INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Report

ITU-T Workshop on Networked RFID: Systems and Services

(CICG, Geneva, 14-15 February 2006)

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Executive Summary

Prior to the meeting of ITU-T Study Group 16, the Lead Study Group on multimedia terminals, systems, applications and ubiquitous applications, ITU-T hosted a workshop on 'Networked RFID: Systems and Services' at CICG in Geneva, Switzerland, 14 - 15 February 2006.

Radio-Frequency Identification (RFID) enables data to be transmitted by a tiny portable device, called a tag, which is read by an RFID reader and processed according to the needs of a particular application. The development of RFID systems creates new possibilities for the support of object-to-object communications. Analysts predict that RFID will revolutionize areas of industry including supply chain management, security and mobile telecommunication services. Additionally, RFID is expected to play an important role in the realization of the Ubiquitous Network Society. All this will create a yet un-quantified demand on telecommunication networks.

Currently, the market for RFID standards is extremely fragmented. Special standards for certain limited fields of applications exist as well as quasi-proprietary or proprietary standards. Many RFID applications still lack global standards for data formats, compatibility, interoperability, interference problems, personal information protection, authentication, key management and others.

ITU-T organized this event to focus on the use of RFID technology in networked environments, and review international standardization. Particular emphasis was given to the impact that networked RFID applications will have on telecommunication networks, especially on network and service capability requirements and interworking aspects.

- Present the status of RFID technology and identify future trends
- Review current and future applications, services and business models leveraging networked RFIDs (NRFIDs)
- Identify NRFID aspects relevant to telecommunications (services and network capabilities, architecture, QoS, performance, security, etc.)
- Analyse how far existing standards can support NRFID applications and services, and identify where enhanced or new standards might be needed
- Identify elements for a roadmap for a standardization framework, including the clarification of the role of applicable SDOs, forums and consortia

During the 2-day workshop, 123 representatives from 25 countries from standards bodies, telecoms service providers, vendors and academia attended the event.

This workshop emphasized the importance of RFID as part of a larger vision of future technological ubiquity and asked ITU-T to take RFID into account in its NGN work, to examine network and service architecture, requirements for machine-to-machine communication, security, information service protocols, interoperability, data format, radio frequency spectrum allocation, network performance and quality of service in its technical study groups.

As far as security is concerned, consumer protection, namely privacy and data protection, has hindered user acceptance and so addressing this area is seen as a prerequisite for public acceptance. ITU has much experience in this field, particularly in the important area of alignment with policy and regulatory issues.

Global frequency harmonization is a hindrance according to some experts towards achieving supply chain efficiencies and security. This is a topic expected to be raised at the upcoming World Radiocommunication Conference (WRC), Geneva, 2007, and workshop participants suggested closer coordination between ITU-T and ITU-R in frequency allocation and standardization.

ITU is also expected to help coordinate ongoing standards work in the field in order to avoid work duplication. Among the groups operating in the area are ISO, ETSI, IEEE, EPCglobal and Near Field Communication Forum. ITU will immediately follow-up on workshop results in its study groups, technology watch, and TSAG, to leverage on the existing momentum.

For more on RFID: ITU-T's Technology Watch, ITU's Strategy and Policy Unit (SPU) report, the Internet of Things). All presentations and an audio archive of the event are also available at the workshop website at: http://www.itu.int/ITU-T/worksem/rfid/index.html.

A small exhibition was hosted during this event in CICG. Three companies, namely NIDA (National Internet Development Agency) of Korea, Information Security Research Division of ETRI, Korea and SOLID - Solutions en Identifications SA from Switzerland, participated in the exhibition.

Highlights of Sessions

Technical Presentations in Opening Session

Mr. Tony Rutkowski introduced the ITU-T work on RFID. He reported that 45 RFID-related contributions have been submitted to ITU-T in the past 9 months. A search of RFID on the ITU website turns up 17,300 references, which is comparable number with 41,500 references for next-generation networks (NGN), which has received much more work and attention. He also emphasised that ITU-T is looking at the role of the ITU-T itself, the ITU and other fora to collectively do the things that need to be done to make the marketplace for object network communications happen.

