Enabling Grids for E-sciencE

Grid Applications and Use Cases

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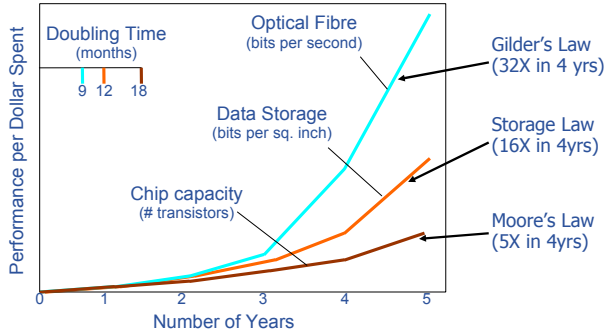
Mumbai, 11.02.06

Slides contributed by FZK + EGEE Team

www.eu-egee.org

Information Society

Exponential Growth ...



Triumph of Light – *Scientific American*. George Stix, January 2001

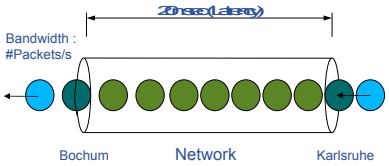
Evolution

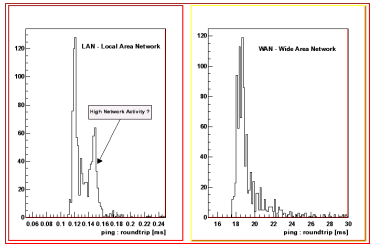
„When the network is as fast as the computer's internal links, the machine dis-integrates across the net into a set of special purpose appliances“

(Gilder Technology Report, June 2001)

Technical Limitations

- „Speed“ of a network consists of two components
- Bandwidth (scales to any number)
- Latency (doesn't scale)
- Possible application types in a distributed environment are limited by latency

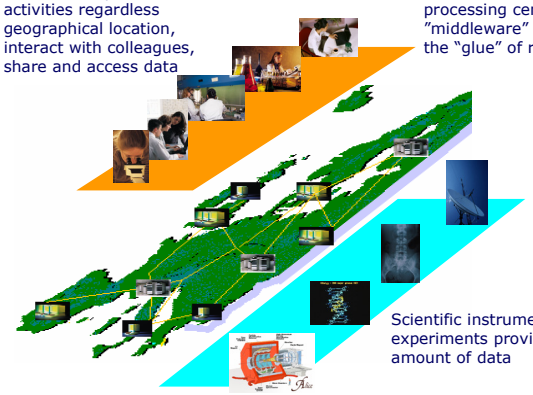




The GRID vision

Researchers perform their activities regardless geographical location, interact with colleagues, share and access data

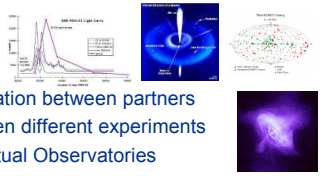
The Grid: networked data processing centres and "middleware" software as the "glue" of resources.



Scientific instruments and experiments provide huge amount of data

Use Case in Science: MAGIC

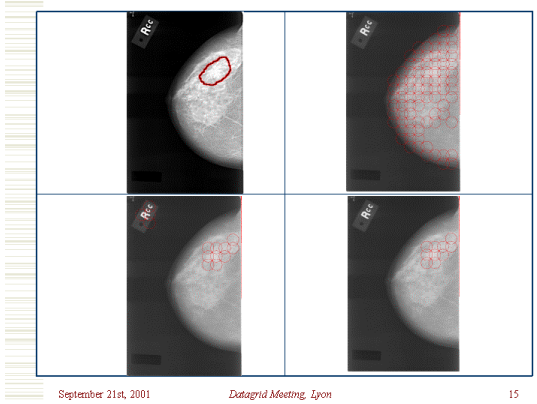
- **Ground based Air Cerenkov Telescope 17 m diameter**
- **Physics Goals:**
  - Origin of VHE Gamma rays
  - Active Galactic Nuclei
  - Supernova Remnants
  - Unidentified EGRET sources
  - Gamma Ray Burst
- **MAGIC II will come 2007**
- **Grid added value**
  - Enable "(e-)scientific" collaboration between partners
  - Enable the cooperation between different experiments
  - Enable the participation on Virtual Observatories



