Workflow Job Manager for NCCP

by Ivan Gibbs, Eric Fritzinger, Sergiu M. Dascalu, Frederick C. Harris, Jr., and Yantao Shen

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Overview

1. Project Background
2. Research
3. Software Model
4. Prototype and Comparison to Other Tools
5. Conclusion

Project Background

Project Background

NCCP is a work by several people involved in the 2008-2013 NSF EPSCoR project.

Figure: NCCP homepage

Project Background

Modeling and Simulation–Use of models to assist in making decisions. Includes things such as :

- financial forcasting
- bridge models
- flight simulators

Project Background

Eric Fritzinger and Demeter–for data processing and coupling of scientific models.

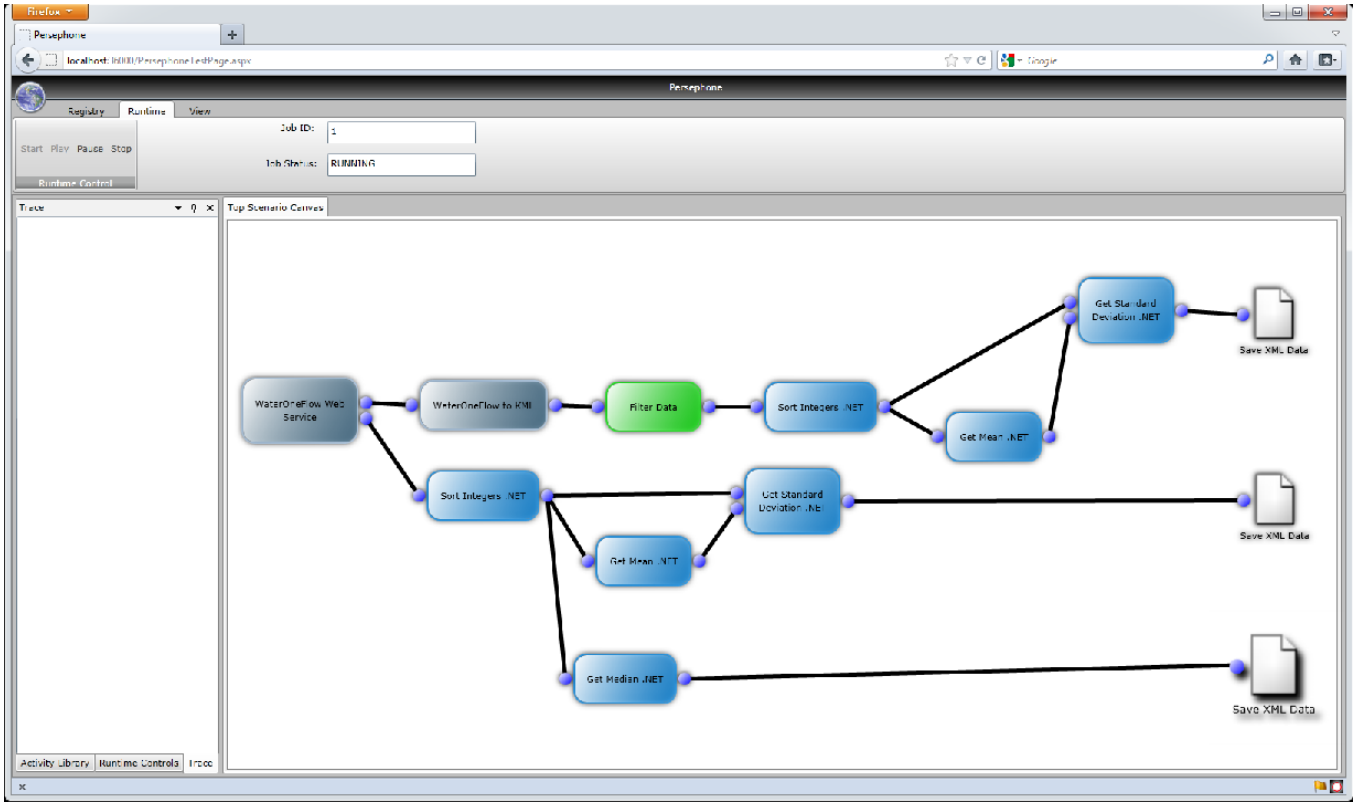

Figure: Persephone

Research

Service Oriented Architecture (SOA)

