Internet of Things

Smart Appliances Workshop
27 May, Brussels

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"The views expressed in this presentation are those of the author and do not necessarily reflect the views of the European Commission"
The Internet of Things: towards a reality in Europe

- European market leaders active on smart sensors, embedded systems, software, network vendors, telecoms and application integrators
- Dynamic Small and Medium-size Enterprises
- Business potential of connected and smart devices has been identified across industries
- Market uptake of wearable devices also contributes to a wider adoption of the IoT
INTERNET OF THINGS

Opportunity is open:

Technology is maturing rapidly and becoming cost-effective.

IoT affects to most application domains important also to our customers and Europe has the needed competences to cover the whole IoT value chain.

(Source: CAF)

Knowledge based systems applications systems and services through:

New digital services (e.g. pervasive sensors and computing)
Better integration of systems (e.g. Open Data, Semantics)
More efficient monitoring (e.g. Complex Event Detection)
More efficient and optimal control even to societal level (e.g. Cloud computing resources)
New ways to analyze information (e.g. Big Data)
$1.9 trillion added to global economy in 2014 (Gartner)

IT spending on smart devices to reach $4 trillion per year (Gartner)

Global spending on IT to grow 3.6% during 2014, to $3.8 trillion (Gartner)

IoT market: > $309 billion in revenue by 2020

2009: 2.5 billion devices with individual Internet IP addresses (servers, PCs, smartphones...); 2014: $10 billion (ABI Research); 2020: 30 billion (Gartner, ABI Research)

50 billion connected devices by 2020 (Cisco); 40 to 80 billion (CNRFID)

Economic impact of the IoT to be $2.7 trillion to $6.2 trillion per year by 2025 (McKinsey)

Cumulative economic impact by 2020 of adding intelligence to all kinds of everyday objects: $14.4 to $19 trillion (Cisco)
Multiple Initiatives

Standards
- ISO, JTC 1
- IEEE
- IETF (e.g. 6LowPan)
- XM2M
- W3C SSN
- ...

Member States
- UK TSB
- Finland
- Germany
- Sweden
- ...

Industry
- Internet of Everything (Cisco)
- Industrial Internet (General Electric)
- Alljoyn alliance (Qualcomm)
- Qeo (Technicolor)
- ARM-Axed (cloud)
- Google-automotive industry,
- ...

→ Risk of Siloes?
<table>
<thead>
<tr>
<th>BUTLER: context awareness</th>
<th>SOCIOTAL: tools for citizen participation,</th>
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<tbody>
<tr>
<td>CALIPSO: IPv6 connectivity, low power stack</td>
<td>RERUM: architectural framework for privacy by design</td>
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<td>OpenIoT: Open Source middleware</td>
<td>ALMANAC: telco integrated service delivery platform</td>
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<td>ELLIOT: experimental platform</td>
<td>COSMOS: application control of IoT resources</td>
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<td>IoT@Work: robustness in manufacturing environments</td>
<td>CityPulse: Semantic resource discovery</td>
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<td>IoT-A: architectural framework</td>
<td>SMARTIE: framework for resource sharing</td>
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<td>iCore: context awareness, cognitive framework</td>
<td>VITAL: virtualisation of IoT resources for easier integration and interop</td>
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<td>IoT.est: service creation and composition</td>
<td>SMART-ACTION (CSA)</td>
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<td>GAMBAS: adaptive middleware</td>
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<td>PROBE-IT: CSA</td>
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Early integrated approach

Future Internet Public Private Partnership

- Platform based, Fi-Ware, including an IoT chapter
- Smart Santander use case (flagship);
- Fi-Ware getting mileage in other smart city scenarios [http://www.mobileeurope.co.uk/Press-Wire/telefonica-to-deploy-fi-ware-in-valencia-smart-city-projec](http://www.mobileeurope.co.uk/Press-Wire/telefonica-to-deploy-fi-ware-in-valencia-smart-city-projec)
- Towards user driven acceptability, phase 3
Towards a holistic approach

IoT from Silicon to Cloud Computing

(sensors, actuators, tags, embedded systems, devices)

“IoT nerves”

IoT connectivity solution

IoT gateway ↔ Communication network

(“IoT Nerve fibers”)

(4G, 5G, access network, Internet)

Application layer + Knowledge layer

Applications and Systems (“IoT Brains”)

(identity, repository, registry, discovery, lookup, resolution)

IoT infrastructure services (“IoT Brains”)

Big data analytics services

Complex Event Detection services

Complex Context Awareness services

Main research challenges:
Massive scalability issues: capacity and management (>70B devices)
Distribution and adaptation of computing due to application needs.
Distribution of information and knowledge (especially resource constraint devices)
Mixed criticality requirements in many applications (performance and energy efficiency)
Cost, privacy, reliability, and trust related issues.

