

Internet of  
Things  
Internet of the  
Future  
Conference

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France  
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Conference report

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## Day 1: Conference Opening

### Key statements

- The development of the Internet is at cross-roads.
- Europe can lead, if we work together.
- Public funding can be effective in seeding innovation.
- The Internet's openness and neutrality are fundamental.
- The infrastructure must be stable, trustworthy and resilient.
- We need a common position on Internet governance.
- We must respect and protect the rights of citizens.
- We need a systematic approach to societal impact.
- The European Commission has launched a public consultation on the Internet of Things.

### Session report

Speaking on behalf of **Michel Vauzelle, President of the Provence-Alpes-Côte d'Azur Region, Mr Laroussi Oueslati, Regional Advisor**, welcomed the participants to the region and to an exceptional conference. He looked forward to the discussions.

Decision makers, researchers and scientists have come from all over Europe to work on the Internet of the Future, and this is very important for the whole world. The choice of Nice and the Côte d'Azur is no mere question of chance. The region contains international centres around which is developing a network of SMEs dedicated to:

- mobile internet
- RFIDs
- telecommunications
- radio frequency engineering
- medicine
- agro-industries
- aeronautics.

Mr Oueslati stressed that around these centres is a new dynamic movement for research and innovation, made concrete by research programmes selected at international level. The regional cluster policy complements a policy led by the French state for "competitive clusters" (<http://www.polesdecompetitivite.gouv.fr/?lang=en> ), which helps establish an ecology involving SMEs in developing innovation. Apart from technological innovation, it is essential to integrate innovation in processes and in digital content. It is in such a spirit of open innovation that the region has launched a new partnership with the Internet Federation.

Mr Oueslati also pointed out the societal challenges. Citizens must take control of new technology changes, so that they perceive them as an opportunity rather than a threat. Actions must be preceded by major European level studies. We need a systematic approach to the societal impacts.

**European Commissioner for Information Society & Media, Mrs Viviane Reding** reminded the conference that 2008 was the 25<sup>th</sup> anniversary of the pilot phase of the pioneering ESPRIT programme in Information Technology research. Since then, European funded research has been a long story of progress, success and leadership in fields such as communication networks, embedded systems and nano-technology. United, Europe would

have won most medals at the Olympic Games, and united Europe can win at world level even for new technologies. Already, four European nations are champions of high-speed broadband penetration, while eight have better distribution of broadband than the USA.

The Internet architecture, based on standardised technologies, has facilitated inter-operability and is open to unlimited numbers of players. This platform opens the way for many users, new content and usages, and unlocks the gate to development. The Internet revolution is only at the beginning, in health, in learning, benefiting all countries.

The openness of the Internet is indispensable. Its plurality and fundamental neutrality is not purely a technical matter, but also political, because it embodies the values of democracy, access, justice and openness. Access for everybody on the Internet is one of its essential characteristics we must protect. It is in full harmony with our European values. The Internet of the Future can become a world force representing the values of access and openness. European leadership implies responsibility to help by transmitting our values to sustain the Internet of the Future; Europe will support its development and competitiveness.

Mrs Reding said it was too early to know whether the future development of the Internet will proceed by *evolution* or *revolution*. But change will happen, and we need a common position on important subjects.

- Firstly, we must develop a system of governance for the Internet, which is open, multi-lateral and democratic, ensuring fair access to resources.
- Secondly, personal and sensitive data must be secured for citizens and for enterprises.
- Thirdly, dependence on infrastructure will become critical, so the system must possess resilience, safety, security and integrity.
- Fourthly, we must manage radio spectrum efficiently and swiftly. The French presidency will ensure that decisions are made regarding the allocation of frequencies in the transition from analogue to digital broadcasting.

Mrs Reding stressed that all these things will shape the economic development of the Internet and its acceptability by public and private players. Technical and legal measures will have to be taken by various bodies, and that has to be implemented today, not tomorrow! These must follow the principles of European bodies and lead to world standards.

This is a lot of work and we have to cooperate, Mrs Reding insisted. As usual, one must first analyse the challenges and stimulate European level debate. The European Commission has published a working document on the website "Your Voice in Europe" [http://ec.europa.eu/information\\_society/policy/rfid/index\\_en.htm](http://ec.europa.eu/information_society/policy/rfid/index_en.htm) for interested parties to submit comments and suggestions. The results will be published. We have reached a turning point and we must not let this opportunity slip by. We are dealing with a subject that will influence our economic strength, our position in the world, our companies and our citizens.

**Mr Eric Besson, Minister of State to the Prime Minister, with responsibility for Forward Planning, Assessment of Public Policies and Development of the Digital Economy**, welcomed everyone to an important and challenging conference. Politicians will look forward to the recommendations and suggestions to make the Internet a source of opportunity. He stressed that the development of the Internet now stands at a crossroads. In the near future there will be changes in the way it develops and it is used. The next step will see the Internet extending to many objects in our daily lives. Services will develop in the fields of:

- medical monitoring
- learning and education
- logistics
- local information
- transport telematics.

Mr Besson said these new technologies will lead to lighter, more efficient consumer goods, and we will be able to build sustainable, intelligent cities of the future. This will create new jobs, jobs founded upon local expertise that will not be relocated to other areas. All this will have major economic, cultural and social consequences, and also political consequences. Europe has key assets and a unique cultural, tourist and scientific heritage.

Underlining points made by previous speakers, he said we must:

- create a European technological ecosystem
- encourage research involving SMEs and new players
- ensure fair competition
- protect civil liberties
- coordinate technology at a European level
- enshrine a citizens' right to deactivate RFID tags
- reinforce links with citizens.

## Session 1: The Challenges of the Internet of the Future and the Internet of Things

### Key Statements

- The Internet of Things will involve greatly increased complexity.
- The new platforms must reflect European values.
- Consumers demand an understanding of the privacy issues.
- Consumer and user trust is essential for the growth of new services.
- RFID tags can contribute to recycling and energy saving.
- Comments on Commission's Working Paper are requested by end November.

