

# Exploring land of IoT on Azure

Ron Dagdag



Internet of  
Things

Mixed Reality

Machine  
Learning

ME

# Build me a house

From these pieces



# Build me a house

From these pieces

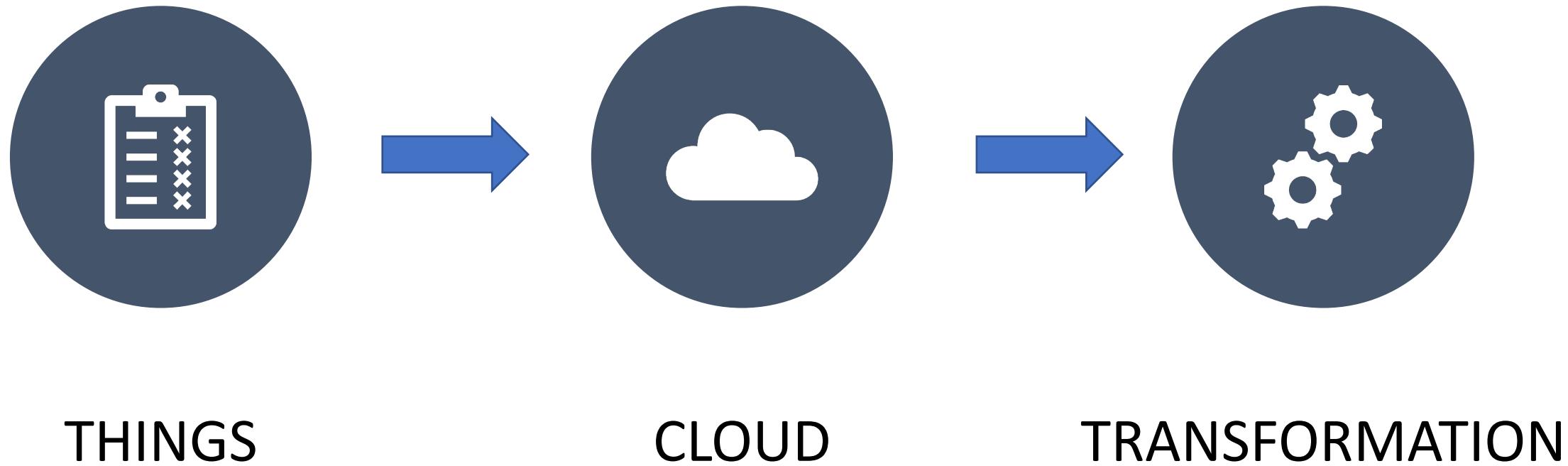
## Would this be simpler?



# Agenda

- Internet of Things
- IoT Central
- Benefits of IoT Central
- Device Template
- IoT Plug and Play
- Visualize data
- Integration

# What is IoT?

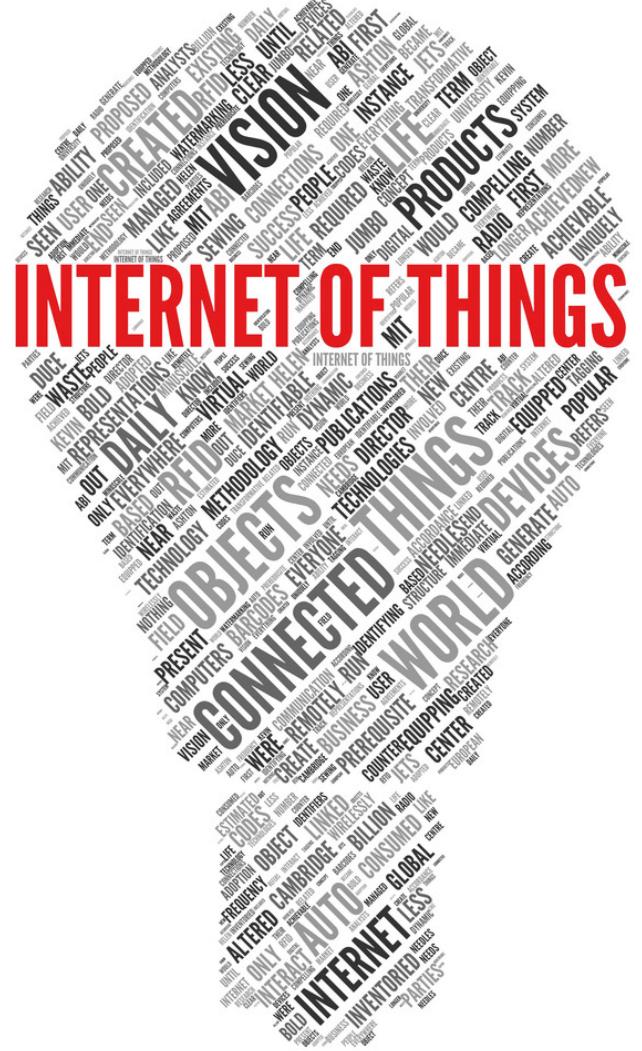


# What is IOT?

## Internet of Things

- connecting Internet to physical world via sensors
- World's first IoT device early 1980s Carnegie Melon Univ
  - vending machine report contents through a network
- Kevin Ashton in 1999
- any device that interacts with physical world around it





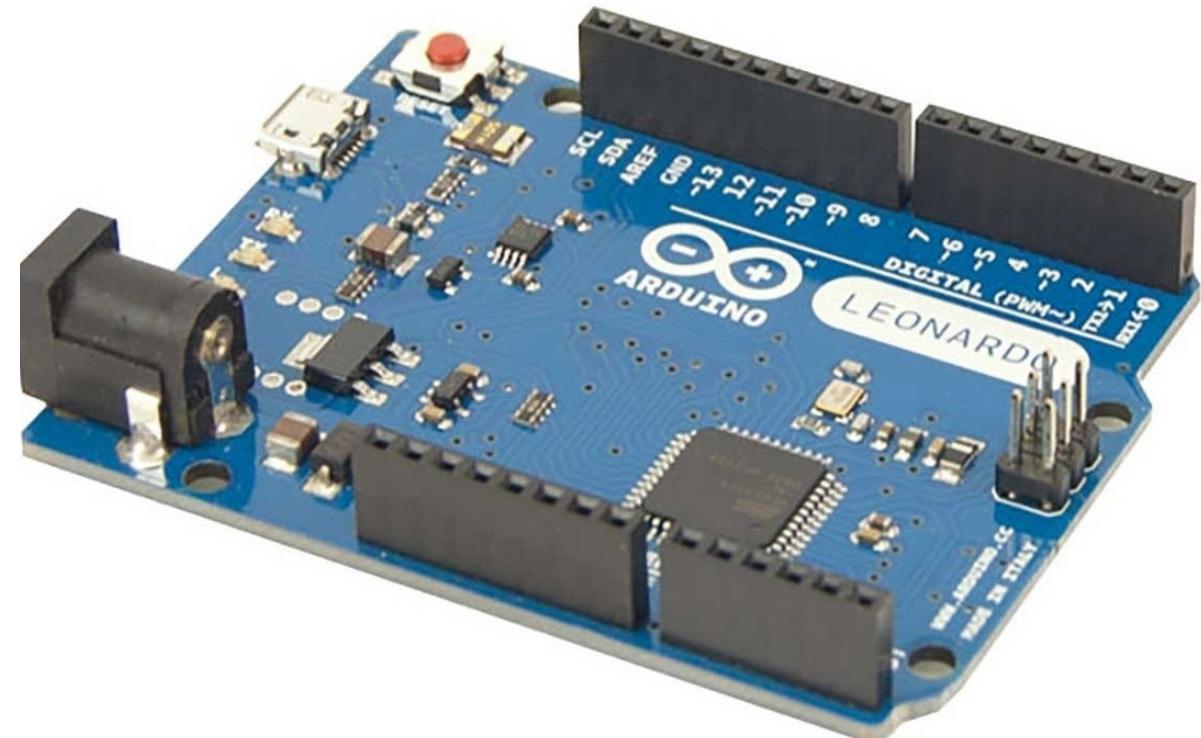
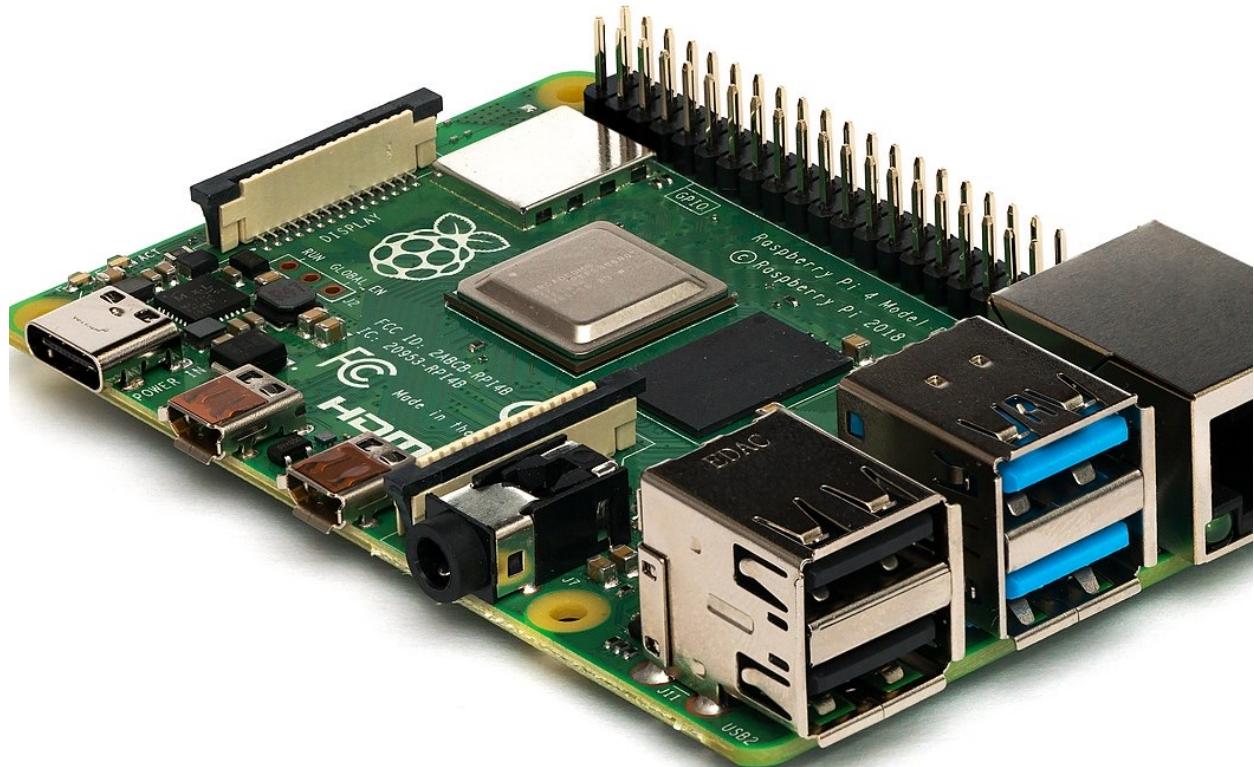
# Remotely Monitor

