First

Implementing cooperation on Future Internet and ICT Components between Europe and Latin America

Objective ICT-2009.9.1: International cooperation

Project 248753

D4.3

Common EU-LatAm Future Internet Strategic Research Agenda

WP4: Setting up the Regional strategy in LatAm for cooperation with Europe

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Foreword

Networks are the neural system of our society: the Internet keeps revolutionizing the world - the way we work, exchange, interact, communicate and behave. Equally, we revolutionize the Internet - the way it works, exchanges, interacts, communicates and behaves. Our needs, usage and visions push it to evolve into the Future Internet. The Internet is consequently a complex and evolving entity where any technological development, no matter how small, may have multifaceted and even surprising consequences.[1]

The current document, D4.3 Common EU-LatAm Strategic Research Agenda on Future Internet Cooperation, is an initiative of the Support Action project, FIRST, funded by the Seventh Framework Programme of the European Commission. It summarizes the common challenges and opportunities for the future research directions in the Future Internet domain for the Latin American and European ICT research community.

Between 2010 and 2011, Future Internet technology platforms were implemented in five countries of the Latin American continent, as one of the main goals of the FIRST project in order to enhance cooperation between both continents. The target field of these Latin American Technology Platforms (LATPs) is Future Internet, a vivid concept that is not yet globally defined, but that makes us ask about where we want to go with the current internet. Europeans had made a huge prospective work and already started to research and develop in a wide spectrum of areas related with this concept. Latin America is in conditions of participating in this important research field and, consequently, can be part of one of the most innovative domains of the future.

Historically, countries of Latin America have established strong bilateral relations with the European Union. This regional Strategy fosters bi-regional cooperation between Latin America, the Caribbean and the European Union.

[1] Fire for Future Internet Success. On line: <http://www.ict-fire.eu/fileadmin/publications/FIRE_broch02_A4_screen.pdf>

LIST OF ACRONYMS

ARTEMIS	EUROPEAN TECHNOLOGY PLATFORM OF EMBEDDED SYSTEMS
EC	EUROPEAN COMMISSION
ES	EMBEDDED SYSTEMS
ENIAC	EUROPEAN TECHNOLOGY PLATFORM OF NANOELECTRONICS
EPOSS	EUROPEAN TECHNOLOGY PLATFORM OF INTELLIGENT INTEGRATED SYSTEMS
ETP	EUROPEAN TECHNOLOGY PLATFORM
EU	EUROPEAN UNION
FI	FUTURE INTERNET
FIA	FUTURE INTERNET ASSEMBLY
FIRE	FUTURE INTERNET RESEARCH & EXPERIMENTATION
ICT	INFORMATION AND COMMUNICATION TECHNOLOGIES
IOT	INTERNET OF THINGS
IPR	INTELLECTUAL PROPERTY RIGHTS
ISI	EUROPEAN TECHNOLOGY PLATFORM OF SATELLITE COMMUNICATIONS
LAC	LATIN AMERICA AND THE CARIBBEAN
LATP	LATIN AMERICAN TECHNOLOGY PLATFORM
NEM	EUROPEAN TECHNOLOGY PLATFORM OF NETWORKED AND ELECTRONIC MEDIA
NESSI	EUROPEAN TECHNOLOGY PLATFORM OF SOFTWARE AND SERVICES
Net!Works	EUROPEAN TECHNOLOGY PLATFORM OF MOBILE AND WIRELESS NETWORKS
PHOTONICS21	EUROPEAN TECHNOLOGY PLATFORM OF PHOTONICS

SC	STEERING COUNCIL
SME	SMALL AND MEDIUM ENTERPRISES
SRA	STRATEGIC RESEARCH AGENDA
R&D&I	RESEARCH, DEVELOPMENT AND INNOVATION
S&T	SCIENCE AND TECHNOLOGY
TP	TECHNOLOGY PLATFORM
WG	WORKING GROUP

TABLE 1

EU-LATAM EXPERTS GROUPS

EXPERTS

Country/Region	LATP/ETP	Name	Organization
Argentina	PLATA	Gabriel Baum	LIFIA
Argentina	PLATA	Daniel Lupi	FAN
Argentina	PLATA	José María Louzao	G&L
Argentina	PLATA	Javier Orozco	Universidad Nacional del Sur
Brazil	BraFip	Antenor Ferreira Filho	EST
Brazil	BraFip	José Jairo Santos Martins	Sucesu
Brazil	BraFip	Eduardo Zied	Itaú-Tec
Brazil	BraFip	Franco M. Lazzuri	CIETEC
Brazil	BraFip	André Hirakawa	USP
Chile	MACHI	Pablo Caroca	GECHS
Chile	MACHI	Mario Andrés Bruno	Universidad de Playa Ancha
Chile	MACHI	Hugo Durney	ProteinLab
Chile	MACHI	Gerardo Rivas	AIE / Addere
Chile	MACHI	Héctor Torres	ProteinLab
Colombia	RECIIF	José Jaime Gómez	Medios y Soluciones
Colombia	RECIIF	Harold Castro	Universidad de los Andes
EU expert	ARTEMIS JU	Eric Schutz	ARTEMIS Joint Undertaking
EU expert	ARTEMIS JU	Irene López de Vallejo	ARTEMIS Joint Undertaking
EU expert	Net!Works	Thomas Michael Bohnert	SAP
EU expert	NEM	Pierre Yves Danet	Orange France Telecom
EU expert	NEM	Julián Seseña	Rose Vision
EU expert	NESSI	Julie Marguerite	Thales
EU expert	NESSI	Tonny Velin	Answare
EU expert	Photonics	Santiago Simon	AIDO
EU expert	Photonics	Amparo Barreda	AIDO
EU expert	ISI	Nicolás Chuberre	Thales Alenia Space
EU expert	ISI	Antonio Alfaro	Rose Vision
EU expert	Génesis Red	Idoia Muñoz	GAIA Zamudio
EU expert	Génesis Red	Carles Cane	CNM
EU expert		Kevin Prescott	
Mexico	MTP	Ing. Guillermo Safa	CSOFTMTY
Mexico	MTP	Dra. Cristina Loyo	LANIA
Mexico	MTP	Javier Allard	AMITI
Mexico	MTP	Jorge Buitron	Canieti

TABLE 2

OBSERVERS

Country/Region	Organization	Name
Argentina	FONSOFT – Fondo Fiduciario de Promoción de la Industria del Software	Rosa Wachenchauzer
Argentina	MINCyT – Ministerio de Ciencia, Tecnología e Innovación Productiva	Mónica Silenzi
Chile	CONICYT – Comisión Nacional de Investigación Científica y Tecnológica	Astrid Waltermann
Chile	GECHS - Gremial Chilena de Industrias del Software	Luis Stein
Chile	ACTI – Asociación Chilena de Empresas de Tecnologías de Información A .G.	Raúl Ciudad
Colombia	COLCIENCIAS – Departamento Administrativo de Ciencia, Tecnología e Innovación	Edison Pérez
Colombia	Ministerio de Tecnologías de la Información y las Telecomunicaciones	María Patricia Asmar
Colombia	Acción Social	Henry Carrillo
Colombia	RENATA – Red Nacional Académica de Tecnología Avanzada	Martha Inés Giraldo
Colombia	Fedesoft – Federación Colombiana de la Industria del Software	Paola Restrepo
Colombia	OCyT – Observatorio Colombiano de Ciencia y Tecnología	Mónica Salazar
Mexico	Coop. Mexico-EU CONACYT	Héctor Samano
Mexico	AMITI – Asociación Mexicana de la Industria de Tecnologías de Información	Javier Allard
Mexico	Secretaría de Economía	Víctor Hugo Estrada
Regional	AHCIET – Asociación Iberoamericana de Centros de Investigación y Empresas de Telecomunicaciones	Francisco Gómez Alamillo
Regional	ALETI – Federación de Asociaciones de Latinoamérica, El Caribe y España de Tecnologías	Roberto Mayer

	de la Información	
Regional	ALETI – Federación de Asociaciones de Latinoamérica, El Caribe y España de Tecnologías de la Información	Silvia Bidart
Regional	ECLAC – Economic Commission for Latin America and the Caribbean	Néstor Bercovich
Regional	European Commission	Klaus Pendl
Regional	IADB – Inter-American Development Bank-FOMIN – Multilateral Investment Fund Member of the IDB Group	Fredy Betancourt
Regional	ILCE - Instituto Latinoamericano de Comercio Electrónico	Marcos Pueyrredon
Regional	OAS – Organization of American States	Jorge Durán
Regional	RedCLARA - Cooperación Latino Americana de Redes Avanzadas	Carmen Gloria Labbé
Regional	SELA – Sistema Económico Latinoamericano y del Caribe	Saadia Sánchez Vegas

TABLE 3

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1. Executive Summary

D4.3 Common EU-LatAm Strategic Research Agenda on Future Internet cooperation corresponds to work package 4 of the FIRST Project; which main objective is the setting up of a Regional strategy in LatAm for cooperation with Europe, in the Future Internet field.

The **EU-LatAm strategy is defined by three key documents** that should support the establishment of future cooperation between European and Latin American researchers in the field of Future Internet:

- D4.2 Common EU-LatAm Vision: already launched.
- D4.3 Common EU-LatAm Strategic Research Agenda (SRA).
- D4.4 Roadmap towards implementation of the SRA: it will be launched after the SRA.

An additional document, D4.1, analyzed key LatAm organizations from the fields of ICT and R&D promotion, and also took into account other relevant Latin American associations.

The **common EU-LatAm Vision** main objective was to **set up the basic concepts, challenges and priorities that shall drive cooperation between Europe and Latin America** in this field during the coming years. In particular, this document pretends to offer a comprehensive and holistic view of the main drivers and challenges that justify the establishment of an active and fluent cooperation between Europe and Latin America in the field of Future Internet.

In the elaboration of this Strategic Research Agenda document the following inputs have been considered:

- LATPs individual Strategic Research Agenda documents.
- European Technology Platforms Strategic Research Agendas.
- Other European inputs coming from EC, FIA, FIRE, Celtic and EU national initiatives.

2. About Latin America

Latin America is a region composed by 20 countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela. The main languages spoken are Spanish and Portuguese. Latin America has an area of 21,069,501 km^2 and a population of 580,086,590 inhabitants[2].

Regarding the socio-economic panorama, according to the Economic Survey of Latin America and the Caribbean 2010-2011 done by the ECLAC[3], the region is growing, but is facing major and complex macroeconomic policy challenges to achieve development with equality. The following problems were identified: inflation is picking up, real exchanges rates are falling and current account balance is deteriorating. The current situation is bringing a series of risks and difficulties, both in the short-term and from a growth perspective (in the long term). The increase in food and fuel prices in a context of strong growth of internal demand is putting pressure on the inflation rate.

Figure 1: Map of Latin America

[2] Wikipedia, Information about Latin American, 2011.

[3] ECLAC, Economic Survey for Latin America and the Caribbean 2010-2011. On line: <http://www.eclac.org/noticias/paginas/1/33941/PowerpointEnglish_EE_2011_Final_rev_upd.pdf>.

The Economic Commission for Latin American and the Caribbean (ECLAC)[4] identified the following strengths and opportunities for Latin America and the Caribbean for the following years:

- Global context is characterized by two-speed recovery.
- Internal demand drives regional growth, supported by better employment indicators and an increase in credit.
- Global context causes diverging trends in external demand.
- External account structure differs significantly from pre-crisis period.
- Macroeconomic policy dilemmas are deepening.

In the following table, it is showed the growth of the GDP in each country of Latin America, values for 2011 are estimated and values for 2012 are projected:

	2008	2009	2010	2011 Estimated	2012 Projected
Argentina	6.8	0.9	9.2	8.3	4.5
Bolivia	6.1	3.4	4.1	5.3	4.0
Brazil	5.2	- 0.6	7.5	4.0	4.0
Chile	3.7	- 1.7	5.2	6.3	4.5
Colombia	3.5	1.5	4.3	5.3	4.5
Costa Rica	2.7	- 1.3	4.2	3.2	3.5
Cuba	4.1	1.4	2.1	3.1	3.0
Dominican Republic	5.3	3.5	7.8	5.0	4.5
Ecuador	7.2	0.4	3.6	6.4	4.0
El Salvador	1.3	- 3.1	1.4	2.5	2.5
Guatemala	3.3	0.5	2.8	4.0	3.5
Haiti	0.8	2.9	- 5.1	8.0	8.0
Honduras	4.2	- 2.1	2.8	3.0	3.0

[4] ECLAC, Economic Survey for Latin America and the Caribbean 2010-2011. On line: <http://www.eclac.org/noticias/paginas/1/33941/PowerpointEnglish_EE_2011_Final_rev_upd.pdf>.

