The Anatomy of a RAIN RFID Solution

RAIN RFID

V 1.0

THE ANATOMY OF A RAIN SOLUTION

Introduction

A solution is a means to resolve problems; to help businesses achieve their objectives and to create value-add for companies and consumers alike. Today RAIN RFID is routinely used to solve many business problems, to offer solutions where none existed before, or to conjure new efficiencies from existing and established processes.

RAIN is being deployed in countless projects around the world but it is not a single piece of technology. Instead a RAIN solution consists of many building blocks from diverse areas of expertise; hardware, software, planning and consultancy services, standardization efforts, certification, and testing.

For the end-user new to RAIN, this mix of components and providers can be formidable. The goal of this white paper, therefore, is to explain and describe the different components of RAIN solutions using industry-standard RAIN terminology, and to provide examples of how RAIN is being deployed to solve real problems today.

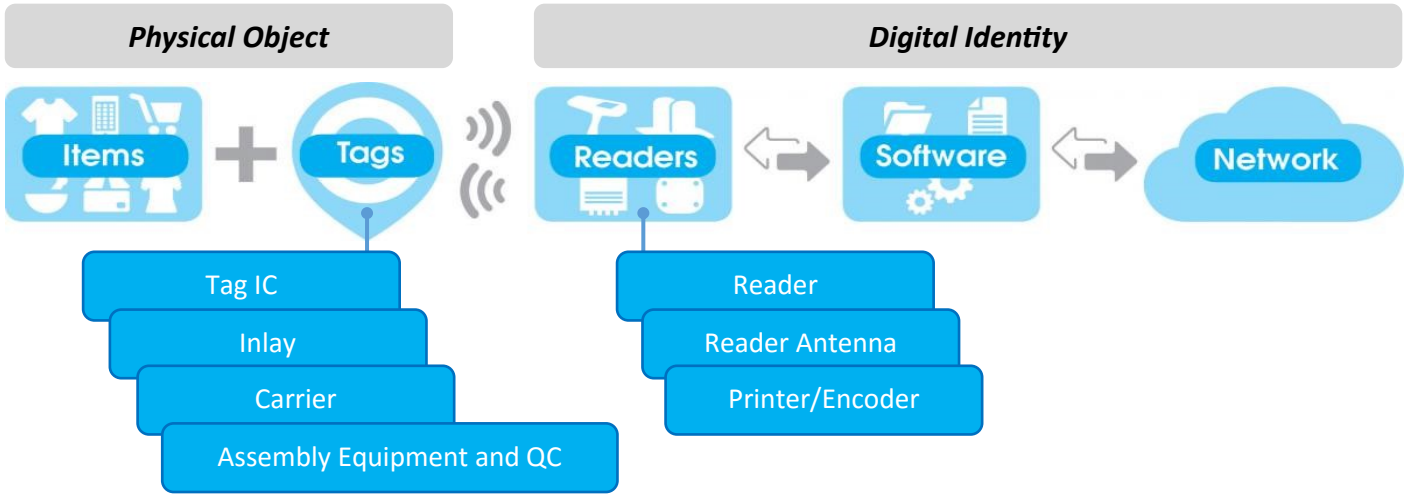
The value proposition is based on a simple, but powerful, idea: imagine that we could identify, locate, authenticate, and engage with any item in our everyday world. We could trace the history of a product as it moves through the supply chain and between entities, measure transit time from the factory to the store sales floor, identify if shipped products were received, ensure that all recalled product is returned, and prevent counterfeit products from proliferating in the marketplace. Once physical items become part of our information systems, innovative analysis can reveal new insights into how an item is used and in what context.

This, in a nutshell, is what RAIN does. RAIN solutions use RAIN tags to extend a unique digital identity to any physical object and to connect it to the digital world.

The Components of a RAIN Solution

A RAIN solution typically starts with an item, object or a “thing” that needs to be identified, located, authenticated, or otherwise engaged with. This is achieved by using a RAIN tag. Such tags communicate bi-directionally with readers that are connected via a software component to the network.

To optimize the performance of a RAIN solution, the interaction and integration of each of these components needs to be carefully considered. In fact, even a single icon in this simple flow-chart contains several important components or manufacturing steps. In the following we provide an introductory glossary for the end-user who might be new to RAIN.



Tag IC

This is the microchip that contains product-related data and a radio unit powered by energy sent by the reader. A wide variety of ICs are available offering different functionality. The most basic have little or no user memory and perform only the essential function of sending a code to the reader. Others might offer additional memory to store data or other features, such as sensors or external interface. Or they might be designed for specific markets or applications.

