Advanced Research Workshop on HPC, Grid, and Clouds
Cetraro, June 21 – 25, 2010

Distributed European Infrastructure for Supercomputing Applications

DEISA

and the

European HPC Ecosystem

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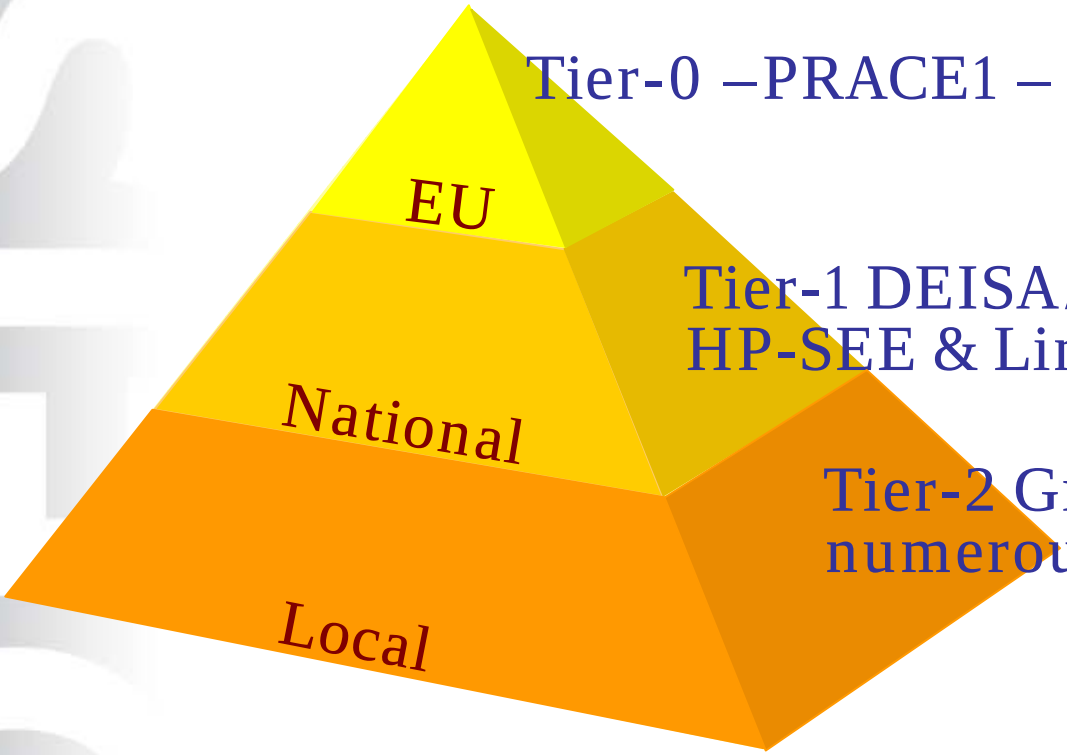
European HPC Eco-System



Tier-0 –PRACE1 – €30 M

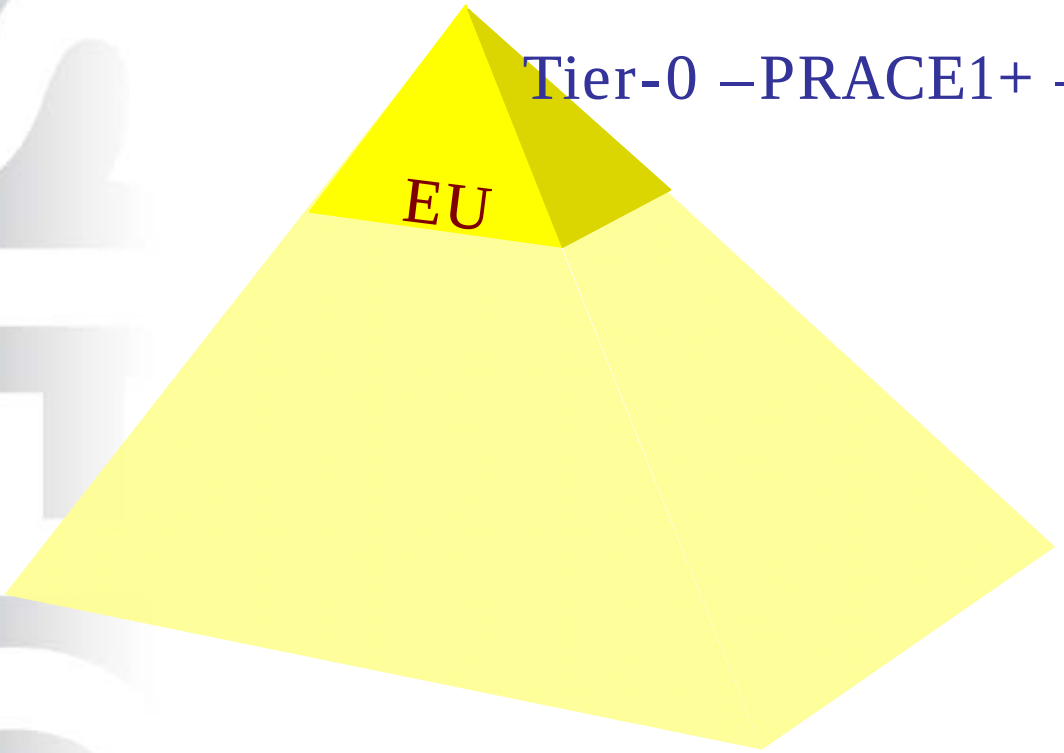
Tier-1 DEISA/PRACE2 – €30 M
HP-SEE & LinkSCEEM2

Tier-2 Grids EGI – €50 M
numerous other projects

Kostas Glinos

European Commission

HPC Eco-System: Tier-0



PRACE

Distributed European Infrastructure for Supercomputing Applications

Vision

- Provide world-class HPC systems for word-class science, supporting European R&D leadership

Objectives

➔ Create a leading persistent HPC infrastructure

- **Deploy** 3 – 6 systems of the highest performance level
- Ensure a **diversity** of architectures meeting needs of users
- Exploit benefits **beyond Science** (societal, industrial)
- Fair, efficient and effective **governance** with open access
- Provide support and training

PRACE – First Results

- ✓ France, Germany, Italy and Spain each have given binding commitments for 100 Mio € over 5 years.
- ✓ 20 Countries signed the PRACE MoU
- ✓ Free-of-charge service for European scientific communities based on peer review, in principle
- ✓ PRACE Tier-0 Infrastructure operational from 08/2010

