

# Employing REST Web Services to Support Unified RFID Reader Access in an Interoperable Environment

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## Extended Abstract

The Internet has made it easier to share information among partners and the current trend is to try to leverage the benefits obtained through information sharing across the businesses to improve operational performance, customer service, and solution development. On the other hand, RFID technology propels current practices towards the Internet of Things and a pervasive computing environment. The integration of Internet and RFID is of major significance towards an interoperable world. The major issues we first have to deal with in this direction are: (a) interoperability and (b) the compatibility between RFID and the infrastructures and protocols of the Internet.

In this context, specifications and standards work towards the target of interoperability by defining specific protocols of communication with hardware and processes. The aim of this effort is to discourage software and hardware vendors from creating and equipping their products with their own proprietary protocols for intercommunication. Unfortunately, in spite of the huge standardization efforts carried out by international organizations (ISO, ANSI, EPCglobal), it is not always the case that these specifications are followed. Additionally, the existence of many conflicting specifications in the same field is certain to generate disorder and work against interoperability.

In the field of RFID technology, EPCglobal is the main organization that provides standardization services. The full set of standards that EPCglobal has published over the last few years is intended to form the EPCglobal Network. The rules of this Network govern the operations of the RFID Readers and the applications that are built upon them. As it is well known, this technology is constantly evolving through the protocols and specifications of EPCglobal. This evolution is expressed either by defining in a better and more efficient way things that are already officially specified, or by extending the EPCglobal Network in areas that have been left vague. One such evolution, which is an extension of the Network, is the Reader Protocol specification (RP) (EPCglobal Reader Protocol). The RP was officially published as a final specification in July, 2006 and specifies the way with which “we” can communicate with a RFID reader, regardless of the reader’s vendor. Unfortunately, the final version of RP was released in a time that many RFID readers had already been manufactured and sold. Thus, all these readers that are currently in use in production are equipped only with their vendors’ proprietary communication protocol. The process of upgrading the firmware,

so that they can support the RP (if such upgrade is available), can be considered impractical because of the risks involved.

One possible solution for this issue is to use a middleware that has embedded the intelligence of translating the proprietary protocol commands to the RP defined commands. This middleware can be a standalone piece of software that provides an application programming interface (API) or a networked program. A program in the second case can provide a custom network protocol that may work, for example, over a TCP connection, or it may be in accordance with a higher level network protocol, such as HTTP (e.g. Web Services).

Our proposed solution is an architecture based on the latter, and, more specifically, it refers to an integration platform based on REST Web Services. This architecture is named PROTON.

