SDN Contribution

CASE STUDY: RFID Enabled Automated Toll Collection Connecting SAP R/3 Using XI.

Summary

RFID is a flexible technology that is convenient, easy to use, and well -suited for automatic operation. It combines advantages not available with other identificat ion technologies. Advent of RFID as an emerging technology in many applications where barcodes were previously used and in the applications which would help in automating them and using a strong ERP Solution enabling strong advantages of both the RFID Technology and ERP Product .

This technical document gives "RFID Plug-In for Toll Collection Connecting SAP R/3 ." Thus enabling a strong Business Collaboration and Technology Convergence of SAP and RFID. Actually Main purpose of this implementation is to propose a generalized plug -in and most importantly get the data into SAP via XI.

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Created on: 28 July 2006

Author Bio

Pawan P. Khilari is presently working as a Technical ABAP Consultant in EAS- SAP practice for Wipro Technologies. He is a Computer Engineering Graduate from Vishwakarma Institute Of Technology, Pune , India. He is working on RFID and Enterprise solutions since his B.E for last two years now .One of his similar designs of RFID-PEOPLESOFT connector has already won laurels at IIT Delhi, IIT Kanpur and IISC Bangalore. He has presented various state level papers and seminars on RFID. He is currently one of the top three contributors in RFID forum on SDN.

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Introduction

Background

Technology is a key component in managing the flow of goods and products, yet a gap still exists between the digital and physical worlds. While data abstractions may represent physical objects, those abstractions have no connection to the real world. An entry in a database indicating an item is stored in a particular location is nothing more than a snapshot taken at the moment of last human intervention. If an object is moved, the database is no longer accurate. Eventually someone still needs to physically verify that the object is present. This is beginning to change. New technology is enabling the automatic identification, or auto-ID, of physical objects. Auto-ID is a core component of automated inventory control systems and supply chain management. Inventories once taken by hand will be conducted automatically. Continual database updates will better reflect the real world. essentially, snapshots will be replaced by "live video".

Overview of Radio Frequency Identification

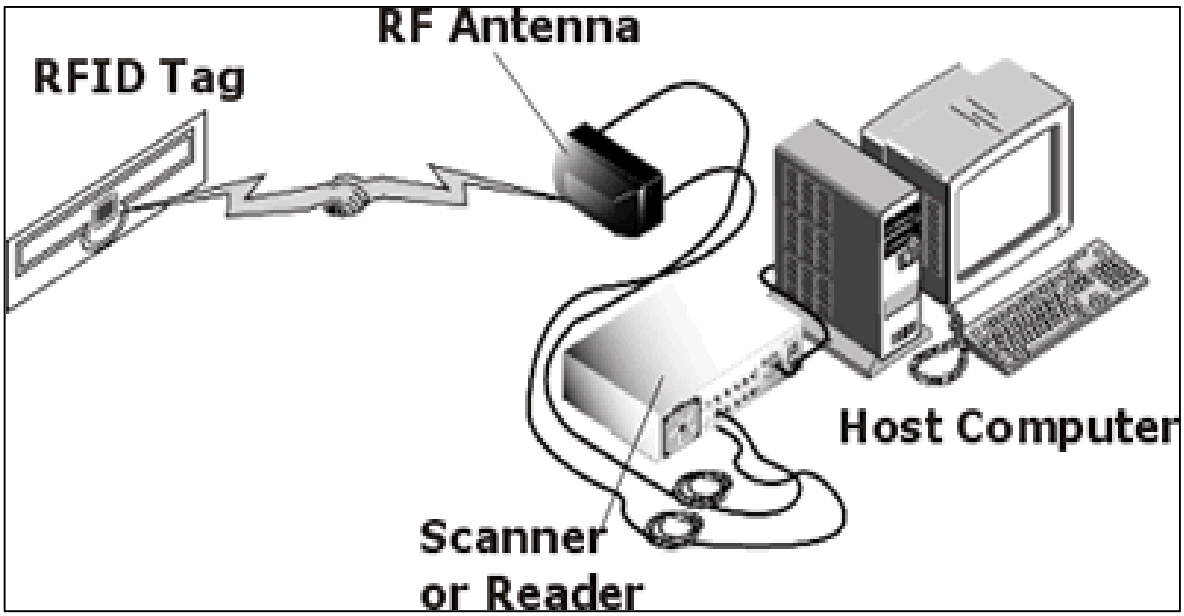
RFID is a flexible technology that is convenient, easy to use, and well-suited for automatic operation. It combines advantages not available with other identification technologies. It does not require contact or line-of-sight to operate, functions under a variety of environmental conditions, and provides a high level of data integrity. In addition, because the technology is difficult to counterfeit, RFID provides a high level of security. RFID devices, such as a tag or label, can be attached to virtually anything — from a vehicle to a pallet of merchandise.

