PROMECE - Entregable E3.2

Informe de posicionamiento tecnológico e institucional

Instituto Tecnológico de Informática

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Resumen

El Instituto Tecnológico de Informática (ITI) cuenta con un Plan de Actividades de carácter no económico (PROMECE) que tiene como objetivo general potenciar las líneas de investigación en las que trabaja el Instituto, enmarcadas dentro del ámbito de las Tecnologías de la Información y las Comunicaciones (TIC).

Este documento describe las acciones de posicionamiento tecnológico e institucional realizadas en 2016 por el Instituto Tecnológico de Informática. Estas acciones han tenido como finalidad dar a conocer las capacidades y tecnologías de las líneas de I+D de ITI en distintos foros nacionales y europeos, aumentar la presencia internacional, y facilitar la creación de alianzas y proyectos en colaboración para abordar los retos presentes y futuros de la sociedad y nuestro tejido industrial. Específicamente, ITI ha mantenido y reforzado su presencia en foros como la BDVA, NESSI, PLANETIC o INTEROP-VLAB, así como ha entrado en otros foros como AIOTI. Se presentan también las contribuciones realizadas a agendas tecnológicas de I+D.

Abstract

ITI (Instituto Tecnológico de Informática) has a Non-economic Activity Plan (PROMECE) which general objective is to strengthen the research lines of the centre within the scope of Information and Communication Technologies (ICT). Through PROMECE, several activities are carried out to transfer the results obtained in the execution of R+D+I projects to companies (the industrial sector) and citizens and institutions (the society).

This document describes the technological and institutional positioning actions perfomed by ITI during 2016. These actions aimed to show the R&D capacities and technologies of ITI in the different national and European forums, to increase the international presence, and to facilitate the creation of alliances and collaborative projects to address current and emerging society and industrial challenges. More specifically, ITI has kept and strengthened its presence in forums like BDVA, NESSI, PLANETIC or INTEROP-VLAB, as well as entering in new forums like AIOTI. This document also presents the contributions done to technological research roadmaps

***Agradecimientos**: Las actividades descritas en este documento se encuadran en el proyecto PROMECE, que está cofinanciado por el Instituto Valenciano de Competitividad Empresarial (IVACE) y por la Unión Europea a través del Fondo Europeo de Desarrollo Regional (FEDER), dentro del programa de Ayudas dirigidas a Institutos Tecnológicos de la Red IVACE, con nº expediente IMAMCN/2016/1*

Índice

1. Introducción

Este documento describe las acciones de posicionamiento tecnológico e institucional realizadas en 2016 por el Instituto Tecnológico de Informática. Estas acciones han tenido como finalidad la promoción de la cartera de conocimientos, capacidades, resultados y servicios de I+D de ITI en distintos foros nacionales y europeos, para el desarrollo de proyectos de I+D+i transferibles a la sociedad y el tejido industrial.

Durante 2016, ITI ha mantenido y reforzado su presencia en las plataformas tecnológicas nacionales y europeas, como es el caso de la BDVA, NESSI, ARTEMIS, INTEROP-VLAB y PLANETIC. Además, destaca la entrada en otras plataformas europeas como AIOTI, la alianza en IoT, lo que le permitirá acceder a otras oportunidades de colaboración de I+D. En el marco de estas plataformas, ITI ha contribuido a la elaboración de agendas I+D tecnológicas, aportando el conocimiento experto de sus áreas de competencia.

Por otro lado, en el ámbito institucional, ITI ha continuado colaborando con entidades regionales, nacionales y europeas en lo que respecta a acciones relacionadas con la participación en programas de I+D+i, la difusión de los mismos, y en aportar feedback para la elaboración de nuevos programas encaminados a mejorar la competitividad empresarial y nacional.

2. Acciones de posicionamiento tecnológico

Durante 2016, ITI ha mantenido (y reforzado en algunos casos) su presencia en los principales foros de discusión a nivel nacional e internacional sobre las estrategias de investigación y políticas a largo plazo en torno a las Tecnologías de la Información y las Comunicaciones. En estos foros se da la oportunidad de dar visibilidad a las tecnologías del ITI, siendo el principal foro las plataformas tecnológicas, las JTI y las PPP.

ITI ha mantenido y mejorado su actividad en las plataformas tecnológicas nacionales y europeas, asumiendo mayor responsabilidad tecnológica en las mismas. En las siguientes secciones se describe el rol y participación de ITI en los foros tecnológicos nacionales y europeos.

2.1 Posicionamiento en foros tecnológicos nacionales

Tabla 1. Participación ITI en plataformas tecnológicas nacionales durante 2016

Foro	Descripción	Rol ITI en 2016
planetic	http://www.planetic.es/ Plataforma Tecnológica Española para la adopción y difusión de las tecnologías electrónicas, de la información y la comunicación. Nace como la fusión de las plataformas INES, PROMETEO y GENESIS	ITI es miembro del **comité de dirección** y ha participado en los **grupos de trabajo** de Software y Servicios, y Sistemas Embebidos. Es **promotor** de la **iniciativa inter-plataformas sobre Big Data** y ha participado activamente la misma, promovida por MINECO y que se propone desarrollar un Position paper sobre los intereses españoles en Big Data.
logistop	http://www.logistop.org Plataforma Tecnológica Española en el área de la Logística Integral	ITI se mantiene como **miembro** de la plataforma recibiendo la información relacionada con iniciativas europeas.
PTFE	Plataforma Tecnológica Ferroviaria Española	El ITI es **miembro** de la misma y se mantiene **activo** en cuanto a la información relacionada con la JTI Shift2rail.
enerTIC	http://www.enertic.org Plataforma Tecnológica de TIC para la mejora de la eficiencia energética	ITI es entidad colaboradora y ha participado en el **grupo de trabajo y de innovación** y en las distintas actividades, como en la validación de las candidaturas de los enerTIC awards.
MANU-KET	http://www.manufacturing-ket.com/manu-ket	ITI ha participado como **miembro** en la plataforma y se ha mantenido al tanto de las actividades programadas por la misma.

2.2 Posicionamiento en foros tecnológicos europeos

Tabla 2. Participación ITI en plataformas tecnológicas europeas durante 2016

Foro	Descripción	Rol ITI en 2016
NESSI	Networked European Software and Services Initiative: tiene por objetivo proveer una visión unificada de la investigación europea relacionada con la arquitectura de sistemas e infraestructuras software, y definir las tecnologías, estrategias y políticas que fomentarán soluciones industriales	El ITI es actualmente partner, **miembro del Steering Committee** y del **Board**. ITI ha participado activamente en las distintas reuniones, **asambleas**

