

Grid Computing

lecture by Camiel Plevier

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- History of Computation Infrastructure
- Grid Concept
- Basic Architecture
 - Resources
 - Human Interfaces
 - Grid Middleware
- Grid Topologies
- Security
- Application Development
- Dutch Space & Grid
- Demonstration

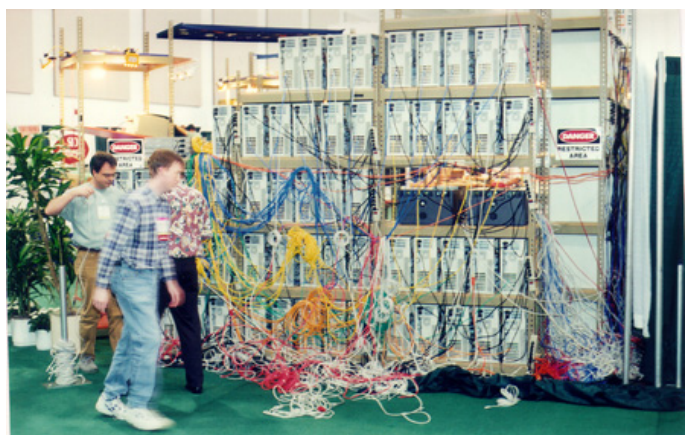
History of Computation Infrastructure

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IT evolution

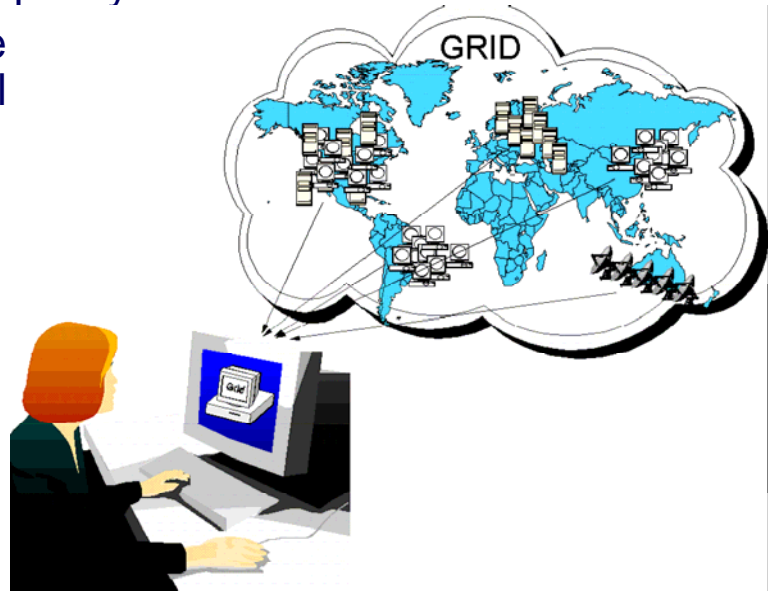
- 1960's - (super) computers with user terminals
- 1970's - desktop PC
- 1980's - networks and clusters (homogenous grid)
- 1990's - Internet connectivity (WWW, HTML, optical networks) & open source (Linux)