RFID is similar in concept to bar coding. Bar code systems use an optical reader and coded labels that are attached to items, whereas RFID uses an RFID reader and special RFID devices that are attached to items. Bar code uses optical signals to transfer information from the label to the reader; RFID uses radio frequency signals to transfer information from the RFID device to the reader.

RFID Advantages

- No line-of-sight required: The positioning is not so critical
- Bulk-reading capability
- Unique Identification
- Repeated Read/Write Capability
- Accurate and Real time data
- Data Capacity: Label can store a larger quantity of data
- Reusability and durability
- Multiple Read
- Robustness: the label is better protected from the environment
- Security: Data is more secured
- Cost Justification: Cost of an single RFID read-write tag may be high at present but the total cost of an RFID implemented system is less than the bar coded system considering the benefits it reaps.

RFID Enabled System Components



RFID transponder or Tag- The function of an RFID transponder is to reply to an interrogation request from an interrogator by returning data such as an identity code .

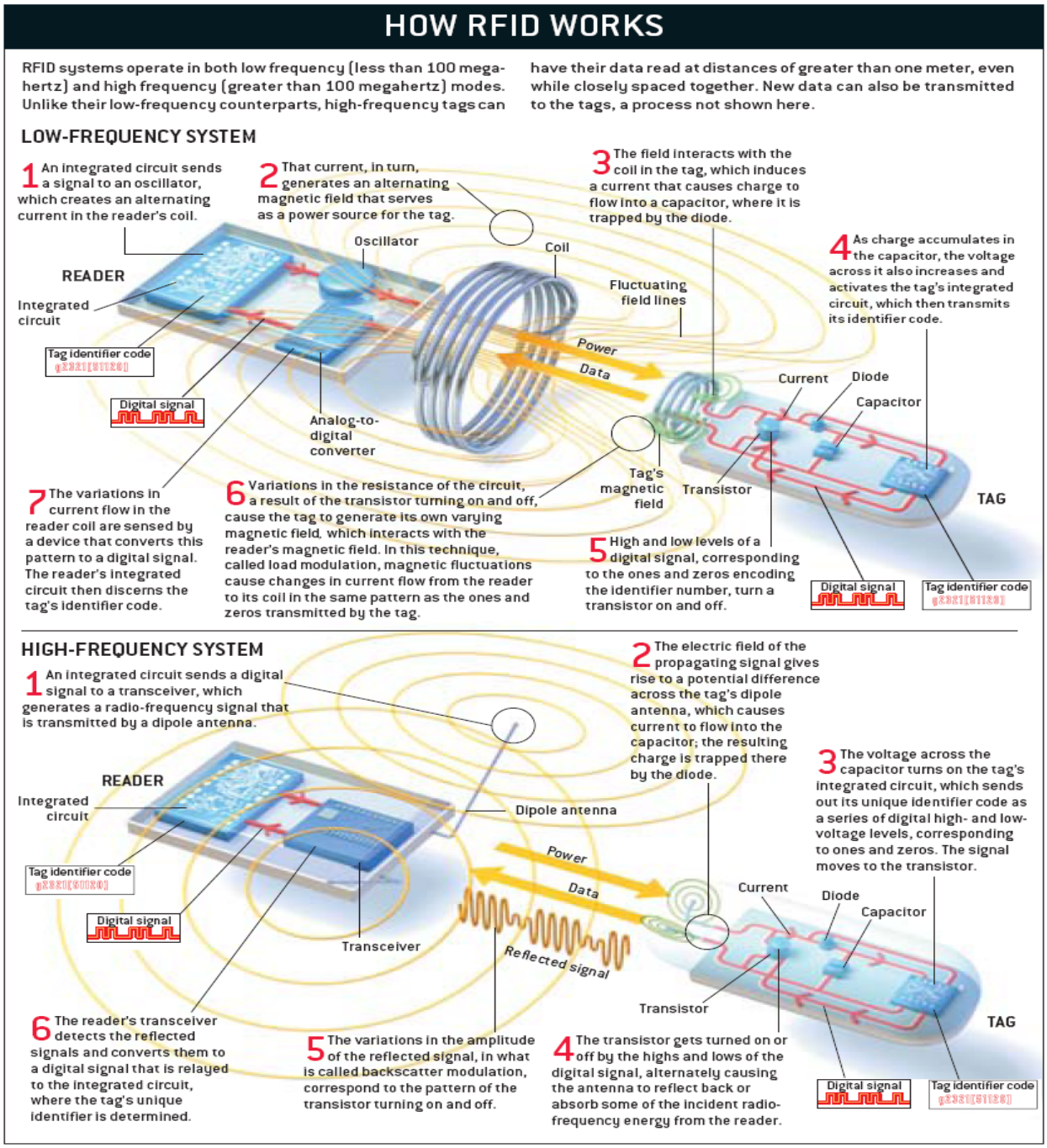
RF Antenna - The function of the antenna is to propagate energy between the interrogator and the transponder. The tag is attached to an antenna.

