

A Survey of Ongoing Research and Development Work Outside Oregon

by

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Presentation Outline

- *Project Objectives*
- *Specification of an “Ideal Model”*
- *Review of Existing Models*
- *Short-Run Guidelines for Model Development*
- *Long-Run R&D Needs*
- *A “New Paradigm” for Integrated Urban Models*
- *Microsimulation*

TCRP Project H-12

*Integrated Urban Models for Simulation of
Transit and Land-use Policies*

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DELCAN Corporation*

*J. Douglas Hunt
University of Calgary*

Project Objectives

- 1. Identify transit's role with LU-TR interaction & appropriate representation of transit within integrated models.*
- 2. Assess state of current art/practice.*
- 3. Identify short-run strategies for improving the state of practice.*
- 4. Develop longer-run R&D program.*

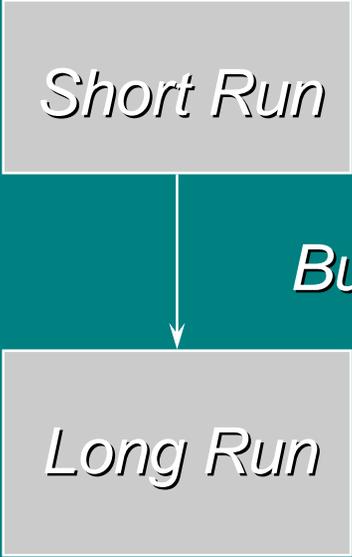
Project Products

4 major products:

- 1. “Functional specification” of an “ideal” modeling system.*
- 2. Review of existing models.*
- 3. Short-run “guidelines”.*
- 4. Long-run R&D program.*

