

# High Performance Computing Infrastructures and Services in Europe



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# DEISA



# PRACE



## Distributed European Infrastructure for Supercomputing Applications

Connecting existing HPC resources  
Members are computing centres

2004-2008: FP6 DEISA project  
2006-2009: FP6 eDEISA project  
2009-2011: FP7 DEISA2 project



## Partnership for Advanced Computing in Europe

Establishing a new Tier-0 infrastructure  
Members are states

April 2007: MoU signed by 14 countries  
now extended to 20 countries  
2008-2009: FP7 PRACE Preparatory Phase  
2010-2013: FP7 PRACE Implementation Phase



# - ESFRI – European Strategy Forum on Research Infrastructures

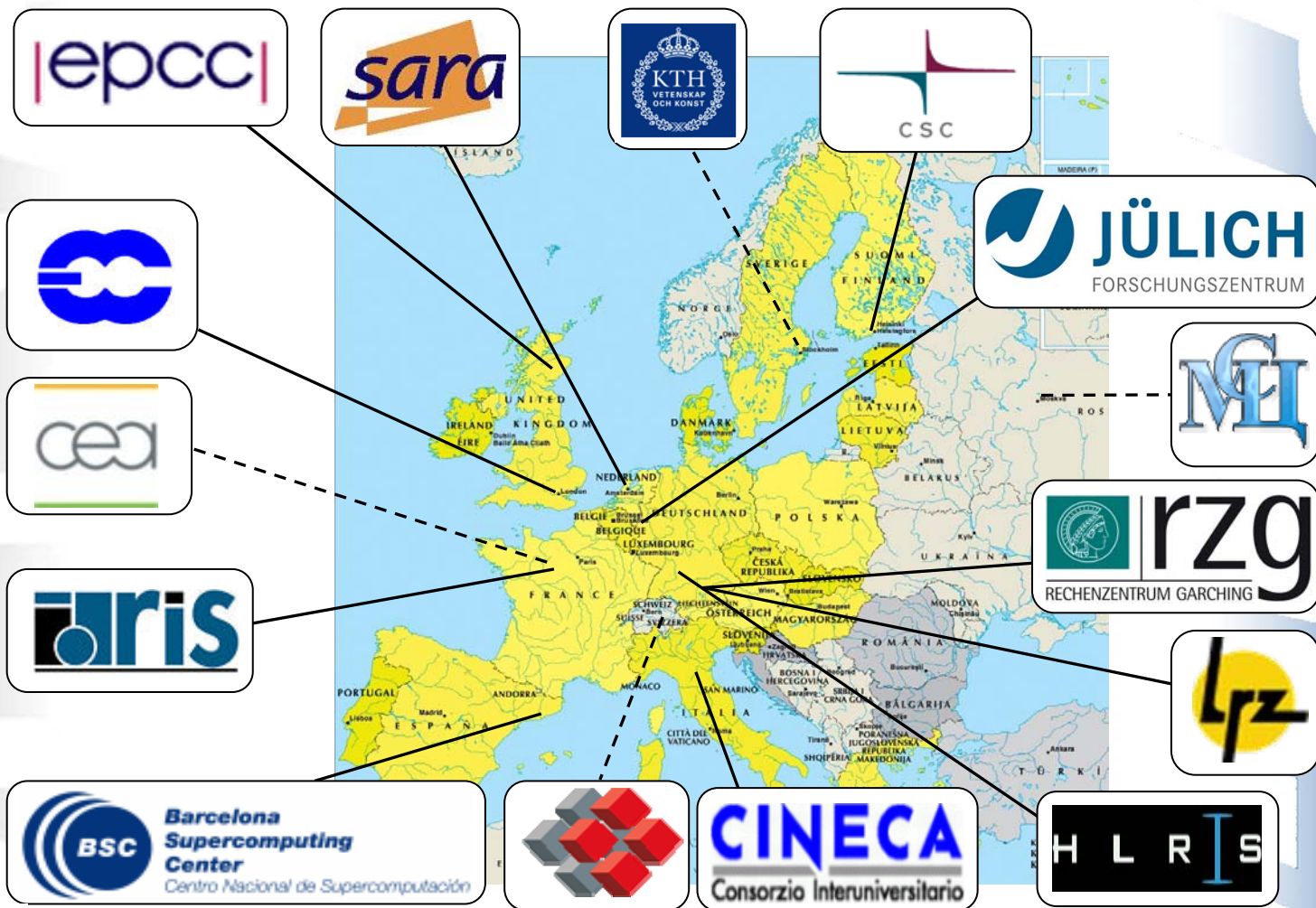
## Recommending a European High-Performance Computing Service

**PRACE**

**DEISA**

A European strategic approach to high-performance computing, concentrating the resources in a **limited number of world top-tier centres** in an overall infrastructure connected with associated **national**, regional and local centres, forming a scientific computing network to utilise the top-level machines.

