



The European Open Ecosystem for Future Internet Experimentation & Innovation

ict.fire.eu





Future Internet
Research and
Experimentation

The Future Internet arena represents a stimulating growth environment, offering new ways for businesses to be innovative and competitive within the Digital Single Market context. In particular, world-class European testbeds and experimental resources offer Companies – medium-to-large corporations, SMEs and Startups – and Research Organizations an ideal framework for testing and validating innovative technologies and ideas in controlled environments, allowing assessment and improvements by reducing drastically the time to market for Next Generation Future Internet applications, services and solutions.

What is FIRE?

FIRE, Future Internet Research and Experimentation, is a crucial initiative launched and financed by the European Commission that has been growing since its inception in 2010 with the ambition of being Europe's Open Lab for Future Internet research, development and innovation. FIRE offers cutting edge test facilities that could not be accessible otherwise by many European players. FIRE, by embracing several related Horizon 2020 initiatives and vertical segments, including 5G, Smart Cities, Manufacturing, eHealth, etc., offers the unique possibility to experiment with networks, infrastructures and tools in a multidisciplinary test environment. This is key to investigating and experimentally validating highly innovative and revolutionary ideas for next generation networking and service paradigms at a lower cost, in a more rapid way.

This brochure, for what?

This brochure presents an overview of the current FIRE landscape by providing a high level description of all ongoing FIRE projects, which have been grouped into five main categories according to their technology focus:

- Federation
- Data Management
- Internet of Things
- Smart Cities
- Networking

Moreover, the current Coordination and Support Action projects are also described, highlighting its cross-programme role in helping ongoing FIRE projects and EC representatives to maximise the impact of the overall FIRE framework.

Save money,
effort and time
by adopting already
available FIRE
test facilities!

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Coordination & Support actions

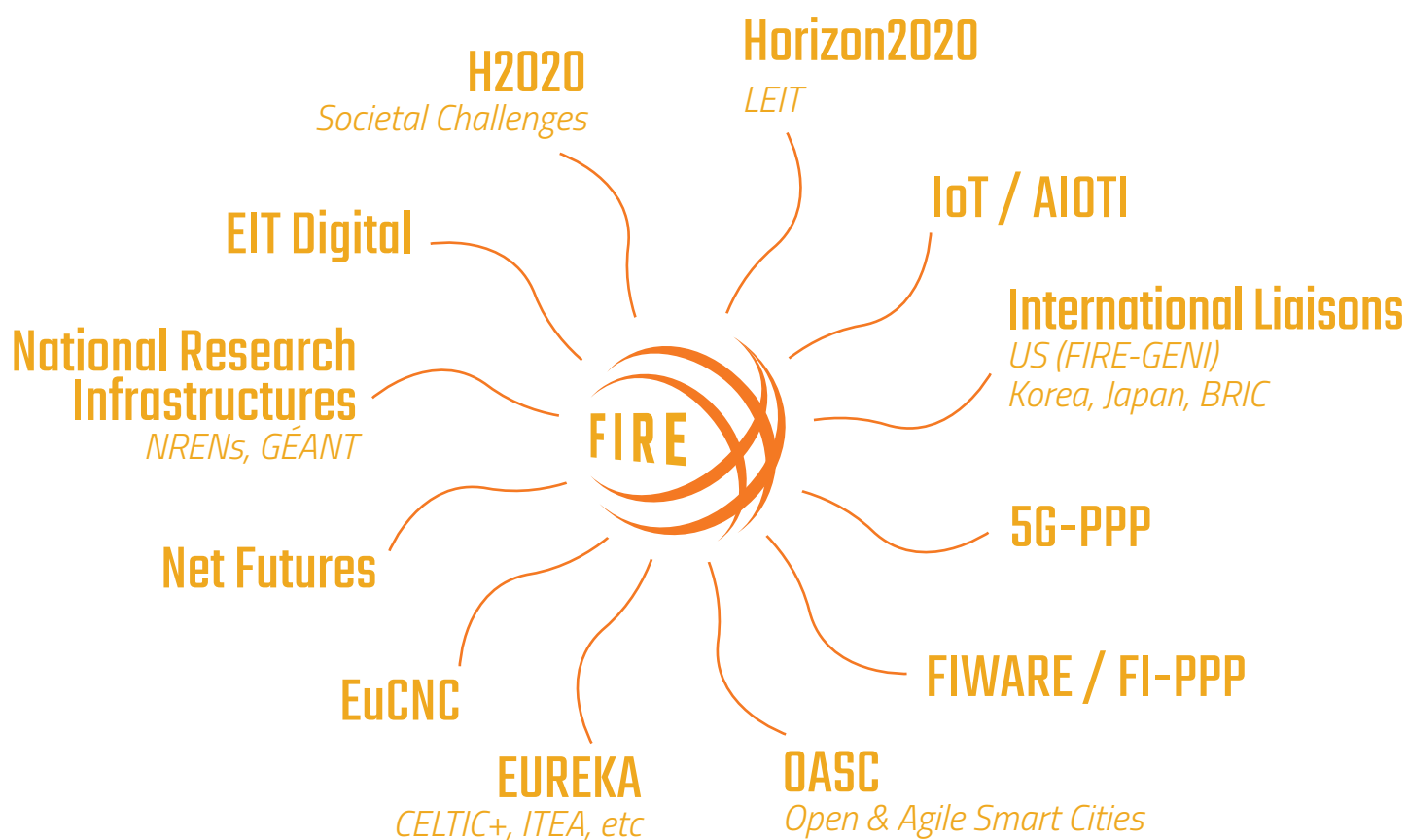
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The Future Internet Research and Experimentation, FIRE, Initiative was launched at the beginning of 2007 as part of Framework Programme 7. It built upon the «Situated and Autonomic Communications» Initiative and other internet-related projects funded under the Future and Emerging Technologies (FET) Programme, as well as on several projects launched as Research Networking Testbeds already under FP6.

In these last 10 years FIRE has continued to grow and currently offers access to experimental facilities and services across a wide range of user segments. FIRE's traditional user category comprises primarily academic experimenters and members of scientific research institutes. In recent years though, thanks to some strategic

reorientation, the concepts of Open Calls and Open Access, and liaisons brought in by the various users, the FIRE Community now includes other stakeholders, such as SMEs, industrial testbed/technology providers, etc. FIRE also continues to build links to related initiatives such as 5G PPP, the IoT/AIOTI, the FI-PPP/FIWARE, the EIT ICT Labs as well as the vertical OASC. Moreover, FIRE makes use of - or collaborates for offering - services and facilities provided by players actively involved in GÉANT / NRENs. The cooperation between FIRE and these other initiatives and players is evolving in line with changing business needs and experimenter requirements on the one hand and technology push factors on the other, both within the FIRE context or in related domains.

The figure below visualises the areas of relevance for FIRE in the broader Future Internet context, including related initiatives and research/innovation programmes.

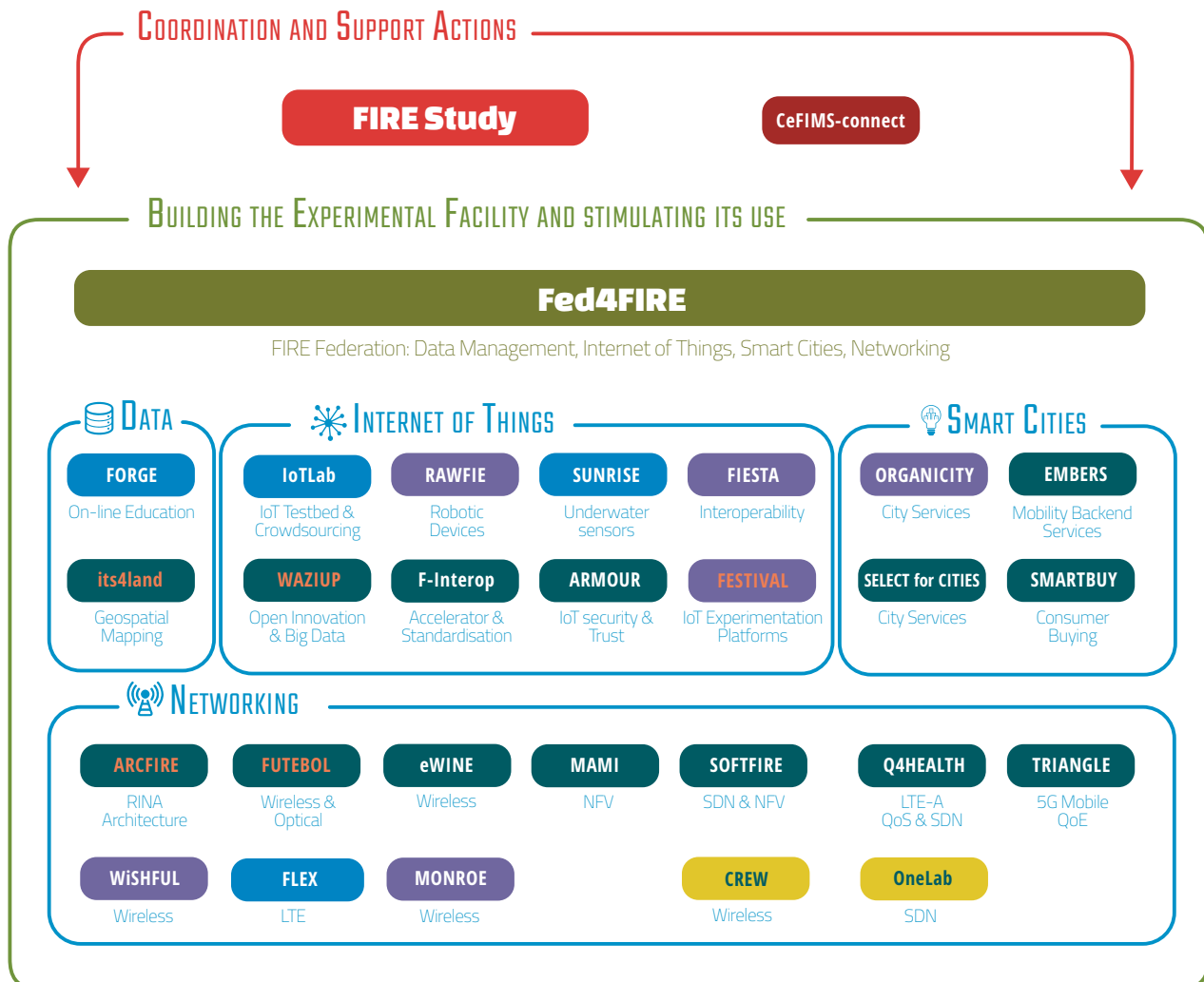


FIRE's current offering (April 2016) includes 27 projects, where 25 are research and/or experimentation projects and 2 are Coordination and Support Action (SA) / Study projects.

