THE INTERNET RESEARCH CENTER

FOSTERING YOUR INNOVATION
The 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 collaboratory 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.

i2cat is prepared to become a key international R+D+i partner in the field of Internet Technologies helping companies to foster their innovation and generating a new digital society and economy.

**MISSION**

i2cat is a mission-oriented research center. Our goal is to develop advanced Internet technologies to the benefit of government, companies and citizens of Catalonia and the rest of the world.

In cooperation with these partners, our research and innovation units want to produce technologies and solutions with the aim of converting Catalonia into a leading global smart region in a Smart Europe, with a flourishing added-value economy and an innovative society.

**BOARD OF TRUSTEES**
I2CAT IN FIGURES

**STAFF**
- Associated personnel: 14
- PhD/Engineers/Graduates: 50

**CURRENT PROJECTS**
- National Projects: 25
- European Projects: 27

**R+D+I COOPERATION**
- Industry/Companies: 80
- Universities and Research Groups: 74

**EXECUTED PROJECTS**
+130

**PUBLISHED PAPERS**
+120

**PATENTS**
4

**SPIN-OFFS**
2
WHAT WE DO

i2CAT has a wide experience in multiple national and European R+D+i projects, leading research lines in new fixed & mobile network architectures, wireless sensor networks, and content-based multimedia technologies, with the aim to develop new products, services and applications in the fields of eHealth, Smart Cities & Smart Regions, Advanced Manufacturing and Culture/Creativity.

USER DRIVEN INNOVATION

Internet is breaking down the traditional top-down model of innovation. New distributed co-creation and user-centric processes are the results of an open distributed network like Internet.

In 2006, i2cat was recognized by the European Network of Living Labs as the first “open living lab” in Spain and one of the first in Europe.
Nowadays, i2cat continues to develop new methods for user engagement, based in a combination of traditional applied anthropology techniques and new approaches based in user-centered design and technoanthropology theories.

i2cat manages the Catalonia Lab, the consortium of all the living labs in the region, and it has been instrumental in launching the BCN Laboratori, the user-driven living lab of the city of Barcelona.
RESEARCH AREAS
The next step is to advance in the research of an Internet based on intelligent systems and smart technologies.

The Internet of knowledge and creativity is the new challenge to face.
Internet is increasingly ubiquitous. The wireless technology allows the connection of everything to Internet: buildings, cities, parks, factories and forests, creating an infrastructure for a smart world.

The Ubiquitous Internet Technologies Unit (UITU) is a tight partnership between i2CAT and the UPC Barcelona Tech that has developed more than 30 projects in the area of wireless communications since 2003. Our main areas of expertise are Wireless Sensor Networks (WSN) and high capacity wireless access technologies that are key enablers for the future Internet of Things and future 5G systems.

Our expertise spans from the physical design of embedded systems, to the design of scalable platforms for data collection, and algorithms for radio resource management. Among the main market sectors impacted by UITU’s technology we find: Smart Cities, Smart Building, Smart factories and Mobile networks.
RESEARCH CHALLENGES

WIRELESS SENSOR NETWORKS (WSN)

Topics:
- Internet of Things
- Delay-tolerant networks
- Mesh networks
- Modular sensor platforms

Applications:
- Radio wake-up Systems
- 6LoWPAN, CoAP
- Ultra-low power embedded Systems
- Data collection platforms
- WiFi, BLE, Zigbee, Sigfox
- Energy harvesting systems

SOFTWARE DEFINED WIRELESS NETWORKS (SDWN)

Topics:
- 5G
- LTE
- Wi-Fi
- SmallCells
- SDN

Applications:
- Algorithms and architectures for high capacity wireless access
- Backhaul solutions for dense small cell deployments
- Protocols for Software Defined Wireless Networks

MAIN PARTNERS

[Logos of various companies and institutions]
An Internet of intelligence requires new architectures and services that could interconnect people, objects and nature in more efficient and dynamic ways than the current Internet.

