

PHILIPS

Supporting e-Science

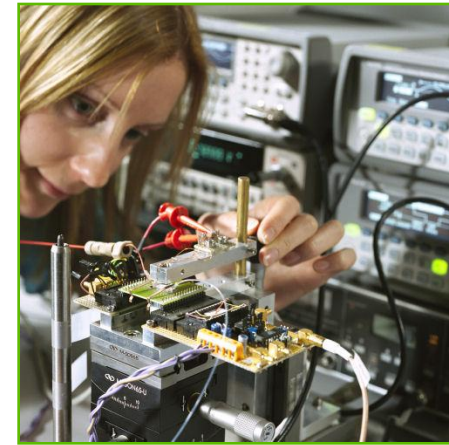
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Observations I

- Developments in application fields
 - e.g. Medical Imaging and Bioinformatics*
 - Many sensors and high-resolution sensors: data explosion
 - Correlation of data from different sources (e.g. SPECT/CT)
- Open Innovation
 - Need to cooperate to get resources and/or knowledge in the right place at the right time: *“Support the technology chain”*
- Infrastructure
 - Cope with the *“data explosion”* and *“large scale data analysis”*
 - Large computations, but much can be parallelized or distributed
 - Must facilitate secure collaboration with partners



From model driven to data driven experiments

Observations II

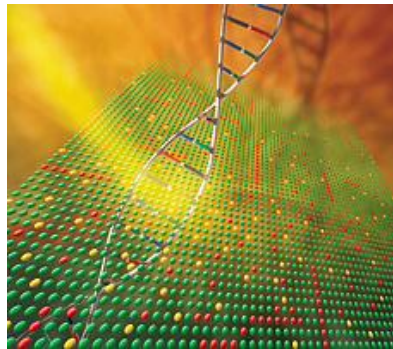
- Big growth in application complexity.
- Resource needs of some application fields may grow orders of magnitude
- Will lead to huge growth in data storage capacity and compute capacity needs.



- And today's business innovation is done in an Open Innovation setting:
 - Collaboration in virtual teams is the way of working. (Industry, Universities & Institutes)
 - Needs to be supported by applications and IT infrastructures.



**Cannot be done by a single entity
Must share and cooperate**



Research



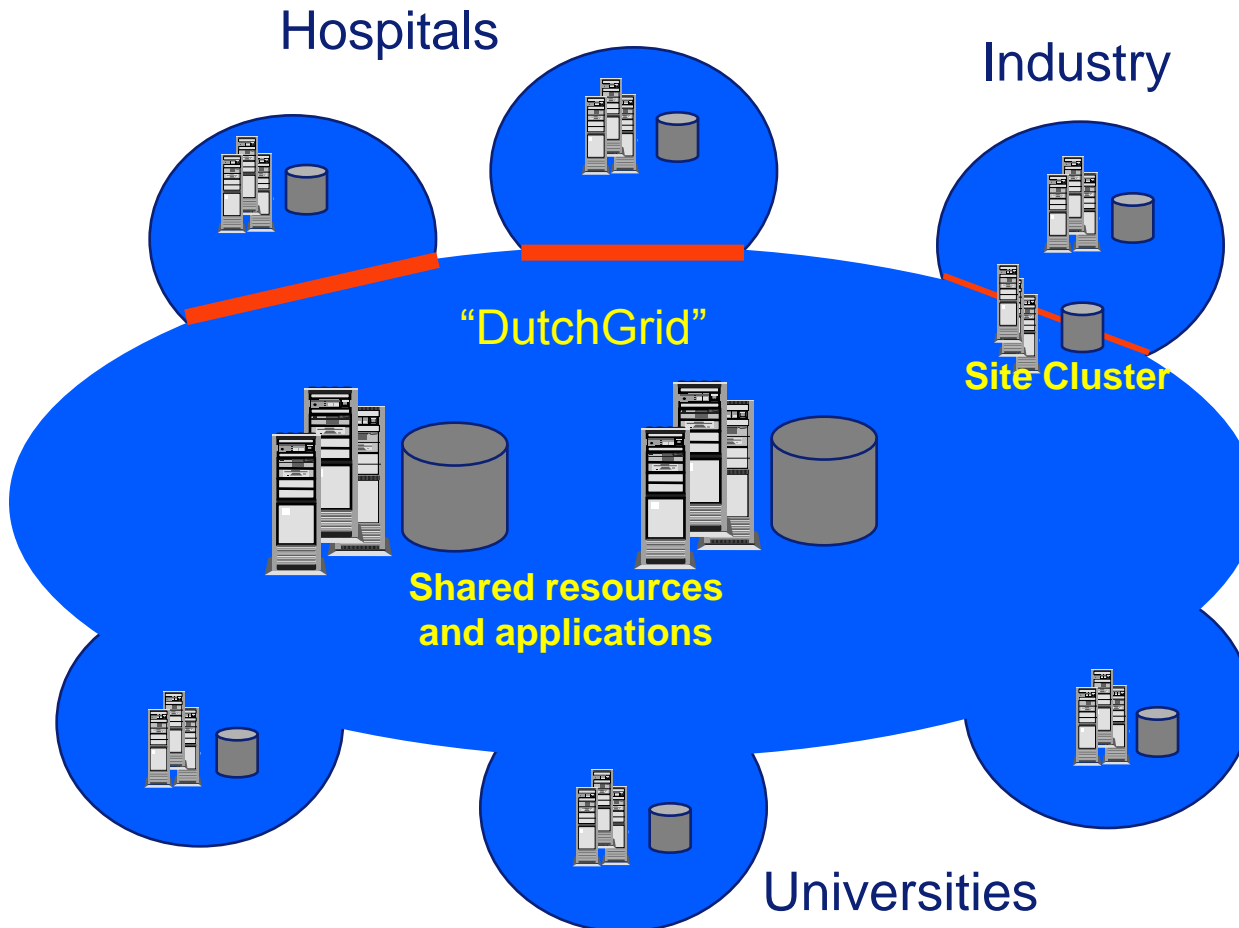
Research Interest in HPC?

