

A photograph of a smart building IoT setup on a wooden desk. A silver laptop is open, displaying a dashboard with multiple line graphs and data points. To the left of the laptop, a breadboard with an Arduino Uno and various sensors is connected to the laptop via a USB cable. A smartphone is also on the desk, showing a similar dashboard. A grey pen lies on the laptop's trackpad area. A semi-transparent red rectangle is overlaid on the center of the image, containing white text.

Smart Buildings met behulp van Azure IoT

WAZUG 31 mei



**Remco
Ploeg**

Cloud Solution Architect



**Sander
Bosman**

Cloud Solution Architect



Kosten
besparen

**Campus
van de
toekomst**

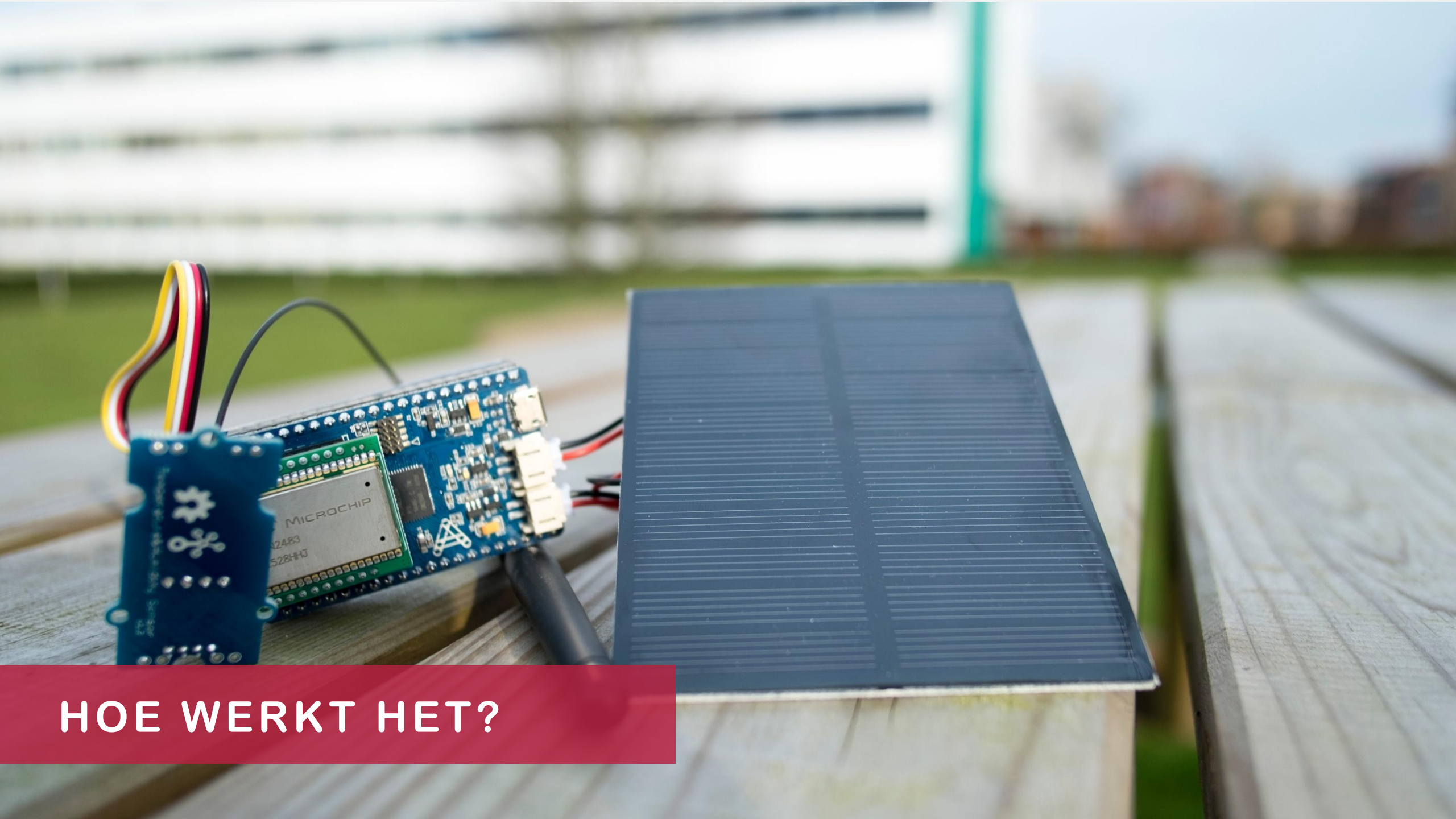
Persoonlijk

Voorkomen
uitval

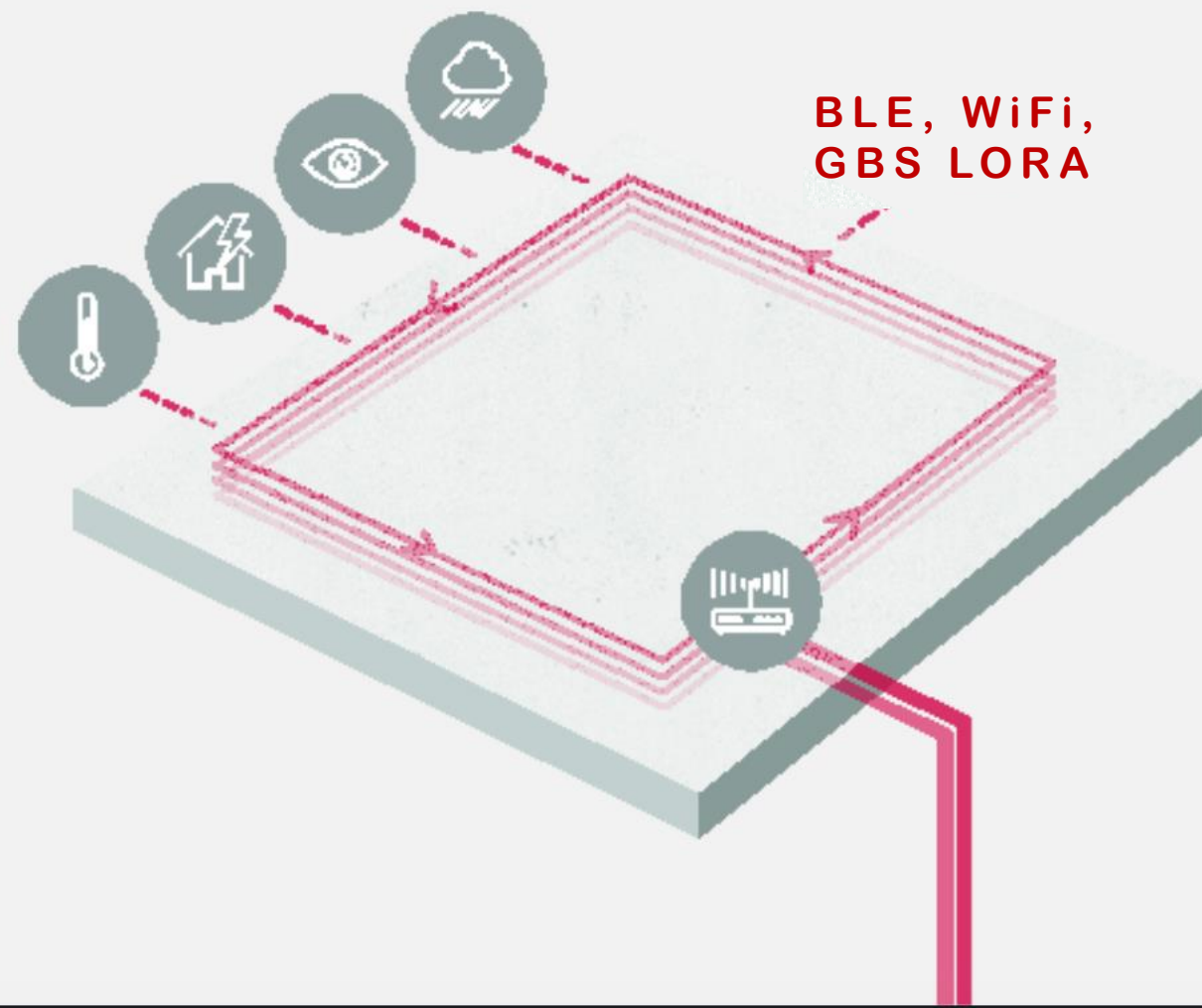
Apps

Duur-
zaamheid

SLIMME GEBOUWEN

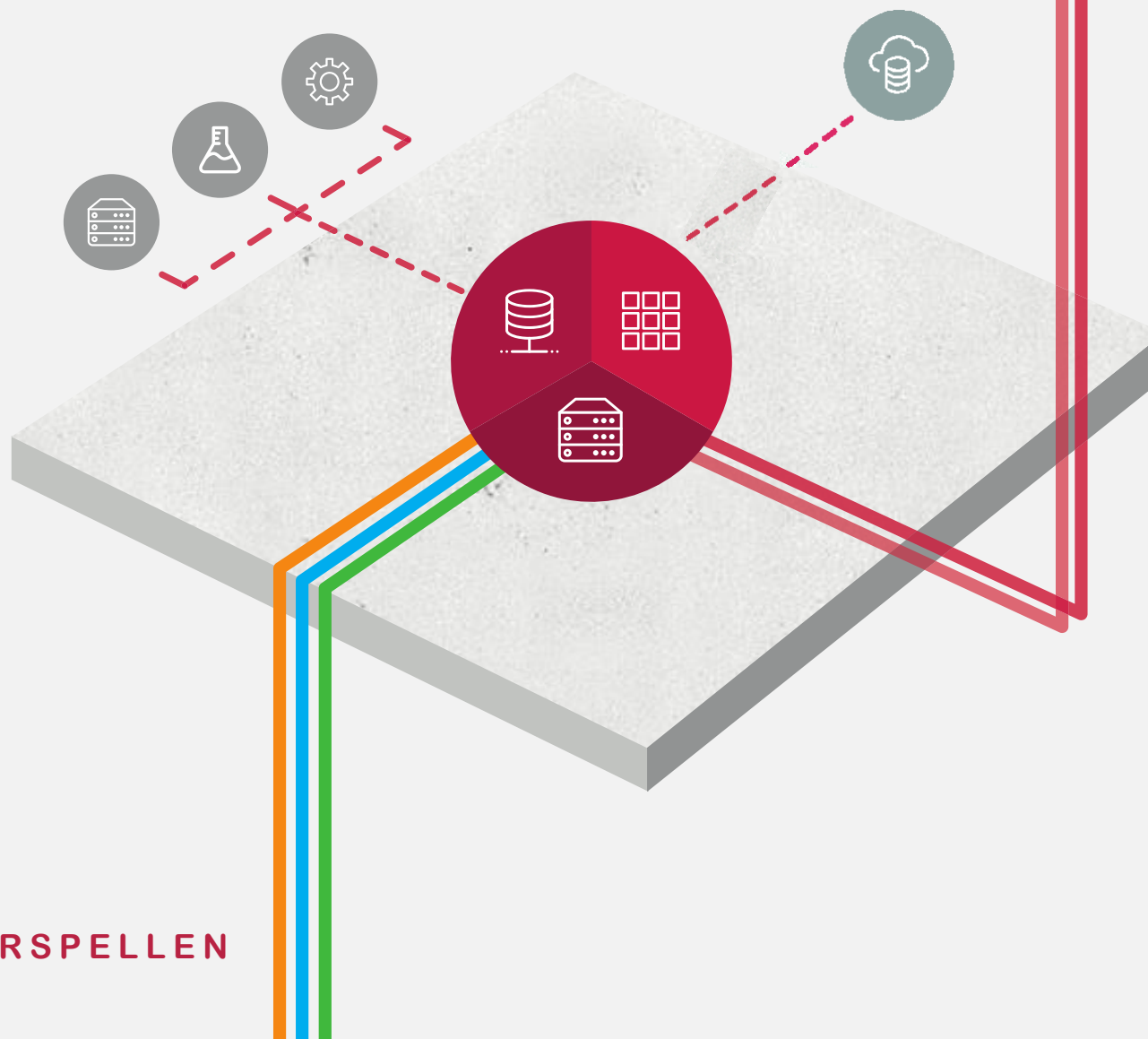
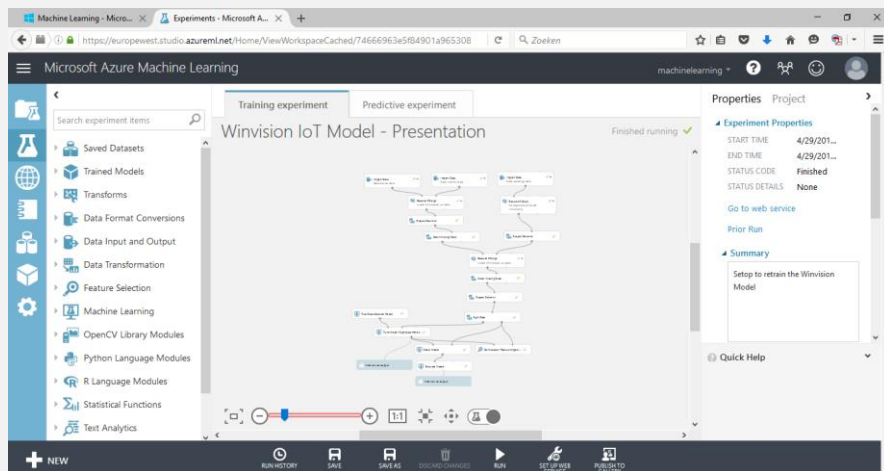


HOE WERKT HET?



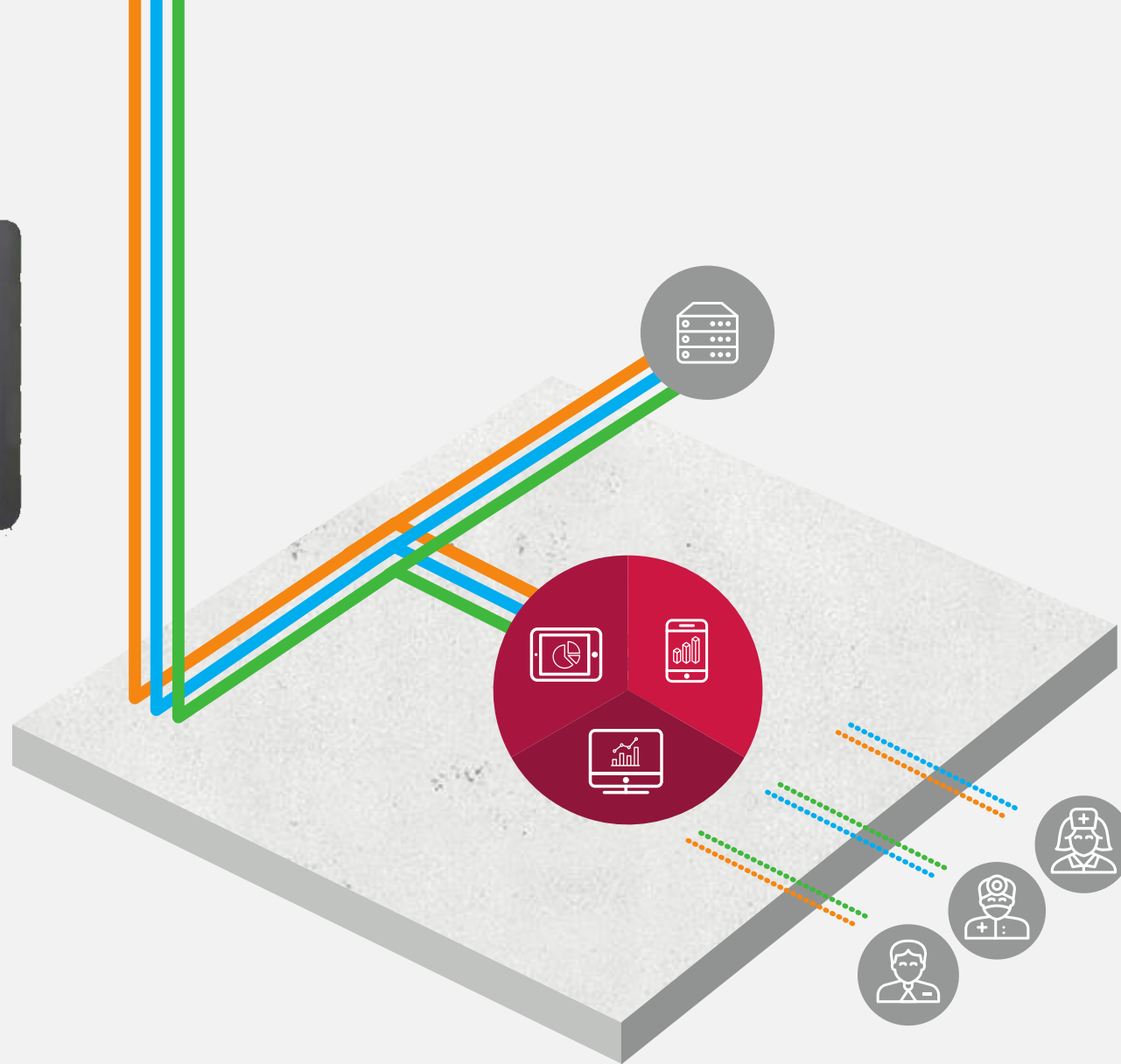
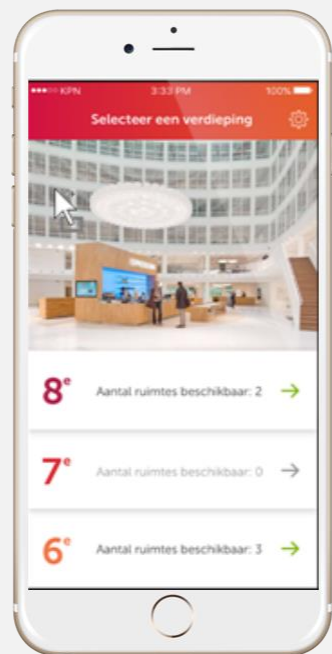
HOE WERKT HET?

VERZAMELEN VAN DATA



HOE WERKT HET?

VERWERKEN, INTEGREREN EN VOORSPELLEN



HOE WERKT HET?