### Session Report

Participants spoke from a variety of perspectives including those of operator, user of RFID tags, equipment supplier, government department and standards organisation.

**Bernard Benhamou**, Delegate on Internet Usage, **French Ministry of Research and Higher Education**, focused on how the mobile Internet is already very much part of life today, with mobile devices being the focus of new developments, especially when coupled with geo-positioning technology. While in the past there had been seen to be a conflict between the use of RFID tags and the protection of privacy, it is now recognised that appropriate protection of privacy is an essential aspect of winning user confidence and is a key to the economic development of the sector. We have to evolve a system in line with the **historic values of Europe**. While the platform may be changing, the key values of the Internet, that is **openness, interoperability and neutrality**, must be remembered.

Speaking from the perspective of an operator, **Marc Fossier**, Chief Executive Officer - **France Telecom**, addressed the conditions for the success of the Internet of Things (IoT) and listed the key technologies and major trends in this evolution. Tags are only the tip of the iceberg of the complex issues involved in managing these interconnected objects. The term **machine-to-machine** might be preferred, since the objects give and receive information. Three complex challenges can be identified: (1) assuring the user that traceability of objects does not lead to **traceability of persons**; (2) guaranteeing respect for privacy, and recognising that a company's image is dependent on retaining the confidence of its partners and clients; and (3) addressing the **relationship of the user to the technologies**. User operations must be easy to understand and intuitive.

The application of RFID tags to the retail supply chain was addressed by **Gert Wolfram**, Managing Director **MGI Metro Group Information Technology GmbH**, who sees an "**Intranet of Goods**". New technologies can transform business models. One key aspect in understanding this relationship is the exchange of data between suppliers and retailers. A change is coming with the new features of RFID using the Electronic Product Code (EPC). Because EPC is a global standard, it can be used in an **open supply chain** on a **global** basis. The Intranet of Goods will be an industry-specific structure, an application of the IoT.

**Chris Adcock**, President of **EPCglobal Inc**, explained the role of GS1 EPCglobal in supporting developments in the use of RFID tags. EPCglobal has defined **6 core principles** [see his slide 3] to ensure its effectiveness. A key feature is visibility across the supply chain, and this is

addressed in the EPCIS interface for exchanging information. This deals with the 4 questions: **what** something is (uniquely identified); **where** something is or was; **when** it was there; and **why** it was in that location. Examples of use cases include inventory visibility, brand protection, and the chain of custody. EPCglobal seeks to provide support by developing **standards** that meet these needs.

A Japanese perspective was provided by **Ryo Imura**, Global Business Promotion Director and Corporate Officer – **Hitachi Ltd**, who addressed the drivers of the ubiquitous networked society and RFID. As well as industries' user needs for the **supply chain**, there is also the **social demand** from the customer, who is interested in security and safety and recycling. An example is traceability in the food chain, and a trial for this was undertaken involving the meat industry—from the farm, through processing to the consumer. However, there is also the need to consider moving from linear supply chains to **recycling**. Life-cycle management is important for a sustainable society.

**Gee Rittenhouse**, Vice President **Bell Labs Research**, identified sensors and machine-to-machine communication as items now on the horizon, with potential for changes in healthcare, transport, etc, that we can only begin to imagine. However, three areas are inhibiting take up of the technologies. The first is the **scale** – managing the enormous number of items. The second is the existence of **too many solutions**. The third is the sheer **complexity** of managing such a complex dynamic network. To address these challenges, Bell Labs are focusing on: (1) **simplification**, involving a smarter network and local processing of data; (2) **network virtualisation**, involving the reuse of network elements in different ways; and (3) **commonality** of architectures and platforms.

The viewpoint of a manufacturer of mobile devices was provided by **Serge Ferré**, Vice President and Corporate Head of EU Representation office - **Nokia Global**. While 50% of the world's population will soon have a mobile phone, ubiquity is not everything. The key is **context**, which can bring added value, not least through advertising. In dealing with consumers and partners, priorities are on **simplicity** and also on the ability for an **instantaneous** response. In the past things were organised into three vertical silos, for broadcasting, fixed line internet and mobility, but the approach is now shifting to the horizontal [see his slide 7] with the same terminal, service and application being used in all cases. RFID tags used in logistics can help reduce our **carbon footprint**. For privacy, there are three fundamental values: you know you have a chip, you know it will transmit information, and you trust it. Trust can be lost in one second but takes 5-10 years to win back.

**Elgar Fleisch**, Director Auto-ID Labs - **ETH Zurich**, outlined three periods: first we connected computers via Ethernet; then we moved to the entire digital world of the Internet; now we have the possibility to have automatic linkage to things like car tyres. One very important aspect is the **changing role of the mobile phone**. In considering the many possibilities, we must not look at this as a single development. One lesson from the last 15 years is that you can forecast technologies, but **you can never anticipate applications**.

**João Schwarz da Silva**, Director Networks & Communication Technologies - **European Commission, DG Information Society and Media**, in summing up the session, referred to three of the slides in his presentation. The European Commission wishes to trigger a debate

[see his slide 10] and anyone is invited to comment on the Staff Working Paper on IoT by the end of **November 2008**.

The Commission has identified open issues and policy issues which are of particular concern, and it is up to participants to shape the future of Europe.

## Session 2A: Which right to privacy in the light of the Internet of Things?

### Key Statements

- Privacy and Security by Design is an important concept.
- Basic principles will endure; new issues relate to implementation.
- The Internet of Things must preserve consumers' rights.
- The Internet of Things may facilitate the profiling of users regarding their behaviour.
- Who is responsible for data in a complex network?
- Privacy compliance and trust are essential for competitive advantage.