# DEISA Partners and Associate Partners



15 partners, 10 countries, EC support 2004-2011



# DEISA Supercomputers

State-of-the art supercomputers

> 1 PF aggregated peak performance

- Cray XT4/5, Linux
  - IBM Power6, AIX / Linux
  - IBM BlueGene/P, Linux
  - IBM PowerPC, Linux (MareNostrum)
  - SGI ALTIX 4700, Linux
  - NEC SX8/9 vector systems, Super UX
- 
- Fixed fractions of resources dedicated to DEISA usage
  - Systems interconnected with dedicated 10Gb/s network

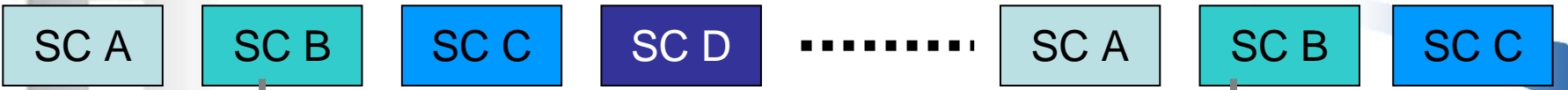
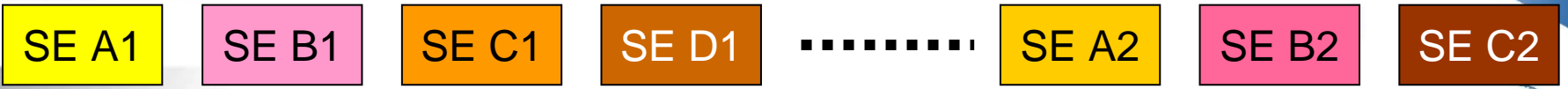
Access via Internet



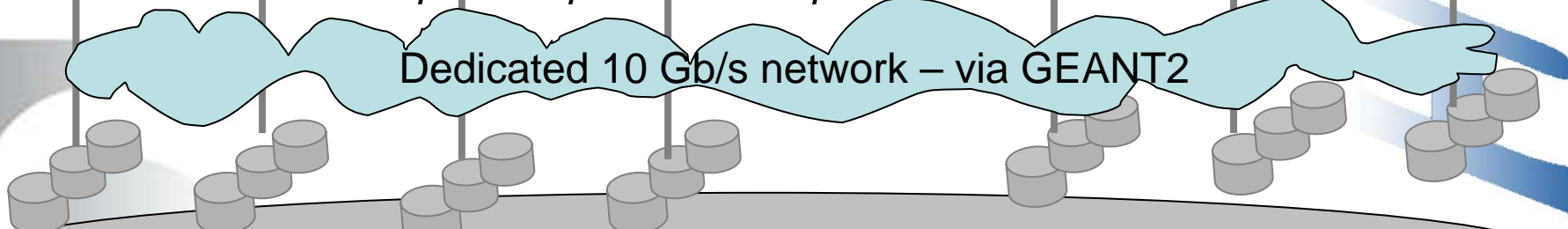
Single sign-on  
Secure login  
(ssh / gsi-ssh -> D-ssh)  
(Unicore, gridFTP)

