

Lab Center – Hands-on Lab

Session 4322

Get Hands-on Next Generation IoT Platform

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1 Introduction to this lab

1.1 Welcome to this lab: Get Hands-on the Next Generation IoT Platform

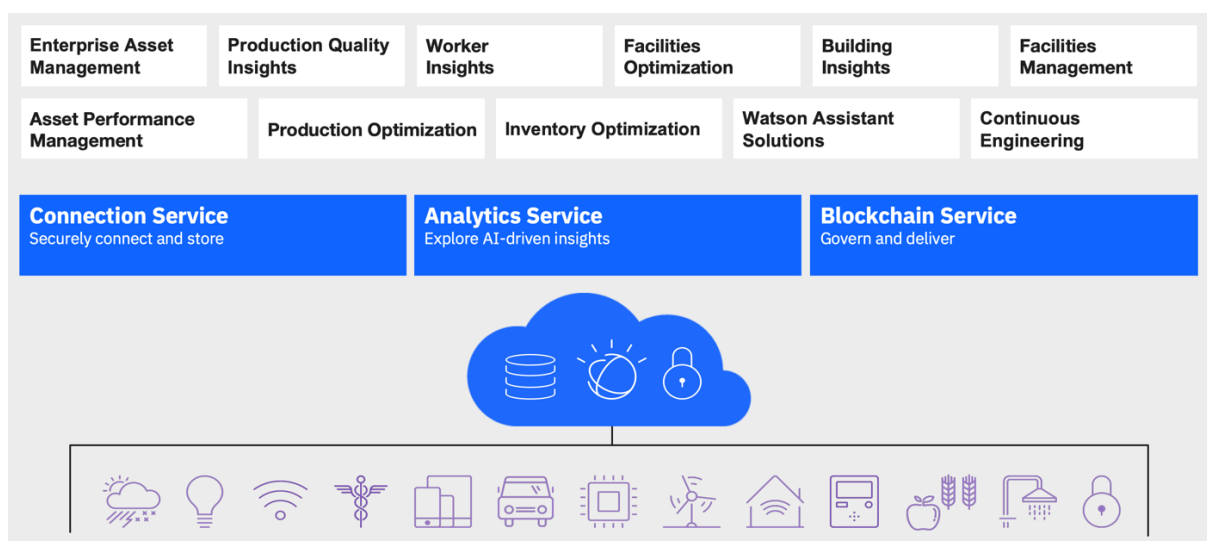
In this hands-on lab you will learn how to get started with the next generation Watson IoT Platform and quickly take advantage of the market leading platform for Industrial IoT. You will learn about the capabilities in Watson IoT Platform and how to connect devices, create device abstractions and transformations. You will also explore and analyze the device data using the IoT Platform Analytics Service to compute data metrics and statistical KPIs.

1.2 About Watson IoT Platform

The IBM Watson Internet of Things Platform is a fully managed, preconfigured cloud-hosted service available in IBM Cloud providing Connection, Analytics and Blockchain services to client applications or IoT Industry solutions.

Using the IBM Watson IoT Platform you turn your device data into meaningful insights. Use these data insights to optimize your business processes and impact the future design of your products or services. Watson IoT Platform provides tools that allow you to process IoT data with both real-time and historical analytics, add “smart” capabilities the IBM Cloud to non-smart products, match appliances with customers, and securely connect your own existing apps and tools to the Watson IoT Platform infrastructure using APIs and SDKs.

Watson IoT Platform serves as a foundational capability for our industry solutions and business use cases.



Connectivity

The Watson IoT Platform provides cloud connectivity to your IoT devices. Use the light-weight standardized MQTT messaging protocol to connect and start sending data securely to the IoT Platform. Use the IoT platform to access IoT data and control devices. Use IoT platform data management tools, such as device twins, to process and shape the IoT data to your needs.

Storage

The Watson IoT Platform provides fully-managed database components for short, medium, and long-term IoT data storage.

Analytics

The Watson IoT Platform provides an analytics service to perform batch scheduled analytics function on the data and implement machine learning predictive models. Choose from a range of predefined analytic operations in an extensible function catalog. Explore and define the key performance indicators for your IoT data and create alerts to respond quickly to system inefficiencies.

Blockchain

The Watson IoT Platform provides the IoT Blockchain Service to enable your IoT resources to participate in blockchain business networks for compliance and supply chain use cases.

1.3 About this lab

In this hands-on lab you will deepen your understanding and experience in the next generation Watson IoT Platform. You will use the Watson IoT Platform to gain analytics insights into the IBM Munich IoT Center.

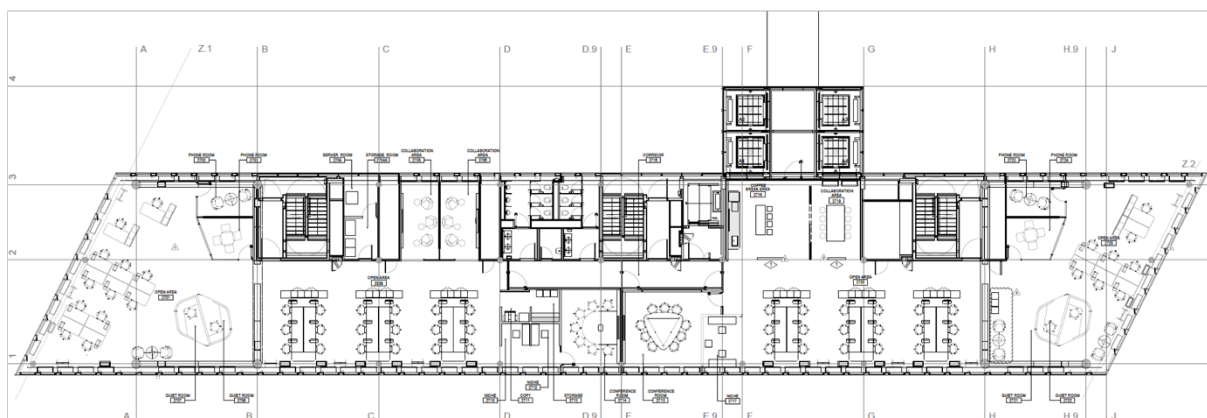
In the first section of this lab, you will first explore the data events sent from the devices instrumenting the 27th floor in the IBM Munich IoT Center building. You will then explore the interfaces and transformation performed as data is ingested into the IoT Platform. In the second section of the lab you will continue to explore the data lake of historical data. Using the historical data, you can discover trends and notifications of events. In the third and last section of the lab you will deep-dive into the analytics capabilities in the Watson IoT Platform and explore analytics on worker safety, comfort levels, and workspace presence and utilization.

1.4 About Watson IoT Munich

IBM is investing over \$3 billion USD to bring Watson to IoT – including \$200 million USD to the new Munich IoT Center. In Munich, the Internet of Things comes of age with advanced Watson cognitive computing technologies and the world's first state-of-the-art client 'collaboratories'. With over 6,000 clients and partners and home to 1,000 IBM'ers, Watson IoT Munich is quickly becoming the center of the smart new global ecosystem.

Take a virtual tour of the Watson IoT Center in Munich at <https://www.ibm.com/internet-of-things/learn/iotcenter/>

The floor plan of the Munich Twin Tower building, hosting the IBM IoT Center, is sectioned into East- and West-wing workspaces and meeting rooms. The wings are separated by the central elevator section, conference rooms, hallways and utility spaces.



1.5 About Sensor Instrumentation of the 27th Floor

The IBM IoT Center in Munich has been instrumented with devices and sensors from many IBM IoT business partners. In this lab we will use devices from Yanzi Networks (www.yanzi.se) deployed to the 27th floor of the building.

