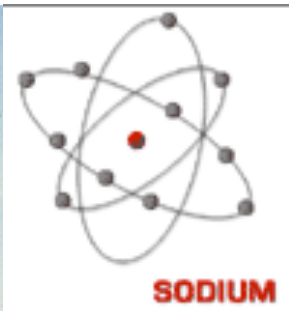


Grid Workflows: SODIUM and JOpera Projects

Cesare Pautasso

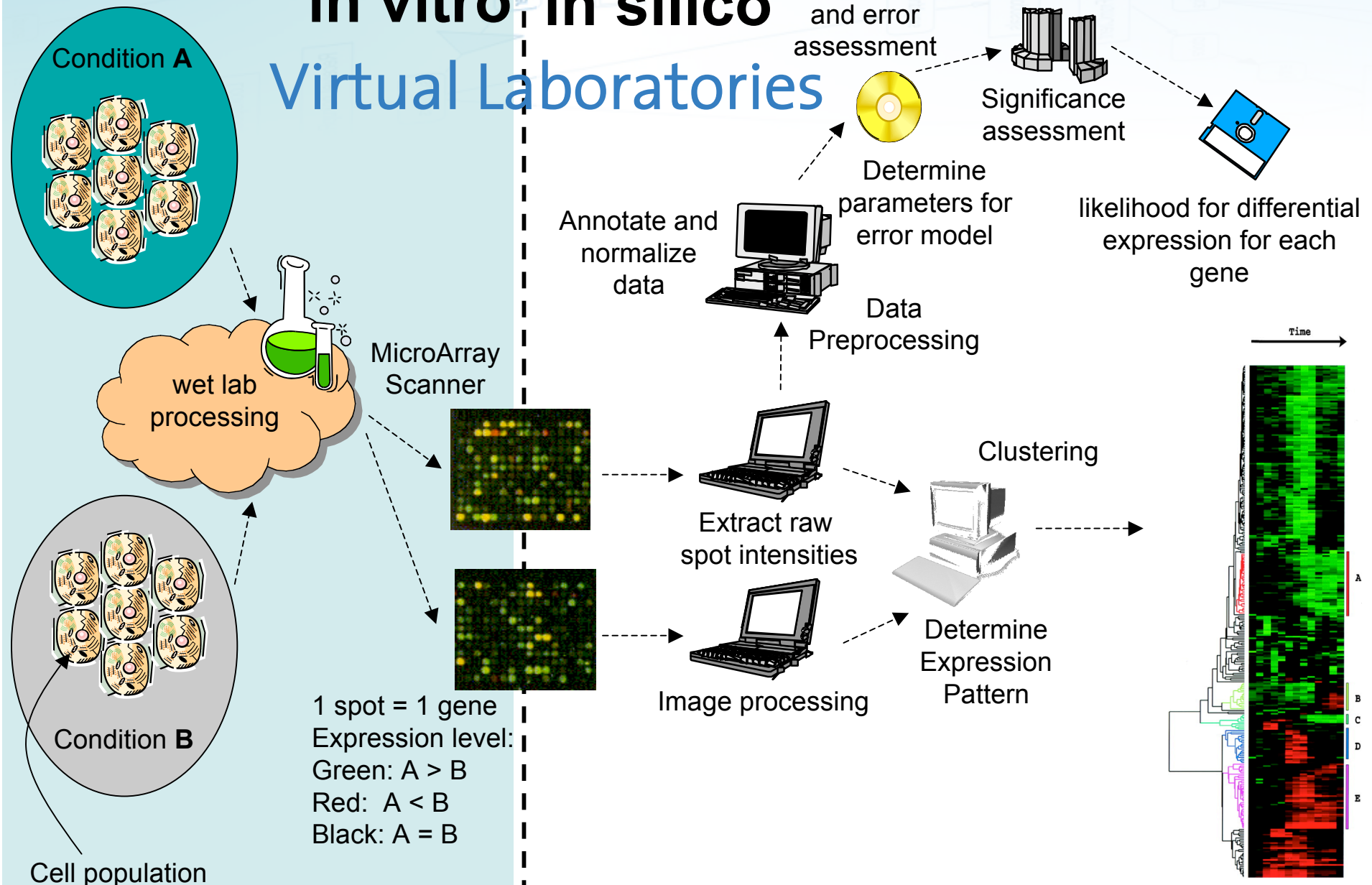
Department of Computer Science, ETH Zurich, Switzerland

pautasso@inf.ethz.ch – www.jopera.org



in vitro | in silico

Virtual Laboratories



How to build a virtual laboratory?

