



THE WHITE ROSE GRID e-Science Centre

GENESIS: Generative e-Social Science

Introduction

The GENeSIS (GENerative e-Social Science) project is a UK-based collaborative project based at the University of Leeds and University College London, which seeks to develop models of social systems where the main applications are to build environments and cities (relevant to the work of architects, geographers and planners) using new techniques of simulation involving complexity theory, agent-based models and micro-simulation. The project is focused on

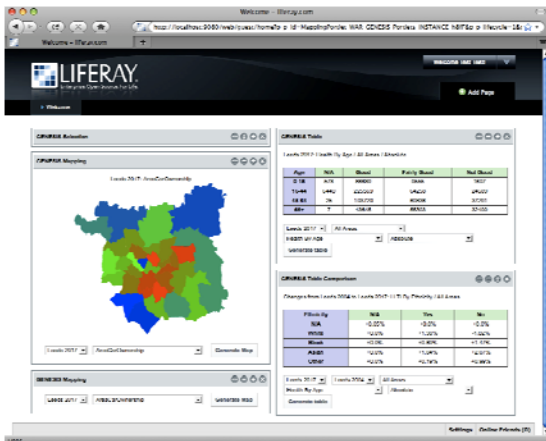
applications involving fine scale models of movement which involve crowding and congestion, residential segregation, demographic change, and urban development in the context of simulations of the entire space economy of the UK, and aims to pioneer new ways of visualizing cities and social science data using Web 2.0, Grid, and Cloud technologies.

As new technology and research methods have allowed social scientists to attempt increasingly sophisticated and complex social modelling and simulation, the social science community has started to use high-performance computing (HPC) - and latterly Grid and Cloud computing - infrastructures to support their experimentation. However, in order to fully exploit the potential of social science applications, it is necessary to develop applications that not only support the above technologies, but provide a user interface that is both intuitive and flexible.

GENESIS is centrally focussed on developing an infrastructure to run a new generation of simulation models and policy applications. These models are focussed on residential and retail-services locations, which are core components of the demographic and economic sectors of the urban and regional system. They form the core of a comprehensive structure for simulation into which more specific demonstrators dealing with local movement (congestion and crowding), residential segregation, and demographic aging and lifecycle effects (particularly in terms of income and welfare) can be plugged. These demonstrators provide a basis on which other users can elaborate and tune the simulations to their own applications.

Web Services

GENESIS functionality has been developed and exposed as a number of Web Services, which can be dynamically found and invoked at run-time.



GENESIS Portlets running in a Web Browser

Modelling and Simulation

The modelling and simulation of people, cities, and societies (and their past, present, and future) is an area rich in applications with potentially high impact results. Potent benefits include the ability for town and governmental planners to gauge the effects of development scenarios in a laboratory environment, and the ability to predict future population demographic trends.



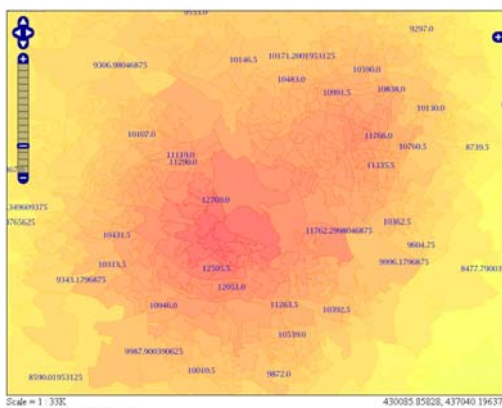
These Web Services allow users to, for example, select areas to analyse on maps, perform analyses, create tables, charts, and maps of the results of those analyses, generate reports, run job-specific comparisons (for example, to support social services workers). By using



GENESIS Google Earth visualisation

Web Services, a number of benefits are obtained, such as: 1) *Multiple entry-points into the system*, such as using a Java Client, a workflow engine, or a web-based interface to call the same services; 2) *Increased user flexibility*, as users can create their own GENESIS

workflows to perform specific functionality; 3) *Improved scalability*, as GENESIS Web Services can be deployed on multiple machines, thus aiding load balancing; 4) *Improved fault-tolerance*, as a level of fault-tolerance can be introduced into processing



GENESIS Open Layers visualisation

by, for example, invoking multiple GENESIS services in parallel and either cross-checking their results or else using the results of the first service to fail without raising an exception; 5) *Easier maintenance*, as despite the increased number of entry points into the system, changes made to a GENESIS service will be reflected in each interface due to clear

separation of the presentation and application logic layers of the system.

Portlet Web Interface

A particularly interesting interface to the GENESIS system is through using GENESIS Web Portlets. Web portlets are small, self-

contained windows within a web portal that display useful information or offer a relevant service. GENESIS has developed standards-based (JSR-286) portlets that can be deployed in any portlet container (such as Gridsphere, Sakai, etc.) to allow users to have flexible access to GENESIS. By using portlets, users can customise how they wish to view GENESIS data; for example, a user may create two "mapping" portlet windows, render a map of car ownership in Leeds in one window, and a map of average population in the other. The user can then move these windows to be next to each other within the web browser, in order to compare the data easily. Although GENESIS functionality is exposed as a series of Web Services, which in turn use a variety of Grid computing software, such as Storage Resource Broker, this is transparent to the user when using the portlet interface.

Visualisation

In addition to the user interfaces created for the GENESIS project, much work has also been performed on visualising GENESIS data. This includes layering GENESIS data onto the Google Earth application, as well as a Google Maps web-based interface, and an open-source web-based mapping tool called Open Layers. Further visualisation work, including the use of 3D visualisations, is being performed by University College London, and is intended to be integrated into the main GENESIS interfaces in the near future.

Further Information

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