FIRE's older 11 facility projects (FESTIVAL, FIESTA, FLEX, MONROE, ORGANICITY, RAWFIE, SUNRISE and WISHFUL) contribute to the FIRE Facility by developing a large-scale testbed or federation of testbeds. Additionally, CREW and Onelab are no longer funded by the EC, but offer Open Access.

Fed4FIRE (Open Access) is an overarching project, which

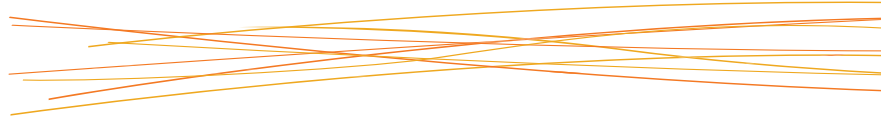
federates testbeds from most of the above mentioned facilities. Other older projects (IOTLAB and FORGE) are specifically research-focused and experimentally-driven. Most of the new FIRE projects started in January 2016, as part of the Call 2 of Horizon 2020. 6 projects (ARMOUR, F-INTEROP, FUTEBOL, SOFTFIRE, SELECT4CITIES and TRIANGLE) are new FIRE facilities which will offer third party financial support (Open Calls) for external experiments. The 8 projects (ARCFIRE, EMBERS, eWINE, ITS4LAND, MAMI, Q4HEALTH, SMARTBUY and WAZIUP) are experimentally-driven research projects.



More details of this graphic
at: www.ict-fire.eu/offering



PORTFOLIO



FIRE+ indicates the evolution of the FIRE ecosystem towards the achievement of the Horizon 2020 vision and beyond into the next Framework Programme and comprises the latest generation of FIRE resources and

projects, which started with the H2020-ICT-2014 Call. The FIRE+ projects have been grouped into five key technology areas to facilitate the identification of the testbeds for potential experimentation.



Federation

The FIRE federation represents a group of computing or networking providers (testbeds) which have agreed upon operations or standards in a collective fashion and testbeds are typically reachable via a single web portal. The Fed4FIRE project federates testbeds also from several other FIRE+ projects.



Data Management

Two FIRE+ projects work with a generic Data Management topics and services including Geospatial Mapping and on-line education.



Internet of Things

Eight FIRE+ projects work with different kinds of IoT sensors, wireless networks, underwater M2M (Machine-to-Machine) technology elements.



Smart Cities

Mobility backend services, City services and Consumer buying are service examples in the four projects working with Smart Cities.



Networking

There are ten FIRE+ projects working with typical telecommunication technology e.g. wireless, wired and optical networks including Long Term Evolution (LTE), Software Defined Networking (SDN) and 5G mobile Quality of Experience (QoE).

Additionally there is one Support Action project (ceFIMS-CONNECT) working with the European Future Internet Forum (FIF) and one FIRE Study project working on the

FIRE+ testbed inventory, roadmap & vision, community building and FIRE+ wide communication and dissemination topics.

The largest federation

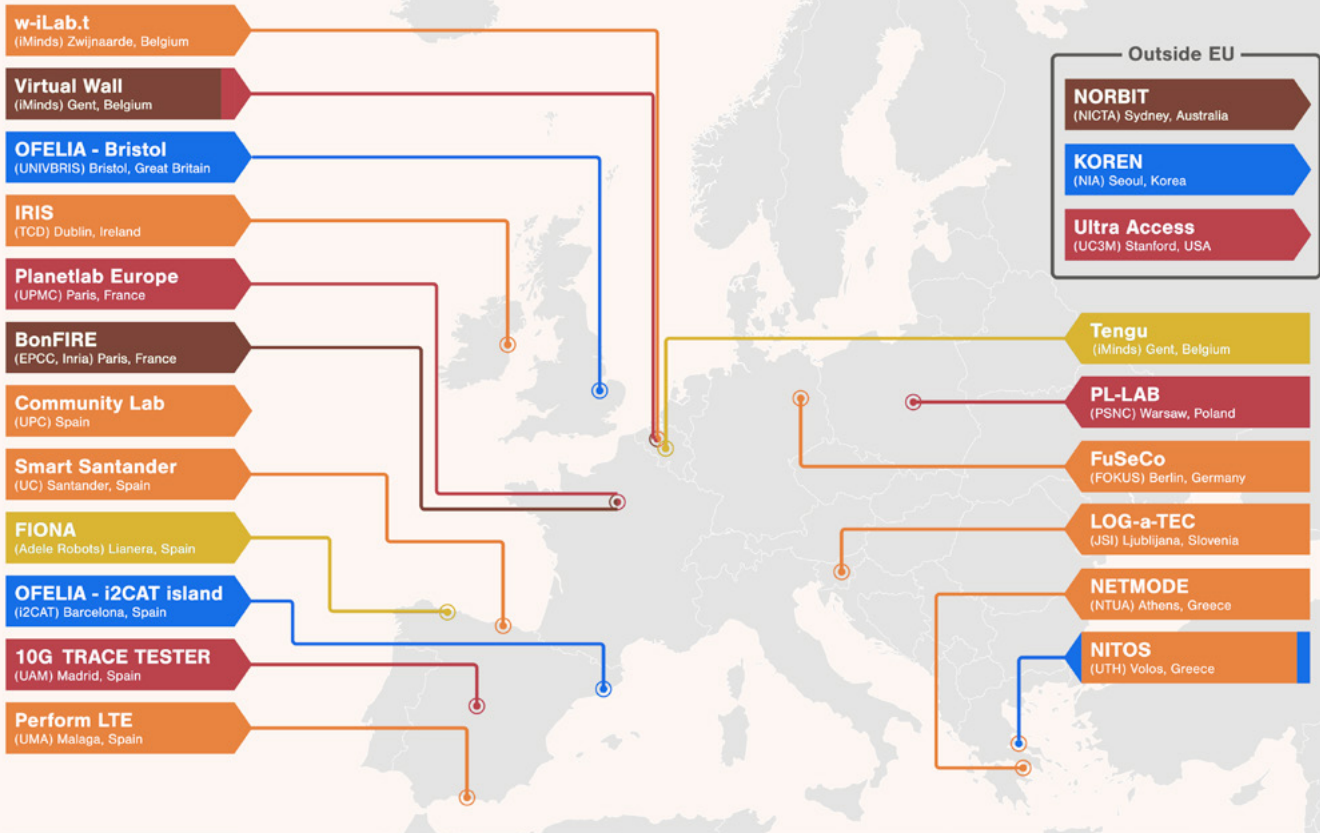


of testbeds in Europe

The main outcome of the Fed4FIRE project is the establishment of a European Federation of experimentation facilities and testbeds, including the necessary technical and operational federation framework. With its 23 testbeds, Fed4FIRE represents the largest federation of testbeds in Europe which allows remote testing in

numerous ICT areas. Various user friendly tools established by the Fed4FIRE project enable the remote usage of the federated testbeds by experimenters who can combine different federated resources, independently on their location, and configure them as needed to perform the experiment.

● Wired ● Wireless ● Openflow ● Cloud ● Other



The main idea behind the Federation of testbeds is to enable easy and efficient usage of already available experimental resources by the entire research and innovation community in the broad area of ICT as well as

various vertical application sectors applying the ICT, such as Energy, Health, Transport, Media, etc. Experimenters, developers and innovators can use the federation of testbeds to speed-up their research and businesses.

Fed4FIRE benefits for experimenters:

- No need to spend time and resources to develop own experimental facility
- Possibility to use multiple testbeds world-wide offering large variety of experimentation opportunities
- User friendly Fed4FIRE tools for remote set-up and execution of experiments
- Support from Fed4FIRE team to run experiments

The largest federation



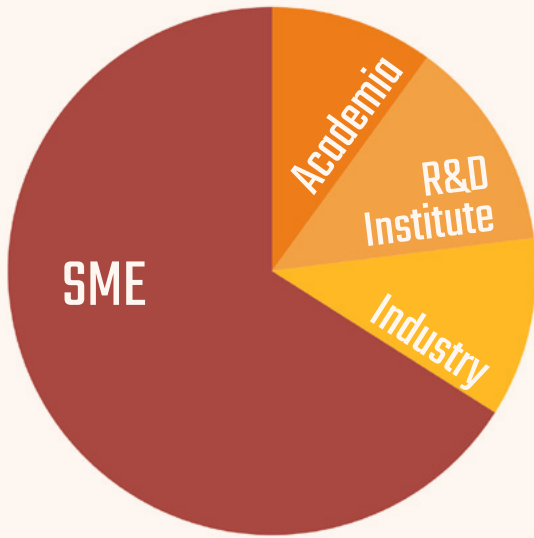
of testbeds in Europe

Until now, more than 50 experiments have used the Fed4FIRE experimental facilities and tools. Part of them took the opportunity of 7 Open Calls for Experiments organized by Fed4FIRE in the last three years. Other experimenters used the Fed4FIRE Open Access mechanism which allows free of charge access to the experimental facilities and support from the Fed4FIRE team for setting up the experiments.

The Fed4FIRE experimenters had the opportunity to experience all the advantages of the Fed4FIRE tools, to configure and successfully execute their experiments. The feedback received from the experimenters on the usability of Fed4FIRE's facilities and tools was very positive.

Moreover, most of the performed experiments would not have been possible without the provision of the Fed4FIRE federation and its experimental facilities. Thus, the Fed4FIRE facilities helped the experimenters to further explore their research and business development based on results gathered from the experiments.

Using testbeds



Fed4FIRE organised 2 Open Calls for Experiments targeting industry, including SMEs, as well as academia and research institutions. In order to increase the opportunities for SMEs to use the Fed4FIRE experimental facilities, 5 specific Open Calls for SME Experimenters have been organised too.

How to get involved?

If you are interested in using the Fed4FIRE facilities to evaluate or characterize your research, development or innovation, our support team is at your service to provide you with the necessary assistance to answer your questions related to the feasibility and applicability of your planned set-up, and will get you started in no time by guiding you through the entire process.