- A number of program, project and application fields at Philips Research will require (or may benefit from) high performance computing:
 - Medical imaging to improve image quality and accuracy.
 - Molecular Medicine and Bioinformatics will be faced with an explosive growth of data.
 - Large simulations and inverse problems
 - Lighting armature optics for solid state lighting
 - System in Package (SIP) and Solid State Lighting may need to introduce 3D models and simulations.
- Important to be part of the ECO system
 - Actively participate in (national) e-Science projects
 - Ability to consume external resources and to provide resources to externals.

Research ICT HPC and Grid Activities

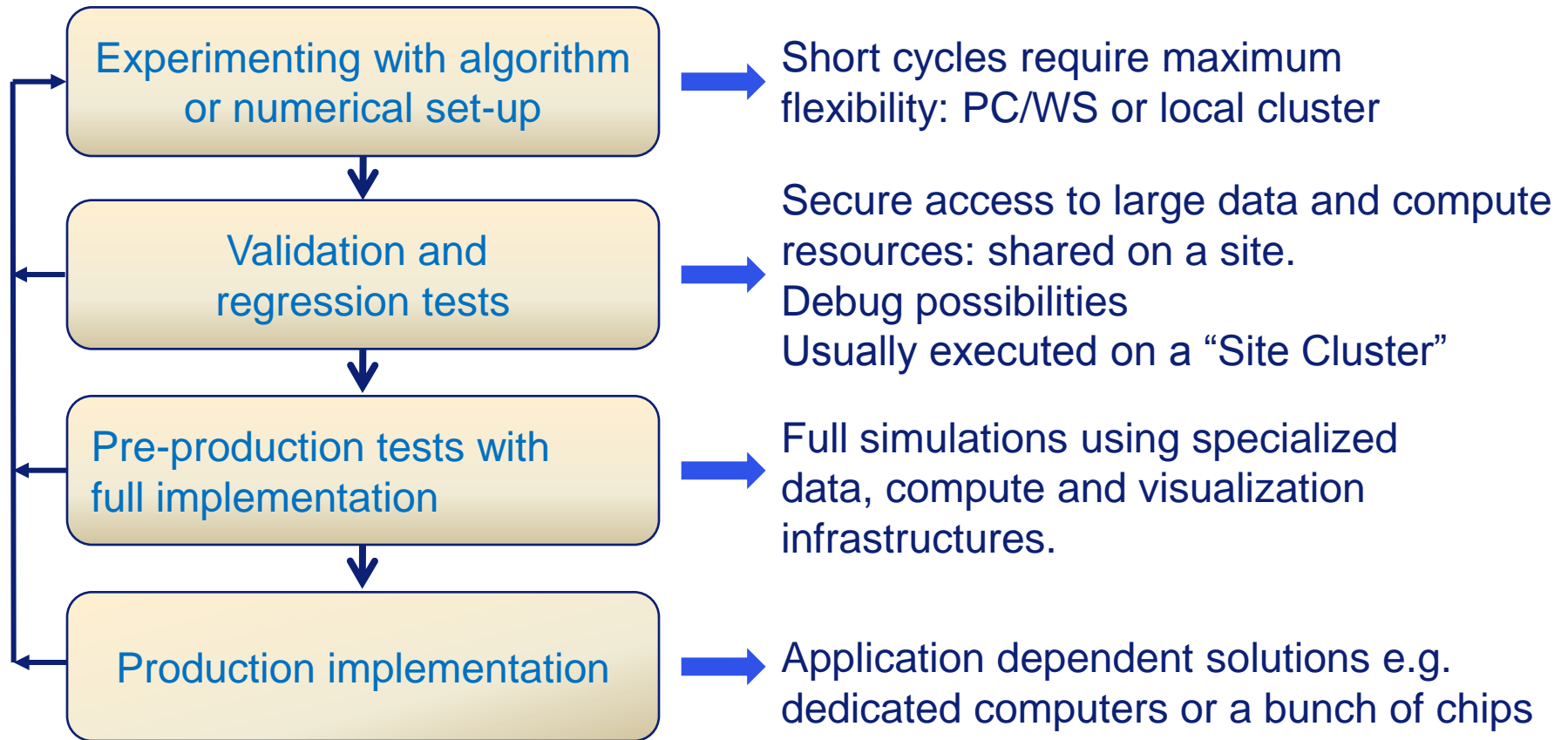
- Philips Research ICT is trying to close the gap between “demanding” jobs that researchers have and the supporting IT infrastructures.
- Translate upcoming IT technology in new strategic options
- Developed various HPC/grid demonstrator aimed at helping researchers to do their calculations faster...
- Installed a cluster that is connect to DutchGrid to understand and investigate the technology
 - Access via “[gLite](#)” or “[UNICORE](#)” grid middleware software
 - Allows for more demanding, jobs to be sent to other (possibly external) “clusters”
- Participate in national initiatives like:
“*Virtual Laboratory for e-Science*” (VL-e) and “*BiG-Grid*”

