

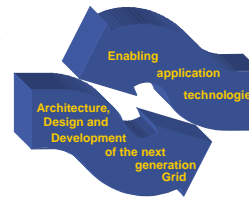
# Next Generation Grids Report 2005

## *Future for European Grids: GRIDs and Service Oriented Knowledge Utilities*

### *Vision and Research Directions 2010 and Beyond*



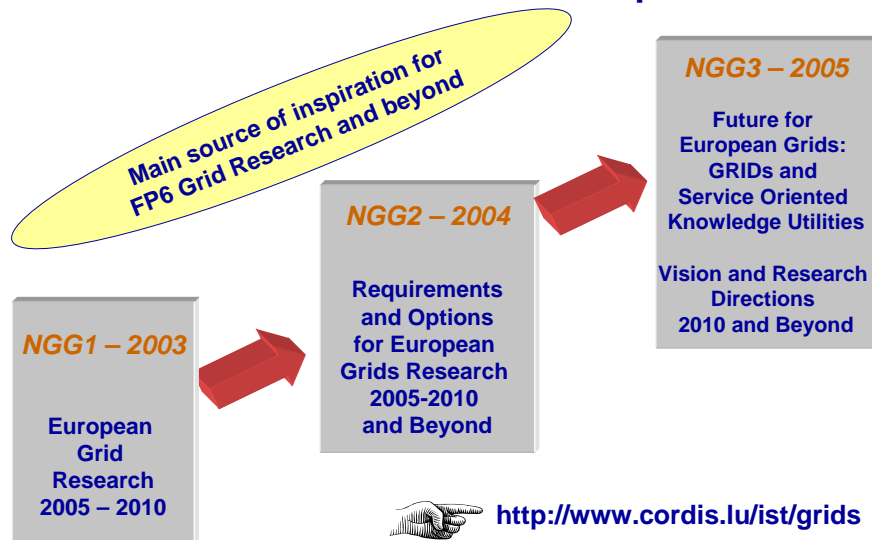
**Vincent OBOZINSKI**  
Grid Technologies Unit  
DG INFSO  
European Commission



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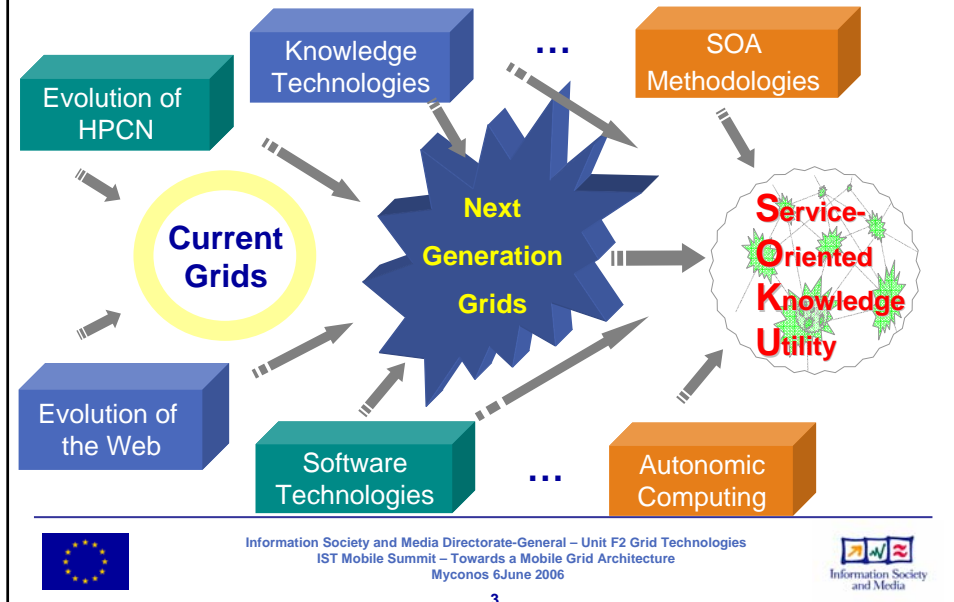
## Next Generation Grids Reports



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## From NGG to SOKU



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## 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**

*Grid is more than meta-computing plus extensions*



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## 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 of 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