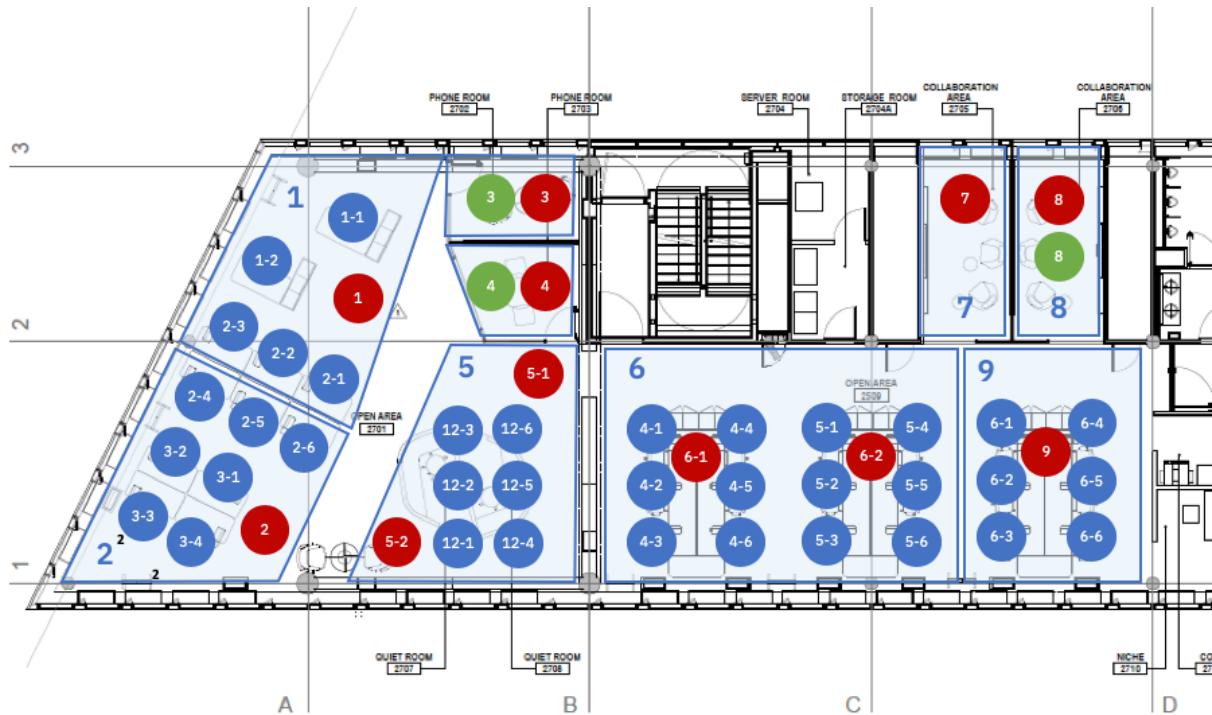
Three types of devices are used:

- **Yanzi Motion** detects motion and monitors the temperature.
- **Yanzi Motion+** devices for monitoring occupancy as well as temperature, humidity, ambient light, and sampled ambient noise.
- **Yanzi Comfort** monitors air quality by measuring levels of carbon dioxide (CO2) and volatile organic compounds (VOC), as well as temperature, humidity, barometric pressure and ambient noise.

The floors in the building has been instrumented to monitor worker safety, comfort levels, and workspace presence and utilization. The devices are assigned to zones representing conference rooms, utility rooms and general workspace areas. The floor plan illustration below indicates the zones in light blue and the devices deployed into each zone as colored circles. Motion type devices are shown as blue circles, devices of Motion+ type as red and devices of Comfort type as green.



Each device is assigned an Id and a Zone in Watson IoT Platform. This metadata information is used to logically associate the device with its location and is used for analytics purposes. As an example, as shown in the illustration below, the meeting rooms zone 3 are instrumented with Motion+ and Comfort type devices.



The two devices in zone 3 register several individual sensors in the Watson IoT Platform. For example, the comfort sensor with id EUI64-0080E10300045A93 is registering individual temperature, CO₂, Air Pressure, Sound Pressure, Humidity and Volatile Organic Compound sensors in Watson IoT Platform. The name of each sensor, of a device, takes the name of the device and adds a sensor post-fix identity to the name. See table below.

Comfort sensor EUI64-0080E10300045A93 in Floor 27, Zone 3.

Device id	Device Type
809646_EUI64-0080E10300045A93-10	soundPressureLevel
809646_EUI64-0080E10300045A93-3	relativeHumidity
809646_EUI64-0080E10300045A93-5	volatileOrganicCompound
809646_EUI64-0080E10300045A93-4	carbonDioxide
809646_EUI64-0080E10300045A93-6	pressure
809646_EUI64-0080E10300045A93-3	temperatureK

Motion+ sensor EUI64-0080E10300045266 in Floor 27, Zone 3.

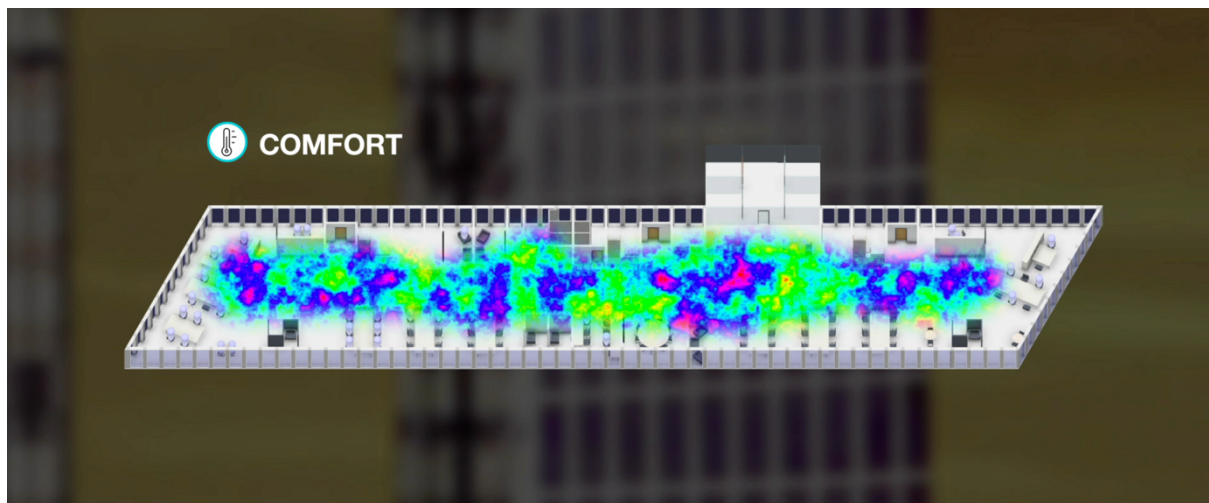
Device id	Device Type
809646_EUI64-0080E10300045266-5	illuminance
809646_EUI64-0080E10300045266-10	soundPressureLevel
809646_EUI64-0080E10300045266-3	temperatureK
809646_EUI64-0080E10300045266-4	motion
809646_EUI64-0080E10300045266-3	relativeHumidity

Using the sensor values from these two devices the IoT Platform can compute metrics and KPIs for the meeting room 3 on floor 27, like CO₂ levels, occupancy and utilization.

Similarity for workspaces, the occupancy of a single desk can be provided using the deployed motion sensors in the zone, for example sensors 1-1, 1.2 and 2-1 to 1-3. The occupancy and utilization of a zone can then be computed by analyzing the sensor values.

Comfort levels can be computed from temperature, humidity, CO₂ levels, light intensity and noise levels. For worker safety regulatory purposes, the office may be monitored ensuring that the comfort levels of temperature, humidity and noise are within compliant levels and that alerts are notifying of CO₂ levels outside of regulatory bounds.

Using the data produced by IoT platform analytics IoT Industry Solution, like IBM Tririga Building Insights, can implement business logic and integrations to the IoT data. The illustration below shows a concept design on visualizing comfort data analytics using the derived IoT data.



With this brief introduction we are now ready to start the lab and explore the Watson IoT Platform.

2 Getting started

2.1 Starting your Workstation

In this lab you will use a Windows 7 workstation. This workstation is only used to run your web browser providing you access to IBM Watson IoT Platform on IBM Cloud. At the start of this lab, all workstations should have been started and ready for you to use with automatic login.

Note: If you fail to log into your workstation, ask your lab facilitators for help.

