

2015  
**WPC**  
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# CP013 Azure IoT Hub : the cloud gateway for the Internet of Things

Paolo Patierno – Microsoft MVP Windows Embedded & IoT

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presenta

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# Who am I? Contacts!

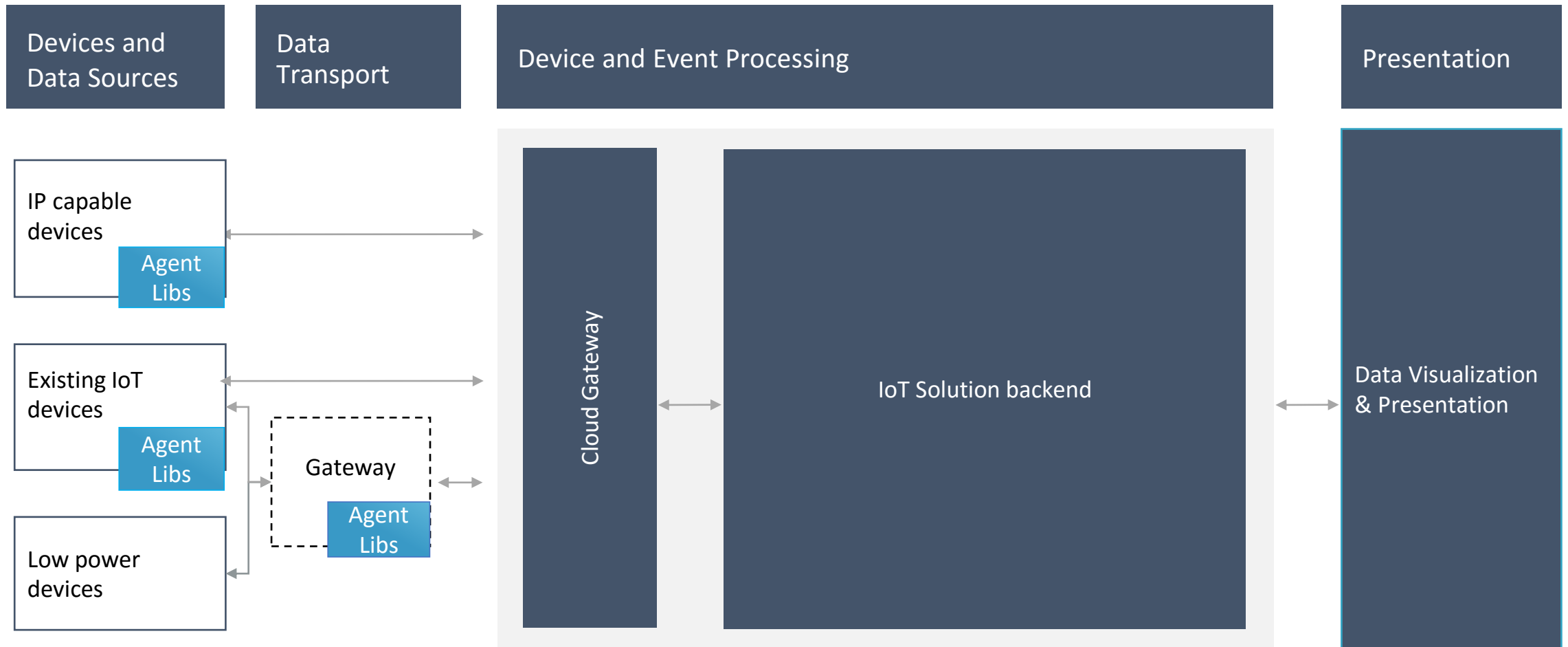
- Senior Software Engineer (*Leonardo Ricerche S.r.l.*)
- Microsoft MVP for Windows Embedded & IoT
- "... *constantly moving between the devices and the cloud ...*"
- «DotNetCampania» member
  - <https://paolopatierno.wordpress.com>
- «TinyCLR.it» member
  - <http://www.tinyclr.it>
- «Embedded101» board of director member
  - <http://www.embedded101.com/Blogs/PaoloPatierno.aspx>
- LinkedIn
  - <http://it.linkedin.com/in/paolopatierno>
- Contacts
  - [twitter] @ppatierno
  - [email] ppatierno@live.com
  - [skype] paolopat80



