Joint 5GIA-AIOTI Vision on Future Networks, Services and Applications –

High societal and economic impact potentials for a collaborative approach in the Horizon Europe Programme

Version 1.0

Introduction

The world is experiencing rapid technological advancements enabling many new applications in various application domains. Those are often designated as 'Smart' thanks to the application of many devices, information and communication technology, artificial intelligence, systems of systems, cybersecurity, robotics and data analytics in a real time connected fashion. They can be regarded as the constituents of 'Internet of Things', Digital Society and 'Big Data'.

ICT in general and networks (mobile and fixed) in particular is a fundamental enabler of a modern society. The Smart Networks of the future will be the nervous system of the Next Generation Internet and other commercial networks and are the platform for driving the digital transformation. Future communication systems and networks are the foundation of the Human-Centric Internet and the enabler for the future data economy. They provide the energy-efficient and high-performance infrastructure on which a multi-service Next Generation Internet (NGI) and other digital services can be developed and deployed. Smart Networks will apply intelligent software (Artificial Intelligence) for decentralised and automated network management, data analytics and shared contexts and knowledge. By virtualisation and strict policies, they will foster a free and fair flow of data which can be shared whilst at the same time protecting the integrity and privacy of data which is confidential or private: Users should be able to control their environment in the Internet and not be controlled by the Internet.

Examples of 'Smart' application domains, supported by a smart and multi-service Next Generation Internet are:

- Smart Cities, addressing the challenges in liveability and sustainability of large cities
- Smart Living, addressing amongst others the challenges of an (aging) society and healthy living, supported by wearable devices, robots and intelligent home control
- Smart Farming, addressing efficient and sustainable food production and traceability
- Smart Industry, enabling efficiency, flexibility and automation transformations in manufacturing
- Smart Energy and Smart Water Management, addressing optimisation of resources
- Smart Mobility including connected vehicles creating solutions for the increasing transportation challenges
- Smart Buildings, creating functional buildings with minimal ecological footprint

The overall 5GIA vision already provides a first big step towards the digitalisation of society and economy. The ICT community (e.g. in ITU-R) is supporting three main pillars:

- eMBB: enhanced Mobile Broadband,
- URLLC: Ultra-Reliable and Low Latency Communication and
- mMTC: massive Machine Type Communication (IoT).

Many proof-of-concept demonstrations have been successfully provided and early large-scale trials are under development oriented towards and engaging a range of verticals. This early momentum should be continued and broaden. Europe has great opportunities but also challenges in engagement across industries and stakeholders to further progress the new smart networks and services solutions, business model enablers, and the application and service delivery platforms on top of it.

A Smart Networks and Services program will further advance the development of technologies that requires close linking with the application domain for many different use cases and sectors. Enabling technologies and infrastructures such as next generation networks require considerable investments, justified only by future applications that will utilize these networks. The required characteristics of infrastructures will strongly depend on the applications e.g. in real time. On the other hand, those applications can only be demonstrated in real scale and subsequently be commercialised when the required communication networks are available.

While the deployment of GSM, which was extremely successful for Europe, was justified by a relatively straightforward application in mobile phone calls, the deployment and expansion of 5G networks and beyond and Next Generation Internet depends on a very complex field of potential applications and ecosystem development for which the business cases of many individual applications are under development or to be developed.

The key success factors for the deployment of Internet of Things and its applications go beyond the technological and functional aspects of use-cases. Increasingly factors such as privacy, security, resilience, flexibility, and portability are becoming critical and they are essential for building 'trust' in digitalisation of society and economy by means of Smart Networks and Internet of Things with end-users.

More than ever:

The viability of infrastructures critically depends on their applications
and the viability of applications critically depends on infrastructures

However, there is still an approach that is scattered over functional and application domain entities that need better connection and cooperation.

Europe is facing severe competition in the digital era. Whereas other regions in the world have large home markets and feature very strong software and application platform driven companies driving an end-to-end approach from technology to applications or feature a strong government lead approach, Europe is characterised by a wide diversity and lacks a multinational software and application platform approach and end-to-end approach in many domains. But at the same time Europe is strong in relevant research and development in many industrial sectors. Due to the fragmentation of the European market and a lack of appropriate investment-friendly conditions to develop a real digital single market, Europe is facing a deployment challenge of new technologies and services and applications.

