
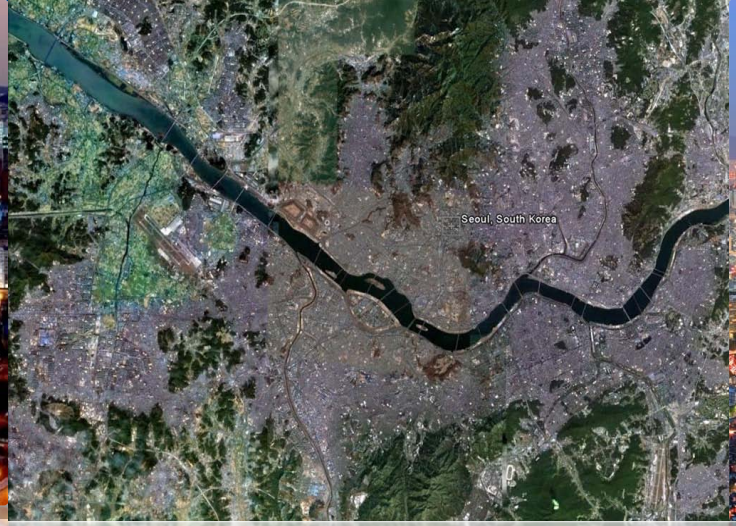

Back to see the future.....

Modeling Our City Growth with UrbanSim

To Inform Public Decision-making

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What would be Seoul City in 20~30 years ?

- Land use pattern
- Urban Growth Boundary
- Environmental quality
- Population growth
- Job density
- Transportation effect on environmental
- Land and Housing price
- Traffic volume

What if?

- We built a new light Rail line, or widened a freeway ?
- We established an urban growth boundary or Reduced Green Belt ?
- We adopted congestion pricing for the city center or Seoul Plaza?

- Or any changes in land use pattern of Seoul Metropolitan Area

Controversies and Values Conflicts

- The domain of urban planning has multiple stakeholders with strongly held, di vergent views, for example:
  - Some stakeholders may be particularly concerned with *sustainability and environmental issues*
  - *Others with economic growth*
  - *Others with equity*

- Decisions regarding such questions are often highly controversial and politically charged.

- **Important to consider:**

✓ Long – term effects (not just short-term)

✓ Land use and transportation interactions and environmental impacts, not just transportation in isolation.

Modeling Framework

- Urban planers and related stakeholders need good land use forecasts
- Many land use models have been developed
  - Simple to complex
  - With/without economic theory basis
  - Support community visioning
  - Aggregated or Disaggregated
  - GIS platform

UrbanSim Modeling approaches

- Considering the various preceding aspects, Professor Paul Waddel Designed to Modeling the patterns of urban development for periods of 20-30 years or more for different policy since 1996

- Later ,Developed by an Interdisciplinary Group at the university of Washington over the past decade, Involving Groups are :
  - Evan school of public affairs
  - Civil Engineering
  - Information School
  - Computer Science
  - Psychology
  - Statistics
  - Urban Design & Planning
  - Urban Geography
  - Economic Geography

Professor Paul Waddel (UC Berkeley)

UrbanSim Users

United States:

1. Puget Sound
2. California
3. Florida
4. Hawaii
5. Michigan
6. Oregon
7. Texas
8. Utah
9. Washington
10. Salt Lake City
11. Honolulu
12. Houston.

Europe:

1. Amsterdam
2. Rome
3. Taipei
4. Detroit
5. Eugene Paris
6. Phoenix
7. and Zurich.

- Middle East Users – Tel Aviv
- **Potential Users - Downloaded from 80 Different Countries**

What is UrbanSim?