Mexico	1.5	- 6.1	5.4	4.0	4.0
Nicaragua	2.8	- 1.5	4.5	4.0	4.0
Panama	10.1	3.2	7.5	8.5	6.0
Paraguay	5.8	- 3.8	15.0	5.7	4.0
Peru	9.8	0.9	8.8	7.1	5.5
Uruguay	8.6	2.6	8.5	6.8	4.5
Venezuela	4.2	- 3.3	- 1.4	4.5	3.5

Table 4: Total GDP Growth

Million Dollars at Constant Prices of the Year 2000 Variation Rates[5]

Regarding the LAC priorities in the ICT field, the Action Plan[6] on the Information and Knowledge Society for Latin America and the Caribbean (ECLAC, eLAC2015) raised the following issues as priorities: access; e-government;environment; education; social security; productive development and innovation; enabling environment; and, an institutional framework for State policy.

Finally, according to Flora Painter, chief of S&T division of the Inter-American Development Bank (IADB), to meet the basic needs of the population of the countries of Latin America and the Caribbean (LAC), "leveraging the opportunities presented by technological change in a globalized economy becomes a necessity for any emerging economy." [7]

[5] ECLAC, Public Information and Web Services Unit, Total GDP Growth, Santiago de Chile, 2010. On line: <http://www.eclac.org/prensa/noticias/comunicados/1/43981/tablaPIB_es.pdf >.

[6] ECLAC, Action Plan on the Information and Knowledge Society for Latin America and the Caribbean (eLAC2015), Lima, 2010. On line: <http://www.eclac.cl/socinfo/noticias/documentosdetrabajo/0/41770/2010-819-eLAC-Plan_de_Accion.pdf>.

[7] IDB, Science, Technology, and Innovation in Latin American and the Caribbean, A statistical compendium of indicators, 2010.

3. EU-LAC International Cooperation

Context

Bi-regional cooperation on Science and Technology between the European Union and Latin America and the Caribbean has been enhanced during the last decades, through a series of initiatives. Actions have being done in the field of interregional collaboration as well as bilateral collaboration.

Regarding bi-regional collaboration, there is a specific S&T Strategy between the European Union and Latin America regions. From the bilateral collaboration point of view, there exist S&T agreements between the EU and Argentina, Brazil, Chile and Mexico respectively. EULARINET and Pro-ideal projects have had an active role in fostering international cooperation through the Río Summit (1999), the Brasilia Action Plan for S&T Cooperation, the Guadalajara Declaration to set up the EU–LA Knowledge Area, the Vienna Summit (2006) and the conclusions of the preparatory Senior Officials meeting in Salzburg, the Lima Summit (2008) and the Madrid Summit (2010). During this meeting, Science, Research, Innovation and Technology was established as one of the six thematic areas of the Action Plan of the Summit. During 2010, a Declaration (La Granja, Spain) and Draft Recommendations (Madrid, Spain) were also agreed. In the same year, during Senior Officials Meetings (Argentina) participants agreed on a Document on the Joint Initiative for Research and Innovation. The aim of the EU-LAC Joint Initiative for Research and Innovation[8] is to strengthen the cooperation in S&T between Latin America, the Caribbean and the European Union. This EU-LAC Joint Initiative for Research and Innovation is currently the most important policy document regarding S&T collaboration between the EU and LAC because it foresees a regular consultation process. Furthermore, this Joint initiative points to a number of joint policy initiatives and joint R&D roadmap.

During the EU-LAC S&T Senior Officials Summit, held in Brussels in (2011), the Roadmap for the implementation of the EU-LAC Joint Initiative for Research and Innovation was approved.

Benefits of International Cooperation

Relevant actions are being carried out to enhance cooperation between Latin America and the European Union on Science and Technology. Once highlighted the support that bi-regional cooperation on Science and Technology has, some benefits of the cooperation EU-LAC are pointed:

- Develop together solutions for societal challenges through the application of technology.

[8] Document on the Joint Initiative for Research and Innovation, EU-LAC SOM on Science and Technology, Buenos Aires, 2010. ONLINE: <http://eeas.europa.eu/lac/madrid2010/events/science/docs/20100226_st_som_final_doc_en.pdf>.

- Achieve common research priorities in a better way, involving researchers from different countries.
- Respond in a synergic way to global technological challenges.
- The European Union is a relevant actor in R&D and Latin America can learn from European experience.
- Exchange of experience, ideas, knowledge and scientific results.
- Consolidate networks between scientist and researchers from Europe and Latin America.

For Europe, cooperating with third countries will increase the benefits related to the opening of the European Research Area (ERA). According to the European Commission, benefits will result from:

- Tackling the research issues related to global challenges more effectively.
- More open conditions for scientists in Third Counties, to access world-leading experts and facilities in Europe.
- Long-term partnerships with Third Countries, to influence joint research priorities for mutual benefit.
- Greater coherence of action in Europe, to help Third Countries interface with Europe.

Finally, following a recent IADB report about policies in international technological cooperation[9], the benefits of international cooperation are:

- Lower costs and resource optimization.
- Increase of the presence and visibility of researchers in the international environment (reputation), enhancing the position in the scientific and economic aspects.
- Domestic markets expansion and opportunity to access international markets.
- Facilitates technology absorption and new sources of knowledge of countries with lower development.

[9] IADB Report for "Reunión de Diálogo Regional para las Políticas de Cooperación Tecnológica Internacional", Document for preliminary discussions, Buenos Aires, November 16-17, 2010, IDOM Consulting, Online: < http://idbdocs.iadb.org/WSDocs/getDocument.aspx?DOCNUM=35516177>.

4. Future Internet Trends

According to the Purple book from the Celtic-Plus Programme[10], the main challenges in the Future Internet field for the next few years are likely to be increasingly centred on the user. This fact is aligned with the EU-Latam Vision 2020 that states that activities related to the Future Internet field must have a double approach: internet for all and hi-tech research. In this sense, the Future Internet "goes way beyond connectivity and exchange of information to start bridging the gap between the digital and the physical worlds."

Future Internet technologies have transformed the access to information and these changes have had modified society, evolving towards the present Information Society. Considering this transformation, Future Internet is a key and necessary tool to achieve the societal challenges highlighted in the Regional Strategy EU-LatAm Vision 2020, which will be described in another chapter.

From the technological point of view, according to the Purple Book from the Celtic-Plus Programme, the current main trends are the following:

- The speed of technology development and deployment is getting faster.
- Moore's law will continue (low cost devices and highly integrated network components due to continuous advancements of price/performance ratio of microelectronics).
- Mainstream IT technologies are revolutionizing the telecommunications business.
- User-Generated Content will grow on a massive scale.
- Location services are new enablers for location information which will leverage all types of services and contents.
- Converged services are expanding, making the convergence with All-IP seamless and flat fee.

The Working Groups contemplated in LATPs and, consequently, in the Future Internet EU-LatAm Strategy, supports the development of the future of internet by its four pillars:

[10] Purple Book, Celtic-Plus programme of possible recommended research items. Version 2011. Online: <http://www.celtic-initiative.org/PurpleBook+/Celtic-Plus%20Purple%20Book-2011-web.pdf>.

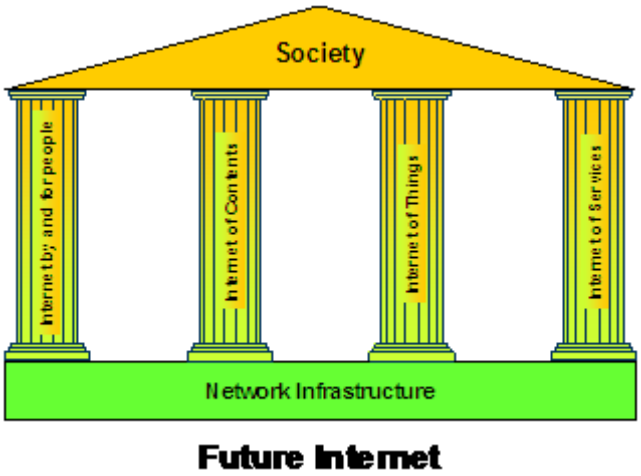

Figure 2: Future Internet Pillars[11]

As shown in Figure 2, the four pillars of the internet of the future are:

- **Internet by and for people:** The users shall be the centre of any future development, and this is particularly important in this region where societal challenges are in the forefront of public policies. Consequently 'users' shall be one of the pillars that guide the definition of the Latin American strategy around Future Internet. Related to this, it is of main importance to stress that the connection with the strategy internet **for all people**, therefore digital divide is a barrier that must be considered and put actions in place in order to overcome it. But turning the digital divide into an information society is not sufficient: e-education seems to fulfill an essential role since it aims to equip the population with the skills needed to live and work in the information society.

- **Internet of Contents and Knowledge:** One of the aspects that have become critical for the success of internet is the access to knowledge and content. This feature, together with the social dimension of internet, has triggered the current evolution that we are living. We believe that this trend will be even clearer in the future and therefore LATPs shall consider it as a key pillar for any future strategy.

- **Internet of Things:** Internet everywhere and in everything. Undoubtedly this is one of the next revolutions that Internet is waiting for. The tremendous societal and economical potential that hides behind the fact that objects and sensors could be interconnected through internet makes it one of the pillars of the Latin American Technology Platforms.

- **Internet of Services:** Services possibly were the first cornerstone that fostered internet as one essential tool for its users during the first stages of the deployment of

[11] Vision Document Future Internet, the Cross-ETPs Vision Document; January 8, 2009. Contributions from eMobility, NEM, NESSI, ISI and EPoSS. On line: <http://www.future-internet.eu/fileadmin/documents/reports/Cross-ETPs_FI_Vision_Document_v1_0.pdf>

internet. Nonetheless, we believe that services still have a very important role to play in the future internet as it reaches more users and involves new technologies and new ways of user-interaction. These new technical developments will make possible a second services revolution in future internet.

These pillars are supported by the Network infrastructure foundation as depicted in Figure 2. "To support and sustain growth of these pillars, the Network infrastructure foundation must itself be the object of specific research resulting from large set of technological challenges associated to the network infrastructure"[12]. In addition, this infrastructure "sustains the resulting capacity and performance requirements that Future Internet will have to provide"

[12] Idem

4. About LATPs

The constitution of Future Internet technology platforms in Argentina, Brazil, Chile, Colombia and Mexico is the major outcome of the FIRST project. LATPs were implemented between 2010 and 2011, by FIRST project local partners.

Latin America Technology Platforms cover a national level and constitute the basic pillars for the promotion of cooperation between Europe and Latin America in the field of Future Internet. Furthermore, LATPs cover a gap of information and network infrastructures. At the beginning of the project, January 2010, the situation of the Future Internet field was the following:

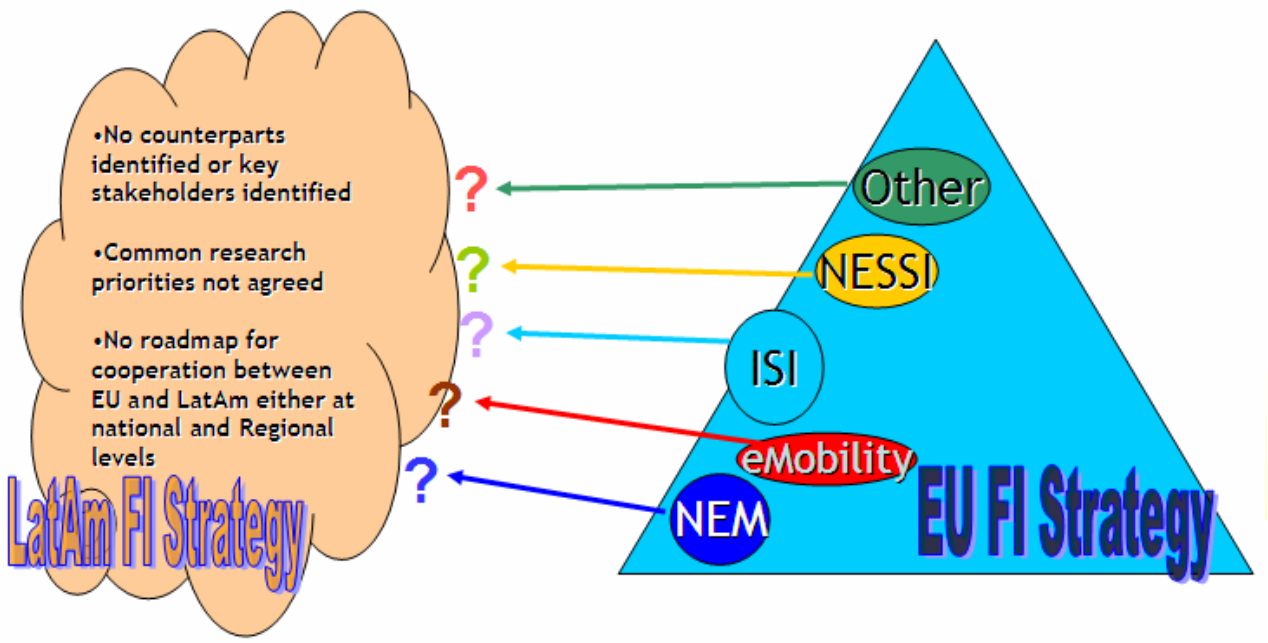

Figure 3: FI situation at EU and LatAm at the beginning of 2010

Taking into account the objective of improving cooperation between both continents, FIRST considered that the organizational model of technology platforms should maximize the synergies with the already existing European model to obtain a broader and more easily measurable impact. By June 2011, the basis was already set by the implementation of five LATPs:

Figure 4: FI situation at EU and LatAm at 2011

As shown in the figure above, there are five LATPs:

- Argentine PLATA
- Brazilian BRAFIP
- Chilean MACHI
- Colombian RECIIF
- Mexican MTP

Each LATPs has developed a Vision, a Government and a SRA (Strategic Research Agenda) documents.