INTERACTIE MET DE DATA

Microsoft has a comprehensive set of offerings for IoT

IoT Solutions (SaaS)

Azure IoT Central
IoT SaaS

Microsoft Connected Field Service
Field Service SaaS

IoT Solution Accelerators (PaaS)

Azure IoT solution accelerators

Remote Monitoring

Predictive Maintenance

Connected factory

Platform Services & Device Support

Azure Sphere

Azure IoT Edge

Azure IoT Hub

Azure Stream
Analytics

Azure HD Insight
Spark, Storm,
Kafka

Microsoft Flow

Microsoft Power
BI

Windows 10 IoT
Core and IoT
Enterprise

AzureML

Azure IoT Hub
Device Provisioning
Service

Azure Time Series
Insights

Azure Event Hubs

Azure Logic Apps

Azure Maps

Azure IoT Device
SDK

Azure Stream
Analytics

Azure Sphere
Security Service

Azure Machine
Learning

Azure Data Lake
Analytics

Azure Event Grid

Azure Monitor

Azure Certified for
IoT

Azure Cognitive
Services

Windows IoT
Update Control

Cosmos DB

Azure Data Lake

Azure Websites

Azure Function

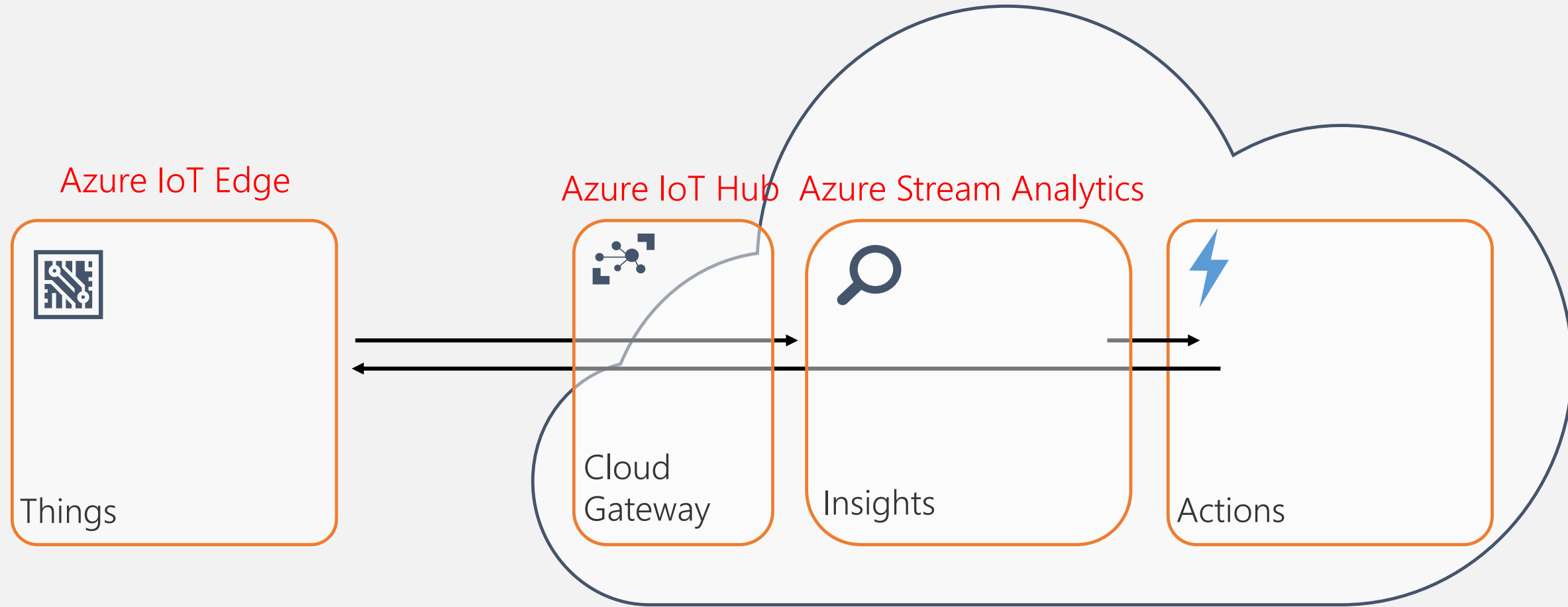
Device Support

Edge Support

IoT Services

Data & Analytics Services

Visualization & Integration Services



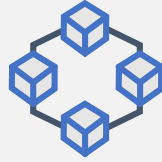
IoT Pattern

Welke Azure IoT diensten gaan wij vandaag behandelen?



Bi-directional

- Millions of Devices
- Multi-language, open source SDKs
- HTTPS/AMQPS/MQTTs
- Send Telemetry
- Receive Commands
- Device Management
- Device Twins
- Queries & Jobs



Enterprise scale & integration

- Billions of messages
- Scale up and down
- Declarative Message Routes
- File Upload
- WebSockets & Multiplexing
- Azure Monitor
- Azure Resource Health
- Configuration Management



End-to-End Security

- Per Device Certificates
- Per Device Enable/Disable
- TLS Security
- X.509 Support
- IP Whitelisting/Blacklisting
- Shared Access Policies
- Firmware/Software Updates

Azure IoT Hub

Introductie

Capability	Basic tier	Standard tier
Device-to-cloud telemetry	Yes	Yes
Per-device identity	Yes	Yes
Message routing and Event Grid integration	Yes	Yes
HTTP, AMQP, and MQTT protocols	Yes	Yes
Device Provisioning Service	Yes	Yes
Monitoring and diagnostics	Yes	Yes
Cloud-to-device messaging		Yes
Device twins, Module twins and Device management		Yes
Azure IoT Edge		Yes

Azure IoT Hub

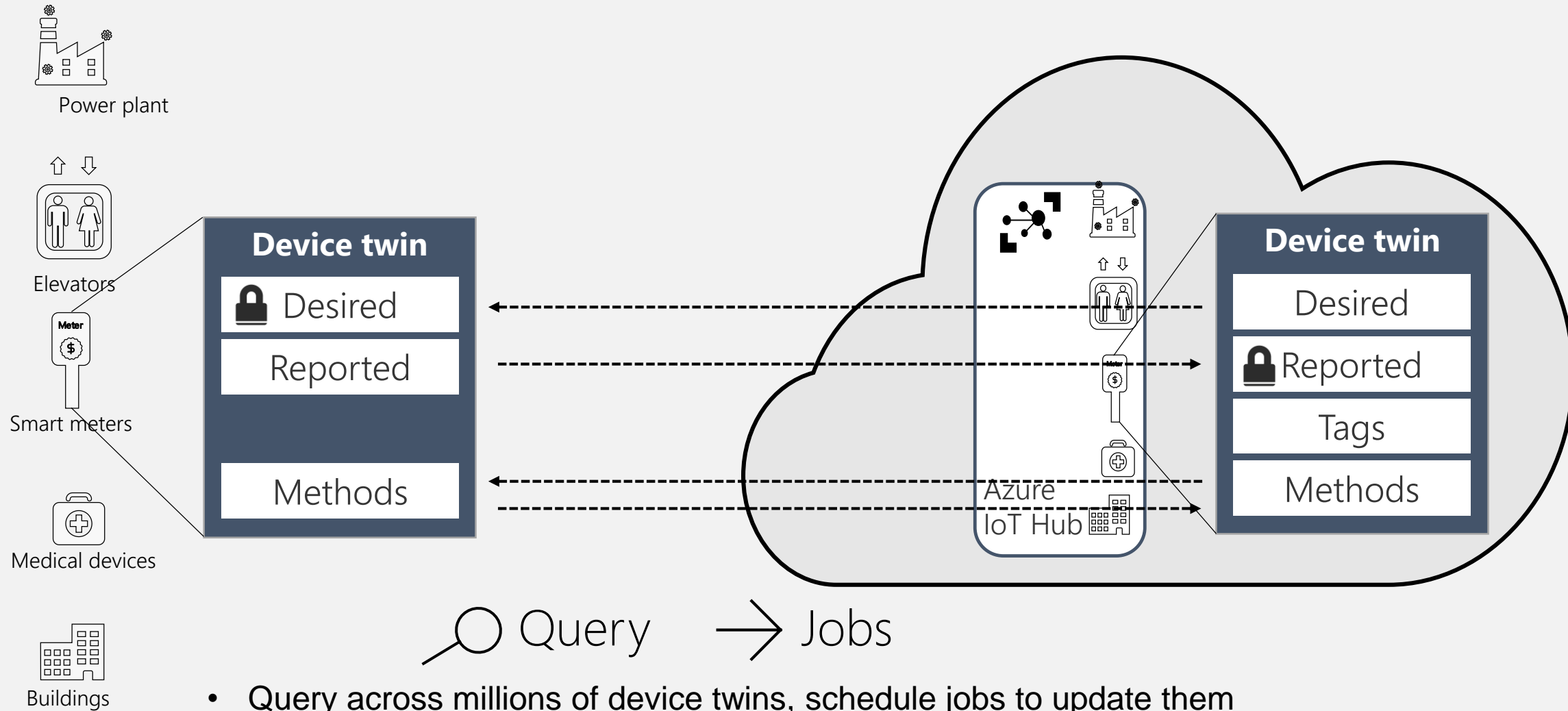
Versions

Home
>
IoT Hub
>
smartbuildings - Pricing and scale
>
Choose your pricing and scale tier

