CoreGRID

Managed by

European Research Consortium for Informatics and Mathematics
ERCIM

Grid Computing

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Information Society Technologies

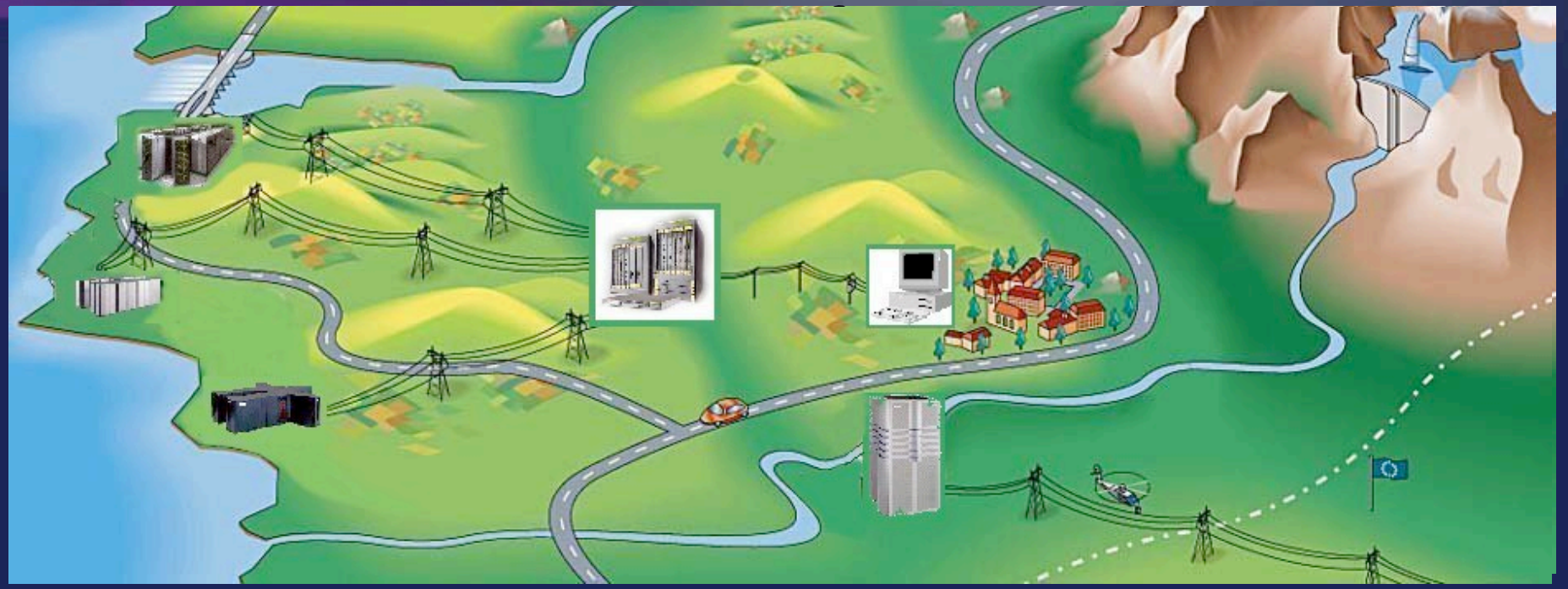
Contents

- The early age of Grid Computing
- Towards Next Generation Grid
- CoreGRID : Towards a European integrated research community

What is the Grid ?

A buzzword ? *A marketing slogan ?*

Just a concept !



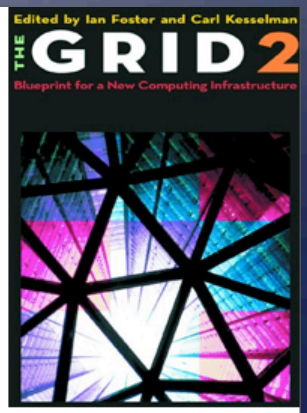
Computing (at large) as utility !

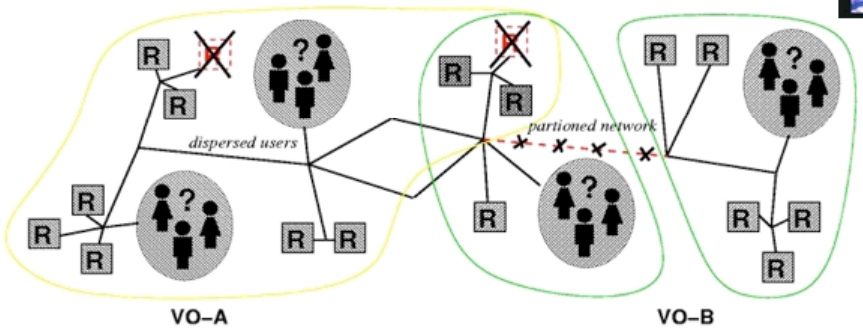
The Grid by I. Foster et al.

the globus alliance
www.globus.org

The Grid

"Resource sharing & coordinated problem solving in dynamic … virtual organizations"





