Microsoft

A Brief Journey from Device to Action …

hackster.io

IoT Virtual Bootcamp

December
12 – 14, 2017

http://aka.ms/IoTVirtualBootcamp

Hardware Partners : adafruit

Microsoft

Microsoft Azure IoT Hub

Kevin Saye

Azure IoT Hub

Hyper scale IoT solution

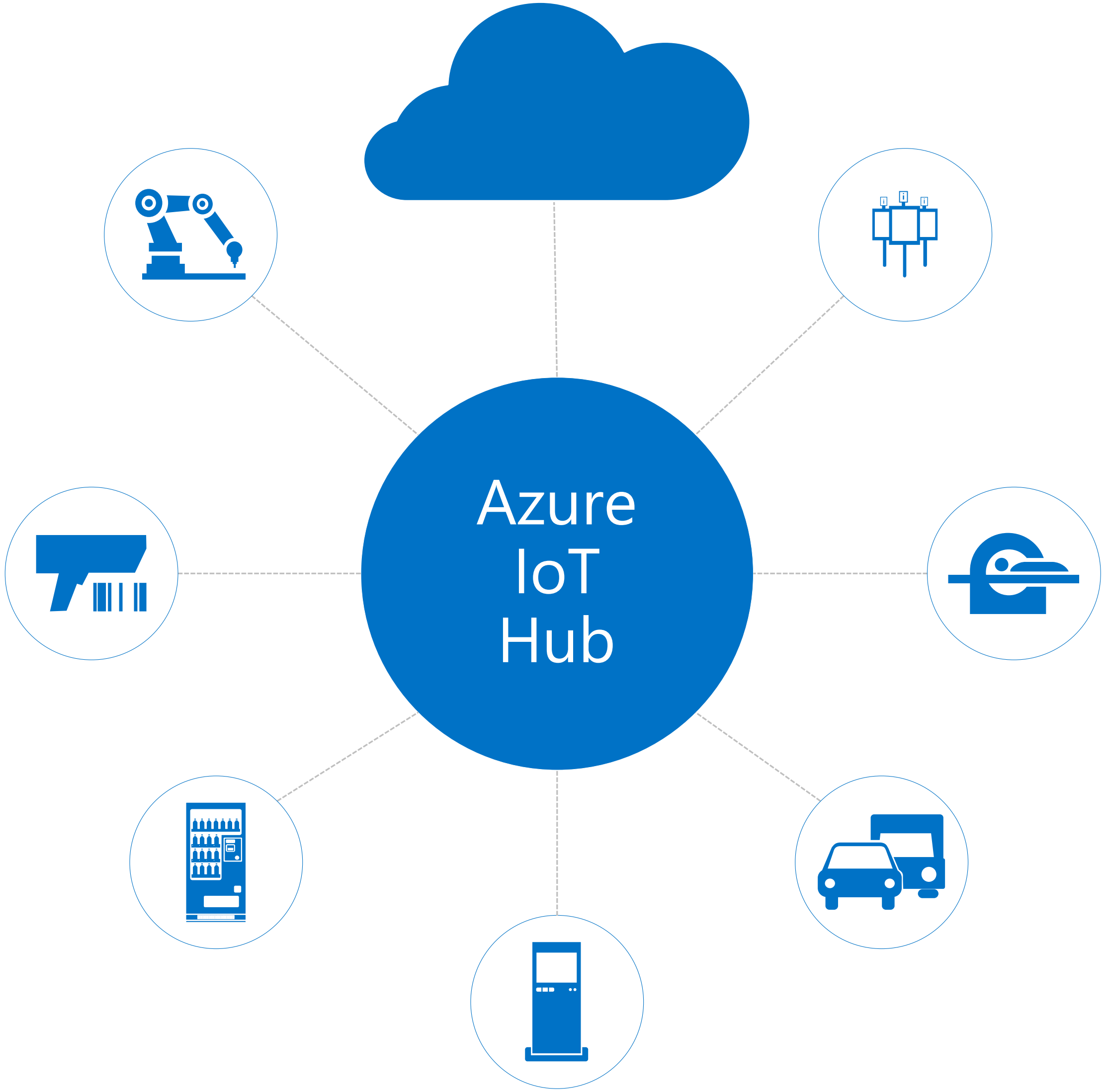
Cloud-scale messaging

Two-way communication

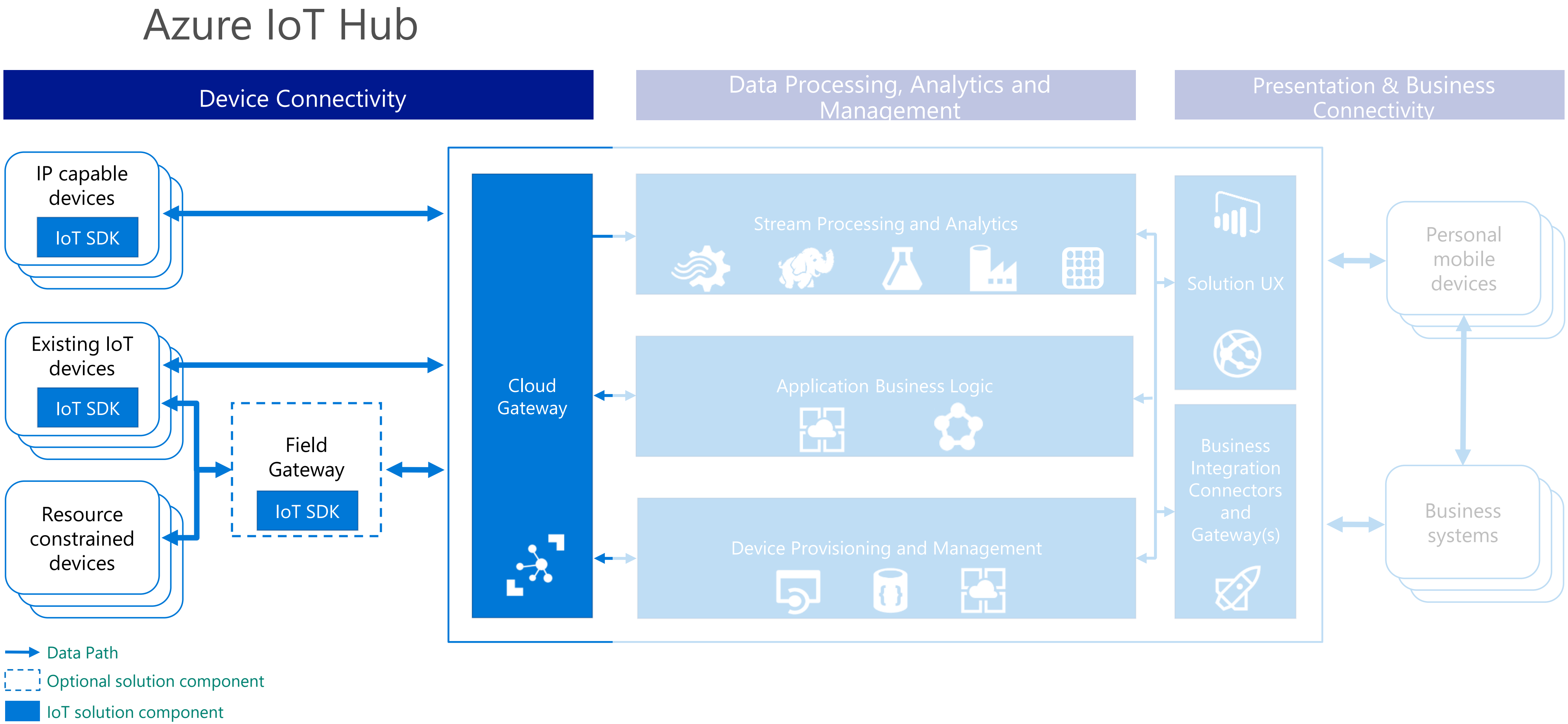
Per-device authentication

Multi-protocol support

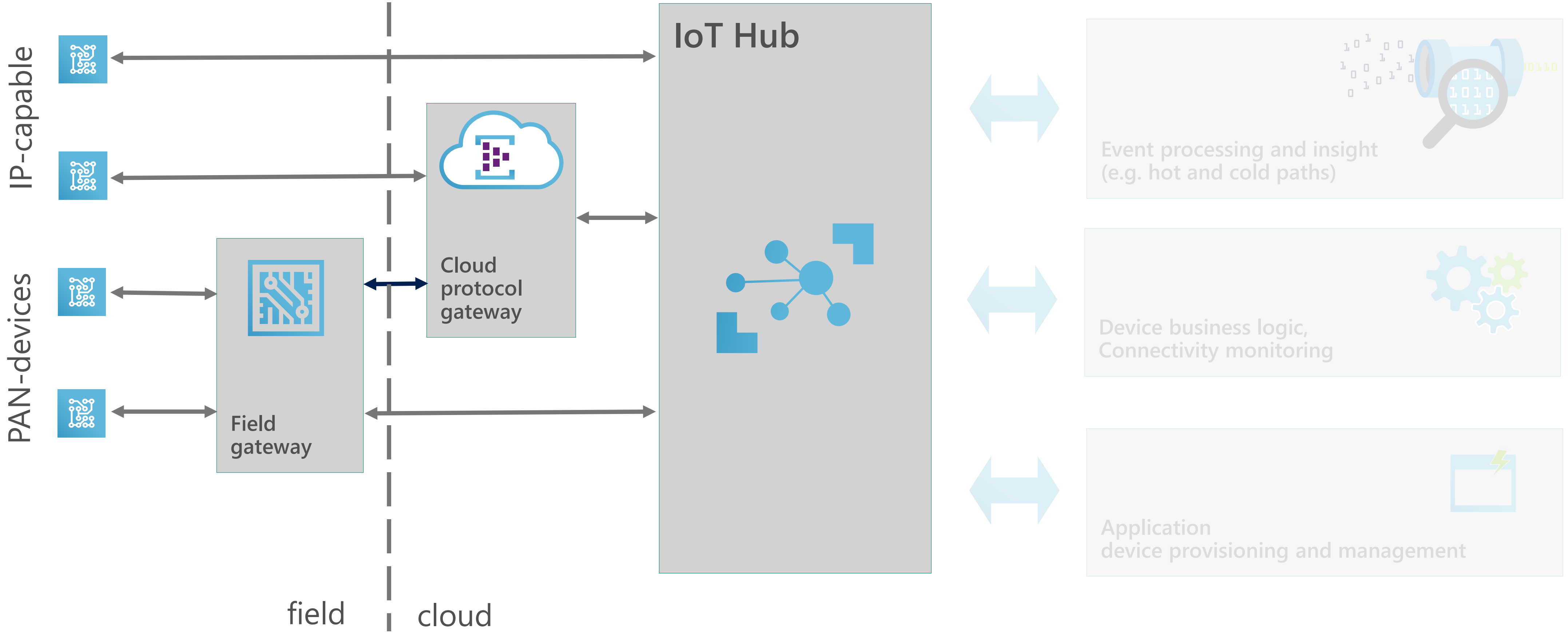
Cloud-scale gateway



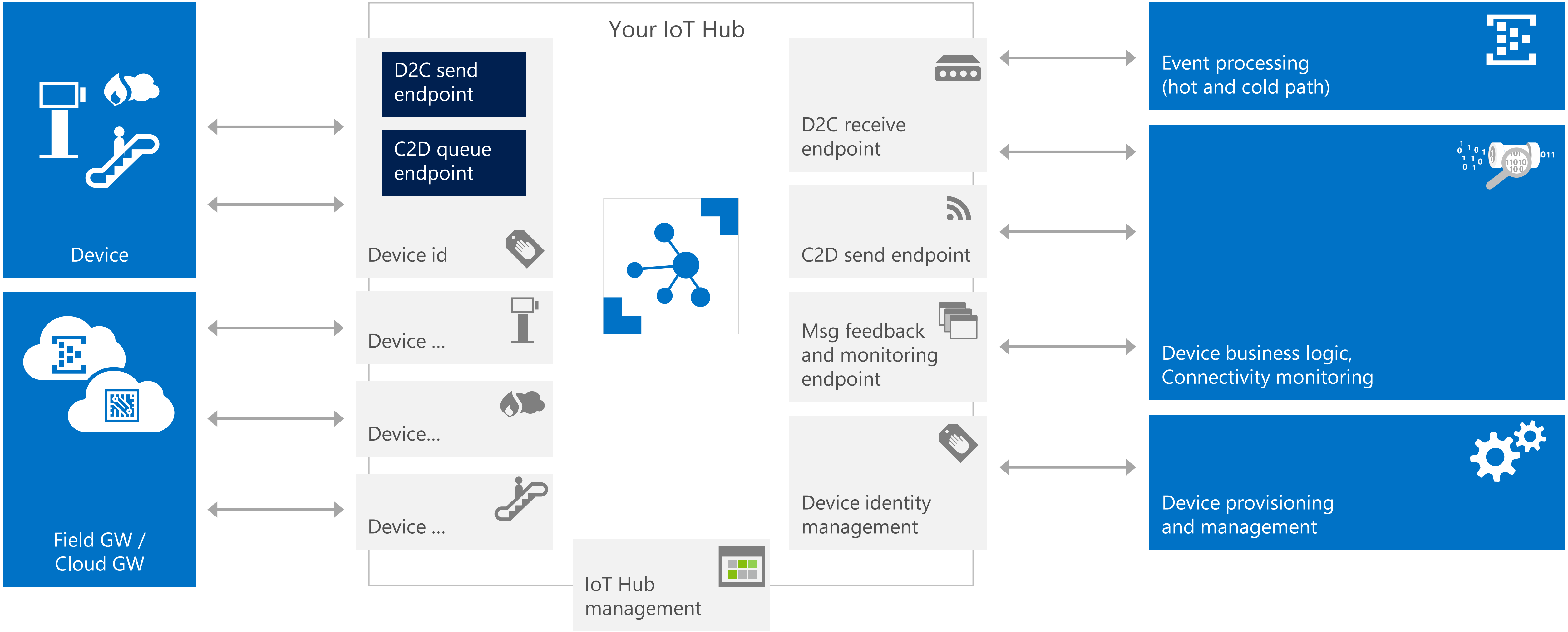
Azure IoT Hub


Azure IoT Hub
Device Connectivity
Data Processing, Analytics and Management
Presentation & Business Connectivity
IP capable devices
IoT SDK
Existing IoT devices
IoT SDK
Resource constrained devices
Field Gateway
IoT SDK
Cloud Gateway
Stream Processing and Analytics
Application Business Logic
Device Provisioning and Management
