Strategic Research Agenda

Latin-American Technology Platform

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1. Executive Summary

PLATA's Strategic Research Agenda is an initiative of FIRST project. FIRST is a Support Action funded by the European Commission Seventh Framework Programme in order to foster International Cooperation in the areas of Future Internet and ICT Components and Systems between Europe and Latin America.

The objective of PLATA's (Argentine Technology Platform) Strategic Research Agenda is to identify research and technological priorities of common interest between the European Union and Argentina in the Future Internet field in the medium and long-term. Furthermore, in the mid-term, one of the aims of PLATA will be to promote joint research initiatives between European and Latin American entities from the Future Internet field.

The Argentine Technology Platform is composed by 93 members. There are 32 members from industries, 30 members from universities, 15 members from research centres, 5 members from government, and 11 members of other type of entities such as industry chambers or independent consultants. In the following chart is showed membership distribution:

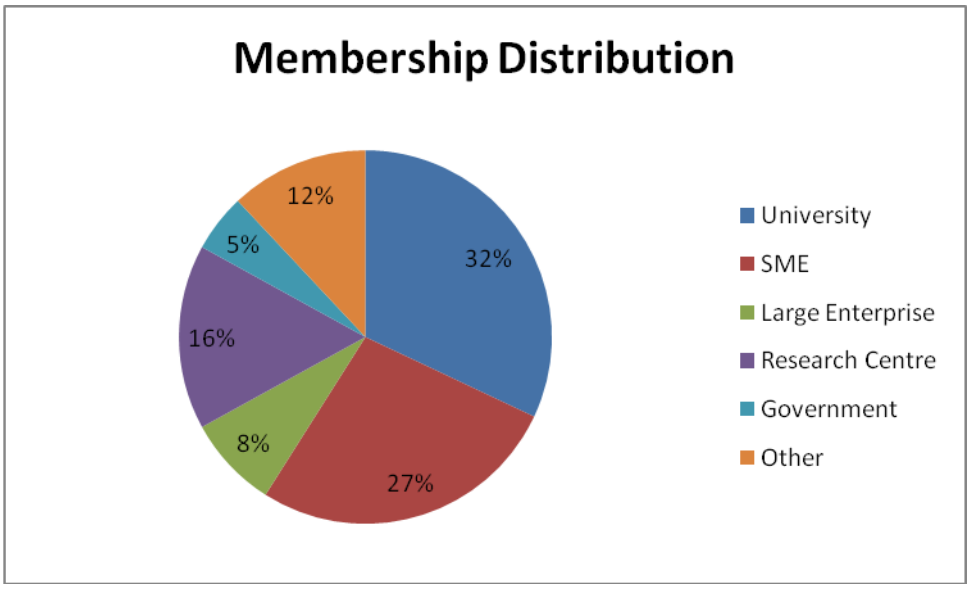


Figure 1: PLATA's membership distribution

After the meeting of PLATA steering council (the founding members) held in December 2010, it was decided to build the platform over an initial structure of 3 working groups that could act as counterparts of the European Technology Platforms (ETPs) considered potentially relevant for EU-Argentina collaboration. These working groups are:

- ICT Components
- NUEVANET
- Smart and Embedded Systems

As it can be appreciated, PLATA founding group has decided to adopt a new nomenclature for working groups (WG). In order to facilitate the identification of appropriate counterparts in Europe, in the following table it is clarified which ETPs correspond to each working group:

ICT Components Group counterparts is **ENIAC**
NUEVANET Group counterparts are **NEM** and **NESSI**
Smart and Embedded Systems Group counterparts are **ARTEMIS** and **EPoSS**

European Technology Platforms, as stated in their Strategic Research Agendas (SRA), are highly interested in international cooperation activities: "Many of the research challenges described in this Strategic Research Agenda can best be achieved, – and can have greater market impact – if faced from an international perspective, involving researchers from countries beyond Europe. A clear European strategy is needed. This SRA should also help other countries around the world, to define their own strategic research agendas, perhaps as a subset of or complement to the NEM SRA[1]."

In the Scientific and Technological Cooperation Road Map 2010/2011 between the European Commission (EC) and Argentina, were selected the following thematic areas for cooperation: Information and Communication Technologies (ICT), Nanoscience and Nanomaterials, Material Science and Industrial Technologies.

According to the *Libro Blanco de la Prospectiva TIC*[2]: "the main challenge for Argentina in Science and Technology is to change R&D&i model". This foresight book raises international cooperation as one of the ways of stimulating cutting-edge research in science and technology with the aim of achieving the best worldwide level in competitive specializations in key and strategic areas. These areas should also be viable in scientific, technique and business terms.

Th*is book* mentions some areas of interest for Argentina, such as eHealth (this specific thematic is relevant in all PLATA's working groups) and ambient intelligence. These areas have a long research history in the European Union and consequently, cooperating in R&D with the EU in these themes can carry along important benefits to Argentina and Europe.

The principles that govern PLATA are:

- Awareness-raising: The objectives and activities of PLATA should be disseminated to all stakeholders involving a wide range of actors such as policy makers, regulators, and the business sector.
- Industry-driven: Support the Argentine private research investment by bringing research closer to industry and improving markets for innovative products.
- Collaboration: PLATA strengthen the collaboration between industry, academia and government. Besides,

[1] Networked Electronic Media Research Agenda, European Technology Platform, September 2009.
[2] Libro Blanco de la Prospectiva TIC, Proyecto 2020, Ministerio de Ciencia, Tecnología e Innovación, 2008.

- Openness and Transparency: It is open to all interest groups and that it is not dominated by narrow interest groupings or lobbies.
- Coherence: Align PLATA with Argentine socio-economic and the Future Internet sector reality and needs.
- Internationalisation: PLATA is a platform for international cooperation since the interaction, collaboration and the relationship with foreigners' countries are crucial. Today the market is global.

2. Societal Challenges

"Information and communication have become pivotal in our society. While the concept of 'information society' is linked to technological innovation, the term 'knowledge society' suggests a social, cultural, economic, political and institutional transformation and a more pluralistic and developmental perspective. The information society is the foundation for the knowledge society. As the technological revolution shows, the information and knowledge society creates new devices that themselves continue the revolution.

For most people the route to the information and knowledge society is through a broadband internet connection. It affects employment, education and health. Broadband supports the expansion of telecommuting which helps workers to balance employment and family life. Broadband technologies also provide easier access to education that stimulates new ways of interactive learning as well as new ways of lifelong learning.

Medical services such as telemedicine or the rapid transfer of medical emergency data go hand in hand with the mobility and health of patients as well as demographic changes.

Other important applications that rely on ICT include e-mobility, e-government agency services and financial services.[3]

Future Internet field technologies have a fundamental impact in many applied areas. The social impact of Future Internet technologies justifies investment in R+D and the Strategic Research Agenda.

An important societal challenge is related to intelligent transportation systems. "Transport is an *essential human activity* which supports and drives economic growth. However, Transport has become one of the grand societal challenges when it has lead to traffic congestion and excessive use of fossil fuels, which are major contributors to GHG emissions and thus to global warming and pollution. The *socio-economic challenge* for Transport is to *make growth and sustainability compatible*, by decoupling environmental impacts from economic growth, while adding to the competitiveness of the Argentine transport industry and enhancing social inclusion by striving to provide mobility for all. Economic downturn, increasing scarcity of non-renewable energy sources, aging, migration, increasing demand for mobility, urbanization, and the globalization of the economy are among the other social and economic challenges to be answered by Transport research."[4]

One of the main goals of PLATA's Strategic Research Agenda is to identify and include research priorities that can be derived from Argentine Societal Challenges.

The challenges included in the EU-Latin American regional vision are aligned with the Argentine needs:

- Energy demand efficient and secure distribution and access

[3] Photonics21 SRA, Second Strategic Research Agenda in Photonics, Page 44.
[4] ITS Argentina, Carmen La Gamba.

- Global healthcare
- Food quality and production
- New security strategies to reduce conflicts and terrorism
- Demographic changes such urbanization, rural inclusion
- Well being and ageing (AAL: Ambient Assisted Living)
- Sustainable and efficient mobility
- Disaster management and rapid response to natural crisis
- Sustainable industries and climate change
- Environment monitoring
- Contributing to a greener world
- Competitiveness and new employment with high added value
- Digital Divide towards social inclusion and equal access to opportunities

PLATA has set another challenge: transparency, integrity, accountability and efficiency in the public and private sectors.

3. Argentine Technology Platform Vision 2020 in the Future Internet Field[5]

Argentina is one of the important actors in Latin America regarding ICT. There are several Future Internet areas that show potential in Argentina. In order to identify them, it is crucial to take a look at the local public policies and vision for R&D. The main governmental institution is the Science and technology Ministry (MinCyT) which is in charge of the design of R&D policies and funds in the country.

The MinCyT has a Social & Productive Innovation Programme (since 2009) in which a specific point aims to boost R&D&i activities of high quality, especially on ICT. The goal is to transfer knowledge to the productive sector by enhancing the bounds between researchers (both public and private R&D centres).

In September 2009, MinCyT published The ICT-Prospective-Project 2020 White Book[6], an effort that gathered more than 150 ICT stakeholders, who sought to identify application, technology and transverse areas that should be promoted in Argentina in the ICT area in Argentina in the coming years.

This ICT-Prospective takes the following vision outlined in the Strategic Plan 2004-2014, within the framework of Blue and White Book:

"Turning Argentina in a relevant actor, as a peripheral country, in the SSI (Software and Information Services) world market." It should be clarified that, despite the fact that the Forum discussed SSI, many of the measures include ICT as a whole or at least partially. In other words, the vision could be expanded to ICT in general and could be redefined as follows:

[5] PLATA Vision Document ON LINE http://www.latin-american-technology-platforms.eu/uploads/PLATA_Vision.pdf

[6] MINCYT (2009) Libro Blanco de la Prospectiva TIC: Proyecto 2020. Ministerio de Ciencia, Tecnología e Innovación Productiva de la Nación, Buenos Aires.

"Turning Argentina in a relevant actor, as a peripheral country, in the ICT world market".