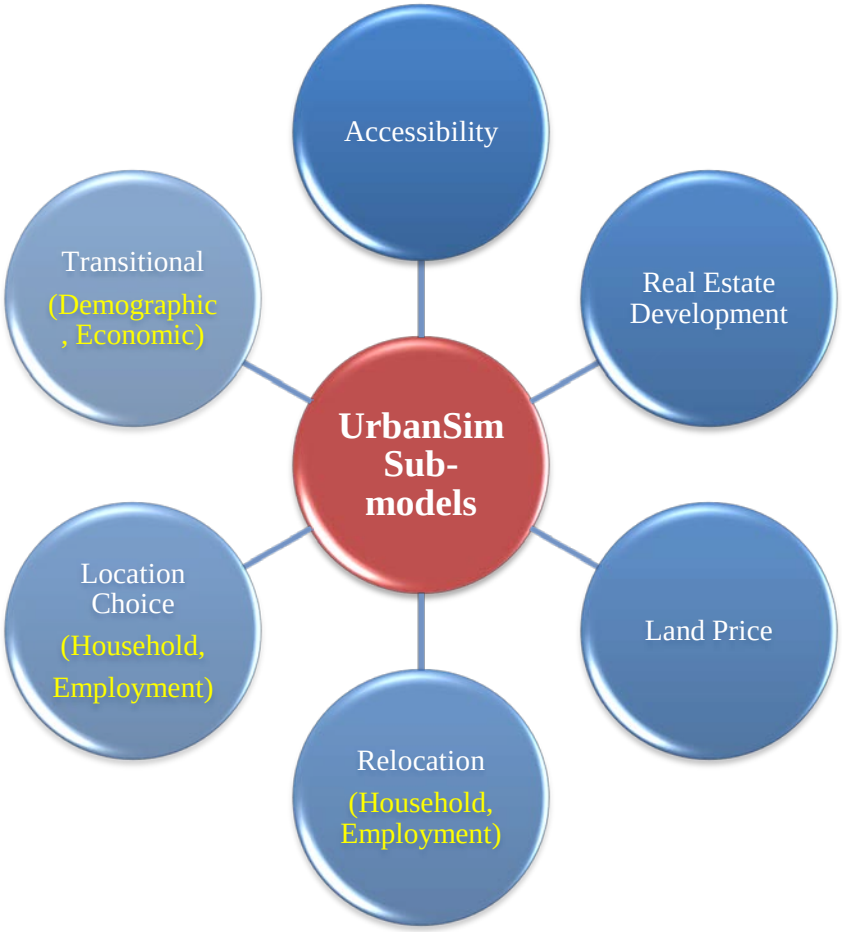
- A software-based simulation Modeling techniques of Urban
  - Land-use,
  - Transportation,
  - And Environmental impacts, over time periods.

- Its primary purpose is to *provide tools* to
  - Urban Stakeholders
  - Urban Planner
  - Policy Makers

to aid in *more informed* , *Sustainable* and *long term* decision – making

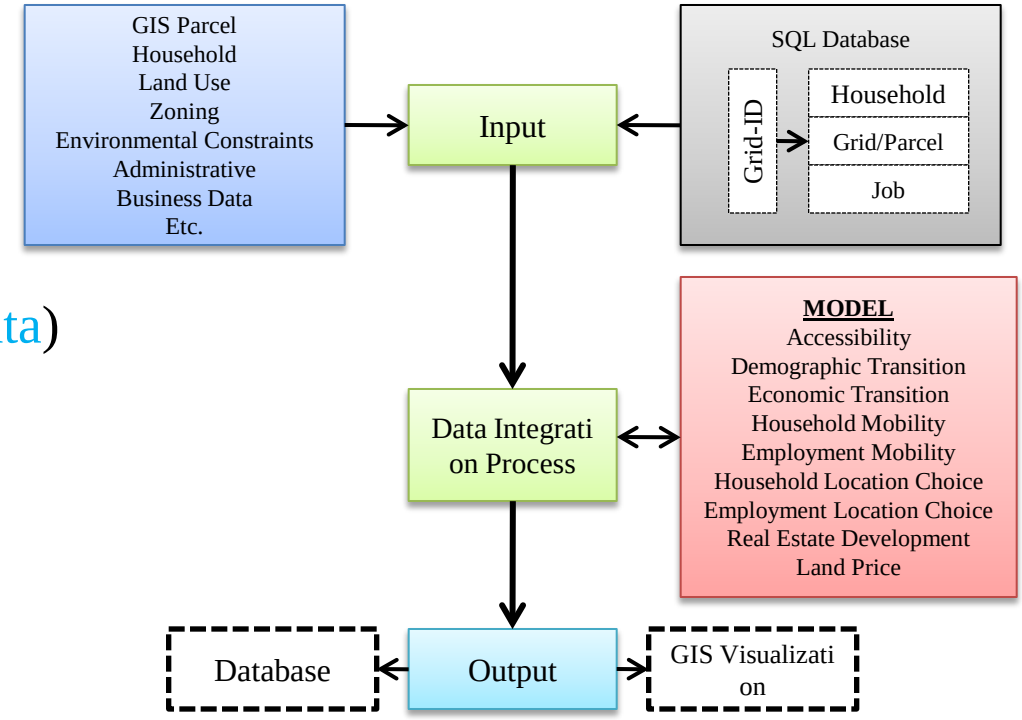
UrbanSim Model Components

UrbanSim has a variety of sub-models



The Five D's of UrbanSim

- Data-intensive (Hungry)
- Disaggregated
- Dynamic
- Disequilibrium
- Driven by trends (Historical Data) and forecasts (20~30 years)



