MOBISIM: A FRAMEWORK FOR SIMULATION OF MOBILITY MODELS IN MOBILE AD-HOC NETWORKS
V. 3.0
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Project homepage: http://sourceforge.net/projects/mobisim/
- Mobile Ad-Hoc Networks
  - Wireless
  - Mobile
  - Self-configurable
  - No initial platform

* Images in this slide are from http://www.hitachi.com/rd/research/sdl/07/soc_02.html
INTRODUCTION

- Where to find mobility traces?
  - Real traces
  - Mobility model generators
- Trace granularity
  - Cell, Ex: Cell phone network
  - GPS based, Ex: Ad-Hoc networks, Vehicular networks
MOBILITY GENERATOR

- Modes:
  - Graphical
    - Simulation
    - Visualization
      - With Various way of presentation
  - Batch (Scenario based)
    - Simulation
    - Scenario configuration
STRUCTURE OF A CONFIGURATION

Simulation Configuration Tree

Save root
Load to root
Start simulation
Selected tree node properties

Selected node menu

Save
Load
Refresh

Update Data using UI

MobiSim v. 3.0
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GENERAL PROPERTIES OF A MODEL

- Location Initializer
  - Predefined (fixed)
  - Random
    - Various distributions
    - Repeatable scenarios using the defined seed
  - Model specific initializer
- Map
  - Reflective Square
  - Reflective Disk
  - Obstacle
  - Model specific maps

Obstacle map and the spatial distribution of nodes in Random Walk model on it
A set of handles will define the properties of each object (Ex: scale, rotation of an obstacle)
Can add, delete, or move a handle
A handle can have its properties
A model may handle it on behalf of its map
A map/model must validate the position of handles
MAP EDITOR: SNAPSHOT

Toolbar

Map graphical view

Status bar

Map supporter parameter configuration

Handle parameter configuration
MOBILITY MODELS: RANDOM MODELS

- Random Waypoint [1]
- Random Direction [2]
- Random Walk [3]
- Levy Walk [4]
- Tortoise
A sequence and loop of
- Transitions with fixed properties
- Transitions with random properties
- A sequence/loop of transitions (make a complex pattern)
- Manhattan Grid [3]
  - Use Mapeditor to manage the grid
- Freeway [3]
  - Use Mapeditor to draw any path
- Special parameters:
  - Safe distance ratio
  - Positive acceleration ratio
  - Lane numbers
- Gauss-Markov model [5]
  - New speed and direction:
    \[ s_n = \alpha s_{n-1} + (1 - \alpha)\bar{s} + \sqrt{(1 - \alpha)^2} s_{x-1} \]
    \[ d_n = \alpha d_{n-1} + (1 - \alpha)\bar{d} + \sqrt{(1 - \alpha)^2} d_{x-1} \]

- Probabilistic Random Walk [6]
  - Change x/y based on a Markov chain

- Exponential correlated model
  \[
  \begin{cases}
  s_{t+1} = \alpha * s_t + A * \sqrt{1 - \alpha^2} * r \\
  d_{t+1} = \alpha * d_t + A * \sqrt{1 - \alpha^2} * r'
  \end{cases}
  \]
Select Leaders’ Model from any models even group models (Usually Random Walk)

Picks a reference point [7] for each group member and define its behavior based on it (with some randomness).

Variations in selecting the point makes different behaviors:

- Nomadic: Pick a point around the leader
- Pursue: The current leader position is the reference point
- String: The previous node’s position will be the reference point
- Row: Choose the point to keep the row structure in the group
MOBILITY MODELS: COMPLEX MODELS

- Multi Model: Compose models
  - Use Mapeditor to manage map of internal models
- ThreeDizer: Add z value based on a ground
  - Use Mapeditor to define the highs and lows
  - Use 3D resimulator to view in 3D environment (needs Java3d)
- File Model: load a trace file as an internal model or group leader’s model
SCENARIOS

- A scenario has a simulation
  - With variable parameters
  - Runs multiple times
  - Used in batch mode to generate a mass of traces
TRACE FORMATS

- Types:
  - Text: Tab separated table with two top lines as configuration and table headers
  - XML: Text format converted to a more readable xml format
  - NS2
  - Models can add trace columns. Ex: group number
Input: multiple trace files
Output: a table of evaluations
Can copy some parameters of each trace file (Ex: model name)
General properties for an evaluator
  - Sample time
  - Sort priority
MOBILITY EVALUATORS

- Spatial dependency [3]
- Temporal dependency [3]
- Relative speed [3]
- Repetitive behavior [8]
- Transition characteristics
  - Time
  - Length
  - Speed
  - Degree change
- Location Distribution Variance
GRAPH EVALUATORS

- Average degree
- Average range
- Clustering coefficient [8]
- Graph connectivity
  - # of disconnection
  - Duration of disconnection
  - Average size of the biggest cluster
- Interference
- Link evaluation
  - Link duration
  - Neighborhood instability [8]
  - Intermeeting time
- Network diameter
Steps:
1. Select input evaluation file and output Excel file
2. Select the input columns for making rows. Ex: model name
3. Select the input columns to create output table columns (variables) Ex: Min/Max speed
4. Select the evaluation column to fill table cells with (will be average value if multiple input rows map into a cell)
5. Can divide tables using other columns onto several sheets
6. Use “Create Diagram” in Excel to draw diagrams using a script
CLASSIFICATION

- Features: input from evaluations
- Distance metrics
  - Euclidean
  - Gaussian: considers data dispersion by standard deviation as a weight for distance of a point from the center of a group/group member.
  - Mahalanobis: considers data distribution by finding the dispersion in n axis defined by SVG
- Classification algorithms
  - Nearest Center
  - KNN
  - Fuzzy Nearest Center
  - Fuzzy KNN
- Evaluating classification algorithms
  - Accuracy
  - Average right membership
FUTURE WORK

- General urban model
- New mobility models
- New trace types
- Dynamic range management
- Power models
- Signal attenuation on obstacles in the graph building algorithm
REFERENCES