JUGENE@Jülich
#4 worldwide, #1 in Europe

Distributed European Infrastructure for Supercomputing Applications

1st PRACE system

IBM Blue Gene/P

72 racks, 294912 cores

1 Petaflop/s peak

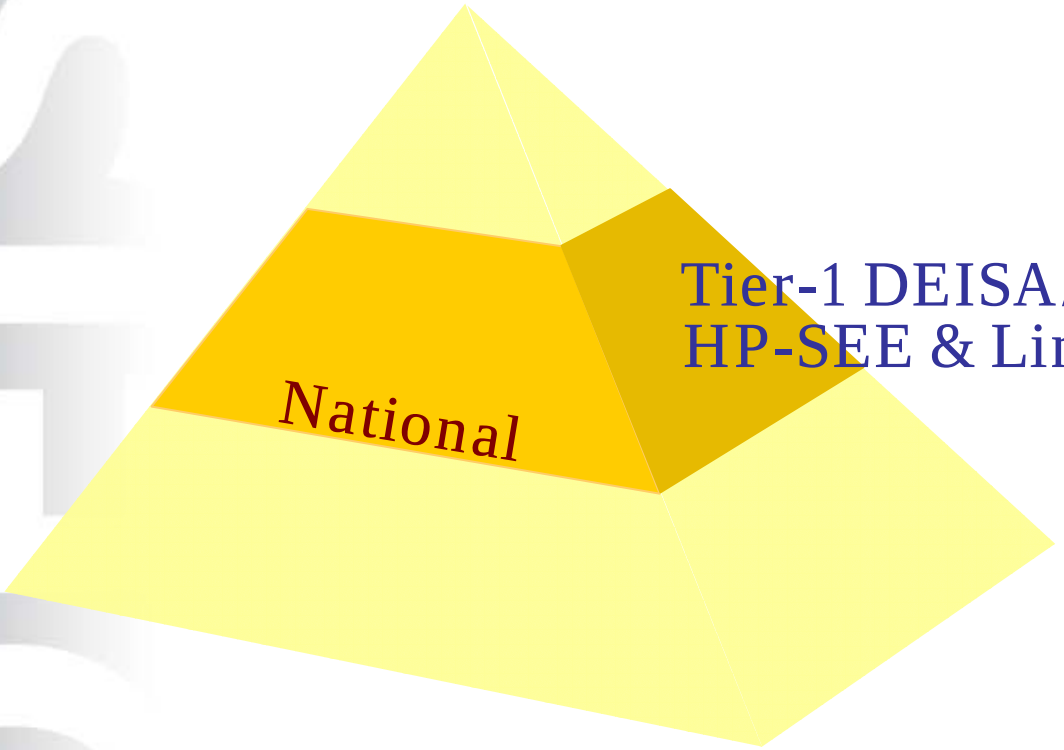
2nd PRACE System

to come end 2010

Priorities and Investment Plans

- **Integrate DEISA and pan-European Tier-1 efforts into the next phase of PRACE** (20 M€ more in 2011)
- Fine tune the organisational and governance models
- Demonstrate impact and benefits of HPC
  - Use and supply
- Development of exa-scale prototypes from 2011 onwards (first tranche of 24 M€)
- Support international exa-scale coordination (in 2010 and 2011: EESI)
- Preparation of 8th Framework Programme

HPC Eco-System: Tier-1 Systems

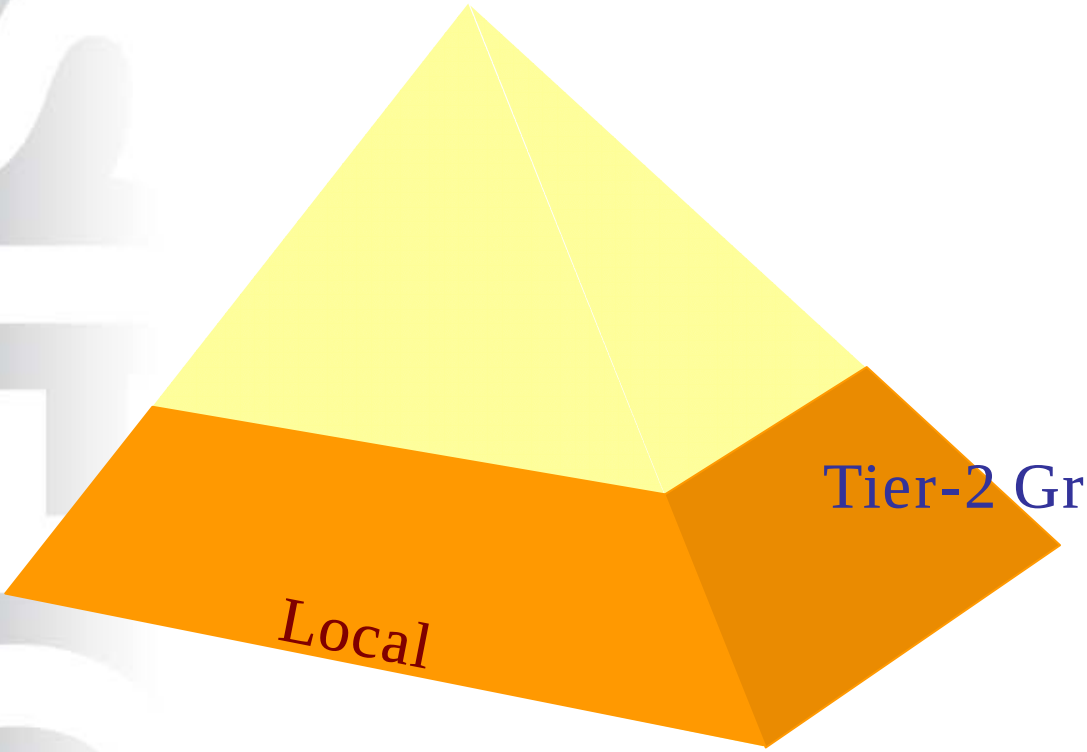


Tier-1 DEISA/PRACE2 – €30 M
HP-SEE & LinkSCEEM2

DEISA: Virtual HPC Services

- Most powerful European supercomputers
- Dedicated high speed network (10 Gb/s)
- Single sign-on, common AAA
- Common production environment
- European teams of experts
- Extreme Computing Initiative
- Virtual Science Communities support
- Grand Challenge Projects on regular basis