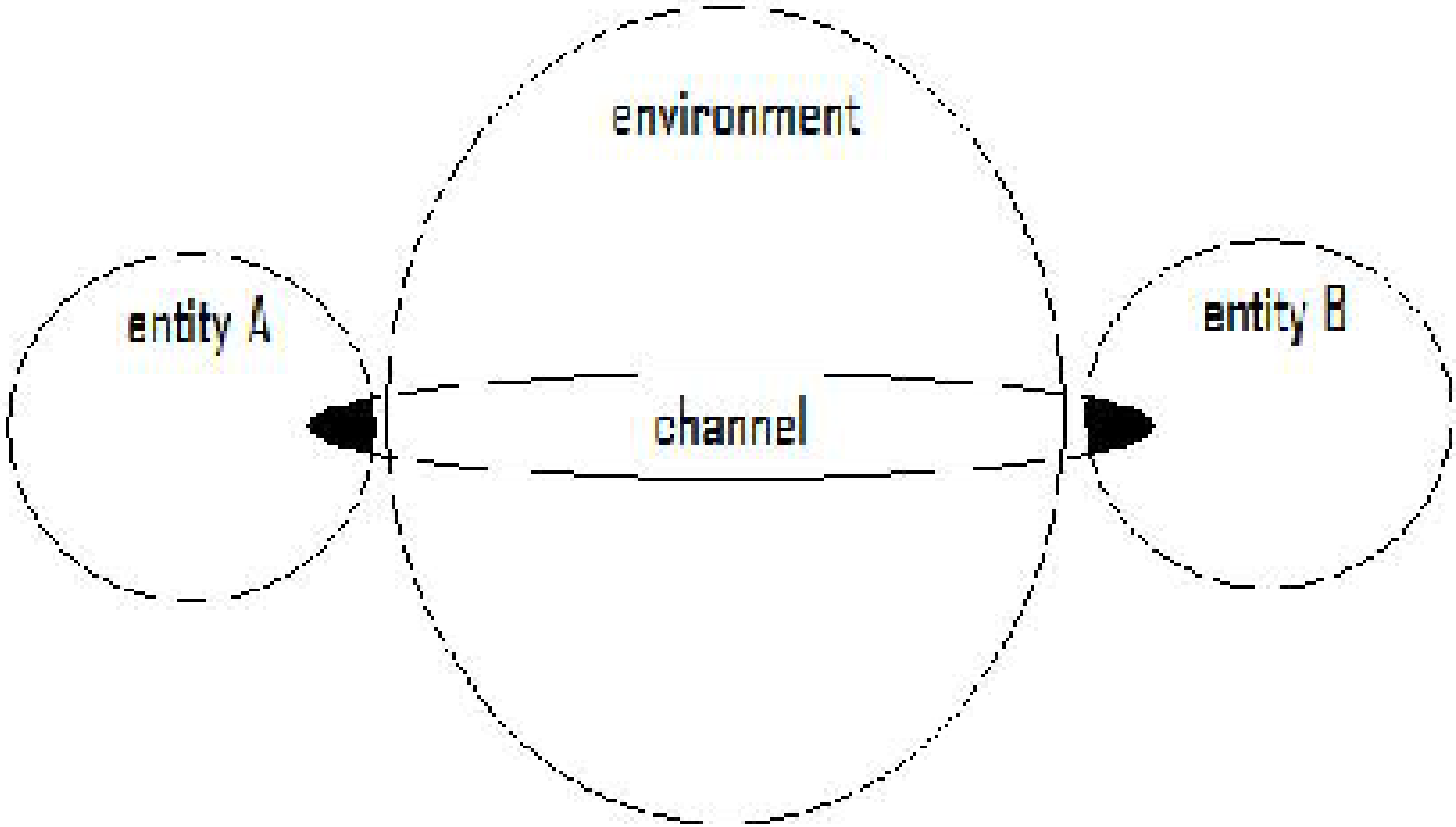

Figure: SOA diagram

Research

Web services

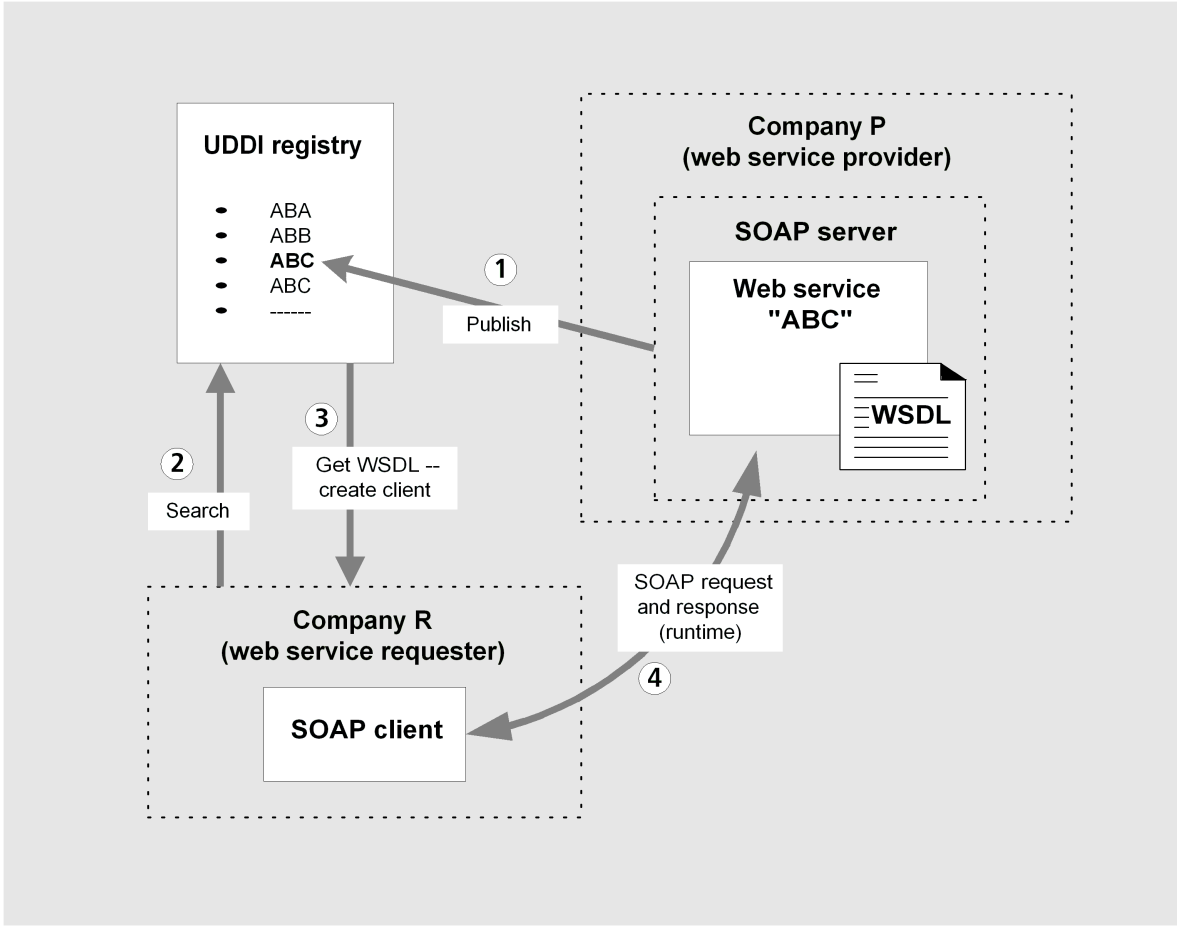

Figure: Web Services using WSDL and UDDI [1]

Research

Interoperability allows software to work together.
Some interoperability enabling standards for SOA are:

1. Common Object Request Broker Architecture (CORBA)
2. Java Platform Enterprise Edition (J2EE)
3. Distributed Component Object Model (DCOM)
4. Remote Method Invocation (RMI)
5. SOAP

Research

Scientific model interoperability through:

1. direct software implementation,
2. data interoperability standards.