### Session Report

Issues relating to privacy had already been raised in Session 1, but were discussed here in more detail. In opening the session, the moderator, Michel Alberganti (Le Monde), raised the question of the extent to which the use of RFID tags would lead to the tracing of people.

**Emilie Barrau**, Legal Officer at **European Consumers Organisation BEUC**, emphasised that the term "Internet of Things" can be misleading; one of the greatest challenges is that it must also work for people. The issue is wider than just privacy, because it affects relationships. The overall goal should be control by the consumer. **Privacy by design** is important to ensure that there is no weak link. The growth of RFID tags makes it more complex to address.

**Alain Brun**, Head of Unit for Citizenship & Fundamental Rights, **European Commission, DG Justice, Liberty and Security**, also emphasised that the protection of rights must be integrated from the start. New legislation may be necessary, but if so, it will be less about principles, which are already established, and more about **how to implement them** in a new environment. The existence of **multiple sources of data** will make it difficult to determine who is responsible.

**Andrea Huber**, Managing Director at **Informationsforum RFID, Germany**, viewed the timescale slightly differently, in that we do not yet know how the IoT will affect consumers. We can see three areas that will need to be addressed: (1) **technology** (anonymization techniques and the ability to change trust levels dynamically); (2) **regulation** (with a 3-tiered approach of privacy impact assessment, compliance with existing data protection framework, and self-regulation); and (3) **education** of consumers. However, it would be **premature** to develop a regulatory framework before it is clear how the technology will really impact the consumer sphere.

**Peter Hustinx**, **European Data Protection Supervisor**, described how the basic trends of growing network access and massive storage capacity mean that the impact of the Internet of the Future goes far beyond that of RFID tags. We must first implement the **existing** privacy frameworks. A key issue is the responsibility of the actors and the jurisdiction or appropriate law. Secondly we have the principles of transparency and opting in, or other mechanisms to give control to users. Thirdly, as mentioned by other speakers, **privacy by design** is

important. Participants are encouraged to read the paper on the EDPS web-site <http://www.edps.europa.eu/EDPSWEB/> Development of RFID will be slowed down if this aspect is ignored.

**Daniel Retureau**, from the **European Economic and Social Committee**, explained that EESC had already been asked to give an opinion on the IoT. Direct attacks on privacy include spam, phishing, viruses, etc, but a key additional area of concern involves the scope for **profiling of individuals**, even according to actions such as a request to a search engine. RFID tags could also lead to inappropriate monitoring of employees, etc. Associated with profiling is the **cross-linking of information**, which will increase with the IoT, so increasing the potential privacy threats. Open software can give more user confidence.

The issue of profiling was also addressed by **Viola Schmid**, Professor of Public Law at **Technical University of Darmstadt**, who presented 5 points, with the key being "As little law as possible; as much law as necessary." There may be the need in RFID applications to establish a legal **right to silence**. As an example, the New York RFID Law includes: (1) Notice – customers must be informed, (2) Labelling – showing which items contain tags, and (3) Deactivation of tags at point of sale.

**Gwendal Le Grand**, Head of IT Experts Department at the National Commission for Data Processing and Freedom, **CNIL, France**, outlined the issue of **traceability** in terms of both space and time, and showed how this has many applications. The environment contributes to this with surveillance and recognition systems, while unlimited storage facilitates traceability in time. 5 pillars were identified as leading to a trusted IoT [slide 3]. It needs to be realised that data protection is not just a right, but can also provide a competitive advantage. The promotion of privacy in the IoT requires adequate resources, interaction between the research community and the data protection authorities, and a system for labelling to certify data protection.

**Thaima Samman**, Associate General Counsel Director, Government Affairs, **Microsoft International**, explained how Microsoft believes that there will not be an IoT if users do not trust it, so it is seeking to build appropriate principles, such as transparency, security and consumer control into its products. These principles include items such as **easy access** to statements on privacy, so users know what to expect, user control, anonymity in research data, **separation** of research data from user account data (so not permitting cross-referencing) and ensuring compliance with local laws and regulations.

## Session 2B: The impact of the Internet of Things on the main industrial sectors (B2B applications & services)

### Key statements

- Innovation will be a key performance factor in commerce.
- The service sector will grow in importance in Europe.
- New strategic research is needed for advanced services.
- RFID technology is fundamental to the retail supply chain.
- The postal value chain is suited to RFID technology.
- RFID will be central in the Internet of Things.
- Large scale standardisation will be essential.
- China has the world's largest IPv6 network.
- China looks forward to more global cooperation.

### Session report

**Arnaud Mulliez**, President **Auchan France** and President of **Picom** (competitive cluster for trade industries), opened the session by reviewing a number of trends in the commercial world. The key factor will be optimisation driven by innovation: to reduce costs, develop new products and manage the enormous cost of product recall. We have to control the logistics of a **global supply chain**, and RFID technology makes it much easier to control and integrate the supply chain. This implies **standardisation** on an international scale. Innovation will provide the products for which customers are waiting: this is what we call a service-based approach. ICT (Information and Communications Technology) is taking over the centre of gravity from pure IT (Information Technology). Interactive customer solutions are becoming mobile and will increasingly depend on mobile phones. Ubiquitous services based on new technologies such as Wi-Fi and RFID, enable customers to shop where they want, even visiting the interactive hypermarket from the beach. Progress in Japan (Tokyo Ubiquitous Network) and Korea (Ubiquitous Korea) in these areas is impressive. The age of mobility and traceability will require new investments. He drew attention to the "**Ubiquitous Metropolis**" project in Lille (northern France), explaining the importance of this and similar "observatory" projects to ensure that right choices are made. Customers must accept the new technologies, and we must ensure they do not become suspicious and reject them.