In the scope of Fed4FIRE Open Access, usage of our facilities is free of charge – subject of feasibility confirmation by Fed4FIRE.

In order to extend its offer in terms of variety of available experimental facilities, Fed4FIRE is open to include new testbeds in the federation and is continuously seeking new infrastructures to join.

Project Facts

CALL: Collaborative Projects | **EXECUTION:** From October 2012 to September 2016

COORDINATOR: Piet Demeester (iMinds)

PARTNERS: iMinds (Belgium), University of Southampton IT Innovation (UK), UPMC (France), Fraunhofer-FOKUS (Germany), TU Berlin (Germany), University of Edinburgh (UK), INRIA (France), NICTA (Australia), Atos (Spain), University of Thessaly (Greece), NTUA (Greece), University of Bristol (UK), i2CAT (Spain), EURESCOM (Germany), DANTE (United Kingdom), Universidad de Cantabria (Spain), NIA (Republic of Korea). **PARTNERS joined after 1st Open Call** (from December 2013): UMA (Spain), UPC (Spain), UC3M (Spain), DEIMOS (Spain), MTA SZTAKI (Hungary), NUI Galway (Ireland), ULANC (UK), WooX Innovations (Belgium), UKent (UK), British Telecom (UK), Televes (Spain). **PARTNERS joined after 2nd Open Call** (from December 2014): UAM (Spain), Trinity College Dublin (Ireland), Jozef Stefan Institute (Slovenia), Adele Robots (Spain), PSNC (Poland), Be-Mobile (Belgium), Nissatech (Serbia), Liberologico (Italy), TELTEK (Spain), Televic Rail (Belgium), CNIT (Italy), CREATE-NET (Italy), SSSA (Italy)

www.fed4fire.eu



Data Management





Forging Online Education through FIRE

The Forging Online Education through FIRE (FORGE) project has transformed the Future Internet Research and Experimentation (FIRE) testbed facilities into learning resources for higher education. Through FORGE, online courses have been enhanced with FIRE-enabled interactive labs supporting experimentally driven research in an online environment.

How does it work?

FORGE is leveraging FIRE testbeds and is enhancing learning approaches by producing educational material reinforced with hands-on experimentation that are supported by multimedia resources for engineering educators and learners. The courses are freely available in different formats, such as HTML, epub3 and Apple iBooks. It is now easy to experiment on real high-performance testbeds on a laptop or tablet from any location in the world.

Key achievements

FORGE has developed a framework called FORGEBBox, which enables hands-on-enhanced interaction with FIRE testbeds. FORGE has also created the FORGESTore as a marketplace of widgets as well as FIRE adapters to support interactive courses. To date, FORGE has produced courses covering a wide range of networking and communication domains. These are freely available from FORGEBBox and has resulted in over 20,000 experiments undertaken by more than 600 students at several

universities worldwide. FORGE is also contributing to the IEEE P1876 Networked Smart Learning Objects for Online Laboratories Standard.

In 2015, the FORGE project was the winner of the "Hottest Pitch" award at NetFutures conference and saw the launch of the FORGE iBook on the Apple iBooks Store. Additionally, the FORGEBBox framework was extended to include Learning Analytics for both learners and educators. FORGEBBox also saw the addition of several advanced experimentation courses including Trinity College Dublin's OFDM and Wireless Signalling courses and iMinds Long Term Evolution (LTE) course. Some of these courses were taught to students in Brazil and Mexico, who were also able to access the advanced FIRE testbed resources, thereby adding to the broad international impact made possible by the FORGE framework.

How to get involved?

New partners can join the FORGE project through the fourth and final Open Call.

Project Facts

CALL: Collaborative Projects Call 10 | **EXECUTION:** From October 2013 to September 2016

COORDINATOR: John Domingue (The Open University)

PARTNERS: The Open University (UK), University of Patras (Greece), iMinds (Belgium), GRNET (Greece), University Pierre et Marie Curie - Paris (France), Trinity College Dublin (Ireland), NICTA (Australia)

Geospatial Technology Innovations for Land Tenure Security in East Africa



its4land delivers an innovative suite of land tenure recording tools that responds to sub Saharan Africa's immense challenge to rapidly and cheaply map millions of unrecognized land rights in the region. ICT innovation will play a key role. Existing approaches to land tenure mapping have failed: disputes abound, investment is impeded, and the community's poorest lose out. its4land reinforces strategic collaboration between the EU and East Africa via a scalable and transferrable ICT solution.

How does it work?

Set in the East African development hotbeds of Rwanda, Kenya, and Ethiopia, its4land combines an innovation process with emerging geospatial technologies, including smart sketch-maps, UAVs, automated feature extraction, and geo-cloud services, to deliver land recording services that are end-user responsive, market driven, and fit-for purpose. its4land has 3 major phases: contextualization, design, and land sector transformation. The transdisciplinary work develops supportive models for governance, capacity development, and business capitalization. In line with Living Labs thinking, localized pilots and demonstrations are embedded into the work. The experienced consortium is multi-sectorial, multi-national, and multi-disciplinary. It includes SMEs and researchers from 3 EU countries and 3 East African countries. Gender sensitive analysis and design is also incorporated.

Key objectives

The specific objectives are to: 1) capture the specific

needs, market opportunities, and readiness of end-users in the domain of land tenure information recording; 2) co-design, adapt, integrate, demonstrate, and validate a land tenure recording suite based on small unmanned aerial vehicles (UAVs), smart sketch-maps, automated feature extraction, and geocloud services; and 3) develop and valorise a governance model that realizes the innovation process by aligning end users' conditions, technological opportunity, business models, and capacity building requirements.

How to get involved?

its4land is building multiple dissemination, exploitation, and valorisation channels - for the tech-industry, international agencies, governments, researchers, and small-holder groups. We want our data and tools to reach the widest possible audience. If you would like to learn more, visit its4land.com or contact the project coordinator.

Project Facts

CALL: Collaborative Projects Call 2 - ICT12 | **EXECUTION:** From February 2016 to February 2020

COORDINATOR: Rohan Bennett (University of Twente)

PARTNERS: University of Twente (Netherlands), University of Munster (Germany), Katholic University of Leuven (Belgium), Hansa Luftbild (Germany), INES (Rwanda), Technical University of Kenya (Kenya), Bahir Dar University (Ethiopia), esri Rwanda (Rwanda)



Internet of Things



Crowdsource The Future



IoT Lab is a European Research project which aims at researching the potential of crowdsourcing to extend the Internet of Things (IoT) testbed infrastructure for multidisciplinary experiments with more end-user interactions. It is also researching IoT testbed integration and federation, as well as crowdsourcing and crowd-sensing with a privacy by design approach. It gives the power to the crowd to be at the core of the research and innovation process, including to trigger new research processes. It gives you the power to change the world and the way we understand it.

How does it work?

The future of IoT research will require closer interactions between researchers and society, in order to better address societal needs and challenges, including end-user acceptance. This will require new approaches for experimentation that will become more pervasive, leaking out from the labs into the real world. IoT Lab is federating several European IoT testbeds to provide Testbed as a Service (TBaaS). In parallel, it is extending experiments with crowdsourcing and crowd-sensing tools to better collect feedback and inputs from real end-users. IoT Lab will serve this future vision by contributing to pave the way to new experimental approaches with innovative "privacy-friendly" crowdsourcing technologies, multidisciplinary approaches and new research schemes, such as crowd-driven research.

Key achievements

IoT Lab has already developed and implemented most of its targeted platform. It first specified a comprehensive

privacy-by-design architecture for crowdsourcing and testbed virtualization. It then developed privacy-friendly crowdsourcing tools as smartphone applications, enabling both crowdsourcing and crowd-sensing with voluntary participants. In parallel, it interconnected several European IoT testbeds into a shared IPv6 network and integrated them into a common TBaaS. This enables researchers to access both IoT and crowd resources through a user-friendly interface, and to perform experiments. The last year of the project is focused on fine-tuning the tools and performing experiments.

Furthermore, IoT Lab has researched and further developed new incentive models for end-user engagement, as well as new business and sustainability models for testbed infrastructures.

Any interested research team is welcome to contact IoT Lab and propose joint experiments. The prime focus is on research involving IoT and end-user acceptance.

Project Facts

CALL: Collaborative Projects Call 10 | **EXECUTION:** From October 2013 to September 2016

COORDINATOR: Sébastien Ziegler (Mandat International)

PARTNERS: Mandat International (Switzerland), University of Geneva (Switzerland), Computer Technology Institute & Press Diophantus (Greece), University of Surrey (UK), Technical University of Lulea (Sweden), Alexandra Institute (Denmark), University of Southampton (UK), DunavNET d.o.o. (Serbia)



Road, Air & Water based Future Internet Experimentation

RAWFIE aims to provide research and experimentation facilities through the growing domain of unmanned networked devices. The project will establish a unique, mixed experimentation environment across the space and technology dimensions by integrating numerous testbeds for experimenting in vehicular (road), aerial and maritime environments. RAWFIE targets to bring EU in the foreground of Future Internet (FI) research and experimentation while facilitating the scientific osmosis between acknowledged IoT research groups with testing infrastructures worldwide.

How does it work?

The basic idea behind RAWFIE is the automated, remote operation of a large number of robotic devices for assessing the performance of different technologies in networking, sensing and mobile/autonomic application domains. These robotic devices will be:

- Unmanned Ground Vehicles (UGV),
- Unmanned Aerial Vehicles (UAVs) and
- Unmanned Surface Vehicles (USVs).

The devices will be hosted on a testbed that will support the experiment lifecycle with fully detailed, controllable, and replicable conditions. All these items will be managed by a central controlling entity which will be programmed per case and it will fully overview/drive the operation of the respective mechanisms.

- Development of the experimentation suite and tools,
- Definition and implementation of the Experiment Description Language (EDL), and
- The first project demonstration through component integration, during the ICT 2015 event.

How to get involved?

The consortium of RAWFIE partners will be supplemented through 2 Open Call cycles, with the goal of expanding the infrastructure and allowing a wide spectrum of experiments to be undertaken prior to the RAWFIE self-sustainability, resource autonomy phase. Third parties that will complement the efforts of the RAWFIE consortium through the Open Calls will consist of experimenters providing specific experiment applications, testbed operators and UxV manufacturers. The 1st project Open Call has already been launched.

