

An Approach to Universal Topology Generation



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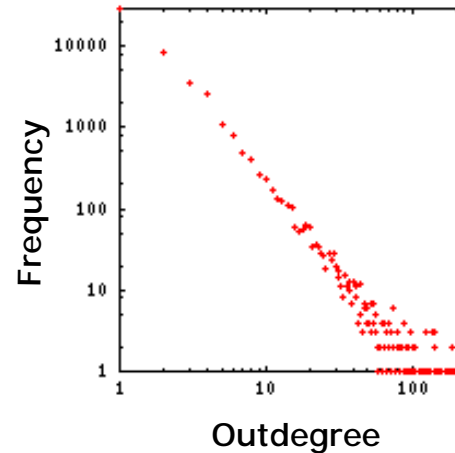
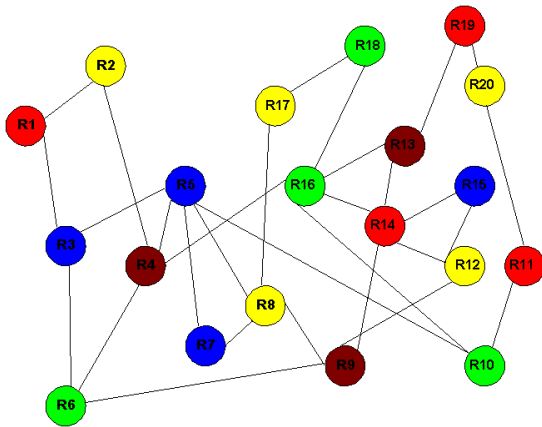


Computer Science

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





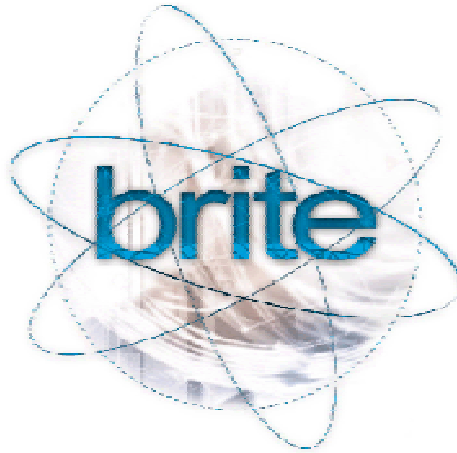
Past Efforts and Status Quo

- 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

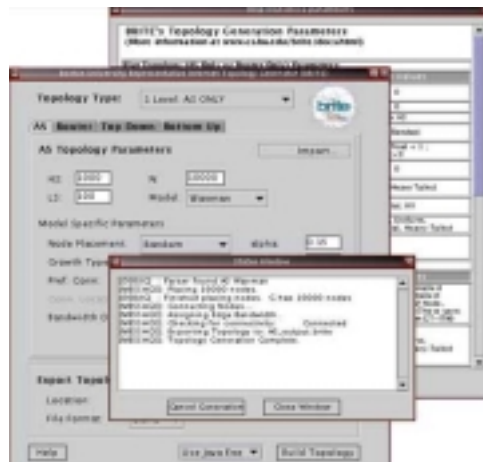
BRITE
Configuration File



Mercator
GT-ITM
Inet
BRITE

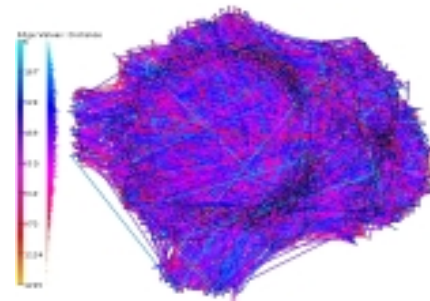
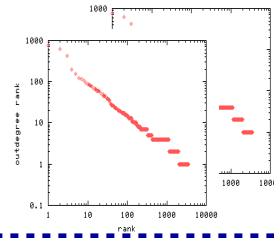
Import