Vision: Shared Resources and Infrastructure



Example: Researchers Workflow

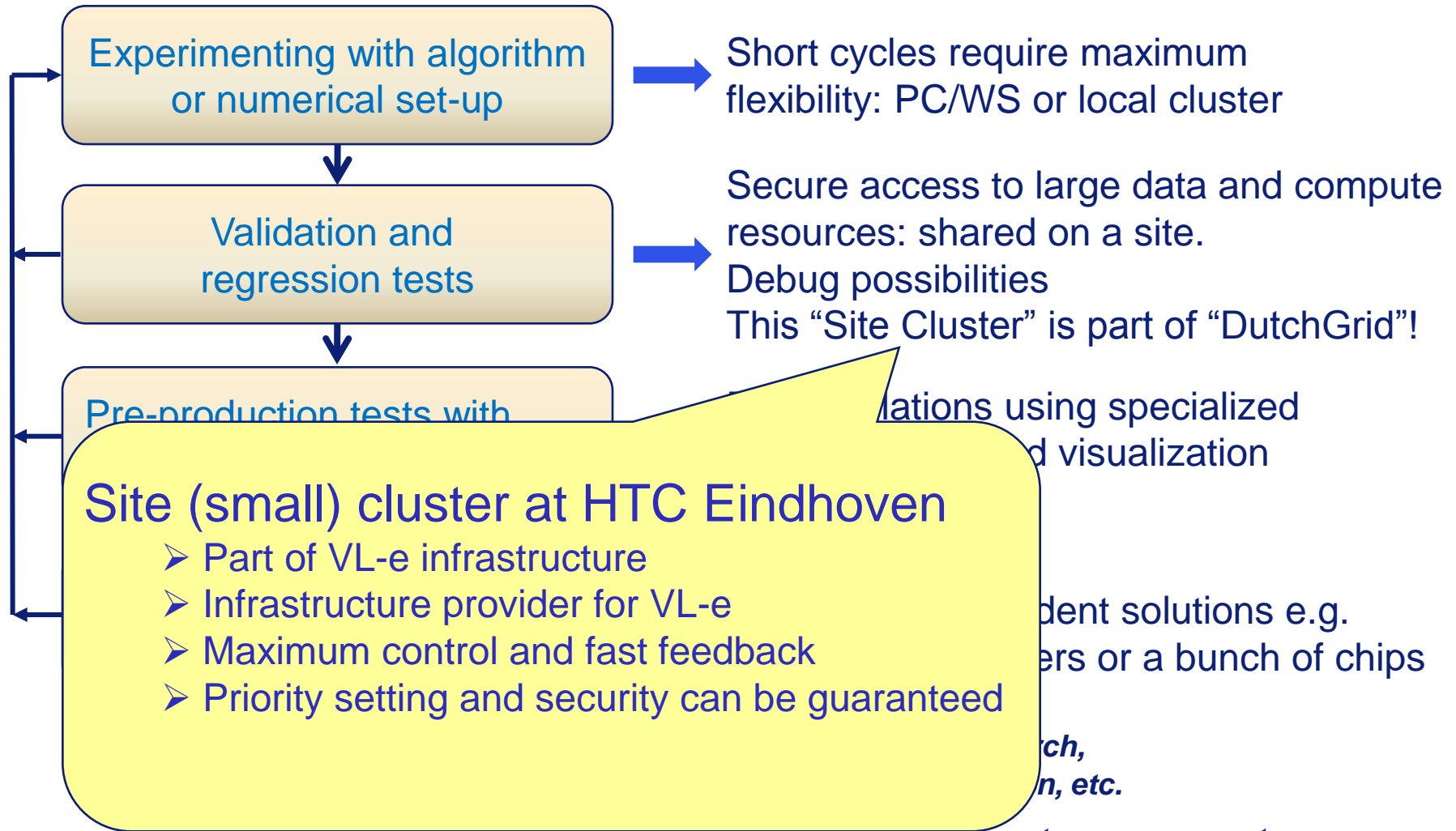
Workflow View



- *E.g. medical imaging, bioinformatics simulation and search, 3D multi-physics modeling, system in package simulation, etc.*
- *Many projects do not follow the complete flow, but stay at one or more stages.*

Example: Researchers Workflow

Workflow View



• Many projects do not follow the complete flow, but stay at one or more stages.

