# Data Load Impact on RFID Anti-collision Protocols

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*Abstract*—**RFID anti-collision is one of the most important issues responsible for slow growth of the technology. Hence, there is an alarming need to study and analyze the existing anti-collision protocols in the light of their performance. The objective of this paper is focused around presenting the impact of data load on the identification time and hence the performance of the ISO 18000-3 mode 1 and ISO 18000-3 mode 1 "Extended mode" Radio Frequency Identification anti-collision protocols. A simulation analysis of the same has been carried out and results have been drawn in this paper for the betterment of the technology.**

***Index Terms*—RFID, Anti-collision, Performance, Issues, Analysis, Data.**

## I. Introduction

When it comes to identification technology, RFID is the prime choice. An RFID system is typically composed up of an individual Electronic Product Code (EPC) that identifies not only the type of object, but reveals which specific object it is. As an example, with RFID it could be easily traced out that in thousands of soft drink bottles, which soft drink bottle would have contained defected stuff. Another component of an RFID system is an RFID tag, which is a tiny electronic circuit that holds the EPC code and other information about the object. It is normally pasted on the object to be identified. A miniature antenna, made from a flat coil of wire, is attached to the RFID tag. Apart from RFID tags, there may be several RFID readers in an RFID system. An RFID reader is a device that sends radio frequency signals out to the tags and reads the signals that come back from the tags. Readers can be attached to the door frame of a warehouse, next to a conveyor belt, or incorporated into a hand-held scanner. In addition to the components mentioned above, software, sometimes called "middleware," is present which takes the data coming in from several RFID readers, filters it, sorts it, and sends the important information on to the main business software [1].

As per the current scenario, RFID (Radio Frequency Identification) technology is one of the most talked about technologies due to the bucket of opportunities it offers. Those opportunities like no line of sight required, read in real time are motivating enough for the grand use of the technology since other existing identification technologies like bar codes lack in those terms [1].

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## II. Problem Formulation

Since every opportunity comes with challenges, RFID poses some difficulties and is still not able to act according to its best. Collision is one such issue faced by this technology which substantially hinders the performance of the technology [3]. Various RFID anti-collision algorithms have been designed and to be designed for handling the collision issue in RFID Tags [2], [4], [5], and [6]. The performance depends upon the identification time in anti-collision protocols. Hence, there is a strong demand to study the impact of crucial factor like data capacity on the identification time in these RFID anti-collision algorithms.

## III. Problem Solution

This paper aims to present the influence of variation of data (in terms of number of bits) on the identification time while requesting the information in the two existing RFID anti-collision protocols namely ISO 18000-3 Mode 1 also said to be in the "main mode" and ISO 18000-3 Mode 1 "Extended Mode" protocols.

### *A. Simulation Analysis of ISO 18000-3 Mode 1 and ISO 18000-3 Mode 1 "Extended Mode" protocols*

In order to analyze the performances of the existing ISO 18000-3 mode 1 and ISO 18000-3 mode 1 "extended mode RFID anti-collision protocols, a simulation study was done. A total of 12 simulations were performed corresponding to both of these protocols belonging to the anti-collision category. Initially, for both the protocols, the data in the requested information was assumed to be 32 bits only. In case of the 18000-3 mode 1 protocol, it was observed that it took 6.411502 seconds to identify a maximum of 300 tags. Its graph is plotted in Fig. 1, where the rise of identification time by this protocol can be clearly seen with the rise in number of RFID tags in the interrogation zone of the RFID reader.

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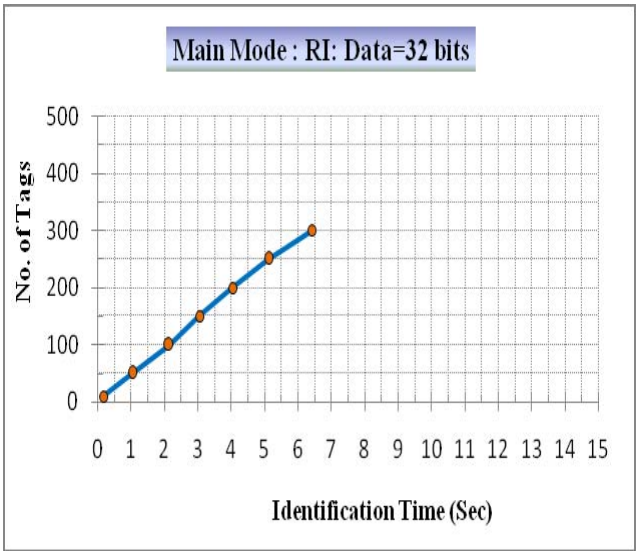


**Fig. 1 The ISO 18000-3 Mode 1 protocol : Identification Time vs Number of RFID Tags with 32 bits of requested information data**

