A Review of Computer Testbeds

Scientific Experiments
- Experiments must be repeatable and results must be reproducible
- This allows for scientific collection of data

Testing Experiments
- Requirements for repeating or reproducing experiments may only require pass/fail results
- Typically focused on assurance

Prototyping Experiments
- Experiments typically explore limitations of program or environment
- Typically focused on functionality

Testbed Characteristics and Implications
We outlined the characteristics of several well-known and often used testbeds.

The information provided in this review is intended to support researchers in choosing the most appropriate testbed based on their experimental goals.

### PlanetLab
- Heterogeneous nodes accurately represent live internet conditions
- Variability allows for a wide range of testing scenarios
- Constantly changing conditions make it difficult to reproduce precise results
- Response centered security policies do not prevent misuse of PlanetLab resources

### Seattle
- Allows high-level user control that allows for more reproducible results or conditions
- Less accurate representation of live internet or networks
- No low-level access to end hosts
- Resource isolation incorporated in design to allow maximal safety when experimenting

### Emulab
- Allows complete control making it easy to reproduce precise results or conditions
- User generated topologies may not represent actual networks or live internet
- Results in possibility of user error (incorrect assumptions, variables etc)
- Can be used to implement more specific scenarios (i.e. DETER)

### ModelNet
- Implemented on researcher’s local cluster and subject to those limitations.
- Is very configurable as it can be used to emulate almost any topology or condition
- Is an emulation raising the question of how accurately it represents live conditions
- Could be limited by assumptions or stipulations enforced by the user

Choosing a Testbed

**Models**
- ModelNet
- Seattle
- Emulab
- PlanetLab
- DETER
- ReAssure

**Questions**
- I have a scientific experiment.
- I have a testing experiment.
- I have a prototyping experiment.
- I need to control variables and conditions.
- I need to implement on my private cluster.
- I need to generate my own network topologies.
- I want to run experiments that may not be safe for the testbed’s infrastructure.
- I need experiments independent of my assumptions.
- I need low-level access to end hosts and systems.
- I need variables and conditions to vary constantly.

**Answers**
- Yes
- No
- Unknown Match

Future Plans: Testbed Development
- GENI (Global Environment for Network Innovations)
- NSF funded testbed under development
- Creators considering several security threat models

Where GENI will fit in the adjacent flowchart will soon be determined.

References
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