Vision: Shared Resources and Infrastructure

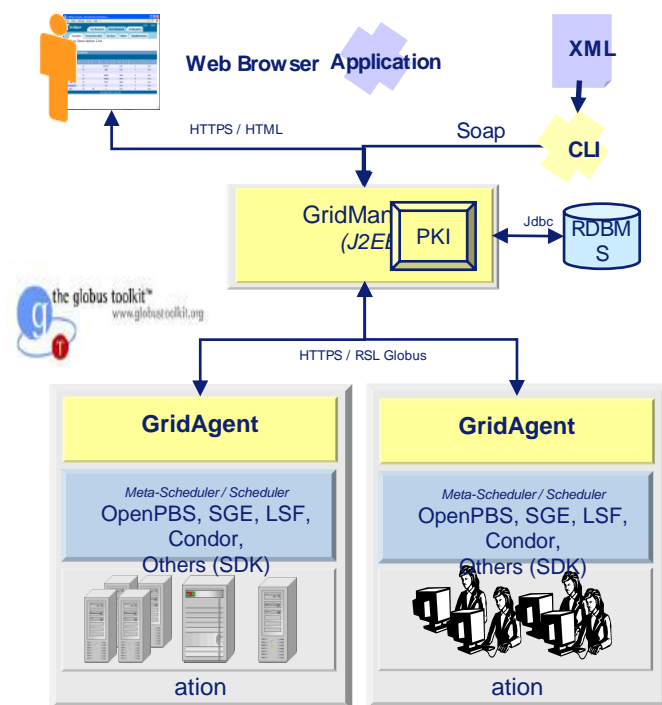
Success factors

- **End-user guidance** and support is essential!!
- Supply **workbenches** for application fields
- Support of **commercial applications**
 - MATLAB, COMSOL Multiphysics , ...
- Support of set of **standard middleware** layers
 - gLite, UNICORE, Globus, ...
- **QoS** and **AAA** are key in e-Science production infrastructures
- Continuous development, be a leader!