# 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

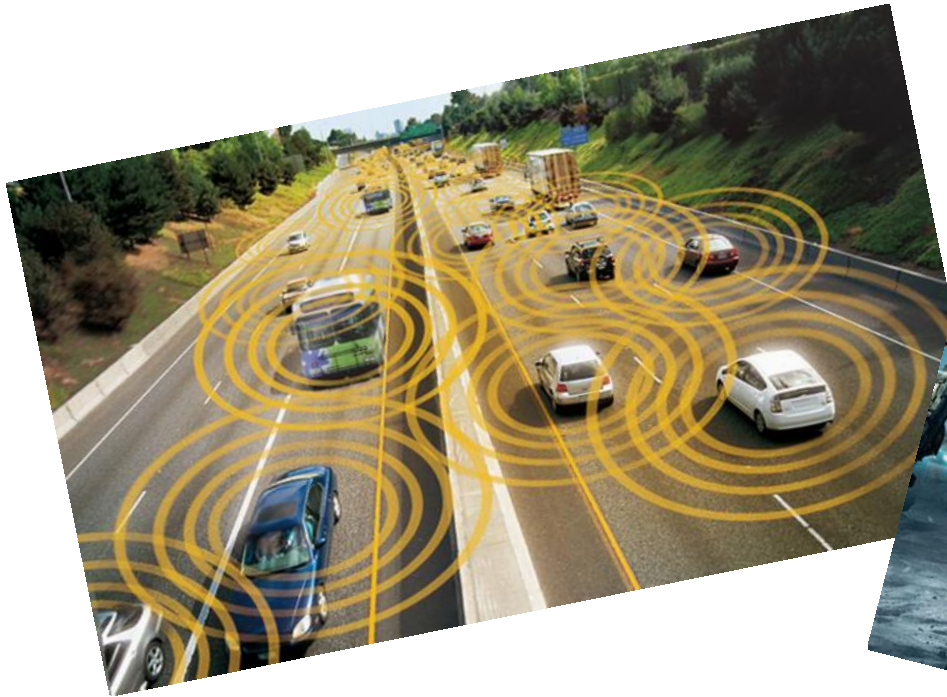
# IoT Reference Architecture





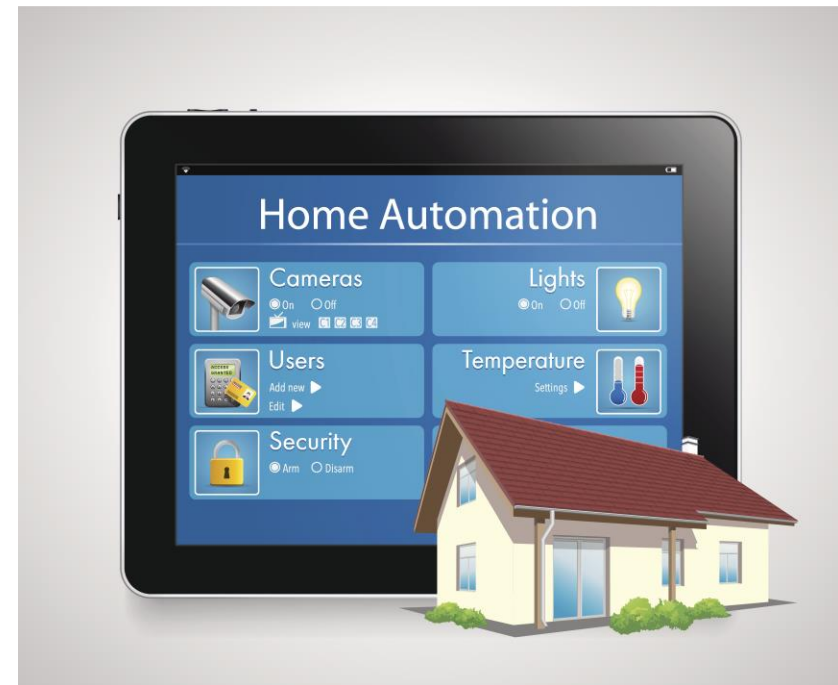
# Telemetry

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



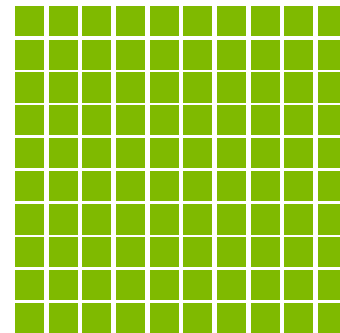
## Command/Notification

- Need to control devices for executing command
- Need to notify devices with some useful information/events

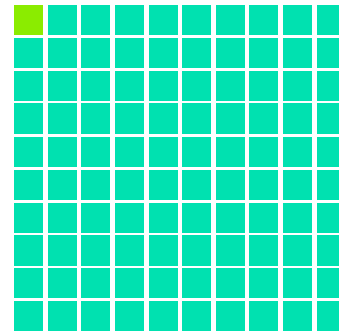


## Think at «scale»

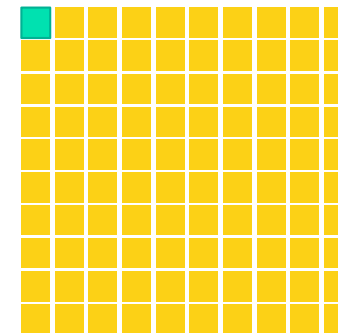
- Start «small» ... to «big»
- Million clients
- Concurrent