HPC Eco-System: Grids



EGEE – Tackling Global Challenges

Enabling Grids for E-sciencE

~ 280 sites in 54 countries

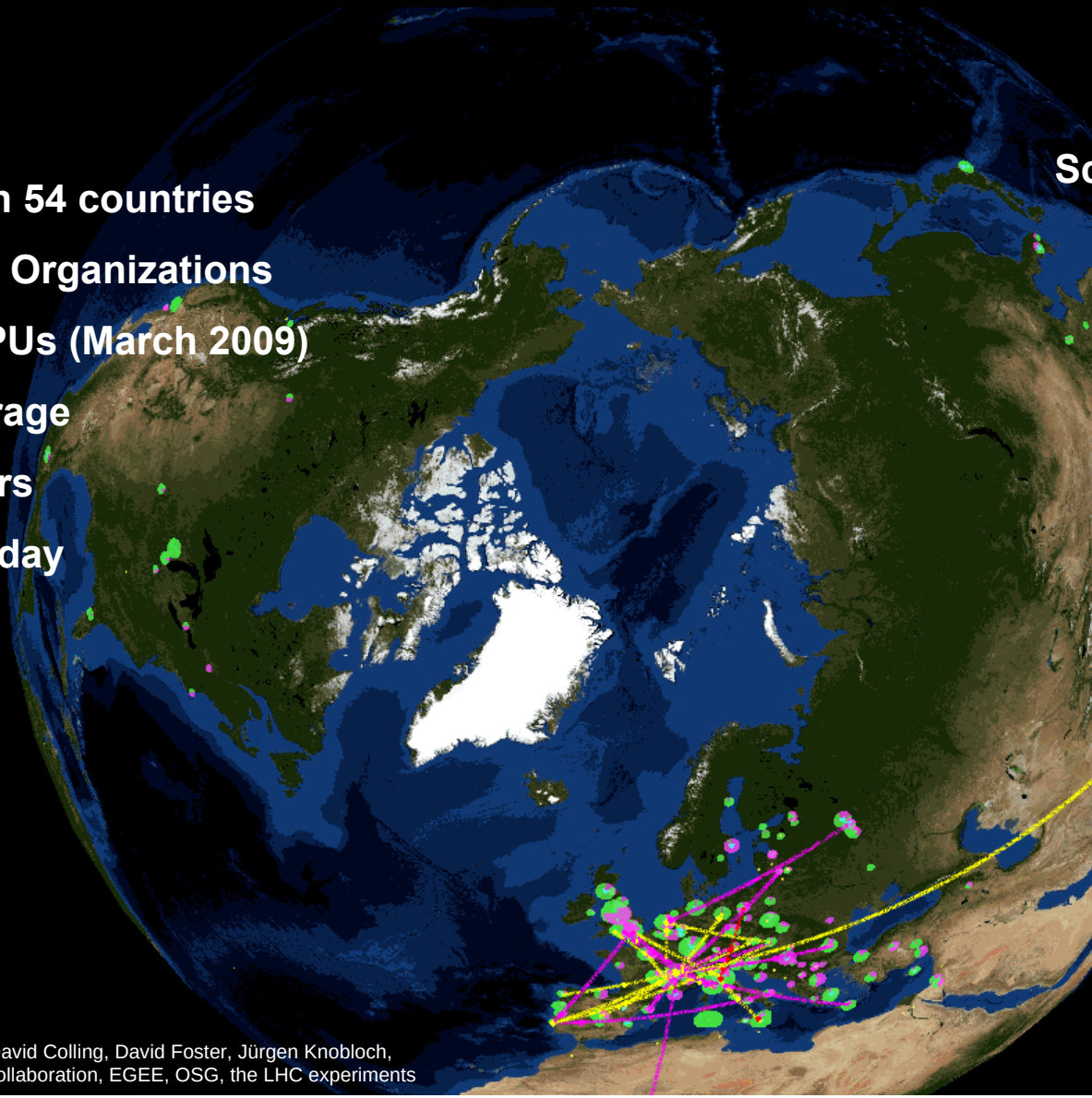
> 200 Virtual Organizations

~ 110 000 CPUs (March 2009)

➢ 20 PB storage

➢ 16000 users

> 250K jobs/day



Scheduled = 21539
Running = 25374

Scientific Communities:

- High Energy Physics
- Astrophysics
- Comp Chemistry
- Fusion
- Life Sciences
- Biomedicine
- Earth Sciences
- Finance
- Geophysics
- Multimedia
- ...and more

Acknowledgements:
Julia Andreeva, Ian Bird, David Colling, David Foster, Jürgen Knobloch, Faïrouz Malek, the LCG Collaboration, EGEE, OSG, the LHC experiments

GridPP
UK Computing for Particle Physics

EGI-InSPIRE

- 4 year project, €25M from EC; project cost €69M

  Estimated Total European Grid Effort Cost

  – €335M from the NGIs involved in EGI-InSPIRE, 8138 PMs

- Project Innovation:

Deploy Technology Innovation

  – Distributed Computing continues to evolve

    • Grids → Desktops → Virtualisation → Clouds →?

Enable Software Innovation

  – Provide reliable persistent technology platform

    • Today: Tools built on gLite/UNICORE/ARC

Support Research Innovation

  – Infrastructure for data driven research

    • Support for international research (e.g. ESFRI)

HP-SEE & LinkSCEEM2

HP-SEE (€2.1 M)

- South-East European and Black Sea regional HPC interconnection
- Expected result: sustainable national HPC centers and collaboration with PRACE

LinkSCEEM2 (€2.5 M)

- Integrate resources by linking established HPC centers
- Focus on climate science, cultural heritage and synchrotron applications
- User support and training programs