Foro	Descripción	Rol ITI en 2016
	novedosas y aplicaciones sociales que incrementarán la seguridad y el bienestar de los ciudadanos (www.nessi-europe.com).	y actividades relacionadas con la plataforma
	Networked and Electronic Media. Tiene por objetivo facilitar a todos los ciudadanos y empresas europeas el acceso a los servicios y aplicaciones audiovisuales y multimedia de banda ancha, teniendo en cuenta la diversidad cultural europea así como permitir a la industria europea dominar las tecnologías necesarias en el entorno audiovisual, Internet, etc., y desarrollar un consenso sobre los estándares necesarios, promover la cooperación internacional, y apoyar el proceso regulatorio (www.nem-initiative.org).	ITI es **miembro** de la plataforma y se mantiene informado de las iniciativas que se llevan a cabo desde la misma
	Embedded Computing Systems. Tiene por objetivo la definición de una visión común y una Agenda Estratégica para implementar dicha visión, lo que implicará el beneficio de los sectores industriales que trabajan con tecnologías de sistemas embebidos y a la economía y sociedad europea en general (http://www.artemis-ia.eu)	ITI ha participado en: - ECSEL Brokerage Event 26 y 27 de enero de 2016. Estrasburgo. - Artemis Technology Conference. Madrid, 4 de octubre de 2016
	Mobile and Wireless Communications	El ITI es **miembro** de la plataforma y de varios grupos de trabajo, manteniéndose al tanto de las iniciativas que se ponen en marcha desde la misma
	Red de laboratorios de Interoperabilidad (http://www.interop-vlab.eu/), de la que el ITI es miembro a través de INTERVAL	ITI ha participado en las reuniones de la red y a la asamblea general celebrada en Bruselas el 7 de junio de 2016. ITI es **responsable de la Task Force de Interoperability for Big Data** y participa activamente en el grupo de trabajo TG11 y TG13
	Big Data Value Association y PPP (www.bigdatavalue.eu)	ITI es **socio fundador** de esta asociación y **miembro del Board of Directors** de la misma. Es **líder del *Task Force* de *Communication and Awareness*** y como tal participa en todas las reuniones de Activity Group celebradas por audio conferencia y presencialmente. También

Foro	Descripción	Rol ITI en 2016
		participa en las reuniones del Board of Directors y Asambleas generales
AIOTI	Alliance for Internet of Things Innovation (www.aioti.eu/), creada en 2015 por iniciativa de la Comisión Europea, y cuyo objetivo es trabajar de cerca con los actores más relevantes en IoT.	En **2016 ITI pasa a ser socio** de esta alianza para la innovación en la Internet de las Cosas, donde se están definiendo recomendaciones y arquitecturas de referencia a seguir por los proyectos de H2020 relacionados con IoT. ITI participa en los grupos de trabajo WG3, WG9, WG10
EUBrasilCloudFORUM	EU-Brasil Cloud Forum es un proyecto CSA de la Comisión Europea cuya finalidad es facilitar los diálogos y la cooperación transatlántica entre la UE y Brasil en áreas relacionadas con Cloud Computing.	A finales de 2016 ITI ha entrado a participar en el **grupo de trabajo** de definición de escenarios futuros y desafíos de investigación para Europa y Brasil. La participación por parte ITI ha sido baja durante 2016.
TAMS CPS	Proyecto CSA de la Comisión cuyo objetivo es desarrollar una agenda estratégica para la colaboración trans-atlántica en Modelling & Simulation for CPS	Durante 2016, ITI ha participado en las **reuniones de trabajo y webinars**, así como en la elaboración de contribuciones para la definición de la agenda estratégica.

2.3 Contribuciones a agendas tecnológicas I+D

En el marco de actividades iniciadas/desarrolladas en los foros tecnológicos anteriores, ITI ha contribuido a la elaboración de whitepapers y hojas de ruta (roadmaps) tecnológicas, describiendo el estado actual de la técnica y líneas futuras de actuación teniendo en cuenta el impacto en la sociedad y la industria.

A continuación se enumeran las principales contribuciones realizadas durante 2016, indicando para cada una de ellas el foro donde se ha contribuido y la participación de ITI. El detalle de dichas contribuciones se presenta en las siguientes subsecciones.

Tabla 3. Listado contribuciones a agendas tecnológicas realizadas por ITI durante 2016

Foro	Contribución	Rol ITI
BDVA	**Whitepaper *in Big Data Technologies in Healthcare*** (20/04/2016 - 21/12/2016). Disponible online[1]	ITI ha contribuido significativamente en la elaboración del whitepaper, participando en distintas secciones. ITI ha identificado aquellas áreas del sector Salud en las que las líneas de investigación ITI podrían aportar para avanzar el estado de la técnica. Principalmente, técnicas de reconocimiento de patrones multi-modal y aprendizaje automático.
BDVA	***Valencia Summit Handbook*** (30/11/2016-02/12/2016)	ITI ha sido el organizador del evento anual de la BDVA, que en 2016 se ha celebrado en Valencia, contando con la asistencia de más de 300 representantes de distintas organizaciones tanto públicas como privadas. Esto ha permitido a ITI posicionarse en el ámbito europeo, pero también dar a conocer y reforzar las capacidades de las entidades valencianas.
NESSI / EFFRA	***ITI contributions to EFFRA Consultation for the FoF 2018-19-20*** (06/04/2016-04/05/2016)	ITI ha contribuido a la identificación y definición de líneas futuras de I+D para apoyar el desarrollo de las Industrias del Futuro. Específicamente, ITI ha aportado contribuciones en 7 líneas futuras de trabajo, como se desglosa en el apartado 2.3.3.
NESSI	**NESSI recommendations for ICT WP 2018-19-20** (10/01/2016-19/02/2016)	ITI ha participado en los foros de discusión internos de NESSI de cara a la elaboración de las recomendaciones en ICT para el WP 2018-19-20
EU-Brasil Cloud Forum	***D3.1 Analysis and identification of the gaps and research opportunities related to cloud computing, including security*** (01/10/2016-18/10/2016)	En el último trimestre de 2016 ITI ha iniciado la participación en el foro de colaboración transatlántica EU-Brasil centrado en desafíos Cloud Computing. ITI ha aportado contribuciones en las encuestas desarrolladas en el seno del grupo de trabajo.
EC	***ITI contributions on the EC Consultation on Cloud Computing challenges for WP 2018-19-20*** (5/10/2016-26/10/2016)	ITI ha contribuido activamente en la consulta pública realizada por la Comisión Europea sobre desafíos futuros de I+D en Cloud Computing: se elaboró una lista de topics I+D a largo plazo y se asistió al workshop realizado en Bruselas. Los topics reflejados han sido

[1] http://www.bdva.eu/sites/default/files/Big%20Data%20Technologies%20in%20Healthcare.pdf

Foro	Contribución	Rol ITI
		incluidos en el informe generado tras la consulta (ver sección 2.3.4)
NESSI	***NESSI contributions on Cloud Work programme*** (18/10/2016)	En el seno de NESSI, ITI ha contribuido a la elaboración de topics de I+D futuros para investigación en Cloud, principalmente relacionados con SLAs y la automatización de los mecanismos de monitorización y control.