In the following table, there are displayed the mirror working groups constituted by country:

	Argentina	Brazil	Chile	Colombia	Mexico
NEM	F	F	F	F	F
NESSI	F	F	F	F	F
ISI		F			
Net!Works		F	F	F	F
EPoSS	F	F	F		
Artemis	F	F	F		F
ENIAC	F				
Photonics21					

Table 5: Future Internet Working Groups per Country

Regarding Satellite Communications, BRAFIP is the only LATPs that has an ISI working Group, in Chile there are also many interest, but not critical mass; in NESSI, for instance, one of Chileans priority is ASTRO-TICs.

5. EU-LatAm Vision 2020

The Common EU-Latam Strategic Research Agenda on Future Internet is aligned with the Common EU-LatAm strategic Vision on Future Internet cooperation[13]. The main objective of the Vision Document is to set up the basic concepts, challenges and priorities that will drive cooperation between Europe and Latin America in the Future Internet field during the coming years.

According to the Vision Document, actions in the Future Internet field in Latin America and the Caribbean must have a double and converging approach that include Internet for all and Hi-tech Research:

- **Internet for all:** the Region must work towards an inclusive information society, bringing a more democratic and egalitarian Internet access in order to guarantee the benefit of the Internet into all segments of the population (e-inclusion). This includes disadvantaged people due to education, age, gender, disabilities, ethnicity and those living in remote areas. In the case of Latin America and the Caribbean, special care is taken on the rural areas and social segments with low incomes and access to technology.
- **Hi-tech research:** being involved in current research activities around how Future Internet will contribute to reducing the digital divides and will help to facilitate the active involvement of Latin American stakeholders in its economy and society.

These two targets are necessary to be able to cooperate in equal conditions, increase competitiveness and achieve sustainable growth based on knowledge and innovation.

In relation to the regional challenges, the common EU-LatAm Strategic Research Agenda on Future Internet Cooperation agrees with the following challenges highlighted in the Regional Strategy EU-LatAm Vision:

- Energy demand
- Efficient and secure distribution and access
- Global healthcare
- Food quality and production
- New security strategies to reduce conflicts and terrorism
- Demographic changes such as urbanization and rural inclusion

[13] FIRST Project, Vision 2020: Common EU-Latam Strategic Vision on Future Internet Cooperation, Online: <http://www.latin-american-technology-platforms.eu/uploads/Vision-2020_Regional-LATP-Vision-2020.pdf>.

- Well being and ageing (AAL: Ambient Assisted Living)
- Sustainable, efficient and safe 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

Other important regional challenge (that was not included at the vision document but because of its relevance it should be mentioned) is to ensure a high level of interoperability in applications based on services, business processes, infrastructure, semantic information, syntactic and telecommunications.

According to the Common EU-LA Vision 2020, the following five objectives are the strategic pillars of the Regional strategy on Future Internet:

- Fostering EU-LatAm joint R&D projects in the field of Future Internet.
- Increasing the competitiveness of the region.
- Internationalization of LatAm industry and academia.
- Fostering the relationship between Industry and Academia in order to perform R&D projects with an innovative perspective.
- Social and economic impact.

6. Methodology for Developing the Strategic Research Agenda

The starting point of the methodology is the Common EU-LatAm Strategic Vision on Future Internet cooperation-2020 since it guides Latin American Technology Platforms in its strategy with the European Union. One of the purposes of planning a methodology is to be coherent with this starting-point document that has set the basis for Future Internet cooperation.

Previous to the definition of a methodology, it is crucial to define the scope that the current document aims to achieve.

Scope

- Set the common Future Internet research priorities of the European Union and Latin America.
- The target group is composed by all those stakeholders that participate in the LATPs and ETPs, therefore it is important to stress that **the current document is a sign of interest of active stakeholders, not a state-of-the art document**. This is a positive characteristic since the SRA is a vivid document that will be enhanced and enriched among the years due to the fact that more stakeholders will be involved and due to the rapid changes of our environment that need continuous adaptation.

Method of work

The definition of a common SRA is a relevant fact since it conjugates the field of action of main Future Internet stakeholders from Europe and Latin America regions. It is not a mere compilation of LATPs and ETPs agendas, but the overlap of both since it shows the areas of possible cooperation.

This agenda is based in the following documents:

- ETPs Agendas
- LATPs Agendas
- Future Internet Documents

In general, each of the set of documents named above had different production methods; therefore, the current Regional SRA has the achievement of harmonizing these different ways of building a document.

In addition, a regional meeting was held on February 9th 2011 through RedCLARA's videoconference, where LATPs members agreed the method of work, described below. One important result of this encounter was the definition of the common grand societal challenges.

Based on the regional meeting mentioned above, the leader of WP4, ALETI prepared a *Methodology for WP4 guide* and proposed a schedule; both were shared with the FIRST consortium in order to perform a peer to peer review that aimed to improve and detect possible failures of the document and time frames.

In the next step, ALETI prepared a draft document that was delivered to two key groups:

- Experts Advisory Group (includes Observers)
- FIRST Consortium

It is important to remark that the selection of the research topics was done with the help of Latin American Partners (CINTEL, ITESM and USP) since the local agendas showed some differences in topic's categories. Thanks to the synergy of LatAm partners, the final product was a harmonized document.

The purpose of the delivery of the a draft version of the document to the two groups mentioned above, regarded in the need of validation that such a document requires; therefore, members of these key groups could send their comments and enhancement suggestions. The contributions received are indicated at "Contributions" table at the beginning of the document. The Experts Advisory Group is composed by important Latin American and European organizations; the list of members is displayed at the chapter *EU-LATAM Experts Group*.

In the following diagram, it is shown the process of validation/improvement of the document:

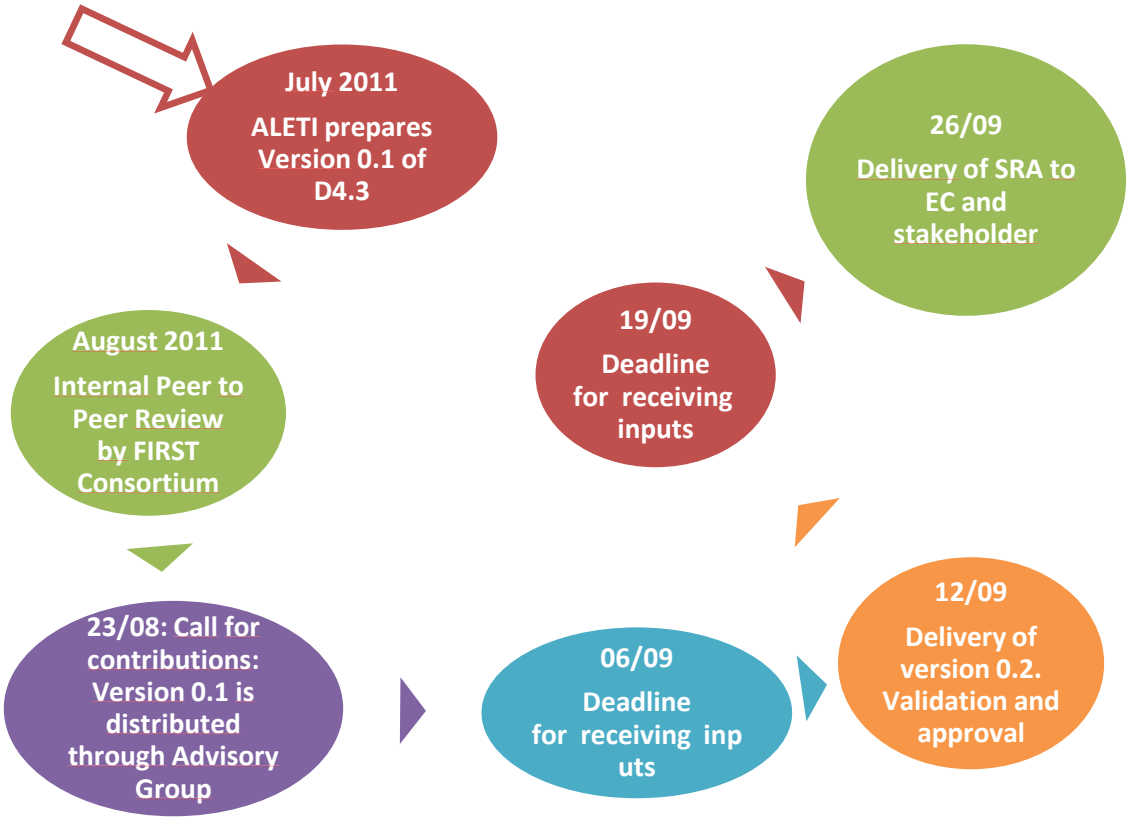

Figure 5: schedule set for developing the Regional SRA

Common Research Priorities Identification

The research priority areas of each LATP (BRAFIP, MACHI, MTP, PLATA and RECIIF) were identified and selected through a research performed by each Technology Platform for developing national Future Internet Strategic Research Agendas (at that stage each LATP identified the research interests of the academic community and main stakeholders in the Future Internet field). The areas were selected between the following technology areas (each one corresponds to a European Technology Platform): Nanoelectronics, Networked and Electronic Media, Software and Services, Software Embedded, Photonics, Intelligent Integrated Systems, Satellite Communications and Mobile and Wireless Networks. The result is reflected in the table below:

	Argentina	Brazil	Chile	Colombia	Mexico
Networked and Electronic Media (NEM)	ℱ	ℱ	ℱ	ℱ	ℱ
Software and Services (NESSI)	ℱ	ℱ	ℱ	ℱ	ℱ
Satellite Communications (ISI)		ℱ			
Mobile and		ℱ	ℱ	ℱ	ℱ

Wireless Networks (Net!works)					
Intelligent Integrated Systems (EPoSS)	F	F	F		
Embedded Systems (ARTEMIS)	F	F	F		F
Nanoelectronics (ENIAC)	F				
Photonics (Photonics21)					

Table 6: Future Internet Priority Technology Areas per country

Once technology areas were defined in each country, the main research topics and sub-topics were identified considering the interests and abilities of the main ICT stakeholders in each country (see Annex I).

7. Research Priorities in Future Internet

The following chapter describes the most relevant R&D common topics Latin America and the European Union. The list of topics that appears in the LATP's SRAs is based on the European topics displayed in their agendas. The fields that appear in this section embrace the working groups that have more presence in the LATPs: NESSI, NEM, ARTEMIS, EPoSS and Net!Works. As ISI and ENIAC only have working groups in Brasil and Argentina, they do not appear in this section.

7.1 NESSI

Latin America is characterized for being a technology adopter, more than a technology producer. One of the exceptions regards in the Software and Service field, where the continent has produced worldwide products. Since the continent is attractive from the economic and from the high quality point of view, the trend is offering services. This means that Internet of Services is a shared priority where Latin American stakeholders want to achieve a high impact in specific activities in the fields of research, innovation and standards. The rationale of this document suggests that the impact will be higher if R&D collaboration is performed between Latin America and the European Union.

The NESSI field should assist the continent "socio-economic development, generating impact in society through research activities related with the state of software technology and its proper transfer through innovation projects"[14].

Figure 6: NESSI Working Groups in LaTAm

[14] FIRST Project: PLATA Strategic Research Agenda, 2011. Online <http://www.latin-american-technology-platforms.eu/uploads/SRA_PLATA.pdf>.

