mPlane: A Measurement Plane for the Internet and its Application to the Cloud

FP7-ICT-318627

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Cloud-based Service Platforms for the Future Internet

ZHAW, Winterthur, 29 November 2012

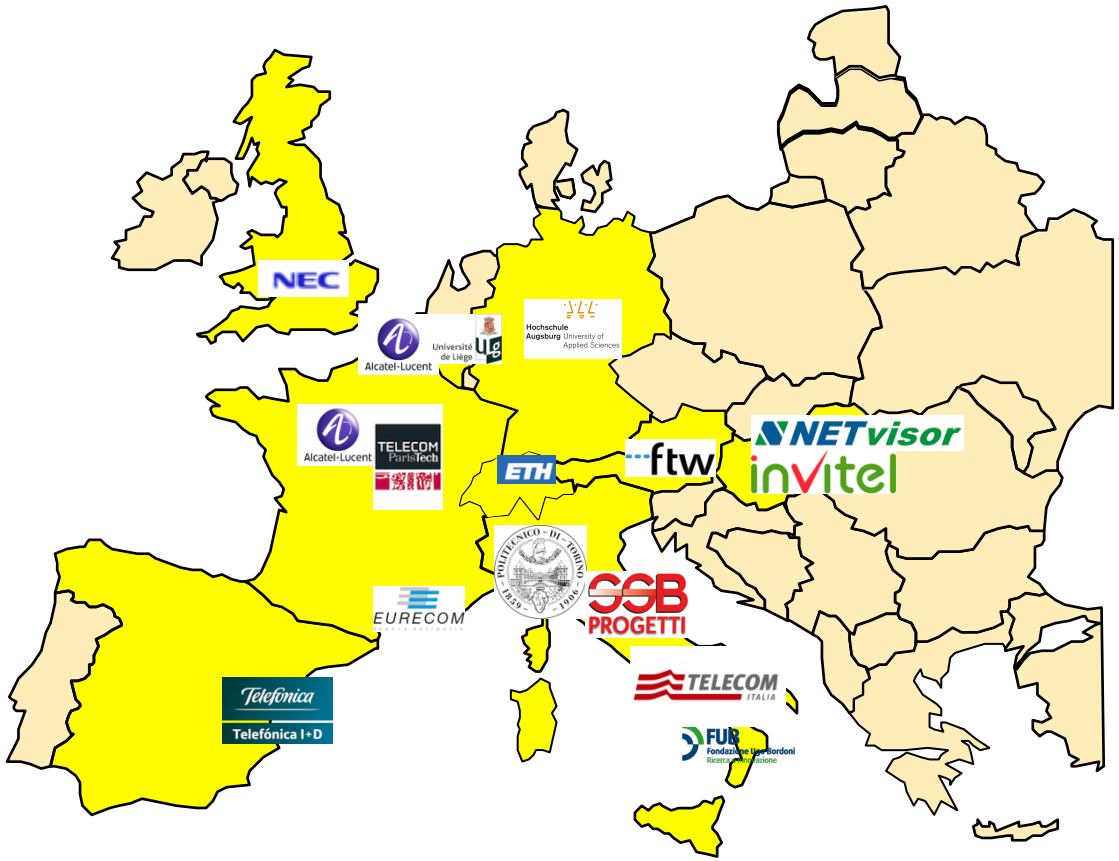
mPlane

SEVENTH FRAMEWORK PROGRAMME

Motivation

- *"The Internet is… the largest experiment in **anarchy** that we have ever had." — Eric Schmidt*
- The Internet is a global interconnection of networks
  - No single organization operates, administers or governs it
  - It is robust thanks to its diversity, but difficult to manage
- In case of "failure", who can tell what's going wrong?
  - Each ISP may have a picture of what happens inside its network
  - But what if the failure is a more global phenomenon?
- Today, the web is a tangle
  - Nobody really understands what happens today in the Internet
  - How to predict what will happen tomorrow?
- We need a system that **collects, analyzes**, **provides visibility to support** better management

