



*Polish Infrastructure  
for Supporting Computational Science  
in the European Research Space*

# **PL-Grid: Modern Computing Infrastructure in European Research Space**

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***[www.plgrid.pl/en](http://www.plgrid.pl/en)***



# Outline

- ◆ PL-Grid Reminder
  - ◆ Motivation, consortium and objectives
  - ◆ PL-Grid and EGI
  - ◆ Organization of the project
  
- ◆ Current Status and Advancements
  - ◆ Status of hardware infrastructure
  - ◆ Operational Centre – tasks and services
  - ◆ e-Infrastructure software, software packages and user's tools
  - ◆ Training and user support
  - ◆ Security aspects
  
- ◆ Conclusions – Future work



# PL-Grid Reminder

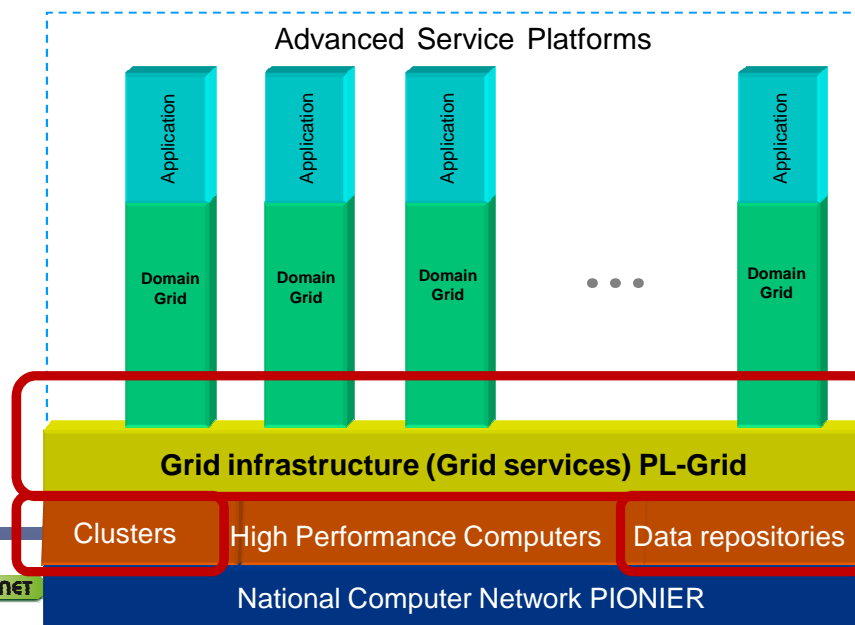
- ◆ January 2007 – Consortium Creation
- ◆ Consortium members – 5 Polish Centres
- ◆ March 2009 – PL-Grid Project proposal got funded by the European Regional Development Fund as part of the Innovative Economy Program
- ◆ March 2010 – First working NGI in Europe in the framework of EGI.eu Project website: [www.plgrid.pl/en](http://www.plgrid.pl/en)

- ◆ **Objectives:**

- ◆ Common (compatible) base infrastructure
- ◆ Capacity to construct specialized, domain Grid systems for specific applications
- ◆ Efficient use of available financial resources
- ◆ Focus on HPC and Scalability Computing for domain specific Grids

## Offer for the Users

- ◆ Computing Power 215 Tflops
- ◆ Storage 2500 TBytes
- ◆ Support from PL-Grid staff hardware, software, services





# Current Status and Advancements Hardware and Software



# Status of PL-Grid Hardware Infrastructure

Current status (March 2011):

## Computational power

### from PL-Grid resources

- ◆ CYFRONET: 53.5 Tflops
- ◆ ICM: 13.1 Tflops
- ◆ PCSS: 23.2 Tflops
- ◆ WCSS: 40.9 Tflops
- ◆ TASK: 29.9Tflops

### in installation

- (+)
- 29.6 Tflops
- 23.6 Tlops
- (+)

### current offer to (PL-Grid) users

- 95 Tflops
- 25 Tflops
- 30 Tflops
- 45 Tflops
- 29.9 Tflops

**Total: 160.6 Tflops**  
**Goal (end 2011): 215 Tflops**

**224.9 Tflops**

## Disk storage

- ◆ CYFRONET: 767 TBytes (+)
- ◆ ICM: 433 TBytes (+)
- ◆ PCSS: 300 TBytes (+)
- ◆ WCSS: 48 TBytes

**Total: 1580 TBytes**  
**Goal (end 2011): 2500 TBytes**

Increase of total performance  
and storage for users  
(→ Cyfronet example)

