



e-Framework Service Usage Model Name

- Name: Modelling and Simulation for e-Social Science (MoSeS) Service Usage Model

Version

- 1.02

Version History

Version	Date	Author	Description	Organization / Project
1.02	Nov 2008	M. Argüello Casteleiro	Initial Draft	NCeSS, University of Manchester
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Rationale

The SUM presented here has a specific focus on Modelling and Simulation in an e-Social Science context and introduces MoSeS.

MoSeS (Modelling and Simulation for e-Social Science) makes use of Grid Computing capabilities and allows exploring the practicality of developing real urban simulations which are calibrated using widespread social and behavioural data.

Although the use of Grid technologies is currently not common within social science research, many social scientists today want to investigate complex research questions, and therefore, MoSeS probes the benefit of applying e-Science techniques to develop a national demographic model and simulation of the UK population.

Classification¹

<i>To be provided by the submitter:</i>				
SUM Type	<input checked="" type="checkbox"/> Domain	<input type="checkbox"/> CORE (a commonly recurring SUM; designation requires e-Framework Integrity Group approval)		
Domain(s)	<input type="checkbox"/> Learning & Teaching	<input checked="" type="checkbox"/> Research <input type="checkbox"/> Libraries	<input type="checkbox"/> Administration <input type="checkbox"/> IT Services	<input type="checkbox"/> Common
Maturity	<input type="checkbox"/> Immature	<input type="checkbox"/> Mature		
Purpose(s)	<input type="checkbox"/> Exemplar	<input checked="" type="checkbox"/> Application	<input type="checkbox"/> Modelling	<input type="checkbox"/> Toolkit
XOR (exclusive "or")	<input checked="" type="checkbox"/> Service Genres	<input type="checkbox"/> Service Expressions		
Development Status	<input type="checkbox"/> Proposed	<input type="checkbox"/> Developmental	<input type="checkbox"/> Prototype	<input type="checkbox"/> Production
Deployment Scale	<input type="checkbox"/> Isolated <input type="checkbox"/> Ubiquitous			
State Behaviour	<input type="checkbox"/> Stateful <input type="checkbox"/> Stateless			

¹ See definitions of the Service Usage Model Classification Scheme categories and their allowable choices at: <http://www.e-framework.org/Services/ServiceClassificationScheme/ClassificationSchemeForSUMs/tabid/817/Default.aspx>

Transactional Behaviour	<input type="checkbox"/> Transactional and ACID	<input type="checkbox"/> Transactional but Non ACID	<input type="checkbox"/> Non-Transactional
Batch Behaviour(s)	<input type="checkbox"/> Individual	<input type="checkbox"/> Batch	
Time-Constraint Behaviour	<input type="checkbox"/> Hard Real Time	<input type="checkbox"/> Soft Real Time	<input type="checkbox"/> None
Service End Point	<input type="checkbox"/> Provider	<input type="checkbox"/> Requestor	<input type="checkbox"/> Transcoder (both requests and provides)
Authentication/ Authorization Dependency	<input type="checkbox"/> Auth-Dependent	<input type="checkbox"/> Auth-Independent	
Protocol Binding(s) (only applies to service expression-based SUMs)	<input type="checkbox"/> Web Service <input type="checkbox"/> SOAP	<input type="checkbox"/> REST <input type="checkbox"/> HTTP	<input type="checkbox"/> Other
To be determined by the e-Framework:			
Status	<input type="checkbox"/> Approved	<input type="checkbox"/> Placeholder <input type="checkbox"/> Unapproved	<input type="checkbox"/> Superseded <input type="checkbox"/> Withdrawn
Confidence Level	<input type="checkbox"/> High	<input type="checkbox"/> Medium	<input type="checkbox"/> Low

Description

MoSeS seeks to demonstrate the applicability of grid-enabled modelling and simulation tools within a variety of substantive research and policy environments. Application domains selected comprise health, business and transport, to demonstrate policy impacts and the value-added through simulation.

MoSeS aims to use e-Science techniques to develop a national demographic model and simulation of the UK population, specified at the level of individuals and households, stretching thirty years into the future.

MoSeS provides a generic framework through which grid-enabled modelling and simulation might be exploited within any problem domain; and to encourage the creation of a community of social scientists and policy users with a share interest in modelling and simulation for e-social science problems.

Business Process Modelling

MoSeS business processes identified [1, 2, 3, 8] are the following:

1. Authentication and Authorization (*security is omnipresent*)

The access control mechanisms provided by this architecture were provided through the authentication and authorisation mechanisms employed by both the JSR-168 compliant portlet container (in the case of earlier demonstrators, Gridsphere) and the SRB installation. Security is very important for MoSeS as it incorporates confidential data (health and census data).