DEISA Common Production Environment

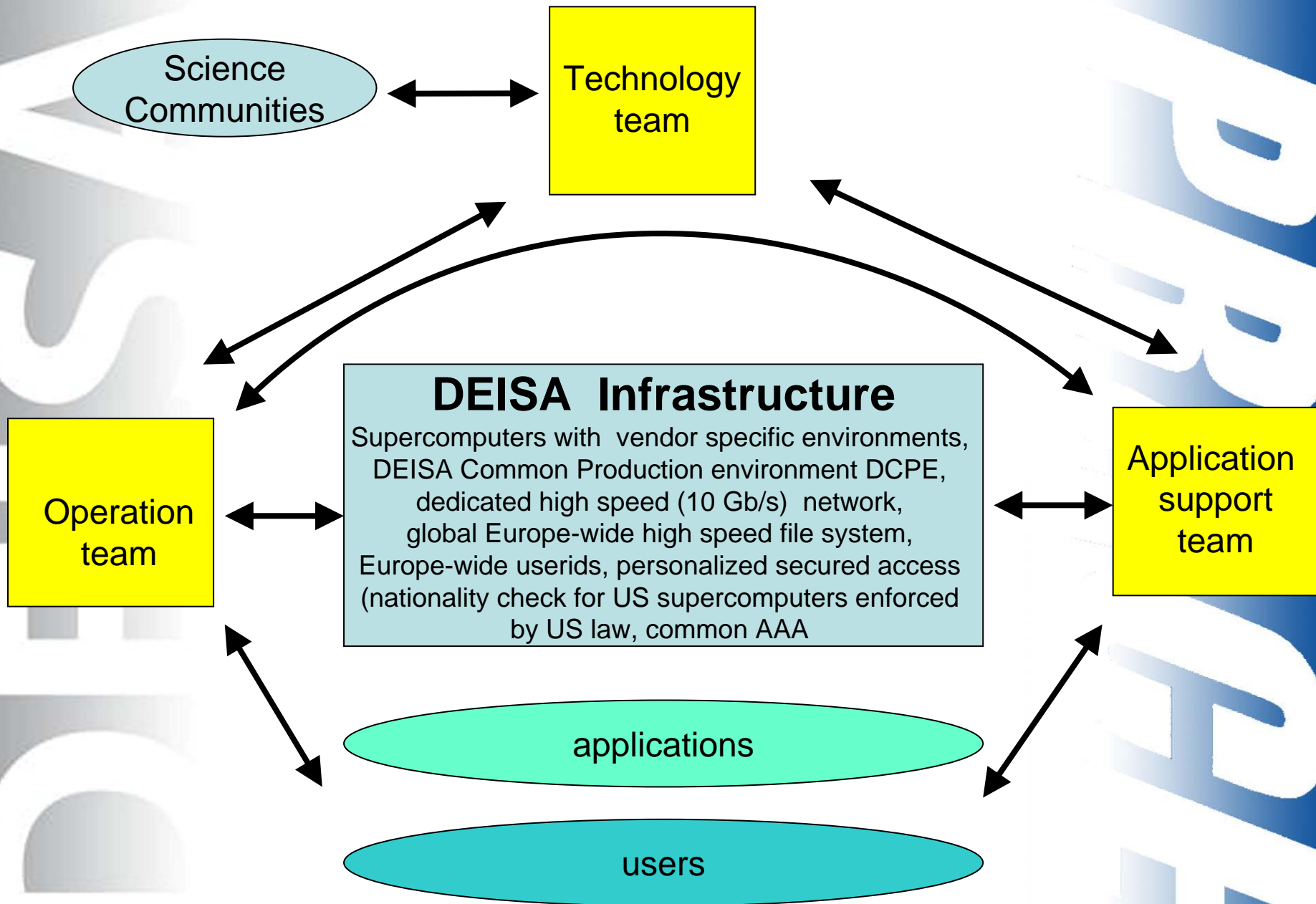
*Different Software Environments*