These impacts mentioned above are real since the application of "different areas cuts across the industry, generating 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"[15].

The transfer to Cloud Computing infrastructure has permitted a larger resilience, a worldwide need to current technologies. This technology "as a trend and as a model for supporting services, still has challenges for its deployment and progress…In particular, R&D&I could focus to solve the challenges on the management of service level agreements in different scenarios, by adopting an integrated end-to-end approach through different layers, including services, network infrastructure, devices and sensors, taking into account not only the quality aspects of service, but also features such as security, privacy and interoperability"[16].

Another factor that collaborates to the resilience is the trend of using mobile devices. Consequently, this will require "greater knowledge applied in the generation of applications sensitive to the context and based in web services, universally accessible"[17].

NESSI Research Topics

NESSI hot topics in Latin America were identified analyzing the research priorities in which each of the five targeted countries (Argentina, Brazil, Chile, Colombia and Mexico) showed more interest through a priority table (see Annex 1).

The following figure shows the most important topics in the Latin American Region. After the figure, these topics and some additional ones are described[18]. The descriptions are based on the European NESSI SRA.

[15] Idem.

[16] FIRST Project. RECIIF Strategic Research Agenda, 2011. Online <http://www.latin-american-technology-platforms.eu/uploads/RECIIF_SRA.pdf>.

[17] FIRST Project: PLATA Strategic Research Agenda, 2011. Online <http://www.latin-american-technology-platforms.eu/uploads/SRA_PLATA.pdf>.

[18] To see what the topics that each country has, go to Annex I: priority research lists.

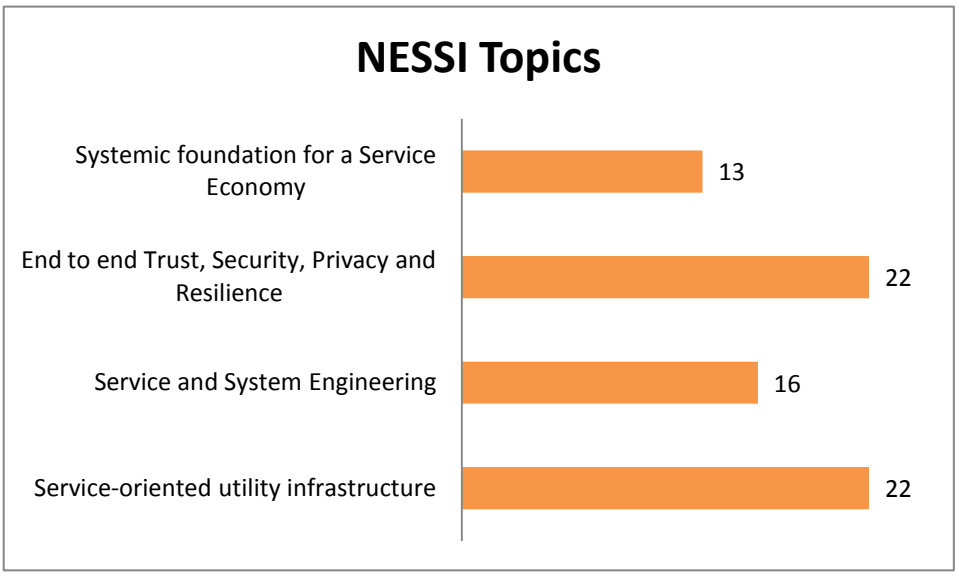

Figure 7: Hot Topics of NESSI

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.

- 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+ Event-Driven Architecture) 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.
- 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 trust-aware when making decision using FI).

Service-oriented utility infrastructure

This area looks to provide a flexible infrastructure to support the networked economy.

- Models of virtualization and energy efficiency in micro grids hardware and operating systems on chip.
- Service-oriented utility infrastructure is mainly constituted by advanced infrastructure technologies in (i) hardware which needs to be virtualized and able to be allocated flexibly, encouraging efficient hardware utilization, in turn enabling energy efficiency; (ii) middleware which needs to be designed on a multi-tier model, with virtualization at each

layer and the ability to replace components at each layer without disturbing the whole stack, (iii) reliable, high performance and low latency **cloud services** that make the virtualized resources available over the Internet (with a transparent deployment) and (iv) related programming models need to support flexible middleware and application software, and for loosely-connected parallel execution environments.

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 and goal-based) including: (i) the management of increasing complexity and variability of requirements; (ii) product line engineering approaches for services; (iii) resolvability 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-centred; (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 the 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 end-user control panel.
- 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 fulfill 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 or future webs) 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.
- 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.

Systemic foundation for a Service Economy

This area's objective is to ensure social, economical, legal and cultural viability.

- Financial Analytic Services. Support emerging business models through (i) services for the marketplace (e.g. accountability, Charging, payments, risk analysis and financial research),
- Service models for research on natural phenomena.
- Multidisciplinary research to build a theory describing the relationship between organizations and social networks in regards to hybrid service-based systems.

Business Process Modeling

The goal of this field is to pave the way towards the collaborative executable enterprise. Business Process Modeling includes:

- Dynamic formalization, management and interaction of business processes implemented through services. This necessitates (i) the transition from business processes to IT applications: modeling of functional and non-functional properties, modeling 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 modeled enterprise architectures being used as "teaching applications" through a full featured interface (the personal interface for the IS).
- Support for long-term and transactional business collaboration. Here (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. Here (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 service 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.

Adaptive Interactions

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

- Services for semantic processing of content.
- Models and languages for audiovisual services: content creation and development of adaptive contents.
- Services of semantic processing for custom applications and for decision making in health care cases.

Reference Architecture and Implementations

The goal is to define open architectures for intranet- to internet-scale service delivery.

- **Harmonize service architectures (SOA) and infrastructure architectures (SOI)** 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.

Services Pervasiveness

Its goal is to materialize the ubiquitous service availability. It embraces:

- Service-web models that are executed in embedded and mobile devices.
- Services of suggestions and recommendations for client-side hardware in mobile devices.
- Turn devices into enablers of services by embodying SOA principles into embedded systems
- Link collaborative devices to services.

NESSI Contributions for Grand Societal Challenges[19]

The updated version of the SRA of 2011 treated the following societal challenge topic: "How can software and service technologies contribute best to solve the grand societal challenges? What is the impact of these trends on software and services?" These were the main questions that guided the discussion within the NESSI community with the goal of identifying the most relevant service characteristics in the future and to derive corresponding strategic research objectives. The resulting highest ranked objectives are (a) achieving interoperability of services, (b) extending and supporting the global accessibility and pervasiveness of services, (c) securing software and services and making them trustworthy, and (d) supporting fast business cycles and increasing productivity by software and services.

[19] http://www.nessi-europe.com/files/Docs/NESSI%20SRA_update_May_2011_V1-0.pdf

7.2 NEM

According to the European Technology Platform on Networked and Electronic Media, the future "electronic media content will include not only the audiovisual services of today but also a wide range of interactive services across all realms of information, education, and entertainment, offering new business opportunities."[20] The Networked and Electronic Media field must be central in the Future Internet strategy, "according with the Future Internet Assembly Roadmap (2011) one of the basic realities of today's Internet is that content, especially video content, represents a very large part of the traffic on the Internet. Controlling the use and distribution, while at the same time fostering its creation of all this content, must be at the centre of any FI strategy." [21]

Figure 8: NEM Working Groups in LaTAm

International cooperation is considered by the European technology platform on Networked Electronic Media as a way of achieving more efficiently and with a greater market impact, many of the research challenges described in the NEM European Strategic Research Agenda.[22]

[20] Strategic Research Agenda "Networked and Electronic Media" European Technology Platform, September 2009

[21] FIRST Project. MTP Research Agenda, 2011.

[22] Strategic Research Agenda "Networked and Electronic Media" European Technology Platform, September 2009

The five target countries that implemented LATPs (Argentina, Brazil, Chile, Colombia and Mexico) have chosen the Networked and Electronic Media field as a priority. In Argentina, NEM group "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."[23] During the last years, in Argentina was created "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."[24]

In Brazil, the NEM field is being developed, there are more than "70 million Internet users, and average weekly hours of navigation is more than 24 hours. Moreover, in Brazil the social networks are widely using and enjoying."[25]

In the case of Chile, the NEM group "needs to develop and adapt the opportunities and possibilities of the media industry (value web creating, storing, adapting, aggregating, delivering, and consuming 'content' – understandable information made available to a user at any stage of the value chain. Content includes both the 'essence' – the data representing text, audiovisual services, games programs, and 'apps' that is the object of the value chain – as well as the metadata that describes the essence and allows it to be searched, routed, processed, selected, and consumed) to Chilean Society challenges."[26] In relation to Chile's societal challenges, "the Chilean NEM sector needs to find the way to make Networked and Electronic Media advantages available to all users with different purposes such as personal, professional and educational purposes".[27]

In the case of Colombia, the country recently released a Policy for the promotion of digital content industry and "is building a content industry with high potential for development, therefore, Internet should provide the necessary tools to facilitate information management, user profiles, user- and context-aware advertising, among others." Research activities "will focus on the generation of innovative digital content that enable high-quality interaction in a virtual world allowing an augmented reality experience; on creating new and better search engines, which even allows the identification of objects within images; and the use of adaptive systems and intelligent inference processes to produce coherent recommendations to users, new service developments, among others."[28]

[23] FIRST Project: PLATA Strategic Research Agenda, 2011. Online <http://www.latin-american-technology-platforms.eu/uploads/SRA_PLATA.pdf>.,

[24] Idem

[25] FIRST Project. BRAFIP Strategic Research Agenda, 2011.

[26] FIRST Project. MACHI Strategic Research Agenda, 2011

[27] FIRST Project. MACHI Strategic Research Agenda, 2011. Online <http://www.latin-american-technology-platforms.eu/uploads/SRA_MACHI.pdf>.

[28] FIRST Project. RECIIF Strategic Research Agenda, 2011. Online <http://www.latin-american-technology-platforms.eu/uploads/RECIIF_SRA.pdf>.

According to the Mexican SRA the NEM field "encompasses many segments such as 3D graphics, audio editing, compositing, authoring, etc. There are other terms available such as *creative media* or *multimedia production*, but they also apply to processes not done digitally, such as drawing paintings by hand or producing in the sense of financing a project. DCC (Digital Content Creation) best describes the software used in connection with output produced by the user and the DCC industry as a whole."[29]

NEM Research Topics

NEM hot topics in Latin America were identified analyzing the research priorities in which each of the five targeted countries (Argentina, Brazil, Chile, Colombia and Mexico) showed more interest through a priority table (see Annex 1).

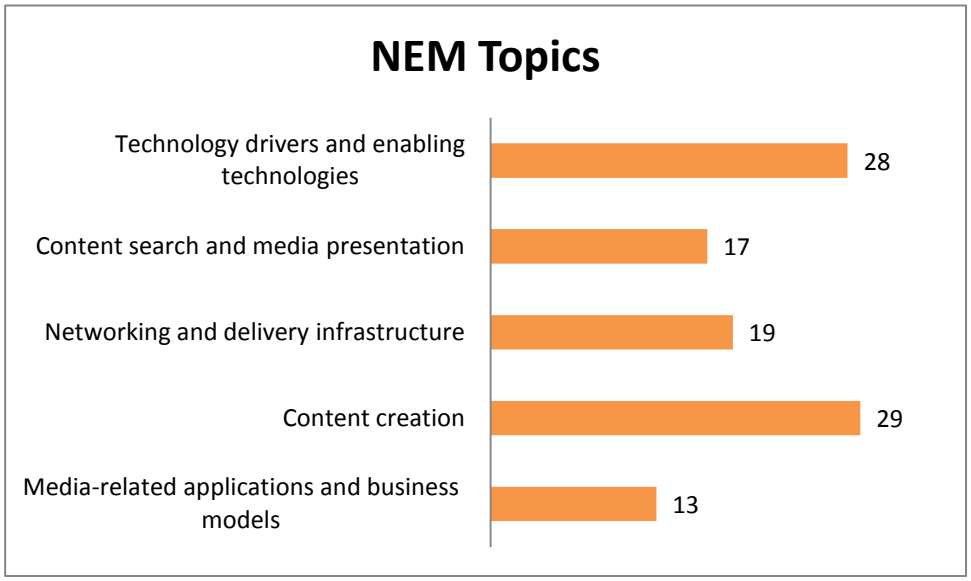

Figure 9: Hot Topics of NEM

Content creation

It means the creation of content to guarantee the offer and availability of new and innovative services. This research theme is the most "popular" from LatAm side.

- New forms of content: How to manage and promote the adoption of new services and how to adapt networked media technologies for wider purposes, such as games with "more serious" purposes.
- 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

[29] FIRST Project. MTP Strategic Research Agenda, 2011.