2.3.1 Whitepaper in Big Data Technologies in Healthcare (Diciembre 2016)

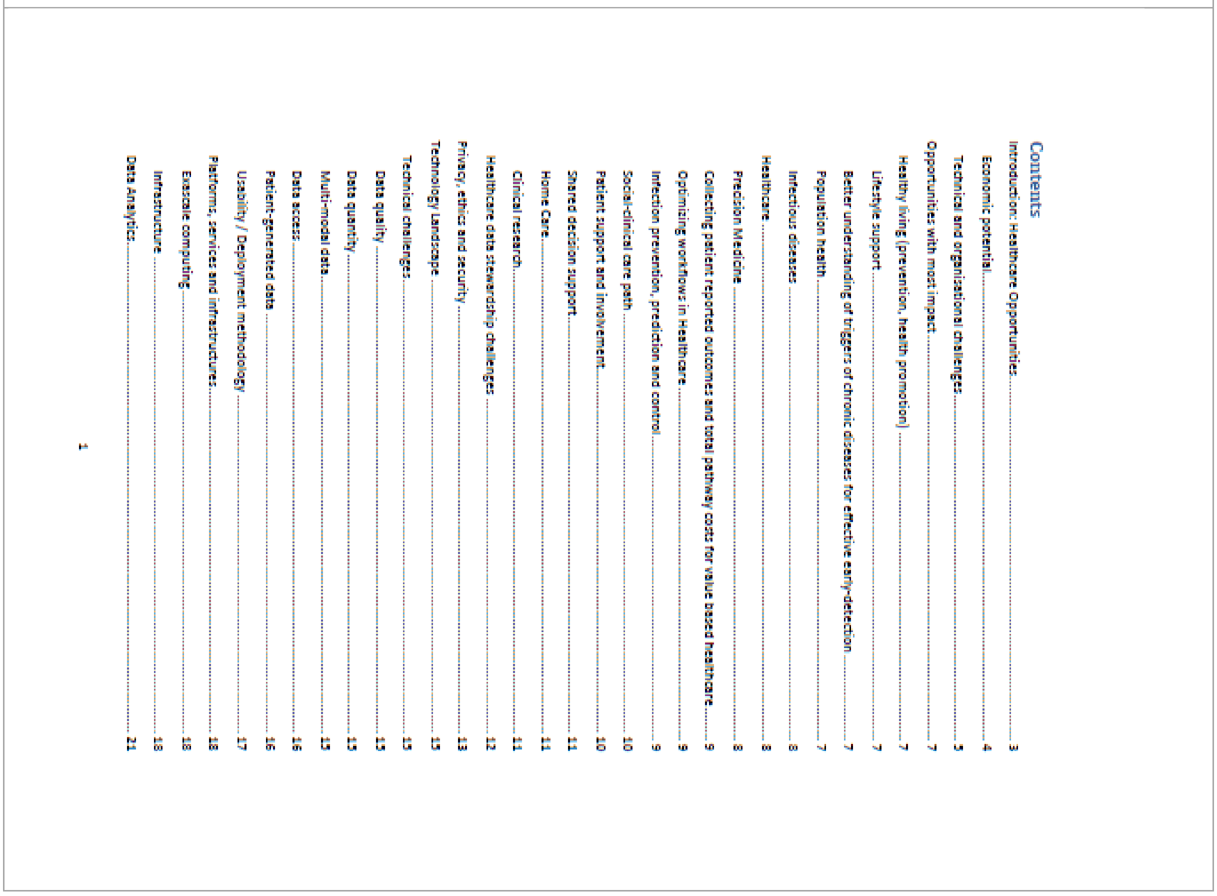
Big Data Technologies in Healthcare

Needs, opportunities and challenges

BDV BIG DATA VALUE ASSOCIATION

TF7 Healthcare subgroup

12/21/2016



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Introduction: Healthcare Opportunities

The healthcare sector currently accounts for 8% of the total European workforce and for 10% of the EU's GDP[1]. However, **public expenditure on healthcare and long-term care is expected to increase by one third by 2060**[2]. This is primarily due to a rapidly aging population, rising prevalence of chronic diseases and costly developments in medical technology. The relatively large share of public healthcare spending in total government expenditure, combined with the need to consolidate government budget balances across the EU, underscore the need to improve the sustainability of current health system models. Evidence suggests that **by improving the productivity of the health care system, public spending savings would be large, approaching 2% of GDP on average in the OECD**[3] which would be equivalent to **€330 billion in Europe** based on GDP figures for 2014[4].

Big Data technologies have already made some impact in fields related to healthcare: medical diagnosis from imaging data in medicine, quantifying lifestyle data in the fitness industry, to mention a few. Nevertheless, for several reasons that will be discussed in the report, the healthcare has been lagging in taking up Big Data approaches, which is a paradoxical situation, since it was already estimated by the Poneman Institute in 2012 that 30% of all the electronic data storage in the world was occupied by the healthcare industry[5]. It is evident that within existing mounds of big data there is hidden knowledge that could change the life of a patient or, at a very large extent, change the world itself. **Extracting this knowledge is the fastest, least costly and most effective path to improving peoples' health**[6].

Big Data technologies will definitely open new opportunities and enable breakthroughs related to, among the others healthcare data analytics[7] addressing different perspectives: (i) **descriptive** to answer what happened, (ii) **diagnostic** to answer the reason why it happened, (iii) **predictive** to understand what will happen and (iv) **prescriptive** to detect how we can make it happen (Figure 1).

It is out of any doubt that the potential impact Big Data technology can bring on technology, economic and society is relevant, boosting innovations in organizations and leading to the improvement of business models. This paper will demonstrate that **Big Data Technologies have the potential to unlock vast productivity bottlenecks and radically improve the quality and accessibility of the healthcare system** and discuss steps that need to be taken towards this goal.

[1] Heath and Health Systems: http://ec.europa.eu/europe2020/pdf/themes/05_health_and_health_systems.pdf?_sm_au_=iHVqq23HLDVwQ7DP
[2] Investing in Health: http://ec.europa.eu/health/strategy/docs/swd_investing_in_health.pdf
[3] Health care systems: Getting more value for money: http://www.oecd.org/eco/growth/46508904.pdf
[4] Health at a Glance 2015, OECD Indicators: http://www.oecd-ilibrary.org/social-issues-migration-health/health-at-a-glance-2015/summary/english_47801564-en;jsessionid=fnol3e9ktakqk.x-oecd-live-03
[5] Healthcare Data Growth: An Exponential Problem: http://www.nextech.com/blog/healthcare-data-growth-an-exponential-problem
[6] Big Data in Healthcare: http://www.healthparliament.eu/documents/10184/0/EHP_papers_BIGDATAINHEALTHCARE.pdf/ 8c3fa388-b870-47b9-b489-d4d3e8c64bad
[7] http://www.gartner.com/it-glossary/predictive-analytics/

Conclusions and Recommendations

This white paper shows that there is a lot of potential in delivering more targeted, wide-reaching, and cost-efficient healthcare by exploiting current big data trends and technologies. However, it has also been shown that the healthcare domain has some very specific characteristics and challenges that require a targeted effort and research in order to realize the full potential:

- Big data access, availability and quality: there is a huge amount of existing data distributed in several repositories and new data generated daily by billions of connected devices or self-generated by people. It is then necessary to find more appropriate and effective ways to leverage these data in line with privacy and ethical principles, to access them, to understand the purposes for their adoption and their quality in order to improve and optimise care processes, diseases diagnosis, personalized care and in general the healthcare system.
- Patients and healthcare professionals profiting from big data: there is a need to develop approaches that allow for humans and machines to cooperate more closely on exploiting big data for a better health. This includes guarantees on the trustworthiness of information, a focus on generating actionable advice, and improving the interactivity and understandability of big data processing and analytics. The requirements of different target groups - researchers, doctors and care-givers, or patients and general population – may require different focus.
- Multi-modal data analytics: there is a need for technologies, which can handle, analyse and exploit the set of very diverse, interlinked and complex data that already exists in the healthcare universe to improve healthcare quality and decrease healthcare costs.
- Healthcare knowledge: next to the big and heterogeneous healthcare data sets, there is already a big amount of medical and healthcare knowledge. This knowledge exists in books and research papers, but also in the heads of healthcare professionals. In fields such as epidemiology or wearable sensors, also completely different knowledge on the real world, organisations and how people live their lives is very valuable to understand patients and the healthcare system in general. New approaches are needed that bring together big data and knowledge, such that knowledge can be used to make better sense of data, and data can be used to generate more knowledge.
- Ethics and privacy in a big data world: further practical approaches are needed to adequately balance the benefit and threats of more and more detailed and sensitive data being available. With the respect to an increasing amount of complexity and automation in clinical data processing and decision support, and in particular in the light of the move towards personal health assistant on smartphones, a targeted focus on the ethical problems connected with these new technologies seems advisable.

