# Internal Workshop of the VL-e Medical Subprogram (SP1.3)
# 9 November 2006
# Informatics Institute, UvA

## Program

| | | |
|---|---|---|
| 11:00 | Welcome with coffee/tea | |
| 11:15 | VL-e Medical: Overview Activities and Midterm Evaluation | Silvia Olabarriaga, IvI/AMC-UvA |
| 11:35 | Future applications of grid computing at the 3.0 Tesla research facility | Aart Nederveen, AMC |
| 11:55 | Distributed Workflow Management System for Automated Medical Image Analysis and Logistics | Jeroen Snel, AMC |
| 12:15 | Grid Architecture for Medical Applications | Jasper van Leeuw, Philips Research |
| 12:35 | Analysis of MR Diffusion Tensor Images at 3 Tesla | Matthan Caan, AMC + TU Delft |
| 12:55 | lunch | |
| 13:45 | Fitting a single equivalent-current-dipole model to MEG data with exhaustive search optimization is a simple, practical and very robust method given the speed of modern computers | Keith Cover, VUMC |
| 14:05 | Brain reading: decoding mental states of humans from functional neuroimaging data | Sennay Ghebreab, IvI-UvA |
| 14:25 | Interactive Visualization | Michael Scarpa, IvI-UvA |
| 14:45 | Problem-solving environment for medical image analysis | Ketan Maheshwari, IvI-UvA |
| 15:05 | tea/coffee break | |
| 15:25 | Vision of AMC for VL-e Medical | Kees Grimbergen |
| 15:35 | Vision of VUMC for VL-e Medical | Bob van Dijk |
| 15:45 | Vision of Philips Research for VL-e Medical | Henk Obbink |
| 15:55 | Vision of Philips Medical for VL-e Medical | Ruud de Boer |
| 16:05 | Panel: Self-evaluation of VL-e medical | Bob van Dijk, Ruud de Boer, Henk Obbink, Robert Belleman, Ard den Heeten, Kees Grimbergen, Jan Just Keijser, Silvia Olabarriaga (moderator) |
| 16:35 | Closing | Silvia Olabarriaga |
| 16:40 | Borrel | all |

# Abstracts

## VL-e Medical: Overview Activities and Mid-term Evaluation

Silvia Olabarriaga
Informatics UvA and Academic Medical Center Amsterdam
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The medical subprogram of VL-e (SP1.3) includes activities performed by (at least) 10 FTE's. An overview of these activities will be presented in the general scope of VL-e. More details about these activities will be provided by all workshop speakers. Additionally, preliminary information about the coming VL-e evaluation will be provided. This evaluation is part of the normal procedure adopted by BSIK funded projects, and it will take place in the first semester of 2007.

## Future applications of grid computing at the 3.0 Tesla research facility

Aart Nederveen
Academic Medical Center Amsterdam
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The 3.0 Tesla research facility is now being used by approximately 30 different groups, both from the AMC and the University of Amsterdam. Several users might benefit in the near future from grid applications, such as automated data storage and analysis. Parameter optimisation in the context of fMRI will especially enable researchers to fine tune their analysis setup within a realistic timewindow. New clinical users for DCE MRI (abdomen, prostate, breast) will need large computer resource in order to be able to use sophisticated quantitative modelling in a clinical context. Laatste zin abstract: This presentation will provide an overview of the research at the 3.0 Tesla scanner and present future applications of grid computing at the 3.0 Tesla research facility.

Team (AMC):
Ard den Heeten, Kees Grimbergen, Jeroen Snel, Matthan Caan, J.N. van der Meer, Erik Akkerman, Cristina Lavini, Silvia Olabarriaga, Aart Nederveen.

## Distributed Workflow Management System for Automated Medical Image Analysis and Logistics

Jeroen Snel
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In the AMC a Distributed Workflow Management System (DWMS) has been developed that supports a wide portfolio of medical image analyses (MIAs) in different CT and MRI application domains. The DWMS is comprised of software components for image import/export, caching, processing and notification that are distributed on a heterogeneous desktop grid. Communication between components is performed by exchanging SOAP messages on request of standard compliant Web services. The workflows are executed fully automatically upon receipt of the medical images. After processing, the results become directly available for the medical specialist or researcher. In the presentation details on MIA workflow will be presented that will be demonstrated on behalf of examples in CT Angiography (CTA) and functional MRI (fMRI). Moreover, future developments regarding telemedicine portals for MIA will be discussed.

