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Design and simulation of a model for authentication, tracing and tracking of Data Center's resources using RFID technology

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Abstract

A data center is a centralized repository for the storage, management, and dissemination of data and information organized around a particular body of knowledge or pertaining to a particular business. At many companies, the data center can be a remarkably large and complex operation. The majority of equipment such as servers and storage units must be accounted for on a regular basis. With large numbers of IT assets that must be tracked and managed, we need some new systems to address this challenge. One of these solutions is Radio frequency identification (RFID). RFID is a system that transmits the identity of an object or person wirelessly, using radio waves. A basic RFID system consists of three components: an antenna, a transceiver (with decoder) and a transponder (RFID tag). It's no surprise that asset tracking is one of the most common uses of RFID. RFID has long been used as an electronic key to control who has access to office buildings or areas within office buildings.

To address the challenge of accurate asset identification and increasing security in data centers, we propose a new model including 37 steps for RFID deployment in data centers. With the use of this model, this data center will experience increased security and ability to better resources tracking.

Key words: RFID, Data center, Asset Tracking .

1. Introduction

The data center is home to the computational power, storage, and applications necessary to support an enterprise business. A Digital Realty Trust survey found that only 26% of data center managers could locate a server that had gone down within minutes. Only 58% could locate the server within 4 hours and 20% required more than a day. The inability to locate equipment in the data center increases the mean time to repair (MTTR) for the equipment and decreases the overall availability [1]. Secure and efficient operation of data center is critical for companies and institutions. With data integrity, legal and industry compliance requirements becoming more critical, the ability to document critical server components is becoming more important than ever. Security and effective data center management starts from visibility of IT assets by real-time tracking and monitoring of servers, disks, and

critical IT components. With large numbers of IT assets that must be tracked and managed, we need some new systems to address this challenge. One of these solutions is RFID technology [2, 5].
RFID is a new generation of Auto Identification and Data collection technology, which helps to automate business processes and allows identification of large number of tagged objects using radio waves. This technology is primarily used for automatic data capture and has the potential to change how businesses operate today revolutionizing the business performances [3].
It uses a tag embedded with a silicon chip and an antenna that enables it to communicate with a reader (Figure 1). The tags affixed to cases, pallets, or other units transmit radio frequency signals when present in the read zone of a reader. The reader picks up the signal and decodes it. This information is then matched with record data in the host computer system and transferred to the database for storage and analysis. So RFID system has three major components, the tag, the reader, and the host computer system which consists of the software also known as middleware that provides the core functionality of converting the data collected from the tags into useful information [4].

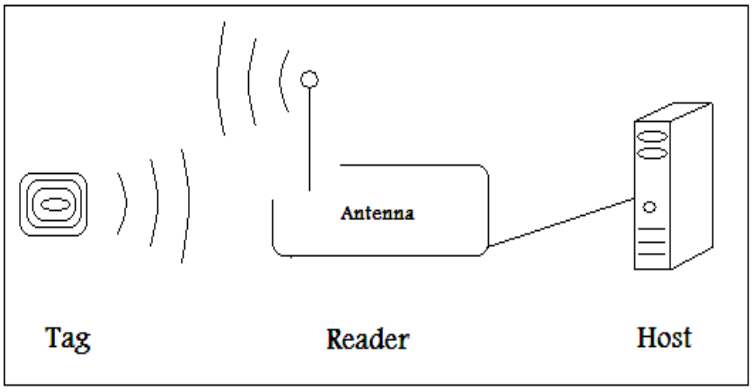


Fig 1: The basic components of a RFID System.

