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D10.4 – Evaluation report on 2nd open call experiments

We wouldn't be in this position now if we hadn't had access to Fed4FIRE facilities (quote from SME experimenter)

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Authors	Brecht Vermeulen (iMinds), Tim Wauters (iMinds), Peter Van Daele (iMinds)
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Abstract	This deliverable presents an evaluation of the experiments from the 2 nd Open Call as well as the 2 nd and 3 rd SME Open Call.
Keywords	Experiment evaluation, feedback, support, sustainability.

Nature of the deliverable	R	Report	X
	P	Prototype	
	D	Demonstrator	
	O	Other	
Dissemination level	PU	Public	X
	PP	Restricted to other programme participants (including the Commission)	
	RE	Restricted to a group specified by the consortium (including the Commission)	
	CO	Confidential, only for members of the consortium (including the Commission)	

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1 Introduction

This deliverable presents an evaluation of the experiments from the 2nd Open call, the 2nd and 3rd SME call in the Fed4FIRE project. The feedback presented in this document is based on information collected from the experimenters through their reports, where specific comments are being distilled and analyzed (detailed reports in D10.3).

The reports from the experimenters have been screened by the Fed4FIRE partners serving as Patrons or by the testbeds on which the experiments have run.

The deliverable is structured as follows: section 2 provides an overview of the experiments from the 2nd general Open Call and both SME Open Calls. Section 3 provides a general overview of the conclusions from the experiment reports, while section 4 goes into more detail on the comments from the individual experimenters. Section 5 lists a set of quotes from the experimenters as a conclusion to this report.

2 Experiments covered in the analysis

This analysis includes the reports from all 8 experiments from the 2nd Open call in the Fed4FIRE project:

- FCD-Scale+
 - o Partner: Be-Mobile
 - o Used testbeds: Virtual Wall
- HyCEP
 - o Partner: Nissatech
 - o Used testbeds: BonFIRE
- MaSTeR
 - o Partner: Liberologico Srl
 - o Used testbeds: BonFIRE
- MH-ScaE2
 - o Partner: TELTEK Video Research S.L.
 - o Used testbeds: Virtual Wall, PlanetLab, BonFIRE
- SILVERWoLF
 - o Partner: Televic Rail
 - o Used testbeds: Virtual Wall
- EVIDENCE
 - o Partner: Consorzio Nazionale Interuniversitario per le Telecomunicazioni (CNIT)
 - o Used testbeds: Virtual Wall
- MyFIRE
 - o Partner: CREATE-NET
 - o Used testbeds: Virtual Wall, i2cat
- ENGAGE-F4F
 - o Partner: Scuola Superiore Sant'Anna, Istituto TeCIP
 - o Used testbeds: UltraAccess, Virtual Wall
- CloudCONFetti
 - o Partner: Poznan Supercomputing and Networking Center
 - o Used testbeds: w-iLab.t, PlanetLab and FuSeCo

In addition, the SME experiments of the 2nd call are also included (for more details on the individual reports, see D10.3 and appendices):

- AGROFIRE
 - o Partner: AGROESTUDIO
 - o Used testbeds: Virtual Wall, PlanetLab, BonFIRE
- SAFE
 - o Partner: RedZinc Services Limited
 - o Used testbeds: Virtual Wall, FuSeCo, PerformLTE
- TUNeR
 - o Partner: InnoRoute GmbH
 - o Used testbeds: Virtual Wall, FuSeCo
- U-M-SHOP
 - o Partner: EUROB CREATIVE SLNE
 - o Used testbeds: SmartSantander and BonFIRE

Finally also the following reports from the 3rd Open Call for SMEs are also included.

- LIVEstats-on-FIRE
 - o Partner: Planet Media Studios S.L
 - o Used testbeds: NITOS
- KeMSE
 - o Partner: Invenia AS
 - o Used testbeds: BonFIRE Virtual Wall
- Polytest
 - o Partner: Talaia Networks, S.L.
 - o Used testbeds: Virtual Wall, Bristol, i2cat
- VPrimeNet
 - o Partner: Incelligent
 - o Used testbeds: Netmode

Note that

- Skilled
 - o Partner: SkilledApp s.r.l.s
 - o Used testbeds: Virtual Wall, BonFIRE
- TCM4FIRE
 - o Partner: Pierpaolo Giacomini
 - o Used testbeds: Virtual Wall, BonFIRE Virtual Wall

both being experiments from this 3rd Open Call for SMEs, are not included because the experiment was not finished. Both experiments opted to align their work and reporting with the experiments from the 4th SME Open Call.