Model Structure and Processing

Underlying Concept of UrbanSim Modeling

Four dominant agents in Urban sphere

- **Household are created / removed**
  - Create vacant units when a household is removed
  - New households select from the stock of available housing units
  - Simulate household decision on where to resides

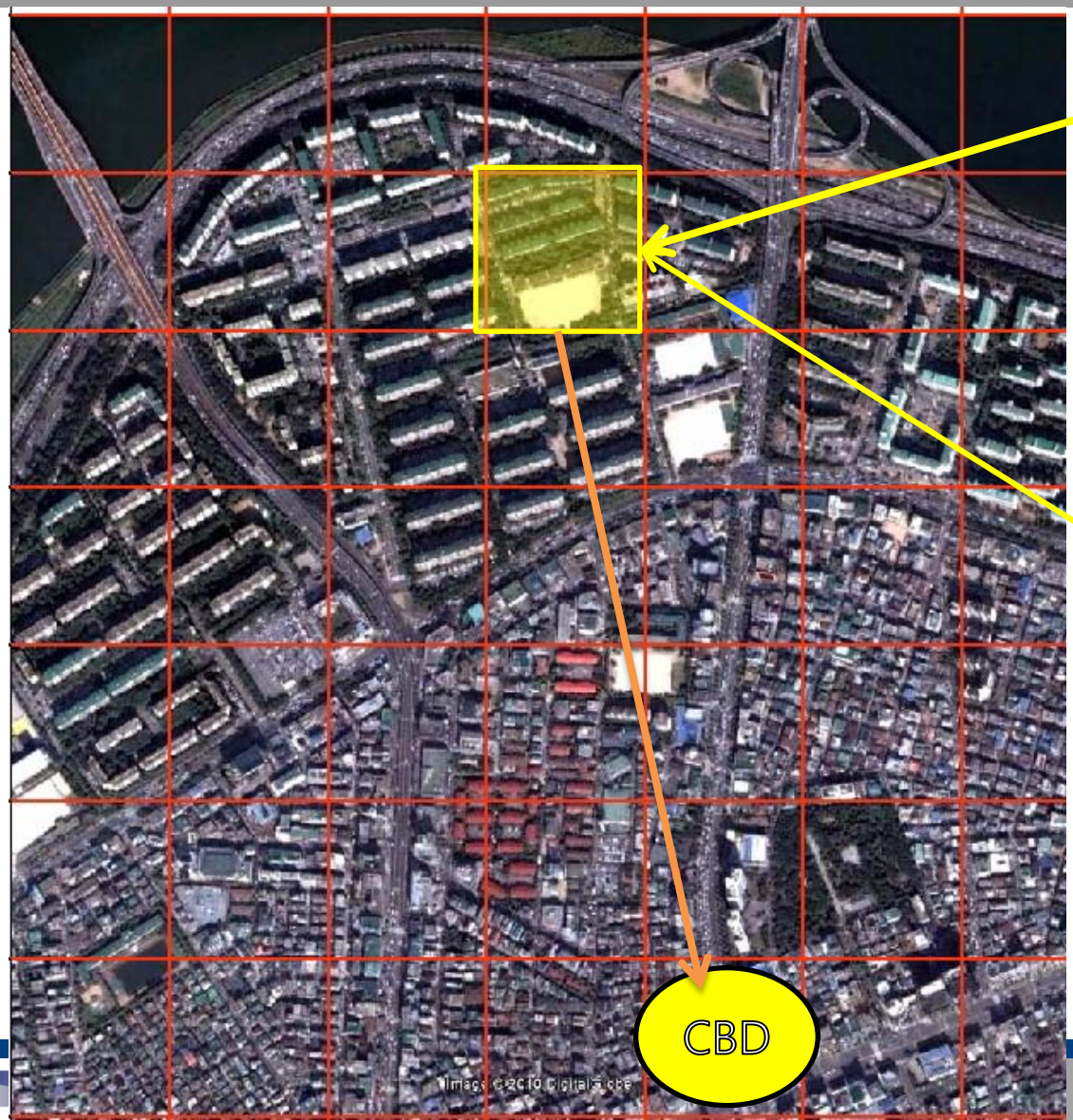
- **Jobs are created / removed**
  - New jobs select from the stock of available job spaces
  - Simulates employer decisions on where to locate a job
- Developer build new housing units and non-residential sq. footage
  - Pick vacant space with in a given location
- Government impose planning rule and allocate facilities

(Accessibility ,Road, Transportation , infrastructure, etc.)