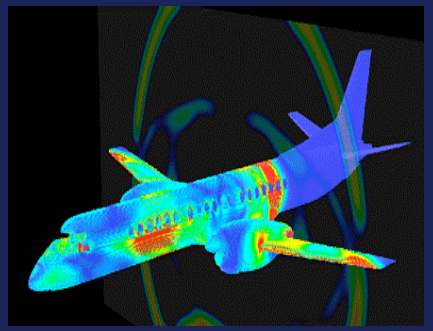
- Enable integration of distributed service & resources
- Using general-purpose protocols & infrastructure
- To achieve useful qualities of service

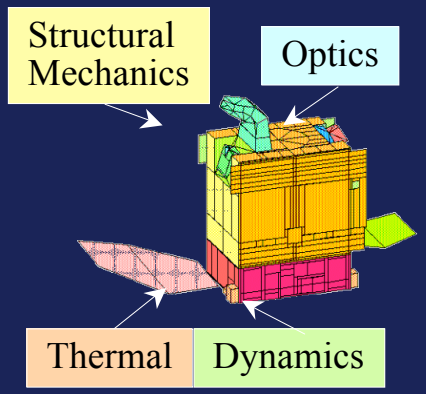
"The Anatomy of the Grid", Foster, Kesselman, Tuecke, 2001

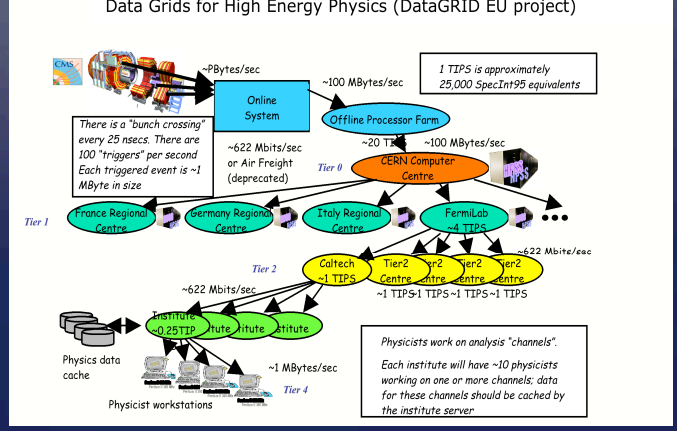
For which applications ?

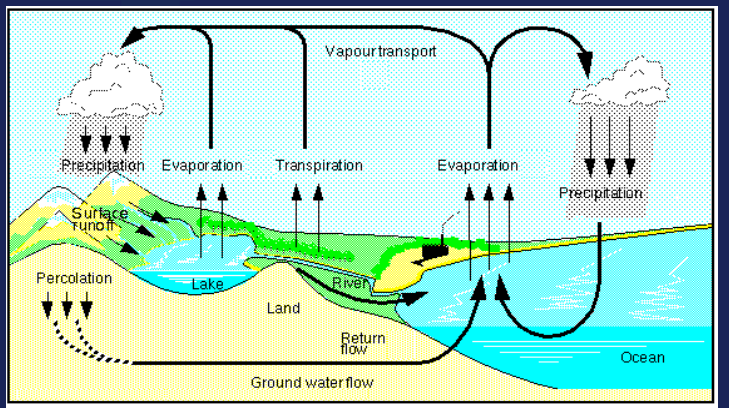
e-Science
- Biochemistry
- High-energy physics
- Climate modeling
- Virtual observatory

e-Engineering
- Aircraft optimal design
- Aerospace
- …





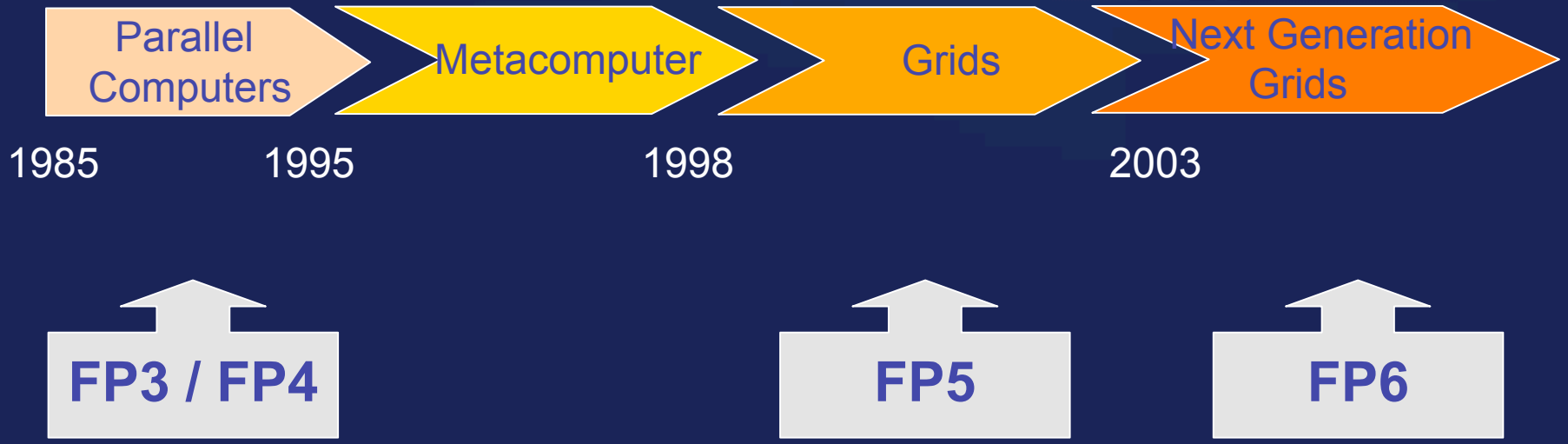




Courtesy Erich Roeckner, Max Planck Institute for Meteorology

Where we come from…
… and where we are going

- Grids came from the needs to get access to more computing resources



The early age of Grid Computing

Grid computing emerged in the end of the 90's

- An evolution rather than a revolution (from metacomputing)
- Made possible by the Internet and basic research carried out during the last 20 years in distributed and parallel computing
- Computing as a utility like Electricity
- Targeted for e-Science applications

