



# The EUROPEAN FUTURE INTERNET INITIATIVE (EFII)

## White paper on the Future Internet PPP Definition

January 2010

### Rationale

This document is intended to convey the vision of the European Future Internet Initiative (EFII) for the Future Internet Dedicated call (PPP):

- As an input to the preparation of the work programme 2011 – 2013 for a dedicated call on the Future Internet.
- As a call to sector industries (utilities, transport, health, energy, content,...) to engage with ICT community in an innovative approach to a focused research programme.
- As a call to others in the ICT industry and academic & research institutions to work with us the development of this programme of activities to accelerate the Future Internet in Europe.

The main objective of this PPP is to significantly advance the implementation and uptake of Future Internet services by 2015 and, in doing so, establish European-scale markets for smart infrastructures with integrated communications functionality.

The concept of supporting and enhancing the life of the citizens in the Digital Society of the future will be an integrating theme in this approach.

We hope to engage the application sectors and the ICT community in a comprehensive discussion on the nature and structure of the activities and projects that could be used to realise the ambitions of this programme in the first half of 2010.

### European Future Internet Initiative Founder Members:





## 1. The new Future Internet Public Private Partnership

Information and communication technology is becoming smarter; smaller and faster; and, at the same time, society is progressively becoming more densely connected. As a result, Internet supported services are entering a new phase of mass deployment which brings a huge number of new opportunities but also new challenges in terms of scalability, capacity, throughput, mobility and trust.

To address these challenges the European Future Internet needs to be tackled from a holistic perspective by taking into account all building blocks from users, services and applications down to the networks. This needs a multidisciplinary approach led by strong European industrial stakeholders, supported by academia and innovative SMEs, to develop the devices, interfaces, networks and services required to support the future networked society and economy.

The concept of “Digital Society”, which will be characterised by a multitude of pervasive ICT technologies ranging from ubiquitous communication and computing facilities over various kinds of actuators and sensors to new modalities of user interaction, is recognised as a theme that can represent the integration of the Future Internet visions. It allows that smart systems for utilities (electricity, water, urban security), communications, traffic (intelligent traffic systems, public transport, and pedestrian guidance), healthcare, ubiquitous access to content, and safety & security can be addressed in a common way to represent a significant part of the future internet. If we add the ideas of context-aware services, that can find, format and deliver content, being seamlessly available for the inhabitants, e.g. for information, guidance and entertainment, then we get a realistic and representative vision of what needs to be implemented to progress the future Internet in Europe.

We propose that the creation of new European-scale markets for smart infrastructures, with integrated communications functionality, will contribute to economic growth in Europe and to achieving European leadership in the global ICT applications markets in the coming decade. It will also provide European SME's numerous opportunities to offer new products, equipment, services and applications to a global marketplace.

As certain industrial sectors such as logistics, automation, energy, health and others are already strong European businesses that will increasingly rely on Internet technologies, there is a need to understand and support their expectations and requirements on the future internet in collaboration with the European ICT community.

**Our goal is to establish a Future Internet pan-European coordinated partnership that will bring about clear benefits for Europe. Our aim is to reinforce and boost the competitiveness of enterprises and administrations, create new economic opportunities, while empowering innovators and citizens to benefit from the future Internet.**

This challenge requires bringing the competence of the application sectors and the ICT sector together to develop common solutions from an end-to-end perspective in a way that has never been possible before. It will require cross-functional and cross-sector projects which can not be created by the current sector-driven structure of calls for proposals. The PPP approach will also consider the economies of scale that allow for exploitation at a pan-European and global level.

Moreover, the efforts that are required, measured in terms of investment or skills, are not within the reach of a single company, a single sector, or a single country. The complexity of the challenge largely exceeds the individual capabilities of today's European stakeholders (operators, vendors, IT providers, vertical and application markets, Public Authorities...).

The proposed Public Private Partnership (PPP) will enable Europe to consider supporting the sector driven requirements, such as identity management, scale and user acceptability, by using known and emerging technologies in a holistic approach to providing entire solutions for societal challenges. The PPP should also identify barriers caused by non-technical issues and instigate a strategy to address them.



As detailed in the EC Communication COM(2009) 479 final released on 28.10.09, the Future Internet (FI) Public Private Partnership (PPP) will boost the European development on Internet, contribute to close the gap between technology and applications, and contribute to close the EU innovation and competitiveness gap. The main objective of this PPP is to significantly advance the implementation and uptake of a European-scale markets for smart infrastructures, with integrated communications functionality by 2015.. The 300 M€ programme will target short- to medium terms impacts and will be complementary to the medium-longer term research of the Framework Program.

This communication was welcomed by the EFII and our approach to instantiating the FI PPP will enable early availability of a framework (specification, standards, development and trials) to ease and speed up the development, deployment and take-up (adoption) of very new and innovative “smarter infrastructures” and services in Europe.

The main result of this Initiative will be demonstrations of pan-European Future Internet services by 2014. This will facilitate an early uptake of the results in the European marketplace, benefiting European citizens, and generating a competitive advantage for European industry in the global market place. The potential to continue this work in some format under FP8 will be considered in the future.

