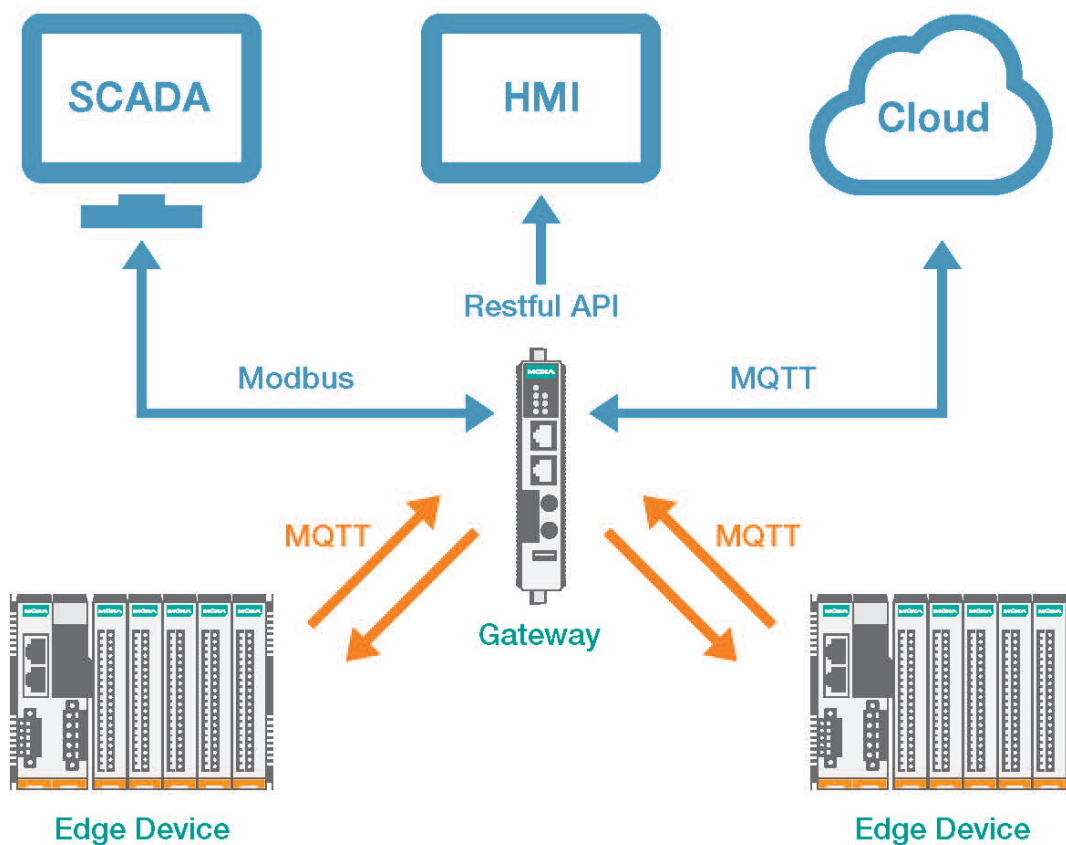


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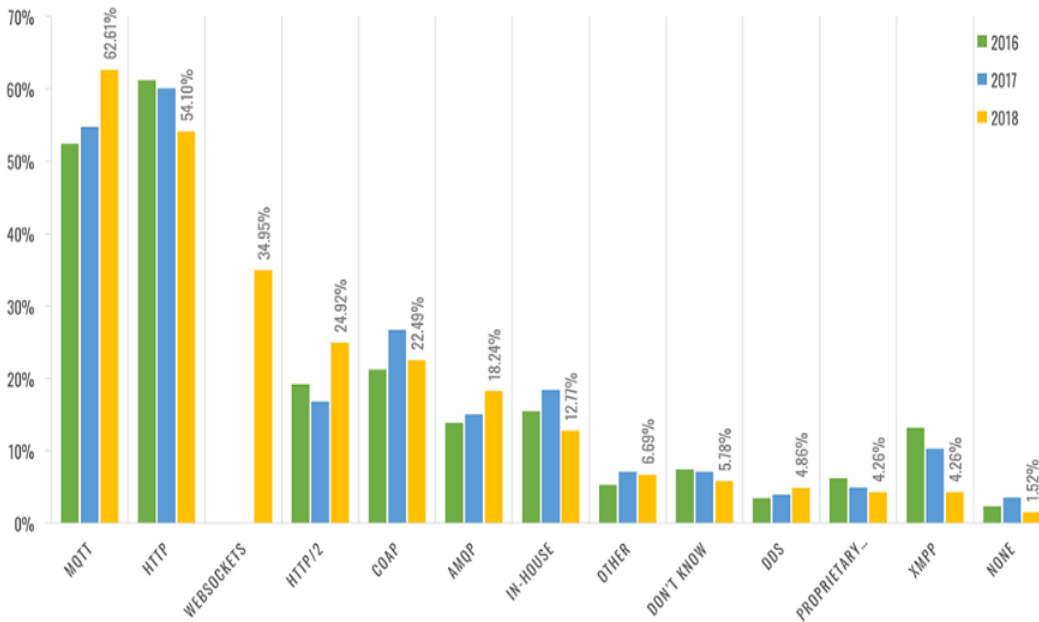
## MQTT - Enabling Edge-device Connectivity in the IIoT Era

