EUROPEAN COMMISSION
Information Society Directorate-General

Communication Networks, Security and software. Applications
eBusiness

WIRELESS TAGS – PROSPECTS & OBSTACLES

Report of the Internal Workshop

held at the

European Commission

in Brussels on 9th July, 2003

Commission européenne, B-1049 Bruxelles / Europese Commissie, B-1049 Brussel - Belgium. Telephone: (32-2) 299 11 11.
Office: BU29 2-35. Telephone: direct line (32-2) 295.69.79. Fax: (32-2) 296.83.87.

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Summary and recommendations

The participants in the workshop agreed on the importance of wireless tags as a key technology to identify individual physical items in space. This identification could have a radical impact on the way we interact with the physical world in the information age. New applications based on wireless tags will bring increased productivity and efficiency and enhanced customer services. These applications will use smart tags in order to manage products individually throughout their life cycle in radically new ways and to allow people for an enriched interaction with the environment.

In order to grasp the full socio-economic potential of wireless tags participants recommended action on three areas:

- Ensuring world-wide interoperability of wireless tag systems and globally harmonised spectrum resources.
- Catalysing the initial demand for wireless tag systems.
- Addressing the emerging concerns of privacy and user acceptance.

The participants felt that although the technology is advancing and the first implementations show the benefits of these systems, mass deployment of wireless tags applications will be hindered in Europe if these three areas do not progress timely.

Recommendations

In order to address the three issues mentioned above the following proposals were discussed:

Spectrum allocation (Interoperability)

The invited experts insisted on the benefits, in terms of costs and operating range, of wireless tags operating in the UHF band as it is the case in US and Japan. In Europe there is only limited capacity available in the UHF band (licence exempt band 862-870 MHz) and power limits are imposed on RFID scanners to avoid interference with other applications. This implies that RFID communication requires a closer distance between the tag and the scanner. Also, the European UHF bands foreseen for RFID are not identical with the US bands, although it seems that the spectrum tolerance of RFID tags in UHF is sufficient to respond to scanner signals in both bands. It was recommended that industry provide a description of their requirements concerning the co-existence of wireless tags services operating in the UHF band with other services. It was noted that CEPT is already working on improving the accommodation of RFID in the UHF band.

Actions:

- Specifications from industry on possible co-existence of wireless tags operating in the European UHF band
- DG INFSO - B to examine whether there is a need for raising the matter in the Radio Spectrum Committee or with CEPT

Standards (Interoperability)

Beyond the interoperability at hardware level, participants expressed the need to harmonise application interfaces and data models and to support international standards. AUTO-ID Centre is producing technical specifications for wireless tags applications supported by leading companies in the area. In supporting widely recognised and industry backed standards it should be considered the potential contribution of the EC Standardisation Action Plan.

Actions:

- Analyse possible co-ordination with the EC Standardisation Action Plan.

Catalysing the demand

Participants considered that both private and public initiatives may be instrumental in catalysing the demand for these applications. For instance, the potential use of wireless tags in identification documents or the co-ordination of the strategies of retailers.

Actions:

- Explore initiatives to co-ordinate strategies of retailers with the support of Commission services (ENTR, INFSO)
- Explore possibilities for co-operation with JAI for the use of wireless tags in passports

Privacy and users acceptance

To take a proactive (rather than defensive) attitude to gain consumer confidence in the use of wireless tags, since this is a key issue that will affect in the future not only wireless tags applications but many other Information Society technologies and services.

Actions:

- Request wireless tags industry to formulate clear recommendations, codes of conduct and guidelines on the appropriate use of these technologies, that can drive the debate.
- To explore with other Commission services (MARKT, SANCO) the challenges and options to address this issue.

Research on interoperable WLT-based systems

Participants considered the European Research programmes to be a good framework to address the new challenges posed by wireless tags applications as a model of future ambient intelligence systems. It should therefore be considered to include within the future calls and work-programmes of IST (e.g. call 3 or the WP2005) activities to research and demonstrate wireless tags based systems addressing interoperability, end user acceptance and catalysing the emergence of innovative applications in large sectors.

Actions:

- Explore the possibility of including specific actions on wireless tags applications in the coming calls.

Open workshop

To organise an open workshop with the objectives of analysing in detail the three areas of concern, providing specific recommendations for action, and building consensus among industry and users on the way ahead.

Background & rationale

Wireless tags (also known as RFID or smart tags) are emerging as a key enabling technology to allow identification of individual objects in the information society. However, to be successful, it requires addressing the remaining technological challenges, massive deployment and acceptance by the users.

