
What is RFID?

RFID Info Day

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What is Radio Frequency Identification (RFID)?

- **RFID** is the generic name for any system that uses radio signals for automatic, contactless and non-line of sight identification of objects, animals or persons that carry a tag.
- There are many types of RFID systems depending on the complexity of the components, the type of radiofrequency signal used, the application requirements, etc.
- Some RFID systems will replace barcode scanners as they allow automatic identification and they can read several tens of items per second.

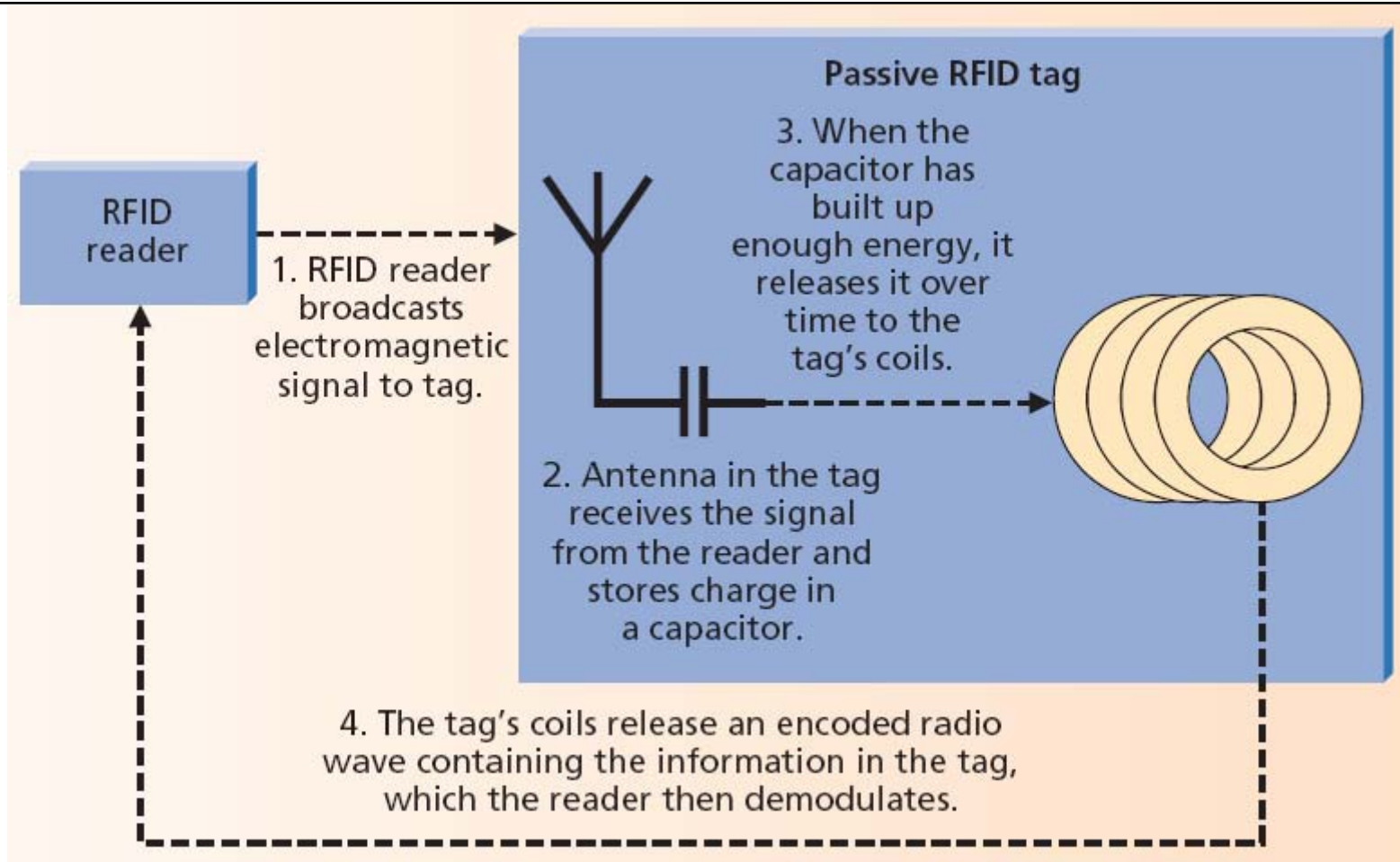
Components of an RFID system

- A basic RFID system consists of the following elements:
- A **reader**, which is the element that requests the information from tags.
- A **tag** is the element that responds to the readers queries by sending appropriate identification codes or signals.
- An **application** and **middleware** components that process the information captured by the reader and manage all the processes.

