

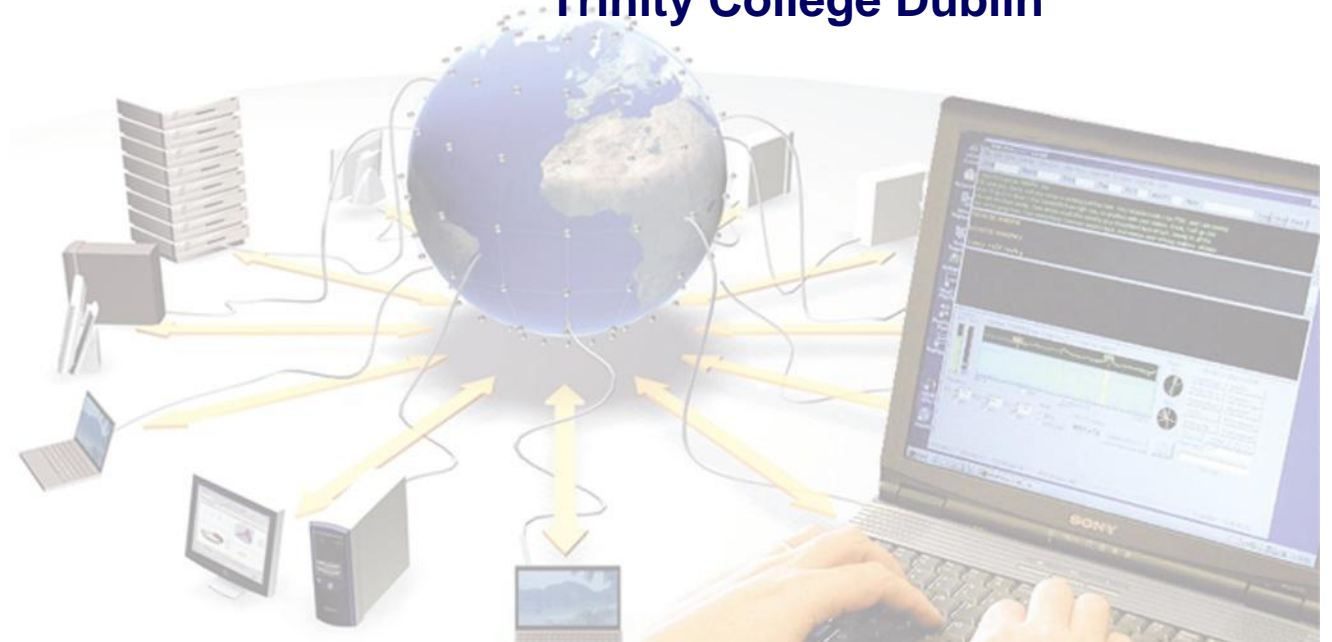


Enabling Grids for  
E-science in Europe



# Introduction

Brian Coghlan  
Trinity College Dublin



# Overview of Course



- **Goal:**
  - To introduce the concepts of Grid computing assuming little previous knowledge, and then
  - To impart in-depth user-level knowledge of the Grid.
- **Topics:**
  - Basic Grid Concepts            Dr.Brian Coghlan
  - EGEE middleware                Dr.Mike Mineter
  - Practical 1
  - Grid-Ireland                        Dr.John Walsh
  - MPI on Grid-Ireland            Dr.Stephen Childs
  - Practical 2



Enabling Grids for  
E-science in Europe



# Basic Grid Concepts

Brian Coghlan  
Trinity College Dublin



# Acknowledgements



- **This talk includes many slides prepared by Mike Mineter of NeSC for EGEE, which itself included slides from previous tutorials and talks delivered by:**
  - Dave Berry, Richard Hopkins (National e-Science Centre)
  - the EDG training team
  - Ian Foster, Argonne National Laboratories
  - Jeffrey Grethe, SDSC
  - EGEE colleagues