2.2 Logging into Watson IoT Platform

IBM Cloud, previously named Bluemix, is a cloud platform as a service (PaaS) developed by IBM. It supports several programming languages and services as well as integrated DevOps to build, run, deploy and manage applications on the cloud. IBM Cloud is based on Cloud Foundry open technology and runs on SoftLayer infrastructure.

In this lab you will use the Watson IoT Platform and the services running in IBM Cloud. All attendees in this lab will use a shared Watson IoT Platform and the corresponding Watson IoT platform service organization across all lab workstations.

To log into the Watson IoT Platform.

1. Open the Firefox browser on your workstation
2. Enter the tenant URL <http://ibm.biz/thinkiotplatform>.

Or use the full tenant URL <https://dashboard-us.connectedproducts.internetofthings.ibmcloud.com/preauth?tenantid=Think-2019>

3. The Watson IoT Platform login page opens

IBM Watson IoT Platform

Welcome to IBM Watson IoT Platform

You can use IBM Watson IoT Platform to turn your device data into meaningful insights. Use these data insights to optimize your business processes and inform the future design of your products or services. Watson IoT Platform provides tools that allow you to process IoT data with both real-time and historical analytics, add "smarts" in the IBM Cloud for non-smart products, match appliances with customers, and securely connect your own existing apps and tools to the Watson IoT Platform infrastructure.

[Log in to Think-2019](#)
[Learn more](#)

IBM Watson IoT Platform

Usage / My cloud industrial plan

32

Number of entities

Exceeded

Remaining

All services (3)

Name	Usage	Subscribed	Consumed	Plan coverage	Status
Watson IoT Platform Service	View Details	Click to hide metrics	25,313 MB	0 MB	Active
Data exchanged			25,313 MB	0 MB	
Data analyzed			25,313 MB	0 MB	
Edge data analyzed			25,313 MB	0 MB	
DNS Warehouse on Cloud	View Details	Expand to see usage (1 metric)			Active
IBM Event Streams	View Details	Expand to see usage (2 metrics)			Active

Need more information?

Need more information? Browse the documentation to learn more about getting started, product architecture, and how to access developer resources. If you still have questions, contact us, and we will help you find what you need.

[Go to IBM Knowledge Center](#)
[Contact IBM](#)

- Click on **Log in to Think-2019**
- Enter the IBM ID "thinkiot@mail.com"
Enter the password "think2019iot"
- Click **Log in**

IBM

Log in to IBM

Don't have an IBMid?

Create an account

Log in with your company credentials (SSO)

Need help?

Contact the IBM Help Desk

IBMID

Forgot IBMID?

thinkiot@mail.com

Password

Forgot password?

☐ Remember me
 [?](#)

Log in

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[Accessibility](#)

7. The Watson IoT Platform Welcome Page is loaded.

IBM Watson IoT Platform


ConnectExploreUsageUsers

thinkiot@mail.com

Hide


Welcome, ThinkLab!

Get started with a few key tasks:




Connect and collect

Connect entities and collect data by using Watson IoT Platform Service.




Explore and analyze

Explore your entities and analyze their associated data.



Track usage

Monitor your usage levels across the services that you are subscribed to.




Administer users

Add users and manage what they have access to in Watson IoT Platform.

Explore / My data lake

Your data lake displays a detailed view of the entity types that are connected in Watson IoT Platform. To explore the metrics and dimensions of your entities in more detail, select Entities. To start applying calculations and analyzing your entity data, select Data.



Number of entities by type

Search entity types

Entity type	Number of entities	Dimensions	Metrics
carbonDioxide		FLOOR, ID, ZONE	CO2Alarm, CO2Warning, ENTITY_ID, rcv_timestamp_utc, time, value
illuminance		FLOOR, ID, ZONE	ENTITY_ID, colorTemperature, rcv_timestamp_utc, time, value
motion			ENTITY_ID, occupied, rcv_timestamp_utc, time, timeLastMotion, value

You have now successfully launched and logged into the IBM Watson IoT Platform.

2.3 Overview of the Watson IoT Platform

The Watson IoT Platform welcome page presents the main capability sections:

- The **Connect and collect** section launches the Watson IoT Platform Service used to connect and manage devices.
- The **Explore and analyze** section provides access to the data lake and Entity time series data
- The **Usage** section provides access to the preconfigured services for messaging and data storage.
- The **Users** section provides control of users and permissions.

IBM Watson IoT Platform | Connect | **Explore** | Usage | Users | thinkiot@mail.com

Welcome, ThinkLab!
Get started with a few key tasks:

- Connect and collect**
Connect entities and collect data by using Watson IoT Platform Service.
- Explore and analyze**
Explore your entities and analyze their associated data.
- Track usage**
Monitor your usage levels across the services that you are subscribed to.
- Administer users**
Add users and manage what they have access to in Watson IoT Platform.

Explore / My data lake
Your data lake displays a detailed view of the entity types that are connected in Watson IoT Platform. To explore the metrics and dimensions of your entities in more detail, select Entities. To start applying calculations and analyzing your entity data, select Data.

Search entity types

Entity type	Number of entities	Dimensions	Metrics
carbonDioxide	1	FLOOR, ID, ZONE	CO2Alarm, CO2Warning, ENTITY_ID, rcv_timestamp_utc, time, value
illumiance	1	FLOOR, ID, ZONE	ENTITY_ID, colorTemperature, rcv_timestamp_utc, time, value
motion	1		ENTITY_ID, occupied, rcv_timestamp_utc, time, timeLastMotion, value

In the sections of this lab we will in-depth explore the usage of the Connect and Explore sections in Watson IoT Platform. In the last section of this lab we will also overview the capabilities for IoT platform administration and user management.

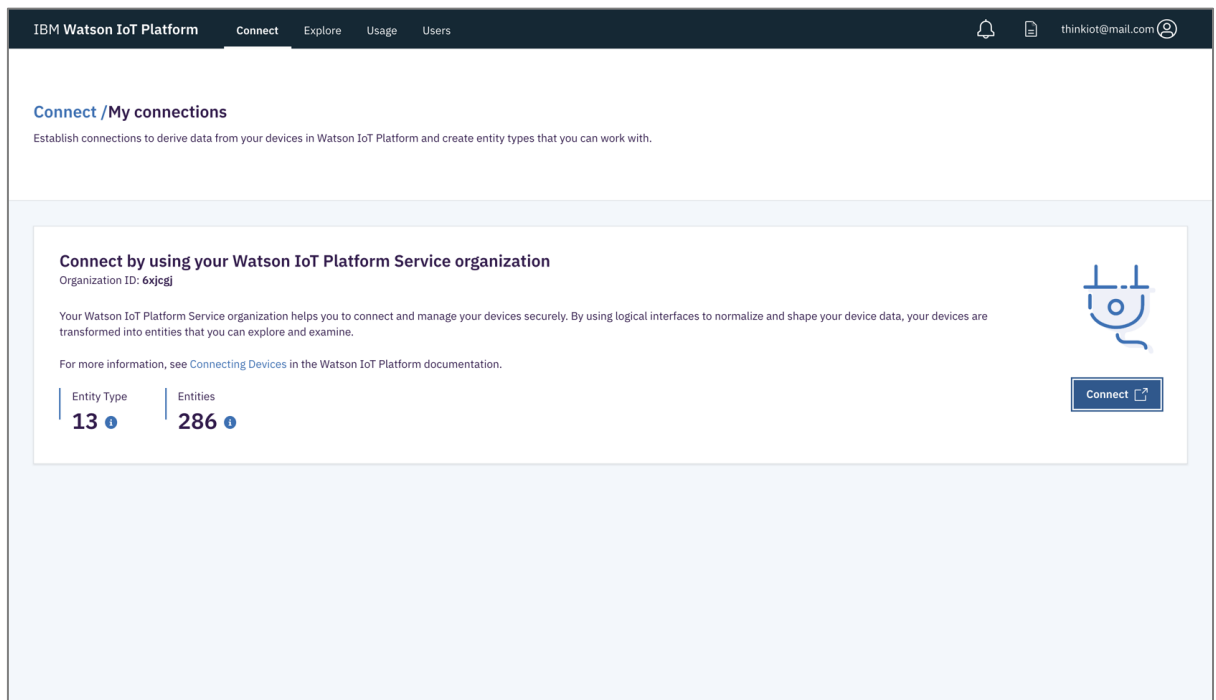
3 Overview of the Watson IoT Platform Service

We are now ready to launch the IoT Platform Service, used in this lab to view device connections and events.

