

A SURVEY OF VARIANTS OF CONSTRAINED APPLICATION PROTOCOL

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ABSTRACT

Constrained Application Protocol (CoAP) is an IOT messaging protocol [6]. Internet of Things consists of Low Power and Lossy Network (LLN). CoAP protocol has been designed to be easily mapped to HTTP protocol [5]. CoAP protocol is selected as an application level protocol for remote data access and representation. CoAP uses the UDP as transport layer protocol by default. CoAP is a web protocol which is optimized for the constrained devices and the networks. CoAP is also designed to communicate between the embedded devices. This paper is composed of the variants of CoAP protocol which are CoCoA model, CoAP-PBF protocol and the comparison of CoAP with CoCoA model and SCoAP protocol.

Keywords- CoAP, CoAP-PBF, SCoAP, HTTP, REST

I. INTRODUCTION

Internet of Things (IOT) is a visualization of connecting various objects in our daily lifetime through wireless or wired approach. It is expected to generate huge amount of data from multiple locations and are aggregated, thus increasing the need to have better throughput and reliability. CoAP protocol uses the REST architecture where URI (Universal Resource Identifier) is used for resource identification. The main difference between CoAP and HTTP is that CoAP is built on the top of connection oriented TCP protocol. Due to the low overhead and simple mechanisms, UDP is selected as the transmission protocol. Within UDP packets, CoAP packets uses four bytes binary header, followed by a sequence of options. CoAP is also called the compressed HTTP.

Various methods defined in CoAP protocol are:

- DELETE: This method in CoAP protocol is used for deleting the resources.
- PUT: This method in CoAP protocol is used for updating resource on the server representation.
- POST: This method in CoAP protocol is used for transferring information.
- GET: This method in CoAP protocol is used for retrieving information.

CoAP is an application layer protocol so it is also based on the client server mechanism [2] in which the client node sends a request to the server and the server in turn sends back a response to the client node after processing the request from client.



Figure 1: client server model of CoAP

Protocol Stack [2] of IOT is shown below which shows that which protocol operates at which layer of the OSI model.

Table 1: protocol stack of IOT

Application Layer	CoAP
Transport Layer	UDP
Network Layer	IPv6/RPL
Adaptation Layer	6LowPAN
MAC Layer	802.15.4
Physical Layer	802.15.4

II. CoCoA OVERVIEW

CoCoA stands for the Congestion Control Advanced [1]. It was developed to address various limitations of CoAP and to more efficiently deal with the congestion in the network. It runs two Retransmission Time Out (RTO) estimator algorithms named Strong and Weak algorithms. Strong RTO algorithm uses RTT that is measured if an acknowledgement was received for a transaction which didn't require any retransmission while Weak RTO algorithm uses the RTT that is measured after retransmission of the CoAP request atleast once.

2.1 COMPARISON OF CoAP and CoCoA PROTOCOL

1) Throughput vs. Packet Frequency

- Behaviour of both protocols in an environment with no wireless losses is described as:
At low frequency there is low congestion, hence throughput is almost the same in both. But as frequency or data rate increases, hence CoCoA performs better. CoCoA has not much higher throughput than CoAP because it has to maintain strong and weak RTO estimators, so it has higher overhead than CoAP protocol.
- Behaviour of both the protocols in lossy environment is described as:
Loss is proportional to distance. As the loss rate increases, throughput reduces for both protocols but CoAP has higher throughput than CoCoA because CoCoA has less retransmission rate. It saves energy, proves conservative in nature and is not able to provide high throughput.

2) Number of Retransmissions

Number of retransmissions decreases with the increase in loss percent. Thus both the algorithms become more conservative in nature.

3) Evaluation of Retransmission Timers

When RTT is calculated as the distance from the point of initial transmission and the point where the ACK is received from the point of final retransmission and the point where ACK is received.

III. CoAP-PBF OVERVIEW

CoAP-PBF stands for the Constrained Application Protocol- Partitioned Bloom Filter [3]. PBF inherits compact and complete information summarization of bloom filters. PBF techniques speed up the entire process. CoAP_PBF saves significant memory cost and look-up time in scenario, where the resource ratio is large, resulting in improved networked performance.

IP address is not specified by CoAP resource discovery protocol . So to provide an IP address an external application is required. CoAP-PBF is an improved version of CoAP resource discovery Protocol in which each device sends resource summary with Partition Bloom Filter. It is more efficient and better than CoAP because compact, complete and encrypted remote devices information is received by all the devices. Because of encrypted format the security increases. CoAP suffers from the increased delay due to the look-up operation with increased resources but it is not so in CoAP-PBF.

Bloom Filter is an array of bits in which 1 represents the resource is present and 0 represents the resource is absent.

IV. SCoAP OVERVIEW

To leverage CoAP based resources, CoAP protocol is designed in such a way that it can be used in web applications. But the structure of CoAP protocol prevents it from being supported. CoAP is translated using HTTP using the HTTP/CoAP proxy. But this translation is not the best solution since most of the CoAP features are limited. So a new solution called SCoAP [4] came into existence. SCoAP is the combination of CoAP in java script called JSCoAP and a special CoAP proxy that uses HTML 5 web socket protocol called WSCoAP to preserve end-to-end communication among CoAP servers and web browsers.

4.1 JSCoAP

It is the java script implementation of CoAP. The four main constituents of JSCoAP are given below:

- 1) JSON Serializer: It is used to serialize JSON objects.
- 2) Array Buffer Descriptor: It does the opposite of JSON serializer. It deserializes the JSON objects.
- 3) Message Queue: Serialized CoAP buffer is transmitted using it.
- 4) Event Handler: CoAP packets are received using Event handler.

4.2 WSCoAP

WSCoAP is HTML 5 web socket based CoAP proxy. It is called private proxy as it is located on or near the edge routers and the public proxy is the one whose address is known to everyone and it can be located on the internet without any cost.

V. CONCLUSION

To integrate CoAP protocol with the web, SCoAP architecture is used. It is better in terms of traffic over the network and reduction of computational demand over HTTP/CoAP proxy in integrating CoAP resources with the web. CoAP-PBF sends the information in encrypted form rather than in plain text to prevent unauthorised

user to obtain devices information. CoAP- PBF sends service and resource publication in the form of sequence of bits rather than plain text.

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