Relationship Between Short & Long Run

Short Run

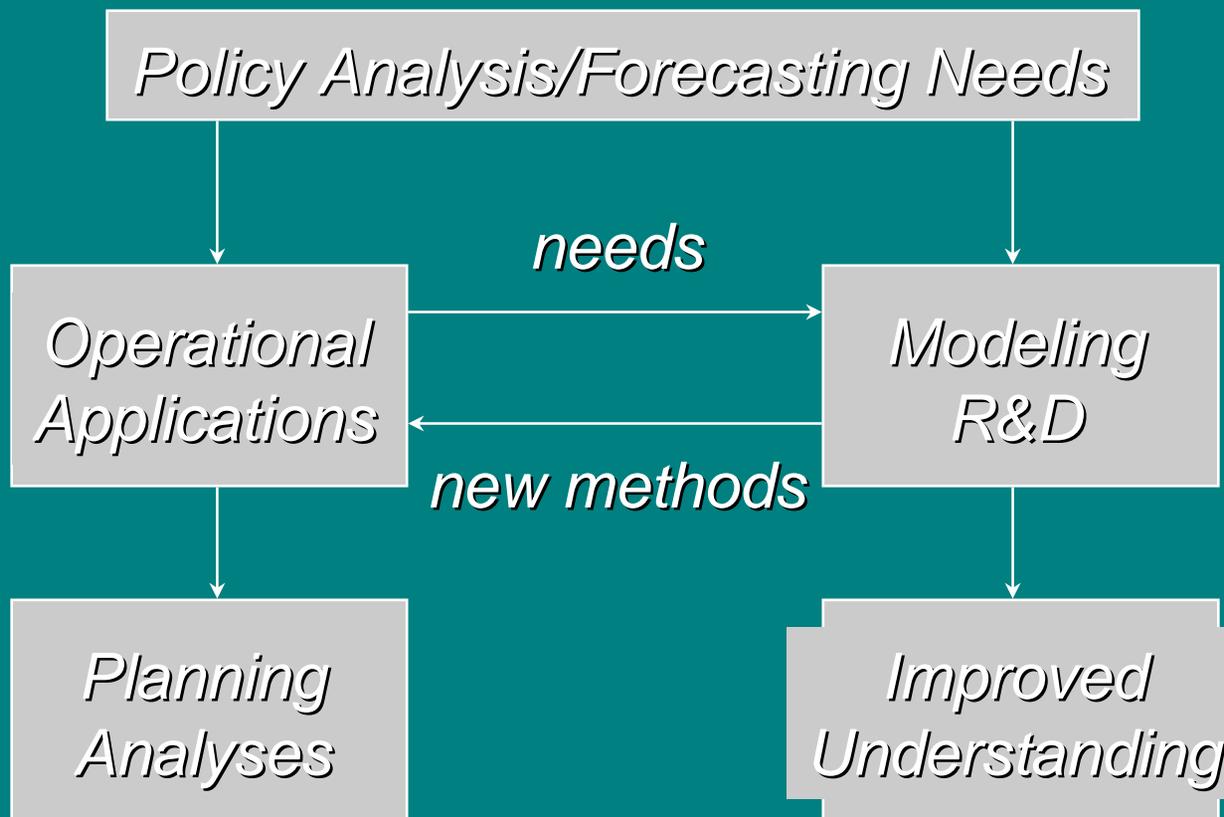


Long Run

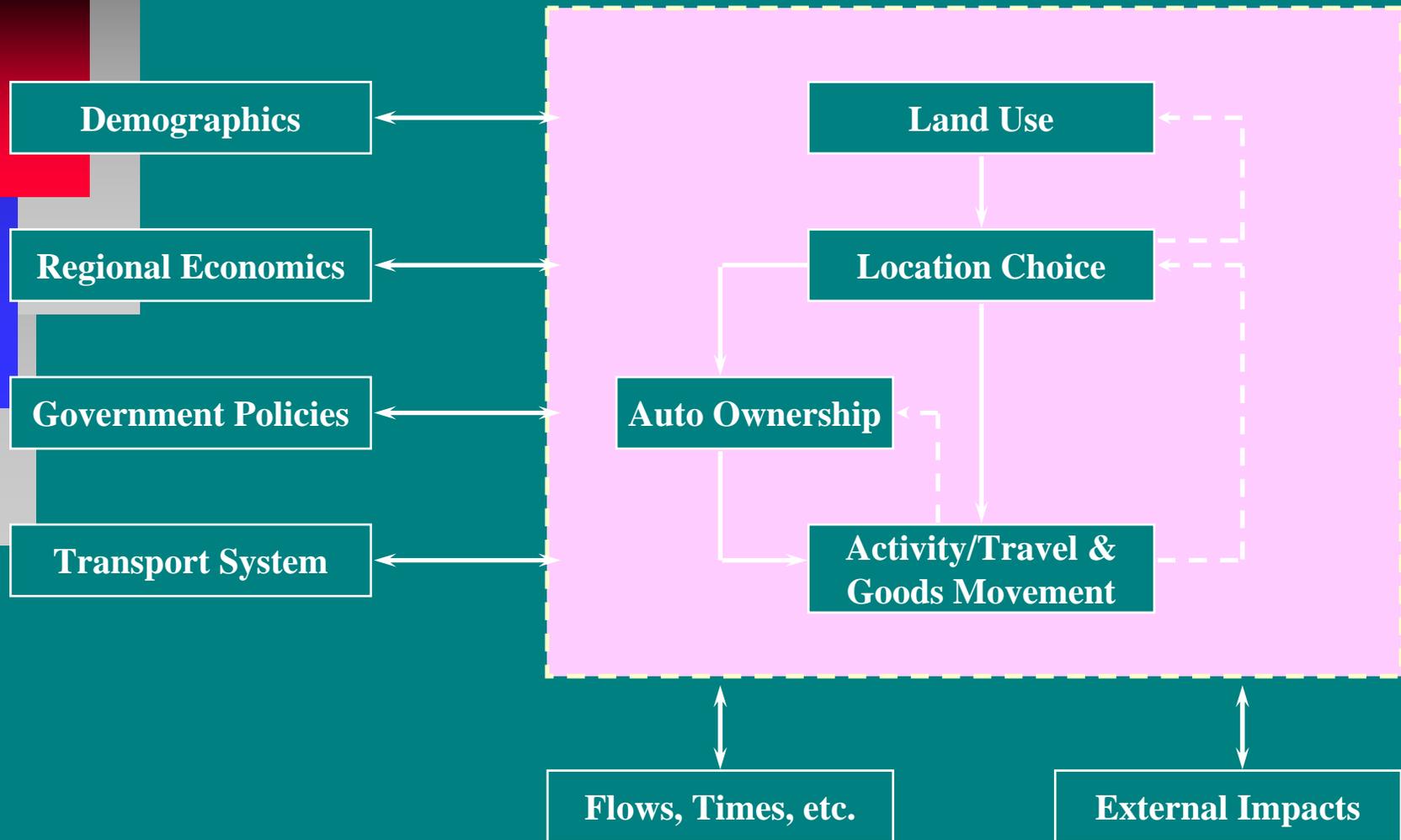
Builds towards by means of:

- *database development*
- *network development*
- *experience*
- *establishment of credibility*
- *evolutionary development*

Relationship Between Research & Operational Applications



Integrated Modeling Framework



Design Issues

Physical System



- **Time**
- **Space (land)**
- **Building stock**
- **Transportation networks**

Active Agents



- **Persons**
- **Households**
- **Firms**

Processes



- **Land development**
- **Location choices**
- **Job market**
- **Demographics**
- **Regional economics**
- **Automobile holdings**
- **Activity / travel demand**
- **Network performance**

