



# Annual report 2017

The Internet  
Research Center





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# Annual Report 2017

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i2CAT Foundation's excellence and milestones achieved have led to a 33% rate growth in the 2015-2017 period.



**Jordi Puigneró i Ferrer**  
President of i2CAT Foundation

# Letter from the President

In 2017, the Government of Catalonia has continued to invest in boosting ICT and advanced digital technologies as strategic drivers for progress. It has also renewed its commitment to i2CAT, a mission-driven research and innovation institution which is key to meet the new challenges faced by the Government to become a smart country. During 2017, the centre has continued to enhance its knowledge and to generate economic and social impact.

i2CAT pursues flagship initiatives that aim to foster the ICT strategies and policies implemented by the Government of Catalonia. To name but a few, i2CAT collaborates in two private-public initiatives driven by the Government: the definition and technical coordination of the new programme in Advanced Research and Innovation, and, within the RIS3CAT strategy, the leadership of an emerging community focused on deploying an open experimental infrastructure in Catalonia based on 5G and the Internet of Things.

5GBarcelona is worth highlighting; a public-private initiative working to transform the metropolitan area of Barcelona into a city-wide open lab for the validation and adoption of 5G technologies.

Additionally, the centre has developed the CatLabs Network to promote and incorporate the social fabric within Catalonia's digital innovation ecosystem. Furthermore, through the City Council of Barcelona, Bloomberg has awarded i2CAT's Vincles II, a project addressed at reducing social isolation.

The quality of i2CAT's research has been recognized with 9M€ in European Commission funds from 2014 to 2017 to carry out a wide array of R&D projects. The centre has strengthened its leading

position in the fields of 5G and VR technologies, both at a local and international scale. Within the H2020 ecosystem, it has carried out 8 5G projects out of the 37 funded by the European Commission and has coordinated 3 projects on Virtual and Immersive media technologies.

Technology Transfer to market has also seen remarkable growth in 2017, reaching more than 40 agreements with companies and entities. These collaborations weight on the outcomes of R&D projects and engender new innovation processes through technology transfer. An agreement with EEUU-based AASA Inc. for the commercialisation of an indoor positioning technology based on Visible Light Communications (VLC) is an example of these achievements, as well as the incorporation of i2CAT as a stakeholder of the start-up Watchity.

The milestones stated above and i2CAT excellence have led to a 33% rate growth in the 2015-2017 period. The centre has also been granted the "Human Resources Excellence in Research Award" (HRS4R) by the European Commission and the TECNIO accreditation seal by the Government of Catalonia, which identifies key enabler centres that provide added-value technologies.

I congratulate the i2CAT team for the landmark achievements of 2017 and encourage them to keep working at the same level of excellence and commitment.

The advanced digital technologies field will be a strategic priority for the Government of Catalonia, which I am convinced will reinforce its commitment to i2CAT so that the centre continues to be a key entity for its strategies and policies.

# 2017 Highlights

Some of the results and milestones achieved in 2017 have been:

**Achievement of 33% (2015-2017) rate growth** reaching an income of 4.85 M€.

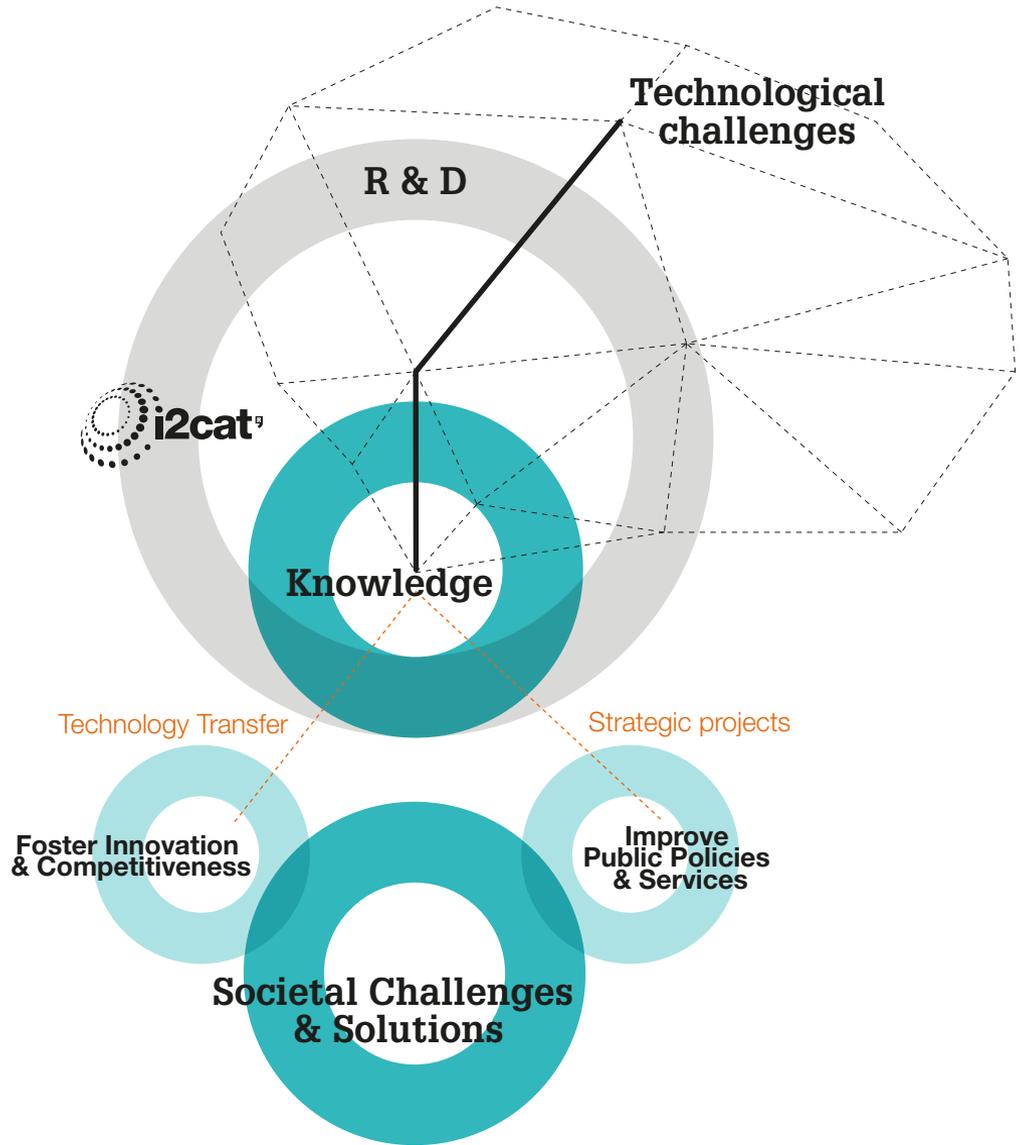
**Grant of the “Human Resources Excellence in Research Award”, (HRS4R). The European Commission** recognizes with this award the institutions which make progress in aligning their human resources policies to the 40 principles of the Charter & Code, based on a customized action plan/HR strategy.

**i2CAT has also received the TECNIO accreditation**, the seal granted by the Government of Catalonia to identify the centers that provide added-value technology and those that are key enablers.

**Strengthening the center’s leading position** in the research and development of 5G and VR technologies, both at a local and International scale. Additionally to the European R&D projects with a total number of 32, the center has been also one of the founding members of the 5GBarcelona initiative.

**Pursuing R&D services to companies and entities to leverage the technologies developed by the center**, 39 R&D services projects have been carried out for companies and entities.

**Enhancing the promotion of the relevant innovations** outcome from the center’s research projects that have potential to reach the market. Since asset and product management is of capital importance for achieving Technology transfer, in 2017 i2CAT has created the Asset & Product Manager role. The i2CAT’s inventions have led into the formalisation of collaboration, commercialisation and technology transfer agreements.



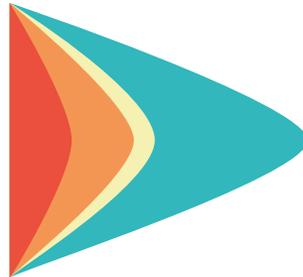
# Facts & Figures

## Funding

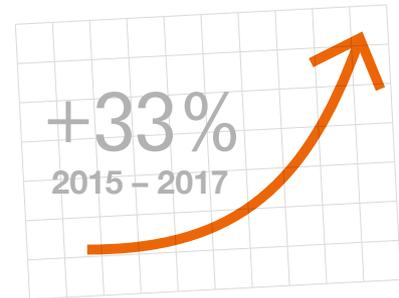
4,85 M€

### Income breakdown (%):

Core funding Government of Catalonia	10%
Competitive Funds	48%
R&D Services to companies	20%
Business & Entities Project Contributions	22%



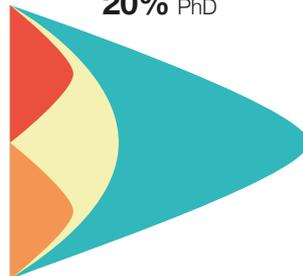
## Growth Rate



## Staff

60 employees  
20% PhD

Research	33
Support & Management	11
Development	8
Innovation	8



## Projects

### Number of R&D Projects

Services to companies	39
Competitive Funds	32
Strategic R&D Projects with Public Administration	8



### R&D Services to Companies

International	26%
National	74%



### R&D Competitive Funding Projects

International	75%
National	25%



# Fairs & Congresses

Participations in scientific & commercial events:

32

# R&D Proposals Submitted

104

# International Networking

Trips across the world:

161

# Publications

35

Some of the 2017 publications included:

## Immersive media: content creation and broadcasting

J. Llobera, J. Nuñez, S. Fernandez, "Creating and broadcasting video-based multi-platform experiences", Journal: MMTC Communications - Frontiers. Vol 11, No. 2.

J. Llobera, R. Boulic, "A tool to design interactive characters based on embodied cognition", Journal: IEEE Transactions on Computational Intelligence and AI in Games vol. PP, no. 99, pp. 1-1. doi: 10.1109/TCIAIG.2017.2755699.

## 5G networks: RAN backhaul and transport network

J. Bartel, N. Vucic, D. Camps-Mur, E. Garcia-Villegas, I. Demirkol, A. Fehske, M. Grieger, A. Tzanakaki, J. Gutiérrez, E. Grass, G. Lyberopoulos and G. Fettweis, "5G transport network requirements for the next generation fronthaul interface", Journal: EURASIP Journal on Wireless Communications.