Mr. Craig Harman introduced various ISO and JTC 1 (ISO/IEC) Technical Committees, Subcommittees, and Working Groups who have been addressing RFID standardization for several years, well-implemented RFID technical standards they have developed in the areas of Technology, Conformance, Data Structure, Network, and Application standards, and on-going work in ISO TC8, TC 104, TC122, TC 204 and ISO/IEC JTC 1.

Mr. Henri Barthel introduced the EPCglobal organization, the standard status and plans, as well as the key drivers to implementation. EPCglobal Network combines radio frequency identification (RFID) technology, existing communications network infrastructure, and the Electronic Product Code™ (a number for uniquely identifying an item) to enable accurate, cost-efficient visibility of information in the supply chain.

Session 1: Introducing RFID - Visions and Implications

In this session, speakers from ITU, European Commission, Japanese Ministry and an US company presented their visions of RFID from diverse perspectives. They all share in common that RFID is part of a larger vision of future technological ubiquity. RFID combined with sensors & developments in nanotechnology is creating an "Internet of Things". The future Internet will be ubiquitous, meaning "universal, user-oriented, and unique", but also "alive". It will be deployed by end-users and not necessarily centrally managed ("paintable").

Speakers in this session also foresaw that the pervasive nature of RFID comes with key challenges from standardization, governance of resources and consumer protection, namely privacy and data protection. Standardization remains fragmented, interoperability and interference keys hurdles. In addition, user acceptance suffers from concerns over consumer privacy, data protection and security

Key players and key issues as introduced in this session include:
- The European Commission has set up an Inter-service working group, for the horizontal coordination of EC activities, and for co-operation with national authorities and standards-setting bodies. Many areas of discussion in Europe include: standards, spectrum, governance, data protection/privacy, ethics, IPRs, trade, health, environment etc…
- In Japan, R&D focuses on: 1) cheaper and smaller devices; 2) convenience; and 3) international cooperation.

The workshop deemed that ITU can play an important role in furthering international standardization efforts in addition to raising awareness about the challenges and opportunities of this exciting technology. During discussion in this session, ITU is suggested to look at the issues as:
- For efficient use of radio spectrum, data prioritization will be key.
- Challenges for item-level tagging: cost of tags, tag power limit, protocol and Interference between readers

Also ITU is expected to focus in standardization of communications:

- between tags and readers
- for obtaining information through networks by the reading of tags on individual things
- for reliable authentication and privacy protocols
- RFID holds great promise for the
  future "ubiquitous network society"

Session 2: RFID Applications – A Sectoral Approach

Several key practical applications of NRFID in different industry sectors such as food chain, maintenance of telecommunication networks, container monitoring & transport, automotive industry and e-health have been described in this session. These applications clearly show the benefit of NRFID applications in product traceability, safety control, efficient supply chain management & logistics and secure medical healthcare. Some of presentations reviewed a security concern relating to network access to the data and also a global harmonization in RFID standards and regulations.

It was concluded in this session that:
- In the specific business industry, one RFID solution cannot satisfy the all needs of several applications across a number of different industry sectors. For example, it has been pointed out that EPC standard is not sufficient for the automotive industry needs. However, industry users do expect the global harmonization in standards.

- The base building block for NRFID is the common platform potentially managed by service providers with appropriate levels of access/security for industry users.
- In the several NRFID applications it is clear that there is a strong need for unique ID numbers for addressing many billions of items without compromising privacy issues.
- Having so many tagged items presents a potential security and privacy risk. IT security and protecting privacy are fundamental societal issues and we should ensure that NRFID does not propagate further problems.

Session 3: RFID and New Business Models

Several service providers described in this session how they intend to include NRFID applications in their respective portfolio, including considerations on business models and their impact on technical standards. These descriptions clearly show strong impact on new business opportunity in mobile RFID service, machine to machine application and location identification. They also show the expectation of the efficient values and benefits of the new business models according to the NRFID technology being used in the industry, the leisure and the culture. It has been surely pointed out that NRFID is a possible extension of the existing network services and these new services must pay clear attention to "security and privacy" issues.