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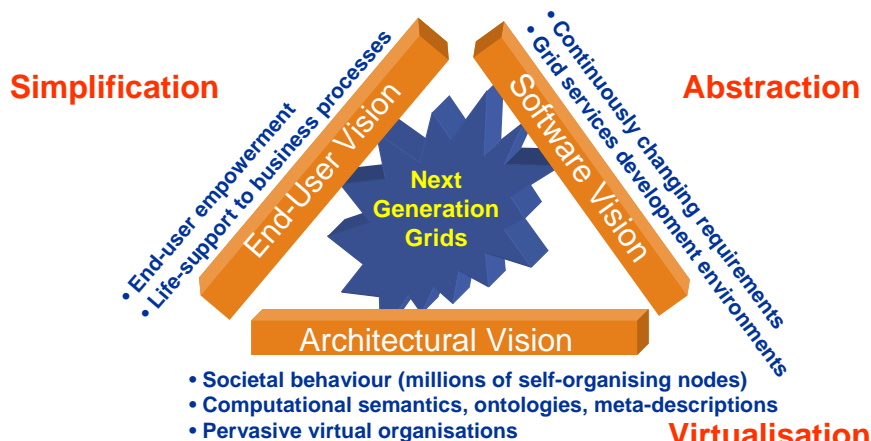


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NGG1

## Next Generation Grids Report 2003: Vision

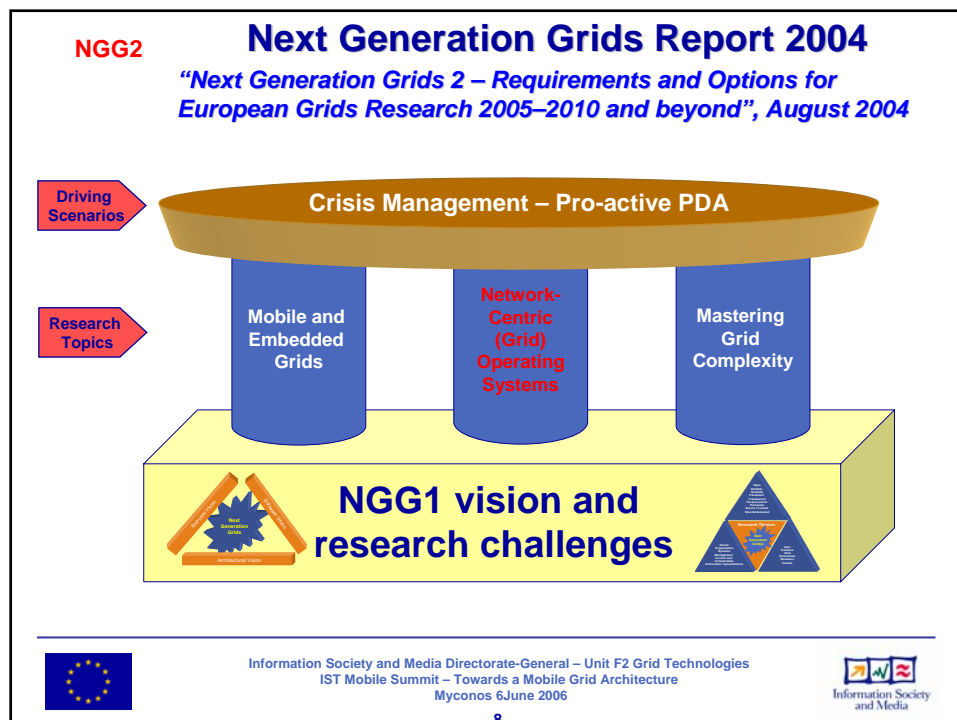
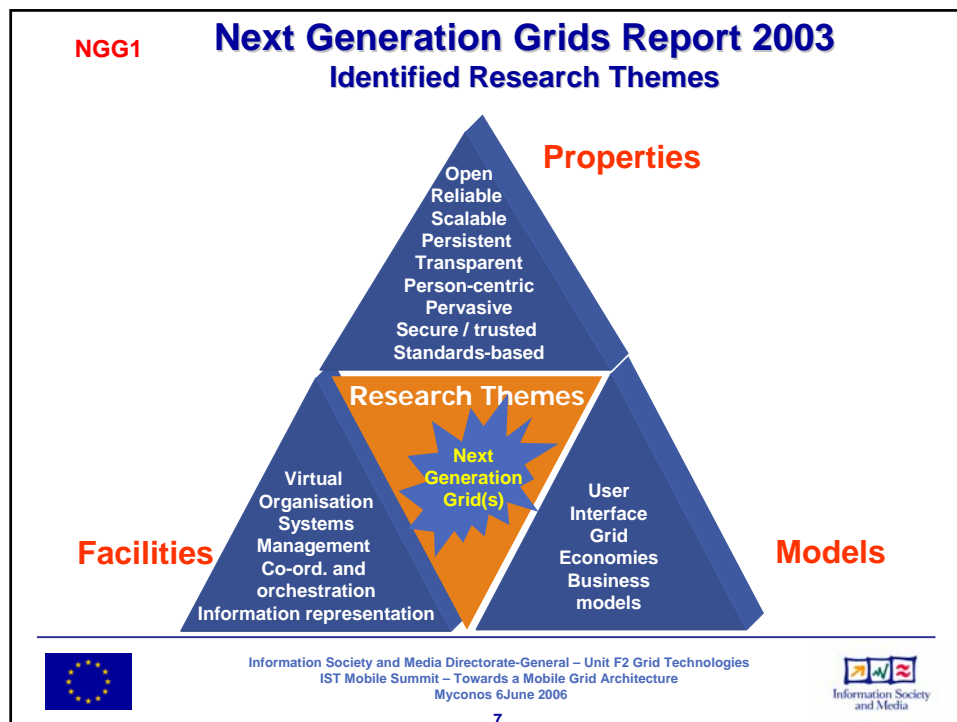
“Next Generation Grid(s) - European Grid Research 2005 - 2010”, June 2003