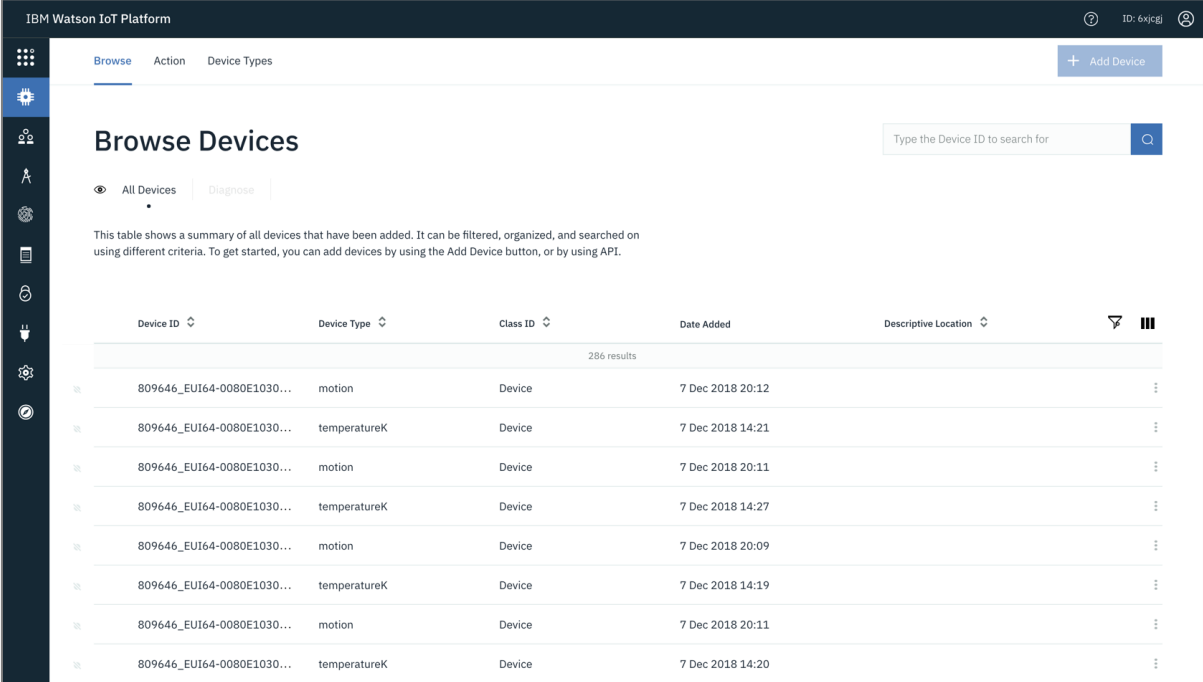
Watson IoT Platform Service is preconfigured part of the Watson IoT Platform. This is the service where you define, register and manage your connected devices. Each Watson IoT Platform service, or *organization*, is given a unique six-character organization ID. Watson IoT Platform Organizations ensure that your connections and data are securely organized and accessible only to your devices, cloud services and business applications. In this lab we will use organization ID: **6xjcgj**.

To open the Watson IoT Platform service

1. Select the **Connect** section on the Watson IoT Platform banner.
2. The Connect page opens

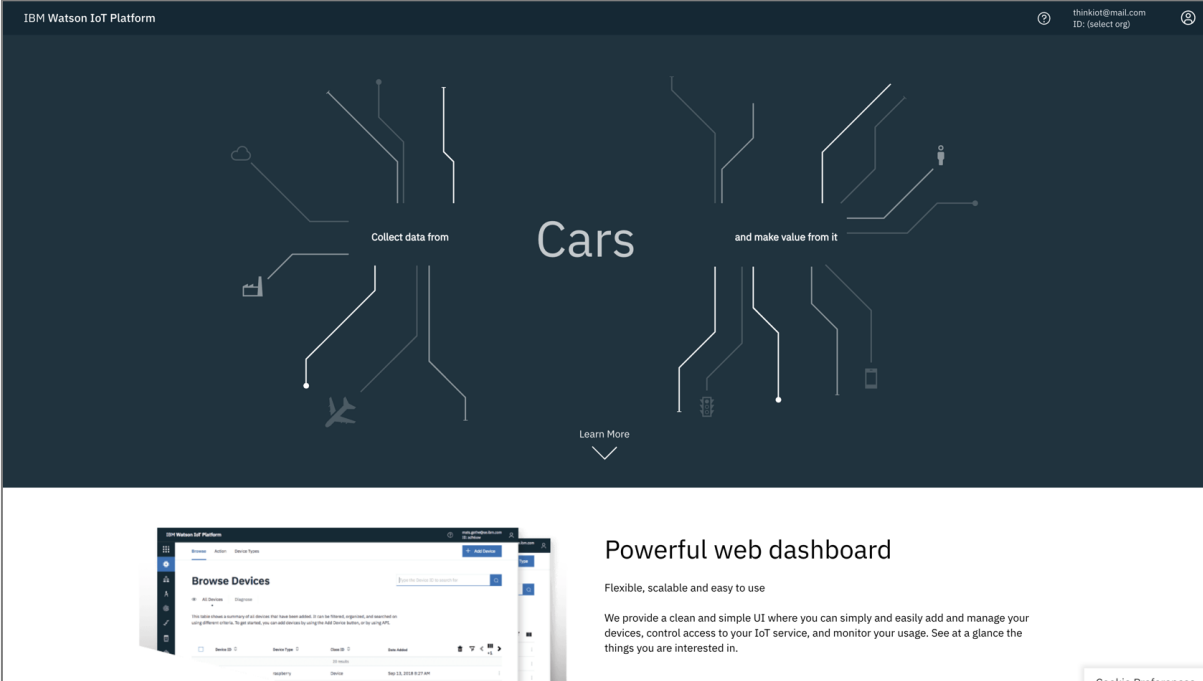


- On the Connect page, click on the **Connect** button to launch the Watson IoT Platform Service.
- The Watson IoT Platform Service opens in a new browser tab



Device ID	Device Type	Class ID	Date Added	Descriptive Location
286 results				
809646_EUI64-0080E1030...	motion	Device	7 Dec 2018 20:12	
809646_EUI64-0080E1030...	temperatureK	Device	7 Dec 2018 14:21	
809646_EUI64-0080E1030...	motion	Device	7 Dec 2018 20:11	
809646_EUI64-0080E1030...	temperatureK	Device	7 Dec 2018 14:27	
809646_EUI64-0080E1030...	motion	Device	7 Dec 2018 20:09	
809646_EUI64-0080E1030...	temperatureK	Device	7 Dec 2018 14:19	
809646_EUI64-0080E1030...	motion	Device	7 Dec 2018 20:11	
809646_EUI64-0080E1030...	temperatureK	Device	7 Dec 2018 14:20	

- Note**, in some cases the Watson IoT Platform Service do not open with the organization 6xjcgj selected, as shown below.