3 General conclusions from the experiment reports

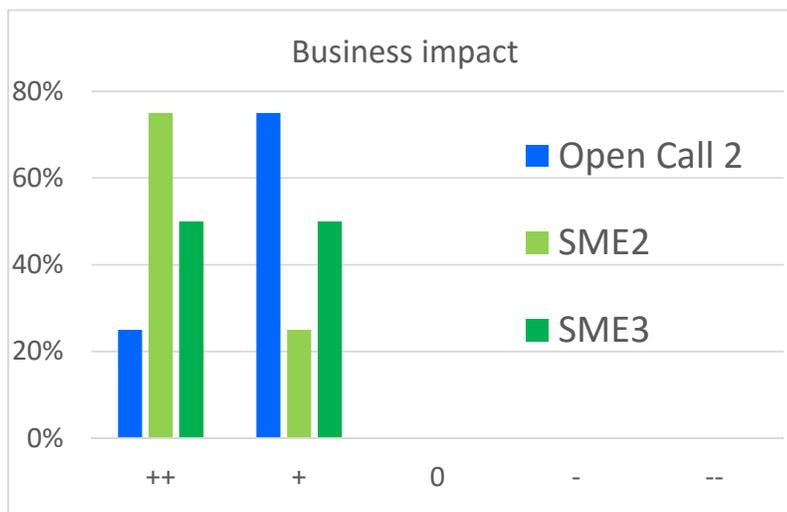
Considering the feedback collected from the experiments in Fed4FIRE, we can learn the following:

3.1 Value to the experimenter:

Nearly all of the experimenters have chosen to submit an experiment to Fed4FIRE:

- To test and evaluate their products in a real environment which is by some companies used as sales argument and proof of the performance or reliability of their product to potential customers **“To test in a real testbed scenario some of the algorithms devised on paper”** (ENGAGE-F4F)
- To prepare their products for the market. **“Fed4FIRE learned us that we are market-ready for large business”**(KemSE)
- To test and evaluate scalability of their products or to carry out stress-tests on their products. Fed4FIRE clearly has the size to carry out these tests **“To identify problems with scalability”** (KemSE)
- Because of the uniqueness of the Fed4FIRE testbeds offering technologies which are not available in commercial testbeds: **“To access infrastructures that otherwise would not be reachable”** (Livestats)
- Because of the financial support received, an argument which is repeated by nearly all SMEs which ran an experiment on Fed4FIRE **“We would have spent thousands of euros to create an infrastructure for testing”** (AGROFIRE)

Taking into account these arguments and the comments, one can distil a score out of this on the “Business Impact” of the experiment for all experimenters.



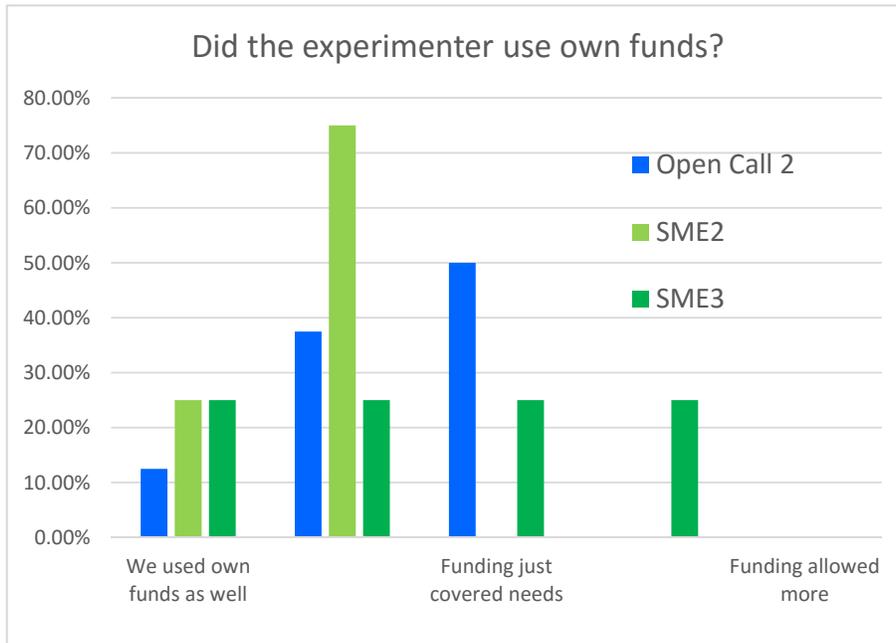
From this graph it is clear that all experimenters indicate a significant to extreme impact on their business from the experiment. This impact slightly differs over the calls, but it is clear that the impact for SME’s is more significant than for the Open Call 2 experiments. It is even so that, looking into the comments in detail, the extreme impacts for the Open Call 2 experiments (2 cases out of 8) also come from SMEs which submitted a proposal to the 2nd Open Call.