The shared cross-sector approach of the PPP will overcome a potential fragmentation in the “smart infrastructure market” and ease the efficiency of technological development as the establishment of a competitive industry in the supply of ICT for “smart infrastructure” technologies as of the associated web services.

## 2. Objectives and Approach

Several initiatives in China, Japan and USA have already started with the aim of developing new infrastructures for the Internet. Although the interest of the European authorities and industry also encompasses the Asian and American trends (further development of the network infrastructure, enhancement of the overall capacity, security...), the priorities of the European approach are different in that they embrace the full system dimension of the Future Internet. As detailed in the Vision Document of the Future Internet Cross-European Technology Platforms (X-ETPs FI), the Future Internet is articulated around the Internet by and for People, the Internet of Contents, the Internet of Services and the Internet of Things supported by the Network Infrastructure foundation.

### **The European Future Internet Initiative ambitions include:**

- Providing the European citizen and industry with better and smarter services and applications that keep, extend in time, or enhance their quality of life and business.
- Fostering the creation of a new extended economy environment over the net, accessible by stakeholders in all 27 member states, which guarantees service provision, service delivery, traceability, information quality and endorsement, and helps the SMEs everywhere in the 27 and especially the emerging economies of Europe to grow and consolidate.
- Leveraging the enlargement of service offering over the net, allowing a wider range of better quality-enabled services to all economy stakeholders, from SMEs to large corporations, from academic centres to public agencies,

### **The main objectives of the FI PPP programme, proposed by EFII are:**

- Increase the effectiveness of business processes, the operation of infrastructures, and applications of high societal value through making use of reappraised Internet architectures, services and technologies in large-scale application contexts,
- Encouraging European industry to enable smart infrastructures for selected application domains, whilst contributing to EU policies in terms of innovation, sustainable growth, energy and environmental targets,
- Fostering cross-sector industrial partnerships built around Future Internet value chains, and involving users and public authorities at local, regional and national levels,
- Leveraging the Internet infrastructure as the basis of user-centred open innovation schemes,
- Addressing regulatory and policy issues such as interoperability, openness, standards, data security, lawful interception, and privacy within the context of the Future Internet complex ‘smart’ usage scenarios.

- Maximising the societal and ecological benefit through involvement of civil society/consumer organisations where needed. Participation of the public sector in the PPP will be a key asset to progress in these non-technological issues

## Doing things Differently

The Future Internet PPP is seen by EFII as a new instrument to bridge the technologies developed in the EC Framework Programme Challenge 1 and the themes explored in other Challenges, as well as integrating themes not located in any challenge so far.

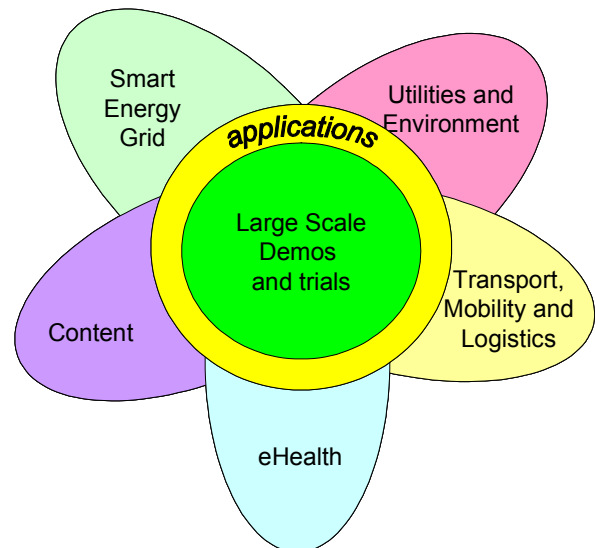
The FI PPP will enable a short to medium term impact, shorter than the usual R&D project application timeframe, and be more representative of the final usage. It will encompass research, development and innovation perspectives and engage multiplicity of companies, including SMEs, in new business models creating economic growth.

The Future Internet PPP will seek maximum commonality across application sectors to facilitate achieving critical mass in the creation of new European-scale markets for smart infrastructures, with integrated advanced communications functionalities. The EFII has identified a number of representative “Application Sectors” in which sets of applications may share common domain expertise, technological and services requirements so that they can, in turn, share framework, technologies, common enablers and architectures.

Those application sectors are (1) Utilities and Environment, (2) eHealth and Ambient Assisted Living (AAL), (3) Smart Energy Grid, (4) Transport and Mobility and (5) Content management.

The targets of the PPP, which need to be refined in partnership with the application sectors, could include things such as:

- Developing and demonstrating large scale infrastructure of eHealth and mHealth services connecting the whole set of involved actors in the healthcare provision chain.
- Developing an open platform for M2M services and demonstrating it through the implementation of innovative urban services
- Setting up a Smart Energy Grid test environment connecting at least three Smart Cities from different countries and involving at least 100.000 end user participants
- Setting up and testing a Pan-European Global Mobility guidance system (multimodal aggregated databases with single access point for Public Transportation Schedules with real-time traffic updates)



All of the demonstrations within the Future Internet PPP programme must be based on shared frameworks, technologies, common enablers and architectures implemented in federated instances of the Future Internet Core Platform concept.