RFID is a generic term for integrated circuits that use radio waves to communicate with a reader. Embedded in any possible consumer product they can be used in order to identify individual items. The main advantages with respect to other tagging systems (e.g. barcodes) are:

- RFID tags do not need to be in the line-of-sight of the reader to access their information. This reduces the need of human intervention and can allow fully automated processing.
- While other tagging systems only identify the manufacturer and the type of product, RFID tags identify individual items and can store additional information: they can distinguish between one can of soda and another, and could track historical data such as storage temperatures.
- They can be integrated into almost any physical item: everything can be tagged.

These characteristics will enable new applications with a tremendous potential to improve the efficiency of distribution, logistics and tracking of products and to enhance customer services. Triggered by larger production volumes and significant technology progress, prices have dropped drastically and mass deployment can be a fact in the coming years. This can have a significant societal impact that needs to be understood: from increased productivity to improved security and on the way individuals interact with technology. Just as a few examples:

- RFID tags will improve supply chain visibility and inventory tracking. Companies will be able to know exactly where every item in the supply chain is at any moment in time.
- Tags used for the identification of persons (in passports together with biometric information), bank notes, smartcards, or for border control will enhance security.
- The “Internet of things” can become a reality. Web-supported readers will allow items to be tracked and their information shared over the Internet, and items will exchange information between them leading to “intelligent” decisions (e.g., the packaging of a product modifies its expiration date according to outside conditions like temperature).

At the same time, mass deployment will require improvements in hardware, network software and protocols, and interfacing languages. International agreements on standards and spectrum allocation may be needed to assure world-wide compatibility, and users’ concerns on privacy invasion need to be addressed to assure the take-up of the technology.

Objectives of the Workshop

The objective of the workshop was to analyse, with the input of external experts, this technology and its potential applications:

- Analyse the socio-economic potential of wireless tags
- Identify possible barriers that may prevent their mass deployment
- Discuss visions of the future of wireless tags: technology and application prospects
- Analyse the need for a possible Commission action in this area.

The agenda, list of participants and copies of the presentations are included in annex.

Main issues discussed

Spectrum allocation: This was a main topic of discussion raised by all invited speakers and in the open discussion. RFID's operate in various frequency zones - Low Frequency (125-134 kHz), High Frequency (13,56 MHz), Ultra-High Frequency (860-930 MHz) and the 2,45 GHz band. While Europe has a leading position in smart tags operating in the Low and High Frequency ranges, the USA is the leader in smart tags applications in the UHF band, which is the most desirable band for operation of smart tags in terms of range and cost. Since the US and Japan do not impose the same restrictions as Europe on the usage of the UHF band, Europe could have a risk of a serious competitive disadvantage that could endanger the market potential of this technology.

The Commission services explained that the decisions relating to the allocation of spectrum in the EU are taken at the level of the Member States, with co-ordination efforts undertaken at CEPT/ECC level (in particular its Short Range Device Management Group) on the basis of international obligations (e.g. WRC Radio Regulations). The Commission can address spectrum needs arising from Community policies in the Radio Spectrum Committee and/or with the CEPT/ECC and its working groups.

Generally, the trend of flexible spectrum usage, that the EC fully supports, would suggest to avoid allocation of spectrum for a particular usage. RFID falling typically under the Short Range Devices category, they are foreseen to operate in the licence exempt bands, thus sharing spectrum with other applications and therefore requiring technical measures (e.g. power limits) to ensure a smooth co-existence. Furthermore, it was pointed out that given the allocation of certain bands in UHF for mobile cellular telephony in Europe (but not in the US), the bands chosen for operating RFID are not identical in the US and in Japan (860-930 MHz) as compared to the European choice (862-870 MHz). The question thus is how tolerant are RFID devices in terms of scanning frequencies. Experts indicated that UHF RFIDs can operate over a large spectrum range, therefore the different choices of bands in Europe and in the US do not seem to constitute a technical problem. However, they pointed out that in Europe power limits imposed on RFID scanners are about 10 times stricter than in the US, i.e. requiring scanners to be positioned much closer to tags given the comparative weak scanning signal. This in practice limits the practical applications (e.g. spatial constraints when moving the tagged goods).

Ultra Wide Band (UWB) technologies were mentioned by the invited experts as a promising alternative to be explored. However, it was also stated that although the use of UWB technologies sounds ideal for smart tags applications this might not prove to be the case in practice.