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2.3.2 BDVA Valencia Summit (30/11/2016-02/12/2016)

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Organized by:

BDV BIG DATA VALUE ASSOCIATION

Hosted and organized by:

ITI INSTITUTO TECNOLÓGICO DE INFORMÁTICA — DIGITAL INNOVATION for the market

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

Special Contribution by:

ANSWARE

Programme and Organising Committee

The Valencia Summit was Constructed and Powered with the help of many, but with particular thanks to the following individuals and organisations who contributed with time and enthusiasm to deliver the Summit.

Organization	Contact	Role
ITI	Daniel Saez	Coordinator, Handbook, Logistics and Marketing
	ITI is a Private Reference Technological Centre specialized in RDI in ICT. It has a team of 150 technologists, which develop their activity in four main areas: Intelligent Information analysis, FI, CPS and Enabling Technologies, contributing to generate solutions for: Intelligent manufacturing, Intelligent Society and IT industry.	
ANSWARE	Tonny Velin	Sponsorship, registration, Handbook & Finance
	Answare provides its customers with quality Hi-Tech solutions. Its European customers have benefit from the know-how of the company in strategic IT areas like Monitor & Control of infrastructures, mobility, GIS and 3D/VR.	
SAP	Laure Le Bars	Day 1 Speakers
	With 12 million users, 96,400 installations, and more than 1,500 partners, SAP is the world's largest inter-enterprise software company and the world's third-largest	

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2.3.3 ITI contributions to EFFRA Consultation for the FoF 2018-19-20 (Abril 2016)

ITI contributions to

"EFFRA Consultation for the FoF 18-19-20 work programme"

Summary: This document contains ITI contributions to EFFRA public consultation concerning the 'Factories of the Future' work programme 2018-19-20, covering the three last calls under Horizon 2020.

Contents

4 Material and resource efficiency in manufacturing

Highlight	Comments
Rate importance (Value from 0-100)	90
Comments on scope	Resource usage optimization is a trending matter nowadays. All the industries are concerned in optimizing (i.e. minimizing) resource usage, so as to: increase factory production, minimize productive time waste, minimize energy usage, etc. In this context, it is obvious that resource management play a determinant role in manufacturing and, because of that, defining a good policy about resource usage/necessity is relevant. The design of efficient production processes should address not only minimization of waste or energy, but also the optimization of the use of existing resources for sustainability, taking into account the heterogeneous nature of manufacturing resources present in any productive organization (raw materials, human resources, equipment and machinery, etc.)
Comments on addressed or deployed technologies	Current headline description does not consider multi-objective optimization technologies as enablers to achieve the goal of maximum resource efficiency. In addition, current multi-objective optimization approaches only cover the optimization of resources with similar characteristics, which is unrealistic when willing to optimize manufacturing processes with different resources involved (materials, human resources, equipment and machinery). For instance, the optimization of human resources involves the stabilization of use in time, that is, use the same amount of human resources most of the time while minimizing unproductive time. Technologies dealing with resource utilization with dissimilar characteristics should be addressed to define optimisation models with different resource types, different treatments, and then different (often opposite) objective functions. • Multi-objective optimization algorithms and frameworks dealing with heterogeneous objectives and heterogeneous resource types. This, aiming to stabilize resource usage, reduce unproductive time, and maximize other resources utilization. This headline should address projects capable of reaching actual productive organizations, involving innovation activities (TRL 5-6 and above)
Indication of type of action	70
Comments on expected impact	The expected impact should be not only economic but also social. Including a stability in human resource usage will impulse more stable jobs

7 Zero-defect manufacturing

Highlight	Comments
Rate importance (Value from 0-100)	100
Comments on scope	Current scope is mixing zero-defect manufacturing (which focus on the quality of parts/products) and predictive/preventive maintenance (which focus on the machinery/equipment to work properly). Both are related to each other, since the end product is affected, but should be addressed in different headlines. In addition, concerning zero-defect manufacturing, current scope description does not consider the importance of advanced inspection systems to identify defects and deviations at part/machine/process levels. Challenges related to advanced inspection systems are: • Enable whole geometry inspection of objects without direct contact • Inspection systems providing not only defect alerts but also other useful information of parts as their 3D geometry and texture surface.
Comments on addressed or deployed technologies	• Industrial inspection taking advantages of recent advances in multi-view 3D reconstruction. • High scalability of inspection systems providing high productivity with only one 3D capture device. Type of action should include validation activities, with TRLs from 7 and above, to enable equipment assessment and awareness making.
Indication of type of action	80
Comments on expected impact	• New 3D industrial inspection will open the opportunity to automate quality inspection activities currently carried out by human operators in some specific tasks that show a big difficulty to be inspected with traditional 2D technologies. • Automatic classification of complex 3D objects (e.g. screws, nuts, washers , springs, ...)

12 Reconfigurable cells, self-reconfigurable cells through smart sensors/devices

Highlight	Comments
Rate importance (Value from 0-100)	90
Comments on scope	Given the challenges described in current scope description, architecture and communication issues must be also considered, as potential enablers of the proposed challenges: • Robust and versatile industrial architectures based on IoT to support dynamism and plug&play devices and cells. Semantic interaction, recognition of units and extensive M2M interaction to minimize the human interaction. • Self-configurable and self-maintained robust wireless communications for tools and equipment.
Comments on addressed or deployed technologies	Some new interesting enablers: • More robust and dependable wireless communication technologies to enable mobile sensing and actuation for reconfigurable cells, CPS, smart-tools, mobile screens, shop-floor vehicles, etc. Industrial wireless communications focused on QoS improvements. Interfaces between wireless and wired world for deterministic communications. • Technologies and protocols to minimize the user interaction in wireless networks (self-configuration, self-management, self-healing...). • Development of smart sensors/actuators, which can be integrated directly in the plant IoT architecture by using a high level language and a M2M communication paradigm. Type of action could include both research activities as well as innovation activities: research activities are needed to address current open issues regarding wireless communication protocols, while innovation activities would address integration and testing of current state-of-the-art communication technologies.
Indication of type of action	50
Comments on expected impact	Development and integration of advanced industrial architectures and communications would have the following additional expected impacts: • Reduce the quantity of cable in the manufacturing cells, which would reduce weight, ease the maintenance tasks, and reduce the costs and deployment time.