Anna Tzanakaki; Markos Anastasopoulos; Ignacio Berberana; Dimitris Syrivelis; Paris Flegkas; Thanasis Korakis; Daniel Camps Mur; Ilker Demirkol; Jesus Gutierrez;

Eckhard Grass; Qing Wei; Emmanouil Pateromichelakis; Nikola Vucic; Albrecht Fehske; Michael Grieger; Michael Eiselt; Jens Bartelt; Gerhard Fettweis; George Lyberopoulos; Eleni Theodoropoulou; Dimitra Simeonidou, "Wireless-Optical Network Convergence: Enabling the 5G Architecture to Support Operational and End-User Services", Journal: IEEE Communications Magazine, vol. 55, no. 10, pp. 184-192

## 5G networks: Advanced media services

Ioannis Neokosmidis, Theodoros Rokkas, Pietro Paglierani, Claudio Meani, Karim M. Nasr, Klaus Moessner, Pouriya Sayyad Khodashenas, "Techno-Economic Analysis for Innovative Media Services in 5G Networks", Journal: IEEE Transaction on Engineering Management.

## 5G networks: SDN and NFV as key technology enablers

Jose-Juan Pedreno-Manresa, Pouriya Sayyad Khodashenas, Muhammad Shuaib Siddiqui, Pablo Pavon-Marino, "On the Need of Joint Bandwidth and NFV Resource Orchestration: a Realistic 5G Access Network Use Case", Journal: IEEE Communications Letters / Blanco, B., J. Fajardo, I. Giannoulakis, E. Kafetzakis, S. Peng, J. Perez-Romero, I. Trajkovska, S. P. Khodashenas, L. Goratti, M. Paolino, and E. Sfakianakis, "Technology pillars in the architecture of future 5G mobile networks: NFV, MEC and SDN", Journal: Elsevier Journal on Computer Standards and Interfaces.

## SDN applied to smart cities

Rod Tucker, Marco Ruffini, Luca Valcarengi, Divanilson R. Campelo, Dimitra Simeonidou, Liang Du, Maria-Cristina Marinescu, Catherine Middleton, Shuang Yin, Tim Forde, Kevin Bourg, Eugene Dai, Ed Harstead, Philippe Chanclou, Hal Roberts, Volker Jungnickel, Sergi Figuerola, et al., "Connected OFCity: Technology Innovations for a Smart City Project [Invited]", Journal: Optical Society of America.

## RINA: scalable routing and forwarding

Sergio León, Jordi Perelló, Davide Careglio, Eduard Grasa, Diego Lopez, Pedro A. Aranda, "Scalable Topological Forwarding and Routing Policies in RINA-enabled Programmable Data Centres", Journal: Wiley Transactions on Emerging Telecommunications Technologies

## Cybersecurity: Big Data and NFV for threat identification and mitigation

G. Gardikis, K. Tzoulas, K. Tripolitis, A. Bartzas, S. Costicoglou, A. Liou, B. Gastón, C. Fernández, C. Dávila, A. Litke, N. Papadakis, D. Papadopoulos, A. Pastor, J. Nuñez, L. Jacquin, H. Attak, N. Davri, G. Xylouris, M. Kafetzakis, D. Katsianis, I. Neokosmidis, M. Terranova, G. Giustozzi, T. Batista, R. Preto, E. Trouva, Y. Angelopoulos, A. Kourtis, "SHIELD: A Novel NFV-based Cybersecurity Framework", Conference: IEEE Netsoft.

# International R&D Activities

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9 M€

Granted by the European Commission in the 2014-2017 period are proof of i2CAT's quality research and remarkable achievements within the Horizon 2020 programme.

## 5G

The center has continued to strengthen its leading position in the research and development of 5G technologies, both in Catalonia and Europe.

## 8

**5G H2020 projects** of the 37 funded by the European Commission

## 22%

by the total number of **funded projects** by the European Commission

### 5G Projects carried out in 2017

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5G ESSENCE



### Assets generated

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- Neutral hosting platform for 5G infrastructure.
- SDN-enabled Enterprise WiFi solution.

# VR

The center works towards the creation of new content formats and experiences for mobile devices and head mounted displays. The objective is to offer new and richer content experiences, immersive and interactive, and the tools to create them.

i2CAT is **leading**

# 3

H2020 Virtual Reality Projects

VR Projects carried out in 2017



Assets generated

- Immersive Media Toolchain

# H2020 Active Projects

Project	Technologies	Project	Technologies
<b>SESAME</b> (GA N° 618098)	5G	<b>Fed4FIREplus</b> (GA N°732638)	Experimental platforms
<b>SODALITE</b> (GA N° 612050)	5G	<b>GrowSmarter</b> (GA N° 646456)	IoT
<b>5G-Xhaul</b> (GA N° 671551)	5G	<b>GN4-2</b> (GA N° 731122)	SDN
<b>FLAME</b> (GA N° 731677)	5G	<b>O4C</b> (GA N° 687818)	Open Big Data, Digital Social Innovation
<b>5G-PICTURE</b> (GA N° 762057)	5G	<b>MUV</b> (GA N° 646456)	Open Big Data, Digital Social Innovation
<b>SONATA</b> (GA N° 671517)	5G	<b>COSIGN</b> (GA N° 619572)	Optical networks, SDN
<b>CHARISMA</b> (GA N° 671704)	5G	<b>ARCFIRE</b> (GA N° 687871)	RINA
<b>SESAME-H2020</b> (GA N° 677596)	5G	<b>ImmersiaTV</b> (GA N° 688619)	VR, Immersive Technologies
<b>5GCITY-H2020</b> (GA N° 761508)	5G	<b>VRTogether</b> (GA N° 762111)	VR, Immersive Technologies
<b>SaT5G</b>	5G	<b>ImAc</b> (GA N° 761974)	VR, Immersive Technologies
<b>5G-ESSENCE</b> (GA N° 761592)	5G		
<b>SHIELD</b> (GA N° 700199)	Big Data, Cybersecurity		
<b>CYCLONE</b> (GA N° 644925)	Cloud networking		

# R&D Activities with Public Administration

i2CAT fosters flagship initiatives to support ICT-based innovative strategies and policies implemented by public administrations.

## 5GBARCELONA

**5GBarcelona** is a public-private initiative working to transform the metropolitan area of Barcelona into an open city-wide lab for the validation and adoption of 5G technologies and applications in a real-life environment.

The initiative creates synergies within the ecosystem and offers an experimental infrastructure to test, prototype and implement new digital solutions in the city. 5GBarcelona wants to stimulate the existing innovation in Barcelona, help to attract foreign investment, boost tech start-ups and generate an entire industry around 5G technology.

The initiative is powered by the Government of Catalonia, Barcelona City Hall, Mobile World Capital Barcelona, i2CAT, CTTC, Atos and the UPC.



## CATLABS NETWORK SMARTCAT

The **Catlabs Network** project is an ambitious collaboration between i2CAT Foundation and the Government of Catalonia to promote new mechanisms for digital, social and collaborative innovation aimed at providing better responses to the challenges faced by the economy and society, and to enable and promote the participation of the quadruple helix in the research and innovation system, RIS3CAT, and new European models of innovation.

During 2017, the project has focused on: i) the creation of a Digital Social Innovation (DSI) Network in collaboration with other catalan entities and ii) the creation of the technical office to boost DSI activities.



**SmartCAT** is the strategy of the Government of Catalonia that, fully aligned with the Europe 2020 strategy of the European Commission, carries out a programme that integrates and coordinates local initiatives, support companies and deploy Smart initiatives throughout the territory. It aims at taking advantage of the use of technology and digital information to innovate in public services, boost economic growth and promote a smarter, sustainable and inclusive society.

i2CAT is collaborating in the following projects created under SmartCat strategy:

The **IoT Catalan Alliance** is an initiative managed and promoted by i2CAT that brings together all the players in the Catalan Smart ecosystem to raise awareness of the potential we have as a country to foster collaboration and the generation of projects in the area of Internet of Things.

In 2017, the main goal of the initiative has been to enhance the adoption of IoT solutions in the fields of Logistics and Health. To do that, the center has worked very closely with the main innovative stakeholders in these fields through workshops and participation in conferences. The community has experienced an exponential growth of 40% during 2017, reaching 85 members.

**SmartLAB** is an initiative that launches pilot tests of innovative solutions to solve technological challenges identified by Catalan municipalities. In 2017, 5 cities have implemented smart solutions and 4 more are currently underway.

**SmartCAT Challenge** is an initiative that promotes entrepreneurship by providing solutions to challenges presented by cities or the non-profit sector to improve the quality of life of citizens. In 2017, SmartCAT Challenge has received 31 solutions, incubated 27 projects and awarded 6 prizes for best technological solution in the fields of urban mobility and social inclusion.



## CYBERSECURITY INNOVATION OFFICE

In 2017 the center has created the cybersecurity innovation office in collaboration with CESICAT, the body in charge of guaranteeing the protection, prevention and governance in matters of cybersecurity of the Government of Catalonia.



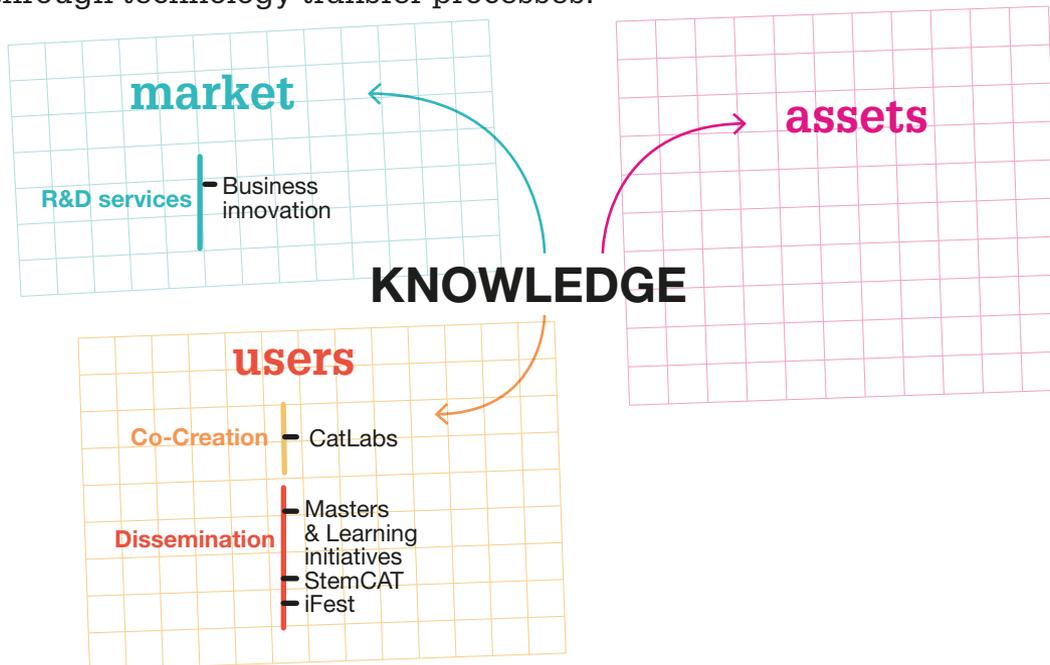
## VINCLES II

A social innovation project designed to strengthen the social ties of elderly people who feel lonely and to improve their well-being with the aid of new technologies. The project creates personalized and connected trust circles that consist of a group of individuals who come together to provide intentional support for someone who is facing a challenging personal situation.