Simulation of agents behavior

- **UrbanSim is just simulate those agents behavior based on:**
  - User defined Grid Cell (150/150 meter or more).
  - Statistical analysis of historical data
  - Combines market behavior, land policies, infrastructure choices

Agent Behaviors Simulation Process



Study area is divided into 150/150 meter grid cells

Grid Attributes

Grid_ID

Relative X and Y

Zone ID

Distance of arterial

Distance of Highway

Households

Non-residential_sq_ft

Land_value

Year_built

Plan_type

%_water:

%_wetland

%_road

Agents Choice Simulation Process

Accessibility

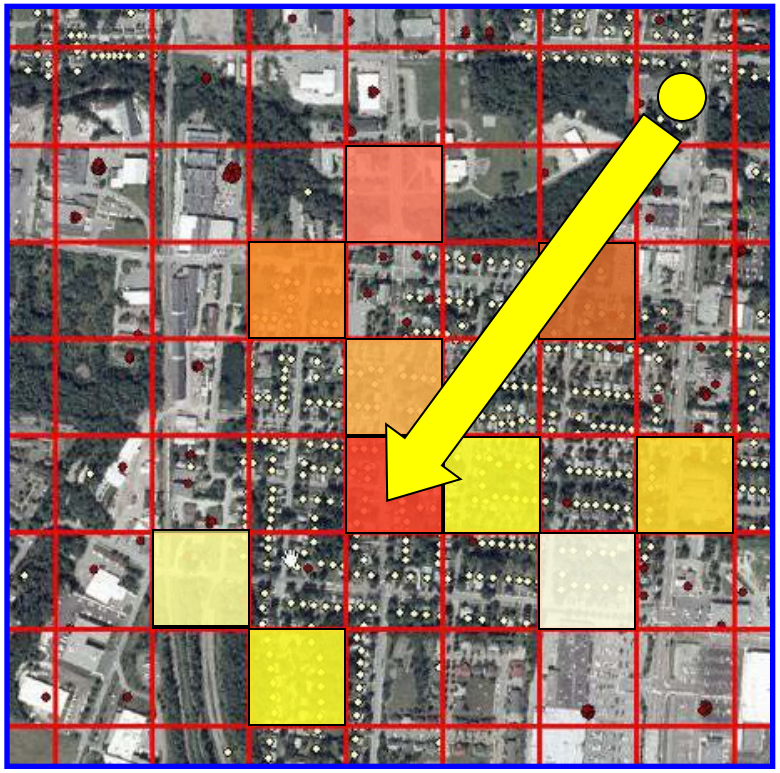
Land Price