We also need new systems and protocols which can transform information into new knowledge allowing the management of it by creating intelligent environments. Users can be empowered to design, reconfigure and manage the networks based in their own interests and needs.

i2CAT is focused on exploring and defining new ways to manage the Future Internet networks, enabling new functionalities and business models by means of integrating technologies like Cloud, Software Defined Networking (SDN) and Network Function Virtualization, and developing new pioneer Internet architectures based on new paradigms beyond TCP/IP.
RESEARCH CHALLENGES

NETWORK TECHNOLOGIES AND SERVICES

5G
  Network architectures
  Software Defined Networking (SDN)
  Network as a Service (NaaS)
  Network Virtualization
  Network Programming

Network access and transport convergence (PON, LTE, DWDM, CGEth)
Recursive Internet Architectures
OpenDayLight deployment and extensions
OpenContrail, Juniper Lab Testing
Mobility and multihoming network support
Naming and Addressing architectures
Cybersecurity in controlled environments

CLOUD TECHNOLOGIES AND DISTRIBUTED APPLICATIONS

Infrastructure as a Service (IaaS)
  Big Data

Openstack deployments and NaaS extensions
Cloud networking (VDC networks, Hybrid clouds)
Hadoop map/reduce techniques
Cognitive computing
Service chaining/orchestration
Distributed application management platforms

MAIN PARTNERS

[Logos of various partners]
Internet is already the global media network. Most of the current on-net traffic is user-generated entertainment video. The next step will be live interacting video merged with virtual/augmented realities for all kind of activities like gaming, education, performing arts, cultural heritage and industry. The Internet user will become media generator, producer and actor in the connected smart augmented world.

i2cat was pioneer 10 years ago in merging the Internet and media technology. Now i2cat wants to lead this interactive and mobile smart media challenge.
RESEARCH CHALLENGES

NETWORKED MEDIA

Topics:
- Connected TV Services
- Content Delivery Networks

Applications:
- HBBTV
- Live Transcoding DASH/HLS/RTMP
- P2P Distribution
- UHD Networked Media
- Low-latency Video Communication
- Cloud Video Mixing

INTERACTIVE & IMMERSIVE MEDIA

Topics:
- Immersive Video
- Mixed / Augmented Reality
- Collaborative Tools / APP

Applications:
- Virtual Reality
- Localization and Mapping
- Web RTC
- 3D Content Visualization
- Social Networks

MAIN PARTNERS
BUSINESS UNITS
In cooperation with partners and users, our Internet research and innovation want to produce technologies and solutions with the aim of converting Catalonia into a leading global smart region in a Smart Europe, fostering added-value economy and an innovative society.
Cities will become the habitat of the most population in this century. Internet has appeared in the cities mainly through their citizens. The amount of information and communications that happens through Internet in every city is outstanding. But these data are not open and accessible.

An open, ubiquitous and intelligent Internet can facilitate all this information collection, processing and valorization, transforming it in add-value knowledge mostly for the benefit of the citizens.

Intelligent cities will be based in a set of new technologies like open big data, software defined networks, crowdsourcing, augmented reality or wireless sensors networks, organized finally around a city operating system. We understand the city as a software defined territory based in user-controlled and reconfigurable networks, based in the collective intelligence of their citizens.
i2cat is working with the following use cases and applications:

1. **COMMUNITY**
   Design of new business models and ecosystems where value can be created both for the citizen that participates in the creation of data about the city, and for the private or public entities who will exploit this data in order to deliver novel services and applications.

2. **PUBLIC SERVICES**
   Novel technologies to increase the efficiency of the waste management based on low power and low cost sensors that can measure and report the occupancy level of a waste dumpster.

3. **TRANSPORT AND MOBILITY**
   Design of lightweight mechanisms to estimate the flow of traffic in a given area of a city, which can then be used to steer traffic in an optimal way, and low cost mechanisms to estimate the availability of parking spaces in areas of high congestion.

4. **CITYOS**
   Architecture definition of a City Operative System able to aggregate open data coming from the sensors and citizens, and by means of Big Data and prediction techniques, capable to extract actionable knowledge from the generated data to enhance its public services or to provide value added services.

**MAIN PARTNERS**

[Logos of Main Partners]
Internet is helping users to play a more active role in healthcare systems. In a knowledge society, patients are getting more information about their own health conditions.

The future of healthcare systems depends upon the co-creation process between health professionals and users by defining the new smart and networked healthcare system with more responsibility by both sides in his sustainability.