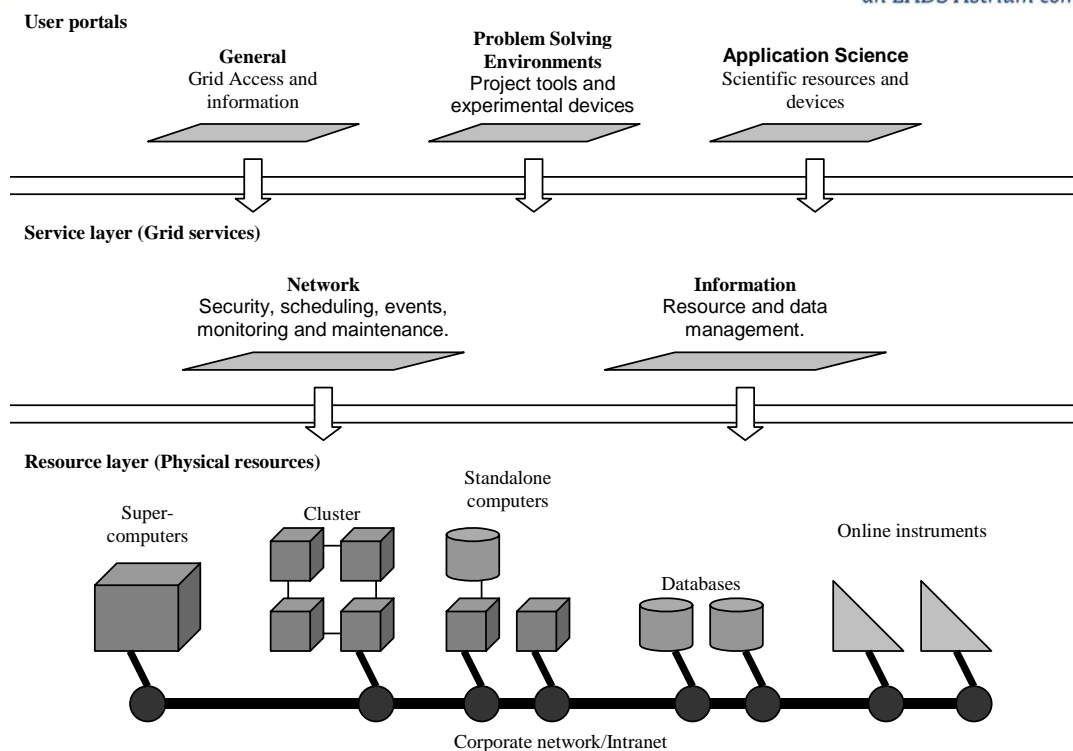
Do you need more?

Grid Concept

- Many heterogeneous computers over the whole world can be used to provide a lot of CPU power and data storage capacity
- Applications can be executed at several locations
- Combining geographically distributed services
- Collaboration
- Seamless access, Web services



Basic Architecture



Anything that your application might need

- Computing – CPU type and speed, memory size
- Data Centres – capacity, sharing
- Communications Network – connectivity, bandwidth
- Software and Licences – OS, local tools and libraries
- Special equipment, services

Non-Technical Characteristics

- Authorisation Policies
 - for example: for medical use only
- Accounting



- User portal or client tools
 - Job definition, submission, control, monitoring and result collection
 - Available grid capacity monitoring
- Resource Provider
 - Sharing based on characteristics
 - Installation, administration and maintenance.
- Administrator
 - Grid status monitoring
 - User and resource management
 - Middleware and server maintenance



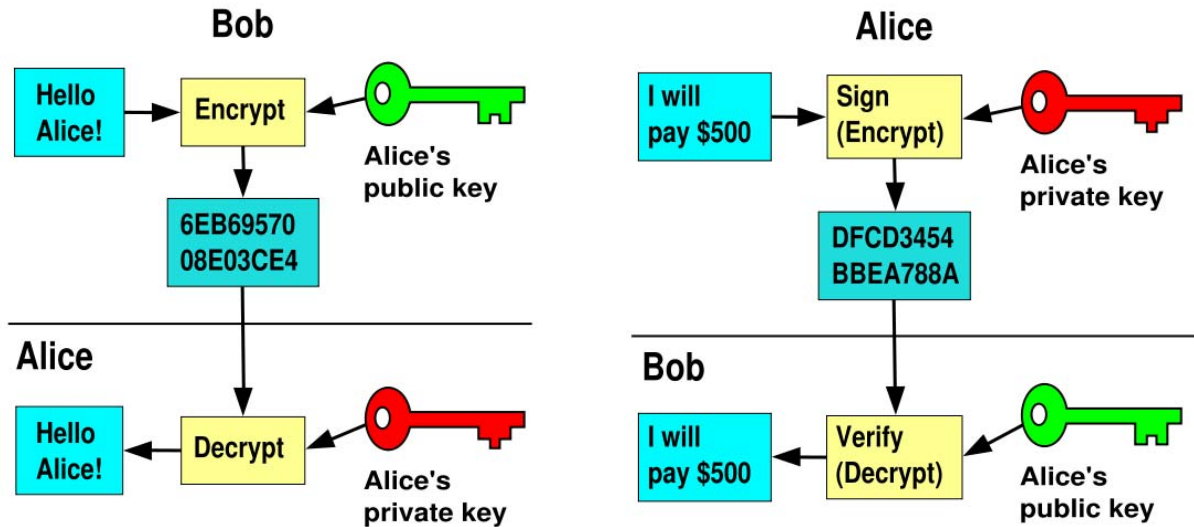
Software that connects other software components or applications to provide the following functions:

- Run applications on suitable available resources
 - Brokering, Scheduling
- Provide uniform, high-level access to resources
 - Semantic interfaces
 - Web Services, Service Oriented Architectures
- Address inter-domain issues of security, policy, etc.
 - Federated Identities
- Provide application-level status monitoring and control



- Intragrid
 - Local grid within an organisation
 - Trust based on personal contracts
- Extragrid
 - Resources of a consortium of organisations connected through a (Virtual) Private Network
 - Trust based on Business to Business contracts
- Intergrid
 - Global sharing of resources through the internet
 - Trust based on certification

- Authentication, Authorisation, Accounting, Assurance
- Public-key cryptography, Certificates



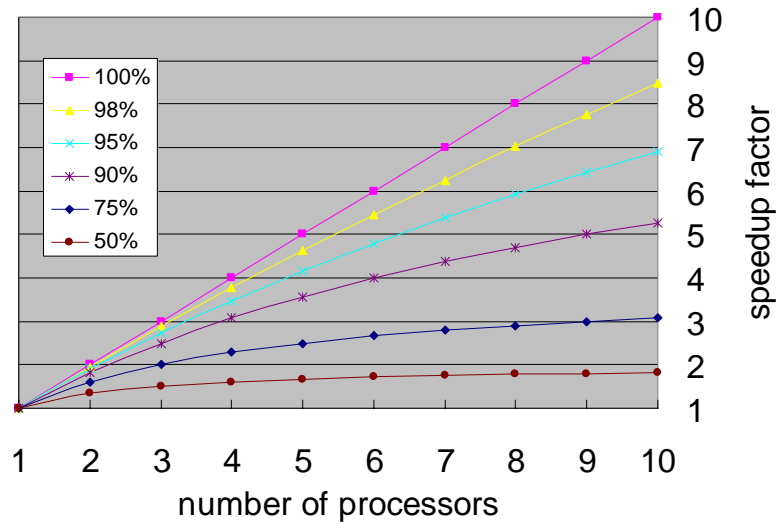
- From Existing Programs
- Parallel Speedup vs. Sequential Fraction
- Formulating new algorithms
 - Reduce dependencies between calculation parts
- Embarrassingly Parallel
 - Monte Carlo Simulations
 - Repeated application to unrelated data (for example: spatial distribution)

Parallel Speedup vs. Sequential Fraction *Dutch Space*

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application parallelizability

