PlanetLab Tutorial

2013-05-23
Eunsang Cho
Contents

• PlanetLab
  • Research Platform
  • Overlay Network Testbed
  • Deployment Platform
  • How It Works
    • Virtual Machines
    • Slices
  • Improvements

• Getting Started with PlanetLab
  • Delay Measurement

2013-05-23
PlanetLab

• Global research network
  • It supports the development of new network services.
  • 1,167 nodes and 551 sites (as of May 21, 2013)

Source: http://planet-lab.org/
Research Platform

- Collecting routing information of the current Internet

- Deploying Internet measurement tools
  - Measurement Lab (M-Lab) [http://www.measurementlab.net/](http://www.measurementlab.net/)

![Diagram of the Hubble architecture.](image)
Overlay Network Testbed

- Overlay networks
  - Purpose-built virtual networks that use the existing Internet for transmission
  - The Internet was once deployed as an overlay on top of the telephony network

- PlanetLab supports planetary-scale services as an overlay network testbed.

Deployment Platform

- Prototyping a new network architecture

**Analysis** (models) ➔ **Simulation / Emulation** (code) ➔ **Experiment At Scale With Real Users**

- Examples
  - CoDeeN: content distribution network
  - ScriptRoute: network measurement tool

How It Works

• Node Contribution
  • Each node is contributed by participating organizations.

• Principal
  • Owner: an organization that owns one or more Planetlab nodes
  • User: a researcher that deploys a service on a set of PlanetLab nodes
  • PlanetLab Consortium (PLC): a trusted intermediary that manages nodes on behalf of a set of owners

• Virtualization
  • Virtual machine: an execution environment on a particular node
  • Slice: a set of virtual machines
Virtual Machines (Old, Linux Vserver)

• Each VM has access to a physical interface with a public IP address.

Virtual Machines (New, LXC)

- Instead of seeing a physical interface with a public IP address, users will see a virtual interface with a private IP address, routed via NAT.

Image Source: http://www.electronicproducts.com/Software/System/Linux_multicore_resource_allocation_and_control.aspx
Slices
Slices

Slices

Improvements

• Layer 2 experiments
  • VINI project: virtual network infrastructure
    • PL-VINI
      • Click modular software router
      • XORP (eXtensible Open Routing Platform)
      • User-Mode Linux
      • OpenVPN

• Performance enhancement
  • Supercharging PlanetLab: Blade servers + Network processors
Getting Started with PlanetLab

• Account Registration
  • Principal Investigator of Site SNUMMLAB: Prof. Kwon
  • Technical Contact: Akmal Khan

• Create an SSH key (in your local Linux machine)

$ ssh-keygen -t rsa -f ~/.ssh/id_rsa
Getting Started with PlanetLab

• Creating a Slice
  • Ask PI to create a slice, or to associate account with an existing slice
Getting Started with PlanetLab

- Connecting PlanetLab node

```bash
ssh -v -l [slice name] -i ~/.ssh/id_rsa [Planetlab node]
```
Getting Started with PlanetLab

• To install additional standard packages
  
  ```
  sudo yum install [package name]
  ```

• `/etc/yum.conf`
  
  ```
  sudo vi /etc/yum.conf
  ```
Delay Measurement

• Round trip time (RTT)
  • Routing in Internet can be asymmetric.
  • A packet traverse from a source to a destination in one path and takes a different path when it returns to the source.
  • It is hard to isolate the direction in which congestion is experienced.

• OWAMP
  • One-Way Active Measurement Protocol
    http://www.internet2.edu/performance/owamp/
  • Command line client application and a policy daemon used to determine one way latencies between hosts.
  • It can isolate the effects of specific parts of a network on the treatment of traffic.
Delay Measurement

• OWAMP is installed on 5 PlanetLab nodes.
Delay Measurement

• Results

86400 sent, 2270 lost (2.627%), 0 duplicates
one-way delay min/median/max = 89.7/138/2.49e+03 ms
one-way jitter = 28 ms
Hops takes 5 values; Min Hops = 12, Max Hops = 51
no reordering

86400 sent, 486 lost (0.562%), 0 duplicates
one-way delay min/median/max = 29.6/74.7/2.36e+03 ms
one-way jitter = 15.7 ms
Hops takes 5 values; Min Hops = 11, Max Hops = 226
no reordering
Delay Measurement

• Results (cont’d)

86400 sent, 311 lost (0.360%), 0 duplicates
one-way delay min/median/max = 37.6/87.2/2.39e+03 ms
one-way jitter = 13.3 ms
Hops takes 5 values; Min Hops = 14, Max Hops = 86
no reordering

86400 sent, 471 lost (0.545%), 0 duplicates
one-way delay min/median/max = 67.7/111/2.48e+03 ms
one-way jitter = 20.6 ms
Hops takes 4 values; Min Hops = 17, Max Hops = 23
no reordering
More Information

• PlanetLab
  http://planet-lab.org/

• PlanetLab Tutorial
  http://planet-lab.org/tutorial

• OneLab (EU approach to Future Internet testbed)
  http://www.onelab.eu/

• Plush (PlanetLab User Shell)
  http://plush.cs.williams.edu/

• NEPI (Network Experimentation Programming Interface)
  http://nepi.inria.fr/