100



10,000



1,000,000



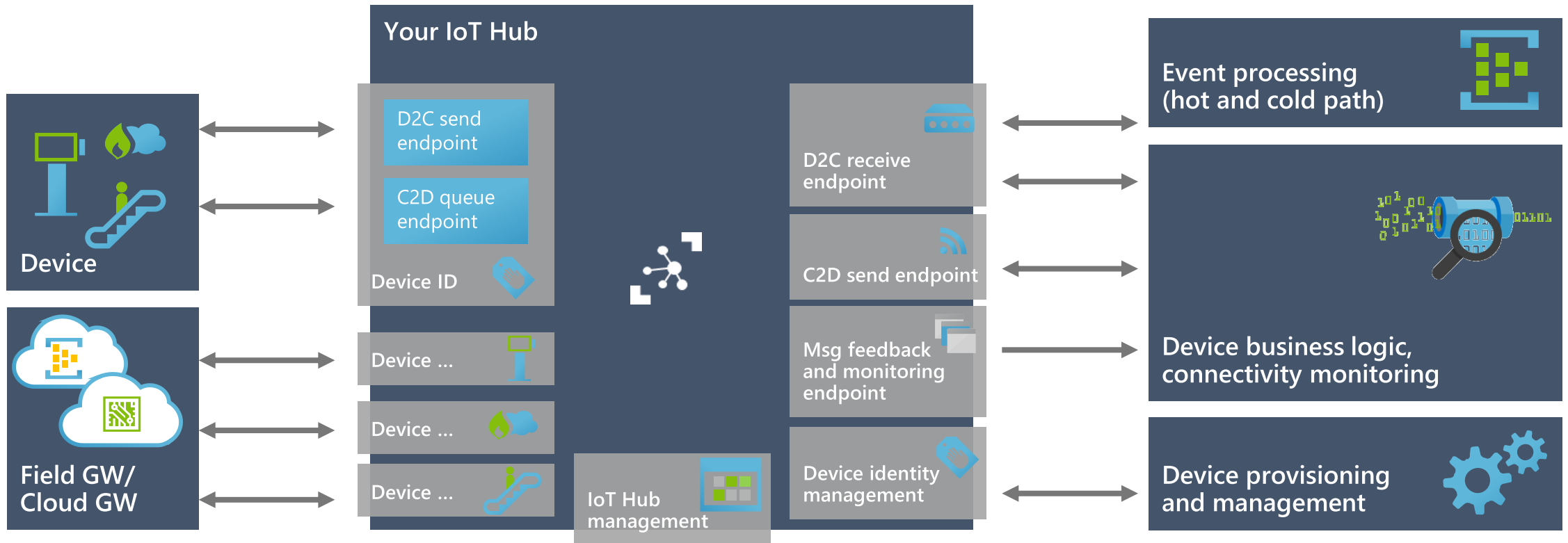
## Need for a “gate”