How does it work?

- In an RFID system, when a tag comes close to the radio coverage area of a reader, and the reader is requesting for information, then the tag proceeds to immediately send an identity signal or code contained in a small memory chip inside the tag.
- Both the reader and tags have an antenna to appropriately send and receive radio signals.
- The reader has more processing capabilities than the tag, and once it receives the requested information it sends it to an application or middleware platform to be displayed to the final user.

How does it work?



History

- RFID is not new. Its origins date back to the 40s, during the second world war, where it was used to identify friendly or enemy aircrafts.
- It was not until the late 80s and early 90s that RFID saw its first commercial applications using LF (Low frequency) and HF (High frequency) components. Passive tags (without battery) were introduced
- Late 90s witnessed the standardization and massive production of simple RFID systems for applications such as smart tickets, access cards, highway toll payments, etc.
- Over the last few years, RFID systems in the UHF (Ultra high frequency) band have reduced their size and cost so as being able to deploy a tag at the item level. However, security concerns and middleware costs are the main obstacles for their massive deployment.

Types of RFID systems (complexity of the tags)

➤ Active tags

- The tags are battery powered, thus giving them more processing capabilities for security and sensing applications.
- They can be read to several meters away. (20 to 100)
- However, the batteries only last for about a year.
- The cost is relatively high.

➤ Passive tags

- They do not require batteries. Instead they pick up power from the radio signal sent by the reader.
- They have several years of life time.
- Their costs are relatively low, which make them suitable for tagging any single object.

➤ Semi-passive tags

- They are battery assisted for only a few operations such as initializing the chip.

Types of RFID systems (frequencies used)

➤ Low Frequency (LF)

- Tags are larger.
- Their speed is limited.
- Their range is very small. Less than 10 cms
- The cost is relatively high.
- Suitable for item management and animal tracking.

➤ High Frequency (HF)

- The tags are smaller than LF.
- Their speed is higher than LF
- Suitable for smart tickets applications, access cards and item level.
- Relatively short range of from a few centimeters up to 2 meters.

➤ Ultra High Frequency (UHF)

- The tags are smaller
- Their range is larger, up to 3 meters
- Suitable for supply chain management and item level

- **EPC. Electronics Product Code Standards.**
 - UHF RFID systems

- **ISO (International Standard Org.) standards**
 - LF RFID for item management (18000-2)
 - HF RFID for item management (18000-3)
 - LF RFID for animal tracking (11784-11785)
 - HF RFID for contacless smart cards (10536)
 - HF RFID for vicinity cards (15693)

- **NFC (Near Field Communication) Standards**
 - Mobile application for RFID using mobile phones.

Comparison with barcode scanners

➤ Barcode systems

- Barcode scanners can only identify around one item per second.
- They have to be operated by a person. Not automatic.
- The tags are very cheap.
- Reading ranges are about 30 cms.
- The only store information about the general product line

➤ RFID

- RFID systems can identify hundreds items per second.
- They are fully automated, not human assisted.
- Tags prices are reducing, but at the expense of range.
- Ranges are up to 3 mts in the best case. 5 to 10 cms worst case.
- They do not need line of sight to operate.
- They store individual product information, history in production line, etc.

- **Item level tracking and stock management.**
 - This mean to keep an updated record of books in libraries, products within a store, control of cars in airports, etc.

- **Supply and cold chain management.**
 - Help retailers to control the products and material throughout all the production line up to the point of sale.

- **Animal tracking.**
 - Pet identification systems are mandatory in most European countries.