Mobility & Transition

Location Choice

Real Estate Development

Residential Land Share



- Movers (Jobs/Household)
- vacant units
- probabilities
- site selection

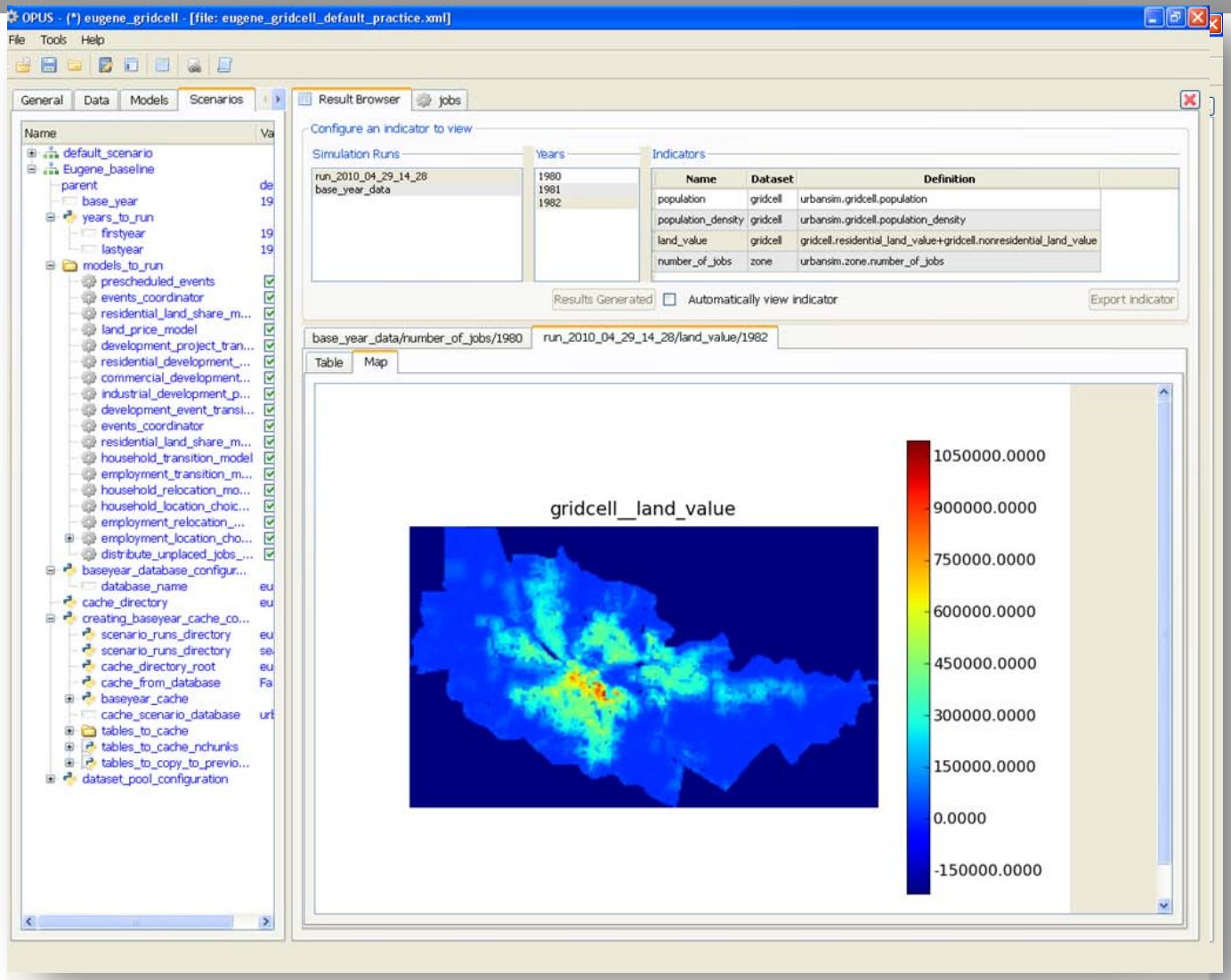
How to determine agents choice?

- Using a Series of Complex algorithms.
  - Discrete Choice Model
  - Random Utility Theory
  - Multinomial Logit Model

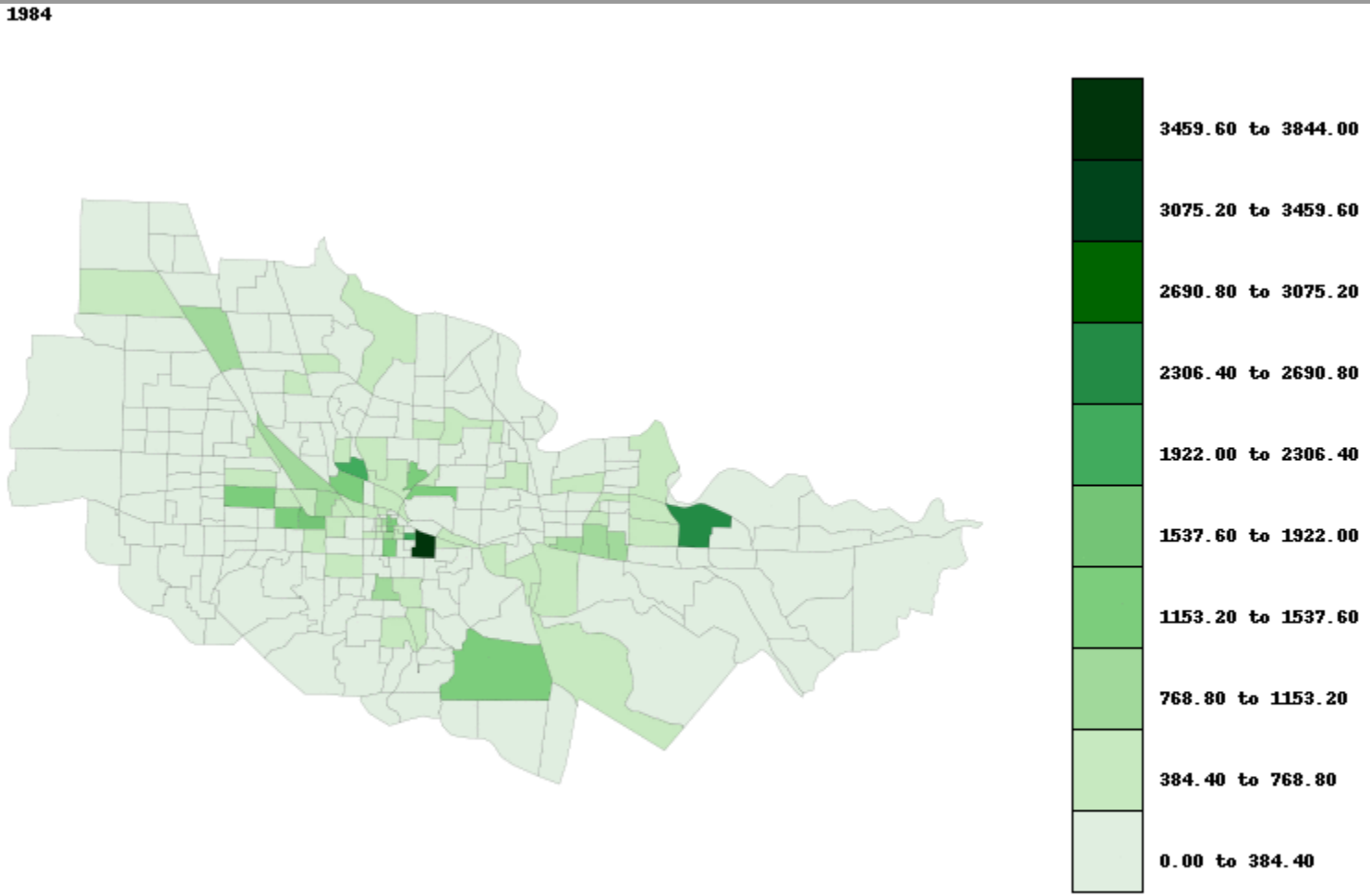
- **Each location has attached to it some Utility**
  - Accessibility of workplace
  - Shopping
  - School
  - Quality of Neighborhood
  - Availability of public services
  - Etc.
- **The location with the highest utility has been selected by agents**

