Grid Introduction

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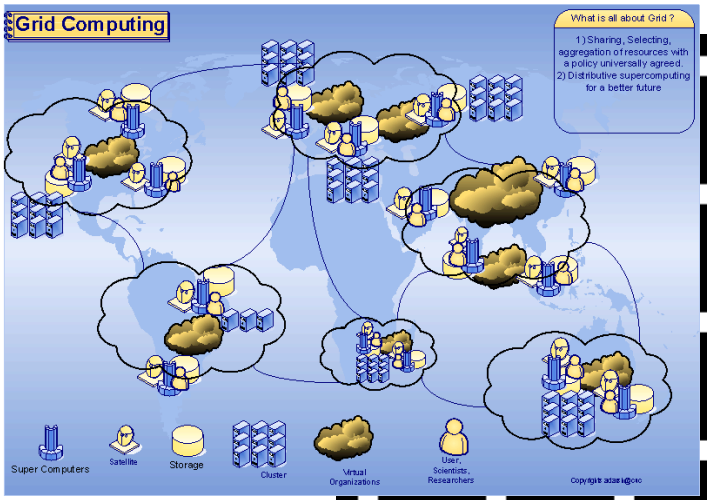
E-science

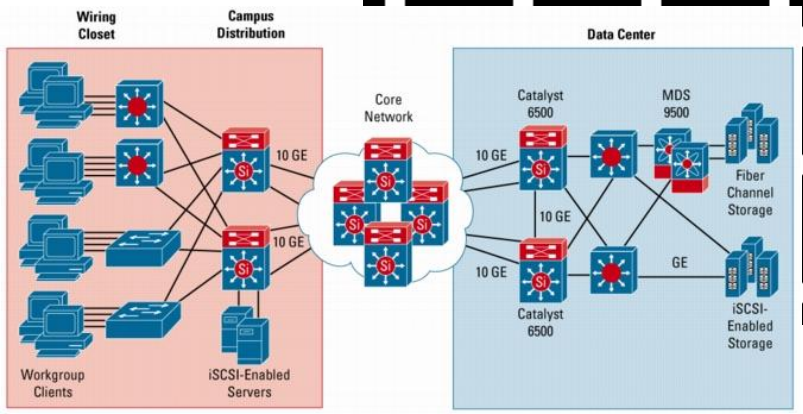
- **Need for more:**
  - Processing power
  - Storage
  - Share facilities

- **E-science: “computationally intensive science that is carried out in highly distributed network environments, or science that uses immense data sets that require grid computing;”**

John Taylor, the Director General of the United Kingdom's Office of Science and Technology

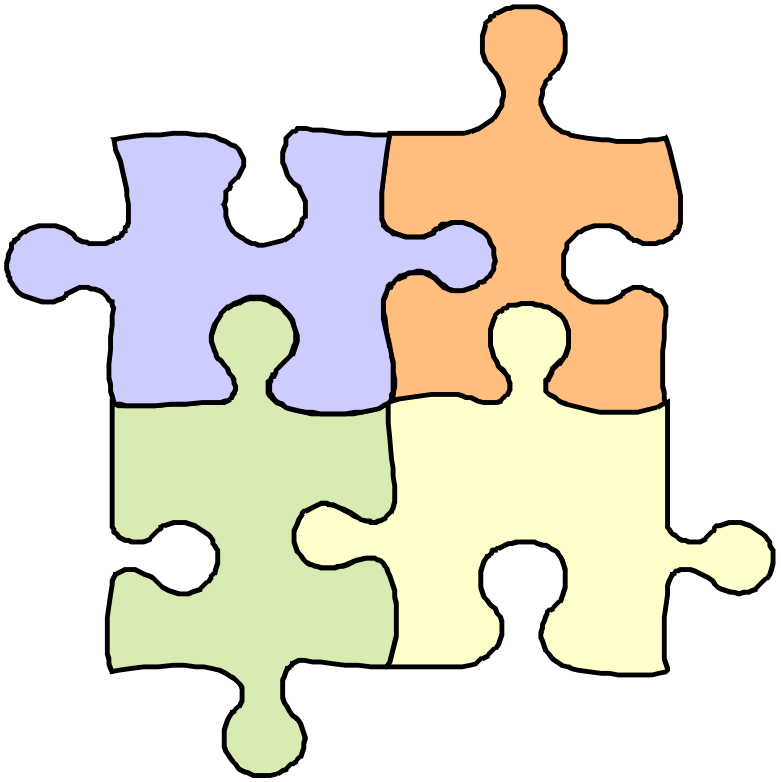
What is “Grid”