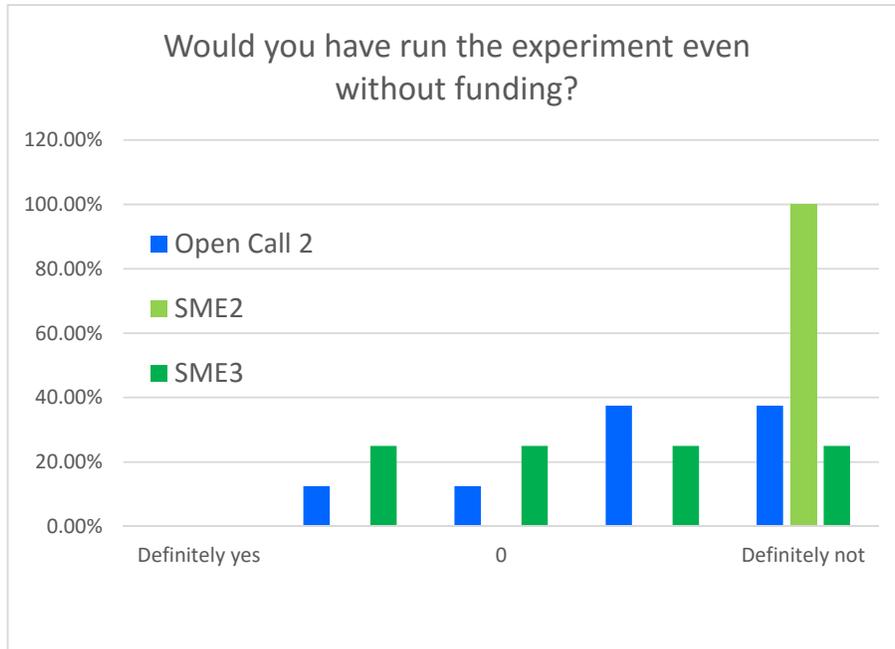
3.2 Appreciation of Fed4FIRE

- Nearly all experimenters are very happy about the support they receive from the testbed operators **“Very strong level of support from UniMalaga team. 5 Star”** (SAFE)
- Quality of the documentation clearly varies and is still evolving, but could still improve.
- Setting up the experiment proved to vary in difficulty. It is clear that simple configurations and experiments are very easy to set up thanks to the user-friendliness of the tools **“The tool is very advanced and yet user-friendly”** (CloudCONFetti). However once the experiment gets more complicated, a learning process is required but in most cases this curve was very steep and once they got used to using the tools, it turned out to be very easy (**“We used JFed for the configuration of the testbeds. At the beginning the configuration seemed a bit complex, but once we got used the operation was quite simple”**(Polytest).
- Most experiments value to use of the standardized tools
- Even in the case experiments were using only 1 testbed, they still acknowledge the value of the federation to provide a one-stop-shop and interface.

3.3 Impact of funding

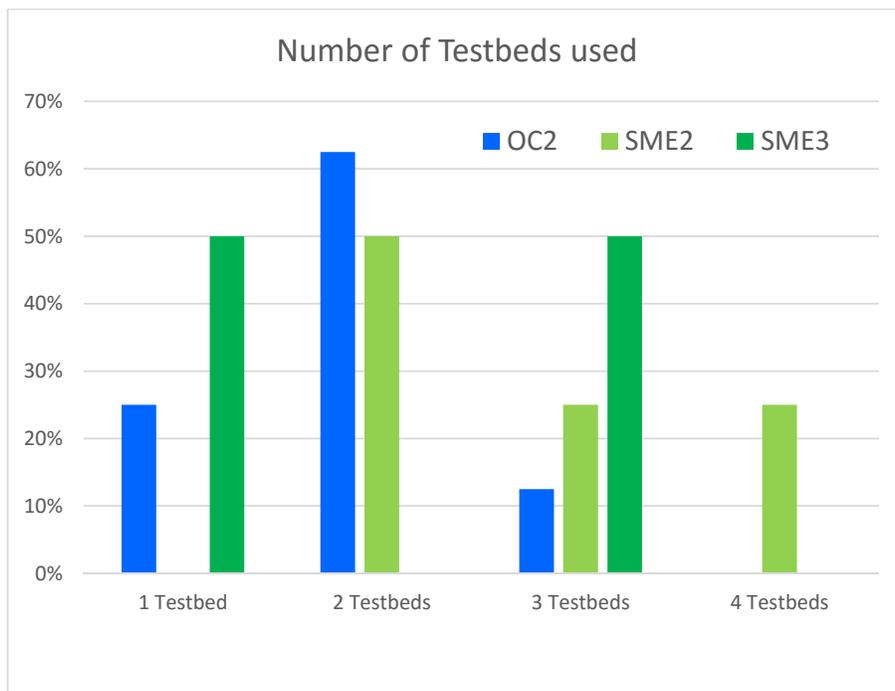
From the reports it is clear that besides the facilities being offered by Fed4FIRE, the availability of funding is a crucial incentive for submitting a proposal. It is however also clear that this incentive more important for SMEs, while for the larger institutes which submitted proposals to the 2nd Open Call, the availability of funding is less a critical issue.





3.4 Use of the federation?

Most of the experiments use multiple testbeds illustrating the benefit of a federate portfolio. It is also interesting to note that most of the SME experiments make use of multiple testbeds, rather than experiments from the 2nd Open Call. This may relate to the high interest and the unique opportunity offered by Fed4FIRE to SMEs.



4 Detailed experimenter comments:

In this part we elaborate on the general conclusions and include some statements (non exhaustive) for specific projects.