Copy & Paste
between different Websites

NCBI

Search Genome for [] Limits Index History

Caenorhabditis elegans
Caenorhabditis briggsae

BLAST homepage
BLAST overview
BLAST FAQs
BLAST news

BLAST against Caenorhabditis elegans / Caenorhabditis briggsae sequences

Compare your query sequence to DNA sequence or protein products.

Organism: Caenorhabditis elegans
Database: DNA sequence Program: blastn MegaBlast: ☒
Enter an accession, GI, or a sequence in FASTA format:



Server Services

- AIAI: Related peptide sequence
- Sequence Specification
- ASAS: Alerting of Structurally Ambivalent Sequences
- Run a DARWIN program
- Evolutionary Analysis
- FastaToDarwin
- Linear Classification
- MassSearch
- ParseEMBL
- PepPepSearch
- Phylogenetic Tree
- TreeGen
- Vertex Cover



Scalable Vector Graphics Plasmid Map

Plasmid Name: [] Size (in base pairs): []
Line Thickness: 0.5 Shape: ☒ Circular ☐ Linear Clear Input

Markers:

Start: [] Finish: [] ☒ Arrow on

Marker style: [] Fill color: Red Line Thickness: 12

Add to list

Enzymes:

Add enzyme in the proper order for correct positioning (I'll fix this bug in later release)

Name: [] Position: []

Add to list

How to build a virtual laboratory?

Copy & Paste

between different Websites

Programming

Java, C++, C#, Fortran...

(Shell) Scripts

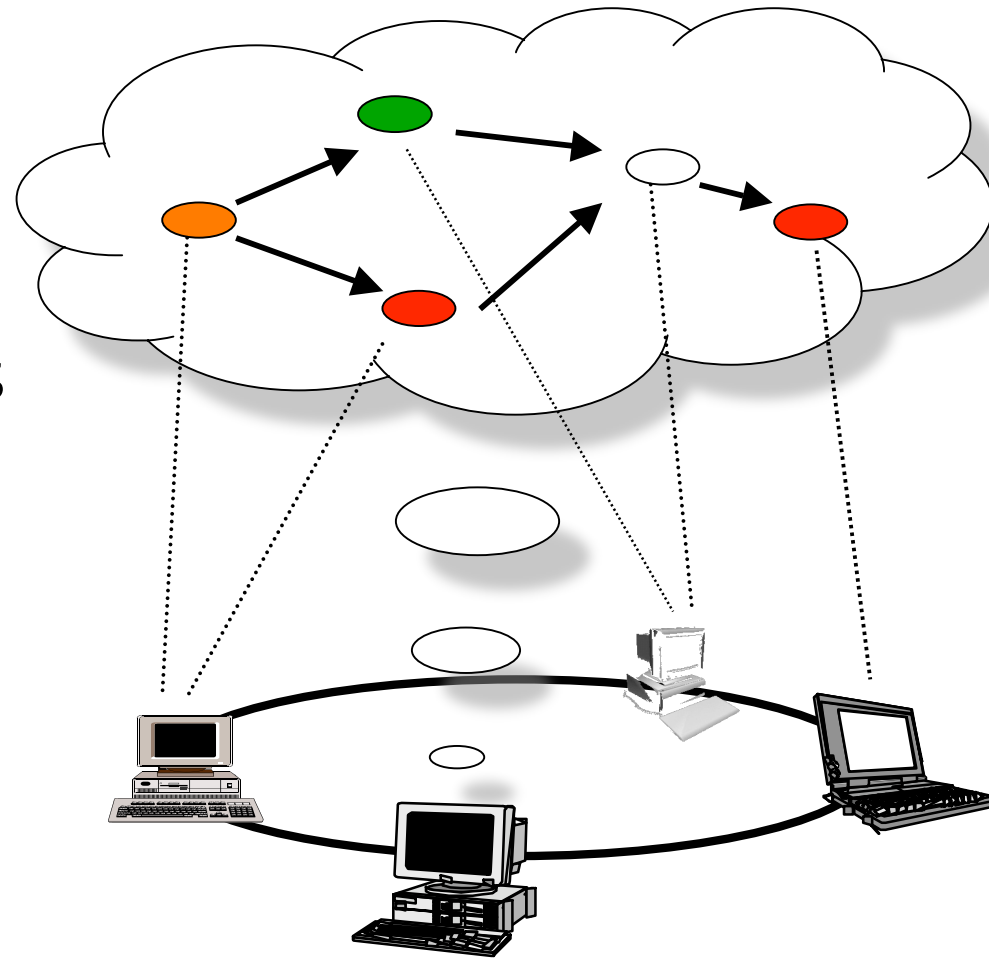
Tcsh, Bash, Makefiles,
Python, Perl...