Key achievements

The results of the 1st year of the project include:

- Development of the web portal,

Project Facts

CALL: Collaborative Projects Call 1 - ICT11 | **EXECUTION:** From January 2015 to December 2018

COORDINATOR: Stathes Hadjiefthymiades (National and Kapodistrian University of Athens)

PARTNERS: National and Kapodistrian University of Athens (Greece), Centre Suisse d'électronique et de Microtechnique SA (Switzerland), Intelligence for environment and security solutions (Italy), FRAUNHOFER (Germany), EPSILON (Bulgaria), Hellenic Aerospace Industry (Greece), SAFE (France), Centre for research and technology Hellas (Greece), OCEANSCAN (Portugal), Haute école spécialisée de suisse occidentale (Switzerland), ROBOTNIK automation (Spain), AVIONTEK GMBH (Germany), Ministry of National Defense (Greece)

www.rawfie.eu

Building the Internet of Underwater Things



Oceans and lakes cover 71% of the Earth surface, and play a key role for the equilibrium of many earth systems, including climate and weather. Moreover, they support the life of nearly half of all species on earth. Approximately 40% of the global population lives within 100 km of a coast. The future of mankind is therefore very dependent on the careful monitoring and exploitation of the marine environments. SUNRISE aims to provide all the tools for the unprecedented exploration of marine environments, extending the concept of the "Internet of Things" to the underwater domain.

How does it work?

SUNRISE concerns developing innovative solutions for networking smart devices to monitor and control the marine environments. Several underwater platforms, including unmanned mobile robots, will be deployed in five different marine areas including the Mediterranean Sea, the Atlantic Ocean, the Black Sea, lakes and canals. These devices will be interconnected wirelessly, through prevailing underwater communication technologies (e.g., acoustic and optical). Data collected by sensors, whether on static or mobile platforms, will be delivered to a control station, where scientist and experts will be able to check 'in real time' the status of the marine environment and take any action, if needed. SUNRISE addresses the FIRE objectives providing innovative technologies for open underwater experimental facilities.

Key achievements

In the 2nd year of the project the different building blocks of the SUNRISE architecture have been designed and implemented, allowing to build cutting edge facilities

usable for experimentation. In particular: 1) Prototypes of Software Defined Acoustic Modems and Software Defined Communication Stacks have been built and successfully tested. The technologies developed enable interoperability and cooperation of heterogeneous, multi-vendor platforms and allow coexistence and dynamic selection of different communication technologies and solutions. 2) Three testing facilities, La Spezia (IT), Porto (PT) and Twente (ND) have been built, extended and federated through the SUNRISE GATE. The SUNRISE GATE allows to access the testbeds remotely through Internet, schedule tests, control in real-time the experiments, gather, store, analyze and present the collected data.

How to get involved?

Three SUNRISE facilities (two additional ones under deployment) are currently accessible. User participation at any level is eased by a user-friendly web interface, enabling the connection to remote underwater devices, to request measurements, and to remotely monitor the status of marine areas.

Project Facts

CALL: Collaborative Projects Call 10 | **EXECUTION:** From September 2013 to August 2016

COORDINATOR: Chiara Petrioli, University of Rome "La Sapienza"

PARTNERS: University of Rome "La Sapienza" (Italy), Evologics Gmb (Germany), NATO STO CMRE (Italy), Nexse (Italy), SUASIS (Turkey), Northeastern University (USA), Universidade do Porto (Portugal), Universiteit Twente (The Netherlands), ISME (Italy), Scuola Superiore Sant'Anna di Pisa (Italy), GridNet (Greece), Marine Southeast (UK), University of Southampton (UK), Universitat de Girona (Spain), Università di Firenze (Italia), Università della Calabria (Italia), Tallinn University of Technology (Estonia), Heriot-Watt University (UK), Tobeez (Italy), Campus (Italy)

www.fp7-sunrise.eu



Federated Interoperable Semantic IoT/cloud Testbeds and Applications

FIESTA-IoT enables Experimentation-as-a-Service (EaaS) in order that IoT testbed/platform operators can bring together their facilities in an interoperable way and focuses on integrating IoT data testbeds/platforms and their provided IoT data in the form of a marketplace. FIESTA-IoT copes with the need to aggregate and ensure the interoperability of data streams stemming from different IoT testbeds or platforms, as well as the need to provide tools, techniques, processes and best practices for building applications that integrate silo platforms and applications.

How does it work?

FIESTA-IoT works by enabling an online infrastructure facilitating researchers and solution providers to access, search and discover IoT data for designing and deploying large scale integrated applications (experiments) that transcend the (silo) boundaries of individual IoT testbeds or platforms. FIESTA-IoT aims to enable researchers and experimenters to share and reuse data from diverse IoT testbeds, opening up new opportunities in the development and deployment of experiments that exploit data from multiple testbeds.

agnostic way. FIESTA-IoT will provide researchers with tools for accessing IoT data resources (linked data) independently of their source IoT testbed/platform. (2) Execution of experiments across multiple IoT testbeds, based on a single API for submitting the experiment and a single set of credentials for the researcher. (3) Portability of IoT experiments across different testbeds, through the provision of interoperable standards-based IoT/cloud interfaces over diverse IoT experimental facilities.

Key achievements

The main goal of the FIESTA-IoT project is to open new horizons in the development and deployment of IoT applications and experiments at the EU (and global) scale, based on the interconnection and interoperability of diverse IoT testbeds and platforms. Overall, FIESTA-IoT's experimental infrastructure will provide European IoT experimenters with the following unique capabilities: (1) Access to and sharing of IoT datasets in a testbed-

How to get involved?

FIESTA-IoT project will issue, manage and exploit a range of Open Calls towards involving third-parties in the project. The objective of the involvement of third-parties will be two-fold: (1) To expand the FIESTA-IoT experimental infrastructure on the basis of additional testbeds/data sets. (2) To ensure the design and integration (within FIESTA-IoT) of more innovative experiments, through the involvement of additional partners in the project (including SMEs).

Project Facts

CALL: Collaborative Projects Call 1 - ICT11 | **EXECUTION:** From February 2015 to January 2018

COORDINATOR: Dr. Martin Serrano (National University of Ireland Galway, Insight)

PARTNERS: National University of Ireland Galway – NUIG-Insight (Ireland), University of Southampton IT Innovation (UK), INRIA (France), University of Surrey (UK), UNPARALLEL (Portugal), Easy Global Market (France), NEC Europe (UK), University of Cantabria (Spain), Com4innov (France), Athens Information Technology (Greece), SODERCAN (Spain), Ayuntamiento de Santander (Spain), Fraunhofer – FOKUS (Germany), Korea Electronics Technology Institute KETI (Korea)

Open Innovation Platform for IoT/Big Data in Sub-Saharan Africa

WAZIUP is an international cooperation action targeting sub-Saharan African countries. It aims to accelerate innovation in Africa through EU- as well as through African- cutting edge IoT cost-effective communication, a Big Data application platform and know-how. WAZIUP maximises the use of standards to create an interoperable open platform, based on open source software, to create radically new paradigms for innovative application/service delivery.

How does it work?

The WAZIUP project is a collaborative research project using cutting edge technology applying IoT and Big Data to improve the working conditions in the rural ecosystem of Sub-Saharan Africa. First, WAZIUP operates by involving farmers and breeders in order to define the platform specifications in focused validation cases. Second, while tackling challenges which are specific to the rural ecosystem, it also engages the flourishing ICT ecosystem in those countries by fostering new tools and good practices, entrepreneurship and start-ups. Aimed at boosting the ICT sector, WAZIUP proposes solutions aiming at long term sustainability.

The consortium of WAZIUP involves 7 partners from 4 African countries and partners from 5 EU countries combining business developers, technology experts and local African companies operating in agriculture and ICT. The project involves also regional hubs with the aim to promote the results to the widest base in the region.

Key objectives

WAZIUP aims to:

- Empower the African Rural Economy;
- Serve the Wealth Growth of Rural Communities
- Innovate Agro-Industry Processes; and
- Improve work conditions.

To increase the impact of WAZIUP on the selected pilots, IoT-Big Data solutions will be sensitive to energy-efficiency constraints, while targeting to be low-cost and easy to maintain.

How to get involved?

WAZIUP will deliver a sustainable open source platform (Including Open APIs and source code) that will be available for all potentially interested users, especially for IT developers and African SMEs.

Project Facts

CALL: Collaborative Projects Call 2 - ICT12 | **EXECUTION:** From February 2016 to January 2019

COORDINATOR: Abdur Rahim (CREATE-NET)

PARTNERS: CREATE-NET (Italy), Easy Global Market (France), University of Pau (France), Unparallel Innovation Lda (Portugal), Innotec21 GmbH (Germany), University Gaston Berger de Saint Louis (Senegal), Coder4Africa (Senegal), CTIC Dakar (Senegal), Polytechnic University of Bobo-Dioulasso (Burkina Faso), iSpace (Ghana), Farmerline (Ghana), Lafricaine DArchitecture (Togo)



Online Interoperability and Performance Tests for IoT

F-Interop is a European research project developing online interoperability and performance testing tools to support emerging IoT-related technologies. It will support researchers, product development by SMEs, and standardization processes, by providing remotely accessible tools to accelerate standardisation processes and support product development, by offsetting cost and time barriers. It will support new IoT standards and technologies from their genesis to the market.

How does it work?

F-Interop gathers standardisation partners together with 3 FIRE federations (Fed4FIRE, IoT Lab and OneLab) to build a common experimental Platform as a Service (PaaS). Following an end-user driven methodology, it directly addresses the needs of emerging standards, including: oneM2M (with ETSI), IETF 6TISCH (co-chaired by INRIA), W3C Web of Things. In parallel, F-Interop will launch an Open Call to enable other communities to develop complementary tools and components.

Key objectives

The aims and objectives of F-Interop can be summarized as follows: 1) to integrate and extend several European testbed federations with a shared "Testbed as a Service" interconnecting three European testbeds federations (Fed4FIRE, OneLab, IoT Lab), bringing together over 32 testbeds and 4755 nodes. It will develop a new architecture model enabling easier access to shared online services. 2) to research and develop online testing tools for the Internet of Things, including for interoperability tests, conformance tests, scalability tests, Quality of Service (QoS) and Quality of Experience (QoE) tests, and energy efficiency tests. 3) to support IoT standardization and enable closer cooperation with the industry, through a close collaboration with standards development organizations, including ETSI, oneM2M, IETF and W3C, and through research and develop online certification and labelling mechanisms. F-Interop will enable an easier participation of researchers and industry in the standardization process. 4) to organize an Open call for SMEs and developers to use and enrich the developed testing platform with additional modules and extensions (additional test tools, test specifications, etc.).