mPlane



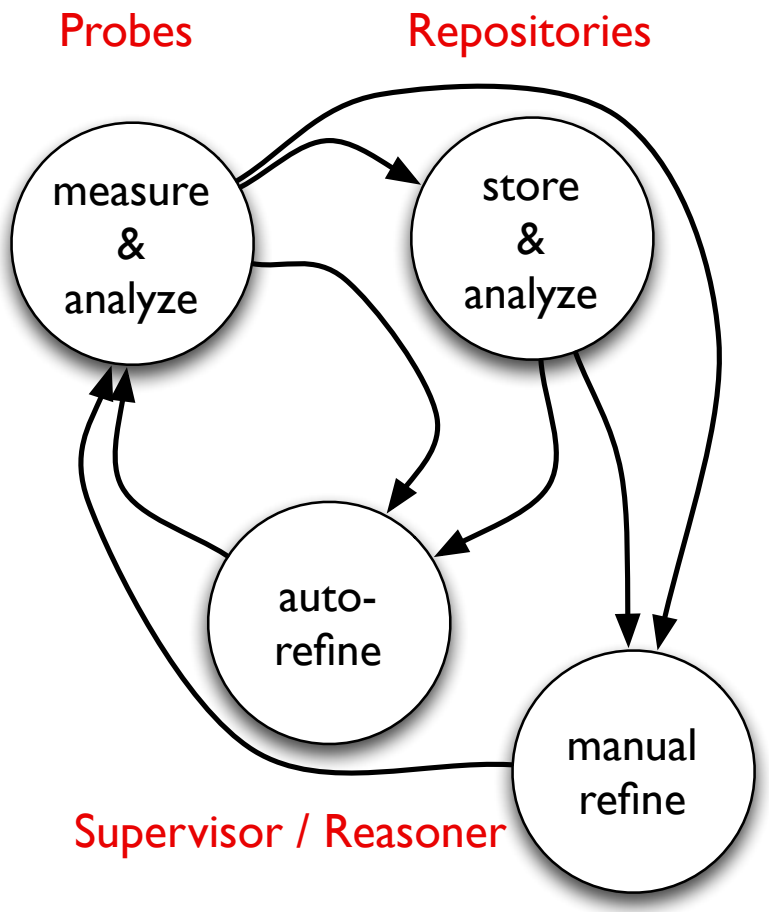
- FP7 IP
- Nov ‘12 – Oct ‘15
- Design and demonstration of an intelligent measurement plane for the Internet

mPlane in a slide

- Build a distributed, open, standard measurement infrastructure for the Internet
  - **Probes – get the data**
    - Build on existing tools/methodologies
    - Offer a flexible, programmable, open platform to run and collect passive, active, hybrid measurement
  - **Repositories – store and process the data**
    - Collect measurement in a standard way
    - Process large amounts of data in efficient ways
    - Control access to interested parties subject to authorization rules
  - **Intelligent reasoner – dig into the data**
    - Automatically extract useful information
    - Drill down to the root cause of a problem

Approach

- **Iterative measurement**
  - *probes* measure
  - *repositories* store and analyze results
  - *reasoner* for auto-refinement and drill-down
- On-demand connections among distributed components via simple interfaces.



Initial Use Cases

- *Cloud and CDN troubleshooting*
- End-User QoE troubleshooting
- Mobile QoE troubleshooting
- SLA certification and verification
- Traffic pattern change detection