2. Set up/ Initialisation

This is a first run which comprises a reconstructed population for 2001 at an individual and household level and 30 snapshots of a dynamical model output, one for each year up to 2031 also at an individual and household level.

3. Generate / Adapt / Re-use demographic data

New reconstructed populations for 2001 can be generated by specifying a different random seed for the optimisation, or by modifying the optimisation so that it uses a different optimisation function or set of control constraints. If the control constraints are kept the same, or relaxed then a previous result can be used as an initial solution in the optimisation.

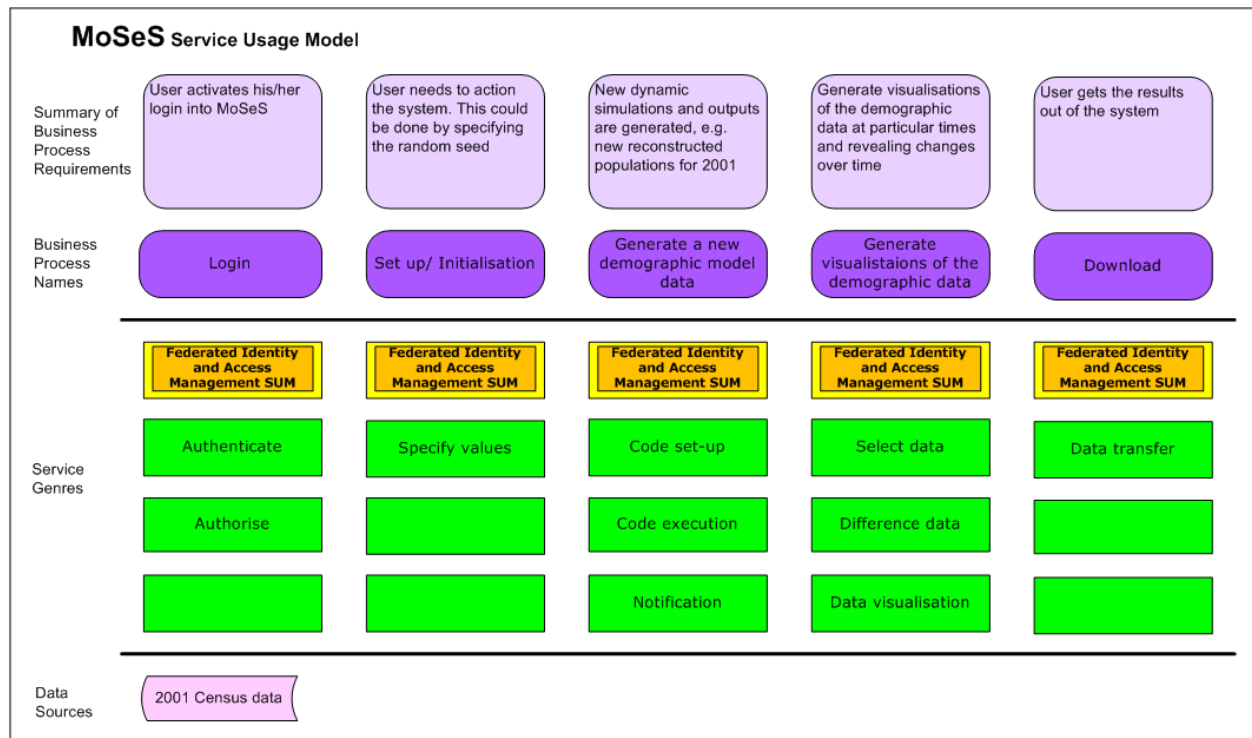
New dynamic simulations and outputs can be generated by modifying random seeds, or modifying probabilities used in the simulation (e.g. age specific death rates).

4. Visualizations of the demographic data

Generate visualisations of the demographic data at particular times and revealing changes over time. For many applications it is good to be able to show trend and extreme results from a number of different runs of the dynamic simulation.

Visualisation of results is in part achieved through interactions with third party mapping software (specifically, Google Maps).

SUM Diagram



Visio® template for SUM diagram, revised 20070822
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Fig. 1 - MoSeS SUM diagram from [8]

Usage Scenarios [optional]

Research question: Linus is a geographer who is currently collaborating with a Primary Care Trust health and a social care analyst. They want to produce a report containing a map of current and forecast change in limiting long term illness distribution in Leeds at a health area level.