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How to get involved?

The Open Call will extend the platform to other standardisation activities, as well as to additional tools extensions and SME product validations.

Project Facts

CALL: Collaborative Projects Call 2 - ICT12 | **EXECUTION:** From November 2015 to October 2018

COORDINATOR: Serge Fdida (UPMC) and Sébastien Ziegler (Mandat International)

PARTNERS: UPMC (France), Mandat International (Switzerland), ETSI (France), EANTC (Germany), iMinds (Belgium), INRIA (France), University of Luxembourg (Luxembourg), Digital Catapult (UK), Device Gateway SA (Switzerland)

Large-Scale Experiments of IoT Security Trust



ARMOUR

The Internet of Things (IoT) is heading rapidly for large-scale, meaning that all mechanisms and features of the future IoT need to be especially designed and duly tested/certified for large-scale conditions. The inadequacies of Security, Privacy and Trust are critical elements that form obstacles to the deployment of IoT systems and to the broad adoption of IoT technologies. Suitable duly tested solutions are therefore needed to cope with security, privacy and trust in the large-scale IoT.

How does it work?

The ARMOUR project is aimed at providing duly tested, benchmarked and certified Security & Trust technological solutions for large-scale IoT using upgraded FIRE large-scale IoT/Cloud testbeds properly-equipped for Security & Trust experimentations. The upgrade to FIRE testbeds will use some European IoT Security & Trust testing solutions (available options include the RASEN toolbox, ETS Security TC, etc.), extending them as needed.

- Define frameworks to support the development of Secure & Trusted IoT applications and setting confidence on their deployment through benchmarking and a certification scheme.

Key objectives

ARMOUR aims to:

- Enhance outstanding FIRE IoT/Cloud testbeds with the ARMOUR experimentation toolbox for enabling large-scale IoT Security & Trust experiments;
- Deliver a set of duly experimented and properly validated methods and technologies for enabling Security & Trust under large-scale IoT conditions; and

How to get involved?

ARMOUR will make available the datasets and benchmarks resulting from the Security & Trust experiments on FIESTA-IoT. Moreover, the experimentation suite for large-scale IoT Security & Trust experiments developed in ARMOUR will be available to the public, being also provided an instance of the experimentation suite on 2 FIRE testbeds: FIESTA-IoT and IoT-LAB.

Project Facts

CALL: Collaborative Projects Call 2 - ICT12 | **EXECUTION:** From February 2016 to January 2018

COORDINATOR: Prof. Serge Fdida (Université Pierre et Marie Curie)

PARTNERS: Université Pierre et Marie Curie (France), INRIA (France), Synelixis Solutions Ltd (Greece), Smartesting Solutions & Services (France), Unparallel Innovation Lda (Portugal), Joint Research Centre - European Commission (Belgium), Easy Global Market SAS (France), ODIN Solution SL (Spain)



Federated Interoperable Smart ICT Services Development and Testing Platform

The development of the Internet of Things (IoT) will have a strong impact on many aspects of society. Testbeds and experimental facilities are essential enablers to facilitate and validate the development of this vision. The IoT research testbeds have been built in Europe and Japan. FESTIVAL aims at leveraging those testbeds by a federation approach where experimenters can seamlessly perform their experiments and gain access to various software and hardware enablers provided in both regions. Facilitating the access to these testbeds to a large community of experimenters is a key asset to the development of an active community of application developers

How does it work?

The project's vision is to provide IoT experimentation platforms enabling interactions with physical environments and end-users, where experimenters can validate their Smart ICT service developments in various domains such as smart city, smart building, smart public services, smart shopping, participatory sensing, etc. FESTIVAL testbeds will connect the cyber world to the physical world, from large scale deployments at a city scale, to small platforms in lab environments and dedicated physical spaces simulating real-life settings. Those platforms will be connected and federated via homogeneous access APIs with an "Experimentation as a Service" (EaaS) model for experimenters to test their added value services.

federation and interoperability of the testbeds through a common API. (3) Build services and experimentation over the federated testbeds cutting across various application domains (energy, building, shopping...). (4) Offer access to external experimenters in both Europe and Japan through an Experimentation as a Service model. (5) Evaluate the technical, economic and societal performance of the experimentations.

How to get involved?

One of the ultimate goals of the FESTIVAL project is to involve external experimenters and to offer them access to its experimentation facilities. FESTIVAL will launch an Open Call for experimenters in the project's second year (October 2016). Although there will not be specific funding for those calls, the experimenters will be able to benefit from the experimental IoT infrastructure that will be provided by the project, both in Europe and in Japan.

Key objectives

(1) Exploit existing European and Japanese assets to enable IoT data collection and processing. (2) Enable

Project Facts

CALL: Collaborative Projects Call 1 - EUJ14 | **EXECUTION:** From October 2014 to September 2017

COORDINATOR: Levent Gurgen (CEA-LETI) and Morito Matsuoka (Osaka University)

PARTNERS: CEA-LETI (France), Universidad de Cantabria (Spain), Engineering Ingegneria Informatica SpA (Italy), Easy Global Market (France), inno TSD (France), Ayuntamiento de Santander (Spain), Sopra (France), Osaka University (Japan), Japan Research Institute for Social Systems (Japan), Kyoto Sangyo University (Japan), Knowledge Capital Management Office (Japan), JR West Japan Communications (Japan), Ritsumeikan University (Japan), ACUTUS (Japan)



Smart Cities





Co-creating Smart Cities of the Future

Building upon – and extending – the legacy of FIRE, Organicity is a service facility based on three mature smart cities: Aarhus (Denmark), London (UK) and Santander (Spain). Organicity aims to enhance the capacities of mature smart cities in a systematic way, co-created with the citizens of the three cities.

How does it work?

Organicity's essential and fundamental starting point is a new, holistic paradigm in city-making. This is a heterogeneous, urban-scale Experimentation-as-a-Service facility. It's a step away from urban planning; a step towards collaborative city-making, breaching classic divisions and sectors. We pursue our goals and work with this new paradigm by focusing on co-creation at the meeting point of society and technology. Our results will be replicable, scalable and sustainable across the Connected Smart Cities Network and beyond.

This technical development has been guided by intense citizen engagement and co-creation in all three cities. Eighteen workshops were held, many public engagements were undertaken involving academic, community and enterprise groups.

Key challenges have been identified for each of the cities involved and an Open Call process for funded citizen experiments has been co-designed with citizens, for launch in 2016..

Key achievements

Organicity has succeeded in developing and unifying more than ten tools for the exploration and utilisation of urban data across the cities of Aarhus, London and Santander. In addition, tools and processes have been provided for the co-creation of citizen experiments which might utilise these data sources or connect new IoT devices.

How to get involved?

Communities and organisations are invited to use the new Organicity facility, self-funded or funded through Organicity. Two Open Calls will be launched in 2016 and 2017, with €1.8m funding for third-party experimental groups (25-35 experiments). Additionally, communities can co-create the Calls in 2015 and 2016, and cities can connect to the facility and become an Organicity.

Project Facts

CALL: Collaborative Projects Call 1 - ICT11 | **EXECUTION:** From January 2015 to June 2018

COORDINATOR: Martin Brynskov (Aarhus University)

PARTNERS: Aarhus University (Denmark), Intel UK (UK), Alexandra Institute (Denmark), Future Cities Catapult (UK), Imperial College London (UK), TST Sistemas (Spain), Luleå University of Technology (Sweden), Computer Technology Institute & Press Diophantus (Greece), University of Lübeck (Germany), Institute for Advanced Architecture of Catalonia (Spain), Commissariat à l'énergie atomique et aux énergies alternatives (France), University of Cantabria (Spain), Santander Municipality (Spain), Aarhus Municipality (Denmark), University of Melbourne (Australia)

Co-Creating the Future of City Innovation

SELECT
for Cities

The Internet of Everything (IoE) is recognised to be one of the dominant developments that will transform the way we manage and live in our urban environments in the future. The extension of the Internet to the physical spaces and objects is a massive opportunity for new services and business, for example in the areas of logistics, transport, environment, security and wellbeing. The IoE is directly linked to the smart city development, but has proceeded slower than expected. The key showstoppers are the lack of common standards, fragmented marketplace, and lack of ways to systematically test and introduce new solutions in the cities.

How does it work?

The common challenge of the SELECT for Cities PCP (Pre Commercial Procurement) is the design, research and development of "cities as linked and large-scale Internet of Everything labs". The challenge lies in developing an open, standardized, data-driven, service-oriented and user-centric platform that enables large-scale co-creation, testing and validation of urban IoE applications and services. This approach fosters the longer-term goal of evidence-based innovation in cities.

The envisaged platform has several requirements, components and features that are currently not available in existing solutions. The platform must allow collaboration between departments and cities, and (automated) testing of IoE services. The design should be based on an open

and modular approach, and support cloud-based, data-driven, service-oriented, user-centric, and co-created large-scale testing.

Key objectives

The joint effort of the partners procuring this pre-commercial track is aimed at guarding the integration capabilities of the platform with solutions that exist in the respective cities today. Particular attention will thus be paid to technologies and tools that allow smooth communication and integration between these existing solutions. The end goal of SELECT for Cities is to take the idea of the city as a large IoE Lab and put it into practice.

Project Facts

CALL: Collaborative Projects Call 2 - ICT12 | **EXECUTION:** From November 2015 to October 2018

COORDINATOR: Hugo Goncalves (Forum Virium Helsinki)

PARTNERS: Forum Virium Helsinki (Finland), iMinds (Belgium), Digipolis (Belgium), Stad Antwerpen (Belgium), Københavns Kommune / Copenhagen Solutions Lab (Denmark), 21C Consultancy Limited (UK)

smartbuy Enhanced Buying Experiences in Smart Cities

SMARTBUY intends to provide the technological infrastructure for small and medium sized retailers to become THE PLACE to buy for people that want to keep the advantages of in-store purchasing, and at the same time experiment with the advantages of eCommerce; comparison of prices, choice of providers, reviews and specification awareness, etc. SMARTBUY converts Smart Cities' physical stores into a Smart geographically distributed mall by providing the logical consistency needed for conducting centralized searches in heterogeneous and geographically distributed physical stores.