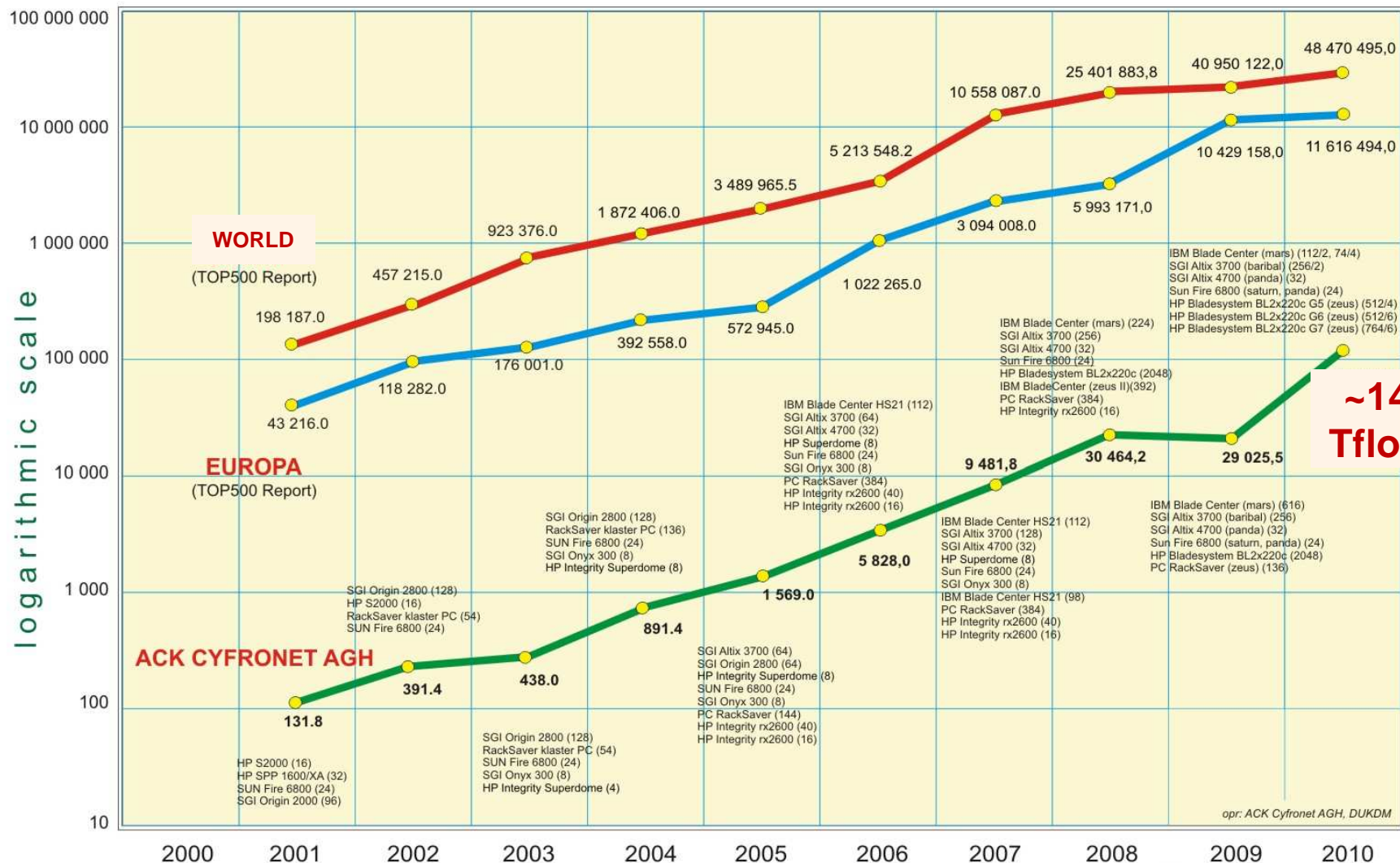


## TOP500 Nov.2010 Polish Sites

Rank	Site	System	Cores	R <sub>max</sub> Tflops	R <sub>peak</sub> Tflops
84	Cyfronet Poland	Cluster Platform 3000 BL2x220, L56xx 2.26 Ghz, Infiniband Hewlett-Packard	9840	88.05	104.7
185	Nasza Klasa Poland	Cluster Platform 3000 BL2x220, L54xx 2.5 Ghz, GigE Hewlett-Packard	8464	46.55	84.64
249	QXL Poland SP ZOO Poland	Cluster Platform 3000 BL2x220, L54xx 2.5 Ghz, GigE Hewlett-Packard	7384	40.76	73.84
297	Gdansk University of Technology, CI Task Poland	ACTION Cluster Xeon E5345 Infiniband ACTION	5336	38.17	49.73
313	PCSS Poznan Poland	Cluster Platform 3000 BL2x220, E5530 2.4 Ghz, Infiniband QDR Hewlett-Packard	4616	37.18	44.31
372	Wroclaw Centre for Networking and Supercomputing Poland	Cluster Platform 3000 BL2x220, L56xx 2.66 Ghz, Infiniband Hewlett-Packard	3840	34.73	40.86

[GF/s]

# R<sub>peak</sub> CYFRONET INSTALLED (Total)



SGI Origin 2800 (32)