Solution UX
Business Integration Connectors and Gateway(s)
Personal mobile devices
Business systems
Data Path
Optional solution component
IoT solution component

Azure IoT Hub with Gateway(s)



IoT Hub endpoints



Device

Field GW /
Cloud GW

Your IoT Hub

D2C send endpoint

C2D queue endpoint

Device id

Device ...

Device...

Device ...

IoT Hub management

D2C receive endpoint

C2D send endpoint

Msg feedback and monitoring endpoint

Device identity management

Event processing
(hot and cold path)

Device business logic,
Connectivity monitoring

Device provisioning
and management

Azure IoT Hub

Designed for IoT

Connect up to 10 million devices

Cloud-scale messaging

Device-to-cloud and Cloud-to-device

Durable messages (at least once semantics)

Per-device authentication

Individual device identities and credentials

Multi-protocol support

Natively supports AMQP, HTTP, MQTT

Designed for extensibility to custom protocols

Service assisted communications

Secure bi-directional communication

Command and control

Cloud-facing telemetry ingestion

Delivery receipts, expired messages

Device communication errors

Connection multiplexing

Single device-cloud connection for all communications (C2D, D2C)

Multi-platform

Device SDKs available for multiple platforms (e.g. RTOS, Linux, Windows)

Multi-platform Service SDK

Security in IoT

Per Device Authentication

No shared authentication

IP Filters

Restrict Public Cloud solutions to IP or ranges of IPs including private network peering

Time Based Authentication

Limit authentication and re-authentication to time based events

SHA 256 hash

Authentication “Token” is SHA 256 hashed (Hash-based Message Authentication Code) to verify device has needed credentials.