Grid Demonstrator – Aachen → Eindhoven

- PET System Simulation
- Runs at Eindhoven “Site Cluster”
- Monte Carlo simulation of the scanner up to the detection of scintillation light
 - ~32 CPU days on 2.8 GHz Xeon
 - 100 x 1 GB output
- System-level simulation of the detector electronics (Mona/Lisa)
 - 2 phase post processing
- Simulation can be highly parallelized
- Based on GridXpert Synergy

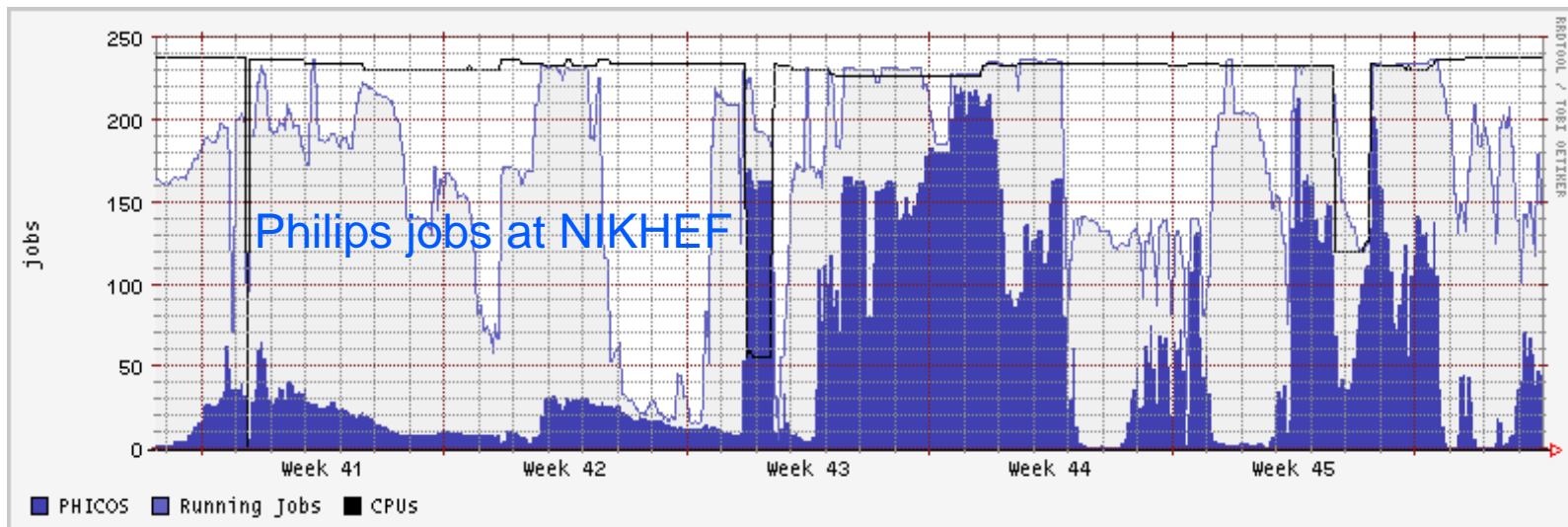
GridXpert Synergy Architecture



SPECT Simulation



- Single Photon Emission Computed Tomography
- 20,000 jobs of ~3.2 CPU hours each
- Executed at NIKHEF and SARA VL-e clusters
- Access via LCG-2 Grid middleware software