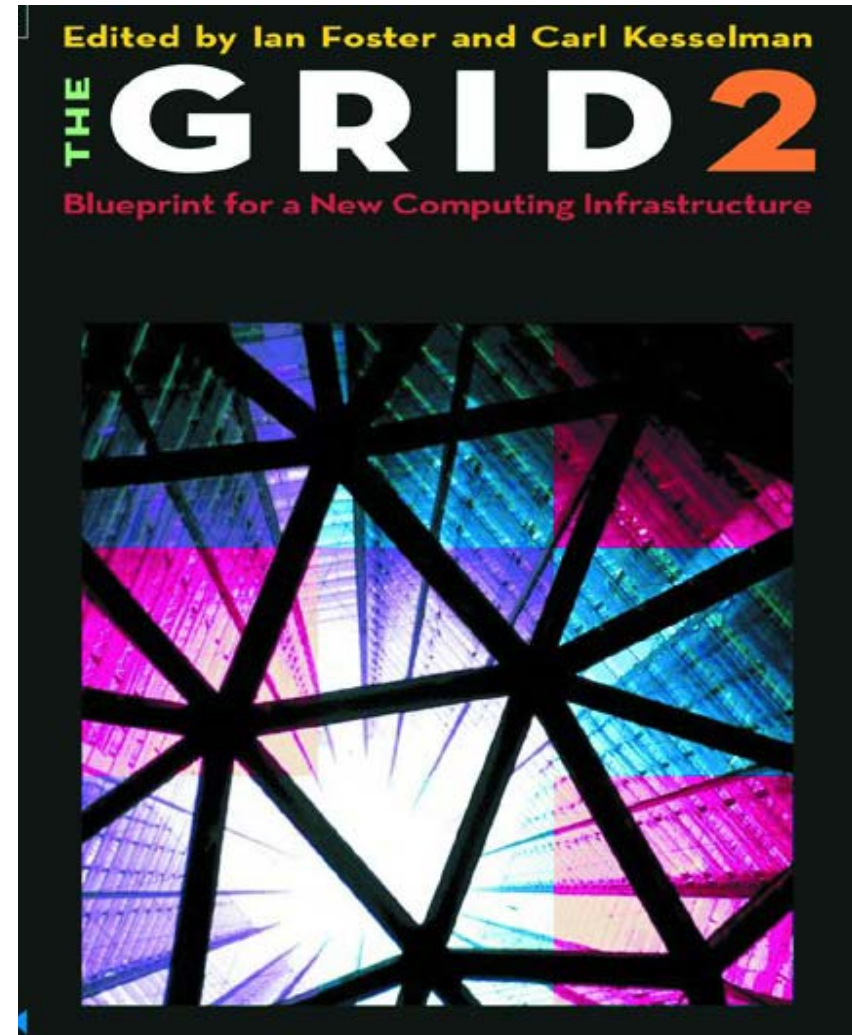
# Why the word “Grid”?



“The word Grid is used by analogy with the electric power grid, which provides pervasive access to electricity ...”

Foster and Kesselman  
- The Grid 2

- “Grid computing” is a much misused term
  - Sometimes in Industry :
    - “Grids” = clusters
  - Also used to refer to the harvesting of unused compute cycles
    - e.g. SETI@home, climateprediction.net



# Before Grids

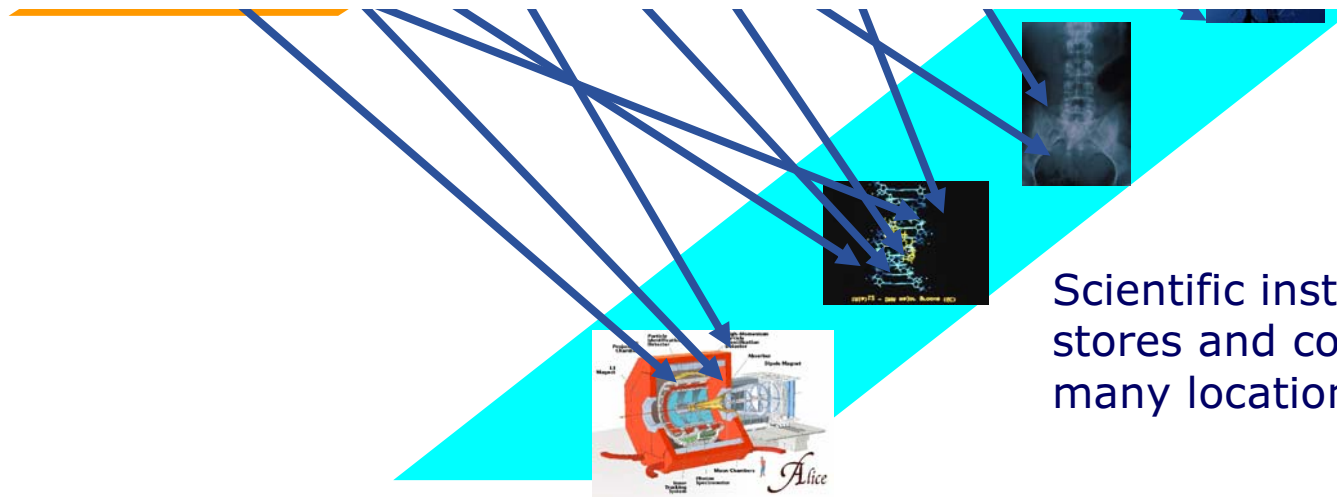


Researchers in many locations need to share resources



FTP, telnet, blood, sweat and tears... and little support for collaboration

There must be a better way of doing this!!!



