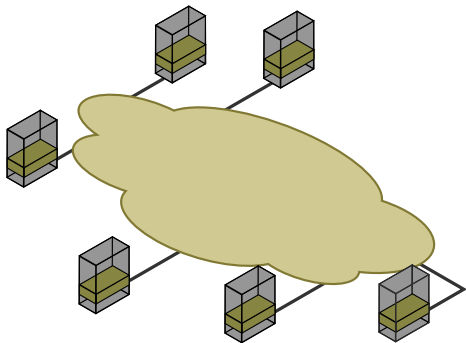**OneLab**

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Overview of TopHat: Interconnecting the OneLab measurement infrastructures

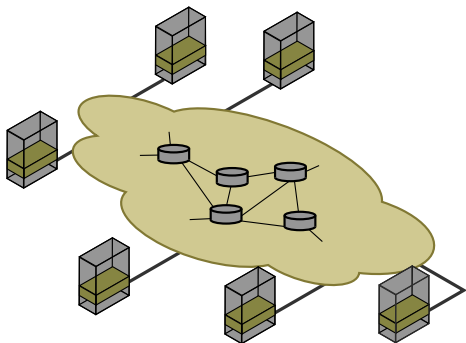**Jordan Augé**, Timur Friedman, Thomas Bourgeau (UPMC)

Outline

Outline

Motivations

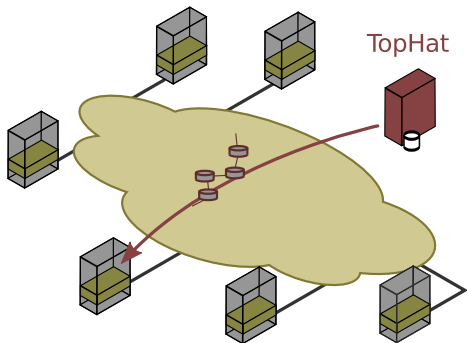▷ PlanetLab testbed allows creation of overlay applications

  ▶ P2P, CDN, etc.

Motivations

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  ▸ P2P, CDN, etc.
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  ▸ topology, delays, etc.
  ▸ *and their evolution...*

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▷ measurements are needed...

Motivations


▷ 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
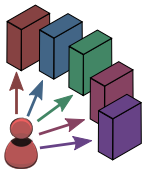
▷ There are many measurement systems
  ▶ Ark/Archipelago, iPlane, . . .
▷ Some are specifically designed for testbeds

▷ 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
▷ TopHat interconnects with OneLab partner systems
  ▶ DIMES extends scope
  ▶ ETOMIC provides high-precision measurements

Outline

Services in support of applications

▷ **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)

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▷ 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)

PlanetLab node selection interface (2/2)

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 request for Setup information

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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

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▷ 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

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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'},
         ...],
    'platform_name': 'TDMI'},

  {'src_ip': '157.181.175.247', 'dst_ip': '132.227.62.19',
    'hops': [ ... ],
    'platform_name': 'SONoMA'}
]
```

TopHat architecture

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| Clients | Researchers | Applications |

| Services | Setup | Live | Rewind | Viz |

| Aggregators | TopHat |

| Measurement infrastructures | TDMI | DIMES | ETOMIC | Team Cymru |

Extending TopHat scope and scale

Ongoing interconnection with OneLab partners and others

DIMES
▷ large-scale, measurements from outside of PlanetLab

ETOMIC, SONoMA
▷ high precision synchronized measurements

TDMI
▷ our own measurement agent, running in a slice

Team Cymru
▷ AS-level information

Outline

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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

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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 !