

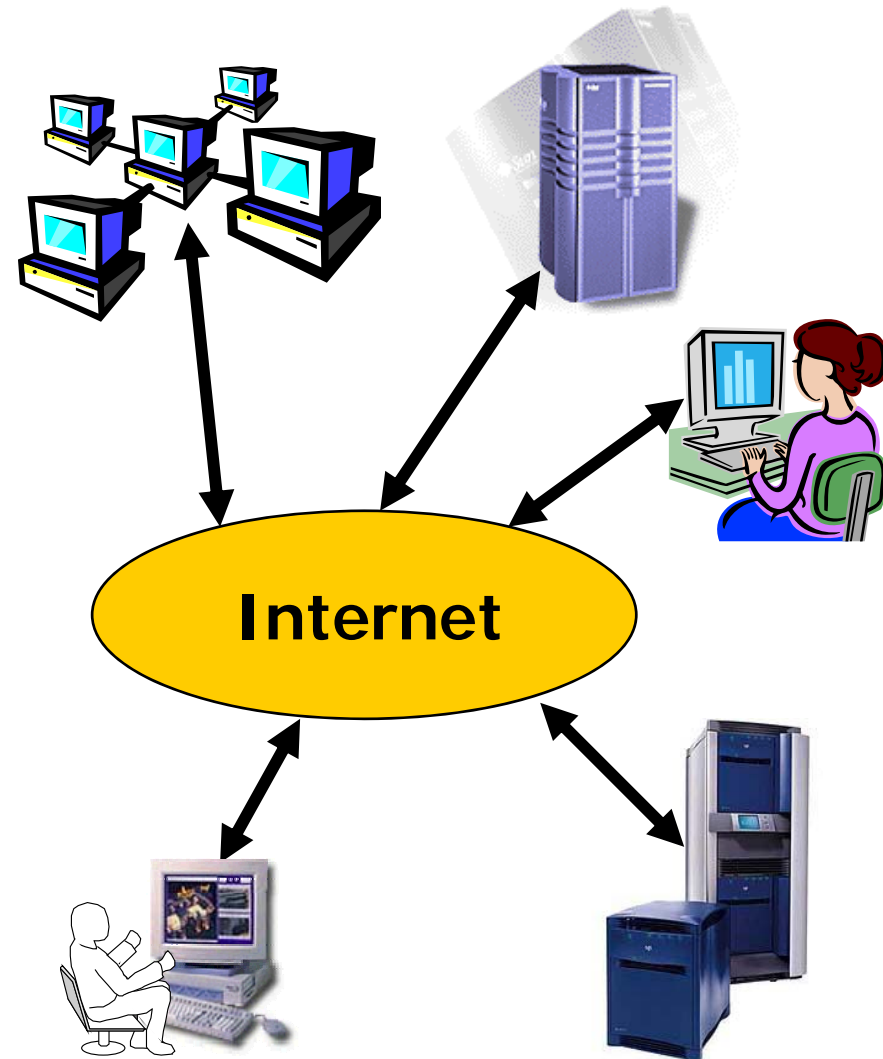


Introduction to Grid and Grid applications

Peter Kacsuk
MTA SZTAKI
www.lpds.sztaki.hu

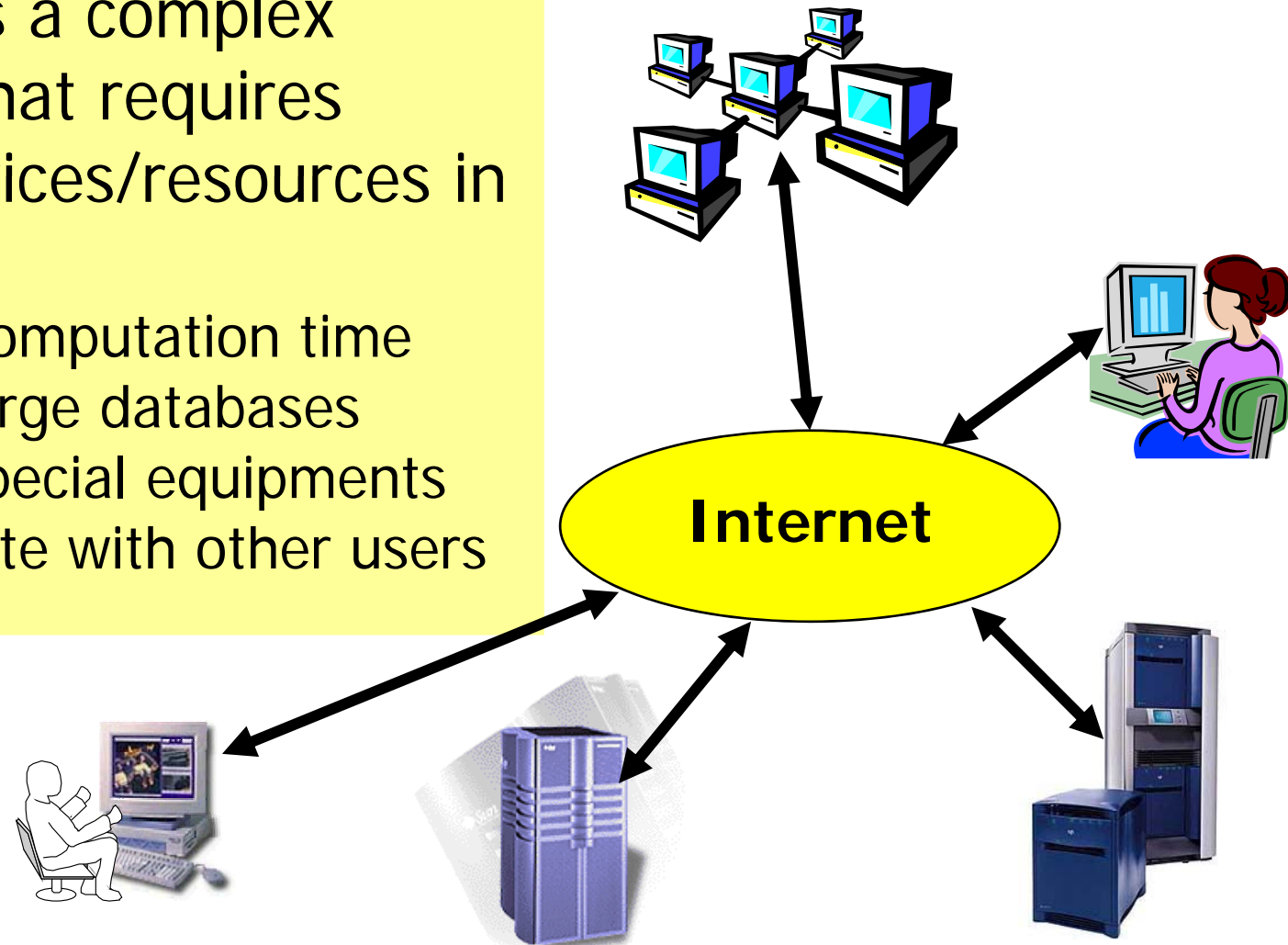
What is Grid?

- A Grid is a collection of computers, storages, special devices, services that can **dynamically join and leave** the Grid
- They are **heterogeneous** in every aspect
- They are geographically **distributed** and connected by a **wide-area network**
- They can be accessed **on-demand** by a set of users



Why use a Grid?

- A user has a complex problem that requires many services/resources in order to
 - reduce computation time
 - access large databases
 - access special equipments
 - collaborate with other users