4.1 Business impact – value perceived

	++	+	0	-	--
Open Call 2	2/8	6/8			
SME2	3/4	1/4			
SME3	2/4	2/4			

4.1.1 Fed4FIRE helped:

- To identify problems with scalability (KemSE)
- To learn on practical implementation (KemSE)
- To access infrastructures that otherwise would not be reachable (Livestats)
- To test in real environments for a 4-month period (Livestats)
- To access varied wireless technologies and infrastructures: Wi-Fi, LTE and WiMAX in outdoor and indoor locations and this in a short time period (Livestats)
- To experiment, evaluate, adapt, and improve our product in an actual SDN/OpenFlow network (Polytest)
- To improve the Intelligent Simulator scenario builder and the Simulator Wi-Fi engine (VPrimeNet)
- To refined our custom traffic generators (VPrimeNet)
- To access testbeds which speeds up our software development cycles. The testbeds of the Fed4FIRE project are ideal for fast prototyping and experimentally driven research. (VPrimeNet)
- To validate our initial idea of providing vegetation index maps by using cloud computing (AGROFIRE)
- To develop a new product line consisting on providing services of precision agriculture (AGROFIRE)
- To demonstrated the feasibility of user-defined networking (TUNeR)
- To incorporate real time IoT sensor data into our recommendation algorithm (UM-Shop).
- To test in a real testbed scenario some of the algorithms devised on paper and tested in a local testbed only. Thus the experiment was capable of bringing our proposed solutions closer to reality (ENGAGE-F4F)
- To create awareness what will happen in the case of having many users and a huge load of the system. There is no other method than using testbeds like this one for predicting what will happen in the realistic case of many users. (HyCEP)
- To improve extensively the performance for one of our core business products. It allows us to scale our cloud deployment more efficiently (MH-ScaE2)
- To empirically validate previous research activity which were leveraging only emulated networks (MyFIRE)

4.1.2 Without Fed4FIRE:

- We would not have had the possibility to do this test documentation in a sensible framework with a feasible effort (KemSE)
- “If we had not been allowed to make our experiment using Fed4FIRE facilities, we wouldn’t have been able to progress on the development of the business model”(Livestats)
- It would have been more complicated to search for early adopters. The project also helped us to prove the feasibility of our product in a real SDN environment. This will make our future early adopters more confident about the viability of the Network Polygraph SDN solution (Polytest)
- We would have spent thousands of euros to create an infrastructure for testing AGROFIRE and anyway we could not test the behaviour of the system under the demand of multiple users in different locations of the world (AGROFIRE)
- We could not be developing our strategic line of products for precision farming (AGROFIRE)
- If no federation would have been available, our work would have been slower (TUNeR)
- It would be difficult for us to conduct our experimentation, as reaching the various testbeds would be costly and time consuming. The federation gives a straightforward and unified access to the testbeds. Without the federation we would be forced to conduct tests on the working system with a group of chosen users. This would make the process riskier, longer and less flexible for trying out various approaches. Moreover, we would not be able to build a wireless test environment comparable to the one available at w-iLab.t. (CloudCONFetti)
- The experiment would have been executed in a local testbed only. In this case the experiment would have been of smaller size and would have not been as close to a real scenario (ENGAGE-F4F)
- We would have run the experiment in a lab testbed using a very restrained set of nodes which affected the results. This issue was overcome thanks to the virtualized resources available in Fed4Fire (eVIDENCE).

4.1.3 Do the experimenters plan any follow-up projects?

- KemSE: most probably future use of Fed4FIRE
- Livestats: yes, but by applying for public funding
- Polytest: probably to test final product
- SAFE: Yes. We would like to repeat part of the experiment with a different video camera feature. We are also interested to conduct a similar experiment with a set of ‘real’ end users.
- TUNeR: Within research consortia, we will welcome the possibility of using Fed4FIRE facilities again
- UMShop: We have applied to incorporate IoT data to our Incity Together product using a similar approach as the one tackled in U-M-Shop experiment and within CPSELabs call for experiment.
- CloudCONFetti: National project applied
- ENGAGE-F4F: Yes, follow-up projects planned
- EVIDENCE: We plan to test the OFVN controller in other environments (e.g., inter-universities network) and under other conditions following the design guidelines that came out from the tests performed on the Fed4Fire infrastructure.

- HyCEP: We would like to continue experiment with testing some other functions of the system.
- MH-ScaE2: Teltek has planned an internal project to introduce in the market the cloud service we provide to our clients adding on top of it the improvements achieved after the Fed4Fire experiment. We are confident we will be able to go to market during 2016Q1
- MyFIRE: The outcomes are already being used in other projects (5G-PPP) and will be leveraged in future calls. The use of the Fed4FIRE facility is already being planned.
- SILVERWOLF: The testbed will be used further on to retrieve more results and further improve the robustness of our offering. Because of the changes in the test infrastructure, we still have a substantial number of valuable tests still to be performed.

4.1.4 Individual statements:

- KemSE: “Fed4FIRE learned us that we are market-ready for large business
- Livestats: “the experiment brings value to our company in a very specific sense ... This module is direct candidate to be integrated in more product developments of the company, which is one of the main business lines of Planet Media”
- Polytest: as a result of this project, we implemented a first version of the mitigation module in Network Polygraph showing that our solution is not only able to monitor the SDN-based network but also to act on it to improve its performance.
- VPrimeNet: The Fed4FIRE infrastructure is well thought and proved to be a very useful tool for Wi-Fi experimentation.
- AGROFIRE: The performance of the system was good so we decided to use the results obtained during AGROFIRE to create a new product for the market.
- AGROFIRE: With AGROFIRE we also established close collaboration with stakeholders: the Spanish cooperative COOVIMAG. ... COOVIMAG presented their interest in the experiment and expressed their compromise to participate in the project from an end user’s perspective. COOVIMAG provided scenarios for testing, feedback and requirements to develop AGROFIRE in a user oriented fashion.
- AGROFIRE: thanks to the acquired knowledge and skills learnt to use FED4FIRE we now have the possibility to advance in new precision farming systems that could include environmental aspects. The success in the experimentation of AGROFIRE we do not need to invest a large amount of money to create an infrastructure to test our system.
- SAFE: QoS profiles with Rx access are impossible to obtain in public networks as evidenced by previous discussions with two large European mobile operators. High order six figure sums are necessary for operators to deploy QoS profiles on public networks as QoS profiles demand licence fees from equipment vendors. Considering this the SAFE project has contributed effective value of the order of six figures to the experimental process, albeit in a lab configuration and not a public network configuration.
- SAFE: The time frame is immediate and the results and analysis of the SAFE experiment will be included into the configuration of the product which will be launched during 2015.
- UMSHOP: In overall U-M-Shop experiment has been a profitable investment on EUROBS's side due to:
 - New business features developed for the company product M-Shop
 - Capacity to test and validate the business approach