SUN Fire 6800



RackSaver klaster PC



SGI Onyx 300



HP Integrity Superdome



Cluster PC



SGI Altix 3700



Cluster PC



SGI Altix 4700

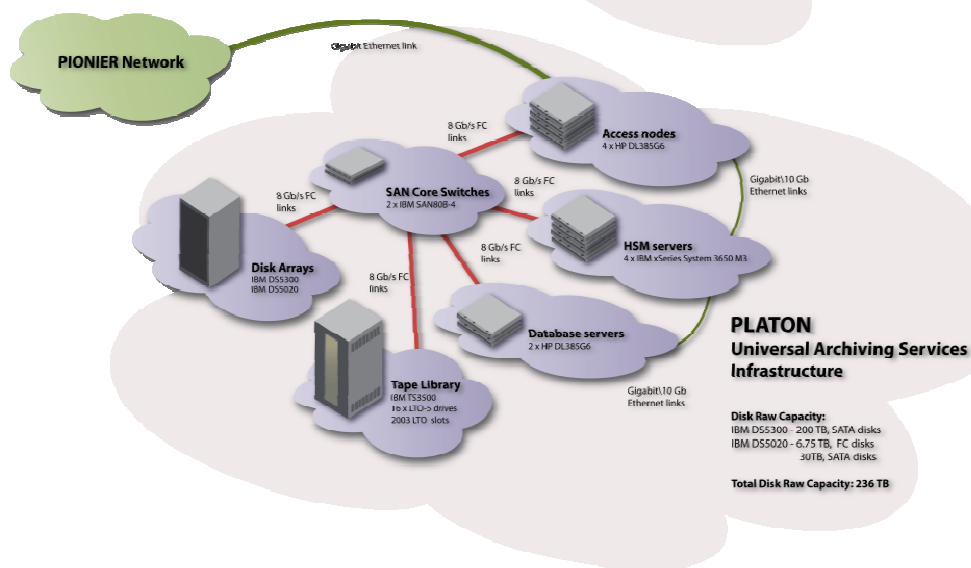
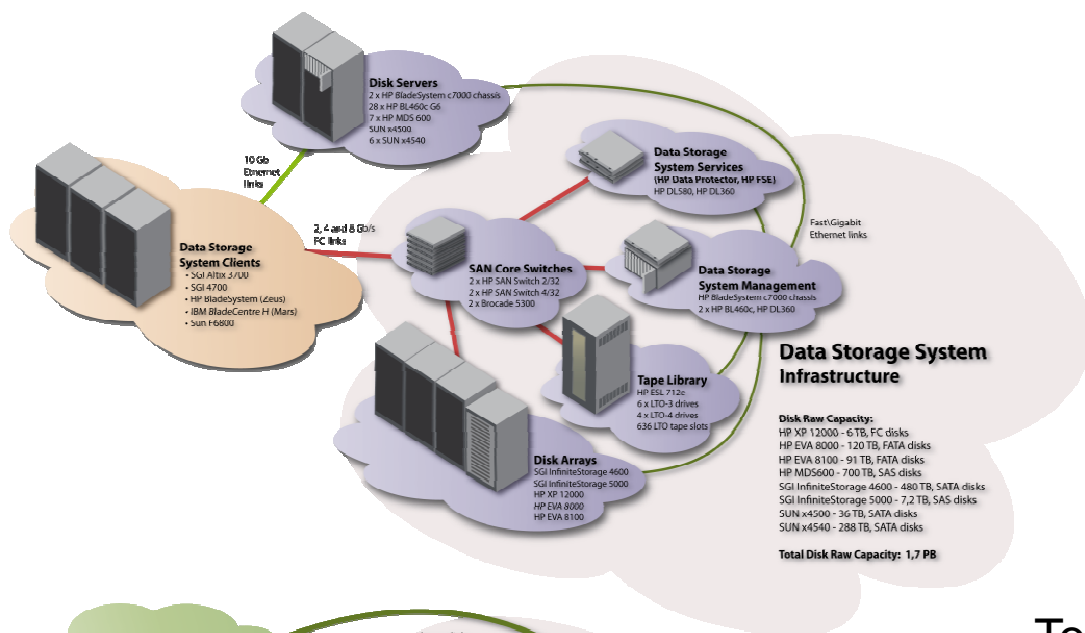


