CP013
Azure IoT Hub: the cloud gateway for the Internet of Things

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Who am I?

Contacts!

- Senior Software Engineer *(Leonardo Ricerche S.r.l.)*
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  "... constantly moving between the devices and the cloud ..."

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Agenda

• IoT Reference Architecture
• IoT Cloud Gateway ? Why ? What ?
• IoT Hub architecture
  • features
  • endpoints
  • messages
• Developing on IoT Hub : SDKs and Hardware
• Identity, Security & Authentication
• Provision a starting IoT solution : IoT Suite !
• Demo time

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IoT Reference Architecture

- **Devices and Data Sources**
  - IP capable devices
  - Agent Libs
  - Existing IoT devices
  - Agent Libs
  - Low power devices
  - Agent Libs

- **Data Transport**

- **Device and Event Processing**
  - Cloud Gateway
  - IoT Solution backend
  - Gateway
  - Agent Libs

- **Presentation**
  - Data Visualization & Presentation
Telemetry

- Need to ingest million events/second from billion (?) devices
Command/Notification

- Need to control devices for executing command
- Need to notify devices with some useful information/events
Think at «scale»

- Start «small» ... to «big»
- Million clients
- Concurrent

100 10,000 1,000,000
Need for a “gate”

- Need for a «gate» to handle communication between:
  - Cloud services (and apps ?)
  - Devices
IoT Hub: the Azure IoT Cloud Gateway

Your IoT Hub

D2C send endpoint
C2D queue endpoint
Device ID
Device...
Device...
Device...

Device ID management

Event processing (hot and cold path)

D2C receive endpoint
C2D send endpoint
Msg feedback and monitoring endpoint
Device identity management

Device business logic, connectivity monitoring

Device provisioning and management
IoT Hub : features

• Connection
  • bidirectional communication
  • reliable & secure channel
  • per-device authentication
  • multiplexing

• Features
  • device to cloud telemetry
  • cloud to device commands and notifications (with TTL & feedback)
  • bulk uploads/downloads
  • monitoring devices (connection, activity, ...)
  • multi protocols (AMQP, HTTP) → IoT Protocol Gateway (MQTT)
IoT Hub : endpoints

- **Device To Cloud**
  - D2C: *send messages to the cloud* (telemetry data, outcome for a received command or request for execution)
  - C2D: *receive commands* for executing the requested action. IoT Hub generates a feedback for the cloud

- **Cloud To Device**
  - C2D: *send messages* (ex. commands) to the devices. Like a queue and each message has a **TTL (Time To Live)**
  - D2C: *retrieve messages from device* (telemetry or outcome for commands). **Event Hubs compatible**. On a different path there are feedbacks on command delivery
IoT Hub: message lifecycle

- **Service send**
  - feedback (none, positive, negative, full)
  - feedback retention
  - message TTL

- **Device receive**
  - complete
  - abandon
  - reject

- **Message size**
  - Max 256 KB / chunk 16 KB
IoT Hub: internal architecture analogy

D2C

/device/[DEVICE_ID]/messages/events

D2C

Event processing (hot and cold path)

C2D

/device/[DEVICE_ID]/messages/devicebound

/messages/devicebound

Device GW

Forwarding on the right device queue reading:
Msg.To = /device/[DEVICE_ID]/messages/devicebound

Feedback generation based on device accept/reject or TTL expiration
/messages/servicebound/feedback

C2D

Device business logic, connectivity monitoring
Developing on IoT Hub: SDKs

- For devices and field gateway
  - Platforms
    - Windows
    - Linux
    - RTOS (freeRTOS), ARM mbed
    - Android, iOS
  - Languages
    - C#, C, Java, JavaScript (NodeJS)

- For back-ends and cloud gateway
  - Languages
    - .Net C#
    - Java
    - JavaScript (NodeJS)

No SDK for your platform? Porting or ... AMQP and HTTP directly!!
Developing on IoT Hub : Hardware

• Raspberry Pi 2
• MinnowBoard Max
• Dragonboard 410C
• Freescale FRDM-K64F
• TI CC3200
• ...
• ...
• Your board !!
Identity, Authentication & Security

- **Identity**
  - devices registry
  - provisioning APIs (create, delete, ...)
  - monitoring (connection status, activity, ...)

- **Authentication**
  - permission (r-only registry, r/w registry, device, service)
  - policy made with one or more permissions
  - per-device auth with SAS token (from device id and device key)

- **Security**
  - encrypted channel ➔ SSL/TLS protocol
Prices, Quotas & Throttling

• prices based on:
  • IoT Hub units (up to 200 or ... contact Microsoft Support)
  • number of devices
  • total number of messages/day
  • messages billed as 16 KB chunk

• throttling based on identity registry ops, device connections, D2C & C2D operations

<table>
<thead>
<tr>
<th>EDITION TYPE</th>
<th>PRICE</th>
<th>NUMBER OF DEVICES</th>
<th>TOTAL NUMBER OF MESSAGES/DAY</th>
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<tr>
<td>Free</td>
<td>Free</td>
<td>10</td>
<td>3,000</td>
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<tr>
<td>S1 (Low Frequency)</td>
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<td>S2 (High Frequency)</td>
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Provision a starting IoT solution: IoT Suite!

- Start from a preconfigured solution to customize...
Azure IoT Suite Remote Monitoring

- [http://www.azureiotsuite.com](http://www.azureiotsuite.com)
Azure IoT Suite Remote Monitoring

- Get started in few minutes
- Dashboard
  - devices location
  - data visualization in real time
  - alarm history
- Manage devices
  - enable/disable
  - commands
  - add your devices (simulator or real device)
- Modify rules and actions
Azure IoT Suite Remote Monitoring: the services
Azure IoT Suite Remote Monitoring: the services
Azure IoT Suite Remote Monitoring Demo
References & Links

- Azure IoT Suite: http://www.azureiotsuite.com
- Azure IoT Dev center: http://www.azure.com/iotdev
- Azure IoT SDKs: https://github.com/Azure/azure-iot-sdk
- Let’s connect: https://azure.microsoft.com/en-us/develop/iot/get-started/
- Azure IoT Remote Monitoring: https://github.com/Azure/azure-iot-remote-monitoring
References & Links


- IoT Hub connection using AMQP stack:
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