However, this drawback could also provide an opportunity as increasingly we see concerns with consumers, businesses and governments becoming aware that they are becoming locked in to monopolistic approaches in the software and application domains while aspects of privacy, security,

resilience as well as innovation enablement may also require a new, more distributed approach. To make such an approach strong and successful, awareness and strengthening of ecosystem development and facilitation becomes crucial, including the joint development of standards that are required in new and sector specific areas.

If Europe is able to orchestrate such a collaborative, distributed end-to-end approach which unites the diversity of individual citizens, regions and countries in applications, a much stronger and sustainable human-centric Internet and Internet of Things with its applications in a digital society could emerge.

A strong collaboration and leverage of partnerships under the Horizon Europe would provide a strong impetus.

5GIA and AIOTI

The 5G Infrastructure Association (5GIA) is an industry driven association which plays a key role in the definition, research, development, standardisation and deployment of future communication infrastructures, that are crucial for not only exponentially increasing exchange of information, but also for the implementation of the Internet of Things (IoT).

5GIA is participated by top European players of the ICT value chain governed by an elected Board in which Industry, Academia and SME are represented. In the 5G PPP, the 5G Infrastructure Association (5GIA) represents the private side and the European Commission the public side. The 5GIA is committed to the advancement of 5G in Europe and to building global consensus on 5G. To this aim, the Association brings together a global industry community of telecoms & digital actors, such as operators, manufacturers, research institutes, universities, verticals and SMEs. The 5GIA carries out a wide range of activities in strategic areas including standardization, frequency spectrum, R&D projects, technology skills, collaboration with key vertical industry sectors, notably for the development of trials, and international cooperation.

5GIA also recognises and addresses the need for stronger vertical engagement of application domain stakeholders in order to get the requirements clear from an application perspective and raise the awareness of 5G potential. To this respect a special Task Force within the Board was put in place to provide guidance on vertical engagement activities.

The Alliance for Internet of Things Innovation (AIOTI) is a member-led organisation that brings together a wide range of stakeholders. AIOTI is very much application driven and aims to strengthen an integrated approach across the digital value chain to accelerate IoT deployment in Europe. To that end, AIOTI features horizontal working groups, addressing common elements in technology, ecosystems, socio-economic and legal aspects and standards adoption and interoperability and vertical working groups driving adoption of IoT innovation in application domains such as living, farming, manufacturing, cities, mobility, buildings, energy and water.

AIOTI provides a thought leadership forum in which global, EU and Members States' IoT innovation activities can be mapped and bridged, best practices can be shared and where collaboration across silos is promoted so that the market for IoT can function effectively and the technology can add value to business and society.

AIOTI co-operates with several other organisations to ensure that the barriers to the development of the IoT market can be eradicated, while European values, including privacy and consumer protection, are maintained.

Horizon Europe

For the upcoming framework programme, Horizon Europe, the EC has defined strong ambitions, particularly in the digitalisation of Europe and the creation of a digital single market. The program will be more mission (outcome) based than before, as technology stimulation only is not enough to create market adoption and a positive socio-economic outcome. Both AIOTI and 5GIA / 5G PPP are very much engaged in this approach while the Smart Networks and Services vision is built on a top-down approach recognising the following key elements:

- United Nations 2030 SDGs (Sustainable Development Goals) require Smart Networks in many different domains to support the digitalisation of society and economy in developing and developed countries

- ICT in general and ubiquitous and affordable communications networks (enabling mobile and fixed use) in particular is a fundamental enabler of a modern society

- Smart Networks of the future will be the nervous system of the Next Generation Internet (NGI) and other commercial networks and the platform for driving the digital transformation of vertical industries (providing smart connectivity to economy and society)

- Smart Networks and Services are the foundation of the Human-Centric Internet

- From supercomputers and parallel computers, to data analytics, passing through cybersecurity, the Internet of Things (IoT), cooperative robots, or autonomous vehicles, it is universally agreed that every system and application must be interconnected to its peers, as well as to other related entities and systems

- Interconnection of everything provided by Smart Networks will be a distinguishable flavour of a competitive advanced society

- Smart Network architecture will be software defined and will provide features significantly going beyond connectivity in services, edge computing, virtualisation functions, Artificial Intelligence, Machine Learning etc.