The first step has been the digitalization of the current practices (patient health records, etc.). The next step is the design of personalized health programs, integrating these records and defining new systems of prevention, diagnosis, treatment and cure adapted to the conditions of each person and its environment. A new generation of smart health technologies is needed for empowering users and health professionals.
i2cat is working with the following use cases and applications:

1. **HEALTH CARE**
   - eHealth Portal: B2C platform for medical support and communication between healthcare professionals and patients
   - eDiagnosys: B2B platform for the support and remote diagnosis in cases of medical emergencies in burnt patients

2. **HOME PERSONAL CARE**
   - Global Telerehabilitation System (GTRS): Physical rehabilitation exercises and decision support systems using natural interfaces

3. **PREVENTIVE CARE**
   - Help4mood: Virtual assistance for supporting the treatment of major depression by measuring daily activity and mood
   - mAssistance: Mobile application for assisting and monitoring chronic and dependent patients, and social network for caregivers
   - mMedication: Mobile app for pill remainder using NFC technologies

**APPLICATIONS**

**MAIN PARTNERS**

<table>
<thead>
<tr>
<th>Hospitals:</th>
<th>Companies:</th>
<th>Public organizations:</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Image]</td>
<td>[Image]</td>
<td>[Image]</td>
</tr>
</tbody>
</table>
A world of distributed creativity, open to everyone, is possible. Internet is allowing an explosion of amateur activities in fields like photography, video, music, literature and journalism. Users are also producers. Internet is beyond the world of broadcasters. The democratization of new technologies like augmented and virtual reality will increase this trend.

Playable cities, gamification, smart crowds, all they are emerging fields that will change the traditional models of culture and creation. The new scenario is a smart and creative city, an augmented open public space. Simulation games in cultural heritage places can change the experience of a new generation of young tourists. Barcelona and Catalonia can be transformed in a global living lab of creativity and culture.
i2cat is working with the following use cases and applications:

1 **CONNECT**
   - BCNLab: Connecting Local Communities and Technology providers to promote creativity and innovation.
   - Specifi: Connecting local and international communities to co-create in distributed environments.

2 **ACCESS**
   - TV-Ring: Accessing new content formats and advanced applications for connected TVs through HbbTV and high bandwidth networks.
   - MITSU/NOTTS: Promoting the development of OTT services by improving media transmission and distribution formats.

3 **EXPERIENCE**
   - Empuries+: Experience the old greek and roman cities by an augmented reality walk through the ruins of Empuries.
   - Terrassa+: Discover the industrial past of Terrassa by an augmented reality walk through the emblematic buildings of the city.

4 **CREATE**
   - FI-Content: Providing enablers to SMEs and developers to create applications and services in the areas of social connected TV, smart city services and pervasive games.
   - Creatifi: Promoting the adoption of FIWare and accelerating creative ideas, products, services and companies.

**MAIN PARTNERS**

[Logos of Ajuntament de Barcelona, Institut de Cultura, Generalitat de Catalunya, Departament de Cultura, EPSON]
Fablabs, makers, are bringing 3D printing and other tools to people. Internet is democratizing the digital fabrication even before the network has been introduced on the production lines of the traditional industries.

Now, programs like Cyberphysical Systems or Industrial Internet in the US or Industry 4.0 in Germany are trying to transform factories in smart systems, where high qualified employees can manage them by using augmented reality systems and increase this way dramatically the productivity and the value of the industrial sectors.

i2cat started in 2006 the Industrial Ring, an advanced Internet platform for collaboration between all the actors in the automotive sector in Catalonia. More than 80 companies, research centers and public organizations are setting the ground for this industrial Internet.
i2cat is working with the following use cases and applications:

1. **SMART WORKER**
   - Deployment of virtual reality applications to practice and simulate critical interventions
   - Access to HPC resources to simulate and validate complex designs for new products or processes.

2. **SMART PLANT**
   - Data-acquisition and real-time information processing through a wireless sensor networks infrastructure enabling IP connectivity among all the systems and devices of the production plant
   - Design and analysis of management systems for machine failure prediction.

3. **DISTRIBUTED MANUFACTURING**
   - Management systems to provide flexible manufacturing adapted to demand forecasts in real time
   - Management platform to control additive manufacturing machines to improve collaborative, personalized and distributed production.

**MAIN PARTNERS**

Service providers: [Images]

Industrial manufacturers: [Images]

R+D: [Images]
CONTACT

NEXUS BUILDING
Gran Capità, 2-4,
Nexus I Building
2nd floor, 08034 Barcelona
fundacio@i2cat.net

I2HEALTH SANT PAU
Hospital Sant Pau i
de la Santa Creu
Sant Antoni Maria i Claret, 167
08025 Barcelona

CASTELLDEFELS
Parc Mediterrani de la
Tecnologia (PMT)
Esteve Terrades, 7
C4-Annex Building
08860 Castelldefels

MEMBER OF

ACER
 Associació Catalana d’Entitats de Recerca

CERCA
Centres de Recerca de Catalunya

Connect-EU
Mèdia, mobilitat i interacció

Global Lambda Integrated Facility

european Network of Living Labs

Networked & Electronic Media