



Enabling Grids for
E-science in Europe

Future of grids

V. Breton
CNRS



Table of contents

- Introduction
- Future of infrastructures : from networks to e-infrastructures
- Future of middleware : from data to knowledge grids
- Future of applications : from e-science to e-health, e-culture, e-business, e-government,...
- Conclusion

Networks
Grid infrastructure
Middleware services
Grid enabled applications
End users

Introduction

- Talk organization : for each topic
 - Present status
 - Foreseeable future
 - Challenges
- Disclaimer : the views expressed in this talk are personal

Networks

- Present status : already very good for research and education
 - GEANT backbone provides 5-10 GB connections between european countries
 - DataTag breaks regularly record speed between Europe and USA
 - National Research & Education Networks provide high bandwidth connectivity to university campuses, research labs,...
- Foreseeable future :
 - GN2 extends GEANT network to more countries within and outside Europe
 - Service Level Agreement : network providers commit to a given level of service which can be application dependent (emergency services)
- Challenges :
 - Digital divide between research networks and the rest of internet
 - Digital divide between developed countries and the rest of the world

Middleware

- Present status : grid operating systems are still a research topic
 - Several software packages on the market (Globus, Unicore, Condor, VDT, DataGrid,...) developed in research laboratories
 - Standards still evolving : convergence of grid and web services
 - First generation of middleware based on web services according to WSRF standards is coming (GT4, Glite,...)
- Foreseeable future : from data grid to knowledge grid
 - Infrastructures require a middleware dealing with knowledge : harmonization of capture, measurement and analysis tools
 - Handling knowledge : image of White Snow mirror
 - Prerequisite : interoperability of data, metadata and technologies
- Challenges
 - Security has to be handled properly
 - Open standards and open source must remain the rule

