Heterogeneous testbeds, tools and experiments
Measurement requirements perspective

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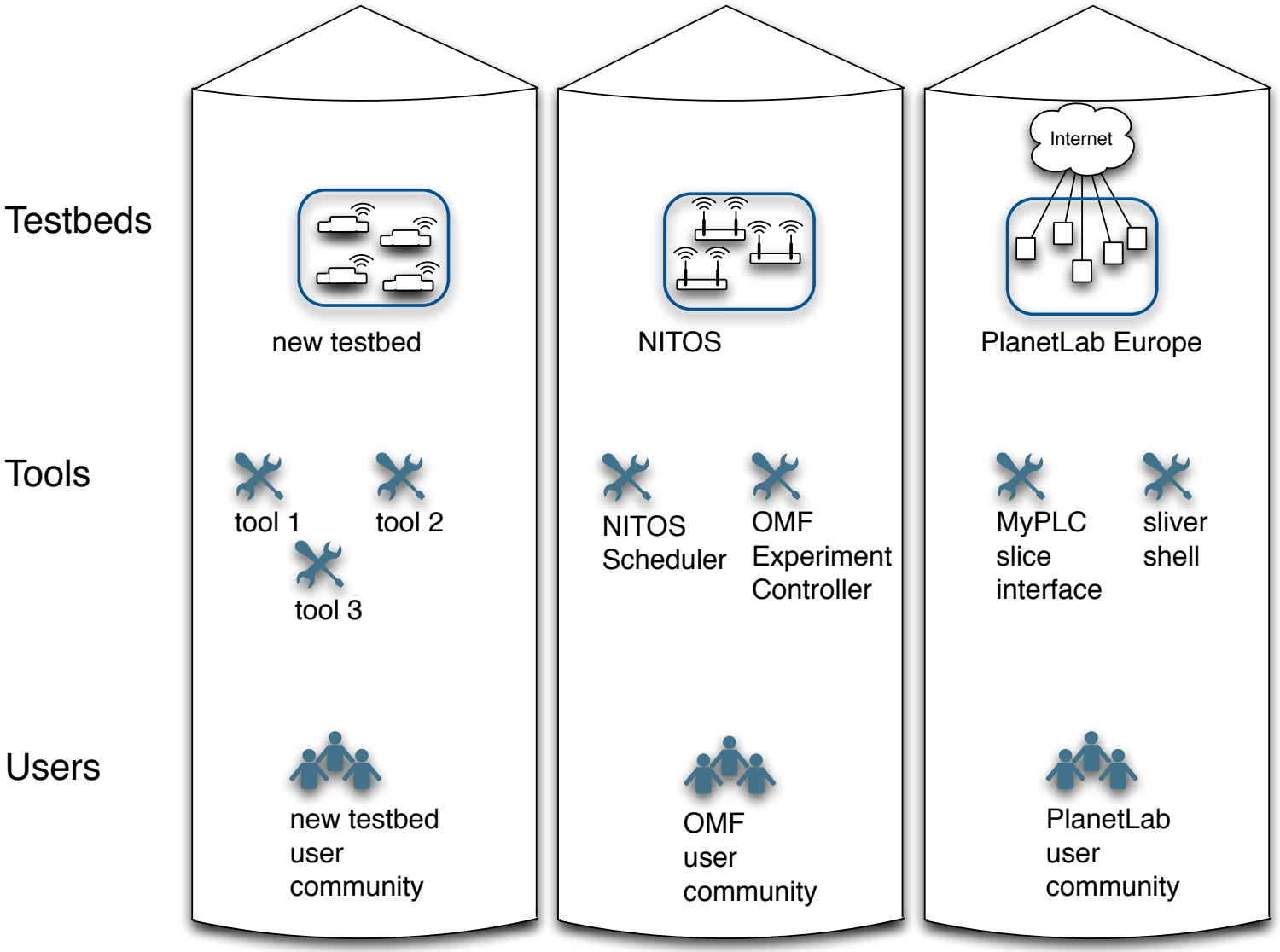
Motivation

- Experimental federated testbeds should enable large scale and diverse experiments
- Experiments with future Internet technologies from components to complete systems
- Validate and compare with existing current or other evolving solutions
- Many testbeds exist, but difficult to sustain
- Many existing testbeds serve similar purposes
  - Diversity is necessary and unavoidable
- Proliferation of tools & management frameworks

