

Annex A



Overall FIWARE Vision

[Ref. https://forge.fiware.org/plugins/mediawiki/wiki/fiware/index.php/Overall_FI-WARE_Vision]

Background and Motivations

Changing ICT Landscapes and Trends

Over the last couple of years, a number of technology trends are recognized as significant new directions in the ICT landscape, which will usher in the era of the Future Internet in Europe. A first major trend is the on-going industrialization of IT in the form of cloud computing and open service delivery platforms. The on-demand, pay-per-use nature of these provisioning models is expected to fundamentally change how IT infrastructures are provisioned, essentially enabling them to be delivered as a service. Secondly, new wireless networking technologies such as LTE (4G) and the deployment of Fibre to The Home (FTTH) will offer increased network capacity and bandwidth to customers, thereby paving the way for new (real-time) applications in mobile data networks as well as for stationary scenarios. Furthermore, the virtualization of classical carrier networks is also on-going and starting to find new areas of application. Thirdly, the Internet of Things is safely taking hold, with the vision of ubiquitously connecting intelligent devices and sensors and offering new possibilities for contextual and environmental information sensing, processing and analysis, thereby opening the door to new automation and control applications and services in various sectors. Lastly, the maturing Internet of Services is accelerating the creation of complex value networks of service providers, consumers, and intermediaries bringing businesses and end customers innovative applications better tailored to their needs. These networks increasingly span

various different players that historically have worked largely separated from each other thereby leading to more agile and dynamic business relationships and environments never seen before.

The Market Stakeholder Perspectives

Brought together, the above trends are the core drivers towards the emergence of a new era in the evolution of the Internet, which we may refer to as Future Internet. It will carry the potential for realizing new business opportunities for established and emerging application and service providers in areas such as telecommunications, healthcare, media and e-government. This Future Internet will address some key demands and expectations from the various market stakeholders which cannot yet be satisfactorily met. Thus, regarding Application and Service consumers:

- **End customers** want to gain access and easily consume applications that can effectively assist them in daily life situations. Some of the underlying problems involved are the management of the ever-growing data and information (e.g. from their sensor-enabled environments) and the seamless access anywhere, anytime and from any device. They also ask for improved means for communication and collaboration within their social networks, families, neighbourhoods in real-time and while being mobile, meeting security and privacy requirements. Overall, these capabilities would transform communities, homes and cities into safer and better places to live and leverage the Internet as an additional societal utility.
- **Enterprises and organizations** on the other hand, wish to get closer to their customers in order to deliver an even more compelling user experience and better service. For this reason, they would like to exploit contextual user data which may lead to a more personalized interaction experience and service offering, and would like to realize a stronger participation of users in all phases of product and service lifecycles, thereby bringing the lessons of the Web 2.0 phenomena into the services space. In order to develop and operate their services, new methods, technologies and tools are needed to speed up the time to market, to establish value added services which may be better configured in partnership with others and to simplify access to relevant resources and capabilities, e.g., from the Internet of Things. Additional requirements on business services include reduced complexity of ICT provisioning, scaling, global availability and meeting security requirements from customers and legal authorities. An appropriate Future Internet platform would greatly contribute to meeting these demands from business customers.

Application/service developers and providers, on the other hand, are challenged to

build smart applications that cover the above mentioned needs from consumers. From a development perspective, such applications and services should be built on top of powerful but easy to use APIs, be standards based and offer flexible deployment and provisioning means (e.g., many devices, multi-tenant architectures, global scalability, and on-demand provisioning) and management frameworks (e.g. in the Internet of Things). Additionally, they should exploit economies of scale and protect investments in the long run. Finally, the ability to combine applications from different sources necessitates innovative revenue sharing models across partners and potentially also customers (e.g. crowd-sourcing) which have to be adapted dynamically as market conditions change.

Towards Strengthening Innovation-enabling Capabilities

The previous observations independently hold across vertical sectors such as health, transportation and logistics, energy and urban management. However, in practice, many solutions in those areas are today realized as custom made applications which are developed multiple times for particular purposes with proprietary interfaces. This severely hinders the growth of economies of scale for application and service developers, and limits the size of the addressable markets and ICT investments that can be made towards new products and services in vertical applications sectors. As most revenues in the ICT sector in 2020 will be generated by products and services which have not yet been developed, it is now commonly agreed by public and private thought leaders that investments into the innovation-enabling capabilities are crucial for success in the global market competition.