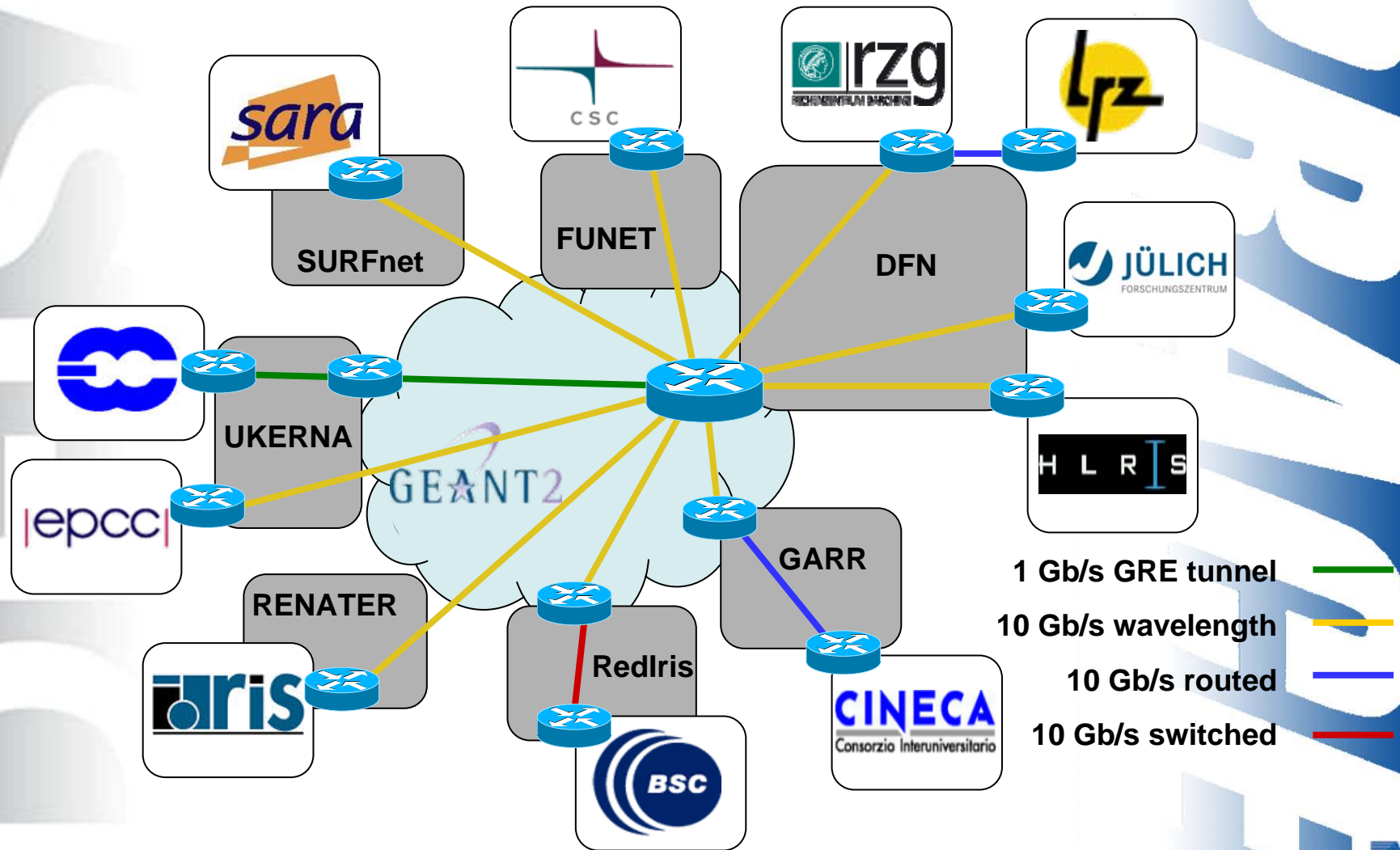
*Different SuperComputers - Compute elements and interconnect*