Inlay

This is the combination of an antenna and the Tag IC. The antenna harvests energy from the reader to power the chip. The optimal antenna design will depend on many factors: the Tag IC, the material to which the inlay is applied, and the environment in which the inlay is used. It is important to use an antenna that is designed for the intended application to optimize performance.

Carrier

The carrier houses the inlay in a format most appropriate for the application and the item to be tracked (examples would include labels, cards, tags, wristbands, or the item/article itself serving as the carrier). The carrier protects the inlay from environmental impact and plays an important role in the overall solution since a failure of the carrier could mean loss of the RAIN inlay.

Assembly equipment

This highly specialized equipment is used to create the RAIN carrier/label/tag/inlay and to perform quality checks on the end product. Often the assembly equipment will employ RAIN hardware to check product quality during the manufacturing process.

Reader

The radio interface to the RAIN carrier is provided by the reader. The reader communicates with tags within its field of operation and can perform a variety of operations on a population of tags or on individual instances. The reader also supplies the power harvested by the RAIN antenna to power the Tag IC. Just as there are different RAIN ICs there are many types of readers and these might be used in different ways, for instance as fixed installations or as portable handheld devices.

Reader antenna

Just as the inlay antenna is important for the performance of the RAIN chip, the reader antenna is a crucial for the RF interface of the reader. Different antenna designs have different properties and the optimal choice will depend on the application and the environment of use.

Printer/encoder

Product identifiers need to be written to the RAIN Tag IC and/or information needs to be printed on to the carrier. This is done by the printer/encoder component. It can be implemented as a stand-alone unit, as a part of other equipment, or the printer and encoder may be placed at different points in the RAIN tag process depending on the solution.

RAIN Vision

Solutions are as diverse as the applications.

Numbering

As mentioned in the Introduction, a unique digital identity for each physical item is fundamental to a RAIN solution. A globally unique digital identity ensures that the network and cloud components can recognize and handle each physical item individually. Even when planning closed systems care needs to be taken to ensure a globally unique identity since physical items from other systems can be read within the closed-system's RAIN readers and infrastructure. For a description of unique numbering for RFID see Guidance on Data Content and Structure in Passive RFID Tags. The globally accepted standard for unique identity in trade items is the GS1 Electronic Product code (EPC). RAIN systems enabled by EPC allow brand owners to assign unique serial numbers to each item, giving trading partners access to key information as that product moves along the supply chain. For more information, see EPC-enabled RFID Serialization Management for SGTIN-96. For non GS1 applications it is recommended that the tag be encoded based on ISO standards which support closed loop applications, where you as the user or your integrator partner can set up and manage the unique digital identity of tag items. This will allow others to recognize the tag data content as relevant to them or not. Reference to the ISO standards can be found in the first link above and also in ISO/IEC 15962 RFID for item management – Data protocol: data encoding rules and logical memory functions.

Software

To take advantage of the data made available by a RAIN solution, software is used to direct the interaction between the readers and the inlays as well as between the RAIN control system and applications/systems such as warehouse management systems, customer information databases, point-of-sale systems, and critical business systems.

Standards

With RAIN components coming from different suppliers, interoperability is vital. Here standardization bodies play a key role in defining, maintaining, and updating the necessary specifications. As a result, RAIN components are interoperable which allows different suppliers to provide solutions that communicate, collect, and exchange data. This

has the added significant benefit of allowing users to choose the most appropriate RAIN components for their solution. Educational institutes within the RAIN alliance also play an important role. Not only are they well-placed to provide independent opinion, but ongoing research can lead to new features that will benefit future RAIN solutions.