IBM BladeCenter



SGI Altix 3700, SGI Altix 4700, HP Bladesystem

# CYFRONET Storage Resources (Total)



Total system disk storage

**1,5 PB**

Total system tape storage

**3,5 PB**

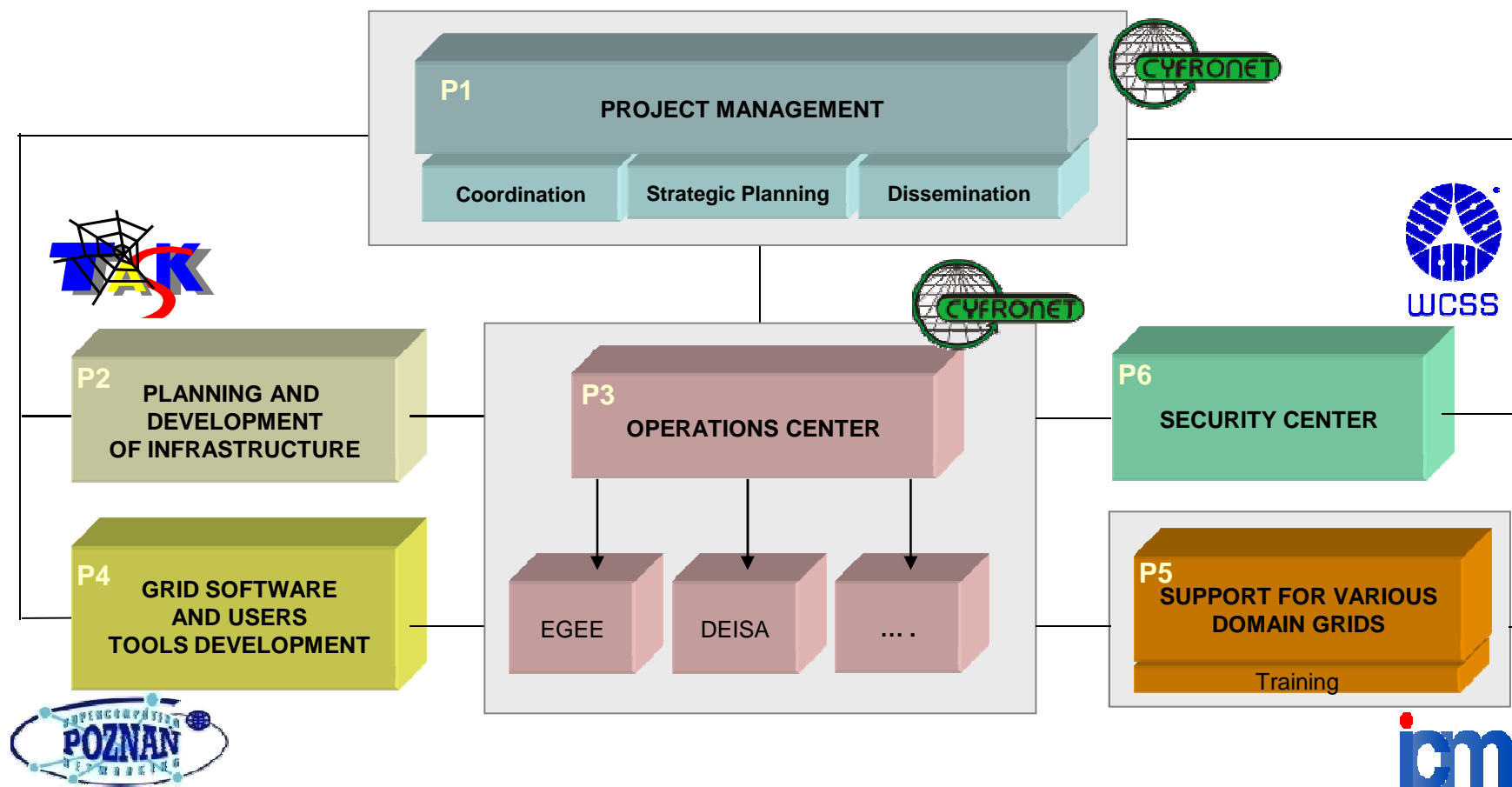




# PL-GRID Project Progress



# Organization of the PL-Grid project





## WP2: Planning and Development of Infrastructure

### Servers rooms – megawatts

#### PL-Grid - modernization and development:

- ◆ Servers rooms
- ◆ Energy infrastructures
- ◆ Power supplies
- ◆ Cooling systems

#### PL-Grid effects:

- ◆ 5 modern server rooms
- ◆ Bigger surface
- ◆ Above 1MW power supplies each
- ◆ About 1MW cooling power each

## Servers rooms – megawatts



← **TASK** - diesel generator  
0.9 MW



**ICM** – ice water cooling system →  
1.3 MW

# ACK Cyfronet AGH



Transformer 1MW



Air Condition



Power supply - generators 1 MW (diesel)  
and 50 KW



# Servers and Storage

## Server types:

- ◆ HP BladeSystem BL2x220 G7
- ◆ HP BladeSystem BL490c G6
- ◆ HP BladeSystem BL465c G6
- ◆ HP BladeSystem BL2x220 G6
- ◆ HP BladeSystem c7000 Enclosure
- ◆ HP BLc IB QDR Switch

## Storage types:

- ◆ HP ProLiant DL160 G5
- ◆ Sun X4540
- ◆ HP BladeSystem BL460 G6
- ◆ MDS 600
- ◆ SGI InfiniteStorage 4600
- ◆ NetApp 3140



CYFRONET - HP BL2x220 G6

## Processors types:

- ◆ Intel Xeon
- ◆ AMD Opteron



ICM – HP BL465C G6 & SUN X4540





## WP3: Computational Infrastructure for Scientists

- Available & Robust infrastructure is a key
  - Deployment of recently procured hardware – status as of 1.03.2011

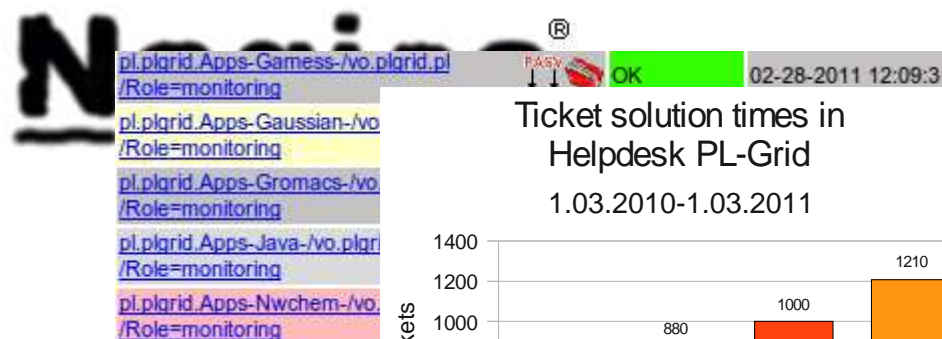
	CYFRONET	WCSS	PCSS	ICM	TASK
Computational Power [Cores]	8302	4300	3416	1152	3078 (vSMP)