IBM Watson IoT Platform

thinkiot@mail.com
ID: (select org)

Collect data from

Cars

and make value from it

Learn More

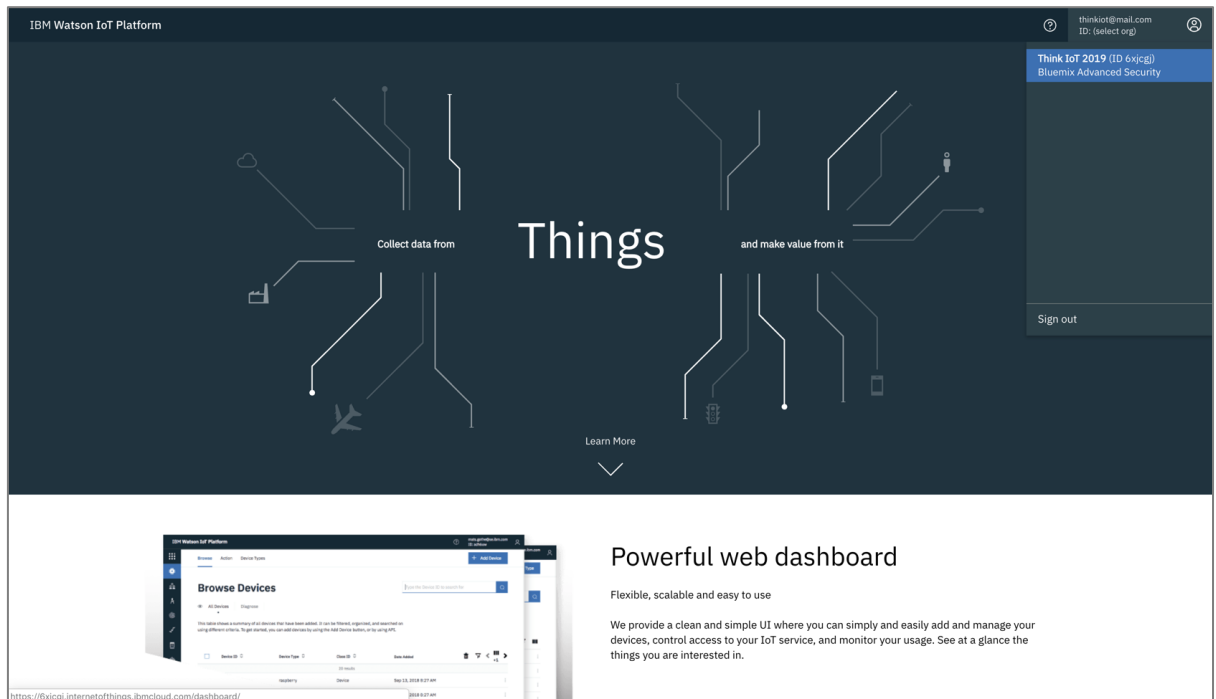
Powerful web dashboard

Flexible, scalable and easy to use

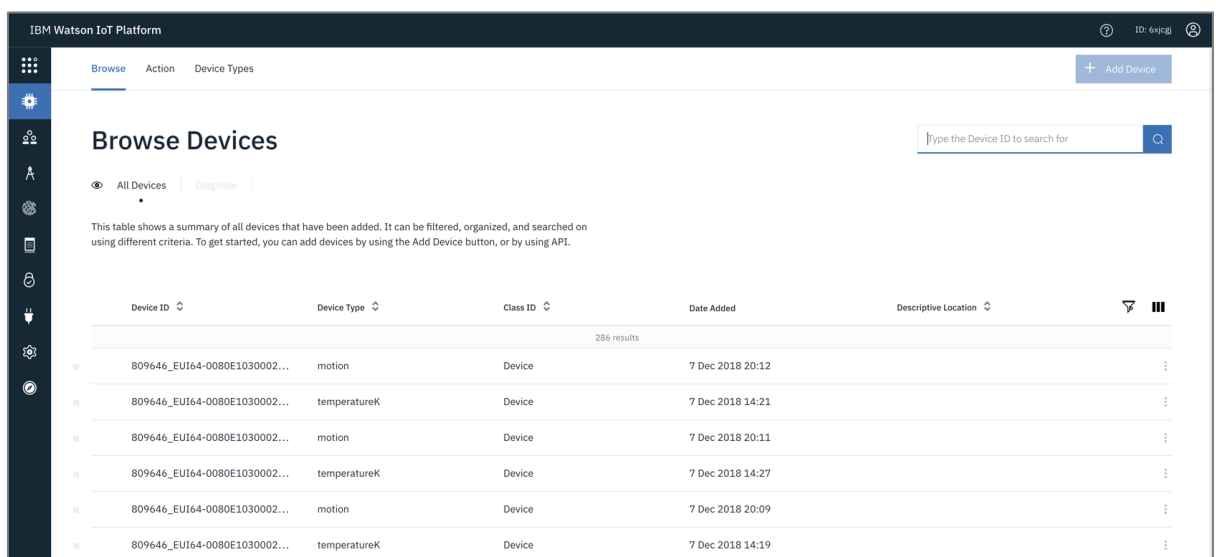
We provide a clean and simple UI where you can simply and easily add and manage your devices, control access to your IoT service, and monitor your usage. See at a glance the things you are interested in.

Cookie Preferences

- Click on the organization switcher menu on the top right and choose “**Think IoT 2019 (ID 6xjcgj)**” from the menu.



Note: By selecting the organization id in the switcher menu, the page will reload and show the selected IoT Platform Service organization.

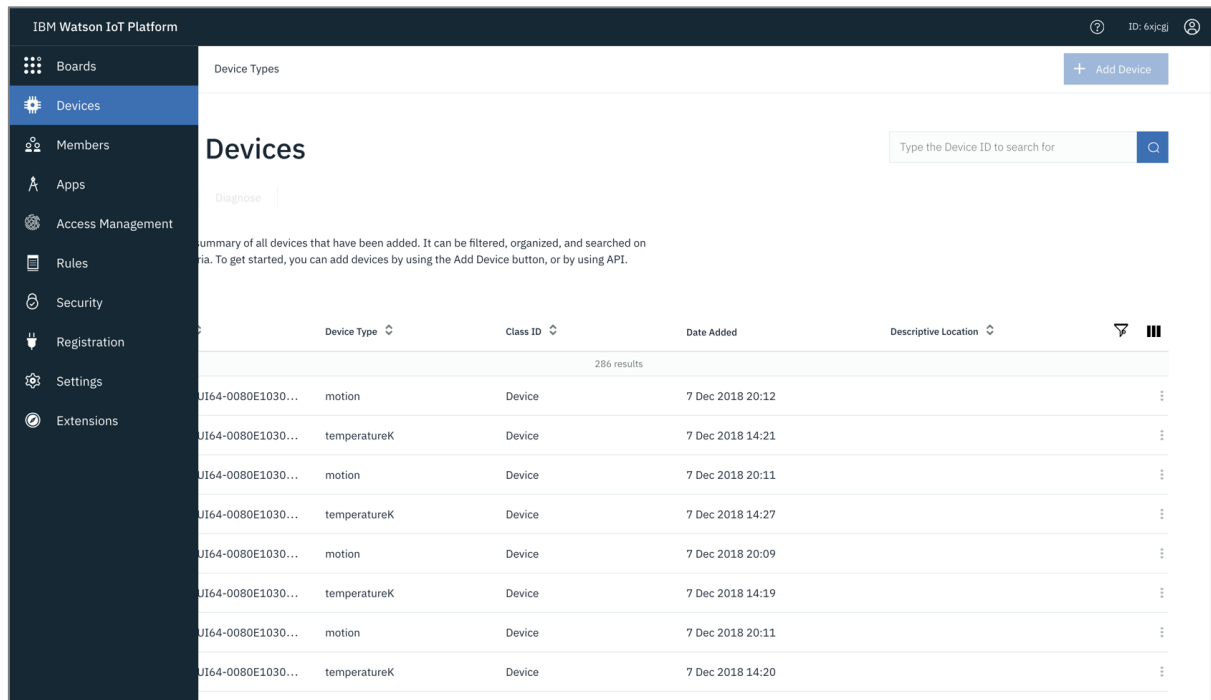


You have now successfully launched the Watson IoT Platform Service organization that we will use in this lab.

3.1 IoT Platform Navigation

IBM Watson IoT Platform Service provides a powerful web application for operators, administrators and developers with secure access to IoT devices and device data. In this section of the lab you will familiarize yourself with the IBM Watson IoT Platform Service user interface.

The navigation bar on the left-hand side provides access to the capabilities of the IoT platform service.