Workflows

Graphical, Drag & Drop
and Connect Environments

Grid Workflows

- High level model of a distributed computation
- Glue Grid services together
- Deal with heterogeneous environment



About JOpera

- **Modeling** virtual experiments behavior
 - Flow-based **composition language** (Visual & XML)
 - Development and Debugging tools for Eclipse
 - Composition of heterogeneous services
- **Execution** of the virtual experiments
 - Distributed engine (on a cluster of computers)
 - Autonomic platform (self-healing, self-tuning)
 - Extensibility (Eclipse plug-ins to provide custom service publishing and invocation adapters)

Drag, Drop and Connect

JOpera Design - demo.oml - Eclipse SDK

125%

JOpera Mo...

JOpera Navigator

- demo
 - ws
 - demo.oml

Outline

- Processes (1)
 - Convert
 - Parameters (5)
 - country1 (xsd:string)
 - country (xsd:string)
 - symbol (xsd:string)
 - ConvertedPrice (String)
 - OriginalPrice (xsd:float)
 - Tasks (3)
 - getQuote
 - getRate
 - Multiply
 - Views (2)
 - Programs (1)

Overview

Overview | Process: Convert | ControlFlow | DataFlow

demo.oml

Problems | **Properties**

0 errors, 2 warnings, 0 infos (Filter matched 2 of 23)

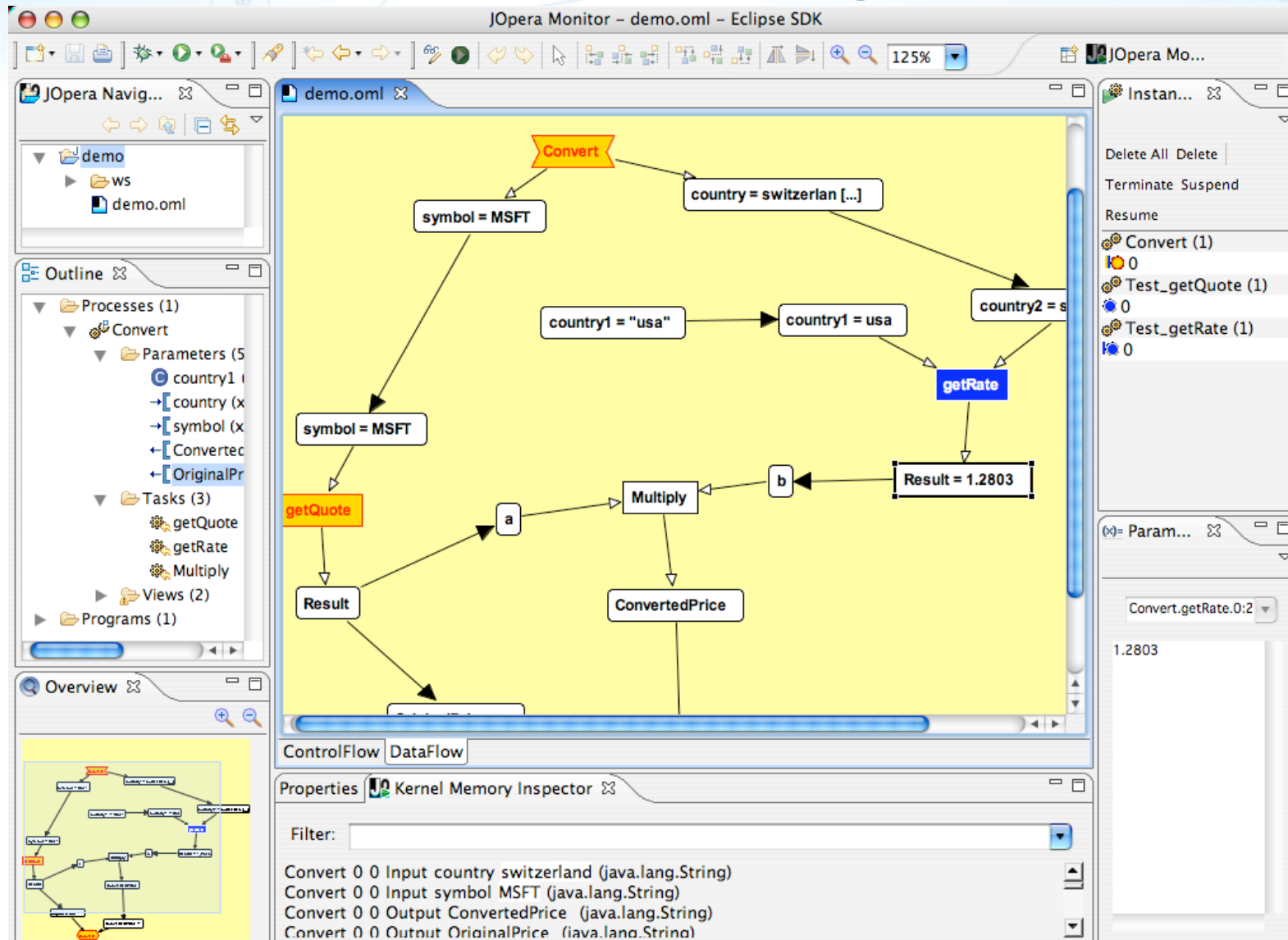
Description	Resource	In Fol
Outbox-Parameter "Convert"	demo.or	de
Process-Output-Parameter "	demo.or	de

