Internet of Things

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PURPOSE: to present an action plan for Europe on the Internet of Things.

CONTEXT: the growth of the Internet is an ongoing process: only 25 years ago it was connecting about a thousand hosts and has grown ever since to link billions people through computers and mobile devices. One major next step in this development is to evolve from a network of interconnected computers to a network of interconnected objects, from books to cars, from electrical appliances to food, and thus create an 'Internet of things' (IoT). These objects will sometimes have their own Internet Protocol addresses, be embedded in complex systems and use sensors to obtain information from their environment (e.g. food products that record the temperature along the supply chain) and use actuators to interact with it (e.g. air conditioning valves that react to the presence of people). As this document describes, **IoT is not yet a tangible reality, but rather a prospective vision of a number of technologies** that, combined together, could in the coming 5 to 15 years drastically modify the way our societies function. The scope of IoT applications is expected to greatly contribute to addressing today's societal challenges: health monitoring systems will help meet the challenges of an ageing society; connected trees will help fight deforestation; connected cars will help reduce traffic congestion and improve their recyclability, thus reducing their carbon footprint. This interconnection of physical objects is expected to amplify the profound effects that large-scale networked communications are having on our society, gradually resulting in a genuine paradigm shift. The paper shows that the Iot can help to improve citizens' quality of life, delivering new and better jobs for workers, business opportunities and growth for industry, and a boost to Europe's competitiveness. It conforms to the wider policy initiatives related to the Lisbon strategy and to the current thinking on post-i2010 initiatives. The idea was first announced in the RFID (radio frequency identification) Communication (COM(2007)0096). It comes in response to the invitation made by the Council to deepen the reflection on the development of decentralised architectures and promoting shared and decentralised network governance for the Internet of things.

CONTENT: the Commission considers that by adopting a proactive approach, Europe could play a leading role in shaping how IoT works and reap the associated benefits in terms of economic growth and individual well-being, thus making the Internet of things an Internet of things for people. It proposes **14 lines of action to exploit the potential of these developments:**

1. **Governance**: the Commission will initiate and promote discussions and decisions on: (i) defining a set of principles underlying the governance of IoT; (ii) setting up an 'architecture' with a sufficient level of decentralised management, so that public authorities throughout the world can exercise their responsibilities as regards transparency, competition and accountability.
2. **Continuous monitoring of the privacy and the protection of personal data questions**: the Commission recently adopted a Recommendation that provides guidelines on how to operate RFID applications in compliance with privacy and data protection principles. In 2010 it intends to publish a broader Communication on privacy and trust in the ubiquitous information society.
3. **The 'silence of the chips'**: the Commission will launch a debate on the technical and legal aspects of the 'right to silence of the chips', which has been referred to under different names by different authors and expresses the idea that individuals should be able to disconnect from their networked environment at any time.
4. **Identification of emerging risks**: the Commission will follow the ENISA work mentioned above and will take further action as appropriate, including regulatory and non-regulatory measures, to provide a policy framework that enables IoT to meet the challenges related to trust, acceptance and security.

5. **IoT as a vital resource to economy and society**: should IoT grow to the importance it is expected to attain, any disruption might have a significant impact on economy and society. The Commission will therefore closely follow the development of IoT infrastructures into a vital resource for Europe, especially in connection with its activities on the protection of critical information infrastructure.
6. **Standards Mandate**: the Commission will assess the extent to which existing standards mandates can include further issues related to IoT or launch additional mandates if necessary.
7. **Research and Development**: the Commission will continue to finance FP7 research projects in the area of IoT, putting an emphasis on important technological aspects such as microelectronics, non-silicon based components, energy harvesting technologies, ubiquitous positioning, networks of wirelessly communicating smart systems, semantics, privacy- and security-by-design, software emulating human reasoning and on novel applications.
8. **Public-Private Partnership**: the Commission is currently preparing the setting-up of four public-private partnerships (PPP) where IoT can play an important role. Three of them, 'green cars', 'energy-efficient buildings' and 'Factories of the Future' were proposed by the Commission as part of the recovery package. The fourth one, 'Future Internet', aims at further integrating the existing ICT research efforts in relation to the future of the Internet.
9. **Innovation and pilot projects**: complementing the research activities listed above, the Commission will consider promoting the deployment of IoT applications by launching pilot projects through CIP. These pilots should focus on IoT applications that deliver strong benefits to society, such as e-health, eaccessibility, climate change, or helping to bridge the digital divide.
10. **Institutional Awareness**: the Commission will regularly inform the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions, the Article 29 Data Protection Working Party and any other relevant stakeholders about IoT developments.
11. **International dialogue**: the Commission intends to intensify the existing dialogue on all aspects of IoT with its international partners, aiming to agree on relevant joint actions, share best practices and promote the lines of action laid down in this Communication.
12. **RFID in recycling lines**: as part of its regular monitoring of the waste management industry, the Commission will launch a study to assess the difficulties of recycling tags and the benefits and nuisances that the presence of tags can have on the recycling of objects.
13. **Measuring the uptake**: monitoring the introduction of IoT related technologies will provide information on their degree of penetration and allow the assessment of their impact on the economy and the society as well as the effectiveness of the related Community policies.
14. **Assessment of evolution**: it is important that a multi-stakeholder mechanism is put in place at European level to: (i) monitor the evolution of IoT; (ii) support the Commission in carrying out the various actions listed in this Communication; (iii) assess which additional measures should be undertaken by European Public Authorities. The Commission will use FP7 to conduct this work, by gathering a representative set of European stakeholders and ensuring a regular dialogue and sharing of best practices with other world regions.

By launching a number of actions and reflections, the Commission intends to be a driving force behind this effort and it invites the European Parliament, the Council and all concerned stakeholders to work jointly to achieve these ambitious yet achievable objectives.