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COMMUNICATION PROTOCOL IN IOT SYSTEMS

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Abstract:

The Internet of Things (IoT) has become very popular due to swift innovation and wide-scale apps that have changed our lives in real-world applications. In linking IoT modules, connectivity plays an integral part. The protocols that provide fast, safe and accurate communication without jeopardising machine and energy constraints of the IoT devices employed take hours for an effective IoT communication. Any of these protocols can be deployed for the transport of information in various strata including CoAP, MQTT, XMPP, RESTFUL Services, 6LoWPAN, RPL etc. This paper analyses the performance and reliability of these protocols based on energy effectiveness, protection, and lightweight design, as well as the various IoT protocols implemented in different layers of the IoT protocol set.

Key Words: Internet of Things (IoT), Application layer protocols, Data Link layer protocols, Network Layer protocols

Introduction:

The IoT is a growing network of computers, sensors, actuators and smartphones linked to the Internet. These instruments gather and feel aggregate and interpret data in order to make informed decisions which would be useful for some applications [1]. In other words, IoT may also be considered a set of non-system computers, which are linked through a network for decision making. In order to be successful in transmitting data in such protocols, IoT communications devices have to agree on various aspects of transmitted data [2], [3], such as memory and control. These protocols play an important role in effective communication. More and more protocols were integrated into the IoT over time as the previous protocols had not been considered appropriate to fulfil the IoT specifications. Thus certain requirements must be followed for their adequacy in IoT environments by the protocols. These criteria include scalability, connectivity, management, security, etc. Therefore it takes an hour to get a proper grasp of the applicability of these protocols. We may then conclude that the overarching purpose of IoT is to preserve the contact efficiency between objects and through various IoT implementations, improve the interaction between them.

Literature Review:

Several experiments and surveys were carried out to demonstrate the different facets of IoT protocols regarding their appropriateness and usefulness in limited settings and the smooth handling of communications. The analysis [1][3][4] compares application layer protocols and concludes that the CoAP on UDp and the web socket minimise overhead connectivity and the MQTT as an optimal alternative for battery-run alternatives is the lightweight one of both. The authors' work [5] indicated that Bluetooth systems had considerably lower power requirements than Wi-Fi devices. Evaluating protocols between CoAP and MQTT-SN revealed that when sending the same payload, MQTT-SN works 30 percent faster than CoAP [6]. The experiment results [7] have shown that the CoAP is more efficient relative to the other protocols, although both the lowest efficiency and the highest TTR due to both transport and device layer ACKs is usable. MQTT has QoS1. In order to test their response period, a smart parking application was introduced by adjusting traffic load [8], thereby improving the efficiency of CoAP in lower server use and that of Web Socket in higher server use.

Standardized protocol stack was recommended in order to satisfy the criteria for energy-efficient, secure and internet connectivity. The analysis [9] indicates that the PHY layer & the MAC layer IEEE 802.15.4-2006 is adequate to meet energy efficiency, while the 6LoWPAN provides the power to low IETF RoLL routing and the CoAP for the application layer. Another paper compares data link protocols [10] to provide a good idea of choosing an acceptable communications protocol based on the implementations, security, power usage, transmission channel aspects. In the context of intelligent grid applications, the Authors [11] suggested the performance measurement of the RPL Protocol. Interoperability across networks in the sense of IoT is also necessary [12]. A Networking Stack (PLC) based on the open standards, namely IEEE 802.15.4/6LoWPAN protocol stack is proposed with RPL as the basis for routing. The protection at the network level can be accomplished with an emphasis on potential RPL and 6LoWPAN threats, counter-measurement steps and network parameters consequences [13]. Protocols such as 6LoWPAN/IEEE 802.15.4, Bluetooth and NFC for m-Health and e-Health applications can be used for advanced clinical wireless devices [14], for example. On the basis of the previous study analyses performed on these protocols, the researchers and service providers have been undertaken to draw attention to their peculiarity in various IoT implementations.

IOT Protocol Stack:

The IETFs CoAP, IBM MQTT, XMPP and AMQP are existing protocols in the IoT application layer used to link stuff and end-user applications online. UDP and TCP are protocols for transport layers and IPv6, and the network path and encapsulation facility ROLL RPL and 6LoWPAN are supported. From the point of view of PHY, we found that PHY layer(s) and upgrade of current IEEE 802.15.4-2006 are appropriate for energy efficiencies. The following section suggests that IoT protocols are acceptable with respect to reliability, protection and energy usage.

