A Technical Modeler's Interface for UrbanSim, a System for Integrated Land Use, Transportation, and Environmental Modeling

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1 Introduction

Patterns of land use and available transportation systems play a critical role in determining the economic vitality, livability, and sustainability of urban areas. Transportation interacts strongly with land use. For example, automobile-oriented development induces demand for more roads and parking (which in turn induces more automobile-oriented development), while compact, pedestrian-friendly urban environments can induce more walking and demand for transit. Both land use and transportation have strong environmental effects, in particular on emissions, resource consumption, and conversion of rural to suburban or urban land.

The process of planning and constructing a new light rail system or freeway, setting an urban growth boundary, changing tax policy, or modifying zoning and land use plans is often politically charged. Strong technical support can play a critical role in fostering informed civic deliberation and debate on these issues, as well as on broader issues such as sustainable, livable cities, economic vitality, social equity, and environmental preservation. We want urban planners and stakeholders to be able to consider different scenarios — packages of possible policies and investments — and then, based on these alternatives, model the resulting patterns of urban growth and redevelopment, of transportation usage, and of resource consumption and other environmental impacts, over periods of twenty or more years.

UrbanSim [1, 2] is a simulation system that is intended to provide such technical support. It performs simulations of urban development, including transportation, land use, environmental impacts, and their interactions. It is written in Java, and is distributed as Open Source software. (Source code, as well as papers and reports, are available from `www.urbansim.org`.) UrbanSim consists of a set of interacting component models that simulate different actors or processes within the urban environment. For example, the Residential Location Choice model simulates the process of household location — of a household deciding whether to rent or buy a dwelling, what kind (detached house, townhouse, apartment, etc.), and in what part of the city. Another model is the Developer Model, which simulates the activities of real estate developers as they decide whether to develop new housing or commercial space, or redevelop existing space.

To date, UrbanSim has been applied in a number of metropolitan regions, including Eugene/Springfield, Oregon; Honolulu, Hawaii; Houston, Texas; and Salt Lake City, Utah. Application to the Puget Sound region (which includes Seattle, Washington) is substantially completed. As part of the process of validating the model, we also performed a historical validation with the Eugene data, starting UrbanSim with the 1980 data, simulating until 1994, and then comparing with what actually happened.

2 The Technical Modeler Interface

UrbanSim is a large and complex application, with significant input data requirements, as well as requirements for calibration and fitting to a particular region. We plan to provide several different interfaces for the system. The one that we currently use, and which we will demonstrate, is designed for technical modelers: domain experts in modeling urban development, who typically work at regional planning agencies, consultancies, or academic research projects. In the future, we will also provide a web-based interface, designed to be much more accessible to decision-makers, members of neighborhood and advocacy groups, and the general interested citizen. Finally, we are working on an experimental *streetscapes visualization tool*, which will produce animated street scenes, driven by the simulation data, and populated with moving pedestrians and vehicles.

When completed, the Technical Modeler Interface will support a variety of functions, including managing the databases of input data, editing database tables, running and controlling the simulation, selecting and computing indicators, and displaying the indicator results using tables, graphs, and maps. We will also provide a scripting mechanism that will allow simulations to be controlled and replayed. We are building the interface using a carefully selected set of Open Source components, rather than writing everything from scratch. These components include: Eclipse, a universal tool platform (`www.eclipse.org`); MySQL, an efficient relational database (`www.mysql.com`), along with the MyCC database editor; and JUMP, a unified mapping platform (`www.vividsolutions.com/jump`).

In our demonstration at the conference, we will first give an overview of the project, and describe current activities (including the outcome of the lawsuit in Salt Lake City, which was in progress when we talked at the Digital Government Conference in Boston in 2003). We will then demonstrate the system in operation for a representative set of modeler tasks, including browsing through the results of a simulation, using indicators of household density, employment density, and the like, in both map-based and tabular format, and at different spatial resolutions. We'll also show the facility for replaying the simulation, so that the indicator results will be rapidly updated for the different simulated years between 2000 and 2020.

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References

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