Economical, Societal, and Political Benefits brought by a FI Core Platform

From an **economic perspective** it can be observed that many companies in the traditional ICT sector face difficulties concerning the transformation of their own business models into new areas, tackling commoditization and marginalization threats. To address this difficulty, a framework is needed where new business models can be explored and validated effectively. Such a framework could help to cultivate an ecosystem comprised of agile and innovative service providers, which in turn consume services provided by the traditional ICT players.

Considering the **societal dimension**, the availability of a platform whereby stake holders across different sectors (e.g., healthcare, logistics, energy management, sustainability, transport etc.) can cooperate will accelerate the development of new innovative services for the European society within and across various sectors. Vertical and horizontal innovations in these areas will contribute to solving major societal

challenges (e.g., Grand Societal Challenges identified by the EU Commission and EU Member States).

Lastly, on the **political dimension**, legal and legislative barriers presently hinder the efficient cross-border establishment of new innovative solutions due to complex or incompatible ICT policies in different countries and regions. The identification of legal and regulative aspects that could be potential barriers for innovation in the Future Internet should thereby be investigated and appropriate mitigation actions should be identified and brought to the attention of policy makers. A FI Core Platform may serve the purpose of revealing such barriers.

Vision and Goals

The high-level goal of the **FIWARE project** is to build the Core Platform of the Future Internet. This Core Platform, also referred to as the “**FIWARE Platform**” or simply “**FIWARE**” throughout the rest of this document, will dramatically increase the global competitiveness of the European ICT economy by introducing an **innovative infrastructure for cost-effective creation and delivery of versatile digital services, providing high QoS and security guarantees**. As such, it will provide a powerful foundation for the Future Internet, stimulating and cultivating a sustainable ecosystem for (a) innovative service providers delivering new applications and solutions meeting the requirements of established and emerging Usage Areas; and (b) end users and consumers actively participating in content and service consumption and creation. Building this ecosystem will strongly influence the deployment of new wireless and wired infrastructures and will promote innovative business models and their acceptance by final users.

FIWARE will be open, based upon elements (hereunder called **Generic Enablers**) which offer reusable and commonly shared functions serving a multiplicity of **Usage Areas** across various sectors. Altogether, such a platform will address the challenges described in the previous section. Note that not all functions that are common to applications in a given Usage Area may lead to the identification of Generic Enablers (GEs). It is the ability to serve a multiplicity of Usage Areas that distinguishes Generic Enablers from what would be labelled as **Domain-specific Common Enablers (or “Specific Enablers” for short)**, which are enablers that are common to multiple applications but all of them specific to a very limited set of Usage Areas. While not all elements that are suitable to be considered as Generic Enablers will be developed in the FIWARE project (this would be a goal that the FIWARE project alone, simply cannot afford), the intention is that all elements developed within FIWARE can widely be accepted as Generic Enablers, per definition above.

Key goals of the FIWARE project are the identification and specification of GEs,

together with the development and demonstration of reference implementations of identified GEs. Any implementation of a GE comprises a set of components and will offer capabilities and functionalities which can be flexibly customized, used and combined for many different Usage Areas, enabling the development of advanced and innovative Internet applications and services. The FIWARE Architecture comprises the specification of GEs, relations among them and properties of both.