In this prospective work, it is suggested that the main challenge for Argentina, in terms of Science and Technology, is to change the R&D and innovation model. This change is an unavoidable precondition to overcome a delay of 50 years in the next 20 years. This transformation can be summarized as the passage from linear to nonlinear R&D paradigm. One of the necessary conditions to achieve this is to establish, prioritize and support multidisciplinary R&D programs oriented to the selected specializations. Not from the "scientific offer" but mainly from the demand for knowledge and solutions required by the specializations.

ICT industry (especially hardware and semiconductors markets) differs from other manufacturing industries in the fact that production workers make up a relatively small proportion of the total workforce. Technological innovation characterizes this industry and is necessary to compete in this market. The extraordinarily dynamic scenario of innovation requires a high proportion of engineers and other technical workers who carry out extensive research and development (R&D)[7].

The Asian region had firmly established as a site for assembly of electronics products and components and more recently as a designer of new products. These countries, have early identified the importance of the global ICT markets and constructed a national development project reaching a resounding success. Nonetheless, it would be useless to replicate their policies now because the window of opportunity of which they took advantage is already mid-way along its life cycle and this region is far ahead in its accumulation in experience for technology production. In spite of this, ICT's fabrication objective would not be abandoned, but the bulk of it would be strengthened in those areas that target high-value low-volume niches, taking advantage of the hyper-segmentation of markets that characterizes the current globalization wave [8][9].

4. SRA Methodology

The definition of the first version of PLATA SRA is a fact of the most relevance. Coherently with the guide delivered by FIRST coordination *"the idea was to devise a mechanism that would lead to the setting up of national Technology Platforms, each dealing at large with Future Internet themes"*[10].

The information showed in the current SRA is product of PLATA's member priorities in the R&D field of Future Internet. All the content is based on the member's

[7] United States Department of Labor, U.S. Bureau of Labor Statistics. ON LINE http://www.bls.gov/oco/cg/cgs010.htm.

[8] Perez, Carlota (2002), *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages*, Cheltenham, Elgar.

[9] Carlota Perez, A VISION FOR LATIN AMERICA: a resource-based strategy for technological dynamism and social inclusion. Prepared under contract with the ECLAC Program on Technology Policy and Development in Latin America. ONLINE www.carlotaperez.org.

[10] FIRST_Specs_for_LATPs_SRAs_production_v01, document delivered by FIRST coordinator.

inputs; therefore it is not a state-of-art document, but a sample of the Argentine active interest in R&D activities and in the participation in a technology platform community.

In order to identify the Future Internet research priorities in Latin America and their alignment with the EU research areas, a matrix of thematic priorities was delivered to PLATA members, as well it was performed an open call to invite all stakeholders to participate.

In December 2010, a questionnaire was completed by some members of the Steering Council where they indicated some of their priorities out of the previous list. Later on April-May 2011, an open call for contribution was launched focusing on the Steering Council but also open to the rest of the members of the platform. Besides, an open call was issued through CESSI and POLO IT in order to get major impact and more reliable results. ALETI participated in some events to promote the SRA and give the possibility to more stakeholders to participate.

The call for contributions for producing the SRA was mainly done through the e-mail, but phone calls were also performed.

E-mail channel:
ALETI sent over 350 e-mails.
CESSI sent the "Call for Contributions" news in its newsletter that arrives to more than 1000 stakeholders.
ALETI sent a message to Argentine ICT prospective group that is delivered to more than 200 experts.
POLO IT Buenos Aires sent the "Call for Contributions" to 150 experts from Buenos Aires City.
33 phone calls were performed.
ALETI also advertise the SRA in Facebook and through CESSI website.

The distribution of the type of organizations that participated is the following:

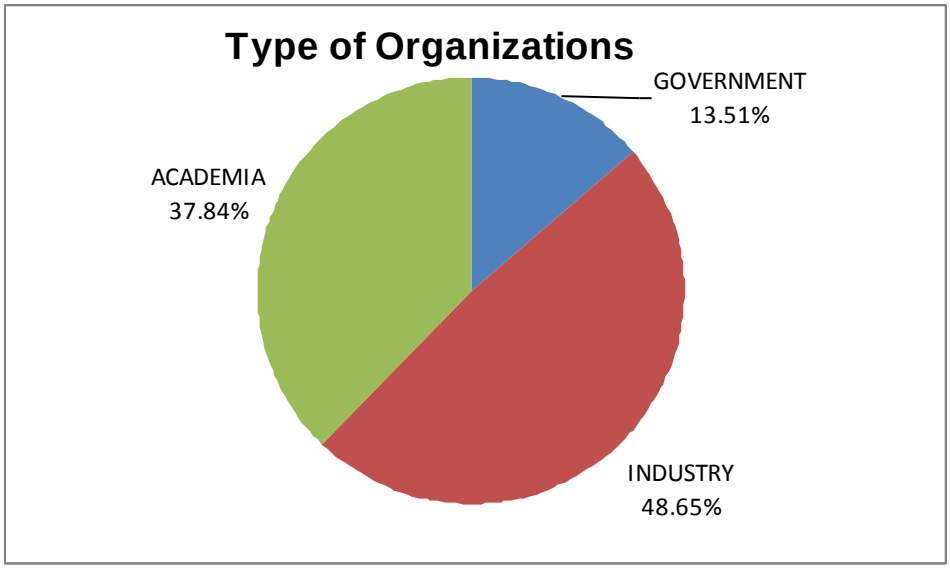


Figure 2: Type of organizations that participated in PLATA's SRA

For comparison and easier understanding these research areas were classified and grouped following the European SRAs, as shown in the following chart:

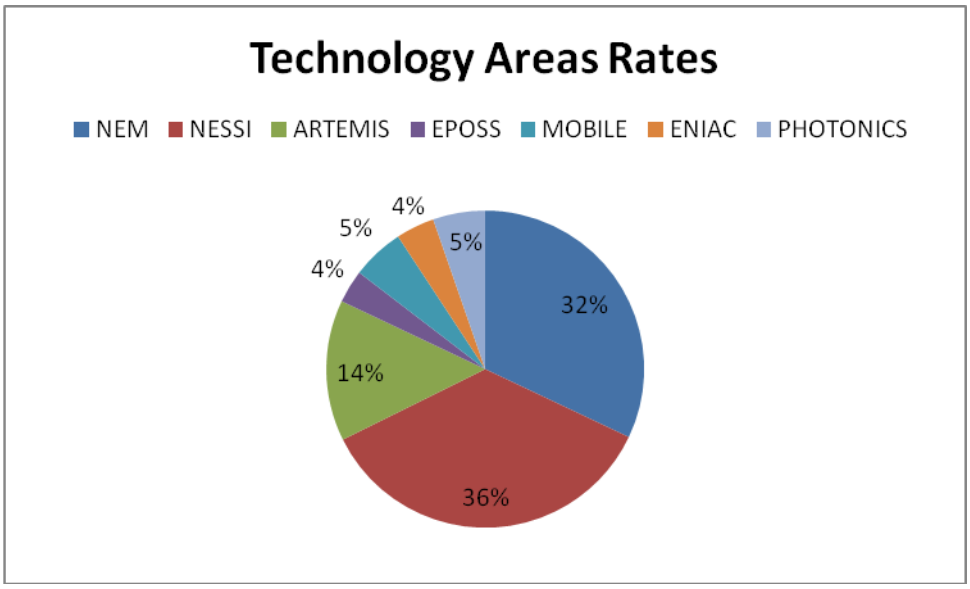


Figure 3: Rate of Technology Areas at SRA

5. Research priorities in the Future Internet field[11]

5.1 ICT Components

5.1.1 State of art of ICT Components and future trends in Argentina[12]

Advances in information and communication technologies (ICT) are becoming central to socio-economic development, transformed nations into knowledge based economic structures and information societies.

The tremendous growths witnessed in this technology and others now enabled by ICTs (eg. Medical, automotive, aerospace, etc.) have been possible by the phenomenal growth of the micro and nanoelectronics.

The Argentine national policies show the identification of micro and nanotechnologies as key-enabling technologies, for the competitiveness of our industry and to meet the new societal challenges.

In this frame, public authorities has founded a lot of nanotechnology initiatives that bringing together industry and the research community, demonstrated a strong commitment to co-operation in micro- and nanoelectronics across the country.

While, world wide More Moore production today is mastered by Asian countries it is important to retain the basic technologies and manufacturing knowledge in the Latin American region, and especially Argentina, as well as the ability to design for the development of highly complex smart systems.

To support this, focusing in More than Moore technologies is a key issue to develop the advanced products required today, and to define potential new Heterogeneous technologies for the local industry, like:

- MEMS -NEMS
- Memmistors - memories tech.
- LEDs high efficient
- Microsensors
- Design for reliability
- Design and co-design (set top box)
- Lab-on-a-chip
- Photonics
- Spintronics

[11] Research topics explanations are mainly based on European Technology Platforms Strategic Research Agendas.
[12] This introduction was written by Daniel Lupi (Fundación Argentina de Nanotecnnología).

With identified application in:

Health Care

- Drug delivery
- Human tissue engineering

Sensors

- Industrial detection devices
- Bio detection devices

Electronics

- Chip interconnects
- RF devices
- Capacitors

Mass data storage

- New memories
- DRAM – replacement

Displays

- Large area displays
- Flexible displays

Energy

- Solar energy
- LED illumination
- Fuel cells

Under a SWOT analysis, Argentine's strengths are:

- Established groups and initiatives dedicated to developing MEMS and Nano (e.g. MEMS Technology Group, Microsystems and Microtechnology Group, etc.)
- Government is committed to develop high technology
- High-tech facilities and Infrastructure for R&D and Manufacturing of micro devices
- Quality university system and extensive research collaboration
- Political, social, and economic stability

In his frame, Argentina has initiated a R+D+i effort in ITC Components and nanoelectronics:

- MEMS gas Sensors, “Electronic Nose”(CNEA, CAB, ANPCyT, CITEFA, JPA SA, and INTA)
- Multi-integrated optical circuit: for optics gyroscopes (CNEA, CoNAE)
- Memmistor memories for satellite application (CNEA,CoNAE)
- RF MEMS switches (CNEA, CoNAE)
- Microsystems (MEMS) based on Silicon: Sensors and BioMEMS (INTI)
- “Lab on a Chip”: Sensors and devices for Microfluidics (INTI)
- Setting up of micro and nanofabrication facilities (INTI)

5.1.2 Research priorities on Nanoelectronics in Argentina

In the following chart are represented the hot research topics of Nanoelectronic in Argentina. There is also interest in other research topics listed and explained below the chart.

