Location & Cost Constrained Multilevel Topology Generation

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wiki.ittc.ku.edu/resilinets/Topology_Modeling

Network Topology Generation

• Goal: generate realistic network topologies
  – based on real world network constraints & evolution
  – representative of the process, not properties
  – emphasis on physical topology, not logical relations

• Network characteristics
  – hierarchical deployment
  – constraints: location, infrastructure, population
  – finite costs

• Conventional approaches
  – simulates network properties using graph models
    • may introduce unwanted artifacts
    • not representative of network resilience

Location and Cost Constraints

• Approach
  – decouple node distribution from node connectivity
  – hierarchical: different models at different levels

• Location constraints
  – physical node locations constrained by design
  – multiple options for node positioning
    • existing networks, population-based clustering
    • heavy tailed distributions, user specified

• Cost constraints
  – fixed and variable costs per link
  – determine feasible link generation parameter values

Hierarchical Model

• Level 1: backbone network
  – nodes distributed based on location constraints
  – mesh of links generated using various models
    • random, locality, Waxman, ...
    • cost determines feasible model parameters

• Level 2: access networks
  – uniformly distributed number per backbone node
  – normally distributed around a backbone node
  – access network connectivity: ring, star, mesh

• Level 3: subscribers
  – normally distributed with multiple connectivity models
    • pure distance, weighted preferential attachment

Implementation

• 3-tiered topology generation example
  – each level may use a different graph model

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