Grid Computing
What is all about Grid ?
1) Sharing, Selecting, aggregation of resources with a policy universally agreed.
2) Distributive supercomputing for a better future
Super Computers
Satellite
Storage
Cluster
Virtual Organizations
User, Scientists, Researchers


Wiring Closet
Campus Distribution
Core Network
Data Center
10 GE
10 GE
10 GE
10 GE
10 GE
GE
Catalyst 6500
MDS 9500
Fiber Channel Storage
Catalyst 6500
iSCSI-Enabled Storage
Workgroup Clients
iSCSI-Enabled Servers

When does it Grid ?

- Coordinates Distributed Resources
- Using standard, open, general-purpose protocols
- Deliver non-trivial qualities of service



Other definitions

- "the technology that enables resource virtualization, on-demand provisioning, and service (resource) sharing between organizations." (Plaszczak/Wellner)

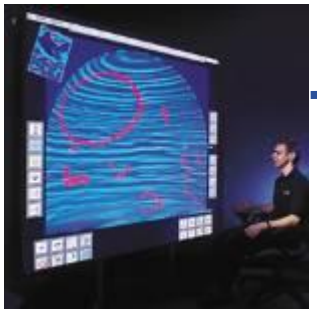
- "a type of parallel and distributed system that enables the sharing, selection, and aggregation of geographically distributed autonomous resources dynamically at runtime depending on their availability, capability, performance, cost, and users' quality-of-service requirements“ (Buyya)

- "a service for sharing computer power and data storage capacity over the Internet." (CERN)