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.

- 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.
- 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.
- 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.
- 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 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 specialised applications – keyboards, mouse, joystick. Metadata parameters such as time and position can be captured through satellite services such as GPS.
- 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.
- 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.

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.
- Virtual reality – interactive technology for communication, business applications such as remote action, and entertainment applications including games.
- 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.
- User number measurement and user behavior logging – to allow service providers to measure audiences and how they are using the service.

Technology drivers and enabling technologies

- 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.
- Identity management and AAA – methods for authentication, authorisation and accounting while taking account of privacy.
- 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.
- 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.
- Charging and payment – a reliable, low cost system of micropayments is needed.
- Power management technologies - energy saving: how the networked electronic media technologies can help save energy in all sectors of the economy

Networking and delivery infrastructure

Networks underlie all the services and applications described in chapter. But in normal operating conditions the user should not have to configure the network to suit an application and should not even need to know how the signal is routed. To achieve that goal, current network technologies need much improvement. The size and complexity of the internet is growing very fast, both in terms of volume of traffic and the numbers of users (not only human users but also inanimate devices). Human users increasingly demand services that are real-time, simple, secure and personalized. Accommodating these requirements presents the main challenge for the Future Internet.

- Network intelligence: Services must be created and delivered to end-users much faster, and constituents of an application (the service components) may come from a larger community of providers in partnership. Service logic will be highly geographically distributed. The end-user experience will be highly individualized based on user context, role, preference, behaviour.
- Networks may soon all be multi-provider and multi-service. In this scenario the network provider will sell connectivity to service providers in fair competition with other network providers. The user will no longer buy connectivity but services, and new business roles like 'service brokers' will appear in the market.

Media-related applications and business models

If new technology will 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.

NEM Contributions for Grand Societal Challenges[30]

[30] This contribution has been sent by Mr. Pierre Yves Danet, from NEM ETP.

Smart energy grid: NEM is also active in Energy efficiency since NEM covers Home Network services which could help people to decrease their electricity consumption. In addition, the NEM agenda is also addressing immersive communication which could help people to communicate in more realistic modes, hence avoiding travel. All these aspects have been described in a specific position paper available on the NEM web site. The conclusion of the position paper points out that climate change is one of the most important challenges the world will face in the near future. Effective actions are therefore required to prevent mankind to face a myriad of disasters and natural catastrophes. The following general consensus was reached: ICTs, and hence NEM technologies, can significantly contribute to solve this problem. To achieve that objective NEM members are supporting the following activities:

- Enable advance ICT for devices and make their functionality available in an open and service oriented way.
- Enable cooperation among devices and enable correlation to the user's tasks.
- Enhance energy efficiency by enhancing user awareness and dynamically enable them to adjust their lifestyle requirements to optimize energy consumption.

Considering these targets, the following positions should be encouraged:

Promotion of the launching of services whose mission will be the provision of information to users about consumption in conjunction with other services developed under the framework of the digital home.

Encouraging the deployment of advanced metering and home network management services.

Proposed action: Establish stronger liaisons with EPOSS in order to map the Internet of Things and Networked media with the objective of enabling home network standardisation which is a key requirement to build a new class of home services able to save energy.

Smart environmental information system: a priori NEM is not able to provide any contribution to that part

Smart systems for transport and mobility: NEM has recently published a position paper pointing out that multimedia services should be part of this challenge since location services combined with multimedia information could help people in their transportation situation. On the one hand, the range of possible applications from the NEM sector should improve the information available to transport users and operators, to make them more aware of the implications of their use and operation of the transport system, and thus to support transport policy objectives. This information will help travellers make more informed decisions about how, when, where and whether to travel. In this case, the ubiquitous and immersive use of audiovisual information is key for the satisfaction of the expectation of travellers regarding reliable ITS information.

Road traffic congestion and road fatalities have been identified as major challenges that Europe's transport system needs to overcome. Conventional approaches such as the development of new infrastructure have not provided the necessary results required by the magnitude of these challenges. Innovative solutions are therefore clearly needed.

NEM technologies can definitively contribute to foster implementation of ITS-based solutions, as they will gradually provide a range of new services to citizens and also enable improved real-time management of traffic movements. Additionally, there will be obvious benefits for transport operators and clients, since the new systems will provide public administrations with rapid and detailed information on infrastructure and maintenance needs. Furthermore, NEM technologies will provide new, more easily used and comfortable services to passengers, and increase safety and security.

Proposed action: Establish a liaison with the European Intelligent Transportation System Forum/platform in order to share our vision and define a set of common research topics. In the Iberoamerican region, there is an organization called ITS Iberoamérica[31] which embraces the Intelligent Transportation System of the region. It is not dedicated to R&D as the European platform, but it can be a good starting point for the American continent.

Smart culture and knowledge: This area is NEM's core research focus. In the last version of our Digital Agenda we have identified 30 research topics which have been ranked by the NEM community through a recent survey. The 6 most important topics are the following:

1. User satisfaction and quality of experience
2. Home and extended home networks
3. Network architecture
4. Intelligent delivery
5. Representation of content
6. Tools for content creation and manipulation

Proposed action for NEM: the platform should share the Smart culture&knowledge requirements to the other ETPs in order to secure that the future technologies will be able to support these services.

[31] www.itsiberoamerica.com/

7.3 ARTEMIS

The working group of Embedded Systems (ES) is present in four (Argentina, Brazil, Chile and Mexico) of the five target countries.

The Chilean SRA has set a strategy that may be applied to the entire continent, as well as to ARTEMIS ETP: "the strategy is differentiating the designs (versus high volume producers such as China) by the high quality, the capability to work in hard environments and by incorporating higher levels of "intelligence" in the systems and certifications"[32]. Consequently, the focus is on design and consulting, not manufacturing. The expectation is that R&D activities between both continents enhance the quality of innovations and the social experiences.

Figure 10: ARTEMIS Working Groups in LaTAm

Today, ES compass the daily life of persons thanks to a set of products and manners of doing. They do not only improve the ordinary life, but they are used to deal with drastic events such

[32] FIRST Project. MACHI Strategic Research Agenda, 2011

earthquakes or to create solutions that will increase the carbon footprint. Another application is the decentralization energy generation, which permits a more connected world.

The ARTEMIS-ETP SRA classifies technological research for Embedded Systems into three **Research Domains:**

1) Reference Designs and Architectures

Sets of agreed rules and concepts for describing the more physical aspects of embedded system implementation, both hardware and software, yielding faster development of innovative solutions across different sectors.

2) Seamless Connectivity and Middleware

Technologies, mostly concerning software, for describing how embedded systems can be made to interact in various ways, to offer better services to the user while radically reducing the time taken to introduce new services. Interoperability of ES is of increasing importance in this domain.

3) (System) Design Methods and Tools

Proposing and defining new ways of addressing the design complexity and productivity gap issues currently faced in ES design, aiming at significantly reducing time-to-market (and therefore improving competitiveness) of participating industries, and providing a basis for new businesses to grow from. To focus the R&D necessary for developing efficient methods and tools, ARTEMIS proposes a scheme of 'Tool Platforms' oriented towards specific industrial needs, around which eco-systems of developers and users can grow.

These Domains are highly transversal, with impact on all applications of Embedded Systems. They are, however, so generic that, without establishing a link to specific areas of innovation, research results risk becoming fragmented collections of single application-specific technology. To fight this tendency, a set of "ARTEMIS Sub-Programmes" (ASP) is identified.

ARTEMIS RESEARCH TOPICS

ARTEMIS hot topics in Latin America were identified analyzing the research priorities in which each of the targeted countries (Argentina, Brazil, Chile and Mexico) showed more interest through a priority table (see Annex 1).

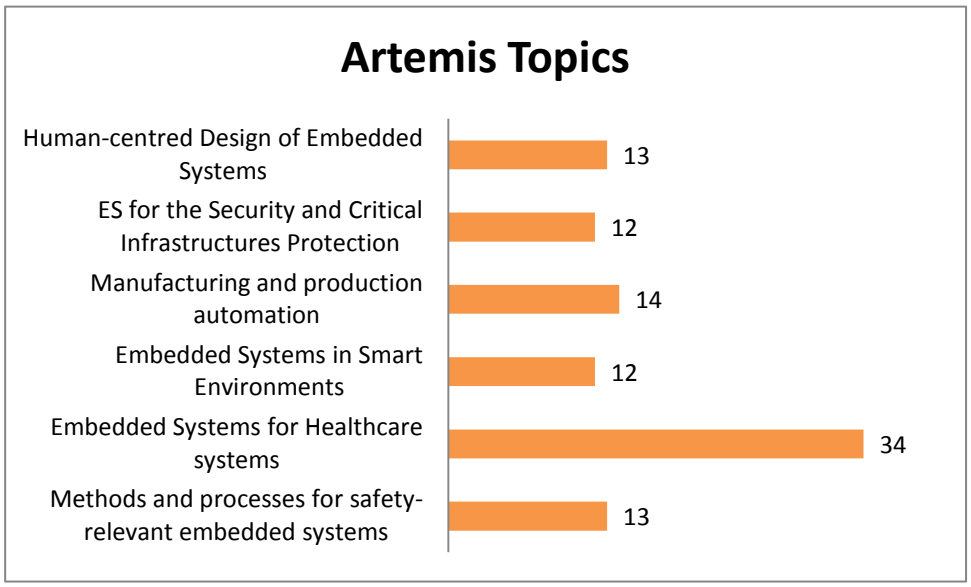

Figure 11: Hot Topics of ARTEMIS

Methods and processes for safety-relevant embedded systems

Systems that must operate in situations where failures may result in harm or damage must be ultra-reliable and predictable (e.g. meeting hard real time constraints) or there must be sufficient redundancy so that a subsystem failure does not lead to a safety related system failure: design assurance methods and processes are required to guarantee hazard-free designs. The main theme and results of this sub-programme are therefore embedded systems for enhanced safety and efficiency in the transport domains (i.e., automotive, aerospace, rail), industrial process control, medical domains and public infrastructures and utilities. The focus is on the cost-effective design and integration of systems with adequate dependability used in safety-critical applications.

- 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.

Manufacturing and production automation

The main themes of this area are embedded systems supporting sustainable, competitive, flexible, reconfigurable manufacturing and delivery of products, and the support of products over their complete life-cycle.

Mastery of these is essential in assuring that manufacturing know-how for efficient and sustainable production of products and services is further advanced, and that product lifecycles can be completely, sustainably and efficiently managed. These aspects contribute to the competitiveness of European and Latin American industries, both directly (improving manufacturing and product efficiency without compromising the environment) and indirectly, by supplying equipment and know-how to international partners as a business in its own right.

- 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, ...);
- Utilities (the infrastructure for public services including electricity/gas supply, fresh and waste water, district heating, …);
- Manufacturing logistics (internal logistic processes across the whole manufacturing chain, emphasizing the value-adding processes) and
- Multimodal logistics management (planning, implementation and control of efficient flow and storage of goods, services and related information).

Embedded Systems for Healthcare systems

This is the theme with the highest interest within Artemis LATPs. The interest is so high that in Mexico an e-health group was constituted; it embraces embedded software technologies as well as others from the Future Internet field.

It addresses embedded systems technology in the context of healthcare, to enable solutions that reduce the rising costs of healthcare and help to cope with the shortage of professional staff. Solutions are oriented to the use at the patient's homes, on the move and in hospitals or other care institutions and cover applications in the area of (remote) patient monitoring, tracking of people and equipment, tele-medicine, imaging technology for diagnostic as well as treatment purposes (e.g. minimal invasive surgery).

- Dynamically configured networks of sensors and actuators for in-home and mobile and institutional situations;
- Networked, distributed control Systems;
- New sensors and actuators are required including new type of sensors for capturing biological and molecular data and
- Multi system integrated workflows.

ES for the Security and Critical Infrastructures Protection

One of the most promising directions that will enhance the features provided by the Internet of Future is the so called "Internet of Things", which aims to more effectively integrate the world of

Internet with the physical world. ES technologies play a key role in the accomplishment of this, as they will represent the smart interconnected objects, or they will constitute the interface between the real world and its virtual representation over future networks.

Services exposed by the embedded systems over the "nets" of the future will transform the underlying networks from merely a communication means to become proactive, service-based infrastructures. With this comes an increasing reliance on their dependable operation, with consequent concerns about privacy and trustworthiness in cases of accidental or malicious disruption.

- Enhanced technology for fault mitigation and recovery of ES clusters;
- Sensing, control and automatic decision making functions;
- Real-time support for efficient interactions.