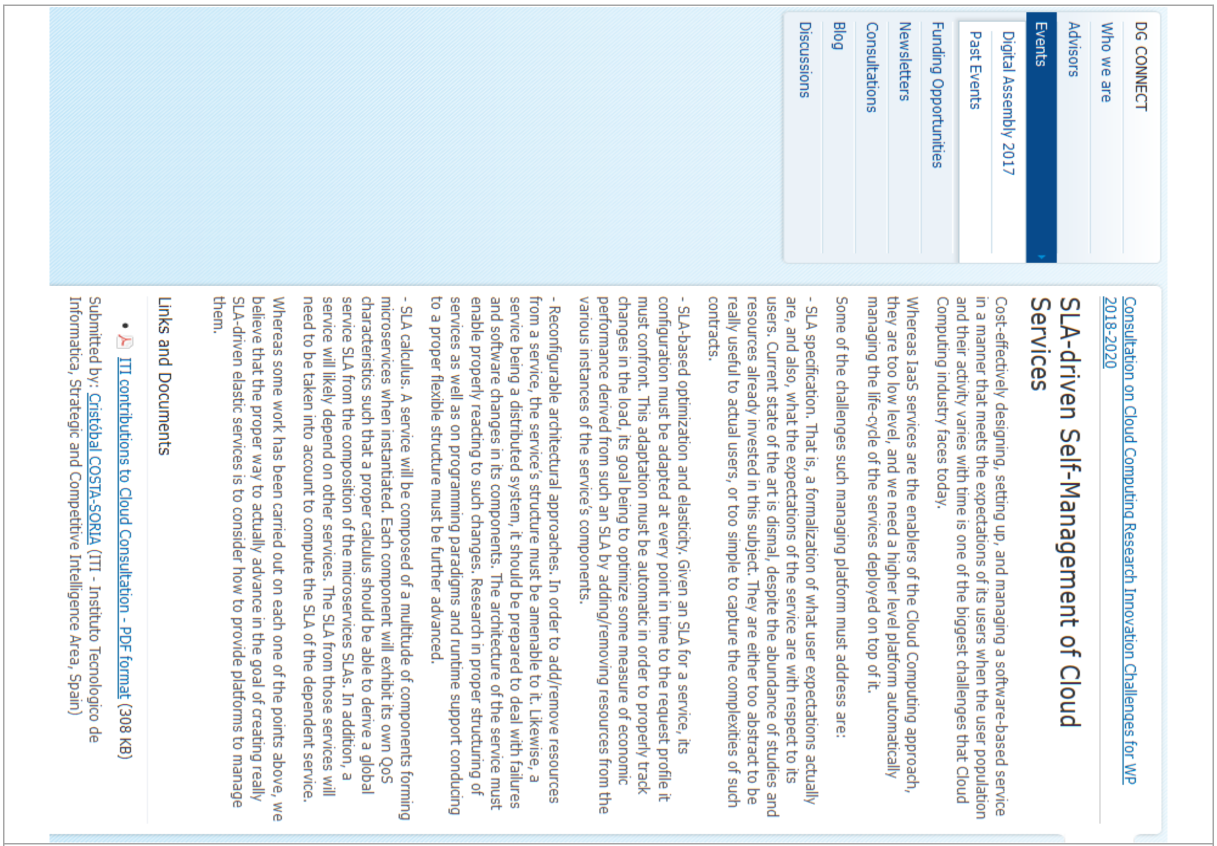
13 Distributed Intelligence Architecture and Systems on the Factory Floor

Highlight	Comments
Rate importance (Value from 0-100)	90
Comments on scope	This could be added regarding the enabling architecture: • Use of advanced architectures to enable real-time communication between machines, process sensing and management, leading to real-time decision-making. • Use of semantics and application layers to enable fast and enriched M2M interaction.
Comments on addressed or deployed technologies	It would be interesting to add this one: • Development of robust wireless sensor networks technologies to enable a reliable real-time communication with sensor and actuators in this distributed architecture And to extend the scope of this existing enabler: • Third bullet ("New definition of industry floor IT Structure and protocols for automated control and supervision fed with sensor data") should be focused on Industrial IoT architectures (robust seamless communications based on IP networks, everything connected to everything, dependable wireless communications and semantic interaction between actors). Type of action could include both research activities as well as innovation activities: research activities are needed to address current open issues regarding wireless communication protocols, while innovation activities would address integration and testing of current state-of-the-art technologies.
Indication of type of action	50
Comments on expected impact	• In "Better resource management" we could add a faster action with real-time decision making, a most precise actuation based on the higher quantity of information the system can use and process for its decision. • This could also enable a better quality management, with a better detection of problems and deficiencies, a faster actuation in case of problems in the line (i.e. damaged tools), etc.

15 On-site manufacturing technologies

Highlight	Comments
Rate importance (Value from 0-100)	90
Comments on scope	Well raised scope. Perhaps it could be interesting to add a new reason/target in the first bullet point: this also facilitates the manufacturing of small customized lots, as some elements from the production line may be moved closer to the final location, matching with its normative, habits, preferences or fashions; while the main/gross of the product is manufactured in a common main factory.
Comments on addressed or deployed technologies	New relevant enablers to be added: • Industrial IoT architectures: IoT enables the communication between all the elements in the portable manufacturing plant with the mother plant or other sites, point to point, and with management software, visualization tools, employees, products, clients... These architectures are a key enabler for Industry 4.0 and surpasses the existing industrial networks (operation technologies) offering greater connectivity, quality of service and a new range of services. • Plug&Play Wireless Sensor Networks: in flexible and portable solutions, the WSN technologies become a potential partner to enable a powerful and versatile solution with a low cost. These solutions are currently hard to configure and set up, so its use for a portable plant could be reject, losing all this potential. With a further research to enable plug&play solutions, improving the communication protocols, the logics in each node and the user tools, this will become a reality. • Fast Deployment Wireless Sensor Networks: the deployment and commissioning of a WSN is complicated and time consuming, and need the presence of skilled communication engineers. A technology to enable the fast deployment of these networks, reducing time and skills, will enable these solutions for portable environments, getting a higher density of sensed points at a low cost. • Robust and co-existent wireless communication technologies: a portable plant could be inserted in different kinds of environment, which include harsh wireless communication areas, presence of other wireless devices, and even spectrum saturation. This portable plant should consider this, developing communication technologies to enable robust wireless communications and intrinsic support for the co-existence. • Cloud platform enabling the coordination among the different mobile/portable manufacturing plants (or to the central plant), capable of elastically adapt service offerings to the demand and address the particular needs of flexible manufacturing. And would extend the scope of some existing enablers: • "Interoperability" should include systems interoperability, to enable the information exchange between different devices, sites or management software. It should include existing standards and initiatives to enable the interoperability between industrial components. • Not just "easy-access user interface", but also user friendly and more natural ways to interact with it. It should support any kind of user, from older and no tech-friendly users, to disabled, allowing the social integration of the potential working population.

2.3.4 ITI contributions to the EC Consultation on Cloud Computing challenges for WP 2018-2020 (Octubre 2016)



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Consultation on Cloud Computing Research Innovation Challenges for WP 2018-2020

SLA-driven Self-Management of Cloud Services

Cost-effectively designing, setting up, and managing a software-based service in a manner that meets the expectations of its users when the user population and their activity varies with time is one of the biggest challenges that Cloud Computing industry faces today.

Whereas IaaS services are the enablers of the Cloud Computing approach, they are too low level, and we need a higher level platform automatically managing the life-cycle of the services deployed on top of it.

