An Introduction to M2M/ IoT Protocols

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Introduction

M2M and IoT are taking the world by storm. The things around us are becoming smarter, intelligent, seamlessly connected and interacting with each other. It has already started enabling new business opportunities by connecting your devices, sensors, cloud services and data to create a network of everything. Very basically, IoT implies the concept of connecting any device with an 'on and off' switch to each other or with the internet. The devices can vary from mobile phones, wearables, fridges, washing machines, microwave ovens and almost everything you can imagine wildly. The network will be from people to people, people to things and also things to things and they all will talk to each other also. However, the real question is what language or protocol does all these devices will communicate with the internet. During the time of internet evolution, there was a strong desire among all the stake holders that all the computers connected to the Internet should be talking in the same language/ same protocol. TCP, IP, UDP etc. were some of the results of a quest around that search. However, M2M/ IoT world still lacks a widely accepted and standard protocol, apart from a few protocols that are being currently used.

The IoT Communication Challenges

In Machine to Machine and IoT, the interconnected devices are usually of short range low power wireless devices with their own predefined set of operations or purpose. Because of this, the protocols that are currently used on the internet cannot be directly used in these devices. This brought in the need for creating a new set of protocols which can be catered to the requirements of the M2M/ IoT world. Some of the most widely used protocols in M2M/ IoT are MQTT, CoAP, OMA LWM2M etc. These protocols specifically target low power devices which have to conserve power so that they can operate for a long time. Compared to the internet protocols where the pay load is heavy along with big headers and footers, in M2M/ IoT protocols the payload is very small. So if internet protocols are being used, the work will be more to reduce the size of the headers and footers for aiding fast communication between the devices and the servers.

The Three Major IoT Protocols

Let us have a look into the three major IoT protocols here.

MQTT (Message Queue Telemetry Port)

MQ Telemetry Transport (MQTT) an open source publish/subscribe messaging transport protocol is designed for power constrained devices and low-bandwidth, high-latency networks. . Despite the word Queue is in the name, MQTT is not a queue based protocol. It is lightweight in nature and is ideal for connecting small devices to constrained networks. MQTT with bandwidth efficiency, data agnostic nature, and continuous session awareness, helps in minimizing the resource requirements for IoT devices. It ensures reliability and assurance of delivery to a larger extent. The protocol is based on topics and hence the receivers of the messages can make sense of the data without even knowing who the sender is. This kind of behavior encourages usage of high-latency and low bandwidth networks which seems to be the norm of the M2M and IoT communication channels. The ports assigned for MQTT are 1883 without SSL and 8883 for MQTT with SSL. Not designed for device-to-device transfer or for "multicasting" data to many receivers, MQTT is ideal for large networks of small devices that need to be monitored or controlled from a back-end server on the Internet.

CoAP (Constrained Application Protocol)

CoAP or the Constrained Application Protocol is a specialized web transfer protocol that is suitable for constrained nodes and constrained networks in IoT. This protocol is described in the RFC 7252 and is taken forward by IETF Constrained RESTful Environments (CoRE) working group. It is designed for M2M applications such as smart energy and building automation. Based on REST model like HTTP, in CoAP also the servers make resources available under a URL, and clients can access these resources using methods such as GET, PUT, POST, and DELETE. The close resemblance of CoAP with HTTP makes it very user-friendly and also makes it easier for making them connected easily using application-agnostic cross-protocol proxies. Like HTTP, it can also carry different types of payloads and is able to integrate with XML, JSON, CBOR, or any data format of your choice. The strong security capabilities of CoAP is another factor which makes it a desired choice among the available IoT protocols. CoAP makes use of Datagram Transport Layer Security (DTLS), with the default level of encryption equivalent to a 3,072-bit RSA key. Designed to use minimal resources, both on the device and on the network it works on microcontrollers with as low as 10 KiB of RAM and 100 KiB of code space (RFC 7228).

OMA LWM2M (Open Mobile Alliance Light Weight M2M)

LWM2M is a light weight protocol developed by Open Mobile Alliance and is specifically for device and service management. The device management includes device statistics, firmware update, access controls etc. It helps in implementing an interface between M2M device and M2M Server and also provides a choice for the M2M Service Provider to deploy an M2M system to provide service to the M2M user. LWM2M helps to implement an interface between M2M device and M2M Server and also provides a choice for the M2M Service Provider to deploy an M2M system to offer service to the M2M user. Designed with the performance constraints of M2M devices in mind to enable low-cost devices and build on CoAP, the state of the art architectural design, extensibility, efficient security features based on DTLS Makes it a preferred option among the IoT protocols.

Conclusion

Comprised of diversified segments including smart cities, buildings, automotive, smart parking, manufacturing, healthcare, education, the IoT/ M2M use cases will be drastically different. However, what all these areas need to be in common is the ability to communicate over a common protocol with each other and over the network, which reminds us the relevance of the IoT/ M2M protocols that we are discussing here. Being in its state of infancy, the IoT/ M2M market is currently in a highly fragmented stage. However, without any doubt we can foresee the huge growth potential of the market of inter connected things/ devices. We are fast moving into an era where billions of devices get connected and communicate with each other. In this upcoming 'Internet of Everything era' let us expect more innovation to come up in the field of IoT/ M2M world to bring in more efficient communication protocols, capable of redefining the IoT/ M2M communication arena.

About the Author

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Shanmugasundaram M. (Shan) Associate Director, Product Engineering Services (PES) at Happiest Minds Technologies is a prolific inventor and creator of many products and who possesses 15 patents in the areas of telecoms, automotive (OBD II, J1939 etc.), M2M etc. He has an overall 14 years of IT industry experience in the areas of R&D(telecoms, automotive, M2M etc.), filing patents, inventions, converting inventions to successful products, customer projects and maintenance projects. An accomplished master and successful implementer in M2M (Machine to Machine) technologies who proved himself again and again in creating and deploying real world cutting edge M2M products. Some of the products are Logica EMO, Static Asset Monitoring, Retail Innovations etc.

These inventions won numerous awards including Golden Peacock award, Nasscom award, The Economist award etc. These inventions provided Logica with much needed global exposure in many different domains including automotive technologies.

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