Applying mPlane To The Cloud

mPlane

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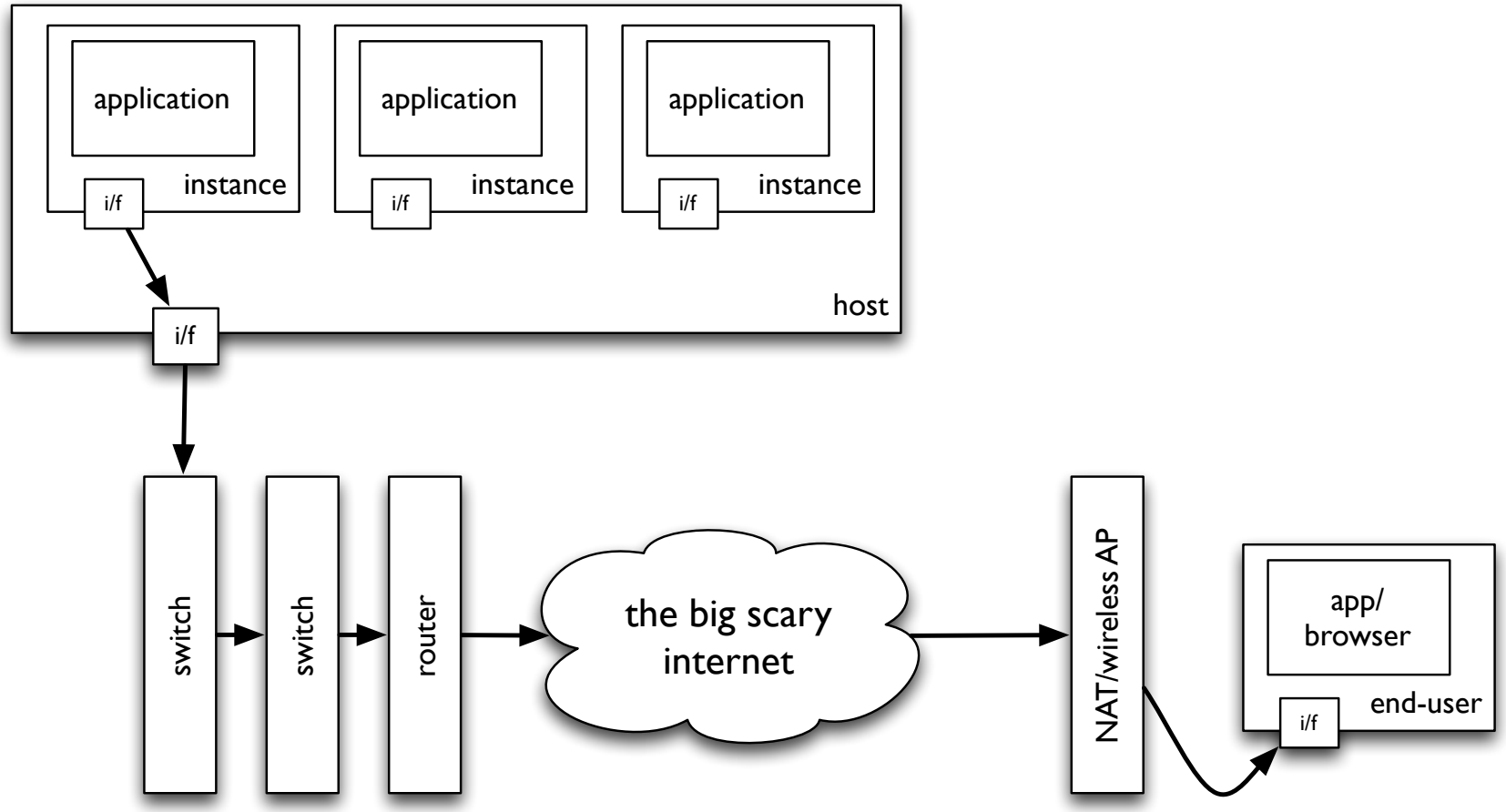
Throughput issue cause analysis

- In a cloud environment, throughput can be constrained at a variety of bottlenecks:
  - Poor application performance
  - Virtual network interface issues
  - Physical network interface issues
  - Network congestion
  - Administrative traffic reduction
  - End-user network/terminal problems