The Grid Metaphor

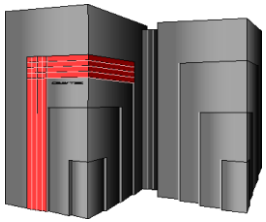
Mobile Access

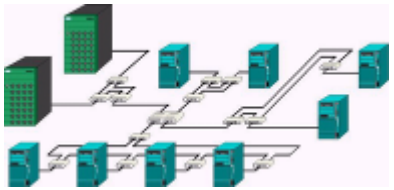
Workstation



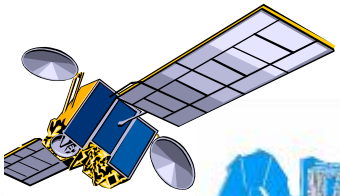
Visualising

GRID MIDDLEWARE

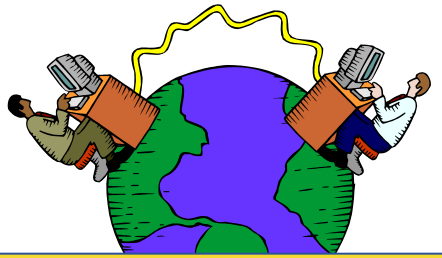




Supercomputer, PC-Cluster



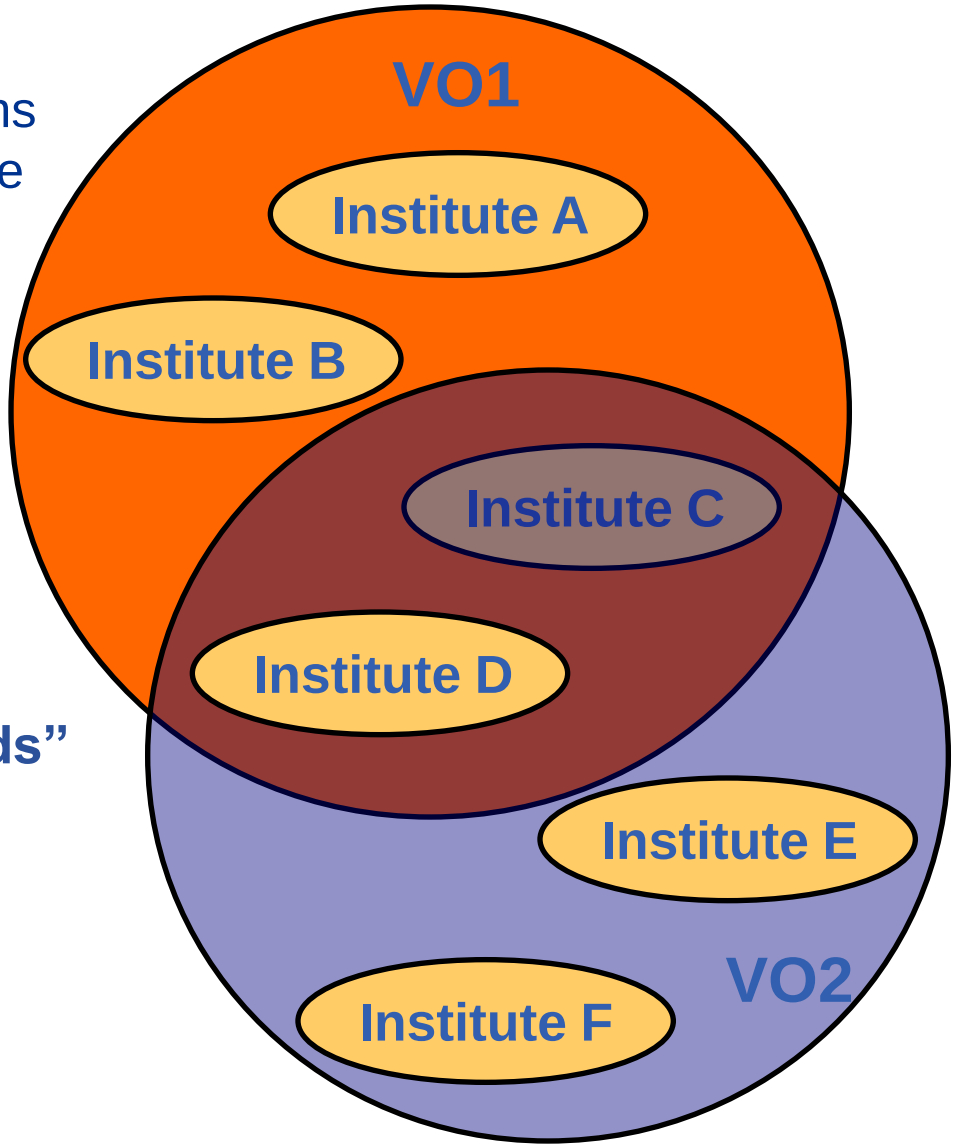
Data-storage, Sensors, Experiments



Internet, networks

Virtual Organization

- **What's a VO?**
  - People in different organisations seeking to cooperate and share resources across their organisational boundaries
- **Why establish a Grid?**
  - Share data
  - Pool computers
  - Collaborate
- **The initial vision: "The Grid"**
- **The present reality: Many "grids"**
- **Each grid is an infrastructure enabling one or more "virtual organisations" to share computing resources**