The IoT platform navigation sections are

- **Boards** – Opens the dashboard and shows the boards and cards
- **Devices** – Opens a browser for registered devices and their device types
- **Members** – User management
- **Apps** – API Key management
- **Access Management** – Roles and Permissions
- **Usage** – Metrics of usage
- **Rules** – Analytics rules and actions
- **Security** – Risk and Security Policies
- **Settings** – Administration settings. For example, client and server certificates.
- **Extensions** – Additional capabilities, optionally enabled

3.2 Exploring Device Types

Devices are things, like smart physical sensors and actuators, that connect to the IoT platform over internet. The Watson IoT Platform Service helps you define and manage your devices. Devices of the same type, brand, make or model are of a *Device Type*.

To view the Device Types registered in the IoT platform service

1. Move your mouse pointer to the left side navigation bar. The navigation bar slides out and shows the IoT platform capability sections.
2. In the navigation bar, choose **Devices**.

IBM Watson IoT Platform

Device Types

+ Add Device

Devices

Type the Device ID to search for

Summary of all devices that have been added. It can be filtered, organized, and searched on using different criteria. To get started, you can add devices by using the Add Device button, or by using API.

Device ID	Device Type	Class ID	Date Added	Descriptive Location
286 results				
809646_EUI64-0080E1030...	motion	Device	7 Dec 2018 20:12	
809646_EUI64-0080E1030...	temperatureK	Device	7 Dec 2018 14:21	
809646_EUI64-0080E1030...	motion	Device	7 Dec 2018 20:11	
809646_EUI64-0080E1030...	temperatureK	Device	7 Dec 2018 14:27	

3. The Devices page opens. This view shows all devices registered in this organization.

IBM Watson IoT Platform

Browse Action Device Types

+ Add Device

Browse Devices

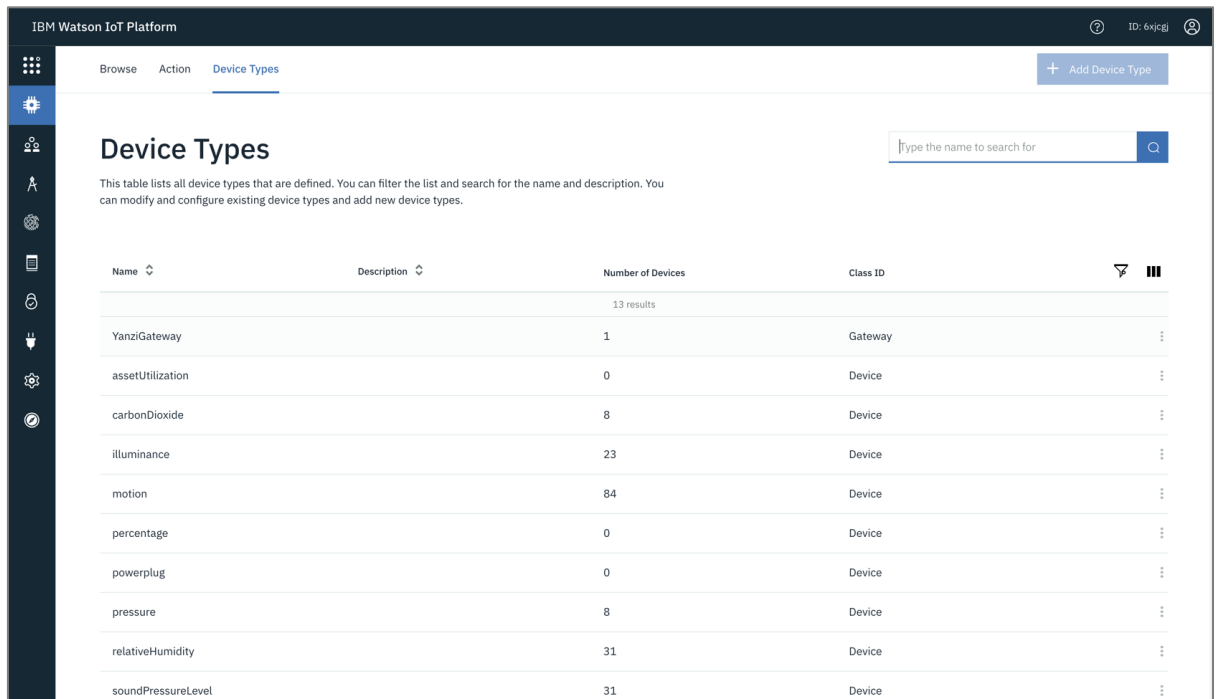
Type the Device ID to search for

All Devices

This table shows a summary of all devices that have been added. It can be filtered, organized, and searched on using different criteria. To get started, you can add devices by using the Add Device button, or by using API.

Device ID	Device Type	Class ID	Date Added	Descriptive Location
286 results				
809646_EUI64-0080E1030...	motion	Device	7 Dec 2018 20:12	
809646_EUI64-0080E1030...	temperatureK	Device	7 Dec 2018 14:21	
809646_EUI64-0080E1030...	motion	Device	7 Dec 2018 20:11	
809646_EUI64-0080E1030...	temperatureK	Device	7 Dec 2018 14:27	
809646_EUI64-0080E1030...	motion	Device	7 Dec 2018 20:09	
809646_EUI64-0080E1030...	temperatureK	Device	7 Dec 2018 14:19	
809646_EUI64-0080E1030...	motion	Device	7 Dec 2018 20:11	
809646_EUI64-0080E1030...	temperatureK	Device	7 Dec 2018 14:20	

4. On the Device page, choose the **Device Types** tab.
5. The Device Types page opens.
This page shows all device types registered in this organization.



Name	Description	Number of Devices	Class ID
13 results			
YanziGateway		1	Gateway
assetUtilization		0	Device
carbonDioxide		8	Device
illuminance		23	Device
motion		84	Device
percentage		0	Device
powerplug		0	Device
pressure		8	Device
relativeHumidity		31	Device
soundPressureLevel		31	Device

Note: The Device and Device Type pages provides a list of existing resources in the IoT Platform. Using the **+ Add Device Type** and **+ Add Device** buttons, new devices and types can be added to the IoT platform.

In this lab we will use the devices deployed at the IBM Munich IoT Center. There are several device types of devices. Viewing the device types page, we see a summary of the device types and the number of devices registered of each type, for example

- Carbon Dioxide sensors
- Air Pressure sensors
- Relative Humidity sensors
- Sound Pressure Level sensors
- Motion sensors
- Temperature sensors

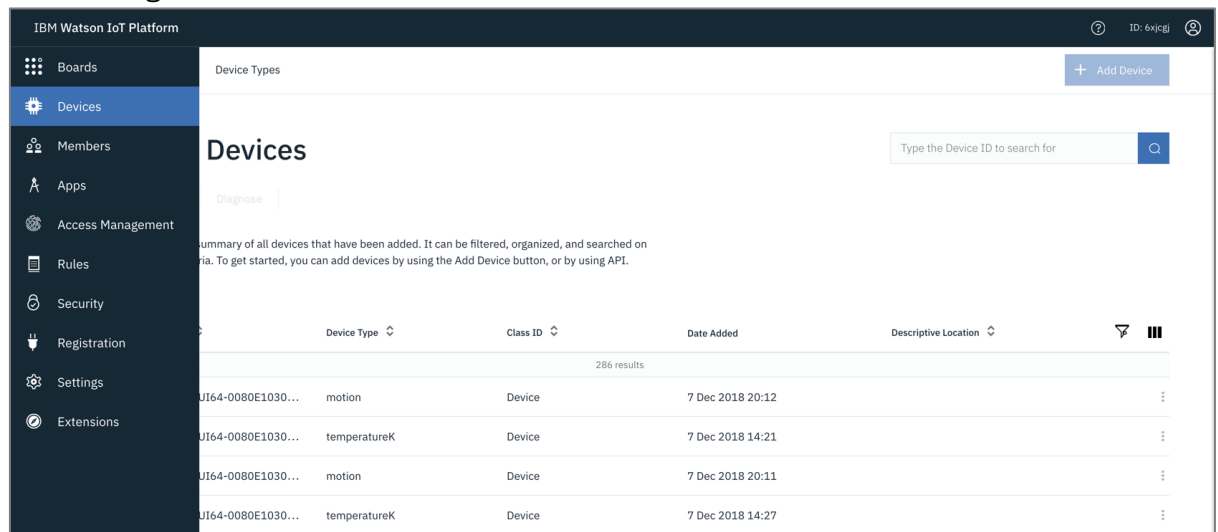
We will later in the section return to this page and explore more details on the data transformation performed by the IoT platform for these device types.