JOpera Library

Search:

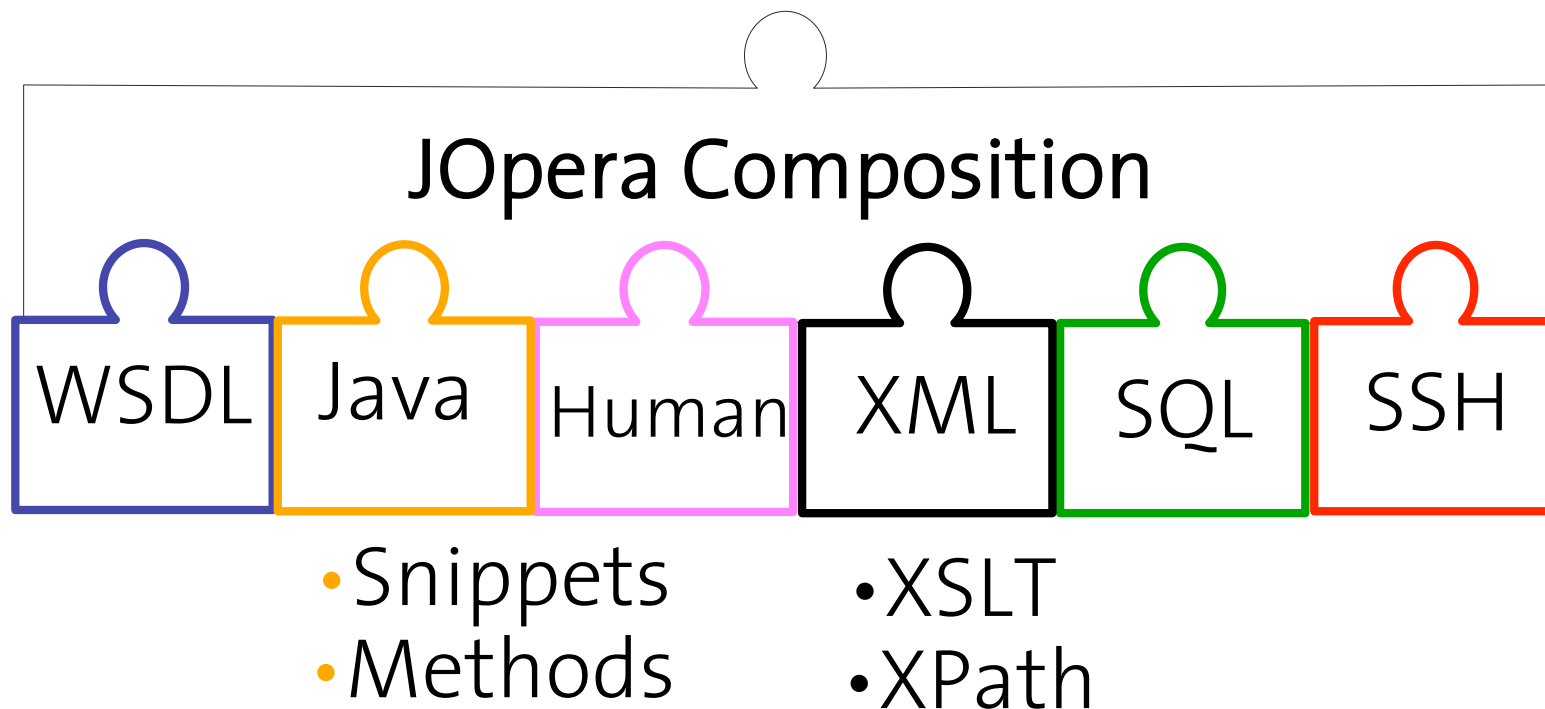
- Convert
- NewProgram
- ws.services.xmethods.net.soap.urnxmethodsdel...
- Test_getQuote
- getQuote