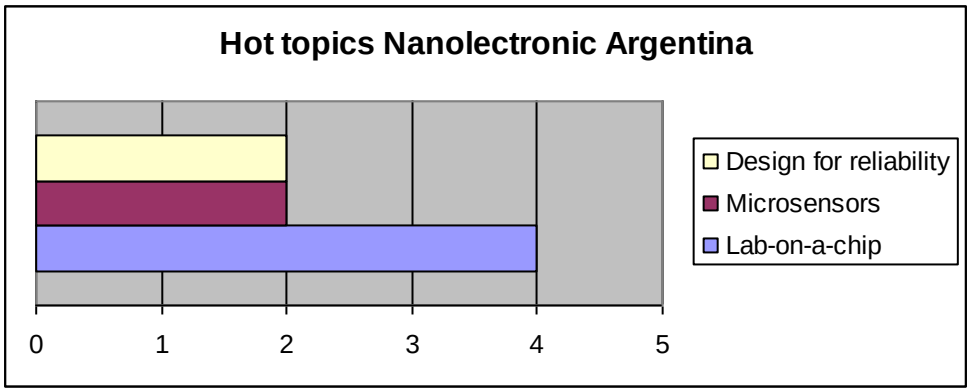


Figure 4: Hot Topics of Nanoelctronic Argentina

- MEMS–NEMS: Microelectromechanical systems and nanoelectromechanical systems.
- Memories memistors (memory resistors) - memories technologies: The driving parameters for advanced memories are primarily integration density (achieved through aggressive scaling), followed by non-volatility, speed and energy consumption.
- LEDs high efficient: Based on semiconductor, organic or polymer light-emitting diodes.
- Microsensors: New analog circuit interfaces will be needed to exploit the extremely small signals from nano-scale sensors.
- Design for reliability: is aimed at the accurate prediction, optimisation and up-front design of reliable products and processes; it is also often referred to as virtual prototyping.

- Design and co-design (set top box): is a device that connects to a television and an external source of signal, turning the signal into content which is then displayed on the television screen or other display device.
- Lab-on-a-chip: is a device that integrates one or several laboratory functions on a single chip of only millimetres to a few square centimetres in size.
- Nanophotonics: allows the confinement and interaction of photons and electrons in a small volume, opening up the possibility of processing data at high frequency without compromising integration density.
- Spintronics: (spin-based electronics) has many potential advantages, including low power operation, non-volatility and co-localisation of data processing and storage.

5.2 NUEVANET

5.2.1 State of art of Networks, Contents and Services and future trends in Argentina[13]

NuevaNet Group gathers Software and Services and Networked Electronic Media.

There is a group of networks, content and services in Argentina that looks forward to assist the country socio-economic development, generating impact in society through research activities related with the state of software technology and its proper transfer through innovation projects.

The application of the different areas cuts across the industry and is often given in combination. This generates large improvements in productivity and competitiveness. The management of business processes is allowing more dynamic and agile organizational structures, supported on the basis of the creation and governance of reusable services. Applying the same model in embedded systems would have impact on systems for different industrial sectors, e.g. for agro-industry. Cloud computing is allowing greater access to contents and a significant reduction of costs associated to infrastructure. Models such as software as a service are possible thanks to cloud computing and are benefiting the SME segment. This segment is Argentine's economic engine.

The trend in the use of mobile devices will require greater knowledge applied in the generation of applications sensitive to the context and based in web services, universally accessible. In Argentina there is a very high rate of internet penetration in jobs and homes. This sets the basis to begin to raise e-Government projects, in order to generate transparency and efficiency in the public and private administration. It is essential for

[13] This introduction was written by Gustavo Guaragna, Fernando Das Neves and Andrés Romero (Snoop Consulting).

Cloud Computing and Internet Services to be sustained in models that guarantee security and privacy in the information.

Finally, a portion of the technological scenario described above is supporting the implementation of a new law of Media and some governmental plans that are fostering a new wave of creating, delivering, distributing contents, not only through the Digital TV, but other new formats brought by Internet.

5.2.2 Research priorities on NESSI ARGENTINA

In the following chart are represented the hot research topics of NESSI in Argentina. There is also interest in other research topics and sub-topics listed and explained below the chart.

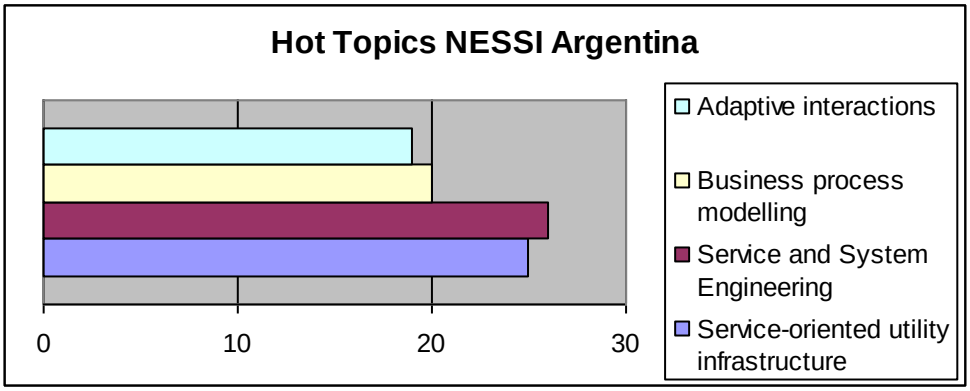


Figure 6: Hot Topics of NESSI Argentina

Adaptive interactions

This field aims to add the dimensions of knowledge and reasoning to the interaction between users and (business and societal) services. Argentina points out to:

- **Social and business intelligence service provision**, including (i) integration and composition of different service technologies, (ii) creation of a social and business intelligence platform to support effective monitoring, collaboration and decision making processes in service provision.

- **Knowledge- and situational-driven personalization of interfaces and services**, including (i) methods and tools to integrate human beings thinking into services technologies (e.g. Web 2.0, mash-up, Web 3.0), (ii) process- and context-sensitive information delivery for knowledge workers and interactions for community networks, (iii) methods and tools to support situational interfaces and reasoning intelligence, and (iv) an object-oriented, service-based, semantic-powered, GUI-delivered personal Interface for the Information Society with full awareness support of identity trust, context, devices and networks.

- **Embodiment of intelligent access to services**, including (i) new methodologies and tools to support acquisition of knowledge and learning from reasoning, which could develop intelligence managed on the user side with native hardware/software interface integration.

- **Embodiment of educating principles in services**, including (i) new methodologies and tools to support the learning and acquisition of solutions built on business process modelled knowledge so knowledge could be equally used as "a software solution" or as "digital encyclopaedia", and managed at the user side with native hardware/software interface integration.

Business process modelling

The goal of this field is to pave the way towards the collaborative executable enterprise. Argentina remarks three fields to work in:

- **Dynamic formalization, management and interaction of business processes implemented through services.** This necessitates

(i) the transition from business processes to IT applications: modelling of functional and non-functional properties, modelling of mediators to support negotiation; supporting round-trip management of business processes, supported by simulation of end-to-end business processes based on a multi-model approach;

(ii) executable enterprise engine i.e. an application engine capable of running modelled enterprise architectures being used as "teaching applications" through a full featured interface.

- **Support for long-term and transactional business collaboration.**

(i) long-running activities are orchestrated and controlled in terms of operational goals and compliance regulations, business rules etc (represented in the form of unconventional atomicity criteria);

(ii) business interactions are conducted in an "all or nothing" manner according to formalised rules, procedures and standardised communications in applications that require complete end-to-end operational integration, e.g. manufacturing, logistics and distribution.

- **Support for event orientation**

(i) the events flowing through the IT layers of an enterprise are monitored, event patterns detected, complex events generated and business process steps triggered in real-time

(ii) underlying services and SW architectures take into account event-orientation and proper techniques are applied to describe event patterns and to model event engines which are adaptable and scalable to business requirements.

Service and System Engineering

The goal here is to provide coherence to the composition of uncoordinated services across all layers and all providers.

- Modelling, Construction and Management of hybrid service based systems (situational, spontaneous, goal-based): (situational, spontaneous and goal-based) including: (i) the management of increasing complexity and variability of requirements; (ii) product line engineering approaches for services; (iii) evolvability of services and systems; (iv) the migration approach to help users to move from one technology to the other; (v) modernize existing legacy code base to become service-centered; (vi) release planning; (vii) spontaneous creation of applications from pre-existing services; (viii) semantic- and goal-based automatic service discovery and composition (ix) smart repositories to support the automation of required on-the-fly discovery and composition of services.

- Mapping quality of experience of the services to non-functional properties of components: based on advanced service lifecycle approaches including engineering, deployment, composition, provisioning, management and decommissioning that support transparent knowledge tracking, feedback loops, prediction and simulation, allow for a clear separation of concerns between different stakeholders (business vs. IT, developers, providers, customers, …) and support the full variety of scenarios. Research on non-functional properties for services including: (i) how to define, describe, develop and evaluate these non-functionals, including privacy issues; (ii) enforcement, monitoring and management of non-functional properties; (iii) mapping of quality of experience to non-functional properties, taking into account how to define and describe these properties according to different usages and contexts (including social and cultural aspects) and the need for negotiation in Service Level Agreement (including trust-related notions); (iv) defining a system by tuning QoE through enduser control panel.

