Yamcs: MQTT Links

Release 0.2.3-SNAPSHOT

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1. MQTT Links Plugin

This plugin extends Yamcs with links to connect via MQTT to packet or frame ground stations such as Leaf-Space[1] ground stations.

Usage with Maven

Add the following dependency to your Yamcs Maven project. Replace `x.y.z` with the latest version. See
https://mvnrepository.com/artifact/org.yamcs/yamcs-mqtt

```xml
<dependency>
  <groupId>org.yamcs</groupId>
  <artifactId>yamcs-mqtt</artifactId>
  <version>x.y.z</version>
</dependency>
```

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[1] https://leaf.space

2. Links

2.1 TM/TC Packet Link

This link subscribes to a MQTT topic for TM and sends TC to another MQTT topic. Both TC and TM are
sent/received as packets.

2.1.1 Usage

```
dataLinks:
  - name: tmtc
    class: org.yamcs.mqtt.MqttPacketLink
    brokers:
      - tcp://test.mosquitto.org:1883
    tmTopic: yamcs-tm
    tcTopic: yamcs-tc
    # other MQTT options
    # other link options
```

2.1.2 Options

brokers (List of strings)
>   **Required**. The list of MQTT brokers to connect to. The MQTT client will attempt to connect to each
>   broker in the list, one by one, until a connection is successfully established. The brokers can be spec-
>   ified using either the format tcp://host:port for unencrypted connections or ssl://host:port for encrypted
>   connections.

username (string)
>   The username to use when connecting to the MQTT broker. If not specified an annonymous connection
>   will be performed. Default: not specified

password (string)
>   **Required** when the username is specified. The password to use when connecting to the MQTT broker.
>   If not specified an annonymous connection will be performed. Default: not specified

clientId (string)
>   The client ID to use for the MQTT connection. This is used by the broker to identify the client. The
>   broker will refuse the connection if another client witht he same clientId is already connected. If you
>   are using two links you have to specify a different clientId for each (or just leave the default randomly
>   assigned clientId). If not specified, it will be automatically generated using a random value.

connectionTimeoutSecs
>   The maximum time, in seconds, to wait for a connection to the MQTT broker before timing out. Default:
>   5

autoReconnect (boolean)
>   If set to true, the client will automatically attempt to reconnect to the broker if the connection is lost.
>   Default: true

keepAliveSecs (integer)
> The keep-alive interval, in seconds, for the MQTT connection. This is the maximum period between communications with the broker before the connection is considered lost. Default: 60

tmTopic (string)
> The name of the topic to subscribe for TM packets. If it is not specified, no topic will be subscribed. Default: not specified

tmConverterClassName:
> The name of the class implementing org.yamcs.mqtt.MqttToTmPacketConverter[2] that is used to extract the packet data from the MQTT message. By default (if not specified) the converter uses the MQTT message payload as the data and uses locally generated time as reception time. *org.yamcs.mqtt.LeafMqttToTmPacketConverter* can be used when connecting to LeafSpace ground station - in this case the messages received are json objects with two fields timestamp and payload.

tmConverterArgs
> The configuration that will be passed to the init method of the TM converter.

tcTopic (string)
> The name of the topic to which the TC packets are sent. If it is not specified, commanding will not be possible for this link. Default: not specified

tcConverterClassName:
> The name of the class implementing org.yamcs.mqtt.FrameToMqttConverter[3] that is used to create the MQTT message from the commands. By default (if not specified) the converter sets the payload of the MQTT message as the binary command (after postprocessing).

tcConverterArgs
> The configuration that will be passed to the init method of the TC converter.

2.2   TC Frame Link

This link sends out CCSDS TC frames as MQTT messages.