Use Case in Science: Bioinformatics

- **GPS@: Grid Protein Sequence Analysis**
  - **Gridified version of NPSA web portal**
    - Offering proteins databases and sequence analysis algorithms to the bioinformaticians (3000 hits per day)
    - Need for large databases and big number of short jobs
  - **Objective**: increased computing power
  - **Status**: 9 bioinformatic softwares gridified
  - **Grid added value**: open to a wider community with larger bioinformatic computations
- **xmipp_MLrefine**
  - **3D structure analysis of macromolecules**
    - From (very noisy) electron microscopy images
    - Maximum likelihood approach to find the optimal model
  - **Objective**: study molecule interaction and chem. properties
  - **Status**: algorithm being optimised and ported to 3D
  - **Grid added value**: parallel computation on different resources of independent jobs

Bio-medicine applications



September 21st, 2001 *Datagrid Meeting, Lyon* 15

Mammogrid -> AliEn

Similarity search

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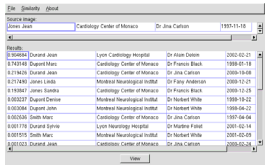
Similarity computation



Job monitoring

Results visualization

Ranked list of images

Source image

Most similar images

Low score images

Bio-medicine applications

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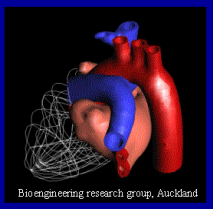
3.3 Heart Modeling

- Objectives: modeling heart anatomy, dynamics and physiology for heart image processing
  - bio-mecanical model
  - electrical model
  - very complex structure
  - biological scale out of range



Bioengineering research group, Auckland

- Finite Element modeling
  - elements oriented in heart fibers direction: fine resolution
  - electrical propagation model based on bidomain theory
  - 4D model (3D+T)

Creatis

GGF1 - DataGrid WP 10 - March 2

Earth observation applications

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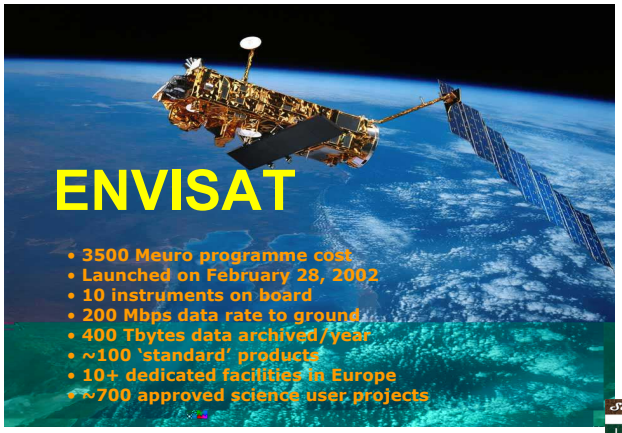

Virtual Observatory

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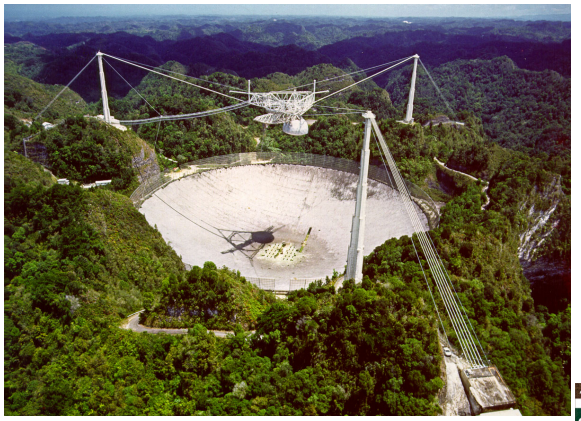
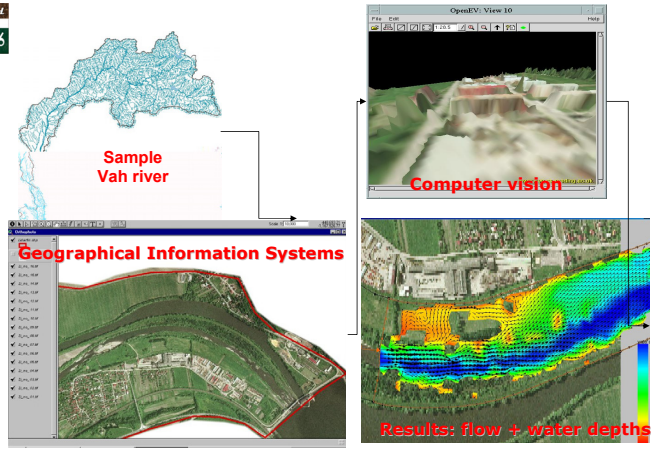