RFID Interrogator or Reader - The function of the interrogator is to manage all RF communications with the transponders and to manage all serial communications with an attached host computer controller.

Controller - The function of the controller is to manage communications between the interrogator and the database.

RFID Host:-A host may be a PC, workstati on, mainframe, or portable data terminal (PDT) where the RFID controlling application resides. That is, the host is simply the box on which you put your RFID -enabled applications after they have been developed supported with a database is to provide an org anize repository or collection of data.

Basic Working Principle of RFID Technology.



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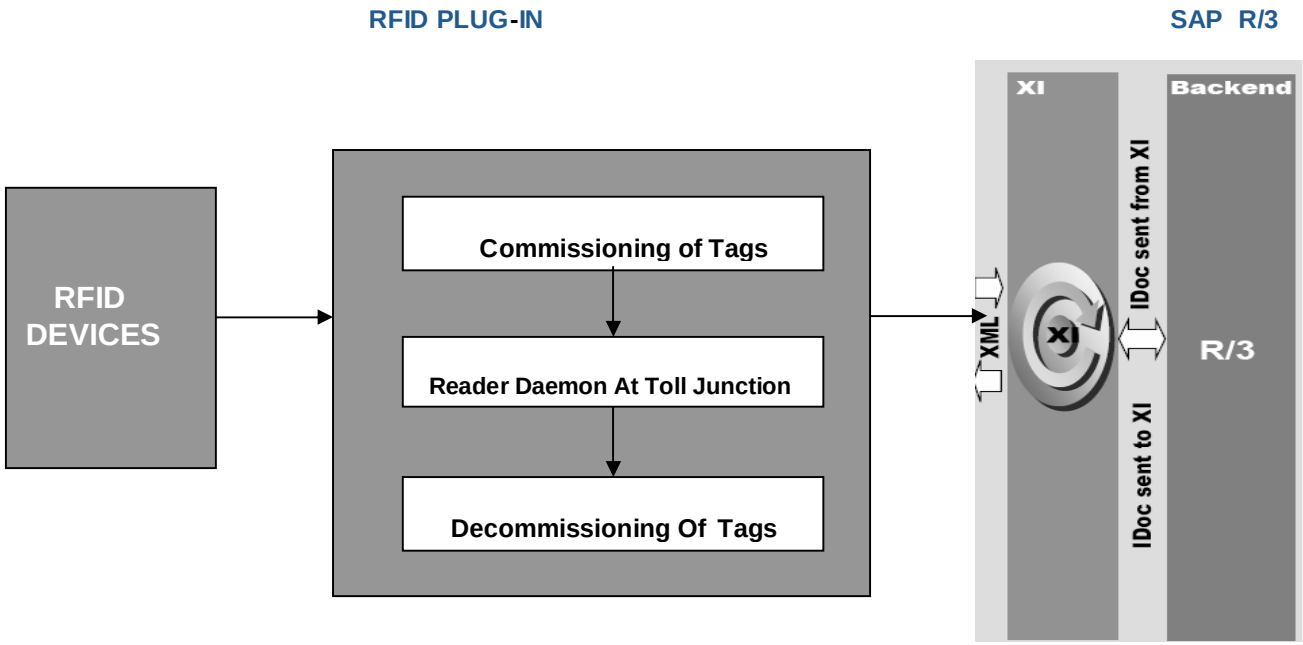
Basic Idea and Design Of the Proposed System