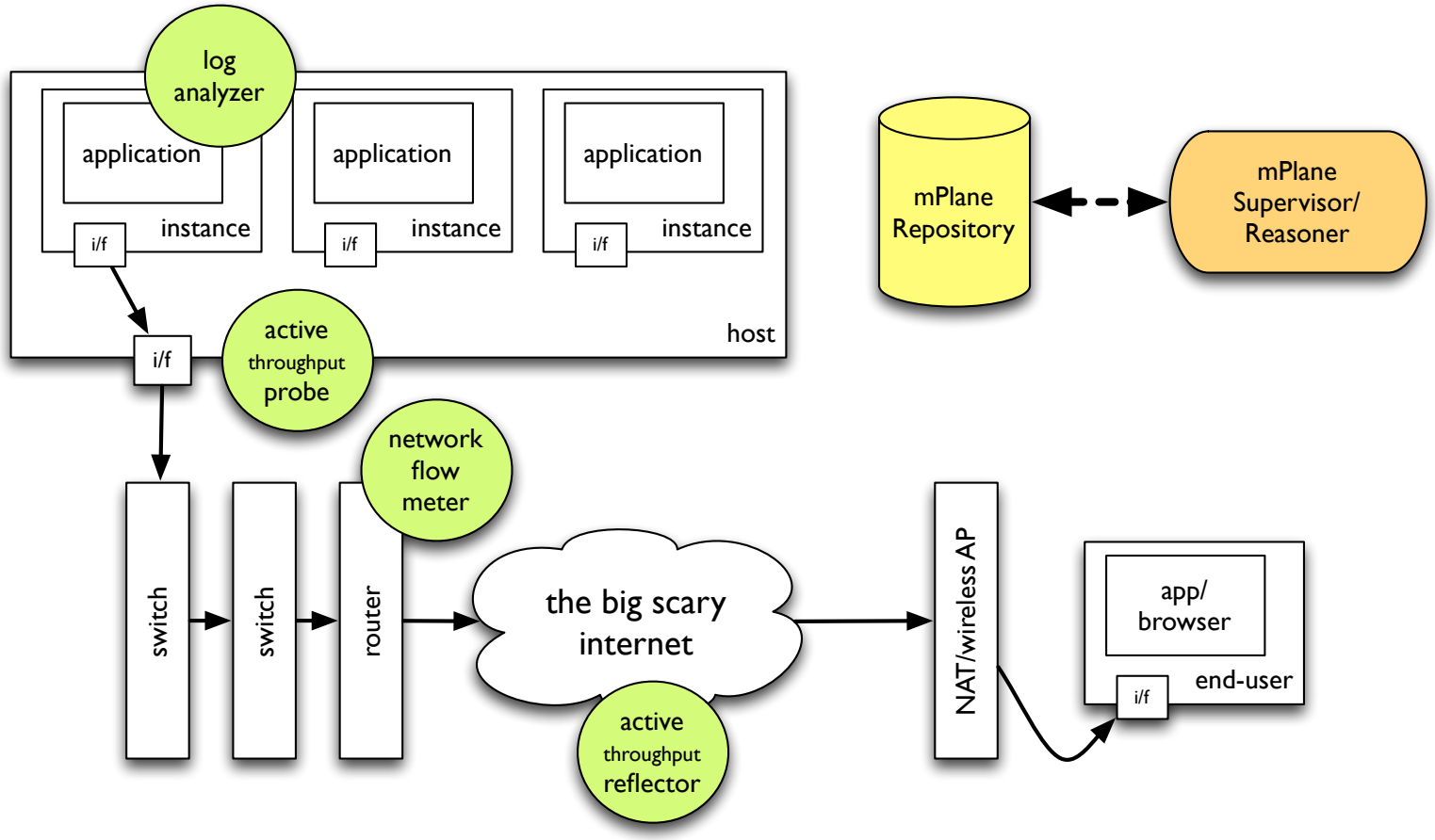
Throughput issue cause analysis



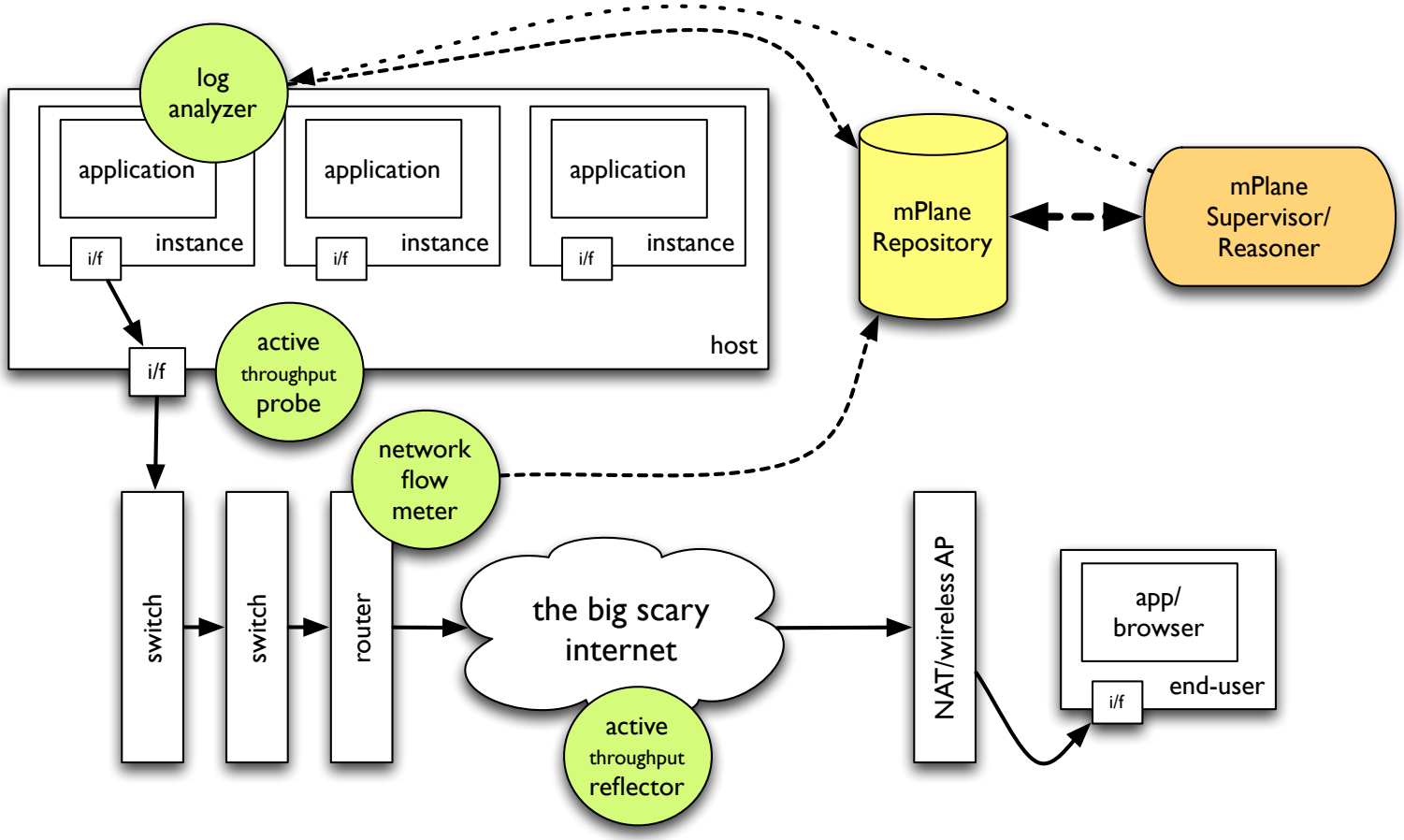
Applying mPlane: Single Domain

- Probes at various scales
  - Passive flow measurement at ToR / access link
    - Correlation of performance with other traffic present
  - Active end-to-end delay/throughput probe from host to remote reflection point
  - Application response time log analyzer
- Repository for correlation/analysis
- Supervisor/reasoner for control
  - Aware of history of issue root causes

