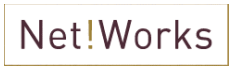
A Cross-ETP Vision for an Innovative Digital Europe



The cross-ETP Vision for an Innovative Digital Europe

This document puts forward an inspiring, cross-ETP vision for an Innovative Digital Europe of all European Technology platforms specialising in ICT (Net!Works, NEM, NESSI, ISI and Photonics 21) and a set of recommendations and actions at European level to deliver this vision and support the realisation of the European Digital Agenda and Innovation Union.

The cross-ETP stakeholders are firmly convinced that public initiatives, such as the European Commission's ICT Framework Programmes, should continue to be part of the EU's Common Strategic Framework Horizon 2020, as they form a powerful and effective instrument to profoundly foster European research, development, and innovation activities to address sustainable growth and respond to the societal challenges.

This paper includes the vision, major scientific and technical (S&T) and innovation areas to deliver this vision as well as the impact these will have in accelerating the delivery of an Innovative Digital Europe. The appendix provides a summary of each of the major S&T themes.

Recommendations

1. A FUNDING PROGRAMME DEDICATED TO THE ICT SECTOR

Strengthen the ICT sector with a dedicated and increased funding program at European level. Agenda-driven and challenge-driven research shall be balanced through a single source of funding based on existing PPP, IP, STREP and CSA instruments. The focus shall be given to innovation on ICT service infrastructures and the building blocks to enable the provision of new services and usage.

2. INNOVATION PARTNERSHIPS

Build EU Innovation Partnerships through ETPs and our Innovation catalysts; including business schools, venture academies and mentors, living labs, coaching professionals, the art and design sector as well as non-profits and social entrepreneurs.

3. SUPPORT SMES IN RESEARCH

Improve access to public funding and research programmes for innovative SMEs, create research programmes suitable for SMEs, simplify instruments, increase technical, admin and financial supports and sharing of best practices.

4. SIMPLIFICATION OF THE CURRENT SYSTEM

Establish a bridge between the cooperation programme and the Competitiveness and Innovation Programme (CIP) and drive pre-commercial public procurement. Foster the interlinking of innovation initiatives across Europe in strategic domains (i.e. cloud, security).

5. STANDARDS DEVELOPMENT

Encourage standard development to allow easiest market access and create a consistent European data privacy legal framework.

6. A MAJOR ROLE FOR A COMMON XETP VISION

The EC as well as the public sector should introduce accompanying measures to realize the common cross ETP vision for an innovation Digital Europe such as public procurement which could play a major role.

1. The Cross-ETP Vision for an Innovative Digital Europe

As Commissioner Kroes underlined in her speech in Cologne on May 17th 2011, "Europe needs growth. And in my view ICT investment is the best way to achieve it and spread it relatively evenly". ICT is recognised as a key enabler for economic growth and social progress. Putting ICT in support of addressing European societal challenges by making use of a connected world and the exponential growth of digital information is essential. Indeed, to the increasing importance of ICT for the individual corresponds an increasing possibility to address wider societal challenges with the help of ICT. The number of global Internet users is expected to reach 3 billion by 2020 and this will be complemented by trillions of devices, sensors and machines. A significant potential is expected from this and it is strongly supported that Europe leads ICT R&D and innovation efforts in this direction.

So far European ICT industry has been the indisputable world leader in some ICT areas but the competition is fierce. Therefore, it is important that Europe provides the necessary public support to its ICT stakeholders, i.e. industry, SMEs, and academic institutions so that they remain at the world leading edge of research and innovation –as this is the main condition for staying ahead globally in the years to come. With this, Europe would be able to continue:

- Develop its competitiveness and reinforce its industrial base;
- Ensure its technology independence, especially for infrastructures supporting institutional objectives;
- Foster the integration of ICT technologies (fixed, broadcast, mobile through terrestrial and satellite networks) and also ICT technologies with others in order to best address societal challenges among which the Europe's digital broadband gap, the security of EU citizens and their goods (land, maritime, air, external borders), the dealing with ageing demographics, the efficiency of European energy grids, the productivity and sustainability of health care systems;
- Develop critical skills in Europe for the design, manufacturing and exploitation of ICT systems and services.