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





# IoT Hub : the Azure IoT Cloud Gateway



## 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)

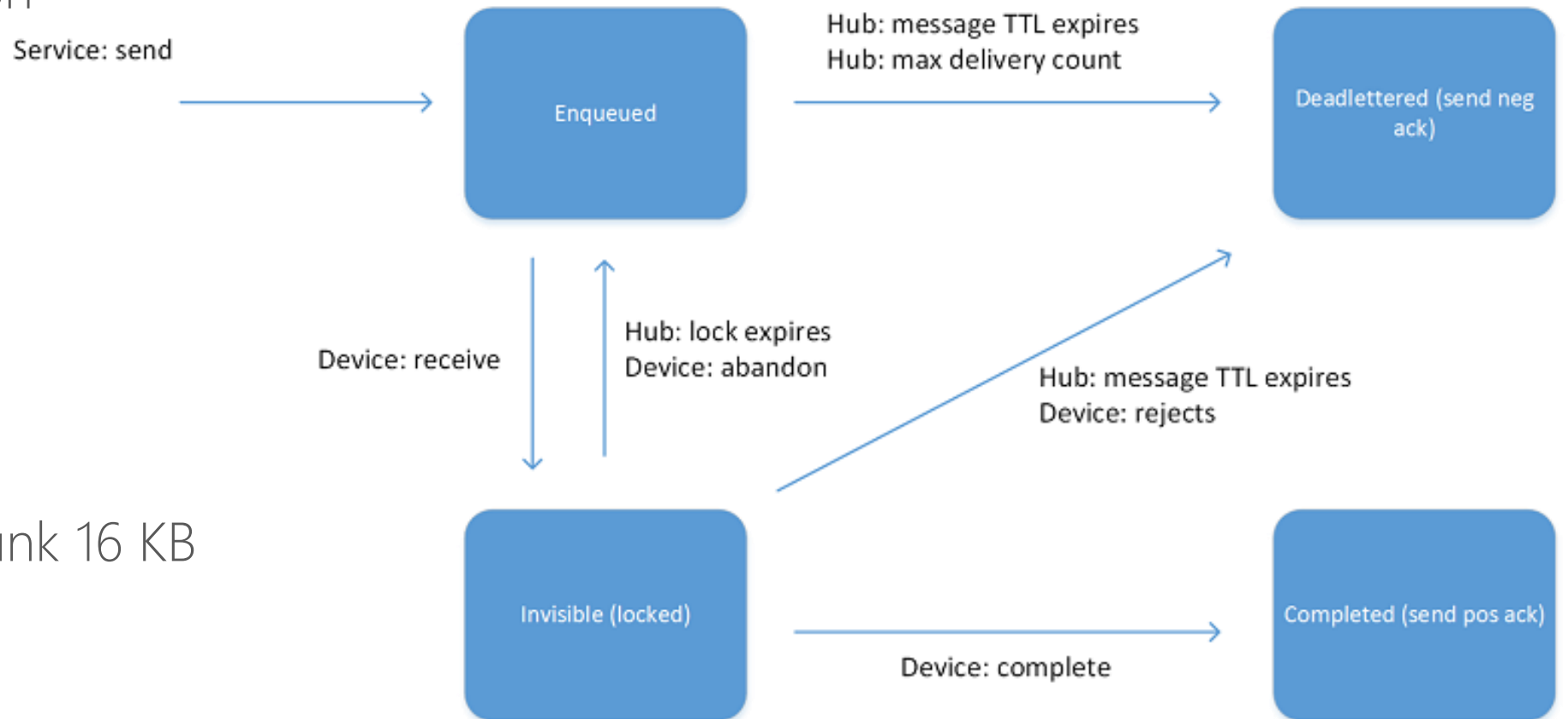
## IoT Hub : endpoints

- 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**

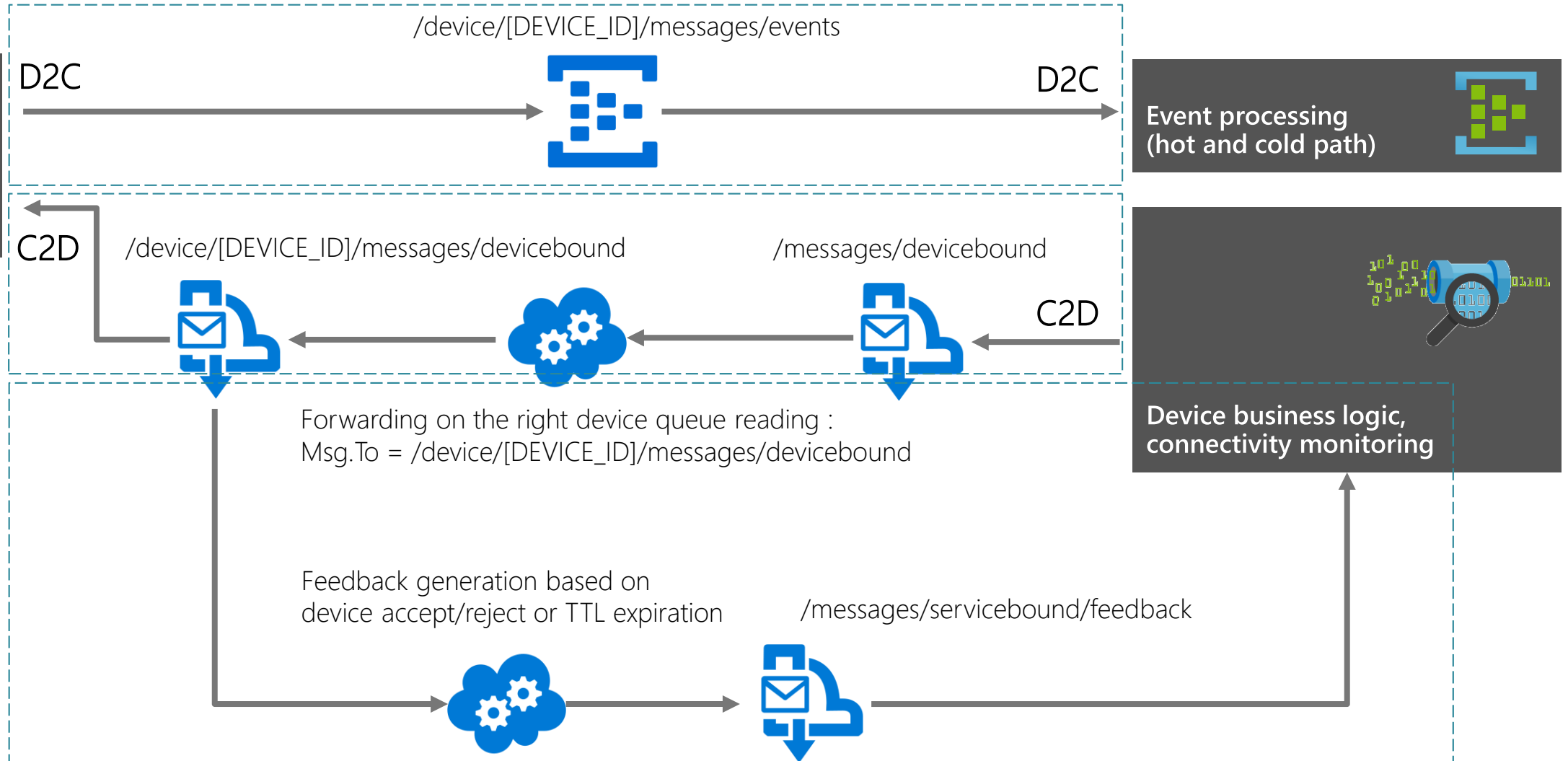


# IoT Hub : message lifecycle

- 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



## Developing on IoT Hub : SDKs

- For devices and field gateway
- Platforms
  - Windows
  - Linux
  - RTOS (freeRTOS), ARM mbed
  - Android, iOS
  - WEC2013 ? .Net MF ? Stay tuned !
- Languages
  - C#, C, Java, JavaScript (NodeJS)
- For back-ends and cloud gateway
- Languages
  - .Net C#
  - Java
  - JavaScript (NodeJS)

# GitHub

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 !!



## Trusted partners to jumpstart your IoT project

The Microsoft Azure Certified for IoT program helps businesses get started on their IoT projects quickly by connecting them with an ecosystem of partners that have offerings that can easily connect to the [Azure IoT Suite](#). Partners who are showcased in the Azure Certified for IoT program are trusted partners with tested and certified offerings who can help businesses with their IoT device and hardware needs.



# 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

EDITION TYPE	PRICE	NUMBER OF DEVICES	TOTAL NUMBER OF MESSAGES/DAY
Free	Free	10	3,000
S1 (Low Frequency)	€21.09	500	50,000
S2 (High Frequency)	€210.83	500	1,500,000



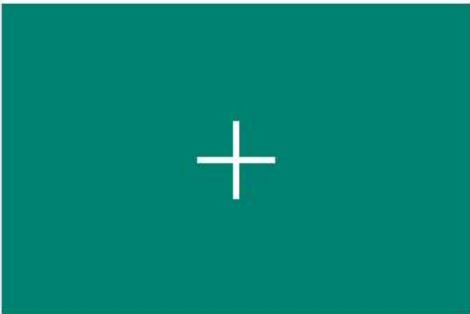
# Provision a starting IoT solution : IoT Suite !