The Core Platform to be provided by the FIWARE project is based on GEs linked to the following main **FIWARE Technical Chapters**:

- **Cloud Hosting** – the fundamental layer which provides the computation, storage and network resources, upon which services are provisioned and managed.
- **Data/Context Management** – the facilities for effective accessing, processing, and analyzing massive volume of data, transforming them into valuable knowledge available to applications.
- **Applications/Services Ecosystem and Delivery Framework** – the infrastructure to create, publish, manage and consume FI services across their life cycle, addressing all technical and business aspects.
- **Internet of Things (IoT) Services Enablement** – the bridge whereby FI services interface and leverage the ubiquity of heterogeneous, resource-constrained devices in the Internet of Things.
- **Interface to Networks and Devices (I2ND)** – open interfaces to networks and devices, providing the connectivity needs of services delivered across the platform.
- **Security** – the mechanisms which ensure that the delivery and usage of services is trustworthy and meets security and privacy requirements.
- **Advanced WebUI** – new user input and interaction capabilities, such as interactive 3D graphics and immersive interaction with the real and virtual world

In order to illustrate the concept of GE, let's analyze some of the GEs that have been initially identified as linked to one of the defined Architecture Chapters in FIWARE, e.g., the chapter linked to Data/Context Management Services. This chapter may comprise some sort of GE that allows compilation and storage of massive data from disparate sources. Note that this GE may in turn be based on a number of GEs, each specialized in gathering data from a specific source (e.g., data from connected "things", data obtained from user devices, data provided by the user, data exported by applications, etc.), The Context/Data Management Service may also comprise a number of GEs dealing with processing of stored data, enabling generation/inferencing of new valuable data that applications may be interested to consume. It may finally comprise a GE which supports a well defined API enabling Future Internet Applications to subscribe to data they are interested in, making them capable of receiving this data in

real time.

To a large degree, the functionalities of the Generic Enablers will be driven by requirements from Application/Service developers. Therefore, FIWARE will establish tools and processes that will help to closely collaborate with concrete Use Case projects dealing with development of concrete Application/Services. Discussions about requirements will require continuous interaction between the FIWARE project and partner Use Case projects. However, FIWARE development needs to be driven by requirements extrapolated for any future Application/Service. Requirements that go beyond those of concrete Use Case projects will be brought by partners of the FIWARE consortium (based on input of their respective Businesses Units). A FIWARE product backlog will be generated from both sources and will be continuously updated, driving development of FIWARE following Agile principles.

The FIWARE project will introduce a generic and extendible ICT platform for Future Internet services. The platform – also referred to as the “Future Internet Core Platform” or “FIWARE” – aims to meet the demands of key market stakeholders across many different sectors, strengthen the innovation-enabling capabilities in Europe and overall ensure the long-term success of European companies in a highly dynamic market environment.

The set of strategic goals of the FIWARE project are as follows:

- To specify, design, and develop a Core Platform (hereunder referred to as “FIWARE”) to be a generic, flexible, trustworthy and scalable foundation, supporting the missions listed previously.
- Design extension mechanisms so as to enable to support for yet unforeseen Usage Areas not being addressed initially. This requires a suitable extrapolation of current technology and business trends and their translation into the specific design and implementation principles of FIWARE.
- To liaise between the project and relevant standardization bodies in order to: a) keep the project up-to-date with respect to the discussions in the standardisation bodies; b) support the submission of contributions from the project in a coordinated way. The aim is to ensure active contribution of specifications leading to open standardised interfaces.
- To implement and validate the FIWARE approach in trials together with Use Case projects in order to develop confidence for large scale investments in solutions for smart future infrastructures on national and European level.
- To enable established players (telecoms, etc.) and emerging players in the

services and application domains to tap into new business models by providing components, services, and platforms for these emerging players to innovate.

- To support the development of a new ecosystem including agile and innovative Applications/Service providers consuming components and services from FIWARE thereby building new business models based on FIWARE and associated Usage Areas.
- To stimulate early market take-up by promoting project results.

FIWARE Generic Enabler Open Specifications, Compliant Platform Products, Instances

Specifications of APIs (Application Programming Interfaces) and Interoperable Protocols supported by FIWARE Generic Enablers (GE) will be public and Royalty-free. GE Open Specifications will contain all the information required in order to build compliant products which can work as alternative implementations of GEs developed in FIWARE. GE Open Specifications will typically include, but not necessarily will be limited to, information such as:

- Description of the scope, behaviour and intended use of the GE
- Terminology, definitions and abbreviations to clarify the meanings of the specification
- Signature and behaviour of operations linked to APIs (Application Programming Interfaces) that the GE should export. Signature may be specified in a particular language binding or through a RESTful interface.
- Description of protocols that support interoperability with other GE or third party products

The FIWARE consortium intends to deliver a reference implementation for each of the Generic Enablers defined in the FIWARE Architecture. Some components of these reference implementations may be closed source while others may be open source. The concrete open source license selected by the owning partners who work together in the implementation of a given component will be agreed by them, taking into account the Access Rights obligations and avoiding any impact on other Project partners they don't desire.