- Gather Data
  - Device Processing
  - Device Status

# Control Device

- Send Commands
  - Set Device Properties

# Internet Of Things





@rondagdag

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# Attributes of successful IoT Solutions

## Scale

(storage,compute,  
networking, multi-tenancy)

## Device Management

(provisioning, updating)

## Big data management

(hot,warm, cold path)

## Analytics, insights, and Extensibility

(rule, automate actions and integration)

## High availability and disaster recovery

(mission-critical, resilient)

## Security and compliance

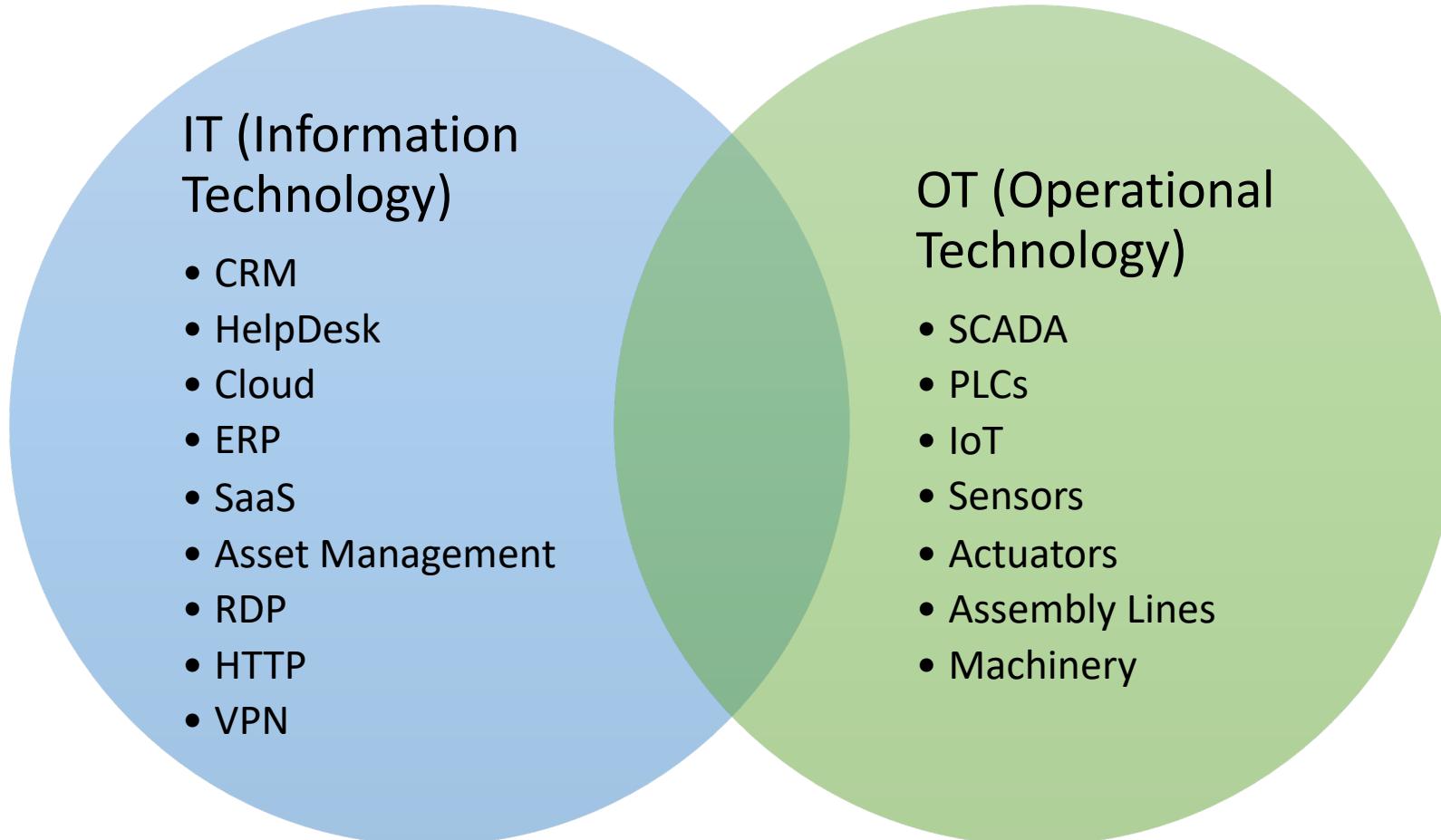
(connectivity, integration, data protection)

## Managing IoT solutions w/ DevOps

(build, Manage, provision, deploy code)

## Understanding total cost of ownership (TCO)

# Information Technology (IT) vs. Operational Technology (OT)



# User Roles in IoT

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**Administrator** - handles administrative tasks, assigning user roles and permissions.

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**Device Developer** - writes code for IoT devices.

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**Operator** - manages devices connected to IoT cloud application.

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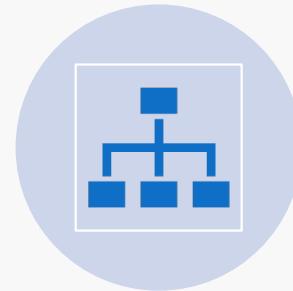
**Solution Builder** - builds the IoT cloud solution that devices connect to

