

Can we build a testbed to explore the futures of the internet

Serge Fdida

Laboratoire d'Informatique de Paris 6 - University Pierre & Marie Curie, France
4, Place Jussieu - 75252 – Paris, France

serge.fdida@lip6.fr

***Abstract.** Exploring the various futures that the Internet might follow is both stimulating and strategic. These are very interesting times for those involved in creating new computing and communications applications, exploiting new technologies, and in seeing the world we live in change with the results. The internet is becoming polymorphic, involving a broad set of devices, from RFID and sensors towards giant clusters and the cloud. Networked systems are appearing in all sectors of our society and digital services now reach the home, the automobile and the street and form part of our social fabric. New ideas that start of the edge of the Internet or of the telecommunications network do not wait to be carefully deployed by industry, but are pushed out from AppStores for anyone to try at modest or sometimes zero expense. However, their ultimate success or failure often depends on how well the infrastructure supports their requirements for interactivity, visual presentation quality, and the responsiveness which the network as a whole delivers the data and rich media that the users expect and now require.*

Putting these emerging technologies and innovations together provide many examples of opportunity, with media distribution and localized services delivered to wireless clients perhaps capturing the most attention. As a result, demand is increasing among researchers and production system architects to combine compute, storage, and network resources from multiple sources (e.g., an organization's own resources, their partners' resources, commercial and academic clouds, programmable network substrates). This objective has emerged in the framework of network testbeds developed to conduct experiments, but the situation resembles what emerging networks faced at the dawn of the Internet. Federation is perceived as a means to increase the utility of a testbed by providing access to a larger set of heterogeneous resources, scaling to large systems, adding geographical diversity, helping to reach sustainability, and benefiting from best practices. Our first major effort in to provide federation of these different services, allowing access and authorization to one to permit access to others, within the policies for usage and security required by each. Such common access methods form a control plane for the testbeds part of the FIRE initiative in Europe but also shared by others like the NSF/GENI framework.

The OneLab project, as a major actor of the FIRE initiative, addresses issues related to federating resources from multiple autonomous organizations into a

global shared resource pool with a standardized interface to access them. OneLab already enjoys global scale through federation and it is running testbeds allowing experimentation with different technologies to meet the variety of needs of a broad customer base. It is developing a single access model to a diversity of networking technologies, it allows resources to be shared through the powerful paradigm of virtualization wherever this is possible, and it is extending its federation model to cover an array of heterogeneous testbeds, thereby lowering the entry cost to each individual facility. Achieving such federation is a challenge, as it requires solutions to issues of identity management, authentication and authorization, resource description, policy specification and enforcement, economics and incentives, virtualization technologies, operations and management, user-level abstractions and services, and governance considerations. Building the facility requires research on the architecture of the system as well as on the tools needed to operate it and provide accurate and secure data to its users.

Experimentally driven research has developed over the years and is recognized as a mean to better understand the Internet ecosystem, mining the visible signals to infer the invisible artifacts, embedding new design in close to real situations, allowing for analysis and optimization. Obviously, it comes at cost to set up the experiment, collect the results, understand the conditions for testing, provide a friendly access, address sustainability. Many still question the approach, whether it already allows discovering an important result for the community and helps breaking difficult challenges. The FIRE initiative in Europe started in 2008 with a first wave of projects aiming at developing an open shared facility. The first phase of projects such as OneLab and PII have terminated. A second wave is now in action enlarging the scope to services, sensors, cognitive radio and OpenFlow. A last wave will start in fall 2011 while the global facility should be addressed with a last FIRE call in early 2012. Those projects share a common forum thanks to the FIRESTATION Support Action. Many international liaisons exists and even further developed to join efforts, share best practices and reach the critical mass required to challenge the objective. At this stage it is important to discuss the achievements, difficulties and solutions brought by these projects as well as the offering and real usage.

The presentation will review the current status of OneLab's federation of testbeds, and will describe the larger ecosystem in which OneLab operates. Technical and operational challenges are outlined. The European roadmap and international cooperation effort is also outlined.