DEISA highly performant continental global file system

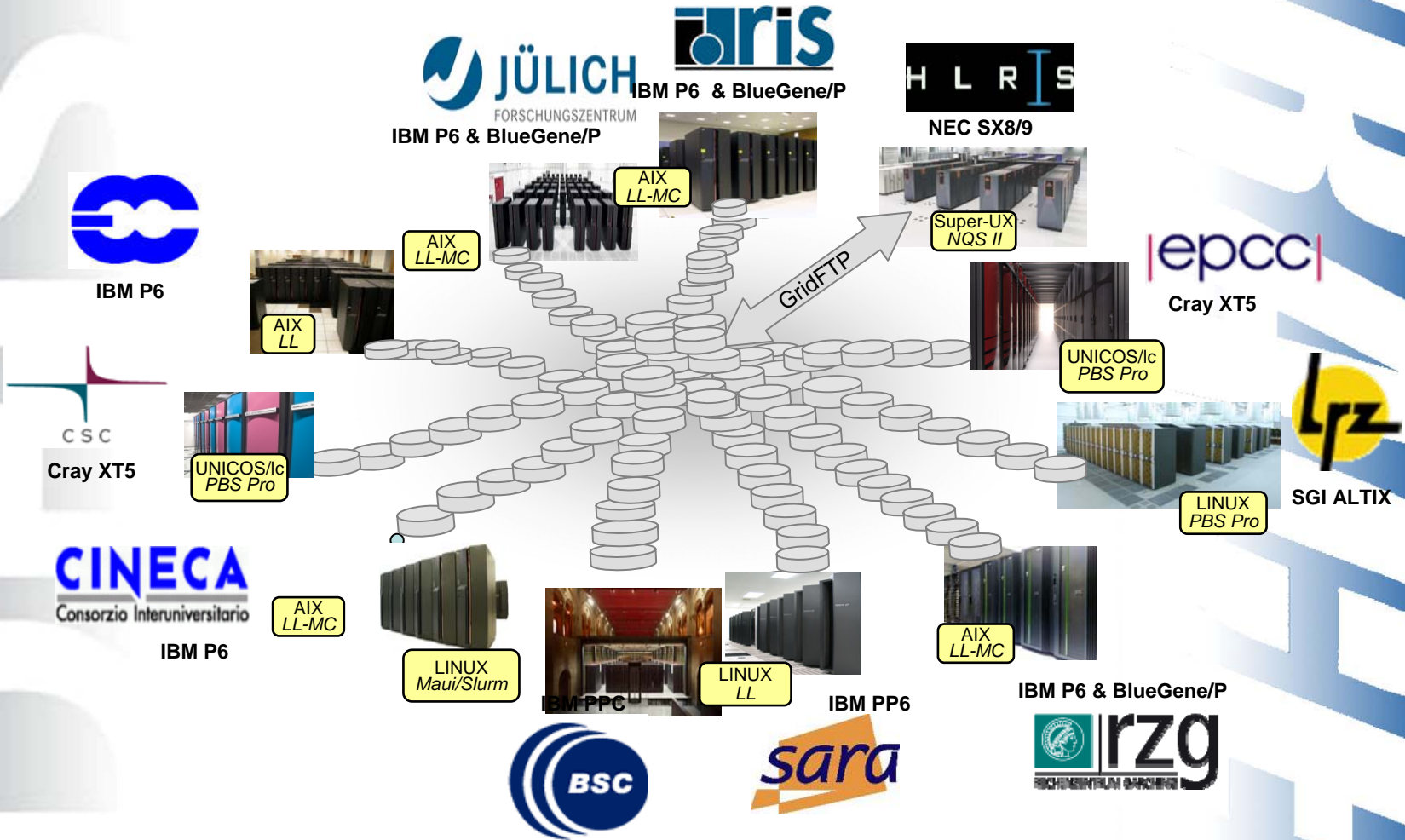


# DEISA dedicated high speed network

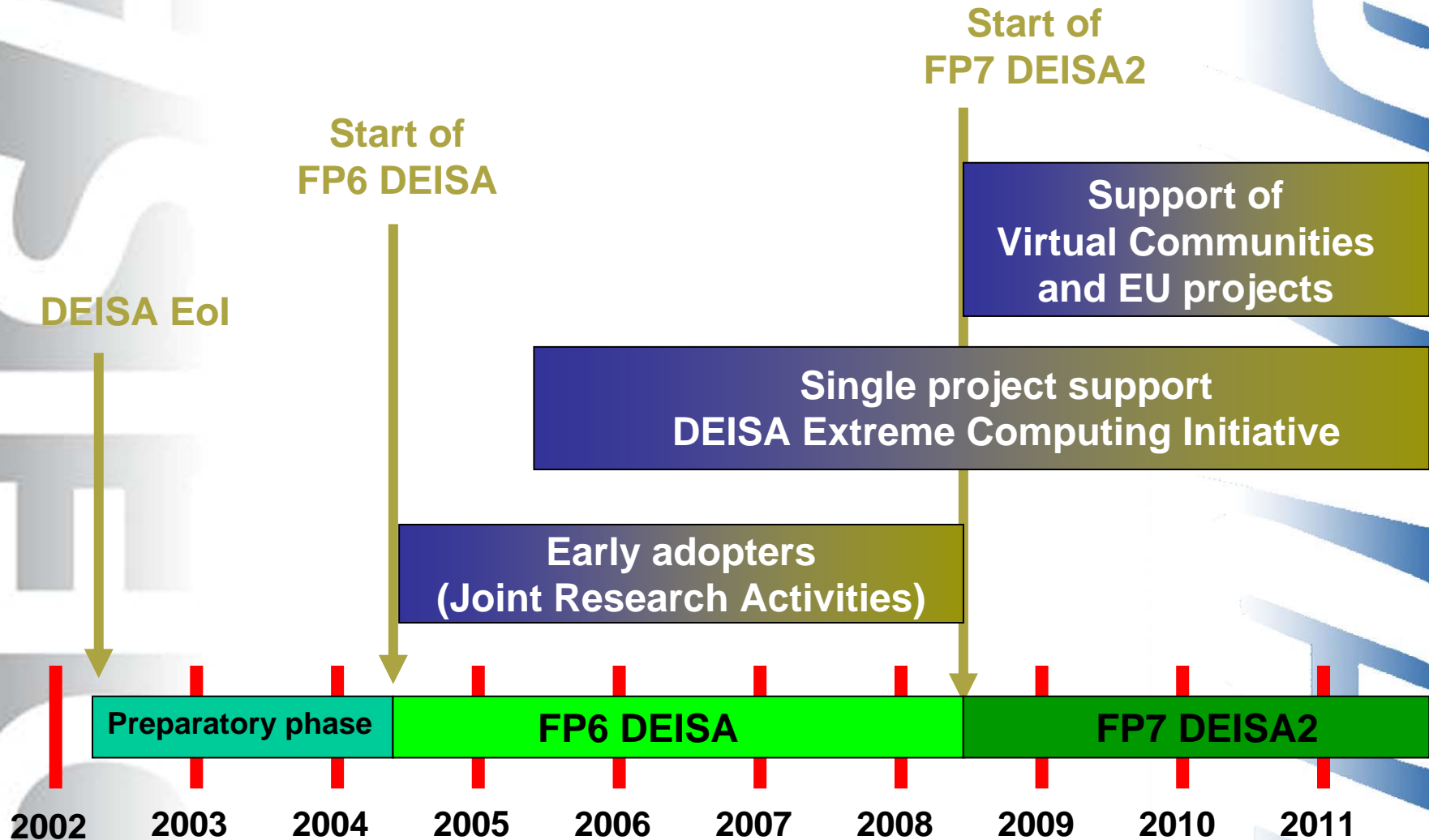




# DEISA Global File System at Continental Scale (based on MC-GPFS)



# Evolution of User Categories in DEISA



# DEISA Extreme Computing Initiative

**Projects from DECI calls 2005, 2006, 2007, 2008, 2009:**

**Involvement of over 180 research institutes and universities from 25 European countries:**

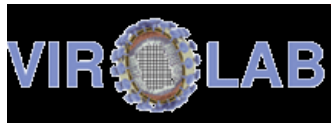
Austria	Belgium	Cyprus	Denmark	Finland
France	Germany	Greece	Hungary	Ireland
Italy	Latvia	Norway	Poland	Portugal
Romania	Russia	Slovak Rep.	Spain	Sweden
Switzerland	Netherlands	Turkey	Ukraine	UK

***with collaborators from four other continents***

**North America, South America, Asia, Australia**

# Virtual Community Support Requests

## Life Sciences



[www.virolab.org](http://www.virolab.org)