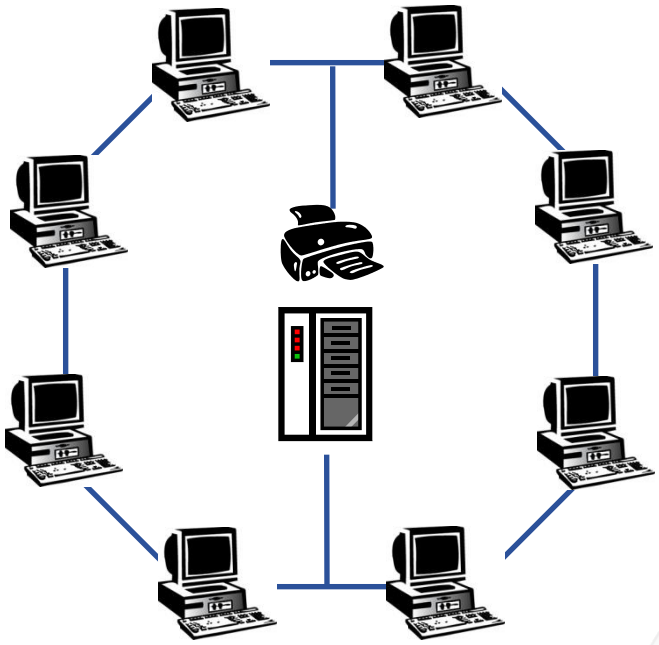
Stand alone computer

Application

Operating system

Hardware

cluster



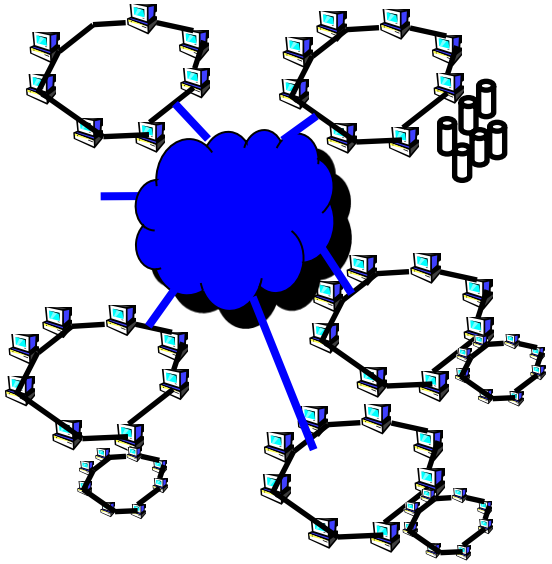
Application

Network stack

Operating system

Hardware

Grid



Application

Grid Middleware

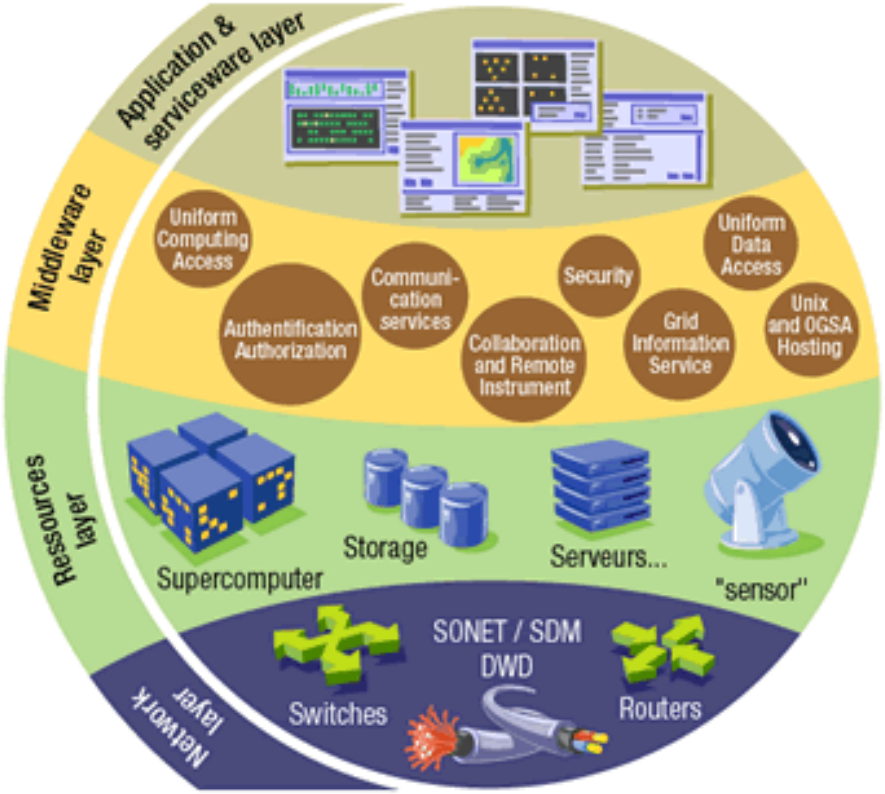
Network stack

Operating system

Hardware

Grid middleware

- **Middleware, is an interfaces between resources and the applications**
  - User/Program Interface
  - Resource management
  - Connectivity
  - Information services
  - Collaboration