- Access to technical resources in order to implement and validate business approach
 - Support from experienced technical teams for testbeds
 - Acquired new technical skills in terms of languages and operation
 - Acquired new knowledges in terms of solution scalability, facing new unforeseen problems, etc.
 - Acquired ideas for additional testing, validation and export to other company products.
- UMSHOP: As direct benefits we can name the incorporation and validation of new functionalities for our Mshop product. For its mainstream production we foresee an additional timeframe of 6-9 months, which will allow us to fine tune the new features, our recommendation algorithm and assess the customer feedback.
 - ENGAGE-F4F: During the experiment we started to appreciate the value of the Fed4FIRE resources. Thus, now we would be more than willing to run the experiment even without receiving any external funding.
 - EVIDENCE: After successfully testing our current product in the Fed4Fire platform, we can now plan to incorporate it or make it interface with other commercial products or open-source cloud platform that are used worldwide.
 - MASTER: we had the possibility to install and use our platform for the first time in a relevant IaaS European infrastructure context, which for us represented:
 - a valuable marketing asset to spend for capturing both the ISVs' attention (the target of our "public cloud application store" business model) and the Telcos / Cloud Providers attention (the target of our "white label cloud application marketplace" specific revenue stream of our business plan)
 - a sort of "quality assurance" both for the previous mentioned ISVs and business partners (Telcos / Cloud Providers). In fact, we declared and advertised all the MaSTeR experiments results in our marketing channels in order to demonstrate the platform robustness and reliability in complex, realistic, infrastructural and technological scenarios.
 - MH-ScaE2: The direct value obtained for our company from the experiment is based in the scalability of our cloud implementation. Thanks to the tested solution we will be able to reduce the associated costs to the cloud deployment for each of our clients.
 - SILVERWOLF: The three promises for customers using our iSync portfolio are: Robustness, Interoperability and Scalability. The FED4FIRE Open Call project supported us increasing both Robustness and Scalability. By injecting errors and scaling to a substantial amount of nodes ('trains') and applications to be managed and deployed, the SILVERWOLF project 1/ improved our product offering and 2/ can be used as reference during the sales cycle for new projects.
 - SILVERWOLF: The value created during the FED4FIRE/SILVERWOLF project will be valorised in new customer projects. In addition, as the test scenarios have been developed during the FED4FIRE project and are now available, it is possible to execute additional tests with a smaller setup time in future, if required. This gives a lot of confidence in the solution and future support. We expect new projects in 2016 and onwards, as we are now quoting our solution to several prospects worldwide.

4.2 Resources

4.2.1 Testbeds used:

<i>Infrastructures</i>	<i>OC2</i>	<i>SME2</i>	<i>SME3</i>	
Wired testbeds				
• Virtual Wall (iMinds)	5/8	3/4	3/4	+ Emulab (UTAH) (1/8)
• PlanetLab Europe (UPMC)	1/8	1/4		
• Ultra Access (UC3M, Stanford)	1/8			
Wireless testbeds				
• Norbit (NICTA)				
• w-iLab.t (iMinds)	1/8		1/4	
• NITOS (UTH)			1/4	
• Netmode (NTUA)			1/4	
• SmartSantander (UC)		1/4		
• FuSeCo (FOKUS)	1/8	2/4		
• PerformLTE (UMA)		1/4		
OpenFlow testbeds				
• UBristol OFELIA island			1/4	
• i2CAT OFELIA island	1/8		1/4	
• Koren testbed (NIA)				
• NITOS testbed				
Cloud computing testbed				
• EPCC and Inria cloud sites (members of the BonFIRE multi-cloud testbed for services experimentation)	3/8	2/4		
• iMinds Virtual Wall testbed for emulated networks in BonFIRE	1/8	1/4		
Community testbeds				
• C-Lab (UPC)				

4.2.2 Use of reserved time & resources

- KemSE: Not enough resources available at the time of the experiment to run a very large scale experiment.
- Livestats: over 50% of the reserved time was used
- Polytest: 50% of the time was not used
- AGROFIRE: 50% of the time reserved was used
- SAFE: 1/1
- TUNer: more than double of the originally planned time was used.
- UMSHop: 100% of resources planned / used