Conclusions of this session:
- In the case of the new global business models with NRFID, it is not clear what the major subjects are needed to be covered.
- In the case of the new business models with NRFID, different business approaches may be necessary according to local market situation.
- For NRFID to succeed, the key industries must work together, such as manufacturing, IT industry and telecom to achieve the new business models.

Session 4: Security issues in RFID

This session comprised of presentations on security issues in RFID and sensor networks, Authentication and privacy capabilities suitable for RFID, and Malicious Traceability within RFID Systems.

Conclusions of this session:
- Light weight security protocol should be developed to provide the confidentiality, anonymity, un-traceability and forgery protection to counter all types of threats in network-based RFID. Moreover, light weight cryptographic primitive should be developed for the sensor network.
- Among the possible cryptographic algorithms, such as secrete key algorithm, public key algorithm, and dedicated algorithm, for implementing the required security goals, the dedicated techniques may be well-suited to RFID tags and offer a safe foundation.
- Preventing from malicious traceability should be provided for privacy protection of RFID, especially for the passport application.
- The problem is a lack of insufficient harmonization with other SDO and forums in the area of security and privacy protection for RFID.
- In general, it is recognized to consider the security and privacy protection issues in each applications using RFID.
- However, key management and scalability are identified to be very challenging problems to be explored.

This session emphasized that security and privacy standardization should be aligned or harmonized with the policy and regulation issues. Especially, the cooperation with academies is very important to develop the security and privacy protection technology in RFID and sensor network environment. It is necessary for ITU-T to collaborate with a number of SDO, forums such as ISO Expert Group, EPCglobal, UID, etc., in the area of security and privacy. Some standardization items identified for SG17 or other SGs of ITU-T as follows:
- Security framework for RFID
- NGN Security architecture for network aspects of identification (including RFID) services and applications
- Various authentication protocol including password access protocol to lock or kill an RFID tag for privacy control
- Privacy management framework and protocol based on a user profile
- Adult confirmation technology
- Protocol for countering malicious traceability
- Secure data exchange protocol for application.

Session 5: Networking Architecture and Capabilities of RFIDs

This session sought to identify architectural models for RFID services from a networking perspective, identifying, for example, the various different network configurations between end-user devices and RFID servers. Speakers from EPCglobal, Cisco, ETRI Korea, Mitsubishi and Siemens shared their approaches to answer two questions: "How do we network the RFID revolution?" and "How does RFID networking fit into the IPNGN Framework?"

To summarize the current RFID networking architecture:
- RFID Technology relying on RF transponders to automatically retrieve data remotely using RF signals
    - Active RFID elements use their own power source to send data
    - Passive RFID elements use power from readers to activate
- Presently four main frequency bands used in RFID systems

- Low Frequency band: 125/134 KHz
- High Frequecy band: 13.56 MHz
- Ultra High Frequency band: 800-900 MHz
- Microwave band: 2.4-5.8 GHz

- RFID typically imbedded in miniscule ASICs attached to objects to be tracked
  - RF readers detect the signals to be processed and networked

RFID networking was found as an evolutionary trend: very low cost/complexity systems for mass market "smart cards" and electronic "bar codes" with imbedded intelligence.

During this session, some of RFID's societal impacts were identified as hindered its wider acceptance:
- Some consumer backlash against ubiquitous use of RFID tags
  - Consumer groups: "smacks of Big Brother are Watching You!"
  - "Do you want your underwear to tell everyone where you are?"
- Are RFIDs simply smart electronic "bar-codes" or something more?
  - Privacy concerns – Who polices personal information in RFIDs?
- Security implications of RFIDs/smart cards – nothing is infallible
  - If codes are cracked, what will happen then?
  - Who monitors what information goes in RFID tags?
- Regulatory aspects
  - privacy protection versus commercial benefits
    - achieving the right balance

Though whether RFID networking architecture approach needs to address these negative perceptions remains unclear, cooperation with ITU-R and ISO and ITU-T is seen as essential and RFIDs need to be essential part of NGN being defined in ITU-T and elsewhere.

Session 6: Future trends in NRFID and Ubiquitous Networks

In this forward-looking session, speakers introduced advanced research projects taken in NIST, Siemens, HEVs of Switzerland and Tokyo Univ. of Japan on the future trends and evolution in ubiquitous services and applications.