   - Model Coupling Toolkit (MCT)
   - Earth System Modeling Framework (ESMF)
   - Common Component Architecture (CCA)
   - OASIS
   - and others

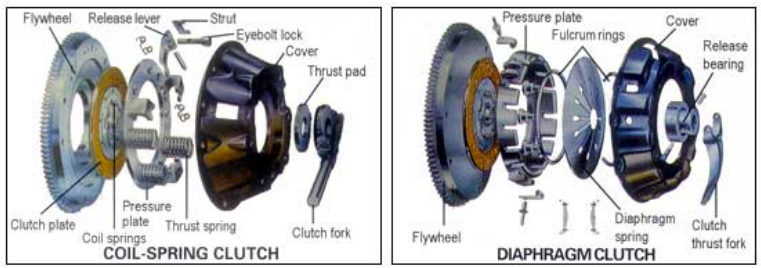

Figure: Clutch of a car[2]

Motivation

1. World Wide Web (WWW) enables more collaboration.
2. combine individual models for larger simulations
3. distributed computing offers low cost computer resources

The Software Model

Table: Functional Requirements

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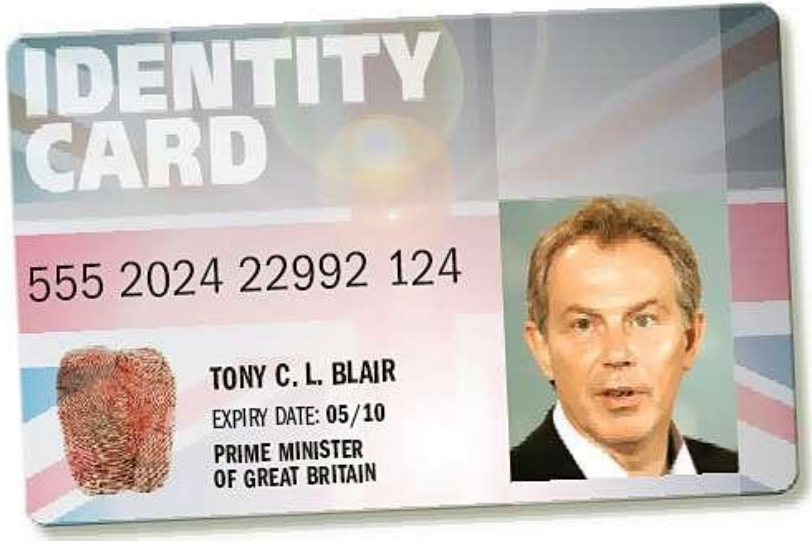
R6	The job manager must provide an ID for each job.



