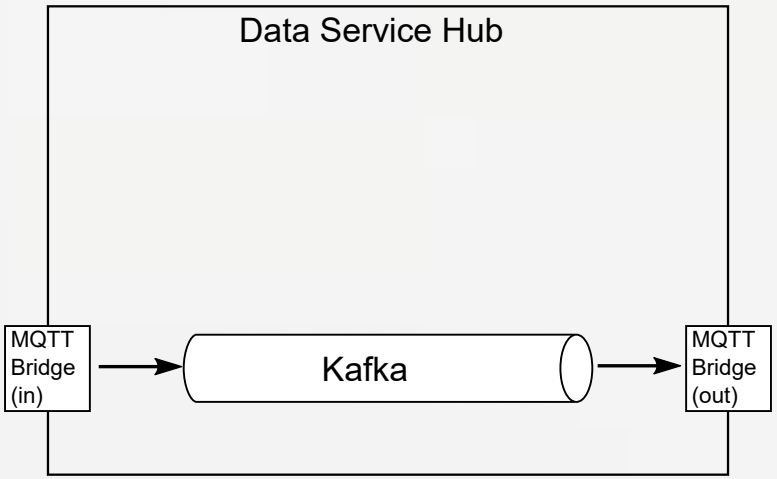
Tutorial

Streaming over MQTT

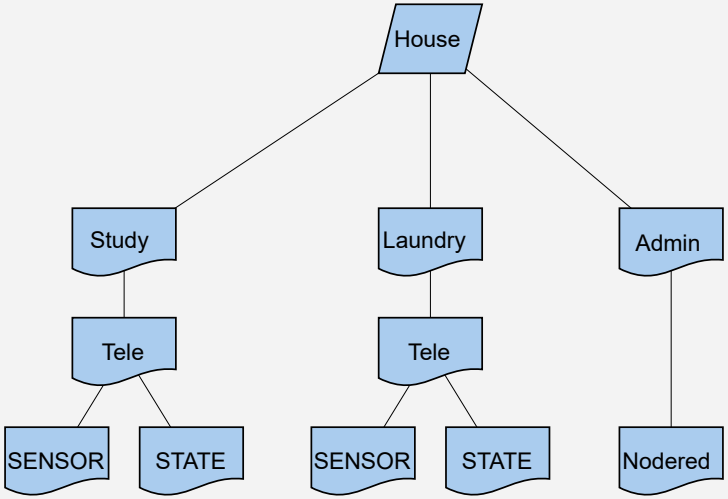
MQTT bridge



Note: MQTT Protocol adapter allows MQTT interface with Kafka

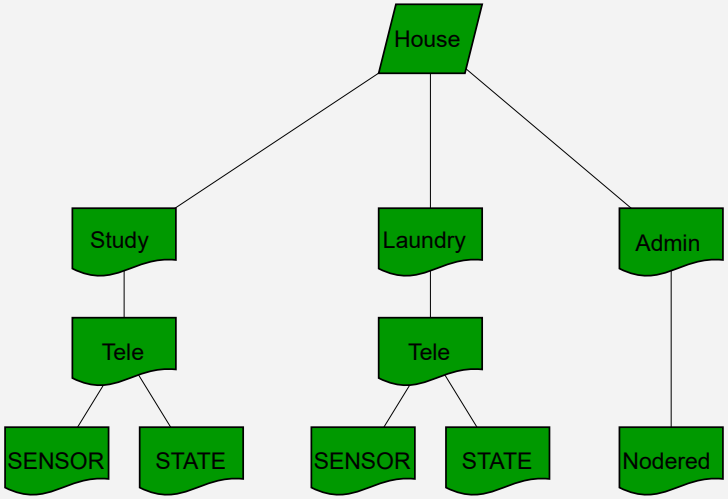
Note: wildcard subscriptions follow

Topic tree



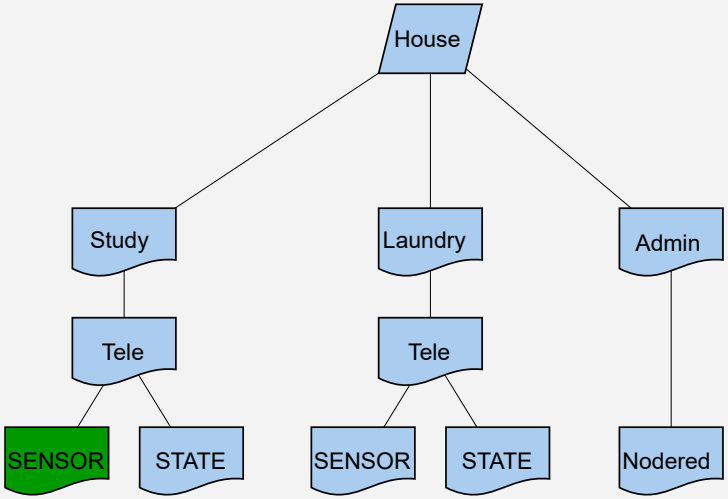

