An Open Federated Laboratory Supporting Network Research for the Future Internet



Overview of TopHat: Interconnecting the OneLab measurement infrastructures

Jordan Augé, Timur Friedman, Thomas Bourgeau (UPMC)

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Presentation of TopHat

Supporting PlanetLab applications







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Supporting PlanetLab applications







- PlanetLab testbed allows creation of overlay applications
 - ▶ P2P, CDN, etc.





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 - P2P, CDN, etc.
- ▷ the underlay is unknown
 - topology, delays, etc.
 - and their evolution...





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- PlanetLab testbed allows creation of overlay applications
 - P2P, CDN, etc.
- the underlay is unknown
 - topology, delays, etc.
 - and their evolution...
- > measurements are needed...
- but a measurement service is better:
 - users can focus on developing the overlay instead of writing monitoring code
 - it allows the use of methods that reduce strain on the network,
 - it generally provides more efficient, correct and accurate results.

TopHat's niche





- There are many measurement systems
 - Ark/Archipelago, iPlane, ...
- Some are specifically designed for testbeds
- TopHat supports the PlanetLab testbed experiment lifecycle
 - from setup through completion
 - provides live measurements to the application
 - callbacks are used to communicate information to the application
- DopHat interconnects with OneLab partner systems
 - DIMES extends scope
 - ETOMIC provides high-precision measurements





Presentation of TopHat

Supporting PlanetLab applications

3 Future plans

Services in support of applications



b four broad services, following the experiment lifecycle.

- Setup : help the user choose nodes before launching his/her experiment
 - Live : provide real-time information about the underlying network
- **Rewind** : give access to historical data
 - Viz : allow visualization of experimental data
- ▷ two interfaces:
 - Web interface
 - ► an XML-RPC API + command-line tool

Setup: choosing the nodes





- TopHat provides topological information for the choice of nodes
- Leveraging PlanetLab topological and geographical diversity

Sample query:

Give me twenty relatively unloaded, reliable nodes that are each **at least five traceroute hops away** from each other with **stable routes** and **no load balancer** on the paths

PlanetLab node selection interface (1/2)



- help researchers deploy and manage their experiments
 - on PlanetLab and future federated facilities
- uniform access to testbed data
 - system information from CoMon (reliability, load, etc.)
 - topological information for TopHat and interconnected systems
- ▷ for example, AS-level information in the default interface

PlanetLab node selection interface (2/2)





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	PLC	pl1.unm.edu	boot	0	n/a	3388		
	PLC	pl1snu.koren21.net	boot	82	0.54	9270		
	PLC	pl2-higashi.ics.es.osaka-u.ac.jp	boot	82	5.26	4730		

PlanetLab node selection interface (2/2) **OneLab**





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Measurement query interface



Functions to get measurements (Get), manage the list of callbacks, etc.

Prototype of the Get function
RET = Get(Auth, Method, Timestamp, Input, Output, Callback)
Auth : authentication token (login/pass, session, etc.)
Method : eg. traceroute, delay, active bandwidth
Timestamp : date, interval, description (now, today, latest, etc.)
Input : a node/a set of nodes, a path/a set of paths
Output : subset of available fields, depends on Method
Callback : used for periodic measurements



```
Sample query:
list = ['planet2.elte.hu', 'planetlab-europe-02.ipv6.lip6.fr']
Get(auth, 'latest', 'nodeinfo', {'hostname': list},
    ['hostname', 'prefix', 'asn', 'as_name', 'platform_name'])
Result:
[{'hostname': 'planet2.elte.hu', 'prefix': '132.227.0.0/16',
    'asn': '1307', 'as_name': 'FR-U-JUSSIEU-PARIS',
    'platform_name': 'Team Cymru'},
{'hostname': 'planetlab-europe-02.ipv6.lip6.fr', 'prefix': '157.181.0.0',
    'asn': '2012', 'as_name': 'ELTENET ELTENET'
    'platform_name': 'Team Cymru'}]
```

Live: supporting running experiments



- classical set of topological queries provided directly via the API
- Akihiro Nakao, Larry Peterson, Andy Bavier,
 A routing underlay for overlay networks,
 in proceedings of SIGCOMM'03, pp.11–18, 2003.
- ▷ callbacks are provided for events, periodic and async. measurements
 - > XML-RPC call, email, RSS, etc.

Example: alert me when the delay between two nodes changes by more than 20%

Live: measurements and interconnection **OneLab**



```
Sample query: traceroute on two different platforms:
path list = [('planet2.elte.hu', 'planetlab-europe-02.ipv6.lip6.fr'),
             ('ape.onelab.elte.hu', 'planetlab-europe-02.ipv6.lip6.fr')]
Get(auth, 'now', 'traceroute', path list,
   ['src ip', 'dst ip', 'hops.ttl', 'hops.ip', 'hops.hostname', 'platform name'])
Result:
[{'src ip': '157.181.175.248', 'dst ip': '132.227.62.19',
    'hops': [
      {'ttl': '1', 'ip': '157.181.175.254', 'hostname': None},
      {'ttl': '2', 'ip': '157.181.126.45', 'hostname': 'taurus.taurus-leo.elte.hu'},
       ...1.
    'platform name': 'TDMI'},
 {'src ip': '157.181.175.247', 'dst ip': '132.227.62.19',
    'hops': [ ... ].
    'platform name': 'SONoMA'}
```

TopHat architecture





Extending TopHat scope and scale



Ongoing interconnection with OneLab partners and others

DIMES

▷ large-scale, measurements from outside of PlanetLab

ETOMIC, SONoMA

b high precision synchronized measurements

TDMI

> our own measurement agent, running in a slice

Team Cymru

AS-level information





Presentation of TopHat

2 Supporting PlanetLab applications



Some challenges (1/2)



Accounting

- > We need to keep track of who uses the system, when, why
 - to understand usage of the system and for engineering purposes and improvements
 - we are funded for the service and need to report about the usage of the system
 - there are scientific reasons to study users' behaviour itself
- ▷ Interconnecting multiple systems makes the accounting problem harder

Some challenges (2/2)



Authentication

- ▷ Make it easy for users to access the different platforms...
- ▷ ... but there are some constraints
 - access to sensitive data, ability to perform measurements
 - some issues have been solved for individual systems (eg. PlanetLab AUP, traceability)
 - more challenging in an interconnected environment

Conclusion



References

Thomas Bourgeau, Jordan Augé, Timur Friedman, TopHat: A topology information service to support applications in a future-internet testbed, accepted to TridentCom'2010, 18-20 May 2010, Berlin, Germany.

Contact
<firstname.lastname@lip6.fr>

Website http://www.top-hat.info

The service will be unveiled for TridentCom

We are interested in interconnecting with your platform !