- High Availability requires monitoring & incident reaction procedures

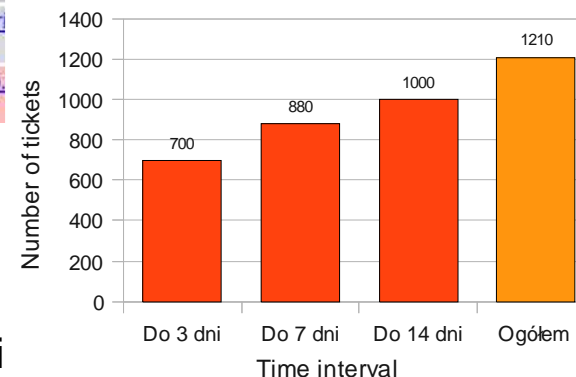
- Grid service monitoring
- Scientific applications

- Solving problems – [haldpesk.plgrid.pl](http://haldpesk.plgrid.pl)

- Ticket tracking system
- Used by 102 researchers
- Solution times: 83% of tickets solved by 14 days
- Improvements: compliance with ITIL® recommendati



Ticket solution times in Helpdesk PL-Grid  
1.03.2010-1.03.2011





## User account management - portal.plgrid.pl

- ◆ One username one password to all tools
- ◆ Getting X.509 certificate on-line
- ◆ Applying for access to services
  - ◆ Virtual Organization vo.plgrid.pl
  - ◆ User interface machines - gLite UI
  - ◆ Local job submission - cluster ZEUS
  - ◆ **Database services** (IV-V 2011)
- ◆ Applying for **PL-Grid computing grants** (IV 2011)



- ◆ PL-Grid courses
  - ◆ Subscription on-line
  - ◆ Access to infrastructure services (hands-on)
  - ◆ Access to BlackBoard platform

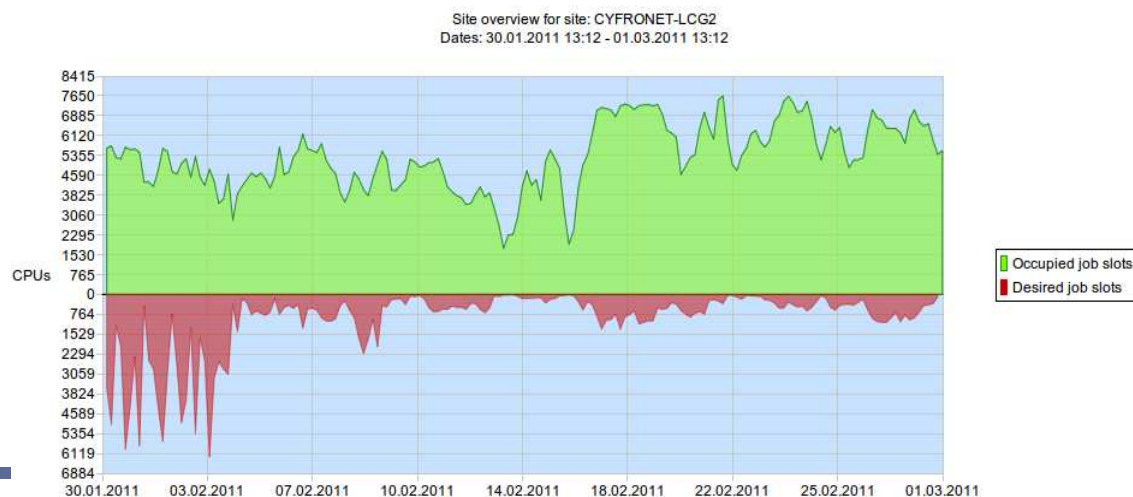
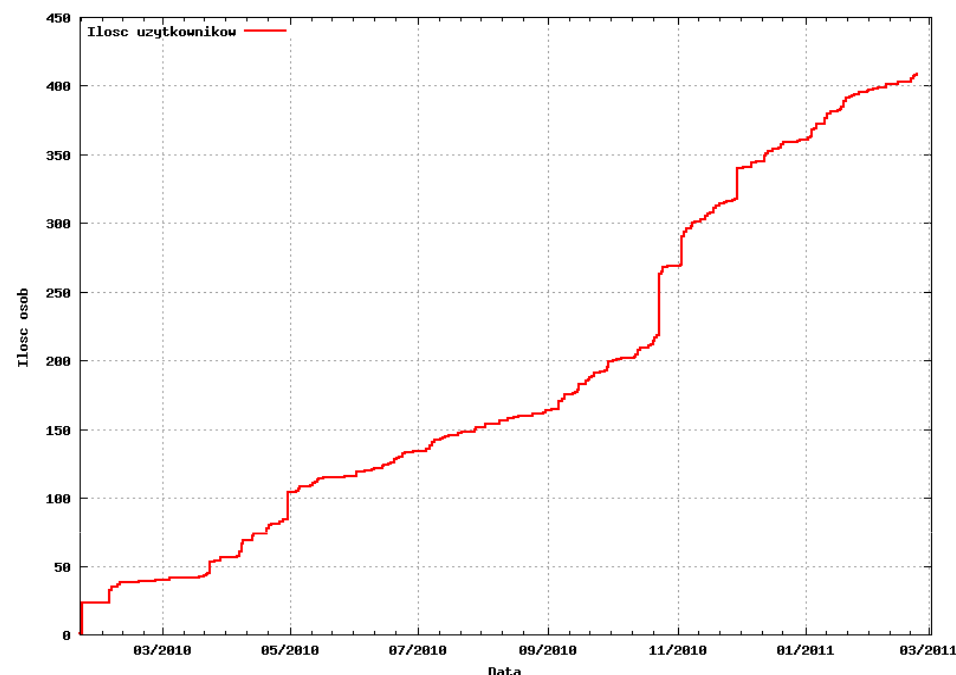