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## NGG2

## Next Generation Grids

[illegible]

?

**Quart** [Type]<sup>m</sup> \* n  
 decompressor 127 (see compressed)  
 extracts four channel rate flags

```

_main:
        .stabd 68,0,2
        stmw r30,-8(r1)
        stwu r1,-80(r1)
        mr r30,r1
        .stabd 68,0,4

LBB2:
        lfd f13,32(r30)
        lfd f0,40(r30)
        fadd f0,f13,f0
        stfd f0,48(r30)
        .stabd 68,0,5

LBB2:
        mr r3,r0
        lws r1,0(r1)
        lmw r30,-8(r1)
        blr

```



```
WSDL
<?xml version="1.0" encoding="UTF-8">
<definitions name="calc">
  <targetNamespace="http://websev.cse.fsu.edu/~cogelov/calc.wsdl">
    <import namespace="http://websev.cse.fsu.edu/~cogelov/calc.wsdl"
      xmlns:tns="http://websev.cse.fsu.edu/~cogelov/calc.wsdl"
      >
    <message name="addRequest">
      <part name="a" type="tns:double"/>
      <part name="b" type="tns:double"/>
    </message>
    <message name="addResponse">
      <part name="result" type="tns:double"/>
    </message>
    <portType name="calcPortType">
      <operation name="add">
        <input message="tns:addRequest"/>
        <output message="tns:addResponse"/>
      </operation>
    </portType>
  </definitions>
</?xml>
```



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## NGG3

***Future for European Grids: GRIDs and Service Oriented Knowledge Utilities – Vision and Research Directions 2010 and Beyond, December 2006***

## 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-organisation
- Towards increased agility, lower cost, broader availability of services
- Empowering service providers, integrators and consumers of ICT
- (R)evolution of concepts from Web, Grid & Knowledge Technologies
- As safe, easy & ubiquitous as existing utilities like electricity or water



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## Service-Oriented Knowledge Utility



The **architecture** comprises **services** which may be instantiated and assembled dynamically, hence the structure, behaviour and location of software is changing at run-time



**Services are knowledge-assisted** ('semantic') to facilitate automation and advanced functionality, the knowledge aspect being reinforced by the emphasis on delivering high level services to the user



A **utility** is a **directly and immediately usable service** with established functionality, performance and dependability, illustrating the emphasis on user needs and issues such as trust and security

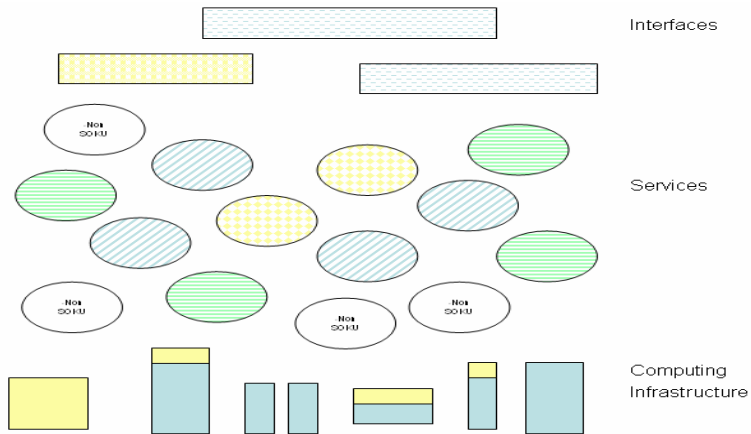


## What is a SOKU service?

- **SOKU services are *semantically described*, i.e. annotated with machine-processable metadata which facilitates their automated use.**
  - ⇒ Can be dynamically composed and configured
  - ⇒ Adapt automatically, providing self-management and autonomic behaviour
- **SOKU services also work with semantically described content and semantic descriptions, i.e. they *process knowledge***
  - ⇒ may contain and use it, consume it, or produce it



