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OPC UA Message Transmission Method over CoAP
draft-wang-core-opcua-transmission-00

Abstract

In Industrial applications, it is very attractive to implement the exchange of semantic information utilizing OPC UA Transmitting in CoAP. This document provides some transmission methods for message of OPC UA over CoAP.

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1. Introduction

Internet of things is one of the attractive applications for CoAP. Utilizing OPC UA Transmitting over CoAP could meet the demand for industry 4.0 based on the exchange of semantic information[draft-wang-core-opcua-transmition-requirements-00]. Similar to OPC UA, CoAP message is exchanged in server/client mode. However, their transmission is not the same. Driven by this, to use OPC UA Transmitting over CoAP, the major problem to be solved is how OPC UA packets are transmitted over CoAP. For the transport layer of OPC UA, the main message transmission method is TCP or HTTP, and CoAP's design inspiration comes from HTTP, thus, there are some connections in transmission method between them. This proposal provides some transmission methods for message of OPC UA over CoAP, so that a communication could be established between client and server.

2. Transmission scheme

2.1. Proxy for OPC UA-CoAP

OPC UA is a protocol mainly for application layer, which defines many services for the different needs of industrial applications. Message is exchanged mainly through server/client mode, utilizing TCP or HTTPS. When security is ignored, OPC UA can be considered to support HTTP transmission. CoAP's design inspiration comes mainly from HTTP, the two can be mapped between each other to meet the needs of some special scenes [draft-ietf-core-http-mapping-17]. Combined with the characteristics of OPC UA and CoAP, a CoAP proxy can be established between OPC UA client and OPC UA server. The architecture is shown in Figure 1.