RFID is becoming more prevalent as a means of asset tracking in the data center. There are some obvious advantages to this technology. The primary advantage is the ability to track an asset throughout its lifecycle, from the loading dock to staging to the rack to decommissioning and disposal. As the asset is moved, it is tracked using RFID readers placed throughout the building, particularly in room entrances. The company sought to implement data center resource management solution that would improve asset visibility, streamline inventory and reporting, and enable its IT staff to spend more time on their core responsibilities and less time searching for IT assets. RFID technology emerged as the most promising solution to meet this challenge. RFID enables the location and identification of assets without direct line of sight, which is required with barcode. An effective RFID solution could therefore help the company identify and track IT assets more quickly and with greater precision. Such a solution could also enable the company's data center teams to take inventory more often and more accurately, thereby getting them closer to determining when asset losses occur and why [5, 6].
To address the challenge of accurate asset identification and increasing security in data centers, we propose a new model including 37 steps for RFID deployment in data centers.

2. Research Methodology

We are going to propose a new model for deploying an RFID asset-tracking system at a data center. This work consists of four major phases: (1) references identification and

search, (2) identification of different assets in a data center and their security requirements, (3) identification of RFID technology and its capabilities, and (4) proposing the new model.`

Phase 1: References identification and search. In this phase, we identify the appropriate sources as the targets for our extensive search for relevant references. Our search covers popular on-line sources such as RFID Exchange, RFID Gazette, RFID Journal, and RFID Solutions Online and major academic on-line databases such as ScienceDirect, IEEEexplore, and Springer Journals.

Phase 2: Identification of different assets in a data center and their security requirements. A data center can contain thousands of assets, from servers, storage and network devices to infrastructure support equipment such as Computer Room Air Conditioners, PDUs and UPSs. Keeping track of these assets is an ongoing task faced by data center managers around the world. We describe the security requirements of each asset and relate them to the RFID implementations.

Phase 3: Identification of RFID technology and its capabilities. The major components of RFID system and automatic identification and tracking capabilities of RFID as a means of tracking IT assets in the data center are identified in this phase .

Phase 4: Proposing the new model. Based upon the collected information about data centers and RFID technology, we design an RFID asset-tracking system for deployment in data centers.

3. Results and Analysis

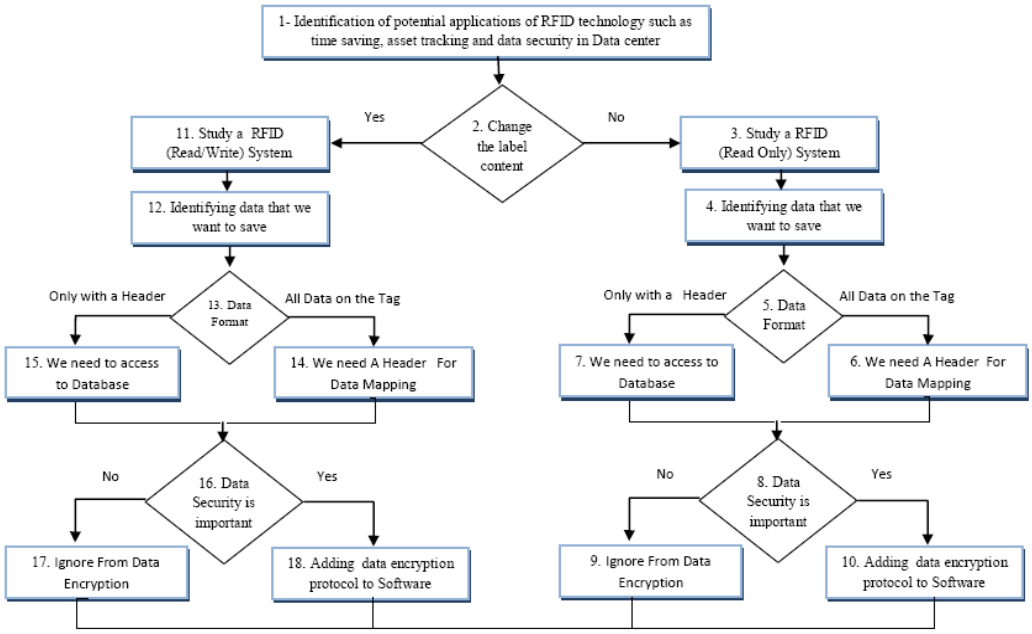
Any In this section we describe a new model for RFID application in data centers. Figure 2 shows this architecture which consists of 37 steps.The first step in this model includes the identification of potential applications of RFID technology such as time saving, asset tracking, data security and so on.