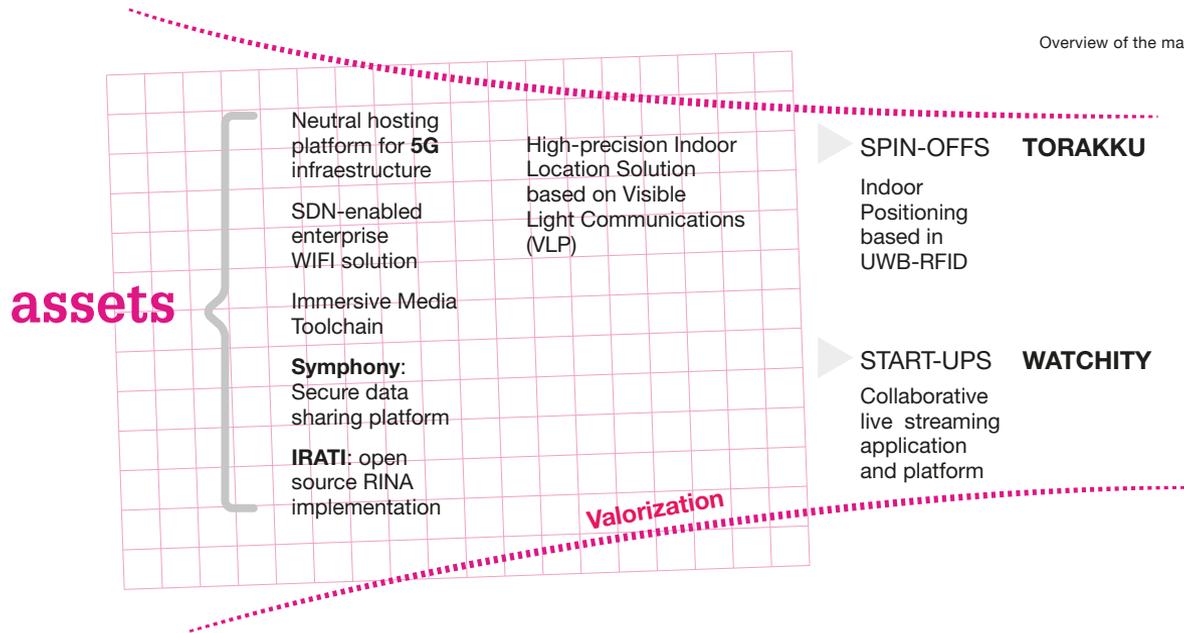
# Technology Transfer

In 2017, i2CAT has collaborated with more than 40 companies and entities in order to leverage its outcomes from R&D projects and generate innovation through technology transfer processes.



The initial screening process performed during 2017 has allowed i2CAT to identify 15 different assets and innovations with different levels of TRL that have been evaluated according to a selection of market readiness criteria.

Overview of the main Assets developed by i2CAT



## VLP

One of these inventions led to the formalisation of a teaming agreement with AASA Inc. for the commercialisation of an indoor positioning technology based on Visible Light Communications (VLC). Two initial projects have been carried out in preparation for an indoor positioning system prototype for a retail scenario,

which has been showcased at the CES2018 event in Las Vegas, NV (USA) in January 2018. The exhibition included augmented and virtual reality demonstrations also using the High-precision Indoor Locations based on Visible Light Communications technology developed by i2CAT.

## START-UP WATCHITY

In 2017, i2CAT has become stakeholder of the Start-up Watchity. The foundation has also signed an agreement to develop a collaborative live streaming application and platform. This is a B2B2C recording platform and application that, in a simple way and without ad-hoc audio-visual infrastructures deployments, allows a manual or

automatic broadcasting of different video streams from different mobile devices in real time. The solution is also integrated with social networks to allow the distribution of audio-visual content 'mono-camera'.

# i2CAT in the Media

i2CAT's activities have received remarkable interest by the media in 2017. Here is a selection of journalistic pieces featuring the i2CAT Foundation.

## Digitalavmagazine - VRGo immersive virtual reality combines with positioning through visible light

<http://www.digitalavmagazine.com/en/2017/02/24/vrgo-combina-realidad-virtual-inmersiva-con-posicionamiento-a-traves-de-luz-visible/>

## Panorama Audiovisual-i2CAT demonstrates data transmission through light at MWC

<http://www.panoramaaudiovisual.com/2015/03/04/i2cat-demuestra-en-el-mwc-transmision-de-datos-a-traves-de-la-luz/>  
GPS World - Indoor location, data see growth at MWC  
<http://gpsworld.com/indoor-location-data-see-growth-at-mwc/>

## EIPuntAvui- Catalonia is the European reference in 5G research

<http://www.elpuntavui.cat/societat/article/5-societat/1147448-catalunya-es-la-referencia-europea-de-la-recerca-en-5g.html>

## RAC1 - El Món a RAC1:

### Digitally advanced technologies and 5G positioning

<http://www.rac1.cat/a-la-carta/detail/a6f29e91-48a8-4ed3-bf80-64a194f1513>

## Betevé - Barcelona and betevé, testbed for 5G technologies

<http://beteve.cat/projecte-5gcity-5g-barcelona-beteve-i2cat/>

## EIPuntAvui – Sunday Edition – Melting time in the net

<http://www.elpuntavui.cat/economia/article/18-economia/1162477-fondre-el-temps-a-les-xarxes.html>

## El Mundo – The global supply chain reaches your home

<http://www.elmundo.es/economia/innovadores/2017/06/12/593e55e322601d79628b4635.html>

## La Vanguardia- SIL Innovation Zone will gather the latest novelties in logistics in cooperation with then i2CAT Foundation

<http://www.lavanguardia.com/vida/20170512/422521207265/el-sil-innovation-zone-reunira-las-ultimas-novedades-logisticas.html>

## El País- Barcelona positions itself as a 5G lab

[http://economia.elpais.com/economia/2017/06/20/actualidad/1497960125\\_295536.html](http://economia.elpais.com/economia/2017/06/20/actualidad/1497960125_295536.html)

## El Mundo – The 5G network of the future is tested in Barcelona

<http://www.elmundo.es/economia/innovadores/2017/06/27/5952379be2704e6e118b4579.html>

## La Vanguardia - i2CAT obtained 4.45 million revenue in 2016, a 22% increase

<http://www.lavanguardia.com/edicion-impresa/20170731/43240557237/el-2016-va-obtenir-ingressos-de-445-milions-un-22-mes.html>

## Terricoles Betevé - Terricoles: Sergi Figuerola, technical director at the i2CAT Foundation

<http://beteve.cat/clip/terricoles-sergi-figuerola/>

## El País – The Catalan government makes a quantum encoded Skype call

[https://elpais.com/ccaa/2017/07/06/catalunya/1499345840\\_163410.html#?ref=rss&format=simple&link=link](https://elpais.com/ccaa/2017/07/06/catalunya/1499345840_163410.html#?ref=rss&format=simple&link=link)

## Alen - GrowSmarter. Implementation of Smart City solutions.

<http://efikosnews.com/growsmarter-implemencion-soluciones-smart-city/?lang=es>

## WhaTech - VR and AR storm IBC2017

<https://www.whatech.com/iptv/news/366714-cbt731-vr-and-ar-storm-ibc2017>

## Fulls dels enginyers – “In the near future, new applications and businesses determined by the IoT will appear”

<http://fullsdelsenginyers.cat/article/en-futur-proxim-sorgiran-noves-aplicacions-negocis-totalment-condicionats-iiot?platform=hoosuite>

## El Mundo – The Internet: smaller and more controlled?

<http://www.elmundo.es/economia/2017/09/20/59c22ced22601dff728b465f.html>

## Panorama Audiovisual - 5G will open a new frontier for audiovisual media

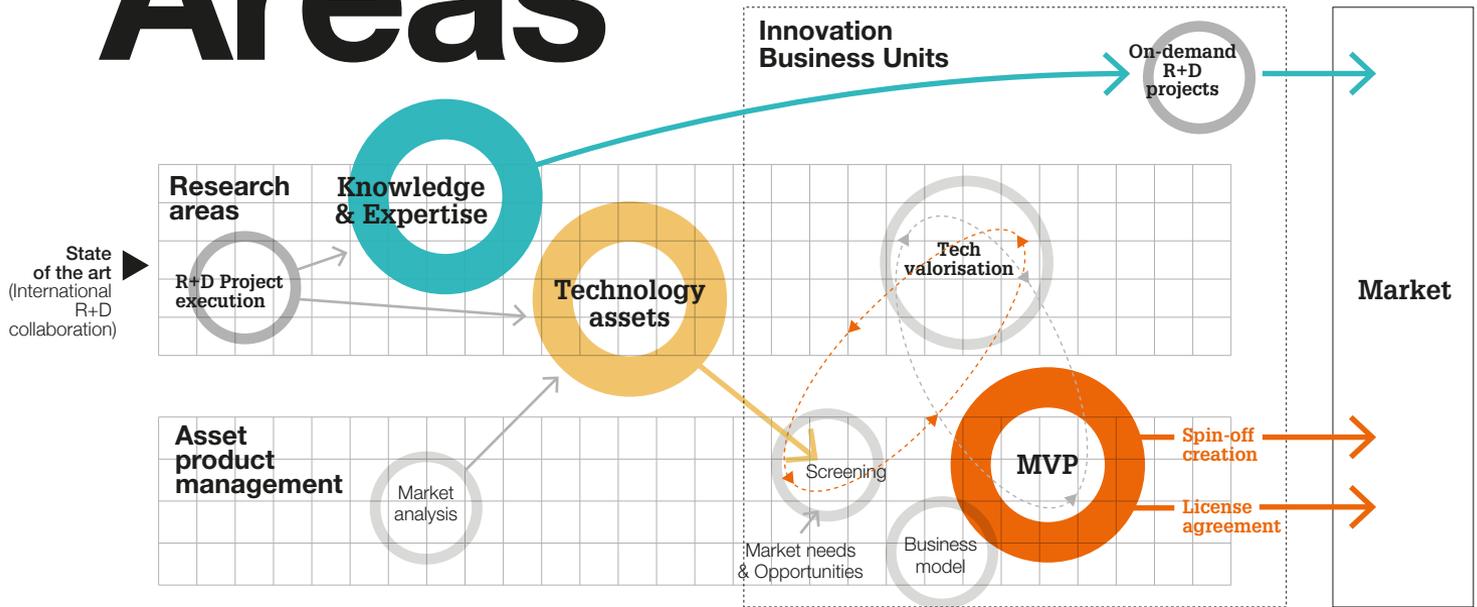
<https://www.panoramaaudiovisual.com/2017/10/04/el-5g-abrira-una-nueva-frontera/>

## Dones en Xarxa- Rosa Paradell, speaker at Table 4: "Smart City"

<http://www.donesenxarxa.cat/rosa-paradell-ponent-de-la-taula-4?lang=ca>

**15 years pursuing  
International and Local  
R&D projects in advanced  
digital technologies  
endorse i2CAT expertise  
to meet business and  
societal challenges  
through innovation.**

# Research Areas



Each Research Area (RA) in i2CAT masters certain areas of knowledge and owns a set of assets: software and/or platforms with a clear roadmap and added value that solve a specific

problem. Such assets and expertise are not only key to get competitive research and innovation projects, but also can potentially be transferred to the market or be the basis of private

service contracts with companies. To accomplish that goal, i2CAT RAs work in close cooperation with Innovation and Business Units as well as the Asset and Product Manager.

