MQTT Protocol

# Definitions

|  |  |
| --- | --- |
| Device | Any system capable of connecting to the MQTT network and publish / receiving packets. A device is defined by its MAC address on the IP network that the MQTT network is running on. |
| Controller | Device through which the operator can control devices on the network. The network can support multiple controllers at the same time but only a single controller can be in control of each channel. |
| SDR | Processing element capable of demodulating signals at the IF frequency |
| Channel | An independent signal processing path within an SDR capable of demodulating a signal. Channels may be capable of RX, TX or both. |
| Card | General term for anything that plugs into the baseboard that is not an SDR |
| Transverter | Card capable of changing the carrier frequency of a modulated signal. This may capable of RX, TX or both. |
| PNT Card | TBD |
| Switch Card | TBD |
| PSU Card | TBD |
| RX | Receiving / Receiver |
| TX | Transmitting / Transmitter |

# Data formatting

## Encoding

All payloads on the MQTT network shall be a UTF-8 encoded JSON object.

## MAC Addresses

All MAC address shall be a string of 6 pairs of hexadecimal characters separated by colons (“:”). Any letters shall be uppercase e.g. “12:34:56:78:9A:BC”

## API Versions

No efforts are made to enforce backwards compatibility between API version. Any non-equal API version numbers should be considered incompatible.

## Optional Fields

All messages must contain all the fields described in this document and no more unless explicitly highlighted.

# /discovery/request

## Purpose

Allows controllers to discover what devices are connected to the MQTT network

## Subscription

All devices must subscribe to this topic

## Publishing

Only Controllers can publish to this topic to request discovery information. This can happen at any time

## Payload

Payload can be anything and should be ignored.

## Response

All devices should publish their discovery information to the “/discovery/info” topic in response to receiving a message on this topic. This includes the Controller that initiated the discovery request.

# /discovery/info

## Purpose

Topic where devices publish their discovery (static) information.

## Subscription

Controllers must subscribe. Anything else should not.

## Publishing

All devices should publish to this topic only under one of the following conditions:

1. On startup
2. In response to receiving a message in the “/discovery/request” topic

## Payload

### All devices

Response from all devices must include the following fields (example values are given):

{

“type”: “SDR”,

“ip”: “192.168.0.1”,

“mac”: “12:34:56:78:9A:BC”,

“name”: “Bob”,

“api”: “0.1.0”,

“linkSpeed”: 100

}

|  |  |  |
| --- | --- | --- |
| **Field** | **Type** | **Description** |
| type | string | "sdr" for an SDR, “controller” for a Controller, other types TBD |
| ip | string | IP Address of the device (Either IPv4 or IPv6) |
| mac | string | MAC Address of the device formatted as 12 hexadecimal characters with colons ":" in between |
| name | string | Human readable device name |
| api | string | Version of the MQTT API this device supports |
| linkSpeed | int | Rated speed of Ethernet link in Mbps |

### SDR specific

SDRs must include the payload described in section 3.4.1 and the following SDR-specific fields:

{

“numSlots”: 6

“channels”: {},

“cards”: {}

}

|  |  |  |
| --- | --- | --- |
| **Field** | **Type** | **Description** |
| numSlots | int | Maximum number of cards that SDR has access to – this is determined by the rack the SDR is installed in rather than the SDR itself. |
| channels | Array(Channel) | Array of discovery info for the channels within the SDR |
| cards | Array(Card) | Array of discovery info for the cards that SDR has access to |

### Channels

Cards themselves are not devices in their own right but they are children of SDRs and should have their discovery information included when the SDR responds. The discovery information for channels must contain the following:

{

“name”: “A”,

“supportsRx”: True,

“supportsTx”: True

}

|  |  |  |
| --- | --- | --- |
| **Field** | **Type** | **Description** |
| name | string | Channel Name. First channel on a SDR should be named “A”, second “B” etc |
| supportsRx | boolean | True if the channel supports RX |
| supportsTx | boolean | True if the channel supports TX |

### Cards

Cards themselves are not devices in their own right but they are children of devices and should have their discovery information included when the device controlling them responds. The discovery information reported by the Card to the SDR controlling it is only partially reported to the MQTT network as some implementation details such as a card’s address on the RS485 bus are irrelevant. Indeed, this protocol doesn’t require the SDR to communicate to the cards using RS485 at all. The discovery information for all card types must include the following:

{

“type”: “transverter”,

“name”: “Anglian”

}

|  |  |  |
| --- | --- | --- |
| **Field** | **Type** | **Description** |
| type | string | “transverter” for a Transverter. Other types TBD |
| name | string | Human readable card name |

#### Transverter specific

A transverter must include the generic card discovery information, as described in section 3.4.3 and the following fields:

{

“minFreq”: 1000000,

“maxFreq”: 1500000,

“minPower”: 0,

“maxPower”: 10,

“supportsRx”: True,

“supportsTx”: False

}

|  |  |  |
| --- | --- | --- |
| **Field** | **Type** | **Description** |
| minFreq | int | Minimum RF (output) frequency of the transverter |
| maxFreq | int | Maximum RF (output) frequency of the transverter |
| minPower | int | Minimum TX power setpoint in dBm |
| maxPower | int | Maximum TX power setpoint in dBm |
| supportsRx | boolean | True if the transverter support RX |
| supportsTx | boolean | True if the transverter supports TX |

## Response

No device should respond to a message in this topic