The information can be configured on a tag in different ways; read-only and read-write. We should determine if it is necessary to change data stored on an RFID tag or not (step 2). If there is no need to change the data stored on the tag, we should adopt a read-only system (step 3). Read-only tags are typically passive and are programmed with a unique set of data (usually 32 to 128 bits) that cannot be modified. Passive tags are lighter, have smaller form factors and are less expensive than the more powerful active tags. In the next step we determine the amount of information that should be stored on a tag (step4).

The next problem that should be addressed is the storage format of data on the tag (step 5). There are two types of formatting that may be used: The first strategy includes the storage of all data on the tag which needs to a header for data storing on the tag. In this case reader must be informed from formatting protocol so that it can decode the contents of tag (step 6). In the second strategy a unique identification code is planned which is stored in information bank for other related information (step 7). The security aspect of data is another problem of read-only systems (step 8). It should be noted that cheap read-only systems don't have coding functions for increasing the information security (step 9). If maintaining the information security is fundamental for data center, we should add coding functions to the system (step 10).

If it is important that we can change the data stored on a tag, then we should use the read/write systems (step 11). Read/writing is the ability of an RFID system to change the data that is stored in a tag. For example, as a product moves from the final packaging area to the warehouse, a read/write tag can be modified to reflect the new location, so that now, when interrogated, it passes the new location as part of its updated data stream. Then we should determine the amount of memory which is needed for data storage (step 12). The storage format of data is the same as read-only system (steps 13, 14 1nd 15). If the security

of stored data is important for these read/write systems (step 16), it's proposed that the expensive systems with coding functions be used (step 18). If the security feature of stored data is not important, RFID systems with middle read range are proposed (step 17).