# What is IoT Central?

connect, monitor and manage your IoT assets at scale



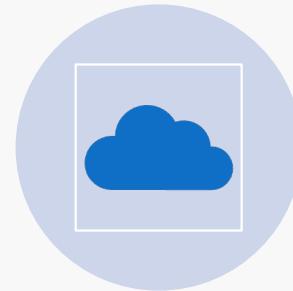
Quick connectivity



Centralized  
management

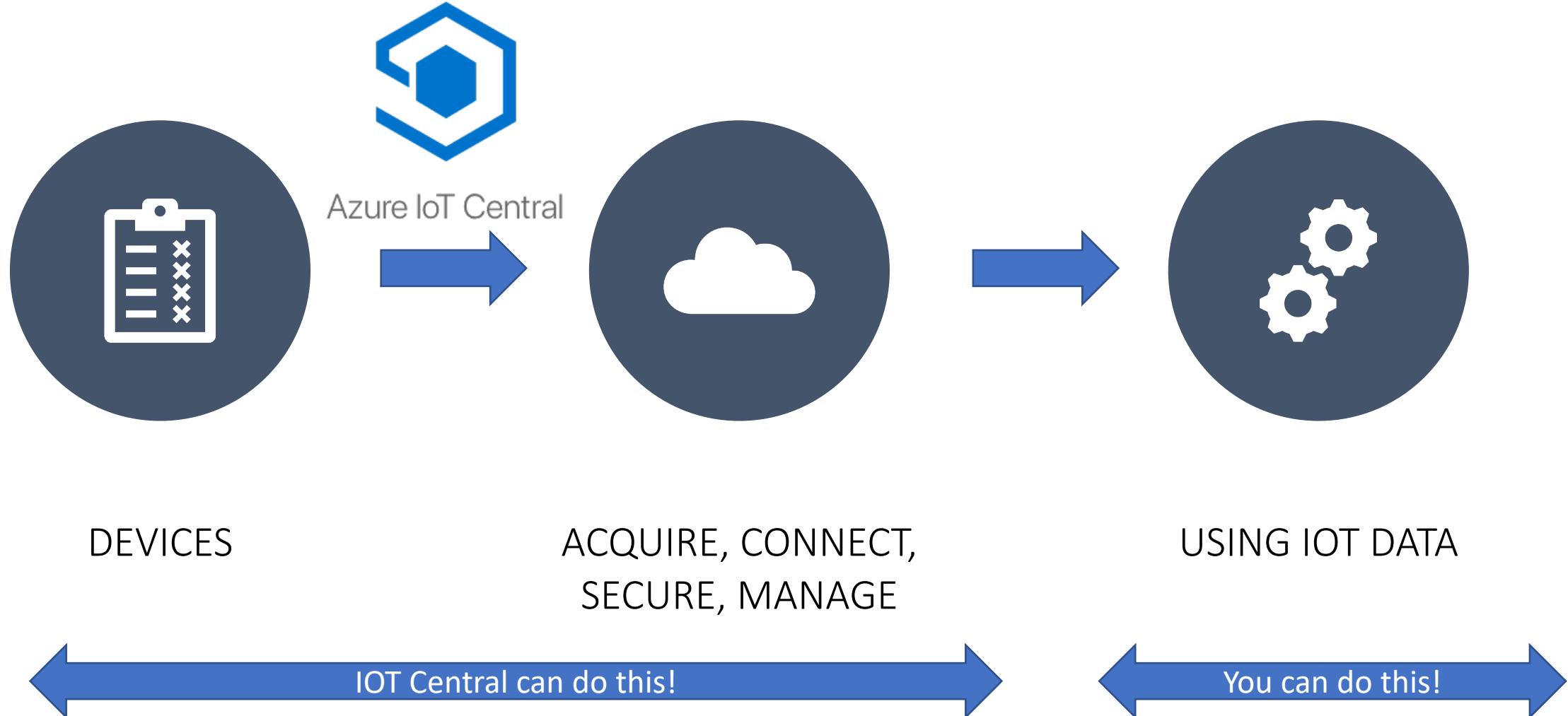


Visualizations and  
analysis



Bridge between business  
applications and IoT  
data

# What is IoT Central?



# Benefits of IoT Central

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Low-code environment

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Fast and Easy way for Data Analysis and Visualization

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Dealing with non-frequently changing data

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Ready-to-use templates

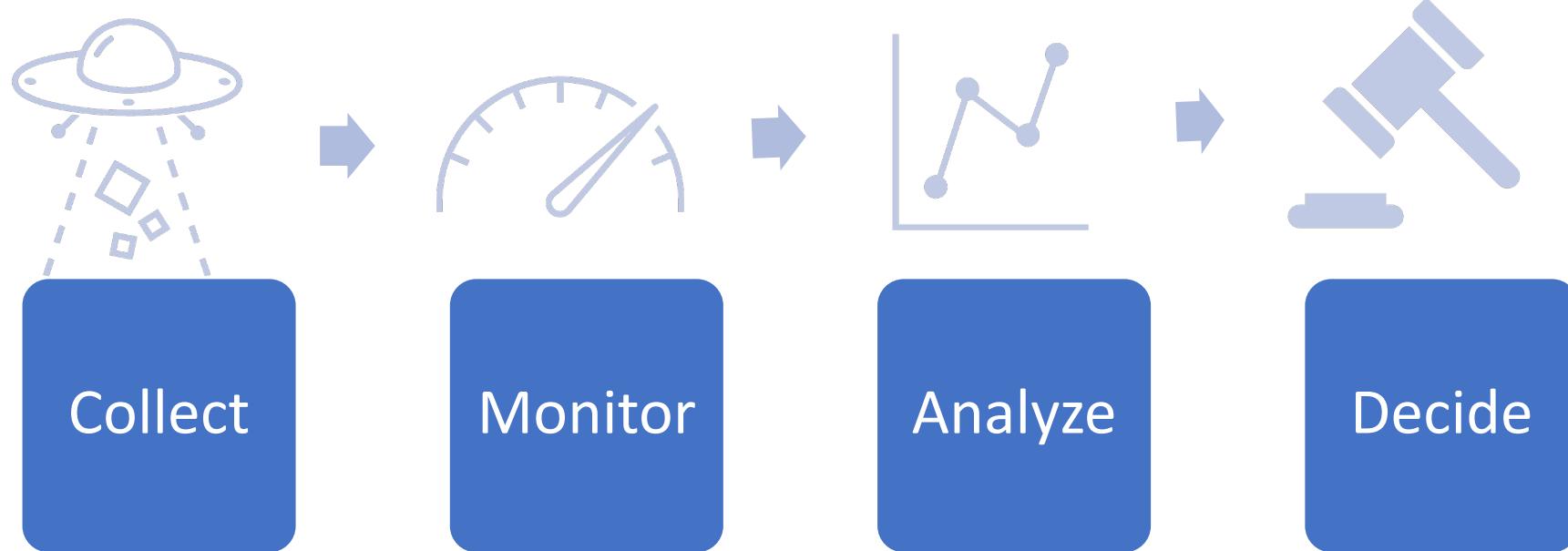
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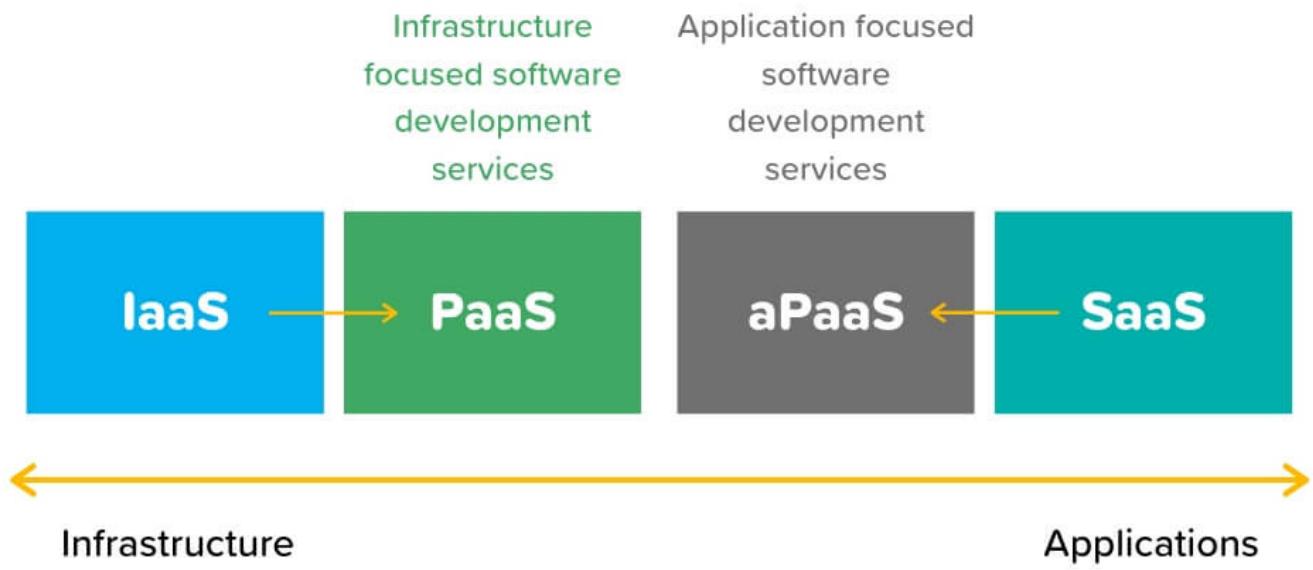
Support for different types of device measurement