Device Management

Allows you to deploy updated configuration and device firmware across millions of devices using a device Twin (class of device representation)

TLS encrypted communication

MQTT/AMQP/HTTP over TSL required for all communications, allowing the device to verify, through CLR and public PKI the authenticity of the IoT Hub

Scale and Secure by Design

Includes HA and Scale to meet small to global scale – eliminating DoS and complex designs

SDK Library

SDK, agent libraries

Easily accessible libraries in GitHub

Cross platform support

Choose real time OS, platform and language

Device support

IP and access control capabilities

Connect IP, and non-IP devices

Support for direct connection devices and resource strained or non-IP devices via gateway and field protocols

Open source framework

Develop custom agents for your devices

Secure communication

Simple and secure D2C and C2D connectivity for messaging, device management and command and control

OS support

RTOS, Linux, Windows, Android, iOS etc.

SDK support

C Libraries supported

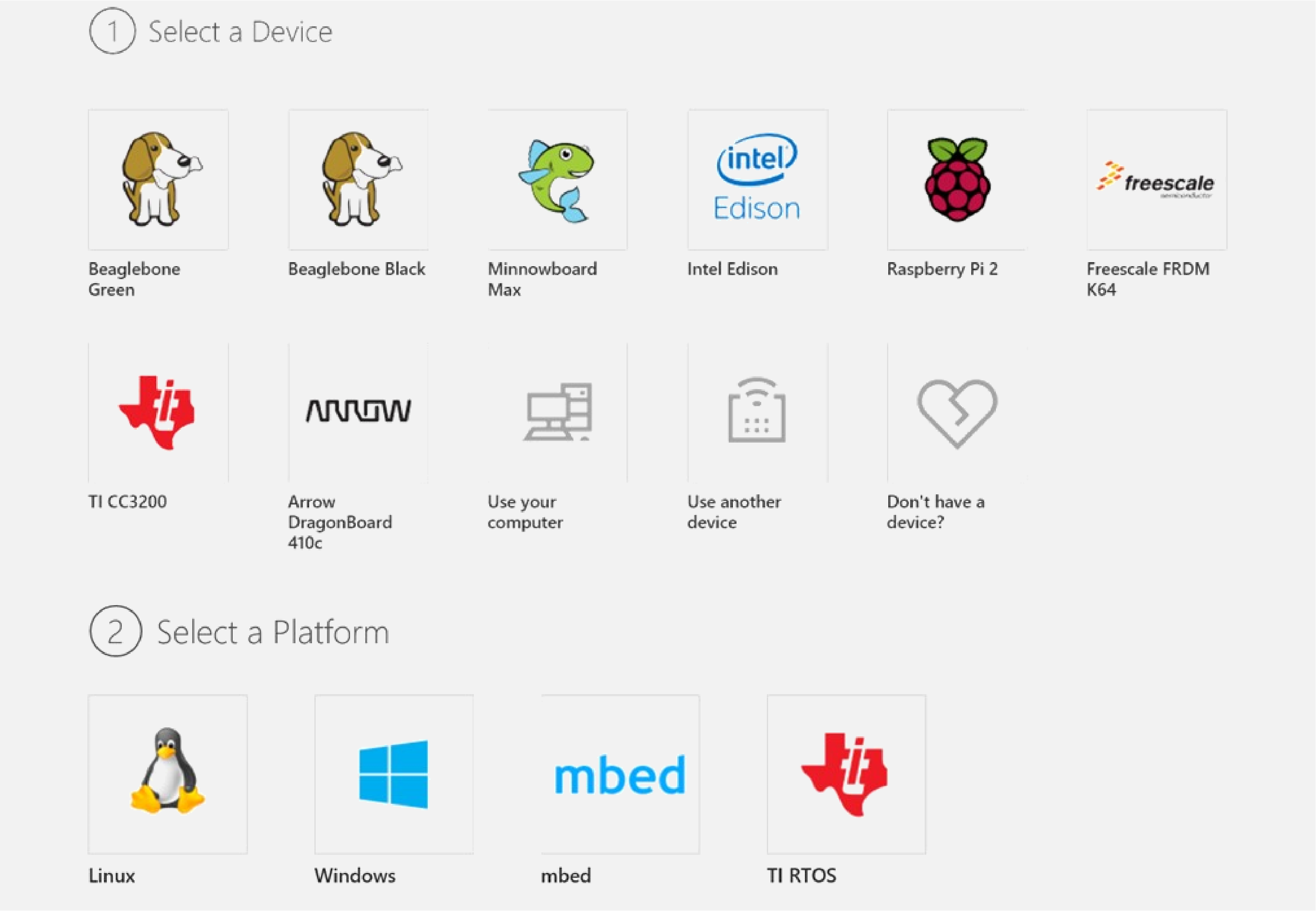
- Debian Linux (v 7.5) HTTPS, AMQP, MQTT
- Fedora Linux (v 20) HTTPS, AMQP, MQTT
- mbed OS (v 2.0) HTTPS, AMQP
- Ubuntu Linux (v 14.04) HTTPS, AMQP, MQTT
- Windows Desktop (7,8,10) HTTPS, AMQP, MQTT
- Yocto Linux (v 2.1) HTTPS, AMQP

Operating systems supported

- Debian Linux (v 7.5)
- Fedora Linux (v 20)
- mbed OS (v 2.0)
- Raspbian Linux (v 3.18)
- Ubantu Linux (v 14.04)
- Windows Desktop (7, 8, 10)
- Windows IoT Core (v 10)
- Windows Server (v 2012 R2)
- Yocto Linux (v 2.1)