## NGG3 Service-Oriented Knowledge Utility



The primary difference to earlier approaches is a switch from a prescribed layered view to a multi-dimensional mesh of concepts, applying the same mechanisms along each dimension across the traditional layers.



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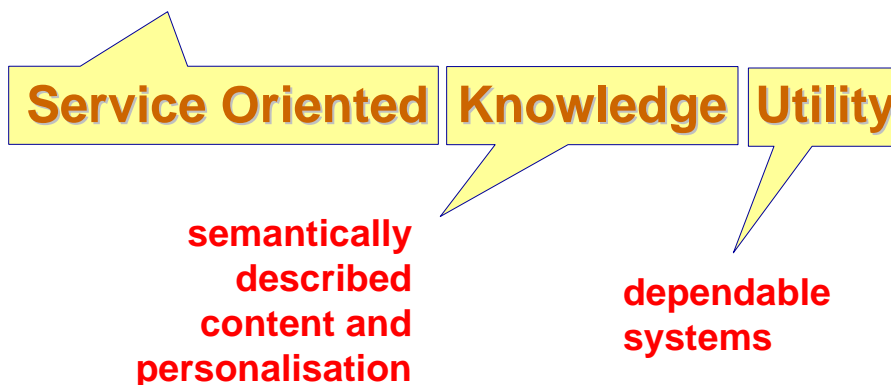


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## Semantics Inside

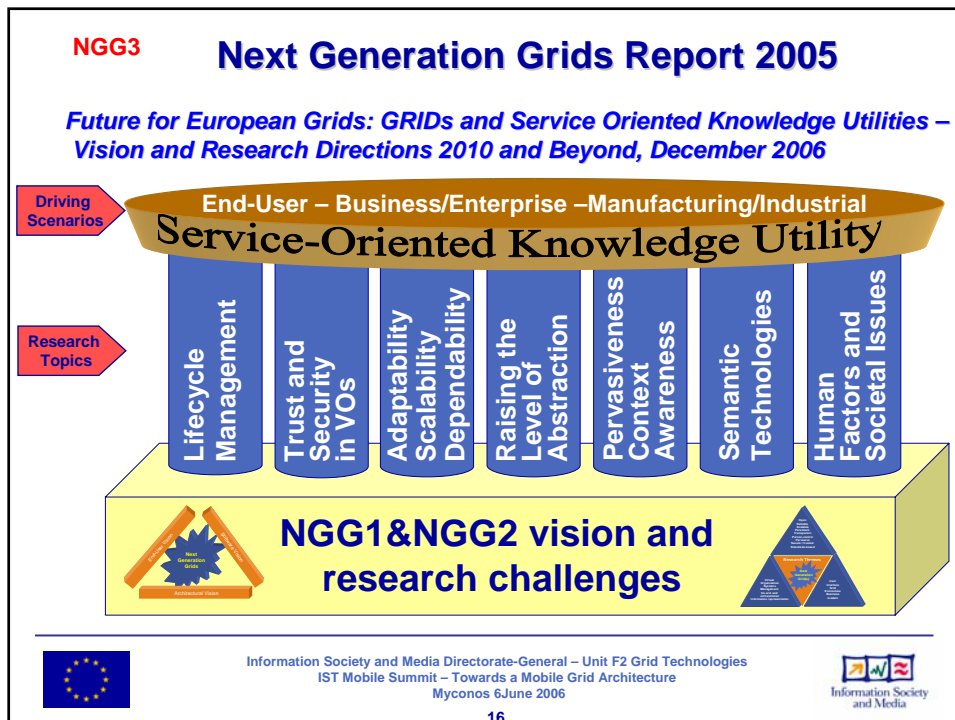
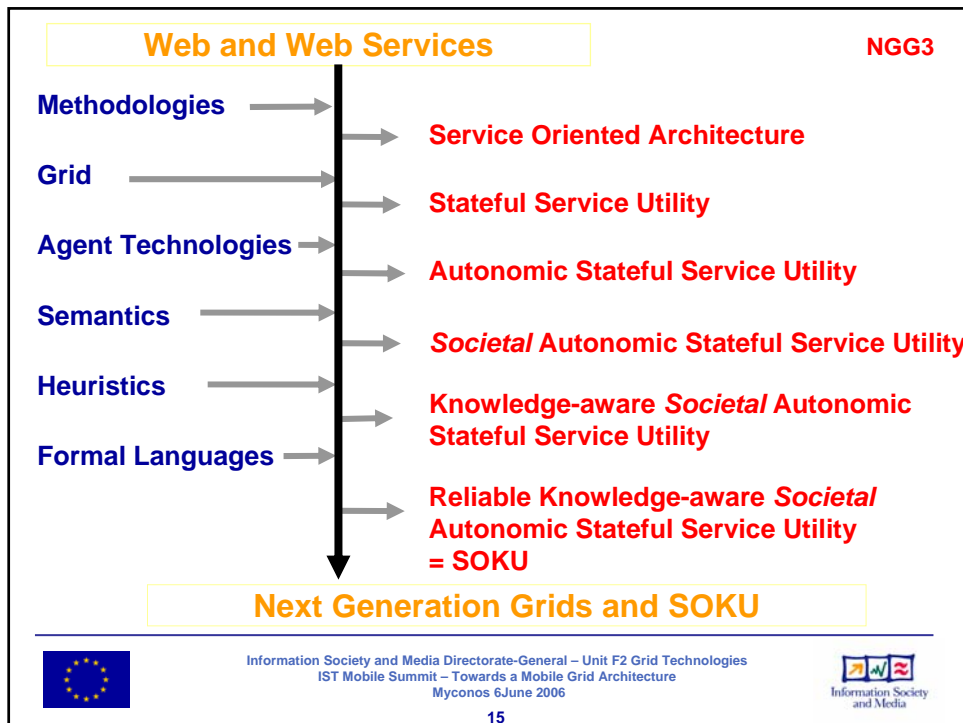
**semantic descriptions  
of services**