```
mosquitto_sub -t ""
```

Topic tree



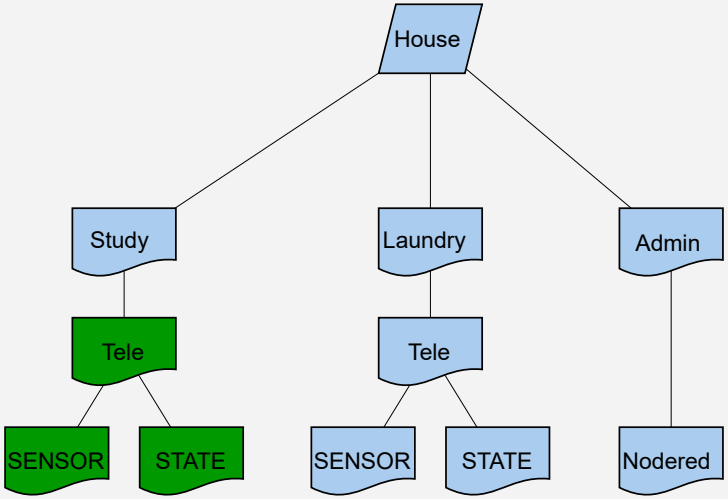

```
mosquitto_sub -t "#"
```

Topic tree



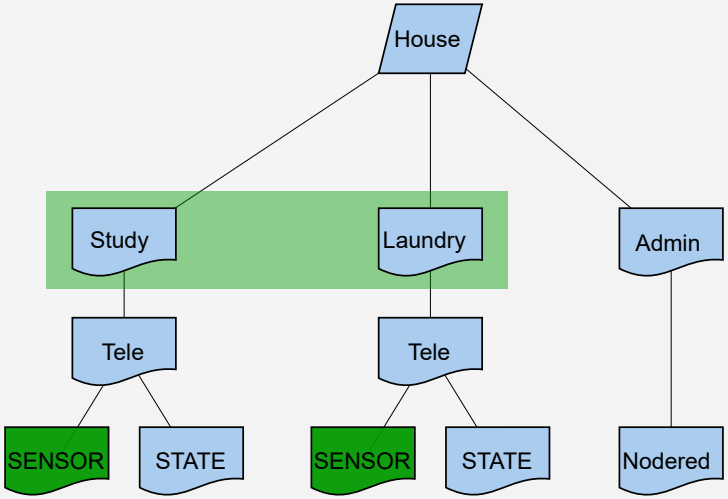

```
mosquitto_sub -t "house/Study/Tele/SENSOR/#"
```

Topic tree

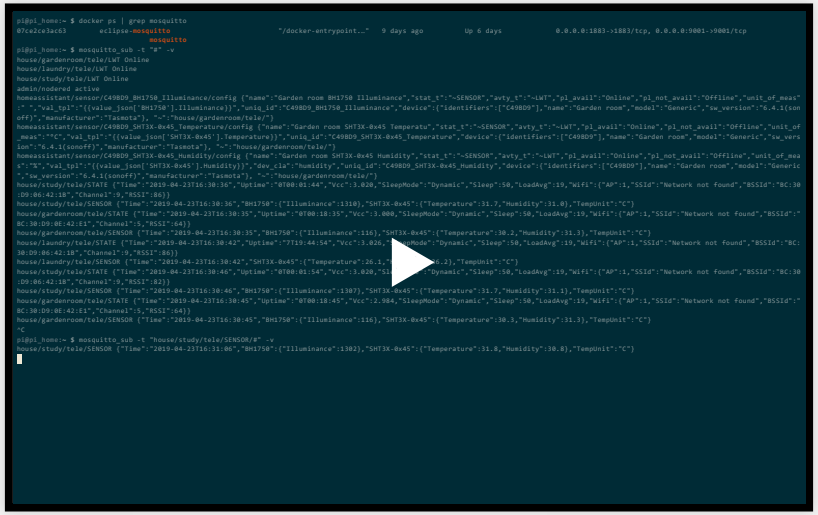



```
mosquitto_sub -t "house/Study/Tele/#"
```