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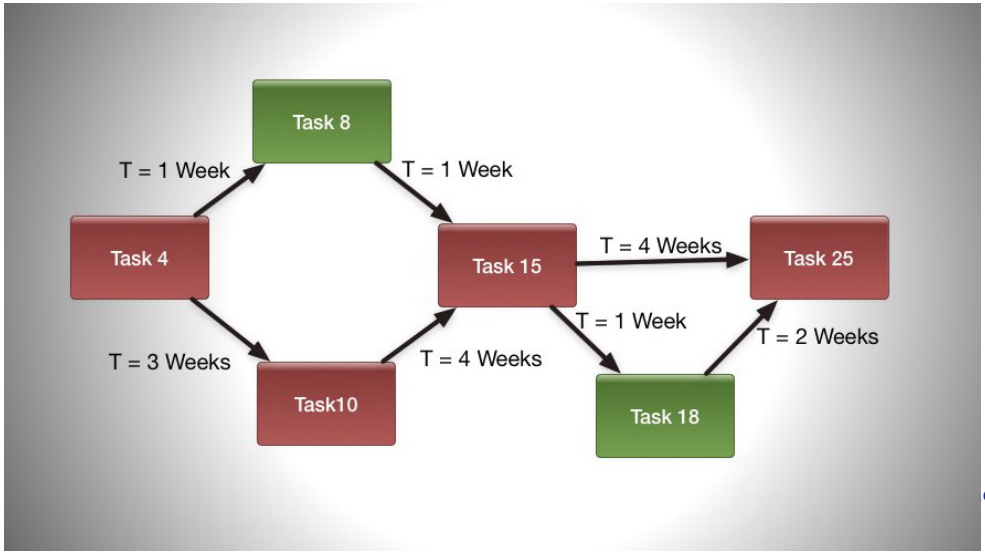
R8	The job manager must allow the user to visualize a job's execution.



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R7	The job manager must provide the current state of a job.
R8	The job manager must allow the user to visualize a job's execution.
R9	The job manager must allow the user to see all of their jobs.
R10	The job manager must allow multiple users to view a job concurrently.

The Software Model

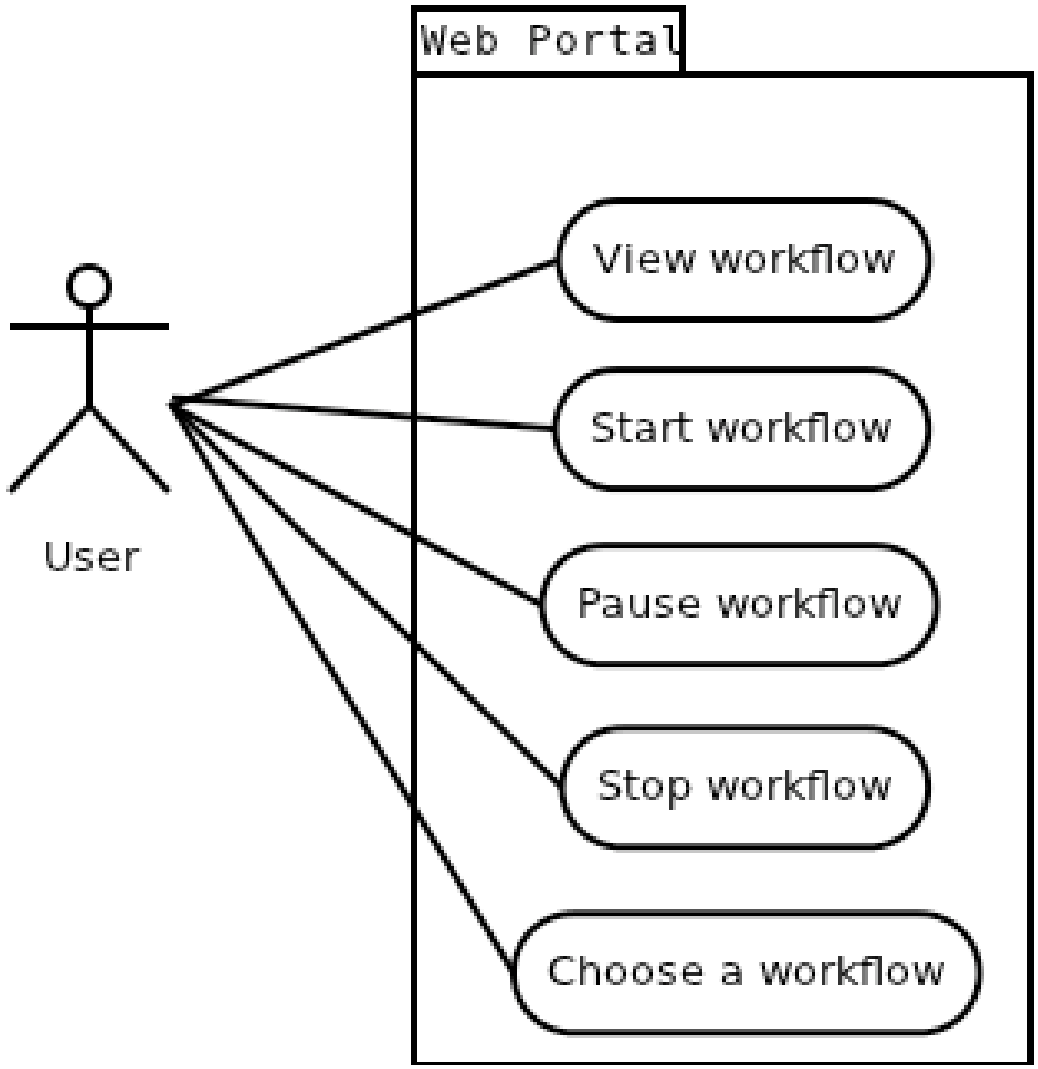
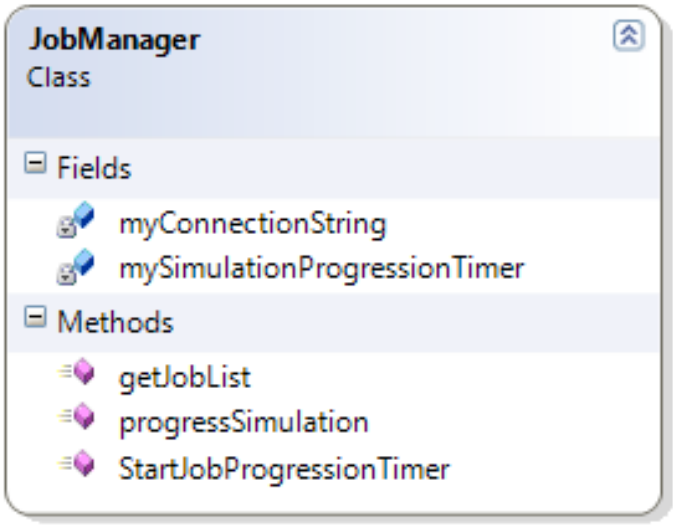