- CloudCONFetti: 100%
- ENGAGE-F4F: 33%
- EVIDENCE: 100%
- HyCEP: 33%
- MASTeR: 100%
- MyFIRE: 100%
- SILVERWOLF: 40%

4.2.3 Tools used:

<i>Tools</i>	<i>OC2</i>	<i>SME2</i>	<i>SME3</i>
Fed4FIRE portal	5/8	2/4	3/4
JFed	6/8	3/4	3/4
Omni	1/8		2/4
SFI			
BonFIRE portal	3/8	2/4	
BonFIRE API	1/8		
Ofelia portal			
OMF		3/4	2/4
NEPI		1/4	
JFed timeline	1/8	1/4	1/4
OML		3/4	

4.2.4 Specific comments:

4.2.4.1 Fed4FIRE Portal:

- KemSE: The new web portal is a clear improvement on the old one.
- Polytest: The portal was quite intuitive

4.2.4.2 jFed:

- KemSE: Powerful tool. We used JFed for reserving temporary nodes during experiment development.
- Livestats: At first, we used jFed almost exclusively, so we consulted the availability of nodes via this tool. Later on, we developed a series of command-line aliases and tools that, together with the web portal reservation system, allowed us to be more efficient.
- Polytest: We used JFed for the configuration of the testbeds. At the beginning the configuration seemed a bit complex, but once we got used the operation was quite simple.
- AGROFIRE: It is a very nice tool, easy to use. The nodes deployment in JFed is also fast. It is also nice to have the possibility of accessing other testbeds from JFed. However, to monitor the network between PlanetLab Europe nodes and BonFIRE it was required the use of NEPI instead. It would be nice to have more functionalities in the integration between testbeds by using JFed, as for example the monitoring of the networks between testbeds.
- CloudCONFetti: The tool is very advanced and yet user-friendly.
- ENGAGE-F4F: The experience with JFed was really good. It facilitates the experimentation with great flexibility

4.2.4.3 *BonFIRE portal*

- AGROFIRE: This portal provided an elegant way of creating and deploying cloud instances.

4.3 Feedback to Fed4FIRE:

4.3.1 Administrative load:

- KemSE: lots of support, low administration
- Livestats: We are very satisfied with the support we had during the experiment, both administrative and technical.
- Polytest: We appreciate this is not one of those projects where you spend more time in doing paperwork than in the work itself.
- AGROFIRE: The work for administration and feedback, as requested by the Fed4FIRE consortium is ok.
- SAFE: Very strong level of support from UniMalaga team. 5 Star.
- TUNeR: The very low level of administrative overhead and the quick direct support were the highlights of the project. Immediate responses to administrative or technical questions were a major positive surprise to us.
- UMShop: Thanks to the subcontracting design of the experiment and the type of the report required we believe that the level of required effort in terms of administration/feedback in comparison with the rest of the experiment is low and adequate, about 5-10% of the total time
- UMShop: We cannot miss the opportunity to thank one more time the support and effort that we have received by all team members of all the partners from the different Fed4FIRE testbeds. Their help has been very important for the success of the experiment and also to the future of our product.
- CloudCONFetti: The organisational overhead was minimal.
- ENGAGE-F4F: The level of work for administration is excellent. It is good to provide some time to make better experiment evaluation report and feedback.
- MASTeR: The level of administrative and managerial work carried out in MaSTeR is aligned with the effort required for the same activities in every research project.
- MH-ScaE2: The requested number of documents to produce was reasonable, as well as the number of meetings we had to attend to.
- MyFIRE: The level of administrative work was indeed minimal and we could focus all our resources on the technical work.

4.3.2 Setting up the experiment:

- Livestats: The very first time, it took a whole week because to acquire enough knowledge to get to use the platform properly.
- Polytest: We found the jFed version in the portal website has several problems.
- Polytest: Once the methodology for deploying the scenarios is clear, the access to the infrastructures is easy. The learning curve with jFed is quick enough.
- AGROFIRE: With the information provided in the documentation and the orientation of the Patron at the beginning of the experiment it was easy to start implementing simple experiments. However, when complexity increased we found some problems to keep the same rhythm in the implementation
- UMSHop: It is true that we needed to install additional programs/addons and made an extensive setup configuration process before being able to perform the actual desired tests. Nonetheless, most of these additional components were clearly documented in the website and in some tutorials which were initially available on the respective sites.
- ENGAGE-F4F: The effort required to set up and run the experiment for the first time was medium/high. The main motivation is that during the proposal phase some the testbed details were known only partially.
- HyCEP: The effort was significant. Not because of the testbed itself and not because one huge issue, but because several smaller ones.
- MASTeR: It was not difficult per se. The main issue for us was the lack of an API Client. Working in a fully automated environment like we do, you cannot use tools like JFed but must rely on the APIs. So we had to write an API Client before starting to execute any experiment.
- MH-ScaE2: The learning curve is a little steep and we spent a lot of time before we got familiar with the three testbeds
- MH-ScaE2: The platform is very flexible and that probably lead us to try complex scenarios and invest a huge effort in the deployment.
- MyFIRE: Since we used jFed, it has been quite easy to get started. This tool is indeed sufficient for designing and managing the experiments.
- SILVERWOLF: It took about two months, by two persons, until we could run our first simulations.