Costs and economic impact: A second issue that came through strongly was the cost of the technology versus the economic impact that can be achieved. All speakers stressed that for this technology to become affordable for the tagging of consumer products, prices per tag have to drop bellow the 5 Eurocents threshold, which will require volumes of 10 billions tags per year. Reaching these figures requires tagging per item and not per case or pallet. It was also recognised that this target may be achieved by 2005. On the other hand, the benefits attainable potentially far outweigh the cost factor. Some examples: Procter & Gamble estimates that RFID will allow them to cut their inventory by 40 % or 1,5 billion Euro; Coca-Cola expects that the use of RFID would eliminate the 7 % loss of sales due

to out of stock goods. Additional obstacles for the wide adoption of smart tags were mentioned, like the lack of low cost / high bandwidth interconnections between sites which is already delaying the deployment of this technology, or the existence of key patents that due to royalty rights maintain the price of the tag at a too high level (patent pooling has been suggested as a possible solution to this problem). Moreover, the lack of basic infrastructure for RFID technologies in Eastern Europe was also of concern.

User privacy: Privacy concerns in the deployment of RFID stem from the possible links that could be established between the tracking of physical objects and the persons that carry / buy them. Different opinions were expressed on user privacy as a major concern for mass deployment. The invited speakers did not express this as such and indicated that many revolutionary consumer products, such as the mobile telephone and retail loyalty cards, raised privacy concerns that eventually were overthrown by the benefits of using them. The 'kill switch', which enables a retailer to de-activate the smart tag once the purchased item leaves the store, was perceived as a minimum requirement to comply with consumer privacy issues. However, it became apparent during the open discussion that many obstacles exist which may hinder mass deployment of the technology due to privacy concerns. The limits in the collection, use, mining and dissemination of collected data seems to be still uncertain, and there is a need to agree on codes of conduct, guidelines and clear recommendations on the appropriate use of these technologies. The seriousness of this issue was also illustrated by some market developments such as the delay of RFID implementations by companies like Benetton and Wall Mart (and as recently became known Gillette).

Security related applications: The potential of tags to keep personal information can also be used to increase security levels, for example, in the identification of persons or transactions. From 26/10/2004 on, the US authorities will require all non-Visa travellers to the US to have passports with embedded smart tags that contain biometrics information (either handprint or face contour information). The selection of the biometrics information coded in these smart tags will obviously affect the market of the readers. The same ISO standard (ISO 14443) that will be used in passports has been adopted by Visa and Mastercard for future credit cards.

Self configuration of products and competition issues: Smart RFID devices can make products smarter. Some examples: Tagging pharmaceuticals can reduce the risk for subscription of conflicting medicines. A printer can recognise the ink cartridge that is in use and adjust the configuration to obtain optimal performance. However, when misused, smart RFID devices can also hinder the entrance of competitors (e.g. the printer will only work with original cartridges from the printer manufacturer…)

Interoperability and standards: This issue was highlighted by most speakers with a particular emphasis on the need of agreements between the EU, USA and Japan. There are many actors involved in the development and deployment of smart tags and the efforts in this moment are dispersed. However, mass deployment will be mainly done by global

companies that are targeting global customers and require solutions that can be applied world-wide. Some different aspects which will need wide agreement were mentioned, e.g., frequency allocation, APIs, or product codes. From the application side, it was mentioned that supply chain efficiency can only be achieved with agreed standards at hardware and software levels, and that all retail sectors should be encouraged to adopt the specifications of the AUTO ID Centre as a complete and viable standard. With respect to product codes, AUTO ID Centre has proposed the Electronic Product Code (EPC) for identification, which EAN agreed to promote as a UN standard. For the tracking AUTO ID has created a mark up language PML that is based on XML. An alternative was proposed for using IPv6, which provides 10,000 addresses per square meter, giving almost unlimited IP addresses and avoiding the need of version numbers to upgrade the product codes for future use. The combination of IPv6 and Ultra Wide Band (UWB) technologies was mentioned as a promising path to be explored which could revolutionise the area and where Europe could establish a strong competitive advantage.

Evolution and future prospects: Technology improvements (low power and higher circuit density) were mentioned as drivers to extend functionalities and performances while decreasing costs. Network centric solutions (read-only tags) will be first introduced followed by distributed architectures supported by tags with increasing memory sizes that could store historical data (goods will carry their own history) and embedding various sensors (pressure, temperature, …). In the long term, an introduction of ad-hoc networking concepts with smart tags talking to each other and exchanging information between them can be expected. As far as the evolution of tag readers is concerned, manufacturers aim towards low power consumption architectures that would enable them to incorporate readers in portable, battery operated devices like mobile phones or PDAs. These trends will open almost unlimited application areas.

Annexes

1) Agenda

2) Participants

3) Presentations

4) Web addresses

1)

WIRELESS TAGS – PROSPECTS AND OBSTACLES

INTERNAL WORKSHOP

JULY 9, 2003

CENTRE A. BORSCHETTE, ROOM 3A.