Research Area	Asset Name	Asset Description	Contributing projects	
5G/IoT	<b>Software Networks</b>	Neutral Hosting Platform for 5G infrastructure	Open-source, secure neutral hosting platform that enables infrastructure (net + compute) slice creation, service lifecycle management and interaction with 3rd party tools	<b>5GCITY, FLAME, 5GESSENCE, SAT5G</b>
	<b>Mobile Wireless Internet</b>	High-precision indoor location based on VLC tech	Composed by a controller, connected to existing LED luminaire and a positioning app on a smartphone or embedded. Target resolution is <10cm in 3D space, <10° in angle	<b>INTERNAL PROJECTS</b>
		SDN-enabled enterprise WiFi solution	SDN-enabled WiFi Access Point built with COTS hardware and custom software, supporting: backhaul/mesh for smart city scenarios, enterprise-grade features and multi-tenancy	<b>5GCITY, 5G-XHAUL, 5G-PICTURE, FLAME, 5GESSENCE</b>
	<b>RINA</b>	IRATI: open source RINA implementation	Open source, programmable RINA implementation for Linux O/S, to experiment with RINA over Ethernet, WiFi, IP and IP over RINA	<b>ARCFIRE</b>
Immersive & Interactive Media	<b>Media Internet</b>	Immersive Media Toolchain	A set of tools for the production, distribution and display of immersive media formats: multi-screen editor, immersive media packager, immersive media players	<b>IMMERSIA TV, IMAC, VR-TOGETHER</b>
Artificial Intelligence	<b>Open Big Data</b>	Symphony: Secure data sharing platform	Cloud-based Big-Data as-a-service solution. Secure and centralized open-source data preparation, sharing, slicing and visualization platform	<b>SHIELD, MUV</b>

# 5G/IoT: Software Networks

The digitalisation era requires an intelligent Internet based on new architectures and services able to interconnect people, objects and environment in more efficient and dynamic ways. New systems and protocols are also needed to transform information into new knowledge by creating intelligent environments. Users shall be empowered to design, reconfigure and manage the networks based on their own interests and needs.

The Software Networks (SN) research area of i2CAT focuses on exploring and defining new ways to provision and manage the Future Internet networks, enabling new

functionalities and business models by means of integrating technologies such as networked Clouds, Software Defined Networking (SDN) and Network Function Virtualization.

## Main partners



## Research challenges

### 5G Network Architectures

5G technologies represent the next generation of communication standards, able to provide ultra-high connection speeds, increased coverage, spectral efficiency, very low latency and to connect billions of devices. This line investigates novel SDN/NFV based networking solutions for more versatile, fast and efficient 5G services.

#### Technologies

Software Defined Networking (SDN)  
Network Function Virtualisation (NFV)  
Recursive Internet Architectures  
Network as a Service (NaaS)

#### Applications

Neutral Hosting  
Multi-tenancy in Open Access Networks  
Virtual network security  
Dynamic network overlays  
Mobility and multi-homing

### Cloud Technologies

Cloud technologies are one of the main drivers of the digital transformation, enabling distributed computing and storage with secure and robust connectivity. SN is actively innovating in cloud technologies, bringing automation to cloud and network services while lowering the transformation barrier for SMEs and more traditional industries.

#### Technologies

Cloud computing  
Fog/Edge computing  
Infrastructure as a Service (IaaS)  
OpenStack, Dockers and Micro-services

#### Applications

Cloud networking  
Hybrid clouds  
Deployment of complex cloud applications  
Data integration and slicing  
Edge services/Edge analytics

## Remarkable projects

**5G City** aims to build and deploy a common, multi-tenant, distributed radio & cloud platform for municipalities and infrastructure owners acting as 5G neutral hosts with demonstrations in three different cities (Barcelona, Bristol and Lucca).

**SAT5G** implements solutions to enable the “plug and play” integration of sitcom components into 5G networks.

**5GESSENCE** introduces innovations in softwarization, virtualization and cognitive management to provide a highly flexible and scalable platform capable of supporting new business models.

## Relevant achievements

**Phase 2 of 5GPPP programme**  
SN repeated its success in Phase 2 of 5GPPP by securing 3 new projects: 5GCITY, SAT5G and 5GESSENCE.

Successful completion of 3 5GPPP (Phase 1) projects: CHARISMA, SONATA and SESAME. Development of a Control, Management & Orchestration platform for multi-tenant 5G networks, security mechanisms for micro-services based SDN/NFV platforms, and edge service orchestration in cloud enabled small cell 5G networks. SN also completed its work in H2020 CYCLONE, dealing with management of federated multi-cloud applications.

**Enhanced version of TeNOR**  
SN delivered an optimized version of TeNOR (an ETSI compliant NFV Orchestration platform) that enables rapid service provisioning in multi-tenant 5G networks.

### Research publications

4 journals, 10 conference papers, 4 book chapters, 3 white papers, 1 workshop and 1 magazine.

# 5G/IoT: Mobile Wireless Internet

The Mobile Wireless Internet Area (MWI) expertise spans from the physical design of embedded systems, application of wireless technologies to indoor location, driver level optimizations of broadband wireless technologies based on IEEE 802.11, software defined networking, and vehicular communications. Among the main market sectors impacted by the technology of the Mobile Wireless Internet Area we find: Smart Cities, Smart Building, Smart factories and Mobile networks.

MWI has developed more than 50 projects in wireless communications since and its current interests lie at the crossroads between 5G and IoT, and their main areas of expertise include:

- 1) Wireless technologies for constrained devices, e.g. WSNs and LPWANs.
- 2) Application of wireless technologies to indoor positioning.
- 3) High capacity wireless networks based on IEEE 802.11 and 3GPP.
- 4) V2X communications.

## Main partners



Innovations  
for high  
performance  
microelectronics



**simon**



## Research challenges

### Internet of Things (IoT)

The IoT research line integrates internet capabilities into devices constrained in terms of energy, compute, storage, and communications to provide connectivity for the next billion devices.

#### Technologies

Radio wake-up Systems  
6LowPAN, CoAP, ZigBee, Z-Wave, BLE, RFID, Ultra Wide Band (UWB), BT mesh  
LP-WAN (LoRa, NB-IoT, SIGFOX, NB-IoT)  
Optical Camera Communications, Visible Light Positioning

#### Applications

Smart Cities (smart lighting, smart mobility, smart energy)  
Industry 4.0 (logistics, positioning)  
Automation and domotics  
Mobile Payment systems

### Software Defined Wireless Networks (SDWN)

The goal of this research line is to design algorithms and protocols that lay the foundation of 5G networks, allowing to provide the wireless capacity required for cope with the forecasted increase of demand on mobile connectivity. The group focuses on experimental improvements of systems based on IEEE 802.11 radios and SDN technology.

#### Technologies

IEEE 802.11 technologies (Sub6 and mm-wave)  
LTE (based on OpenAirInterface)  
SDN (openvswitch, OpenDayLight, NETCONF)  
Linuxwireless stack  
Bare Metal Wi-Fi

#### Applications

Wireless backhauling supporting e.g. Small Cells, surveillance  
Neutral Small Cell operators  
High density venues (e.g. stadium, concert)  
Smart City Wi-Fi

### Vehicular communications

The V2X line designs algorithms and applications enabling the future connected and autonomous cars. Expertise in wireless technologies powering V2X, namely 802.11p and C-V2X, combined with practical knowledge of the facilities offered by the ETSI-G5 stack.

#### Technologies

IEEE 802.11p  
LTE Release 14 C-V2X  
ETSI-G5  
Cohda MK5  
Outdoor localisation with lane precision  
OMNET/SUMO simulators

#### Applications

Safety services including position awareness, and interaction with traffic lights. Smart road infrastructure to support vulnerable road users (pedestrians, bikes)

## Remarkable projects

**5G-XHAUL.** H2020 project defining the future transport networks for 5G. Its vision is a converged transport architecture, composed of wireless and optical technologies, able to support joint backhaul and fronthaul services. MWI demonstrated its SDN technology to jointly control Sub6 and mm-wave wireless backhaul radios in an experimental testbed in Volos, Greece.

**VLP-SEAT.** Demonstration of high precision indoor location technology based on Visible Light Positioning. Project sponsored by SEAT in a factory environment to find solutions for real-time tracking of AGVs.

**SENSEFIELDS-OTA.** Development of novel Over-The-Air (OTA) upgrade and maintenance system for Sensefields, manufacturer of smart mobility sensors. The system allows for autonomous upgrades, preventing disruption of service operations.

## Relevant achievements

### Home automation technologies.

MWI was selected by SIMON to develop all the communications stack, including Z-Wave certification, of the novel SIMON 100 product line.

**H2020 5GPPP.** Consolidation in the H2020 5GPPP ecosystem by securing participation in 3 new Phase 2 projects: 5G-PICTURE, 5G-ESSENCE) and 5GCITY. Work completed for H2020 SSESAME project, dealing with virtualization of Small Cells in 5G, with very positive feedback by the EC.

### UWB and RFID based solutions.

Development of novel technology that combines UWB and passive RFID to track assets in Industry 4.0 environments. It was demonstrated at the IoT Solutions World Congress in Barcelona.

# 5G/IoT: Recursive InterNetwork Architecture (RINA)

RINA is an effort to simplify the network protocol stack, minimizing the network complexity and solving the fundamental issues of the “TCP/IP protocol suite”.

The RINA Area is exploring the potential of RINA-based technologies, documenting the benefits of its adoption in different networking environments: data-centre (DC), multi-access service providers, core networks,

overlays. i2CAT is also educating potential stakeholders and engaging key players in RINA research and development activities to mature the technology and its associated specifications so that RINA can be deployed in production networks.

## Main partners



## Research challenges

### RINA implementations

To develop programmable RINA implementations for experimentation and realisation of Proofs of Concept. Such implementations not only allow the practical verification of RINA's theoretical benefits, but can also be the basis of future RINA-based products.