Grid Portal for PET System Simulation

Positron Emission Tomography

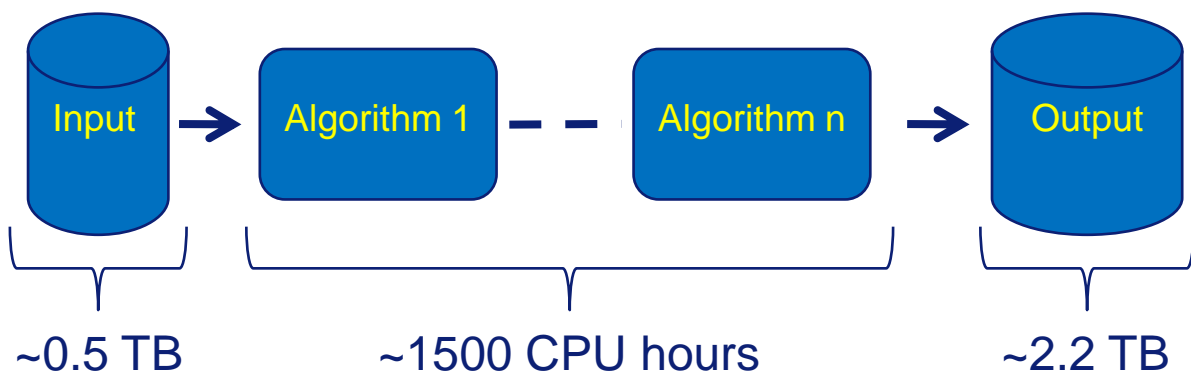
- Application developed by Researcher in Aachen.
- Design (graphical/web) portals
 - Core services too complex to present to scientists
- Based on GridSphere web portal technology (JSR-168)
- Initial version developed with assistance from GridwiseTech

The screenshot displays a complex web portal interface for a grid-based simulation system. The interface is divided into several sections:

- Navigation Menu:** Located on the left, it includes links for "List Available Resources", "Job Submission", "Job Queue", "Job Output", and "Clean Job Queues".
- Main Content Area:** Features a "JDL Creation Panel" with various configuration options for a job, including:
 - System:** Architecture (LINUX), OpSys, RunTimeEnvironment.
 - Memory:** Min Physical Memory (9 MB), Min Local Disk Space (0 MB).
 - Queue management:** LRMS Type (LPBS), LRMS Version.
 - Miscellaneous:** Max CPU Time (4.0 sec), Free CPUs (0), Estimated Traversal Time (3.2 sec), Average S100 (2.6).
- MACS System Window:** A separate window titled "MACS System" showing a flowchart of the simulation process and a "Create Etl..." button.

Simulate Full HDTV Data Processing Chain

- Picture quality enhancement algorithms
 - Picture rate-up conversion
 - Pixel perfect
 - ...



Original (Frame repetition)



Measured > 50 MB/s data transfer rates between Amsterdam ↔ Eindhoven over GigaPort connection