Note that not all components in a compliant implementation of a GE need to interoperate with components linked to implementations of another GE, nor provide APIs (Application Programming Interfaces) to Application Developers. While implementations of Generic Enablers developed in compliance with FIWARE GE Open Specifications should be replaceable, components linked to a particular implementation of a Generic Enabler may not.

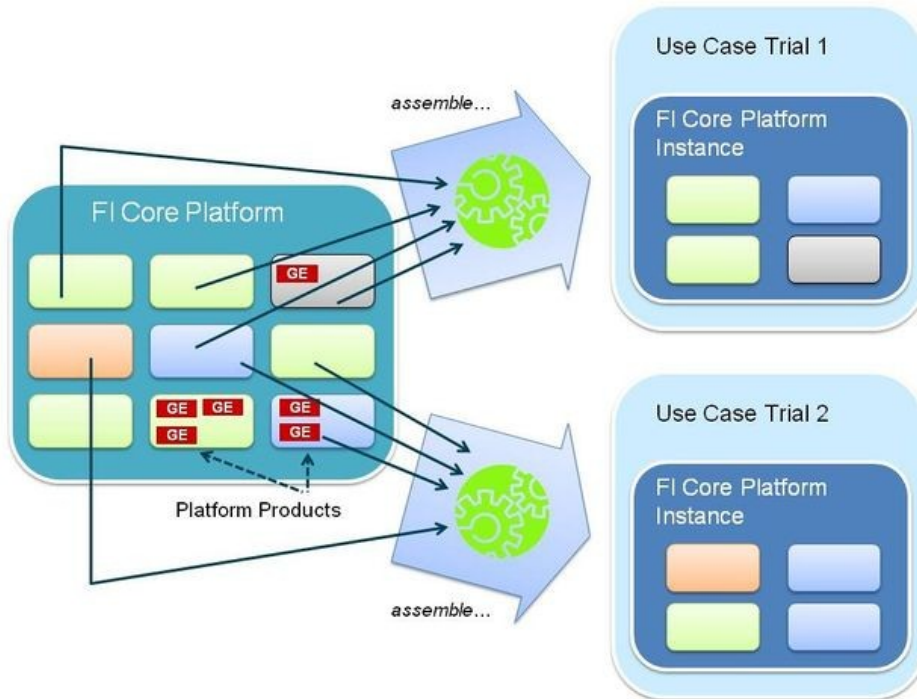
The FIWARE project will draw upon the wealth of results already achieved through earlier research projects, not only within the EU FP7 but also at national- or corporate-funded levels, aiming to leverage them further through a systematic integration with a complete system perspective. In the FIWARE project, there is an equal focus on advancing technologies linked to Generic Enablers as well as integrating them in order to meet the actual requirements of all stakeholders. R&D activities in FIWARE will comprise:

- Evolving components contributed by partners or available on the market in order to:
 - incorporate new features not covered by these components but required to implement GEs in the context of the Future Internet
 - allow GEs implemented through these components to be integrated (pluggable) with other GEs in the FIWARE Architecture
- Creating new components that may cover gaps in the FIWARE Architecture

Products implementing FIWARE GEs can be picked and plugged together with complementary products in order to build **FIWARE Instances**, operated by so called **FIWARE Instance Providers**. Complementary products allow FIWARE Instance Providers to differentiate their offerings and implement their desired business models. For example, a company playing the FIWARE Instance Provider role may decide to develop and/or integrate their own set of monitoring/management tools, because this will allow it to benefit from a better integration with the tools already used by the company for the monitoring/managing of other services, therefore making operations much more efficient. FIWARE Instance Providers would also typically develop their own solutions for monetization of the services delivered through the FIWARE Instance they operate. This solution will typically imply integration with proprietary Billing or Advertising Support Systems. In this respect, GEs defined in FIWARE will not impose restrictions on the particular business model a FIWARE Instance Provider intends to implement.

