Mobile RFID with IPv6 for Phone Services

Yi-Wei Ma, Chin-Feng Lai, and Yueh-Min Huang
Department of Engineering Science
National Cheng Kung University
Tainan, Taiwan
huang@mail.ncku.edu.tw

Jiann-Liang Chen
Department of Electrical Engineering
National Taiwan University of Science and Technology
Taipei, Taiwan
lchen@mail.ntust.edu.tw

***Abstract*—This study proposed integrating Mobile RFID and IPv6 mechanisms, in order for mobile phones to read ID labels on posters, acquire data via mobile network without need of data transmission and conversion by several servers. This mechanism could reduce data transmissions and waiting time of users, and provide the users with more convenient applications. Moreover, the proposed architecture complies with RFID-related standards of EPCglobal, making it possible for users to select the intended system, depending on their requirements and degree of equipment support. Final the experiment results show that the proposed system can save an average access time of 100ms.**

Keywords: Mobile RFID, IPv6, Phone Services

I. Introduction

RFID may identify specific targets and read relevant data using wireless signals, while no mechanical or optical contact is established between identification systems and specific targets. Rather than a pure barcode label, RFID could now accommodate more messages without manual access. RFID has been widely applied recently, due to its ease in management and operation. According to a statement from the White House, RFID technology is already used in passports, which contain ID messages of the holders to prevent unlawful forgery. In the future, the mobile RFID system is expected to grow considerably, enabling the users to immediately read RFID tags or other important data via mobile phone. Therefore, a simplified framework based on existing Mobile RFID message transfer processes is needed to promote real-time and convenient operation for users [1, 2].

II. Background Knowledge

Mobile RFID phone service has incorporated the RFID Reader into mobile phones, enabling the users to read RFID tags and acquire data, via WAP (Wireless Application Protocol) or through third-generation mobile telecom transmission systems. In the near future, RFID tags may be attached to posters, and mobile phones equipped with a RFID Reader can directly read the tags; then, addresses stored on the tags are transmitted through the network, thus, multimedia messages of music or film can be obtained in real-time.

Under EPC Network environment defined by EPCglobal, messages on tags are sent to Local ONS/ Cache after they are read by the mobile phone. The Local ONS serves as a Cache does in a computer, by storing all new data into Local ONS, and clears the data after a certain period to ensure the real-timeliness and validity of the data. If Local ONS/ Cache fails to locate data, it will send a tag ID to Root ONS for an enquiry, which is where Local ONS data is stored, then send the result back to Local ONS/ Cache. Finally, the Local ONS/ Cache will send a tag ID to EPCIS to enquire which server the data is loaded into, and send the results back to Local ONS/ Cache, which will contact the mobile phone and write the data back into the database for subsequent use. Meanwhile, the mobile phones may extract data according to its URL [3, 4]. The transmission process is shown in Figure 1.

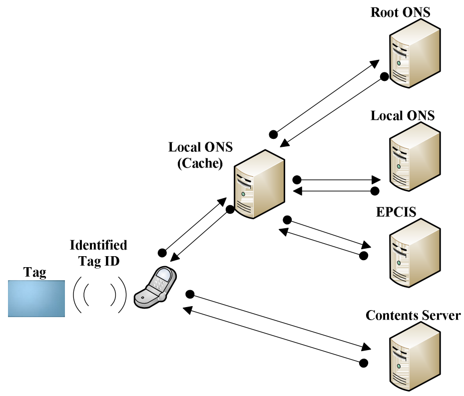

Figure 1. Figure 1 Mobile RFID Transmission Process

The EPC Network transmission process provides a RFID Code reader, with functions for corresponding with URL websites. This, however, consumes heavy mainframe bandwidth as numerous packets are generated in the network environment during the transmission process, and thus, waiting time will be prolonged.

III. Mobile RFID With IPv6 Service

To resolve the time delay of RFID in bypassing EPC Network, this study proposed to integrate RFID and IPv6 technologies, able conduct intended data acquisition more conveniently and reduce bypassing of packets.

The EPC coding mode of original RFID tags is reserved to ensure compliance with EPCglobal. IPv6 codes are incorporated into the memory of RFID tags so that Mobile RFID with IPv6 are compatible with EPCglobal and the proposed framework.

The capacity of a traditional one-dimensional barcode is 50Bytes, and that of two-dimensional bar is 2~3000Bytes, and max. Capacity of RFID tag up to Megabytes. Thus, IPv6 messages are proposed to be incorporated into the memory of RFID tags. When mobile phones support the IPv6 telecom protocol, tags have tag ID and IPv6 messages, it is possible to acquire relevant music, pictures or video data from servers. The mechanism is shown in Figure 2.

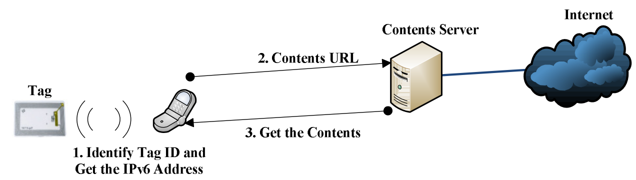

Figure 2. Figure 2 RFID with IPv6 for Mobile RFID Phone Service

According to the design, Mobile RFID IPv6 will store a group of IPv6 addresses in the memory of a RFID tag, of which the preceding 64bits are defined by its network prefix, and the later 64bits are designated as tag id developed by EPCglobal.