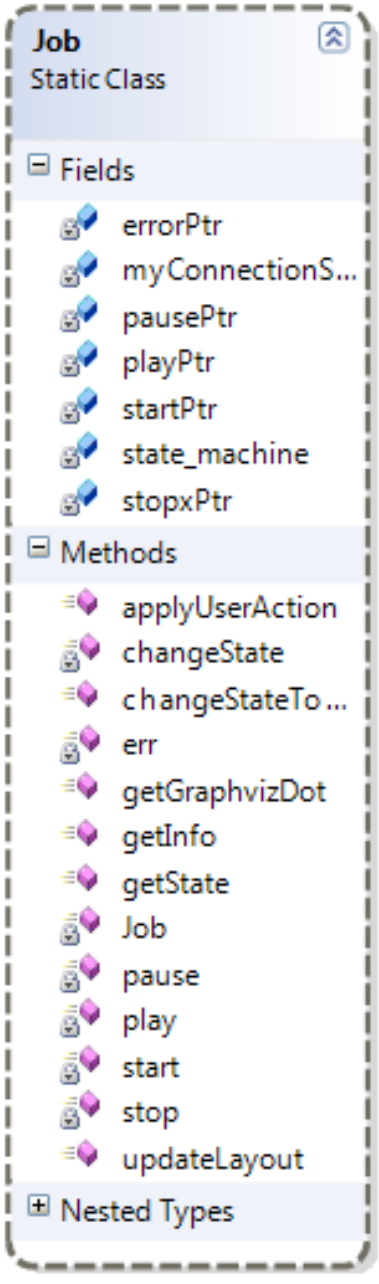
Figure: Use case diagram

The Software Model

Figure: Silverlight web application diagram

The Software Model





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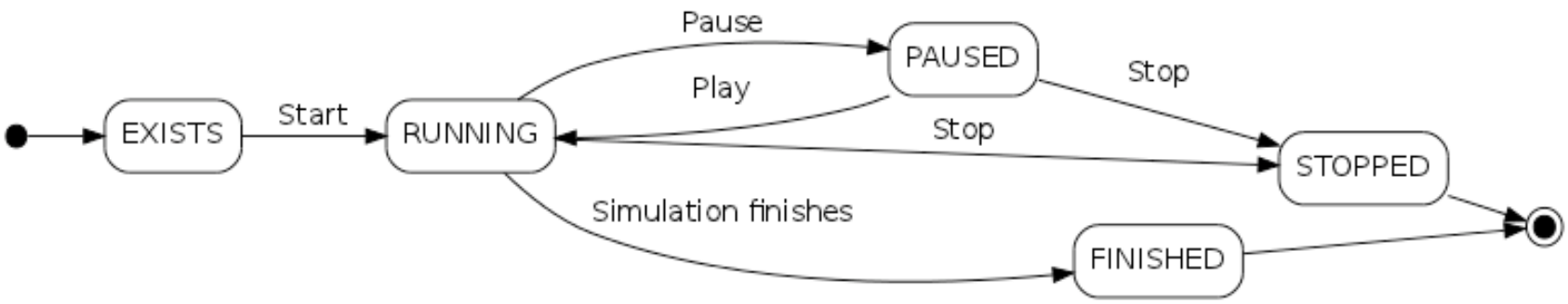

