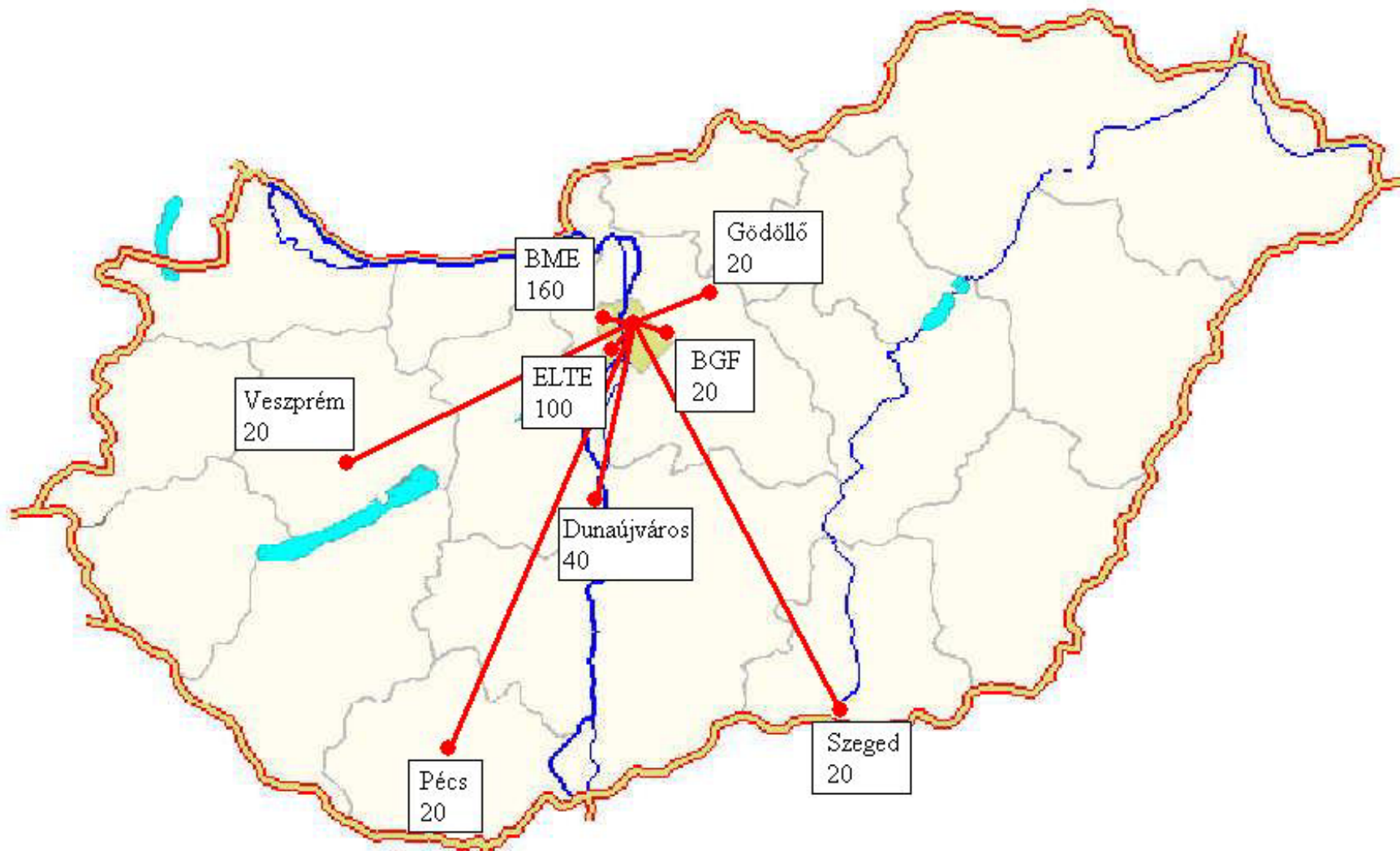
Credit to Peter Stefán (NIIFI)

Statistics of the work in April

Credit to Peter Stefán (NIIFI)

Organization of the project

- A Technical Committee led by NIIFI works on the technical realization of the project (6 persons and the system administrators of the Grid sites)

- A Steering Committee led by MGKK
  - defines the long-term development needs
  - Organizes international collaborations

Further Developments in 2003

- ## Problems
  1. High-level Grid programming environment is missing
  2. There is no parallel check-point support under Condor
  3. Condor job monitoring is not satisfactory
  4. The single entry-machine will be a bottle-neck due to the Condor file-handling mechanism

- ## Solutions
  1. **P-GRADE** (Parallel Grid Run-time and Application Development Environment) will be installed
  2. A joint work is under way to combine P-GRADE and Condor and to develop a parallel check-point system => **high-performance Grid**
  3. The **GAMI (Grid Application Monitoring Infrastructure)** developed by SZTAKI in the DataGrid and GridLab projects will be adapted
  4. On every site a separate entry-machine will be used

Reflection to some problems raised in the workshop

- Yannis Kalogirou:
  - Chicken and egg problem: first users or infrastructure?
  - **Our answer**: First a production Grid infrastructure and then the users can come
- Kyriakos Baxevanidis:
  - Concern of loosing control/acces to owned resources
  - **Our answer**: It was a real problem in the beginning but when the system started to work with the first 3 universities and 200 PCs, people realized that it is not the case and became **volunteers to offer their resources**

Conclusions

- The Hungarian ClusterGrid provides an
  - inexpensive way of creating large size Grid system
  - based on existing clusters/laboratories
  - even if they are used for other purposes during the day

- It already works as a **production Grid**

- There is already interest in other countries to build their national ClusterGrid (Ireland, Izrael)

- We propose to form an **EU project** to further develop the ClusterGrid idea and to connect it to other Grid systems like the DataGrid and EGEE systems.