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## Lifecycle Management



### Research Topic 1

- On-the-fly service creation and deployment
- Robust, efficient and semantically aware discovery of services
- Composition of services
- Management of functional and non-functional properties and requirements
- Support for multiple “economic models” for the grid



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## Trust and Security in VOs



### Research Topic 2

- Ad hoc and managed virtual organisations of digital and physical entities
- Policy and business practice
- Service-level agreements
- Authentication and authorisation in a multi-domain environment in which entities have multiple identities and multiple roles



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## Adaptability, Scalability, Dependability



### Research Topic 3

- **Self-\* systems**
  - ⇒ self-managing, self-optimising, self-configuring, self-healing, self-protecting, self-organising
  - ⇒ autonomic systems
- **Scalability**
  - ⇒ How to handle millions of entities (services, resources, ...)
  - ⇒ Peer-to-peer approaches
- **Dependability**
  - ⇒ mission or life-critical services with performance



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## Raising the Level of Abstraction



### Research Topic 4

- **Higher level programming models and tools**
- **New or improved management abstractions**
- **Better operating systems capable of managing more complex resources and requirements from application, service and system contexts**
- **Abstract/virtual service containers**
- **Compact data formats**



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## NGG3 Pervasiveness and Context Awareness



- High-level interoperability, smooth composition and automatic self-organisation of software with structure and behaviour changing at run-time
- Non-functional requirements related to interoperability, heterogeneity, mobility, and adaptability

### Research Topic 5



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## NGG3

## Semantic Technologies



- Mechanisation of composition
- Scalable reasoning and formalisation
- Heterogeneous and dynamic semantic descriptions
- Lifecycle of knowledge
- Collaboration and sharing

### Research Topic 6

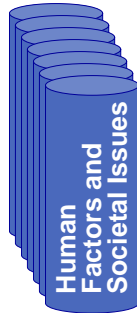


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## NGG3 **Human Factors and Societal Issues**



- **User requirements and evaluation**
- **Intersection between the physical world and the digital**
- **Personalisation techniques**
- **Issues of collaboration and community**
- **Socio-economic aspects**

### **Research Topic 7**



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## **NGG3 Conclusion**

- **The confluence of Next Generation Grids and SOKU will shape the future of Grid research in Europe**
  - ⇒ **It extends the Grid vision to cover a broader range of applications and thus a wider impact on economy**
  - ⇒ **It gives more challenges to researchers to realise this vision**
  - ⇒ **Research will be driven by the development of novel applications**