---

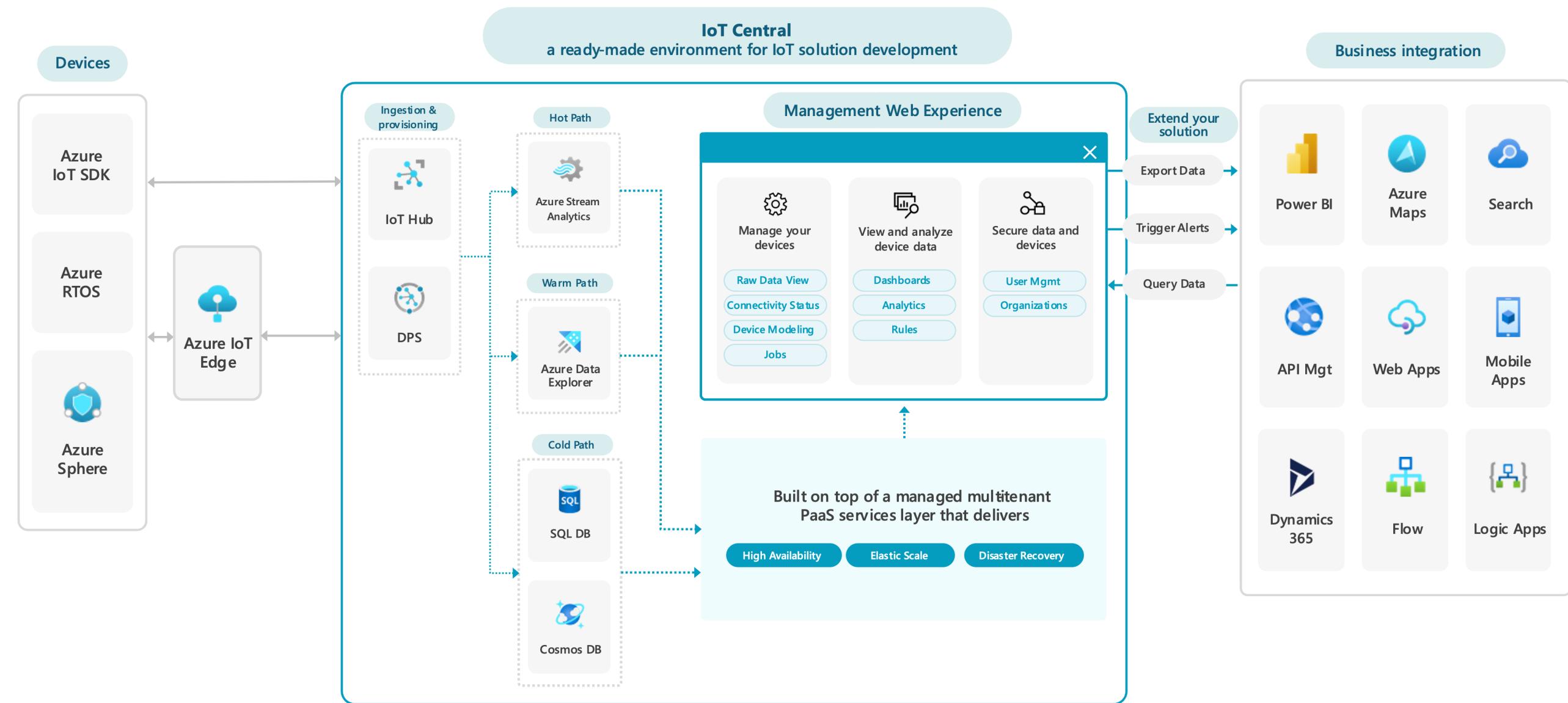
Highly secure authorization and authentication

# Leverage Azure IoT Central





# Azure IoT Central aPaaS Architecture



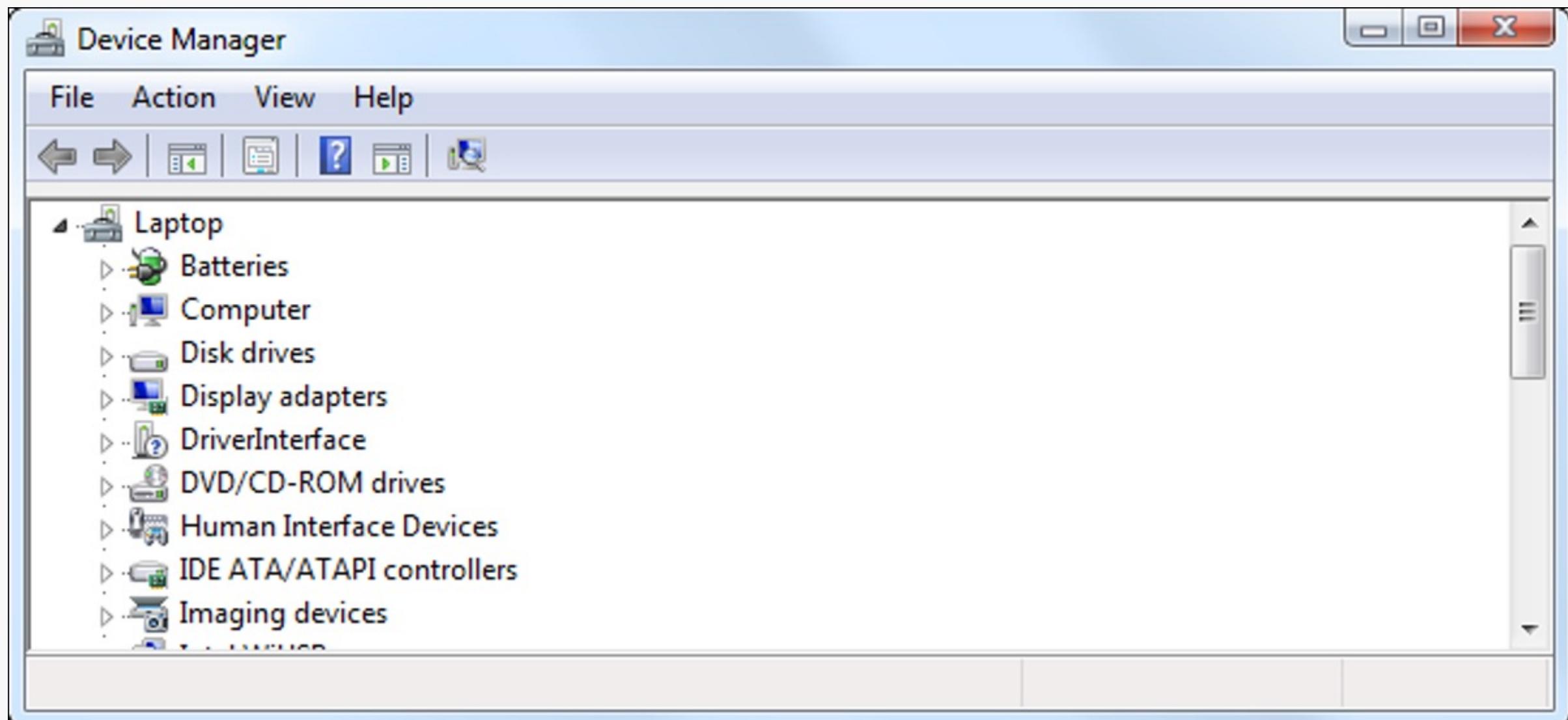
# When to use Azure IoT Central

- **Experience**
  - lack of skills and experience (very common)
  - always consider the skills and abilities of the IoT team
- **Customization**
  - IoT Central Platform provides ready-to-use application with few customization options
  - Try building Companion apps than the Custom-built solution from scratch

*Azure IoT Hub* is the better option for experienced professionals that need full control over their IoT solution