Performance Issues

Applicability



- **Theoretical soundness**
- **Policy sensitivity**
- **Precision (spatial, temporal)**
- **Validation**

Feasibility



- **Computation requirements**
- **Data requirements**
- **Technical support requirements**
- **Cost**

Usability



- **Ease of input preparation**
- **Model run time**
- **Output / presentation capabilities**
- **Portability / transferability**
- **Flexibility / adaptability**

Models Reviewed

- *MEPLAN*
- *ITLUP (DRAM/EMPAL)*
- *MUSSA*
- *NYMTC-LUM (METROSIM)*
- *TRANUS*
- *URBANSIM*



Focus on operational models



Build upon, not duplicate, previous reviews:

- *Wegener (1994)*
- *Southworth (1995)*



Use “Ideal Model” as framework for review

Review of Models

General



- Operational history
- Platform
- Commercial availability
- Cost
- Support

Treatment of
Time, Land
and Space



- Time (time step, establishment of equilibrium)
- Land (zone size, land categorization, developable land, micro-scale)
- Developed space (floor space, units, prices)

Treatment of
Transportation



- Transportation networks
- Transportation supply (*infrastructure + services*):
 - Transit representation
 - Goods movement
 - Other transportation services

Review of Models, cont'd

**Treatment
of Actors**



- **Persons**
- **Households**
- **Private establishments:**
 - **General**
 - **Developers**
 - **Carriers**
- **Public authorities**

**Motivational
Framework**



- **Housing market**
- **Floor space market**
- **Goods and services market**
- **Job market**
- **Personal transportation market**
- **Goods movement market**
- **Transportation infrastructure market**
- **Auto (vehicle) market**

Review of Models, cont'd

**Spatial
Allocation
Processes**



- **Housing supply and demand**
- **Floor space supply and demand**
- **Goods and services supply and demand**
- **Labor (workers) supply and demand**
- **Demographic processes**

Policy Capabilities

Land Use



- Pricing
- Infrastructure and services
- Regulatory
- Education / marketing

Transportation



- Pricing
- Infrastructure and services
- Regulatory
- Education / marketing

Other



- Pricing
- Infrastructure and services
- Regulatory
- Education / marketing

Performance

Applicability



- **Scope**
- **Theoretical consistency**
- **Spatial precision**
- **Temporal precision**
- **Validation**
- **Transit representation / sensitivity**

**Feasibility /
Usability**



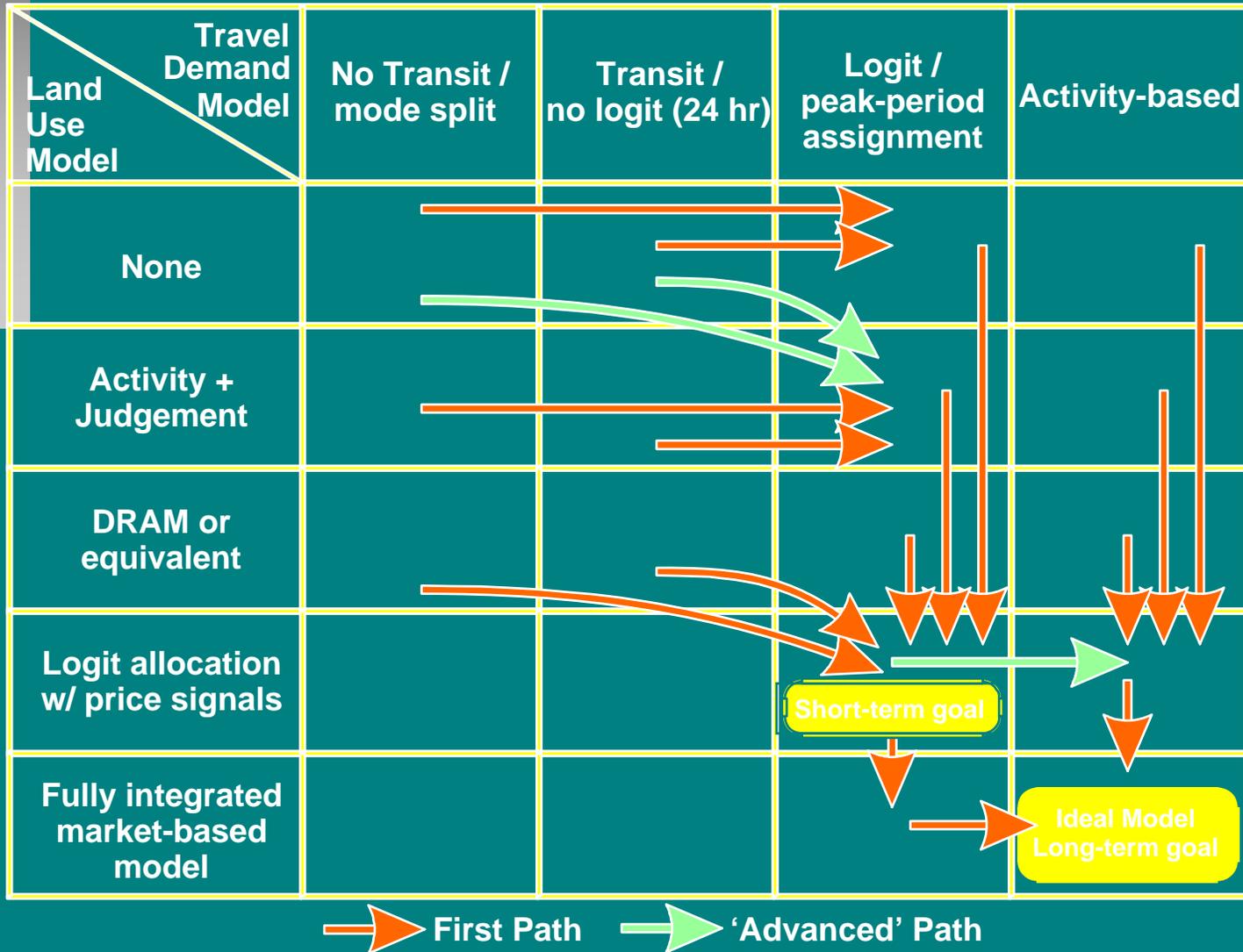
- **Input requirements**
- **Technical support requirements**
- **Output / presentation capabilities**