- Using Monte Carlo Sampling to pick location and GRID_ID

Simulation of Agents Behaviors (Sample -Eugene, USA)



Simulation Result for 10 years



Role of GIS in UrbanSim

GIS Role in Land use and Transportation Modeling

- GIS Systems

- Autodesk
- Intergraph
- ArcInfo
- ArcView
- IDRISI
- GeoMedia
- MapInfo
- Maptitude
- TransCAD

- Transportation Planning

- TranPlan
- MinUTP
- TP+
- Cube, TRIPS
- Emme 2/3
- Tmodel
- Visum
- QRS
- Omnitrans
- ESTRAUSS

Land Use Models

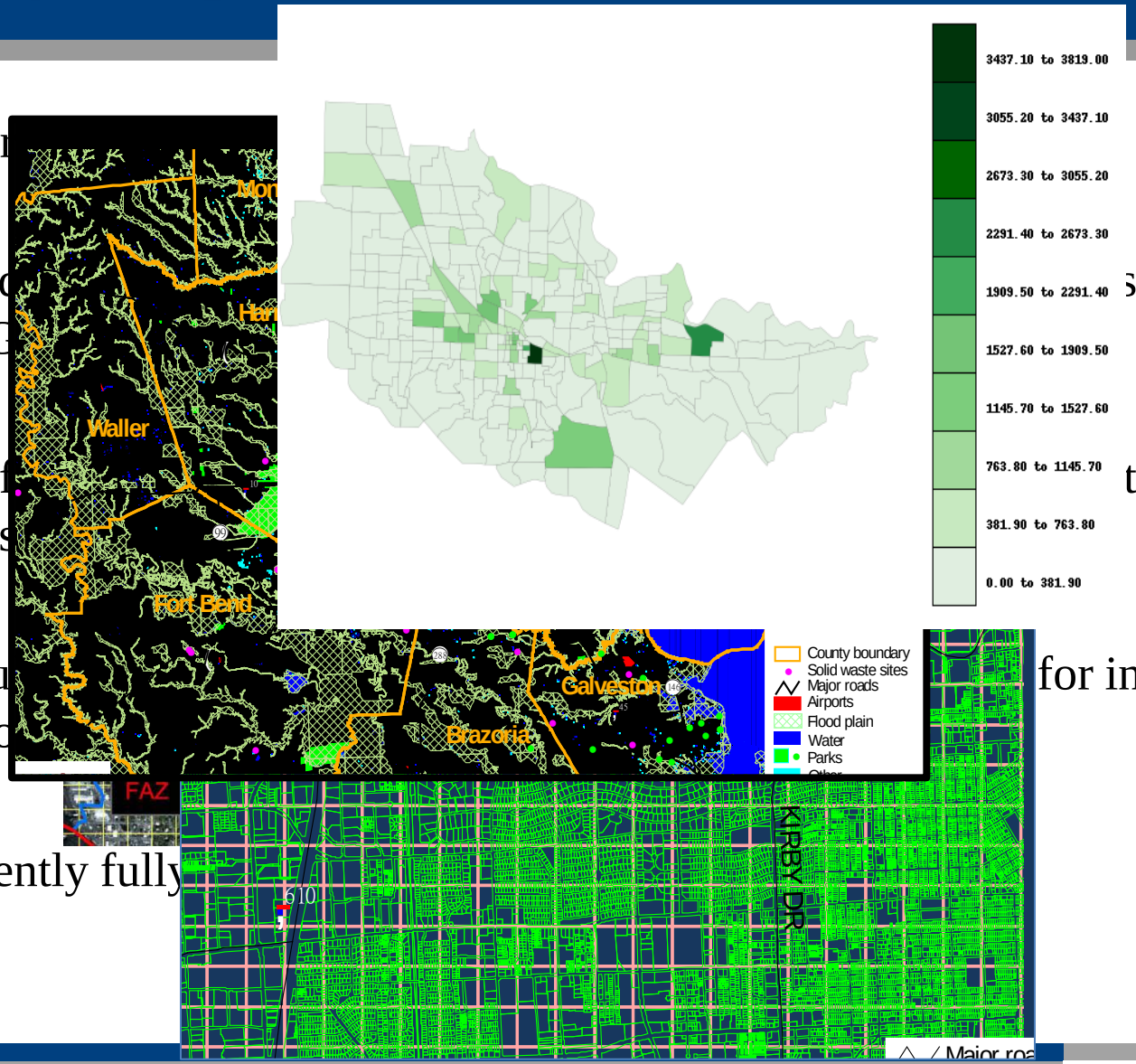
- DRAM/EMPAL
- CUF-1,2
- POLIS
- TRANUS
- UrbanSim
- MEPlan