## 3. Our recommendations for the programme

### 1. Large scale projects

- Large scale integration of results will not happen in many autonomous small projects so we must ensure having a critical mass of resources and key market players in each project to ensure sustainable results.

### 2. Flexibility in every stage

- The Future Internet is a hard target to follow so the programme management must be open to adapting the work plan as results accumulate.

### 3. Systematic approach to project selection

- Projects must contribute to the programme and uniquely address aspects of the programme, a programme coordination function must be installed

### 4. Facilitate the sharing of project foreground across all projects in the FI programme when such project foreground is needed for the implementation of research goals

- by having an extended consortium agreement across the programme and
- by having the clear understanding that ownership of such project foreground shall always remain with the entity having generated it

### 5. Integrate user sector competence with the ICT competence

- The PPP target is to demonstrate how the Future Internet can enhance all application sectors

### 6. Lead by example: large scale trials and demos

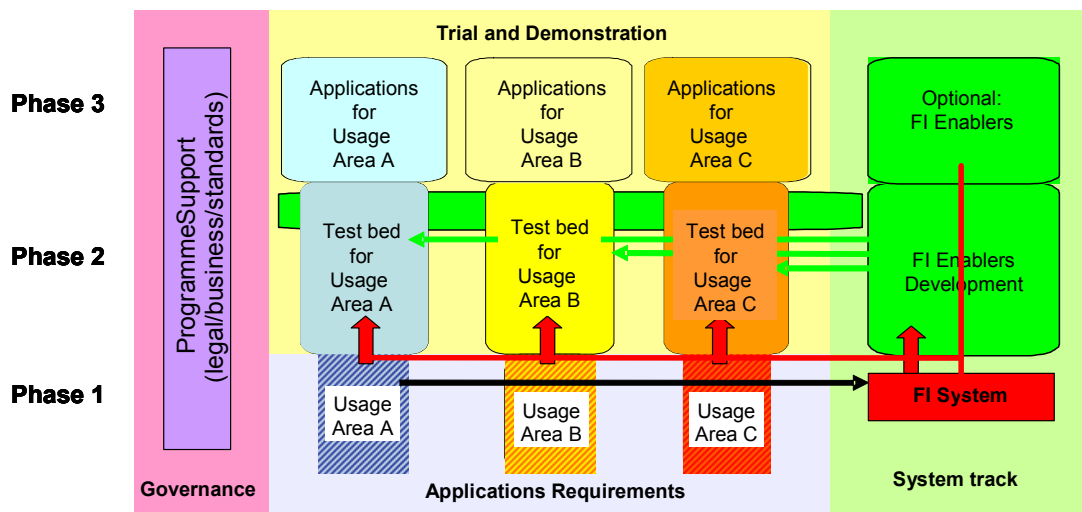
- Proving scalability, viability and international interoperability

### 7. Synergy: build on existing results and resources

- Time and scale dictate that the projects must be pragmatic and will be exploiting available results and facilities more than seeking novel technologies.

## 4. Proposal for the Structure of the Programme

The current draft status of the EFII thinking on the Future Internet PPP programme and possible division into projects is captured in the following figure:



The EFII concept is that the programme will have three main phases:

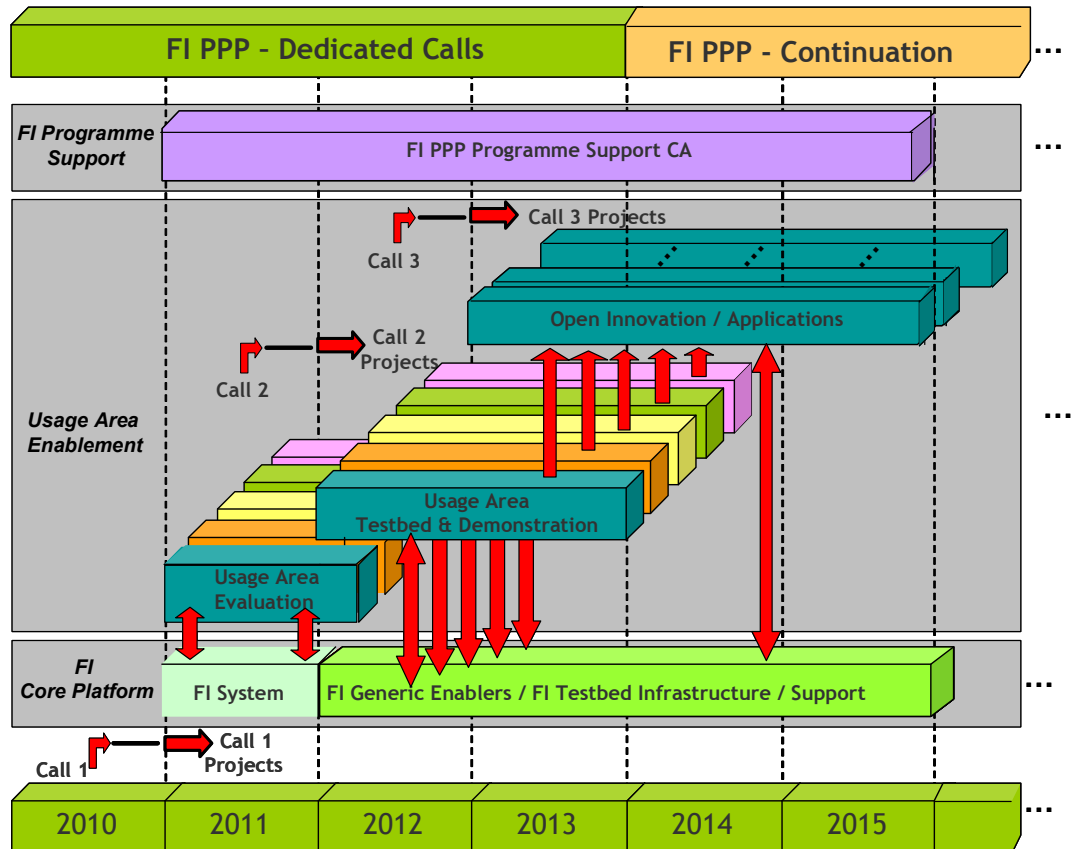
In the first phase, we must define and continuously up-date the Future Internet related requirements coming from the different application sectors. We need to identify the cross sector enablers that are not already known and propose the evolution of the sector business models with enhanced ICT services. We must also define the standardization, regulatory and policy measures to be engaged. The Future Internet System project in Phase 1 will commence development of the predefined enablers and continue to integrate the perspectives developed in the different applications projects which are designed to contribute to the definition of the Future Internet "Generic" Enablers.