DEISA Ecosystem for HPC Grand-Challenge Applications

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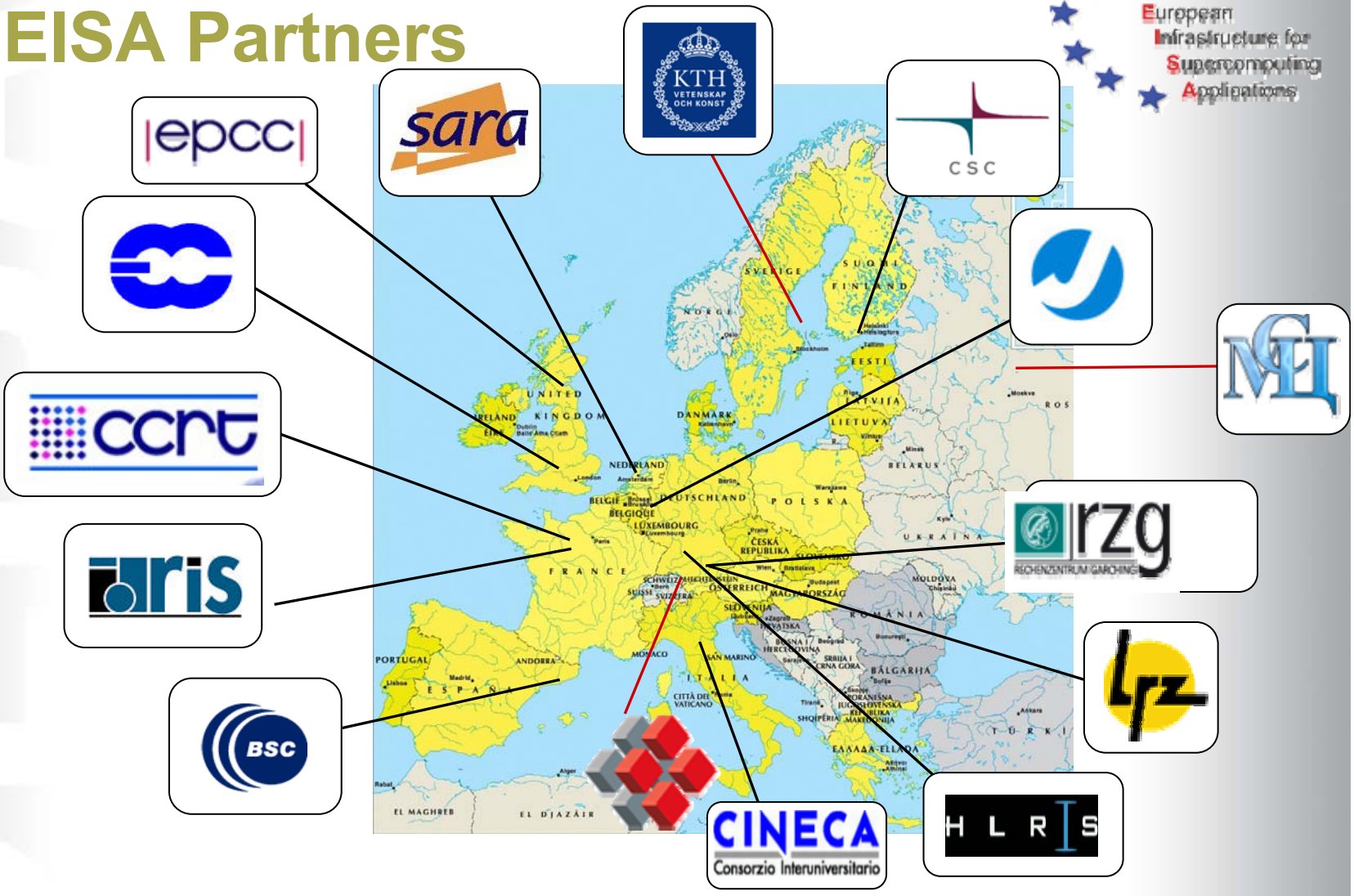
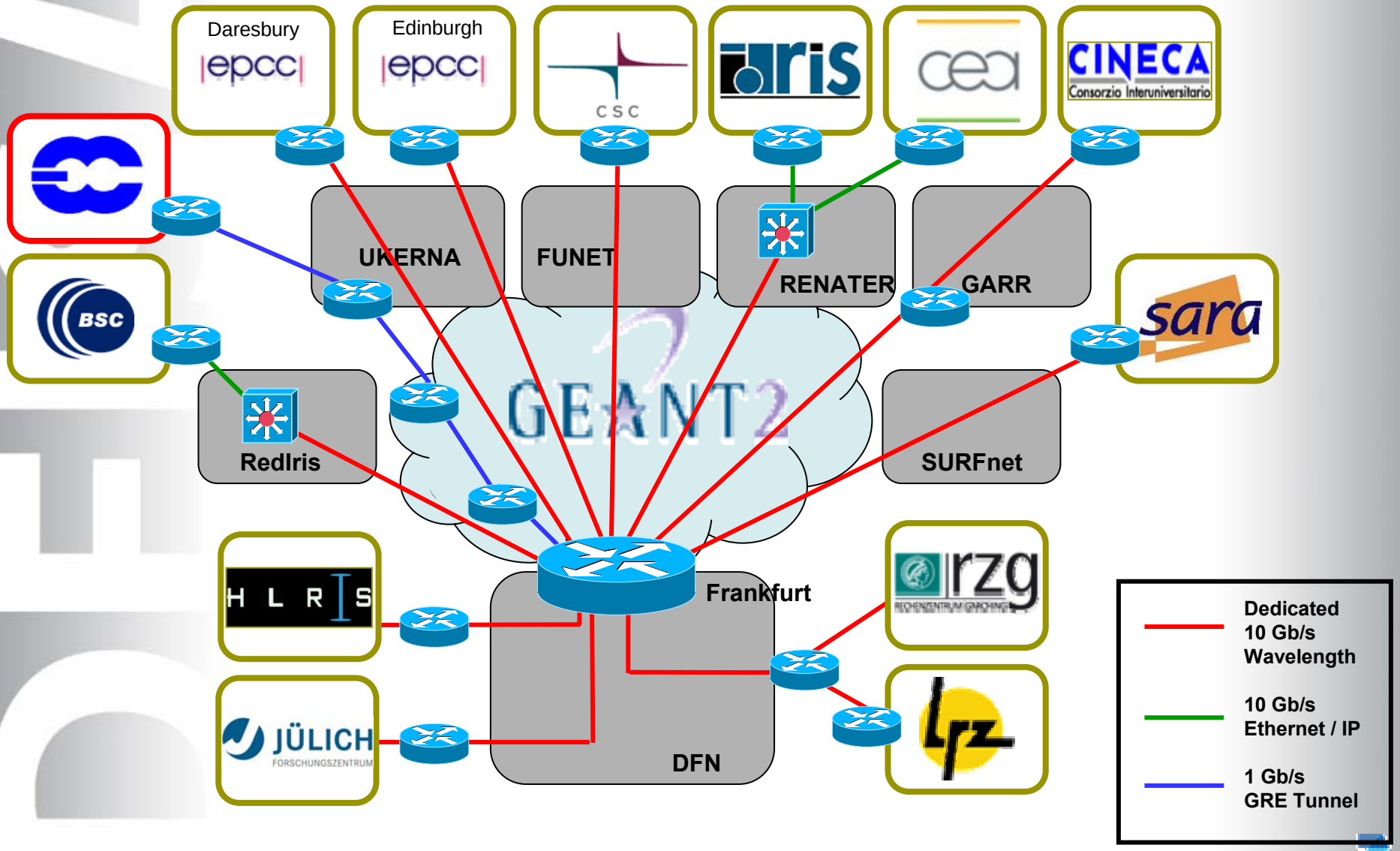
DEISA Partners



DEISA1: May 1st, 2004 – April 30th, 2008

DEISA2: May 1st, 2008 – April 30th, 2011

Dedicated high speed network (10 Gb/s)



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DEISA: Vision and Mission

Distributed European Infrastructure for Supercomputing Applications

Vision:

Persistent European **HPC ecosystem** integrating Tier-1 (Tflop/s) centres and European Tier-0 (Pflop/s) centres.

Mission:

Enhance Europe's capability in computing and science by **integrating most powerful supercomputers** into a European HPC e-infrastructure.

Build European Supercomputing Service **on top of existing national services**,

based on the deployment and operation of a persistent, production quality, distributed supercomputing environment with continental scope.