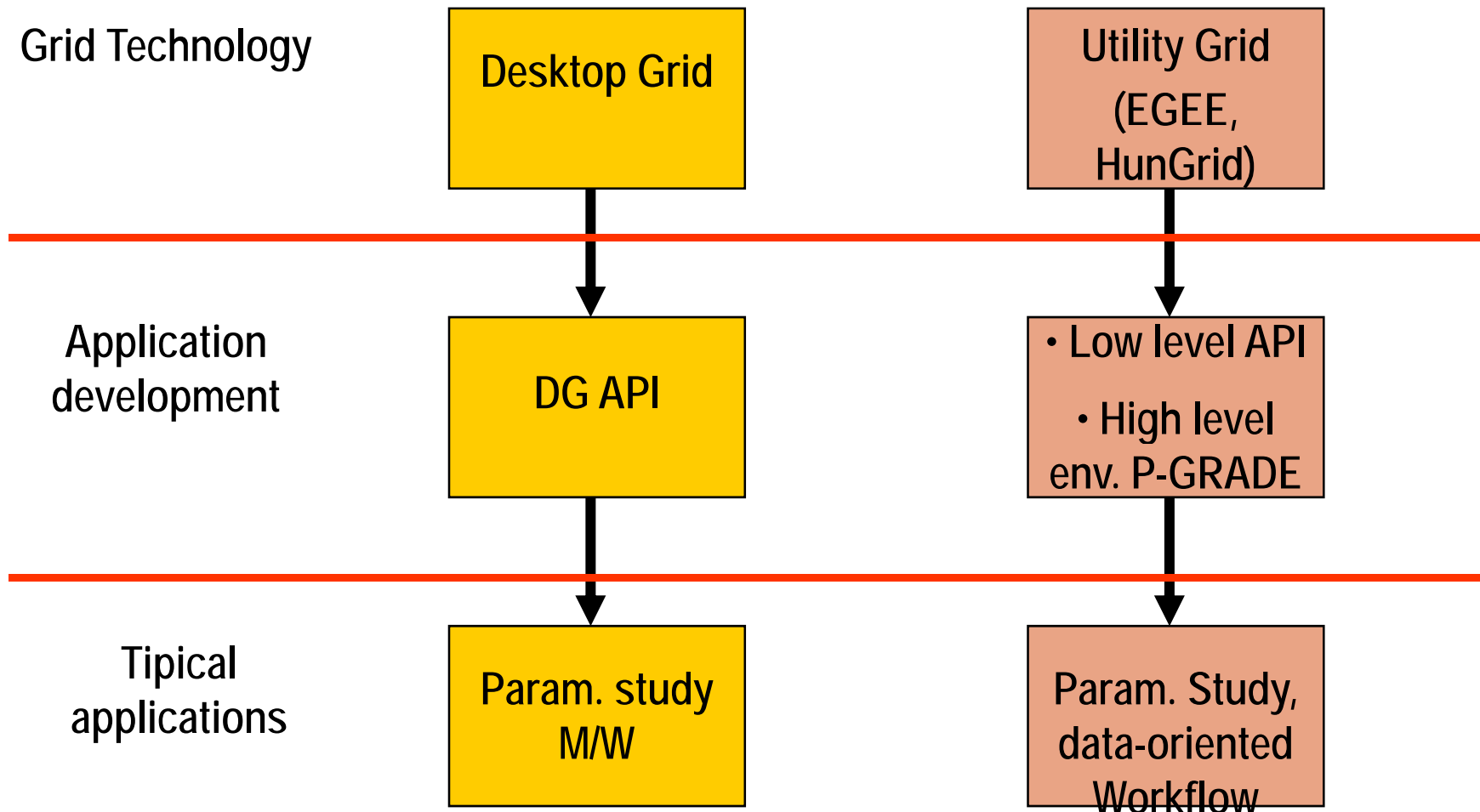
Typical Grid application areas



- **High-performance computing (HPC)**
 - to achieve **higher performance** than individual supercomputers/clusters can provide
 - Requirement: **parallel computing**
- **High-throughput computing (HTC)**
 - To exploit the **spare cycles** of various computers connected by wide area networks
- **Collaborative work**
 - Several users can jointly and remotely solve complex problems