- **Smart tickets.**
 - Currently used in many transportation systems

➤ **Access cards.**

- Used to have access to office buildings.

➤ **Human tracking.**

- Allows a range of medical applications where the tag stores the medical history of each person, among many others.

➤ **Passport fast identification.**

- In this application, passport control at airports and borders become easy using an automatic identification and control system.

➤ **Car security systems.**

- Currently many security systems for cars are based on RFID. The cars engines are only securely started when the appropriate tag is detected by a reader within the car.

- **Credit cards fast transactions.**
 - Used to speed up credit card transactions. The card number and identity are stored in an RFID tag and automatically sent to the authorized reader.

- **Medical centers.**
 - RFID tags on an item level help to track and test the activities of patients with disabilities or recovering from accidents.

- **Airport baggage management.**
 - Helps to keep control of the bagged throughout the airport and ensure their safe delivery to the correct planes.

- **Tracking of environmental variables**
 - RFID tags can not only carry id information, but they can measure position, speed, temperature, etc, which add value to a whole RFID system.

Examples in Portugal

➤ Throttleman

- The important retailer Throttleman has been deploying RFID systems to tag each one of its products.. By 2003 and 2005 Throttleman had already tagged two more of its departments.

➤ Byblos

- One of the largest libraries in Lisbon, Byblos, deployed in 2007 what they claim to be the largest RFID deployment in order to track and inventory over 100,000 book titles, cds, and multimedia discs.

➤ Vicaima

- The Portuguese door manufacturer Vicaima announced in 2007 the deployment of a large RFID system to track every piece wood from the start of the supply chain up to the Point of Sale.

➤ Dog tracking

- The Portuguese government announced in 2005 that Digital Angel Corp would be providing an implantable RFID system for dog tracking and identification to be completed by 2007

Examples in Portugal

➤ Portugal airports passport control

- The main international airports of Portugal, in Lisbon and in Porto, were the first European airports to implement the RFID passport identification system in 2005.

➤ Subway and transportation systems

- Trains, subways and highways in Portugal are current examples of HF (High Frequency) RFID deployments, such as all the transport modes in Porto (2004) and in the Lisbon region:
 - Underground: Metropolitano de Lisboa (2000)
 - Urban Bus and Tram: Carris (2003)
 - Boats & Ferries: Transtejo (2004)
 - Trains: CP (2005/6)
 - Private train: Fertagus (2006/7)
 - Private light-rail: Metro Sul do Tejo (2006/7)
 - Sub-urban bus (private): several operators (2007),

Future deployments in Portugal

- **Tracking packages for the postal service CTT**
 - RFID will be also deployed by CTT, the postal service of Portugal, to track and manage the transportation of packages from one place to another.

- **Portugal Railways**
 - In the railway systems RFID will help to identify failures in Bogies, Axies, etc.

- **Portucel**
 - In the supply chain of the pulp and cell industry.

- **Baggage control. Portugal airports**
 - Tracking of luggage and trolleys in 8 domestic and international airports of Portugal

Structure of the enterprises in Portugal

- The Portuguese enterprises are dominated by SMEs.
 - 99.6% of the total number of enterprises
 - 75.2% of the number of jobs.
 - 56.4 % of business volume

- The enterprises are mostly in the tertiary sector:
 - Commerce 31.7%, Services 30%

- IT infrastructure
 - 60% of SMEs have access to a computer and internet.

RFID requirements for SMEs and issues

- SMEs have conventional IT systems, not resource intensive. Therefore middleware and software should be light.
- RFID costs are still high for SMEs
- Tag costs are being reduced, but no costs of readers and middleware platform.
- Security concerns are undermining RFID massive deployments.
- Secure tags are more expensive.
- Middleware platforms are also quite expensive.
- SMEs can be benefitted from a low cost RFID solution.

- Current RFID middleware platforms are simplistic and proprietary.
- Envisioned RFID applications require more intelligence in the middleware
- Security and Privacy issues are slowing down RFID
- Total cost of ownerships are still high
- There is no standard platform for software developers.