Europe needs to continue working on its leadership for a **Connected and Smarter Society**. A Connected Society means that everybody and everything is connected to a network, whether fixed, mobile, or satellite, whenever relevant and whatever the location. This paradigm will open many new opportunities for European business and citizens, as they would provide and have access to a great number of innovative applications and services that need to be addressed in the coming years. Continuity of service would also have to be offered to meet the demands of end-users.

A connected and smarter society			
Connecting transport	**Connecting the energy and environmental monitoring sectors**	**Connecting health applications**	**Connecting 'things'**
Networking technologies have been a key enabler in the development of Intelligent Transport Systems, providing a more effective and	The ability to securely collect data and disseminate information while staying conformant to numerous policies, providing widespread	Health informatics and telemedicine are among the key areas of innovation in the health and social services sector.	Connected things will be able to provide information that will enrich existing content. - Online content storage - 3D videoconferencing

efficient use of road infrastructure. - Urban and road traffic control; - Efficient trip management; - Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications; - The mobile office - Security, trust and privacy and resilience	access to a knowledge data base and an efficient means of monitoring quality of the environment for the general public is of significant importance to society. - Monitoring environmental parameters - Providing the means to have alarms e.g. in case of floods, fires, volcanoes eruptions, etc. - Efficient resources management - Technology waste	- Future wireless diagnostic and disease management systems; - Hospital consultation and emergency scenarios; - Assistive technologies; - Well-being and personalisation.	- Tele-immersion

An innovative Digital Europe shall also be aiming at supporting a **Knowledge Society**. This relies not only on a Connected Society but also on using efficient means for managing, processing, storing, recovering and communicating information digitally.

A knowledge society		
Content availability	**User interfaces and immersive experiences**	**User and usage data**
The amount of new audio-visual content created by professional, "prosumers" or anybody is increasing rapidly (User Generated Content). - Finding truthful content; - Quality content available to all (young, elderly, people with or without special needs).	With an aging population, the shift towards intuitive user interfaces, 3D and beyond HD experiences opens up many new opportunities for business. - Connected TV as an open platform; - New applications and services to the home.	The next challenge is to make it easy for Internet users to access in a secured way the massive quantity and diversity of information available on the Internet with the best quality while preserving digital rights when they apply. - A user-centric Internet of services; - Access to all types of information (health, transportations, pictures, music, movies, power, sensors, social….)

There is a need to put ICT in support of a changing life and working style in Europe – by **making ICT contextual & personal**. An Innovative Digital Europe will see advanced services that are people centric and personalized instead of being centered on one activity sphere. Preserving privacy, protecting security and achieving trustworthiness of services as well as guaranteeing service continuity over lifetimes will be essential in the context of the new powerful and personalized service environments of a Digital Europe, therefore putting **ICT in support of the security, trust and privacy needs of the Europeans.**

The complexity of the underlying ICT service environments is significantly growing in order to reach this vision. It needs to be a priority for the whole ICT industry to create an experience of services as being accessible, seamless, smart, adaptable and personalized. **Put people and purpose first, and increase the "invisibility" of ICT**, is another great challenge ahead of us.

2. Major S&T areas to deliver cross-ETP vision

The cross-ETP vision implies a next generation of fundamental ICT advancements. They are further described in detail in the Appendix. In particular the cross-ETP group wants to highlight the need to:

- Boost access networks bandwidth ;
- Provide true ubiquitous personal mobile broadband ;
- Provide trusted and resilient services across heterogeneous networks;
- Support the connection of billions of sensors, actuators and smart items;
- Advance generic software and service technologies – including cloud computing and the foundations for trust, security, privacy and resilience;
- Build the basis for the Future of Media and Content– including the exploration of new user involvement means such as immersive, personalized and collaborative media;
- Develop and/or deploy future telecom capabilities to support EU institutional missions.