Some of the challenges such managing platform must address are:

- SLA specification. That is, a formalization of what user expectations actually are, and also, what the expectations of the service are with respect to its users. Current state of the art is dismal, despite the abundance of studies and resources already invested in this subject. They are either too abstract to be really useful to actual users, or too simple to capture the complexities of such contracts.

- SLA-based optimization and elasticity. Given an SLA for a service, its configuration must be adapted at every point in time to the request profile it must confront. This adaptation must be automatic in order to properly track changes in the load, its goal being to optimize some measure of economic performance derived from such an SLA by adding/removing resources from the various instances of the service's components.

- Reconfigurable architectural approaches. In order to add/remove resources from a service, the service's structure must be amenable to it. Likewise, a service being a distributed system, it should be prepared to deal with failures and software changes in its components. The architecture of the service must enable properly reacting to such changes. Research in proper structuring of services as well as on programming paradigms and runtime support conducing to a proper flexible structure must be further advanced.

- SLA calculus. A service will be composed of a multitude of components forming microservices when instantiated. Each component will exhibit its own QoS characteristics such that a proper calculus should be able to derive a global service SLA from the composition of the microservices SLAs. In addition, a service will likely depend on other services. The SLA from those services will need to be taken into account to compute the SLA of the dependent service.

Whereas some work has been carried out on each one of the points above, we believe that the proper way to actually advance in the goal of creating really SLA-driven elastic services is to consider how to provide platforms to manage them.

Links and Documents

- ITI contributions to Cloud Consultation - PDF format (308 KB)

Submitted by: Cristóbal COSTA-SORIA (ITI - Instituto Tecnologico de Informatica, Strategic and Competitive Intelligence Area, Spain)

ITI INSTITUTO TECNOLÓGICO DE INFORMÁTICA

ITI contributions on Cloud Computing challenges for WP 2018-2020

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Report on the Public Consultation on
Cloud Computing Research and Innovation Challenges:
Horizon 2020 Work Programme 2018-2020

Web-based consultation: 5 September-10 October 2016

Workshop date: 7 November 2016

Final version

8 December 2016

Rapporteur: David Griffin

Disclaimer: The views expressed in this document are those of the participants in the consultation exercise as interpreted by the rapporteur. They do not necessarily reflect the view of the European Commission.

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2.9 Cloud infrastructure, middleware and software-defined data-centres

Further research is needed on **cloud middleware and frameworks to scale applications and underlying resources** in a robust, reliable and consistent way, with management APIs, design patterns, and automation to optimise resources for performance reasons as well as to reduce energy usage and ecological impact [31]. A key challenge is to develop a framework for **elasticity à la carte** to support any scaling techniques and optimisation policies and automatically and dynamically select the right elasticity strategy to match varying demand [33] [39].

IaaS services are low level enablers of cloud computing and further research is needed on **higher level platforms that automatically managing the life-cycle of the services** deployed on top of them [43], integrating serverless models for the execution of microservices and application components directly without installation of a complete system stack [37]. More development is needed on **PaaS and SaaS levels** including components to manage replication and reliability [5] [33] [49]. Further challenges are raised by developments towards **Business Process as a Service** (BPaaS) to abstract from pure technical aspects of cloud resources up to business and domain-specific concerns in order to describe and distinguish cloud offerings on domain-specific business grounds, moving from a bottom-up point of view to a business process top-down point of view [4].

Further work on middleware is required to enable **automatic and transparent combinations of hardware and software resources** according to the needs of applications, with resource provisioning, runtime migration, and recovery from minute-to- minute failures being managed automatically by autonomous data-driven components. The application should be able to form automatic and fleeting associations of hardware and software resources across multiple locations and cloud providers. Application developers will no longer need to worry about provisioning servers, storage, or communication resources as the provisioning process will happen automatically [30].

New approaches are needed for the **unified management of virtualised and non-virtualised resources** at the infrastructure and resource layer. This will allow for example the seamless integration of accelerators, smart network cards, FPGA, SDR or SoC devices as well as integrate non-virtualised security components [32]. A combined and coordinated approach to elasticity between VMs and containers is needed to overcome problems when resizing container resources that are limited by the resources of the virtual machine [33]. New cloud resources are expected to emerge, such as supercomputing on demand and high-performance storage [30].

Research should be carried out to identify new **cloud models to support machine-to-machine communication** [54] and further work is needed on the integration of cloud computing model with machine-to-machine computing, solving the challenges of separate technology stacks and dealing with limited memory, storage, computation capacity of edge devices; moving towards **highly automated data centres** to support a massively federated, scalable software architecture with orchestration through network awareness [30].

Further research is needed on **architectural patterns for building software applications running on highly distributed and heterogeneous cloud infrastructures** taking advantage of containerisation, micro-services, cloud-native patterns and serverless computing [14].

More focus is needed on the **differences between architectural design in on-premises and in-cloud environments.** Assumptions on the locality of processing and mirroring for high availability are not valid in the cloud and cloud instances can vanish at any time: the ability to manage and recover from failures must be built into the logic of the solution. More work is needed on **application composability** [39] that moves away from monolithic software systems towards the orchestration of interacting software components and agents in the cloud [35]. Methods are needed for creating, understanding and validating software executing as **swarms of communicating computational units** where the behaviour of a swarm program emerges from the total behaviour of its components [36]. Reconfigurable architectural approaches are needed to deal with failures and software changes and research is needed into the structuring of services, programming paradigms and runtime approaches for adding and removing resources from a service at runtime [43].

Cloud computing requires the composition of multiple complex layers and components from multiple vendors. Each layer (compute, storage, orchestration, workflow, messaging, database, SDN, etc.) is itself a complex stack of software, operating system, virtual and physical hardware. The interaction of these layers may introduce bugs, errors and undesirable behaviours in a non-deterministic manner and **new approaches are required for debugging and profiling of complex cloud systems** using mathematical approaches to handling complex and non-deterministic systems [7].

More work is required on the development of **liquid applications** formed from software that casually and effortlessly follows users as they use different types of computing devices in their daily lives, migrating computation, code and state flexibly between those devices [36].

Traditional software systems relied on rebooting as a general solution to failure. IoT systems represent a different type of computing environment where the entire system consists of a large number of independently operating devices/processors and a new approach is needed for designing **software for systems that never sleep** [36].

2.11 Cloud-networking and the management of network resources

While server virtualisation has simplified the management of computational load within data centres and across the cloud, the management and configuration of the network policies, QoS, VLAN and VPN path configuration and access control haven't achieved the same level of automation [2]. More work is required on the techniques for **cloud services and applications to deploy and manage on-demand network capabilities** [34]. With the advent of SDN and the migration of a large part of the telco industry towards NFV, the **management of network resources and behaviour is using the same principles as the management of classical IT services** (on-demand provisioning, automation of operations, collection of relevant data, data based optimisation, etc.). This evolution not only introduces cloud computing principles deeper in the network architectures but also **facilitates the design and deployment of distributed clouds** [2] [5] [31]. Techniques are needed to **integrate networking aspects as another component of cloud-based systems** [39] to enable **applications to automatically and instantaneously initiate, update or terminate networks** according to their business requirements through programmatic APIs [34].