Note that the open nature of GE specifications will allow to replace a GE implementation developed in FIWARE within a particular FIWARE Instance.

FIWARE GEs are further classified into core FIWARE GEs and optional FIWARE GEs. Core FIWARE GEs are required to be deployed in every FIWARE Instance.



Fiware Instances

The FIWARE Testbed and FIWARE Lab

The FIWARE project will generate a FIWARE Instance, hereunder referred to as **FIWARE Testbed**, which will allow partner Use Case projects (including a number of Use Case projects that are part of the European FI PPP initiative) to run and test Future Internet Applications based on FIWARE Generic Enablers. This FIWARE Testbed will be available shortly after delivery of the first FIWARE major release. FIWARE Instances linked to trials or commercial services (exploitation phase) are, in turn, referred to as “**FIWARE Instances in production**”.

The FIWARE Testbed is aimed to be complete, in the sense that it will comprise reference implementations of all Generic Enablers defined in the FIWARE Architecture. The testbed will not necessarily be centralised, but will be under central control and be accessible from a dedicated website. The FIWARE partners will provide support to Use Case projects for the deployment of applications (e.g., the conceptual prototypes) on top of the FIWARE testbed. Tests run by the partner Use Case projects, coordinated with

tests defined by the FIWARE project, will help to validate Generic Enabler Open Specifications, the reference implementations of FIWARE Generic Enablers developed within the FIWARE project, as well as the conceptual prototypes developed by Use Case projects.

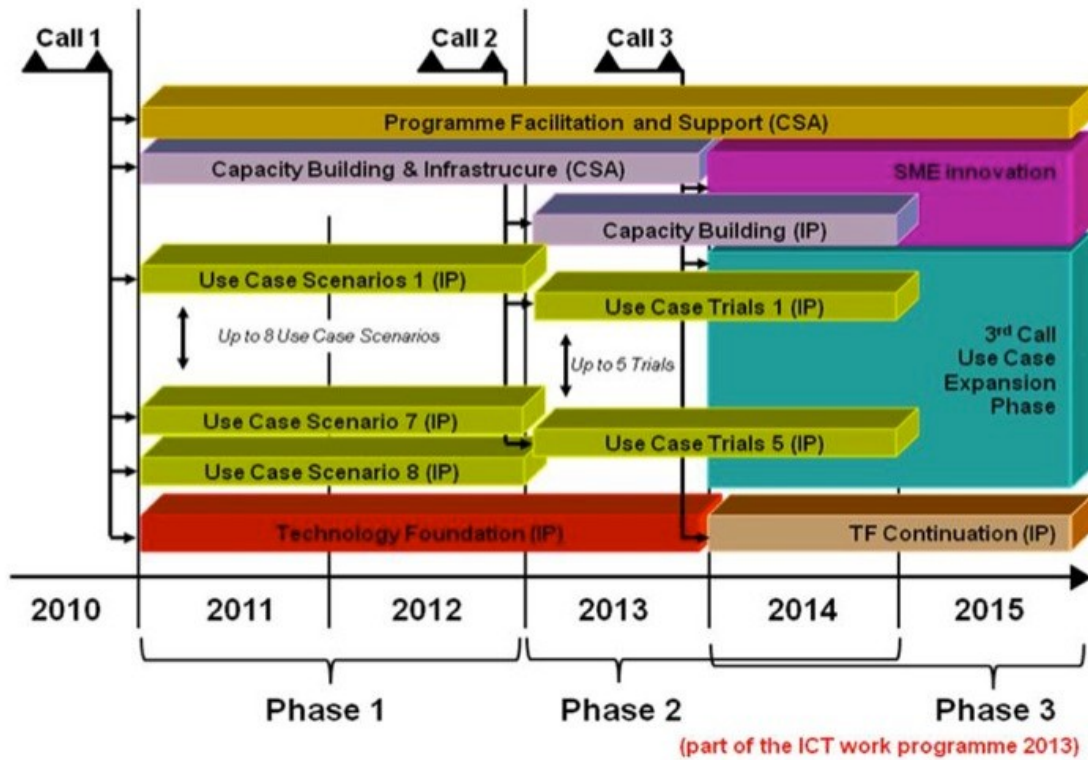
In order to pave the way for a successful exploitation and sustainability, the FIWARE project will work on setting up an **Open Innovation Lab** (FIWARE Lab) similar to the FIWARE testbed after the second release of FIWARE. This FIWARE Lab will support community involvement beyond the initial partner Use Case projects, offering a space where future innovations on top of the generic enablers provided by FIWARE can be nurtured. The availability of FIWARE Lab per se does not guarantee innovation as such, therefore FIWARE Lab will comprise all what is needed to stimulate awareness among target application providers and users so that they feel attracted to participate and build a community. It will also bring tools helping members of the community to share their experiences, needs, etc.