3.3 Exploring Devices

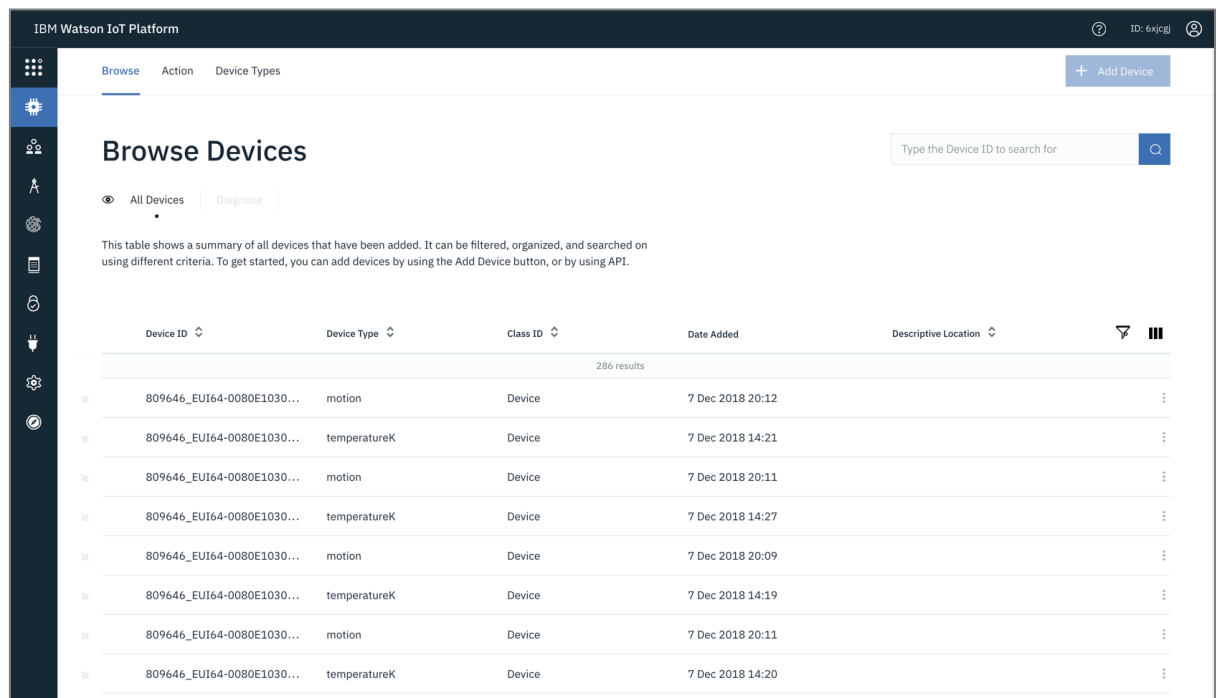
Devices are the physical sensors and actuators that connect to the IoT platform over internet. The Watson IoT Platform Service helps you define and manage your devices and ensures a secure connection for transferring data from the device to the cloud.

To view devices registered in the IoT platform organization


1. Move your mouse pointer to the left side navigation bar.
The navigation bar slides out and shows the IoT platform capability sections.
2. In the navigation bar, choose **Devices**.

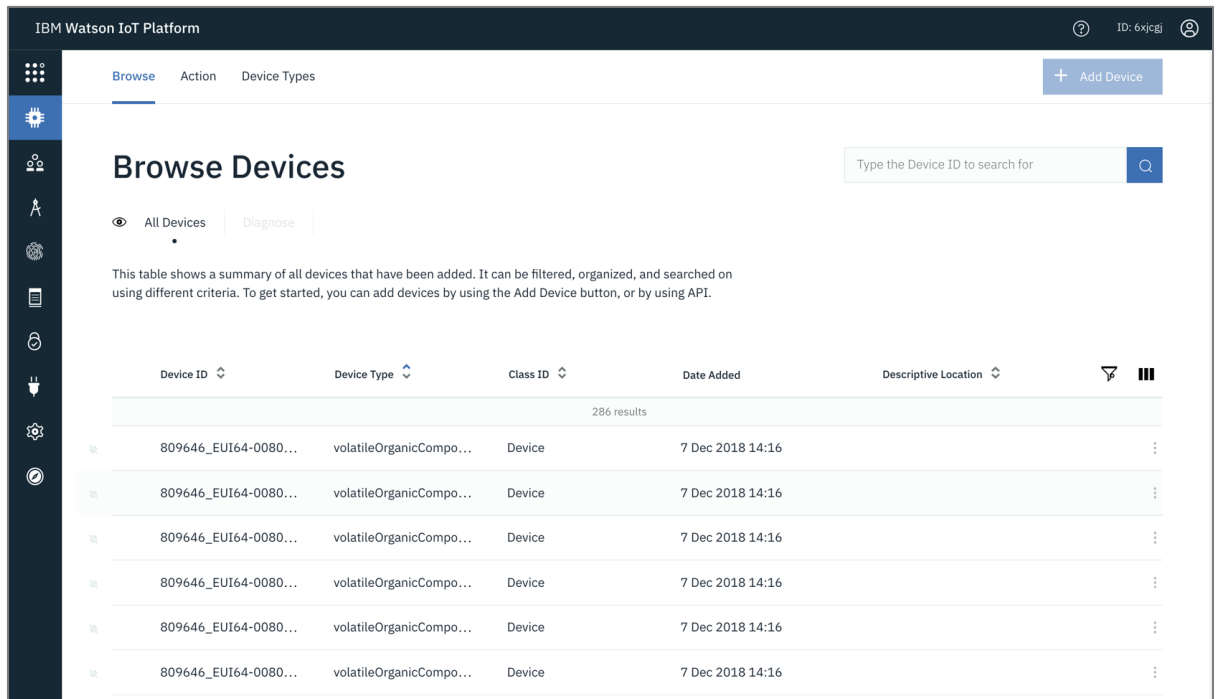


3. The Devices page opens. This view shows all devices registered in this organization.




4. The Devices are by default sorted by the Device ID column. Use the sort icon to sort the devices by any column.

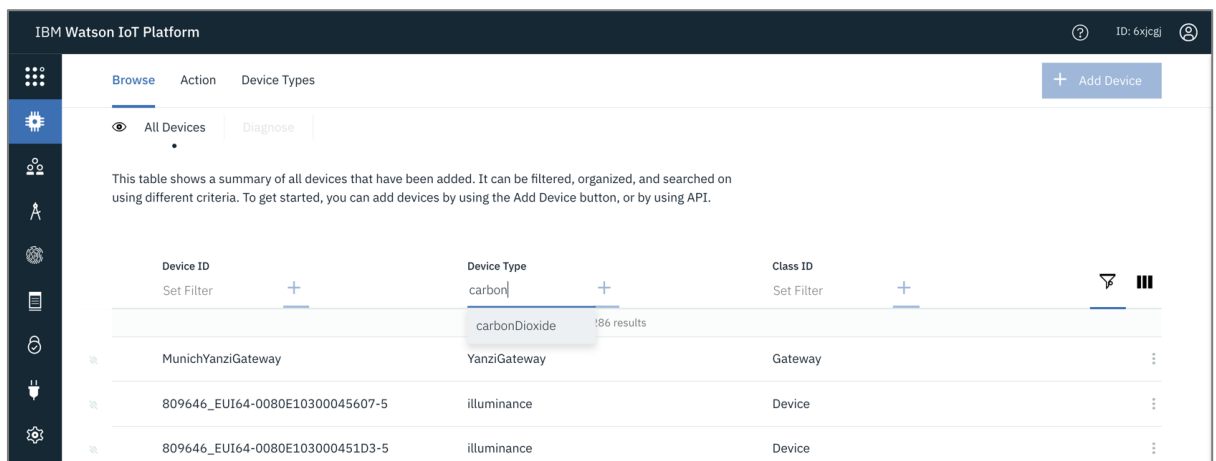
Click on the Device Type column sort icon  to sort devices by type.