Choose your pricing and scale tier

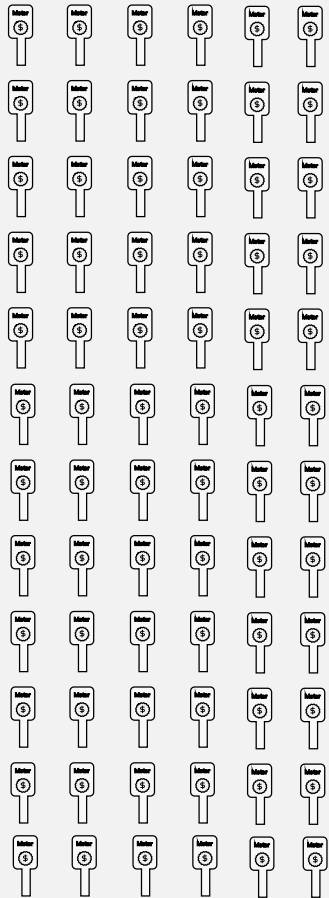
S1 Standard	S2 Standard	S3 Standard
<div>400k messages/unit/day</div> <div> Device-to-cloud telemetry </div> <div> Message routing </div> <div> Cloud-to-device commands </div> <div> IoT Edge </div> <div> Device management </div> <div> <div>21.08</div> <div>EUR PER IOT HUB UNIT</div> </div>	<div>6M messages/unit/day</div> <div> Device-to-cloud telemetry </div> <div> Message routing </div> <div> Cloud-to-device commands </div> <div> IoT Edge </div> <div> Device management </div> <div> <div>210.83</div> <div>EUR PER IOT HUB UNIT</div> </div>	<div>300M messages/unit/day</div> <div> Device-to-cloud telemetry </div> <div> Message routing </div> <div> Cloud-to-device commands </div> <div> IoT Edge </div> <div> Device management </div> <div> <div>2,108.25</div> <div>EUR PER IOT HUB UNIT</div> </div>
B1 Basic	B2 Basic	B3 Basic
<div>400k messages/unit/day</div> <div> Device-to-cloud telemetry </div> <div> Message routing </div> <div> Upgradable to standard </div> <div> <div>8.43</div> <div>EUR PER IOT HUB UNIT</div> </div>	<div>6M messages/unit/day</div> <div> Device-to-cloud telemetry </div> <div> Message routing </div> <div> Upgradable to standard </div> <div> <div>42.17</div> <div>EUR PER IOT HUB UNIT</div> </div>	<div>300M messages/unit/day</div> <div> Device-to-cloud telemetry </div> <div> Message routing </div> <div> Upgradable to standard </div> <div> <div>421.65</div> <div>EUR PER IOT HUB UNIT</div> </div>
F1 Free		
<div>8k messages/unit/day</div> <div> Device-to-cloud telemetry </div> <div> Message routing </div> <div> Cloud-to-device commands </div> <div> IoT Edge </div> <div> <div>Downgrading to a lower tier is not allowed.</div> </div>		

Azure IoT Hub – Device Management

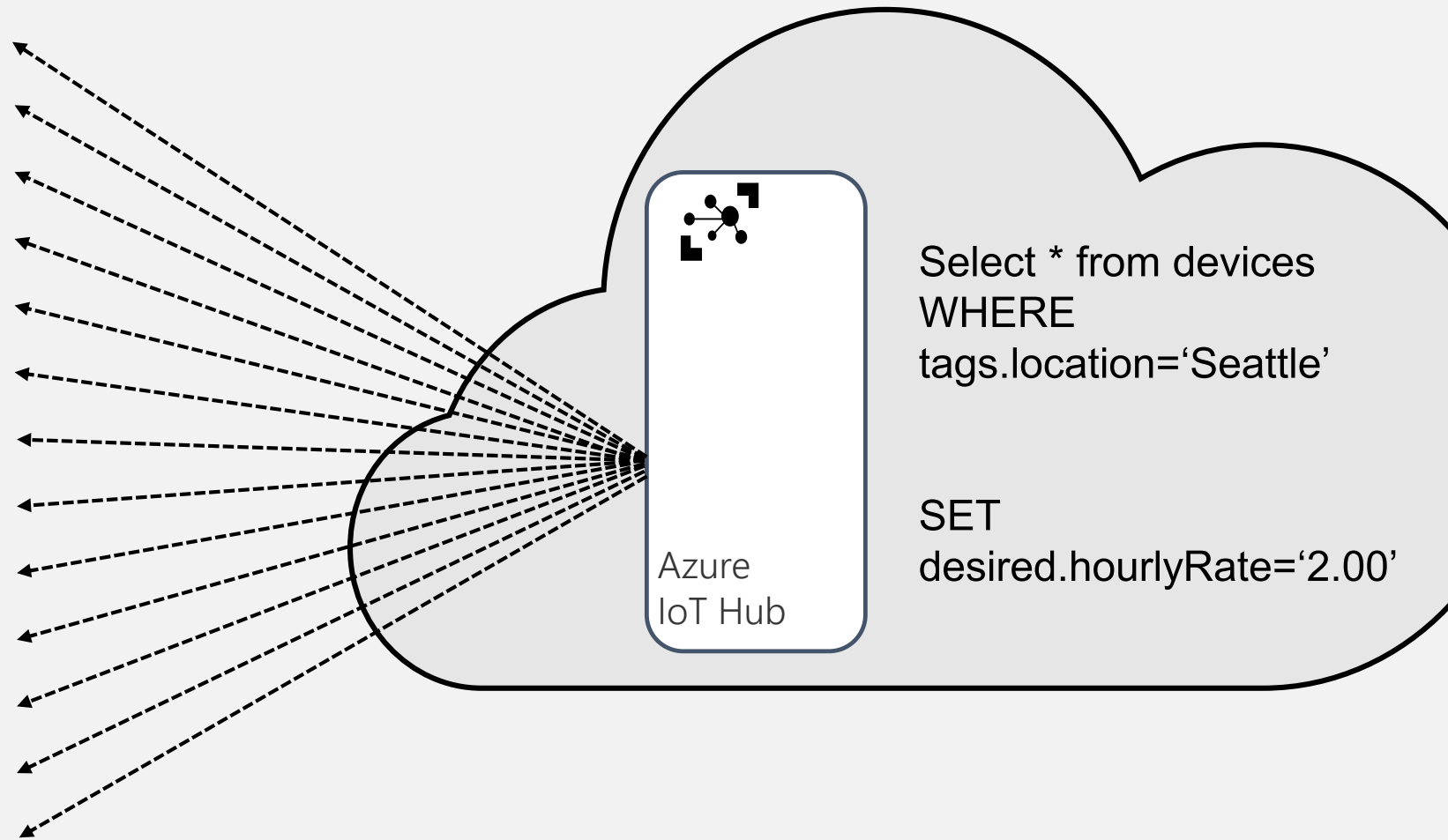
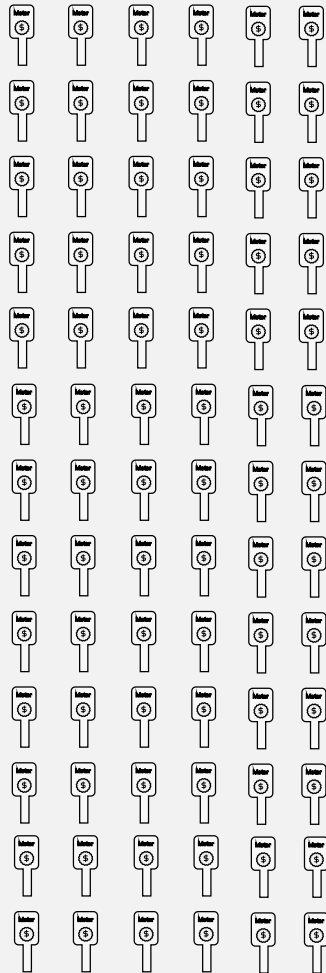