One concept, several implementations

- Virtual Supercomputer

Internet Computing

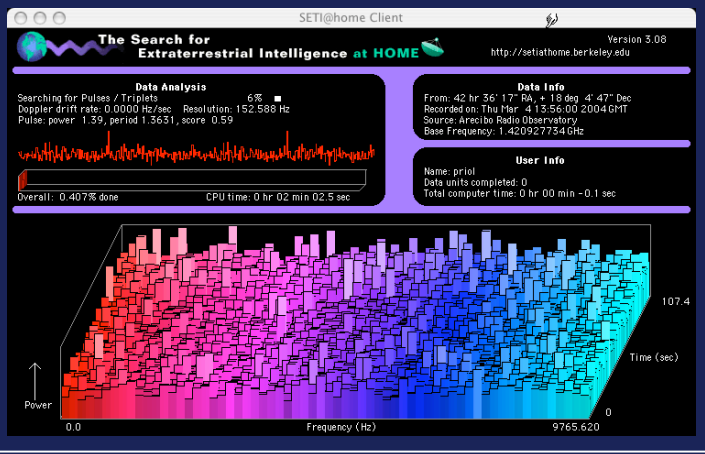
Internet Computing (Desktop Grid)

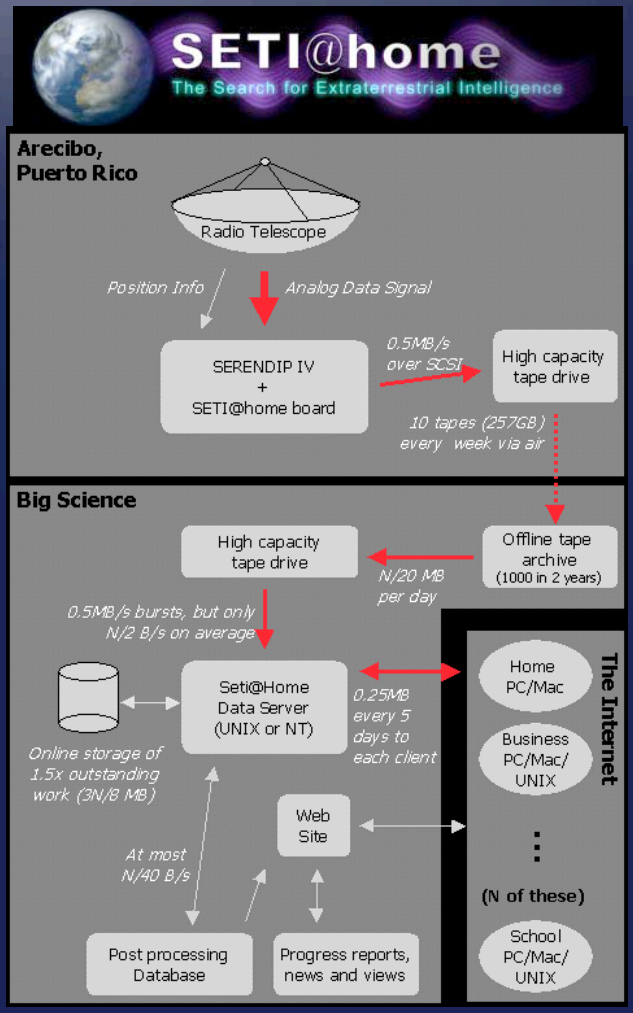
Principle

- Exploiting unused resources in the Intranet environments and across the Internet

Example

- SETI@home
  - Search for Extraterrestrial Intelligence
  - 62 Teraflop/s !