Unified Access and Use of HPC Resources

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Access via Internet

single sign-on (based on X.509 'Grid' certificates)
gsi-ssh -> D-ssh
Unicore, gridFTP

DEISA Common Production Environment

Different Software Environments

SE A1 | SE B1 | SE C1 | SE D1 | ..... | SE E1 | SE B2 | SE C2

Different SuperComputers - Compute elements and interconnect

Dedicated 10 Gb/s network – via GEANT2

DEISA highly performant continental global file system

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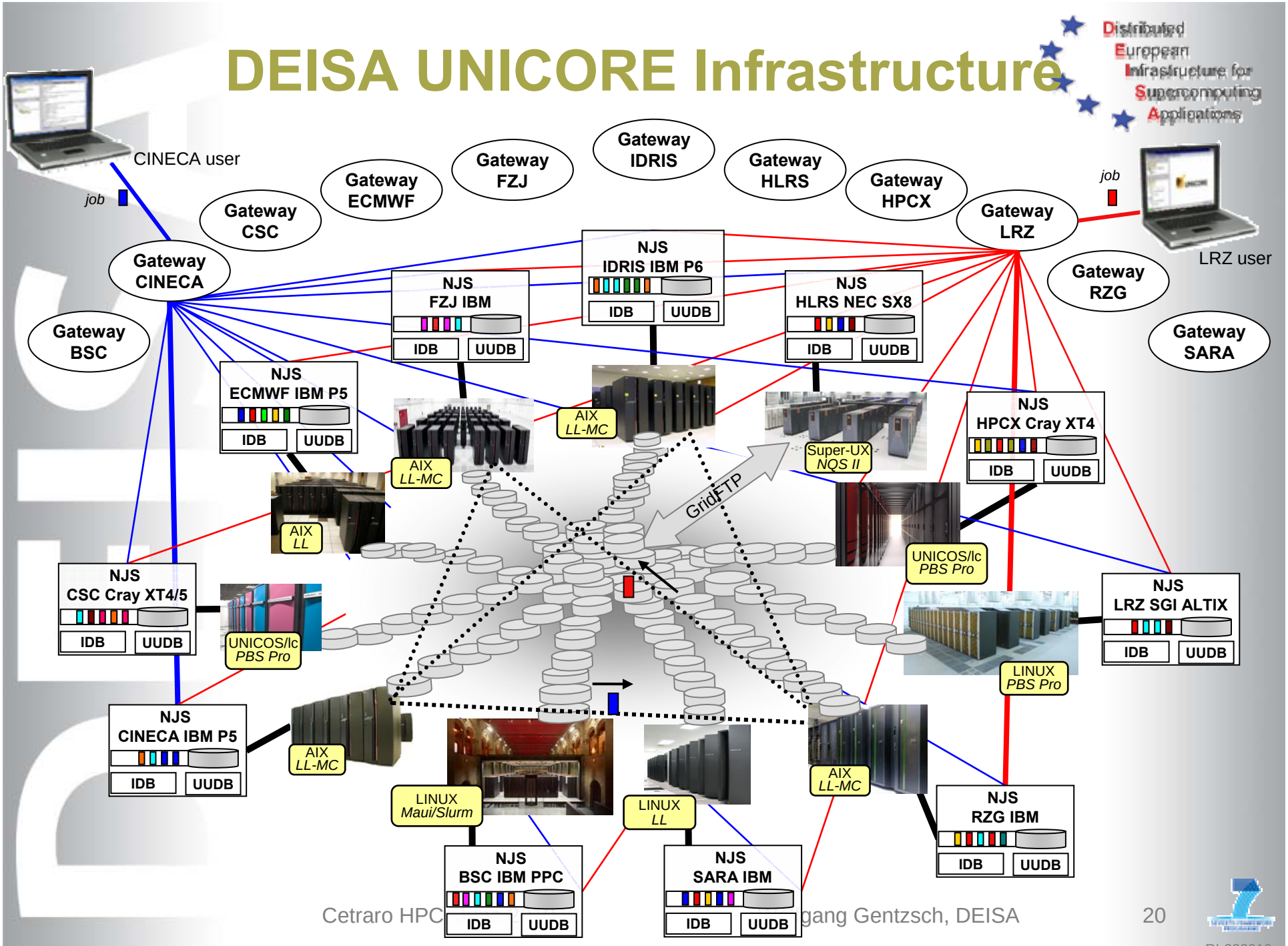
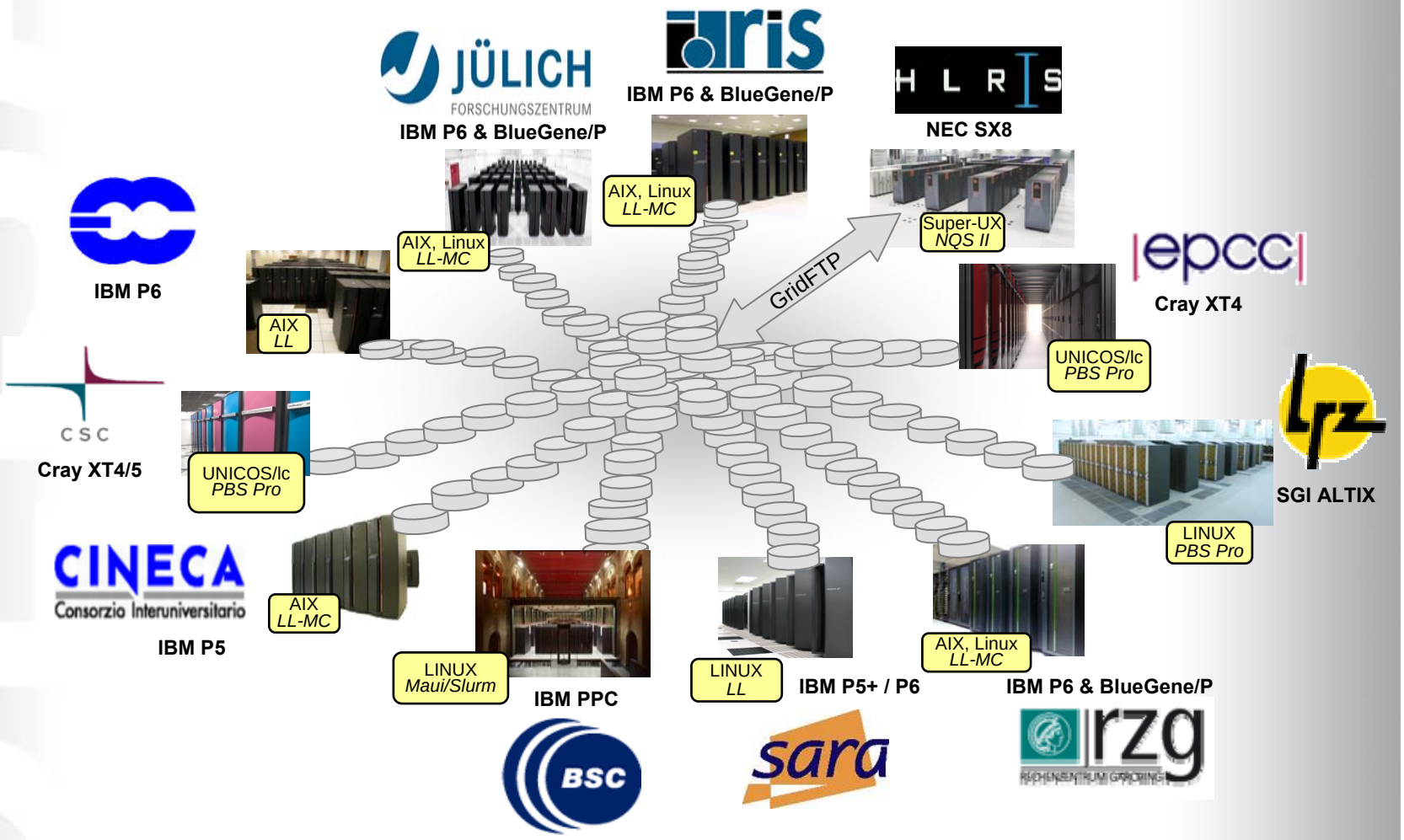
DEISA Service Layers