**Thierry Kunicki**, Director of Governmental Programs at **IBM France**, stressed the importance of the **service sector** in Europe's economies. It already accounts for 70% of European GDP and the proportion is growing. At IBM, 2008 will be the first year for which software accounts for more turnover (58%) than hardware. Contrary to popular misconception, the service sector supports many high-grade jobs requiring skill and education. Service is now a core concept in economic, social and computer sciences. He urged the member states and universities to concentrate on services research, moving away from manufacturing and physical sciences. This might be an extension to the 7<sup>th</sup> Framework programme. He expressed a hope that ministers would come to more creative trade agreements following the failure of the Doha talks, and closed by inviting participants to visit IBM's research facility in La Gaude.

**Pierre Georget**, President of **GS1 France**, explained that the best way to reduce prices and improve the consumer experience in the retail sector is to reduce costs in the **supply chain**.

To give an example, bar codes have reduced consumer prices by 6.5%. We will not reduce costs without automation. RFID technology is fundamental here: "farm to fork" visibility is vital, since product safety cannot be taken for granted, while complaint handling is extremely expensive. But automation needs us to have tools, as supply chains are not closed chains. A complex, open, collaborative infrastructure will be necessary, based on information sharing. This is why GS1 and Electronic Product Code Global (EPCglobal) are working together to introduce worldwide standards. Responding to a question about how the EPCglobal system can be open, he replied that open standards would enable open communication with domain name servers (DNS), and that GS1 had entered into a partnership with AFNIC in France (*Association Française pour le Nommage Internet en Coopération*).

Besides handling physical mail, the world's post offices also handle financial services and e-business. **Akhilesh Mathur**, Programme Manager, Standards and Certification, at the **Universal Postal Union (UPU)** made clear that the global postal value chain is well suited to RFID technology. As the world's largest logistical operation, the **global postal service** has many potential RFID applications, for example:

- tracking and tracing
- quality measurement
- theft detection
- item routing.

If the deadly anthrax letters in the USA had incorporated RFIDs, their perpetrators could have been located within days. The Universal Postal Union plans pilot trials in 2009 and phased implementations from 2010, and is contemplating standards for a unique bar code identifier. He envisaged a day when every envelope would have an embedded chip. A questioner asked at what price RFIDs could replace stamps. The answer was 5c (they are currently 70c), so the first implementations would concentrate on higher value items and quality measurement applications.

RFID technology is central to, but not the same as, the Internet of Things. **Patrick Gatellier**, Research Director at **THALES France**, examined some principles of RFIDs. An RFID gives the object that bears it an identity, stores data about it and presents that data for external interrogation. In this way, it exposes behaviours. To make this useful requires not only standardisation of the data and communication, but also of the way the RFIDs behave. Large-scale standardisation will be complicated and difficult. He went on suggesting two technical approaches:

- Firstly, each RFID should contain data that announces what it contains ("**symbolic representation**"); this enables readers to know the content and so only query it when it is of interest.
- Secondly, he argued for a "**password**" to protect the RFID, that interrogating devices would have to know to obtain the data. This, he thought, would solve most security and privacy concerns for enterprises and citizens.

China is now the world's largest Internet user country, and is committed to the development of IPv6 networks. **Huan Huan** of the **Beijing Internet Institute** revealed how the **China Next Generation Internet (CNGI)**, with an initial budget of 1.4 billion renminbi, is linking 40 cities with six backbones up to 10 Gbit/sec and the world's largest IPv6 network. The joint project involves eight ministries, six network operators and over 100 Government funded application

projects. CNGI, which covers the period 2008-2010, has real economic goals. It aims to promote IPv6 service commercialisation, develop at least 500,000 IPv6 trial commercial users by 2010, promote the transition to real commercial use and cultivate new economic growth. The 2008 Beijing Olympic Games accelerated the development of IPv6, since the Games used the network for important applications. These included:

- video surveillance
- sensor networks
- intelligent traffic management
- lighting control.

The lighting control application reduced energy consumption by 10%. "China," he said, "will become one of the engines and flagships of the new Internet economy, and looks forward to more cooperation with the world."

## Session 3A: Economic challenges & technological perspectives

### Key statements

- Markets are becoming less predictable.
- Markets will be driven by users' wants and needs.
- Think carefully and imaginatively about the applications.
- Markets will not be driven by technology.
- Someone has to invest in the infrastructure.
- Beware of barriers to entry and exclusive technology.
- Open and stable platforms are indispensable.
- Establish open standards and sound guidelines.

### Session report

A number of speakers made two points: firstly that people and applications will drive the Internet of the Future; and secondly that **the focus will be user-centric, not technology-centric**. These thus formed a consensus of the session. Furthermore, it was acknowledged that the growth of new user-centric services over the "humanised" Internet would be unpredictable, that there would be increased openness and user input in both the processes of innovation and in the business models deployed.

In her opening remarks, **Lara Srivastava**, Senior Research Fellow at **Aalborg University, Denmark**, characterised the key questions as demand, openness, the mass market, research and innovation, and techno-social issues (see her slide 15), underlining the overall need for a holistic approach. The Internet of Things emerged as a European priority in 2007, while we are observing the phenomenal growth of social networking, increased user contribution to content and innovation, and the growth of mobility. From being a repository of information, the "old" Internet is evolving into a "Web 2.0" of sharing and socialisation.

**Heinz-Paul Bonn**, Vice President of **BITKOM Germany**, raised concerns about **entry barriers**, fearing that the Internet of Things was in danger of evolving into an exclusive club. He thought that a lack of transparency in certain processes supported European misgivings and especially those of SMEs. The monopolisation of the **Object Name Service (ONS)** is a real possibility. He thought that a democratisation of the Electronic Product Code global (EPCglobal) processes and a revision of the licence conditions were required, although this view was disputed during the discussion session. He urged that Europe continue with a harmonised approach to RFID technology and the Internet of Things.