How does it work?

This project relates to the Topic: Integrating experiments and facilities in FIRE+. In order to address the specific challenges of this topic, SMARTBUY is based on mature components provided by the partners of the consortium and FIRE infrastructure. The project will be validated on top of the infrastructures provided by the project "ORGANICITY" in the framework of the FIRE initiative.

Key objectives

The SMARTBUY project pursues scientific, technical and business objectives including analysis and utilisation of the available infrastructures provided by the ORGANICITY project as well as the IoT Innovation Lab for the validation of the SMARTBUY platform. Customization of a cloud secure platform for the provision of services supporting the process of ubiquitous smart buying is a key component of SMARTBUY whereas services will be provided to potential customers through multi-channel systems

for the interaction of potential customers with the platform. Web portal and Mobile Apps (for Android and IOS) with geolocation capabilities will be used. Furthermore, validation of the SMARTBUY system on top of the FIRE infrastructures provided by ORGANICITY project and IoT Innovation Lab will take place as well as enhancing and improving the Smart Cities ecosystem by incorporating a smart and highly replicable system. Finally, the project will guarantee the access of SME retailers to the SMARTBUY system.

How to get involved?

Stores can participate in the validation of Smartly platform. Participation is free of charge during the project. After the end of the project, prices will be affordable. Stores participating in the project will be involved in the definition of the pricing strategy. SMARTBUY can provide an inventory system for stores free of charge.

Project Facts

CALL: Collaborative Projects Call 2 - ICT12 | **EXECUTION:** From January 2016 to December 2017

COORDINATOR: Lorena Bourg (Planet Media)

PARTNERS: Planet Media (Spain), City Passenger (France), Luleå University of Technology (Sweden), CTI (Greece)

Enabling a Mobility Back-End as a Robust Service

EMBERS

EMBERS will bring to market a back-end for smart city mobility developed by a European small enterprise, based upon its smart parking & smart traffic management products that two municipalities in Portugal currently deploy. The Mobility Back-end as a Service (MBaaS) replaces current all-in-one systems, in which a municipality purchases all components from a single vendor. Instead, the city manager can purchase best-of-breed devices and apps developed by third parties, that interoperate with a common back-end via a free, open, smart city mobility API.

How does it work?

The domain-specific API lowers barriers to entry for app and device developers, making it easier for innovative SMEs to enter the market

Furthermore, the API is offered via a variety of generic interfaces, including oneM2M, ETSI M2M, OMA LWM2M, and FIWARE NGSI. EMBERS thus clears the way for developers and to municipalities that have adopted any one of these potential emerging machine-to-machine (M2M) communication standards.

Beyond its primary goal of bringing the MBaaS to market, EMBERS will stimulate development of an entire ecosystem around the MBaaS smart city mobility API.

Separating out the back-end from the other components will, however, require rigorous testing. EMBERS will experiment with the system on two testbeds that

are part of the FIRE+ OneLab facility: the FUSECO Playground, for M2M communications, and FIT IoT-LAB, for wireless sensor devices.

How to get involved

EMBERS will host a hackathon and an app challenge to bring in third party developers.

The project will also include three experiments by third parties via an open call. These activities will contribute back to FIRE+ by demonstrating successful experimentation by SMEs developing close-to-market products.

The project will also conduct real-world pilots in two or more cities as a final step in bringing the MBaaS to market.

Project Facts

CALL: Collaborative Projects Call 2 - ICT12 | **EXECUTION:** From December 2015 to December 2018

COORDINATOR: Timur Friedman (Université Pierre et Marie Curie)

PARTNERS: Université Pierre et Marie Curie (France), Ubiwhere Lda - UW (Portugal), Fraunhofer FOKUS (Germany), Technische Universität Berlin - TUB (Germany), INRIA (France)

Networking



FIRE LTE testbeds for Open Experimentation



FLEX aims to enhance existing FIRE facilities with cellular infrastructure for 4G-and-beyond technologies mobile access. FLEX's experimentation environment features highly flexible and versatile equipment: macro-cells, pico-cells, small-cells, real and emulated mobility frameworks. FLEX is integrating the infrastructure with the existing FIRE tools for managing and experimenting with testbed resources. FLEX equipment is leveraging both commercial and open source solutions: 1) the commercial equipment can be used for evaluating novel applications and algorithms on top of fully programmable testbed equipment, whereas 2) the open source setup can be used for implementing technologies and concepts towards 5G technologies. FLEX has organized two Open Calls, through which 2 new testbeds have been integrated in FLEX and 13 innovative experiments have been selected for running over the infrastructure.

How does it work?

FLEX testbeds are already available for experimentation! All the FLEX testbeds follow the open access paradigm, and are remotely reservable and accessible. Five different islands are available for experimentation: The NITOS testbed in Greece; The w-iLab.t testbed in Belgium; The OpenAirInterface testbed in France; The PerformNetworks testbed in Spain; and The FUSECO playground in Germany.

FLEX is following two experimentation approaches. The first approach offers a commercial network that is configurable and enables testing that needs compliance with the market products, while the second one allows for full redesign of the system.

Key achievements

FLEX achievements can be summarized as follows:

- Five FLEX testbeds are online and operating.
- FLEX equipment has been integrated with the existing FIRE management and experiment control tools.
- Real and emulated mobility involving the FLEX components is available for experimentation.
- 6 new partners have been introduced to FLEX via the 1st Open Call.
- 9 innovative experiments have been introduced via the 2nd Open Call. They will be executed over FLEX.

How to get involved?

The FLEX portal offers valuable information on how to conduct experiments and use the infrastructure.

Project Facts

CALL: Collaborative Projects Call 10 | **EXECUTION:** From January 2014 to December 2016

COORDINATOR: Prof. Thanasis Korakis (University of Thessaly)

PARTNERS: University of Thessaly (Greece), iMinds (Belgium), SiRRAN Engineering Services Ltd. (UK), Eurecom (France), ip.access Ltd. (UK), COSMOTE (Greece), Rutgers – The state university of New Jersey (US), NICTA (Australia), University of Malaga (Spain), Technical University of Berlin (Germany), Fraunhofer FOKUS (Germany), University of Nis (Serbia), i2Cat (Spain), Intracom Telecom Solutions (Greece), Université Pierre and Marie Curie (France), Ubiwhere (Portugal)

www.flex-project.eu



Measuring Mobile Broadband Networks in Europe

Mobile broadband (MBB) networks underpin many vital operations of modern society, and the immense popularity of mobile devices has radically changed the way most people access and use the Internet. Consequently, there is a strong need for objective information about MBB performance, particularly, the quality experienced by the end user. MONROE is designing and operating the first European transnational open platform for independent, multi-homed, large-scale monitoring and assessment of performance of MBB networks in heterogeneous environments.

How does it work?

MONROE is building a dedicated infrastructure comprising both fixed and mobile nodes (on buses, trains, trucks) distributed across Norway, Sweden, Spain and Italy. The nodes are designed to be flexible and powerful enough to run most measurement and experiments tasks, which includes experimenting novel services and applications. All nodes are connected to three MBB providers, and often also to WiFi. This makes MONROE particularly well suited for experimentation with multi-homing. MONROE nodes collect metadata from the connected modems such as cell ID, signal strength, connection mode, etc. Measurement results and metadata are provided as OPEN DATA in regular intervals.

MONROE makes it easy to access the system and deploy experiments on all or a selected subset of the nodes through a Fed4FIRE compliant interface.

Key objectives

The main objectives of MONROE are to build, operate and support an open and large-scale European measurement and experimental platform, supporting multi-homing with MBB and WiFi. Furthermore, the project will identify key MBB performance parameters, thus enabling accurate, realistic and meaningful monitoring and performance assessment of such networks. Finally, Experiments as a Service (EaaS) will be provided through well-documented tools and high-level scripts to execute experiments, collect results, and analyze data in order to lower the barrier for external users to use the platform.

How to get involved?

MONROE is running a series of Open Calls where external users can get funding to run experiments. More than 40 proposals were received from the 1st Open Call. The 2nd Open Call will be announced by the end of 2016. Beside the Open Calls, the platform will be available to external users from 2017 under the Open Access scheme.

Project Facts

CALL: Collaborative Projects Call 1 - ICT11 | **EXECUTION:** From March 2015 to February 2018

COORDINATOR: Dr. Özgü Alay (Simula Research Laboratory)

PARTNERS: Simula Research Laboratory (Norway), IMDEA Networks (Spain), Karlstad University (Sweden), Nextworks (Italy), Politecnico Torino (Italy), Celerway Communications (Norway), Telenor (Norway)

Wireless Software and Hardware Platforms for Flexible and Unified Radio and Network Control



Many of the recent trends in the development of information systems, such as Industry 4.0 and the Tactile Internet, require innovative solutions in wireless communication, thus increasing the pressure to be able to quickly prototype and test potential solutions before creating market-mature products. The WiSHFUL project aims to enable shorter development cycles by offering proper development and testing environments.

How does it work?

The WiSHFUL project offers advanced test facilities for the experimental validation of end-to-end innovative wireless systems and solutions. WiSHFUL develops, implements and prototypes a unified software architecture that can be leveraged to speed up the development time and reduce the costs of wireless solutions for different vertical markets.

Key achievements

Several showcases have been presented to exhibit the latest results of WiSHFUL, including coexistence of heterogeneous wireless technologies, load and interference-aware MAC adaptation, efficient airtime management and infrastructure-initiated handover strategies. Results have shown that using the WiSHFUL framework can enhance significantly the performance of supported wireless technologies and minimize the overhead of control implementation.

A portable Fed4FIRE enabled testbed has been designed and implemented based on OTS devices that will be used to exhibit the above showcases in various venues on-site.

The first Open Calls have been concluded with success, 26 proposals have been submitted in all 3 categories (Innovation by SMEs, Scientific Excellence, Extensions) and the final results will be announced soon. Keep looking at the project's website for future Open Calls and important dates.

How to get involved?

You can get involved in 3 ways. (1) start using the already existing WiSHFUL facilities located at iMinds, TCD, TUB and RUTGERS. (2) follow our updates for new software releases, fork the software, try it and contribute feedback or improved code. (3) follow the upcoming Open Calls that will be launched throughout the project's lifecycle.