Virtual laboratory for infectious diseases

EU FP6 project

8 EU countries, 11 EU partners



[www.vph-noe.eu](http://www.vph-noe.eu)

EU FP7 project

7 EU countries, 13 EU partners

# Virtual Community Support Requests

## Fusion Energy Research:



[www.efda.org](http://www.efda.org)

European Fusion Development Agreement

Legal entity

26 EU countries, 31 EU partners



[www.euforia-project.eu](http://www.euforia-project.eu)

EU Fusion fOR Iter Applications (EUFORIA)

EU FP7 project

14 EU countries, 14 EU partners

# Virtual Community Support Requests

## Space Science / Cosmology



**LFI-PLANCK** [www.esa.int/SPECIALS/Planck](http://www.esa.int/SPECIALS/Planck)

Planck space mission of European Space Agency (Low Frequency Instrument part)

Project of EU organisation

6 EU countries, 6 EU partners, plus USA



[www.virgo.dur.ac.uk](http://www.virgo.dur.ac.uk)

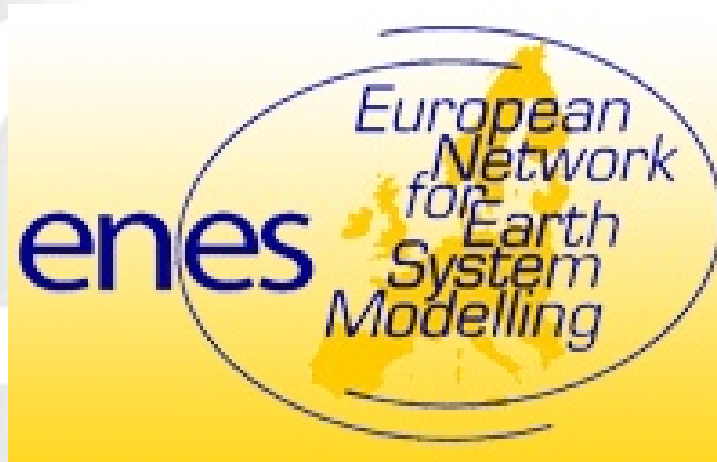
International VIRGO Consortium and Cosmocomp project