The basic idea behind the Proposal is to develop a RFID Plug-in which can be used for automatic toll collection ,connected to SAP R/3 which can be further extended to other related applications like vehicle identification or fuel filling or any other application mentioned above

This RFID Plug-in is a generalized plug-in which can be used for any of the RFID application . Toll Collection is the application which we intend to implement in this proposal. As this Plug-in is connected to SAP R/3 using ,It includes strong advantages of both RFID technology and SAP R/3 discussed later. It can be extended to any other RFID based applications making minor changes in the RFID Plug-in.

RFID Plug-In Architecture



RFID Plug-In Architecture For Toll Collection Connecting SAP R/3

Input-Output Specification and Process Description

Algorithmic Analysis:

The Case study would have four basic modules operating.

1. Commissioning Of Tags at Vendors Location
2. Reader Daemon located at Toll Junction
3. Decommissioning of Tags at the Vendors Location
4. SAP R/3 Back -end Operations connecting the above three modules

Functional Analysis:

1. Commissioning Of Tags at Vendors Location:

This process would be done at the vendor's location. At the very beginning the customer has to register himself as the user of the automatic toll collection system. The registration process will be carried out where he has to pay a fixed amount for a period depending on his frequency of the usage of the toll system. A contract account of the customer would be created in the SAP system. His account information and the transaction details would be maintained in the SAP R/3 system; at this instance we are creating custom Tables and transaction for this purpose. After the SAP account of the customer is active he will receive a unique id i.e. Asset_Id which is an 10 digit auto generated number, which will be written on the tag (Active Transponder) and this tag will be placed on the wind screen of the car and the tag is commissioned.

The contract information stored in the contract ztable is than converted into an IDOC and then using XI this IDOC is converted into an XML file and connected to our RFID module. This Asset_Id is actually parsed from this xml file given by XI. This Asset_Id would be then written on the tag and the tag be fixed on the windscreen of the customers car. In this way the tag is commissioned at the vendor's location. We are also thinking of the possibility of using the PAN -CARD No or SOCIAL SECURITY No (depending on the country)as the Unique -id of the customer in order to make it a generalized process.

A) Input:- An XML file is obtained from XI which actually picks the data from SAP via an IDOC.

B) Function:- Parse the given XML file and extract the Unique -ID.

C) Output:- Write the given Unique -ID onto the tag and commission the tag on the Windscreen of the customer's car.

2. Reader Daemon located At Toll Junction

When the car reaches the tollbooth, a Interrogator (reader) at the booth sends out a signal that wakes up the transponder on the windshield, which then reflects back a unique ID to the reader at the booth. The Asset_Id is associated with an account opened by the car owner, who is billed by the toll authority. Consumers spend less time fumbling for change or waiting on lines to pay their toll fee.

The interrogator continuously polls multiple tags in Autonomous Mode; this is successfully implementing using Threading. The interrogator obtains the Asset-Id of the tag and updates it along with other information like timestamp, date into a flat file which is again picked up by XI and converted into an IDOC and stored into the Billing Ztable in SAP R/3. A fixed amount would be deducted from the customers account and using a SAP billing module a bill will be generated and would be emailed to the customer through SAP Workflow module.

A) Input:- A car reaching a toll booth.

B) Function:- A unique multiple read facilities would be provided wherein the reader is enabled to read the Asset_Id of the multiple vehicles passing the toll booth at same time.

C) Output:- Write the multiple read Asset-Ids along with other information as in the date and the timestamp into a flat file which is again picked up by XI and converted into an IDOC and updated into the Billing Ztable in SAP R/3. This information would be latter used by the Customized BILLING module to generate the bill and emailed to the respective Customer informing him about his balance using workflow .Once the data read from the tag is stored in an IDOC form lot of powerful features provided by SAP product can Used, further making this application more beneficial and powerful.