- Start from a preconfigured solution to customize ...

Microsoft Azure IoT Suite


Default Directory ▾ Paolo Patierno ▾

## Provisioned solutions



**Create a new solution**  
Create your own fully integrated provisioning solution

✓ Ready

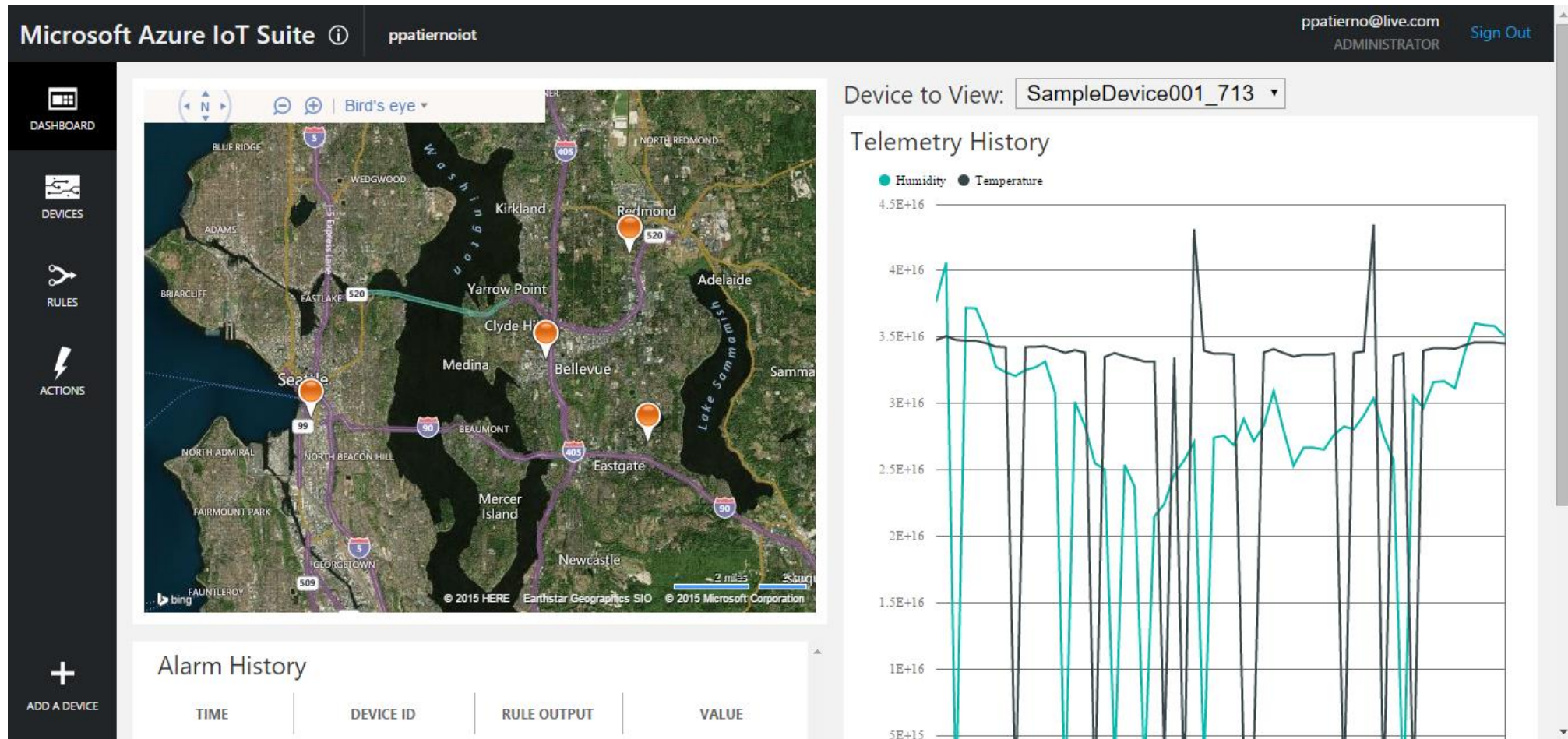


**ppatiernoiot**  
Monitor events and conditions from your devices in the field.

Launch

# Azure IoT Suite Remote Monitoring

- <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

The screenshot displays the Microsoft Azure IoT Suite interface for the workspace 'wpc2015iot'. The interface is divided into two main sections: 'Device List (5)' and 'Rules (2)'. A sidebar on the left contains navigation icons for Dashboard, Devices, Rules, and Actions.