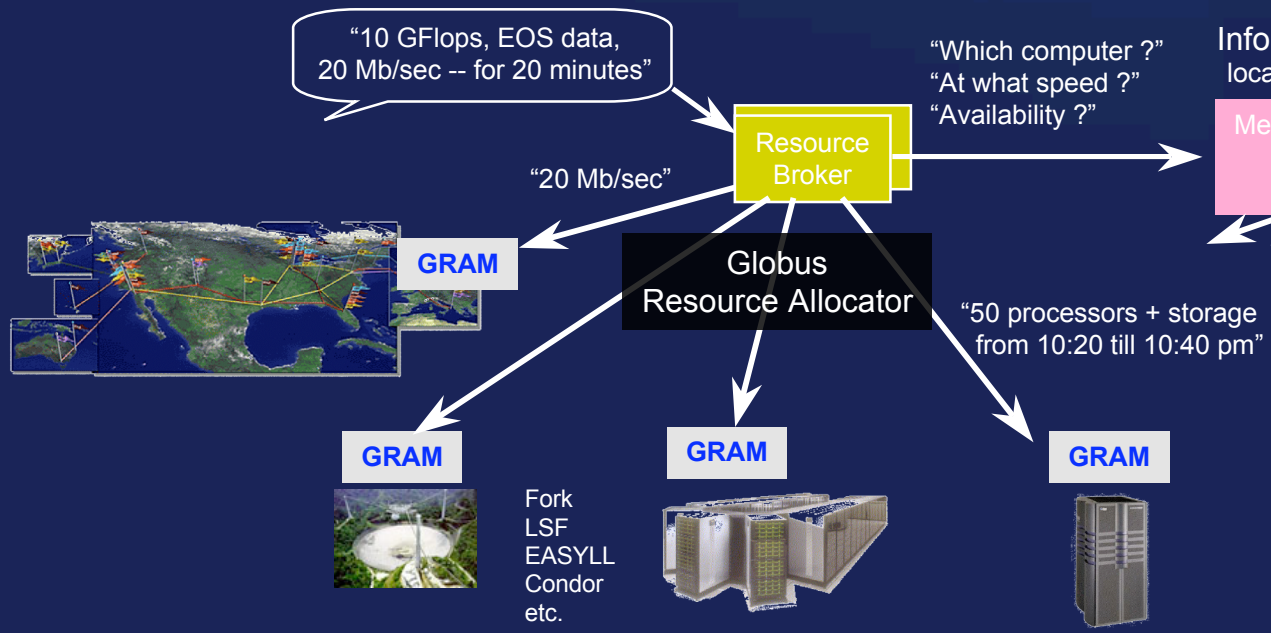
Virtual Supercomputing

Principle

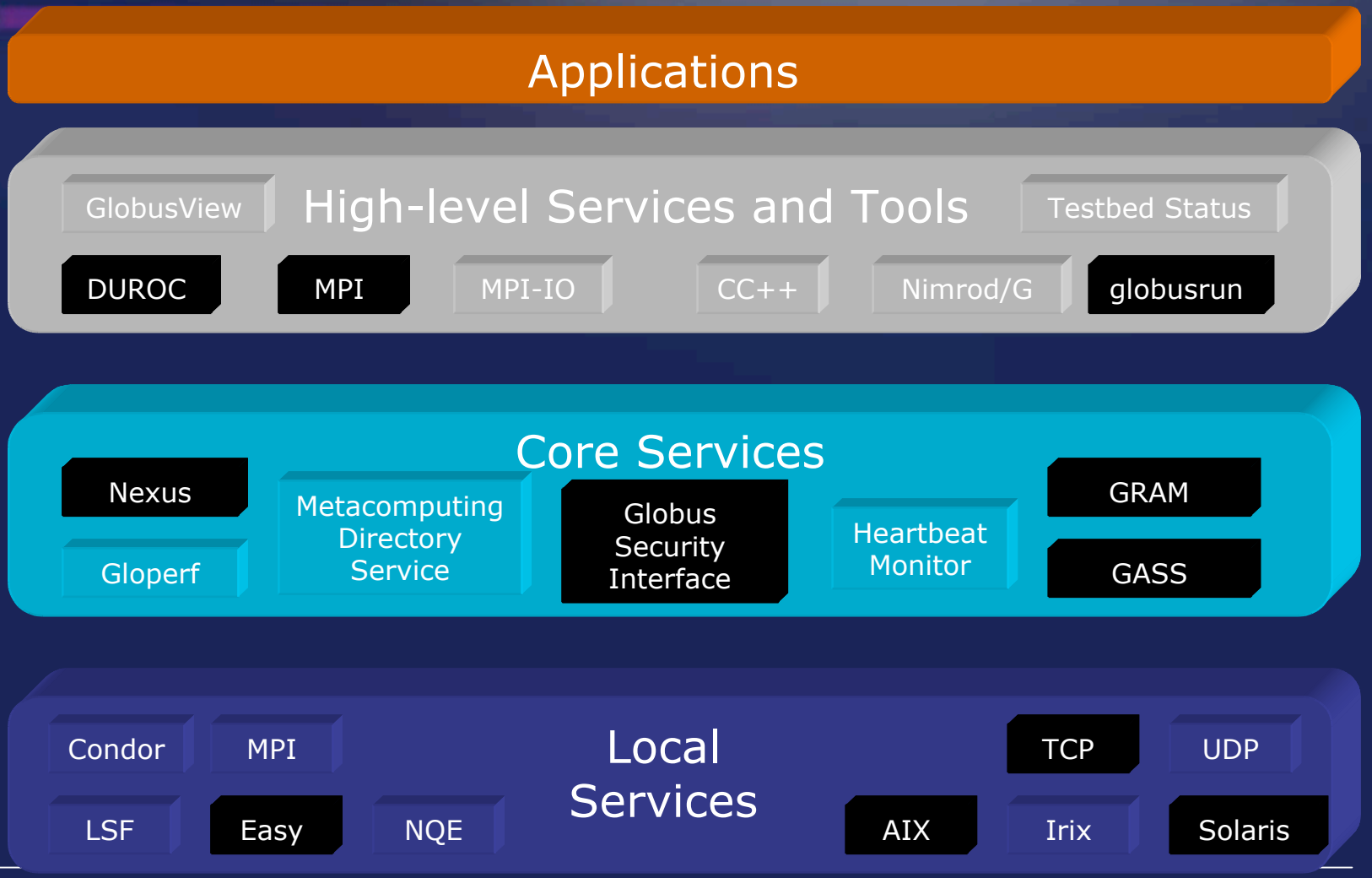
- Build a virtual supercomputer
- To execute applications remotely