GUI-Driven BRITE Generation
Engine

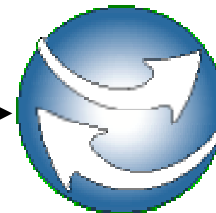


Export

Topology analysis
in BRIANA



Visualization in
otter



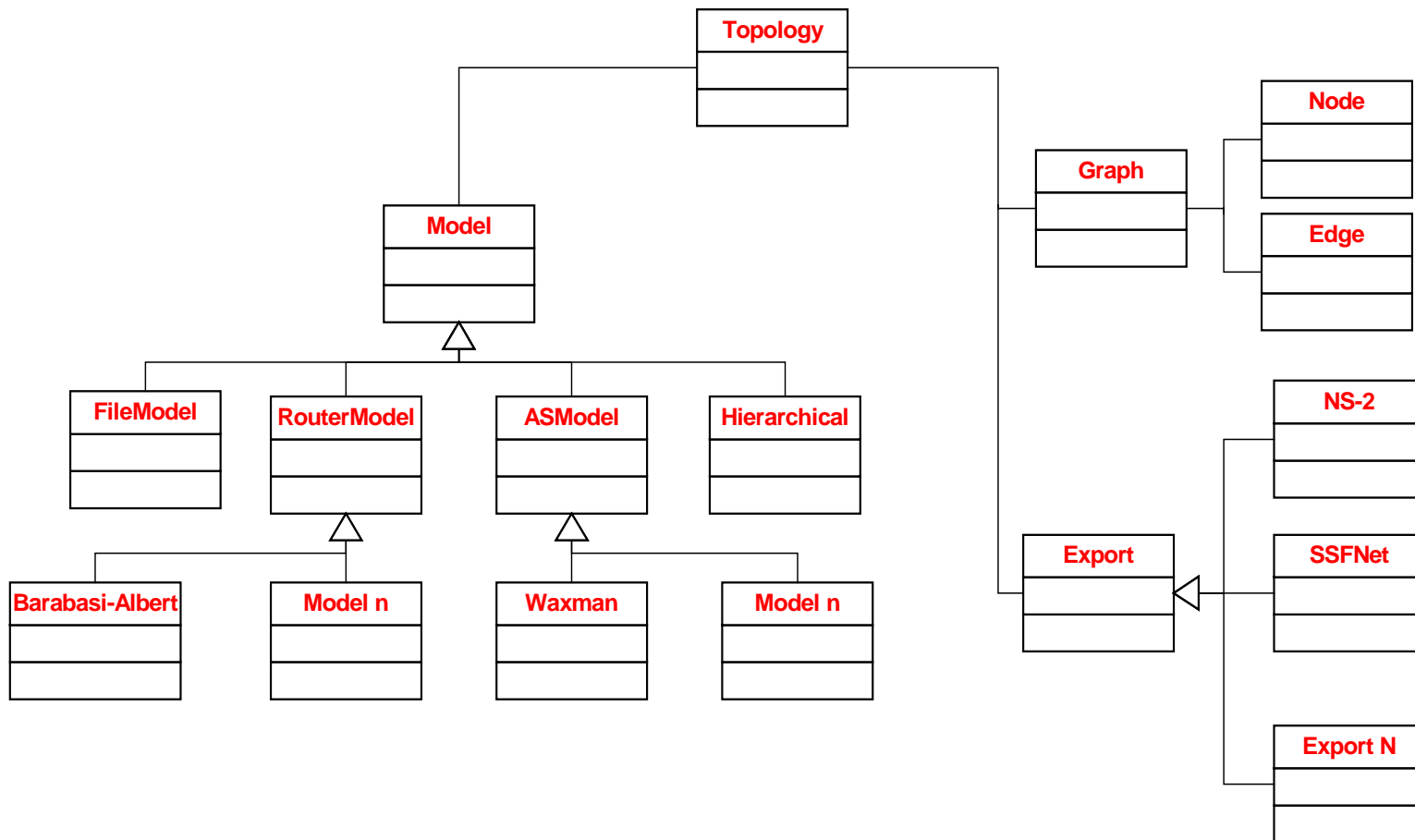
Large-scale
SSF or ns
simulations



Computer Science

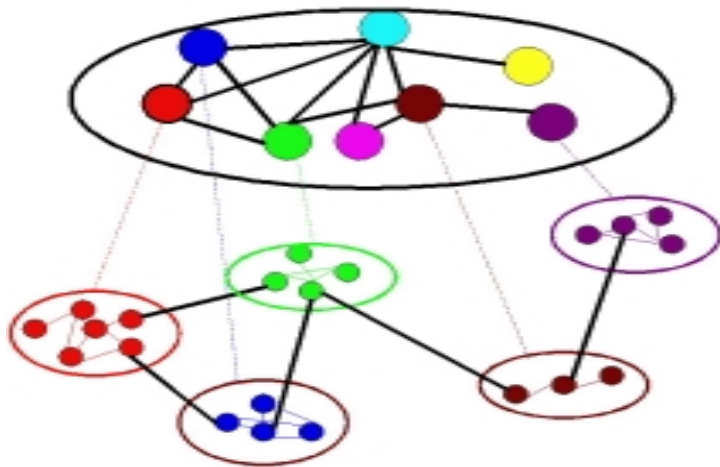
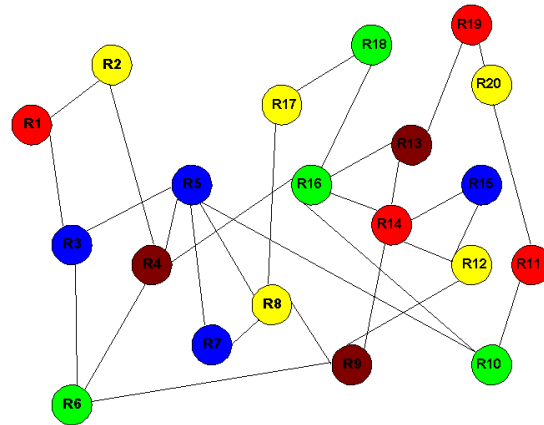
BRITE Architecture