## PL-Grid Users & Usage

- ◆ As of 1.03.2011
- ◆ Registered users: **409**
  - ◆ Including 95 PL-Grid employees
- ◆ OPI owners: 92
- ◆ Wards  
(authorized by OPI owners): **222**
- ◆ Resource usage  
VI.2010 – I.2011
  - ◆ **647** CPU-years walltime
  - ◆ **950** cores occupied on average



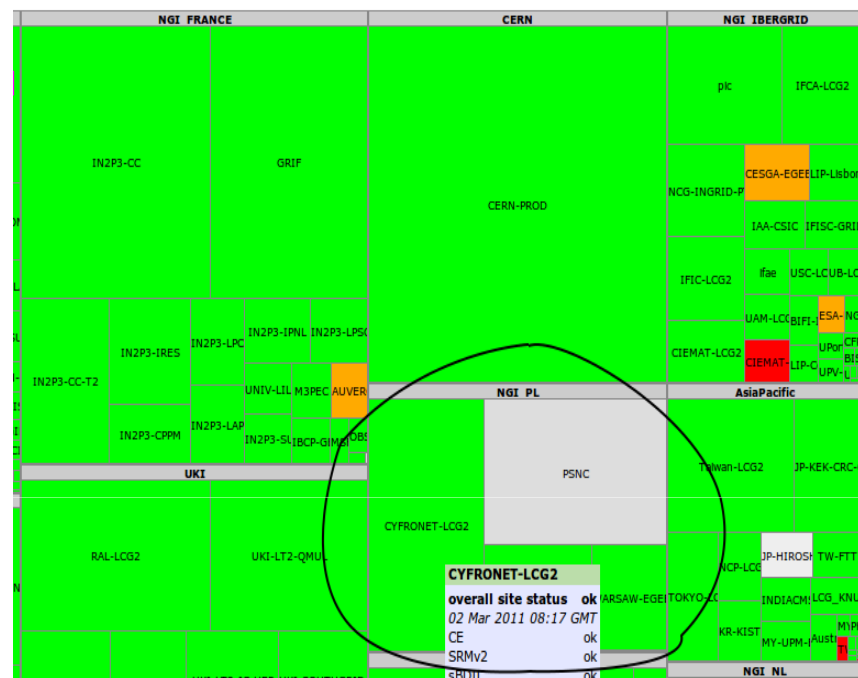
- ◆ CYFRONET ZEUS cluster usage over last month
  - ◆ Y-axis represents occupied cores
  - ◆ Max: 7637



# Cooperation with European Grid

◆ PL-Grid is responsible for operating Polish part of European Grid Infrastructure which means maintaining the operational interface i.e:

- ◆ Grid Infrastructure monitoring
- ◆ Support System (ticket flow)
- ◆ Accounting
- ◆ Operational Security
- ◆ Overall Coordination
  - Software rollout at sites
  - Reconfiguration mgmt



	Nicolaus Copernicus Astronomical Center	APEL crit N/A
	ACC CYFRONET AGH, Cracow, Poland	APEL crit ok
	Institute of Nuclear Physics PAN	APEL ok ok