In the second phase the main focus will be on the implementation of the test and trial infrastructures in the light of the selected demo scenarios. The system work will focus on core platform and key developments related to the Future Internet technologies and services and developing the technical enablers identified later in phase 1.

Phase three will be the actual performance of the trials and demonstrations relying on specific prototyping facilities, trials on existing networks and "real" Internet (e.g. through public networks). The system work in this phase will be to support the applications and the platform instantiations.

## Details of the Calls

The approach being discussed with the commission entails having three calls within the dedicated programme. The first call would happen in 2010 with a view to having the projects evaluated and ready to be contracted in early 2011. The second call would be one year later with a view to projects starting January 2012. The third call following this would be again one year later and the projects should start January 2013.



The logic of the calls is to progressively build up the activities and increase the involvement in these activities.

### Ambitions of call 1:

- Set the creation of the core platform and the development of the basic enablers in motion
- Engage a limited set of Usage areas in progressing their requirements on the Future Internet and how their business processes may be supported. They must also define their test scenarios and negotiate with available infrastructures to support their functionality. In addition they must begin preparing their domain specific functionality for their test and demonstration work.
- Establish a programme support/governance activity that ensures the integration of the project activities across the programme and addresses not-technical issues to enhance the usefulness of the technical results.
- Start the evaluation of test infrastructures and consider where investments need to be made to bring infrastructures to the level necessary to enable our planned capabilities.

### Ambitions of Call 2:

- The main ambition of call 2 is to ensure the availability of the necessary test infrastructure and to instantiate the platforms with the common enablers that would allow the tests/demonstrations to run.



- The next goal is to facilitate the integration of the test and trial infrastructure on a pan European scale.

#### **Ambitions of Call 3:**

- Call 3 must facilitate the population of the test environments with a variety of applications to prove the feasibility of scale, use of common enablers and viability of the environments.
- Further work must be done to increase the scope and functionality of common enablers and support the application work.
- Some activity on the maintenance of the test and demonstration infrastructure must be envisaged.

In addition across the three calls there must be ambitions to publish results on interfaces, architectures and other reference points that can be used to support standardisation. This approach will enable markets and ensure that the markets for the envisaged services can grow and develop in an open way.

The Commission proposal for the budgets of these calls is 70M€ for call 1, 100 M€ for call 2, and 130M€ for call 3.

### **Mapping the Projects onto the Calls**

Based on the idea of the scope of the calls in terms of the achievements necessary, the next step is to understand what this means in terms of projects that need to be organized.

The following suggestion is a preliminary high level consideration and is going to be discussed and progressed in the EFII discussions in the next period.

All suggestions here are very provisional as the scope of the programme is still under discussion.

- **Call 1 (July 2010) – budget 70 M€**
  - Technology Foundation: One large project
  - Usage Areas Evaluation: several mid-size projects (not more than 5)
  - Programme support: one mid-size project
  - Infrastructure identification and development
- **Call 2 (mid 2011) – budget 100 M€**
  - Build testbeds to support and demonstrate advanced services on one or more Usage areas: several large projects (not more than 4)
  - There will still be work needed on the core platform for further developments and refinements as well as handover of results to the testbed projects.
- **Call 3 (mid 2012) – budget 130 M€**
  - Enlargement of Usage Area Testbeds
  - System/Technology Foundation – top-up
  - Populate the application Domain by application developers: there should be a discussion on multiple applications in a limited number of large integrated projects to achieve coherence versus more smaller projects working to interfaces.