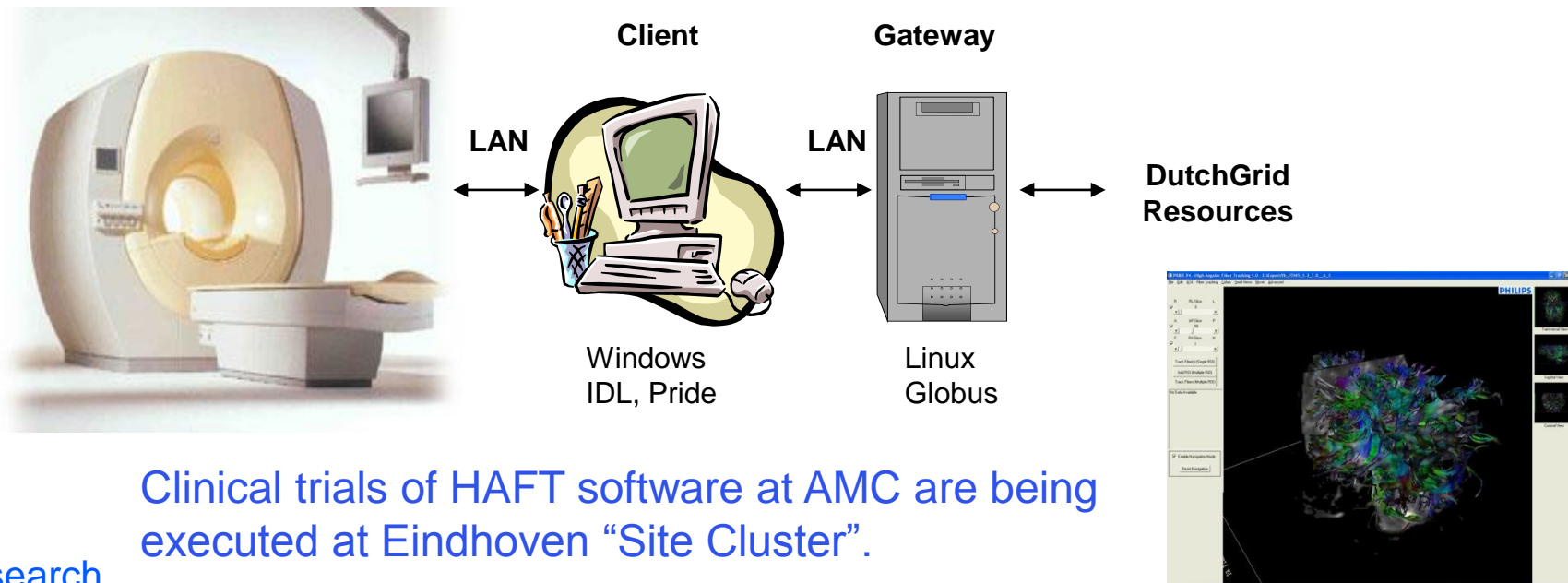
DIGITAL
NATURAL MOTION

GAMA Research

Healthcare Systems Architecture research group

The GAMA architecture: computational Grids

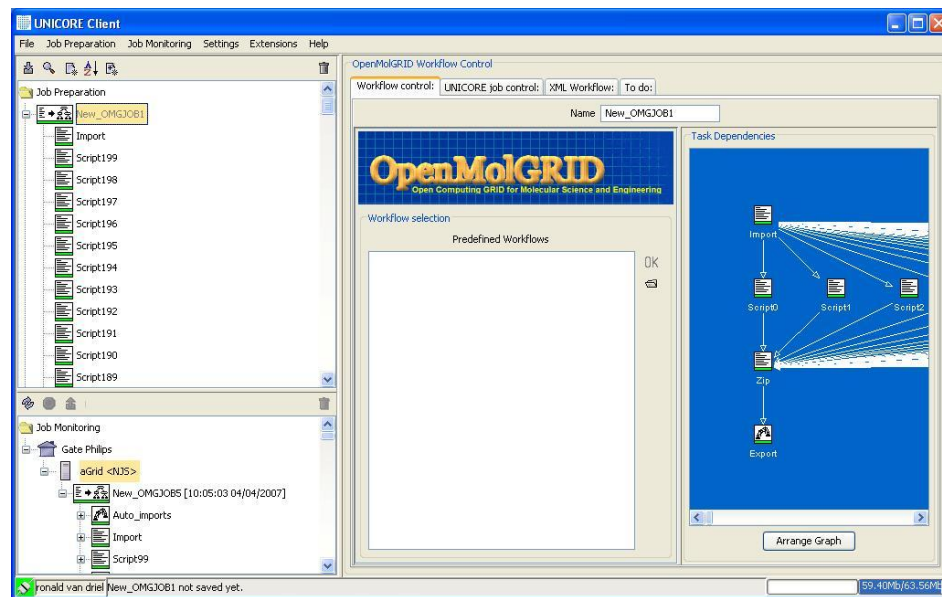
- Architecture for solving compute-intensive medical applications
- Minimally invasive: Running on Grid as alternative, easy fall back to local versions
- Simultaneously provides different sets of services to multiple users and applications
- Adaptive to various healthcare applications
- **Example:** Brain imaging, the High Angular Fiber tracking (HAFT) application



Non-invasive Glucose Monitoring Simulation

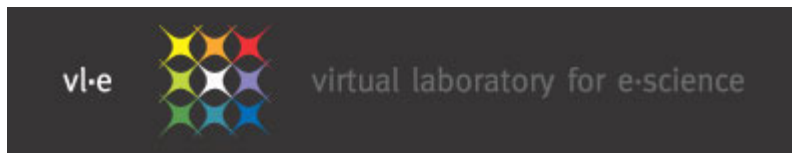
- Speedup Monte Carlo based simulation package developed on Microsoft Windows platform
- Ported application to Linux and fixed various inconsistencies in floating point arithmetic.
- Allows for easy parallelization using loosely coupled jobs
- Deploy UNICORN client on Microsoft Windows platform
- Modified OpenMolGRID plugin to process application specific input file.

UNICORE



Our view on Grid

“Grid is just a Grid (services and collaboration),
the real added value will come
from e-Science”



Questions?