Figure: Workflow State Machine diagram

Prototype

- JobManager.swf
  - illustration of Job Manager client app
- Demeter_Stop.swf
  - Job Manager running in full size browser client: simulation is stopped
- Demeter_Finish.swf
  - Job Manager running in full size browser client: finishes simulation

Comparison to Other Tools

The Trident Workbench job manager.
http://www.youtube.com/watch?v=BZMjqVgJiIo (1:00 and 2:00 - 3:00)

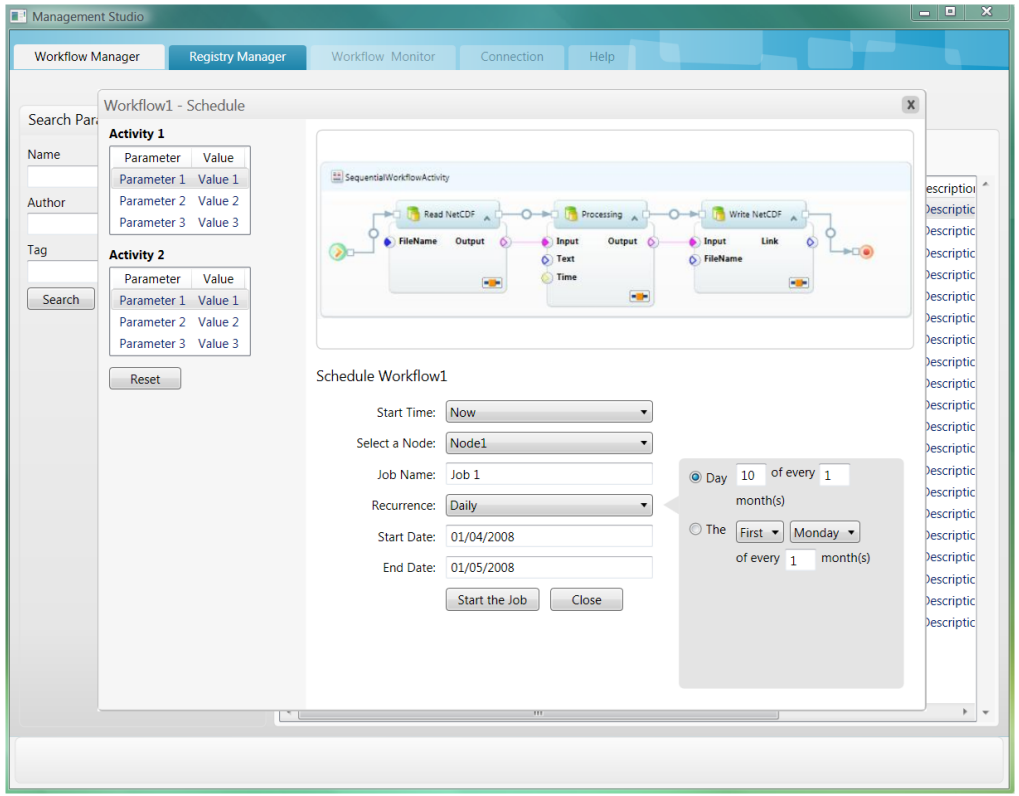

Figure: Trident workflow manager[3]

Comparison to Other Tools

The RealFlow job manager.

- uses esoteric language (job note, IDOC, etc.)
- IDOC - Independent Domain Of Computation
- http://www.youtube.com/watch?v=-1pnD5w7kz8