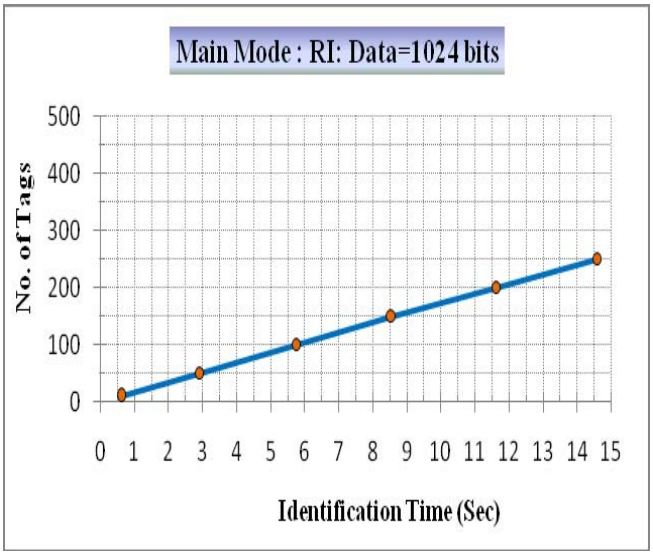


**Fig.3 The ISO 18000-3 Mode 1 protocol : Identification Time vs Number of RFID Tags with 1024 bits of requested information data**

In fig. 2, the simulation results corresponding to the ISO 18000-3 mode 1 "extended mode" protocol have been depicted. It can be seen as a part of this result that, as compared with the ISO 18000-3 mode 1 protocol, the identification time is quite less in case of the ISO 18000-3 mode 1 "extended mode" protocol. Here, corresponding to 32 bits of requested information of data, 450 tags were identified in 1.880866 seconds only, which is a huge difference.

After considering the 32 bits of requested information data in both the RFID anti-collision protocols under consideration, the number of bits in the requested information data was then further varied by taking 64, 128, 256,512 and 1024 bits. Fig. 3 and Fig. 4 represents the tag identification time versus number of tags plots corresponding to ISO 18000-3 mode 1 and ISO 18000-3 mode 1 "extended mode" protocols respectively . The number of bits in this case for the requested information data equals 1024.

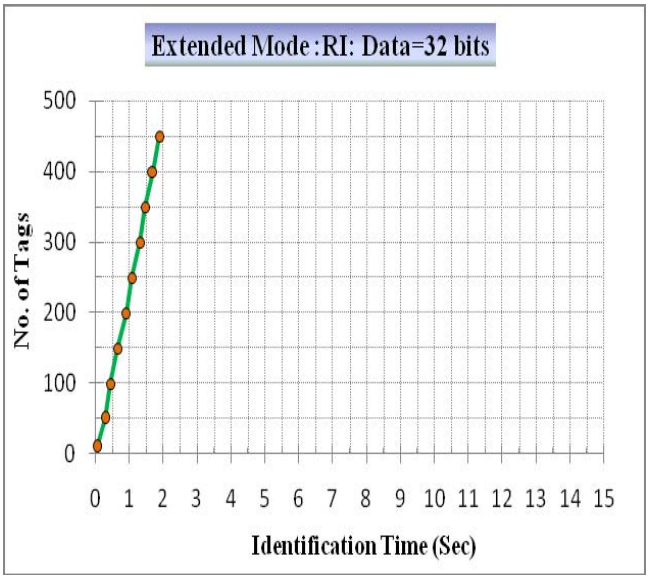


**Fig. 2 The ISO 18000-3 Mode 1 "Extended Mode" protocol : Identification Time vs Number of RFID Tags with 32 bits of requested information data**

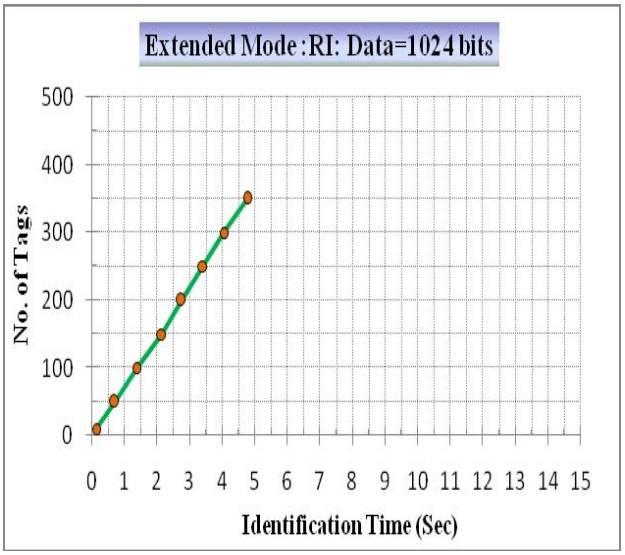


**Fig. 4 The ISO 18000-3 Mode 1 "Extended Mode" protocol : Identification Time vs Number of RFID Tags with 1024 bits of requested information data**

## IV. Results

Figures 5 and 6 clealy reveal the impact of data bits being increased from 32 initially through 1024 in the requested information from the RFID reader. Fig. 5 depicts the comparable identification times corressponding to the ISO 18000-3 mode 1 and ISO 18000-3 mode 1 "extended mode" protocols, where the data bits were raised from 32 through 1024.