System Integration

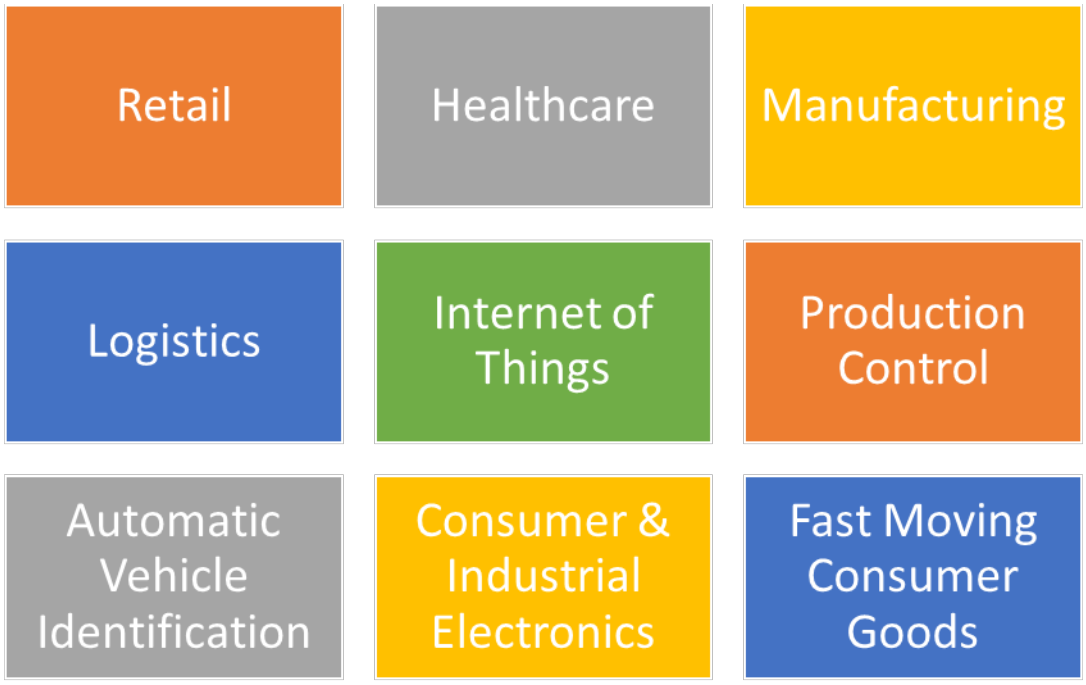
Finally, we need to make everything work when deploying a solution. System Integration is the process for doing this and we can identify the three primary areas that will, when taken together, provide the RAIN solution to the business problem:

- The consumables including the RAIN Tag IC, inlay, label/tag
- The infrastructure such as the reader and antenna, printers, software, network.
- The processes including installation, training, definition of operating procedures, and data collection and analysis.

RAIN Solutions Create Value

RAIN solutions are as diverse as the applications. Solutions in some areas might be “off the shelf”, in others they might be “flexible” to better match specific customer needs. In the extreme they can be entirely customized. Naturally, a solution should ensure a return on investment within the shortest possible time, leading to increased revenue and business profitability.

RAIN has already proven to be valuable in a range of businesses:



Each market has different business requirements. Different products are tagged under different conditions and different key performance indicators/metrics will apply. Even within a market, applications can vary widely. Yet the maturity and flexibility of RAIN provides many solutions in hand for a vast range of business problems.

RAIN Example Solutions

The diversity of applications for RAIN is enormous. Here we illustrate the essential elements of a RAIN solution by highlighting some of the issues raised when considering RAIN applications in three very different markets.

Retail

RAIN is gaining tremendous traction in the retail supply chain. New retailers are adopting RAIN and existing deployments are getting expanded into new categories resulting in solid results for all trading partners. EPC-enabled item level RAIN is the key enabler to delivering the "always-on, always open" omni-channel shopping experience consumers demand. RAIN provides the item level visibility needed to connect inventories with consumers for all types of fulfillment models including the increasingly popular buy online, pickup in-store model.

For manufacturers, RAIN offers multiple benefits including brand protection, decreased inspection costs, shrinkage reduction, and enhanced logistics accuracy. For retailers, RAIN provides greater than 95% inventory accuracy, boosts sales, decreases out-of-stocks, reduces obsolete inventory write-downs, increases margins, improves delivery times, expedites returns, and satisfies customer demand.

Other RAIN benefits include driving point-of-sale improvements, improving loss detection, enhancing stock conversion reporting, and creating new sales channel opportunities for formerly single-unit inventory. Finally, as the number of deployments increase, the training of sales associates on the proper use of the technology is becoming common-place, as is providing proof to upper management of the subsequent ROI results.