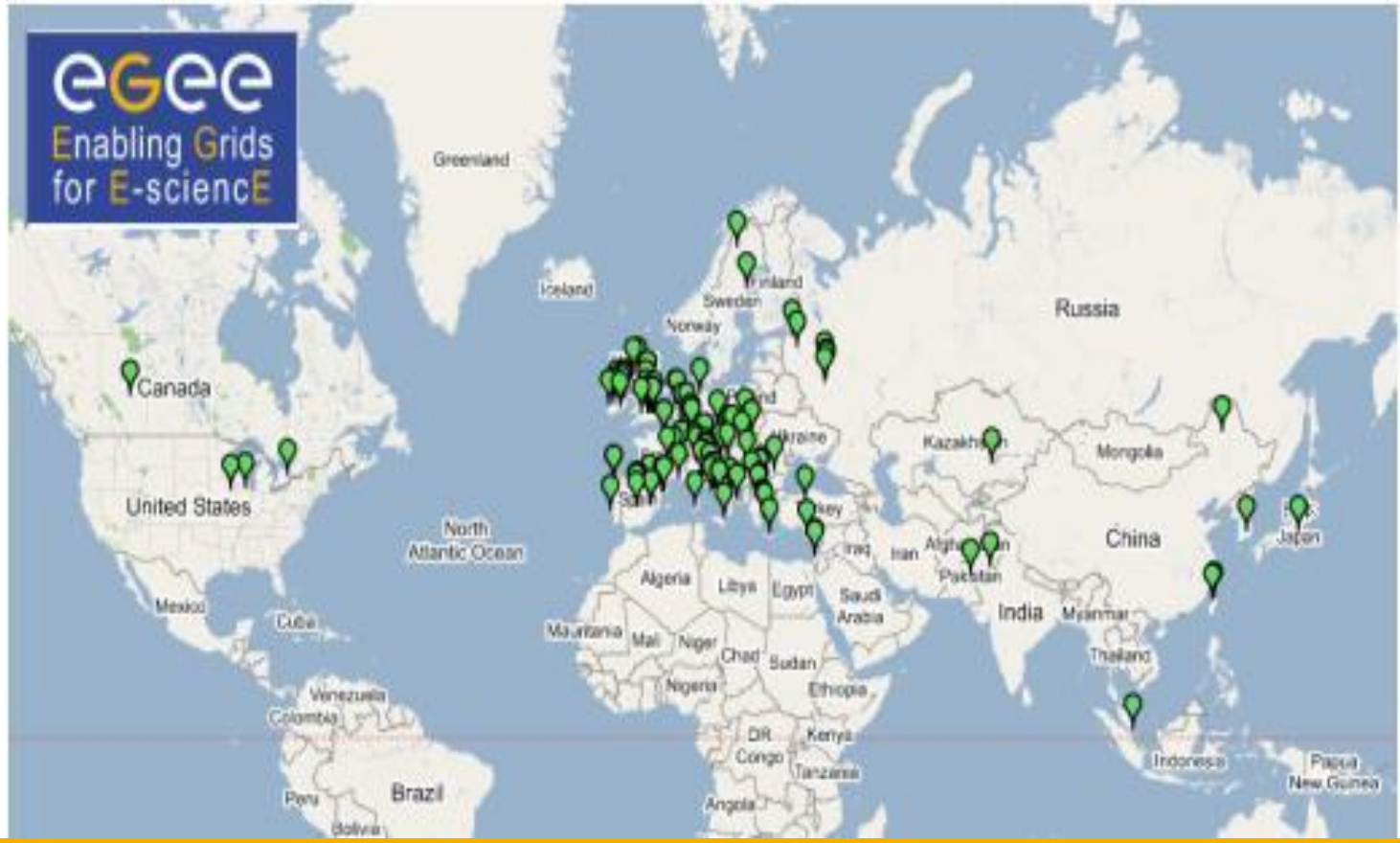


EGEE is …

EU-funded project that has established the largest multi-VO production grid in the world

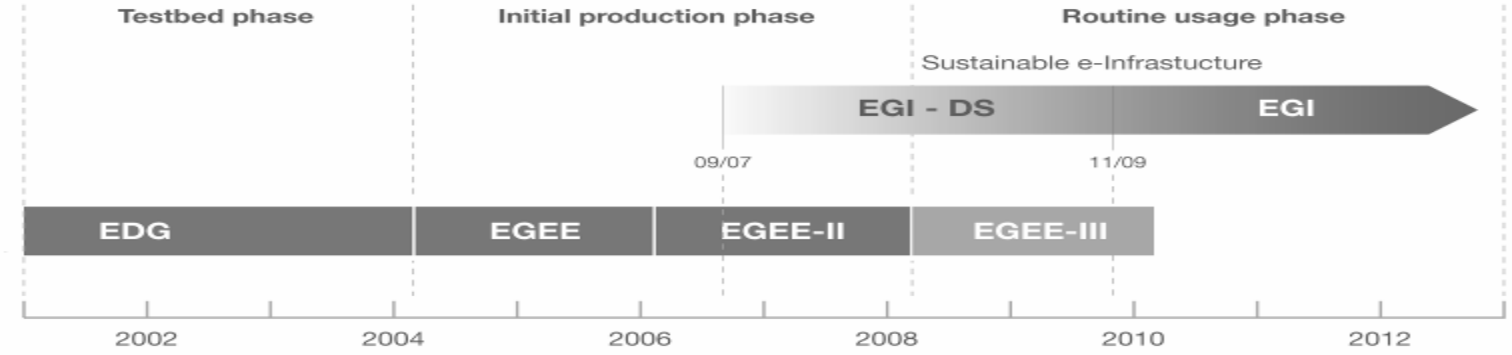
Project leader : CERN

- **265 sites**
- **45 countries**
- **>70 VOs**
- **81K CPUs**
- **~700PB Storage**
- **Avg 50K jobs/day**
- **Data transfers >1.9 GB/s**



European Grid Initiative

- Need to prepare permanent, common Grid infrastructure
- Ensure the long-term sustainability of the European e-Infrastructure independent of short project funding cycles
- Coordinate the integration and interaction between National Grid Infrastructures (NGIs)
- Operate the production Grid infrastructure on a European level for a wide range of scientific disciplines

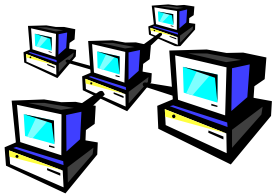


Main components

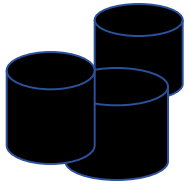
- ***Access service*** How users logon to a Grid

- ***Resource Broker (RB)***: Service that matches the user's requirements with the available resources on a Grid

