



Contribution ID: 80

Type: **Demonstration**

NeuroLOG platform: federating multi-centric neuroscience resources

Monday, 11 April 2011 07:30 (9h 30m)

Overview

The NeuroLOG platform is a distributed environment dedicated to the support of collaborative and multi-centric studies in neurosciences. It leverages grid technologies to deploy a highly secure, large scale data federation and to deliver high throughput neuro-images analysis. It is interfaced to the gLite middleware and takes advantage of the EGI grid. NeuroLOG provides a mediation interface and a federation layer to adapt to existing heterogeneous distributed site-specific neuro-informatics resources. It thus adapts to legacy neuroscience environments. It delivers a data and processing tools federation functionality using both grid and semantic Web technologies. It aims at easing collaboration between multiple neuroscience centers.

Impact

Neurosciences are increasingly relying on computerized analysis of large, coherent data sets including images and associated information on the clinical and environmental context. Indeed, epidemiological, therapy and drug impact studies require the analysis of large population of patient images over long periods. Furthermore, large data sets are required to build neuro-atlases characterizing the anatomy and physiology of the normal or pathological brain. Federating domain-specific resources is increasingly important to assemble the data sets required, or to compare data analysis procedures developed in neuroscience centers. Data sets can be assembled for pathologies with low occurrence rates. Specialized atlases can be composed for specific populations. Variations of pathologies can be studied over large geographical areas. Best practices can be identified and exchanged. Concrete data analysis pipelines have been deployed on the NeuroLOG platform in the area of Multiple Sclerosis, Brain Stroke, Brain Tumours analysis, and Alzheimer's disease. The neuro-scientists are standing half way between clinical neurologists and computer scientists. They are accustomed to the use of computing environments for supporting their experiments and they are a vector to demonstrate the use of computerized models and tools to the clinical world.

Description of the work

The NeuroLOG platform is currently deployed over a federation of five collaborating neuroscience centers. Its data management layer integrates neuro-images, associated neuro-pathological test results and other meta-data stored in the site-specific databases. A domain-specific ontology was developed. A relational representation of this ontology is used as a federated data schema that provides a unified view of heterogeneous databases. A data mediation layer dynamically maps specific data representations to the federated one, exploiting the DataFedorator relational mediation tool from SAP. A specific access control policy was designed to support multi-centric collaborations while ensuring that the local privacy policy of each provider prevails. In addition, the middleware provides neuro-data analysis tool representations and deployment functionality. The collaborating centers can expose and share their data analysis algorithms for integration in neuro-image

analysis pipelines through a rich legacy code wrapper service interface and a specialized ontology of Web Services. The MOTEUR workflow designer and enactor is used to describe neurosciences studies. The workflow engine is seamlessly integrated to the data management layer to facilitate the manipulation of experimental data sets. The workflow executor was semantically enriched to take advantage of the rich data representation delivered by the NeuroLOG platform. The platform semantic data stores are also enriched along data processing, using semantic rules defined in the ontology. The interface of MOTEUR to the gLite middleware makes it possible to handle very large scale analysis pipelines. The NeuroLOG environment is accessible through a unique high level, portable and integrated GUI that integrates all facets of the middleware. It includes a specialized medical image viewer from the Visioscopie company that complies with radiology device viewers' best practices.

URL

<http://neurolog.polytech.unice.fr>

Conclusions

The NeuroLOG platform is an example of a domain-specific integrated environment interfacing legacy environment with grid resources. It is non-invasive and does not interfere with regular local site policies and practices. This demonstration will show the use of the NeuroLOG middleware in concrete neuroscience data analysis use cases: adding users to the federation, granting access to the resources, browsing the distributed data sets, selecting data sets relevant for a given study and executing a neurosciences pipeline. The platform demonstrated integrates data and processing tools provided by four neuroscience centers. The demonstration will emphasise on the use of distributed resources and the exploitation of the EGI grid for the addressing the computation needs. It will discuss the usability of grid resources for neurosciences and the perspectives to better support that community in the future.

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Session Classification: Demonstrations

Track Classification: Demonstration - Application/User