RAIN RFID Solutions include:

- **Retail**
- **Healthcare**
- **Automatic Vehicle Identification**
- **Logistics**
- **Internet of Things**

Healthcare

The benefits of implementing RAIN solutions for the healthcare industry are numerous. RAIN solutions are currently implemented in pharmacy operations to manage critical inventory, such as procedural and emergency medication kits and trays for hospitals, and medications that are high value, short expiration, or narcotics. These solutions ensure that the right medication is available at the right time and in the right location to support patient care with optimized inventory levels. Real-time visibility of inventory within RAIN storage and management systems enables manufacturers and distributors to maintain consignment programs for high-value, critical dose medications, track their usage, manage a cold-chain pedigree, bill only as products are used, and guarantee medication availability. RAIN solutions in hospital pharmacies decrease labor costs, reduce medication errors, provide timely identification of recalled or expired medication, enable accurate charge capture, and ultimately improve patient care and safety.

Full implementations and pilot programs utilizing RAIN technology to track healthcare personnel, and the critical inventory in their possession, are currently being deployed. Future RAIN solutions will improve the efficiency and safety of the pharmaceutical supply chain from the pharmaceutical manufacturer to the patient for example, as mandated by the Drug Supply Chain Security Act (DSCSA) in 2013.

The challenges to implementing RAIN solutions in the healthcare market include tagging a wide variety of medication form factors and substances while conforming to FDA labeling regulations, gaining supply chain labeling participation from pharmaceutical manufacturers, accurately identifying large quantities of tagged items in small enclosures, and implementing portal systems in ambient, cold, and freezing environments.

Electronic Vehicle Identification

Electronic Vehicle Identification is an emerging solution for RAIN that has tremendous growth potential. The applications range from vehicle identification, licensing, tolling, to law enforcement applications. Many governments around the world are currently evaluating and implementing systems.

When considering an EVI deployment several points need to be considered. Decisions to be made include tag placement as well as how and when a tag is read. For example, on a car the tag may be placed on a windscreen, license plate, or a bumper. Each decision is feasible but each creates different challenges for the RAIN system.

Summary

In reality a broad range of issues and application scenarios are common to many RAIN deployments. Members of the RAIN Alliance are here to help, aid, and assist to ensure successful deployments. Global support is available from our members.

Today there is sufficient cumulative knowledge in the RAIN community to ensure that even the most challenging RAIN deployment can be successful. Detailed background on all the issues and solutions mentioned above for EVI, Healthcare, or Retail can be obtained from RAIN Alliance members.

Questions to Consider

While the applications above demonstrate that deploying a RAIN solution is both technically feasible and economically justified, each application will have its own specific requirements. When considering your own application some important questions will help you understand the different factors that will impact a successful deployment.

- What is the application and what are the intended goals of the deployment?
- What are the necessary performance targets for a deployment? For example, what reading distance is anticipated, what tag read rates are acceptable, what reliability is being sought?
- What are some of the positional conditions that deployed RAIN tags will have to face? To what material will RAIN tags be applied, what are the antenna sizes and form factors, what is a likely tag orientation?
- What are some of the environmental conditions that a deployment will face such as the presence of metallic fixtures, ease-of-access, and obstructions?
- Is the project starting from scratch or is there already a deployed production or pilot infrastructure?
- For the information system, what software back-end is already in use? What information needs to be collected and made available to other components in the system?

There are many roads to a solution and there is rarely one “right” solution. However, consultants, system integrators, and inlay manufacturers, as well as the RAIN hardware and chip providers, will all have good perspectives. The RAIN industry alliance is here to support you.

ABOUT RAIN RFID ALLIANCE

The RAIN RFID Alliance is an organization founded in April 2014 to promote awareness, increase education and support the universal adoption of UHF RFID technology. RAIN members are manufacturers, distributors, resellers and researchers working with the EPC Gen2 UHF RFID specification, incorporated into the ISO/IEC 18000-63 standard.

RAIN RFID is a wireless technology that connects billions of everyday items to the Internet, enabling businesses and consumers to **identify**, **locate**, **authenticate** and **engage** each item. For more information, visit www.RAINRFID.org.

The RAIN RFID Alliance is part of AIM Global, the worldwide authority on automatic identification, data collection and networking in a mobile environment. AIM is dedicated to accelerating the growth and use of Automatic Identification and Mobility technologies and services around the world. For more information, visit www.aimglobal.org.

Connecting with RAIN Members

The RAIN Alliance consists of more than 110 members and each member provides one or more of the components that are vital to a RAIN solution. The RAIN website lists all these members and they will help you realize a successful RAIN deployment.

RAIN® RFID

Association for Automatic Identification and Mobility

RAIN RFID

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If you're interested in having your company become a member of RAIN or have any questions about the RAIN alliance, please send RAIN an e-mail: info@rainrfid.org