- Refining semantics to become appropriate across hybrid service based systems: (i) The semantic approach for services uses ontologies to fully describe goals and both functional and non-functional characteristics. (ii) The semantic approach for processes requires: declarative choreography languages; semantic business process descriptions; improved maintenance and updating; improved reasoning

- Product Line Engineering applied to services: (i) Guidance and decision criteria for dividing an application into a set of services. (ii) Orchestration and composition of services for different customer environments. (iii) Variability of applications and service runtime environment e.g. regarding hardware platform, footprint, reliability, level of dynamism (binding at design time / start-up / runtime), communication protocol, etc

- Suitable platforms to fulfil future trends and challenges for different levels of the automation pyramid, in particular for the control level (Embedded System) and the Corporate level (Enterprise System): (i) The size and complexity of embedded systems, especially of their SW-portions, is growing fast. The capabilities to easily integrate with other systems are becoming more and more important. Thus the demand for better modularization and flexibility of SW used there is growing. The challenge is to support service delivery and service providers also on lower layers of the automation pyramid. (ii) New trends for enterprise systems (e.g. Software as a Service, Cloud Computing, Internet of Services and Web 2.0) become more and more important to address challenges like cost-effective scalability, ease of deployment and flexible service & software delivery. These trends have to be evaluated regarding their practical relevance for readiness necessary enhancements or adaptation for industrial use.

- Vertical integration between different layers of the automation pyramid: Industrial solutions consist often of multiple systems which span over multiple levels of the automation pyramid. This requires flexible and still simple integration capabilities between software applications and platforms used in different levels of the pyramid. The fact that those systems are delivered often by several companies requires integration to be loosely coupled and standard-based. Suitable concepts, techniques, technologies to address this challenge have to be elaborated.

Services-oriented utility infrastructure

This area looks to provide a flexible infrastructure to support the networked economy. Argentina has detected the following focuses:

- Operating Systems (merge physical- and virtual- machines execution with service-oriented application execution at OS level)

- Desktop Virtualization (access private/secure desktops from anywhere, over the web, etc.)

- Middleware (new composite system designs, harmonized virtualization)

- Related programming models

- Transparent deployment of cloud services

Reference Architecture and Implementations

- Harmonize SOA and SOI architectures to support all kinds of business and provisioning models: to advance the structure of multi-tier, federated and Internet scale architectures, support all kinds of business models, applications and hardware environments and provide transparent and integrated access for all relevant stakeholders (architects, engineers, operators, consumers, etc.). The points of focus include: (i) dynamically manage the complexity linked to the continuous emergence of innovation in software and hardware; (ii) dynamic operational support to uncoordinated governance; (iii) support compliance between different emerging ICT solutions; (iv) design for resilient service architectures for guaranteed delivery; (v) integration of dependable building blocks (e.g. fault prevention); (vi) support the creation of domain specific platforms; (vii) provide scalable, reliable, fast service architectures for enterprises of any size, acting in any domain, and adopting heterogeneous technologies.

End to end Trust, Security, Privacy and Resilience

The objective of this area is aim for a secure, reliable, resilient, compliant and trustworthy (hybrid) service-based systems:

- A chain of trust across all levels and trust zones achieving security by design
- A chain of trust across all levels and trust zones achieving security by design
- Security by Design: Service-based systems and Future Internet (not limited to FI of Services) calls for further advancement in security engineering and in architecture paradigms from a security perspective (e.g. Secure SOA+EDA) to achieve built-in security by design. This includes approaches and mechanisms to ensure and balance confidentiality, integrity and availability of information and knowledge in the context of Future Internet.
- Embed user-centric intuitive security mechanisms
- Protection against threats: Means for proactive identification and protection from arbitrary attacks such as Denial of Service and Intrusion detection.
- Enabling users to understand security, privacy and trust: service consumers have to be educated in order to make informed decisions so as to be tuned as real FI user (so security-, privacy- and trustaware when making decision using FI).

Systemic Foundation for a Service Economy

This area's objective is to ensure social, economical, legal and cultural viability. PLATA stresses out mainly the "principle" Make services accessible to all, which is the base of a Future Internet for all citizens:

- Make services accessible to all
- Multidisciplinary research to build a theory describing the relationship between organizations and social networks in regards to hybrid service-based systems
- Support emerging business models for innovation
- Understanding OS community collaborative processes
- Understanding OS business models and the impact on the Service Economy

Services pervasiveness

This areas objective is to ensure social, economical, legal and cultural viability. PLATA stresses out:

- Turn devices into enablers of services by embodying SOA principles into embedded systems. This is performed by embodying SOA principles into embedded systems and link collaborative devices to services through

5.2.3 Research priorities on NEM ARGENTINA

In the following chart are represented the hot research topics of NEM in Argentina. There is also interest in other research topics and sub-topics listed and explained below the chart.

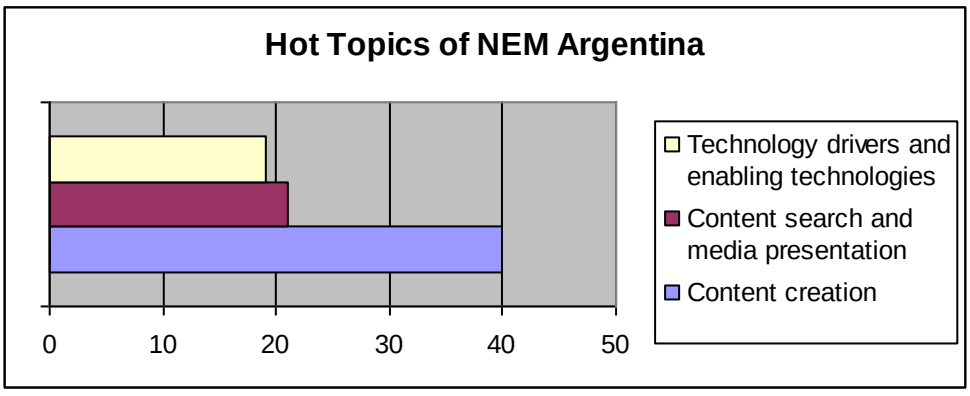


Figure 7: Hot Topics of NEM Argentina

Media-related applications and business models

If new technology is to be adopted, advances are needed in understanding applications and how they create value.

- Value web – to understand how value is created, and how can it be protected.

- Social networking and media sharing – to see how social networking can have a positive impact on the content industry.

- User satisfaction and quality of experience – to develop methods of measuring quality of experience which could replace quality of service metrics.

Content Creation

Work on content creation will help to ensure the availability of innovative new services.

- New forms of content – to drive take-up of new services and to adapt networked media technologies to wider purposes, for example through 'serious' games.

- Representation of content – file formats for the audio, 3D video and data that are the active constituents of services, plus the metadata that describes them and allows them to be processed; modelling formats for avatars are included, with auralisation formats to represent realistic sound fields; video coding will be based on the objects in the scene; new tools must be developed to classify metadata;

- Metadata (data about data) can be classified as 'descriptive metadata', describing the structure and meaning of the different components of audiovisual content, 'functional metadata', specifying, at a high level of abstraction, the processing operations that can be performed on the content depending on system conditions, and 'semantic metadata' providing descriptions that can be understood and processed not only by human users, but also by machines.

- Modelling formats – There are different types of modelling formats such as synthetic models, multi-view-video; light-field, believable virtual characters or avatars and auralisation.

- Content Capture – Traducers for capturing content include sensors and actuators for human senses: audio, video, taste, smell, touch, and for other parameters (temperature, position, motion, force, etc.). Today the only transducers that can be considered relatively mature and massively deployed

are the audio and video ones together with certain very specialized applications – keyboards, mouse, joystick. Metadata parameters such as time and position can be captured through satellite services such as GPS.

- Scene-based content description – A scene is a combination of different audio and video objects – or a composition of scenes itself. The scene can be described by describing the most important elements of it and how they should be rendered to generate the presentation. This description is then independent of any specific output device that might be used to reproduce the scene, and of any scenario for using it. The content creator or assembler can prioritise specific elements (objects or scenes) and can thereby influence the rendering process. Simple alternative elements, objects and scenes can be provided that can replace more complex low-priority content if necessary.

- Overcoming human language barriers – For all citizens to become e-included in the information society, the products and services of that society must be accessible in their languages.

- Tools for content creation and manipulation – including transducers for capturing content (not just audio and video, but other human senses as well); manipulation of audiovisual content must be easier than using today's word processors, and content once created must be easily and automatically adaptable to the changing circumstances of users on the move; metadata must be automatically captured.

- Content manipulation Authoring tools – It is crucial that content developers have better access to more economical and more easily usable technology that enables them to create content and implicitly opens the way to distribution channels. A new generation of authoring tools is needed, taking into account the increasing relevance of user-generated and community-generated content. One example emerges in the gaming industry, where there are barriers to market entry similar to those of early film or television. The production of interactive content will become the most important element of content production. Content produced by organisations for public consumption will ask for contributions from individuals; and individuals will wish to personalise and adapt content produced by others and to make it available to third parties. This includes metadata creation and adaptation for the interactive content, by means of both automated and collaborative methods: content becomes useless without metadata. Collaborative tools for metadata production, in particular for video (social segmentation and tagging of video material) is necessary.

- Content adaptation – Is the ability to tailor content to the current circumstances of the user. The adaptation required is determined by the capabilities of the terminal(s) and equipment available at the user's current location, the capabilities (such as bandwidth) of the communication

networks at the user's disposal, and the physical circumstances of the user - who may, for instance, be visually impaired. Such adaptation must be transparent to end users, so that they do not need to know all the technical parameters that may be of influence. Content adaptation is related to content personalisation, which is concerned with tailoring content semantically to the user's requirements.

Content search and media presentation

There will be new ways of presenting services to users, and new ways for users to interact with services.

- Automated semantic annotation – to generate metadata automatically from new or existing content using semantic techniques.
- Effective recommendation systems – to help people to find content they might want to access, from the vast amount available.
- User number measurement and user behaviour logging – to allow service providers to measure audiences and how they are using the service.
- User-system interaction – multimodal user interfaces aiming at mimicking human communication skills that use several modes of communication could offer a natural and transparent way to deal with the complexities of interaction while hiding them from the user.
- Virtual reality – interactive technology for communication, business applications such as remote action, and entertainment applications including games.

Technology drivers and enabling technologies

Policy and societal concerns shape the direction of technology development, and a set of horizontal technologies will act as a foundation for the functionality of the entire end-to-end chain.