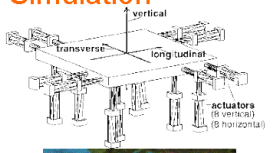
Flood simulation

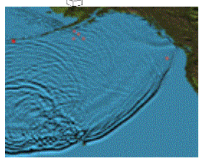


Engineering applications

Network for Earthquake Engineering Simulation

- NEESgrid: national infrastructure to couple earthquake engineers with experimental facilities, databases, computers, & each other
- On-demand access to experiments, data streams, computing, archives, collaboration

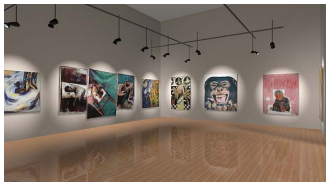




NEESgrid: Argonne, Michigan, NCSA, UIUC, USC

Grid Applications: Art

Paintings are being scanned in at 30 GB each in the EU CRISATEL Project



Museo Virtual de Artes El Pais (MUVA)

Books are being scanned in at 767 MB per page 1/2 Terabyte for Gutenberg Bible

Connecting *People*: Access Grid

Summary / Conclusion

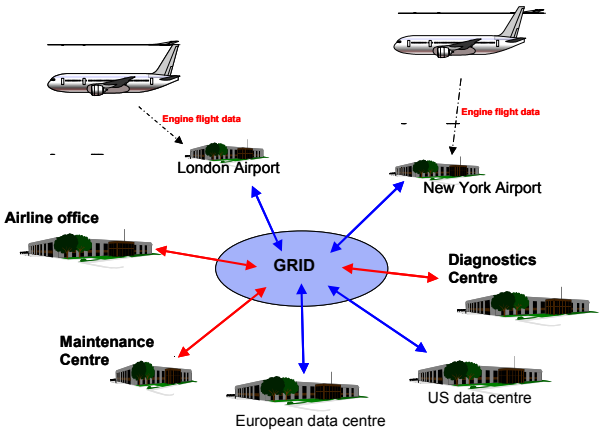
- Many different Grid types (although not in the mainstream)
- Typical Areas:
  - „Embarrassing Parallel“ Applications (or „nicely parallel“)
  - Collaboration
  - Distributed Databases
  - Some real parallel processing (rare)

Use Case: Business (1) – CPU Cycles

- Selling compute cycles
- Sun: 1$ / CPU-hour

IBM

Use Case: Business (2) – DAME



Slide taken from talk given at GridKa School by Dr. Tom Jackson, University of York

Use Case: Business (2) – DAME

DAME Objectives

- **Building a demonstration system as proof of concept for Grid technology in the aerospace diagnostic domain.**
- **Three primary Grid challenges:**
  - Management of large, distributed and heterogeneous data repositories;
  - Rapid data mining and analysis of fault data;
  - Information management and data fusion for diagnosis/prognosis applications;
- **Other key (commercial) issues:**
  - Remote, secure access to flight data and other operational data and resources;
  - Management of distributed users and resources;
  - Quality of Service issues (and Service Level Agreements)

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Thank you !
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I'd like to thank
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Questions, please !!
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