Team:
AMC:Jeroen Snel, Johan Alkemade, Aart Nederveen, Hugo Gratama van Andel, Matthan Caan, Cristina Lavini, Erik Akkerman, AMC, Silvia Olabarriaga
HvA: Bart Rekel, Ricardo Ciric, Frank Vierbergen, Erik Valkering
CWI: Bas Warmerdam

## Grid Architecture for Medical Applications

Jasper van Leeuw
Philips Research Eindhoven
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The Grid Architecture for Medical Applications (GAMA) project proposes a architectural solution for accessing GRID resources from an hospital environment. Experiences with preparing for deployment are shared in this talk.

Team (Philips Research Eindhoven):
Anca Bucur, Jasper van Leeuwen, Henk Obbink, Jeroen Vrijnsen

## Analysis of MR Diffusion Tensor Images at 3 Tesla

Matthan Caan
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Diffusion Tensor Imaging is used in comparative studies to brain diseases. By measuring the diffusion of water, the brain structure can be reconstructed, which is expected to be affected by the disease. Advanced Image Processing techniques and Machine Learning Frameworks are developed and applied to data acquired at the AMC in Amsterdam. Distributive computation using Matlab is demonstrated within the VL-e Proof Of Concept environment. This enables more extensive parameter optimizations within the near future.

Team:
Delft University of Technology: Lucas van Vliet, Frans Vos, Matthan Caan
Academic Medical Center Amsterdam: C.A. Grimbergen, G.J. den Heeten

## Fitting a single equivalent-current-dipole model to MEG data with exhaustive search optimization is a simple, practical and very robust method given the speed of modern computers

Keith Cover
VU Medical Center
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Fitting an equivalent current dipole (ECD) to magnetoencephalography (MEG) data is a widely used method for analyzing MEG data, especially in clinical applications. However, as is well known, the iterative fitting algorithms routinely employed can converge on a local minima far from the best fit. While a host of fitting algorithms have been proposed to remedy this problem, the simple exhaustive search optimization algorithm has not been considered in the literature - possibly because it is assumed to be too slow for routine use. Taking advantage of the speed of modern computers, it is demonstrated that using exhaustive search to fit the parameters of a single ECD to 151 MEG channels yields both robust and reproducible fits within reasonable computation times.

## Brain reading: decoding mental states of humans from functional neuroimaging data.

Sennay Ghebreab
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Recent trends in cognitive science, computer science and functional neuroimage analysis are rapidly converging to a new research area: decoding mental states of humans from functional neuroimaging data. This research area aims at identifying, understanding and simulating processes and representations involved in the interpretation of natural stimuli such as real world scene by combining psychophysical and computational experiments with multivariate pattern analysis techniques. In this talk I will elaborate on our research in mapping brain activation data to natural sensory stimulation data and briefly report on our participation in the brain reading competition.

## Interactive Visualization

Michael Scarpa
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This talk will discuss Interactive visualization in relation to grid-stored data, different displays (desktop to VR/AR) and distributed (grid) resources.

Team (Informatics UvA): Robert Belleman, Michael Scarpa, Abdullah Zeki Ozsoy

## Problem-solving environment for medical image analysis

Ketan Maheshwari
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Workflow Management Systems (WfMS) and Problem Solving Environments (PSE) are important research areas in e-science. WfMS and PSE give researchers the desired abstraction level to manage experiments in the form of tasks. Existing WfMS and PSE support different and complementary tasks, so they are used in combination to perform more complex tasks. This gives rise to a necessity to make these work in coordination with each other. Medical Image Analysis Support System (MIASS) is one of the application areas where a coordination of several WfMS and PSE is desired. The talk will focus on a discussion of approaches to integrate and interoperate WfMS and PSE to achieve an ideal MIASS. The considered systems in this work are Nimrod, Dataflow Driven Workflow Engine (DDWE), the Delft Visualisation and Image Processing Development Environment (DeVIDE) and Distributed Workflow Management System (DWMS).