- Security privacy and trust – to provide services and their content securely between all users, guaranteeing the privacy of each participant in a media transaction and securing networks against breakdown and malicious attack.
- Multimedia middleware – Is a software layer providing a stable architecture and application programming interface (API) dedicated to multimedia and accessible by service developers and providers. This middleware layer is used to allow application software to execute multimedia functions with a minimum knowledge of the inner workings of the multimedia terminal – which may be used for generating content or for reproducing it.

- Contextual awareness – for services to be context-aware, means are needed to capture contextual information and standardize its representation.
- Personalisation/profiling – will personalised services be seen as useful, or as an invasion of privacy?
- Federated services – services built up from multiple components from different originators; enabling such services to mobile users with different terminals will require networks and terminals to be aware of users' context.
- Identity management and AAA – methods for authentication, authorisation and accounting while taking account of privacy.
- Charging and payment – a reliable, low cost system of micropayments is needed.
- Assisted Living – technology for e-Inclusion of the elderly or disabled, and to reduce the requirements for human careers.

5.3 Smart and Embedded Systems

5.3.1 State of art of Smart and Embedded Systems and future trends in Argentina[14]

Embedded Intelligence and Systems: Introduction

An Embedded System (ES) is a computer system designed to do a few dedicated functions often as a part of a larger machine which includes hardware and mechanical parts. Most of them are evolved with severe real-time computing constraints They are usually called Safety-critical systems and we could find them in flight-control systems, drive-by-wire vehicles, nuclear reactors and medical equipments. By contrast, a general-purpose computer like a PC is designed to be flexible and versatile, having in mind to cope the vastly different end-user necessities and applications.

ESs control many devices in common use today but they are. Except by some examples, are barely conceived as an end-user equipment as its own. Industry made them from simple 8-bit microcontroller based system to complex and powerful multi-core CPUs, GPUs and DSPs and FPGAs that implement processing, communications and control algorithms. Since embedded systems have specific purpose, designers can optimize it aiming to reduce for example: the size and/or the cost, the environmental vulnerability, the power consumption of the product and increase the reliability to support unattended operating and performance.

[14] Javier Orozco (Universidad Nacional del Sur) wrote part of this introduction.

By way of example, we mention some of the possible applications:

- Smartphones, photo and video cameras, tablets, PDAs.
- Game consoles, multimedia players and digital television equipments and associated appliances.
- Home appliances and building automation.
- Precision agriculture.
- Environmental monitoring.
- Human and animal health monitoring.
- Medical equipment.
- Mobile control systems, autonomous navigation. Robotics.
- Automotive and aircraft electronics systems.
- Industrial, urban and home security systems.
- Telecommunications systems.
- Digital television systems. Extensions for access to information and communication through Internet.
- Embedded Automation. Pervasive user interfaces for digital home protocol technologies (INSTEON, Z-Wave, KNX, ZigBee, X10 and others).
- Digital government infrastructure in communication networks, access points nodes and information processing.
- Electronic money equipments.

Both, the consumer electronic and the costly-low volume equipment industry have increasing needs for models and design structures that respond to short product life cycles and continuously increased requirements, features and performance. In spite of the fact that ES are for specific purposes, their components just as the control units, dedicated processors and other programmable elements continuously evolve, opening a wide range of new applications. This scenario needs large software and hardware engineers efforts in research to maintain efficiency, robustness and reliability. Recently, Argentine academy and industry have increased its competence in the design of application-specific integrated circuits, sensors and actuators, custom and semicustom system design using programmable Logic (FPGA/ASIC), and real time - fault tolerant software engineering methodologies and design. The ongoing penetration of ES and information technology is by far not saturated, given us a great opportunity to generate technological innovations for the global market.

Embedded Intelligence and Systems: Local Situation

According to a study made by INTI in 2007 which covered 384 production companies, 78% of them said that working with own designs which is a good technology signal.

In addition to entrepreneurial skills produced by the mentioned companies, the main responsibility lies with the universities, considering that it’s necessary a new

generation of highly qualified technicians trained in the research and development groups.

Although most of them are small, a good number of research and development groups are working on embedded systems: UTN Regional Buenos Aires, Córdoba, Rosario and Rectorate, Universidad Nacional del Sur en sus departamentos de Ingeniería Eléctrica y de Computadoras y el de Ciencias e Ingeniería de la Computación, Facultades de Ingeniería de la Universidad de Buenos Aires, La Plata, Centro de la Provincia de Buenos Aires, La Matanza, Córdoba, Tucumán, San Juan, San Luis, Mendoza and Litoral, Facultad de Ciencias Exactas de la Universidad de Buenos Aires and institutions such as the INTI, CONEA CITEFA, CONAE and INVAP. In the last call made by the National Scientific and Technological Promotion of SECyT (now the Ministry of Science, Technology and Innovation) selected three related IPPA with electronics, relative to the design of integrated circuits, other with sensors and the third, the Red EICAR which includes a large proportion of embedded systems projects. EICAR Network consists of groups of 8 Academic institutions from across the country, comprising over 200 researchers and professionals in electronics and software, and is supported by two business chambers (CEIL and CASEL).

The National Agency for Science and Technology Promotion form the Ministry of Science, Technology and Innovation Nation, by Resolution 004 of January 27, 2011, support the proposal "Platform for High Complexity Electronic Technology (TEAC)" presented by the consortium Technopolis del Sur (Bahia Blanca). The amount of the grant is (Arg.$) $18,915,365 from the Agency and $15,000,000 from private investment. The TEAC project involves scientific, technology and business to enhance economic development in the region based on the design and low production volumes of high complex electronic ICs.

Smart System Integration

Smart Systems are defined as "intelligent, often miniaturised, technical subsystems with their own and independent functionality evolving from microsystems technology. Smart Systems are able to sense and diagnose complex situations. They are *predictive*, they have the capability to decide and help to decide as well as to interact with the environment. They may also be energy autonomous and networked. Utilising a functional design approach, Smart Systems use properties of devices and materials in completely new ways. Smart Systems are or will be indispensable for the competitiveness of future products and even entire industry and business sectors"[15].

Smart System Integration is interdisciplinary and since it can help to address some of Argentina's challenges since a new spectrum of product applications. For instance, smart systems can decrease the carbon emissions in a 23% thanks to a better management and distribution of energy and a smarter control of electrical drivers.

[15] EPoSS SRA, page 9.

5.3.2 Research priorities on Embedded Intelligence and Systems

In the following chart are represented the hot research topics of Embedded Intelligent and Systems in Argentina. There is also interest in other research topics and sub-topics listed and explained below the chart.

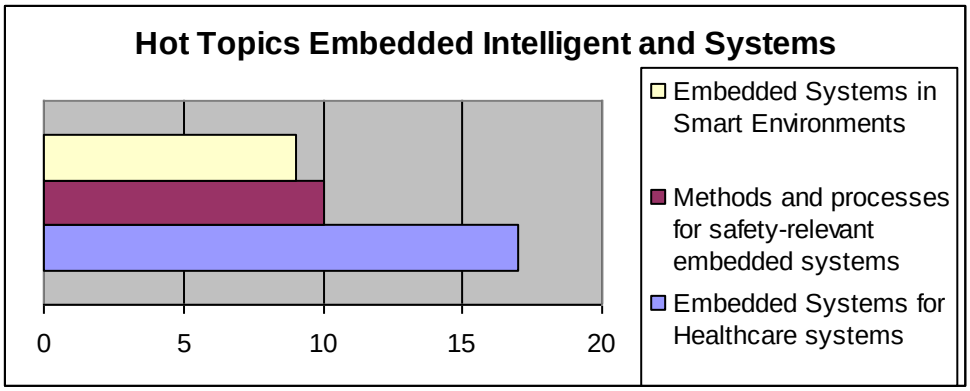


Figure 8: Hot Topics of Embedded Intelligence and Systems Argentina

Methods and processes for safety-relevant embedded systems

- Requirements management will be improved to ensure completeness, consistency, correctness, verifiability and traceability of functional and extra-functional requirements across the supply chain based on requirements formalization and management.

- Architecture modelling and exploration solutions for systems/multi-systems and systems of systems architecture choices against business and operational criteria

- System analysis methods have to provide a usable suite of analysis methods covering all phases and all viewpoints in the development of safety-critical embedded systems, including cross-viewpoint dependencies, enabling cost-efficient certification.

- Component-based design has the objective of providing techniques, methods and tools to design, validate, verify, certify/qualify products made of available or new components in the context of safety-critical systems.

- Platform technologies for safety-relevant embedded systems are required (e.g., communication services, diagnostic services, robustness services, security services) as a stable baseline for the development of safety-relevant embedded applications.

Embedded Systems for Healthcare systems

- Dynamically configured networks of sensors and actuators for in-home and mobile and institutional situations
- Smart power management
- Networked, distributed control systems
- Safe and secure ambient identification and authentication
- Massive reliable medical (image) data processing in a distributed network obeying latency, bandwidth security and privacy. New image detectors are required for enhancing medical imaging applications and supporting image guided interventions.
- Models to compare physical and biochemical of the normal and abnormal behavior of living organs are needed to ensure right and personal centric treatment.
- New sensors and actuators are required for capturing biological and molecular data
- New embodiments of sensors suitable for new types of deployment (e.g. injectable, swallowable)
- Multi system integrated workflows
- Multimodal interaction technologies (speech, vision and gestures) for diagnostic and surgical equipment.
- Remote system life-cycle management.

Embedded Systems in Smart Environments

- Common analysis and design tools and methods that can capture requirements from different domains, and describe the domain and context specific information in common, shared formats
- Interoperability solutions including a semantic platform that can address scalability, performance, security and evolvability requirements arising from different kinds of environments and usage scenarios.
- Interaction technologies and solutions for different environments and user groups.

- System design and application development tools and methods that address very different kinds of domains and systems, including legacy, and the different programming environments and application areas.

Manufacturing and production automation

- Discrete Manufacturing (characterized by individual or separate unit production e.g. of vehicles, computers, …)
- Batch and Continuous Process (continuous flow, e.g. oil and gas, chemical industries, pharmaceutical, food and beverage, power generation, ...)
- Multimodal logistics management (planning, implementation and control of efficient flow and storage of goods, services and related information).