#### Technologies

Linux, C, C++, KVM, WiFi, Ethernet

#### Applications

RINA overlays, RINA in the core, RINA for Distributed Mobility Management and Open Multi-Access Edge Computing, RINA as a transport solutions for IP and Ethernet flows and VPNs

### RINA specifications and network design

To maintain and evolve core RINA specifications, maturing them to the level of enabling interoperable, production-grade implementations.

To design policies for a variety of network environments, to proof the flexibility of RINA and demonstrate that its architectural principles can be applied to any type of network.

#### Technologies

IRATI RINA implementations

#### Applications

Data Centres, service provider nets, app-specific overlays

## Remarkable projects

### H2020 ARCFIRE

ARCFIRE will experimentally demonstrate RINA's key benefits integrating current EC investment in advanced networks (IRATI, PRISTINE) and FIRE+ testbeds focusing on 5 goals:

- 1) Facilitate comparison of converged operator networks using RINA to operator's current network designs.
- 2) Produce a robust RINA software suite ready for Europe to engage in large-scale deployments and long-living experiments.
- 3) Provide relevant experimental evidence of RINA benefits to network operators, their equipment vendors, application developers and end-users.
- 4) Build on the current EU Future Internet community and raise the number of organisations involved in RINA development and deployment.
- 5) Enhance the FIRE+ infrastructure with ready to use RINA software.

## Relevant achievements

**Demonstrations of RINA Proofs of Concepts at public events, using the IRATI open source implementation.** RINA showcased the benefits for slicing, mobility management and renumbering at IEEE NFV SDN and EUCNC 2017, as well as in ETSI ISG NGP meetings. PoCs have been demonstrated to network operators in dedicated workshops and webinars.

**Contributing to standard bodies such as ETSI and the ISO.** i2CAT is an active participant at the ISO SC6 WG7 and at the ETSI ISG NGP, where the RINA specifications and RINA principles (respectively) are an important part of both groups work.

**Publications at IEEE conferences.** i2CAT researchers have published papers to the IEEE WCNC and IEEE SDN NFV conferences, as well as a RINA paper on hierarchical addressing to a Wiley journal.

## Research Areas

# Open Big Data

The Media Internet Area explores new immersive and interactive experiences and develops the systems that enable the Internet distribution and consumption of such experiences. Its research activities bring forward the newest formats and experiences, focusing on how to capture, produce, distribute and render them. The main research areas are: Distributed and Interactive Systems, Human Computer Interaction, and Immersive Media Formats.

The main R&I line of the area is data virtualization, a concept that allows tailored access to shared Big Data environments where several users access to the same data sources

but that they are so large it is difficult to process them using traditional database and software techniques and moreover, they cannot be moved or replicated.

## Main partners



CITY OF BTP-F&E IT COMPANY

## Research challenges

### Data slicing

- To develop the data slicing concept for a multi-tenant Big Data architecture for central data repositories.
- To study and adapt current Big Data technologies to permit tailored and isolated access to shared data resources through data slicing.
- To use machine learning techniques to help the user define schemas (data slices) on top of shared big data lakes.
- To mature the data slicing as a scalable option that can replace traditional ETL processes.

### Technologies

SPARK, HADOOP, ElasticSearch

### Applications

Heterogeneous data integration, ETL processes, central open data repository, tailored and secure access to shared data resources, data preparation.

## Remarkable projects

**H2020 SHIELD** is an Innovation Action H2020 project that introduces an Intrusion Detection and Protection system (IDPS) that replaces specific hardware for generic software to perform monitoring and reacting functions in a network. To this end, SHIELD mixes three trending sectors: virtual network functions, hardware attestation, and a central decision engine. This project is concerned about the ETL problem in a Big Data environment.

**H2020 MUV** - Mobility Urban Values levers behaviour changes in local communities in an entirely novel approach to reducing urban traffic. It raises citizen awareness on the quality of the urban environment to promote a shift towards more sustainable and healthy mobility choices.

## Relevant achievements

### Creation of the first prototype of “Symphony: A secure data sharing platform”

Through this platform, data providers can share their datasets while developers, researchers and entrepreneurs can access easily and in a centralized manner an integrated slice of data tailored to their needs, and to the tools plus infrastructure needed to work with it.

### SHIELD project

The Open Big Data Research Area led successfully the developments of the project holding also the technical leadership of the platform.

### Consecution of MUV H2020 project

MUV is a collaboration with the Living Labs unit and its achievement is a step forward to the adoption of the evidence based decision making to solve social and environmental challenges.

### Collaboration with the Bioinformatics Barcelona

Together with the Autonomous University of Barcelona (UAB) and the Hospital Sant Joan de Déu, the area is collaborating in the definition, creation, and development of a master in Big Data and Life Sciences. This is the first master in the sector that uses real data from a Hospital.

# Media Internet

The Media Internet Area explores new immersive and interactive experiences and develops the systems that enable the Internet distribution and consumption of such experiences. Its research activities bring forward the newest formats and experiences, focusing on how to capture, produce, distribute and render them. The main research areas are: Distributed and Interactive Systems, Human Computer Interaction, and Immersive Media Formats.

## Distributed and Interactive Systems (DIS)

Technological aspects and solutions to next-generation distributed systems over heterogeneous environments, while guaranteeing high-performance, scalability, ubiquity, adaptability and synchronization, among other relevant challenges.

## Immersive and Interactive Media (IIM)

Novel capturing, production, encoding, rendering Technologies and Formats (360° video, point cloud, 3D, object- & scene-based audio, light fields...).

## Human & Computer Interaction (HCI)

Analysis of how humans interact with the technology and contents and among other users using the technology in order to maximize accessibility, social integration, comfortability, comprehension, usability, among relevant aspects. Likewise, MIA is also interested in exploring what evaluation metrics and methodologies are best suited to determine the benefits in the previous research fields.

## Main partners



## Research challenges

### Networked Media

The main goal of this research line is to study and develop efficient software systems to manipulate digital media over the network by using and aggregating industry standards. The Media Internet Area implements core services which are easy to orchestrate and appropriate for a cloud-based virtualized environment, where scalability and orchestration is a major requirement.

#### Technologies

Network Protocols  
Adaptive Delivery  
Hybrid Broadcast Broadband  
Content Delivery Networks  
Clock Synchronization  
Advanced Encoding  
Metadata Models  
Cloud Computing  
Virtualization & SDN

#### Applications

Connected TV Services  
Ultra-HD media delivery  
Low-latency video communication  
Cloud operations (transcoding, mixing)  
Content Delivery Networks

### Immersive & Interactive Media

This research line works towards the creation of new content formats and experiences for mobile devices and head mounted displays. The objective is to offer new and richer content experiences, immersive and interactive, and the tools to create them.

#### Technologies

Omnidirectional Media  
Spatial / Depth-based Media  
Object-based Media  
Eye Tracking  
Lightfields  
Field of View (FoV)-based delivery  
Virtual Reality  
Augmented Reality  
Mixed Reality

#### Applications

Novel content formats  
Multiplatform content (HMD, TV, tablet, mobile)  
Cultural heritage  
E-learning

## Remarkable projects

**ImmersiaTV** H2020, coordinated by MIA). This project targets at overcoming the existing challenges to enable coherent and customizable immersive multi-screen TV experiences.

**ImAc**, H2020, coordinated by MIA). This project explores how accessibility services (including subtitling, sign language interpreting and audio description) can be efficiently integrated with immersive media.

**VR-Together**, H2020, coordinated by MIA). The goal of this project is to offer ground-breaking truly social VR experiences between users located in remote domestic scenarios, based on photorealistic immersive content, and in a cost-effective manner.

## Relevant achievements

Highlighted projects that MIA has coordinated, executed, presented research contributions/outputs and been granted:

**H2020 ICT-19-2015. ImmersiaTV project.** The technological solutions devised in its first year have been refined, and pilot 2 provided support for: live events; dynamic switching between 360° cameras, and inclusion of interactive and contextual contents presented as overlays (“portals”) to the 360° videos.

**Demonstration of ImmersiaTV pilots** using the software developed by i2CAT. They have been showcased in industrial and research events like IBC 2017, TNC 2017, NEM SUMMIT 2017 and WORLD VR FORUM 2017.

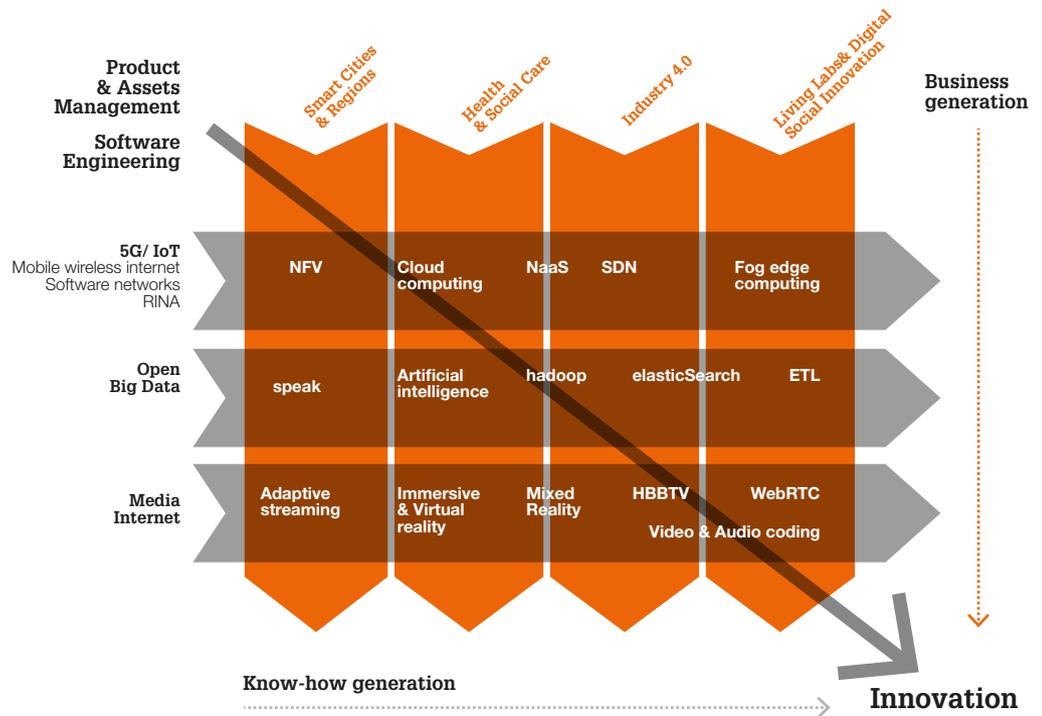
**Scientific publications** in a relevant IEEE e-Letter (IEEE COMSOC MMTC Communications - Frontiers) and ACM conferences (TVX 17 and AltMM 17).