**Device List (5)**

STATUS	DEVICE ID	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FIRMWARE	PLATFORM
Running	SampleDevice001_18	Contoso Inc.	MD-669	SER7043	1.23	Plat-31
Running	SampleDevice002_18	Contoso Inc.	MD-406	SER8626	1.4	Plat-86
Running	SampleDevice003_18	Contoso Inc.	MD-587	SER9373	1.19	Plat-39
Running	SampleDevice004_18	Contoso Inc.	MD-524	SER2180	1.62	Plat-36

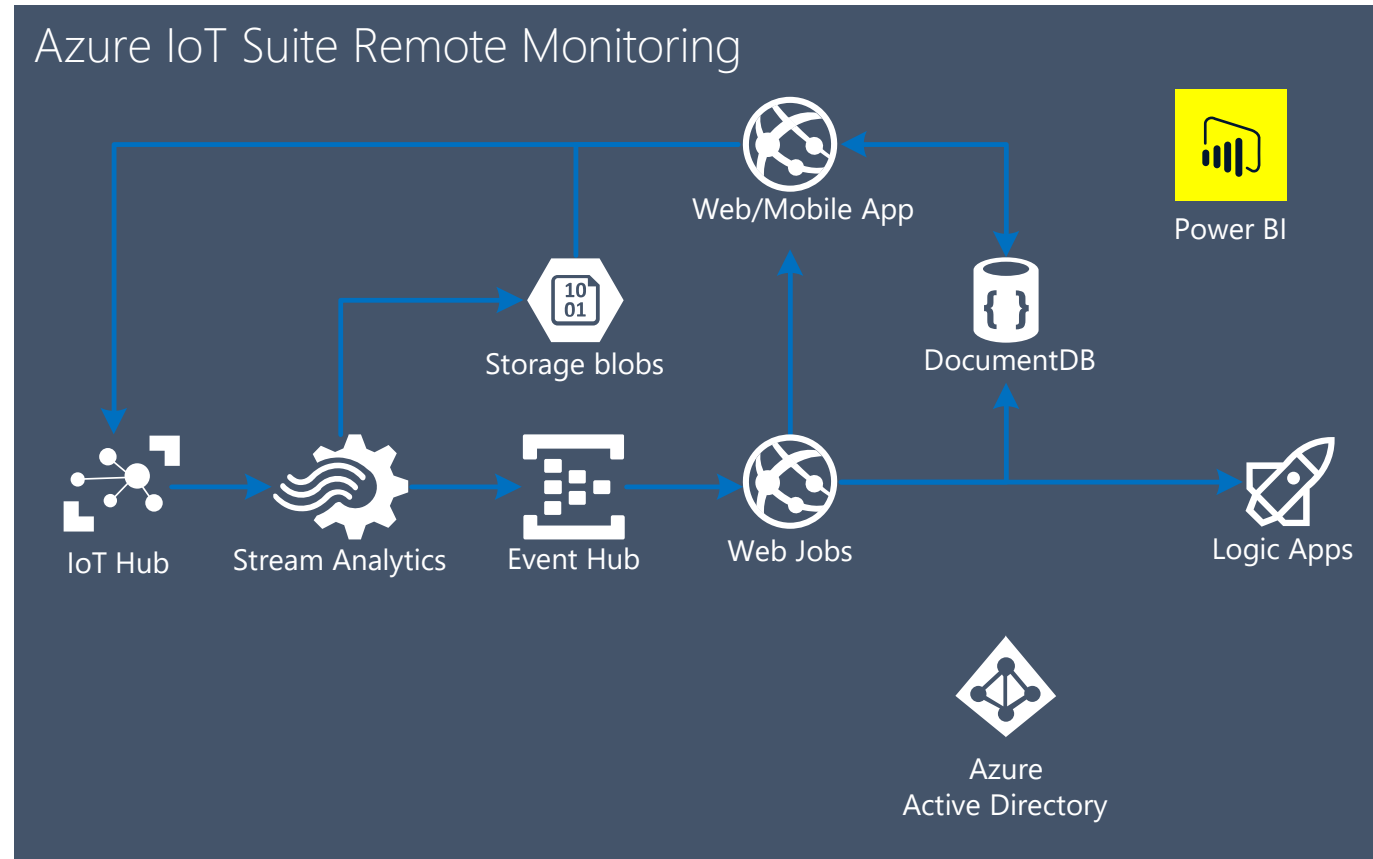
**Rules (2)**

STATUS	RULE ID	DEVICE ID	DATA FIELD	OPERATOR	THRESHOLD
Enabled	31d508a1-834f-4f9c-9950-5f5010fde0c4	SampleDevice001_18	Temperature	>	38,00
Enabled	d0981740-8a37-4f8a-8e90-53fbf55316a1	SampleDevice001_18	Humidity	>	48,00