A. IOT Application Layer Protocols:

The IoT implementation layer ensures efficient connectivity between the IoT modules, which are restricted from low cost to low energy resource. It also defines the range of protocols [1], [3], [4] for messages passing through the application stage, including the Constricted Layer application (CoA P) Protocol. A broad comparison of these protocols is provided below based on different criteria. Reasonable applicability, service efficiency, reliability, protection, responsiveness and IoT implementation for

the IoT application level is given. IBM MQTT is on the other side deployed to connect with a distance/cloud. MQTT is considered a good alternative to achieve performance in battery-driven applications. However, the protocols for query/interaction consume more resources in comparison to the protocol for publishing/subscribing [8], [12].

XMPP offers fast and better answer and addresses devices for contact between people along with a system for using our telephone to access different applications. It is best suited for IoT implementations that are consumer-oriented for better protection and scalability. MQTT [1] is used in satellite connectivity, dial-up and short-range cell networking situations, on the other hand. It requires less power, is small in size, is efficient and give information to more than one receiver has minimized data packages and performance.

B. IOT Network Layer Protocol:

The IoT network layer can be subdivided into a routing layer, which performs packet transfer in data link layer images for IoT implementation from source to destination as well as encapsulating the IPv6 data graph. RIP [4], [5], [9], [15] i.e. low power and loss network routing protocol, while standards for the layer encapsulation can be used in the IoT network Layer communication, in IPv6 and 6LoWPAN [2], [9], [13]. 6LoWPAN is a flexible and protected Protocol for small devices with minimal processing capacities, optimized for low power applications. IPv6 is less interoperable with these protocol's than RPL and 6LoWPAN [2], [9]. RPL and 6LoWPAN have made compatibility possible for IPv6 that guarantees global coverage, scalability, stability and network security.

C. IOT Data Link Layer Protocol:

The key function of the IoT data access layer is to control data transfer over the physical network connection. It also guarantees initial link initialization and assigning of suitable physical protocol to the data, manages communication errors and provides a specified network layer interface. The networking protocols for the IoT data-link-layer [9] [10] are protocols such as Bluetooth, ZWave, ZigBee, Home plug Green PHY, Dash7 etc. To date, both protocols have lower power consumption and low cost. BLE is used for communication with small distances, while ZigBee is used for communications with long ranges. Home Plug GP offers stable and secure home automation LAN networking spanning MAC and PHY layers.

The Dash7 is ideal for long-term scalable connectivity [9], [10], in contrast with ZigBee. For a powerful, short distance communication, Bluetooth is built. Wi-Fi is also designed to connect over a long time with lower energy demand [5].

Hence, in-vehicle networking including short range connectivity, BLE, ZWave, Home Plug GP protocol serves good purposes for applications such as domestic domain domains domain automation grid automation. Among them, Home Plug GP beats others by being able to reduce energy usage and expense while ensuring interoperability, efficiency and coverage of the network. Zigbee and Dash7 enable a broad variety of network topologies to fit smart homes, remote controls and healthcare networks for flexible IOT applications.

Conclusion:

In interdisciplinary IoT applications, communication over confined environments is efficient, accurate and secure. This research highlights the characteristics and applicability of real life implementations of current IoT connectivity protocols. The findings demonstrated that CoAP and MQTT are mostly handheld and battery-operated application layer protocols for two applications. Although CoAP provides lightweight memory connectivity and power restricted applications via MQTT, it does not provide the same payload for the transmission of increased MQTT-SN. ZigBee and Dash7 have not only a well-defined network layer interface, but also function well with the physical and MAC layer in line with IEEE 802.15.4E. When rudimentary features of IOT protocols have been shown, the requirement for efficient connectivity and interoperability for IoT implementations cannot be fulfilled by a single protocol. The following protocols can be combined to write a standardised protocol for multiple layers to suit all IoT applications in order to achieve these characteristics. In the future, this mixture of protocols in the various layers will facilitate secure connectivity between restricted devices. The recently established specifications should be used to verify their performance in order for the IoT systems to have stable protection, robustness and light weight.

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