Although the MQTT protocol has been around for nearly three decades, the design of the protocol makes it ideal for Industrial Internet of Things (IIoT) applications, the latest trend in automation engineering, MQTT is especially helpful in bringing field-site data to cloud platforms. Read on to discover how MQTT can help you overcome the challenges of transforming a traditional OT application to an IIoT application.

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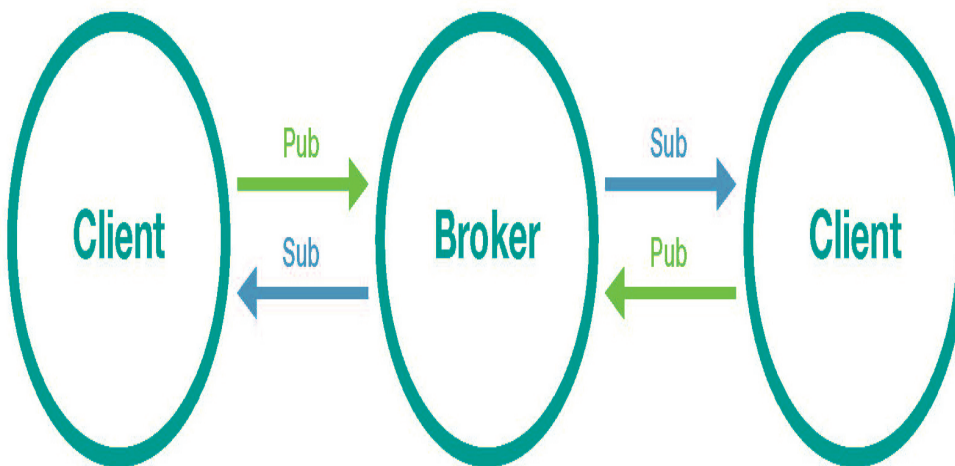


The MQTT protocol is now the top choice for most IIoT applications. As shown on Figure 1, more than half of IIoT developers use MQTT as their communication protocol.



## What is MQTT

MQTT uses a publish-subscribe pattern (see Figure 2) with one broker and several publisher and subscriber clients. Publishers send data to the broker, which distributes the data to subscribers.



### Publish-subscribe Messaging Pattern

Only the broker needs to be online all the time. The clients only need to get online when a connection is available or when they need to send or receive data.

**Event-driven** MQTT clients only publish data to the broker when certain conditions are met (e.g., a warning signal is triggered). That is, clients actively update data, instead of passively waiting for another device to request the data.

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## Many-to-many Communication

In factory machine-to-machine (M2M) applications machines at each station share their own process statuses with machine at other stations. Using MQTT to implement M2M communication improves both efficiency and reliability.

## QoS Design

The MQTT protocol uses three QoS levels to prioritize data: QoS 0 (at most once), QoS 1 (at least once), or QoS 2 (exactly once).