Device SDK's

SDK IoT Hub Stream Analytics Machine Learning PowerBI



1 Select a Device

2 Select a Platform

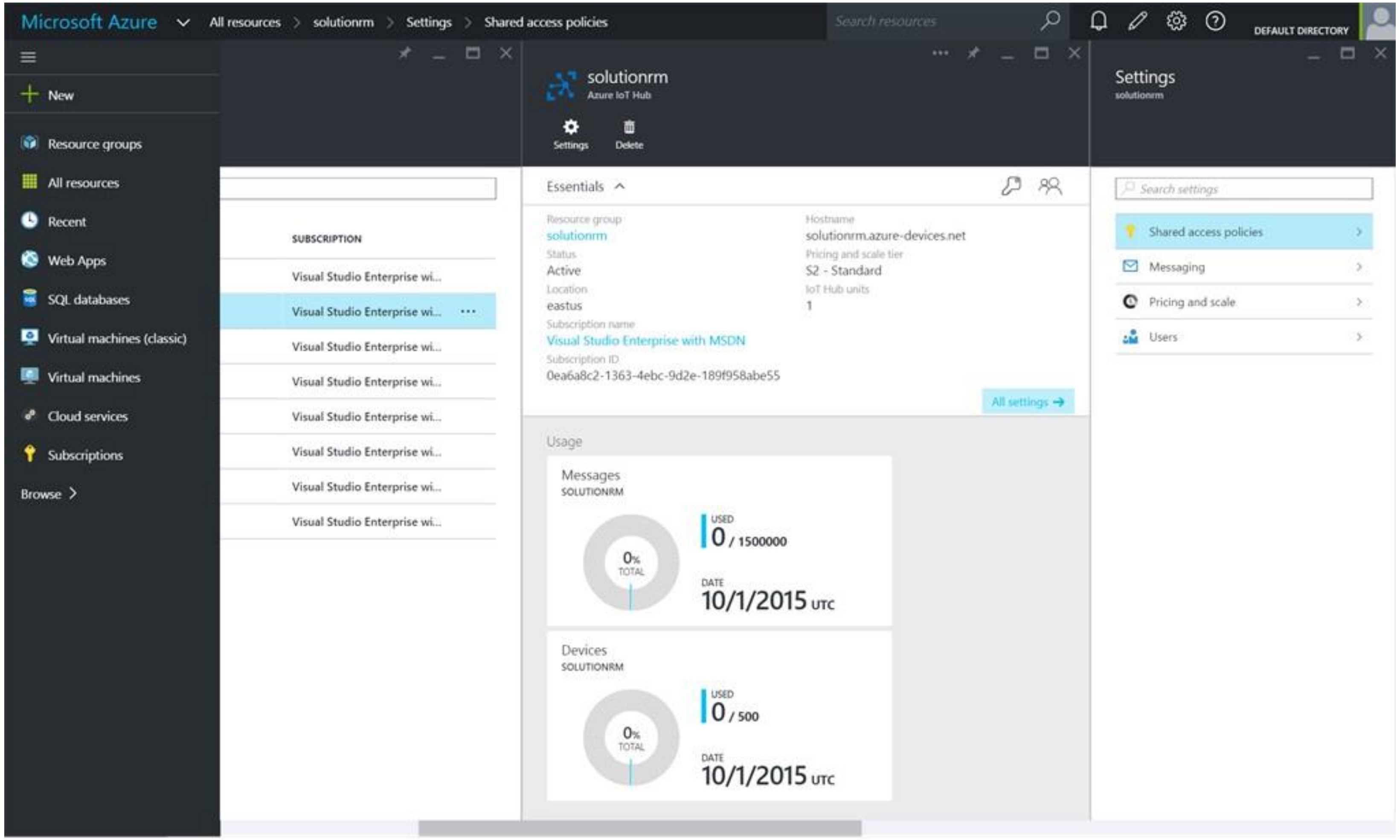
Supported devices:

Select physical devices to connect, including using you computer, or create simulators to add to your solution

Supported OS platform:

Select the preferred platform/OS for your device(s), including: Linux, Windows, mbed, Ti RTOS

Manage IoT Hub in Azure portal


Microsoft Azure
All resources > solutionrm > Settings > Shared access policies
Search resources
DEFAULT DIRECTORY
New
Resource groups
All resources
Recent
Web Apps
SQL databases
Virtual machines (classic)
Virtual machines
Cloud services
Subscriptions
Browse >
SUBSCRIPTION
Visual Studio Enterprise wi...
Visual Studio Enterprise wi...
Visual Studio Enterprise wi...
Visual Studio Enterprise wi...
Visual Studio Enterprise wi...
Visual Studio Enterprise wi...
Visual Studio Enterprise wi...
Visual Studio Enterprise wi...
solutionrm
Azure IoT Hub
Settings
Delete
Essentials
All settings →
Settings
solutionrm
Search settings
Shared access policies >
Messaging >
Pricing and scale >
Users >

Resource group: solutionrm
Hostname: solutionrm.azure-devices.net
Status: Active
Pricing and scale tier: S2 - Standard
Location: eastus
IoT Hub units: 1
Subscription name: Visual Studio Enterprise with MSDN
Subscription ID: 0ea6a8c2-1363-4ebc-9d2e-189f958abe55

Usage

Messages
SOLUTIONRM
0% TOTAL
USED 0 / 1500000
DATE 10/1/2015 UTC

Devices
SOLUTIONRM
0% TOTAL
USED 0 / 500
DATE 10/1/2015 UTC

Simple navigation

Management of devices, volume and scaling made easy through the IoT Hub settings in the Azure Management Portal