# What made Windows successful?

Working with Device manufacturer to have compatible drivers



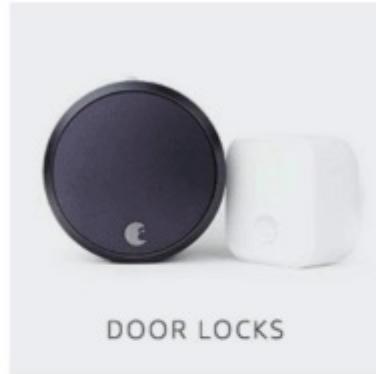
# Alexa Compatible Devices

Working with Device manufacturer

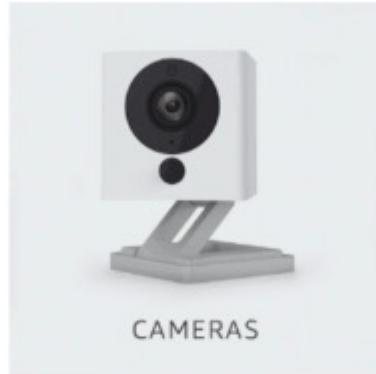
SHOP BY CATEGORY | SMART HOME



LIGHTING



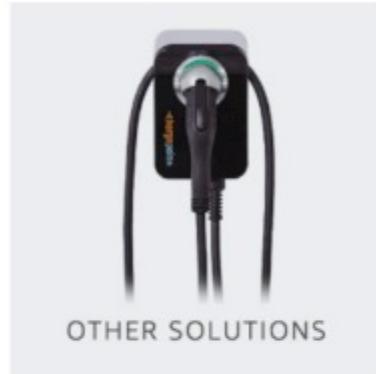
DOOR LOCKS



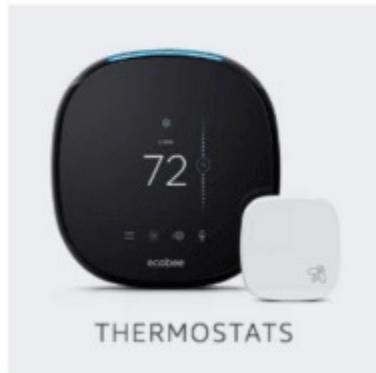
CAMERAS



PLUGS



OTHER SOLUTIONS



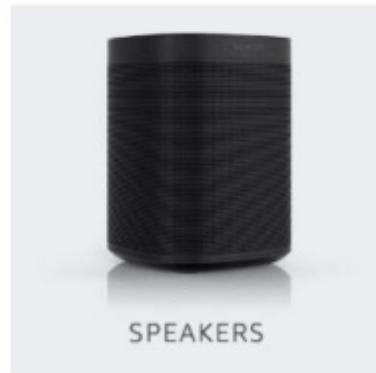
THERMOSTATS



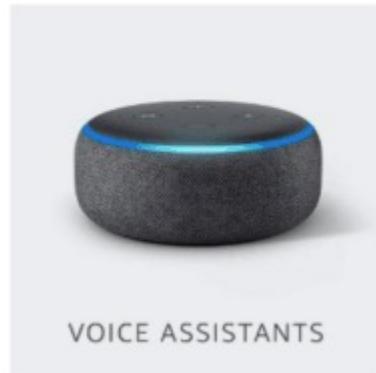
SECURITY SYSTEMS



TELEVISIONS



SPEAKERS



VOICE ASSISTANTS



# Azure IoT Plug and Play

---

integrate smart devices solutions – no manual configuration

---

device model - advertises its capabilities to an IoT Central

---

eliminate the hassle of configuring devices

creating templates

adding features and interfaces

# Azure Certified Device Catalog

Filter by: [Clear all filters](#)

[Certification programs](#) 1

- Azure Certified Device
- Edge Managed
- IoT Hub Certified devices (legacy) •
- IoT Plug and Play

[Device Class](#)

- Gateway
- Other
- Sensor

[Azure Technical Level](#) 1

- 0
- 1
- 2
- 3
- 4

[Connectivity](#)

[Device Type](#)

[Geo Availability](#)

[Industrial Protocols](#)

[Industries](#)

- Automotive
- Education
- Energy
- Government
- Healthcare
- Hospitality
- Manufacturing
- Other
- Retail
- Smart Buildings

[Integrated Sensors](#)

Showing 1-20 of 86 device(s)

[Devices](#) [Solutions](#)

All Devices:

Azure Certified Device



NEXUS

By LAB3 Solutions

[Shop](#)

Azure Certified Device



Advantech-WISE-4250AS-S231

By Advantech Co., LTD

[Shop](#)

Azure Certified Device



PIC-IoT WM Development

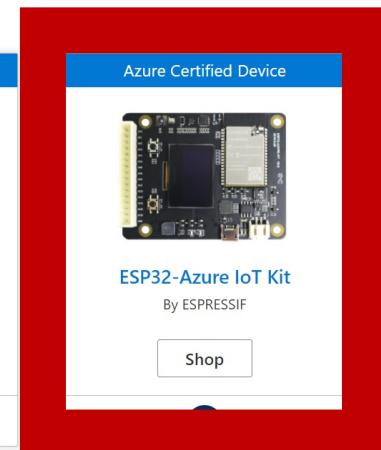
Azure Certified Device



Industrial Optical Distance

By CloudRail GmbH

[Shop](#)



ESP32-Azure IoT Kit

By ESPRESSIF

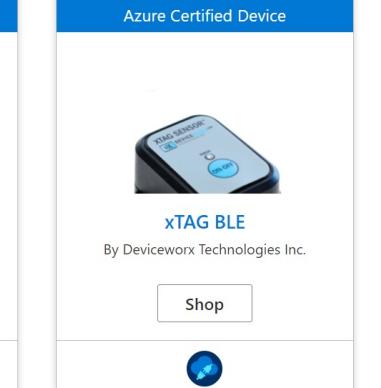
[Shop](#)



iAeris2 IAQ Detector

By Sysinno Technology

[Shop](#)



xTAG BLE

By Deviceworx Technologies Inc.

[Shop](#)



xTag USB

By Deviceworx Technologies Inc.

[Shop](#)

Azure Certified Device



AT\_Cactusphere150\_Basic



AT\_Cactusphere110\_Basic



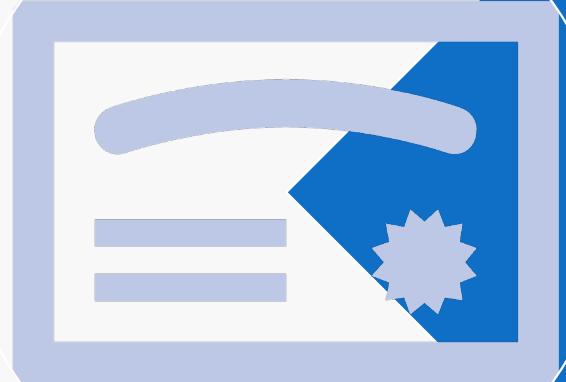
iAeris1 IAQ Detector

# 1. Device Types

<b>IoT Device</b>	<p>Free-standing device</p> <p>Sends its individual sensor data directly to IoT Central</p>	<p>Sends telemetry data</p> <p>Reports property values</p> <p>Receives writable property values</p> <p>Responds to commands</p>
<b>IoT Edge Device</b>	<p>Device that connects directly</p> <p>Has ability to process data locally</p>	<p>Acts as a standalone IoT device</p> <p>OR</p> <p>Middleman for other devices that can't connect directly to cloud</p>
<b>Gateway Devices</b>	<p>IoT device that connects to downstream devices</p>	<p>Manages other devices that connect to Azure IoT Central</p>

## Connection

- shared access signatures
- X.509 certificates
- Trusted Platform Module (TPM)



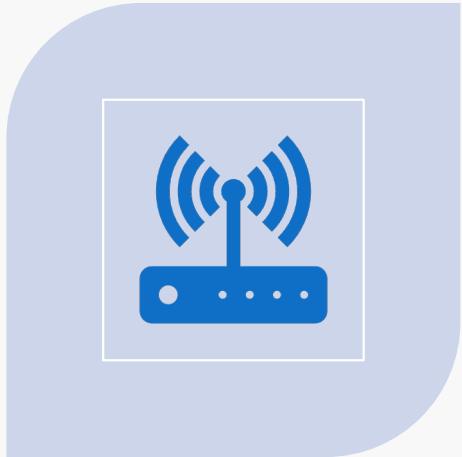
## Communication Protocols

- MQTT
- AMQP
- HTTPS



# 2. Device Template

Blueprint definition



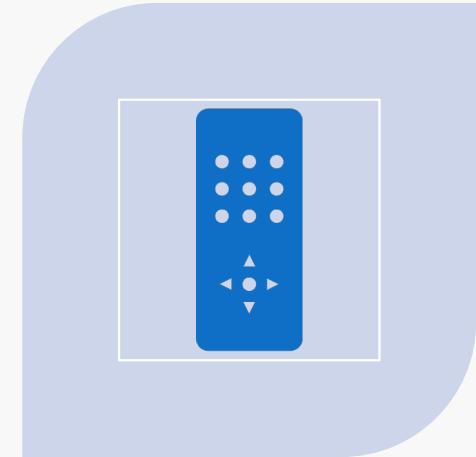
## TELEMETRY

Device sends to Cloud



## PROPERTIES

Device synchronizes with Cloud  
(device twin)



## COMMANDS

Cloud calls on device.

# Demo IoT Central Provisioning

1 Million Devices Per IoT Central App



# 3. Provisioning

Devices > sample-device-01

sample-device-01  
Disconnected | Last data received: 10/19/2022, 2:36:20 AM | Status: Registered | Organization: Simpler Way

Raw data Mapped aliases Files

Device connection groups ×

ID scope (i)  
 Copy

Device ID (i)  
 Copy

Choose the connection type for this device. You can change this later if you need to.

Authentication type  
 ▼

Key QR code

Shared Access Signatures (SAS) use security tokens and keys to connect to IoT Central. Use the SAS keys from the default enrollment group shown below to register your device. [Learn more](#)

Primary key (i)  
 Copy

Secondary key (i)  
 Copy

Close

# 4. Monitoring

- monitor the health of applications and IoT devices
- analyze historical data collected by devices in the past

## Device monitoring

- monitoring devices to identify when there are issues

## Application monitoring

- Metrics are provided by charts
- Azure Portal, REST API, or queries written with PowerShell or Azure CLI.

# Demo IoT Central Device Monitoring



# 5. Visualize Data

About   Overview   Commands   Raw data   Mapped aliases   Files

Temperature, Humidity, Light, Pressure

The chart displays four data series: Temperature (green line), Humidity (black line), Light (red line), and Pressure (yellow line). The x-axis shows two time points: 08:57 PM 12/03/2022 and 09:28 PM 12/03/2022. The y-axis scales vary by series: Temperature (21.5-22), Humidity (50-52), Light (48-52), and Pressure (90-100).