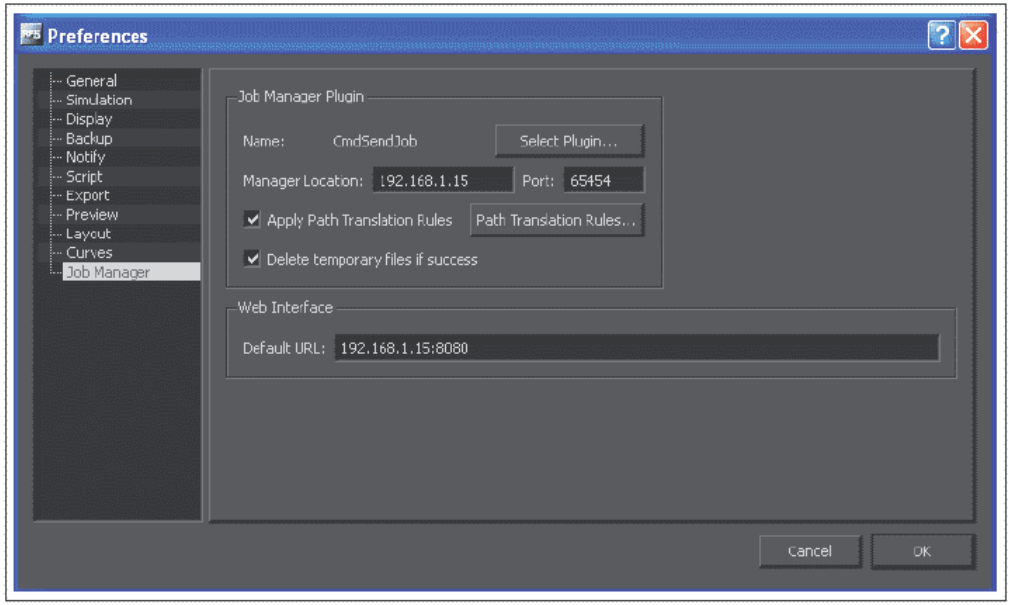

Figure: RealFlow Job Manager Preferences[4]

Comparison to Other Tools

The HPC job manager.

- all text interface

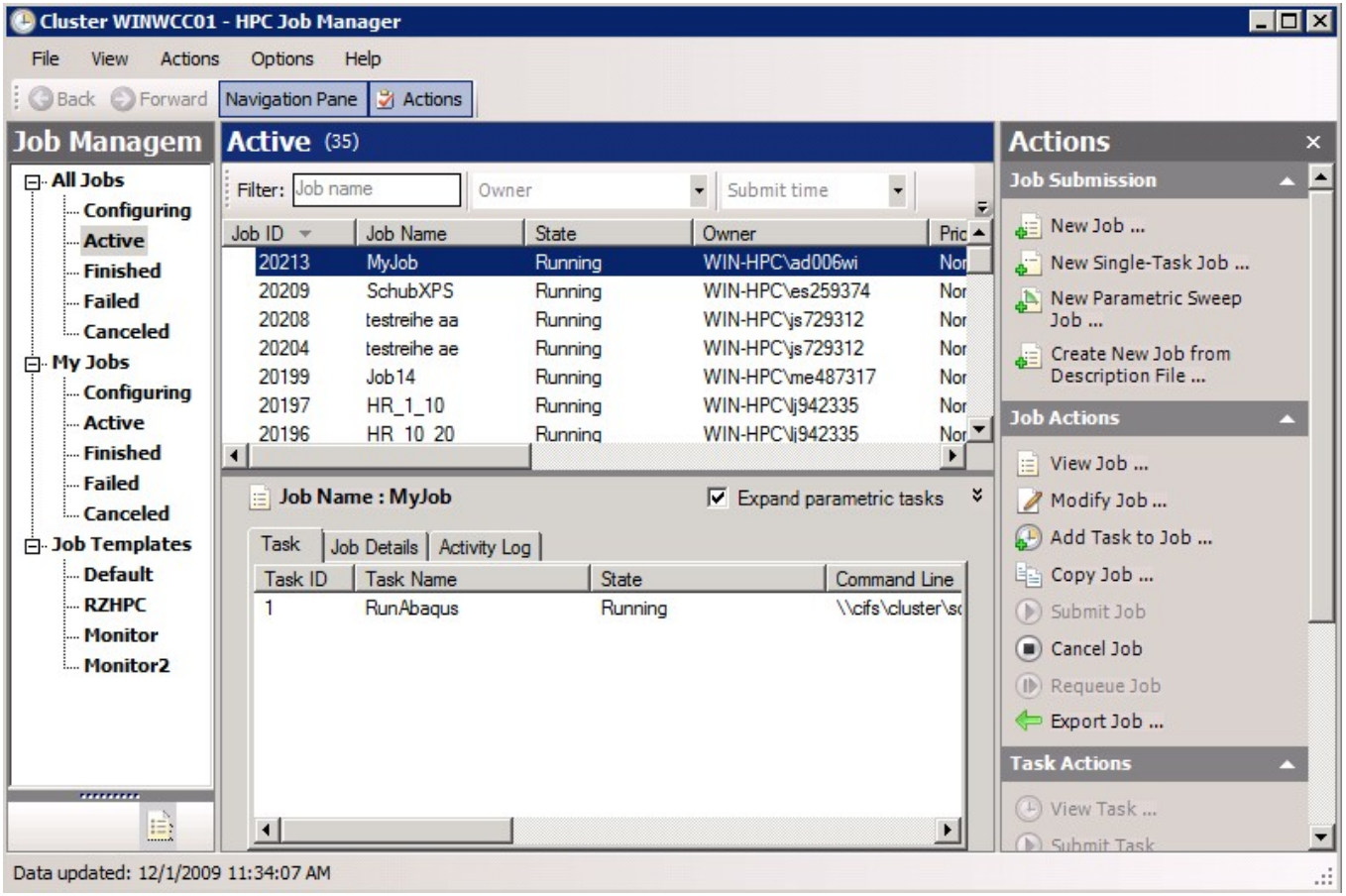

Figure: HPC Job Manager[5]

Comparison to Other Tools

The Taverna job manager.