Realizing these important goals requires a coordinated approach to core areas of ICT research – such as on future networks. As experience in the past thirty years has shown, the development of a new generation of network technology needs to start about 10 years before the introduction of new services to consumers is possible. Also fundamental software and service technologies usually start to become developed 5 to 10 years ahead of wider introduction into the market. I.e. the boost of commercial cloud computing has significantly benefitted from the technological basis laid by research and developments on grid computing, service oriented computing and virtualization as done in the past decade.

Research needs to start now to have a new generation of networks ready for use in the years beyond 2020 ensuring that the networks can support the traffic which applications will be generating by then. The same applies to supporting fundamental ICT technologies – where we can expect a multi stage introduction to the market. European research – i.e. on immersive media technologies, Internet of Things core technologies or federated clouds – is well ahead of the market now and it is essential for the European ICT industry to maintain and further develop this position. This research should be technology driven.

At the same time, research has to be undertaken to integrate the new generation of networks, service and media technologies being introduced for commercial use in the time period up to 2015 with applications addressing the societal challenges of ensuring efficient transport systems, sustainable energy supply and support services for the ageing population.

This research should be challenge driven. Both the technology and the challenge driven approaches are needed and they should take place in parallel programmes both aiming to have commercial systems in operation in the 2020 timeframe:

- **Technology-driven research** aiming at introducing new communications systems and fundamental advancement of ICT core technologies – e.g. service, media technologies or privacy & security - in 2020

- **Challenge-driven research** aimed at introducing new applications systems in 2020, integrating communications systems being introduced in the next few years for commercial use.

The strategic technologies identified by the cross-ETP group (see Appendix) in relation to these two approaches are those that Europe ought to invest in for the next 10 years, to generate a high European impact on global Future Internet solutions and standardization and on job creation in Europe.

While 5% of European GDP is generated directly by the ICT sector, over 50% of improvements in the efficiency of business processes is based on the introduction of new ICT technology. Such an approach would enable Europe to reap the maximum economic benefit from the huge investment in mobile and wireless network technology development and network deployment already made in Europe.

High impact research will require an efficient methodology and approach. The research methodology should build on the success of Europe's past and current collaborative research programmes, involving stakeholders from both industry and academia. This should be complemented by the use of Europe's well-known and unique research approach to future systems, which is based on ensuring a holistic, end-to-end approach to developing integrated and efficient solutions, whilst minimizing interoperability problems.

All European approaches to undertake core ICT research should aim to maximize the impact of results and form good differentiating factors when compared to research approaches in other regions of the world.

Research should be supported and conducted in a multidisciplinary fashion, both within the communication and networking technologies sector, (encouraging collaboration between radio, signal processing, networking and services specialists), and in parallel, between the disciplines of Information and Communications Technologies (such as software and services, new media technologies, security & privacy) and those of the health, transportation, energy, environmental monitoring and control other utility services sectors. So it is essential to provide for an intense alignment between the two parallel programme strands as defined before.

3. Major Innovation challenges to deliver cross-ETP vision

The ICT sector is a key for Europe to remain competitive and lead innovation globally, and must be strengthened by substantial, dedicated funding at European level. This should include the use of ICT technologies and research outputs, as well as design-driven and business model innovation, which will help fast-track solutions and deliver innovative products and services.

A. Innovation Partnership: from ETP Value-chain to ETP Innovation-chain

ETPs are leading a move geared around both the European grand societal challenges and the ICT sector. The full research and innovation cycle must be supported by strengthening the role of collaborative projects, placing emphasis on ICT technologies along with the integration of ICT generic and specific components supporting multi-disciplinary research (energy, transport…).

ETPs cover the whole value-chain across ICT sectors and are uniquely place to create powerful innovation ecosystems by engaging innovation catalysts that complement this value-chain, leading a move towards Technology and Innovation Platforms that can help fast-track innovation for Digital Europe.