Preview: Azure IoT Hub Automatic Device Management

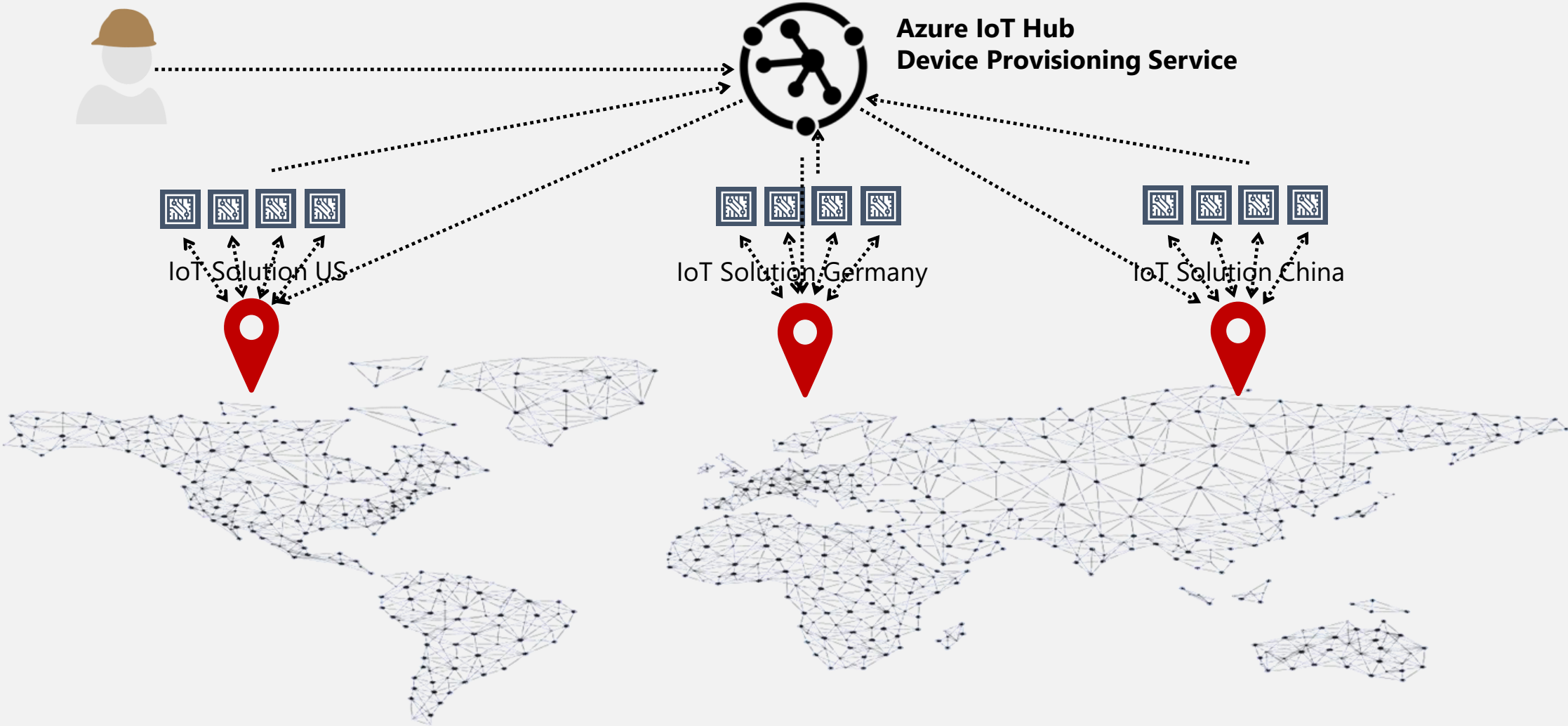
Redmond

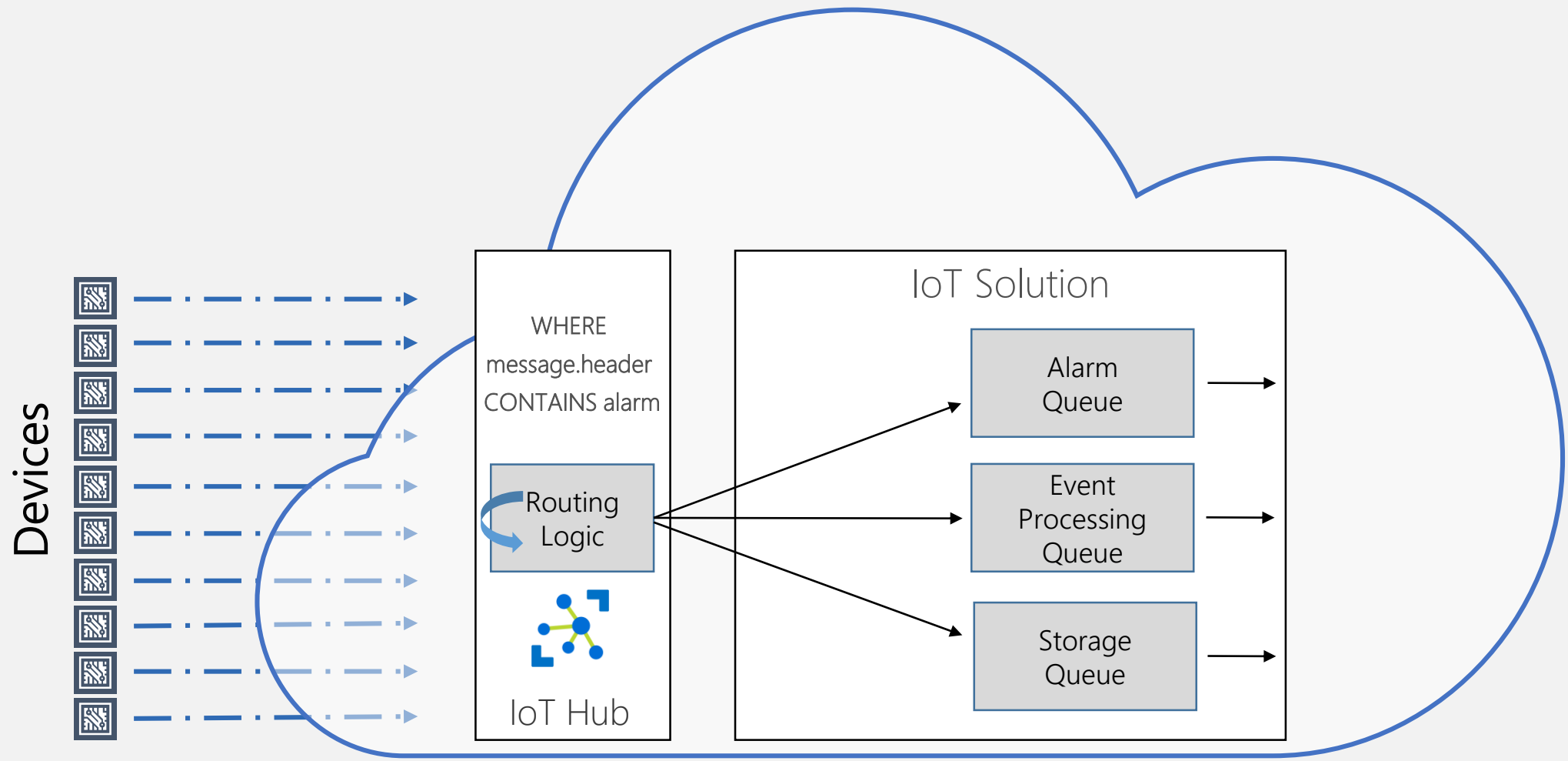


Seattle



Generally Available





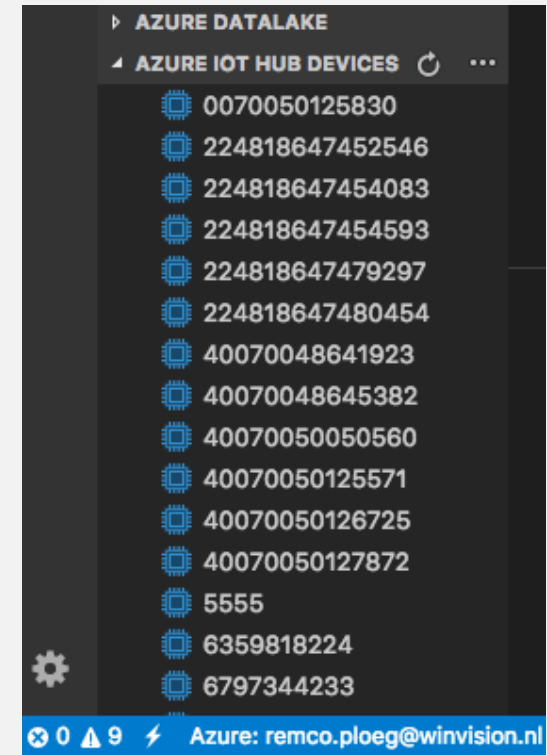
Azure IoT Hub Message Routes

```
$ iothub-explorer help
```

```
Usage: iothub-explorer [options] <command> [command-options] [command-args]
```

Commands:

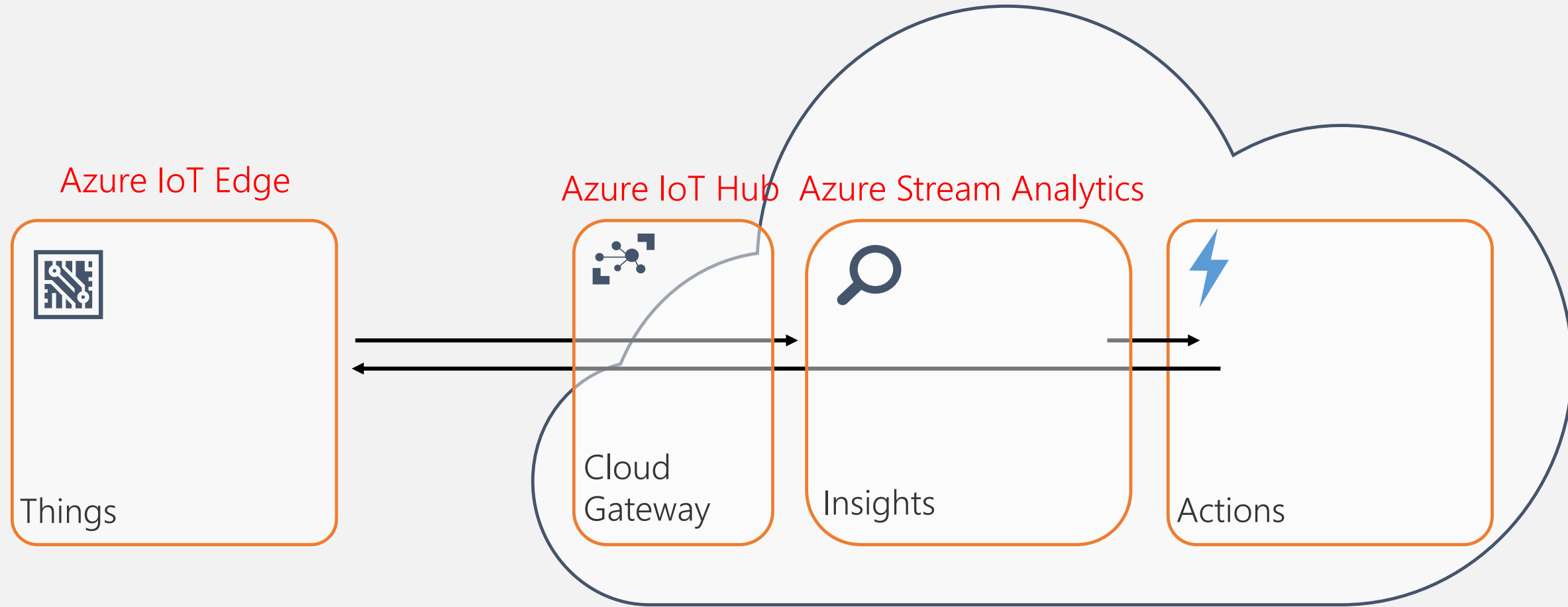
login	start a session on your IoT hub
logout	terminate the current session on your IoT hub
list	list the device identities currently in your IoT hub device registry
create <device-id device-json>	create a device identity in your IoT hub device registry
delete <device-id>	delete a device identity from your IoT hub device registry
get <device-id>	get a device identity from your IoT hub device registry
import-devices	import device identities in bulk: local file -> Azure blob storage -
export-devices	export device identities in bulk: IoT hub -> Azure blob storage -> 1
send <device-id> <message>	send a message to the device (cloud-to-device/C2D)
monitor-feedback	monitor feedback sent by devices to acknowledge cloud-to-device (C2D)
monitor-events [device-id]	listen to events coming from devices (or one in particular)
monitor-uploads	monitor the file upload notifications endpoint
monitor-ops	listen to the operations monitoring endpoint of your IoT hub instance
sas-token <device-id>	generate a SAS Token for the given device
simulate-device <device-id>	simulate a device with the specified id
help [cmd]	display help for [cmd]



Azure IoT Hub management

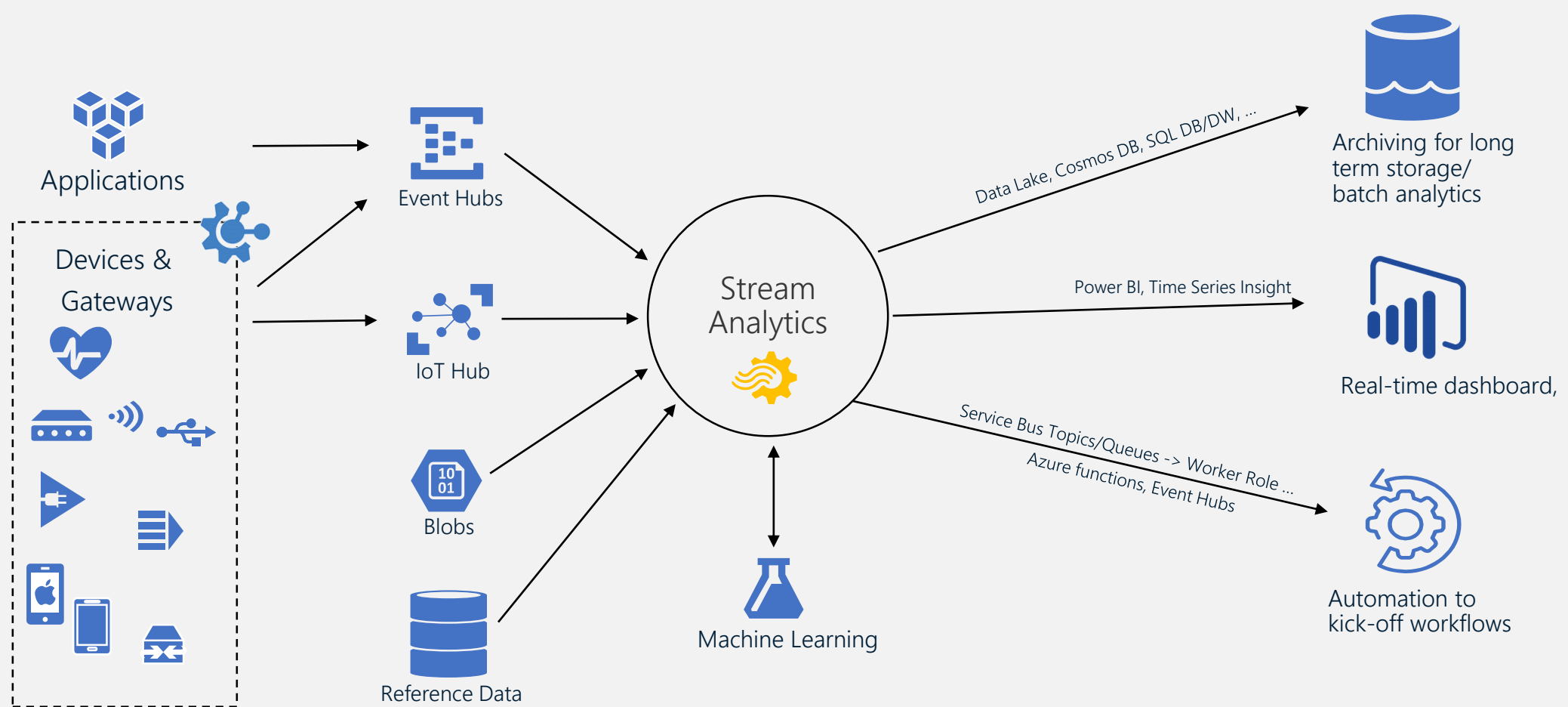
Demo

Azure IoT Hub



IoT Pattern

Waar gaan wij het vandaag over hebben?



Azure Stream Analytics

Schaalbare oplossing voor het analyseren van verwerken van data

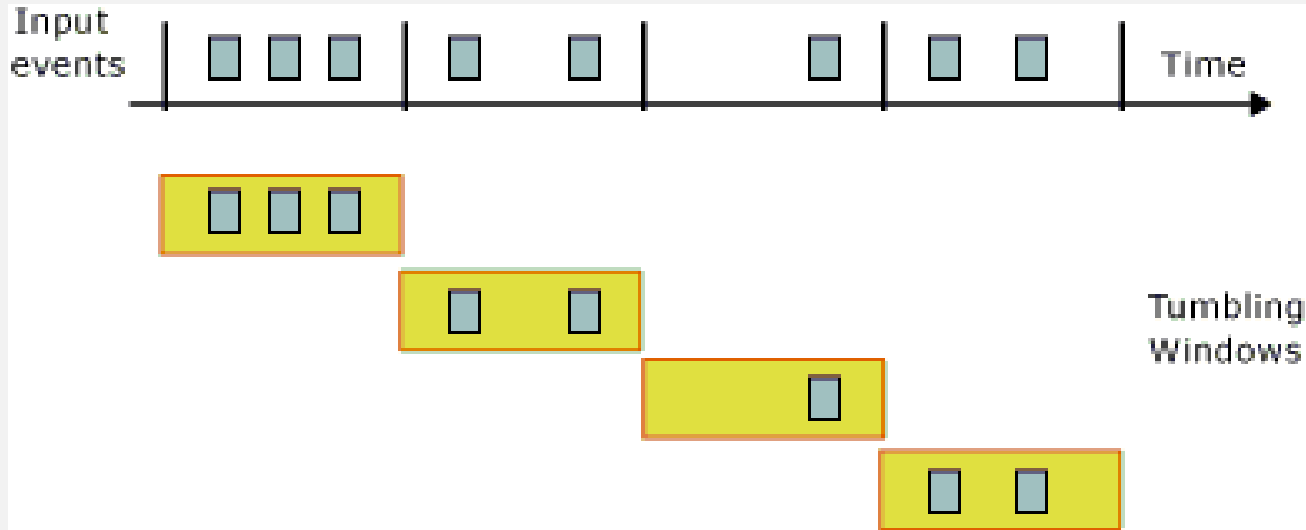
- SELECT EntryTime, TollId, LicensePlate
- FROM EntryData
- WHERE State = 'CT'

ENTRYTIME	TOLLID	LICENSEPLATE
2014-09-10T12:02:00+00:00	3	ABC 1004
2014-09-10T12:03:00+00:00	2	XYZ 1003
2014-09-10T12:11:00+00:00	1	NJB 1006

Querying op een data stream

Alle auto's die langs een tolpoortje komen met hun tijd, tolhuis ID en kentekenplaat.

