



CYGNET IOT ENABLED: MQTT SUPPORT

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Weatherford®



AGENDA

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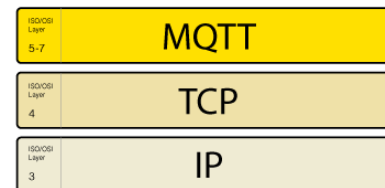
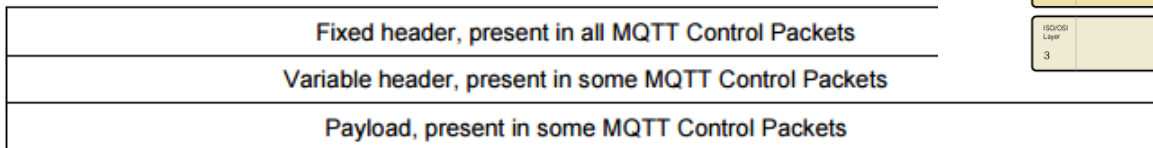
MQTT HISTORY

- Arlen Nipper (IBM) and Andy Stanford-Clark(Cirrus Link) 1999
- Requirement : Minimal battery loss and min bandwidth connecting oil pipelines over satellite connection
- Goal
 - Simple to implement
 - Provide a Quality of Service Data Delivery
 - Lightweight and Bandwidth Efficient
 - Data Agnostic
 - Continuous Session Awareness

MQTT STRUCTURE

- Low overhead (at min 2 bytes)

Figure 2.1 – Structure of an MQTT Control Packet



2.2 Fixed header

Each MQTT Control Packet contains a fixed header. [Figure 2.2 - Fixed header format](#) illustrates the fixed header format.

Figure 2.2 - Fixed header format

Bit	7	6	5	4	3	2	1	0
byte 1	MQTT Control Packet type				Flags specific to each MQTT Control Packet type			
byte 2...	Remaining Length							



QUALITY OF SERVICE

- Different priority
- 3 levels
 - 0 At most once
 - 1 At least once
 - 2 Exactly once



WHY MQTT?

- A lot has changed since 1999.
 - Increased bandwidth
 - Many standard protocol options
- Why is MQTT better than all the other protocols?
 - It's not, it's different.
 - The Pub/Sub model works well in our environment.
- It's the adoption and tooling
 - Many client and server options
 - Tools, tools, tools.



WHAT IS AN MQTT BROKER

- The middle component.
- What is the benefit over going direct?
 - One to many publishers to subscribers
 - Notification of communication failure



BROKERS

- HiveMQ, Mosquitto, VerneMQ, EMQ, Paho, ...

WHAT BROKERS ARE CURRENTLY IN USE?



How does this relate to CygNet?

- With version 9.2 CygNet will consume data from an MQTT broker.
- All the CygNet technologies you know and love can make use of this data source.
- We are using the EIE framework for MQTT
- A communications driver will support the protocol.
- A remote device driver will support the data normalization and processing

COMMUNICATIONS DRIVER

- Not traditional poll based comm
- Notified when data is ready
- No get button, no MSS task
- Similar to OPC async comm driver

The screenshot shows the 'MQTT Comm Device Editor' dialog box. It contains the following fields and options:

- Manufacturer/Model:** CygNet Software, Inc./Mqtt
- Device ID:** MQTTNYPWR
- Description:** (empty text box)
- IP address:** (empty text box)
- Port:** 1883
- Broker settings:**
 - MQTT Version:** Detect (dropdown menu)
 - Health check rate (sec):** 30
 - Username:** (empty text box)
 - Connection timeout (sec):** 10
 - Password:** Change password... (button)
 - Reconnect interval (sec):** 5
 - Retain state between sessions
 - Maximum inflight messages:** 0
 - Default QoS:** 0
- Enable TLS 1.2 encryption
- TLS 1.2 encryption settings:**
 - Trust store:** (empty text box)
 - Key store:** (empty text box)
 - Private key:** (empty text box)
 - Private key password:** Change password... (button)
 - Validate server certificate
- Enable device
- Buttons:** OK, Cancel



FAILOVER

- Utilize existing methods
- Define additional communications devices as necessary



