Skitter vs. DIMES: Topology-based Simulations of Mobility-related Protocol Metrics

Matthias Wählenicht\textsuperscript{1,2}, Thomas C. Schmidt\textsuperscript{1}
\{t.schmidt, waehlisch\}@ieee.org

\textsuperscript{1}HAW Hamburg & \textsuperscript{2}link-lab

70th IETF Meeting, 2007
Agenda

Motivation

Current Large-scale Measurement Projects

Characteristics of Skitter and DIMES

Conclusion & Outlook
Motivation

- Topologies are ingredients for simulations and analytical studies
- Graph properties help to describe the topology
- Example 1: Handover performance estimates for FMIP
  - Determine distance between two nodes inside a city
  - Derive anticipation time based on inter-access router delay
- Example 2: Multicast mobility
  - Mobile multicast routing complexity depends on state changes
  - Calculate router states persistent under handoff

⇒ We need to include real-world measurements into analysis and simulations
Current Large-scale Measurement Projects

**Skitter**
- 26 global monitor points
- Continuously refreshed destination list of 971k nodes
- AS, IP and router level view

**DIMES**
- Distributed architecture of volunteer agent hosting (> 15k agents)
- Agent based on Java
- Dynamic destination list
- AS, IP and router level view
- [http://www.netdimes.org](http://www.netdimes.org)
Tool Chain: Topology Generator & Converter

- Steps to solve:
  - Pre-processing: Clean up original data (s. DIMES)
  - Data filters
  - Data export to well known simulator formats
- For comprehensive tool chain extend existing generator
  - Boston University Representative Internet Topology Generator
  - BRITE supports many topology models, modular architecture
- BRITE extension includes
  - Import of DIMES and Skitter data
  - Filter schemas: Map sampling and radius view
  - Additional graph analysis
- DIMES fix script & extension available at:
Comparing Skitter and DIMES

Graph Metrics

- Average node degree, degree distribution, ...
- Is there a comprehensive metric to conclude to other metrics?
  - Mahadevan et al.: “The Internet AS-Level Topology: Three Data Sources and One Definitive Metric”, CCR, 26 (1), 2006
- Joint degree distribution $P(k_1, k_2)$
  - Describes a correlation
  - Randomly selected edge connects nodes of degree $k_1$ and $k_2$
  - Reflection symmetric distribution
  - Gives information about 1-hop neighbourhood of nodes
Graph Characteristics: Skitter vs. DIMES

Degree Distribution

- Skitter: $\langle x \rangle = 4.42$, $\sigma_x = 6.28$
- DIMES: $\langle x \rangle = 6.77$, $\sigma_x = 9.52$

Linear fit with slope $\gamma$

$\gamma = -2.19$

$\gamma = -2.24$
Graph Characteristics: Skitter vs. DIMES
Part of Joint Degree Distribution

Skitter

DIMES
Conclusion & Outlook

- Different measurement approaches
  - End devices or infrastructure centered
- Fix DIMES data before use
- DIMES sees more interconnections, i.e., core structure
- Skitter provides data from individual vantage points
- Conclude from general graph properties to mobility metrics