## **5. Applications: Driving the Evolution**

The 5 vertical usage areas selected by the FI PPP programme are: (1) Utilities and Environment, (2) eHealth, (3) Smart Energy Grid, (4) Transport, Mobility and Logistics and (5) Content management. All areas share the goals of producing conceptual models, guiding principles, architecture guidelines, open interface specifications and design patterns to facilitate quick implementation of future Internet services. This is not intended to be a definitive list of usage areas and the possibility of addressing other areas as resources allow is expected. However, any additional areas would need to be addressed using the same methodology.

### **5.1 Utilities and Environment**

For a town to function properly, a considerable amount of services need to be put in place, such as waste management, public lighting, water or gas networks, parking, etc. Machine to Machine (M2M) can provide monitoring and control solutions to optimise these processes. This optimisation has an

impact on the consumption of resources as well as the environment: it is therefore a determining factor in the sustainable development of a town. However, the variety of stakeholders involved in these services causes a fragmentation of the technologies that are used for M2M, which in turn is a source of complexity and redundancy, and slows down the development of these solutions. The current development of M2M is therefore limited and inadequate for a large number of urban services. Solutions offered to the cities have to be improved in terms of genericity and flexibility, scalability and efficiency, security and simplicity but also in term of energy efficiency of the solution.

In this context, the PPP aims to meet three major challenges:

- **Technical:** Developing and testing of an open IT platform for M2M, and demonstrating it through the implementation of urban services,
- **Financial:** The emergence of new services in the town, adapted to the needs of urban service operators (local institutions...),
- **Environmental:** Demonstrating the positive impact of these solutions on a town's sustainable development, and developing eco-designed networks and sensors.

**The main challenges of the PPP related to Utilities and environment is to specify, design, prototype and test a Global Urban Service Platform that will give applications unified, standard access to urban installations. This platform could also offer a hosting solution to small and medium sized urban-service operators.**

## 5.2 eHealth

FI will enhance 21<sup>st</sup> century Healthcare scenario. A secure and trusted Future Internet communication environment will connect monitoring devices or sensors with hospital information systems. Information systems will collect and integrate patient information, providing a more personalized treatment. Medical professionals and patients will have real-time communication and access to the information. FI applications will adapt its performance to the user (patient, health professionals, relatives, etc), wherever they may be, and to the context (hospitals in urban or rural areas, smart houses, wearable devices...). In addition, FI will allow proactive services, covering a much wider variety of interface services and devices. On the other hand, based solutions in FI should be economically viable and affordable by public health systems.

The combination of new generation sensors (including contactless, context awareness, and nano-scale devices) with Internet of Things (based on wireless communications among these devices) will be one of the most remarkable breakthroughs in eHealth. A one large scale project, focused on the development of a smart ensemble of sensors (both wearable and ambient), including the management of information among them, and with other information systems (such as clinical repository and electronic health records) will be proposed. This project should provide a modular system, allowing an easy aggregation of new objects. The expected usage of wireless sensors, as well as interconnection of all devices in the hospitals and home environment will optimise both the logistics processes and provide better care.

**The main challenges of the PPP related to eHealth is to specify, design, prototype and test a eHealth Service Platform that will give doctors patients and applications unified, standard access to medical information and support service features such as telerehabilitation, vital signs monitoring (automatic monitoring with established thresholds that trigger alarms), alerts, telepresence of health care professionals, remote medical administration monitoring, medication reminders, appointment reminders, location tracking, context information processing, etc.**

## 5.3 Smart Energy Grid

Due to the extensive use of renewable energies and the evolution in the area of electro-mobility, the power grid of the future will be characterized by decentralized energy generation and storage as well as by a bidirectional flow of the energy. This power grid of the future together with its control through a communication network (Future Internet) is commonly understood as the "Smart Energy Grid".

The Smart Energy Grid will thrive on an integration of the physical architecture of energy generation, provisioning and consumption with a concurrent open and shared ICT architecture. It is a fundamental ambition of this initiative to design, enable and advance this integration based on Future Internet technologies. In particular, Future Internet technologies from all layers, from network protocols to high-level software infrastructures, as well as heterogeneous in terms of

access technologies will be pivotal in securing the Smart Energy Grid's stability, efficiency, modularity, openness, and evolvability.

**The PPP will aim at designing, enabling, and advancing the integration of the physical architecture of energy generation, provisioning and consumption with a concurrent open and shared ICT architecture.**

#### 5.4 Transport, Mobility and Logistics

Among the numerous challenges to be highlighted in the future of smart cities, the transportation area is probably the major one. In this area, the coming ICT innovations, as described in the Future Internet proposition, shall bring incredible opportunities to manage successfully relevant issues as well as traffic monitoring, reduction in energy consumption and pollution... In fact, citizens are strongly waiting for efficient and low impact transportation solutions. In order to reach this target, several services can be envisaged: (1) For local authorities and transportation operators: Road traffic monitoring, infrastructure management system (traffic light...), public transportation monitoring, toll collection system (parking, congestion tax...), systems to make decision about future transportation infrastructures... (2) For citizens: Car sharing services, enhanced navigation solution (with eco driving assistance, in-building navigation, real-time traffic updates...), easy-to-use multimodality transportation network, on demand public transportation services... and (3) For companies: Goods multimodality transportation solutions.