**Jean-Claude Nataf**, Director of the global competitive cluster on **SCS (Secure Communicating Solutions)**, explained the French Government's policy of supporting **clusters of excellence**. Between 2005 and 2008, \$2 billion has been invested, and the programme has been extended for three further years. A cluster is a regional ecosystem of large companies, SMEs and research labs. 140 research projects, mainly about applications and some progressing right through to usage, have been funded over 65 clusters.

**Eli Noam**, Director of the **Columbia Institute for Tele-Information**, raised a sceptical voice, challenging people to take a more visionary outlook. He said proposed applications such as meter reading and traffic light control seem basic. A house with 30 sensors and 5-6

applications barely needs 300 bit / sec. He went on to consider video surveillance, and showed that in practice event recognition and crime detection needed people. The stress, he said, should be on interfacing between applications and people, and he cautioned against expecting the new applications to reduce the personal involvement. Turning to top-down applications such as government road-tolling or automobile maintenance monitoring, he argued that the really exciting applications would follow when the data, say from BMW car sensors or of aeroplane locations, were extended horizontally for anyone to use in innovative applications. Of course, this raises the question of undesirable uses. In summary, he recommended:

- have horizontal systems
- integrate with people
- support the core, not just the periphery, of life.

**Frithjof Walk**, Member of the Board of **AIM-Germany**, noted that RFID technology has been subject to hype since at least 1991. He underlined other speakers' pleas for a healthy environment for **SME participation**.

**Sam Paltridge**, Doctor in the Directorate of Science Technology and Industry of the **OECD** outlined some of the work of the OECD, which included technology foresight, applications awareness, economic impact and reviews of government initiatives. This has led to an **official policy guidance document** on RFID technology, containing 14 policy guidelines merging economic and social streams of the work. A ministerial meeting on the future of the Internet economy was held in Seoul in June 2008

(<http://www.oecd.org/dataoecd/49/28/40839436.pdf> ). Further work includes: security and privacy issues; developing and elaborating the policy guidelines; and further exploring economic dimensions and opportunities.

**Laurent Sorbier**, Technical Advisor from the **French Cour des Comptes**, reflected on the enormous opportunities presented by the transition to the Internet of Things, and referred to a wide range of technical issues. He drew especial attention to ethical and confidence issues, noting that we must be very careful to avoid **societal fracture** through the **disadvantage of excluded groups**.

During the **general discussion**, a questioner asked how we might ensure the openness of the Internet of Things. On one hand, one could argue that the Internet was already open, so will we not keep it open simply by not closing it? There is the danger of attempted lock-in via closed devices, but also a certain confidence that such products, for example the iPhone, might invite competition and not stay locked-in. However, it is better to continue the debate and declare opinions now (as at conferences such as this), than to let things take their course and complain later.

Another questioner invited the panel to further explore the view that new applications would be unpredictable. Since we do not know the new applications in advance, the speakers agreed that openness remained critical. However, openness is not enough. While the "old" Internet has grown over existing infrastructure, **the Internet of the Future will require new infrastructure and investment**. This means that we cannot simply stand aside and let the applications happen by themselves. Someone must think about the platforms and infrastructure. Since fibre upgrade is not happening in many European countries, public subsidy or regulatory encouragement may be considered.

## Session 3B: Applications and Services of the Mobile Internet

### Key Statements

- Users can be allowed to create their own applications.
- RFID-reader equipped mobile phones offer great potential.
- Web-based applications may have advantages in the mobile Internet.
- Open standards have key roles in RFID tags and interfaces.
- Domains such as vehicle communication demand cooperation.

### Session Report

The session was moderated by Emmanuel Paquette (Les Echos), and the speakers addressed a wide range of different applications and services that might use RFID tags, the Internet of Things (IoT) or the Internet of the Future.

**Rafi Haladjian**, Founder of **Fluxus**, **Ozone** and **Violet**, described how realisation that certain past inventions had become pervasive had led to a vision for the Internet of Things, which in turn had led the company to develop the rabbit Nabaztag – something tangible, which you could interact with, and was fun. The aim was for the user to be able to have control. A new device, being launched soon is Mirror, a mass-market RFID tag reader which can be connected to a PC/Mac via USB, and can read Ztamps, pre-purchased RFID tags that can be attached to any object. The aim is to allow **users to create** their own applications, not be constrained to pre-programmed items.

The wide range of uses of an **RFID-equipped mobile phone** was addressed by **András Vilmos (Project StoLPaN)**. The key characteristics of NFC (near field communication) systems were first summarised. The potential application to mobile phones is obvious considering the enormous number of phones. A mobile handset equipped with a tag reader can not only be used as easily as a card, but can offer much more. The existence of the **display** and **key pad** allows added value, and the phone can provide a **communication channel** to link the NFC interface to a remote point. Examples of potential uses extend beyond purchasing to health care and field force management. The inclusion of an additional chip to act as a universal mobile wallet can greatly increase dynamic operation, allowing applications to be added or deleted.

**Ken Sakamura**, Professor at the **University of Tokyo**, described work in Japan on the (ubiquitous) uID approach to giving tags unique identifiers. The key is **context-awareness**, whereby objects and places are recognised automatically. The unique u-code is resolved by the uID center, and allows a ubiquitous communicator to obtain information from servers. Potential applications are food and drug traceability systems, recycling, obtaining local information, assistance to the handicapped, etc. The u-code structure could allow EPC global codes to be embedded. The NPOs running the system are international in nature, and open standards and specifications are seen as key to success. The system has been trialled in Tokyo.

An application in the area of **public transport and smart ticketing** was addressed by **Etienne Graindor**, Project Manager for MOBIB, **STIB, Belgium**. The smart ticketing system implemented by the public transport system in Brussels is based on the use of validators, which can not only validate cards, but are equipped with the function of selling. Payment may

be made using an e-purse built into the card, or alternatively by home banking, which allows people who have paid for contracts to be placed on a green list. The use of a microprocessor-based card improves security. The use of a mobile phone is another alternative, but it is not essential to the system implemented. Data is duplicated on a server, so a card which is stolen or lost can be stopped and a replacement issued.