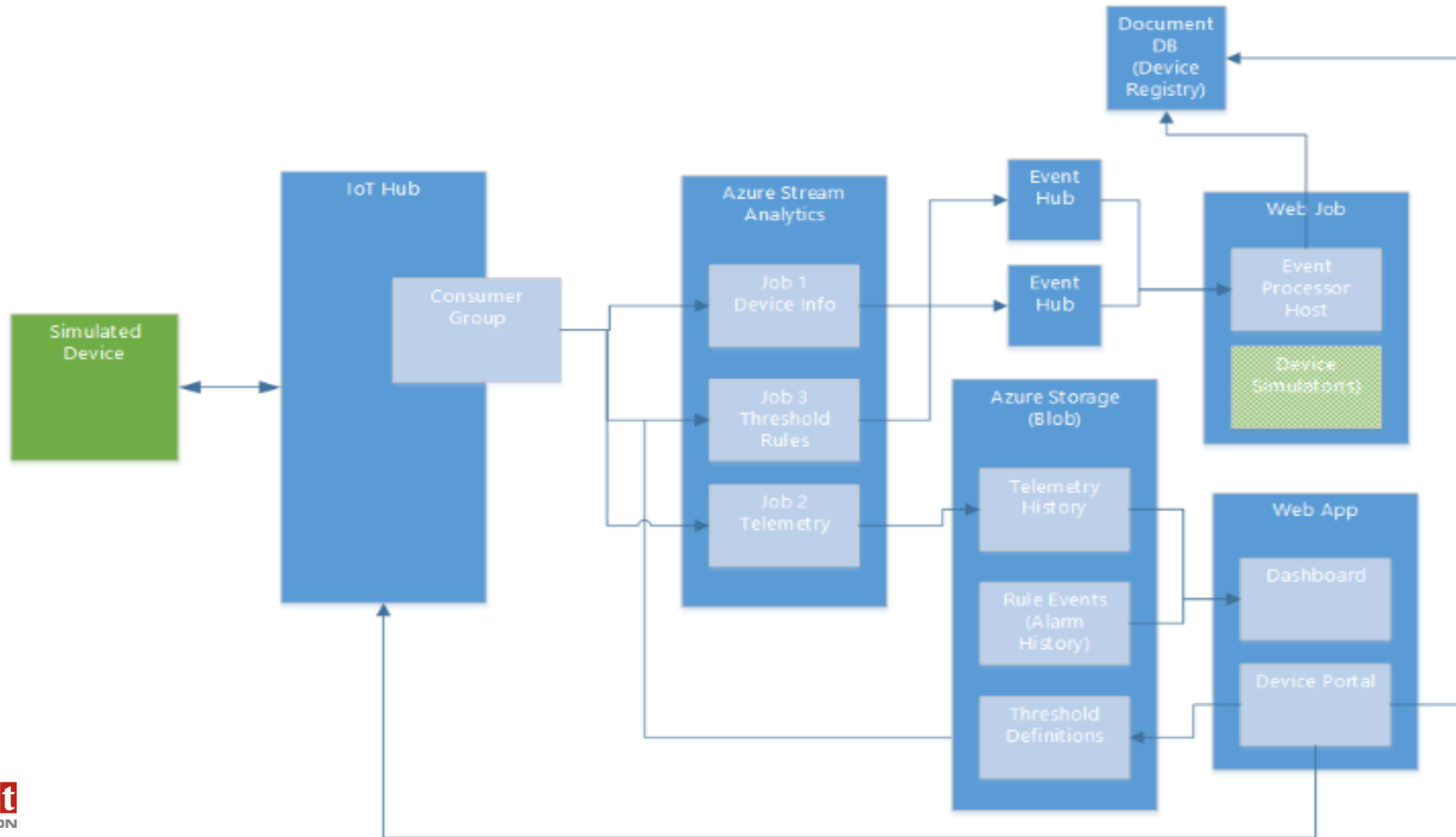
A modal dialog is open, asking 'How would you like to define the Device ID? (DeviceID is case-sensitive)'. It offers two options: 'Generate a Device ID for me' (selected) and 'Let me define my own Device ID'. Below the options is a text input field labeled 'Enter a Device ID' and two buttons: 'Create' and 'Cancel'.