Temperature   Humidity   Light   Pressure

...

Temperature

22.11

Average, Past 12 hours

Humidity

50.87

Average, Past 12 hours

Light

52.56

Average, Past 12 hours

Pressure

101.27

Average, Past 12 hours

Magnetometer X

62,77...

Average, Past 12 hours

Magnetometer Y

3,300....

Average, Past 12 hours

Magnetometer X, Magnetometer Y, Magnetometer Z

The chart displays three data series: Magnetometer X (green line), Magnetometer Y (black line), and Magnetometer Z (red line). The x-axis shows two time points: 08:57 PM 12/03/2022 and 09:28 PM 12/03/2022. The y-axis scales are: Magnetometer X (62,690-62,700), Magnetometer Y (3,330-3,340), and Magnetometer Z (870-880).

Magnetometer X   Magnetometer Y   Magnetometer Z

...

Magnetometer Z

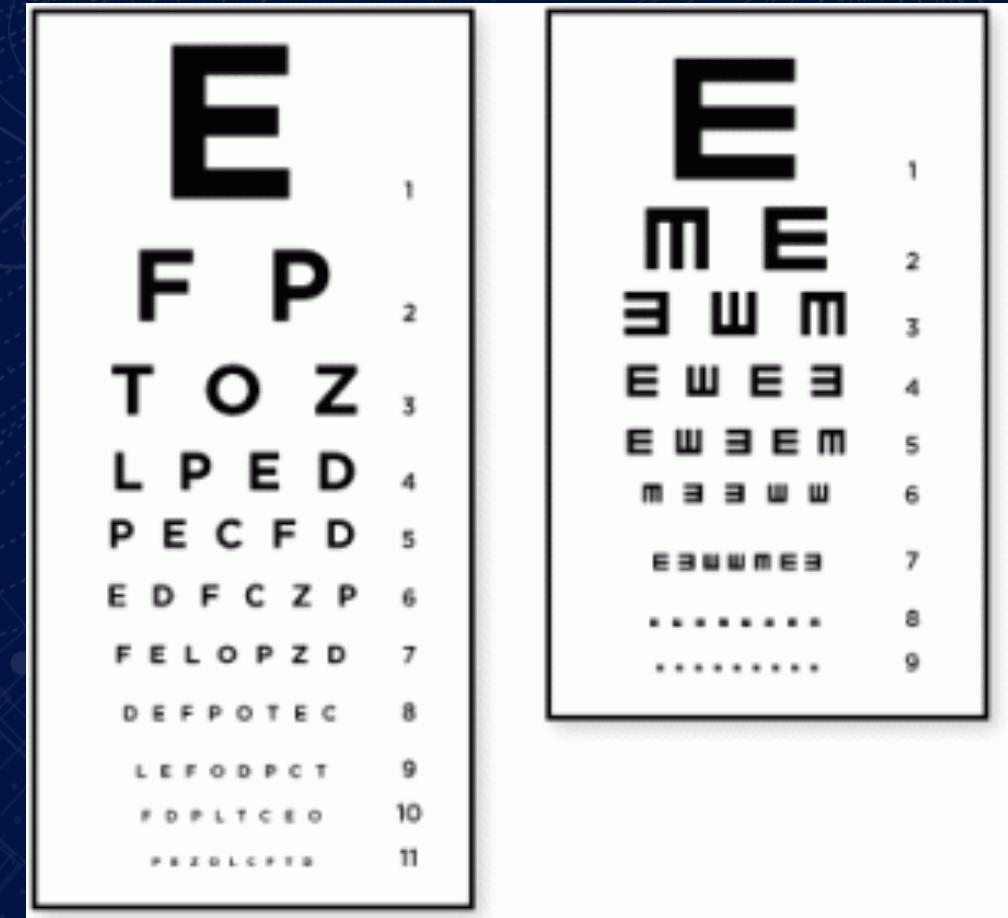
870.58

Average, Past 12 hours

This section provides a detailed view of the Magnetometer data from 08:57 PM to 09:28 PM on 12/03/2022. It shows three stacked line charts for Magnetometer X (green), Magnetometer Y (black), and Magnetometer Z (red) against time.

08:57 PM 12/03/2022   09:28 PM 12/03/2022

# Demo IoT Central Data Visualization



## 6. Jobs

- manages connected devices at scale
- do bulk updates to
  - Device properties
  - cloud properties
  - run commands
  - change device template
- use CSV files to import and export devices in bulk.

# Demo IoT Central Jobs

5 concurrent  
job executions



I DID A GOOD JOB

## Review

### Configuration [Edit](#)

Job name send command to devices to display hello

Description -

Device group ⓘ Espressif ESP32 Azure IoT Kit - All devices  
1 device the next queued batch starts.

Organization Simpler Way

### Job type: Command

#### DisplayText

```
1 {  
2   "Request": "Hello World!"  
3 }
```

Set threshold to all of your devices, or make it specific to

[Previous](#)[Run](#)[Save and exit](#)