Model driven Topology Generation

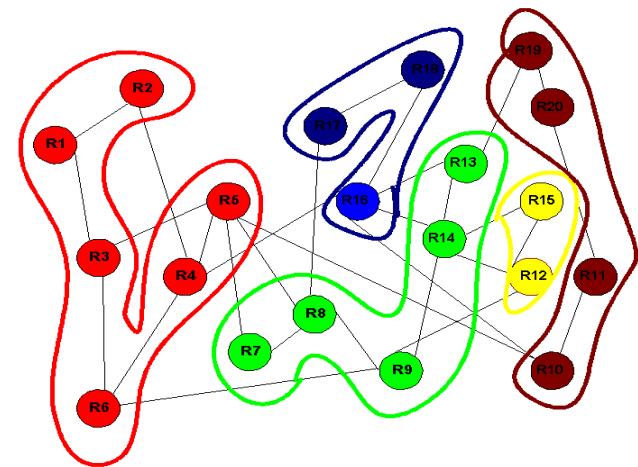


More on Generation Models

- **Single-level** models
 - Node placement
 - Node interconnection
 - Attribute assignment
- **Hierarchical** models



Top Down



Bottom Up



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





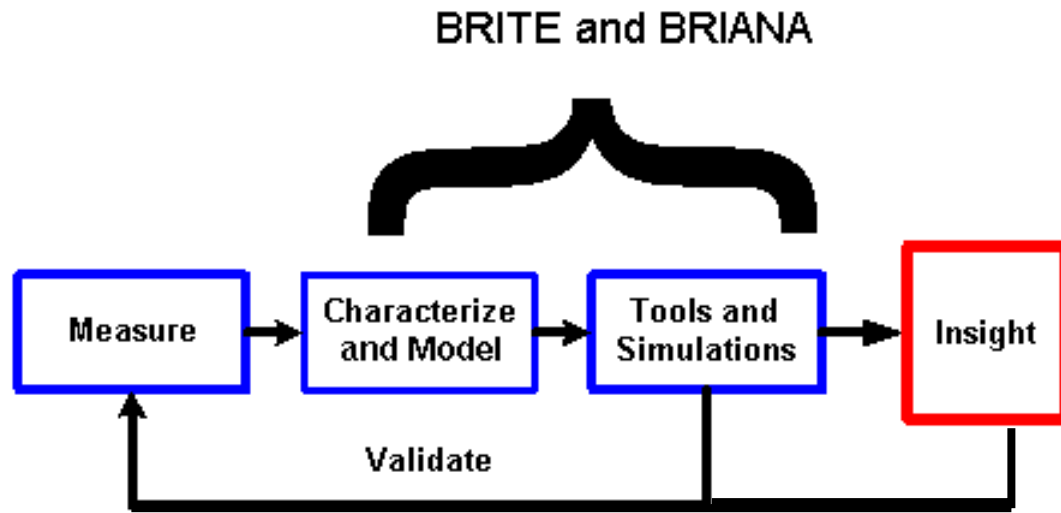
Performing a Simulation

- 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.

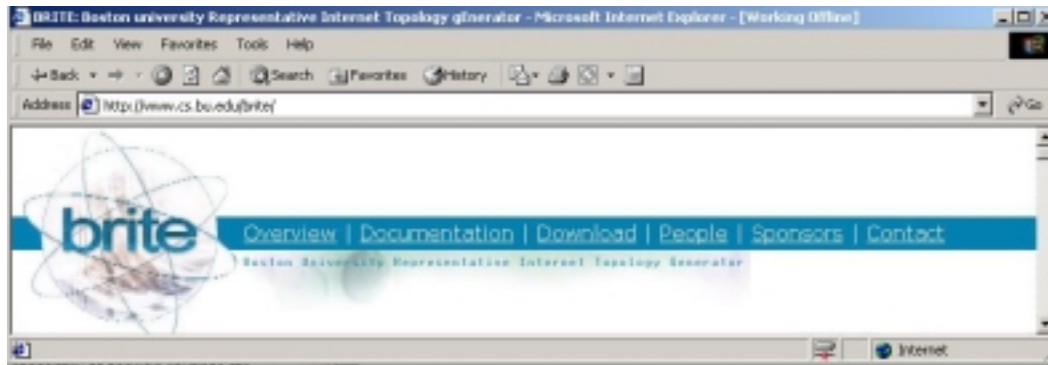
Build: Incorporate generation models into BRITE.

Validate: Verify the predictions our models make.



Final Remarks

- Visit <http://www.cs.bu.edu/brite>
Download, User Manual, Relevant Publications



- Email 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