**The Media team has solidified its positioning as a key European partner**, in the Media research and innovation European landscape, and so i2CAT’s Media R&D positioning, being granted with 2 new H2020 projects as Coordinator, a fact that proves the vanguard role of i2CAT in this field.

# Innovation Business Units

Innovation to drive ICT research towards market and society needs. The Innovation Business Units (IBUs) aim is to boost the collaborations with the innovation ecosystem and at increasing the social and business impact of the research capabilities and the knowledge generated by i2CAT.

Focused on verticals, the Innovation Business Units have a deep knowledge of the market (companies, needs, relevant players, users, etc.) in order to figure out innovative solutions based on the expertise and technologies of i2CAT research areas.



The i2CAT Innovation Business Units are focused on the following fields:

## Smart Cities & Regions

Smart City Platforms, IoT, Big Data  
Mobility: Smart Infrastructures for Connected Cars  
Sustainability: Energy Efficiency  
Intelligent Transport Systems  
Public Services: Interoperability, Reliability, Resiliency

## Industry 4.0

Industry digitization: industrial Internet; logistics 4.0; Virtual Reality  
Smart Manufacturing: Artificial Intelligence, Advanced Robotics  
Industrial Platforms: IoT, Cloud services; Big Data, HPC

## Health & Social Care

Patient Empowerment  
Social Inclusion  
Active Ageing  
Future Health Systems

## Living Labs & Digital social innovation

Social Innovation  
Open Innovation  
Systemic Innovation  
Citizen Laboratories

The main activities of the Innovation Business Units, always in collaboration with the research, software engineering and support areas, are the following:



### Co-development

Fostering strategic alliances to create innovative market-oriented technologies and solutions addressed to the different verticals



### Technology roll-out and validation

Coordinating the design and deployment of trials for technological and functional validation purposes with local partners, public administrations and users.



### Technology and knowledge transfer

Setting up IPR exploitation agreements, creating mixed R&D teams with companies, and boosting and supporting the creation of start-ups.

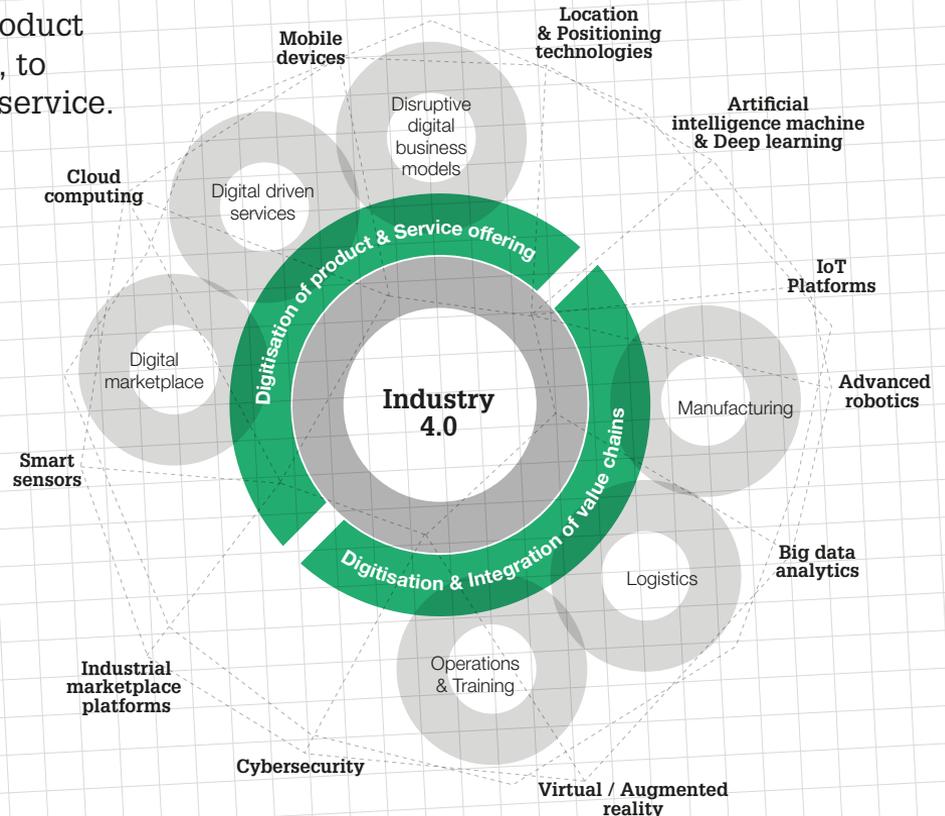
# Industry 4.0

Industry 4.0 is the digital transformation across the entire industrial ecosystem, from product development and purchasing, to manufacturing, logistics and service.

i2CAT's Industry 4.0 Innovation Business Unit aims at collaborating with companies in:

- The development and deployment of digital technologies that allow the collection, integration and analysis of all data about operation processes.
- The digitisation of products, by adding smart sensors and data analytics tools to generate data on product use and refine products to meet the increasing needs of end-customers.
- The expansion of the companies offering by providing disruptive digital solutions like data-driven services and integrated platform solutions.

i2CAT is focused on the following Industry 4.0 framework:



## Remarkable projects

**Continental:** i2CAT has developed a technological solution that allows to automatically position moulds in an efficient way and with a minimal cost. The proposed solution is based on metal-RFID and UWB (Ultra Wide Band) technology.

**Continental** is a Tier 1 global supplier for most automotive OEM's. They have a production facility in Rubí (Barcelona) dedicated to plastic parts made by injection moulding. The identification and localization of injection moulds in the manufacturing plant is a critical part of production planning and optimization.

**Boost 4.0** is the biggest European initiative of Big Data applied to Industry 4.0. With 50 partners and a 20M€ budget, Boost 4.0 will lead the construction of the European

Industrial Data Space that will improve the competitiveness of Industry 4.0 and will foster the Big Data technology introduction in the factories. This will provide the industrial sector with the necessary tools to obtain the maximum benefit of Big Data. Ten pilots will be deployed in several factories, one of them will be developed with the collaboration of i2CAT in Gestamp Spain, the multinational company automotive.

**ScaleUp:** It is a market-driven action which aims at identifying a portfolio of a minimum 200 high potential start-ups through the 4 connected hubs and to help them scale-up and to become leaders in the emerging Internet of Things (IoT) applications markets.

## More relevant initiatives

**DIH:** i2CAT has participated in the Digital Innovation Hubs (DIH) Working Groups in Europe (DG Connect and S3Platform) and has contributed to identify and propose the Catalan strategy for DIH-CAT development.

**Stamping 4.0:** The main objective of the project is to elaborate a White Book of the Fabric4.0 for the stamping industry, covering the entire productive and logistic process, from the receipt of raw material to the distribution to the client. The project contemplates the latest technologies that mark the current trends of digital transformation and provides a vision of the state of the art in the different technological areas contemplated.

**Industrial Platform 4.0:** During 2017 i2CAT developed a cloud Platform providing a unique marketplace of Industry 4.0 services amongst Catalan companies, where digital services can be listed and consumed within the Platform. The project is a part of the RIS3CAT Strategy and the Catalan Agreement for the Industry.

**Industrial Ring:** Ecosystem of engineering and industrial companies, technology providers, associations, research centres, universities and the regional government with the objective of identifying, developing and promoting best practices in Industry4.0.

### Main partners



# Smart Cities & Regions

Cities are responsible for most of the GHG emissions globally and are also the main power consumers. Governments, as well as citizens, must commit to an efficient and responsible use of resources to guarantee a high quality of life for citizens as well as a sustainable future for the planet.



With the help of ICT resources (IoT solutions, Big Data, Edge Computing, etc.) Smart cities and regions transform public and social services, improving the interaction with citizens.

From the Smart Cities & Regions Unit we help local and regional governments to define and implement Smart strategies based on i2CAT's know-how in order to achieve their objectives in a sustainable and efficient manner.

## Remarkable projects

### IoT Catalan Alliance

IoT Catalan Alliance is an initiative of the SmartCAT strategy of the Generalitat de Catalunya. It brings all the players in the IoT Catalan ecosystem together to raise awareness of the potential we have as a country and to foster collaboration and new projects within this area.

In 2017, the main goal of the initiative has been to promote the adoption of IoT solutions in the fields of Logistics and Health. To do that, we have worked very closely with the main innovative stakeholders in these fields through workshops and participation in conferences. The community has experienced an exponential growth of 40% during 2017, reaching 85 members.

## More relevant initiatives

### SmartLAB

SmartLAB is an initiative of the SmartCAT strategy of the Generalitat de Catalunya that launches pilot tests of innovative solutions to solve technological challenges identified by Catalan municipalities. In 2017, 5 cities have implemented smart solutions and 4 more are currently underway.

### SmartCAT Challenge

SmartCAT Challenge is an initiative of the SmartCAT strategy of the Generalitat de Catalunya that promotes entrepreneurship by providing solutions to challenges presented by cities or the non-profit sector to improve the quality of life of citizens. In 2017, SmartCAT Challenge has received 31 solutions, incubated 27 projects and awarded 6 prizes for best technological solution in the fields of urban mobility and social inclusion.

### LoRa BCN Project

The LoRa BCN Project is a feasibility study to deploy and implement a LoRa network in Barcelona in order to improve the city's urban services management. Currently, there are 2 urban services projects underway.

### Smart Polígons

Smart Polígons is a feasibility study that aims at improving security, mobility and the management of industrial areas through broadband connectivity. Currently, there are 3 pilot projects under definition.

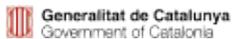
### Smart Region Platform

The Smart Region Platform defines the technological architecture and services of the Smart Region Platform for the Catalan Government in collaboration with the Diputació de Barcelona and some of the more advanced and smart Catalan municipalities.

### V2x

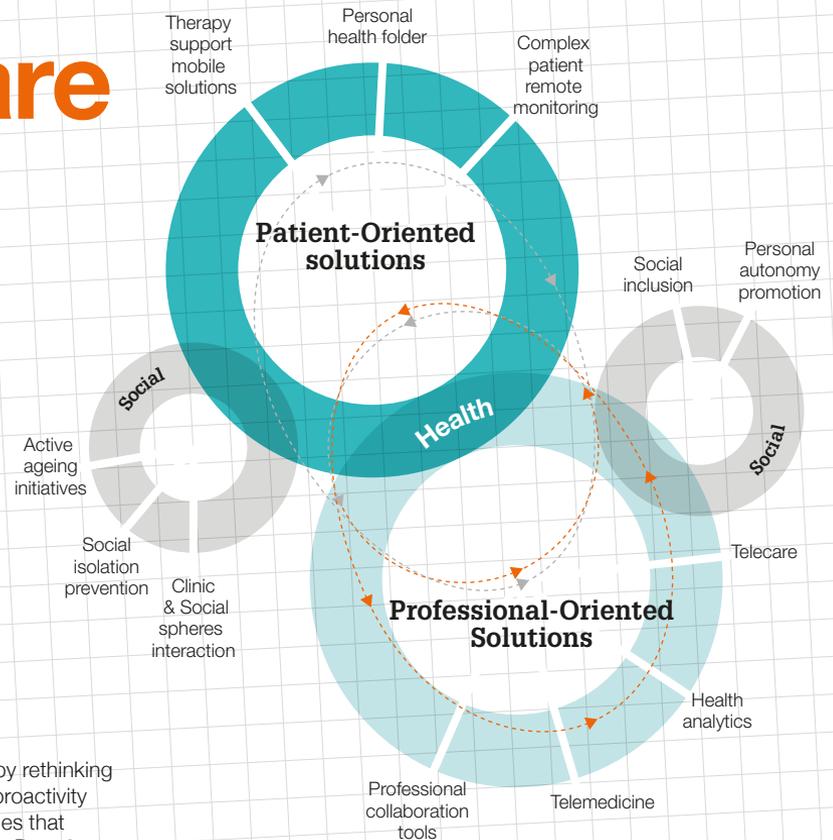
Collaboration with different stakeholders to deploy new services using V2X technologies.