- ***Information System***: Characteristics and status of resources

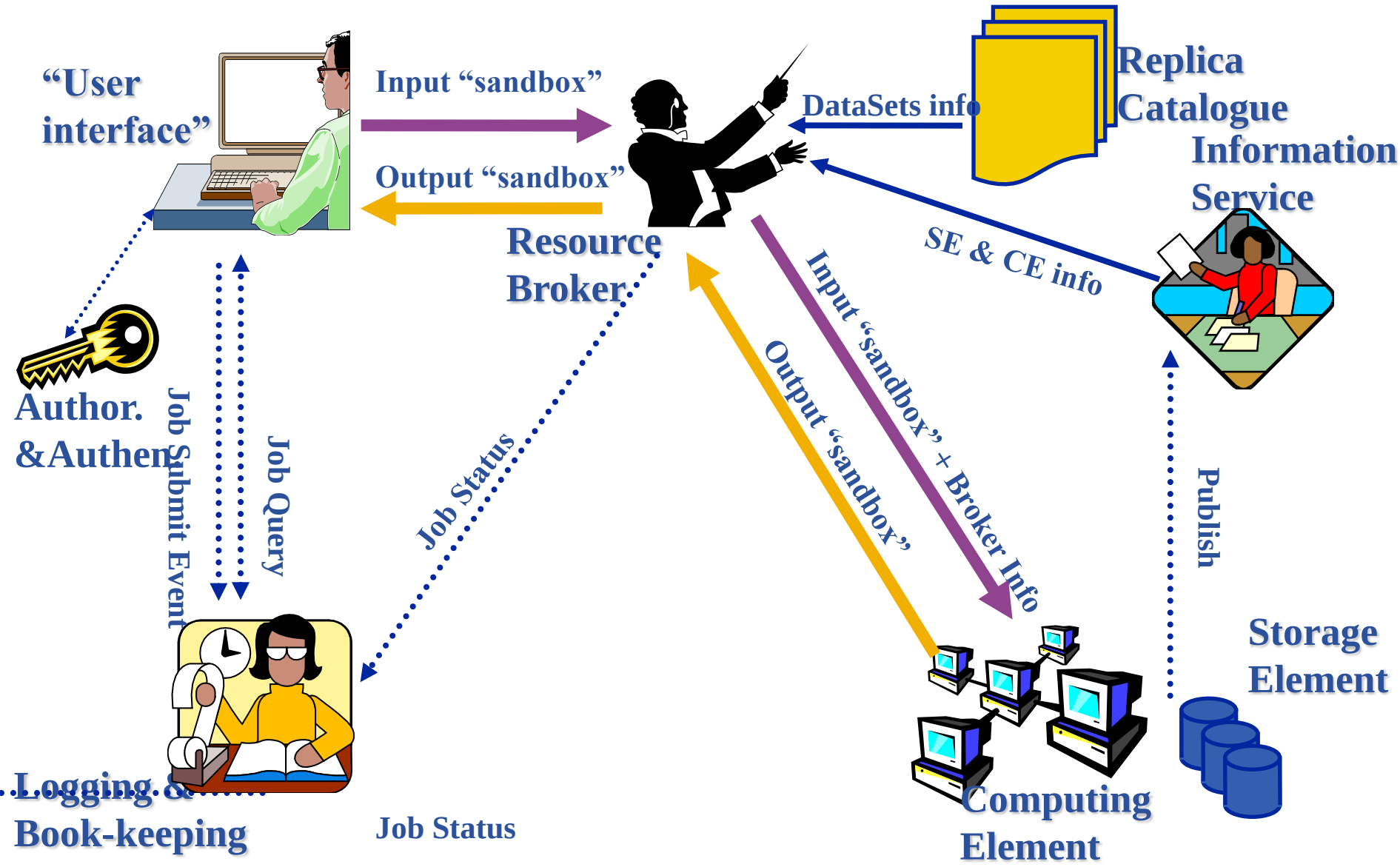


- ***Computing Element (CE)***: A batch queue on a site's computers where the user's job is executed



- ***Storage Element (SE)***: provides (large-scale) storage for files

Middleware components – The batch approach



End of the introduction and beginning of the journey