An Internet measurement platform for the e-learning community

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• European research initiative
• Promotion of wide-scale federations testbed and experimentation facilities for Internet and network-related research.
• €20 million investment since 2010
• 27 projects founded
Some FIRE projects...
PlanetLab Europe

- European portion of PL (since 2008)
- Operated by UPMC
  - In collaboration with INRIA, U. Pisa and Hebrew U.
- ~350 nodes at ~200 sites
• Educational Layer over FIRE facilities
  – Transforms FIRE testbeds into learning resources for education
• Similar usage patterns between researcher & educational learner
  – Resources are discovered, selected, reserved, provisioned
  – Experiment executed, controlled, monitored, results collected
  – Resources release.
FORGE: Hidden Complexity

- Steps are preconfigured and automated
  - **Teacher**: discover, select reserve, provision resources
  - **Student**: web based control and monitoring elements

- Supported by:
  - **Widgets**: micro-applications that perform a dedicated task
  - **Adapters**: Backend scripts that interact with FIRE testbed facility
Since not all FIRE facilities offer guaranteed resource availability and reservation, this should be carefully considered in the requirements phase of a new lab course. Also, since it is not guaranteed that learners can interact with the FIRE facility via the same mechanisms as researchers, it is recommended that the specific reservation mechanism be hidden from the learner and also integrated in a FORGE widget and adapter.

To further alleviate the scarcity of resources, it can also be interesting to offer an additional layer of multiplexing or queuing on the widget side so multiple learners can independently use the same FIRE resources. However, this requires that during the design phase of the lab, every exercise has a clearly defined pre and post state, with well-defined transitions between post and pre states of different exercises. If it is not possible to guarantee that the resources return to the same state after each exercise, an additional maximum duration for exclusive access (normal coincides with the experiment duration) should be defined and enforced to limit the frustration of the learner. This also implies that a maximum number of simultaneous users per resource should be defined. For example, for a Wireless LAN lab, we were able to define a maximum experiment duration of one minute and three simultaneous users to be within the limits of what learners found comfortable.

One should also consider the differences in level of control between a learner using the FORGE tools and a direct testbed user for which a FIRE facility was envisioned. This is especially relevant when considering troubleshooting possible software and hardware failures that are often unavoidable when using state-of-the-art research equipment and immature technologies. When a learner has only access via a web interface, a series of watchdog programs and actions should...
FORGE Courses

• Prototypes courses:
  – TCP congestion control
  – Wireless LAN throughput
  – Network router configuration
  – Introduction to OFDM
  – ...

• Opencall courses:
  – Metrology of the Internet
  – Project-based learning for master level students
  – GÉANT Testbeds Service – User Certification Programme
  – FORGE-based Local Area Networks
  – ...

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[Logos]
MOOC "Internet Measurements: a Hands-on Introduction"

- Week 1: Introduction
- Week 2: Topology and routes
- Week 3: Connectivity, losses, latency, and geolocation
- Week 4: Bandwidth
- Week 5: Traffic measurements
Week 1: Introduction

1. Motivation
2. Background: Internet infrastructure and traffic
3. Types of measurements
4. Measurement platforms
   A. Overview
   B. PlanetLab Europe
5. Sound measurement practices
6. Ethical issues
Client/server architecture
(MOOC/PLE widget)

• MOOC maintain its students’ privacy
  – Student authenticate themselves to the MOOC
  – The MOOC request measurement on its behalf (not revealing their identity)
  – Chain of accountability in case of disruptive measurement

• PLE to preserve its resources
  – Queuing of requests
  – Execution of measurement at a predefined rate
  – Sanity check

• Extensibility
  – Other clients, other measurement systems...
Results of the first MOOC execution

Average age = 35

1824 enrollments

156 certificates delivered

A very good satisfaction rate

1% 7% 52% 36%
Perspectives

• PLE Widget operational
  – MOOC: Next session 2017
  – Web client for classical labs
    • TCP/IP course
    • Advance course on Internet measurement

• Extensions of the PLE Widget
  – New PLE commands (DNS, HTTP and packet capture)
  – Integration of new measurement platforms?
Additionnals slides
# MetroMOOC PLE Interface

<table>
<thead>
<tr>
<th>Experiment overview</th>
<th>New experiment</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Experiment name</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PlanetLab Europe node</td>
<td>onelab2.pl.sophia.inria.fr</td>
</tr>
<tr>
<td>Command name</td>
<td>traceroute</td>
</tr>
<tr>
<td>Arguments</td>
<td></td>
</tr>
<tr>
<td>Destination</td>
<td><a href="http://www.google.fr">www.google.fr</a> or 216.58.209.99</td>
</tr>
</tbody>
</table>

Launch
<table>
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<tr>
<th>Pin</th>
<th>Name</th>
<th>Date &amp; time</th>
<th>Status</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>🚀</td>
<td>iperf 1 thread TCP example</td>
<td>8 months, 3 weeks ago</td>
<td>job completed</td>
<td>View</td>
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<td>View</td>
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<td>View</td>
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<td>job completed</td>
<td>View</td>
</tr>
<tr>
<td>🚀</td>
<td>iperf UDP example 1</td>
<td>8 months, 3 weeks ago</td>
<td>job completed</td>
<td>View</td>
</tr>
<tr>
<td>🚀</td>
<td>Ping example</td>
<td>9 months, 2 weeks ago</td>
<td>job completed</td>
<td>View</td>
</tr>
<tr>
<td>🚀</td>
<td>Traceroute example 2</td>
<td>9 months, 2 weeks ago</td>
<td>job completed</td>
<td>View</td>
</tr>
<tr>
<td>🚀</td>
<td>Traceroute example 1</td>
<td>9 months, 2 weeks ago</td>
<td>job completed</td>
<td>View</td>
</tr>
<tr>
<td></td>
<td>test-tr-lip6</td>
<td>1 day, 10 hours ago</td>
<td>job completed</td>
<td>View</td>
</tr>
<tr>
<td></td>
<td>test-lip6</td>
<td>1 day, 10 hours ago</td>
<td>job failed</td>
<td>View</td>
</tr>
</tbody>
</table>
MOOC: Participants profile

A majority of male learners

73% men

16% women

Average age = 35

95 different countries

TOP 10
France
Brasil
USA
Morocco
Algeria
Tunisia
GB
Senegal
Cameroon
Germany
MOOC: Participant profile

59% have a professional activity

A majority holds a Master's degree

- None: 9.4%
- Other: 44.3%
- Elementary / Primary school: 16%
- Secondary / High School: 7.2%
- Bachelor's degree / Bac+3: 5.1%
- Master's or professional degree: 8.8%
- PhD / Bac + 8: 20.8%
- PhD candidate / Post-doctoral: 13.6%
- Student: 14.2%
- Employee in the private sector: 30.4%
- Self-employed / Company: 4%
- Looking for a job: 7.4%
- No response: 1.3%
- Teacher / Instructor: 3.4%
- On training leave: 0.7%
- Retired: 0.7%
- Other: 0.7%
MOOC: Participant motivation

Motivations and expectations regarding the course

- Learning for my personal pleasure or needs: 60%
- Learning as part of my professional occupation: 59%
- Extend my professional opportunities: 48%
- Learning as part of my studies: 28%
- Try online education: 13%
- Complete a training course already taken on the subject: 11%
- Increase the chances that I graduate successfully: 10%
MOOC: Stress on PLE