## Main partners



# Health & Social Care

Internet is helping users to play a more active role in their own health and social environment. At i2CAT, we work not only to provide technology to the professional side of the health and social care fields, but also to empower the citizen by intensifying the use of technology on their own behalf.



The Health & Social Care Unit focuses on social and health care needs, supporting new assistance models thanks to ICT.

We help citizens by creating sustainable communication channels with professionals, and

assist professionals by rethinking assistance towards proactivity through the capabilities that technology offers (Big Data & Analytics, Artificial Intelligence & Machine Learning, Blockchain, Fog Computing & Internet of Things and Event Driven Architectures).

## Remarkable projects

### Acadom

Acadom ensures the success of speech rehabilitation therapies at the patient's home through telemedicine. Intelligent systems suggest therapy steps and adapt to the patient's evolution through voice recognition systems.

### HL4.0

This project aims at identifying and collecting all healthcare data generated both inside and outside of the hospital, profiting from technologies like Big Data and analytic systems to establish new ways of providing services. It involves clinical data, genomic information, biomedical images and other hospital systems or information generated by patients themselves in online communities.

## More relevant initiatives

### Vincles II

A social innovation project in collaboration with Barcelona City Council, designed to strengthen the social ties of elderly people who feel isolated and to improve their well-being with new technologies. This is achieved through personalized and connected trust circles, consisting of a group of individuals who come together to provide intentional support for someone who is facing a challenging personal situation.

### Remote Health Services Platform

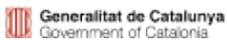
Remote Health Services platform is a reliable and accessible health care system developed to provide remote access to professional health services from any place and at any time. This project is a collaboration between everis and the i2CAT Foundation.

### Blockchain & Healthcare

In collaboration with hospitals and healthcare centers, i2CAT is developing a pilot project that empowers citizens to take control of their medical history and encourages medical centers to adopt the system in order to share anonymized data of their patients for their benefit. The services and products are developed through Cloud, IoT devices and SDN networks with component architectures (Control Plane-Data Plane).

In 2017, i2CAT has also engaged in AI Predictive Models research for healthcare. Artificial Intelligence incorporates predictive methodologies through regression techniques. These models use statistical technologies to find massive amounts of data, analyze it and predict patient's results and outcomes.

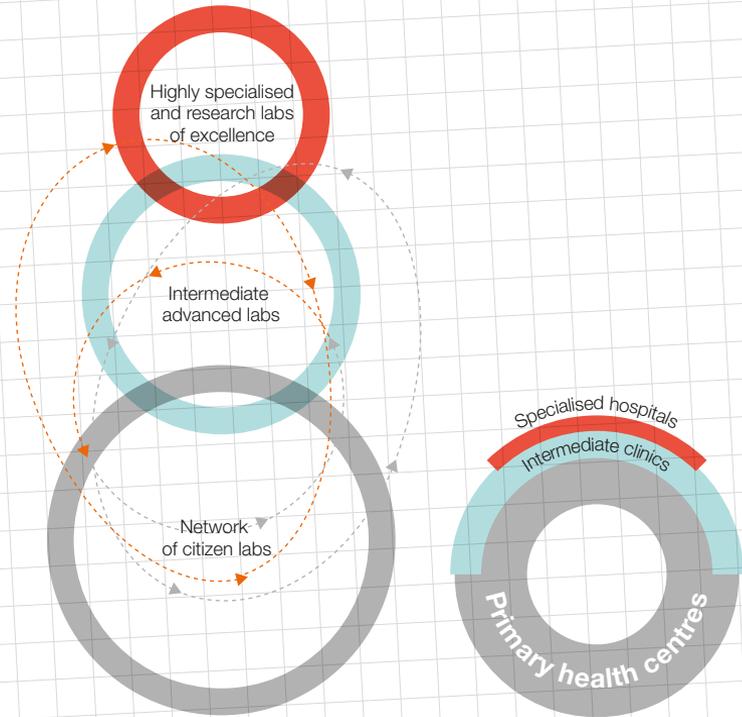
## Main partners



# Living Labs & Digital Social Innovation

Living Labs-DSI is in charge of i2CAT's definition of the Quadruple Helix model and strategy, promoting the Living Lab approach across the R&D areas of the organization, as well as designing, testing and evaluating new living labs in Catalonia.

The area is generating its own research projects around the vision of co-laboratories as universal innovation ecosystems, based in networks of open research and open innovation labs.



**i2CAT's Collaboratories**  
A universal innovation system at different levels inspired by the European universal healthcare systems



**European universal healthcare systems**  
Covering 100% of population

## Remarkable projects

### Catlabs Network

The Catlabs program has created a state-of-the-art open labs movement in Catalonia, gathering the interest of more than 70 institutions around the territory. The Catlabs network congregates the main open labs in the region (living labs, fab labs, biblio labs, innovation labs, etc.) with the goal of promoting digital social innovation. This initiative complements the different programs of RIS3CAT.

In 2017, the Catlabs Network achieved official recognition for the Fourth Helix model of innovation in RIS3CAT, testing new co-creation methodologies like the Aalto Social Innovation Camp, receiving the interest of leading EnoLL institutions like the Laurea University of Helsinki and introducing the co-laboratory approach in ENoLL's Manifest for Innovation, among other milestones.

## More relevant initiatives

### MUV (Mobility Urban Values).

MUV is an H2020 project dedicated to building testbeds that will change the mobility model in 6 European cities (Barcelona, Helsinki, Amsterdam, Fundão, Palermo and Ghent) through a mobile app and a network of air monitoring stations, bringing citizens, local authorities and commercial shops together for more sustainable cities.

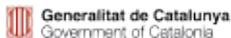
### LID (Laboratori d'Innovació Democràtica)

LID is a citizen-driven lab for democratic innovation that introduces the living lab approach into citizen participation. It is a collaboration project between i2CAT and Barcelona City Council's Participation Area.

### Open4Citizens

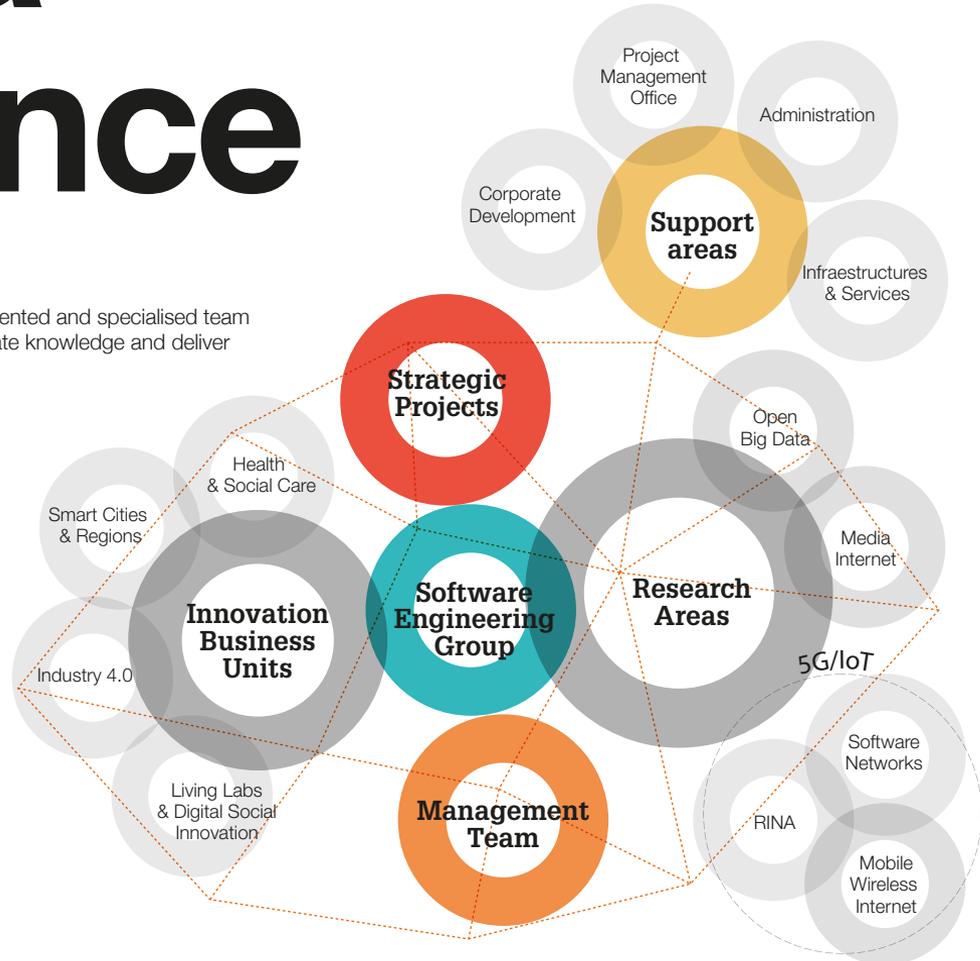
This CAPS-SI initiative, funded by the EC, has implemented a model of citizen innovation lab focused on delivering open data based innovations that tackle societal needs. In 2017, the pilot has carried out two citizen hackathons, one in the Moroccan city of Casablanca together with the Smart City Expo, and a second in Barcelona in partnership with the Catalan Government's Department of Transparency.

### Main partners



# At a Glance

i2CAT's employees compose a talented and specialised team that cooperates in order to generate knowledge and deliver innovative solutions.



# Mision and Vision

i2CAT Foundation is a non-profit research and innovation centre which promotes mission oriented R+D+i activities on advanced Internet architectures, Applications and services. The centre stands for a new open innovation framework, fostering the collaboration between companies, public administration, the academic environment and end-users.