Computing Platforms for Embedded Systems

- New architectures for embedded systems, addressing key challenges such as very high throughput (multi-core) embedded systems, low power (power management) solutions including physical architecture and installation, as well as HW / SW architecture strategies.
- New design paradigms that render the practical implementation of multi- and many-core solutions tractable, allowing them to truly contribute to market innovation.

ES for the Security and Critical Infrastructures Protection

- Models/Methods/Tools for predicting complex, dynamic behaviour in distributed and cooperating ESs, including their SPD characteristics
- Capability to measure and enforce Quality of Service across heterogeneous domains
- Robust, predictable and self adaptive protocols in large-scale, dynamic ES networks
- Real-time support for efficient interactions

Human-centred Design of Embedded Systems

- New methodologies for building cognitive user models, both as a support to usability design and refinement, and at product level as references for adaptive and context aware interfaces
- New technologies for intelligent multi-modal interactive systems, which are intuitive and easy to use and adapt to the user state, context and capabilities

5.3.3 Research priorities on Smart System Integration

In the following chart are represented the hot research topics of Smart Systems Integration in Argentina. There is also interest in other research topics and sub-topics listed and explained below the chart.

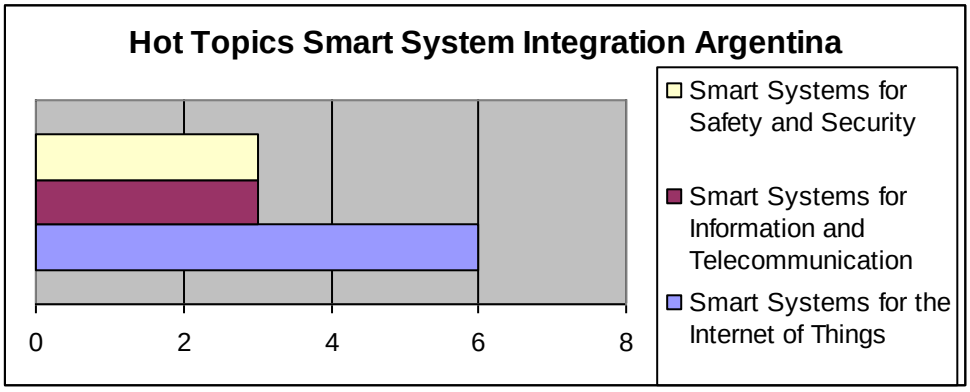


Figure 9: Hot Topics of Smart System Integration Argentina

Smart Systems for the Internet of Things (IoT)

While the current Internet is a collection of rather uniform devices, heterogeneous in some capabilities and very similar in terms of purpose and properties, the future IoT will exhibit a much higher level of heterogeneity, as totally different objects, in terms of functionality, technology and application fields will belong to a common communication environment.

Argentina showed potential in two fields:

- Intelligent Systems: Context-awareness / inter-machine information exchange / IoT global architecture / peer-to-peer communication models / bio-inspired approaches from a centric view to a distributed one / development of autonomous devices able to generate automatic code and behaviours / integration of sensors and actuators / new power efficient hardware/software security architectures / highly efficient, multistandard and adaptive communication sub-systems / adaptable antennas (smart beam steerable phased array antennas, multi frequency band antennas, on chip antennas (OCA), coil on chip, printed antennas, embedded antennas and multiple antennas using different substrates and 3D structures) / miniaturised smart RFID readers supporting multi standards to be used with mobile devices for different applications.

- Energy Sustainability: it refers to energy efficient and self-sustainable systems, new ways of energy harvesting need to be explored and developed

in order to create systems that require little external energy, if any. Efficiency in processing and in communication must also be achieved through novel programming paradigms and the further development of energy efficient protocols and smart antennas. Research efforts will focus on: multimodal identifiable sensing systems enabling complex applications such as implants monitoring vital signs inside the body and drug delivery using RFID / printed batteries manufactured with sensor / thin film solar (thermal) cells for energy harvesting / vibration and piezoceramic devices for energy harvesting / (or even micro fuel cells for long term power generation) wireless power supply to sensors and thin batteries with lifetimes of 10 years / Hybrid energy generation, storage and transmission based upon a combination of RF / piezoelectric / battery power generation.

Smart Systems for Information and Telecommunication

- Ultra broadband, spectrum agile wireless agile: Reconfigurable and/or simultaneous multiband FR module.

- Energy efficient base stations: is composed by direct-to-digital power amplifiers and efficient thermal management.

- Small form-factor base stations: is composed by active antenna arrays.

Smart Systems for Safety and Security

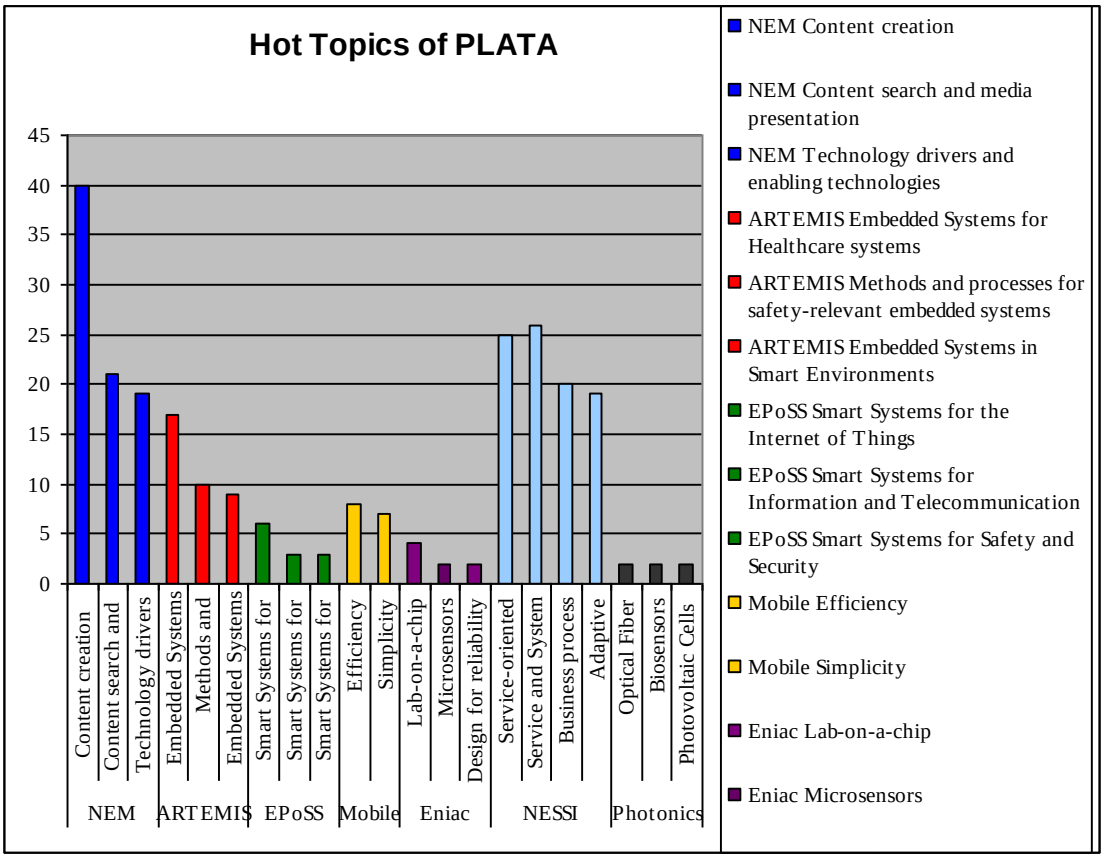
Smart systems can provide the necessary sensors, computing power and reliability at cost levels that allow safety and security to be built into the fabric of our environment.

- Full security: This involves the founding of the smart systems related technologies needed to meet Information Technology security challenges: trusted personal devices, personal emergency and home security systems security of Information Technologies within infrastructure. The specific areas involved are 3D secure and reactive packaging and vulnerability analysis framework.

- Detection, Authentication and surveillance: Biometrics are one approach to allow authentication or identification of persons to access their private and personal devices, but also to improve access control at border checkpoints, within countries and at critical infrastructures. The technique should increase the efficiency of security checks while giving comfort to the end user. Data related to individuals needs to be preserved so secured.

6. Conclusions

There are different potential areas were Argentina and European Union can perform R&D activities together. Below there is a graphic that shows the most important research topics:



The identification of common research priorities for Argentina and EU must be a dynamic process because they reflect changes in Argentine and European Society. Therefore, it is proposed that this SRA should be revised periodically.

Finally, this SRA will be the Argentine input for developing the LatAm Region Strategic Research Agenda.

7. Annex I: Table of Participants

1	Government	ANSES
2	Industry	AZ
3	Industry	Biosence
4	Government	Comisión Nacional de Energía Atómica, Grupo de Spintrónica
5	Industry	Epidata
6	Industry	G&L
7	Industry	Hospital Italiano
8	Academia	Instituto de Física de Rosario
9	Government	Instituto Nacional de Tecnologías Industrial (INTI), Grupo de Fraigi
10	Industry	ISALUD
11	Industry	Levin Global
12	Academia	LIFIA
13	Government	Comisión Nacional de Energía Atómica – Departamento de Química
14	Government	Comisión Nacional de Energía Atómica – Gerencia Investigación y Aplicaciones "Laboratorio Tandar"
15	Industry	Physis
16	Industry	Polo IT
17	Industry	Pragma
18	Industry	Snoop Consulting
29	Industry	Sofrecom
20	Industry	Telefónica Argentina
21	Industry	Thinknet
22	Academia	Universidad de Luján
23	Academia	Universidad de Río Cuarto
24	Academia	Universidad Nacional del Sur, Laboratorio de Ciencias de las Imágenes
25	Academia	Universidad Nacional del Sur, Laboratorio de Sistemas Digitales
26	Academia	Universidad de Palermo
27	Academia	Universidad Tecnológica Nacional de Rosario
28	Academia	Universidad Tecnológica Nacional de Santa Fe
29	Industry	PRONECTIS SRL
30	Industry	AEROPUERTOS ARGENTINA 2000
31	Industry	AUTOMATIZ DISEÑO Y DESARROLLO SA
32	Academia	UNIVERSIDAD NACIONAL DE TRES DE FEBRERO
33	Industry	LATINVIA
34	Academia	ESCUELA TECNICA ORT
35	Industry	Open Solutions
36	Academia	Universidad Tecnológica Nacional, Regional Buenos Aires
37	Academia	Universidad Nacional de Lomas de Zamora