Human-centred Design of Embedded Systems

It covers User Centred Design approaches and solutions for Human Machine Interfaces (HMI) of Embedded Systems(...)The aim is to promote technology development that supports designers to build intuitive HMIs that integrate naturally into operational environments and that are effective and easy to use, especially in safety critical domains.

- New knowledge on human performance in association with new and innovative assistance and information systems;
- Human Machine Interfaces (HMI) of Embedded and
- New technologies for intelligent multi-modal interactive systems, which are intuitive and easy to use and adapt to the user state, context and capabilities.

Embedded Systems in Smart Environments

The overall goal is to provide methods, tools, technology and models with which developers will be able to build 'smart environments', i.e. ecosystems of smart and heterogeneous devices interacting with each other and with the environment, and cooperating together to provide a foundation for rapid local applications and service innovations. This theme is closely related to EPoSS working group.

- 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 and
- Interoperability solutions including a semantic platform that can address scalability, performance, security and evolvability requirements arising from different kinds of environments and usage scenarios.

ARTEMIS Contributions for Grand Societal Challenges

The Artemis-Artemisia Message (2011)[33] states that Networked Embedded Systems are THE NEURAL SYSTEM OF SOCIETY. Besides the fact that Embedded Systems are key enabling technology for industrial an societal future, it will also provide core solutions for big societal challenges, such as: affordable healthcare and wellbeing, green and safe transportation, reduced consumption of power and materials, reduction of food waste, smart buildings and communities of the future, and an imminent lack of natural resources. Another societal challenge that it is not pointed out in ARTEMIS message, but for sure is a LatAm-EU challenge, is the disaster management.

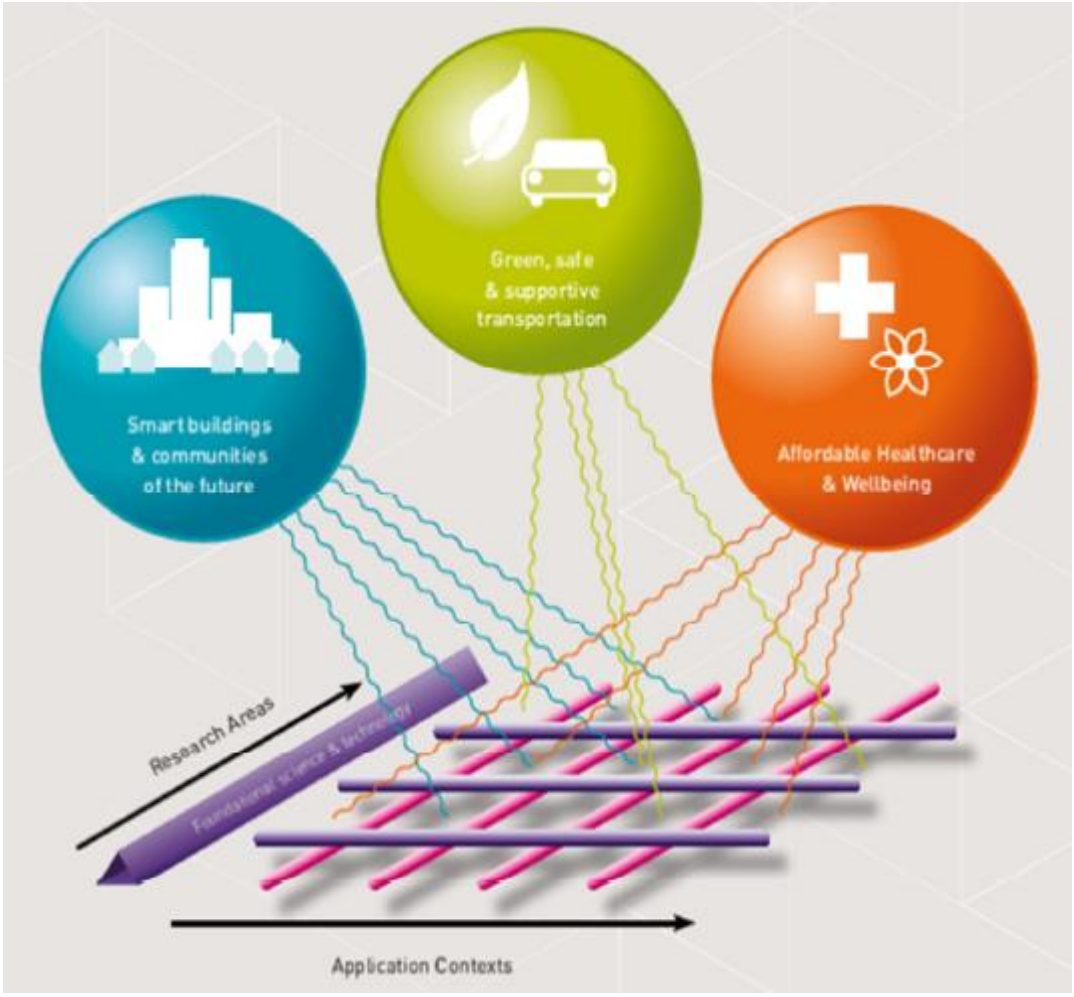

Figure 12: SRA application contexts, research priorities and societal challenges into perspective[34]

Proposed action for ARTEMIS: Establish a liaison with the European EPoSS platform in order to share our vision and define a set of common research topics.

[33] ARTEMIS: Intelligence on the Spot, ARTEMIS Message SRA 2011. Online: <http://www.artemis-ia.eu/sra>
[34] Extracted from ARTEMIS message document.

7.4 NET!WORKS

According to the Mobile and Wireless Communications Technology Platform's Strategic Applications Research Agenda[35], "Mobile communications has become a basic necessity in life and its networks together with Internet are now considered as part of national critical infrastructures for many countries. Their high reliability and availability is becoming more important and vital in efficient operation of businesses, Governments, public services, emergency services all the way to an individual's private, public and business. From economy point of view, mobile communication services and technologies is a large contributor to a country GDP and employment."

Four countries that implemented LATP, Brazil, Chile, Colombia and Mexico have chosen Mobile and Wireless Communications technology area as a priority area. The Brazilian Technology Platform considers that Brazil "must work to transform mobile communications technologies in socio-economic value to enable development and welfare of citizens and believes that Brazil should focus much of its efforts on this area."[36] From the market perspective, the Chilean mobile communications market is quite mature and wireless communications are widely spread, although still is not reaching all the sectors of the Chilean society.[37] From the socio-economic point of view, "By the year 2015, mobile and wireless communications will play a central role in all aspects of Mexican citizens' lives, and will have a major influence on global economy, wirelessly enabling every conceivable business endeavor and personal lifestyle." [38]

Figure 13: Net!Works Working Groups in LaTAm

[35] eMobility Mobile and Wireless Communications Technology Platform, Strategic Applications Research Agenda, 2010. Online < http://www.networks-etp.eu/fileadmin/user_upload/Publications/SARA/Emobility-SARA-100731.pdf>

[36] FIRST Project. BRAFIP Strategic Research Agenda, 2011.

[37] FIRST Project. MACHI Strategic Research Agenda, 2011. Online <http://www.latin-american-technology-platforms.eu/uploads/SRA_MACHI.pdf>.

[38] FIRST Project. MTP Strategic Research Agenda, 2011.

In the case of Colombia, Mobile and Wireless Communications are considered as "a tool to achieve that all Colombians have access to the information highway. These communications have proved to be tools for economic development, job creation and improving quality of life in different scenarios."[39]

NET!WORKS RESEARCH TOPICS[40]

Net!Works hot topics in Latin America were identified analyzing the research priorities in which each of the five targeted countries (Argentina, Brazil, Chile, Colombia and Mexico) showed more interest through a priority table (see Annex 1).

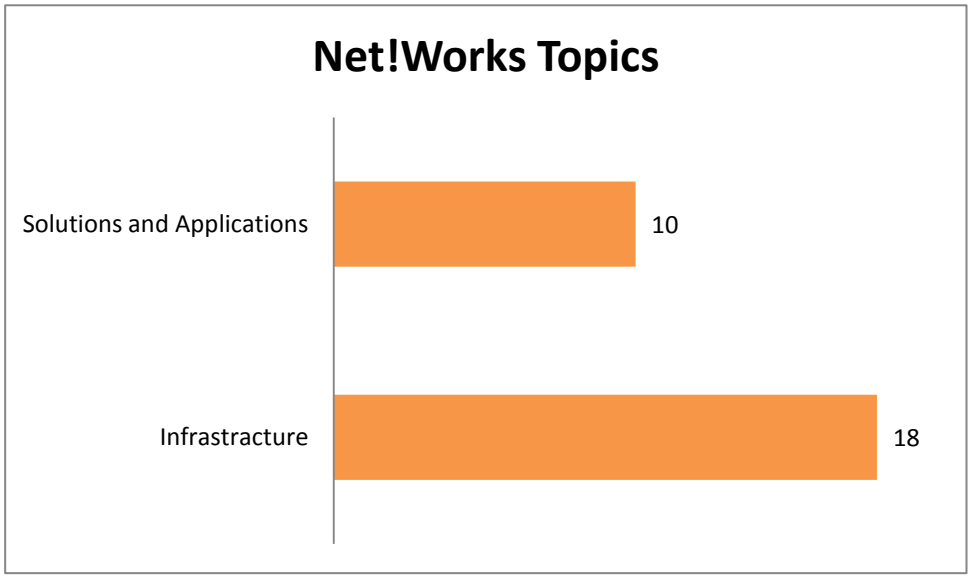

Figure 14: Hot Topics in Net!Works

Infrastructure

- Mobile and Wireless Broadband:

Multimedia applications are increasingly demanding greater bandwidth. To achieve high data rates for future services it will be necessary to develop new technologies that support the efficient delivery of these services, which poses challenges in mobile and wireless technologies. R&D&I activities could focus on mobile and wireless broadband networks and communications systems as

[39] FIRST Project. RECIIF Strategic Research Agenda, 2011. Online <http://www.latin-american-technology-platforms.eu/uploads/RECIIF_SRA.pdf>.

[40] The descriptions are a quote of RECIIF Strategic Research Agenda.

well as fourth generation systems (4G, LTE-Advanced) and subsequent developments (5G), with special attention to the evolution of these systems that support greater speed and capacity. Also, are of interest new developments in radio transmission, design of systems for mobile broadband communications and new methods of signal processing.

Finally, it is also considered R&D&I in high-capacity end-to-end technologies enabling the ubiquitous broadband access; convergence and interoperability of heterogeneous dynamic mobile technologies (interoperability of 2G, 3G, 4G and later); development of robust and secure networks with optimized interconnection to core, metro and edge networks, both wired and wireless, in a domain of several telecommunication network and services providers.

- Spectrum management

This research priority includes developing tools (methods, information systems, databases) for analyzing, storing and displaying information on the allocation, licensing and spectrum usage. It also requires new innovative methods to measure the spectrum, its use and to evaluate the results in order to make efficient and transparent use of it. Research can then be aimed at enabling technologies for flexible use of spectrum for mobile broadband, including approaches such as cognitive networks, and devices for sensing the environment and allocating the spectrum in an opportunistic way, taking into account the regulatory constraints and new technologies that arise. It is also important to create the tools for monitoring and controlling this resource and to support new pricing and licensing models.

- Mobile and wireless ad hoc networks

R&D in this field will support the expansion of Internet to physical objects, the Internet of things. In this sense, research in this field will be aimed at managing information on real objects through the use of sensor networks and wireless devices in different scenarios. This will require secure communication protocols that adapt to the characteristics of objects. Research may then focus on wireless object networks, wireless sensor networks, and short-range technologies, which enable the development of home networking, among others.

- Fixed Mobile Convergence

In this field, it is important to investigate new protocols and architectures for access and core network that allow the convergence of fixed and mobile communications with a strong integration of different networks using wireless technologies to serve as support for unified seamless communications and deployment of services, which allows simple, efficient and transparent communications. Fixed-mobile convergence should support the convergence of platforms in order to reduce costs. Research on the integration of radio technologies with fibre optic networks for the consolidation of mobile and wireless networks integrated communication systems that provide high-speed wireless access at home, on the street or at work as well as technologies as Radio over fibre can be considered within this area.

- Satellite communications

Given the coverage and monitoring capabilities in wide geographical areas and their potential support to systems such as systems for e-health, satellite communications can facilitate the flow and exchange of medical knowledge in emergency situations where the available information must be accurate and timely, especially in regions where infrastructure is scarce. Satellite communications research could focus on developing secure, integrated and flexible satellite communications through the development of high-capacity architectures and technologies that enable end-to-end connectivity with lower transmission costs than the current systems. For this, it is necessary to develop capabilities for integrating satellite communications with terrestrial networks to support the Future Internet, fixed and mobile, through joint dynamic reconfiguration of satellite-earth protocols. In addition, it is encouraged to undertake R&D&I in innovative technologies and robust but flexible network architectures that enable deployment of multiple services and a secure and reliable communication, where there is need for high network availability, high efficiency in information processing and interoperability with other systems.