Topic tree



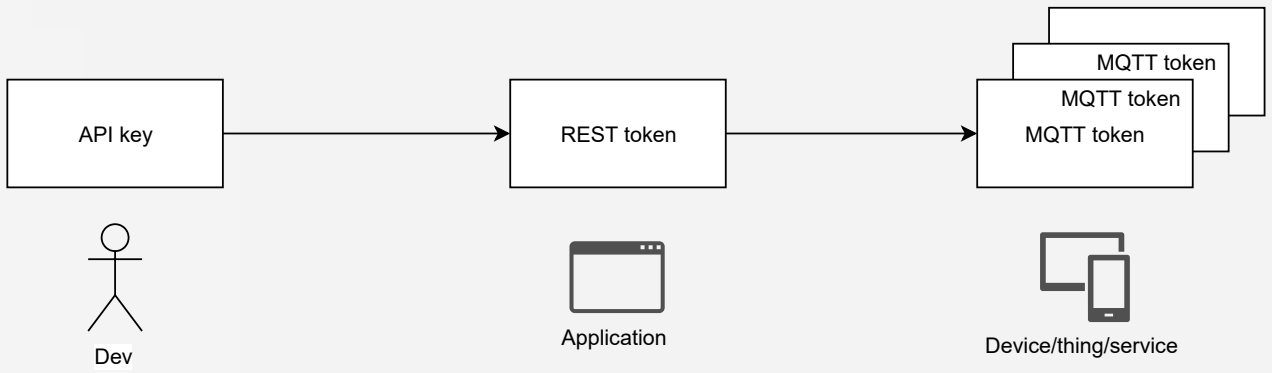

```
mosquitto_sub -t "house/+/Tele/SENSOR/#"
```


pi@pi_home:~ $ docker ps | grep mosquitto
07ce2ce3ac63 eclipse-mosquitto "/docker-entrypoint..." 9 days ago Up 6 days 0.0.0.0:1883->1883/tcp, 0.0.0.0:9001->9001/tcp
mosquitto
pi@pi_home:~ $ mosquitto_sub -t "#" -v
house/gardenroom/tele/LWT Online
house/laundry/tele/LWT Online
house/study/tele/LWT Online
admin/nodered active
homeassistant/sensor/C498D9_BH1750_Illuminance/config {"name":"Garden room BH1750 Illuminance","stat_t":"~SENSOR","avty_t":"~LWT","pl_avail":"Online","pl_not_avail":"Offline","unit_of_meas"
:" ","val_tpl":"{{value_json['BH1750'].Illuminance}}","uniq_id":"C498D9_BH1750_Illuminance","device":{"identifiers":["C498D9"],"name":"Garden room","model":"Generic","sw_version":"6.4.1(son
off)","manufacturer":"Tasmota"}, "~":"house/gardenroom/tele/"}
homeassistant/sensor/C498D9_SHT3X-0x45_Temperatura/config {"name":"Garden room SHT3X-0x45 Temperatu","stat_t":"~SENSOR","avty_t":"~LWT","pl_avail":"Online","pl_not_avail":"Offline","unit_of
_meas":"°C","val_tpl":"{{value_json['SHT3X-0x45'].Temperatura}}","uniq_id":"C498D9_SHT3X-0x45_Temperatura","device":{"identifiers":["C498D9"],"name":"Garden room","model":"Generic","sw_vers
ion":"6.4.1(sonoff)","manufacturer":"Tasmota"}, "~":"house/gardenroom/tele/"}
homeassistant/sensor/C498D9_SHT3X-0x45_Humidity/config {"name":"Garden room SHT3X-0x45 Humidity","stat_t":"~SENSOR","avty_t":"~LWT","pl_avail":"Online","pl_not_avail":"Offline","unit_of_mea
s":"%","val_tpl":"{{value_json['SHT3X-0x45'].Humidity}}","dev_cla":"humidity","uniq_id":"C498D9_SHT3X-0x45_Humidity","device":{"identifiers":["C498D9"],"name":"Garden room","model":"Generic
","sw_version":"6.4.1(sonoff)","manufacturer":"Tasmota"}, "~":"house/gardenroom/tele/"}
house/study/tele/STATE {"Time":"2019-04-23T16:30:36","Uptime":"0T00:01:44","Vcc":3.020,"SleepMode":"Dynamic","Sleep":50,"LoadAvg":19,"Wifi":{"AP":1,"SSId":"Network not found","BSSId":"BC:30
:D9:0E:42:18","Channel":9,"RSSI":86}}
house/study/tele/SENSOR {"Time":"2019-04-23T16:30:36","BH1750":{"Illuminance":1310},"SHT3X-0x45":{"Temperature":31.7,"Humidity":31.0},"TempUnit":"C"}
house/gardenroom/tele/STATE {"Time":"2019-04-23T16:30:35","Uptime":"0T00:18:35","Vcc":3.000,"SleepMode":"Dynamic","Sleep":50,"LoadAvg":19,"Wifi":{"AP":1,"SSId":"Network not found","BSSId":"
BC:30:D9:0E:42:E1","Channel":5,"RSSI":64}}
house/gardenroom/tele/SENSOR {"Time":"2019-04-23T16:30:35","BH1750":{"Illuminance":116},"SHT3X-0x45":{"Temperature":30.2,"Humidity":31.3},"TempUnit":"C"}
house/laundry/tele/STATE {"Time":"2019-04-23T16:30:42","Uptime":"7T19:44:54","Vcc":3.026,"SleepMode":"Dynamic","Sleep":50,"LoadAvg":19,"Wifi":{"AP":1,"SSId":"Network not found","BSSId":"BC:
30:D9:06:42:18","Channel":9,"RSSI":86}}
house/laundry/tele/SENSOR {"Time":"2019-04-23T16:30:42","SHT3X-0x45":{"Temperature":26.1,"Humidity":46.2},"TempUnit":"C"}
house/study/tele/STATE {"Time":"2019-04-23T16:30:46","Uptime":"0T00:01:54","Vcc":3.020,"SleepMode":"Dynamic","Sleep":50,"LoadAvg":19,"Wifi":{"AP":1,"SSId":"Network not found","BSSId":"BC:30
:D9:06:42:18","Channel":9,"RSSI":82}}
house/study/tele/SENSOR {"Time":"2019-04-23T16:30:46","BH1750":{"Illuminance":1307},"SHT3X-0x45":{"Temperature":31.7,"Humidity":31.1},"TempUnit":"C"}
house/gardenroom/tele/STATE {"Time":"2019-04-23T16:30:45","Uptime":"0T00:18:45","Vcc":2.984,"SleepMode":"Dynamic","Sleep":50,"LoadAvg":19,"Wifi":{"AP":1,"SSId":"Network not found","BSSId":"
BC:30:D9:0E:42:E1","Channel":5,"RSSI":64}}
house/gardenroom/tele/SENSOR {"Time":"2019-04-23T16:30:45","BH1750":{"Illuminance":116},"SHT3X-0x45":{"Temperature":30.3,"Humidity":31.3},"TempUnit":"C"}
^C
pi@pi_home:~ $ mosquitto_sub -t "house/study/tele/SENSOR/#" -v
house/study/tele/SENSOR {"Time":"2019-04-23T16:31:06","BH1750":{"Illuminance":1302},"SHT3X-0x45":{"Temperature":31.8,"Humidity":30.8},"TempUnit":"C"}