Multiple ways to access	Workflow managemnt	Common production environmnt	*Presen-tation layer*
Single monitor system	Job rerouting	Co-reservation and co-allocation	*Job manag. layer and monitor.*
Data staging tools	Data transfer tools	WAN shared File system	*Data manag. layer*
Unified AAA	**DEISA Sites**	Network connectivity	*Network and AAA layers*

DEISA UNICORE Infrastructure



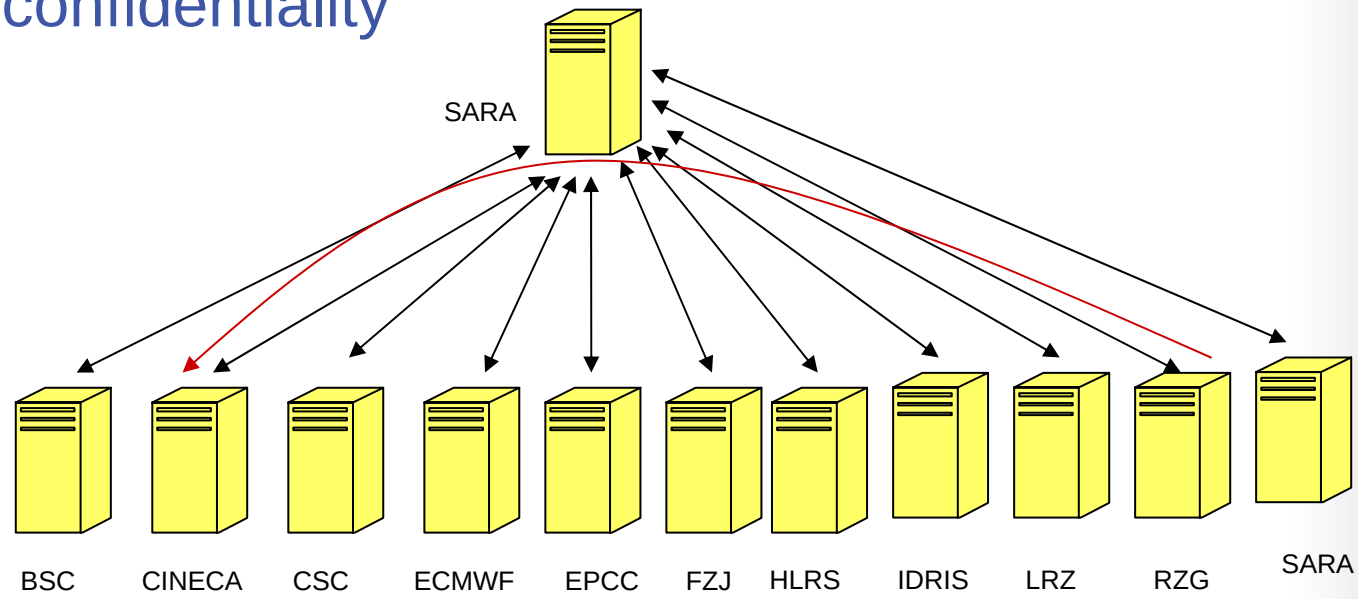
DEISA Global File System



Global transparent file system based on the Multi-Cluster General Parallel File System (MC-GPFS of IBM)

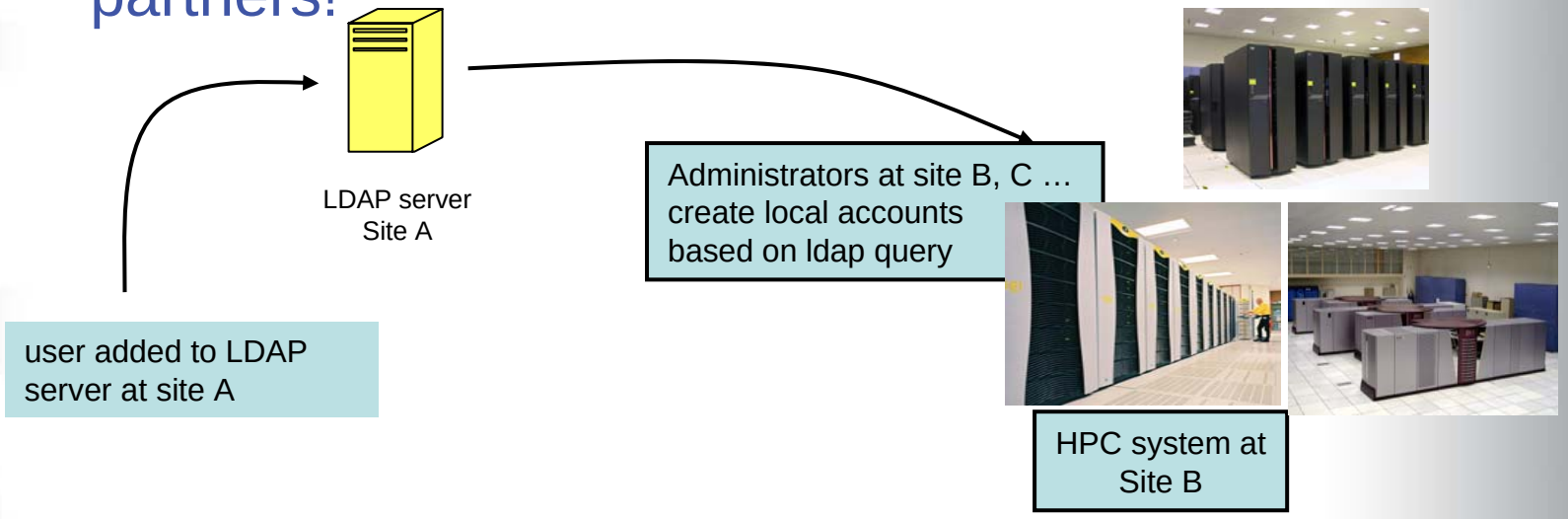
Management of users in DEISA

- A dedicated LDAP-based distributed repository administers DEISA users
- Trusted LDAP servers are authorized to access each other (based on X.509 certificates) and encrypted communication is used to maintain confidentiality