1. Login

Linus activates his login into MoSeS

2. Set-up / Initialisation

Linus needs to action MoSeS. This can be done by specifying the random seed

3. Generate a new demographic model data

New dynamic simulations and outputs are generated, e.g. new reconstructed populations for 2001

4. Generate visualisations of the demographic data

Generate visualisations of the demographic data at particular times and revealing changes over time

5. Access stored demographic models generated / Download

Linus can re-use or adapt the results and even download

Functionality

MoSeS functionality identified [1, 2, 3, 8] is the following:

- **Authentication and Authorization** (*security is omnipresent*)
- **Computationally intensive demographic and forecasting modelling** – It is related to parallel processing on the Grid
 - MoSeS forecasting module
 - MoSeS demographic module
- **Virtualised storage resources brokered** – It is related to Storage Resource Broker (SRB) Cluster
 - MoSeS archive store
 - MoSeS forecasting store
 - MoSeS virtual population
- **Collection of portlets that formed the user interface to the project** – e.g the ones related to visualise the results of simulation runs
 - MoSeS Archiving portlet
 - MoSeS Mapping portlet
 - MoSeS Charting portlet
 - MoSeS Analysis portlet
 - MoSeS Selection portlet

Structure & Arrangement

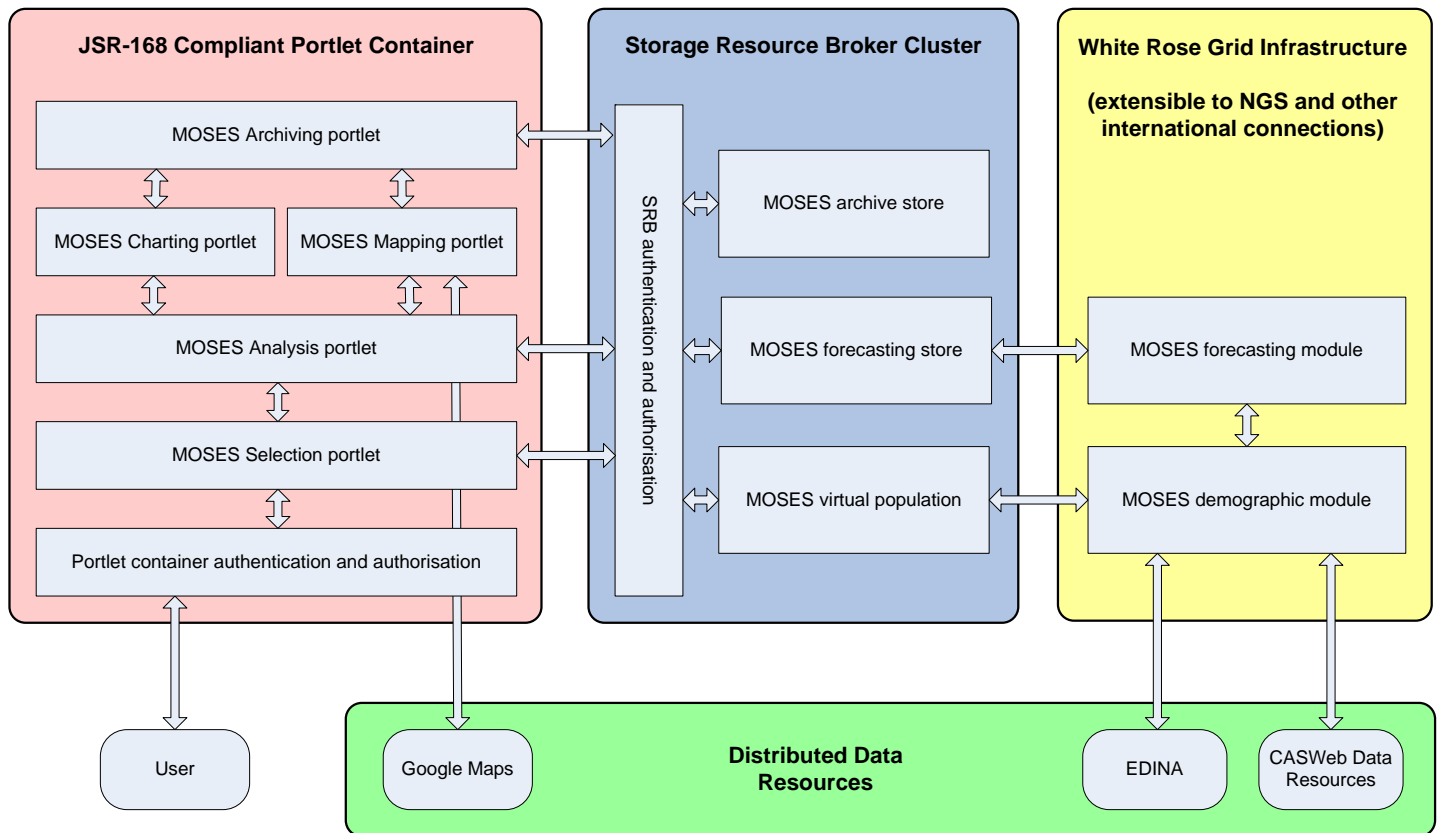


Fig. 2 - MoSeS architecture from [3]