This involves engaging new catalysts and improve links between them, including: **business schools** (that complement the high quality of academic members and innovation fora); ***venture academies and mentors*** (to help SMEs and start-ups); **coaching professionals** (to help organizations, executives and growing SMEs to deliver business and broader Innovation, and accelerate high-growth); **testbeds and living labs** (to test innovations in Large Scale User Trials).

Fostering academic excellence in Computer Science and related disciplines – in particular in the emerging domains of an Internet and Service science – and supporting students and workforce in the acquisition of key complementary competences such as on managing innovation, digital business building and entrepreneurship is a key element in supporting Innovation in Europe. Support continuous training through virtual campus.

We also believe that the **cultural, art and design sectors** are key catalysts in building innovative products and services and increasing user acceptance. We can help engage these communities with our members and together with key stakeholders from **non-profit and social entrepreneurship sectors** in an inspiring and results driven way.

B. EU Funding instruments and legal aspects for Innovative Digital Europe

To realize the cross-ETP vision for Innovative Digital Europe we need dedicated ICT sector funding and powerful instruments for the future CSF. ICT sector depends upon intense, usually interdisciplinary, research efforts, and requires significant investments. Future breakthroughs depend on the clustering of players drawn from across Europe. The CSF must provide a single source of funding for projects in order to give the consortia certainty if their proposal is accepted.

ETPs can be instrumental to help improving European regulatory framework conditions for Digital Innovation and Standardization, for example to push, and when feasible, coordinate pre-standardization efforts.

The European regulatory framework needs to**:**

Support global ICT standards and interoperability by identification and policy support of *strategic* **standardization areas and quality criteria for standards** (e.g. regarding openness) ;

Foster the **interlinking mechanisms between innovation initiatives** across Europe – in particular between EU, national and regional initiatives – on identified *strategic innovation domains* such as cloud computing, security and *societal challenges ;*

Drive the implementation of a balanced, clear and consistent European **data privacy legal framework** *;*

Coordinate, monitor and share European data to address cyber-security and fight against cyber-threats (e.g. crime).

4. Impact

Impact on the European ICT industry

The software and services that provide the fundament of an Innovative Digital Europe represent significant direct business growth opportunities and a multi-billion Euro market for the European ICT industry. According to IBM market insights[1], just e.g. the cloud-computing segment of the global ICT services market could reach 125 billion Euros by 2015 and the emerging big data analytics segment another 12 billion Euros by the same time. An attractive market environment, regulatory framework and talent pool will also further attract global ICT companies to concentrate investments in Europe.

Today, optical communications represent a large market with a stable annual increase of approximately 10%. The significant share of European companies in this dynamic sector of economic activity is reflected by the presence of major European companies, a large number of SMEs, and hundreds of thousands of European employees. Investing in emerging photonic technologies for communications is a strategic choice of major significance to ensure that European industry retains its current market share and further consolidates its leadership. Indeed, the development of broadband applications and services supported by advanced photonic techniques and infrastructures is expected to have in turn a major impact on the economic growth and productivity of European economies in a broader sense.

Impact on ICT user industries

Making Europe the leading market for applied Digital Innovation and a strong alignment with Digital Innovation in the public sector will also foster innovation in other industries and enable them to create their next generations of services – such as the energy sector or the health care industry. Creating an Innovative Digital Europe will also ensure to maintain leadership in many more traditional industries that increasingly depend on ICT for their innovation.

Societal impact

An Innovative Digital Europe will also have a strong impact on societal challenges. This is due to a new level of connectivity and networking between devices and data-sources on the one hand and people on the other hand. ICT technologies will have a significant societal impact in diverse areas such as education, sustainable health, social care and e-government, including the direct participation of citizens in the democratic process.

In summary, ICT technologies are a key contributor to the societal challenges, specifically in 6 domains:

- Transport and mobility;
- Healthcare;
- Digital literacy, skills and inclusion (content);
- Security;
- Energy;
- Environmental monitoring.