Internet has produced a superabundance of data, information and networks. The next step is to advance in the research and innovation of an Internet based on intelligent systems and smart technologies. The Internet of knowledge and creativity is the new challenge to face. The i2CAT vision for the next 10 years is a networked smart world, a co-laboratory based in a new generation of networked intelligent technologies and systems, a co-creating platform between machines, people and the environment for a sustainable and smart future.

## Core values

### Excellence:

talent, knowledge, experience.

### Inspiration:

motivation, creativity, challenges.

### Commitment:

integrity, trust, flexibility.

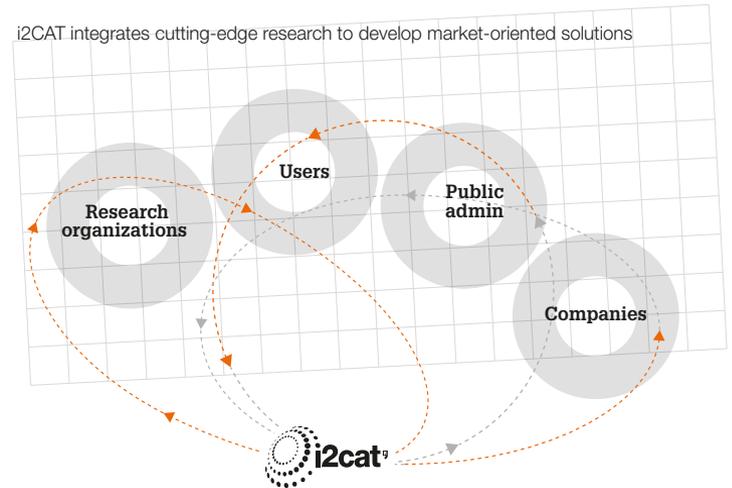
### Collaboration:

team, open innovatin, agreements.

# Value chain

i2CAT's activities span the following three areas:

- **Research**, both International and local level: i2CAT plays a key role in the EU Framework programme for Research & Innvovation.
- **Strategic projects**: Leading local initiatives to deploy digital strategies and policies of the Government of Catalonia.
- **Technology Transfer**: Fostering R&D collaboration with companies to develop innovative market-oriented solutions.



### Cooperation & Co-creation to foster business innovation

Applied research → R+d+i projects → Proof of concept → Pre-Commercial solutions → Technology transfer → Commercialization

## At a Glance

# Board of Trustees

As of the 30th of April 2018, the members representatives were:

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Vice-President, Rector of the Universitat Politècnica de Catalunya (UPC)

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CEO at ACCIÓ

**Mr. Carles Gómara Martínez,**

Innovation Manager at ACCIÓ

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**Mr. Francesc Subirada Curcó,**

General Manager of Research, Government of Catalonia

**Mr. Víctor Vera Vinardell,**

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**Mr. Joan Bennassar,**

Technical Manager at Media Pro

**Mr. Miquel Oliver Riera,**

Coordinator of the ICT Department at Universitat Pompeu Fabra

**Mr. Lluís Comellas i Riera,**

Vice-Chancellor for Research at Universitat Ramon Llull

**Mr. Diego Matas Morillo,**

General Manager at Interoute Iberia

**Ms. Francesca Bria,**

Chief Technology and Digital Innovation Officer at Barcelona City Council

**Mr. David Noguer i Bau,**

Regional Manager at Juniper Networks

**Mr. Mateo Valero,**

Director at Barcelona Supercomputing Center

**Mr. Felip Fenollosa,**

General Manager at Fundació CIM

**Mr. Ernest Quingles,**

Vice-President Business Sales at Epson

**Mr. Xavier Gatius,**

Director at CESICAT, Centre de la Seguretat de la Informació de Catalunya

## At a Glance

# Executive Committee

As of the 30th of April 2018, the members representatives were:

**Mr. Lluís Rovira i Pato,**  
President, Director at CERCA Institution

**Mr. Carles Salvadó Usach,**  
Vice-President, Head of Telecommunications Service at Secretary of Telecommunications, Cybersecurity and Digital Society, Government of Catalonia

**Mrs. Montserrat Cereza Carril,**  
Territorial Manager of Institutional Relations at Orange

**Mr. Sergi Marcen López,**  
Chief Innovation and Strategy Officer at Centre de Telecomunicacions i Tecnologies de la Informació (CTITI)

**Mrs. Ana Simón Villacampa,**  
Deputy Director of Technological Cooperation at ACCIÓ

**Mr. Lluís Comellas i Riera,**  
Vice.Chancellor for Research at Universitat Ramon Llull

**Mr. Miquel Oliver,**  
Coordinator of the ICT Department at Universitat Pompeu Fabra

**Mr. Xavier Ferrandiz,**  
Engineering and Infrastructures Manager of CCMA

**Mr. Joan Bennassar,**  
Technical Manager at Media Pro

**Mr. Javier Marcos Álvarez,**  
Technological Innovation Unit Manager at Cellnex Telecom

**Mr. Jordi Martínez,**  
Innovation Director at TICSalut Foundation

**Marc Llebaria Roig,**  
Business Development Manager at Vodafone

**Mr. Xavier Buxeda Lladó,**  
General Manager at Fujitsu Technology Solutions in Catalonia

**Mr. Carles Batalla Teruel,**  
Customer Solutions Architect, at Cisco Systems

**Mr. Diego Matas Morillo,**  
General Manager at Interoute Iberia, S.A.U

**Mr. Francisco Rodríguez,**  
Managing Director at IMI (Barcelona City Council)

**Mr. David Noguer i Bau,**  
Regional Director at Juniper Networks

**Mr. Jordi Berenguer Sau,**  
Vice-Rector for Knowledge Transfer at Universitat Politècnica de Catalunya (UPC)

**Mr. Josep Maria Martorell i Rodon,**  
Deputy Director at Barcelona Supercomputing Center

**Mr. Felip Fenollosa,**  
Director at Fundació CIM

**Daniel Marco,**  
Director of SmartCat Strategy at Government of Catalonia

**Tomàs Roy Català,**  
Chief Strategy Officer at CESICAT, Centre de la Seguretat de la Informació de Catalunya

**Maria Zaragoza de Pedro,**  
Marketing Director at Epson

At a glance

# Staff\*

## Management Team



**Artur Serra**  
Director



**Artur Serra**  
Deputy director



**Joan Manel Martín**  
Managing director



**Sergi Figuerola**  
Chief technology & Innovation officer



**Daniel Camps**  
5G/IoT; MWI



**August Betzler**  
5G/IoT; MWI



**Laura Herrera**  
5G/IoT; MWI



**Marisa Catalán**  
5G/IoT; MWI



**Bruno Cordero**  
5G/IoT; MWI

## Research areas



**Matteo Grandi**  
5G/IoT; MWI



**Pol Delgado**  
5G/IoT; MWI



**Miguel Catalan**  
5G/IoT; MWI



**Marc Combalía**  
5G/IoT; MWI



**Joan Josep Aleixendri**  
5G/IoT; MWI



**Shuaib Siddiqui**  
5G/IoT; Software Networks



**Hamzeh Khalili**  
5G/IoT; Software Networks



**Javier Fernández**  
5G/IoT; Software Networks



**Miquel Puig**  
5G/IoT; Software Networks



**Pouriya Khodashenas**  
5G/IoT; Software Networks



**Apostolos Papageorgiou**  
5G/IoT; Software Networks



**Carolina Fernández**  
5G/IoT; Software Networks



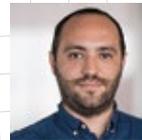
**Daniel Guija**  
5G/IoT; Software Networks



**Eduard Grasa**  
5G/IoT; RINA



**Miquel Tarzán**  
5G/IoT; RINA



**Bernat Gaston**  
Open Big Data



**Marc Roig**  
Open Big Data



**Sergi Fernández**  
Media Internet



**David Gómez**  
Media Internet



**Einar Meyerson**  
Media Internet



**Ibai Jurado**  
Media Internet



**Isaac Fraile**  
Media Internet



**Juan Antonio Núñez**  
Media Internet



**Themistoklis Karavellas**  
Media Internet



**Alexandre Via**  
Media Internet



**Ignacio Reimat**  
Media Internet



**Mario Alberto Montagut**  
Media Internet

## Support Areas



**Flaminio Minerva**  
PMO



**Jan Vara**  
PMO



**Jose Miguel Sanjuan**  
PMO



**Mónica Fernández**  
PMO



**Vanessa Llobet**  
PMO



**Violeta Morquecho**  
PMO



**Rocío Segura**  
Administration  
Finance & Accounting



**Sonia Beltrán**  
Administration  
Finance & Accounting



**Roger Onnen**  
Human Resources

## Development



**Susana Otero**  
Corporate  
Development



**Miriam Castillo**  
Corporate  
Development



**Laia Pérez**  
Corporate  
Development



**Gregori Martínez**  
Software  
Development



**Alfonso Egio**  
Software  
Development



**Belén Pousa**  
Software  
Development



**Enric Almiñana**  
Software  
Development



**Jesús Muñoz**  
Software  
Development



**Julio Carlos Barrera**  
Software  
Development

## Innovation Business Units & Strategic Projects



**Xavier Gallart**  
Software  
Development



**Adrián Roselló**  
Software  
Development



**Josep Pons**  
Software  
Development



**Ricardo González**  
Software  
Development



**Miguel Ángel Pérez**  
Strategic Projects



**Mireia Casanovas**  
Strategic Projects



**Rafael Nualart**  
Strategic Projects



**Eduard Escalona**  
Product & Asset  
Manager



**Rosa Paradell**  
Smart Cities  
& Regions IBU



**Laia Barbarà**  
Smart Cities  
& Regions IBU



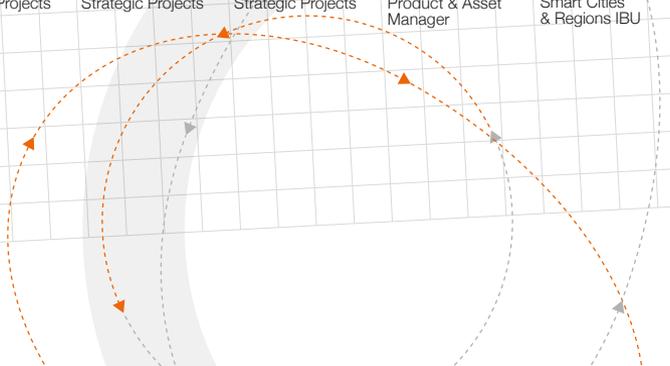
**Sílvia Castellví**  
Industry 4.0 IBU



**Marc Vicente**  
Industry 4.0 IBU



**Andrea Cervera**  
Health & Social Care  
IBU



At a glance

## Official Certifications



## Associations, Standardization Organizations & Platforms



# Exhibitions at Fairs & Congresses during 2017



**OTRI**  
Mineco



\*  
Event organization partner

## 2017 YEAR IN REVIEW



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