Testbeds today



Challenges

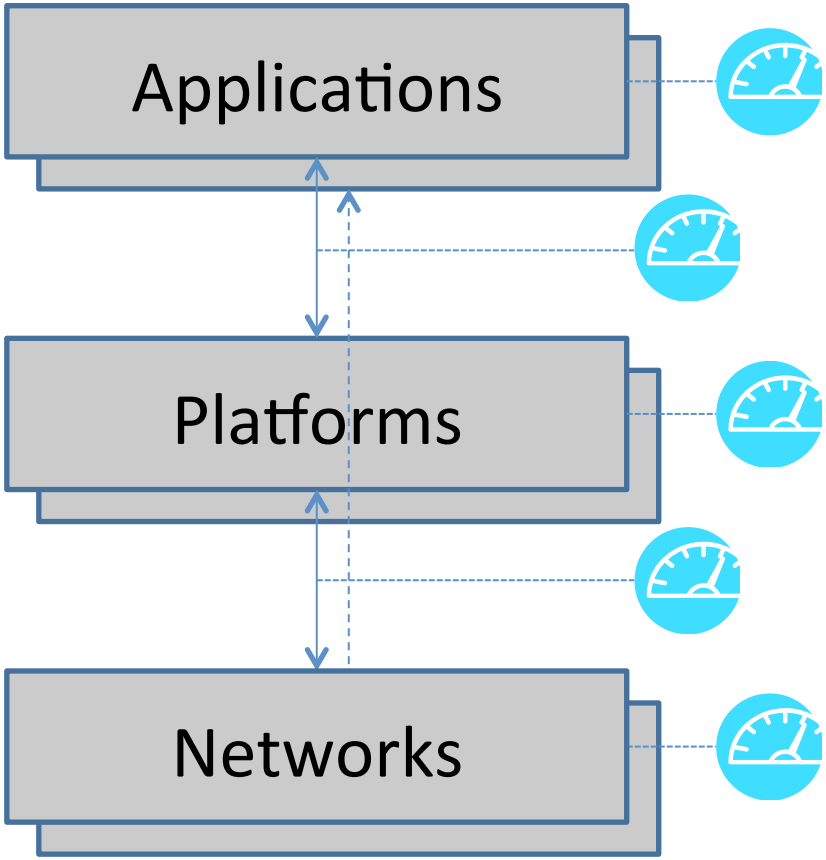
- Testbeds today look like silos
  - Comparable to the world of telcos BIP (Before IP)
- New excellent testbeds emerge
  - How to bring existing user communities to these new testbeds?
- Excellent tools are often tailored to the testbeds
  - How to re-use these tools in other testbeds?
- Testbeds for similar purposes exist
  - How can experiments be reproduced?
- Enlarge scale or scope
  - How can cross-testbed experiments be conducted?

Systematic experimental methodology

- specification of the performance objectives, constraints, and description of expected results
- definition of relevant performance criteria and metrics
- description of the modus operandi including configuration, initialization, and running conditions and (iterative) procedure(s) to be executed
- reporting on observations and the resulting analysis and the feedback on each iteration before reaching (partial) conclusion

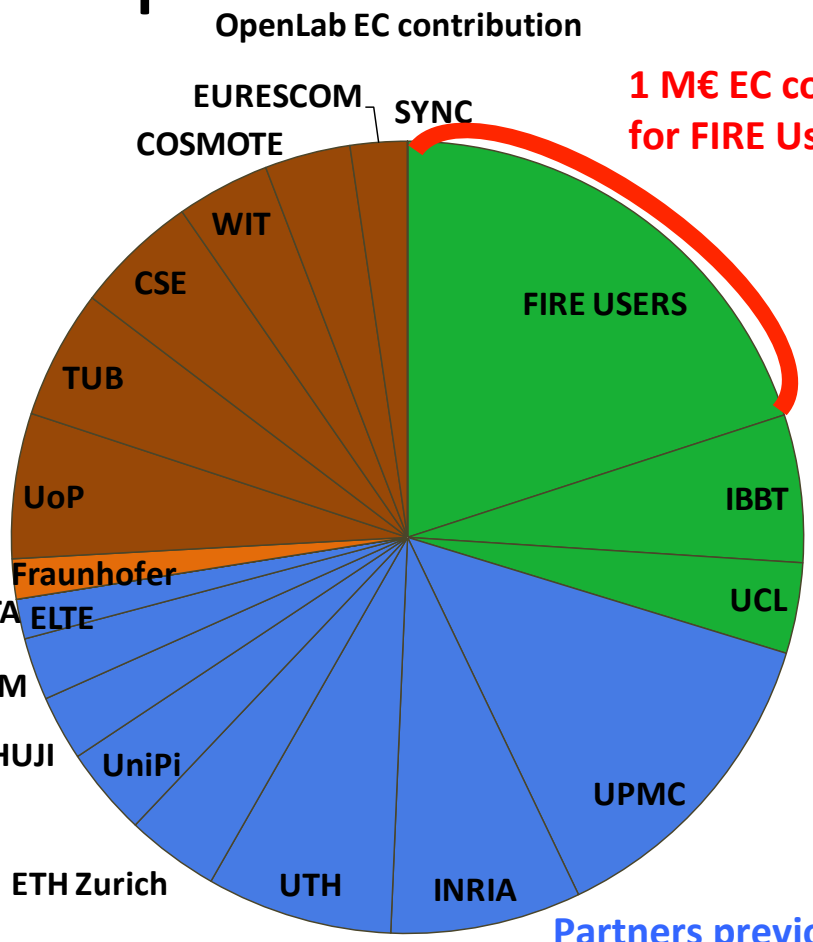
- formal description of experiments
- degree of control of the relevant input variables of an experiment
- degree of monitoring of the relevant output variables of an experiment
- degree of confidence in the verifiability, reliability, repeatability, and reproducibility of the experimental results