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[1] *IBM Market Insights Cloud Opportunity Phase 2 Assessment, Sept 2010. See Presentation „Channel Strategy" by IBM VP Melinda Clarkson under http://www-05.ibm.com/ch/presentations/profit_event/. Furthermore, the European Cloud IT Opportunity is estimated by IBM to 40 billion Euros by 2015.*

Ecological impact

It is now widely recognised that reducing the level of global energy consumption is of paramount importance. The ICT sector and advanced photonic technologies offer significant advantages towards achieving this goal. Currently, the total energy required to power the Internet, including data centers, network nodes and user terminals, amounts to about 4% of today's electricity generation. With Internet traffic doubling every 18 months, a 64-fold increase in the Internet's total power consumption is expected in less than 10 years, and this would require a more than doubling of the required total capacity for global electricity generation! Effort shall be spent to achieve substantial reductions in energy consumption and fight against climate change. Clearly these major environmental improvements will be accompanied by a pronounced advantage to the economies that lead this technology development: Europe should embrace and further enhance its leading role.

Appendix: Key ICT S&T Areas to deliver the cross-ETP vision

This appendix outlines the key ICT science and technology areas that need to be addressed at a European level to deliver the cross ETP vision. We suggest that they should also form the backbone of a specific ICT workprogram in the CSF. Further detail on each of the areas can be found in the Strategic Research Agendas of the ICT ETPs of this cross ETP Group.

1. Boost access networks bandwidth

Much as petroleum was viewed in the past, bandwidth is now understood to be the "blackgold" of a future that will require our technologies to offer bit rates to end users that may be up to 1000-fold higher than can be obtained with today's DSL solutions. Disruptive photonic, wireless and satellite technologies will, over the coming decades, be key enablers for revolutionary advancements in the telecom and datacom fields across the world. S&T areas that will help Europe to boost network bandwidth:

- **Novel components, architectures and systems for the optical wide-area, access and home networks** that will enable efficient exploitation of available bandwidth, provisioning of diverse services, low-cost network operation, security and low bandwidth.
- **Novel approaches for increasing the capacity of the optical fibers**, such as the usage of advanced multi-core fibers, new multiplexing techniques exploiting the multitude of modes supported by novel optical fibers, and the exploitation of advanced modulation formats.
- **New materials and advanced integration technologies for photonic components and subsystems.** Large-scale integration represents the only way for photonic circuits and subsystems to meet the requirement to support advanced functionalities in a reliable and cost-efficient way, thereby meeting energy reduction and bandwidth enhancement challenges.
- **Novel optical techniques for signal processing.** All-optical techniques have the potential to achieve data processing speeds up to 1000 times faster than what is achievable with conventional electronic signal processing, and so represent a key approach to reach the multi-terabit per second regime. Novel techniques, enabled by the development of new materials, will have the potential to extend the speed of operation even further, together with achieving a simultaneous reduction of power consumption.
- **Optical interconnects:** The amount of information exchanged today in modern data centers is already creating serious bottlenecks for information transport. The incorporation of thousands of servers has created the need for transferring massive amounts of data between server racks, calling for the implementation of broadband connectivity using photonic interconnects. Optical interconnects within systems represent the disruptive technology that will eliminate capacity bottlenecks by penetrating into board- and chip connectivity and ultimately into the chip itself. For example, bringing 'light-into-the-box' will be critical to achieving skew-free distribution of clock and data signals, even at ultra-high speeds between different subsystems, and will bring us one step towards the all-optical machine.
- **High Throughput Satellite Communication systems** that will enable to address low density populated areas and ensure broadband access to 100% EU citizens.

2. Provide true ubiquitous personal mobile broadband

Ubiquitous personal mobile broadband services will require cost-effective and resource-efficient technologies, such as **self-organisation**, **cooperative and collaborative advanced**

techniques, **new cell deployment strategies** with special emphasis on **small cell technologies**, and **advanced signal processing techniques** that will make use of interference and convert it into useful signals.