4.4 Use of federation?

4.4.1 Testbeds:

	1 Testbed	2 Testbeds	3 Testbeds	4 Testbeds
OC2	2/8	5/8	1/8	
SME2		2/4	1/4	1/4
SME3	2/4		2/4	

4.4.2 Commercial testbed an option?

- KemSE: Technically spoken yes, but access to a budget to carry out large-scale test of our system was an important factor to go for Fed4FIRE
- Livestats: Probably the answer would be no, at least in the short term. ..., in order to progress on the innovation process in our company, ... we needed support; we wouldn't have been able to run an experiment like this without funding at this point.
- Polytest: We currently do not know any commercial testbed with SDN networks. Even so, we would not been able to conduct the experiment at a commercial environment without the help of external funds.
- AGROFIRE: we do not have funding enough to test our experiment in a public commercial cloud. We have been using Fed4FIRE for 6 months with the resources explained above. That would have been too expensive for us to test AGROFIRE in commercial infrastructures.
- AGROFIRE: it has also been said before, Fed4FIRE is independent of any other infrastructure, and it can also be integrated with commercial infrastructures, for companies is very important to avoid vendor lock-in, which in the commercial cloud field is a major problem, since this vendor lock-in is part of the business model of those companies offering the services.
- SAFE: We are not aware of any LTE testbeds available to SMEs except via FIRE. Most LTE testbeds are closed and owned by the Telcos or the large equipment vendors.
- TUNeR: Possibly not. Cloud data centres are available all around the world, but the easy access to support for experimentation is, to our knowledge, not available somewhere else.
- U-MShop: It would not have been possible due to the fact that U-M-Shop experiment includes access to physical sensors and retrieving and processing data in a fashion that we believe it is not available beyond lab testbeds nowadays.
- ENGAGE-F4F: The possibility of running the experiment at a commercially available testbed infrastructure would have been unlikely mainly because of the novelty of some implemented solutions, such as OLT LC and ONU sleep mode.
- HyCEP: There was no testbed infrastructure we could use in such a "comfortable" way
- MASTeR: Unfortunately no, we could not, since the experiments on a commercially available testbed, as said before, would be too expensive.
- MH-ScaE2: Yes, it would be possible, even though it would have been really expensive and not affordable for us at this stage of the project.
- MyFIRE: Not possible
- SILVERWOLF: We believe it would have been possible (and easier) to conduct the experiments in commercially testbeds, since we required only a lot of identical hosts.

4.4.3 Added value of the federation

- KemSE: The federation's main contribution is making individual facilities visible and usable through a homogenous set of standards and tools. Support has been excellent. Single point of contact and tools. The available documentation was well-written, but didn't cover some of our specific needs. Admittedly, we knew this going in. Software tools are decent and have been improving over time. A little extra effort could be spent on making them even easier to use. Flexibility in configuring offered technology and resources.
- Licvestats: Diversity and quantity of the nodes to test the kind of server-client application that we were testing: (different technologies, types –outdoor/indoor-, different locations, possibility to combine infrastructures and resources. & A homogeneous platform, once learned, it was very simple to use.
- Polytest: To us, the most valuable element from Fed4FIRE is the access to a SDN infrastructure.
- AGROFIRE: To develop projects that can provide services at European level, with millions of potential users at the same time, it is necessary to have a test infrastructure with sufficient technical resources. Another point is the need of staff with high technical qualifications to develop and implement the processes. Fed4FIRE offers technical and human resources needed to develop new solutions in an easy and cost effective way. In AGROFIRE it was very important to have federated testbeds since we implemented AGROFIRE as realistically as possible by using three different testbeds. We also made use of the federated tools which facilitate the experimentation.
- AGROFIRE: Close to reality: The implementation of an experiment in Fed4FIRE is so close to reality that any development carried out in the environment can be migrated to a commercial platform.
- AGROFIRE: The innovative industry driven experiment that we proposed requires the use of large and scalable infrastructures. The experiment is complex and relevant for the agricultural European sector, since it is conceived to offer an on demand service to agricultural producers.
- SAFE: Federation in 'a one stop shop' and 'brokerage' environment providing access to the experimental platforms is very valuable to SMEs.
- SAFE: The federation model of Fed4FIRE is very powerful from RedZinc's point of view. Our control plane software is designed for multi domain federated autonomous systems. As such the federation of Fed4FIRE is very valuable from RedZinc's point of view.
- TUNeR: The federation made life much easier, because there were no ambiguous responsibilities. This way no time and effort were wasted in addressing the wrong person
- TUNeR: It was a mixture of the technical infrastructure available (especially the large number of nodes), of the easy application process, and the availability of budget for our experiments.
- UMSHOP: It would have not been possible to execute the experiment/validate our approach, since although several cities are already starting to deploy sensors, their richness/availability/access to data is far beyond those provided in the experiment, so it would have been far more complicated to validate our approach and also the lack of the technical support provided by Fed4FIRE would have made the process longer and with uncertain results.
- ENGAGE-F4F: The most important component provided by the federation is combining infrastructures.