Project Facts

CALL: Collaborative Projects Call 1 - ICT11 | **EXECUTION:** From January 2015 to December 2017

COORDINATOR: Ingrid Moerman (iMinds)

PARTNERS: iMinds (Belgium), Trinity College Dublin - TCD (Ireland), Consorzio Nazionale Interuniversitario per le Telecomunicazioni - CNIT (Italy), Technische Universität Berlin - TUB (Germany), nCentric (Belgium), Rutgers University (USA), Seoul National University - SNU (Korea), Federal University of Rio De Janeiro - UFRJ (Brazil)



Large-scale RINA Benchmark on FIRE

ArcFire brings RINA (Recursive InterNetwork Architecture) from the labs into the real-world. RINA is an innovative “back-to-basics” architecture that facilitates full integration between distributed computing and networking. RINA addresses the challenges that drive the move from specialised hardware to almost completely virtualized infrastructure. The next paradigm shift, towards 5G, makes it now the right time for ArcFire to provide experimental evidence of RINA’s benefits, at large scale, in compelling and realistic business cases.

How does it work?

The project facilitates the comparison of converged operator networks by applying RINA to operator’s current state of the art network designs. ArcFire will produce a robust RINA software suite ready for Europe to engage in large-scale deployments and long-living experiments; and use it internally to provide experimental evidence of RINA’s benefits to network operators, their equipment vendors, application developers and end-users. Open Source software and high quality results published in high impact journals will help ArcFire to raise the number of organisations engaged. The work done in ArcFire will enhance the FIRE+ infrastructure with ready-to-use RINA software and documentation on how to setup RINA playgrounds for experimentation.

Key objectives

ArcFire will lay out the design of RINA converged operator networks; specifying the types and scope of the layers in the network, different policy choices and

optimized network management strategies. Key to the project’s success is the adaptation, enhancement and robustification of a RINA software suite – leveraging the results of previous FP7 projects. The last goal of ArcFire is to perform large-scale experimentation with the RINA software suite on FIRE+ facilities – exploiting the extensive catalogue of FI experimental facilities available in FIRE. Experiments will focus on the management of multi-layer networks, provisioning of reliable services over heterogeneous physical media, end-to-end service provisioning across multiple operators, and effectiveness against DDoS attacks.

How to get involved?

Information on RINA is available at the ArcFire and PSOC websites. ArcFire is building on the IRATI open source RINA implementation, which is already available on github. PRISTINE has produced a number of reports on setting up and running experimental scenarios.

Project Facts

CALL: Collaborative Projects Call 2 - ICT12 | **EXECUTION:** From January 2016 to December 2017

COORDINATOR: Sven van der Meer, (L.M. Ericsson)

PARTNERS: L.M. Ericsson (Ireland), i2Cat (Spain), Nextworks (Italy), Telefónica I+D (Spain), iMinds (Belgium), Boston University (USA)

Elastic Wireless Networking Experimentation



The elastic Wireless Networking Experimentation (eWINE) research project will realize elastic networks that can scale up to a high number of users in a short timespan through the use of an agile infrastructure (intelligent software and flexible hardware), enabling:

- dynamic on-demand end-to-end wireless connectivity service provisioning
- elastic resource sharing in dense heterogeneous and small cell networks (HetSNets)
- intelligent and informed configuration of the physical layer.

How does it work?

eWINE will develop and validate algorithms for advanced Cognitive Networking (context determination & sensing, optimization & negotiation techniques, and online learning algorithms) through experimentally-driven research on top of existing FIRE/FIRE+ facilities (in particular CREW and WiSHFUL). Several partners are involved in these facility projects. The consortium includes both academic researchers and industrial developers (3 SMEs + 1 multinational company).

Key objectives

The uptake of the project results will be promoted by making openly available the Intelligence Toolbox and organizing the eWINE Grand Challenge; through Open Calls of WiSHFUL; and by educating the wireless community via FORGE, VideoLectures.net and YouTube.

How to get involved?

To cope with the increasing density of wireless devices, eWINE will primarily address the EU's need for intelligent solutions to mitigate the spectrum scarcity and network configuration problems and strengthen the competitiveness of European companies (reducing development costs, speeding product validation and shortening time-to-market) in developing innovative products able to increase wireless capacity and energy efficiency, and lower electromagnetic exposure.

The project results will lead to improved European innovation in several domains (secured & robust communication, IoT, 5G, etc.).

eWINE will leverage research to exploit the full potential of the coordinated use of heterogeneous wireless networks, and as such will contribute significantly to regulatory policies and standardization.

Project Facts

CALL: Collaborative Projects Call 2 - ICT12 | **EXECUTION:** From January 2016 to December 2017

COORDINATOR: Ingrid Moerman(iMinds)

PARTNERS: iMinds (Belgium), Trinity College Dublin (Ireland), Technical University of Berlin (Germany), Technical University of Dresden (Germany), Institut Jozef Stefan (Slovenia), Thales Communications & Security (France), Martel Innovate (Switzerland), SIGFOX Wireless SA (France), Innovative Solutions Slawomir Pietrzyk (Poland), Spacetime Networks Oy (Finland)



Federated Union of Telecommunications Research Facilities for an EU-Brazil Open Laboratory

FUTEBOL federates wireless and optical testbeds in Europe and Brazil, develops a supporting control framework, and conducts experimentation-based research on converged optical/wireless networks. Wireless trends such as cell densification and cloud radio access networks require joint consideration of optical and wireless network architectures. These problems are of direct impact to Brazil, with highly heterogeneous infrastructure capabilities and demand, as well as to the EU, which aims to regain its leadership in the next generation of telecommunication technologies.

How does it work?

FUTEBOL establishes the research infrastructure to address these research challenges through innovation over this infrastructure, with a consortium of leading industrial and academic telecommunications institutions. In this capacity, the methodology of the FUTEBOL project is organized into three steps: i) the composition of federated research infrastructure suited for integrated optical/wireless experimentation, ii) the development of a converged control framework to support experimentation on the federated research infrastructure, and iii) the direct advancement of telecommunications through research using the developed research infrastructure and control framework.

Key objectives

The overall objective of the FUTEBOL project is to develop and deploy research infrastructure, and an associated control framework for experimentation, in Europe and Brazil, that enables experimental research at the convergence point between optical and wireless networks. The infrastructure and control framework created in FUTEBOL will be federated according to principles developed in the FIRE initiative and facilities in the two continents interconnected through infrastructure deployed by the FIBRE project.

The FUTEBOL federation and tools will be used in experimental research on optical and wireless convergence that is critical to the capacity gains envisioned in the evolution of these networks over the next decade.

Project Facts

CALL: Collaborative Projects Call 2 - ICT12 | **EXECUTION:** From March 2016 to February 2019

COORDINATOR: Luiz DaSilva (Trinity College Dublin) and Cristiano Both (Universidade Federal do Rio Grande do Sul)

PARTNERS: Trinity College Dublin (Ireland), University of Bristol (UK), VTT Oy (Finland), Instituto de Telecomunicações Aveiro (Portugal), Intel Deutschland (Germany), Universidade Federal do Rio Grande do Sul (Brazil), Universidade Federal do Espírito Santo (Brazil), Universidade Federal do Ceará (Brazil), Universidade Federal de Minas Gerais (Brazil), Universidade Estadual de Campinas (Brazil), Intel Brazil (Brazil), DIGITEL (Brazil)

Measurement and Architecture for a Middleboxed Internet



The MAMI project seeks to restore balance among end-user privacy concerns in the face of pervasive surveillance, innovation in network protocols in the face of increasing ossification, and the provision of in-network functionality needed for economically viable network operation by re-architecting the Internet to allow explicit cooperation between endpoints and middleboxes.

How does it work?

Recent revelations about large-scale pervasive surveillance of Internet traffic have led to a rapidly expanding deployment of encryption in order to protect end-user privacy. At the same time, network operators and access providers rely on increasing use of in-network functionality provided by middleboxes for network operations and management. In addition, new applications such as interactive video make new demands on the transport layer, requiring the deployment of new protocols and extensions, which is often impaired by current operation of middleboxes. These three trends are on a collision course. The MAMI project targets this problem by developing and deploying a new Middlebox Cooperation Protocol (MCP) embedded in a more flexible encrypted transport layer to support the evolution of new transport protocols and features. The MAMI project will develop this new architecture based on a background of middlebox behaviour models, derived from large-scale measurements of middlebox behaviour in the public Internet. These meas-

urements aim not only to classify existing middlebox impairments but will also provide further insights of the prevalence of the observed conditions. The MAMI project will use the facilities provided by MONROE project for Internet measurement as well as experimentation with the new architecture to evaluate its applicability to a set of real-world use cases for transport layer evolution, focusing on incremental deployability in the presence of both cooperative and uncooperative middleboxes.

How to get involved?

MAMI does not operate or extend a FIRE testbed itself; rather, it is focused on applications of the MONROE testbed. However, MAMI's measurements of middlebox behaviour in the Internet will be available for research and network operations purposes via a Path Transparency Observatory operated by the project, with public access available after the project's first year. Check the project website for announcements and details.

Project Facts

CALL: Collaborative Projects Call 2 - ICT12 | **EXECUTION:** From January 2016 to June 2018

COORDINATOR: Mirja Kühlewind (Swiss Federal Institute of Technology)

PARTNERS: Swiss Federal Institute of Technology (Switzerland), Telefonica (Spain), Alcatel-Lucent/Nokia (UK), Zurich University of Applied Sciences (Switzerland), University of Aberdeen (UK), University of Liege (Belgium), Simula Research Lab (Norway)

www.mami-project.eu

Q4Health

Optimization of Real Time Video for Emergency Services over LTE

The Q4HEALTH project is an Innovation Action focused on the optimization of real time video for emergency services over LTE (Long Term Evolution) networks.

The project is implemented as a set of experiments conducted over the FIRE platforms PerformNetworks (formerly PerformLTE) and OpenAirInterface. The motivation is to study and improve video performance on LTE-A, in scenarios comprising wearable live video for first responders, with a particular innovation focus on 3GPP release 12.

How does it work?

To achieve this goal, six different experiments will be performed focused on resolving a set of six challenges, as well as addressing a range of Key Performance Indicators (KPIs). Q4HEALTH faces different challenges, such as the inability of applications to negotiate a Quality of Service (QoS) agreement with the network, the delays introduced on live video, the appropriate scheduling algorithms on the access nodes, the service availability in indoor scenarios and the communication between geographically correlated entities.