Source: CAF
Towards a multifaceted strategy

• Catalyze the development of IoT ecosystems in Europe;
• Platform based;
• Connect to tangible playgrounds (Smart Cities)
• Solve remaining technological roadblocks
• Promote (open) innovation;
• Foster replicability,
• Piggyback on existing developments and initiatives
• International cooperation
Step 1

• Based on existing WP 2014-15 of H2020
  • Innovation, promotion of Open Disruptive Innovation (ODI) towards stakeholders (bottom up)
  • Platform and ecosystems: ICT 30:
    ➢ Adaptability and dynamic reconfigurability
    ➢ Open to innovation
    ➢ Reference implementation
    ➢ Pilots validations through selected use cases.
Step 2

• Towards deployments and operations
  
  • Stakeholders engagement under Smart City Call
  • Towards replicable large scale pilot systems to
    ➢ Solve tech roadblocks (e.g. security)
    ➢ Validate business models and replicability
    ➢ Foster cross use case scenarios
    ➢ Support open innovation
Step 3

- Supporting policy issues: Standards
  - Technical standards
    - Identification and search of objects, Interfaces between devices and systems
  - Privacy & security standards
    - Privacy by design, Elements of cybersecurity
  - Semantic standards & ontologies
    - Cross application information exchange
  - Cross-industry standards / specifications
    - Process compliance, Reference Architectures
Workshop "Standards for an Internet of Things"

- Co-organized by EC DG Connect and ETSI.
- 3, 4 July 2014 - Sophia (France)
- Requirements and implications of IoT, relations between IoT and M2M, what standards are needed, business models they contribute to enabling, policy issues triggered by “all things connected”.
- Bring together different perspectives (industry from the supply and user sides, public policies, research, SDOs, national initiatives, etc.)


Launch similar exercise to that initiated with the Cloud Computing Strategy
Links to 5G initiative

- From IoT to U-HDTV, ubiquity;
- "Verticals" requirements
- Tactile Internet
- True ubiquitous "ABC" access
- Traffic growth (spectrum) and complexity
- Cost /energy

ITU PDNR "IMT VISION"
International Cooperation

- **Collaboration on**
  - IoT Infrastructure (e.g. Network management)
  - IoT Architectures (e.g. Federation of IoT platforms, interoperability, trust)
  - Large-scale pilots for Smart Home, Smart City

- **Collaboration around**
  - Reciprocal participation in research and innovation programs
  - Identification of policy recommendations of common interest in areas of e.g. innovation, trust, interoperability, standardization

- **Collaboration with (mainly)**
  - China (Smart City umbrella)
  - Japan, Korea: joint R&D
Constituency events


• 19 september, ICT 30 Information event, Brussels, CCAB;

• 2nd Call proposers day, (Florence, 9 and 10 October) will cover ICT30.
In nutshell

• EC is committed to make IoT an economic and social reality in Europe
• Holistic approach;
• Strategy being defined with large set of stakeholders
• Deployment and innovation are core focus of the next phases
• Piggybacking on very rich expertise of multiple EU players and Member States
Useful Links

• IERC – Internet of Things European Research Cluster

• Internet of Things - CONNECT Digital Agenda

• EC Communication Internet of Things — An action plan for Europe

• Robotics - platform EUROP
  http://robotics-platform.eu

• Embedded and Cyber-Physical Systems - CONNECT Digital Agenda

• Embedded and Cyber-Physical Systems - JTI ARTEMIS
  www.artemis-ju.eu

• Micro-systems - platform EPOSS
  www.smart-systems-integration.org
Thank You