Short-Run Guidelines

Addressed to MPO's, State DOT's interested in developing/improving their integrated modeling capabilities.

Emphasis is on short-run, incremental, evolutionary steps using current methods, etc.

Steps Towards the Ideal Model



General Principles

- 1. Data first.*
- 2. Develop/improve travel demand model.*
- 3. A step-by-step approach is required.*
- 4. An explicit plan is required.*

Requirements for Model Development/Improvement

- 1. Data.*
- 2. Staff.*
- 3. Commitment to model development, separate from daily operations.*
- 4. Managerial/institutional commitment.*
- 5. Include modelers in decision-making.*
- 6. Understand the proper role of models.*
- 7. Don't underestimate or dismiss models.*
- 8. Don't settle for too little.*
- 9. Don't accept the status quo.*
- 10. Move incrementally, but move towards the long run.*

Long Run R&D Program

A funded, structured, substantial R&D program is essential for significant progress in integrated urban modeling.

R&D Program Elements

Training of Professional Staff/Information Dissemination

Data Assembly, Documentation, Dissemination

*Implementation,
Testing,
Extension,
Documentation
of Existing
Models*

*R&D to
Develop "Next
Generation"
Models*

- Other R&D*
- non-model tools*
 - qualitative studies*
 - empirical studies*

A Paradigm Shift

“Old paradigm”:

- *spatial interaction*
- *static equilibrium*
- *extreme aggregation*
 - *space*
 - *people*
 - *activities*
- *demographics exogenous/absent*

Paradigm Shift, cont'd

New, emerging paradigm:

- accessibility only one factor in location processes*
- dynamic disequilibrium*
- disaggregation*
- demographics endogenous*
- activity-based*

New Paradigm Examples

MUSSA (Chile, F. Martinez):

- *coherent economic theory of spatial markets (bid choice theory)*
- *extensive disaggregation*

DELTA (UK, D. Simmonds)

- *dynamic disequilibrium*
- *careful treatment of time dimension*
- *multiple paradigms for sub-models*

New Paradigm Examples, cont'd

Microsimulation Models

- *ILUTE (Canada, Miller, et al.)*
- *MASTER (UK, Mackett)*
- *LOCSIM (Netherlands, Oskamp)*
- *IRPUD (Germany, Wegener)*