FIWARE in the context of the European Future Internet Public Private Partnership (FI-PPP) Program

The FIWARE project will design, develop and implement the so-called Core Platform within the European Future Internet Public Private Partnership (FI-PPP) Program defined under the ICT FP7 Work Programme. More information about the Future Internet PPP initiative can be found at:

- <http://www.fi-ppp.eu>
- http://ec.europa.eu/information_society/activities/foi/lead/fipp/index_en.htm

The following figure illustrates the basic FI-PPP approach, where several partner Use Case projects (eight in Phase 1 of the program) will cooperate with the FIWARE project to provide requirements about Generic Enablers which are distinguished from Domain-specific Common Enablers (see previous sections). The identified requirements from the eight Use Case projects provide part of the requirements, which FIWARE has to fulfil. Other requirements come from other partner Use Case projects that may arise during lifetime of the FIWARE project or from the Business Units of the partners in the FIWARE Consortium.



FI-PPP Program

A first release of the reference implementation of GEs in FIWARE will be provided before the end of phase 1 in the context of the European Future Internet Public Private Partnership (FI-PPP) programme and can be integrated to setup FIWARE Instances serving Usage Trial projects in phase 2 of that programme.

Business Ecosystem

The following table describe the different roles in the overall value chain envisioned around FIWARE:

Role	Description
FIWARE GE Provider	Any implementer of a FIWARE GE. The open and royalty-free nature of FIWARE GE specifications will allow parties other than partners in the FIWARE consortium to develop and commercialize platform products that are in compliance with FIWARE GE specifications.
FIWARE Instance Provider	A company or organization which deploys and operates a FIWARE Instance and establishes some sort of business model around that particular FIWARE Instance. Note that in building a FIWARE Instance, a FIWARE Instance Provider may rely on products being developed in the FIWARE project or products being developed by any sort of FIWARE GE Provider.
FIWARE Application/Service Provider	A company or organization which develops FI applications and/or services based on FIWARE GE APIs and deploys those applications/services on top of FIWARE Instances. Note that the open nature of FIWARE GE specifications will enable portability of FI applications and/or services across different FIWARE Instances.

While there are clear boundaries among these roles, a company/organization may take one or more of the roles defined above. Indeed, we foreseen it will be very common that some companies/organizations play one of these roles as its core role but will try to gain differentiation in the market or try to capture additional revenue streams by playing any of the other complementary roles. Thus, scenarios like the followings may apply:

- A FIWARE Application/Service Provider may also play the role of FIWARE Instance Provider, deploying FIWARE Instances tailored to run the Applications and Services they have developed (i.e., following a sort of ASP model). Conversely, a FIWARE Instance Provider may decide to develop some Application/Services targeted to end customers on top of the same FIWARE Instance they offer to third-party for development of their respective Application/Services.
- A FIWARE Application/Service Provider may also decide to provide their own

implementation of some GEs that will bring a differential value when bundled together with the final Application and Service they provide. Therefore, they may also play the role of GE provider.