Nevertheless, it seems that serious roadblocks are today on the track. Because of a lack of platform interoperability and devices openness, and transportation information systems homogeneity, it is highly probable that the operational launch of these services could be delayed for a while.

**To accelerate the deployment of these added-value services, the PPP will aim at defining APIs, defining interoperability guidelines and encouraging technological enhancements for communication between vehicles, systems and other devices, and open platforms.**

#### 5.5 Content Management

A multidisciplinary and integrated approach to handling and delivering content of all types is needed where massively distributed services and applications are run over large scale and secure Internet infrastructures is the only means to deal with the increasing complexity of intertwined application and service demands. The missing piece is the establishment of a common consolidated API and resource abstraction.

Besides the heterogeneity of the network and device interfaces, innovative content distribution/exchange is also facing a major topographical change. The topology of content networks is moving from a centralized content generation model to a decentralized exchange model. With the emergence of user generated content (UGC), P2P communication, or mobile content generation and services, the existing infrastructure for fast and secure access to content is not sufficient. In the close future also the media generation and the end devices will evolve such that for example 3D content or very high quality video will be made available and exchanged. That means, there will be new requirements to the networking infrastructure in terms of bandwidth, delay, jitter, and context awareness of devices and users.

In particular, the required increase in quality calls for new approaches for access to network resources which are today hidden in the walled gardens of network providers. To achieve efficient cross-layer integration, these network capabilities need to be made available by network providers to service developers and integrators.

But also on a business level, future content networks require massive changes. To be able to interconnect different content delivery platforms (like CDNs, terrestrial and satellite broadcast networks,...), those platforms have to open their interfaces and provide interoperability features. Those features also include digital rights management, billing systems, but also media conversion and transcoding. Also business-2-business applications have to be considered. For such content, the content network has to provide much higher reliability and security mechanisms including lawful interception.

**The PPP will aim to provide a unified and consolidated interface between the hardware & network and the applications & services running on the infrastructure enabling consumers to use any device or application to browse, search, purchase and consume content from a distributed collection of content catalogues at a European or global level.**

## 6. Common Enablers – the essence of success

A first analysis has been done by the EFII within five working groups on the selected usage areas (1) Utilities and Environment, (2) eHealth, (3) Smart Energy Grid, (4) Transport, Mobility and Logistics and (5) Content Management concerning the required Future Internet related enablers. The enablers which occurred in several usage areas have been identified as a provisional list of generic enablers and are listed below.

The analysis of the generic enablers is ongoing and the results of this evaluation will be made available in the future. Moreover, a prioritization of all the generic enablers needs to be done. Finally this will lead to the EFII recommendation on the generic enablers to be addressed by the PPP FI programme in the first phase. This Process is ongoing.

The FI Common Enablers Development activity will focus on how core platform functionality can be provided and used by the application areas. The architectures, interfaces and information flows must be defined allowing the technical enablers to be developed.

Open interfaces and reference implementations of each of the capabilities (IoS, IoT, IoC, IaaS, NaaS) have to be considered too.

Based on implementations of solutions for selected application areas, and maybe even reference implementations of these building blocks where available, platform prototypes will be built which shall be used by the usage area enablement activities as a basis.

### Initial set of Common Enablers :

The initial set of Common Enablers will provide support for the following functions:

- Event / Data aggregation, transformation, correlation and Filtering
- Data / Data classification
- Entities Naming Resolution (applicable to services, things, devices, nodes, resources, ...)
- Service Repository
- Service composition, brokering and execution
- Application Communication Infrastructure
- Content/Service indexing, searching and discovery
- Localization
- Context Management
- Recommendation System / Decision Support
- Identity and Access Management
- Confidentiality and data sharing
- User privacy management
- Dynamic adaptability of services / content
- Device Description Repository
- Frontend Channel Maker (frontend access to content and applications)
- Generic rating, charging, billing
- Applications/Service marketplace
- Provision of shared Infrastructure (communication, computing, storage) as a Service
- Provision of Platform as a Service
- Large-scale media and data delivery
- Cloud federation
- Lifecycle Management Support
- Usage accounting
- Real-time logging
- Support for Analytics
- Tele-traffic analysis/servers
- DRM support
- One-to-many communication support
- Nomadic and mobility Support
- Permanent and Non-permanent Connectivity Support
- Dynamic Multi-homing Support
- Dynamic TCP stack and parameter tuning
- Network protection

## 7. Supporting common enablers – core platform concepts

The Future Internet needs to be tackled from a holistic perspective by taking into account all building blocks from users, services and applications down to the networks. This needs a multidisciplinary approach led by strong European industrial stakeholders, supported by academia and innovative SMEs, to develop the devices, interfaces, networks and services required to support the future networked society and economy.

Each Future Internet Application will typically be built on top of a platform instance. Each platform instance can be build upon a selection of capabilities.

Capabilities selected for a given platform are configured and glued together as to create a consolidated Platform which could be provided as a Service (PaaS). Future Internet Application Providers can use interfaces provided by this PaaS to deploy and monitor Applications for which the platform was designed.

