Application Layer Protocols for the Internet of Things: A survey

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Abstract—The "Internet of things" (IoT) concept nowadays is one of the hottest trends for research in any given field; since IoT is about interactions between multiple devices, things, and objects. This interaction opens different directions of enhancement and development in many fields, such as architecture, dependencies, communications, protocols, security, applications and big data. The results will be outstanding and we will be able to reach the desired change and improvements we seek in the fields that affect our lives.

The critical goal of Internet of things (IoT) is to ensure effective communication between objects and build a sustained bond among them using different types of applications. The application layer is responsible for providing services and determines a set of protocols for message passing at the application level. This survey addresses a set of application layer protocols that are being used today for IoT, to affirm a reliable tie among objects and things.

Keywords— IoT application layer Protocol; XMPP; MQTT; CoAP; RESTFUL; DSS; AMQP; WebSocket

I. INTRODUCTION

Many of the devices nowadays adopt the terminology of Internet of Things (IoT) to interconnect; and with this change in interconnection, these devices need different protocols (Bluetooth, Wifi) to avoid the problem of interoperability. The Application Layer – which interacts directly with the end user – consists of applications each with its own application layer protocols, not forget to mention the amount of new protocols that are needed to solve the rising IoT challenges as the old ones don't perform the same.

This survey will introduce the existing application layer protocols in details, which focus basically on message exchange between applications and the internet. This survey also provides a comparison among all discussed protocols based on transport layer used, architecture and communication model. The first section in this proposed paper discusses one of the most common application layer protocols that are used in IoT. The next section shows a comparison between the protocols which are previously discussed in previous sections. Last section suggests some future work to achieve more enhancement in this research area.

II. CONSTRAINED APPLICATION PROTOCOL (COAP)

Constrained application protocol (CoAP) is request/response protocol; it is similar to client-server model. Nevertheless, this protocol is only sufficient in constrained environment such as: constrained node with low capability in RAM or CPU, and constrained network, such as lower power using wireless personal area network (WPAN). This constrained environment led to bad packet delivery and high overhead. CoAP was designed by Internet Engineering Task Force (IETF) which is mainly interested in machine to machine (m2m) applications and the automation of systems to reduce overhead, enhance packet delivery, and to increase the simplicity of work, by using simple interface with HTTP [1].

CoAP supports publishe/subscribe architecture, this architecture provides multicast communications, and the publisher sends the message so on the other hand multi-subscribers can catch the message and takes the actions. This scenario is done in an Asynchronous way. Publish /subscribe architecture is used to support a large number of users and provide better performance than the traditional way [3].

The most important features in CoAP are simplicity and reliability; since it supports unicast and multicast request by taking advantage of UDP, and provide the ability to Asynchronous message exchanges. CoAP is a single protocol with two layers, the first layer is the messaging layer and the second one is the request/response layer; messaging layer aims to achieve reliability based on UDP, while request/response layer aims to act the interactions and communication.

CoAP uses different types of massages: Conformable Message, Non-conformable Message, Acknowledgement Message, Reset Message, Piggybacked Response, Separate Response, and Empty Message [1] [2]. The following points provide a brief description for each: