

Contract Number 235542

RACE networkRFID

FP7 Thematic Network
ICT-PSP: a European concerted effort on RFID

D2.2 – Technology and application Roadmap

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Dissemination Level		
PU	Public	PU
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Preface

RACE Network work package 2, Task 2.2:

“Technology and application Roadmap“

The technology roadmap aims to show the state of art, the research and the expected development of the Radio Frequency Identification technology and all other significant technologies related to RFID.

Procedure and method:

- Collection of all relevant terms and technologies related to RFID
- Check availability on the market
- Selection of the relevant terms and technologies
- Coordination and consultation with the network
- Working out the draft
- Organization of a workshop with the members in cooperation with Robotica in Bilbao
- Coordination and consultation with the network
- Include the feedback

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1. Approach

Various technologies and basic approaches lead to a complex market situation. In association with the Internet of Things RFID is the major technology, but many others are also significant and must not be ignored. Continuing technological developments lead to a greater importance of the interaction of technologies related to RFID.

The second part of the work package is the technology roadmap which shows the development from a different scope. It displays not only the research of the RFID technology, but also the development in correlation with important technologies. It points out which technologies are already available or in which stage of development they currently are.

The different technologies and concepts have a dissimilar degree of research. The closer they are arranged at the center, the greater is the level of development. An arrangement close to the edge means that the technology is not yet fully developed.

Overall, a clear overview of the RFID environment is shown not only for providers, but also for politicians and the public. The potential users get an overview about the current state of the art and will be able to decide which technologies they could use for their applications.

In this context the RACE network is meant to increase the awareness and development especially of RFID in connection with related technologies.

The preliminary first version of the technology roadmap is separated into 3 parts: RFID, related technologies and concepts.

The sector RFID shows, amongst other things, the different device complexities. They range from simple devices with a unique identification number to interacting devices, which are able to communicate with each other. Furthermore some relevant terms are mentioned. All present and upcoming RFID related technologies are listed in the technology sector of the roadmap. The last sector deals with the concepts related to RFID and shows in which stage of development they currently are. The result is available at <http://www.openid-center.de/race>.