- A FIWARE Instance Provider may decide to be the Provider (implementer) of some of the GEs in the FIWARE Instance it operates. This may be because of costs (no need to buy licenses or pay per use of a particular FIWARE GE compliant product) or because it believes it may gain some differentiation by means of implementing part of the FIWARE GEs against other FIWARE Instance Providers.
- Considering all the previous points, a company may decide to play all of the three roles.

Many different business stakeholders will be part of the ecosystems creating Future Internet based applications and services. They are likely to have different business objectives and offerings. The following categorisation summarises the relevant stakeholders, the roles they are expected to play and, consequently, the impact FIWARE may induce:

Established Telecom Industry

- **Telecom Service Providers:** They will typically play the role of FIWARE Instance Providers as their core role, relying on FIWARE technologies to develop new open and innovative business models leveraging the assets they already have, i.e. exploring possibilities to "open up" their existing networks or the data they manage or connecting third Application/Services Providers with their large customer base. In general, trying to create a compelling ecosystems for Application/Services Providers that leverages on revenue share models. They, of course, will need to understand the technical hurdles, which need to be overcome. They can also play a relevant role as FIWARE GE Provider and accelerating the development of standards based on FIWARE results. They also may play the role of FIWARE Application/Service Providers, developing new services and applications for large Usage Areas where telecom-based communication, security and availability levels as well as support to roaming users are required. Also to leverage their position as FIWARE Instance Provider or simply extend its portfolio, thus being able to keep growing in the Digital world.
- **Network equipment manufacturers (core and access networks):** Develop and provide technical solutions to support Telecom Service Providers in their role as FIWARE Instance Providers. They may generate product/platforms covering a number of FIWARE GEs and provide services on which Telecom Service

Providers may rely to implement their role as FIWARE Instance Providers or FIWARE Application/Service Providers. They can also play the role of FIWARE Application/Service Providers, commercializing compelling ICT-based services based on FIWARE which can be bundled together with other Application/Services in their portfolio to bring solutions to different Usage Areas or to enrich the Applications/Services ecosystem a given Telecom Service Provider wishes to build around the FIWARE Instance it operates.

- Mobile terminal manufacturers: Develop and provide appropriate terminal devices with new features, M2M communication equipment and sensors for new application domains, which can interface easily with FIWARE Applications and Services. Some of these new capabilities may require they implement some FIWARE GEs, so that they are more suitable to run on their devices. Based on open standardized interfaces, economies of scale and affordable/interchangeable solutions for customers can be achieved.

IT Industry

- Software vendors: They will typically play the role of FIWARE GE Provider. Therefore, they will explore, develop and provide new software components, services, middleware, business services (delivery) platforms and cloud-based infrastructure components needed for emerging Future Internet applications and services in a converging IoT, IoS, and IoC environment.
- IT Providers: Many of them are evolving in a line similar to Telco Service Providers, therefore playing any of the three defined roles.
- IT Solution integrators: They will typically play the role of FIWARE Application/Service Providers, adapting to the new challenges of developing and integrating new converged Telecom/IT solutions. They sometimes may decide to play the role of FIWARE Instance Providers, offering the outsourcing of all ingredients that are part of the solution.

Usage Areas

The various stakeholders in the Usage Areas are expected to have very different objectives. Many of them suggest basic improvements of their business processes and the more efficient use of resources of any kind. Others request solutions to support them in the development of new cross-sector solutions currently considered as complex to implement and operate. Both of them are in charge of supporting societal challenges either based on financial incentives or based on regulatory requirements. FIWARE is a key element to support the different sectors in their approach.

Emerging Future Internet solution aggregators for converged services

In a converged Future Internet ICT industry new challenges for developing / composing / deploying of (domain- or sector-specific) solutions emerge. Established or new players especially from the SME sector will increasingly have to develop solutions in a world of complex service networks crossing telecom services. Therefore, they will play the role of FIWARE Application and Service Providers, thereby adapting their business models and technology know-how appropriately.

Note that convergence equally well applies to cross-sector innovation concerning domain-specific service providers, e.g. from the areas of logistics, healthcare, energy, services, where new services are composed by linking and services from different sectors and developing new business models around them.