- Security

Security of mobile communications is still a matter of vital importance, since without an adequate protection for networks, equipment and information, the confidence of users of these systems could decrease and thus the use of mobile communications. Security threats over the Internet will become increasingly relevant for mobile and wireless communications, given the increasing integration between mobile systems offering data services and Internet services. This research area includes also topic such as reliability, availability and privacy.

Solutions and applications

- Mobile applications

It is important to highlight that social networks are one of the main applications that encourage the use of mobile broadband and as this application there are other applications and services that will strongly encourage the use of Internet in the short, medium and long term. In this research area, it is important to carry out R&D&I activities in novel and innovative applications for mobile financial services (m-banking), business services (m-commerce, mobile advertising, social networks), entertainment (video, social network, information and dissemination), mobility (intelligent transportation systems), education (m-learning) and health (m-health).

- Mobile Health

This field deserves special attention within the applications and solutions that could be offered through mobile and wireless communications. Within this research area, it is important to highlight R&D&I activities in the design of patient monitoring systems and intelligent systems for remote health in order to help patients undergoing treatment at home, to allow the interconnection of the health system while improving healthcare in rural areas and with low population, to deliver remote monitoring and care, to increase the efficiency of diagnostic and treatment, to reduce treatment and management costs and to provide citizens with better quality of life. It is also important to develop R&D&I activities to facilitate the Internet usage and approach to ICT for people with physical disabilities (e-disability).

- Machine-to-machine communications

Machine-to-machine communications (M2M) represent technological solutions and implementations enabling machines to communicate with each other without any human intervention. The infrastructure of these solutions is supported by sensor networks and actuators to measure and exchange information through the network. M2M solutions are characterized by a high degree of autonomy and a most efficient use of network infrastructure. Currently, M2M communications represent one of the most attractive emerging markets, with applications in logistics, smart metering, and health, among many others, to facilitate the daily lives of citizens. In this field, it is important to undertake R&D&I activities in information and context management models: new models for traffic, data and billing; as well as in the scalability of solutions and interoperability.

Net!Works Contributions for Grand Societal Challenges[41]

The field of wireless and mobile communications is a key enabler for building the smart infrastructures of the future and future networks. The White Paper of 2010 from eMObility ETP (now called Net!Works) indicates: *Information and communication technologies for future networks provide the key technologies and systems, which enable the essential building blocks for many application sectors and will support solutions for Grand Societal Challenges*.

The societal challenges that can be highlighted are:

- Climate Change
- Energy and Resource Efficiency
- Health
- Demographic Change Transport (in addition addressed by eMobility)

Future networks will be the basis of smart cities, smart transport, smart homes and smart environments. A strong and ubicous infrastructure will help the following societal challenge:

- Digital Divide towards social inclusion and equal access to opportunities

Proposed action for Net!Works: Establish a liaison with the following European platforms: EPoSS and ARTEMIS.

[41] eMobility Contributions to Solve Grand Societal Challenges, White Paper, Date: 15 September 2010. Online: <http://www.networks-etp.eu/fileadmin/user_upload/Publications/Other_Publications/eMobility_position_paper_Grand_societal_challenges.pdf>

7.5 EPoSS

EPoSS Working Groups in Latin America work around Smart Systems, which are defined as "intelligent, often miniaturized, 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. Utilizing 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"[42].

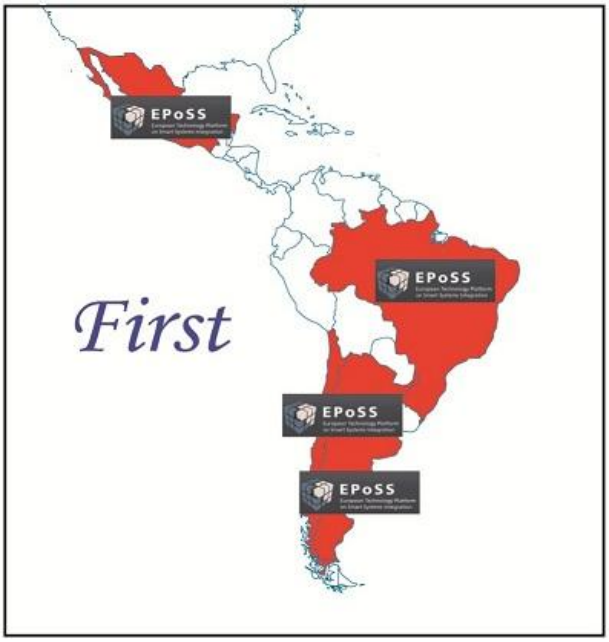

Figure 15: EPoSS Working Groups in LaTAm

EPoSS Working Groups in Latin America are one of the smaller groups in terms of quantity of stakeholders, but since its promising future and its high potential in the continent, its interdisciplinary and since it can help to address some of Latin American challenges since a new spectrum of product applications, moreover, it can help global problems. 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. Latin America stands in the first generation of Smart Systems:

[42] EPoSS SRA, page 9.

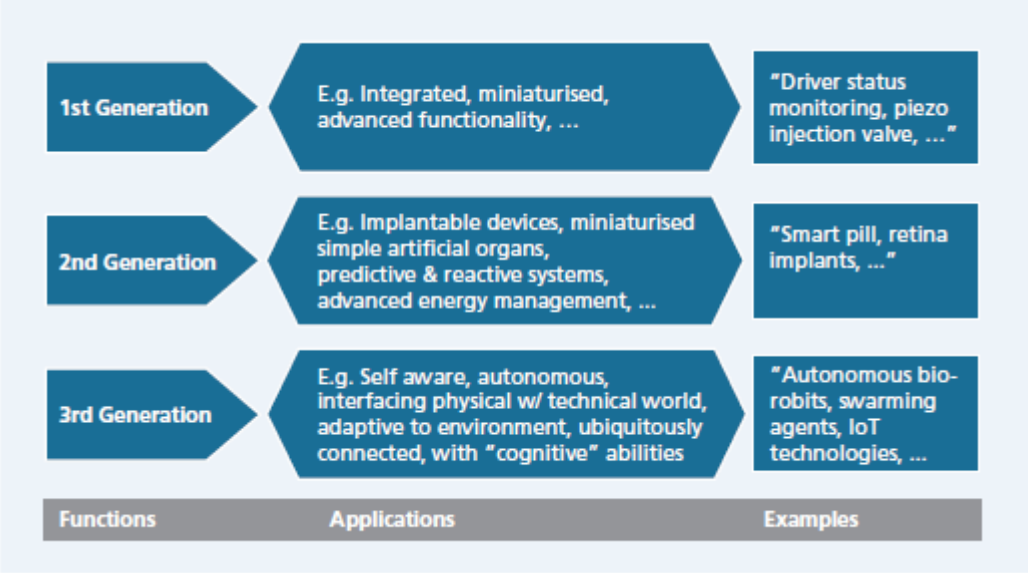

Figure 15: Continuing revolution of Smart Systems Integration[43]

EPoSS Research Topics in Latin America

EPoSS hot topics in Latin America were identified analyzing the research priorities in which each of the targeted countries (Argentina, Brazil and Chile) showed more interest through a priority table (see Annex 1).

[43] Idem

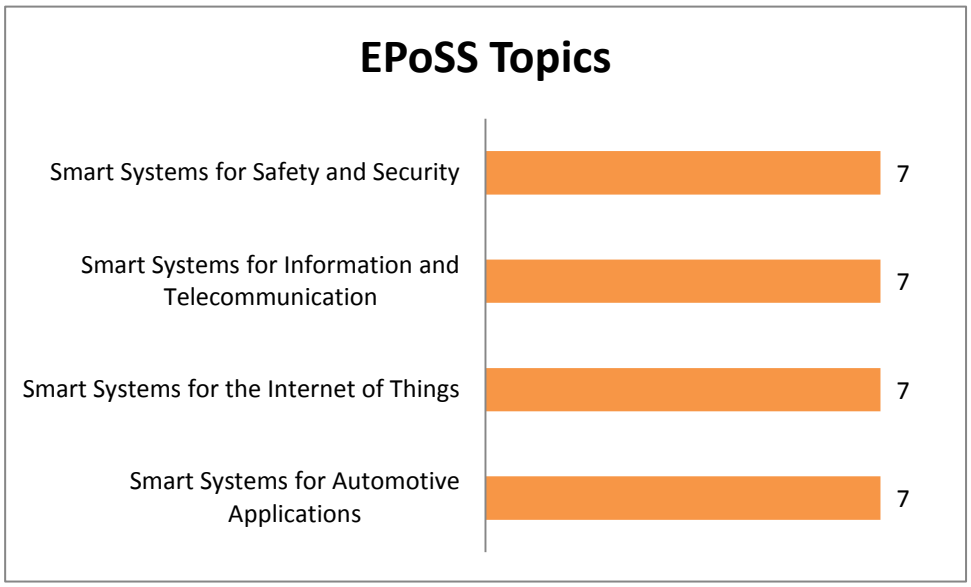

Figure 16: Hot Topics in EPoSS

1. 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. It can be highlighted two themes:

- **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.

Energy efficiency and the use of non-conventional energy sources is worldwide priority since it can help to reduce the carbon footprint.

2.	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.
- 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.
- Personal emergency and home security systems: Biometrics (facial, fingerprint, iris, retina recognition) / mm-wave to THz imaging systems, enabling hidden objects detection at low cost and without the risks associated to the current solutions based on X-ray imaging / Spectrometry sensors, which can detect gases and chemical agents prior to accidents / High resolution / large number of pixels cameras, enabling precise identification by large field of view cameras / Fast, high sensitivity IR sensors, for global scene analysis without light-dependent artefacts / All weather day/night imaging sensors, avoiding collisions and/or enhancing site protections / Active and passive systems for individual protection / Mobile scanning devices for container screening / RFID tags, for tracking of identified of authorized objects / Sensor fusion, as precise detection or identification without unacceptable false alarm rate will generally be obtained only by cross-checking information coming from different type of sensors / Localisation technologies
- Secure IT for Infrastructure (IT Security): Information and communication systems have come to play a crucial role in every walk of life. But certain types of organisation are more vulnerable than others to the consequences of a data security breach. Governments and institutions are good examples, as are financial institutions and operators of critical infrastructure. Research priorities: Smart secured devices / Packaging and technology against counterfeits and security threats to the device / Anti-tampering coating and encapsulation / New materials to counter invasive and non invasive attacks / Embedded microsensors and reactive devices / Smart Systems in 3D packaging offering high performing signal processing, flexible interconnect and communications capabilities / Vulnerability analysis to counter new hackers and attacks (physical analysis + reverse engineering, …). Failure analysis capabilities / Design methodology / Security Insurance and related capabilities

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 Automotive Applications

This theme is present in Brazil and Chile only and it points out the following issues:

- Safety
- Driver Assistance
- Convenience
- Energy efficiency
- Smart Power Train

All the applications that are related to Intelligent Transport System and that points out to reduce the car accidents have a worldwide market.

EPoSS Contributions for Grand Societal Challenges

Not in vain, EPoSS chapter is the last of the priority list that Latin America has in common with the European Union. The "paradigm" of the Future Internet is the connected and communicated world: smart cities, smart homes, and smart environments.

Smart Systems can help to solve various challenges already mentioned above:

Health & Ageing

Sustainable Mobility

Safety & Security

Communication

Sustainable Consumption & Production

Energy & Resource Efficiency

Proposed action for EPoSS: Establish a liaison with the following European platforms: Net!works, ARTEMIS, Photonics21 and ENIAC..