These challenges will be approached from different perspectives. The applications will be extended to provide information to the EPC and the scheduler in the RAN (Radio Access Network) regarding the type of traffic as well as their traffic requirements; the radio access where different scheduling strategies will be explored for emergency video; and the core network where mechanisms to perform QoS reservation, techniques for seamless mobil-

ity between heterogeneous access technologies and SDN techniques to improve communication will be studied.

Key objectives

Q4HEALTH has defined 20 KPIs and these will be formulated as a baseline at the start of the project. At the end of the project we will measure the KPIs on an integrated optimized experiment in order to validate the project's success.

Q4HEALTH will participate in the EIT KIC (The European Institute of Innovation and Technology Knowledge and Innovation Communities) as well as FIRE and 5G PPP events in order to disseminate the results to the wider innovation ecosystem. All the project results and extensions will be showcased to maximize the exposures to other companies that might also exploit the outcomes of the project.

Project Facts

CALL: Collaborative Projects Call 2 - ICT12 | **EXECUTION:** From January 2016 to December 2018

COORDINATOR: Donal Morris (Redzinc)

PARTNERS: Redzinc (Ireland), Universidad de Málaga (Spain), Eurecom (France)

Software Defined Networks and Network Function Virtualization Testbed



The SoftFIRE project aims to pursue the integration of existing experimental facilities, testbeds and laboratories into FIRE+. The project focuses on new technologies such as SDN and NFV in order to create a reliable, secure, interoperable and programmable experimental network infrastructure within the FIRE+ initiative. The Consortium will federate four existing experimental testbeds in order to create an infrastructure that third parties can use to develop new services and applications. The federation is a step towards the creation of a new network of the experimental infrastructure that could be used for 5G testing.

How does it work?

The SoftFIRE federated testbed will offer the possibility to assess and improve programmable solutions offered by distributed and heterogeneous infrastructure. Experimenters will be able to access to the federated testbed and allocate resources in the different interoperable islands and build new applications and services on this infrastructure. In addition, experimenters can functionally extend the federated testbed capabilities by introducing new programmable features.

Key objectives

The main objective of this project is to demonstrate and assess the level of maturity of adopted solutions and technologies and to show how they can unleash the full potential in a real-world infrastructure by creating, nur-

turing and supporting an ecosystem of Third Parties able to make use of the SDN/NFV functionalities.

How to get involved?

The project aims at creating a broad ecosystem of companies engaged with the evolution of the SoftFIRE testbed. In order to achieve this goal, the project will spend a considerable part of its effort and budget for involving Third Parties in the usage and consolidation of the platform. The mechanisms envisaged for this are: Open Calls and specific events (such as Hackathon, Plug-tests and Challenges). The federated infrastructure will be used in order to a) develop new services and applications from Third Parties, and b) develop new platform functionalities..

Project Facts

CALL: Collaborative Projects Call 2 - ICT12 | **EXECUTION:** From February 2016 to January 2018

COORDINATOR: Susanne Kuehrer (EIT Digital IVZW)

PARTNERS: EIT Digital (Belgium), Deutsche Telekom (Germany), Ericsson (Italy), Fraunhofer FOKUS (Germany), Reply (Italy), Technical University of Berlin (Germany), Telecom Italia (Italy), University of Surrey (UK)



TRIANGLE: 5G Applications and Devices Benchmarking

The focus of TRIANGLE is the development of a framework that facilitates the evaluation of the Quality of Experience (QoE) of new mobile applications, services and devices designed to operate in future 5G mobile broadband networks. The framework will exploit existing FIRE facilities, adding new facilities when necessary. The project will identify reference deployment scenarios, will define new Key Performance Indicators (KPIs) and QoE metrics, will develop new testing methodologies and tools, and will design a complete evaluation scheme.

How does it work?

The project will focus on the development of a framework to ensure user QoE in the new challenging situations, especially those due to heterogeneous networks and considering the role software will have in the new 5G ecosystem. The framework will also provide the means to allow certification and a quality label for the applications, services and devices compliant to the requirements and test specifications developed in the project, but also extendable to other FIRE test solutions. This will allow vendor differentiation, especially for start-ups and SMEs, in the current globalized and competitive markets, and further visibility for the FIRE facilities. The test facility will incorporate all the end-to-end elements that could influence the performance of a 5G-based service: from the latest generation of Radio Access Networks, currently LTE-A, to emulated SDN-powered transport network and 3GPP Evolved Packet Core, to IMS and business services such as Virtual Path Slicing.

Key objectives

The framework, methods and tools developed during the project will enable non-experts in the radio and networking fields, such as Mobile App developers and Device Manufacturers, to define and run controlled live tests on their products. This facilitation role of the project will promote testing, benchmarking, and certification of all the end-to-end elements of the future 5G-based services.

How to get involved?

The first Open Call will soon be published on the project website and potential experimenters and contributors will be able to submit their proposal by the end of 2016, and start their experiments in the beginning of 2017. Furthermore, the project is open to receive inputs from the different players in the value chain regarding their needs, that would help in properly defining the architecture and the structural elements of the test bed.

Project Facts

CALL: Collaborative Projects Call 2 - ICT12 | **EXECUTION:** From January 2016 to Decembre 2018

COORDINATOR: Michael Dieudonné (Keysight Technologies)

PARTNERS: Keysight Technologies (Belgium), Keysight Technologies (Denmark), Universidad de Malaga (Spain), RedZinc Services Limited (Ireland), University College London (United Kingdom), AT4 wireless (Spain), Quamotion (Belgium)

Coordination & Support Actions





Coordinating European Future Internet Research

The ceFIMS-CONNECT project addresses the need for closer integration and coordination of ICT research and innovation among Member States and Associated Countries and the EU.

ceFIMS-CONNECT supports the European Future Internet Forum of Member States and Associated Countries (FIF) by providing a Secretariat and supporting the activities of the FIF in Horizon 2020 and the transition to the 5G PPP. It publicises Member State and Associate Countries' Future Internet (FI) initiatives as they unfold, according to the priorities of the FIF by facilitating the collection and sharing of information on Member State and Associate Countries' FI initiatives, strategies and priorities.

How does it work?

The project is establishing mechanisms for the exchange of experiences, best practices and for identifying common challenges and cooperation opportunities. It also undertakes targeted dissemination activities to Member States and Associated Countries in cooperation with the FIF members.

members of national funded FI projects. At the request of the FIF members, the FIF RDB has been designed to capture both national and international funded FI R&I projects, with a step by step data entry process starting with government departments and funding agencies for each project culminating with details about the projects, participants, topics, tags, and other supporting information.

Through its Secretariat role to the EU FIF, ceFIMS-CONNECT supported all FIF meetings held in 2014 and 2015, and plans to continue in the FIF meetings of 2016.

Finally, to facilitate the exchange of information, the project started a FIF and 5G Monitor service and disseminated relevant Future Internet news via its website, newsletter, and social media channels.

Key achievements

As part of their strategic activities, the project published a Guidelines report for the FIF members, which provides a standardized way for gathering information on Future Internet Research & Innovation (FI R&I) structures in MS/ACs and has developed and started populating the ceFIMS-CONNECT FIF Repository Database (FIF RDB) with comprehensive data being provided by the FIF

Project Facts

CALL: Coordination and support actions Call10 | **EXECUTION:** From March 2014 to February 2017

COORDINATOR: James Clarke (WIT-TSSG)

PARTNERS: Waterford Institute of Technology - TSSG (Ireland), Fundação para a Ciência e a Tecnologia (Portugal), Asociación de Empresas de Electrónica, Tecnologías de la Información, Telecomunicaciones y Contenidos Digitales (Spain), ICHB PAN - Poznan Supercomputing and Networking Center (Poland)

Inventory of experimentation facilities and roadmap



The FIRE STUDY SMART 2015/0019 - Inventory of European and National experimentation facilities and roadmap of the future needs for advanced networking experimentation - is continuing and expanding on the FIRE/FIRE+ programme-wide activities (e.g. Community building, Dissemination, Roadmap and KPI analysis) started by the previous Coordination and Support Actions, namely FIRE STATION and AmpliFIRE. Additionally, the FIRE STUDY is creating a FIRE Testbed Inventory based on the XiPi repository, which will be integrated with the FIRE Portal to facilitate discovery and access to FIRE testbeds, and will also continue to support the European Commission in defining and developing the scope and strategy for the future H2020 Work Programmes.

Key objectives

- To develop the FIRE Inventory based on the XiPi repository (www.xipi.eu) that contains European, National and Regional experimental facilities, testbeds and laboratories available for integration into the FIRE environment.
- To develop a roadmap analysing the relevant technical and business factors. It will contribute to define a vision and concrete steps to address the future needs for advanced networking experimentation and ancillary services with a large-scale experimental need on top of FIRE.
- To strengthen and enlarge the FIRE community, including all relevant stakeholders, by engaging them through the various opportunities.
- To support FIRE+ projects' dissemination and communication activities to promote the various project initiatives and results and, at the same time, keep the FIRE community connected.
- To monitor and assess the progress and effectiveness of FIRE by collecting and evaluating the FIRE Key Performance Indicators as defined by the European Commission.
- To make policy recommendations for Future Internet experimentation for 2018-2020 to be elaborated as a concrete mean to support the EC and the various FIRE stakeholders to properly steer future activities.

Project Facts

TENDER: Ares (2015) 2433315 | **EXECUTION:** From February 2016 to September 2017

COORDINATOR: Dr. Monique Calisti (Martel Innovate)

PARTNERS: Martel Innovate (Switzerland), Associazione Create-Net (Italy), Interinnov SAS (France), Universidad Politécnica de Madrid (Spain), University of Southampton (UK)

Want to know more?

Come and visit the FIRE web portal (www.ict-fire.eu) where you can find all the information and documents related to the FIRE programme; News, Resources, Announcements, Events, Webinars, ongoing and upcoming funding opportunities to join the programme (Open Calls), Open Access possibilities and much more!

You can also get in contact directly with the FIRE projects through their specific websites in case you need more precise practical and technical information.

If you have any other specific questions, which might not be covered in this brochure, do not hesitate to contact us at: contact@ict-fire.eu we'll update you with the most recent information.

And don't forget to subscribe to the FIRE Newsletter on the FIRE web portal to stay tuned about our latest news!



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