Clearly the Internet of Things represents one of the largest innovation areas in the coming decade and is also addressed in the mMTC pillar of the 5G vision. It fuses many technologies, devices, systems and data in applications that will have to contribute to a sustainable, safe and secure, healthy and prosperous future society. The Internet of Things will build on advancements in semiconductors, photonics, sensing technologies and embedded systems for the 'things', on the creation of next generation information and communication platforms such as 5G, next generation internet, and beyond and it will generate massive amounts of data providing input for hypercomputing and enabling new applications in services, robotics, artificial intelligence and 'smart' systems of systems. In the years to come, the application of IoT will be an essential component in the digital transformation of all

industry sectors, which is currently on-going. Such transformation process is having an impact not only in high-tech sectors, but also in those sectors where digital technologies have been traditionally less present.

However, the success of IoT is not guaranteed by state-of-the-art technology and infrastructure but critically depends on its deployment in application domains and acceptance in society in general. There are many concerns with industrial and societal stakeholders related to

- Business cases and identification of relevant use-cases

- Privacy, security, resilience of IoT systems and applications

- Legal and liability aspects

Resolving these potential inhibitors of the development of an economically viable, human-centric Internet/IoT requires a strongly integrated approach that is reflected in AIOTI's mission

- Creating sustainable innovation ecosystems (collaboration platforms) that both large and small companies can access and benefit from

- Connecting people working in technology, infrastructure and horizontal domains (legal, socio-economic) with people working in application domains, establishing sustainable collaboration platform, supported by technology platforms with common standards and interoperability

- Stimulating experimentation and supporting the further development of digital innovation hubs (DIHs) with a focus on SMEs

- Support mechanisms for industrial investments in enabling technologies and their applications such as Large-Scale Pilots and innovative procurement

- Addressing education of stakeholders and securing early stage involvement of end-users in IoT innovation, improving the development of relevant use-cases and business cases

- Paying more attention to non-functional aspects of digitisation/IoT, including liability and supporting the development of distributed systems and intelligence for resilience, safety and security

- Earning trust with end-users and society at large

The Horizon Europe programme assumes a strong alignment and collaboration along the value chain for its success. Collaborative platforms and ecosystems need to be established and that is why the number of European partnerships under Horizon Europe is expected to be strongly reduced compared with Horizon 2020. Those partnerships will then require a much more integrative approach combining e.g. technology, platform and application stakeholders and stakeholders from multiple application domains.

The new partnerships provide a strong opportunity for industry to speed up innovation to market, avoiding working in silos that individually could not have sufficient impact and to gain experience working in ecosystems in a precompetitive phase that will pay off in commercial networks. It provides a unique opportunity to meet future suppliers, customers, competitors and other stakeholders in 'Living Labs' in the various member states of Europe, gaining early feedback on what works and what does not work in digital innovation.

Why cooperation of 5GIA and AIOTI in Horizon Europe makes sense

5GIA and AIOTI have a strong complementarity in their focus area but those areas are also critically dependent on each other. With respect to the different innovation cycles of technology research, development, standardisation, regulation and deployment in the order of several years and in the application domain in the order of a year or even months on established platforms, a parallel approach and mutual adaptation and fine tuning is needed for technical requirements based on use cases. This also comes with building a strong mutual trust between the application domains and the infrastructure providers, jointly 'planning for success' and not waiting for the success of others to be established. The application domains should not wait to define innovative use-cases for the infrastructure to be fully ready, but trust that it will be. At the same time should the infrastructure domain have sufficient trust that large scale applications will justify their investments. This 'planning for success' is strongly developed in regions competing with Europe but usually in a much more monopolistic way. A collaborative approach would much strengthen innovation and implementation of European-based Future Networks, Services and Applications.

Apart from the economic interdependence, there is also a strong technical interdependence as the requirements for a reliable, safe and secure and high-performance Next Generation Internet need to be developed and formulated in close collaboration with application domain experts. The network requirements for autonomously driving cars are very different from the requirements for sensing networks in rural areas for smart farming, or for smart home applications. In functional requirements as in non-functional requirements. On the other hand, it is uneconomic to deploy dedicated parallel infrastructures. Therefore, systems have to be flexible enough to be adapted to different use cases. The concept of network slicing is the current emerging approach to provide that flexibility based on a single deployed physical infrastructure. Moreover, those requirements cannot be fully stated today and continuous research and learning via experimentation in real scale is required. This implies that experts from the various domains and disciplines have to meet, not once but continuously on a collaborative platform.

