Building an Intelligent Measurement Plane for the Internet

mPlane consists of a Distributed Measurement Infrastructure to perform Internet monitoring; but most of all, mPlane is about an Intelligent Reasoner to support understanding and managing the Internet.

Main Objectives
Why Skype is not working? Which is the best ISP in my area? Where is YouTube traffic coming from? How to optimize my LTE network for Facebook? The Internet is a global interconnection of networks, that no single person, organization or government operates, administers or governs. It is robust thanks to its diversity, but it is vulnerable and fragile: in case of “failure”, who can tell what is going wrong? Today, the web is a tangle where nobody really understands what happens or might predict its development. By enabling pervasive measurement throughout the Internet, the mPlane project allows solving these problems. It benefits everyone:

- ISPs get a fine-grained picture of the network status, empowering effective management and operation
- Application developers gain powerful tools for handling performance issues of their solutions
- Regulators and end-users can verify adherence to SLAs, even when these involve multiple parties
- Customers of all kinds can objectively compare network performance, improving competition in the market.

mPlane is a large scale and collaborative FP7 Integrated Project. It will significantly advance the state of the art in Internet measurement, from innovative probe technology to intelligent algorithms for distributed data analysis. The development of the Reasoner is a key result that will allow structured, iterative, automated analysis. An emphasis on open, standard interfaces will speed adoption and increase the impact of the project.

The Mplane Consortium is made up of 16 organizations chosen for their complementary skills and competences: 3 large Manufacturers contribute with their expertise, 3 large Telecom Operators, 2 Research Centres, 2 SMEs, 6 University Research Groups.
Technical Approach

The mPlane research activities are organized into eight work-packages (WPs) as listed below:

WP1- Use Cases, Requirements and Architecture
WP2- Programmable Probes
WP3- Large-scale data analysis
WP4- mPlane Supervisor: iterative adaptive analysis
WP5- Integration, data collection, evaluation
WP6- Demonstration
WP7- Dissemination, exploitation, standardization
WP8- Management

The design of the architecture will be detailed in Work Package 1. A set of representative use cases will be considered to seed the architecture specification and requirements. Use cases span from CDN troubleshooting to video and web browsing quality of experience monitoring, i.e., problems commonly faced today by Operators, End-Users and Regulatory Agencies.

The measurement plane will consist of three main components. The first is the measurement layer, which combines a set of innovative (software and hardware) programmable mPlane probes with legacy probes adapted to the mPlane measurement layer interface into a common, large-scale, distributed measurement layer. It is concurrently accessible to a wide set of stakeholders (ISPs, Application Providers, Regulators, Researchers,...)

The figure summarizes the mPlane layer components. Measurement probes are integrated into a common measurement layer by implementing a common, open mPlane interface. This allows the measurement layer to bring them together into a common distributed measurement system.

The mPlane measurement layer will allow going beyond the current dichotomy between passive and active measurements, enabling a novel class of measurements, i.e., “hybrid measurements”. According to the latter, active measurements traffic is tracked and passively observed at intermediate vantage points along the path.

The second component, the repository and analysis layer, provides an efficient framework to store and already process the large volumes of data collected by the measurement layer. The third component of the mPlane project is the mPlane Supervisor, which controls the actions and synthesizes the results of the far-flung probes and repositories, and iterates on these results to drill down to the root cause of a specific issue and/or investigate the relationship underlying a general phenomenon. This iterative analysis, supported and automated by an intelligent reasoner, is sorely missing in present measurement systems and is one key element of the measurement plane. Its design will advance the state of art by providing intelligent algorithms for distributed data analysis. At last, the project will undergo both experimental validation and actual demonstration to quantitatively assess the mPlane benefit.

Key Issues

- Improving knowledge of the state of the Internet and enabling better network management and operations
- Increasing the transparency of the Internet
- Enlarging the market of Internet applications
- Defining a set of quality indicators to assess the Quality of the Internet and support users' rights assessment
- Increasing the trust amongst providers and consumers
- Offering to the research community a large, extensible and well defined set of measurements coupled with an open platform.

Expected Impact

- Strengthened positioning of European industry by providing breakthrough technology for the Internet monitoring and management.
- mPlane will shed light on the Internet operational obscurity and it will thus heavily contribute to the development of the future generation of the European broadband and mobile network infrastructure.
- Aiming at the definition of an Internet measurement plane, standards and standardization are an integral part of mPlane;
- Stakeholders will be able to easily debug network availability and performance problems, resulting in lower management costs and in an increased economic efficiency of the network.
- Industry adoption of this mPlane component and the related technologies will enable all Internet stakeholders to make the Internet a better operated, more secure, better understood and evolvable infrastructure.