Two basic Grid directions

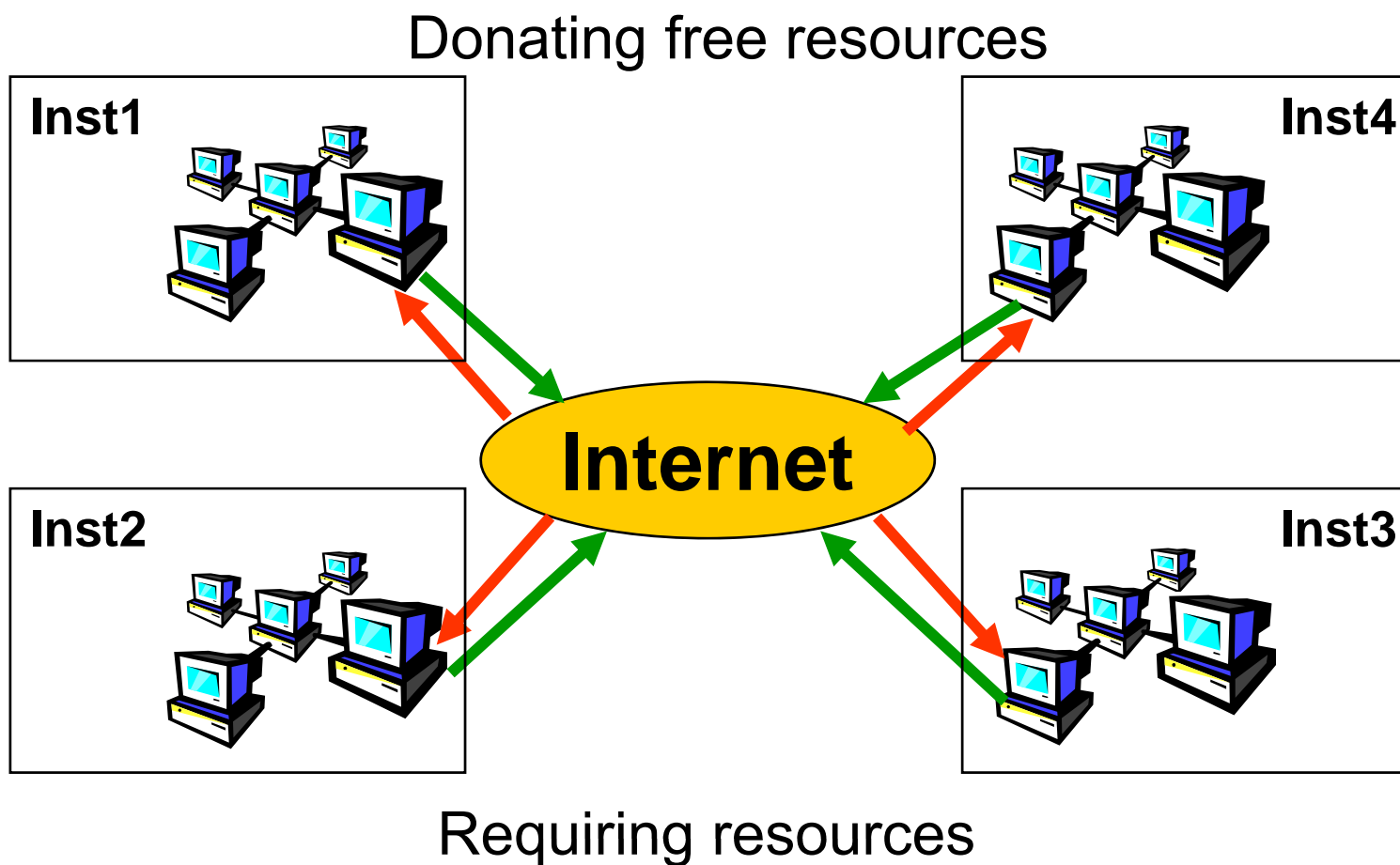




Two players of the Grid



- Resource donors = D
- Resource users = U
- Relationship between the two characterizes the Grid:
 - if $U \sim D$ \Rightarrow generic Grid model
 - if $U \gg D$ \Rightarrow utility Grid model
 - if $U \ll D$ \Rightarrow desktop Grid model