- all text interface

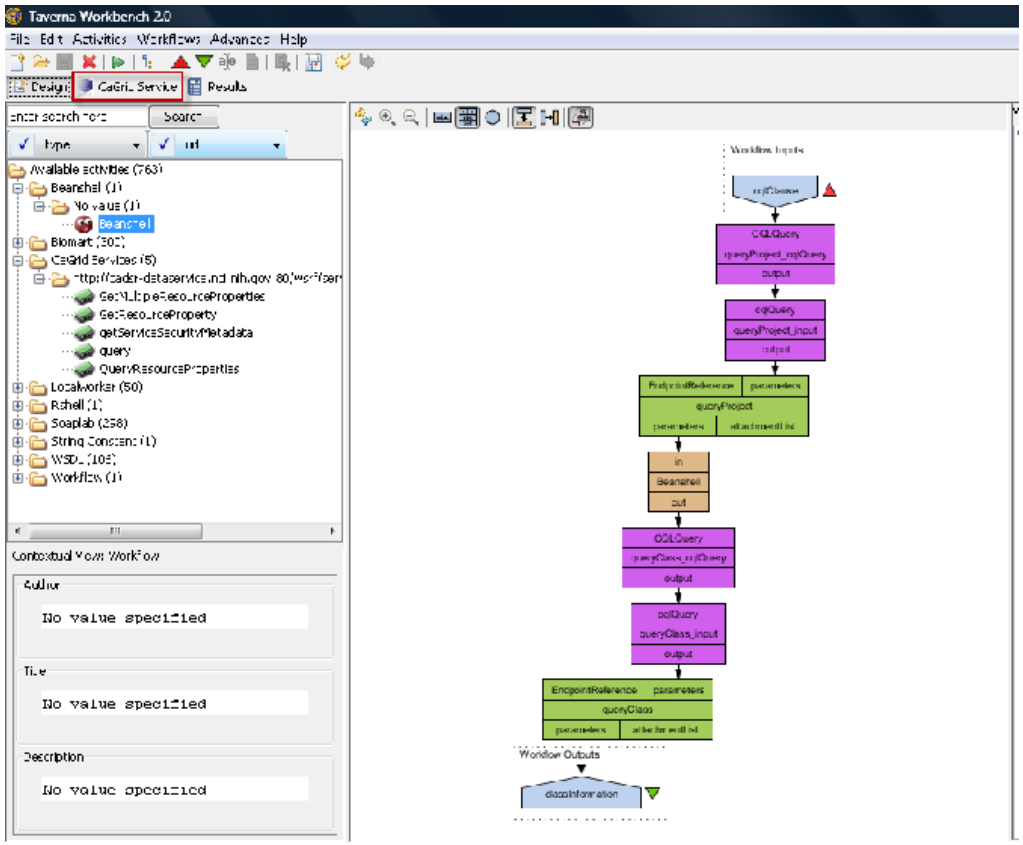

Figure: Taverna Job Manager[6]

Comparison to Other Tools

- Condor-G: gives access to multi-domain resources
- DAGMan: manages dependencies between jobs for Condor
- Globus: to build Grids for distributed computing

Table: Comparison of Technical Aspects

Software	GUI	Platforms	Condor-G	DAGMan	Globus	GraphViz
Trident Workbench	stand-alone web portal	W/M/L	N	N	N	N
RealFlow Job Mgmt		W/M/L	N	N	N	N
Natural Organic	web portal	W	N	N	N	N
HPC Job Mgr.		W/M/L	Y	Y	Y	N
Kepler	stand-alone	W/M/L	N	N	Y	N
Taverna Workbench	JRE client cmd line	JRE	N	N	Y	Y
Pegasus	stand-alone Java webstart	W/M/L Web	Y	Y	Y	N
NCCP	web portal	W/M	N	N	N	Y

Comparison to Other Tools

Table: Comparison of Functional Aspects

Software	pause/ resume/ stop	monitor execution via web	distribute execution
Trident Workbench	Y	Y	Y
RealFlow Job Mgmt	Y	Y	Y
Natural Organic	N	Y	Y
HPC Job Mgr.	Y	Y	Y
Kepler	Y	Y	Y
Taverna Workbench	Y	Y	Y
Pegasus	N	Y	Y
NCCP	Y	Y	Y

Conclusions

- offered a job management interface as a web service
- satisfied functional requirements
- implemented functions compare well with other applications

Contributions

- Job Manager presents a depiction of simulation progress with a dynamic graph

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- uses separation of concerns through a state-transition matrix to guard for concurrency

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- user friendly interface for small devices
- built an integrated interface for NCCP
- extensible interface for Demeter

Acknowledgements

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