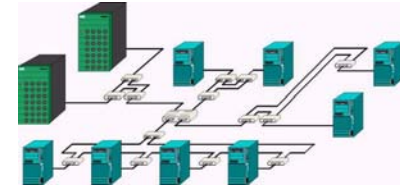
Scientific instruments, data stores and computers in many locations

# Middleware

MIDDLEWARE



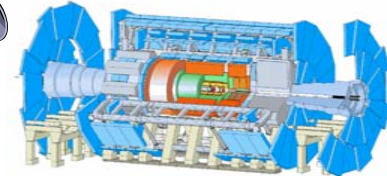
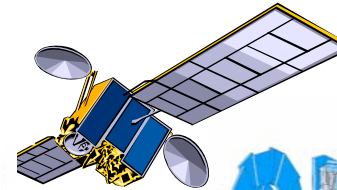
Mobile Access



Supercomputer, PC-Cluster



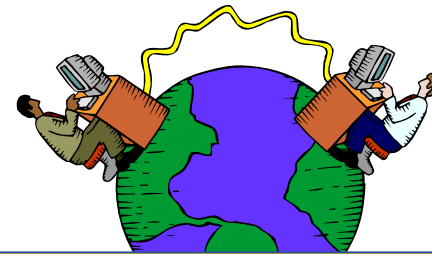
Workstation



Data-storage, Sensors, Experiments



Visualising

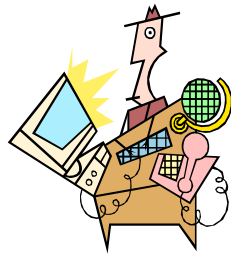


Internet, networks

# Grid Musicians



**eGEE**  
Enabling Grids for  
E-science in Europe