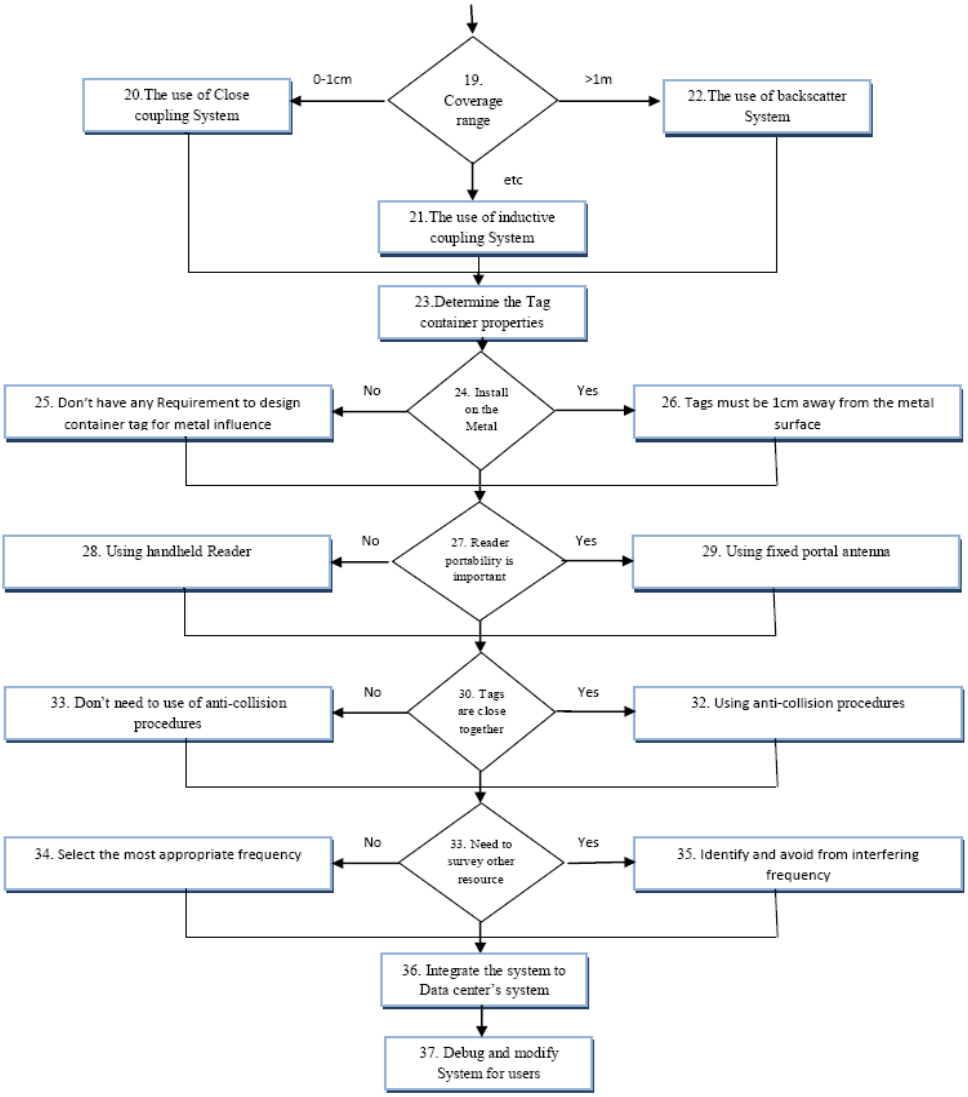


Fig 2: The proposed model for RFID deployment in a data center.

Another important issue for both systems is their read range (step 19). The read range determines the method that tags use to transmit data to the reader. If the read range is between 0 to 1 cm, the proposed tag-reader coupling system is a close coupling system which uses frequencies below 30 MHz (step 20). If the read range is between 1 cm to 1 meter, an inductive coupling system is appropriate (step 21). These two systems belong to passive tags which do not have a battery. For read ranges above 1 meter, backscatter coupling is used (step 22). Here the tag antenna receives signals and energy from the electromagnetic field emitted by the reader. In order to transfer data to the reader, the reflected power is modulated by the transponder.

An important problem about tag is its container properties (step 23). Is it necessary that the system be installed in highly metallic environments (step 24)? If the tag is used near metallic objects, it's essential that RFID tags be 1 cm away from the metallic surface (step 26). If the RFID tag is not in contact with metallic surfaces, there is no need for interference (step 25). The next problem that should be studied is the reader portability (step 27). If we don't want to transfer the reader, it's better to use a fixed portal antenna (step 29), otherwise a handheld reader is proposed (step 28).

An important problem about RFID tags is their proximity (step 30). If they are installed very close to each other, anti-collision algorithms should be employed for preventing radio

waves from one device from interfering with radio waves from another (step 32); otherwise there is no need for this deployment (step 31).
The impact of electromagnetic energy from other sources on RFID operations is the next problem (step 33). When we choose the transmission frequency, specific considerations should be adopted for preventing other electromagnetic waves (step 35), but if there is no interfering source of waves, we can use the best frequency depending on our object (step 34).Integrating the RFID system with data center's information system is a fundamental step (step 36). Finally, we should debug and modify the system for its users (step 37).

4. Conclusions

The success of an RFID project depends on its strategy, the implementation process, the characteristics of the technology and the organizational context. The value of a new technology is rooted in business, not in the technology itself [6].
In this paper, we proposed a new model which provides a successful deployment of RFID application in data centers. This architecture offers an efficient workflow which could be used in different data centers. Our model shows how RFID is deployed to meet the needs and practice of data centers. As mentioned throughout this paper, RFID is the technological key enabler for a more efficient, reliable and flexible data center management. In the future, we will extend security aspects and data management accordance with the RFID environment.

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