Note that for different application domains there might be different domain-specific instantiations of platforms each of which is built on a selection of capabilities in the listed categories. However, a number of capabilities are foreseen to be present and common in all kind of Platforms, namely:

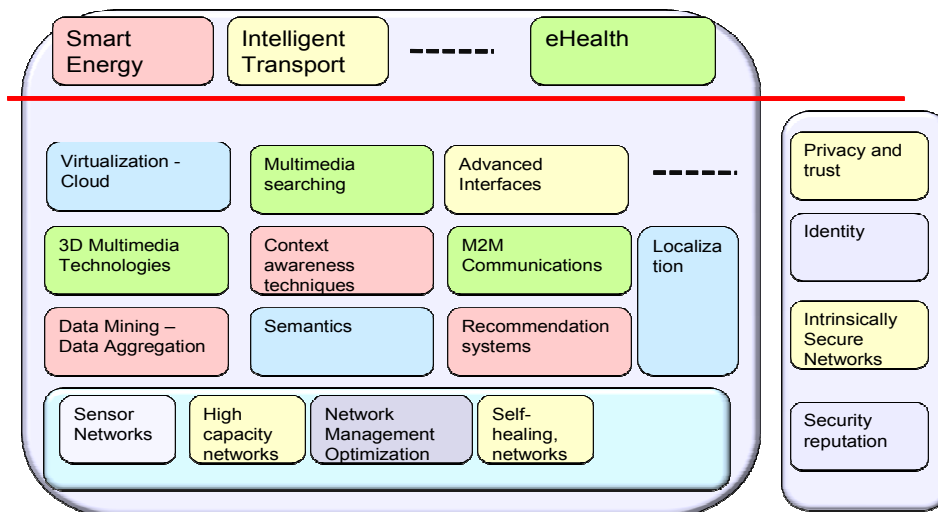
- Capabilities enabling generation, composition and sharing of data (about things, contents, users, etc., which indeed may be exploited as info about context). This will be required to make applications become context aware but also to support data cross-fertilization among applications running on top of different Platforms,
- Capabilities enabling application-related services, things and contents to be visible and accessible by end users in a uniform way, with the ability to mash-up them together. This will be required to make applications ultimately usable and more suitable to users' needs. It also enables applications running on top of different Platforms be accessed in a consistent manner,
- Trust and Identity capabilities enabling end users and service providers to be identified globally in a trusted manner including lawful interception.
- Communication capabilities which are high capacity, scalable, easy to use, reliable, resilient, trusted and secure based on wire-line, wireless and satellite access technologies.

Supporting the different types of innovation and in particular any kind of horizontal innovation requires a fundamental rethinking of our research priorities for the Future Internet. We are addressing research challenges from both – a theoretical as well as a practical angle – that cannot be solved with the traditional types of research instruments. In particular these challenges require breakthrough in a number of areas such as

- Flexibility, adaptability and configurability while ensuring the required availability, dependability, reliability, resilience and security and evolvability,
- Multi-tenant platform design,
- External (automated) manageability of platforms,
- Platform federation,
- Interoperability between platforms (vertical and horizontal) not only on a data integration layer but also from an architectural perspective,

These areas have to move into the centre of investigation because the FI PPP would offer the unique chance to conduct credible research and experimentation. It also offers the possibility to study platform design on all layers of the FI including extra-functional properties such as scalability, security and dependability which is highly relevant to achieve industrially exploitable tangible results.

The Future Internet PPP will use an exciting approach of core platform and key technology development, large scale prototypes, demonstrations and field trials to show the feasibility, scalability and usability of the services of the Future Internet.



## 8. Trials, Test and Demonstrations – Large Scale!

The pace of technology evolution towards future Internet applications requires a number of evolutionary or even revolutionary steps concerning the supporting infrastructure, regardless of whether this affects the transport network architecture, the supporting platforms in the wider sense, or the processing of information.

In most cases new networks, services, and business models must be trialled in a large scale environment that mimics as far as possible the Future Internet, although we certainly do not know how this will look like. However we can expect that the Future Internet will not be too different from the aggregation of the best ideas currently in research on how to construct and operate networks and platforms. For this reason large scale test and experimental infrastructures (networks and platforms) emerge that aim to provide the environment for new applications to be tested and trialled at scale.

The same pace of technology evolution has dramatically decreased infrastructure lifetime – the time an infrastructure remains at the technology's cutting edge – making investments in expensive isolated and specialised infrastructures more risky than they were already. This applies in particular to complex cross-layer and cross-technology infrastructures. For this reason existing and future test and experimental infrastructures increasingly endorse federation principles.

Federation enables combining infrastructural network resources and services of more than one independently controlled domain which enhances significantly the utility of the infrastructures. Federation enables access to additional resources increasing scale, or access to resources with unique properties to enrich demonstrations and trials for a given application. Furthermore the combination of resources from different industry sectors promotes collaboration between these sectors and related research groups.

The following principles are fundamental for an efficient test and experimental infrastructure federation that provides added value to the Initiative:

- **Openness:** Federation implies openness at all levels, including provision, implementation and use.
- **Excellence:** The federation principle aims for “best of breed” and must assure excellence of the capabilities and offered services of the federation.
- **Management:** In order to achieve scale, diversity, cost efficiency and to improve the sustainability and quality of the individual infrastructures and the federation as a whole, proper management of the whole infrastructure is necessary.
- **Governance (including business issues):** In order to ensure a long-term operation of the infrastructure, it is important to address issues like sustainability in terms of capital and operational expenditure, cost of usage, IPR protection, and methods for sharing scarce resources.

