Grid applications

Computing GRID: the issue ….

- Supercomputer, cluster,…
  - How to extract the 99,999999% of the computing power of my limited powered expensive environment
- GRID environment
  - How to extract the very power I need from the theoretically infinite powered cheap environment
- Consequence
  - Speedup/efficiency curves are not any more relevant information..

Grid vs. Cluster computing from application view

- Cluster
  - Have applications, build a cluster for those applications
  - High efficiency but expensive
- Grid infrastructure
  - Have existing platforms, find applications that can efficiently run on those platforms
  - Cheap but not well tailored to every application

Types of Grid applications

- Type 1:
  - Traditional HPC applications running within a site (VO)
    - Using traditional models (MPI, PVM,…)
    - Ready-to-run, no need to modify/re-compile
    - Role of the Grid middleware
      - Resource discovery
      - Deploy and run the application remotely, securely on the discovered resource

Types of Grid applications

- Type 2:
  - New HPC applications running across multiple sites (VOs)
    - Require new programming models/tools
      - Multiple level parallelism
      - Embracing parallelism
    - Example: bio-informatics, parameter sweeping
    - Huge speedup can be achieved
  - Very few applications
  - Role of the Grid middleware
    - Resource discovery
    - Resource allocation and co-allocation
    - Application supporting services
    - Dynamic deployments and executions of application components

Issues

- Missing high-level services
  - QoS of resources
- Heterogeneity
- Code portability
  - Binary/Byte code or source code?
- Resource connectivity
  - Firewall/NAT/ Virtual IP
- Fault tolerance
  - Resource volatility
- Data protection
  - Protect sensitive data from stealing

Grid in the world

United Kingdom

- E-Science, 215M€ over 5 years
  - *e-Science will refer to the large scale science that will increasingly be carried out through distributed global collaborations enabled by the Internet.*

1 - National Network of Grid Centers

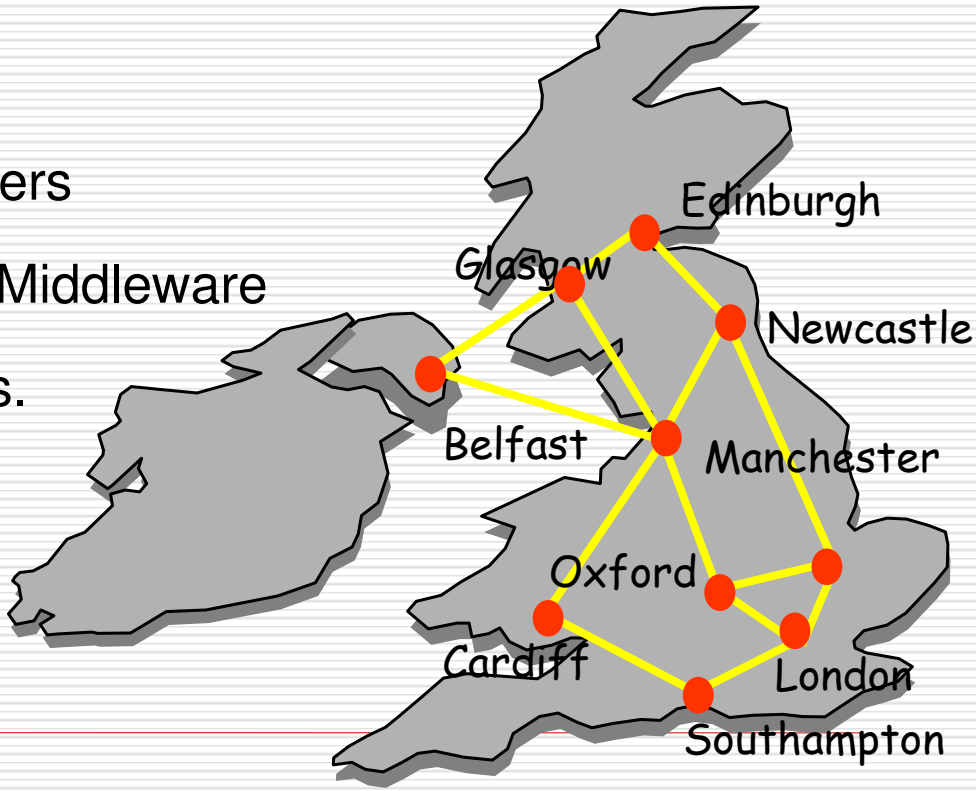
2 - Development of Generic Grid Middleware

