# An Overview on FIRE and its approaches towards federation and collaboration.

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## I. FIRE PORTFOLIO

The FIRE project portfolio (Fig. 1) contains research and experimental facility projects. An important part of the research projects focuses on end-user needs with applications or services at the edge of the Internet. Examples are Nanodatacenters that moves P2P to the edge, N4C that implements delay tolerant networking in sparsely populated areas of northern Sweden and Slovenia, and Hobnet working with smart buildings. FIRE also includes projects performing research on more basic infrastructure technologies, such as ECODE performing research on cognitive routing, and NOVI working with virtualized infrastructures. Other projects have background from telco, eg Vital++ integrating IMS and P2P in order to support charging and security issues.

Several FIRE projects are creating experimental facilities to be used by research. Already ongoing projects are OneLab2 implementing PlanetLab/Europe and federation with wireless testbeds, PII implementing tools (Teagle) for deployment of testing facilities using IMS, and Federica supporting basic networking technology research (using the Geant infrastructure). Now starting are OFELIA working on OpenFlow in collaboration with the US, CREW implementing cognitive radio, picking up a thread that ORBIT started and taking it much further, SmartSantander/Wisebed integrating a large number of disparate sensor measurements. BonFIRE and TEFIS will create facilities supporting experiments and development of software services in a networked environment.

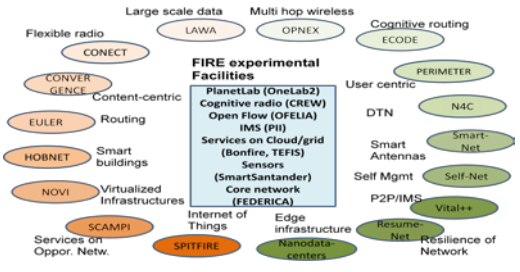


Figure 1. FIRE portfolio call2 & call5.

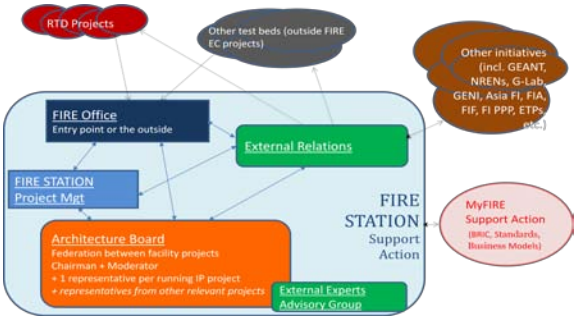


Figure 2. FIREstation project.

With these projects in the FIRE portfolio the opportunity now exists to support new classes of users and experiments combining heterogeneous technologies, all representing key aspects of the future Internet. The research done already in FIRE compares well with similar work in the world. However, the FIRE projects have not yet produced a federated experimental facility for European researchers. Such a facility would considerably reduce the obstacles of complexity and unfamiliarity that are encountered when new applications are explored (using the increasing power of the future Internet, from its edge to its core with computation and storage embedded everywhere). Individual projects, for the most part, have concentrated on improvements in one technology, or two technologies that they can connect directly. The projects just starting add new technologies to the mix, while others bring new attention to the building blocks of real applications, and to exposure to end users.

## II. FIRESTATION

All new projects acting as facility providers have made a commitment to cooperate with other parts of FIRE, devoting one part of their budgets to shared coordinated development in support of this goal, and another part to open calls for use of their experimental facilities by researchers outside their projects. This coordination will be supported by the

FIREStation project (Fig. 2). The major parts of FIREStation include user support (FIRE office), a project collaboration group (the "FIRE Architecture Board", with members from all facility projects) and an external relations group helping connecting to other projects and initiatives at national and international level. Still, the facility projects each have different notions of experimenters, of use cases, and of the range of collaborations that can be expected to augment the value of the technologies they bring to FIRE. Coordination of these efforts through architecture and careful selection of the timeliest areas to emphasize can pay large benefits in the scope of the problems FIRE can address, in the scalability of the solutions, and in sustainability of the FIRE federated experimental facility. But it is also important not to impose an abstract goal of federation when there are no use cases for combining two or more specific facilities.

Among the facility projects several different approaches are found. There are currently in FIRE two major solutions of federation implementation (Fig. 3): one is more top-down and centralized (represented by Teagle/Panlab), and the other one is bottom up and distributed (represented by SFA as in OneLab2/PlanetLab). Both solutions have their own merits and joining them into one or supporting them to live in parallel will be discussed in the FIRE Architecture Board. This issue is only one example where a common solution will affect the advancing of international standards in test bed technologies.

FIRE facility projects (IP projects) all have budgets to support usage of their test beds (open calls) and also budgets for extending it to meet the planned experiments by users.

The diagram in figure 4 captures the set of issues which must be dealt with by a single facility or (by recursion) by a federation of facilities. This also provides a simple way of categorizing the issues that must be addressed to support real external experimenters:

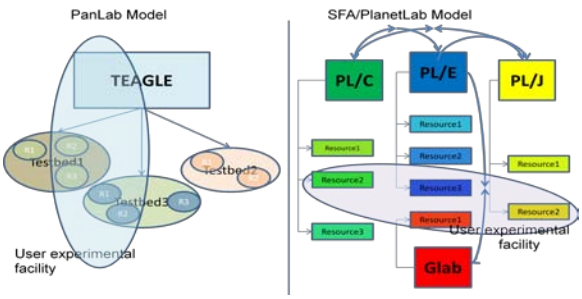


Figure 3. Alternative federation strategies in FIRE

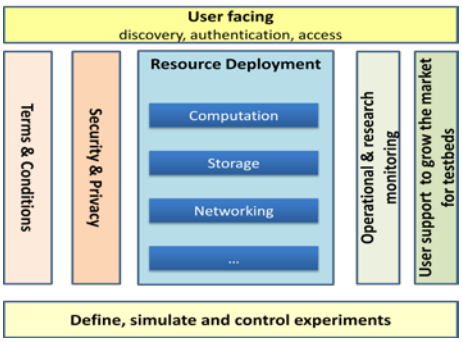


Figure 4. Issues for facility supporting experimenters

*User facing* is the way a facility is discovered, how you can be authenticated as a user and how the access to the facility can be defined. It is not only a list of facilities, but it should also create an understanding how a facility may be used.

*Operational & Research Monitoring* is the function to start, stop and meter experiments and to monitor other operational aspects of experiments.

*Security & Privacy* defines the ability to protect the IPR of the experimenter and the facility provider. It also includes methods to protect privacy of traffic data.

*Define, simulate and control experiments* is the process of creating and supporting the experimental development process.

*User support to grow the market for test beds* is the process to make public what facilities are available and when, announce federated facilities and promote use of facilities by other research groups.

*Deployment of resources* is the process of creating the virtual test bed for an experiment where both physical and software resources will be bound to an experiment.

Further information can be found as mentioned below.


[1] "Towards a collaboration and a highlevel federation structure for the FIRE facility". J. Crowcroft, P. Demeesteer, J. Magen, P. Tran-Gia, J. Wilander
www.ict-fireworks.eu

[2] "FIRE portfolio analysis". S. Kirkpatrick, J. Magen, D. Trossen, J. Wilander
still to be released
www.ict-firestation.eu