Device-to-cloud messages

Interface

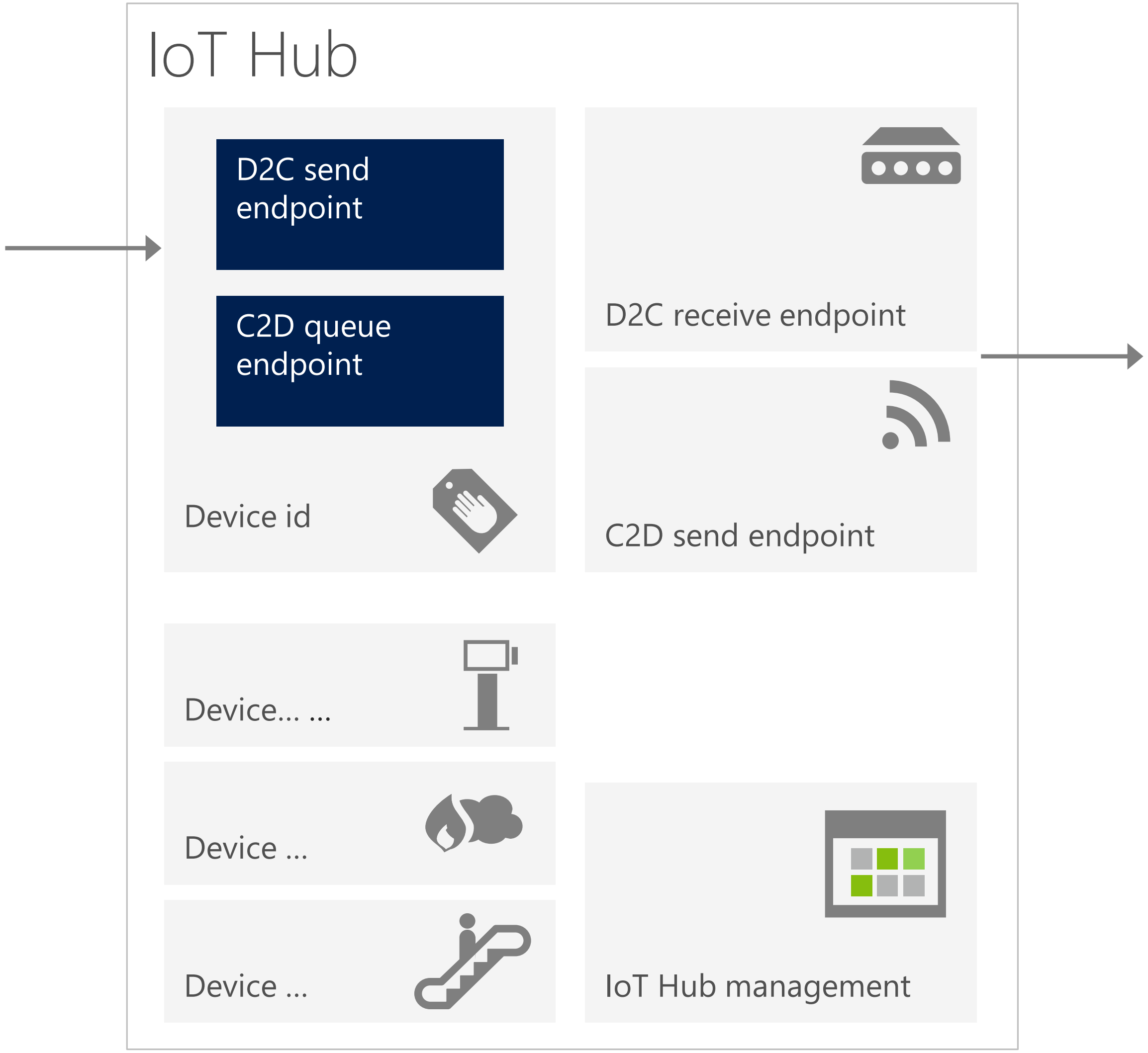
- AMQP and HTTPS device-side endpoint
- AMQP service-side endpoint
- Device and service SDKs

Compatible with Event Hubs

- Partitioned receiver, client check-pointing
- Integrations with Azure Stream Analytics, Storm, …
- 100% compatible with Event Hubs receivers

IoT Hub services for D2C

- Millions of simultaneously connected devices
- Per-device authentication
- Connection-multiplexing:
- C2D and D2C traffic
- Across multiple devices for gateway scenarios



Device identity in IoT Hub

Identity registry

- Contains per-device security materials
- Individual device blocking
- No queries → keep a device registry to query by app-data

Authenticated comms

- Label incoming telemetry
- Ensure identity of devices receiving messages

Custom

- AAD integration
- “Master” key for gateway scenarios

Device provisioning orchestration

- IoT Hub (identity registry)
- Device registry (e.g. DocDB, SQL)
- Other(e.g. ERP)

Accessing IoT Hub from cloud components

Authorization policies

- Each hub allows multiple policies
- Each policy grants a set of permissions
- Primary and Secondary keys

Permissions

- DeviceConnect – for any component connecting as a device (e.g. send D2C, receive C2D, …)
- ServiceConnect – for back-end components (e.g. read D2C, send C2D, receive feedback/monitoring)
- RegistryRead – for provisioning components that have to read the hub’s device identity registry
- RegistryWrite – for provisioning components that have to modify the hub’s identity registry

A sample scenario

Simulated wind turbine

- Emits telemetry every second
- State machine (Starting→Started→Stopping→Stopped