Examples

- Globus
- Legion
- gLite
- Unicore



The Globus big picture…



Grids and standardization

- Several projects aiming at designing Grid middleware with their own API and protocols
  - Globus, Legion, Unicore, gLite, …
- Needs for standardization
  - Interoperability, reusability
- Adoption of a Service-oriented architecture (industry standard)
  - OGSA based on Grid Services (OGSI) and later on Web Services (WSRF)
    - Form stateless to stateful web service
  - And how Grid became a marketing slogan…
- Standardization bodies

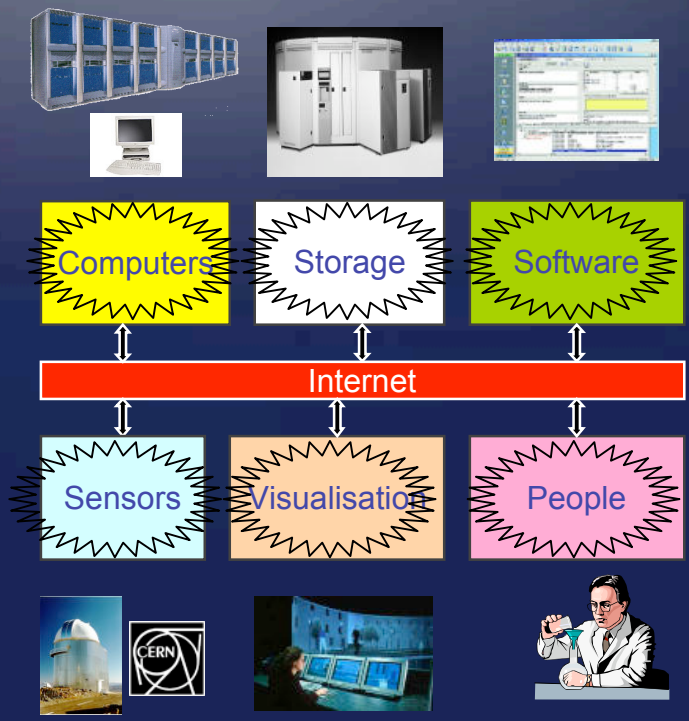
2001 2003 2006

Resources as services

Encapsulation of resources into services

- Computers, storage, software, sensors, visualisation and even people…

Web services are becoming the instruction set of Grid infrastructures



WSRF: Grid instruction set

```
…
<portType name="calcPortType">
 <operation name="add">
  <input message="tns:addRequest"/>
  <output message="tns:addResponse"/>
 </operation>
</portType>
```

Service definition

An evolution rather than revolution in software development methodologies using modular design:

- Object-oriented by inheritance
- Component-oriented by composition
- Service-oriented by coordination/orchestration at runtime

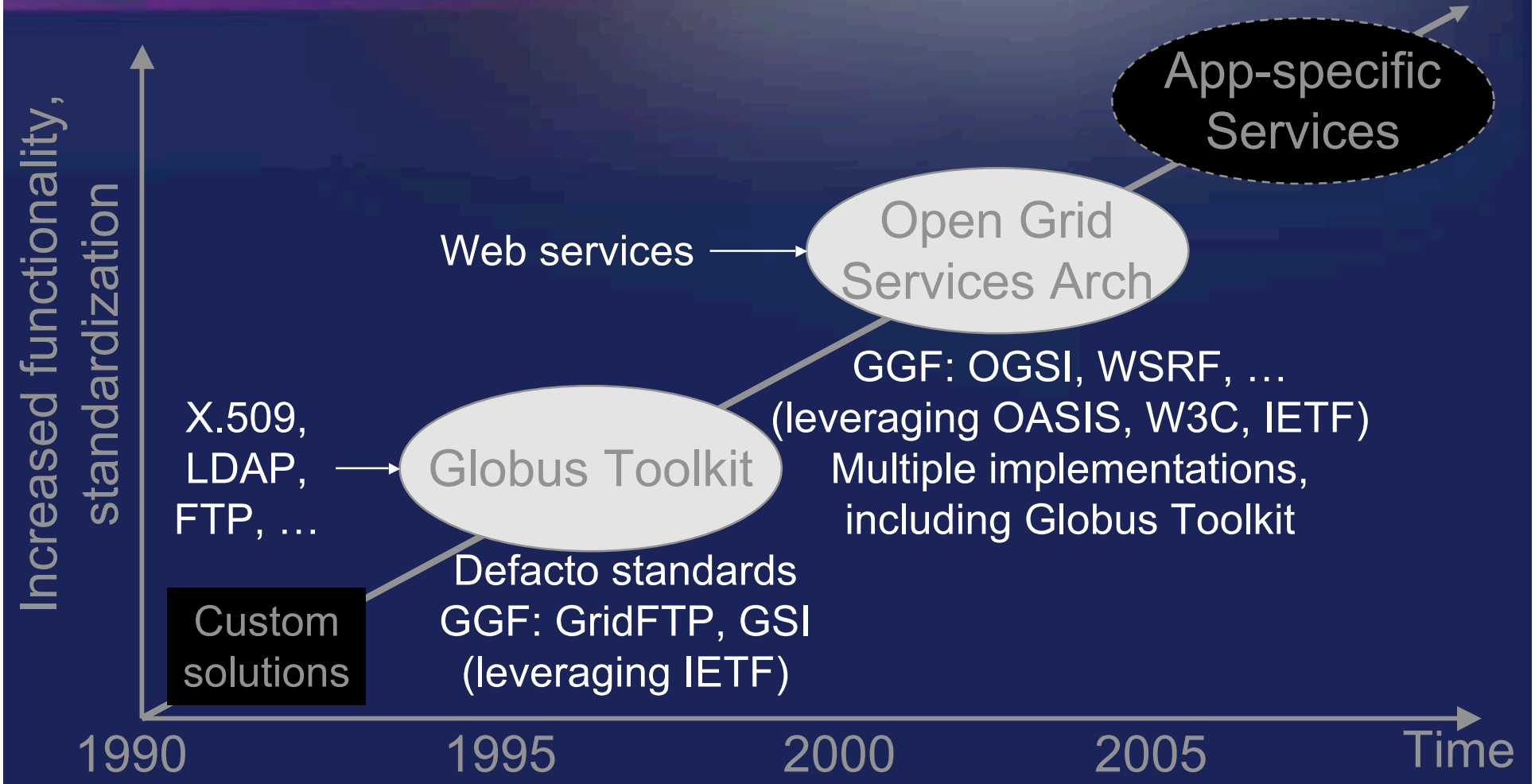
Make the development of distributed applications more « agile » by:

- Specifying an interface contract independent for the underlying platform (HW, OS, comm. protocol, languages)
- Dynamic discovery and service invocation through messages
- Maintaining its own state (self-contained)
- Loose coupling of services / on-the-fly network binding
- Tolerating evolution at runtime

But service does not mean “Web Service”

- Web Service is just a technology to implement services

Evolution of the Grid Middleware (Globus)



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NGG Group of Experts

Information provided by a group of independent experts convened by the European Commission with the objective to identify potential European Research priorities for Next Generation Grid(s) 2010 and beyond

Experts are both from Industry and Academia

Enlarge the scope of applications for Grid Technologies

- From e-Science/e-Engineering to e-Business

Next Generation Grids Reports

Main source of inspiration for FP6 Grid Research and beyond

http://www.cordis.lu/ist/grids

Next Generation Grid definition

A fully distributed dynamically reconfigurable scalable solution for business & science applications, with not only compute power but also access to information and knowledge through a coordinated set of services

Next Generation Grids Report 2003:
Identified Research Themes

Next Generation Grids Report 2004

Driving Scenarios

Crisis Management – Pro-active PDA

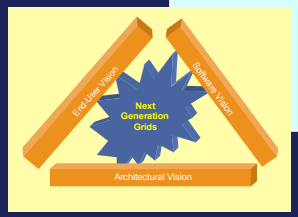
Research Topics

