



Version & Status	Date	Author	Current affiliation	Project
V 1.8 Initial Draft	June 2008	M. Argüello Casteleiro	ESRC National Centre for e-Social Science (NCeSS), University of Manchester, UK	JISC-funded e-Infrastructure Use Cases and Service Usage Models (eIUS)
		Andy Turner	Centre for Computational Geography (CCG), University of Leeds, UK	Modelling and Simulation for e-Social Science (MoSeS)
		Pascal Ekin	ESRC National Centre for e-Social Science (NCeSS), University of Manchester, UK	Grid Enabling MIMAS Services (GEMS I & II) Grid Enabled Microeconomic Data Analysis (GEMEDA)

Linus is a geographer that has been researching, modelling, and developing proof-of-concept *Spatial Decision Support Systems* for about 10 years. He is interested in how information technology can support decision making in a geographical context.

Linus is driven by research questions; he reads to gain awareness of developments; is keen to collaborate with other researchers; actively contributes to projects; and is co-author of papers related to modelling societies and their behaviour.

Linus' research involves data integration (bringing together various types of data sources), visualisation (data and information presentation), and the use of high end computational resources to achieve this. Although, these are the three fundamental aspects of his research, collaboration is also key to getting at the data and potential end-users.

Linus is an academic that has a *UK e-Science certificate*¹ that enables authenticated use of disparate grid computing infrastructure over the internet, where trust and security are of prime importance. Linus is used to obtain CAS attribute data (downloaded via MIMAS² / Casweb³) and the associates boundaries (downloaded via EDINA⁴ / UKBorders service⁵).

Linus is keen to develop and play something like *SimCity*⁶ for real, i.e. interface between geography and urban planning in the context of town planning. He wants to build realistic simulations that can help identify potential and assess likely impacts of changes or forecast the future.

Linus has just come across a project called *Modelling and Simulation for e-Social Science*⁷ (also known as MoSeS) that aims to develop a representation of the entire UK population as individuals and households, together with a package of modelling tools which aim to help specific research and policy questions to be addressed. He contacted the project and they are keen to get him using MoSeS outputs and are guiding him through the process of getting the necessary data licences and certificates. He is very excited as he learns how MoSeS combines methodological advances within the core social science domain of demography in geography, with the development and application of a sophisticated computational infrastructure for decision support systems using the latest technology for Grid

¹UK e-Science certificate, <http://www.grid-support.ac.uk/content/view/23/182/>

² MIMAS, <http://www.mimas.ac.uk/>

³ Casweb, <http://casweb.mimas.ac.uk/>

⁴ EDINA, <http://edina.ac.uk/>

⁵ UKBorders service, <http://edina.ac.uk/ukborders/>

⁶ SimCity, <http://simcity.ea.com/>

⁷ Modelling and Simulation for e-Social Science (MoSeS), <http://www.ncess.ac.uk/research/nodes/MoSeS/>



computing. He is keen to see how the MoSeS demographic and geographic models can be applied to address research questions in the domains of: healthcare planning; transportation research; and socio-economic change.

Linus 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 Bradford at a health area level. They want to merge individual patient data with synthetic demographic data from a micro-population database. Rick thinks that the MoSeS project outputs and the people involved in the project will be of great help.

Linus becomes an academic registered user of relevant datasets and computer resources (such as NGS⁸). He activates his MoSeS logon (single sign-on) into the MoSeS Grid Portal that is based on GridSphere⁹. To solve the problem at hand, the first step is to calculate the probability that a particular individual suffers from limiting long-term illness, in order to do that, relevant probabilities can be obtained from the *2001 UK Population Census Data*¹⁰ and used as a basis for assigning health status to synthetic individuals. 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. There are things that can be constrain or optimise for certain applications. The creation of a *2001 UK Demographic Initialisation* is part of the UK demographic modelling for MoSeS. This initialisation is related to two types of constrains: control constrains and optimisation constrains. The initialisation is very computationally intensive and data intensive task. MPJ Express¹¹ was used to parallelise the processes to run on distributed hardware which allowed results to be generated within a more reasonable time frame on hardware available.

Linus needs to action MoSeS, and this could be done by seeding the random number generator which is important to be able to replicate data forecasts which are stochastic in nature. 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).

Linus obtained visualisations from MoSeS; these are generated from the demographic data at particular times and reveal changes over the time. This is extremely useful as it is good to be able to show trend and extreme results from a number of different runs of the dynamic simulation. The graphical representations of MoSeS are dynamically generated by JFreeChart¹².

Linus finds particularly useful that MoSeS allows storing the demographic models generated so it is possible to re-use or adapt them. Linus can also have the possibility of downloading the stored demographic models generated.

⁸ National Grid service (NGS), <http://www.grid-support.ac.uk/>

⁹ GridSphere, <http://www.gridsphere.org/>

¹⁰ 2001 UK Population Census Data, <http://www.statistics.gov.uk/census/>

¹¹ MPJ Express, <http://mpj-express.org/>

¹² JFreeChart, <http://www.jfree.org/jfreechart/>



Linus was introduced in the use of wikis by a colleague and he is an enthusiastic user of this collaborative technology, so each time that Linus and the social care analyst have a meeting, the information goes to a web page / wiki based on HTML. Linus also manages a web blog for daily activity with links to relevant web pages. Thus, Linus is an active contributor to Web 2.0¹³. Nowadays the wiki saves Linus most time that what costs producing, as he can find out what happened in the previous meeting with the social care analyst and report progresses of agreed actions.