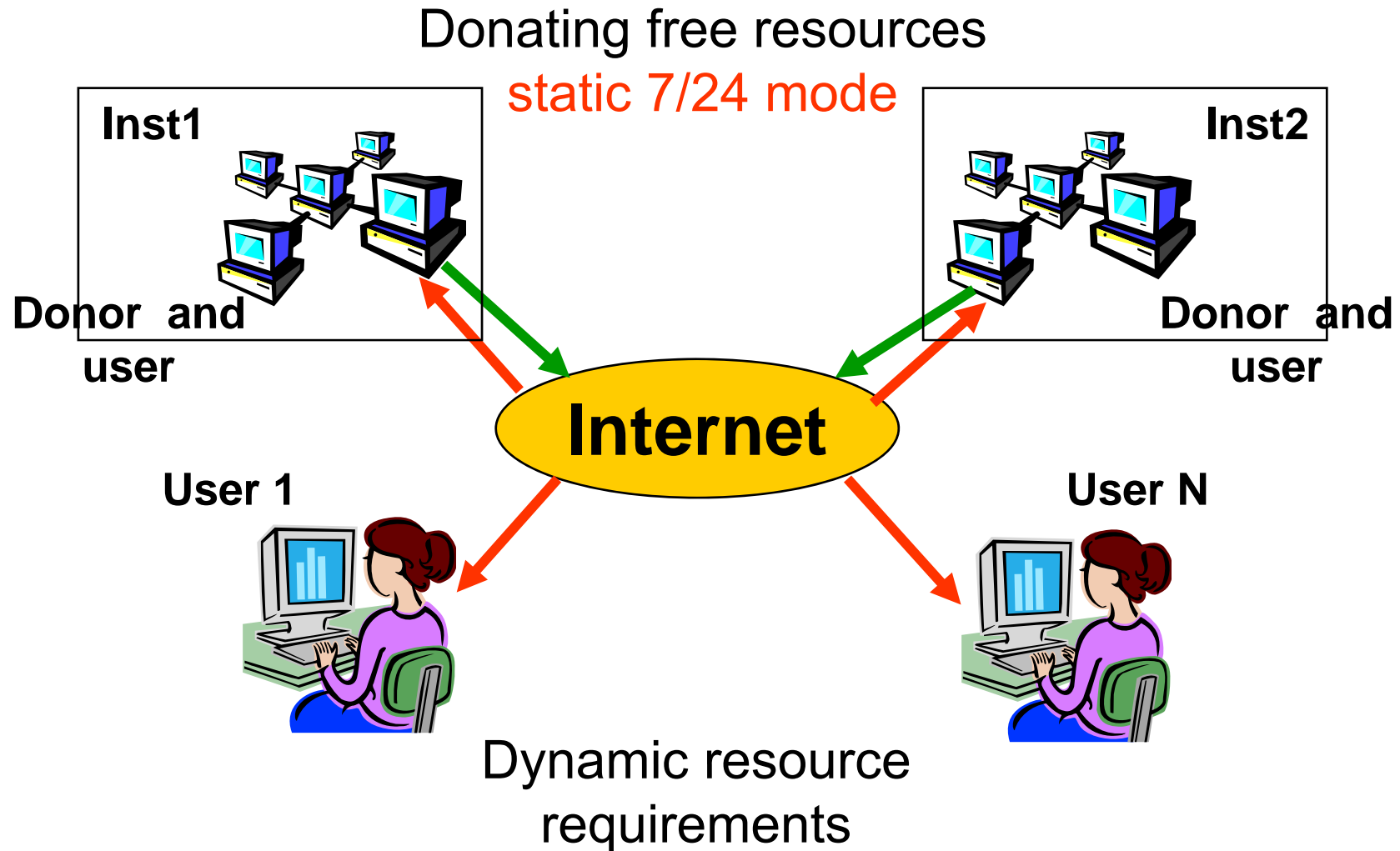


Characteristics of the generic Grid model



- Anybody can donate resources
- Heterogeneous resources, that dynamically join and leave
- Anybody can use the donated resources for solving her/his **own** applications
- Symmetric relationship between donors and users:
$$U \sim D$$
- Examples:
 - GT-2 grids
 - Jini based JGrid (developed in Hungary)
- **Problems:** Installing and maintaining client and server grid software are too complicated