The operating process of this system is as follows: first, the mobile phone will read a tag ID and memory data, and judge if the memory of the tag contains IPv6 addresses, and then judge if the mobile phone supports the functional format of IPv6. If these conditions are met, the mobile phone can conduct data linking and inquiries through the proposed Mobile RFID phone service, and immediately acquire the relevant music, pictures or video data from the server. If the tag has no IPv6 address or the mobile phone does not support IPv6 protocol, the mobile phone will send the tag ID to the EPCglobal network for inquiry purposes. Therefore, it is required to meet the compatibility standards of Mobile RFID phones and offer maximum support under different conditions, with the operations shown in Figure 3.

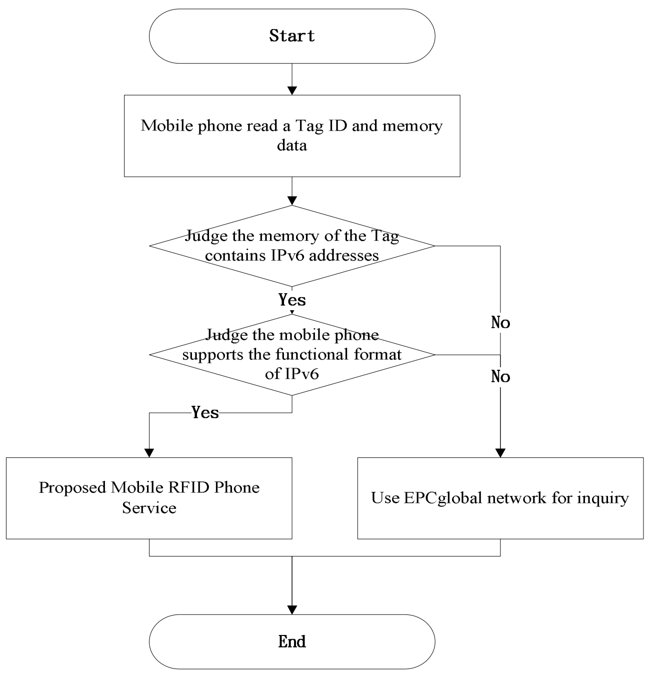

Figure 3. Figure 3 Proposed System Operations

IV. PERFORMANCE ANALYSIS

Different performance can be predicted separately by these two systems. In the process of EPCglobal, the first part requires a time of r1+t1+t2+t3+t4+t5, of which r1 is the time required by the mobile phone to read tags, t1 is the round-trip data transmission time from the mobile phone to the local ONS/ Cache, t2 is the round-trip data transmission time from the local ONS/ Cache to Root ONS, t3 is the round-trip data transmission time from the local ONS/ Cache to local ONS, t4 is the round-trip data transmission time from the local ONS/ Cache to EPCIS, and t5 is the round-trip data transmission time of obtaining messages by mobile phone.

In the transfer framework developed by this study, the time required for data transmission is only r1+t5, however, it is possible to reduce the t1+t2+t3+t4 transmission time, and improve the quantity of network packets. The proposed system framework is proven a fast, low-load transmission system allowing the users to obtain intended data in real-time. The performance analysis is shown in Figure 4.

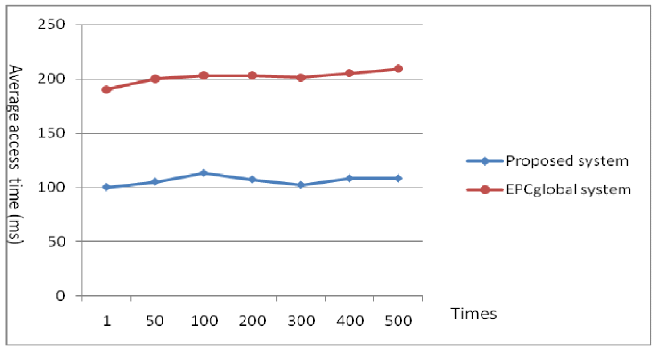

Figure 4. Figure 4 Performance Analysis

V. CONCLUSION

By integrating Mobile RFID and IPv6 mechanism, a mobile phone can immediately acquire data after reading labels, and without data transfer and processing of several servers. This could reduce the data transmissions and service waiting time, and improve the applicability of mobile RFID phone services. In the future, different RFID systems can be applied to IPv6 environments, helping to support the system, meet more requirements, and offer additional applications.

REFERENCE

[1] R. Weinstein, “RFID: A Technical Overview and Its Application to the Enterprise,” IEEE Journal of IT Professional, Vol.7, No.4, pp.27-33, May-June, 2005.
[2] S. Deering and R. Hinden, “Internet Protocol, Version 6 (IPv6) Specification,” RFC 2460, Dec. 1998.
[3] D. Johnson, C. Perkins and J. Arkko, “Mobility Support in IPv6,” RFC 3775, June 2004.
[4] EPCglobal Inc. (www.epcglobalinc.org/)