**Francesco Lilli**, Project Manager - **Fiat Research**, outlined the range of possibilities the Internet of the Future offers in the automobile industry on the theme of **connected cars**. There is a growing trend for vehicles to be equipped with telematic devices, with technological trends advancing in the areas of infotainment and multimedia and wireless communication. Standards are important, and there is great scope for strategic alliances and cooperation between interested parties. Different environments can be defined for (1) **in-car** wireless communication and (2) communication from the vehicle **outside** to the Internet, which may be based on GPRS and give access to IP-based services. Cooperative Internet services demand agreed protocols. **Car-to-car** communication addresses issues related to safety on the roads.

The domain of **healthcare and hospitals** was address by **Christian Chabannon**, Professor at Marseille School of Medicine and Head of Cell Therapy Facility at **Institut Paoli-Calmettes**, Marseille, who outlined some of the needs of medical practitioners, and services that everyone will need some day. Drivers for improved systems include the increasing number of patients and growing pressure to reduce costs, but also the complex involvement of different players and different types of data (large image files, etc) and the fact that health practitioners need to use the same data for different purposes. A complex flow of information between different departments is involved. Furthermore, healthcare **research** in medical science and biology needs sources of data; in some circumstances patient data can be such a source of useful information but there need to be appropriate channels to provide such access. **Patients rights** require security and confidentiality. The needs currently unmet include improved **traceability** (barcodes, RFID, etc) and **improved data management** (digitized files, nomadic access, access for research purposes, and a range of political and ethical questions).

**Philipp Hoschka**, Deputy Director **W3C Europe**, introduced the work of W3C and the mobile web initiative, leading to the **Web of Things**. There is a trend to use web-based applications that will run on mobile devices. Web-based applications are no longer just for documents. The advantages over native applications running on a PC are that they are **easy to deploy and update** and there is a big developer base. However, it is necessary to open things up and give the browser access to other information like location information, and this requires standardisation. The Web of Things is still a vision, but is a natural continuation of the mobile web. More web standards are needed in areas such as device-to-device communication and user interfaces. There are security and privacy issues which are to be addressed at a workshop in London on 10 December 2008.

## Day 2: Opening: The Challenges of International Cooperation

### Key Statements

- Internet governance involves multi-stakeholder collaboration.
- Stakeholders' different frames of reference can lead to misunderstandings.
- International cooperation is essential for stability and security.
- Key issues for international cooperation include IPv6 and spectrum allocation.
- Global cooperation is necessary for standards for openness and interoperability.
- We must recognise limits to the power to regulate.

### Session Report

**Marcus Kummer**, Executive Coordinator, Secretariat of the **Internet Governance Forum, United Nations**, started with the question of what type of cooperation was needed – more of the same or something new. At the time of the World Summit of the Internet Society, there was a conflict between old and new schools, some feeling that the Internet needs to be managed in the same way as inter-governmental cooperation, while the Internet community wanted collaborative cooperative processes. The term **internet governance** was coined, in the context of **multi-stakeholder cooperation**. The Internet Governance Forum was a result of this – a platform for dialog which brings all stakeholders together. Internet governance does not necessarily mean new regulation, but can be based on sharing information, sharing best practices and raising awareness. We do not necessarily need new forms of government or new institutions but more of the same multi-stakeholder collaboration, based on the bottom up Internet community.

In sharing some of the principles adopted in the US, **Meredith Atwell Baker**, Acting Assistant Secretary for Communications & Information NTIA **National Telecoms and Information Administration, USA**, outlined 4 key areas in which international cooperation is needed. These were: promoting an enabling environment through competition; avoiding burdensome regulation; embracing the global cooperative nature of the network; and supporting continued private sector leadership, since this sector is the primary investor in infrastructure. There is the need for all actors to work together to ensure that the Internet of today and that of the future will be **stable and secure**, as was demonstrated recently with regard to DNS security. Other areas for international cooperation include the **IPv4 to IPv6** transition and the use of **radio spectrum**.

**Andrew Robinson**, Chairman of **French Business Council, UK**, focusing on **people** rather than technology, spoke on the subject of whether ICT can bridge the gap in Citizens' Europe. Global Internet integration presupposes European integration. There is a search for a model of selective integration that can make life simpler for the citizen, and services more cost effective. In spite of the many stages of development since the formation of the EEC, citizens still **do not buy into integration**. In recent disaster situations worldwide, European citizens did not realise that they could be assisted by any member state. The Internet offers opportunities for cross-border working and living that people may need to be aware of. The vision is to have a model of bridging, not blending, those things which are preserved in national systems.

In the context of cooperation and the Internet of Things, **Michael Niebel**, Head of Unit Internet, Network and Information Security - **DG Information Society and Media**,

**European Commission**, introduced three pillars: **research and development, architecture** and **public policy issues**. In the case of R&D, Europe has programmes for scientific and technological cooperation. In the case of architecture and applications, the first challenge is that of **openness**, to avoid monopolistic structures, while the second is **interoperability**, to avoid multiple, incompatible systems. Global cooperation in standardisation is necessary in order to make this work in areas such as harmonised spectrum for IoT devices that will travel to different regions (such as luggage). RFID raises specific challenges. While Europe has been in the vanguard of protecting privacy, RFID raises a new dimension of danger with greatly increased scope for profiling, etc. As stated in Tunis agenda item 62, Internet governance should be **inclusive, responsive and promote an enabling environment**.