 Copy job  Job properties  Results log

30-day history > Rerun send command to devices to display hello

## Rerun send command to devices to display hello

### Results



 Completed	1
 Failed	0
 Pending	0

### Duration

05  
Seconds

Start 12/3/2022, 8:57:26 PM  
End 12/3/2022, 8:57:30 PM

### Name

### Device ID

### Status

### End Time

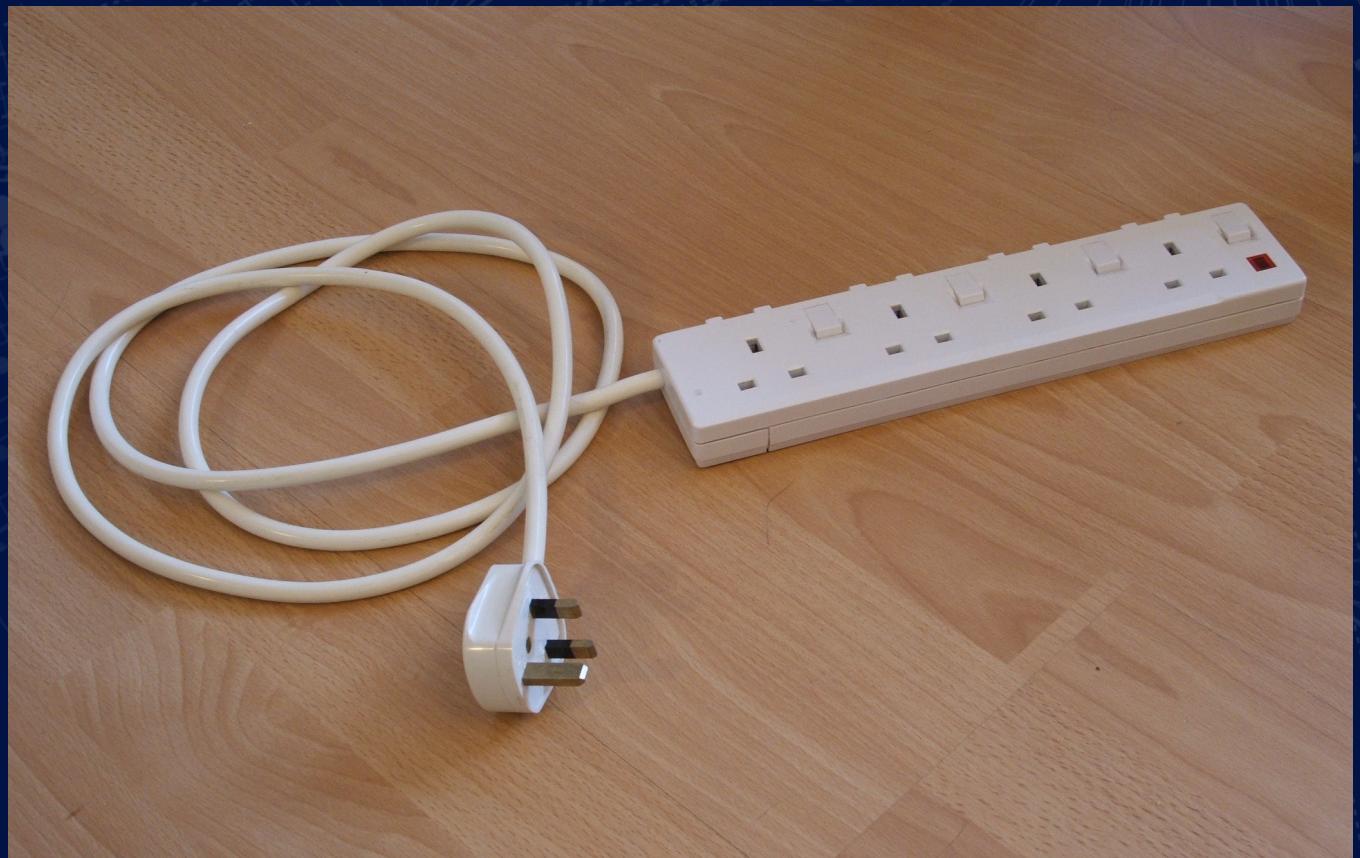
mydevice

mydevice

 Completed

12/3/2022, 8:57:30 PM

# Extending IoT Central



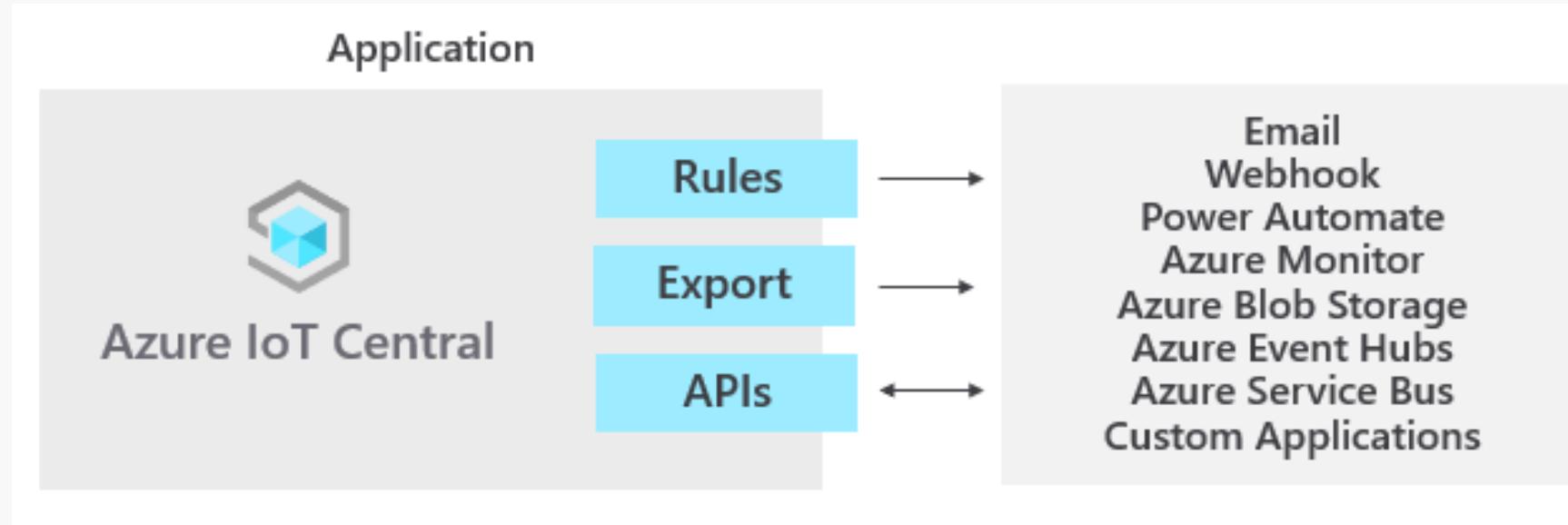
# Extending IoT Central

DATA  
EXPORT

RULES

REST API

# Integrate with other services



# 7. Data Export

Azure Service	Use
Azure Event Hubs	Process, transform, and store millions of events with speed and precision
Azure Service Bus	Send messages between devices, applications, and services in the cloud
Azure Blob Storage	Store large amounts of unstructured data
Azure Data Lake Storage	Process and analyze large amounts of data
Webhook Endpoints	Trigger <i>HTTP</i> callbacks to other applications based on predefined rules

# Destination

Destinations > request bin

## request bin

To update your webhook destination, enter a new callback URL. [Learn more](#)

### Destination type

Webhook

### Callback URL \*

http://dnsdatacheck.vy3n8mhtlg091k0.b.requestbin.net

### Authorization

No auth

No auth

OAuth2.0

Authorization token

Add custom headers to each message that you export to this destination. Custom headers can be used by [triggers](#) and [actions](#).

+ Header

# Data Export

## Enrichments

Add additional information to your export. This will appear as a key value pair in exported messages. [Learn more ↗](#)

Key \*

IsSample

Value \*

true

X

Organization

Organizations

X

+ Custom string + Property

## Destinations

Select destinations for your export. If you can't find your destination, [create a new one.](#)

Destination \*

request bin

Data transformation



Edit

Export status

✓ Healthy

Details

+ Destination

# Export Data Transformation

## Telemetry values

- restructure JSON payloads
- rename fields
- filter out fields
- run simple calculations

## Limitations

- 10 data export jobs
- 10 data export destinations
- 10 data export destinations per job
- 10 filters and enrichments per data export job

# Data Transformation

```
import "iotc" as iotc;  
{  
    schema: "default@v1",  
    deviceName: .device.name,  
    templateName: .device.templateName,  
    messageSource: .messageSource,  
    messageType: .messageType,  
    enqueuedTime: .enqueuedTime,  
    enrichments: .enrichments,  
    model: .device.properties.reported |  
iotc::find(.name == "model").value  
}  
  
→  
  
{  
    "deviceName": "neural bandwidth",  
    "enqueuedTime": "2011-05-  
29T05:54:00.76817568Z",  
    "enrichments": null,  
    "messageSource": "deviceConnectivity",  
    "messageType": "disconnected",  
    "model": "Quia veritatis dicta a.",  
    "schema": "default@v1",  
    "templateName": "Espressif ESP32 Azure  
IoT Kit"  
}
```

# Demo IoT Central Data Integration



## 8. Rules

- Notifying operators in other systems
- Starting business processes or flows
- Monitoring alerts on a custom dashboard
  
- 50 rules per application
- 5 actions per rule
- 1 alert email per rule
- 1 webhook alert every 10 seconds

## Actions

Choose what action your rule should take.

### Webhook: Webhook 1

Notify external systems when a rule is triggered in IoT Central. When the conditions of the rule are met, a POST request will be sent to the callback URL you provide.

[Learn about the structure of the payload](#)

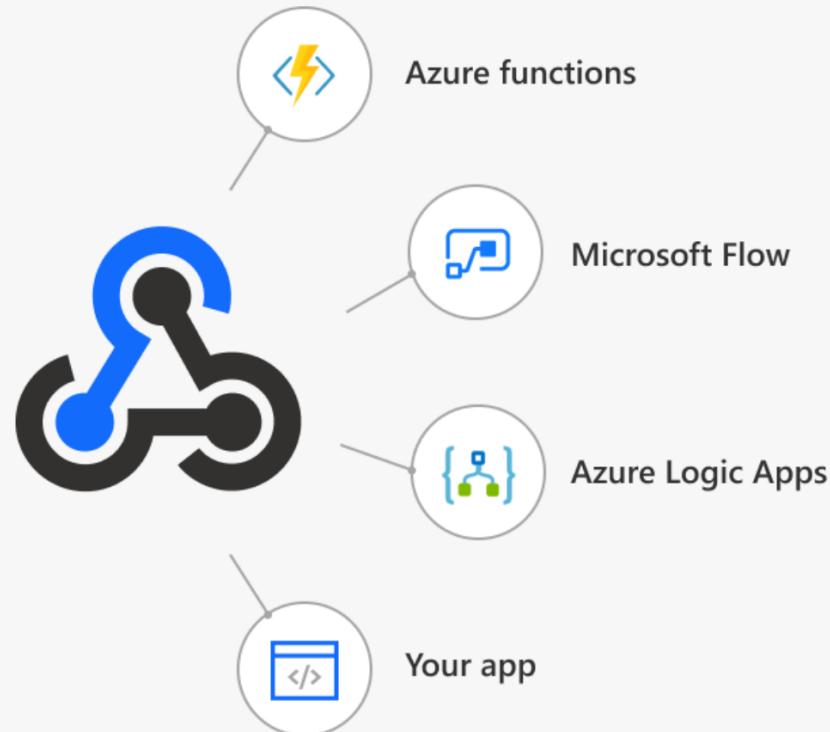
Display name

Webhook 1

Callback URL \* ⓘ

http://dnsdatacheck.vy3n8mhtlg091k0.b.requestbin.net

Done



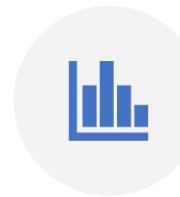
Add another action

+ Email + Webhook + Azure Monitor Action Groups + Microsoft Power Automate + Microsoft Azure Logic Apps

# 9. REST API



**App Management**



**Device Modelling**



**Device Onboarding**



**Device Management**



**Data and Insights**



**Limitations –**  
1 query API req/s  
20 API req/s

Simpler Way

Search for devices

Permissions < + New

Organizations

Users

Roles

Device connection groups

API tokens

Connect

Devices

Device groups

Device templates

Analyze

Data explorer

Dashboards

Manage

Jobs

Extend

Rules

Data export

Security

API tokens

Use API tokens to connect developer tools to your IoT Central application. [Learn more](#)

Generate token X

Enter a name for this API token and then assign it to a role. The assigned role determines the token's application permissions. [Learn more](#)

Token name \*

Organization \*

Role \*

Generate Cancel

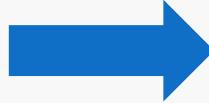
The screenshot shows the 'API tokens' section of the Microsoft Azure IoT Central interface. A modal dialog titled 'Generate token' is open, prompting the user to enter a token name ('test-token'), select an organization ('Simpler Way'), and choose a role ('App Operator'). The 'Generate' button is visible at the bottom right of the dialog.