More work is required on tools for the efficient use of SDN to **dynamically configure networking and network routing to ensure optimal performance of cloud services** (particularly hybrid, multi-site and inter-cloud configurations). This involves dynamic optimisation of the network to suit the cloud application, the dynamic optimisation of the cloud application deployment to suit the network topology, or the dynamic interaction of both [7] especially to improve the performance of applications that depend heavily on data access and analysis [27].

Specific challenges in cloud networking include: **building on-the-fly network services** by deploying them on the cloud [39]; **integration of SDN with cloud systems load balancing** [38]; application- and service-aware virtual networking, going beyond offering network functions as a pure infrastructure service and are therefore isolated from the cloud value chain they serve [2] [27]; heterogeneity, considering PaaS and SaaS layers, and fog computing models, creating **homogeneous overlay networks on-demand over heterogeneous clouds** in multi-tenancy environments [22] [27]; improved support for virtualised networking in the cloud, for example through a new Network PaaS [32]; provision of **rich and flexible interaction interfaces between the distributed cloud management platforms and the backbone network** for establishing connectivity and higher layer networking services for intra-PoP, multi-PoP, PoP-to-data-centre and PoP-to-end-user resources [34].

In addition, a promising approach to **scalable security in edge clouds** is through extensions to the real-time monitoring and analysis of data streams with **security autonomics making use SDN mechanisms to trigger actions such as blocking malicious flows** or isolating and replacing application instances under attack [32].

2.12 SLAs, compliance and QoS

In an open and highly dynamic cloud ecosystem relationships will be created on a more temporary basis with a higher degree of anonymity between stakeholders. Thus, on one hand, it is necessary to offer **methods and tools to quantitatively assess and evaluate cloud stakeholders**, e.g., audit and monitoring functions, analysis of service failure probability, risk of data loss, price of service, and probability of SLA violations. On the other hand, methods to measure stakeholder satisfaction are also important, e.g., individual and group perceptions, reputation of stakeholders, or individual previous experiences [2].

A **uniform and standardised representation of SLAs** which is agnostic to different cloud providers is needed to facilitate the **automatic comparison of offers from different providers** to increase competition, avoid vendor lock-in and enhance the opportunities for the automated optimisation of cloud deployments across multiple providers [5] [27] [43] [55]. There is a need to develop a **universal semantic-based service description language** covering both functional and non-functional aspects to describe cloud services at multiple levels of abstraction [27].

Improved mechanisms for **QoS and SLA management are required for service composition and aggregation across multi-cloud and federation scenarios** [53] to deal with the composition of SLAs from end customers, brokers and cloud providers, including the ability for customers to define penalties on SLA violations [2]. Each component of a complex service composed of a multitude of microservices will exhibit its own QoS characteristics and work is needed to define a proper **SLA calculus** to derive a global SLA from the SLAs of the individual components [43].

Methods to efficiently assess cloud services continuously are still in their infancy. Current certification schemes, such as CSA STAR and EuroCloud Star Audit cover security, reliability, and legal compliance for a validity period of one to three years, based on the assessment made at the time the certificates were issued. Further work on **continuous certification of cloud services**

[39] *Research Issues for Future Cloud Infrastructures, Inria Position Paper*, Frédéric DESPREZ, INRIA, Research Department, France.

[40] *Safe and valuable cloud*, Michel DE ROUGEMONT, University Paris II, Economy & Computer Science, France.

[41] *Secovia Project Results*, Franco CIMA, Lepida SpA, European Affairs, Italy.

[42] *Secure cloud solution to enhance interoperability in LEA's*, Patrick PADDING, ENLETS, European Network of Law Enforcement Technology Services, Netherlands.

[43] *SLA-driven Self-Management of Cloud Services*, Cristóbal COSTA-SORIA, ITI - Instituto Tecnologico de Informatica, Strategic and Competitive Intelligence Area, Spain.

[44] [duplicate contribution]

[45] *Swiss-made and validated eHealth Middleware to enhance compliant international sensitive and personal data management*, Evelina GEORGIEVA, PRYV SA, Business development and Compliance, Switzerland.

[46] *The Challenge of Trustworthy Cloud Service Certification*, Sebastian LINS, University of Kassel, Chair for Information Systems and Systems Engineering, Germany.

[47] *Tools and techniques for an agile and robust reengineering of software*, Cosimo LANEVE, University of Bologna, Computer Science and Engineering, Italy.

[48] *Two approved certifications or CoC for the GDPR*, Cyril BARTOLO, EUROCIO, France.

[49] *CERN input to the Consultation on Cloud Computing Research Innovation Challenges*, Bob Jones, CERN, Switzerland.

[50] [duplicate contribution]

[51] *Tweet from EBU*, European Blind Union.

[52] *EC Public Consultation on Cloud Computing Research Innovation Challenges for WP2018-2020-GEANT input*, GEANT.

[53] *EU Consultation on cloud research challenges - Observations & Views from Hewlett Packard Enterprise*, Hewlett Packard Enterprise, United Kingdom.

[54] *Consultation on Cloud Computing Research Innovation Challenges for WP 2018-2020*, Trust-IT Services, United Kingdom.

[55] *Cloud technologies for the media sector*, Ralf NEUDEL, IRT, Germany.

[56] *Economic impact of cybercrime*, Ari LATVALA, TAXUD-Taxation and Customs Union Directorate-General (European Commission) [personal capacity contribution], Belgium.

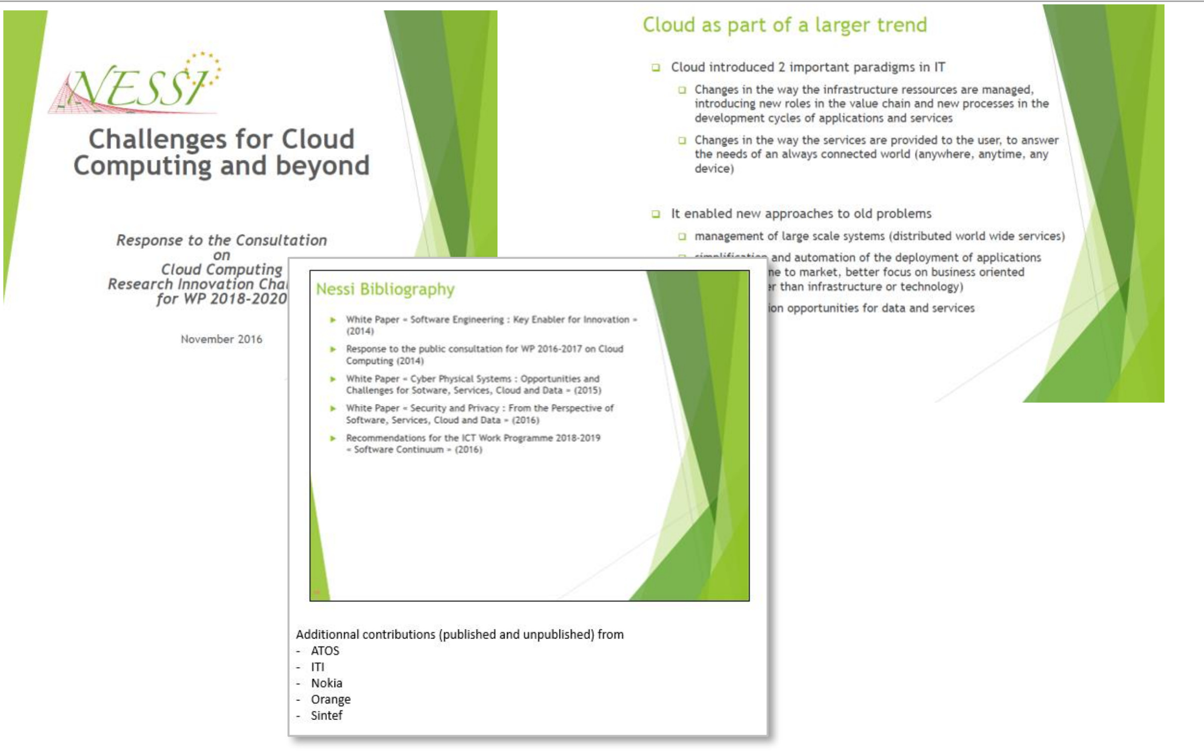
[57] *Input from BBC Research & Development*, Judy PARNALL, BBC Research & Development, United Kingdom.

