



### AWS IoT message broker

- Processes and routes data from your devices into AWS IoT Core.
- Scalable, reliable, with low-latency, message routing.
- Uses the publish and subscribe model to decouple devices and applications.
- Allows two-way message streaming between devices and applications.
- Allows data transformation, rerouting, and enhancement with external data sources.
- Based on the Message Queuing Telemetry Transport (MQTT) version 3.1.1.
  - Supports MQTT Quality of Service (QoS) levels 0 and 1 only.

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# **Decoupling Produces and Consumers**



# Publish - Subscribe Paradigm







## Bi-directional, asynchronous "push" communication



#### Supported Protocols

- ▶ MQTT through IP version 4 and IP version 6.
- MQTT over the WebSocket protocol.
- HTTPS protocol only to publish through IP version 4 and IP version 6.

#### Topic-based communication

- Topics register interest for incoming messages.
- Specify where to publish messages.
- Topics are 8-bit Unicode Transformation Format (UTF-8) encoded hierarchical strings

▲ロト ▲圖ト ▲国ト ▲国ト 三国

Each forward slash indicates a topic level.

Topic level separator home/office/lamp Topic level Topic level

## Multi-level Subscriptions

scores/football/big12/Texas scores/football/big12/TexasTech scores/football/big12/Oklahoma scores/football/big12/IowaState scores/football/big12/TCU scores/football/big12/OkState scores/football/big12/Kansas scores/football/SEC/TexasA&M scores/football/SEC/LSU scores/football/SEC/Alabama



single level wildcard: +

multi-level wildcard: #



![](_page_4_Figure_0.jpeg)

![](_page_5_Picture_0.jpeg)

### IoT Rules engine

- Sensor publish data continuously or periodically raw data
- Depending on Variety/Velocity/Volume of raw data we might end up with Big Data.
- Usually not all raw data are useful.
- The rules engine listens for incoming messages that match a rule based on the MQTT topic stream:
  - Saving a file, or a set of data, to an Amazon Simple Storage Service (Amazon S3) bucket.
  - Writing data from a device to an Amazon DynamoDB database.
  - Invoke an AWS Lambda function to extract specific data.
  - Send a message to an Amazon Simple Notification Service (Amazon SNS) topic.
- The rules allow devices to interact with AWS services.

![](_page_6_Picture_11.jpeg)

### Rules engine language

Uses SQL-like statements to filter and route MQTT messages.

![](_page_6_Figure_14.jpeg)

![](_page_6_Figure_15.jpeg)

#### IoT Analytics

- Automates the steps required to analyze IoT data.
- ► Helps collect only the data you need from your devices.
- Apply transformations to process the data.
- Enrich the data with device-specific metadata, such as device type and location, before storing it.
- Analyze by running queries using the built-in SQL query engine,
- Perform more complex analytics and machine learning inference.

![](_page_6_Picture_23.jpeg)

### IoT Analytics Terminology

- Channel collects and archives raw, unprocessed message data before publishing this data to a pipeline.
- Pipeline consumes messages from a channel and enables to process and filter the messages before storing them in a data store.
- Data store not a database, but a scalable and queryable repository of messages. May have multiple data stores for messages that come from different devices or locations.
- Dataset retrieve data from a data store by creating a dataset.
  - Enables you to create a SQL dataset or a container dataset.
  - Allows to view dataset contents from the console.

#### Closer analysis of the process

![](_page_7_Figure_8.jpeg)

![](_page_7_Figure_9.jpeg)

### Device Shadow service

- ► A Digital Twin.
- Maintains a shadow for each device you connect to AWS IoT.
- Interact directly with the Digital Twin to get/set state over MQTT or HTTP.
  - ▶ If Actual Device is connected, changes are propagated.
  - If Actual Device is not connected, changes are kept by Shadow service and propagated when device reconnects.
- Applications are not aware of the connection status of each IoT device.

![](_page_7_Picture_17.jpeg)

# An Example of Device Shadow Usage

# Device Shadow Lifecycle

![](_page_8_Figure_2.jpeg)

![](_page_9_Figure_0.jpeg)

## Interacting with the Device Shadow

Each device is assigned with 4 MQTT topics:

- \$aws/things/ThingName/shadow/update
- \$aws/things/ThingName/shadow/get
- \$aws/things/ThingName/shadow/get/accepted
- \$aws/things/ThingName/shadow/delete
- \$aws/things/ThingName/shadow/update/delta

![](_page_10_Picture_7.jpeg)