**System  
Managers**



**File  
Systems**



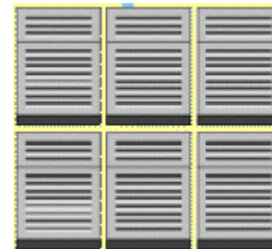
**Operating  
Systems**



**Logging  
& Bookkeeping**



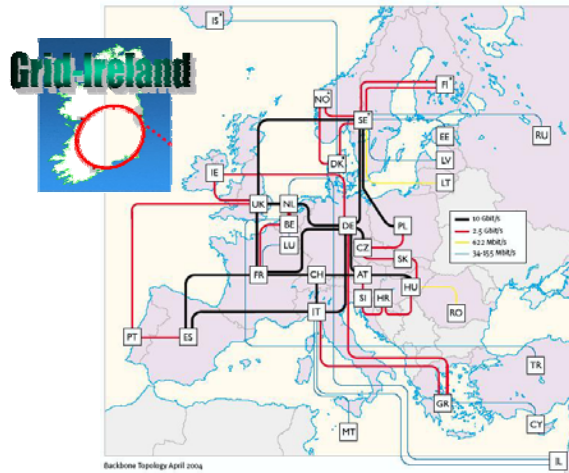
**Storage**



**Computing Nodes**



**Scientists  
& Application Developers**



**Certification  
Authorities**



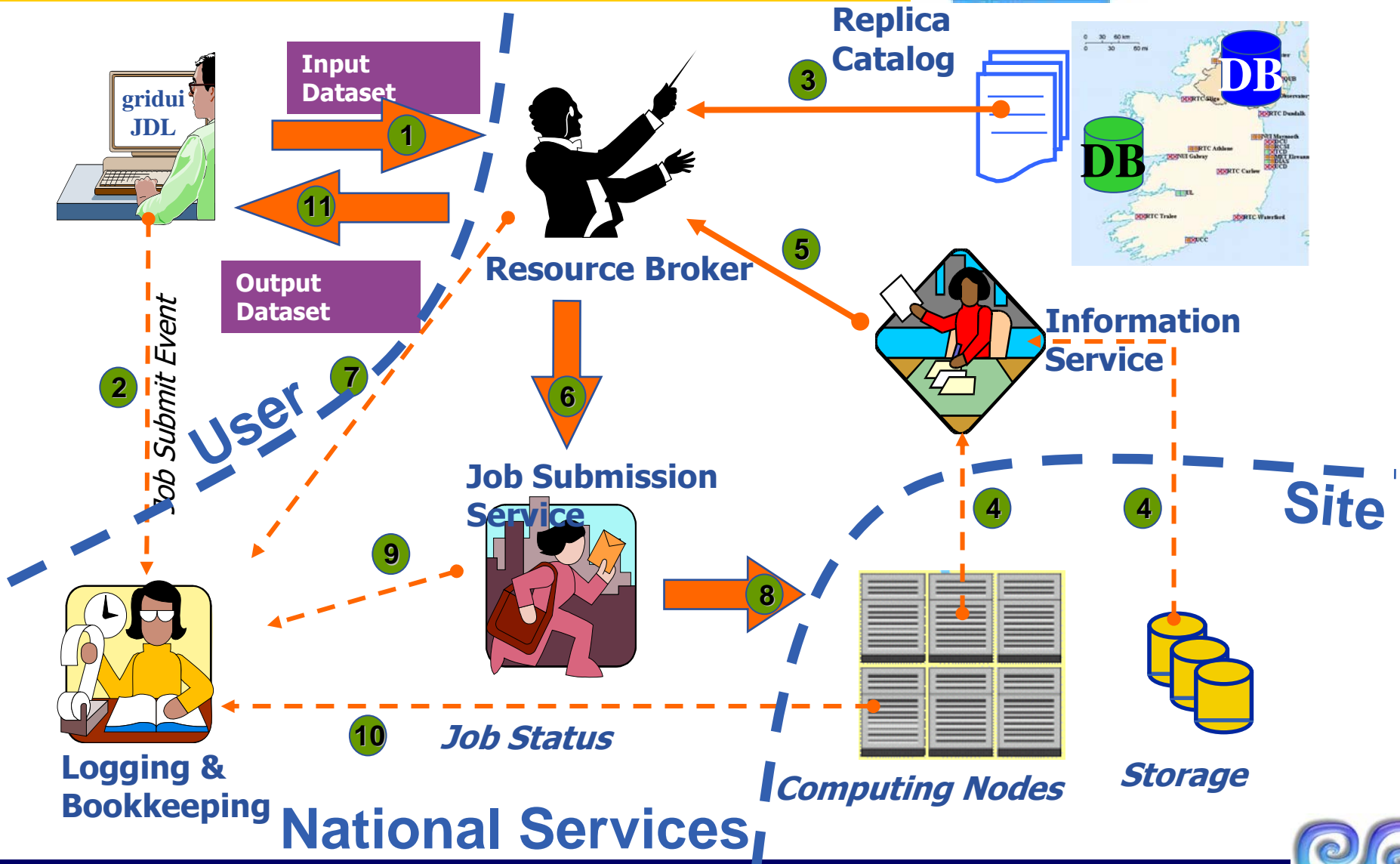
**Batch Systems  
PBS, LSF**



# Grid Symphony



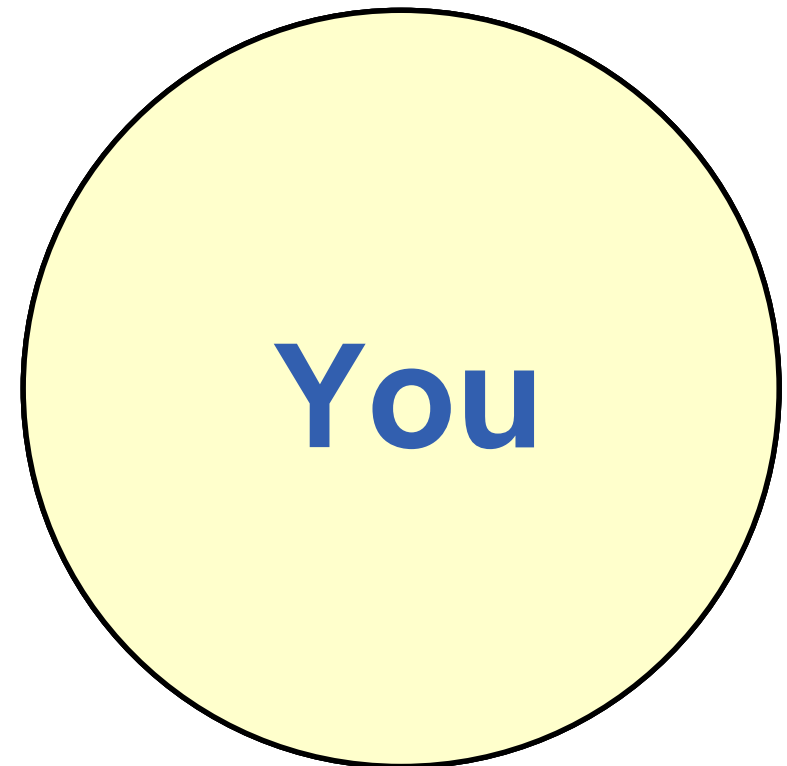
**eGEE**  
Enabling Grids for  
E-science in Europe