End users

Further end users affected by the FI-PPP and contributions of FIWARE are citizens, (non-governmental) organisations, individuals, employees, and the generation of prosumers (possibly also aiming at generating their personal income). Solutions that have direct impact on this group of stakeholders are highly desirable

Terms and definitions

Following are the definitions of some terms that are key to the FIWARE vision and are widely used. As mentioned before, the terms “Core Platform”, “CP” or “FIWARE” can be used indistinctly:

- **FIWARE Generic Enabler (GE):** A functional building block of FIWARE. Any implementation of a FIWARE GE is made up of a set of components which together supports a concrete set of Functions and provides a concrete set of APIs and interoperable interfaces that are in compliance with open specifications published for that GE.
- **FIWARE GE Open Specifications:** GE Open Specifications will contain all the information required in order to build compliant products which can work as alternative implementations of GEs developed in FIWARE and therefore may replace a GE implementation developed in FIWARE within a particular FIWARE Instance. GE Open Specifications will typically include, but not necessarily will be limited to, information such as:

- Description of the scope, exhibited behaviour and intended use of the GE
 - Terminology, definitions and abbreviations to clarify the meanings of the specification
 - Signature and behaviour of operations linked to APIs (Application Programming Interfaces) that the GE should export. Signature may be specified in a particular language binding or through a RESTful interface.
 - Description of protocols that support interoperability with other GE or third party products
 - Description of non-functional features
- **FIWARE Compliant Platform Product:** A product which implements, totally or in part, a FIWARE GE or composition of FIWARE GEs (therefore, implements a number of FIWARE Services). Different FIWARE compliant Platform Products may exist implementing the same FIWARE GE or composition of FIWARE GEs. Actually, the open and royalty-free nature of FIWARE GE specifications allows the existence of alternative implementations of a FIWARE GE. FIWARE compliant Platform Products are made up of components. While implementations of Generic Enablers developed in compliance with FIWARE GE Open Specifications are replaceable, components linked to a particular FIWARE compliant Platform Product may not be replaceable.
 - **FIWARE Generic Enabler implementation (GEi):** A way to refer a FIWARE Compliant Product, or a component that is part of a FIWARE Compliant Product, implementing the Open Specifications of a given FIWARE GE.
 - **FIWARE Instance:** The result of the integration of a number of FIWARE compliant Platform Products and, typically, a number of complementary products. As such, it comprises a number of FIWARE GEs and supports a number of FIWARE Services. Provision of Infrastructure as a Service (IaaS) or Context/Data Management Services are examples of FIWARE Services a particular FIWARE Instance may support, implemented by means of combining a concrete set of Platform Products. While specifications of FIWARE GEs define FIWARE in functional terms, FIWARE Instances are built by means of integrating a concrete set of FIWARE compliant Platform Products.
 - **FIWARE Instance Provider:** A company that operates a FIWARE Instance. Note that FIWARE Instances may not consist only of the integration of FIWARE compliant Platform Products but their integration with other products which allow the FIWARE Instance Provider to gain differentiation on the market (e.g. integration with own Operating Support Systems to enhance

FIWARE Instance operation or with other products supporting services that are complementary to those provided by FIWARE GEs) or to enable monetization of its operation (e.g., integration with own Billing or Advertising systems).

- **Future Internet Application:** An application that is based on APIs defined as part of GE Open Specifications. A Future Internet Application should be portable across different FIWARE Instances that implement the GEs that Future Internet Application relies on, no matter if they are linked to different FIWARE Instance Providers.
- **FI-WARE Testbed:** A concrete FI-WARE Instance operated by partners of the FI-WARE project that is offered to Use Case projects within the FI-PPP Program, enabling them to test their proof-of-concept prototypes. The FI-WARE Testbed is also offered to third parties to test their Future Internet Applications although support to them is provided on best-effort basis.
- **FI-WARE Instance in production:** A FI-WARE Instance run by a FI-WARE Instance Provider in the context of a trial (e.g., trials in phase 2 of the European FI PPP initiative) or as part of its service offering to the market. FI-WARE Instances in production will typically have their own certification and developers community support environments. However, several FI-WARE Instance Providers may establish alliances to setup common certification or developers community support environments.