Rarely updated data sources

- MQTT stores only the last value
- DSH implements a 'latest value store'

Authentication relations



Prerequisites

- Required: Curl
- Required: Mosquitto (MQTT-client)
- Optional: jq
- Alternative: Virtual Machine containing the tools
- Available: An API-Key (will be provided)

Goal

Learn how to subscribe and publish data on one of the DSH public datastreams via MQTT

Steps

1. Get an API-key
2. Use API-key to request a REST token
3. Use REST token to request an MQTT token
4. Use MQTT token to subscribe to a datastream
5. Use MQTT token to publish on a datastream

API-keys on DSH

Are used to *identify* entities that can manage DSH MQTT access for a group of things.

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Each of these entities can use this API-key to:

- onboard *multiple* things to DSH MQTT
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- control on a *per thing basis* what streams a thing can access (out-of-scope)

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we call these entities *tenants*

Get an API-key

Along with the API-key you will also receive:

- the name of a DSH deployment (`PLATFORM`)
- the name of the tenant (`TENANT`)
- other info you do not need for this tutorial

Take a look at the existing variables.

REST tokens

- can be requested over the *REST API* of DSH on the `/auth/v0/token` endpoint
- this endpoint requires an *API-key* and the name of your *tenant*

Command

```
curl -X POST \
  "https://api.$PLATFORM.kpn-dsh.com/auth/v0/token" \
  -H "apikey: $API_KEY" \
  -d '{"tenant": "'$TENANT'"}' > rest-token.txt
```

Output

- This command will result in a *REST token*
- This is a *JWT* containing a set of *REST claims*
- These claims describe
  - what *other* REST APIs you can access
  - which *actions* are allowed on those APIs

- The `datastreams/v0/mqtt/token` claim should be in the token, otherwise it will be impossible to request an MQTT token

Contents of a JWT

Execute

```
cat rest-token.txt
```

to see the token and navigate to https://jwt.io and replace the data in the encoded form on the webpage by the contents of the JWT (REST token) you received in the previous step.

