An Approach to Universal Topology Generation

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IEEE MASCOTS 2001 (Tools), Cincinnati, Ohio, August 2001
What is Topology Generation?

An attempt to capture the...

Structure of the Internet

Attributes of the Internet

- Edges: bandwidth and delay
- Router Nodes: buffer sizes
The need for good topologies

- Protocol Design
  - Topologies to evaluate protocol performance

- Effective Engineering
  - Capacity Planning, Resilience to failures, ...

- Wide Area Infrastructure Development
  - Optimal server placement, Content Distribution, ...

- Scientific Understanding
  - Origins and Evolution
Past Efforts and Status Quo

- Connection Based Models
  - Hierarchy and Locality in the Internet
  - GT-ITM, Tiers, ...

- Generative Models
  - Degree distributions in the Internet
  - Inet, PLRG, BRITE 1.0, ...

- No single-model captures all invariants

How can we develop an adapting generation tool that interfaces “general” Internet research and “pure” topology generation research?
Our Contribution

- A Universal Topology Generation Approach
- Analysis Framework: BRIANA
- Infrastructure to make topology research more effective.
BRITE Features

- **Representative**
  - Produces accurate synthetic topologies
- **Flexible**
  - Encompasses multiple generation models
  - Generates topologies over wide range of sizes efficiently
- **Extensible**
  - Enables easy addition new generation models
- **Interoperable**
  - Integrates with other generators and simulation environments
- **Portable**
  - Java and C++ implementations; Open source
- **User Friendly**
  - Graphical interface
The Big Picture

GUI-Driven BRITE Generation Engine

Topology analysis in BRIANA

Visualization in otter

Large-scale SSF or ns simulations

BRITE Configuration File

skitter
caida

Mercator
GT-ITM
Inet
BRITE

Import

Export

BRIANE
More on Generation Models

- Single-level models
  - Node placement
  - Node internconnection
  - Attribute assignment

- Hierarchical models
Generating a Topology

- Choose from multiple generation models.
- Configure if desired
- Visualize and Output

Demonstration
BRIANA: The BRITE Analysis Engine

- A repository of analysis routines for topologies
- Share and create benchmarks to compare topologies
- Features:
  - Cross Platform
  - Language Independent
  - Extensible GUI

Demonstration
Performing a Simulation

- **Why**
  - Validate abstractions and models of the Internet
  - Visual understanding of protocol dynamics

- **BRITE supports:**
  - ns-2 and nam
  - SSFNet

Demonstration
Research with BRITE

**Measure:** Conduct experiments and mine existing datasets for quantities of interest.

**Model:** Characterize and model invariants from measurements.

**Build:** Incorporate generation models into BRITE.

**Validate:** Verify the predictions our models make.
Final Remarks

- Visit [http://www.cs.bu.edu/brite](http://www.cs.bu.edu/brite)
  Download, User Manual, Relevant Publications

- Email [brite-users-request@cs.bu.edu](mailto:brite-users-request@cs.bu.edu) with subscribe as body to join brite-users list

- New Release Version 2.1 coming

- Please Contribute to BRITE and BRIANA