Utility Grid model



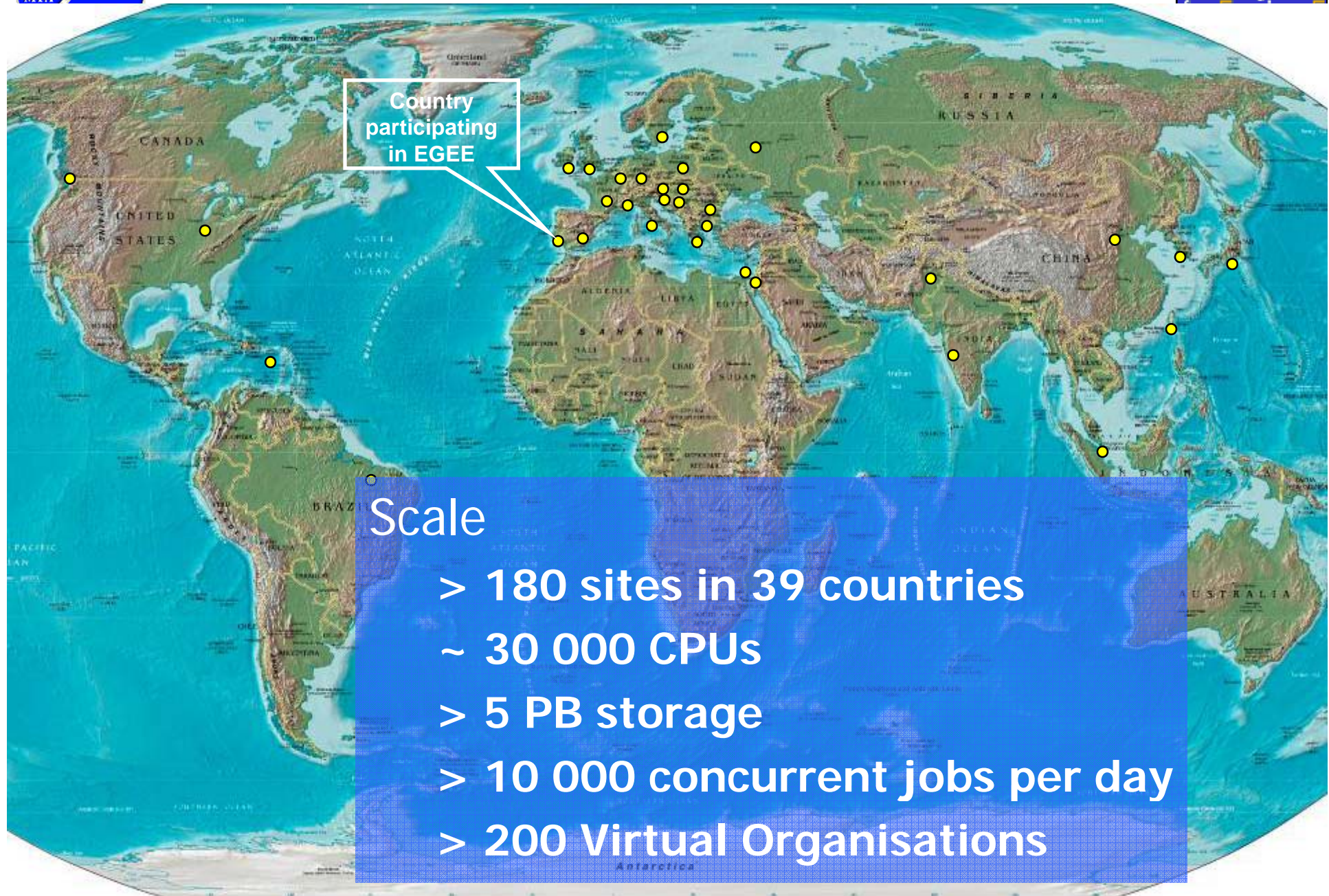


Characteristics of the utility Grid model



- Donors can be only “professional” resource providers who provide production service (7/24 mode)
- Homogeneous resources
- Anybody can use the donated resources for solving her/his **own** applications
- Asymmetric relationship between donors and users:
$$U \gg D$$
- Examples:
 - **EGEE -> HunGrid, SEE-Grid**
 - UK NGS, NorduGrid (Europe)
 - OSG, TeraGrid (USA)