Land use models and GIS

- Most land use models do not exploit power of GIS
- Linked vs. Integrated
- This may be temporary as in Transportation Planning
- GIS tools important for LU models accessible only in in tegrated environment
  - Spatial Queries
  - Adjacency, proximity
  - Accessibility, visibility
  - Spatial Autocorrelation

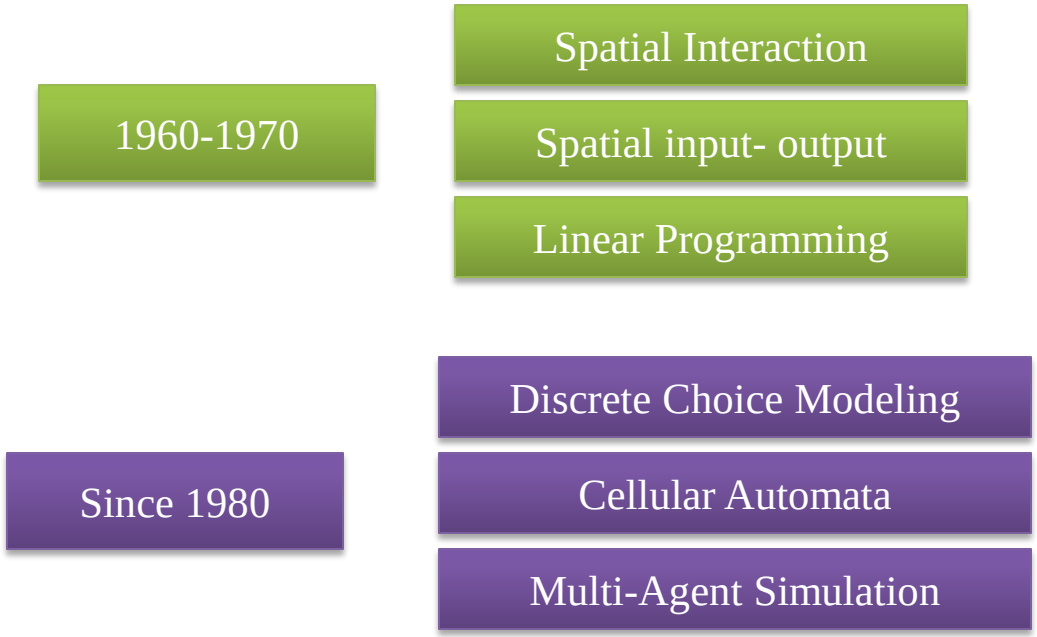
GIS linked in UrbanSim

- Input data are
- GIS-based lan straint
  s (e.g. Urban G
- GIS Overlays f teep sl
  opes, or other s
- Simulated resu for interact
  ive visualizatio
- UrbanSim recently fully



Modeling approaches

- Since the half of the last century ,several different urban model ing approaches have been developed and applied to either plan ning or research objectives over the past several decades.