## Security

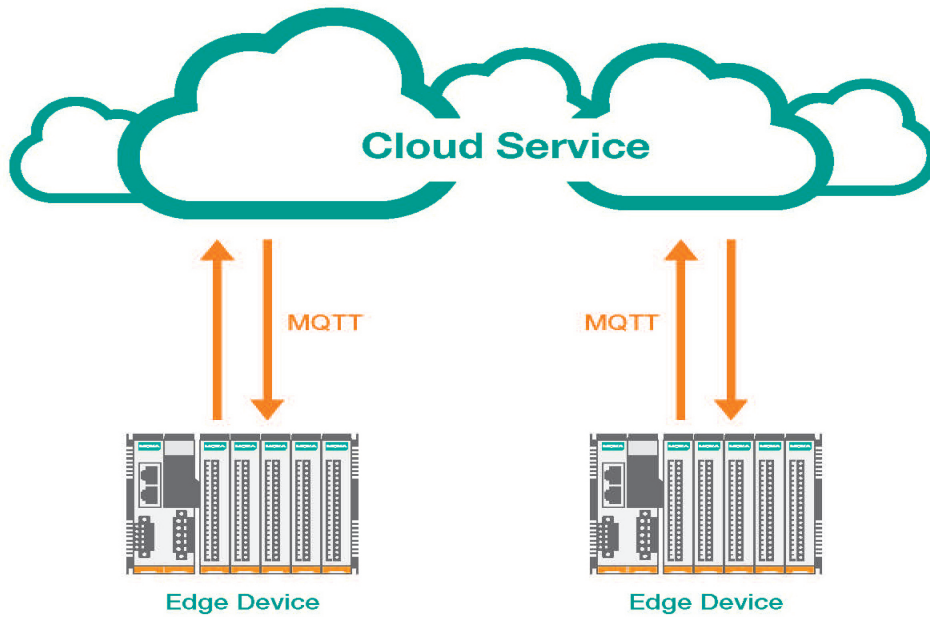
MQTT brokers support account names and passwords to prevent unauthorized clients from connecting to the broker to subscribe to topics, and TLS encryption for data transmissions greatly minimizes the chance that data will get hacked during transmission.

## MQTT Application Architecture

Two major system architectures are used:

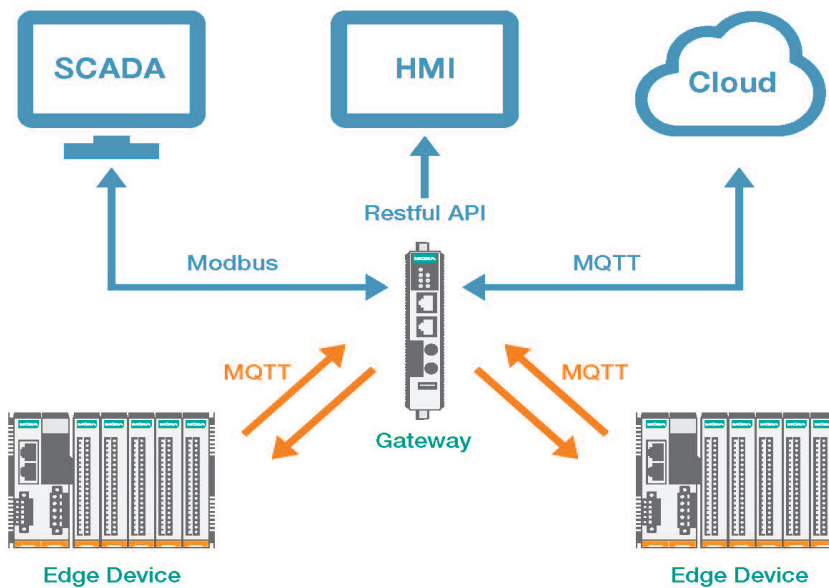
### Connecting Directly to the Cloud

Most public cloud services (AWS, Azure, Google Cloud, Alibaba Cloud, etc.) support the MQTT protocol to allow edge devices to connect directly to the cloud to remain competitive and help shape the future of the industry, cloud services should at least provide the following benefits: time saving, non-stop service and a rich set of data mining tools.



### Connecting to a Local Gateway

Connecting edge devices directly to the cloud has benefits, but you should also be aware of various concerns related to adopting cloud services for IIoT applications: cost and data security.



### The Challenges of Converting to an IIoT Application

You can expect to encounter some or all of the following challenges when transforming a traditional OT application to an IIoT application

#### Legacy Devices Currently In Use Do Not Support MQTT

For many facilities, engineer will first need to survey and purchase new remote I/O products and gateways that support MQTT. With so

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many legacy devices still being used at field sites around the globe, converting a factory to an IIoT-based setup could require a huge investment

### **Merging IT With Traditional Automation Applications Is Easier Said Tahn Done**

For example OT protocols like Modbus use data packets with small headers and payloads whereas IT protocols use MQTT, RESTful API and SNMP to collect data. Many ITengineers are not familiar with Modbus.