The largest production Grid: EGEE





HunGrid: Hungarian VO of EGEE



KFKI-RMKI

- 150 processor
- 3.4 TB storage

SZTAKI

- 26 processzor
- 2 TB storage

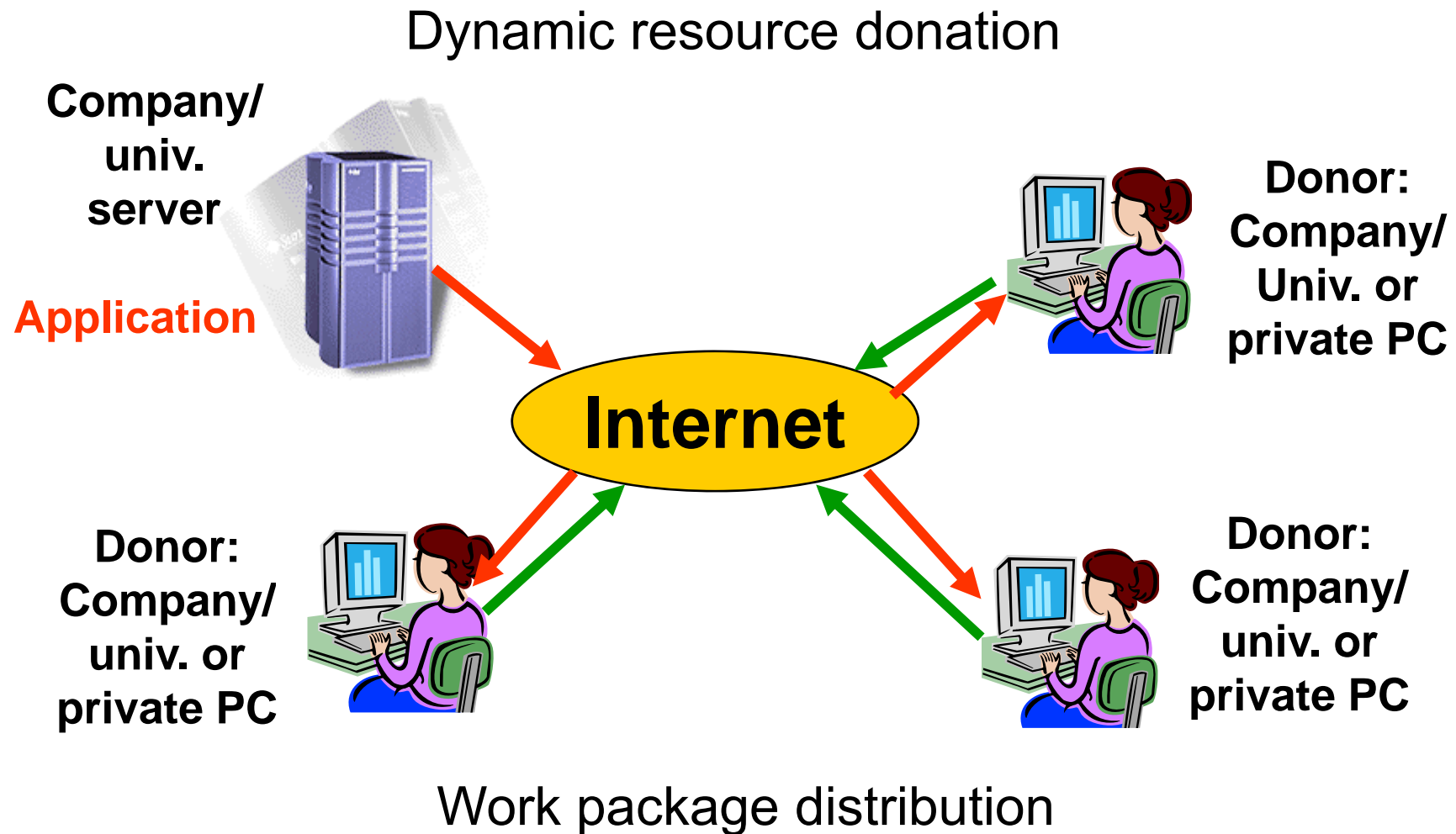
ELTE

- 50 processor
- 1.5 TB storage



Additional members: KKKI 12 processor, Veszprémi (6)