## WP4: Achievements and New Tools

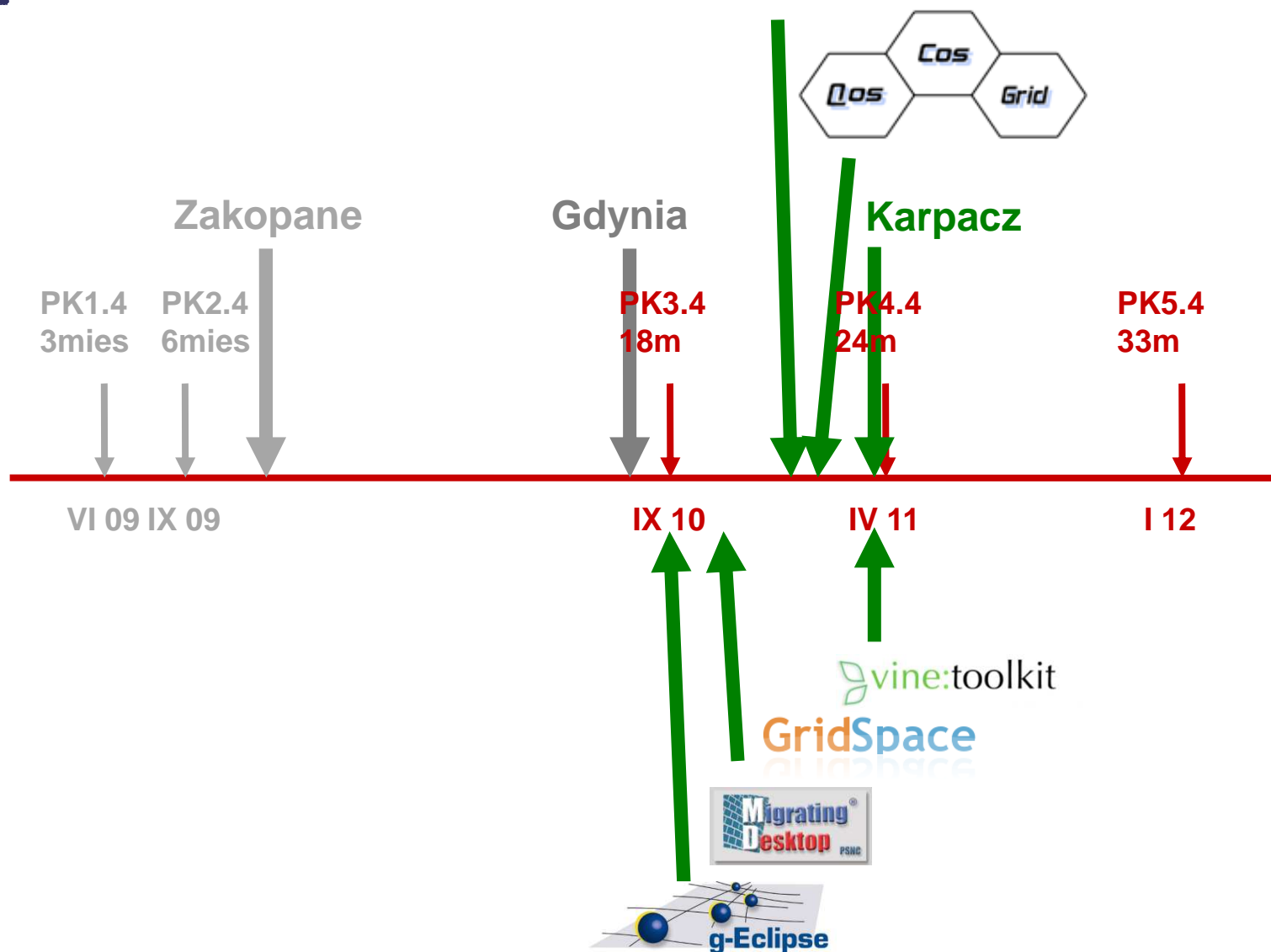
- ◆ Extension of GridSpace environment
- ◆ Implementation and provisioning advanced graphical interfaces for visualization and task management with usage Vine Toolkit
- ◆ Performance tests of new middleware – QosCosGrid and it's integration with gLite and Unicore infrastructure.
- ◆ Integration of Migrating Desktop and gEclipse with many PL-GRID service
- ◆ New tools for virtual organization management – FIVO
- ◆ Beta version of user and administrator tools: Bazaar, mobile access to the infrastructure, new security tools
- ◆ Integration of the developed tools with portal environment Liferay, and Nagios monitoring system





## WP4 Integration Plans

## New services in the production environment



## WP5 Users' Support

- ◆ Continuous activity
- ◆ Problems, questions send to:
  - ◆ e-mail: [helpdesk@plgrid.pl](mailto:helpdesk@plgrid.pl)
  - ◆ Web page : [helpdesk.plgrid.pl](http://helpdesk.plgrid.pl) (preferred – direct access to experts)
- ◆ Typical groups of problems:
  - ◆ *User registration*
  - ◆ *Usage of portal*
  - ◆ *General problems with gLite, UNICORE*
  - ◆ *Queues for Specific problems:*
    - *Chemistry/Biology*
    - *Fluid dynamics*
    - *High Energy Physics*
    - *others*
  - ◆ *Default queue* (other problems)
- ◆ Goal: quick reaction with high competence

# Scientific software packages

- ◆ Access to software packages is provided to users through:
  - ◆ gLite
  - ◆ UNICORE
- ◆ Examples of available packages in various fields:
  - ◆ **biology:** AutoDock, BLAST, ClustalW2, CPMD, Gromacs, NAMD
  - ◆ **quantum chemistry:** ADF, CFOUR, Dalton, GAMESS, Gaussian, Molcas, Molpro, MOPAC, NWChem, OpenBabel, Siesta, TURBOMOLE
  - ◆ **physics:** ANSYS FLUENT, Meep
  - ◆ **numerical computations and simulation:** Mathematica, MATLAB
  - ◆ **other:** Blender, POV-Ray
- ◆ Users may report us their expectations through a survey available at:  
*<http://www.plgrid.pl/ankieta>*
- ◆ The system of testing the software packages in the grid environment has been prepared and deployed
- ◆ The correctness of functioning of the packages is monitored automatically in each of the centers



## Training and Users' Support

- ◆ **Basic training** on access to the PL-Grid infrastructure through gLite and UNICORE conducted in all centers participating in the project – in Gdańsk / Kraków / Poznań / Warszawa / Wrocław
- ◆ More advanced training (Chemistry, Computational Mechanics)
- ◆ Similar (free) training may be conducted in other centers, if necessary
- ◆ **eLearning courses** offered through the Blackboard system ( available for registered users of the PL-Grid infrastructure)
  - ◆ PL-Grid for dummies
  - ◆ Introduction to gLite middleware
  - ◆ Usage of UNICORE
  - ◆ For LHCb users
  - ◆ Others in preparation
- ◆ Questions, proposals: [szkolenia@plgrid.pl](mailto:szkolenia@plgrid.pl)
- ◆ New User' s Manual
  - ◆ Access via PL-Grid portal and from main PL-Grid page
  - ◆ For novice