Consortium and FP7 project

6 EU countries, over 6 EU partners, plus US, CA, AR, JP, CN

# Virtual Community Support Requests

## Climate Research



[www.enes.org](http://www.enes.org)

**European Network for Earth System Modelling**  
operating the **IS-ENES Project**

Consortium and international project  
15 EU countries, 44 EU partners, plus USA

# Virtual Community Support Requests

## Types of services requested

- |   |     |
|---|-----|
| 1) High Performance Compute resources           | 6 x |
| 2) Access to state-of-the-art HPC architectures | 4 x |
| 3) Community data repository                    | 4 x |
| 4) Application enabling                         | 5 x |
| 5) Technology support                           | 5 x |

**On-going dialogue with every Virtual Community to understand their requirements and how these requirements change over time**



# PRACE=Tier-0

- PRACE is an effort to implement the ESFRI Tier-0 infrastructure, based on the HET-science case
- PRACE is both
  - A multi-national pan-European cooperation
    - Based on an MoU
  - An FP7 supported project
- The cooperation growing from 14 (2007) to 20 (2009)
- PRACE FP-7 program running from 1/2008-1/2010
- PRACE FP-7 implementation phase starting 2010

# PRACE participation

- Partner overview



## PRACE goals

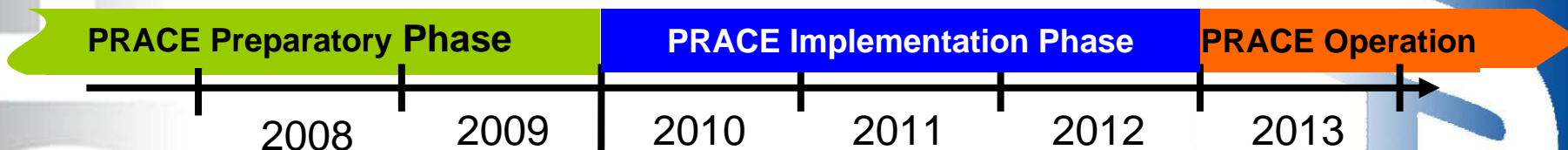
- To realise a persistent pan-European Tier-0 HPC infrastructure for research and development for all who qualify
- To provide support for efficient use
- To provide education/course material
- To have the Tier-0 facilities well integrated in the European e-ecosystem
- To prepare for sustainability:
  - Cooperate with vendors and users
  - Learn about future development
  - Bridge to the US and Japan

## PRACE services

- PRACE will offer
  - Multi-petaflop/s performance systems
  - Easy access (technically)
  - Fair access (financially) for third parties
  - Variety of architectures
  - “Open” peer review process
- You can influence PRACE developments

# PRACE present status

- WP overview/tasks
  - Define the legal & administrative framework (WP2)
  - Dissemination, outreach & training (WP3)
  - Cooperate with the European HPC ecosystem (WP2/3)
  - Distributed computing (WP4)
  - Prototype system assessment (WP5)
  - Software enabling for prototype systems (WP6)
  - Procurement strategy: Petaflop/s systems for 2009/2010 (WP7)
  - Future Petaflop/s technologies, vendor cooperation (WP8)



September 22, 2009



# PRACE services are here today

- Prototypes available
  - Coverage of all mainstream architectures:
    - MPP
    - SMP-ThinNode
    - SMP-FatNode
    - Hybrid (combination of architecture/processor technology)
  - For both internal and external usage
    - Scientific communities with their own codes through light review mechanism
    - Experiences possibly included in PRACE deliverables