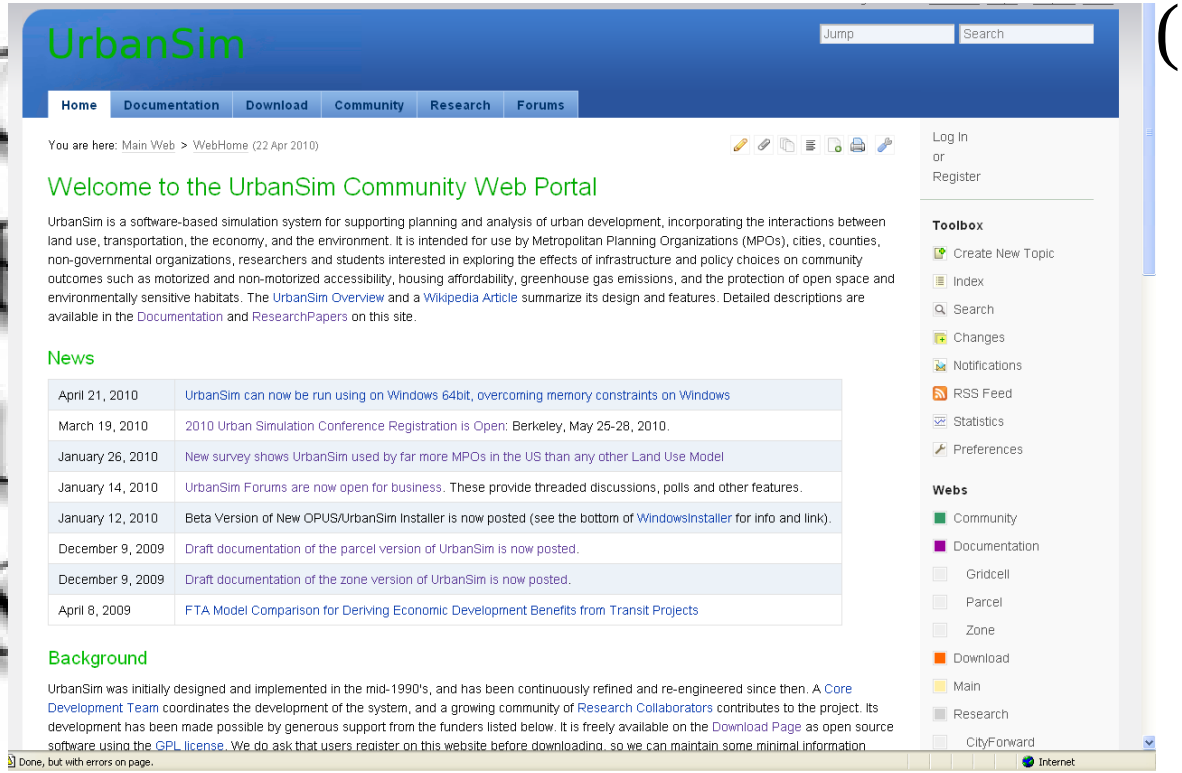


Integration of Modeling Approaches in the Design of UrbanSim

- In the design Urban SIM, several of the preceding modeling ap proaches have been assimilated-
  - It uses **Micro simulation** to model the individual choices of households and jobs.
  - **Discrete Choice** is to predict location choices of households and jobs and the real estate development of developers
  - **GIS** uses to integrate input data and to display model results

Open Platform for Urban Simulation (OPUS)

- Open source software can be downloaded (www.urbansim.org)
- Urban (GUI) and a
- MySQ
- Pytho
- Used



Required Data (Data Hungry Project)

- Employment data
- Household data, merged from multiple census sources
- Parcel database,
  - with acreage land use
  - housing units
  - nonresidential square footage,
  - year built,
  - land value
  - improvement value
- City and County General Plans
- GIS Overlays for environmental features such as
  - wetlands,
  - flood ways
  - steep slopes, or other sensitive or regulated lands
- Traffic Analysis Zones

Conclusions

- Intensive data hungry project ***(65% of total project time is ne eded to data acquisition)***
- Forecasts future land-use (households, jobs) 20~30 years
- State-of-the-art
  - Defensible microeconomic theory
  - Incorporates transportation accessibility
  - Locally calibrated
  - Tremendous interest across the U.S.
- Still in developmental stages
- UrbanSim recently used parcel based data instead of grid-based
- Major commitment

Thanks for your attention