Desktop Grid model





Characteristics of the desktop Grid model



- Anybody can donate resources
- Heterogeneous resources, that dynamically join and leave
- **One or a small number of projects** can use the resources
- Asymmetric relationship between donors and users:
$$U \ll D$$
- Advantage:
 - Donating a PC is extremely easy
 - Setting up and maintaining a DG server is much easier than installing the server sw of utility grids



Types of Desktop Grids



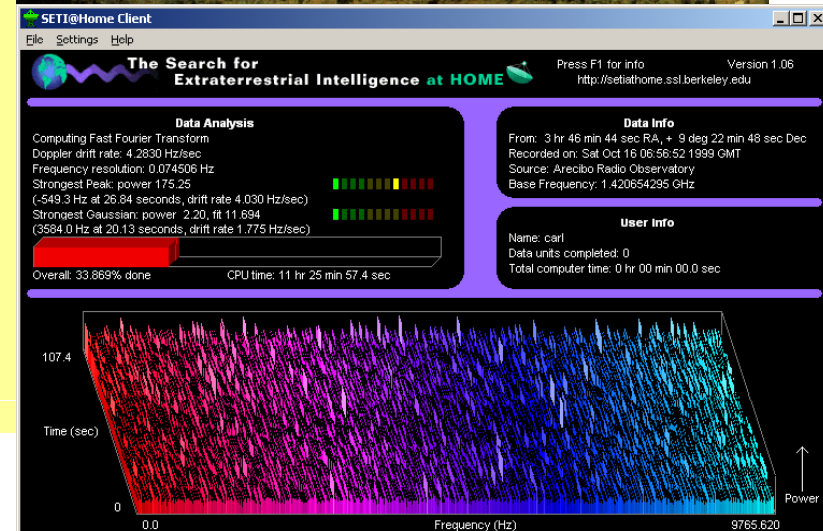
- Global Desktop Grid
 - Aim is to collect resources for grand-challenge scientific problems
- Example:
 - BOINC (SETI@home)
- Local Desktop Grid
 - Aim is to enable the quick and easy creation of grid for any community (company, univ. city, etc.) to solve their own applications
- Example:
 - SZTAKI Desktop Grid



SETI: a global desktop grid



- SETI@home
 - 3.8M users in 226 countries
 - 1200 CPU years/day
 - 38 TF sustained (Japanese Earth Simulator is 32 TF sustained)
 - **Highly heterogeneous**: >77 *different* processor types





SZTAKI Desktop Grid: a local DG system



- Main objective:
 - **Enable the creation of local DG for any community in Hungary**
 - **Demonstrate how to create such a system**
- Three steps to try and use the system:
 1. Donate one PC to test the client site
 2. Port application to the DG server and register PCs for that application
 3. Set up a DG server for the community
- SZTAKI helps in steps 2 and 3
- Number of registered donors: 18.000
- Number of registered PCs: 33.000
- How to register a PC?
 - <http://www.lpds.sztaki.hu/desktopgrid/>



User concerns of Grid systems



- How to cope with the variety of these Grid systems?
- How to develop/create new Grid applications?
- How to execute Grid applications?
- How to observe the application execution in the Grid?
- How to tackle performance issues?
- How to port legacy applications
 - to Grid systems
 - between Grid systems?
- How to execute Grid applications over several Grids in a transparent way?



Goal of the EGEE/SEEGRID Summer School



- This is a **user-oriented** and not a grid developer **school** with goals:
 - To give answers for the questions above
 - Concentrating of the EGEE Grid technology
 - Teaching the low-level EGEE user interface and APIs
 - Showing high-level Grid portal interfaces
 - Showing Grid applications developed for EGEE and SEEGRID
 - Showing how to develop applications for the EGEE-like Grids (and for other Grids)