3. Decommissioning of Tags At the Vendors Location

If a customer has to discontinue these services he has to inform the vendor and visit him. So that the data from the tag is deleted his transactions are cleared and his contract account in SAP system is deleted and thus the Tag is decommissioned so that it can be reused for another customer.

A) Input:- Tagged asset (owner's car) having the Unique-Id written on it.

B) Function:- Erasing the information from the Transponder.

C) Output:- The Tag is decommissioned and ready for re-use.

4. SAP R/3 Back-end Operations connecting the above three modules

This module would be working in backend in co-ordination with the above three modules through out the process life cycle. The details of its usage are already mentioned in the above modules.

Implementation Details

I plan to write a separate document regarding the complete implementation details of the above mentioned case study. Here are some highlights.

RFID Side

We are using T6 STANDARD for RFID .Here are some of the features.

1. Accepted by ANSI T6 committee

2. under consideration by international standards bodies

3. Clearly defines API

    a. Function Call Nomenclature / Purpose

    b. Data Structure Nomenclature / Pu rpose

    c. Specific Function Calls / Parameters

    d. Supports “interoperability” between T -6-compliant vendors

The entire RFID Plug -in is an VC++ (MFC) application. For XML parsing we are using an ATL based parser which can parse any XML file.

Hardware Require ments:

All the required RFID hardware could be provided by any of the manufacturer of RFID equipments. Actually RFID implementation depends lot on the hardware we are using. For this case study implementation we are using the simulators and devices provid ed by INTERMEC which is one of the leading manufacturers of RFID hardware.

1.Passive multiple read/write tags: 915 MHz Container Tag

2. Fixed Interrogator with antenna: The Intellitag® Fixed Reader

3. Antenna**:** Cushcraft Communication Antenna

SAP Side

On SAP side we are integrating many components with this RFID Plug -in .At this instance we are using ztables for demonstration as our main concern is to get the RF data into SAP system. Later we intend to use the standard functionalities available with SAP.

We are using XI as the middleware which connects to SAP R/3 via an IDOC. We are having an e -mail facilty through which both the concerned Vendor authority and the customer is informed regarding the transaction and the threshold information using Workflow.

Possible Benefits Of Proposed Toll Collection

- RFID is an emerging technology to identify and track an asset (CAR) using Radio frequency.
- Consumers spend less time fumbling for change or waiting on lines to pay their toll fee.

- Real time and accurate inform ation about the assets (CAR) and their transactions is present in the SAP system.
- Tags can be reused.
- Get the transaction information of any customer at any time.
- Enabling Faster and accurate method of Toll Collection as no manual intervention is required, reducing Time consumption of the customer and reaping more financial benefits to the vendors.
- The usage of RFID is widening with an increasing Return on Investment (ROI)
- SAP is a key player in applying RFID to business applications, with many live custome rs around the world
- Make SAP RFID solution part of ESA family and many more

The benefits are absolutely endless.

Possible Commercial Application of The Proposed RFID Plug-In

- Industrial automation
- Building access control
- Skiing arenas
- Anti-Theft-Devices
- Toll Collection
- Electronic Article Surveillance(EAS)
- logistics
- Asset Management
- Waste Management
- Yard Management
- Fare Collection
- Animal Identification
- Luggage Tracking in Airports
- Industrial laundries
- Fugitive Emission Detection
- Totes/Conveyor
- Vehicle Identification
- Automotive Anti-theft
- Employee Identification

Conclusion

This Plug-In can be used for implementing any of the above mentioned RFID appl ication connecting it with SAP making certain changes in the design depe nding on the hardware used and the bus iness logic. Automated toll collection is the application which is taken as a case study an RFID application connected to an Powerful ERP Product l ike SAP is an innovative idea, giving powerful advantages and benefits catered by both RFID technology and SA P R/3.

Though RFID is widely us ed in US and other foreign countries, use of RFID and its applications is very less or redundant in India probably due to its cost factor. But considering the market pressures, commercial benefits, financial profits it reap s after few years this technology is making amicable progress in India. Already big software giants like WIPRO have launched themselves in RFID research and application.

So future of RFID in India is very bright , this technology is already buzzing around thus SAP business collaboration RFID technology convergence holds the key.

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