A survey with owners and users of Experimental Facilities aimed at applications on Future Internet

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Abstract. *FIRE initiative aims at creation of advanced experimental facilities to foster the Future Internet services. MyFire project conducted a survey to sketch a landscape of the present state of Experimental Facilities(EF) related to Future Internet(FI). Survey results point to attention areas for research communities and policy makers: need for more documentation and ease of use of EFs, education and support for the adoption of standardisation and interoperability of EFs, adequate business models for sustainability of EFs, improved pathways to transfer experimental research into innovative services open to the extended community.*

1. Introduction

Future Internet Research and Experimentation-FIRE [Commission 2008] initiative aims to address current and future expectations that will be put on the future internet. The FIRE experimental facility is aiming to become a major support instrument for medium and long-term research on networks and services by industry and academia. The vision includes a large scale experimental facility, with a broad range of advanced and interconnected testbeds, which cover areas from network connectivity to the service architecture. These testbeds will be used for development as well as for proof of concept and pre-service trials. There is considerable interest in interoperation of different testbeds, leading to collaboration around the globe[Stanton 2010].

MyFIRE project[Myfire 2010] aims to develop efficient mechanisms of testbed processes to make them more effective and widely used, especially by standardized approaches. To achieve these goals a mass consultation with the enlarged FIRE community has been built, to harvest details on Experimental Research Facility in the field of FI. This document shows the results of a worldwide survey to cover several aspects to FIRE initiatives.

2. Survey description

The survey, conducted via web by MyFire project team members, was designed to collect quantitative data on several aspects from Future Internet.
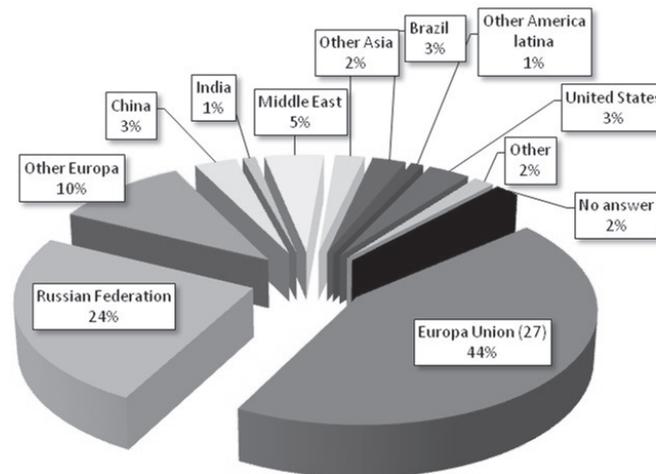
Figura 1. worldwide survey

The web survey questionnaire has been distributed to a large number of people involved in ICT research(5.142), especially those who use or possess an experimental research facility. MyFIRE project distributed the survey to representatives from various geographical areas, especially in European and BRIC countries. From a total of 439 returned questionnaires(301 valid), the profile of respondents included 44% from Universities or Education Institutions, 24% from Private commercial organisations, 18% from Public organisations, and 14% from other origins. The Figure 1 shows the local coverage.

3. Survey Results and findings

The data was collected on the following topics: 1) Researchers and users needs in terms of Experimental Research Facilities; 2) Research commercialization and the innovation pathway; 3)Socio-economic aspects; 4) Standardisation aspects.

3.1. Researchers and users needs

Most used EF services by respondents are experimental setup (57%), measurement and reporting (45,5%), training (44%), and testing methodology expertise (39%). **EF are mostly set-up for internal experimentation**: 61% of users use only internal EF and 40% of providers opens their EF only to internal users. **The main reason to use external EF is financial**: 49% of users of external EF declare using external EF to reduce their experimentation cost, and 31% to capture public fund. We noticed that **resources or competencies reasons are also important**: 44% of users of external EF declare using external EF because they don't have adequate facilities, and 23% because they have a lack of internal expertise. **The main reason for providers of EF to not open to external users is also financial**: 32% of providers of EF opened only for internal users don't opened their EF because they don't have financial interest in doing so. We noticed also a **lack of knowledge from the providers on the potentialities and opportunities of opening their EF for external users**. The main choices of criteria to select a specific EF are the availability of information about it, the fit with user technical needs, and the ease of use. **Existing EF available services need to be well advertised and documented so to be easy to be found and use**. Support for testbed federation mechanisms and standardised methods are not identified as important requirements for users. Users agree that testbeds