Team (Informatics UvA): Adam Belloum, Silvia Olabarriaga, Ketan Maheshwari

## Panel discussion

How does VL-e Medical currently address the goals and vision of VL-e (below)?

- What works well, what does not?
- What could be done to effectively make visible and propagate the positive developments?
- What could be done to improve the negative parts?

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*From http://www.vl-e.com/*

**Virtual Laboratory for e-Science**

The aim of the 'Virtual Laboratory for e-Science' project is to bridge the gap between the technology push of the high performance networking and the Grid and the application pull of a wide range of scientific experimental applications. It will provide generic functionalities that support a wide class of specific e-Science application environments and set up an experimental infrastructure for the evaluation of the ideas.

**P1 e-Science in applications**

* The objective of this research programme line is to create several research prototypes of advanced e–Science application specific Problem Solving Environments (PSEs) in the area of food science, medical science, telescience, data intensive computing, bioinformatics and biodiversity. All cases will be based on the VL-e generic part of the PSE and the facilities and functionalities it provides. The research prototypes will be further developed towards proof-of-concepts and will act as a driver for key research areas in the generic Virtual Laboratory programme line and, as such, provide suitable field tests.

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*From http://www.vl-e.com/main_bottom_res_p13.htm*

**SP1.3: Medical Diagnosis and Imaging**

In this public/private collaboration a problem-solving environment (PSE) will be developed that can handle data from various medical imaging detectors such as MEG, fMRI, CT, etc. The huge dataflow of this type of equipment, the available imaging software technology together with the multidisciplinary expertise of the Science Park Amsterdam, the two medical hospitals in Amsterdam and one of the major industrial players will provide a unique opportunity to work out innovative strategies for image based medical diagnosis and surgical planning as well as neuro-imaging applications. This e-Science domain promises to provide relevant expertise and feedback with regard to scaling up and validation.

*From VL-e project proposal*

See a summary in https://gforge.vl-e.nl/docman/view.php/21/73/VL-proposal-ch1.pdf
See complete text: https://gforge.vl-e.nl/docman/view.php/21/72/VirtualLab-proposal.pdf
Below a extract of complete text, pages 42-43

### 3.3 VL-E key questions and approach

#### 3.3.1 Key questions to be answered

The key questions are defined by several determinants. First of all, the VL-E consortium mission, strategy and aims (see Section 2.4), which are to boost e-Science by research towards new methodologies and reusable components along the complete e-Science technology chain to facilitate creation of application specific e-Science problem-solving environments. Second, the scientific problem and associated general requirements for a high quality e-Science ICT environment (see section 3.2), define the scientific framework for the VL-E project. Taken into account all these different elements, the following key questions, emerge:

1. Will it be possible to create flexible collaborative e-Science environments providing time and location independent experimentation and allowing processing, sharing and combining data and resources from "in vivo or in vitro" and "in silico" experiments?
2. Will it be possible to improve the quality and speed for realizing new R&D applications via the use of generic and re-usable software components, focused on required software, data, and information?
3. Will it be possible to create a secure and reliable distributed hardware/software infrastructure base that can be used for offering and accessing grid computing, storage and visualisation resources, instrumentation and information?
4. Will the developed methodology and resulting software in VL-E scale in real life applications?
5. How can we transfer the knowledge obtained during the project into industry and society?

#### 3.3.2 Approach

The key questions translate into an approach with five activities. The five activities are:

1. Realize prototypes of application-specific problem solving environments for different application areas
2. Fundamental knowledge development on generic Virtual Laboratory methodology
3. Fundamental knowledge development on large scale distributed systems
4. Field-test and evaluate proof-of-concept environments for several real life applications
5. Set up a centre to transfer the acquired knowledge to industry and society

The first four activities are scientific ones and will be described in detail in Chapter 4 (Scientific Relevance). The last activity will be described in Chapter 8 (Knowledge Distribution and Transfer).

## Participants

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