Mobile and Embedded Grids

Network-Centric (Grid) Operating Systems

Mastering Grid Complexity

NGG1 vision and research challenges

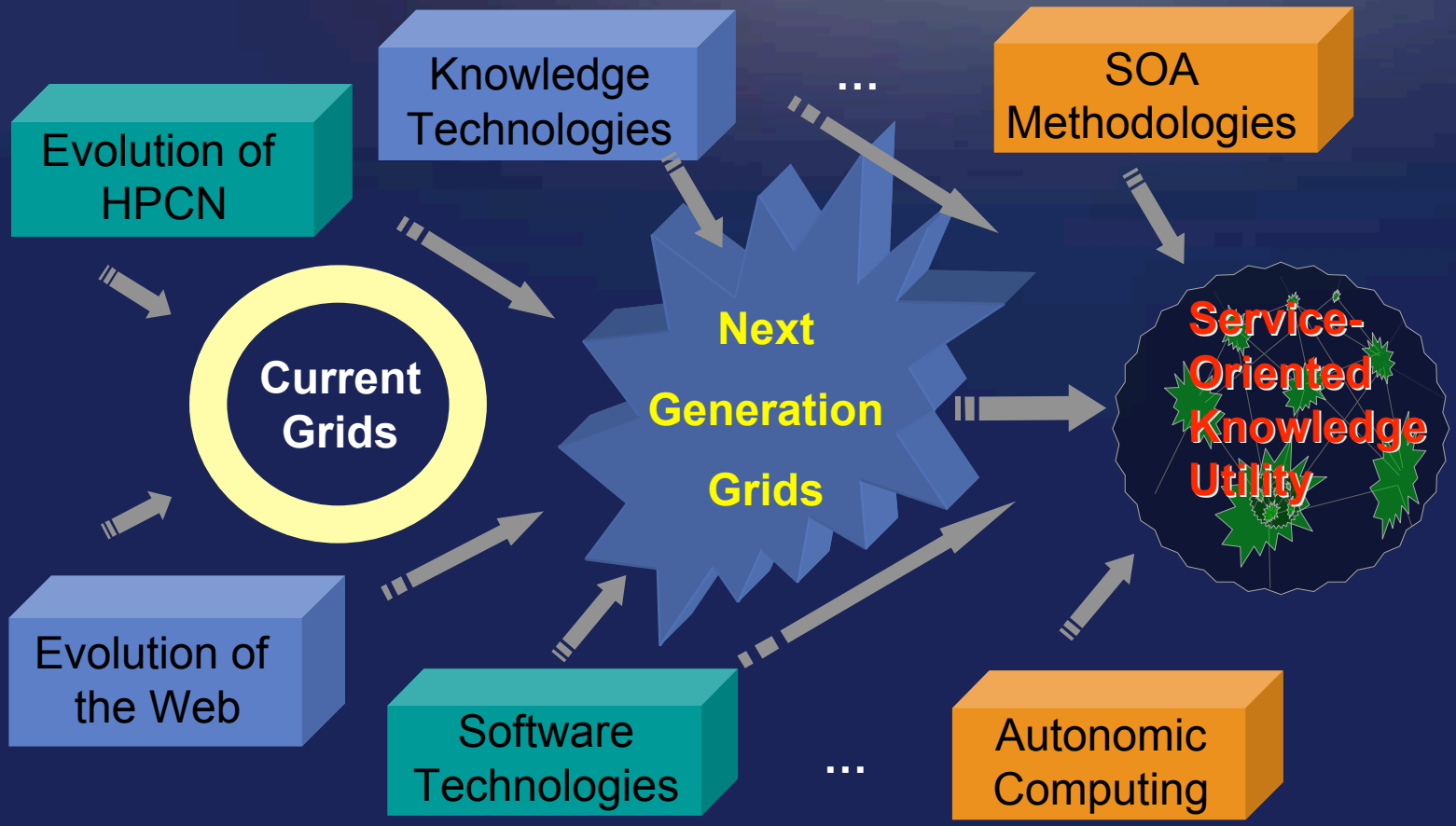


Next Generation Grids Report 2005
Service-Oriented Knowledge Utility (SOKU)

A flexible, powerful and cost-efficient way of building, operating and evolving IT intensive solutions for business, science and society.

- building on existing industry practices, and emerging technologies
- support ecosystems that promote collaboration and self-organization
- towards increased agility, lower TCO, broader availability of services for all
- empowering service providers, integrators and end-consumers of ICT
- (r)evolution of concepts from Web, Grid & Knowledge technologies
- as safe, ease und ubiquitous as existing utilities such as electricity or water

From Grids to SOKU



Next Generation Grids Report 2005

Driving Scenarios

Business/Enterprise - End-User - Manufacturing/Industrial

Service-Oriented Knowledge Utility

Research Topics

- Lifecycle Management
- Trust and Security in Virtual Organizations
- Adaptability, Scalability, Dependability
- Raising the Level of Abstraction
- Pervasiveness and Context Awareness of Services
- Semantic Technologies
- Human Factors and Societal Issues

NGG1&NGG2 vision and research challenges

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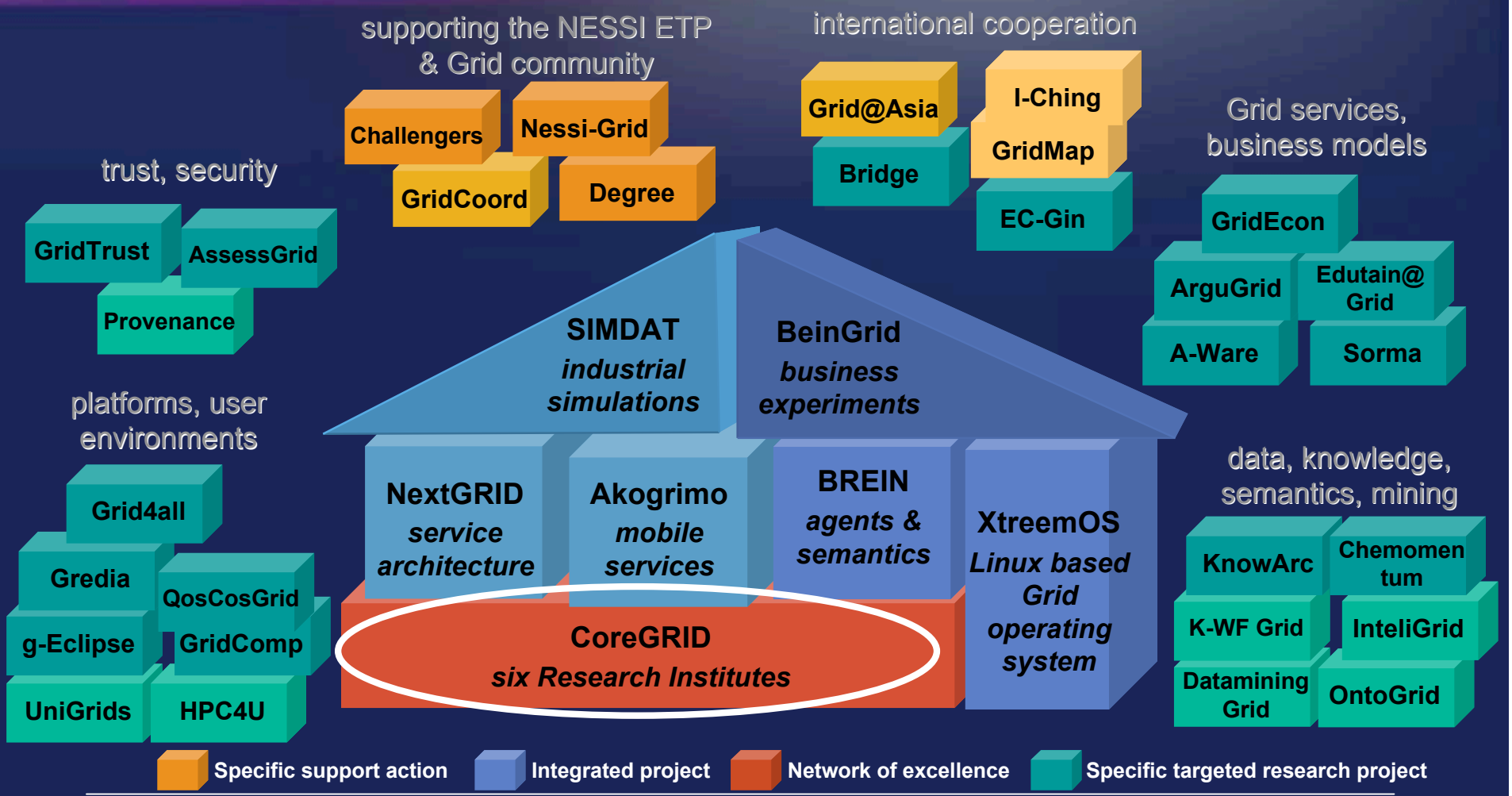
Where we are in the Grid House ?