From [3]:

There were three major components to this architecture; computationally intensive demographic and forecasting modelling, virtualised storage resources brokered through the use of a Storage Resource Broker (SRB) [4] cluster, and the collection of JSR-168 [5] compliant portlets that formed the user interface to the project. This architecture was designed to take into account the distributed and decentralised nature of e-Science research; for example, data resources are distributed both spatially and across organisational boundaries, and the computational requirements of the MoSeS forecasting and demographic modules are handled through parallel processing on the White Rose Grid [6] and the UK National Grid Service [7].

Data Sources Used

- EDINA (2001 Census data)
- CASWeb Data Resources

Related Data Sources UsedSUMs [optional]

- **Identity and Access Management (IAM)** available at *Service Usage Models Registry* <http://www.e-framework.org/Contributions/ServiceUsageModels/tabid/665/Default.aspx>

Services Used

List of Service Genres used

- Authenticate [it appears in the list of e-framework Service Genres – 9 May 08]
- Authorise [it appears in the list of e-framework Service Genres – 9 May 08]
- Specify values
- Code set-up
- Code execution
- Notification
- Select data
- Difference data
- Data visualisation
- Data transfer

References

This document takes into account existing material, such as conference and journal papers. The most relevant sources are the following:

- [1] M. Birkin, A. Turner, B. Wu (2006), *A Synthetic Demographic Model of the UK Population: Methods, Progress and Problems*, Proceedings of the 2nd International Conference on e-Social Science, Manchester
- [2] P. Townend, J. Xu, M. Birkin, A. Turner, and B. Wu (2007), *Modelling and Simulation for e-Social Science: Current Progress*, UK e-Science All Hands Meeting, Nottingham, available at <http://www.allhands.org.uk/2007/proceedings/papers/889.pdf>
- [3] P. Townend, J. Xu, Jie, M. Birkin, A. Turner, and B. Wu (2008), *Modelling and Simulation for e-Social Science Through the Use of Service-Oriented and Web 2.0 Technologies*, Proceedings of the 4th International Conference on e-Social Science, Manchester
- [4] Rajasekar, A., Wan, M., Moore, R., Schroeder, W., Kremenek, G., Jagatheesan, A., Cowart, C., Zhu, B., Chen, S.-Y., Olschanowsky, R. (2003): *Storage Resource Broker—Managing Distributed Data in a Grid*, Computer Society of India Journal, Special Issue on SAN 33, No. 4, 42–54
- [5] JSR 168: Portlet Specification, <http://jcp.org/en/jsr/detail?id=168>
- [6] Dew, P.M, Schmidt, J.G., Thompson, M., Morris, P. (2003): *The White Rose Grid: Practice and Experience*, in Proc. UK e-Science 2nd All-Hands Meeting, Simon J. Cox Eds, Nottingham Conference Center, U.K., ISBN 1-904425-11-9.
- [7] The UK National Grid Service website, <http://www.ngs.ac.uk>
- [8] M. Argüello, P. Ekin, A. Turner, S. Peters, P. Townend, M. Fraser, P. Halfpenny, R. Procter, A. Voss, and M. Jirotko: Highlighting e-Infrastructure patterns in Grid-based e-Social Science applications. Accepted for Regular Session at UK e-Science All Hands Meeting 2008 (AHM 2008), Edinburgh, UK, September 2008



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Submitting the Service Usage Model Description

For additional guidance in preparing the Service Usage Model description, refer to [Guidelines for Submitting a Service Usage Model to the e-Framework](#)² and the technical definitions of the [Service Usage Model Description Elements](#).³ For further assistance, contact the e-Framework editor at: editor@e-framework.org

Prior to submitting the description, please read the e-Framework [Intellectual Property Rights statement](#).⁴ Also add your information to the copyright statements in the footer of this template.

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When you have completed the Service Usage Model description, go to the [Submit SUMs](#)⁶ page at www.e-framework.org. Click on “Upload your submission” and follow the directions.

² Guidance for using this template: <http://www.e-framework.org/SUMs/SubmitSUMs/tabid/715/Default.aspx>

³ Service Usage Model Element Definitions: <http://www.e-framework.org/Services/SUM/SUMElements/tabid/745/Default.aspx>

⁴ Intellectual Property Rights Statement: <http://www.e-framework.org/About/Policies/tabid/611/Default.aspx>

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⁶ Submit Service Usage Model template: <http://www.e-framework.org/SUMs/SubmitSUMs/tabid/715/Default.aspx>