As a result of the fruitful collaboration with the Primary Care Trust health and a social care analyst, they produce a high quality paper that is about to be published in the *Journal of Artificial Societies and Social Simulation*¹⁴ (also known as JASSS).

Material used to develop the eIUS Use Case:

- 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
- M. Birkin, M. Clarke, H. Chen, P.Dew, J. Keen, P. Rees, J. Xu (2005) *MoSeS: Modelling and Simulation for e-Social Science*. Proceeding of the UK e-Science All Hands Conference
- Numerous web pages related to <http://www.geog.leeds.ac.uk/people/a.turner/>
- eIUS interview notes and audio files
- Relevant notes produced to serve as the basis for a paper abstract submitted to AHM 2008
- Relevant Web searchers

PARTIAL SHORT eIUS Use Case (NOTE: images will be included in further versions)

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

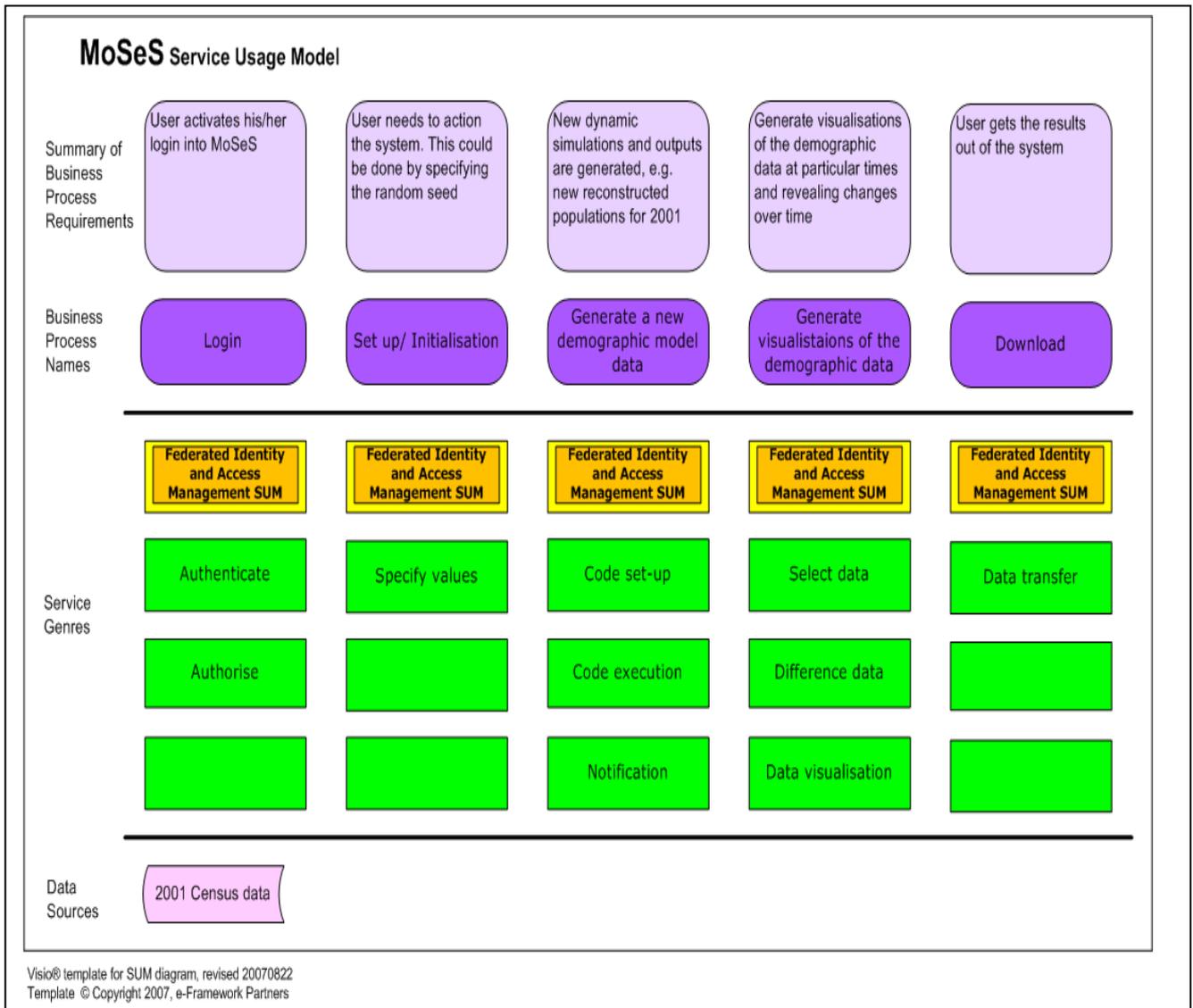
¹³ Web 2.0, <http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html>

¹⁴ Journal of Artificial Societies and Social Simulation, <http://jasss.soc.surrey.ac.uk/>



Linkage between e-IUS Use Cases and e-Framework SUMs

e-Framework SUM diagram¹⁵



¹⁵ Generic SUM diagram, <http://www.e-framework.org/Default.aspx?tabid=760>