TOPICS

- String identifier that categorizes, identifies or describes the data.
 - Subscriptions can include wild cards '#' or '+' for names
 - Case sensitive
- Examples
 - facility/meter
 - spBv1.0/Houston/NDATA/Facility/Device
- Length
 - Unsigned short



CYGNET IOT REMOTE DEVICE

- Partial topics are defined on the remote device
- First step in identifying incoming data
- The comm device associated with the remote will handle subscriptions

The screenshot shows a dialog box titled "Properties for: 'NYPOWER' - Type: 'CygNet SingleItem'". The dialog has several tabs: "Device", "Facilities", "Data Group", "UIS Commands", and "Points". The "Device" tab is selected. The "Manufacturer/Model" field contains "CygNet - SingleItem". The "Device ID" field contains "NYPOWER". The "Description" field is empty. The "Topic" field contains "ny-power/upstream/fuel-mix" and is highlighted with a red box. The "Communications" section has a "Comm ID" field containing "MQTTNYPWR" and an "Options" dropdown menu. There is an "Advanced" button next to the "Options" dropdown. The "Device security" section has an "Application" field containing "DDS" and an "Event" field containing "ACCESS". There is a "..." button next to the "Event" field. At the bottom left, there is a checked checkbox labeled "Enable device". At the bottom of the dialog, there are buttons for "Comm Data", "Audit History", "OK", "Cancel", and "Apply".

DATA GROUP PROPERTIES

- Using the remote device partial topic a complete topic is created
- Define quality of service settings
- Comm device creates an MQTT subscription from the properties

Data Group Properties

Device ID: NYPOWER

Data group type: Hydro

Description: Hydro

Sub-topic: Hydro

Facility ID: NYPOWER

QoS: 0 Use comm default

Hide data group Web accessible Transaction replication

Transaction retention

Failed transactions to retain: 10

Retain successful transactions by count 20 transactions

Retain successful transactions by date 7 days

Keep at least 0 but not more than 20 transactions

Device operational security

Application: DDS Event: ACCESS

OK Cancel



PAYLOAD

- Payload data is a simple array of bytes
 - 268,435,456 bytes -> Should not be reached... Ever.
- Can be interpreted as JSON document. Arbitrary data structure.
- Also Google protocol buffers. Well defined data structure.

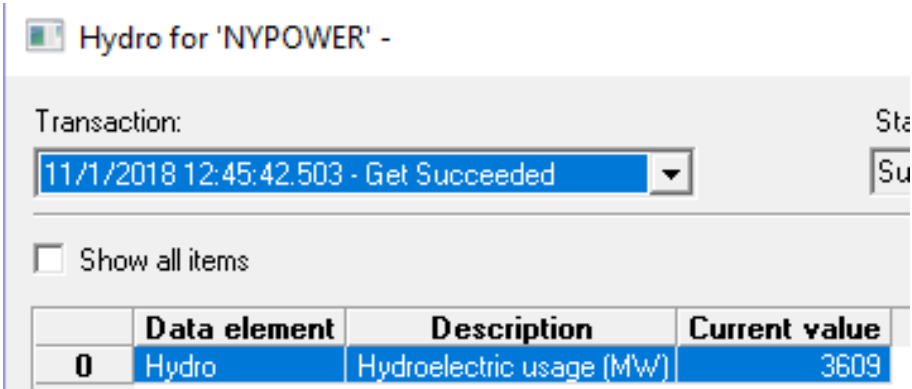


DATA STRUCTURE

- Sparkplug
 - Data definition already defined
- JSON
 - Device template defines relationship
 - Elements in the template are associated with elements in the payload
 - Data relationship is used on data arrival to update CygNet points

EXAMPLE PAYLOAD

```
{  
  "ts": "11/01/2018 13:40:00",  
  "value": 3609,  
  "units": "MW"  
}
```



Hydro for 'NYPOWER' -

Transaction: 11/1/2018 12:45:42.503 - Get Succeeded Sta Su

Show all items

	Data element	Description	Current value
0	Hydro	Hydroelectric usage (MW)	3609

- Incoming is examined and processed
- Timestamp is applied to point
- Unit conversions
- All other point processing events



DEMO

- Consuming data from <http://ny-power.org/> MQTT broker
- If you want to see MQTT data from a CygNet data source attend “CygNet IoT: Collect, manage, distribute at the Edge”



I THANK YOU