8. Conclusions

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

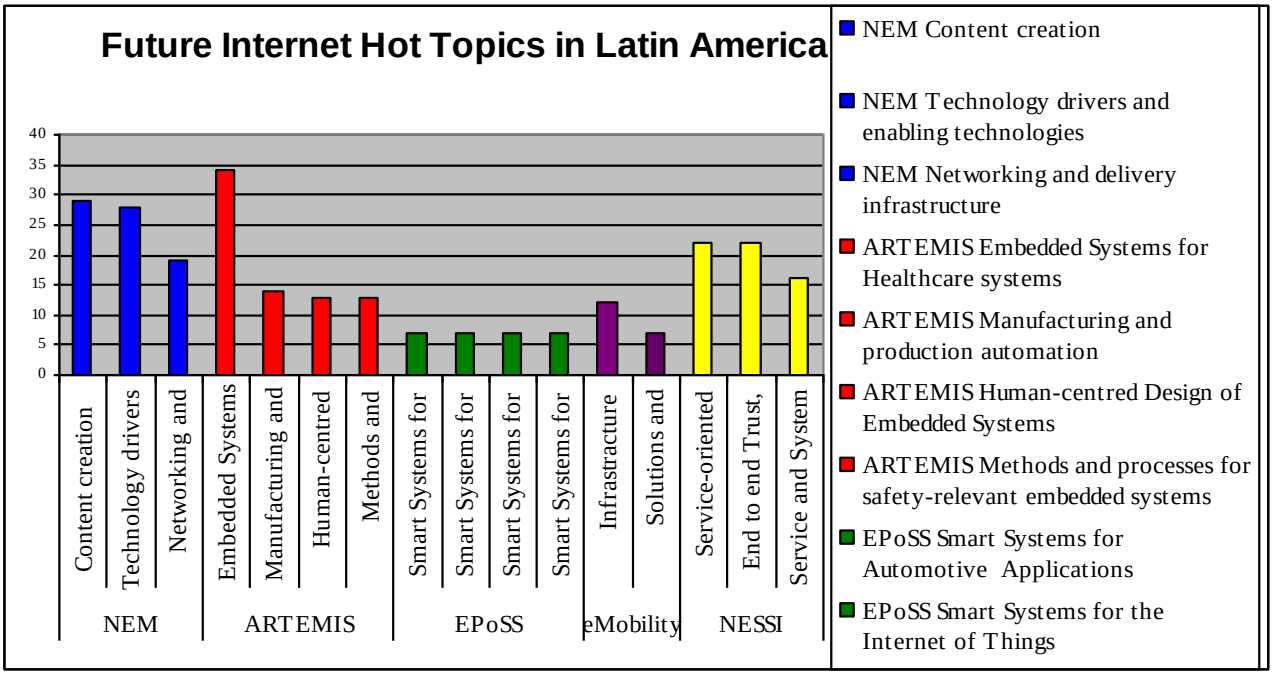

Figure 17: Future Internet Hot Topics in Latin America

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

Another issue of main importance is being aware about the common challenges that the European Union and Latin America have in common. Each research priority chapter identifies societal challenges that both continents have.

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ANNEX I: EU-LA Research Priority Table

NESSI

Area	Topic	ARGENTINA	BRAZIL	CHILE	COLOMBIA	MEXICO
NESSI Software and Services	**Service-oriented utility infrastructure**					
	Advanced infrastructure technologies in:					
	Hardware (flexible allocation, virtualization, advanced storage, energy efficiency)	X	X	X	X	X
	Operating Systems (merge physical- and virtual-machines execution with service-oriented application execution at OS level)	X		X		X
	Desktop Virtualization (access private/secure desktops from anywhere, over the web,)	X	X	X		X
	Middleware (new composite system designs, harmonized virtualization)	X	X	X		
	Related programming models	X		X		
	Related power-aware software design methods			X		
	Transparent deployment of cloud services	X		X	X	X
	Service and System Engineering					
	Modelling, Construction and Management of hybrid servicebased systems (situational, spontaneous, goal-based)	X		X		X

	Mapping quality of experience of the services to non-functional properties of components	X	X			
	Refining semantics to become appropriate across hybrid servicebased systems	X				
	Product Line Engineering applied to services	X		X		X
	Suitable platforms to fulfill future trends and challenges for different levels of the automation pyramid	X	X	X	X	
	Vertical Integration between different layers of the automation pyramid	X	X		X	
	Adaptive interactions					
	Social and business intelligence service provision	X	X	X		X
	Knowledge- and situational-driven personalization of interfaces and services	X				X
	Embodiment of intelligent access to services			X		
	Embodiment of educating principles in services			X		X
	Business process modelling					
	Dynamic formation, formalization management and interaction of business processes implemented through services	X	X	X		X
	Support for long-term and transactional business collaboration	X		X		X
	Support for event-orientation	X		X		
	Reference Architecture and Implementations					
	Harmonize SOA and SOI architectures to support all kinds of:					
	business and provisioning models	X	X	X	X	X
	applications and hardware environments		X			X
	Stakeholders		X			
	Services pervasiveness					
	Turn devices into enablers of services by embodying SOA principles into embedded systems	X	X	X		X

	Link collaborative devices to services		X	X		X
	End to end Trust, Security, Privacy and Resilience					
	Implementing Privacy, Identity Management and Trust in servicebased systems and in the FI society through:					
	A chain of trust across all levels and trust zones achieving security by design		X			X
	Security by Design	X	X	X	X	X
	Embed user-centric intuitive security mechanisms	X	X	X	X	X
	Protection against tretas	X	X	X	X	X
	Enabling users to understand security, privacy and trust	X	X	X	X	X
	Systemic foundation for a Service Economy					
	Make services accessible to all	X				X
	Multidisciplinary research to build a theory describing the relationship between organizations and social networks in regards to hybrid service-based systems	X		X	X	X
	Support emerging business models for innovation	X			X	X
	Understanding OS community collaborative processes	X				X
	Understanding OS business models and the impact on the Service Economy	X				X

TABLE 6

NEM

Area	Topic	ARGENTINA	BRAZIL	CHILE	COLOMBIA	MEXICO
NEM **Networked Electronic Media**	**Media-related applications and business models**					
	Value web	X			X	X
	Social networking and media sharing	X	X	X	X	X
	User satisfaction and quality of experience	X	X	X	X	X
	Content creation					
	New forms of content	X	X	X	X	X
	Representation of content	X	X	X	X	X
	Modelling formats	X			X	
	Scene-based content description			X	X	
	Metadata	X		X	X	
	Tools for content creation and manipulation	X	X	X	X	X
	Content capture	2		X	X	
	Content manipulation	X		X	X	
	Content adaptation	X		X	X	
	Overcoming human language barriers	X			X	X
	Networking and delivery infrastructure					
	Intelligent delivery		X		X	X
	Network intelligence	X		X	X	
	Quality of service	X	X	X	X	X

	Network architecture	X	X	X	X	X
	Home and extended-home networks	X		X		X
	Content search and media presentation					
	Automated semantic annotation	X	X	X		
	Authentic, true-to-original media reproduction					
	Virtual reallity	X	X	X	X	X
	User-system interaction	X		X	X	X
	Effective recommendation systems	X		X	X	
	User number measurement and user behaviour logging	X		X		
	Technology drivers and enabling technologies					
	Security privacy and trust		X	X	X	X
	Rights management		X			X
	Federated virtual devices					
	Federated services					X
	Contextual awareness	X		X	X	X
	Location					
	Identity management and AAA	X		X		X
	Personalisation/profiling	X		X	X	X
	Charging and payment					X
	Multimedia middleware	X	X	X		X
	Assited Living					X
	Power management technologies - energy saving		X		X	X
	Spectrum economy				X	

TABLE 7

ARTEMIS

Area:	Topic	ARGENTINA	BRAZIL	CHILE	MEXICO
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.	X	X	X	X
	Architecture modelling and exploration solutions for systems/multi-systems and systems of systems architecture choices against business and operational criteria	X	X	X	
	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.				X
	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.			X	X
	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.	X		X	X
	Embedded Systems for Healthcare systems				
	Dynamically configured networks of sensors and actuators for in-home and mobile and institutional situations	X	X	X	X
	Smart power management	X		X	X
	Networked, distributed control systems	X	X	X	X

	Safe and secure ambient identification and authentication	X	X	X	X
	Massive reliable medical (image) data processing in a distributed network obeying latency, bandwidth security and privacy.	X			X
	New image detectors are required for enhancing medical imaging applications and supporting image guided interventions.				X
	Comparison of the patient condition with models of the physical and biochemical of the normal and abnormal behavior of living organs are needed to ensure right and personal centric treatment.	X			X
	New sensors and actuators are required including new type of sensors for capturing biological and molecular data;	X	X	X	
	New embodiments of sensors suitable for new types of deployment (e.g. injectable, swallowable);	X	X		
	Implantable but also non-invasive sensors.		X		
	Multi system integrated workflows	X	X	X	
	Multimodal interaction technologies (speech, vision and gestures) for diagnostic and surgical equipment.	X		X	X
	Remote system life-cycle management.	X			X
	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	X		X	X
	Interoperability solutions including a semantic platform that can address scalability, performance, security and evolvability requirements arising from different kinds of environments and usage scenarios.	X	X	X	X
	Interaction technologies and solutions for different environments and user groups.	X	X	X	
	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.	X		X	

Manufacturing and production automation				
Discrete Manufacturing (characterized by individual or separate unit production e.g. of vehicles, computers, …),	X		X	X
Batch and Continuous Process (continuous flow, e.g. oil and gas, chemical industries, pharmaceutical, food and beverage, power generation, ...),	X		X	X
Utilities (the infrastructure for public services including electricity/gas supply, fresh and waste water, district heating, …),			X	
Manufacturing logistics (internal logistic processes across the whole manufacturing chain, emphasizing the value-adding processes) and		X	X	X
Multimodal logistics management (planning, implementation and control of efficient flow and storage of goods, services and related information).	X	X	X	X
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.	X	X	X	X
New design paradigms that render the practical implementation of multi- and many-core solutions tractable, allowing them to truly contribute to market innovation.	X			X
ES for the Security and Critical Infrastructures Protection				
Seamless and secure communication/cooperation of heterogeneous ES over telecommunications infrastructures;		X		X
Models/Methods/Tools for predicting complex, dynamic behaviour in distributed and cooperating ESs, including their SPD characteristics;	X			
Spontaneous (ad-hoc) yet trustworthy cooperation between smart objects;				
Enhanced technology for fault mitigation and recovery of ES clusters;			X	

	Virtualization of resources exposed by the ESs in a network;				
	Capability to measure and enforce Quality of Service across heterogeneous domains;	X	X		X
	Robust, predictable and self adaptive protocols in large-scale, dynamic ES networks;	X			X
	Sensing, control and automatic decision making functions;			X	
	Real-time support for efficient interactions;	X		X	
	Trustworthiness and High Dependability features;				
	Advanced methods for improved confidentiality.				
	Embedded Technology for Sustainable Urban Life				
	Human-centred Design of Embedded Systems				
	Human Machine Interfaces (HMI) of Embedded		X	X	
	New knowledge on human performance in association with new and innovative assistance and information systems	X	X	X	X
	New methodologies for agile HMI prototyping enabling the user centric design approach at all stages of product development		X		X
	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	X			X
	New technologies for intelligent multi-modal interactive systems, which are intuitive and easy to use and adapt to the user state, context and capabilities	X		X	X

TABLE 8

Net!Works

Area	Topic	CHILE	CHILE	COLOMBIA	MEXICO
Net!Works / Emobility	**Infrastracture**				
	Mobile and Wireless braodband	X	X	X	X
	Spectrum Management		X	X	X
	Mobile and Wireless ad hoc networks	X	X	X	X
	Fixed mobile convergence	X		X	X
	Satellite			X	
	Security		X	X	X
	Solutions and Applications				
	Mobile applications	X	X	X	X
	Mobile Health	X		X	X
	Machine to Machine		X	X	X

TABLE 9

EPoSS

Area: EPoSS	Topic	ARGENTINA	BRAZIL	CHILE
Intelligent Integrated Systems	**Smart Systems for Automotive Applications**			
	Safety		X	
	Driver Assistance		X	X
	Convenience		X	
	Energy efficiency		X	X
	Smart Power Train		X	
	Smart Systems for Medical Applications			
	Energy Management Systems		X	
	Intelligent Power		X	
	Vehicle2Grid			X
	Active Control Units			
	Smart Systems for the Internet of Things			
	Intelligent Systems	X	X	X
	Energy Sustainability	X	X	X
	Integration Into Materials			
	Energy Harvesting			X
	Smart Systems for Information and Telecommunication			
	Ultra broadband, spectrum agile wireless access	X		X
	Energy efficient base stations	X		X
	Ultra compact handset transceivers			
	Small form-factor base stations	X		

	Wide-area sensor networksCompact			X
	Energy autonomous sensorsImplantable			X
	Implantable BAN transceivers			
	Smart Systems for Safety and Security			
	Secure Personal Devices, including Smart Cards		X	
	Secure IT for Infrastructure		X	X
	Personal emergency and home security systems			X
	Full Security	X		
	Detection, Authentication and surveillance	X		X
	Vital Infrastructure Security			
	Emergency and security			
	Smart Systems for Aerospace			
	By-light functions			
	Fuel Cell APU			
	By-wire functions			
	Electrical Power Management			

TABLE 10