Provision device

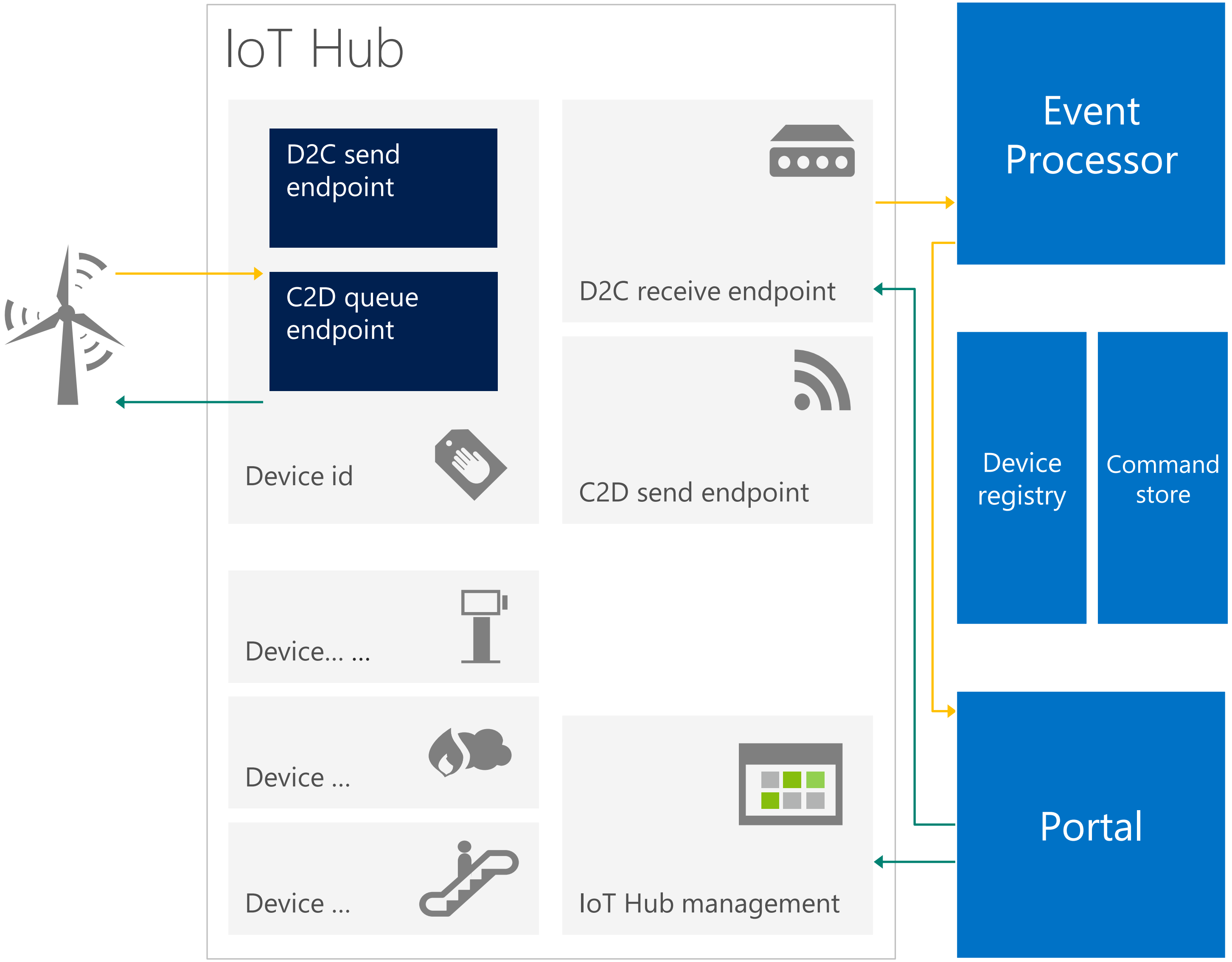
- Device registry to query devices and track provisioning
- Device identity and key stored in IoT hub

Device emits telemetry

Event processor receives telemetry and updates portal visualization

Send commands

- Portal sends commands to devices
- Command lifecycle is stored in device registry



IoT Hub

D2C send endpoint

C2D queue endpoint

Device id

D2C receive endpoint

C2D send endpoint

Device… …

Device …

Device …

IoT Hub management

Event Processor

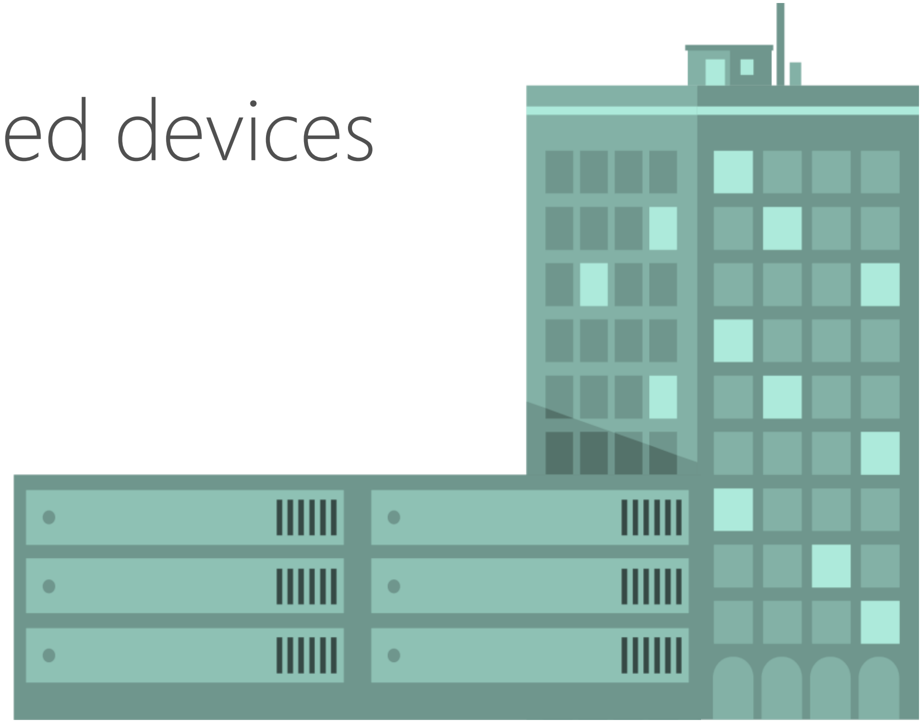
Device registry

Command store

Portal

IoT Hub helps connect your devices to Azure

- ✓ Millions of simultaneously connected devices
- ✓ Per-device authentication
- ✓ High throughput D2C messaging
- ✓ Reliable C2D messaging