5GIA and AIOTI can uniquely establish such multi-actor collaboration platform, that may involve several application domain platforms, and attract the non-technical stakeholders that often are lacking in EU innovation programs today. Increasingly, those stakeholders will provide critical input for the success of digitising Europe and will also need to play an ambassador role in the innovation and deployment.
The 5G Infrastructure Association and the Alliance for Internet of Things Innovation are exploring a collaboration based on their unique focus areas and expertise that could lead to a common approach in the Horizon Europe programme.

Value propositions towards different stakeholders

The collaboration between 5GIA and AIOTI under Horizon Europe will provide clear advantages to many stakeholders, building on the achievements of Horizon 2020 but providing essential opportunities for successful innovation and deployment of Smart Networks and its applications in IoT.

Under Horizon Europe new partnerships will be defined and the establishment of those partnerships will require significant efforts. It is explicitly expected by the EC that application and infrastructure

activities will cooperate under a common framework. Keeping it separate would insufficiently drive advancements in Europe. But both infrastructure and application areas do need focus and dedicated Action Lines in the Work Program, including budgets that are well balanced. Jointly 5GIA and AIOTI can justify a large structural investment in both, stronger than when they would be on their own.

The advantages are (not exhaustively) listed below:

Towards members of 5GIA and AIOTI

- Membership of associations remains unchanged and members can still opt for either one of them or both and join the working groups of their preference. But the collaboration will provide a wider scope and better insights along the value chain.
- The collaborative approach is a prerequisite to be recognised as viable partner for the EC, strongly reducing the number of partners that address a single dimension. A collaborative approach will raise the voice and increase the impact of both 5GIA and AIOTI members towards the Commission.
- It enables to orchestrate stimulus programs that are more relevant and impactful to our members, particularly in speed of use-case adoption. For AIOTI members it would enable them to be closer involved in IoT application programs, which pays off not only for application companies (including SME), but also for infrastructure companies.
- For 5GIA it would pay off to have a dedicated partner driving the research, development and deployment of Smart Networks and Services on networks in various domains and contributing to requirements formulation for these networks.
- For members of both organisations it would provide a wider scope of activities with a stronger value proposition towards external stakeholders (Member States, Parliament). On program level, it will lead to better alignment of individual projects and better fit in an overall architecture / structure with less duplication and overhead. A significantly better leverage of common infrastructure and faster track to application can be expected.
- For members of either or both organisations, it would enable participating in stronger vertical teams

Towards the EC

- Strengthening of infrastructure and technology research with parallel application research from a holistic perspective.
- Strengthening the communications infrastructure and applications sector in Europe with respect to technology sovereignty and network security.
- A common approach supports the implementation of the Digital Single Market.

Towards end-users in application domains and society in general

- Bringing technology and perceived complex and capital-intensive next generation infrastructures closer to real life applications in society, justifying those investments with clear examples in many domains (e.g. smart city, farming, energy, mobility, connected cars, …)
- Forging stronger, multi-disciplinary vertical teams in application areas
- Stronger engagement of member states via local applications
- Stronger engagement of non-technical stakeholders in early stage infrastructure developments as they usually engage via applications rather than technology

- More integral approach in non-functional aspects such as privacy and security, which require measures on many architectural levels as well as on user side

Towards European member states

- EU programs coming closer to them, stronger linkage of citizens
- Easier to create an understanding of the relevance of technological and complex infrastructure investments as it comes with applications that are easier to communicate
- Speeding up of Smart Networks and Services in Europe and stimulation of local innovation using this infrastructure

Next steps

This document only reflects a first vision on how a collaboration of 5GIA and AIOTI with the EC under Horizon Europe could bring significant benefit to multiple stakeholders and how it could be organised. This collaboration is envisioned to continue along Horizon Europe, in order to stimulate programs and projects that are most relevant for the digitisation of Europe. This not only concerns the uptake of many application areas in IoT but also the implementation of key technologies such as AI that are strongly dependent on the deployment of future Smart Networks and Services in many areas.

But clearly more work is needed to get it implemented. Just like the digitalisation of Europe cannot be arranged overnight, the successful implementation of this collaboration will require that members (and candidate members) of 5GIA and AIOTI and many stakeholders in the EC and in Member States are enthusiastically lining up behind this vision. Timely and open communication on concrete proposals is essential and this paper intends to contribute to this, making stakeholders familiar with the idea while no commitments are made yet. But it is the intention of 5GIA and AIOTI leadership to make this a success.

Joint working teams on scope and governance are exploring the options and in the course of spring 2019, members of both associations will be engaged more directly.

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