**Paul Twomey**, President & CEO **ICANN**, posed some questions about the way ahead on the IoT. The Internet poses a whole new range of questions for international cooperation, including the issue of law for a medium that knows no boundaries. The **multi-stakeholder approach** raises issues because of the different backgrounds of the various stakeholders. Each stakeholder brings a **unique frame of reference**, and this can lead to mistaken assumptions about what other stakeholders know and are willing to accept. Words can have meaning far beyond their connotation. Engineers and lawyers have different perspectives, and stakeholders may even have differing views on what constitutes a network or the Internet. ICANN has stood for the practical implementation of a single interoperable Internet. We are facing enormous innovation and change with major subjects to be addressed. Multi-stakeholder discussion is very important and it should continue to be technology neutral.

**Lawrence Lessig**, Professor at **Stanford Law School**, gave an invited address in which he considered the change in attitudes that have taken place over the last 10 years. He focused on three issues: **competition**, control and the idea of regulatory humility. Competitors don't actually like competition. They seek to use technology to build barriers to entry. For the network, intelligence may be pushed to the edges, but applications can run over the network using open and public protocols. Many of the key innovations on the web were invented by kids (Hotmail, ICQ, Yahoo, Google). The innovations were outside the domain of the controllers. **Control** must not be allowed to extend to the core network. But this owner control is very different from state control, and governments need to be able to regulate while preserving the nature of the network. If the architecture is understood, ideas can be banned just locally. The third point is that we should have the humility to **recognise the limits** to the power to regulate. We may regulate where it is possible to achieve objectives through regulation, but act differently where this is impossible.

## Session 4A: The Strategy for Interoperability and the Standardization of the Internet of Things

### Key Statements

- Standards must allow room for innovation.
- Standards require global collaboration in areas like spectrum.
- The standards model needs to extend to Web services, etc.
- Simple approaches like 2D bar codes are sometimes to be preferred.
- Full tag deactivation may eliminate certain consumer benefits.

### Session Report

**Jorgen Friis**, Deputy Director General, European Telecommunications Standards Institute **ETSI**, opened the session with a brief summary of the work of ETSI, which undertakes significant work relevant to the Internet of Things (IoT). Ten working groups are all active in RFID standardisation, and ETSI has so far organised two Plugtest<sup>1</sup> events which are particularly relevant. Key issues for standardization today are **spectrum harmonization** and **trust and security**.

The session included contributions from two EC projects, and **Henri Barthel**, Director Global Partnerships & Projects - **GS1**, introduced project **GRIFS** under the title "Building the Global RFID Standards Forum". GRIFS' goal is to establish a global forum for RFID standards, by documenting work on standards and establishing liaison with on-going projects and standards bodies. Key activities have included **workshops and fora** in North America and the Far East, in addition to Europe. The diagram of the Global RFID Standards Repository [see his Slide 5] gives a clear indication of the range of standards to be considered. In addition to a report, GRIFS hopes to produce an **Internet supported platform**, probably in the form of a Wiki to help keep this information alive. Coordination with other activities, such as CASAGRAS is important.

**CASAGRAS** is the second EC project reported on in this session, and **Anthony Furness**, Chief Technology Officer, **AIDC, UK**, described its scope. It is an international project with partners from around the world, and seeks to provide a framework for foundation studies that can assist in accommodating international issues with regard to standards for RFID and the IoT. The model that it has adopted is inclusive and embraces not only the evolving Internet but **Web and Grid Service** concepts, Service Oriented Architecture, Unique Item Identifier and namespaces resolving issues, and "edge" technologies, including RFID and object-connected data capture. The seven work packages in CASAGRAS cover international standards with respect to RFID and extend to areas of **applications** and the standards associated with them.

**Leslie Daigle**, Chief Technology Officer at **ISOC World**, spoke on how standards can drive tomorrow's Internet; collaboration between appropriate organisations is important. She outlined three things that have made today's Internet successful: **standards**, **interoperability** and **collaboration**. Standards cannot be developed in isolation and involve coordination and collaboration. The existing network was built on open standards and

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<sup>1</sup> A Plugtest is an event where engineers can come and test equipment by connecting it to a test bed to check compatibility.

interoperability and any entity could join and improve it. Taking the example of cars, different models may use the same components and the same road infrastructure, but be very different for diverse markets, with kit cars even allowing local innovation. The need for interoperability is key for this model, and organisations involved in these standards must collaborate.

**Laurent Sciboz**, Head of Institute at **University of Applied Sciences Western Switzerland – HES-SO**, presented the view that the technology used over the "last mile" can be **simple**, while still allowing interaction with day-to-day items, such as a slab of cheese. The EPCglobal technology, which allows all objects to be identified, offers great possibilities. The example of cheese shows how a **2D bar code** can be used to provide services without the need for RFID tags and readers. A **mobile phone** can act as a reader for a 2D bar-code and can be linked to via the phone's communication links to **applications** such as Google Earth, which can show the fields where the cows graze and where the cheese came from. This is real traceability. **Interoperability** is a problem, with there being many types of 2D bar-code standard. For the user, this can be a jungle, but the application described shows an alternative way of how RF (mobile phones) can be combined with ID (bar codes).

**Humberto Moran**, Founder and Director of **Friendly Technologies**, raised the important point of how standards can allow for innovation. He described some of the problems of conventional tags, such as data **collisions** when multiple tags are physically close and solutions using tags which only reply when their particular ID is addressed by the reader. Such tags can also **protect privacy**, since they are silent unless specifically addressed and they are also more difficult to counterfeit. Another design copes with the requirements of a supermarket, using smart shelves to keep the **tags simple** and putting the intelligence in the network. These are examples of how an innovative idea may offer privacy by design, but may not be compatible with standards unless standardization also leaves **room for innovation**.

**Joseph Alhadeff**, Vice President for Global Public Policy and Chief Privacy Officer for **Oracle Corporation**, explained how an RFID tag system can be thought of as supporting an **eco-system**. In the example of coffee production, the supply and clearing system can lead to sustainable consumption. But it can also extend to **recycling** when thinking of what happens to the jars, to safety in transport if the delivery truck has tag-equipped tyres, or even pharmaceuticals to help you sleep after drinking coffee! Earlier discussion on **deactivation** (the 'silence of the chips') may be a false dichotomy. **Partial** deactivation may be appropriate, so retaining certain functions which can provide **consumer benefits**. Therefore it is important to consider the principles for privacy law, which are not just about collecting data, but control, reasonable use, and the purpose.