Run, Monitor, Steer and Debug



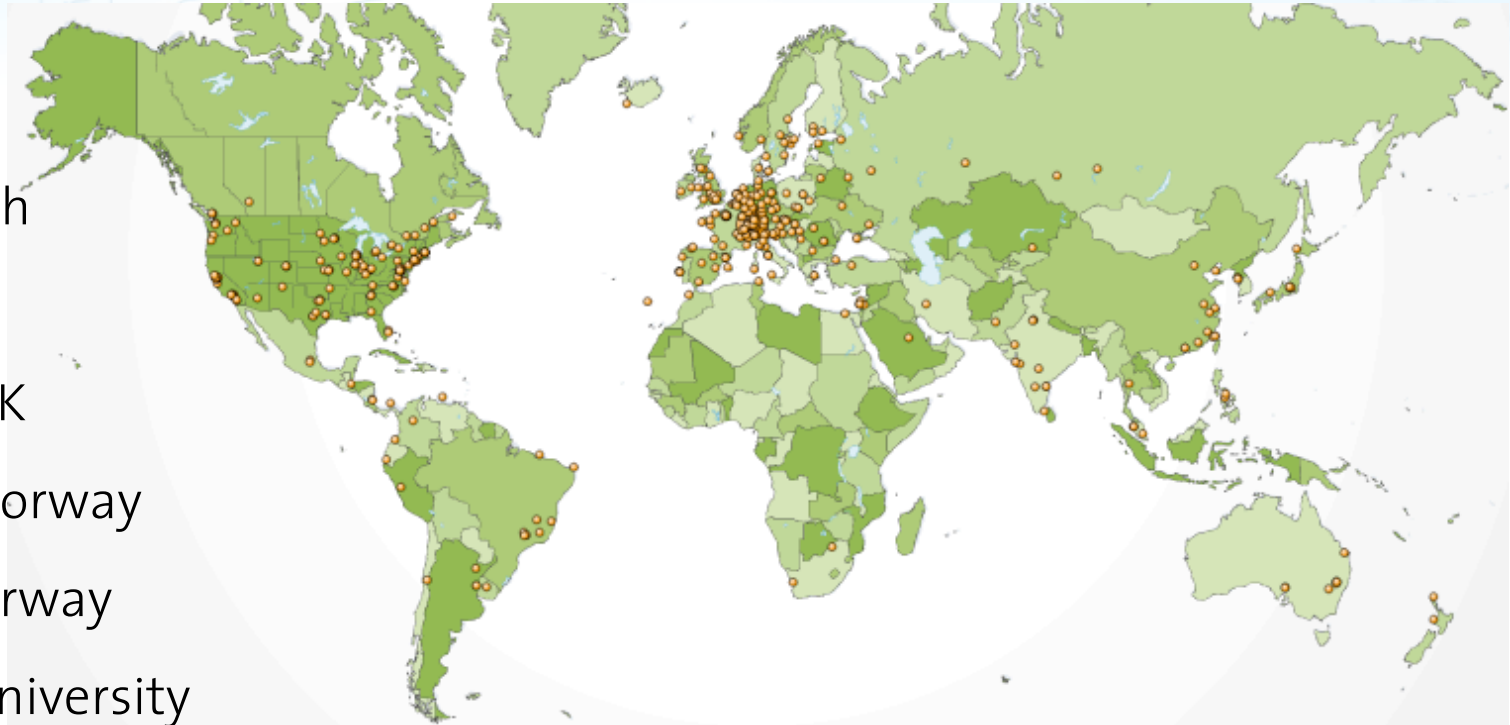
Dealing with heterogeneity in JOpera

- The JOpera composition language does not have to be changed when adding a new kind of service



A Growing User Community

- ETH Zurich
- NCSA
- Arjuna, UK
- SINTEF, Norway
- Locus, Norway
- Purdue University
- McGill University, Montreal
- Singapore Management University
- National University of Defence Technology, China

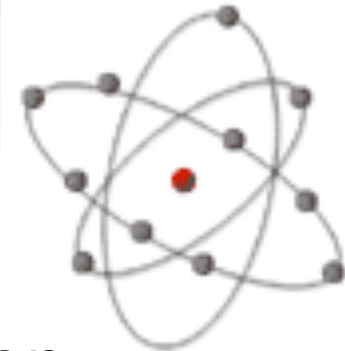


SODIUM

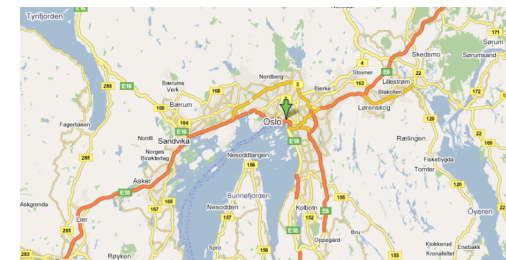
- Service Oriented Development in a Unified Framework
- EU IST-FP6 Project, 6 Partners
ETHZ, Switzerland
SINTEF, LOCUS, Norway
NKUA, ATC, Greece
MEDISYSTEMS, Romania

- UML Composition of Web, Grid and P2P Services
- Pilot applications in GIS, e-Health and emergency rescue services

Jopera
Process Support for Web Services



SODIUM



Climate Modeling on TERAGRID

- Continuous processing of satellite feeds for climate modeling and weather forecasting
- JOpera a key part of the infrastructure to glue together the data and analysis services into Grid workflows





Cyberinfrastructure for e-Science at the National Center for Supercomputing Applications

- Grid Workflows important part of the Service Oriented Grid middleware stack
- JOpera Pilot Application: porting the data flow based “Data 2 Knowledge” toolkit to Eclipse

Why users like JOpera

- **High Level Workflow Language**