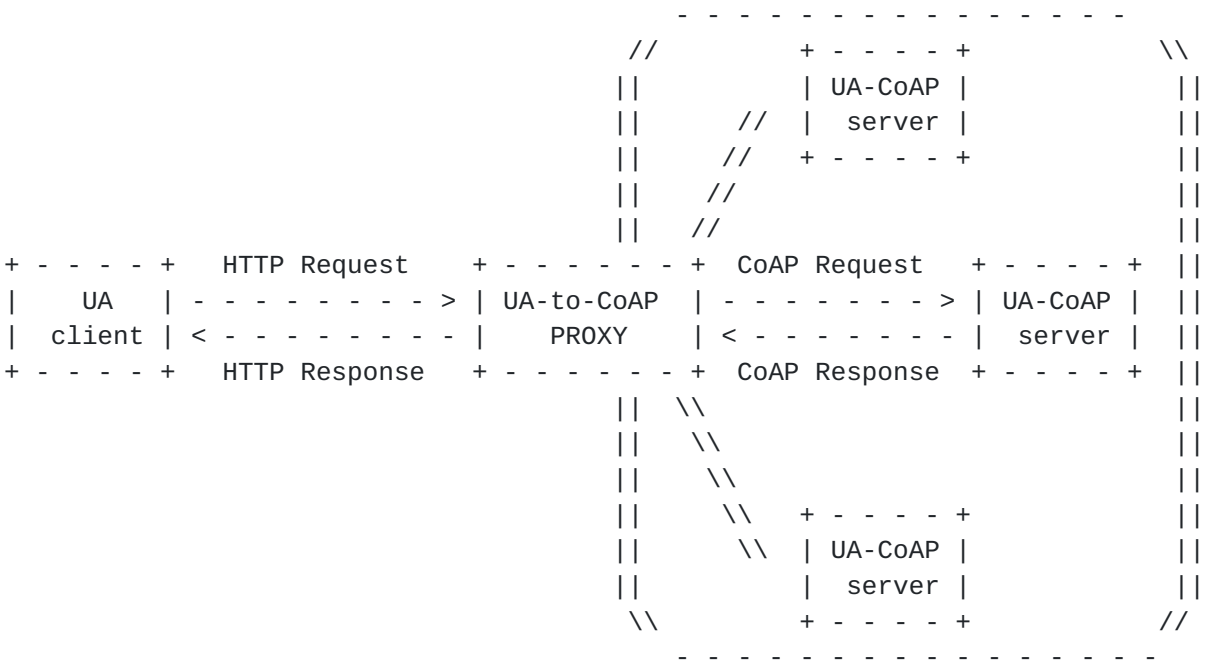

Figure 1. Proxy for OPC UA-to-CoAP

As shown in Figure 1, assume all OPC UA servers are based on CoAP [draft-wang-core-opcua-transmition-requirements-00], and all OPC UA-CoAP server can be viewed as a network, introducing UA-to-CoAP proxy at the boundary of the network. When a traditional OPC UA client initiates an HTTP request to the UA-CoAP server in the network, the UA-to-CoAP proxy maps the http request to the corresponding CoAP request and sends it to the UA-CoAP server in the network. After receiving the request, the UA-CoAP server sends a response to the UA-CoAP proxy. The proxy maps the CoAP response to the HTTP response and returns it to the UA client. For the UA client, the network

proxy and conversion is transparent, in this way, the transfer of OPC UA in CoAP does not need to make any changes to the UA Client.

2.2. Direct transmission

The transmission of OPC UA supports TCP protocol and HTTP protocol, when security is ignored, OPC UA can be considered to support HTTP transmission. On the other hand, CoAP is seen as a simplified HTTP protocol so that it can be applied to resource - constrained network. Therefore, this document considers the use of CoAP to directly transfer OPC UA messages. OPC UA packets are encoded in either binary or xml format, and the optional fields in the CoAP header specify parameters that support these two formats, and the option field in the CoAP header can specify parameters that support both formats. Therefore, according to the format specified by the CoAP header, the entire packet of the OPC UA can be encapsulated in the payload of the CoAP message for direct transmission, as shown in Figure 2. Noted that this method of transmission needs to be modified on the server side and the client side of the OPC UA according to CoAP.

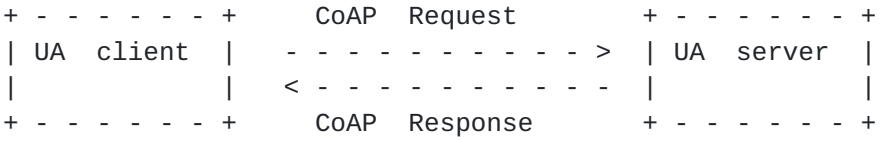

Figure 2. Direct transmission OPC UA based on CoAP

2.3. REST transmission for OPC UA

OPC UA is a set of data exchange specifications for industrial communication, the core of the OPC UA protocol is information modeling and transmission, which marks each node in the address space with a unique identifier. A series of state interactions are needed before performing normal reading and writing, including message handshaking, opening a secure channel, creating a session, activating a session, etc. Besides, some states also need to be maintained during read and write operations.

In OPC UA, each node has an independent identifier in the address space, and different types of nodes can establish contact with each other by reference. OPC UA defines a variety of services, and these services are fixed, the user cannot arbitrarily modify, each service is invoked through a single message, without relying on the previous message, the service response is also completed by a separate

message and do not rely on other messages. The above features are in line with the REST architecture, due to CoAP is based on the REST architecture. Therefore, it is possible to simplify the interaction before the OPC UA performs the normal communication, and carry the OPC UA message by using the communication mode of the CoAP. Communication process is shown in Figure 3.

a Traditional OPC UA communication b REST architecture communication

Figure 3. The communication of traditional OPC UA and the REST transmission

In Figure 3(a), the traditional OPC UA requires a series of interactions between normal read and write operations. Figure 3 (b) shows that when using CoAP to carry OPC UA message, the interaction process is significantly reduced, which is conducive to the application of OPC UA in the restricted scene. The cost of simplifying the interaction process is that the secure channel number is set to 0 by default, how to conduct secure data interaction needs further discussion[RESTful Industrial Communication With OPC UA].

3. Publish subscription for OPC UA and CoAP

As an application sublayer, CoAP provides publish-subscribe functionality, primarily for resource or network-constrained scenarios. Introducing broker into the network [draft-ietf-core-coap-pubsub-00], when a node needs to sleep, the node information is sent to the broker agent, when a node requests to obtain information of this node, the broker release function can provide information. OPC UA defines the publish-and-subscribe function as a service in the service set. The client initiates the subscription request directly to the server, and the server periodically sends the information to the client. Comparing the characteristics of the two protocols, it is found that each of them has its own advantages. Joint design can be conducted for restricted devices.

4. Security Considerations

5. IANA Considerations

This memo includes no request to IANA.

6. References

6.1. Normative References

6.2. Informative References

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