## Session 4B: Architectures and governance of the Internet of Things

### Key statements

- The future of the Internet will be different from before.
- Regulation and standardisation of mechanisms will not be enough.
- Governance requires a holistic, systemic approach.
- We must develop an ethically based governance framework.
- The management and role of the ONS is important.
- The structure of the ONS needs further work.

### Session report

**Philippe Gautier**, Chief Information Officer of **Heinz-Bénédicta**, opened by contrasting the “old” and “new” Internet. The first is bound and deterministic, enabling mainly data exchange. The second will be open and transversal, based on information sharing between autonomous actors. This leads to:

- much more complexity
- a non-deterministic cyberspace
- application added value through synergy and association between actors.

He said the regulation of the Internet by control and standardisation of mechanisms, as has been the case so far, will not be enough. What is now needed is a framework of governance based on a living and evolving scheme of values. This scheme of values will be based on:

- ethics
- possibly US-style jurisprudence
- not European exhaustiveness.

An ethical approach will permit attention to bad trends, such as positive feedback situations leading to lock-in. What is not forbidden is allowed, but may be forbidden later if its effects are negative. Such a value scheme is more than a constitution, since it would address behavioural values, and, depending on context, economic values such as added value or rarity, etc.

**Patrik Fälström**, Senior Consulting Engineer with **Cisco Systems**, confirmed the openness of the Internet of Things. It contains whatever we choose to connect to it; it increases our reach globally and increases the reach of existing tools. He went on to identify a number of issues:

- Is Internet Protocol (IP) suitable for sensors?
- We must migrate to IPv6 for addressability.
- Name Server security is most important.
- Are business models a barrier to entry?

Contributing to the debate on the Object Name Service (ONS) in the Internet of Things, he gave the following views:

- ONS is not needed in federated situations where applications already know where the data is.
- We need more discussion on the need for multiple roots: that need is not self-evident.
- It is premature to insist that we must have a second root in Europe. It may not help at all.
- Name space management is essential, but not the same as having multiple roots.

A big problem regarding governance is that we have not even started to look at existing regulation and policies as they apply to the Internet of Things and RFIDs. We are not studying in detail how the European privacy directives might apply.

**Désirée Zeljka Miloshevic**, Special Advisor to the chair of the **United Nations' Internet Governance Forum Advisory Group**, reviewed a wide range of issues (see her presentation), but warned that we will not reach conclusions today. From her work at ICANN, she drew attention to the risks of dominance by a particular government. Saying that global coordination and collaboration is a pre-requisite, she called for a dynamic and responsive regulatory environment to promote business, competition and responsible use and implementation.

**Milton Mueller**, Professor at the **Delft University of Technology**, analysed the problem posed by the monopoly of the Domain Name Server (DNS) root. The U.S. government insists there is value in having control of a sole root. He went on to argue that while ownership of the root did confer some political and economic power, this was in practice limited and vulnerable to bypass (see his slide 5). Multiple roots are possible. The economic value that really counts is in applications, so he reached the following conclusions.

- Do not worry about who is controlling the root.
- Regulate services and applications, not the root mechanism.
- Try to stop national fragmentation.
- Make commercial services more open and competitive.

**Mathieu Weill**, Director-General of **AFNIC**, outlined the role of AFNIC in France (*Association Française pour le Nommage Internet en Coopération*) and its recent partnership with GS1. He presented an angle on the relation between the Domain Name Server (DNS) and the Object Name Service (ONS), giving his views on the best way forward for ONS. He said ONS is a secondary level domain that is architecturally similar to DNS, though it differs in its standardisation processes, naming scheme and normal usages.

There are two possible routes ahead for ONS, of which he advocated the second:

- to remain an industry-specific piece of middleware, within the scope of EPCglobal
- to become an essential service of the Internet of the Future, enabling both the EPCglobal community's needs and unexpected applications to grow.

This second scenario, he said, will enable innovative and unforeseen applications to thrive on the network, with the intelligence at the edges. Governance challenges, interoperability and open standards will be much more important in the second scenario, but its benefits outweigh by far the cost of additional governance.

**Wang Wengfeng** of the **China Electronic Standardisation Institute** reviewed the Chinese e-strategy under the 11<sup>th</sup> Five-Year Plan to 2010 (see his presentation). The government is participating in setting the strategic objectives from early stages. He concluded with three suggestions:

- to carry out more application research in the fields of environmental monitoring, disaster warning, home networking and intelligent traffic management
- to carry out the study of standards architecture and to speed up the key technologies of next generation networks, sensor networks, RFID and object identification

- to strengthen international communication and cooperation.

**Wolfgang Kleinwächter**, Professor for International Communication Policy and Regulation at the Department for Media and Information Sciences of the Danish **University of Aarhus**, posed the following four questions, suggesting some answers:

- Does **ONS** have a public policy component? Yes: privacy and freedom.
- Does ONS need governance? No for the root, but yes for openness, for prevention of monopolisation and for interoperable standards.
- Can something be learned from DNS governance? Probably: we can learn about the addition of new domains.
- Do we need an ONS governing council? No.

Professor Kleinwächter made four pleas.

- Avoid debate about new bodies or bureaucracies.
- Provide a flat and flexible collaboration model.
- Formalise specific matters of detail according to proven need.
- Have an annual European discussion for coordination and cooperation.

The **discussion at question time** highlighted the following points:

- Multiple roots are possible, but name spaces must be controlled.
- ONS could in principle be registered as a top-level domain.
- Unlike DNS, ONS names have no semantic value, hence they are unlikely to have value as coveted names.