For the purpose to the Initiative, the test and experimental infrastructures form the substrate in which the needed platforms for the applications can be deployed. In this context a platform is an instance of aggregated and properly configured enablers, functions and other resources that serve a specific application in an area. These enablers, functions and resources can be any relevant artefact as long as we know how to configure, connect, deploy and provision it. Examples can be access and core network elements, physical and virtual machines, routers, switches, operating systems, database servers, application servers, software components, etc. If these enablers, functions and resources are properly described, they form part of a configured platform that can be (ideally) provisioned automatically.

A key challenge for the Initiative will be to leverage existing and future advanced test and experimental infrastructures and to use these for conducting large scale trials of new innovative and integrated Future Internet Applications. Many of the existing test and experimental infrastructures have not been designed, build and deployed to adhere to the requirements of the Initiative; others may well be reused. The Initiative must embark on a strategy of partnership with existing infrastructure deployments in order to assemble a pan-European federation of test and experimental infrastructures where the results of the Initiative can be implemented.

The Initiative must engage in a process to select a sufficient number of individually controlled test and experimental infrastructure domains based on the principle of excellence (“best of breed”) and formulate the requirements for the evolution of these infrastructures and the federation thereof in

order to meet the needed level of maturity for testing and trialling the new Future Internet applications of the Initiative.

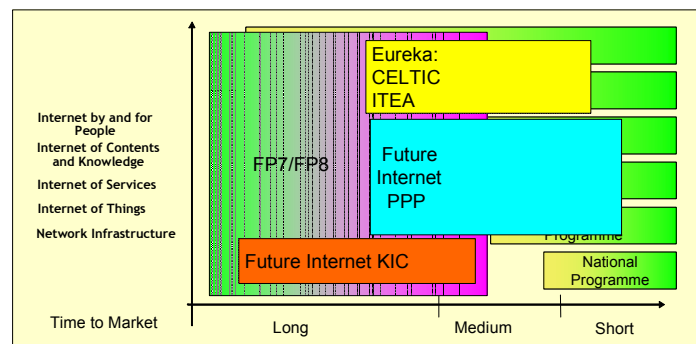
To facilitate the availability of the infrastructure across Europe the needed work and financial investments have to be planned immediately, since it is a major challenge to form a homogeneous infrastructure – as seen from the applications – out of the large diversity of different technologies and implementations. The target outcome of the work is the availability of required infrastructure capabilities and APIs across Europe by the start of phase 3 so that the application providers from the industry sectors can validate their application scenarios in a representative environment.

## 9. Positioning the PPP in the ERA

In relation to other programmes, the PPP calls are encompassed within the R&D area, and they must be prepared as impact-oriented projects, in a way to complement with the challenges of FP7 and FP8. In addition, their orientation to impact must not drive to locate them outside the R&D area, and hence without any overlapping with the CIP programme. In parallel many of the longer term research programmes under the 7<sup>th</sup> and 8<sup>th</sup> framework programmes should obtain inputs from the FI PPP and be able to build on the results.

The way FI PPP interacts with the challenges of the ICT theme such as Challenge 1 (Pervasive and Trustworthy Network and Service Infrastructures) and Challenges 4 (Digital Libraries and Content), 5 (Towards sustainable and personalised healthcare), 6 (ICT for Mobility, Environmental Sustainability and Energy Efficiency) and 7 (ICT for Independent Living, Inclusion and Governance) is straightforward. The FI technology will come from the Challenge 1 projects and subjects, and will evolve in the PPP so it prepares applications for a set of subjects, some of which might be related to challenges 4, 5, 6 and 7. However, none of the applications to be developed will enter into conflict with the vertical themes under construction in challenges 4, 5, 6 and 7.

In addition, the connection between FI PPP and large ongoing initiatives such as Green Car PPP, Energy Efficient Building PPP, Factory of the Future PPP, ARTEMISIA or the Ambient Assisted Living (AAL) programme, will be thoroughly explored and defined. The infrastructure under development in the FI PPP will be the ICT basis for the services for a variety of application fields including the ones addressed by the initiatives mentioned above.



## 10. Work with us.

The European Future Internet Initiative is open to all interested organizations seeking to work on the development of this programme of activities.

During the first half of 2010 we will be publishing some documents as Requests for Comments as well as inviting active contributors to participate in discussions.

Throughout 2010 there will be a series of workshops to discuss what can be achieved under this programme and how we can address the challenges together.

**Our goal is to establish a Future Internet pan-European coordinated partnership that will bring about clear benefits for Europe. Our aim is to reinforce and boost the competitiveness of enterprises and administrations, create new economic opportunities, while empowering innovators and citizens to benefit from the future Internet.**

You can register to follow the EFII activities at:

<http://initiative.future-internet.eu>

Ask us questions via: [initiative@future-internet.eu](mailto:initiative@future-internet.eu)