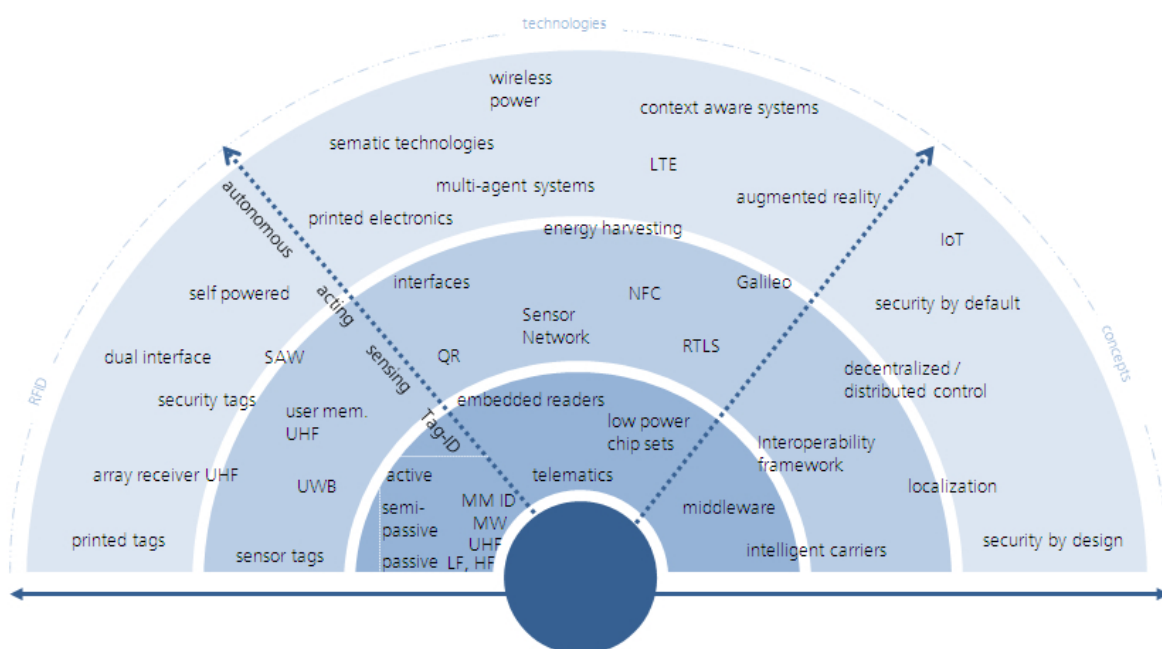


Illustration 1: Technology Roadmap
<http://www.openid-center.de/race>

2.1 RFID

Acting: Acting RFID devices are able to act and react autonomously.

Active: Active Tags contain a battery and are able to transmit signals independently.

Array receiver UHF: An Array Receiver functions as a single point of data collection, provisioning, command and control, and integration with enterprise systems. It operates across the entire UHF frequency band (868-MHz to 928 MHz).

Autonomous: Autonomous RFID devices are able to communicate with each other.

Dual interface: A Dual Interface provides read and write access by two different interfaces. It gets both, the energy and the data stream from the RF reader and enables on-board energy savings and provides easy and convenient remote access to electronic product parameters.

HF: High frequencies (HF) are frequencies between 3 and 30 MHz.

LF: Low frequencies (LF) are frequencies (RF) between 30 and 300 kHz.

MM ID: Millimetre wave identification (MMID) is an extension of the RFID concept to millimetre wave frequencies, typically 30-300 GHz. At mm waves high data rate communication can be easily implemented.

MW: Microwave frequency RFID usually operates at 2.45GHz or 5.8GHz and offer high data read rates.

Passive: Passive Tags do not have an own power supply and draw their electrical power from radio waves.

Printed tags: Printed Tags are functional RFID transponder which are generally printed on materials such as silicon, ceramic or plastic.

SAW: A surface acoustic wave (SAW) is an acoustic wave traveling along the surface of a material exhibiting elasticity. SAW sensors are based on the fact that the propagation properties of SAW substrates are inherently sensitive to several physical quantities, such as temperature, strain, and pressure. The changing propagation properties typically affect either the resonance frequency (resonance sensors) or the time response (delay-lines) of the SAW device.

Security tags: Security tags provide security features, such as secure data access or security on demand.

Self powered: A Self Powered RFID device provides itself with power by using [energy harvesting](#).

Semi-passive: Semi Passive transponders have an additional power source (e.g. a battery) for the memory or supply of the sensors. However, this power source is not used for data transmission.

Sensing: Sensing RFID devices are able to record or transfer a status.

Sensor tag: Traditional RFID provides item and product visibility within the supply chain. This visibility can further be translated into actionable data and predictive changes with additional information attained through sensors. RFID transponders with sensor functionalities (active, semi-passive, passive) are being developed, which will further enhance RFID usability and applications. As an example, they will allow the automated monitoring of transit and environmental conditions through the supply chain.

Tag-ID: Tag ID is the unique identification number of the tag.

UHF: Ultra High Frequency (UHF) designates a range of electromagnetic waves with frequencies from 300 MHz to 3 GHz. Most UHF RFID systems operate in the 858 - 930 MHz frequency band.

User memory UHF: Extended User memory supports applications where users cannot count on a database connection. It offers a portable, but private database to travel with the tag.

UWB: Ultra-Wideband (UWB) is a radio technology that can be used at very low energy levels for short-range high-bandwidth communications by using a large portion of the radio spectrum. Recent UWB applications target sensor data collection, precision locating and tracking applications.

2.2 Technologies

Augmented reality: Augmented reality is a concept in which a view of reality is modified by a computer and allows the user to see the real world, with virtual objects superimposed upon or composited with the real world. Therefore, Augmented Reality supplements reality, rather than completely replacing it. AR systems combine real and virtual and are interactive in real time.