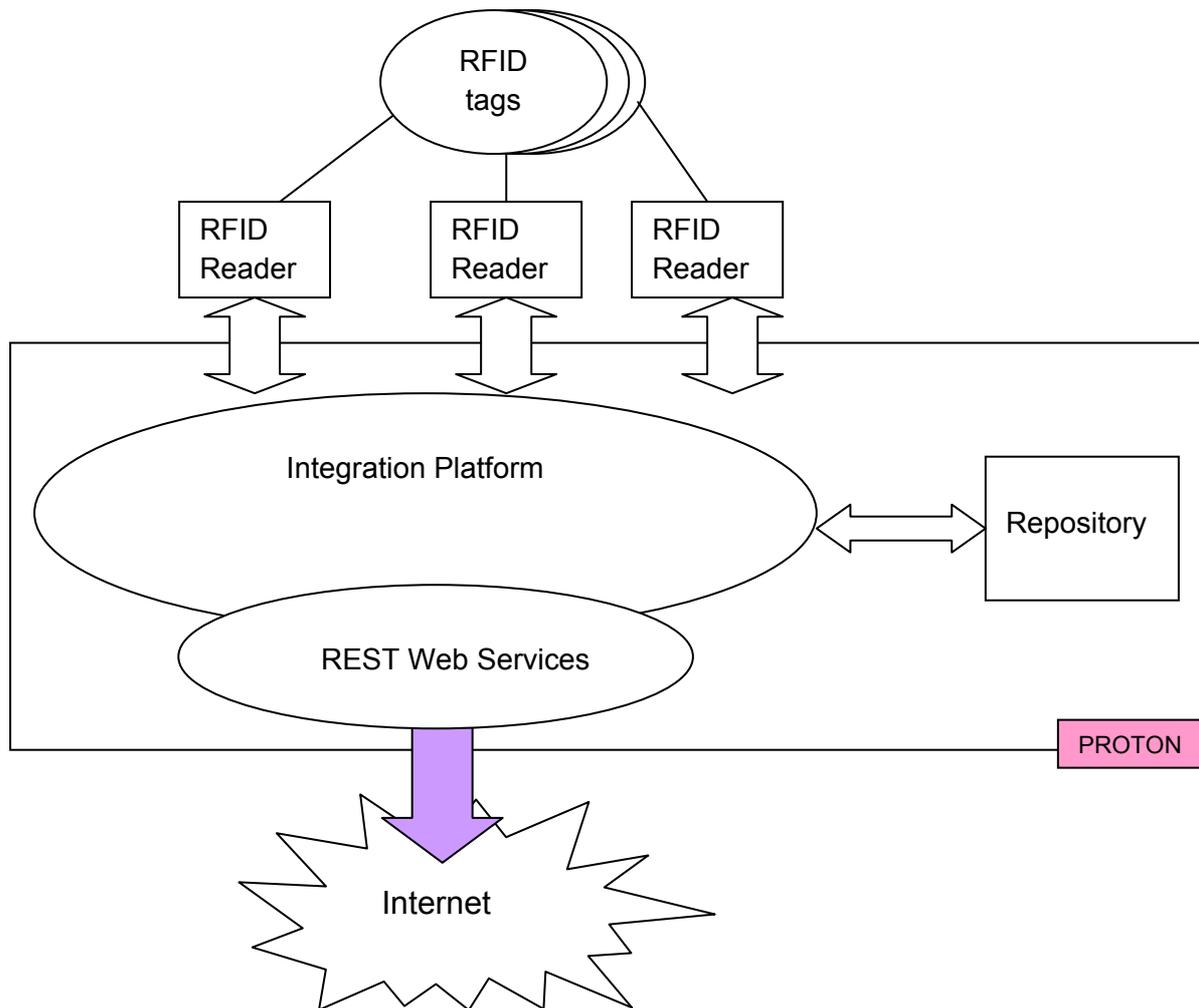


Figure 1: Architecture of the PROTON Interoperability platform

Web Services appear as the de facto solution in addressing interoperability; and there are two approaches of developing web services, i.e. SOAP and REST. SOAP has been the common practice since the beginning of web services. Nevertheless, there is a clear shift towards the new architecture named REST (Fielding et al, 2000). Representational State Transfer (REST) is a software architectural style for distributed hypermedia systems like the World Wide Web. The term originated in a doctoral dissertation about the web written by Roy Fielding, one of the principal authors of the HTTP protocol specification, and has quickly passed into

widespread use in the networking community. REST web services are based strictly on the Internet infrastructure and HTTP (Muehlen et al, 2005), contrary to SOAP which defines and uses a custom protocol above HTTP. This approach is totally in line with our objective which is to integrate RFID infrastructure with the Internet.

Figure 1 depicts the concept of our proposal. A number of RFID tags are identified by a number of different RFID readers. These readers may or may not implement the Reader Protocol standard or any other standard defined by EPCglobal (e.g. Management Protocol standard). The Integration Platform that we define embeds reading, writing, management and other capabilities, which are defined by EPCglobal standards, and thus provides a standardized method for accessing the RFID readers. The repository maintains information that is related to the RFID infrastructure, such as readers' location, information about readers' supported standards, access control lists, etc. The accumulative information that exists within the interoperability platform is made available to the authorized users through the Internet via REST web services.

This proposed architecture has been validated with two RFID readers that do not implement the EPCglobal Reader Protocol standard, namely the Alien AL-8750 and the Intermec IF5. Through the integration platform, an Internet user, who has the permission to read through a specified set of antennas, can request and acquire information about the RFID tags which are within the field of these antennas. This request / response sequence is translated into HTTP requests and responses to a REST web service. An example of such a request / response scheme is depicted in Figure 2.

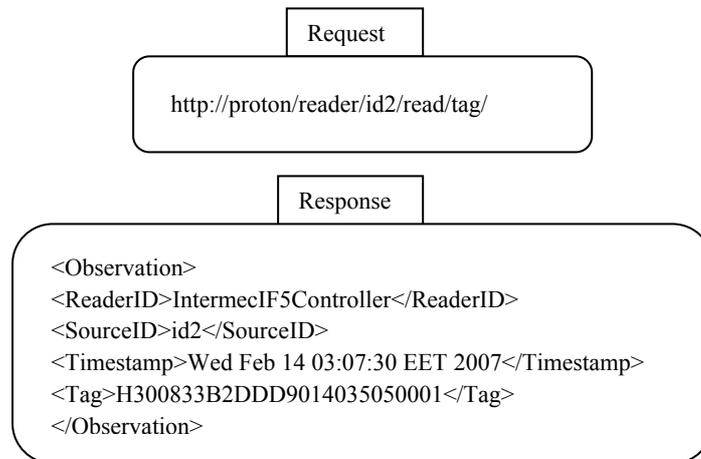


Figure 2: A request / response example

PROTON contributes in the aim of bringing the Internet of things closer to its realization. It provides a common, simple and standardized interface from the RFID world to the Internet overcoming possible interoperability issues.

## References

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