Emulating Large-Scale Wireless Networks using ModelNet
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Goal: evaluate unmodified wireless applications under realistic mobile
and ad hoc scenarios using a scalable and accurate emulation environment

Motivation

Current techniques for evaluating wireless applications

• Simulation
  - Limited scalability, need to rewrite applications for the
    simulator, omit important system details

• Live deployment
  - Limited size, not reproducible, hard to isolate faults

• Emulation
  - Static, small scale, difficult to configure

Our Requirements

  - Combine advantages of live deployment and simulation
  - Support large scale applications
  - Run unmodified applications on unmodified OS’s
  - Reproducible Behavior
  - Allow movement patterns during the experiment

ModelNet Architecture

ModelNet Cores
  - Responsible for routing packets
  - and performing emulation

Edge nodes
  - Run user-level services

Pipes
  - Emulate network links with
    specified bandwidth, loss-rate
    and latencies

Virtual Nodes
  - Have an IP address and
    corresponding location in the
    emulated topology

ModelNet Usage

Creation
  - Generate initial mobile/adhoc topologies

Assignment
  - Assign pipes to ModelNet cores

Binding
  - Assign VN to edge nodes, bind physical nodes to cores

Execution
  - Execute target applications

Initial Results

Ad hoc Scenario

- 670m square, 50 mobile hosts with random start points
- Implement “random waypoint” movement model
  
Bandwidth variation with time and mobility

Bandwidth as a function of varying communication ranges

Future Research

- Emulating MAC layer
- Implementing various ad hoc routing protocols in ModelNet core
- Evaluate under range of real application behavior