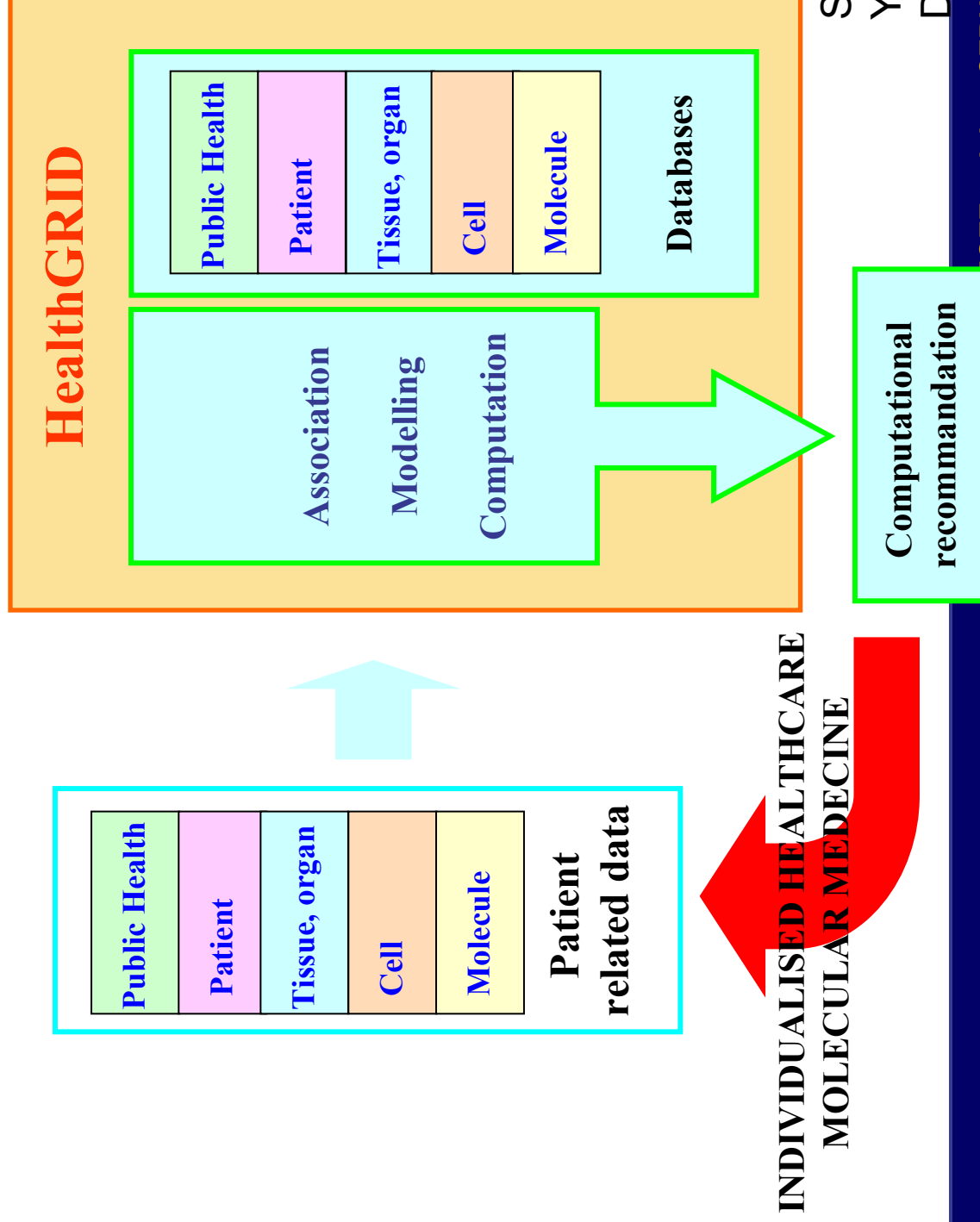
Einfrastructures

- E-infrastructure = networks + distributed resources of a production grid
 - Accessible to research communities for large scale data storage and analysis
- Foreseen by the European Commission to structure the European Research Area
 - Very significant FP6 funding
 - Already workshops to prepare FP7
- EGEE and DEISA are the first generation e-infrastructures
 - Demonstrate the viability of the concept

Future of applications

- Present : a few pioneering application fields
 - DataGrid : HEP, biomedical applications, earth observation
 - EGEE : HEP, biomedical applications, soon earth observation, computational chemistry, astrophysics
- Future
 - Enlarge the number of research communities
 - From e-science to e-culture, eHealth,...
- Challenges
 - Middleware functionalities must meet broad requirements including security
 - Adoption of grids by new communities

The example of eHealth



S. Nørager
Y. Paindaveine
DG-INFOS

Keys to the success of grid technology in HEP

- HEP is a very centralized community
 - Teams are skilled to work in large collaborations and to submit to standards and agreed rules
 - HEP was the only community able to start DEPLOYING large scale grids as it did DEPLOY internet
- Within the HEP community, there is expertise at every level relevant to grid technology
 - Network experts
 - System engineers
 - (Software developpers)
 - End users skilled in computer science willing to get their hands dirty
- It is more challenging for other research communities to adopt grids
 - Lack of system engineers (life science)
 - Lack of skilled end-users (eHealth)
 - Lack of international collaborations with strong technical leadership (all)

Challenges beyond e-science

- Network level
 - NRENs provide much better connectivity than private operators
- Middleware level
 - Interoperability of data, metadata and technologies (standards)
 - Intellectual property
 - Privacy and protection of personal data
- Application level :
 - Development of intermediate layer between “real” end users and e-infrastructure
 - Multilingualism
 - Legal framework, data policies
 - link enduring (culture, history), personal and collaborative (science) knowledge and skills
- End user level :
 - e-literacy (from teaching IT in school to education of all citizens)
 - culture of data sharing

R&D priorities beyond e-science

- Interoperability of data, metadata and technologies
- Development of middle layers between e-infrastructures and researchers
- Methods and techniques for privacy and protection of personal data
- Multilingual tools for access to European knowledge
- Creation of metadata according to standards
- Accumulation and preservation of digital data & knowledge
- Making available content testbeds for communities, researchers as distributed repositories
- Col-laboratories and collaborative classroom: ambient intelligence at school and university
- e-creativity work space at collaborative and personal levels

Conclusion

- 3 scenarios
 - The pessimistic scenario : nobody else than HEP uses grids. LCG stays an exception and computer scientists discover a new concept to get money for their own research
 - The medium scenario : only scientific communities deploy “real”, non internal grids.
 - The optimistic scenario : there is a real adoption of the concept and, like Internet, a generalized usage in the society.
 - No “matrix”, no “Big Brother” requires e-security
- It depends a lot on us
 - Grids are not as spectacular as internet: they are useful if they are transparent to the users...
 - History of computer science shows that great hypes may end up with miserable impact : artificial intelligence,... Even Internet is still poorly used in eHealth...
- My personal view : as researchers, our responsibility is to maximize the societal impact of the tool we develop for our research, even if it may require us some time to go the extra mile...
- EGEE is a great opportunity to demonstrate how fundamental research can still today improve the citizen quality of life