[58] *The integration of IoT with Cloud and Fog computing*, Antonio PULIAFITO, University of Messina, Italy.

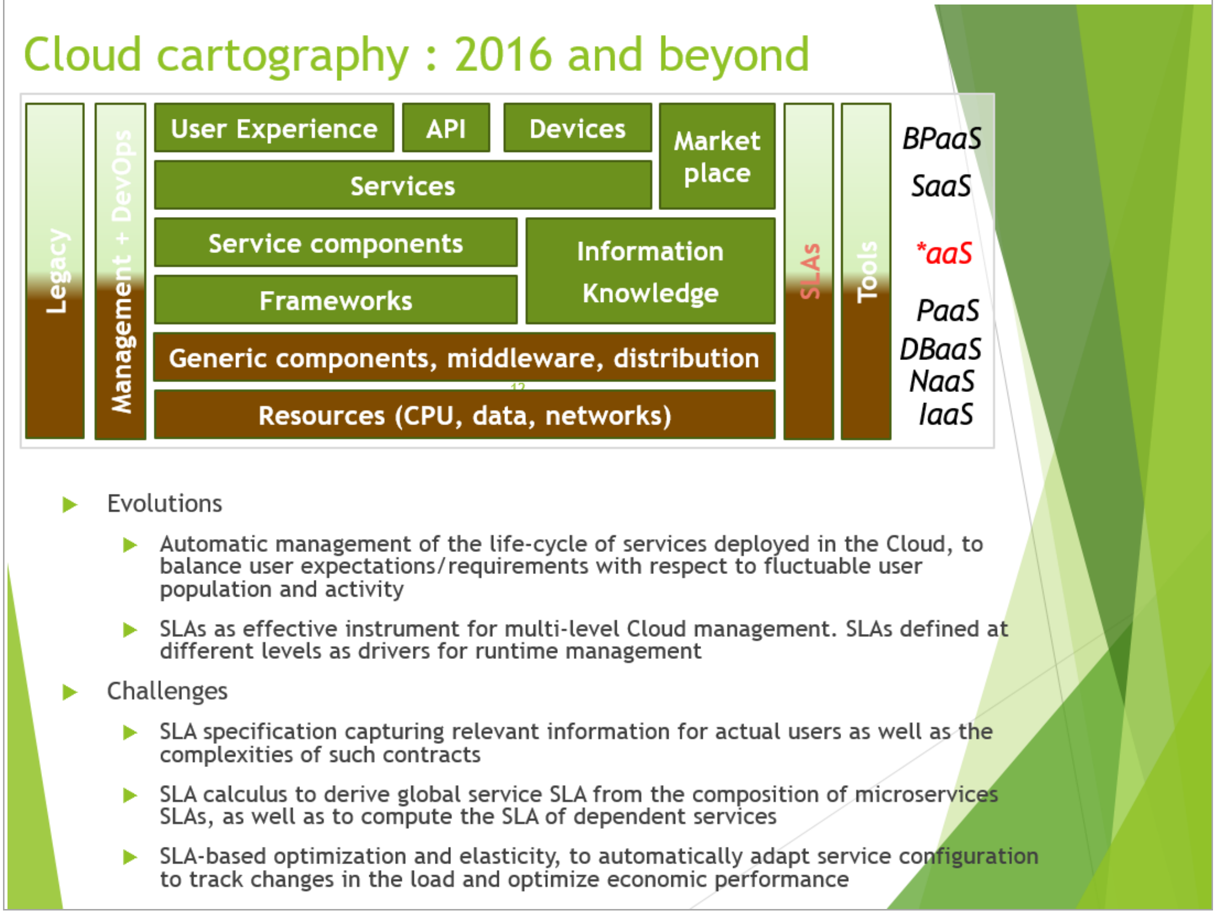
[58a] *OFE's contribution to the cloud research consultation*, Diana COCORU, Open Forum Europe.

[58b] *EU-Brasil Cloud Forum contribution*, Marco VIEIRA, EU-Brasil Cloud Forum.

2.3.5 NESSI contributions on Cloud Work programme (Octubre 2016)



ITI contributions:



3. Acciones de posicionamiento institucional

Durante 2016, ITI ha realizado contactos con los distintos organismos que definen las políticas y programas de apoyo a la I+D+I con el objetivo de obtener información importante sobre las diferentes convocatorias que sirva para orientar mejor los proyectos a presentar en las mismas así como para dar a conocer los proyectos en los que el ITI está trabajando.

Algunos de estos contactos se listan a continuación:

Tabla 4. Acciones ITI de posicionamiento institucional durante 2016

Entidad	Contacto(s)	Objeto
IVACE	Roberto Parras, Rafael Escamilla, Ana Botella, Carmen Marcos	Trabajo en el RIS3 de la Comunidad Valenciana y la definición de Digital Innovation Hub sobre Industria 4.0 en la Comunitat Valenciana
Diputación Valencia	Oficina europea: Bartolomé Nofuentes	Identificación de administraciones locales para participar en proyectos europeos, búsqueda de oportunidades de colaboración
DGTIC	Vicente Aguiló, Enrique Valls, Juan López, Gabriel Carrión	Establecimiento de colaboraciones para el diseño de la estrategia de Tecnologías de la Información y las Comunicaciones de la Generalitat Valenciana.
CDTI	Marina Martínez, Paloma Dorado, Maite Boyero, Javier Echávarri, Fernando Martín, Fernando Rico, Andrés Martínez, Luis Guerra	Consultas relativas a propuestas europeas en preparación. Envío de contribuciones para futuro programa de trabajo H2020 2018-2019-2020, en FoF, Cloud Computing, ICT
MINETUR	Rafael Lucena, José Luis Alonso	Contactos realizados principalmente para la JTI ECSEL y el posicionamiento del ITI como un referente en el ámbito de CPS.
MINECO	Mª Luisa Delgado, Mª Luisa Poncela, Carmen Vicente, Mª Ángeles Ferré	Principalmente para el establecimiento de las directrices de los grupos de trabajo dentro de Planetic relacionados con Big Data y Fabricación Avanzada.
Comisión Europea	Wolfgang Treinen, Marta Nagy, Beatrice Covassi, Javier Hernández Ros	Contacto con Project y Programme Officers para la definición de estrategias de Investigación en Big Data
Comisión Europea	Kimmo Rossi	Inputs relacionados con las acciones de coordinación a nivel Europeo en torno al Big Data, en el marco de la BDVA