URBANSIM

- *incorporates many of these features*

Microsimulation

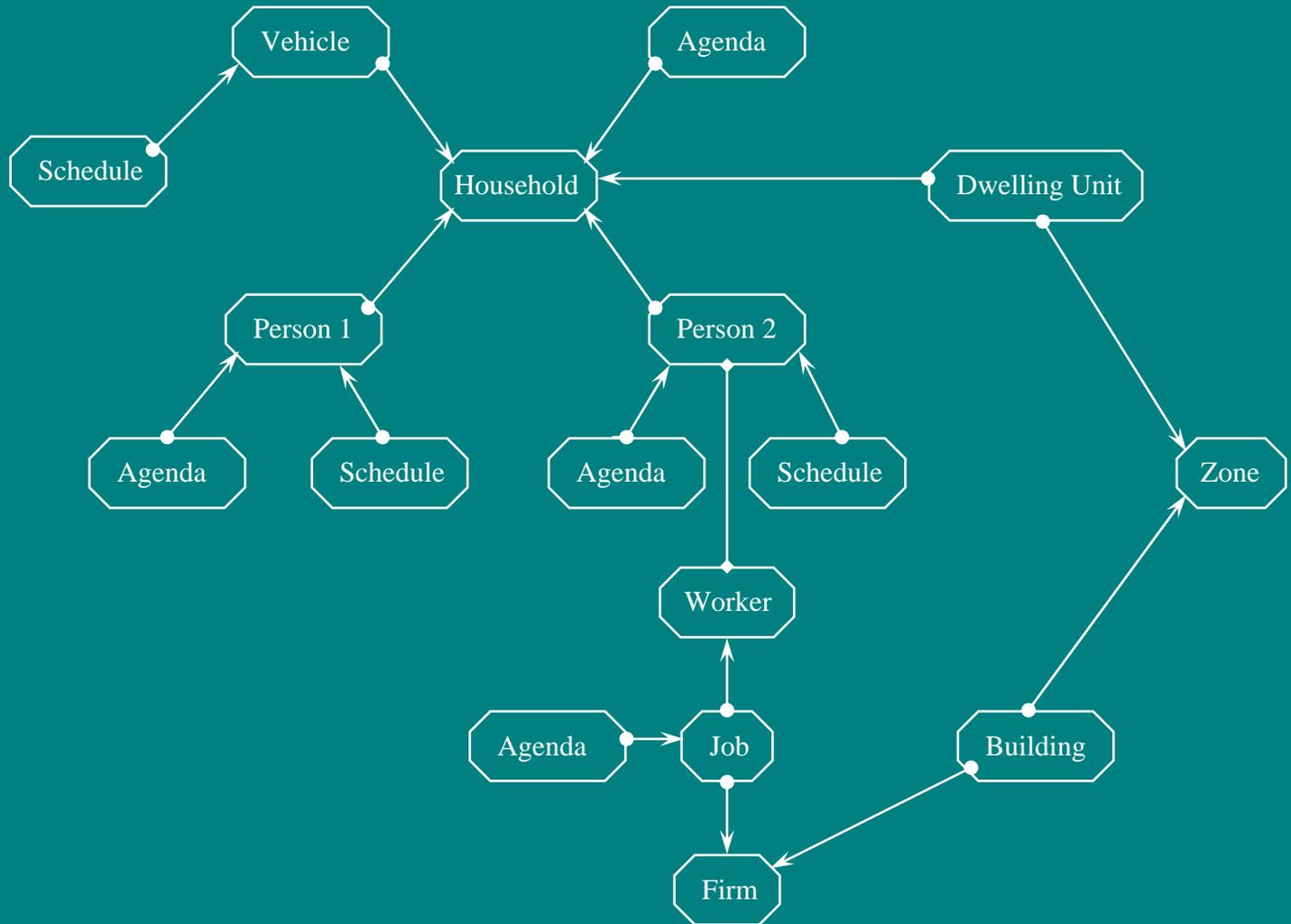
Method for exercising models, not a model per se.

Just beginning to understand/apply the method.

Ultimately, adopting the microsimulation approach will lead to new models.

This will probably involve adopting the “object model” of object-oriented programming.

Object Model of Persons, Households & Jobs



Person Class Variables

State Information:

- Person ID
- Date of birth
- Gender
- Marital Status
- Emp. Status
- Educ. Status
- Educ. level
- Dr. Lic. Status
- Income
- Hh. ID
- Job ID
- School ID
- ...

Person Class Processes

Behaviors:

- Give birth (if female)
- Compute age
- Die
- Get married
- Get divorced
- Find a job
- Leave current job
- Join a hh.
- Leave current hh.
- Obtain a dr. lic.
- Attend school
- Quit current school
- ...

Lessons for Oregon & USA

There is life after Lowry:

- options exist*
- worldwide activity*

URBANSIM “on the right track”

- moving US practice into the new paradigm*

R&D, such as is occurring in Oregon is essential.

The time for concerted effort in this area is now.

- evolutionary development of existing models*
- “basic” research into new methods*