3 - Support for e-Science Projects.

e-Science support centre

Grid Network Team

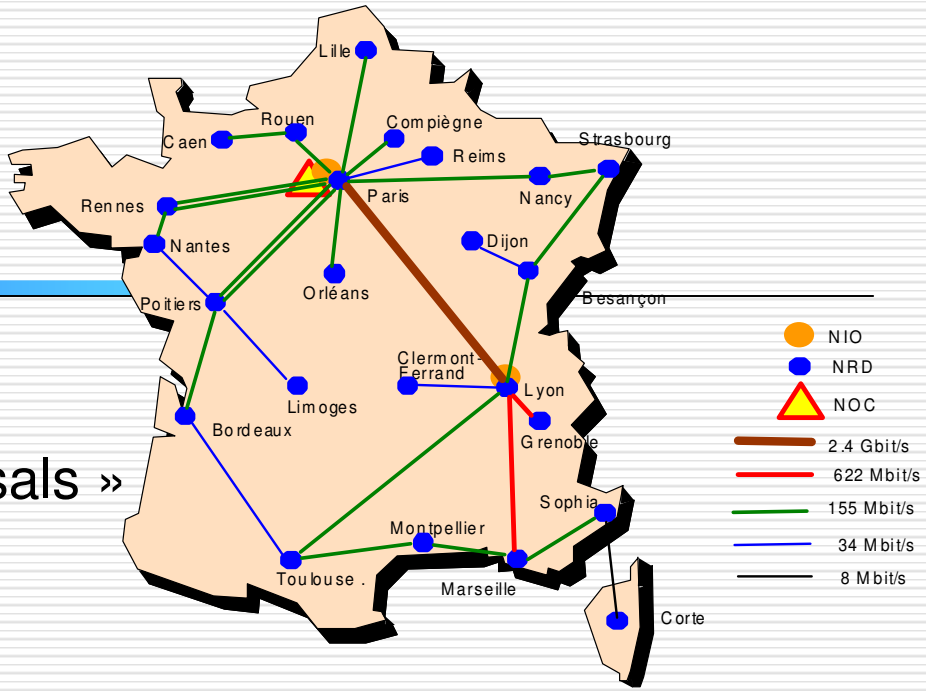
Grid Engineering Task Force



Nederland

- Virtual Laboratory for e-science (VL-e), 55 M€ over 5 years
  - 21 partners in 19 institutions
- The mission of the VL-E project is:
  - To boost e-Science by the creation of an e-Science environment and doing research on methodologies.
- The strategy will be:
  - To carry out concerted research along the complete e-Science technology chain, ranging from applications to networking, focused on new methodologies and reusable components.
- The essential components of the total e-Science technology chain are:
  - e-Science development areas,
  - a Virtual Laboratory development area,
  - a Large Scale Distributed computing development area, consisting of high performance networking and grid parts.

France



- ACI-GRID, ~8 M€ 2001-2004
  - Based on « call for proposals »
  - Use RENATER network
- GRID 5000
  - Building a nation wide experimental platform for Grid researches (like a particle accelerator for the computer scientists)
  - 10/11 geographically distributed sites, every site hosts a cluster (from 256 CPUs to 1K CPUs)
  - All sites are connected by RENATER (French Academ. Network)
  - RENATER hosts probes to trace network condition load
  - Design and develop a system/middleware environment for safely test and repeat experiments
  - Only experimental platform (no production)