8. Annex II: Common Research Priorities Table

Area	Topic	TOTAL
NEM Networked Electronic Media	**Media-related applications and business models**	
	Value web	4
	Social networking and media sharing	10
	User satisfaction and quality of experience	3
	Content creation	
	New forms of content	6
	Representation of content	4
	Modelling formats	4
	Scene-based content description	2
	Metadata	5
	Tools for content creation and manipulation	5
	Content capture	2
	Content manipulation	5
	Content adaptation	4
	Overcoming human language barriers	3
	Networking and delivery infrastructure	
	Intelligent delivery	2
	Network intelligence	4
	Quality of service	3
	Network architecture	4
	Home and extended-home networks	4
	Content search and media presentation	
	Automated semantic annotation	5
	Authentic, true-to-original media reproduction	0
	Virtual reallity	3
	User-system interaction	5
	Effective recommendation systems	4
	User number measurement and user behavior logging	4
	Technology drivers and enabling technologies	
	Security privacy and trust	1
	Rights management	0
	Federated virtual devices	0
	Federated services	1
	Contextual awareness	2
	Location	1
	Identity management and AAA	3
	Personalization/profiling	5
	Charging and payment	1
	Multimedia middleware	4
	Assisted Living	1
	Power management technologies - energy saving	0
	Spectrum economy	0

Area:	Topic	TOTAL
ARTEMIS Software Embedded	**Methods and processes for safety-relevant embedded systems**	
	Requirements management will be improved to ensure completeness, consistency, correctness, verifiability and traceability of functional and extra-functional requirements across the supply chain based on requirements formalization and management.	1
	Architecture modelling and exploration solutions for systems/multi-systems and systems of systems architecture choices against business and operational criteria	4
	System analysis methods have to provide a usable suite of analysis methods covering all phases and all viewpoints in the development of safety-critical embedded systems, including cross-viewpoint dependencies, enabling cost-efficient certification.	1
	Component-based design has the objective of providing techniques, methods and tools to design, validate, verify, certify/qualify products made of available or new components in the context of safety-critical systems.	1
	Platform technologies for safety-relevant embedded systems are required (e.g., communication services, diagnostic services, robustness services, security services) as a stable baseline for the development of safety-relevant embedded applications.	3
	Embedded Systems for Healthcare systems	
	Dynamically configured networks of sensors and actuators for in-home and mobile and institutional situations	3
	Smart power management	1
	Networked, distributed control systems	2
	Safe and secure ambient identification and authentication	1
	Massive reliable medical (image) data processing in a distributed network obeying latency, bandwidth security and privacy.	1
	New image detectors are required for enhancing medical imaging applications and supporting image guided interventions.	0
	Models to compare physical and biochemical of the normal and abnormal behavior of living organs are needed to ensure right and personal centric treatment.	1

	New sensors and actuators are required including new type of sensors for capturing biological and molecular data;	2
	New embodiments of sensors suitable for new types of deployment (e.g. injectable, swallowable);	1
	Implantable but also non-invasive sensors.	0
	Multi system integrated workflows	1
	Multimodal interaction technologies (speech, vision and gestures) for diagnostic and surgical equipment.	1
	Remote system life-cycle management.	3
	Embedded Systems in Smart Environments	
	Common analysis and design tools and methods that can capture requirements from different domains, and describe the domain and context specific information in common, shared formats	3
	Interoperability solutions including a semantic platform that can address scalability, performance, security and evolvability requirements arising from different kinds of environments and usage scenarios.	2
	Interaction technologies and solutions for different environments and user groups.	2
	System design and application development tools and methods that address very different kinds of domains and systems, including legacy, and the different programming environments and application areas.	2
	Manufacturing and production automation	
	Discrete Manufacturing (characterized by individual or separate unit production e.g. of vehicles, computers, …),	2
	Batch and Continuous Process (continuous flow, e.g. oil and gas, chemical industries, pharmaceutical, food and beverage, power generation, ...),	1
	Utilities (the infrastructure for public services including electricity/gas supply, fresh and waste water, district heating, …),	0
	Manufacturing logistics (internal logistic processes across the whole manufacturing chain, emphasizing the value-adding processes) and	0
	Multimodal logistics management (planning, implementation and control of efficient flow and storage of goods, services and related information).	1
	Computing platforms for Embedded Systems	
	New architectures for embedded systems, addressing key challenges such as very high throughput (multi-core) embedded systems, low power (power management) solutions including physical architecture and installation, as well as HW / SW architecture strategies.	1

	New design paradigms that render the practical implementation of multi- and many-core solutions tractable, allowing them to truly contribute to market innovation.	1
	ES for the Security and Critical Infrastructures Protection	
	Seamless and secure communication/cooperation of heterogeneous ES over telecommunications infrastructures;	0
	Models/Methods/Tools for predicting complex, dynamic behaviour in distributed and cooperating ESs, including their SPD characteristics;	1
	Spontaneous (ad-hoc) yet trustworthy cooperation between smart objects;	0
	Enhanced technology for fault mitigation and recovery of ES clusters;	0
	Virtualization of resources exposed by the ESs in a network;	0
	Capability to measure and enforce Quality of Service across heterogeneous domains;	1
	Robust, predictable and self adaptive protocols in large-scale, dynamic ES networks;	1
	Sensing, control and automatic decision making functions;	0
	Real-time support for efficient interactions;	1
	Trustworthiness and High Dependability features;	0
	Advanced methods for improved confidentiality.	0
	Embedded Technology for Sustainable Urban Life	0
	Human-centred Design of Embedded Systems	
	Human Machine Interfaces (HMI) of Embedded	0
	New knowledge on human performance in association with new and innovative assistance and information systems	1
	New methodologies for agile HMI prototyping enabling the user centric design approach at all stages of product development	0
	New methodologies for building cognitive user models, both as a support to usability design and refinement, and at product level as references for adaptive and context aware interfaces	2
	New technologies for intelligent multi-modal interactive systems, which are intuitive and easy to use and adapt to the user state, context and capabilities	2

Area: EPoSS	**Topic**	**TOTAL**
EPoSS -	**Smart Systems for Automotive Applications**	

Inteligent Integrated Systems	Safety	0
	Driver Assistance	0
	Convenience	0
	Energy efficiency	0
	Smart Power Train	0
	Smart Systems for Medical Applications	
	Energy Management Systems	0
	Intelligent Power	0
	Vehicle2Grid	0
	Active Control Units	0
	Smart Systems for the Internet of Things	
	Intelligent Systems	5
	Energy Sustainability	1
	Integration Into Materials	0
	Energy Harvesting	0
	Smart Systems for Information and Telecommunication	
	Ultra broadband, spectrum agile wireless access	1
	Energy efficient base stations	1
	Ultra compact handset transceivers	0
	Small form-factor base stations	1
	Wide-area sensor networks Compact	0
	Energy autonomous sensors Implantable	0
	Implantable BAN transceivers	0
	Smart Systems for Safety and Security	
	Secure Personal Devices, including Smart Cards	0
	Secure IT for Infrastructure	0
	Personal emergency and home security systems	0
	Full Security	1
	Detection, Authentication and surveillance	2
	Vital Infrastructure Security	0
	Emergency and security	0
	Smart Systems for Aerospace	
	By-light functions	0
	Fuel Cell APU	0
	By-wire functions	0
	Electrical Power Management	0

Area	Topic	TOTAL
Net!Works / Emobility	**Simplicity**	
	• Ubiquitous connectivity and session continuity through auto-connectivity between legacy and new types of networks: WSN, PAN, LAN, Home Network, Moving Networks, Wide Area Networks and techniques which facilitate self-(configuration, organisation, healing)and management of heterogeneous and dynamic networks and services.	2

	• A network agnostic service execution platform that interacts with networks and terminals and also facilitates the deployment, adaptation and management of services on the various(including mobile) devices.	2
	•Innovative services based on a user's ambient intelligent and streamlined context classifications methodology.	1
	• Enabling techniques for user-created content facilitating peer-to-peer communication.	1
	• Smart user interfaces and interactions with learning capabilities to evolve with a user interests and age, for all types of users and in particular elderly with emphasis on portable personalisation of services and networks.	1
	• New mobile device form factors, included embedded wireless chip connectivity.	0
	• Radically simplified mechanisms and technologies for context capturing, processing, distribution and integration into intelligent services.	0
	• New and efficient search engines with automatic zero-configuration and complexity management (including the management of privacy and trust).	0
	• Intelligent customer care and provision of smart support in real-time in case of technical difficulties.	0
	• Seamless user experience for all age groups with emphasis on portable personalisation for both the services and the connectivity.	0
	Efficiency	
	• Joint optimization of coverage, capacity and quality techniques through cooperation and adaptation techniques.	0
	• Efficient mechanisms for joint exploitation and operation of available diversities in time/space/frequency/code/power domains.	1
	• Investigation of alternative deployment concepts and system architectures beyond the classical cellular approach.	0
	• Efficient cross-layer operation and optimization.	0
	• Intelligent resource (frequency, battery, power, hardware, software) discovery and management techniques.	1
	• End-to-end content and media adaptation techniques such as time-shifting, intelligent catching, opportunistic transport/transmission, rate/quality adaptation.	0
	• Centralised and de-centralised self-organising network topologies for both operator based and operator-less radio access network concepts for special application areas (e.g., disaster relief and campus networks).	1
	• Seamless convergence between fixed and mobile at both service and network levels, exploiting broadband optical technologies.	1