# Overview of presently installed Tier-0-avant-la-lettre



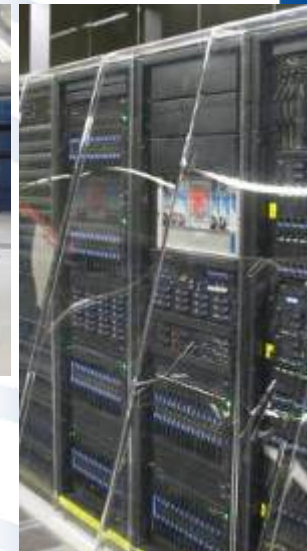
IBM BlueGene/P (FZJ)  
01-2008



IBM Power6 (SARA)  
07-2008



Cray XT5 (CSC)  
11-2008



IBM Cell/Power (BSC)  
12-2008



NEC SX9, vector part (HLRS)  
02-2009



Intel Nehalem/Xeon (CEA/FZJ)  
06-2009

## Services today (2)

- Selected and available systems
  - MPP: IBM BlueGene/P, FZ Juelich, Germany
  - MPP: Cray XT5, CSC, Finland (in combination with CSCS, Switzerland)
  - SMP-ThinNode: Bull cluster with Intel Nehalem, CEA/FZJ, France/Germany
  - SMP-FatNode: IBM Power6 cluster, SARA/NCF, The Netherlands
  - Hybrid: IBM Power6 + Cell, BSC, Spain
  - Hybrid: NEC vector + Intel x86 cluster, HLRS, Germany



# Services today (3)

- System details:

Host	Machine	Committed dedicated in cores	Committed non-dedicated in %	#cores total non-dedicated	Availability since	#months
FZJ	BlueGene	0	2,00	65536	Jul 2008	17
CSC/CSCS	Cray XT5	1440	10,00	9424	Dec 2008	12
FZJ+CEA	TN-x86 (CEA)	1024	0,00	0	Apr 2009	8
FZJ+CEA	TN-x86 (FZJ)	0	2,00	17664	Jun 2009	6
NCF/SARA	FN-pwr6	128	5,00	3328	Dec 2008	12
BSC	Hyb-Cell	144	0,00	0	Dec 2008	12
HLRS	Hyb-vector	96	0,00	0	Mar 2009	9

- External access to the prototypes:

- <http://www.prace-project.eu/prototype-access>
- Fill out prototype access form (available on web site)
- Applicable to European groups from academia and industry
- Assessment of proposals done by the PRACE Prototype Access Committee
- Applications can be sent all year round
  - Application deadlines for 2010 not available yet



# Reach-out, education, publicity



## Industry seminars:

- 1st Seminar Sept. 3, 2008 Amsterdam, The Netherlands
- 2nd Seminar Sept. 7-8, 2009 Toulouse, France

## Summer & winter schools:

- Stockholm, Athens

## PRACE booths:

- ISC, ICT, SC,



ICT 2008, PRACE-Booth

PRACE Summer School Stockholm

PRACE Winter School at the OTE academy, Athens  
26-29.8.2009

# PRACE and stakeholders

- Users
- Projects
- Industrial Research
- Vendor Industries
- Other infrastructures

# PRACE and Users

- PRACE will take care well of all users
  - Open and transparent peer review system
  - (Fully digital process and progress report)
- Three types of resource allocations
  - Test / evaluation access – fast turn around
  - Project access – for a specific project, grant period ~ 1-year
  - Programme access – resources managed by a community
- No additional cost for European scientific communities\*

*“the best systems for the best science”*

\* Definition yet to established

# Prace and Projects

- PRACE is establishing special contacts with special communities, in particular with
  - EC/FPx sponsored projects
    - ESFRI-research facilities/communities
  - Other EC adopted technical/scientific themes
  - (Adopted and reviewed national themes)
  - Large scientific multi-annual projects
- Allocation committee will be instructed to establish an allocation procedure that takes these special efforts/activities into account while prioritising
- User Committee will be formed as permanent and critical sparring partner for PRACE and the PRACE infrastructure

# PRACE and Industrial research

- PRACE actively approaches the (potential) user industries
- First PRACE Industry Seminar Amsterdam September 2008
- Second PRACE Industry Seminar Toulouse September 2009
- PRACE will continue to engage with the user industries
- Conditions for access yet to be negotiated, but no principal issues
- User Industry Forum will be established for future regular contacts



# PRACE and Vendor Industries

- PRACE establishes proper contacts with vendor industries
- Contact meetings
- Openness regarding plans and planning
- Seek proper reciprocity
- Stimulate indirectly the strengthening of European ICT business and industry



## PRACE and other infrastructures



- PRACE is not a stand-alone activity for a select group
- PRACE is for who need to look into the future 6-12 years ahead
- PRACE to be fully embedded in the European e-ecosystem of networks and resources
- PRACE to be well connected to all ESFRI-facilities and/or their communities
- PRACE seeks to connect to similar level HPC and other infrastructures in the US and the Pacific (and other places where opportune)

*PRACE is yours*