2.2.1   Usage

```
dataLinks:
    class: org.yamcs.mqtt.MqttTcFrameLink
    # MQTT connection parameters
    brokers:
        - tcp://test.mosquitto.org:1883
    topic: yamcs-tc-frames
    # other MQTT options
    # other frame link options
```

2.2.2   Options

brokers (List of strings)
> **Required**. The list of MQTT brokers to connect to. The MQTT client will attempt to connect to each broker in the list, one by one, until a connection is successfully established. The brokers can be specified using either the format tcp://host:port for unencrypted connections or ssl://host:port for encrypted connections.

username (string)
> The username to use when connecting to the MQTT broker. If not specified an annonymous connection will be performed. Default: not specified

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[2] https://docs.yamcs.org/javadoc/yamcs/latest/org/yamcs/mqtt/MqttToTmPacketConverter.html
[3] https://docs.yamcs.org/javadoc/yamcs/latest/org/yamcs/mqtt/FrameToMqttConverter.html

password (string)

Required when the username is specified. The password to use when connecting to the MQTT broker. If not specified an annonymous connection will be performed. Default: not specified

clientId (string)

The client ID to use for the MQTT connection. This is used by the broker to identify the client. The broker will refuse the connection if another client witht he same clientId is already connected. If you are using two links you have to specify a different clientId for each (or just leave the default randomly assigned clientId). If not specified, it will be automatically generated using a random value.

connectionTimeoutSecs

The maximum time, in seconds, to wait for a connection to the MQTT broker before timing out. Default: 5

autoReconnect (boolean)

If set to true, the client will automatically attempt to reconnect to the broker if the connection is lost. Default: true

keepAliveSecs (integer)

The keep-alive interval, in seconds, for the MQTT connection. This is the maximum period between communications with the broker before the connection is considered lost. Default: 60

topic (string)

Required The name of the topic to which the TC frames are sent. Default: not specified

converterClassName:

The name of the class implementing org.yamcs.mqtt.FrameToMqttConverter[4] that is used to create the MQTT message from the binary frame data. By default (if not specified) the converter sets the payload of the MQTT message as the binary frame data.

converterArgs

The configuration that will be passed to the init method of the converter.

Note: Other available link options are general frame processing parameters as specified at https://docs.yamcs.org/yamcs-server-manual/links/ccsds-frame-processing.

2.3   TM Frame Link

This link receives MQTT messages and processes them as CCSDS Frames.

2.3.1   Usage

```
dataLinks:
    class: org.yamcs.mqtt.MqttTmFrameLink
    # MQTT connection parameters
    brokers:
        - tcp://test.mosquitto.org:1883
    topic: yamcs-tc-frames
    # other MQTT options
    # other frame link options
```

brokers (List of strings)

Required. The list of MQTT brokers to connect to. The MQTT client will attempt to connect to each broker in the list, one by one, until a connection is successfully established. The brokers can be specified using either the format tcp://host:port for unencrypted connections or ssl://host:port for encrypted connections.

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[4] https://docs.yamcs.org/javadoc/yamcs/latest/org/yamcs/mqtt/FrameToMqttConverter.html

username (string)

The username to use when connecting to the MQTT broker. If not specified an annonymous connection will be performed. Default: not specified

password (string)

Required when the username is specified. The password to use when connecting to the MQTT broker. If not specified an annonymous connection will be performed. Default: not specified

clientId (string)

The client ID to use for the MQTT connection. This is used by the broker to identify the client. The broker will refuse the connection if another client witht he same clientId is already connected. If you are using two links you have to specify a different clientId for each (or just leave the default randomly assigned clientId). If not specified, it will be automatically generated using a random value.

connectionTimeoutSecs

The maximum time, in seconds, to wait for a connection to the MQTT broker before timing out. Default: 5

autoReconnect (boolean)

If set to true, the client will automatically attempt to reconnect to the broker if the connection is lost. Default: true

keepAliveSecs (integer)

The keep-alive interval, in seconds, for the MQTT connection. This is the maximum period between communications with the broker before the connection is considered lost. Default: 60

topic (string)

Required The name of the topic to subscribe for TM frames.

converterClassName:

The name of the class implementing org.yamcs.mqtt.MqttToFrameConverter[5] that is used to extract the frame data from the MQTT message. By default (if not specified) the converter uses the MQTT message payload as the data and uses locally generated time as Earth Reception Time (ert). *org.yamcs.mqtt.LeafMqttToFrameConverter* can be used when connecting to LeafSpace ground station - in this case the messages received are json objects with two fields timestamp and payload.

converterArgs

The configuration that will be passed to the init method of the converter.

Note: Other available link options are general frame processing parameters as specified at https://docs.yamcs.org/yamcs-server-manual/links/ccsds-frame-processing.

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[5] https://docs.yamcs.org/javadoc/yamcs/latest/org/yamcs/mqtt/MqttToFrameConverter.html