	• Innovative transceiver architectures and jointly optimized RF and baseband hardware designs, matching the nano-electronics roadmaps and exhibiting new degrees of scalability, flexibility, security, energy-aware performance, cost efficiency and design productivity.	1
	• Evaluation of Network Information theoretical limits of cooperative and self-organising networks and research into advance coding design and signal processing schemes to achieve these limits.	0
	• Investigation of the impact of new frequency bands for future systems on the radio	1
	propagation and specification of appropriate output power levels to ensure compliance with relevant guidelines and regulations related to human exposure to radio frequency electromagnetic fields.	0
	• New methods of frequency usage, coexistence, cooperation and sharing techniques for/between exiting and newly identified frequency spectrum and radio access technologies, based on cognitive and spectrum-agile radios to select the most appropriate radio access technology for a given environment.	2
	Trust	
	• Secure data management, and synchronization and private exchange of user profile and context information.	0
	• Efficient encryption and cryptographic mechanisms and algorithms suitable for different types of devices and networks.	0
	• Identity management & privacy.	0
	• Secure and dependable end-to-end network protocols and applications enabling a simple-to-use trusted transaction environment.	0
	• Unified Digital Rights Management.	0
	• Transparent and flexible Service Level Agreements.	0
	• Combined multi-layered mobility support and authentication/authorization across diverse networks and support of simultaneous use of multiple access technologies.	0
	• Secure software and execution environment including O/S.	0
	• Device and network protection against (virus, trojan, DoS attacks) and intrusion detection.	0
	• Safe and secure software download enabling networks and device re-configurability.	0
	Application Areas	
	Health and Inclusion	2
	Transportation	1
	Environment	0
	Other	1

Area	Topic	TOTAL
ENIAC **Nanoelectronics**	MEMS –NEMS	1
	Memories memistors - memories tech.	1
	LEDs high efficient	1
	Microsensors	2
	Design for reliability	2
	Design and co-design (set top box)	1
	Lab-on-a-chip	4
	Photonics	1
	Spintronics	1

NESSI Software and Services	**Service-oriented utility infrastructure**	
	Advanced infrastructure technologies in:	0
	Hardware (flexible allocation, virtualization, advanced storage, energy efficiency)	3
	Operating Systems (merge physical- and virtual-machines execution with service-oriented application execution at OS level)	3
	Desktop Virtualization (access private/secure desktops from anywhere, over the web,)	6
	Middleware (new composite system designs, harmonized virtualization)	3
	Related programming models	4
	Related power-aware software design methods	1
	Transparent deployment of cloud services	5
	Service and System Engineering	
	Modelling, Construction and Management of hybrid servicebased systems (situational, spontaneous, goal-based)	6
	Mapping quality of experience of the services to non-functional properties of components	3
	Refining semantics to become appropriate across hybrid servicebased systems	3
	Product Line Engineering applied to services	5
	Suitable platforms to fulfil future trends and challenges for different levels of the automation pyramid	3
	Vertical Integration between different layers of the automation pyramid	6
	Adaptive interactions	
	Social and business intelligence service provision	8
	Knowledge- and situational-driven personalization of interfaces and services	8
	Embodiment of intelligent access to services	1
	Embodiment of educating principles in services	2
	Business process modelling	

	Dynamic formation, formalization management and interaction of business processes implemented through services	9
	Support for long-term and transactional business collaboration	6
	Support for event-orientation	5
	Reference Architecture and Implementations	
	Harmonize SOA and SOI architectures to support all kinds of:	1
	business and provisioning models	1
	applications and hardware environments	0
	stakeholders	0
	Services pervasiveness	
	Turn devices into enablers of services by embodying SOA principles into embedded systems	2
	Link collaborative devices to services	1
	End to end Trust, Security, Privacy and Resilience	
	Implementing Privacy, Identity Management and Trust in servicebased systems and in the FI society through:	1
	A chain of trust across all levels and trust zones achieving security by design	2
	Security by Design	2
	Embed user-centric intuitive security mechanisms	3
	Protection against threats	3
	Enabling users to understand security, privacy and trust	4
	Systemic foundation for a Service Economy	
	Make services accessible to all	5
	Multidisciplinary research to build a theory describing the relationship between organizations and social networks in regards to hybrid service-based systems	5
	Support emerging business models for innovation	3
	Understanding OS community collaborative processes	2
	Understanding OS business models and the impact on the Service Economy	2

9. Annex III: Sources

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10. Annex IV: List of Acronyms

Acronyms	Spanish	English
R&D	Investigación y desarrollo	Research and development
ICT	Tecnologías de la Información y Comunicación	Information and Communication Technologies
SRA	Agenda Estratégica de Investigación	Strategic Research Agenda
ARTEMIS	Iniciativa para los sistemas informáticos embebidos o empotrados	Embedded Computing Systems Initiative
NESSI	Iniciativa europea de Software y Servicios	European software and services initiative
NEM	Tecnologías audiovisuales en red	Networked Electronic Media
Emobility	Comunicaciones móviles e inalámbricas	Mobile and wireless communications
EpoSS	Sistemas inteligentes integrados	European Technology Platform on Smart Systems Integration
EU	Unión Europea	European Union
MINCYT	Ministerio de Ciencia, Tecnología e Innovación Productiva	Minister of Science, Technology and Productive Innovation
PLATA	Plataforma Tecnológica Argentina	Argentine Technology Platform
ENIAC	Consejo Asesor de la Iniciativa Europea de Nanoelecrónica	European Nanoelectronic Initiative Advisory Council
ALETI	Federación de Asociaciones de Latinoamérica, El Caribe y España de Entidades de Tecnologías de la Información	Federation of Latin American, the Caribbean and Spain Information Technology Associations
CESSI	Cámara de Empresas de Software y Servicios Informáticos	Software and Servicies Argentine Industry Chamber
CNEA	Comisión Nacional de Energía Atómica	Argentine Atomic Energy Commission
CoNAE	Comisión Nacional de Actividades Espaciales	National Space Activities Commission
INTI	Instituto Nacional de Tecnología Industrial	National Institute of Industrial Technology
INTA	Instituto Nacional de Tecnología Agropecuaria	National Institute of Agropecuary Technology
CITEFA	Instituto de Investigaciones Científicas y Técnicas para la Defensa	Institute for Scientific and Technological Research of the Armed Forces

11. Annex V: List of stakeholders contacted to produce the SRA[16]

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6	Admisnistracion Nacional de Seguridad Social - ANSES	Rouget, Sandra
7	AEROPUERTOS ARGENTINA 2000	Viader, Walter Alejandro
8	AFESIF	Renzeti, Gerardo
9	Allegro Microsystems	Monreal, Gerardo
10	AUTOMATIZ DISEÑO Y DESARROLLO SA	Bernal, Jose
11	AZ	Aguirre, Gustavo
12	Bioscience	Irigoyen, Martín
13	BIZ DRAGON	Colombo, Flavio
14	CAETI - Centro de Investigación en Tecnología Informática, Universidad Abierta Interamericana	Balich, Nestor
15	CAMAC	Campos, Luis
16	CEIL	Barragán, Gustavo
17	Centro de Investigaciones Opticas (CONICET La Plata-CIC) CIOP	Trivi, Marcelo
18	CESSI	Luchessi, Vanessa
19	CESSI	Racca, Fernando
20	Cibermapa	Menke, Damian
21	CICOMRA	Ballarino, Alfredo
22	CICOMRA	Capellan, Norberto
23	CIDNOA	Jara, Andres
24	CNEA e Instituto Balseiro	Alejandro, Fainstein
25	CNEA, Grupo MEMS	Fisher, Maximiliano
26	CNEA, Unidad de Investigación y Aplicaciones no nucleares	Lamagna, Alberto
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28	CODES	Palacios, María Laura
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30	Comisión Nacional de Actividades Espaciales CONAE	Fisher, Maximiliano
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34	Comision Nacional de Energia Atomica - CNEA	Palumbo, Felix

[16] This list excludes the contacts made by CESSI and Polo IT.

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39	Conicet Santa FE	Guarneri, Fabio
40	Consultor Independiente	Valle, Luis
41	Duje y Asociados	Duje, Daniel
42	eABC	Biscay, Carlos
43	Epidata	Anacleto, Valerio Adrián
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45	Fluxit S.A.	Urrizola, Santiago
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48	G&L	Louzao, Jose Maria
49	G&L	Vink, Paula
50	Gobierno Ciudad Buenos Aires	Darini, Pablo
51	Hexacta	Farias, Ricardo
52	Hospital Italiano	Ritacco, Lucas
53	IBM	Thienemann, Jonathan
54	Informatizaciones San Justo	Alesso, Maximiliano
55	INIFTA	Vela, Maria Elena
56	Innova Red	Gattone, Aníbal
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59	Instituto Nacional de Tecnologia Industrial – INTA, Gerencia Gestion de la Informacion	Bellati, Javier
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64	Instituto Nacional de Tecnologia Industrial – INTI, Grupo MEMS	Muset, Graciela
65	Instituto Nacional de Tecnologia Industrial – INTI, Relaciones Institucionales	Fraigi, Liliana
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67	INVAP	Sagarzazu, Ricardo
68	Isistemas NET	Castaño, Alberto

69	ITS Argentina	La Gamba, Carmen
70	ItSitio	Manzanedo, Carlos
71	KOC	Fingeret, Daniel
72	Laboratorio de Investigacion y Formacion de Informatica Avanzada- LIFIA	Torres, Diego
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80	Nokia	Cordoba, Paula
81	NOSIS, Laboratorio de Investigación y Desarrollo	Aquerreta, Juan Carlos
82	Nuevo Banco de Santa Fe S.A.	Cribb, Roberto
83	Open Sol	Zarate, Carlos
84	ORT, Escuela Técnica ORT Sede Belgrano	Hawryluk , Ruben N.
85	ORT, Escuela Técnica ORT Sede Belgrano	Mischener, Dario
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90	Secretaría de Gestión Pública de la República Argentina	Thill, Eduardo
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97	SOLUS S.A.	Pinciroli, Fernando
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101	Tenaris R&D	Bonadeo, Nicolas
102	TESIS OYS	Ugarte, Lisa
103	THINKNET	Giorgetti, Gustavo
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120	Universidad Nacional de Jujuy	Griot, Jorge
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124	Universidad Nacional de La Plata	Colman Lerner
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132	Universidad Nacional de Rio Cuarto, EXA	Planes, Gabriel Angel
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148	VATES	Schmira, Diego
149	Xinapsys	Jara, Virgilio