End-to-End Network Topology Generation

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ABSTRACT

Internet researchers need high quality, multi-scale, end-to-end network topology generators which take into account the dynamic failure and growth of the Internet nodes and links. After examining a number of commonly used generators and comparing their output with data sources available at wide area (AS level), ISP (IP routing level) and enterprise networks, we are developing a mechanism for synthetically generating topologies which are able to represent networks across multiple scales. We are extending this work to incorporate the dynamic evolution of networks.

COMPARISON OF TOPOLOGY GENERATORS

Many Models available:

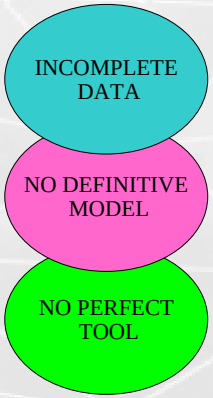
•AS-Level,and Router Level (e.g. Waxman , BA, GLP, PLRG)

•Degree-based and structural

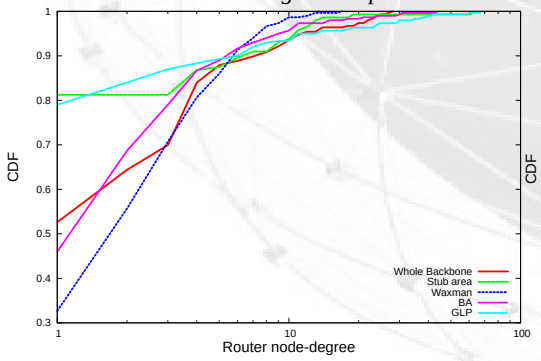
•Statistical and empirical

Tools available: Tiers, Inet, Igen, BRITE, PFP, Orbis, etc.

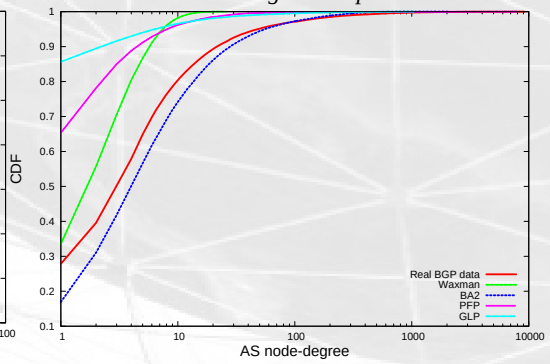
Many models embedded within different tools, a topology generator is needed which brings together all these models.



Router-level node-degree comparison CDF



AS-level node-degree comparison CDF



MULTI-SCALE TOPOLOGY GENERATION

Distribution-based approach

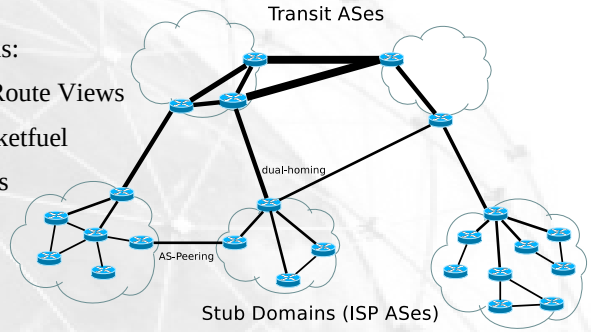
Based on measurements at various levels:

•BGP data from GEANT, Abilene, Route Views

•Router-level data from Skitter, Rocketfuel

We include evolution and failure models

Based on analysis of various networks.



DYNAMIC NETWORK MODELS

Topologies must include spatial and temporal models for addition of nodes, link withdrawals, link maintenance and link and node failures. Such models lead to generation of topologies that evolve over time.

Models for network evolution are inferred from various data sources:

•AS-level: BGP updates (available from GEANT, Abilene, Route Views)

•Router-level: IS-IS and OSPF data (available from GEANT, Abilene, corporate networks)

•Documented maintenance and failure data available from an ISP NOC

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