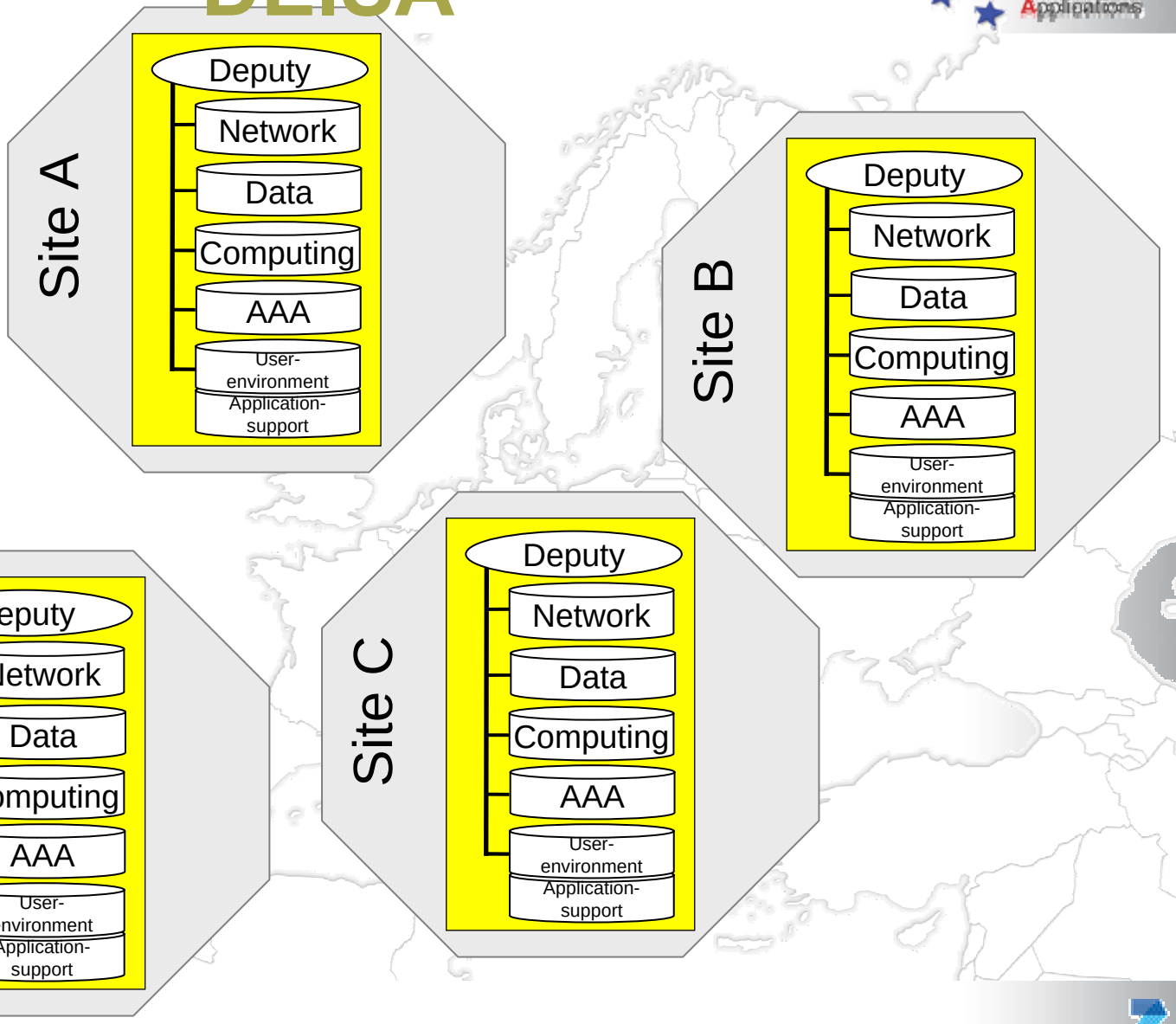


Common User Administration

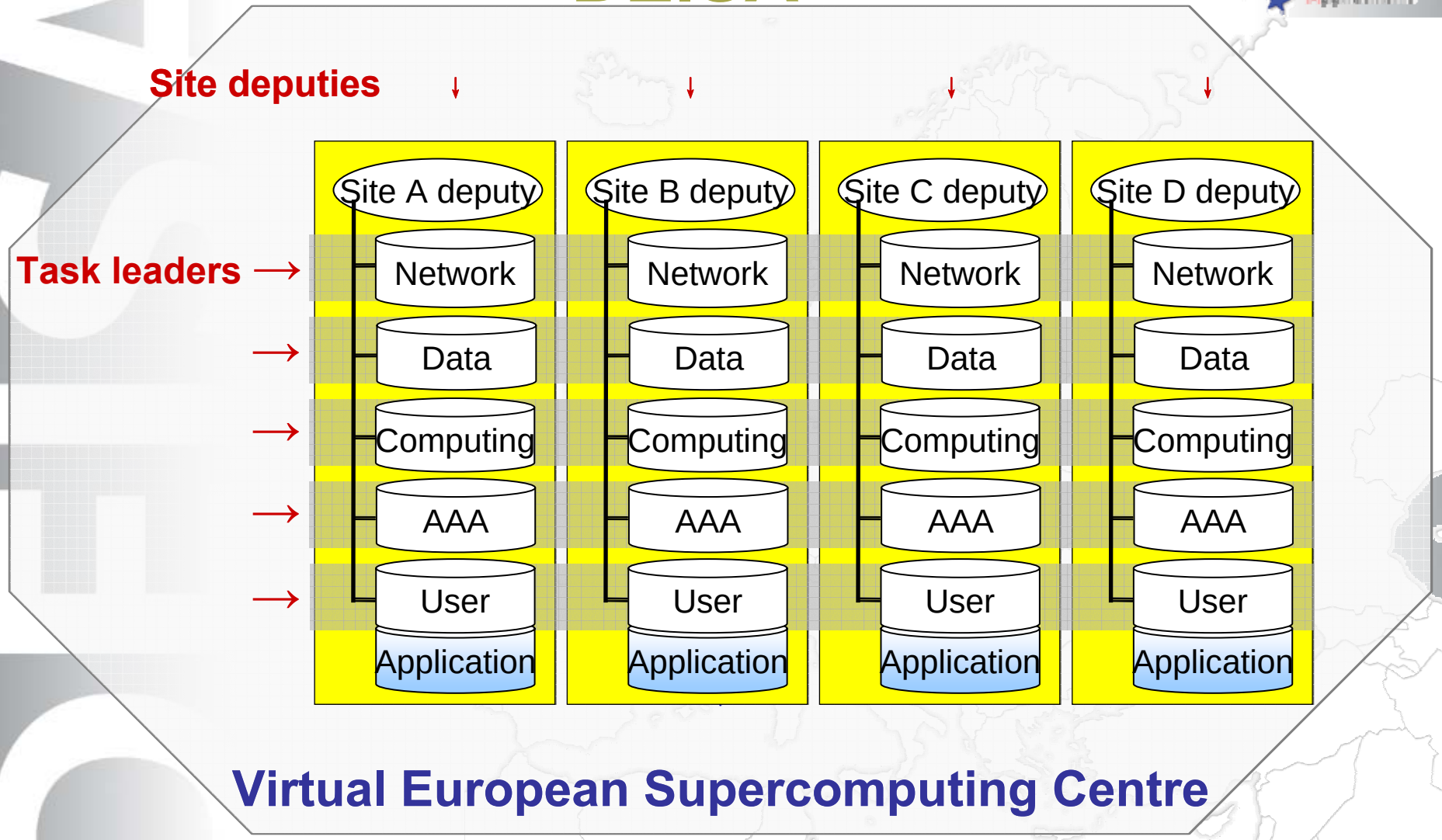
- Each partner is responsible for the registration of users affiliated to the partner (home organization)
- Other partners update local user administration (LDAP, NIS, /etc/passwd) with data from other sites on a daily basis. Based on trust between partners!