Amdahl's law



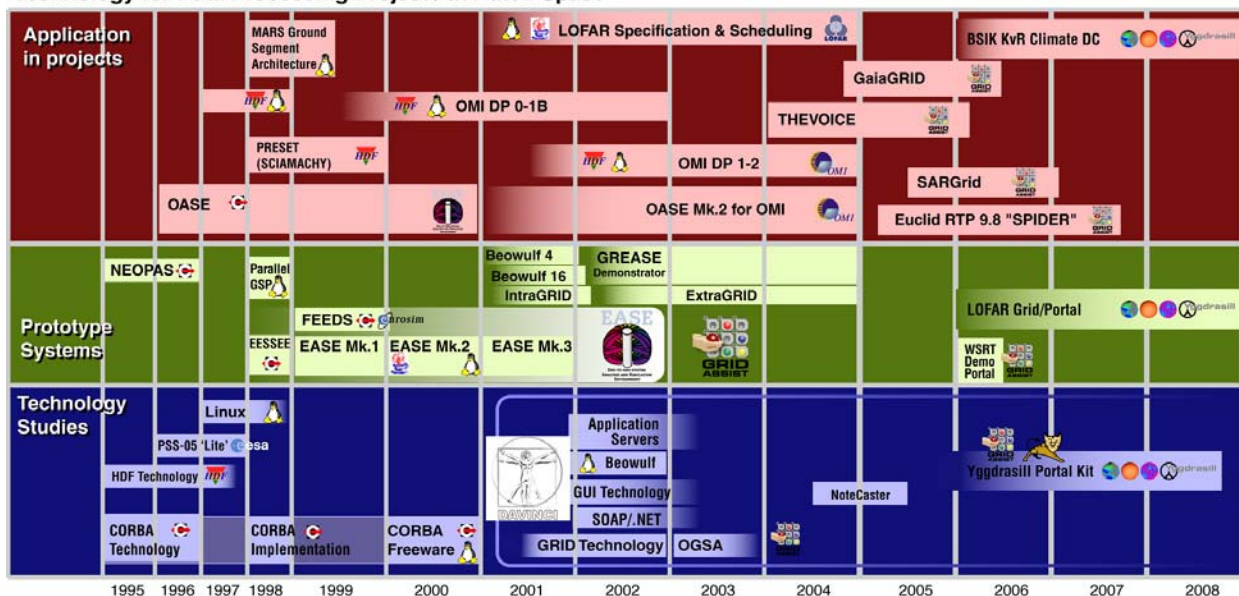
- speedup assumed proportional with number of processors
- viewpoint from existing application; new applications will be fitted to the possibilities

Dutch Space & Grid

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Technology for Data Processing Projects at Dutch Space



Demonstration

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[Tide_grid_workflow_demo.avi](#)

Thank you for your attention

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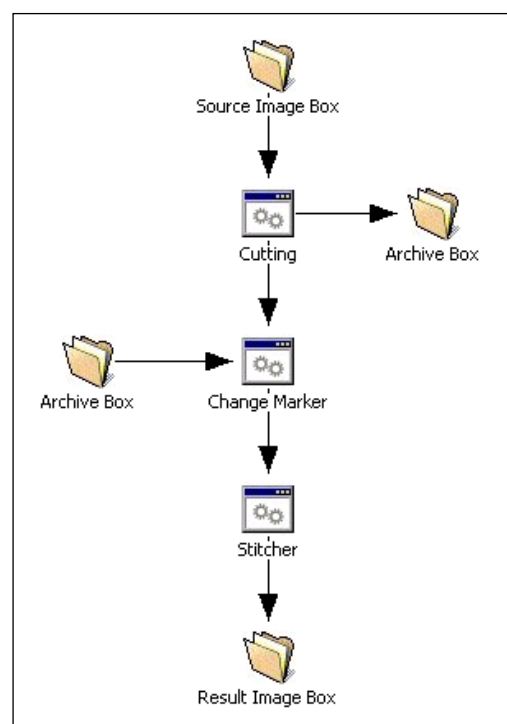
Grid?
Middleware?
Scheduling?
Service?
Authorization?
Broker?
Authentication?
Job?
Data centre?

Exercise

- Pick a role from the stack.
- Play your role in an anticipating fashion; try to prepare as much as possible
- Every data communication should be on paper, passed on one-on-one (no broadcasting)
 - User <-> Middleware
 - Middleware <-> Resource
 - NO resource <-> resource (third party transfers)
- Middleware actors should discuss to divide the work. Write discoveries and agreements on the role definition paper.

Role overview and Workflow

- User
- Middleware
 - User Portal
 - Controller
 - Scheduler
 - ... Need more?
 - Broker
 - Agents
- Resources



- Static
- Dynamic resources
- Failing jobs
- Cancel application
- Different topology
 - grouping resources into cluster
 - dividing middleware into middleware groups