Context aware systems: Context aware systems are able to sense their environment. They use information related to the context and adapt their behavior accordingly.

Embedded readers: Embedded Readers are RFID modules which are integrated into a module.

Energy harvesting: Energy harvesting is the conversion of energy from external sources (e.g. kinetic energy, wind energy, solar power). This technology is frequently used to power small, wireless autonomous devices, like those used in wearable electronics and sensor networks.

Galileo: Galileo will be Europe's own global navigation satellite system, providing a highly accurate, guaranteed global positioning service under civilian control. It will be inter-operable with GPS and Glonass, the two other global satellite navigation systems.

Interfaces: An Interface is a defined transition point between two or more components or software programs. The best possible compatibility can be realized through standardization. Typical interfaces of a personal computer are for example USB, eSATA or Firewire.

Low power chip set: Low power chipset is a chipset with low energy requirement.

LTE: Long Term Evolution is a new standard in mobile network technology. It offers high data rates and short connection times.

Multi-agent system: A multi-agent system (MAS) is a network of software agents that interact to solve problems that are beyond the individual capacities or knowledge of each problem solver.

NFC: Near Field Communication (NFC) is a new short range wireless connectivity technology that is compatible with earlier HF RFID technologies and enables simple and safe two-way interactions between electronic devices. It uses magnetic field induction to enable communication between electronic devices and offers an intuitive and simple way of data transmission. NFC operates in the standard, globally available 13.56 MHz frequency band and supports data transfer rates up to 424 kbps.

Printed electronics: Printed electronics are electrically functional devices which are generally printed on materials such as silicon, ceramic or plastic. Thereby functional materials in liquid or pasty form are printed, instead of printing inks. The characteristics are a simple, flexible and a cost efficient fabrication.

QR: Quick Response (QR) is a corporation-wide strategy to decrease the response times, when the marked development (i.e. the demand) changes unexpectedly. It aims to realize short reaction and lead times along the supply chain within the enterprise and improves quality and reduced cost.

RTLS: Real Time Locating Systems are automated systems that continuously monitor the location of assets and people.

Semantic technologies: Real Time Locating Systems are automated systems that continuously monitor the location of assets and people.

Sensor network: Spatially distributed autonomous sensors to cooperatively monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants.

Telematics: Telematics is the use of information and communication technology to send, receive and store data from telecommunication devices.

Wireless power: Wireless power is a cable-free transmission of electrical energy from a power source to an electrical load without interconnecting wires.

2.3 Concepts:

Decentralized/Distributed control: Decentralized control is a mode of control which is not controlled by a central computer. The elements communicate with each other and decide for themselves.

Intelligent carriers: Intelligent carriers are reusable containers or charge carriers which are able to communicate by integrated communication interface. The communication takes place through RFID or sensor technology. The range of intelligent carriers reaches from a simple box with passive RFID tag to a pallet with an integrated active tag and Global System for Mobile Communications (GSM).

Interoperability framework: Interoperability framework is a standardized set of concepts, practices and criteria for facilitating the ability of different devices, systems and organizations to work together (inter-operate).

IoT: Internet of Things (IOT) is an integrated part of Future Internet and could be defined as a dynamic global network infrastructure with self configuring capabilities. It is based on standard and interoperable communication protocols where physical and virtual "things" have identities, physical attributes, virtual personalities and use intelligent interfaces. They are seamlessly integrated into the information network.

Localization: Localization is a technique for determining the location of a wireless transceiver and thereby the position of containers or unit loads at the time of the identification or otherwise registration.

Middleware: A Middleware is software that connects applications or software components. It is used to communicate and pass data between the applications.

Security by default: Default configuration settings are the most secure settings possible.

Security by Design: Security by design means to take into account security aspects in the design of a system or device.

3. LIST OF ILLUSTRATIONS

Illustration 1: Technology Roadmap (2010)

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www.openid-center.de/race