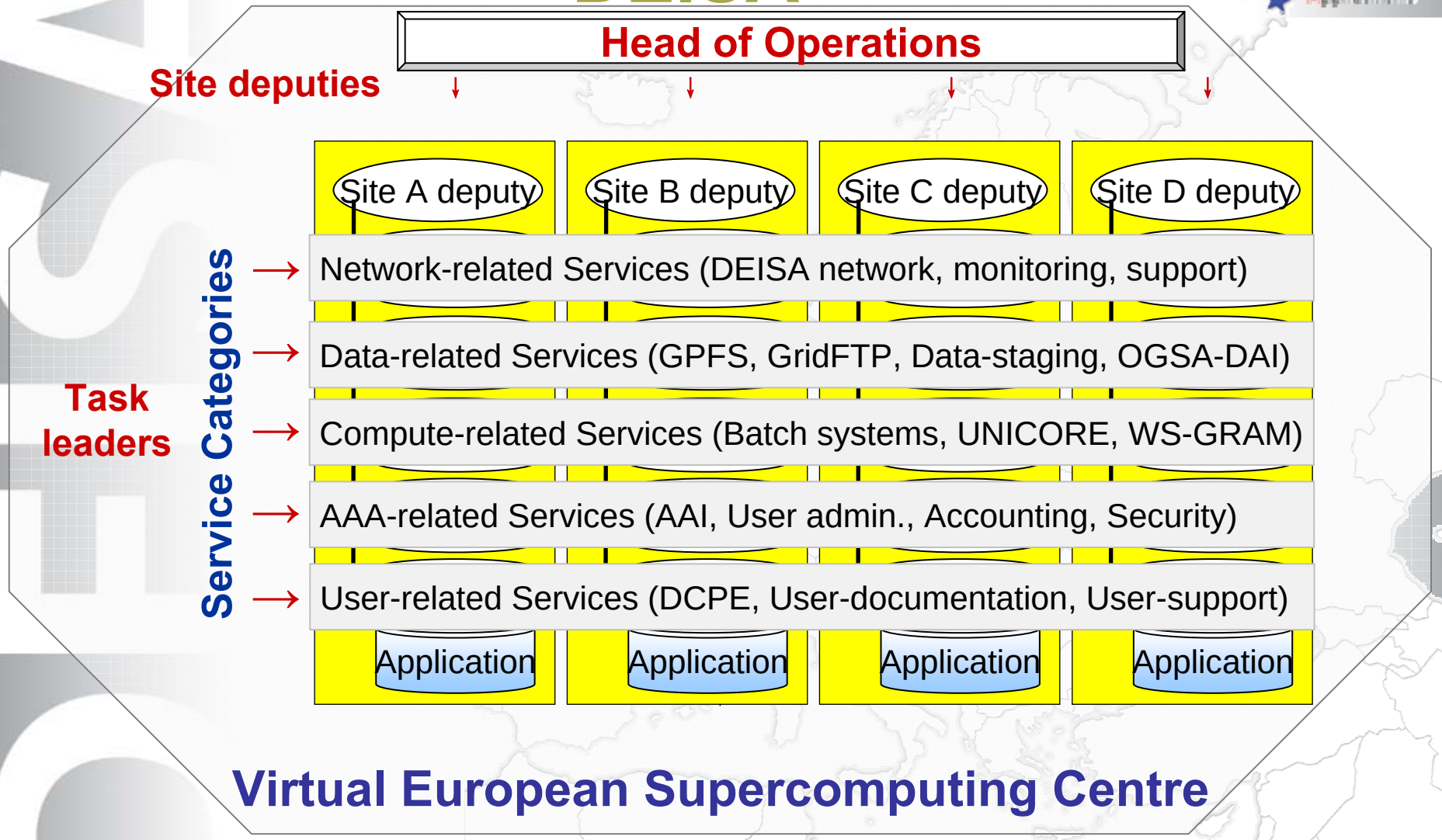
Federated Operation of DEISA



Federated Operation of DEISA



Federated Operation of DEISA



DEISA Extreme Computing Initiative (DECI)

- DECI launched in 2005: complex, demanding, innovative simulations requiring the exceptional capabilities of DEISA
- Multi-national proposals encouraged
- Proposals reviewed by national evaluation committees
- Projects chosen on the basis of innovation potential, scientific excellence, relevance criteria, and national priorities
- Most powerful HPC architectures for most challenging projects
- Most appropriate supercomputer architecture selected

Projects and Science Communities

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DECI call 2005

29 proposals accepted — 12 mio core-h granted*****

DECI call 2006

28 proposals accepted — 12 mio core-h granted*

DECI call 2007

45 proposals accepted — 30 mio core-h granted*

DECI call and Science Communities 2008

42 proposals accepted — 50 mio core-h granted*

3 communities — 5 mio core-h granted*

DECI call and Science Communities 2009

50 proposals accepted — 60 mio core-h granted*

7 communities — 12 mio core-h granted*

***)** Core-h normalized to IBM P4+@1.7GHz

Science Communities Support

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Life Sciences

VIROLAB

Virtual Physiological Human network of excellence

Fusion Energy Research

EFDA
EUROPEAN FUSION DEVELOPMENT AGREEMENT

EUFORIA

Space Science / Cosmology

esa planck

Climate Research

enes European Network for Earth System Modelling

2008 3 communities — 5 mio core-h granted*
2009 7 communities — 12 mio core-h granted*

Conclusions

- e-Infrastructures provide the platforms for data and computation-intensive collaborative Science
- HPC becomes part of EU policy
- DEISA and PRACE are delivering tangible results
- Comprehensive EU strategy for HPC to be developed
  - Use vs. supply, industry vs. academia, national vs. EU, ...

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Thank You

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