RUE FROISSART 36, BRUSSELS.

Agenda

- *15:00* *Introduction and objectives of the workshop*
  - Commissioner Liikanen
- *15:10* *Socio-economic and technology challenges and opportunities*
  - *Economic and efficiency impact of the use of wireless tags.*
    Joachim Schaper, VP EMEA and Director CEC Karlsruhe, SAP
  - *Technology and application prospects*
    Andrea Cuomo, Corporate VP for Advanced System Technology, ST Microelectronics
- *15:50* *Opportunities for mass deployment of wireless tags: user benefits, security, consumer acceptance and standards*
  - *Applications for identification and security: technologies and standards*
    Timo Lindstrom, President, Rafsec Oy
  - *Creating an Internet of things: users' concerns and standardisation issues*
    Kevin Ashton, Steve Hodges, Associate Director AUTO-ID Center, Cambridge
- *16:30* *Break*
- *16:45* *Discussion forum* (Chairperson : Peter Zangl)
  - Is there a need for an European Commission action ?
  - Next steps
- *17:45* *Closing of the workshop*
  - Peter Zangl

2)

External participants:

- Mr. Lutz Heuser, VP SAP Corporate Research and Mr. Joachim Schaper, VP EMEA and Director CEC Karlsruhe, SAP AG.
SAP is involved in the development of RFID solutions for large retailers and has announced that it will integrate RFID into their Supply Chain solutions.

- Mr. Andrea Cuomo, Corporate VP for Advanced System Technology, ST Microelectronics
ST Microelectronics' strategy is to become one of the main semiconductor players of the RFID market by pushing devices compliant with ISO standards.

- Mr. Timo Lindstrom, President, Rafsec Oy
Rafsec specializes in the production and development of card, ticket and label transponders, based on RFID.

- Mr. Kevin Ashton, Executive Director AUTO-ID and Mr. Steve Hodges, Associate Director AUTO-ID Center, Cambridge
Auto-ID Center is a unique partnership between almost 100 global companies and five of the world's leading research universities including MIT in the US and Cambridge in the UK. The organisation is building a global infrastructure that will make it possible for computers to identify any object anywhere in the world instantly.

3) Presentations

1) J. Schaper, SAP
2) A. Cuomo, STM
3) T. Lindstrom, Rafsec
4) S. Hodges, Auto ID Centre

4) Webaddresses

SAP Company Profile

http://www.sap.com/company/investor/aboutsap/

Information on technology offer

http://www.sap.com/company/press/press.asp?pressID=1330&printview

ST MICROELECTRONICS Company Profile

http://us.st.com/stonline/company/index.htm

Information on speaker

http://us.st.com/stonline/company/bio/cuomo.htm

Information on technology offer

http://us.st.com/stonline/bin/hilite.exe?file=/stonline/prodpres/memory/eeprom/eep_cmc.htm&words=RFID

RAFSEC Company profile

http://www.rafsec.com/printer/company.htm

Information on speaker

http://www.rafsec.com/contact/cont_main.htm#contact

Information on technology offer

http://www.rafsec.com/printer/product.htm

AUTOID Company profile

http://www.autoidcenter.org/aboutthecenter.asp

Information on speaker

http://www-mmd.eng.cam.ac.uk/people/seh/seh.htm

Information on technology offer

http://www.autoidcenter.org/aboutthetech_whyfocus.asp

http://www.autoidcenter.org/abouttheteh_creating.asp

http://www.autoidcenter.org/abouttheteh_identifying.asp

BACKGROUND INFORMATION

Privacy issues:

http://www.eetimes.com/issue/fp/OEG20030428S0019

Benetton

http://www.benetton.com/press/

http://209.182.28.192/article/mailtofriend/471/1/1/ (Information on Benetton)

Application areas

http://www.aimglobal.org/technologies/rfid/

http://www.aimglobal.org/common_applications_rfid.asp

Texas Instruments

http://www.ti.com/tiris/docs/news/news_releases/2003/rel6-2-03.shtml

Michelin

http://www.rfidjournal.com/article/articleview/269/1/1/

http://www.semiconductors.philips.com/markets/identification/articles/success/s52/

Gillette

http://www.rfidjournal.com/article/articleview/258/1/

Toyota

http://www.semiconductors.philips.com/markets/identification/articles/success/s48

Nestlé

http://www.semiconductors.philips.com/markets/identification/articles/success/s48

Dell

http://www.semiconductors.philips.com/markets/identification/articles/success/s49

Singapore Airlines

http://www.semiconductors.philips.com/markets/identification/articles/success/s26

Tesco

http://www.vnunet.com/News/1138048