- MASTeR: The federated infrastructure allowed us to make more complex stress-tests and thus have more valuable results under a market perspective. In the end thanks to the Fed4FIRE federation we had the chance to test our platform in a production-like environment. If there were no federation, our tests would have been less effective for our business objectives.
- MH-ScaE2: In case we hadn't had a federated architecture available for the experiments it wouldn't be possible
- MyFIRE: For our experimentations, we basically needed computing resources and a programmable (i.e. Openflow enabled) network. We valued the high number of available resources on the Virtual Wall for large topology experimentation, and the high and stable bandwidth available on the i2CAT OpenFlow switches.
- SILVERWOLF: Easy setup of experiments, Support available from the testbeds

4.4.4 Suggestions for improvement:

- KemSE: We think Fed4Fire would be well served if it made an effort to improve the support for commercial entities.
- Livestats: The technology, especially the LTE nodes, was amazingly fast. As for the other nodes / testbeds, they were quite sufficient. The most positive aspect of the experiment would be that once the federation architecture was understood, every resource had a standard way to use.
- Livestats: Having Windows images in the NITLab testbeds would have been really very useful.
- Also, jFed did not work as expected, it lacked some functionality (calendar), and was less explicit in the info about the platform than entering via SSH and executing commands in the console.
- Polytest: It would be interesting to have a more detailed description of the testbeds configuration and devices. This way the planning of the project can be designed more accurately.
- AGROFIRE: However, we would like to highlight that 4 months experiment is too short time to carry out an experiment in Fed4FIRE for the following reasons:
 - Training is required to work with testbeds and tools which are continuously being updated.
 - Fed4FIRE is not in an operational stage yet. There are delays in the use of testbeds because sometimes they are updated, or they fall down.
- AGROFIRE: The interoperability and interconnectivity between testbeds is really good. It allowed us to execute the experiment in real time and online with interconnections between the three different testbeds. However it would be nice to have JFed mature enough to do it from there. This tool has also a really high potential to design and implement systems in Fed4FIRE by using a common, graphical and easy to use tool.
- TUNeR: Webinars on the various aspects of experimentation on Fed4FIRE testbeds
- ENGAGE-F4F: What is missing, in our humble opinion, is a more autonomic setup and running of the experiment. As an experimenter I would like to design my experiment and then having an engine that finds the resources and the measurement tool on my behalf.
- MyFIRE: In Virtual Wall, we would have appreciated a more realistic and transparent testbed from the networking point of view.

5 Quotes:

- KemSE: we're now able to formally document these test findings to potential partners and customers
- LiveStats: We wouldn't be in this position now if we hadn't had access to Fed4FIRE facilities, because the particular scenario for our platform required human, time and physical resources that are too costly for us to address.
- Livestats: The results obtained brought great value for our company and our action plan.
- Polytest: Fed4FIRE provided us a unique opportunity to enhance the development of our new product.
- VPrimeNet: This is a wealth of resources for small R&D companies and access to such testbeds reduces their products' TTM considerably.
- AGROFIRE: Fed4FIRE enhanced our main research and innovation line, providing us training, economical funds, prestige and international publicity supporting us to create a new product which hopefully will compete with the main actors of market, mainly found in USA and Australia.
- AGROFIRE: Fed4FIRE has a huge potential for SMEs and start-ups. Large companies usually have budget and resources enough to create a data center and test their developments. SMEs do not, and Fed4FIRE provides the possibility of focusing in the idea more than in the development of the infrastructure to develop such an idea.
- AGROFIRE: Fed4FIRE provides the following values from our point of view:
 - o Federation of testbeds for experimentation.
 - o Possibility of developing systems without vendor lock-in.
 - o Every development carried out in Fed4FIRE can be migrated to other infrastructures very easily.
 - o Free use
 - o JFed
 - o International visibility
 - o To be part of one of the most important projects of Future Internet in Europe
 - o Easy to use
- AGROFIRE: Thanks to the experiment I conducted within Fed4FIRE I could start internationalizing my company. However I expect that in the following months I can say: Thanks to the experiment I conducted within Fed4FIRE I could launch a new innovative product to the European market.
- SAFE: the SME initiative by the Fed4FIRE project is a great idea. The federated 'testbed market place model' of Fed4FIRE with 'one stop shop' is a valuable platform which can be used to help derisk technical configurations as new innovations are brought to market
- TUNeR: we were able to tune our network traffic models that are the basis of InnoRoute's YouQoS technology. Especially the experiments with large numbers of hosts and varying topologies would have been much more expensive and would have been much harder to setup without Fed4FIRE.
- UMShop: we have been able to improve and incorporate additional outstanding features in our products leading to greater sales and market impact.

- CloudCONFetti: I have created and tested a solution improving our product, possibly accelerating our customer growth and increasing our market share.
- ENGAGE-F4F: It was possible to experiment dynamic reconfiguration of a green access/aggregation network based on software defined networking (SDN) in a real scenario.
- HyCEP: we were able easily to identify bottlenecks in our system, identify points of suboptimal design and coding and test our system in a production-like environment before cashing out considerable money for cloud hosting services.
- MASTeR: we performed large scale simulations and assessed the robustness of the platform in specific stress-test scenarios. Now we can guarantee to our customers the same excellent service level as the ones offered by the best of breed players from USA
- MH-ScaE2: we will be able to offer our clients a more refined cloud based product, optimizing the delivery time for their video content
- MyFIRE: I have been able to validate our solution at scale in realistic settings and with real hardware.
- SILVERWOLF: Soon a robust iSync for train provisioning will conquer the world!