need to be well documented and easy to use. **EF needs to be well documented to attract users**. To keep their users informed, providers of EF pass information through collaborative projects for more than 50%. And the most cited way to identify the relevant EF for users is partnership. Thus **collaborative projects are opportunities to access external EF**. The main reason to not use a FIRE facility is the lack of information about the FIRE EFs, but for those who have used a FIRE EF, finding information about the EF is identified as a good experience. **Information on FIRE EF exists but is difficult to find, mainly for new comers on Future Internet community**. Overall, **EFs are recognised as key tools** of the Future Internet Research, because they **increase reliability and quality of research, and they increase visibility of the research team**. In addition, users of **EFs recognised the efficiency of standardised methods to permit conformance and interoperability, and increase reliability of testing**. And yet, use of standardised methods mentioned were valued as of very low importance by users.

3.2. Research facility commercialization and the innovation pathway

Another main topic for MyFIRE is the commercialization of research results. The objective is to understand the innovation pathway, and the impact of use of EF in the innovation pathway. Forty two per cent (42%) of users of EFs commercialise innovation in Internet technologies. The **typical time to market is 1 to 2 years**. For more than half of the respondents (59%), the innovation pathway is made within the research network. Other pathways use open source research communities (29%), transfer of research ideas to commercial companies through patents and spinoffs (28%), contributions to standards and regulation organizations (26%), and direct transformation of research by commercial firms into products and services (23%). Thus, without surprise, **research networks are the actors the most cited by users for the introduction of innovation into the Internet field**. Commercial network operators and Internet platform operators are important actors, too, in the innovation process. We note a correlation between the time to market and the pathway to innovate: transfer through contribution to open source communities is the most short term time-scale with 96% declaring a time-scale under 2 years. On the other side, exploitation via spin-off or patents is logically the longest innovation pathway, with 42% declaring a time-scale longer than 2 years. To better exploit their research, users express a need for international coordination of research and policy. Dominance by a few large technology firms and difficulties in **transferring research to industry are identified as major bottlenecks for exploitation of research**.

3.3. Socio–economic aspects

In terms of usage cost of EF, the access is in general **free of charge for internal EF** (73%), and it is mostly a paying service when using external EF (56%). Pricing is made against consumed resources: manpower (29%), technical (33%) or time (33%). The model whereby you pay membership fees is not a business model used by EFs. In duration terms, **the average time to gain access to EF is longer for external EF than internal EF**. We also noticed that **users run longer experiments in external EF than in internal EF**. Seventy four (74%) of users think that the duration of experiments is adequate. For the unsatisfied users, two trends can be identified: users of internal EF consider the duration too short but limited by the cost or time availability, while users of external EF think that the time is too long and can be reduced. **More than 90% quantify the efforts needed to conduct their experiment**. Planning of experiments is mostly based upon staff

efforts (69%). Running experiments often consume more time (33% of users) and human resources (26% of users) than planned. **Mechanisms for charging customers are rare**: 80 % of providers of EF for internal users said that they don't charge for the use, and this rate decrease to 55% for external users. For University and Education institutions, offer of commercial EF services are practically nonexistent (8% of EF providers); there is funding in many cases by research project (50% of EF providers). **Sustainability is not a priority for providers of facility**: only 37% declared to have a business model for the sustainability of the EF. Finally, when we consider the long-term outlook, practically half of providers declare continued funding from research projects (48%), and a third a shift to commercialization of test and experimental activities (29%).

3.4. Standardisation

Standardised approaches are rarely used by users of EF, either to specify or to validate their experiments. However, 70% of users think that using a standardised method for describing experiments is useful or very useful. This result is surprising, given that most of the respondents either do not know or do not use standardized methods. This confirms the added value to support standards adoption, given that formal standardized methods help users to outsource testing and help operators of EF to offer services to external users. Sixty per cent (60%) of users do not participate in standardization activities. Indeed, **users need technical support** to understand standard development processes and participate in standardization activities.

4. Conclusion

The survey shows that EFs are mostly set-up for internal experimentation and providers open their EFs having in mind internal users. Existing EFs available services need to be well advertised and documented so to be easy to be found and used by the extended community of researchers. Commercial use of EF is still in it's infancy. Support for testbed federation mechanisms and standardised methods, deemed to be essential to future internet applications, are not identified as essentials requirements for users, posing a question for policy makers on how to improve these aspects in future projects. The innovation pathway is made mostly within the research network. Researchers are mostly concerned with academic objectives and lack expertise to bring experimental research results to the market through patents or spinoffs. Finally, low priority of sustainability and the absence of a business model pose a question mark on the continuity of present EFs, when the funding of the projects ends.

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