- **Small cell technologies** with self-organising and managing capabilities, together with efficient hybrid systems of fibre optics, satellite and wireless links, should be considered as a way to deliver high capacity and energy efficient broadband mobile communications.
- More emphasis should be put on system level research and innovation with integration and optimisation of **advanced multi-cell, multi-user and multi-networks cooperative techniques** that collaborate and operate cognitively.
- **Cognitive radio and cognitive networking systems**, together with network resource virtualisation and information-centric networking will form the salient features of next generation mobile and wireless systems.

3. Provide trusted and resilient services across heterogeneous networks using fixed, broadcast, mobile terrestrial and satellite networking technologies – ultimately leading to The Future Internet

The availability of these basic building blocks of the Future Internet, together with already extensive worldwide connectivity, purpose designed quality of service mechanisms, efficient mobility management, robust security schemes, and efficient support of other domains mean that mobile and wireless networks can meet future user requirements. The Future Internet will evolve from the current Internet, integrating new clean slate solutions, which will probably first be implemented as pilot scale deployments, before they are integrated into the mainstream public Future Internet. In particular this will result in an efficient convergence of different networks that compose the Internet including mobile, wireless and fiber networks.

- **Heterogeneous network architecture** based on fixed, broadcast, mobile technologies through terrestrial and satellite networks will deliver **resilient and trusted services in a transparent manner** to the user while taking advantage of each ICT technology specific properties
- Such future systems will have to be **"cognitive and intelligent"** with the capability for **autonomous adaptation** and configuration enabling **local optimization**, **whilst achieving global system stability and optimisation** in a distributed architecture.
- **Complete network resource virtualisation**, coupled with intelligence and cognition mechanisms, are essential features of a fully cognitive system. Cognitive operation requires mechanisms for capturing the appropriate information and its' efficient utilisation ensuring.
- The information needed to (autonomously) self-manage, heal and optimise systems includes **"user, environment, network, devices" contexts and profiles**. The context information and profiles are essential for providing true personalized services at the right time and location, and, generally speaking, in the appropriate context instances.

4. Support the connection of billions of sensors, actuators and smart items

Complementary to the increasing capacity and complexity of the heterogeneous networks that build the Future Internet - is the exponentially growing number and diversity of devices that are connected to it.

Most elements that have been described in the cross-ETP vision demand indeed a significant advancement with regard to integrating new smart devices – i.e sensors in such diverse application areas as personal health, energy or environment information - as endpoints into the Future Internet.

This not only implies technical challenges springing from the individual connection needs of different families of devices (i.e. those requiring real time data processing) but also includes many concerns on the Internet level such as managing the address space or handling the massive data flows expected in this context.

In fact, as much as limited Internet connectivity to diverse smart devices is already working on the small scale – this **scale-up towards an Internet of Things** is a major scientific and technological challenge.

5. Advance generic software and services technologies – as the basis for advanced services in the Future Internet

Of equal importance to the networks and the integration of devices in the Future Internet are the higher-level software layers that truly leverage the capacities of this increasingly complex ICT environment to realize advanced services – as those laid out in the cross-ETP vision.

Again a major concern here is the scale-up. Significant scientific and technical progress in ground level software and service technologies has to be made in order to leverage the application capacities of the Future Internet.

Fundamental S&T areas in this context are:

- **Service Usage** - Technologies that change the ways in which users can interact with services *(e.g. to improve personalization, intuitive and seamless use of services)*
- **Service Infrastructure and Cloud Technologies** – Infrastructure and cloud technologies to build Internet-scale services *(e.g. to manage hybrid or federated cloud infrastructures)*
- **Security, Privacy and Trust** – Provide the foundations for secure, reliable, resilient, compliant and trustworthy services in the Future Internet (e.g. to increase usability and user-centricity or to manage trust, privacy protection and identity across multiple service providers)
- **Service systems analysis at Internet scale** - New methods, approaches and technologies to analyze complex service systems (e.g. with regard to usage patterns, the petascale-data processed in the these systems or the analysis of their complex interoperability requirements)
- **Service Engineering** - New methods, approaches and technologies to design and implement complex Internet-scale services
- **Software Engineering** - New methods, approaches and technologies to design and implement software components that will power this new generation of services (e.g. with regard to new approaches to software requirements engineering, design, construction, test and maintenance)