Instrumentation



- Research towards Future Internet modelled as a complex distributed system
- Iterative cycles of research
- Research must address all associated aspects holistically, at all relevant levels and layers.
- Research directions must take into account the data and observations gathered from experimentation in previous iterations
- “Measurement-based” which requires the specification of relevant metrics and measurement tools

Users in OpenLab



5 M€ EC contribution (total budget 7.35 M€)

1 M€ EC contribution for FIRE Users

New partners

New users

ibbt connect.innovate.create

w-iLab.t

UCL

HEN

30%

Partners previously involved in PII

Panlab

Pan European Laboratory Infrastructure Implementation

WIT IMS testbed

UoP IMS testbed

Greenstar NETWORK

30%

40%

Partners previously involved in OneLab2

OneLab

FUTURE INTERNET TESTBEDS

PlanetLab Europe

NITos

etomic

User experiments, measurements (i)

- Observe and track the long term growth of storage networks (CDNs, clouds, information-centric networks, …)
  - Gain insight into the evolution of the Internet towards a content-centric, distributed delivery model
  - Intercept and capture URLs, analyze patterns, identify web server hostnames
  - Discover location of content servers
  - Draw the map of the deployed infrastructures

User experiments, measurements (ii)

- Assess, evaluate and justify the benefits of social-aware virtual network embedding mechanism towards implementing wireless cloud based CDNs
  - CDN performance
  - Metrics related to the wireless medium
  - Efficiency of the proposed embedding approach
  - Social-aware related metrics
  - Reproducibility in two wireless testbeds

User experiments, measurements (iii)

- Analysis for Future Internet architectures for the Internet of Things (several aspects)
  - Connection setup time, transit time of packets (latency), available bandwidth over time, average time to transfer a file
    - one vs. many connections (bandwidth and scalability)
  - Handover delay, packet delay, packet loss (if any), effects on the transmitting and non-transmitting connections
  - With malicious nodes, measure interference (delay, broken connections)
  - Repeat previous after introduction of security-oriented, identity-based control plane and document improvements

User experiments, measurements (iv)

- Large-scale experiments on geo-location aware greedy routing architecture
  - Measurement based space-embedding
    - IP geo-location running on PLE
  - "geo-location aware" overlay to allow routing along near-optimal paths in the physical network
  - Precise measurement tool to monitor availability of links between nodes for fast error recovery
    - ETOMIC platform
  - Emulation of link/node failures and measure effects on ongoing flows (packet loss, delay, recovery time)

OpenLab – Calls for experiments

- OpenLab requires the participation of new partners to carry out certain tasks within the project. In particular the tasks pertain to the execution of innovative experiments that demonstrate technological expertise, scientific novelty and quality in the area of Future Internet.
- First call: OpenLab-1 closed on 30 November 2011
- Second call: OpenLab-2 planned for end 2012/early 2013
- Check regularly http://www.ict-openlab.eu/open-calls
- Any experiments can be proposed
  - As long as they can be supported by the available infrastructure
  - Experimentally validate Future Internet Architecture improvement proposals?
  - Experiments concerning network neutrality?

Further Information

- www.ict-openlab.eu – OpenLab website
  - contact@ict-openlab.eu

- Future Internet Assembly, Aalborg, Denmark
  - "Hands-on" FIRE Demonstration Evening, 10 May 2012

- TridentCom 2012, 11-13 June 2012 Thessaloniki, Greece
  - http://www.tridentcom.org/2012