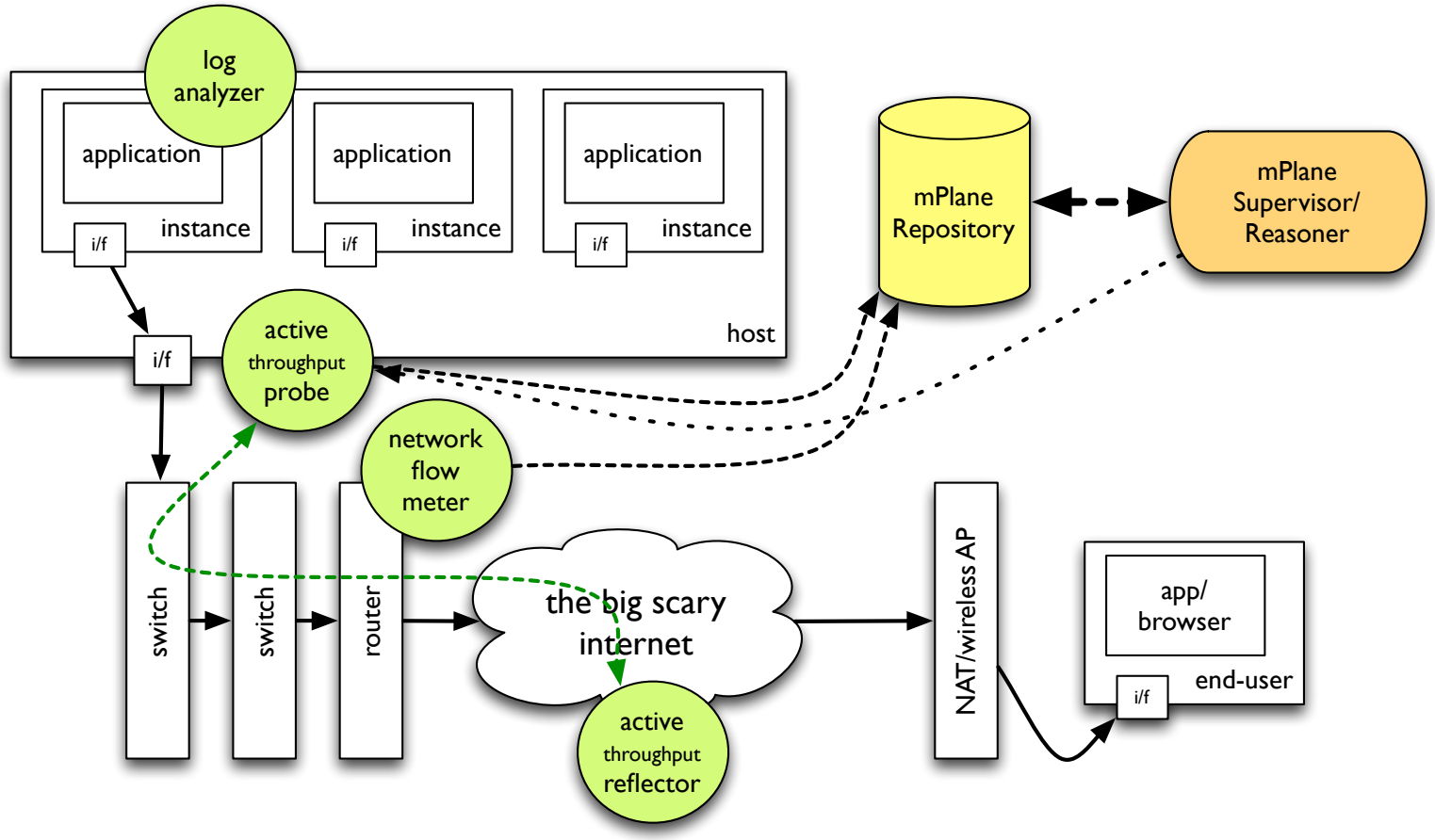
Applying mPlane: Single Domain



Applying mPlane: Log Analysis



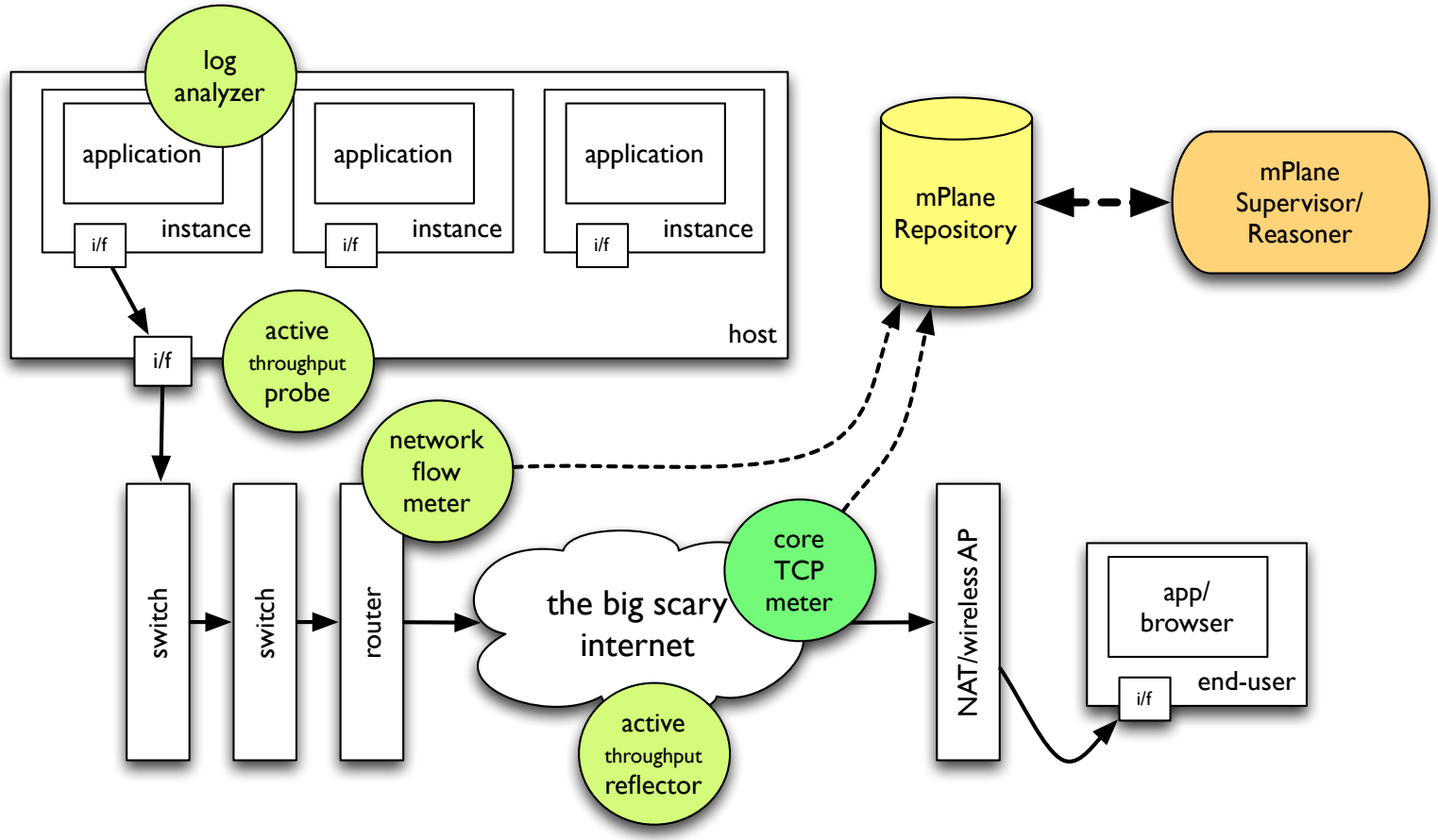
Applying mPlane: Active Probing



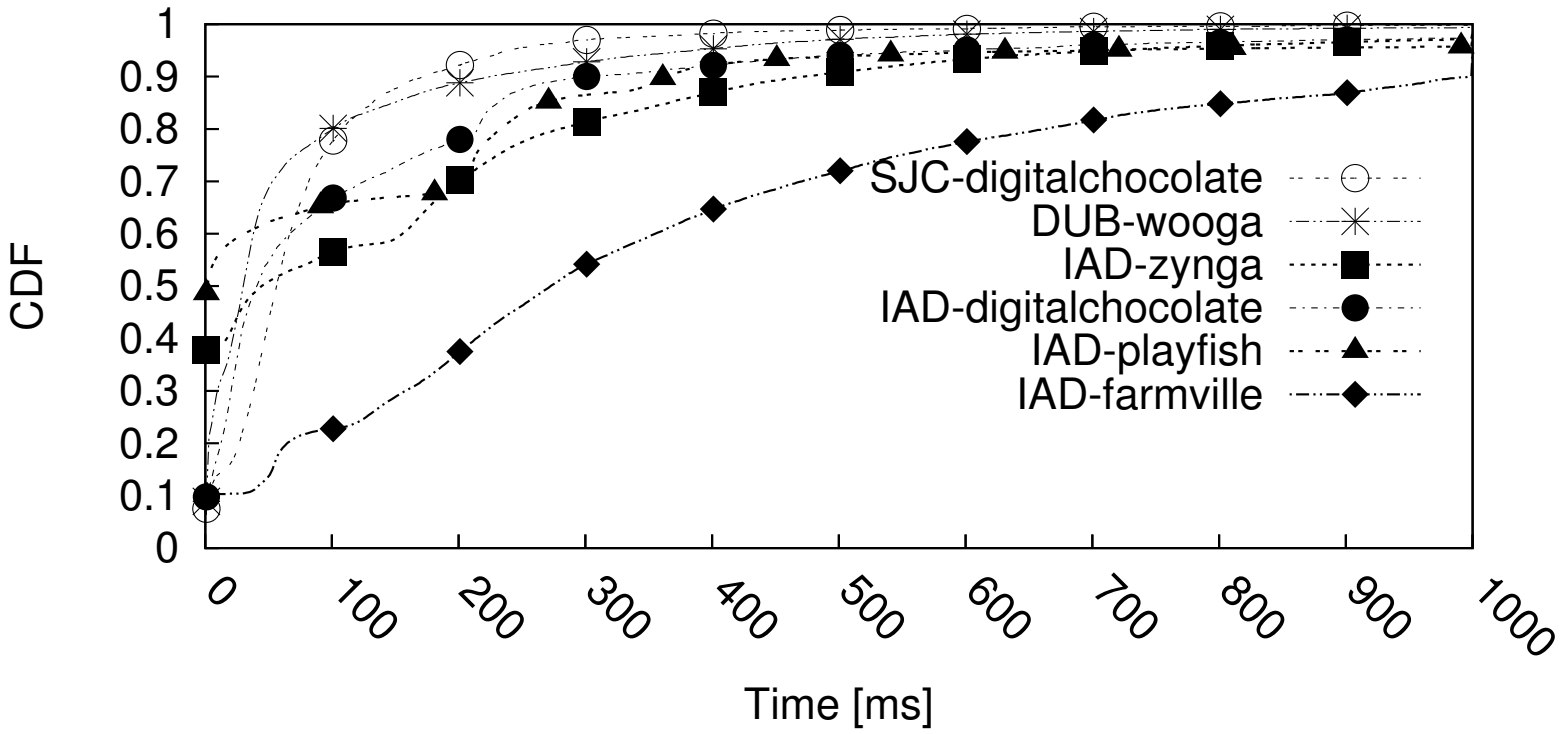
mPlane in Multiple Domains

- Consider a *measurement service provider* that passively monitors flows at multiple points in the network.
- Clients of this provider contract to receive detailed information about flows of interest at an mPlane repository.
  - TCP performance: goodput, response time, etc.
- The mPlane platform allows new models of applying measurement to operations.

Applying mPlane: external probes



Results of analysis of remote passive monitoring on AWS services



Bermudez, S. Traverso, M. Mellia, M. Munafò, “Exploring the Cloud from Passive Measurements: the Amazon AWS Case”, to appear at INFOCOM 2013 mini-conference, Turin, Italy, April 14-19, 2013.

mPlane and the Cloud

- How do these architectures interact?
- Measuring and Troubleshooting Clouds
  - probes in instances and throughout DCs
- Cloud support for mPlane
  - repositories are compute-intensive and can be dynamically associated

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- More info: http://www.ict-mplane.eu/