6. Build the basis for the Future of Media

The global evolution of people's perceptions regarding networked electronic media technologies (devices, services, etc.) leads to new possibilities for future media. This includes electronic media to become:

- **More immersive:** 3D, augmented and virtual reality, holographic for entertainment content as well as video-conferencing and games should take advantage of these new technologies.
- **More personalized**: people having access to more and more information and access to the right information at the right moment, need more generalized context awareness and information profiling and filtering. In addition, information is becoming obsolete very quickly, so there is also a need to propose information rating services.
- **More collaborative:** people are used to communicate and share content through social networking and to work more and more in a collaborative way. This implies that a combination of content sharing and interpersonal communication services becomes necessary.
- **Anything, anytime, anywhere on any device:** People use several types of devices depending on location and personal context. There is a need to be able to provide any service on any type of device, whatever the connectivity.

7. Continue to evolve the European Regulatory Environment in support of an Innovative Digital Europe.

New ICT technologies are creating new issues of regulatory concern and a closer alignment between the scientific and technological development and the regulator development is needed. An excellent example for such as proactive regulatory strategy is the current initiative for a European Cloud Strategy by the European Commission.

Whereas Internet innovation mechanisms so far have certainly always benefitted from a limitation of regulation, we are expecting that the cross-ETP vision will imply further areas where proactive collaboration between ICT ETPs and European regulators will be necessary in areas such as data security and personal privacy when dealing with digital data or preserving net neutrality. This should be done while balancing the growing necessity for Future Internet regulation with the potential effect on its innovation mechanisms.

A more intensive dialogue is needed between experts on technological and application-level trends and experts on European legal and regulatory issues. It is in this context essential for Europe to further build scientific capacity and drive global excellence in the domains of digital and Internet law as well as socio-economic analysis.

8. Foster a next generation of digital Skills and Education

Education is a basic pillar and starting link of the innovation chain. The future shape of higher education will be influenced by new structures and new business models, enabled by information technology. New models for education are needed as students become more diverse and as learners' needs expand across a lifetime, more flexible models for education are emerging. Online learning and accelerated programs provide greater flexibility than traditional campus programs. To promote international exchange, transferability of credits from one institution to another becomes necessary, as time-to-degree increases and lifelong learning grows.

New educational programs should be created, with new profiles and fields of expertise, aligned to the innovation strategies of the cross ETP vision. The basic target is to obtain new professionals with a deep knowledge of the wide ICT sector, its needs, closer to the market,

with a special emphasis on the needs of innovation and creativity, to promote the development of new systems and new services, according to the social evolution.

9. Develop and/or deploy future telecom capabilities to support EU institutional missions

The seventh meeting of the Space Council held in November 2010, acknowledged "the reinforced EU engagement in security and defense matters embedded in the Lisbon Treaty and the setting-up of the European External Action Service" and invited the European Commission, the EU Council, assisted by the European Defence Agency (EDA), together with Member States and the ESA "to explore ways to support current and future capability needs for crisis management through cost-effective access to robust, secure and reactive space assets and services (integrating global satellite communications, Earth observation, positioning and timing), taking full advantage of dual-use synergies as appropriate.".

In line with this, some efforts shall be spent to research and develop heterogeneous satellite/terrestrial network solutions offering adequate service capabilities (safety broadband communications) to support institutional security missions among which crisis management, external security actions, critical infrastructure protection, transport security, maritime and border surveillance.

Such heterogeneous network infrastructures combined with navigation and earth observation assets will enable to meet the EU objectives in security.