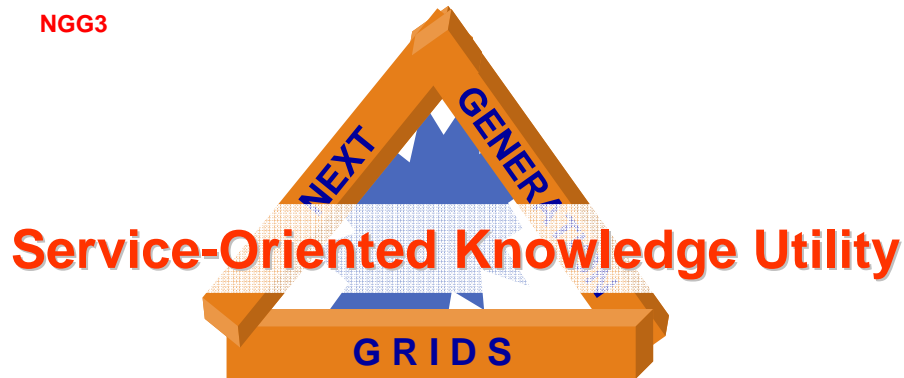


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**A flexible, powerful and cost-efficient way of building, operating and evolving IT intensive solutions for business, science and society**



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## More information

[www.cordis.lu/ist/grids/](http://www.cordis.lu/ist/grids/)

## Acknowledgements

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## Next Generation Grids Expert Group 2005

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I. Fikouras

M. Fisher

A. Fuggetta

W. Gerteis

C. Goble

Y. Guo

J. Hierro

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T. Kielmann

D. Laforenza

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T. Priol

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A. Reuter

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H. Saikkonen

J. Sairamesh

D. Snelling

C. Thole

T.A. Varvarigou

W. Waterfeld

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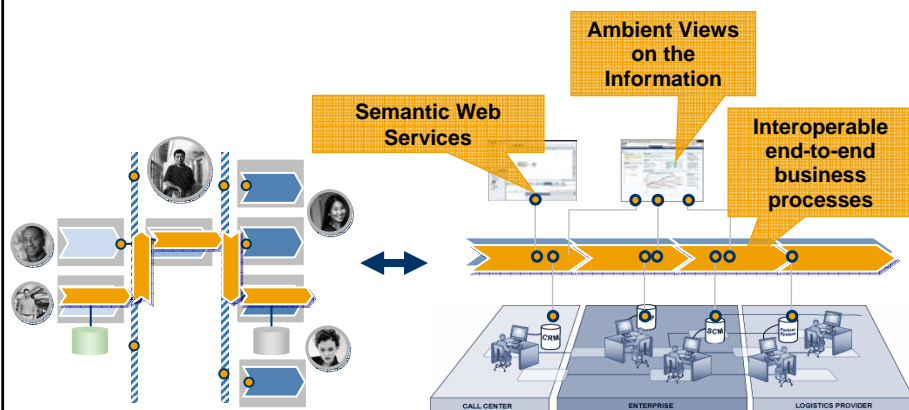
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## A New IT Architecture



Services Architecture and scalable Infrastructures to deliver future applications



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## NESSI

[www.nessi-europe.com](http://www.nessi-europe.com)

- **Networked European Software and Services Initiative, launched September 2005**
- **Industry-led Technology Platform**

- ⇒ **Provides unified view for European research in Services Architectures and Software Infrastructures**
- ⇒ **Supports the transformation of the European economy into a knowledge-based economy**

Atos Origin,  
British Telecom,  
Engineering  
Ingegneria  
Informatica,  
HP, IBM, Nokia,  
ObjectWeb, SAP,  
Siemens,  
Software AG,  
Telecom Italia,  
Telefónica, Thales



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## The Missing Item: Mobility

- **Wireless Grids versus mobile Grids**
  - ⇒ **Distributed resources sharing by mobile, nomadic and fixed devices**
- **What are mobile Grids ?**
  - ⇒ **Mobile resources in ad-hoc Grids**
  - ⇒ **Service providers and service consumers**
- **IMS (IP Multimedia Subsystem) and SIP and their importance to the telecom industry !**
- **Support of Web services in telecom infrastructures**
- **Convergence to a All-IP infrastructure (IPv4-IPv6),**
- **Next Generation Networks & Next Generation Grids**



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