# Expanding Horizons



- The initial vision: “The Grid”
- The present reality: many “grids”
- Each grid is an infrastructure enabling one or more “Virtual Organisations” (VOs) to share computing resources
- What makes a VO?
  - People in different organisations seeking to cooperate and share resources across their organisational boundaries



# Different Grid Perspectives

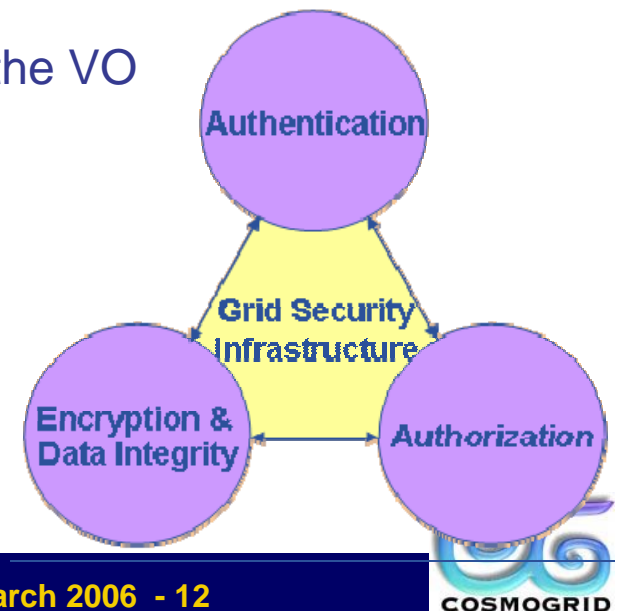


- **Users need:**
  - Single sign-on:
    - ability to logon to a machine just once per grid session
  - To trust owners of resources they are using
- **Resource providers need:**
  - Risks to be controlled:
    - they are asked to trust users they do not know
  - Minimal impact on security
  - Ability to trace who did what
- **The solution comes from:**
  - Virtual Organisations
  - Digital Certificates

# Users & VOs



- **CAs issues digital certificate to user**
  - For all of this to work you must keep your certificate secure !!!
- **User joins a VO**
  - Digital certificate is basis for:
    - Single sign-on: authentication + authorisation + non-repudiation
    - Authentication: how do I identify myself to a resource ?
  - Identity passed to other resources you use
    - it is mapped to a local account as agreed with the VO
- **The users trust the VO:**
  - to only enroll trustworthy members
  - to only use resources that are safe/secure



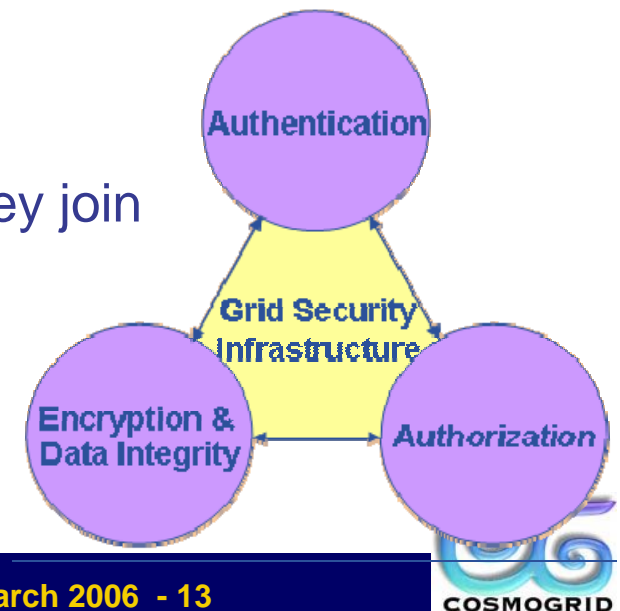
# Resource-Providers & VOs



- **Resource-Provider contributes resources to a VO**
  - Digital certificate is basis for:
    - Authentication + authorisation + non-repudiation + accounting
    - Authorisation: what can I do?
      - *The VO negotiates rights with resource providers*
    - non-repudiation + accounting: was it actually you that did ... ?
      - *Non-repudiation is ability to prove you did ...*

- **Acceptable Usage Policies (AUPs)**

- Users must (digitally) sign VO's AUP when they join
- The VO trusts its users
- Resource-Provider trusts the VO
- **VO is central element !!!**



# Basic Grid Concepts



- **Now you know the basics of:**
  - Why
  - How
  - What
  - Who
  
- **It's time to delve further ...**