Hoeveel auto's komen elke 5 minuten langs per tolpoortje



```
SELECT TollId, COUNT(*) FROM EntryStream  
GROUP BY TollId, TumblingWindow(minute,5)
```

Querying op een data stream

Windowing functions

Every 5 seconds give me the

count of tweets for all topics which have more than 10 tweets in the last 5 seconds

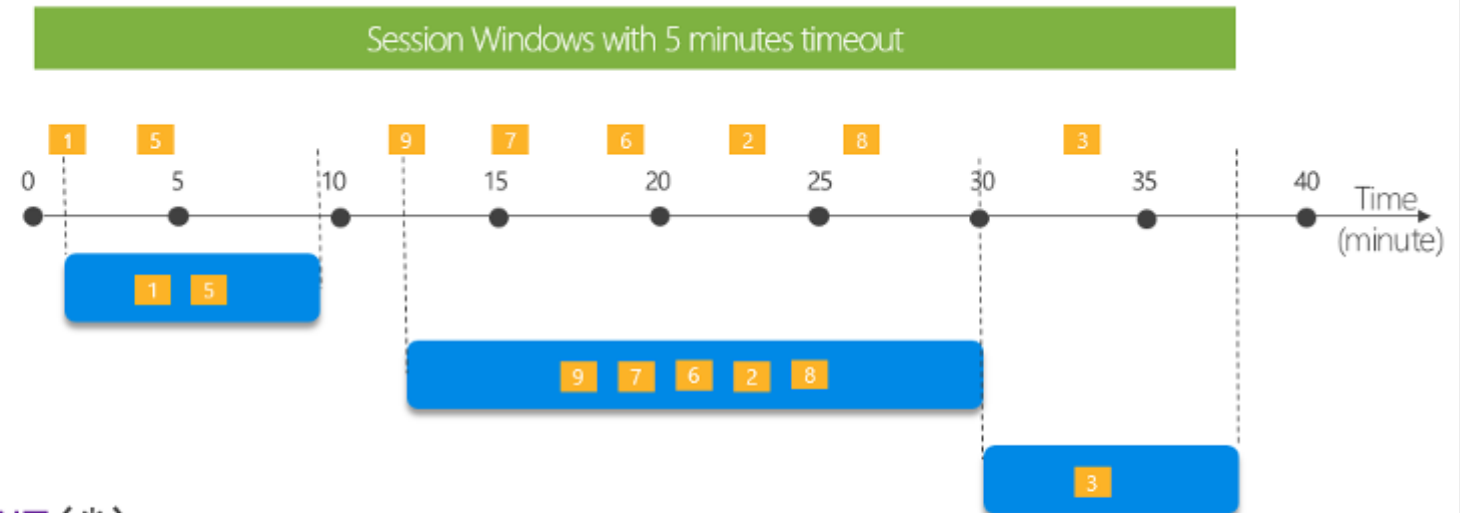
Give me the count of tweets for all topics which have more than 10 tweets in the last 5 seconds

Tell me the count of tweets that occur within 5 minutes to each other.

```
SELECT Topic, COUNT(*)  
FROM TwitterStream  
GROUP BY Topic, SessionWindow(minute, 5, 10)
```

A 10-second Hopping Window with a 5-second "Hop"

A 10-second Sliding Window



Querying op een data stream

Windowing functions

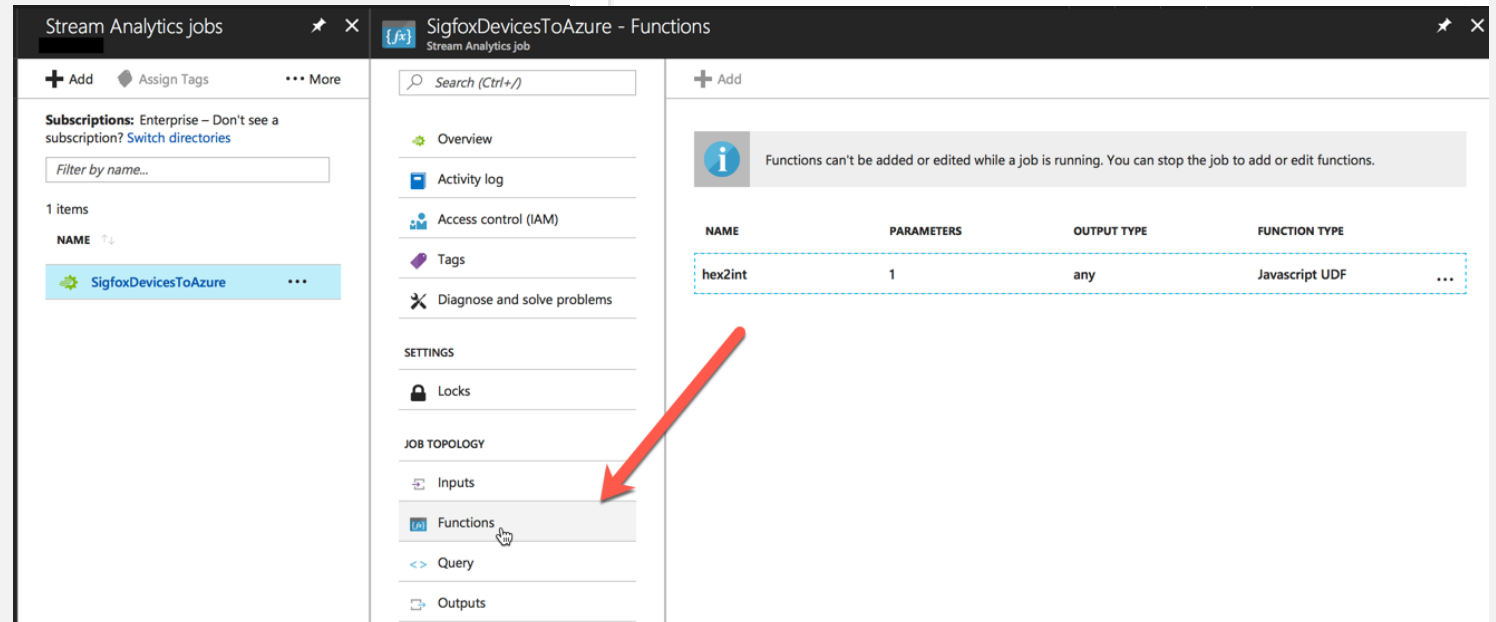
Demo

Azure Streaming Analytics

- Parsen van string met regular expressions
- Sorteren, join, find en fill van arrays
- Math functions
- Decoderen van data berichten
 - Bijv. Sigfox/LORA Hex berichten naar INT

udf.hex2int

```
1 // Convert Hex value to integer.  
2 function main(hexValue) {  
3     return parseInt(hexValue, 16);  
4 }
```



Stream Analytics jobs

+ Add Assign Tags ... More

Subscriptions: Enterprise – Don't see a subscription? [Switch directories](#)

Filter by name...

1 items

NAME
SigfoxDevicesToAzure

SigfoxDevicesToAzure - Functions

Search (Ctrl+/)

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

SETTINGS

Locks

JOB TOPOLOGY

Inputs

Functions

Query

Outputs

Functions can't be added or edited while a job is running. You can stop the job to add or edit functions.

NAME	PARAMETERS	OUTPUT TYPE	FUNCTION TYPE
hex2int	1	any	Javascript UDF

JavaScript User defined

Azure Stream Analytics

Simple usage to detect anomalies over one hour of time series data

```
select id, val, ANOMALYDETECTION(val) OVER(LIMIT DURATION(hour, 1)) FROM input
```

Anomaly detection (Preview)

Azure Stream Analytics

Scenario's:

Eenvoudig om bijv. alerts te versturen

Mails

Andere triggers af te voeren in externe bronnen die supported in ASA

Azure Functions en ASA

Azure Stream Analytics

Output details

alert

Test

Delete

* Import option

Provide azure function settings manually

* Function app

JSADDemo

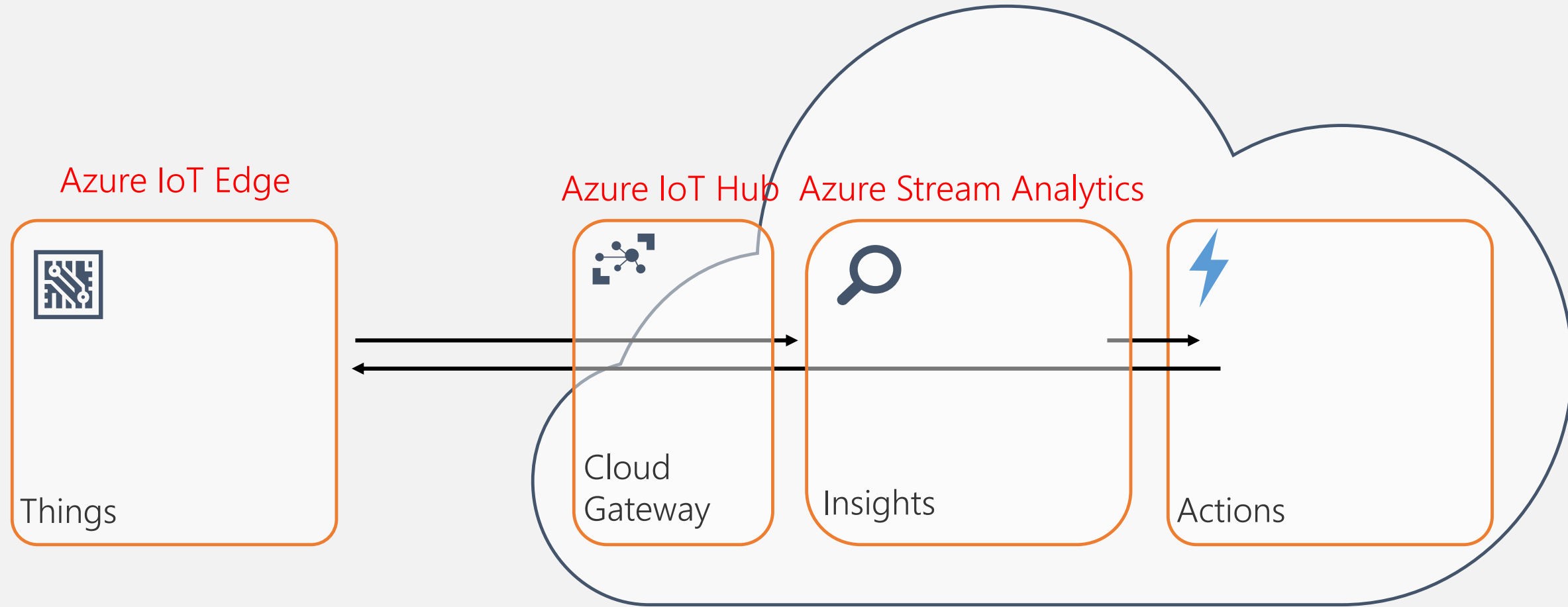
* Function

HttpTriggerCSharp1

Key

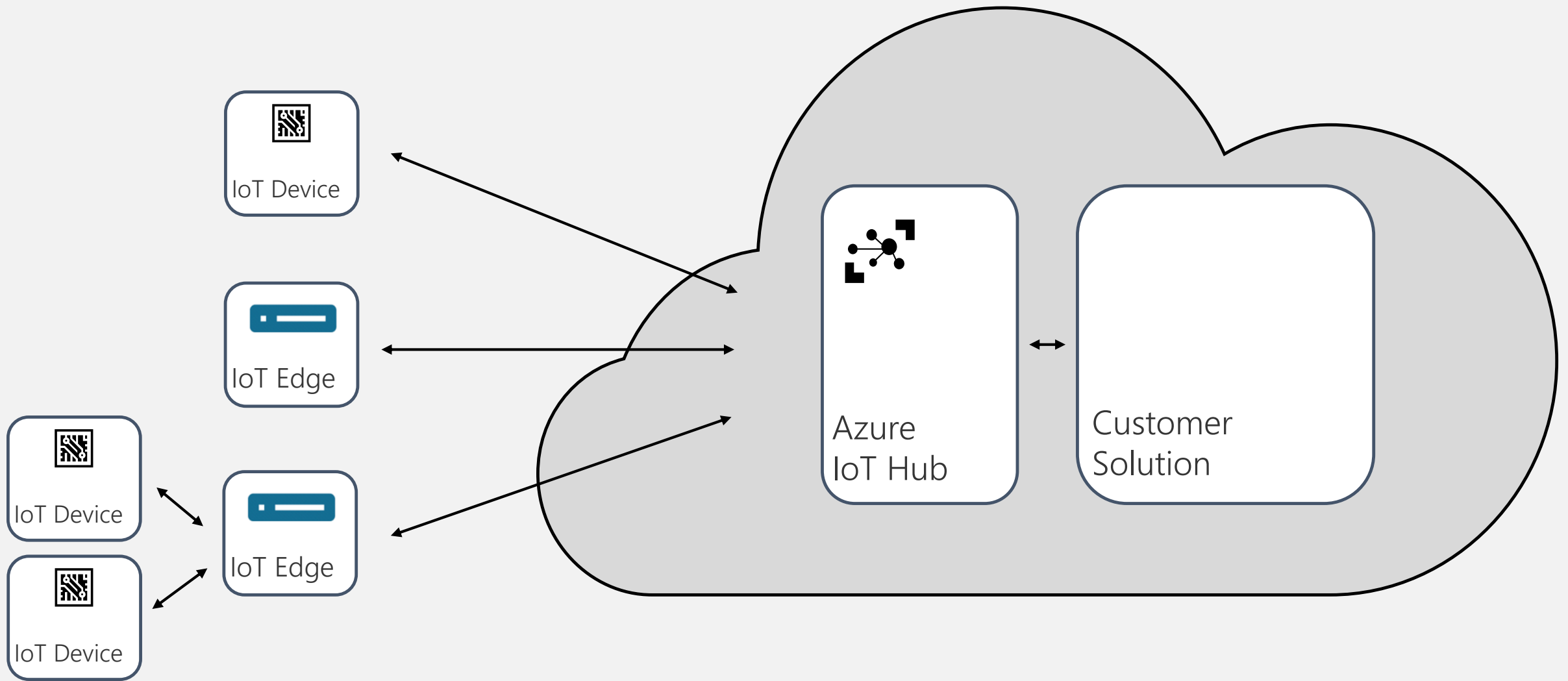
Max batch size ⓘ

Max batch count ⓘ



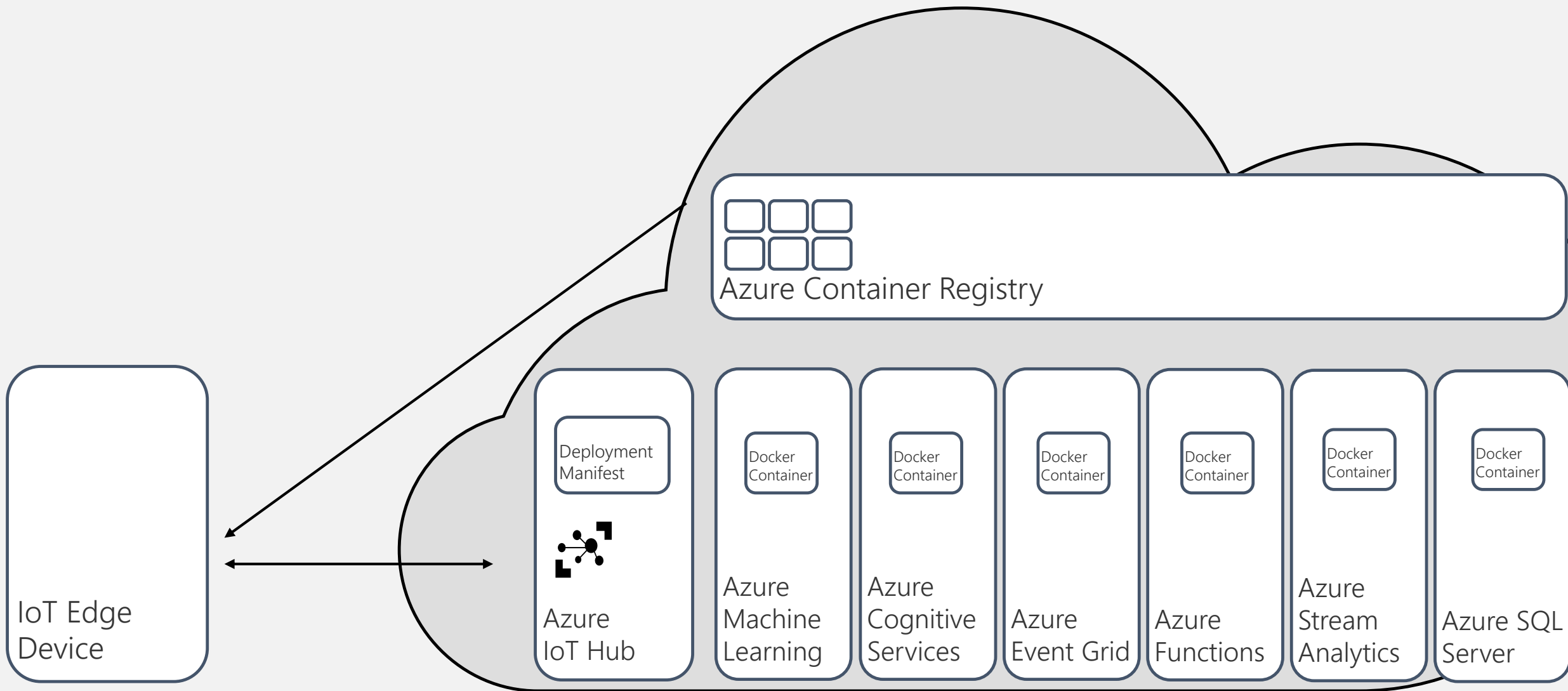
IoT Pattern

Waar gaan wij het vandaag over hebben?



High Level Topology

Azure IoT Edge



Deployment

Azure IoT Edge



Hardware

Hardware voor Azure IoT Edge

Demo

Azure IoT Edge



The image shows a workspace on a wooden table. A silver laptop is open, displaying a dashboard with multiple line graphs. To the left of the laptop, an Arduino Uno is connected to a breadboard with various electronic components, including resistors and LEDs. A white USB cable connects the Arduino to the laptop. A smartphone is also on the table, displaying a similar dashboard. A grey pen lies on the laptop's keyboard. A large red rectangle with the word 'BEDANKT' is centered over the laptop screen.

BEDANKT