CoreGRID objectives

- To build a European-wide research laboratory
  - To avoid fragmentation of Grid research activities in Europe
  - Create the European "Grid Lighthouse" and be seen as such worldwide
  - To achieve integration and sustainability
- To build solid foundations for GRID and P2P technologies
  - Both on a methodological basis and a technological basis
  - Support medium and long term research activities
- Achieve and promote scientific and technological excellence within & beyond the Grid research community
- Gather and disseminate European research
- A think-tank for spin-off projects
  - EC funded, bilateral projects, international cooperations, …

CoreGRID Membership

40 partners from 18 Countries (1 from S. America)

CoreGRID researchers

- Sep 2004: 118 researchers
- Aug 2005: 145 researchers
- 7 researchers left the Network, 34 new ones were included

CoreGRID PhD students

- Sep 2004: 163 PhD students
- Aug 2005: 169 PhD students
- 22 left the Network, 28 new ones were included

CoreGRID Grid vision

"A fully distributed, dynamically reconfigurable, scalable and autonomous infrastructure to provide location independent, pervasive, reliable, secure and efficient access to a coordinated set of services encapsulating and virtualizing resources (computing power, storage, instruments, data, etc.) in order to generate knowledge"

A set of well identified research challenges

Knowledge & Data Management

- Handling information/data that are required/produced by a wide range of diverse processing power

Programming Model

- Making the programming of Grid infrastructures as simple and transparent as possible

Architectural Issues: Scalability, Dependability, Adaptability

- Designing the next generation Grid middleware

Grid Information, Resource and Monitoring Services

- Scalable information service to implement a service view of the Grid

Resource Management & Scheduling

- Scheduling jobs/applications/tasks/computation within a Grid environment

Systems, Tools and Environments

- Integrating various middleware, tools and applications for problem solving

A Network operated as a European-wide Research Laboratory

Integrated Activities

Spreading of Excellence

Sergei Gorlatch

WESTFÄLISCHE WILHELMS-UNIVERSITÄT MÜNSTER

Domenico Talia

Knowledge Data Management

Research Groups

Marco Danelutto

Programming Model

Research Groups

Artur Andrzejak

Architectural Issues: Scalability, Dependability, Adaptability

earch Groups

Pierre Guisset

cetic

Norbert Meyer

Grid Information, Resource & Workflow Monitoring Services

Research Groups

Resource Management & Scheduling

Ramin Yahyapour

Research Groups

Systems, Tools and Environments

Vladimir Getov

Research Groups

CoreGRID Institutes

Collaboration Gateway

Wolfgang Ziegler

Fraunhofer Gesellschaft

UNIVERSITÀ DELLA CALABRIA
Dipartimento di ELETTRONICA, INFORMATICA E SISTEMISTICA

UNIVERSITÀ DI PISA

ZIB

SUPERCOMPUTING POZNAN NETWORKING

UNIVERSITÄT DORTMUND

UNIVERSITY OF WESTMINSTER

CoreGRID European Research Laboratory

- 23 CoreGRID Workshops
- 5,482 visitors on www.coregrid.eu between Jan. and Aug. 2006
- Edition of 4 CoreGRID Springer series
- Publication of 60 CoreGRID Technical Reports
- Dissemination of CoreGRID marketing materials (brochures, stand, 2005 annual report, posters…)
- Organisation of scientific and industrial events
- …

"Operated as a European Research Laboratory, CoreGRID is facilitating the promotion of Europe's world-class scientific and technological excellence in order to improve European competitiveness."

Acknowledgments

Special thanks to

- W. Boch and his team (European Commission - Unit F2)
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- David de Roure (NGG3 editor-in-chief)
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