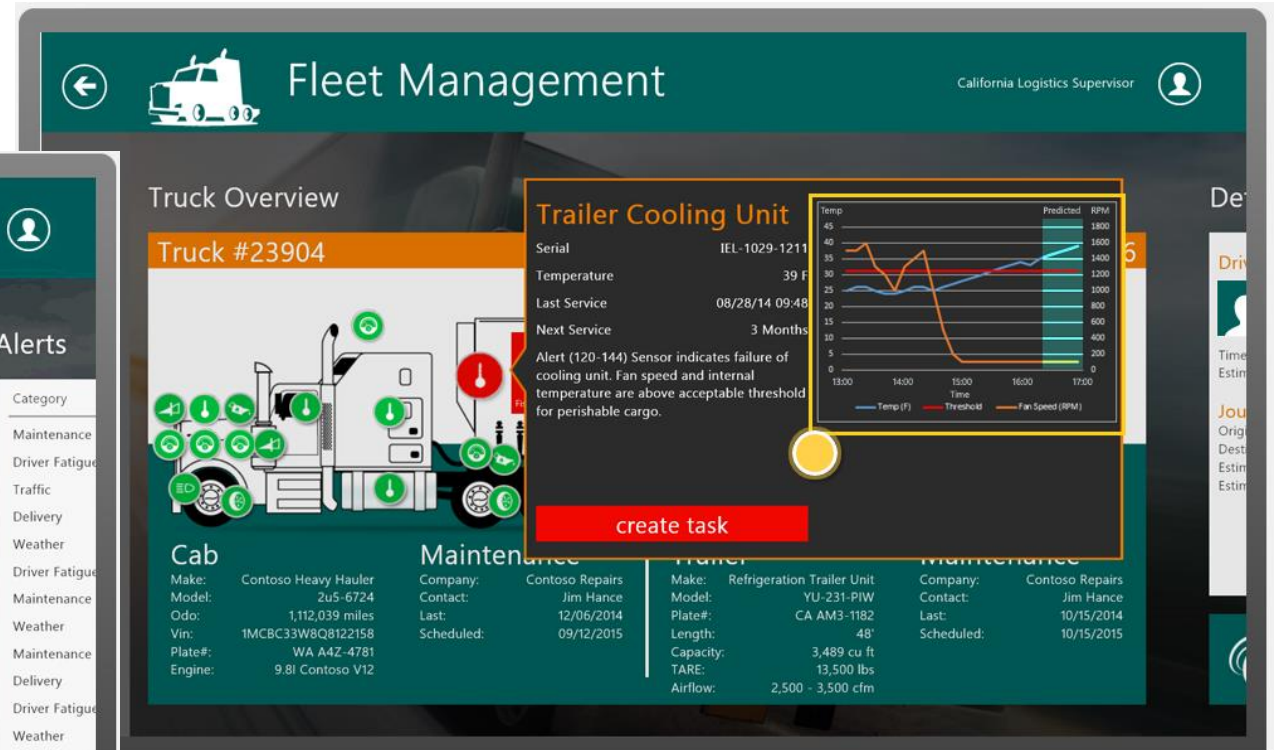
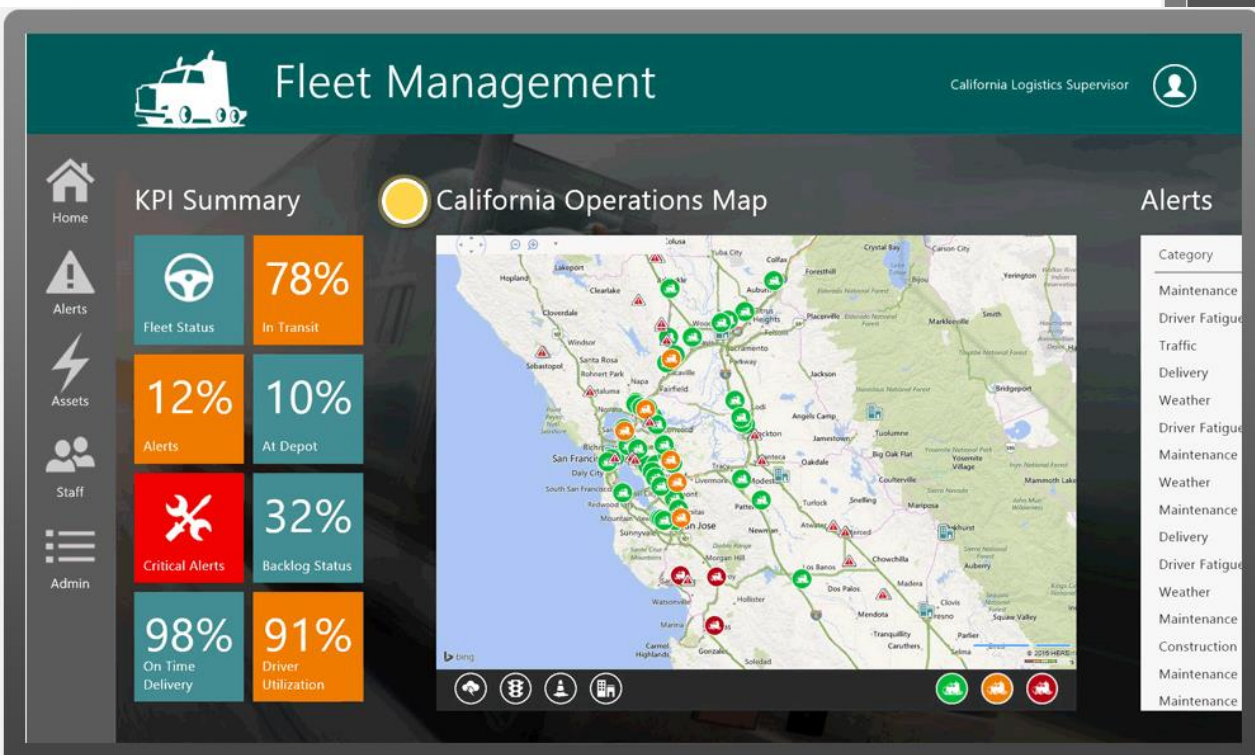
# Azure IoT Suite Remote Monitoring : the services



# Azure IoT Suite Remote Monitoring : the services



# Azure IoT Suite Remote Monitoring Demo



## References & Links

- Azure IoT Hub : <https://azure.microsoft.com/en-us/services/iot-hub/>
- 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-sdks>
- Azure Certified IoT : <https://azure.microsoft.com/en-us/marketplace/certified-iot-program/>
- Let's connect : <https://azure.microsoft.com/en-us/develop/iot/get-started/>
- IoT Protocol Gateway : <https://github.com/Azure/azure-iot-protocol-gateway>
- Azure IoT Remote Monitoring : <https://github.com/Azure/azure-iot-remote-monitoring>

## References & Links

- IoT Hub vs AWS IoT : <https://paolopatierno.wordpress.com/2015/10/13/an-iot-platforms-match-microsoft-azure-iot-vs-amazon-aws-iot/>
- IoT Hub connection using AMQP stack :
  - <https://paolopatierno.wordpress.com/2015/10/24/connecting-to-the-azure-iot-hub-using-an-the-amqp-stack/>
  - <https://paolopatierno.wordpress.com/2015/10/31/azure-iot-hub-commands-and-feedback-using-amqp-net-lite/>
  - <https://paolopatierno.wordpress.com/2015/11/02/azure-iot-hub-get-telemetry-data-using-amqp-stack-and-azure-sb-lite/>



Q & A

# Domande e Risposte

# Contatti OverNet Education

## OverNet Education

[info@overneteducation.it](mailto:info@overneteducation.it)

[www.overneteducation.it](http://www.overneteducation.it)

Tel. 02 365738

@overnete

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