Mr. Kang Lee from NIST mentioned that RFID are going to play a key role in automated universal identification system for accessing, securing, and tracking assets, personnel, equipment, products throughout the supply chain. Combining RFID devices and sensors could expand the overall functionality and capability of the above applications. IEEE is currently developing a suite of smart and wireless sensor standards, IEEE 1451. This set of standards will make it easier for transducer manufacturers to develop smart devices and to interface those devices to networks, systems, and instruments by incorporating existing and emerging sensor and networking technologies. We are exploring effective integration of RFID and smart and wireless sensor networks in a standard fashion aiming to facilitate interoperability.

Mr. Daniel Evers from Siemens divided RF ID technology basically into two segments: Low-cost systems for the mass market and advanced tags for special application scenarios, where more functionalities than pure identification are required. Following this way, it becomes obvious that RF ID and wireless sensors are quite similar and strongly related. His presentation gave an overview over Siemens' research activities dealing with advanced functionalities and capabilities like robustness against temperature and mechanical stress, high reading distances, localization features or the combination of RF ID and sensors.

Mr. Koshizuka from Tokyo Univ. specially introduced Japanese government's plans to facilitate the

national infrastructure for ubiquitous information services using NRFID and clarified the importance of standardization for these future trends.

In conclusion, this session call for the following actions:
- Standardization of active tags, ID and all aspects of RFID technology
- Plan interoperability beyond sensor
- Security and privacy mechanism to help build public confidence

Session 7: Panel – Wrap-up

At the end of the workshop, a wrap-up panel session chaired by Mr. Pierre-André Probst with chairmen from previous sessions reviewed the outcome of the workshop and discussed how to focus effort on standardization for RFID. Key conclusions from this and all the other sessions are identified below.

Workshop Conclusions and Recommendations

Participants agreed that standardization in the field is essential in order to roll out the technology on a global scale. Many new work areas have been identified for ITU as a result of the workshop, giving further momentum to work already started in some ITU-T Study Groups. The tentative list of standardization topics of common interest from this workshop is as follows:

- Scope: address both RFID and Sensor Networks
- Business models (e.g. service broker architecture issue)
- Architecture (network, service stratum) for distributed applications (NGN compliance, etc)
- MM service/network requirements and capabilities to support present and future applications (B2B, B2C, C2C)
- Signaling and control protocols
- Ubiquitous information service protocols
- Security (confidentiality, privacy, cryptography, etc)
- Interoperability, roaming
- Data format
- Reader management issue
- OID Systems (coherent, scalable, trusted, rapid resolution of identifier, interoperability)
- Content negotiation issues
- Performance and QoS
- RF aspects (spectrum allocation, intra and extra RFID compatibility), especially global frequency harmonization in regulation
- common terminology among different SDOs

A clear key conclusion of the workshop is that there needs to improve and strengthen cooperation among key players include:

- ITU:ITU-T, ITU-R, ITU-D
- ISO/IEC JTC 1: SC6, SC17, SC27, SC31
- ISO:TC104, TC122, TC204
- ETSI
- IEEE
- EPCglobal
- NFC
- Regional Key Players

Future work in ITU-T study groups should be done cooperatively with other standards development organizations and not to duplicate their work.

Global frequency harmonization in regulation was identified as an import problem and this workshop called upon closer work between ITU-T and ITU-R in this area of frequency allocation to have a global standard that uses internationally organized frequencies, which would greatly improve business efficiencies and port security.

Participants from developing country called upon ITU-TSB to take consideration of needs from developing countries on RFID in this workshop.

ANNEX
WORKSHOP EVALUATION

Of 123 participants, 41 returned the filled evaluation form. From the respondents, 32% indicated an overall ranking for the Workshop as "very satisfied", 39 % as "satisfied and 5% as "neutral".

1= very dissatisfied, 2= dissatisfied, 3= neutral, 4= satisfied, 5= very satisfied

The average overall ranking of the Workshop was: 4.46

56 % of respondents would welcome another ITU_T workshop on the same subject in the next 1-2 years