Europe - CERN

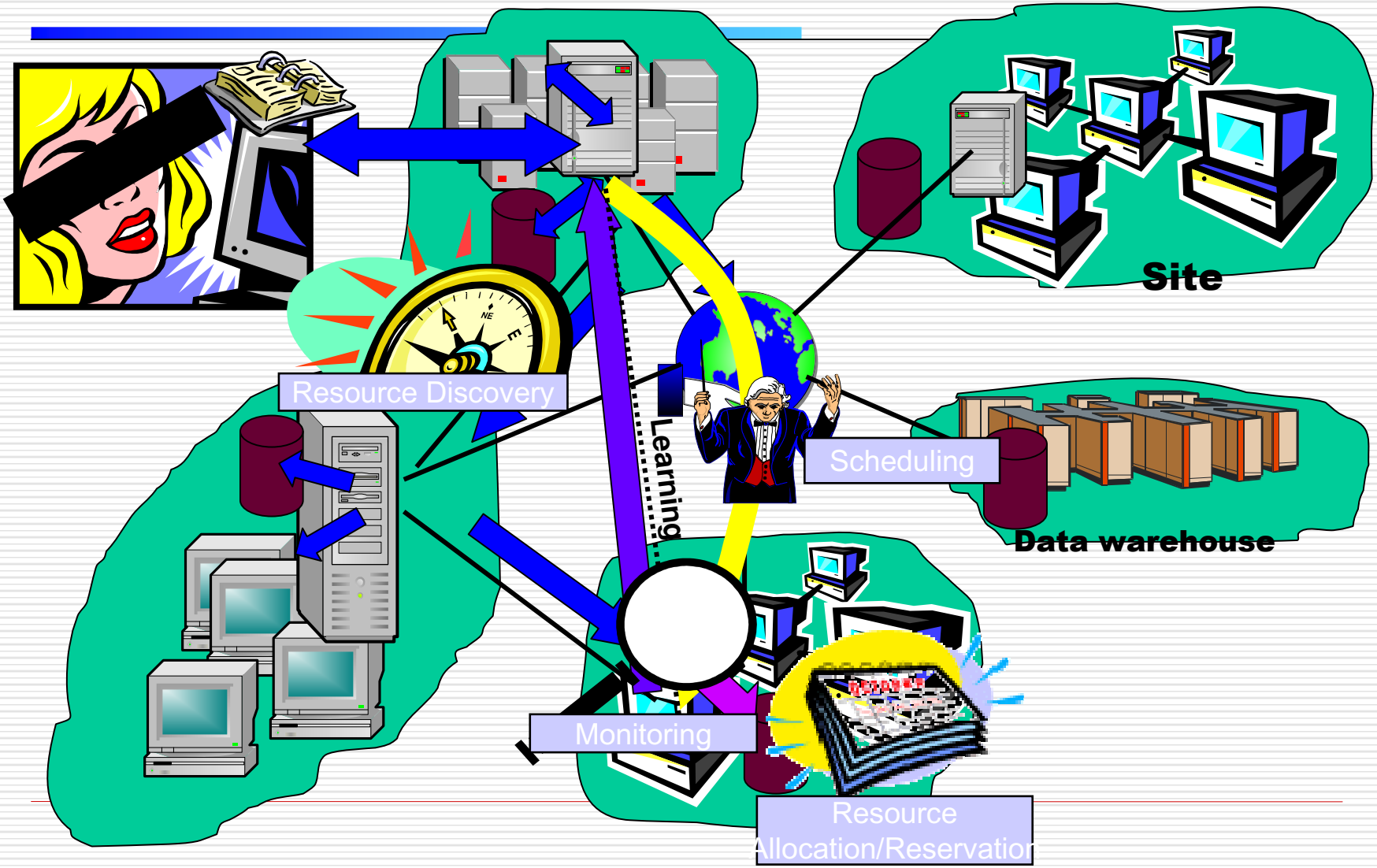
- DATAGRID 10M€, ended beginning 2004
  - 21 partners
  - Feasibility project, final test bed
    - 1000 computers, 15 Terabytes on 25 sites
- Followed by…
- EGEE, 4 years, 40 M€ for the first two years
  - 70 partners in 27 countries
  - To provide the necessary storage and computing infrastructure to LHC (and others..)

…and at HCMUT….

VN-Grid: toward a national-scale computing Grid

- Main focus: ***infrastructure***
  - High-level services
    - Resource discovery and reservation
    - Scheduling
    - VO and policy management
  - OGSA and WSRF compliance
  - Programming support
    - MPI
    - POP-C++
- We do not develop from scratch!
  - Using GT for providing base services

A VN-Grid scenario



Our first prototype-to-be-built

- Keep in mind the heterogeneity the dynamics
  - “Virtual site” concept (VSite)
  - Combine the flexibility of P2P technologies (partial view assumption) with the efficiency of centralized management on each VSite
  - Flexible to involve more resources
  - Flexible security management
    - Multiple level authentication and authorization (VO, user,…)
- Programming supports
  - Parallel object model (POP-C++)
  - MPI
- Applications
  - Oil exploitation (geo-physic data computation of oil fields)
  - Supraconductor study
  - Aviation
  - Chip Design

VN-Grid testbed