 - Data and Control Aspects (Graphical Representation)
 - Recursion, Iteration, Parallelism and Pipelining Constructs
- **Open and Extensible Component Model**
 - Run existing code without changes
 - Synchronous, Asynchronous, Streaming interaction
 - Web services support (Axis, WSIF)
 - Secure access to remote file systems and hosts (SSH, SCP)
 - Easy to integrate with existing schedulers (Condor already supported)

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 - Easy to integrate with existing schedulers (Condor already supported)
- **Strong Eclipse Foundation**
 - Platform Independent (Eclipse/Java)
 - Flexible, Extensible, Modular and Embeddable

JOpera Roadmap



- Eclipse 3.2
- Standalone JOpera Server
 - Remote Monitoring Client
- Streaming Support
 - Pipelining over RSS feeds (or other data stream sources)
- Lineage Tracking Perspective
 - Data Provenance Queries over Process Execution History
- Axis2 Upgrade (WSS, WSR)

Cesare Pautasso Thomas Heinis Bioern Bioernstad Andreas Bur Fabian Pichler Patrick Moor Adrian Listyo Patrick Jayet Sandra Brockmann Christoph Schwank
Dennis Rietmann Dominique Schneider Markus Egli Michael Lorenzi Christian Rupp Markus Haller Axel Wathne Antonio Caliano Oliver Deak
Reto Schaeppi Nicholas Born Philip Frey Claus Hagen Win Bausch Gustavo Alonso

Thank you for your feedback:
www.jopera.org

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