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Did you just blindly give away credentials to an unknown website?

Contents of a JWT

Command-line alternative for Linux:

```
cat rest-token.txt | \
sed "s/[^.]*\.\([^.]*\)\.[^.]*/\1===/;s/\(\(....\)*\).*/\1/"
base64 -d | \
jq .
```

Command-line alternative for macOS:

```
cat rest-token.txt | \
sed "s/[^.]*\.\([^.]*\)\.[^.]*/\1===/;s/\(\(....\)*\).*/\1/"
base64 -D | \
jq .
```

MQTT tokens

- can be requested over the *REST API* of DSH at `/datastreams/v0/mqtt/token`
- this requires a *REST token* with the `datastreams/v0/mqtt/token` claim
- required to request the token for a named thing

```
export THING_ID=...
```

Command

```
curl -X POST \
"https://api.$PLATFORM.kpn-dsh.com/datastreams/v0/mqtt/token"
-H "Authorization: Bearer `cat rest-token.txt`" \
-d '{"id":"'$THING_ID'"}' > mqtt-token.txt
```

Output

Some remarks

- The mqtt thing id **must be unique** (within your tenant) since only one connection with this id is allowed.
- Not all REST tokens allow all thing ids (some are bound to one specific THING_ID)

Inspect the JWT

Use jwt.io or use the command-line alternative for Linux:

```
cat mqtt-token.txt | \
sed "s/[^.]*\.\([^.]*\)\.[^.]*/\1===/;s/\(\(....\)*\).*/\1/"
base64 -d | \
jq .
```

Use jwt.io or use the command-line alternative for macOS:

```
cat mqtt-token.txt | \
sed "s/[^.]*\.\([^.]*\)\.[^.]*/\1===/;s/\(\(....\)*\).*/\1/"
```

```
base64 -D | \
jq .
```

Subscribe

- We will all subscribe to *dshdemoshared*, a stream created specifically for this tutorial.
- If you inspect the mqtt token, you will see that the allowed pattern for the subscription is `+/#`
  - `+` => a topic level element is allowed here, but no mqtt wildcards
  - `#` => wildcards are allowed here
  - `word` => you need to copy this verbatim

Command

On Linux, execute the following command:

```
mosquitto_sub -h mqtt.$PLATFORM.kpn-dsh.com -p 8883 \
-t "/tt/dshdemoshared/$THING_ID/#" --capath /etc/ssl/certs/ \
-d -P "`cat mqtt-token.txt`" -u $THING_ID -v
```

On macOS, use `--cafile iso --capath`:

```
mosquitto_sub -h mqtt.$PLATFORM.kpn-dsh.com -p 8883 \
-t "/tt/dshdemoshared/$THING_ID/#" \
--cafile /usr/local/etc/openssl/cert.pem \
-d -P "`cat mqtt-token.txt`" -u $THING_ID -v
```

Notes

- The username (`-u ...`) is not required for the DSH; it gets overruled by the `THING_ID` in the token. We put it here because some versions of the mosquitto client expect it to be there.
- `--capath` or `--cafile` is where the mosquitto client can find the SSL root certificates on your system, required to be able to connect to our mqtt protocol-adapter over SSL

Publish

- To see any data on our subscription, we need to publish some first
- Open a new terminal, we are going to use it to periodically send a message to DSH over mqtt
  - Ensure the required environment variables are available

Command

On Linux, execute the following command:

```
while sleep 1; do date "+$THING_ID%S"; done | \
mosquitto_pub -h mqtt.$PLATFORM.kpn-dsh.com \
-p 8883 -t "/tt/dshdemoshared/$THING_ID/" \
--capath /etc/ssl/certs/ \
-d -P "`cat mqtt-token.txt`" -u $THING_ID -l
```

On macOS, execute the following command:

```
while sleep 1; do date "+$THING_ID%S"; done | \
mosquitto_pub -h mqtt.$PLATFORM.kpn-dsh.com \
```

```
-p 8883 -t "/tt/dshdemoshared/$THING_ID/" \
--cafile /usr/local/etc/openssl/cert.pem \
-d -P "`cat mqtt-token.txt`" -u $THING_ID -l
```

Notes

- What do you see? Why?
- Try replacing `sleep 1` by `true`; what happens?

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- Try replacing `sleep 1` by `true`; what happens?
- To allow the platform to scale, publish rate over MQTT is limited to 10 msgs/sec.

Practical part; Kafka

Kafka