

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

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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
- ▶ <http://www.caida.org/tools/measurement/skitter/>

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>

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:
<http://www.realmv6.org/brite-extension.html>

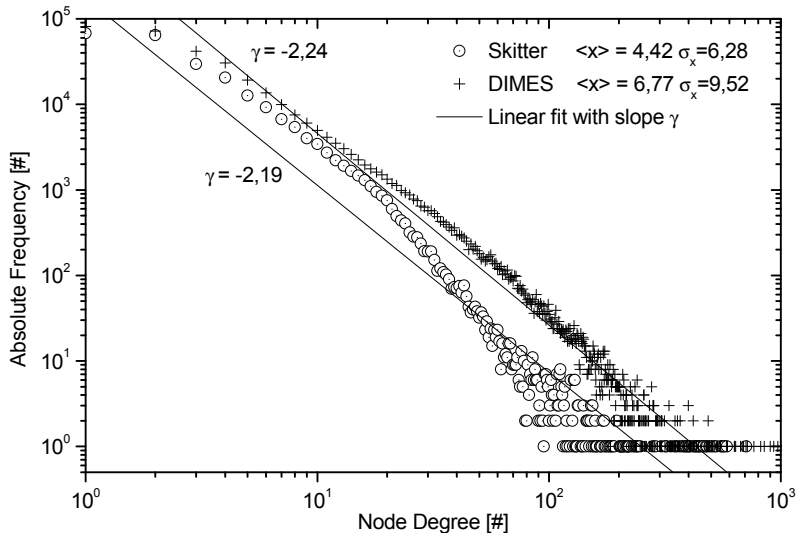
Comparing Skitter and DIMES

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

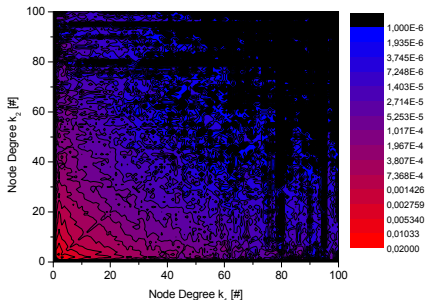
Degree Distribution



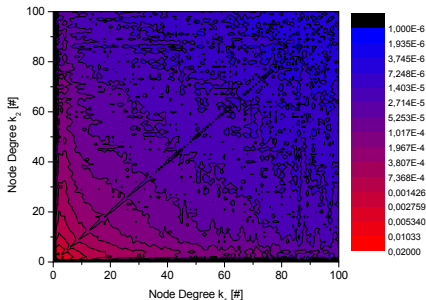
Graph Characteristics: Skitter vs. DIMES

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