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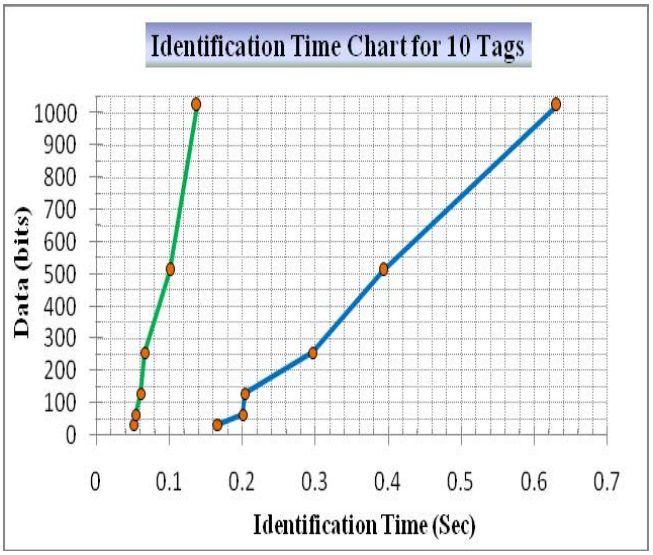


**Fig. 5 Impact of Data size on Identification Time: Performance Comparision of ISO 18000-3 Mode 1 and ISO 18000-3 Mode 1 "Extended Mode" protocols for 10 RFID Tags**

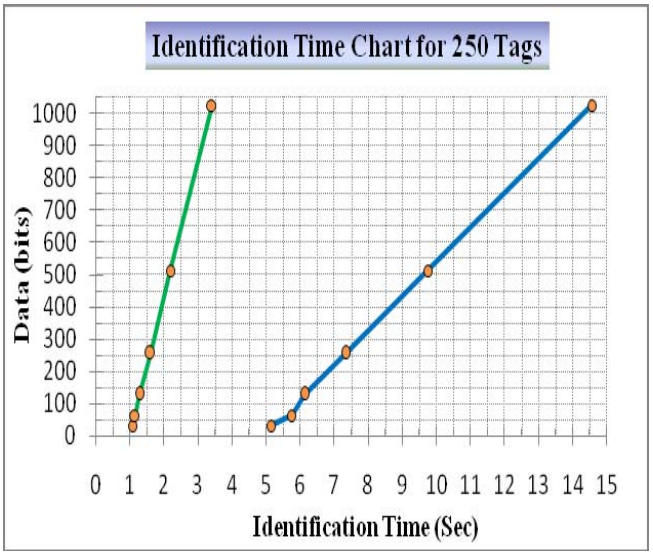


**Fig. 6 Impact of Data size on Identification Time: Performance Comparision of ISO 18000-3 Mode 1 and ISO 18000-3 Mode 1 "Extended Mode" protocols for 250 RFID Tags**

As apparent from the Fig 5, when the requested information data was varied from 32 bits through 1024 bits, for 10 tags in the zone of the reader, the identification time in case of ISO 18000-3 mode 1"extended mode" protocol rises from 0.051876 seconds to 0.138057 seconds. Whereas, in case of the ISO 18000-3 mode 1 protocol, the identification time of 10 tags rises from 0.167292 seconds to 0.631035 seconds. Clearly, the ISO 18000-3 mode 1 "extended mode" protocol took less time to identify the same number of tags as in the ISO 18000-3 mode 1 protocol.

In Fig 6, when the number of tags in the interrogation zone of the reader was raised upto 250 tags, its impact on the ISO 18000-3 mode 1 "extended mode" protocol was that the initial identification time for 32 bits of data came out to be 1.062708 seconds and as the number of bits in the data was increased through 1024, the identification time came out to be 3.404634 seconds. In ISO 18000-3 mode 1 protocol, for 32 bits of data, the identification time was still high as 5.127272 seconds and it went further higher as 14.558955 seconds when the data became heavier through 1024 bits. Clearly, again, the ISO 18000-3 mode 1 "extended mode" protocol took less time to identify the same number of tags as in the ISO 18000-3 mode 1 protocol even if the number of tags in the zone of the reader was increased to 250.

## V. Limitations

It was observed as a part of the above results that, in, both the existing protocols, as the number of tags to be identified in the interrogation zone of the reader increased beyond a certain capacity, a time out error occurred and as a result all the tags which were existing in the reader's zone at a given moment of time could not be detected.

## VI. Conclusion

As the number of RFID tags were increased from 10 through 250, the ISO 18000-3 mode 1 "extended mode" protocol outperformed the ISO 18000-3 mode 1 protocol in terms identification time and data capacity. Hence, in the range from small number of tags through high number of RFID tags in the interrogation zone of the reader, the ISO 18000-3 mode 1 "extended mode" protocol performs better than the ISO 18000-3 mode 1 protocol, even when the number of data bits accommodated in the requested information is high.

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