# New User's Manual

- ◆ Introduction
  - ◆ What is grid ? How to use it ?
  - ◆ Existing Applications
  - ◆ How to become a user ?
- ◆ Establishing user's account using PL-Grid portal
  - ◆ standard
  - ◆ Account for training
- ◆ Application for certificate
  - ◆ Simple CA
  - ◆ Polish Grid CA (advanced)
- ◆ Using gLite
  - ◆ Application for a service
  - ◆ Certificate registration or conversion
  - ◆ Register of Virtual Organization in PL-Grid
  - ◆ Using JDL language
  - ◆ Run a job
- ◆ Using UNICORE
  - ◆ Access to UNICORE
  - ◆ UNICORE environment
- ◆ Local access to resources
  - ◆ Application for the access
  - ◆ Login to computing clusters
  - ◆ Local jobs management
  - ◆ Auxiliary on-line documents
- ◆ Looking for support?
  - ◆ Address e-mail
  - ◆ Helpdesk Portal
  - ◆ Other resources



## WP6: Security in PL-Grid

- ◆ Security audits
  - ◆ Thorough review of source code of critical system applications
  - ◆ Dynamic security tests of crucial system components, including modern approaches like protocol and application level fuzzing
  - ◆ Use of self developed auditing tools, i.e. XML fuzzer
  - ◆ Security bugs identified and removed, software is certified before production deployment
  - ◆ Security flaws found also in external software, like commercial and not commercial middleware.
- ◆ Penetration tests
  - ◆ Test of working infrastructure to check for misconfiguration errors and not up-to-date software
  - ◆ Both Black-Box and White-Box approaches
  - ◆ Taken periodically
  - ◆ As a result per-site vulnerability assessment
  - ◆ Help provided to administrators in order to make their sites more secure and conform to the security policies



## WP6: Security in PL-Grid

- ◆ EGI Computer Security Incident Response Team participation
  - ◆ Regular participation in international working meetings
  - ◆ Participation in regular meetings maintaining current incidents, vulnerabilities and other operational events
  - ◆ Security monitoring of Polish infrastructure using tools provided by EGI
  - ◆ Coordination and support for all security issues between EGI-CSIRT and Polish computing centers
  - ◆ Informing Polish computing centers about new vulnerabilities (often not yet published), incidents and ways to deal with them

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## Conclusions

- ◆ Good and promising partial results of the PL-Grid Project
- ◆ Justified expectations to Project completion according to its goals and requirements
- ◆ Generic services and generic applications in development
- ◆ Further development needed, as identified currently, mainly on Domain Specific Grids
- ◆ Request from the users' communities
- ◆ Capacity for organization of future development according to
  - ◆ Expertise and experience
  - ◆ Strong scientific potential of the users' communities being represented by PL-Grid Partners
  - ◆ Wide international cooperation concerning the Consortium and individual Partners, good recognition worldwide
  - ◆ Good managerial capacity

# Acknowledgements

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- ◆ Bartek Palak
- ◆ Tomasz Piontek
- ◆ Dawid Szejnfeld
- ◆ Paweł Wolniewicz

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- ◆ Rafał Tylman
- ◆ Mściśław Nakonieczny



<http://www.plgrid.pl/en>



Polish Infrastructure  
for Supporting Computational Science  
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[Home](#) [PL-Grid Portal](#) [Helpdesk online](#)

Start → in English

**Menu**

- About the Project
- Our offer
- PR materials
- Useful links
- Contact
- Collaboration with EGI

**News**

**The article on PL-Grid in the "ISGTW" newsletter**

 The article on the PL-Grid project was published in the "ISGTW" newsletter (issue nr 193, from 22 September 2010).

[More...](#)

**PL-Grid project at the CGW'10**

 The PL-Grid project will be promoted at the exhibition stand held during the CGW'10 in Krakow, Poland, on 11-13 October 2010.

## Welcome to the web site of the Polish Grid

**Polish Infrastructure for Information Science Support in the European Research Space PL-Grid.**

The goal of the project is to provide the Polish scientific community with an IT platform based on Grid computer clusters, enabling e-science research in various fields. This infrastructure will be both compatible and interoperable with existing European and worldwide Grid frameworks. The system will ensure scalability and enable the integration of additional local clusters, belonging to universities, research institutions and technology platforms. We foresee exploitation of PL-Grid by state authorities, crisis management teams and industrial partners.

[Full information...](#)

**New materials**

**PL-Grid movie (9 min. demonstration)**



[See the demonstration in a higher resolution ...](#)

**PL-Grid leaflet, GridSpace and MD brochures**



**A talk on PL-Grid given at the HPC 2010 workshop**



[Search](#)



**Events**

 **ICT 2010**

Brussels, Belgium,  
2010-09-27 - 2010-09-29

 **CGW'10**

Krakow, Poland,  
2010-10-11 - 2010-10-13

 **eChallenges e-2010**

Warsaw, Poland,  
2010-10-27 - 2010-10-29

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[Next events...](#)

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