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Consuming D2C events

Code against SB msg API

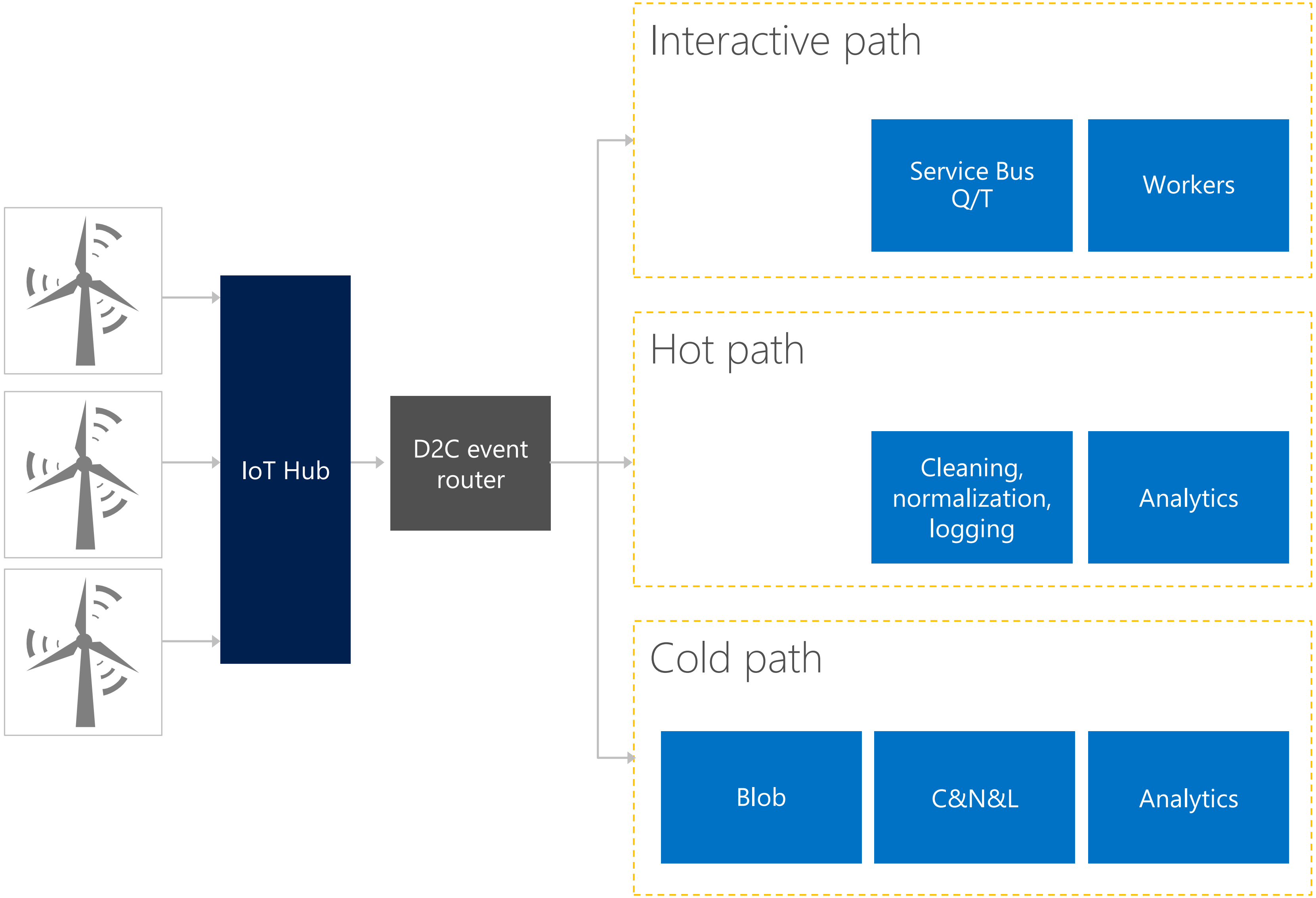
- Easy event processor implementation
- Enable deduplication on Q
- Easy routing to different subcomponents
- Create SB Q/T based on expected throughput

Use any event processor

- Easy to select only “real-time” data.
- Storm / Spark
- Custom code
- Azure Stream Analytics

Run batches from blob

- Reuse existing batch code
- Easy with Azure Data Factory



Demonstration

- Creating an IoT Hub
- Connection String
- Device Explorer

Summary:

Azure IoT Hub is the first cloud portion of an IoT Solution

Azure IoT Hub is Microsoft’s at scale solution to:

- Secure Device management
- Secure Device two way messaging

Microsoft provides access to IoT Hub via:

- Client SDKs (C, .Net, Node, Java and Python)
- Standard Protocols (HTTP, MQTT, AMQP)
- REST API

Additional References

- www.InternetofYourThings.com
- https://blogs.microsoft.com/iot/
- https://azure.microsoft.com/en-us/services/iot-hub/
- https://docs.microsoft.com/en-us/azure/iot-hub/

Microsoft

www.InternetofYourThings.com

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