# REST API

## Sample Request

```
POST https://simpler-
way.azureiotcentral.com/api/devices/mydevice/commands/DisplayText?api-version=2022-
07-31
Content-Type: application/json
Authorization: SharedAccessSignature sr=6c8..
```

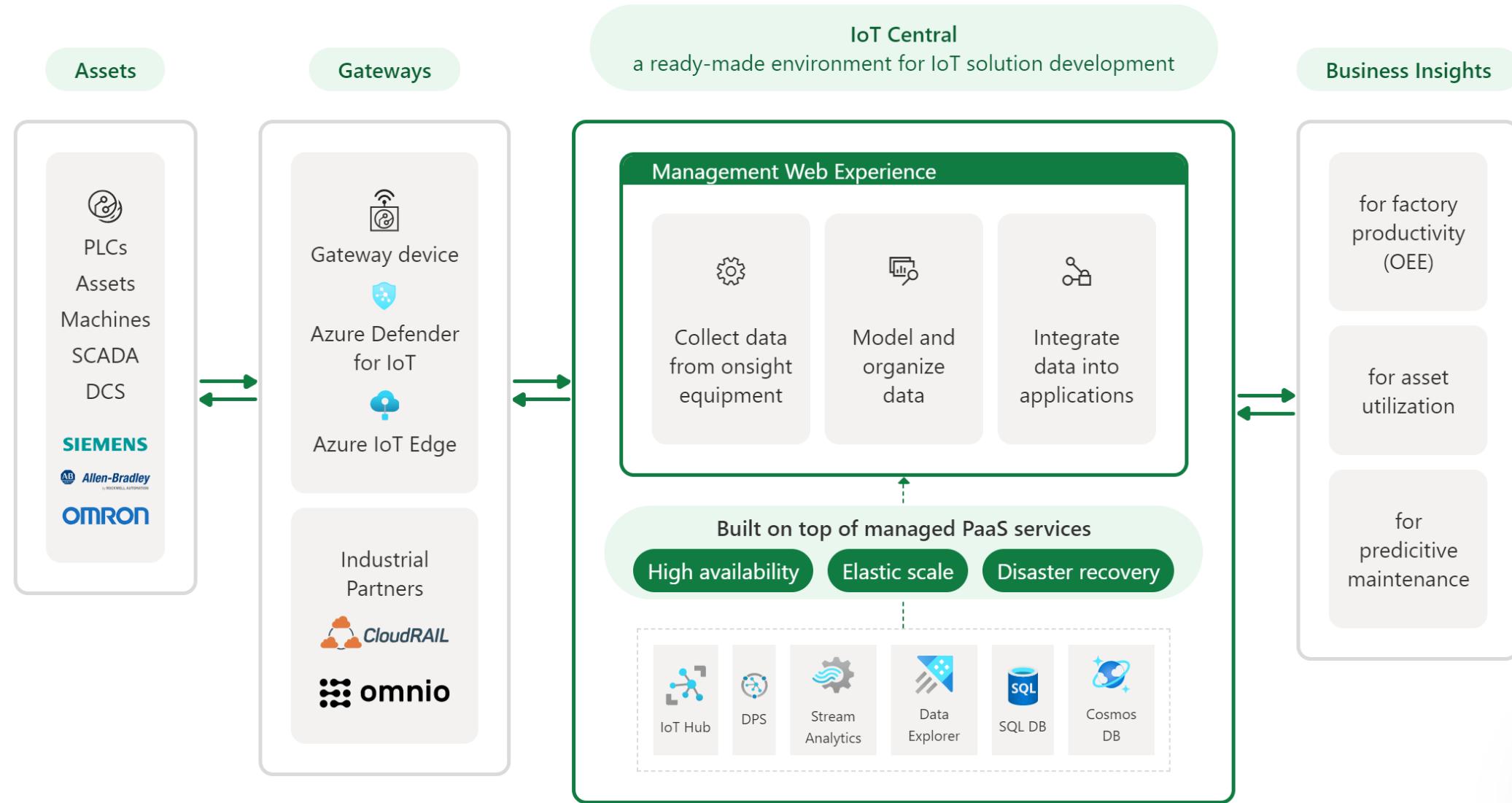
```
{
  "request": "Hello World!"
}
```



## Sample Response

```
Status code: 201
{
  "request": "Hello World!",
  "response": {},
  "responseCode": 200
}
```

# Industrial IoT



# Summary

Internet of Things – Remotely Monitor and Control Device

IoT Central – simplifies the creation of IoT solutions

Benefits of IoT Central – low-code environment

- 1. Device Type
- 2. Device Template
- 3. Provisioning
- 4. Monitoring
- 5. Visualize Data
- 6. Jobs
- 7. Data Export
- 8. Rules
- 9. REST API



<https://github.com/rondagdag/exploring-land-of-iot-on-azure>

# Call to Action

- Learn more about IoT Central on [Microsoft Learn](https://apps.azureiotcentral.com/home)  
<https://apps.azureiotcentral.com/home>
- IoT Central REST API  
<https://docs.microsoft.com/en-us/rest/api/iotcentral/>
- Connect ESPRESSIF to IoT Central  
<https://learn.microsoft.com/en-us/azure/iot-develop/quickstart-devkit-espressif-esp32-freertos>

**Award Categories**

AI, Windows Development

**First year awarded:**

2017

**Number of MVP Awards:**

6

<https://linktr.ee/rondagdag>

# About Me

## Ron Dagdag

Director of Software Engineering at Spaceee

6<sup>th</sup> year Microsoft MVP awardee

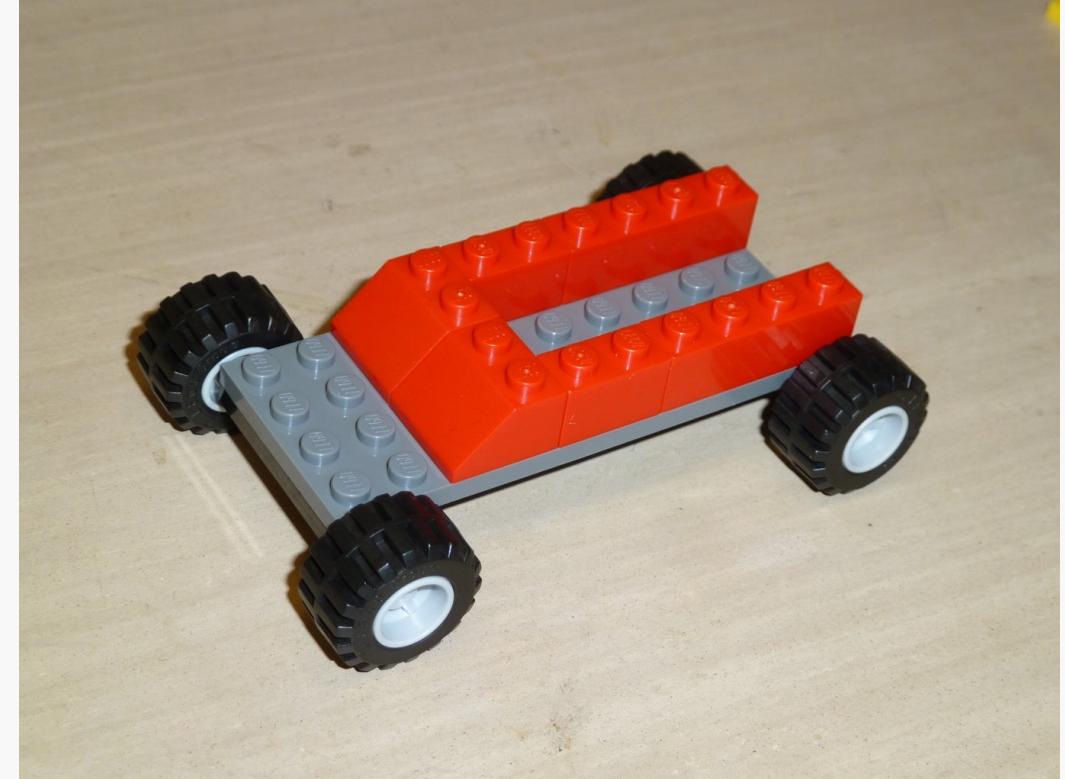
ron@dagdag.net  
@rondagdag

Linked In  
[www.linkedin.com/in/rondagdag/](https://www.linkedin.com/in/rondagdag/)

Feedback is appreciated. What did you learn that's new?

# Build me a car

From these pieces



# Build me a car

From these pieces



CLASSIC



10692

