Bulk Configuration Updates

Draft

10 Pages

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Abstract

When several configurations have related updates, processing all the updates at once can considerably reduce churn. This behavior can be implemented by a Coordination. The configuration management agent that updates the configuration starts a Coordination, and the consumer of the updates such as DS registers as a participant in the Coordination and tracks the configuration events received during the Coordination. After completion the consumer can process all the updates in a suitable order. Labeling the Coordination with a well known name enables consumers to detect that the Coordination is actually involved in configuration. ManagedService and

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ManagedServiceFactory can be registered with a similar (or identical) well known name so config admin itself can implement this behavior on their behalf.

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0.3 Feedback

This document can be downloaded from the OSGi Alliance design repository at https://github.com/osgi/design The public can provide feedback about this document by opening a bug at https://www.osgi.org/bugzilla/.

0.4 Table of Contents

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0.5 Terminology and Document Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY" and "OPTIONAL" in this document are to be interpreted as described in 10.1.

```
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0.6 Revision History

The last named individual in this history is currently responsible for this document.

Revision	Date	Comments
Initial	*September 5 2016*	*Initial contribution - Tim Verbelen*

1 Introduction

Internet of Things (IoT) is becoming an important application domain of OSGi. The ability to run an OSGi framework on a gateway device as well as a Cloud server, together with the ability of transparently calling remote services using distributed OSGi makes it perfect base for an IoT platform. However, the proliferation of IoT protocols makes it difficult to integrate the many technologies available. One popular IoT protocol for connecting such IoT devices is MQTT. This RFC provides a solution to transparently handle MQTT events in OSGi via the EventAdmin.

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2 Application Domain

MQTT is a lightweight publish/subscribe messaging protocol on top of TCP/IP standardized by OASIS [3]. It is widely used in IoT applications. MQTT uses a central broker where all clients send their messages to and where clients can subscribe on certain topics.

MQTT topics are represented as hierarchically structured strings with a forward slash topic separator, i.e. “sensors/temperature/mysensor1”. To subscribe to topics, filters can be used containing wildcard characters. The hash sign '#' is used as a multi-level topic wildcard, the plus sign '+' is used as a single level wildcard. Topic names starting with a dollar sign '$' are special topics that relate to the event broker, and clients should not use topic names starting with '$' to exchange messages with other clients.

The MQTT broker supports multiple QoS levels: QoS level 0 : best effort delivery: the message is not acknowledged by the receiver or stored and redelivered by the sender. QoS level 1: the message is guaranteed to be delivered at least once to the receiver. The sender stores the messages until it gets an acknowledgement. QoS level 2: the message is delivered exactly once to the receiver. This is the highest and slowest QoS level.

MQTT also supports so called “last will and testament” messages, which are sent out by the broker when the sender loses connectivity with the broker. The MQTT specification does not specify any format the message payload should adhere to. However, the application developer will know the payload format, as this is implicitly defined by the topic(s) he subscribes to.

3 Problem Description

Although there are already solutions for using MQTT within an OSGi application, these still leave it up to the developer to use the specific APIs of the MQTT library used, which is currently not standardized in OSGi. For example the Eclipse Paho [4] MQTT client API is used in the Eclipse Kura [5] platform. To facilitate interaction with an MQTT broker, this RFP aims to bridge MQTT and EventAdmin:

- subscribe to an MQTT broker topic by registering an EventHandler in the OSGi framework

- sending out MQTT messages by publishing an Event via EventAdmin

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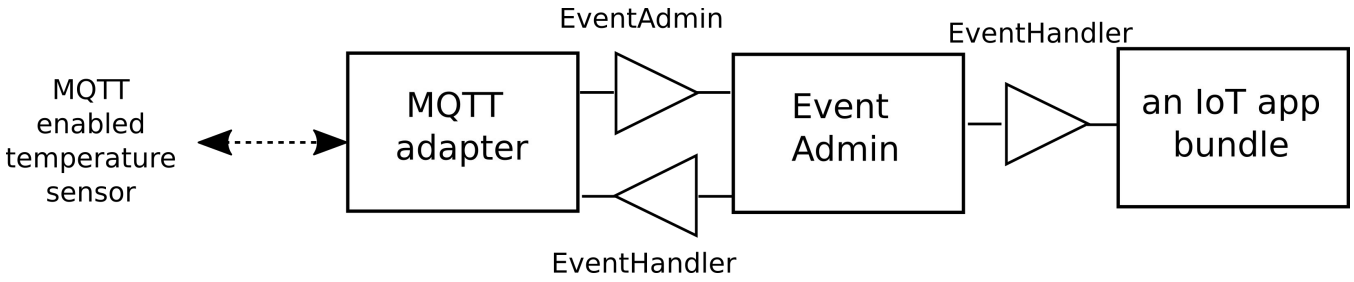
4 Requirements

- M0010 – The solution MUST define a mapping from an MQTT topic to an EventAdmin topic
- M0020 – The solution MUST define a mapping from an MQTT message to an OSGi Event
- M0030 – The solution SHOULD provide a mechanism to define which OSGi Events have to be sent to the MQTT broker and which EventAdmin topics have to be subscribed with the MQTT broker
- M0040 – The solution MUST be configurable (i.e. which MQTT broker to connect to)
- M0050 – The solution MUST support the different MQTT QoS levels
- M0060 – The solution MUST support providing last will and testament messages

5 Technical Solution

The most straightforward solution to integrate MQTT with OSGi is by providing an adapter bundle that listens for MQTT messages on given topics, convert these to OSGi Events and publishes them out to EventAdmin, and similarly converts OSGi Events to MQTT messages that are sent back to the MQTT broker.



5.1 Configuring the MQTT adapter

The MQTT adapter has to be configured with the MQTT broker to connect to, optionally authentication username/password, and which topics to subscribe/publish to. MQTT topic names support more wildcard options that OSGi EventAdmin, therefore the use of wildcards is restricted to a trailing '#' in an MQTT topic, which maps to a trialing '*' in the corresponding EventAdmin topic.

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The MQTT adapter is configured with the topics it should listen to from OSGi EventAdmin that should be broadcasted to MQTT, and which topics it should subscribe to with the MQTT broker that are to be published via OSGi EventAdmin.

An example minimal configuration could be:

```
{
    "service.factoryPid":"org.osgi.mqtt",
    "broker" : "tcp://iot.eclipse.org:1883",
    "event.topics" : ["my/topic","my/wildcarded/topic/*"]
    "mqtt.topics" : ["mqtt/topic"]
}
```

TODO: also add QoS options to the mqtt.topics?

TODO: create a DTO representing this configuration?

5.2 Converting payload

MQTT messages have no specified payload format. OSGi events on the other hand are formatted as a key-value map. The following conversion rules are used:

- The OSGi event map is converted to a json string as MQTT payload using the Object Convertor.
- An MQTT payload that is a json string is converted to an OSGi event map using the Object Convertor
- If the MQTT payload cannot be converted, the resulting OSGi event map has a single key “payload” with the raw byte[] from the MQTT message.

TODO: configure MQTT last wil/testament messages by sending OSGi events with mqtt.testament key set?

5.3 Avoiding message publishing loops

When there is bidirectional traffic (both events published and received) on a single topic, this might result in an endless loop (the adapter publishes the event to MQTT, receives it again from the MQTT broker as it is also subcriber, sends it out to EventAdmin again …). Therefore, the adapter should add an extra “sender” field to the MQTT messages it sends out, containing the framework UUID. Messages containing the framework UUID as sender should not be propagated further by this MQTT adapter.

5.4 Whiteboard pattern

Other bundles can also set the 'mqtt.topics' property on any service it registers. This way a bundle can request to also publish events on these topics to an MQTT broker. Similarly an EventHandler with 'event.topics' property can set 'mqtt.subscribe=true' to also subscribe on these topics via the MQTT adapter.

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6 Data Transfer Objects

7 Javadoc

8 Considered Alternatives

9 Security Considerations

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10 Document Support

10.1 References

[1]. Bradner, S., Key words for use in RFCs to Indicate Requirement Levels, RFC2119, March 1997.

[2]. Software Requirements & Specifications. Michael Jackson. ISBN 0-201-87712-0

[3]. MQTT Version 3.1.1. Edited by Andrew Banks and Rahul Gupta. 29 September 2014. OASIS Standard. Latest version: http://docs.oasis-open.org/mqtt/mqtt/v3.1.1/mqtt-v3.1.1.html.

[4]. Eclipse Paho, https://www.eclipse.org/paho/

[5]. Eclipse Kura, https://www.eclipse.org/kura/

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10.3 Acronyms and Abbreviations

10.4 End of Document

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