Device ID	Device Type	Class ID	Date Added	Descriptive Location
286 results				
809646_EUI64-0080...	volatileOrganicCompo...	Device	7 Dec 2018 14:16	
809646_EUI64-0080...	volatileOrganicCompo...	Device	7 Dec 2018 14:16	
809646_EUI64-0080...	volatileOrganicCompo...	Device	7 Dec 2018 14:16	
809646_EUI64-0080...	volatileOrganicCompo...	Device	7 Dec 2018 14:16	
809646_EUI64-0080...	volatileOrganicCompo...	Device	7 Dec 2018 14:16	
809646_EUI64-0080...	volatileOrganicCompo...	Device	7 Dec 2018 14:16	

5. A filter may be applied to find a specific set of devices, for example of a single type or using a common name pattern.

Click on the filter icon , type “carbon” in the Device Type filter and select carbonDioxid in the auto-complete menu.



Device ID	Device Type	Class ID
186 results		
MunichYanziGateway	YanziGateway	Gateway
809646_EUI64-0080E10300045607-5	illumiance	Device
809646_EUI64-0080E103000451D3-5	illumiance	Device

6. The Device table applies the filter and only shows the carbonDioxide sensors.


The screenshot shows the 'Browse Devices' page in the IBM Watson IoT Platform. The 'Device Type' filter is set to 'carbonDioxide'. The table displays 9 results, all of which are carbon dioxide sensors located on various floors and zones of FLOOR 27.

Device ID	Device Type	Class ID	Date Added	Descriptive Location
809646_EUI64-0080E1030...	carbonDioxide	Device	7 Dec 2018 14:16	FLOOR 27, ZONE 3
809646_EUI64-0080E1030...	carbonDioxide	Device	7 Dec 2018 14:16	FLOOR 27, ZONE 4
809646_EUI64-0080E1030...	carbonDioxide	Device	7 Dec 2018 14:16	FLOOR 27, ZONE 8
809646_EUI64-0080E1030...	carbonDioxide	Device	7 Dec 2018 14:16	FLOOR 27, ZONE 10
809646_EUI64-0080E1030...	carbonDioxide	Device	7 Dec 2018 14:16	FLOOR 27, ZONE 16
809646_EUI64-0080E1030...	carbonDioxide	Device	7 Dec 2018 14:16	FLOOR 27, ZONE 17
809646_EUI64-0080E1030...	carbonDioxide	Device	7 Dec 2018 14:16	FLOOR 27, ZONE 18
809646_EUI64-0080E1030...	carbonDioxide	Device	7 Dec 2018 14:16	FLOOR 27, ZONE 11

7. To filter devices by floor or zone, apply the filter “zone 3” to the descriptive location column.

The screenshot shows the 'Browse Devices' page with the 'Descriptive Location' filter set to 'zone 3'. The table displays 13 results, including sensors for illuminance, sound pressure level, relative humidity, volatile organic compound, carbon dioxide, and pressure, all located in FLOOR 27, ZONE 3.

Device ID	Device Type	Class ID	Date Added	Descriptive Location
809646_EUI64-0080E1030...	illuminance	Device	7 Dec 2018 13:49	FLOOR 27, ZONE 3
809646_EUI64-0080E1030...	soundPressureLevel	Device	7 Dec 2018 14:06	FLOOR 27, ZONE 3
809646_EUI64-0080E1030...	soundPressureLevel	Device	7 Dec 2018 14:08	FLOOR 27, ZONE 3
809646_EUI64-0080E1030...	relativeHumidity	Device	7 Dec 2018 14:11	FLOOR 27, ZONE 3
809646_EUI64-0080E1030...	relativeHumidity	Device	7 Dec 2018 14:12	FLOOR 27, ZONE 3
809646_EUI64-0080E1030...	volatileOrganicCompound	Device	7 Dec 2018 14:16	FLOOR 27, ZONE 3
809646_EUI64-0080E1030...	carbonDioxide	Device	7 Dec 2018 14:16	FLOOR 27, ZONE 3
809646_EUI64-0080E1030...	pressure	Device	7 Dec 2018 14:17	FLOOR 27, ZONE 3

8. Click on the filter icon  to disable filtering.

The device table has a Search function that quickly finds matching devices by name.
To find a device, or a group of devices

1. Enter a search string into the quick search field.

Type a full device id, like “809646_EUI64-0080E10300045A93-3”, or just a part of the name, like “93-4”

2. The carbon dioxide sensor 809646_EUI64-0080E10300045A93-4 is found and shown in the list

IBM Watson IoT Platform

Browse Action Device Types

+ Add Device

Browse Devices

93-4

All Devices Diagnose

This table shows a summary of all devices that have been added. It can be filtered, organized, and searched on using different criteria. To get started, you can add devices by using the Add Device button, or by using API.

Device ID	Device Type	Class ID	Date Added	Descriptive Location
2 results				
809646_EUI64-0080E10300045A93-4	carbonDioxide	Device	7 Dec 2018 14:16	FLOOR 27, ZONE 3
809646_EUI64-0080E10300045A93-3	motion	Device	13 Dec 2018 11:03	FLOOR 27, ZONE 3

3.4 Exploring Events

Events is the mechanism by which devices publish data at a regular heartbeat to the Watson IoT Platform. The frequency is decided by the device, for example every second, every minute, every hour, or once a day. The device controls the content, or *payload*, of the event. Similar events are defined as an *Event Type*. and the payload data structure of the event type is defined by a schema. Events can be published in different formats, for example, JSON, string, binary, and more. By default, the Watson IoT Platform expects events in JSON format specified by a JSON schema.

To view events sent by a device

1. Choose a device in the device table, for example the temperature sensor 809646_EUI64-0080E10300045A93-3. (ID 3 in Zone 3)

Clicking on the device row in the table will show more details on the device

IBM Watson IoT Platform

Browse Action Device Types

+ Add Device

809646_EUI64-0080E10300045A93-3

All Devices Diagnose

This table shows a summary of all devices that have been added. It can be filtered, organized, and searched on using different criteria. To get started, you can add devices by using the Add Device button, or by using API.

Device ID	Device Type	Class ID	Date Added	Descriptive Location
2 results				
809646_EUI64-0080E1030...	relativeHumidity	Device	7 Dec 2018 14:12	FLOOR 27, ZONE 3
809646_EUI64-0080E1030...	temperatureK	Device	7 Dec 2018 14:22	FLOOR 27, ZONE 3

Identity Device Information Recent Events State

Device ID 809646_EUI64-0080E10300045A93-3

Device Type temperatureK

Date Added 7 Dec 2018 14:22

Added By a-6xjcgj-au4dtzk2lk

Connection Status Disconnected

2. Choose the **Recent Events** tab

IBM Watson IoT Platform

Browse Action Device Types

+ Add Device

Device ID	Device Type	Class ID	Date Added	Descriptive Location
2 results				
809646_EUI64-0080E1030...	relativeHumidity	Device	7 Dec 2018 14:12	FLOOR 27, ZONE 3
809646_EUI64-0080E1030...	temperatureK	Device	7 Dec 2018 14:22	FLOOR 27, ZONE 3

Identity Device Information **Recent Events** State

Showing Raw Data | The recent events listed show the live stream of data that is coming and going from this device.

Event	Value	Format	Last Received
Waiting for device events...			

Note: The screen does not at first show any events. Wait a minute for the next event sent from the device to show.

3. Newly received events from the device are shown in the recent events list.

IBM Watson IoT Platform

Browse Action Device Types

+ Add Device

Device ID	Device Type	Class ID	Date Added	Descriptive Location
2 results				
809646_EUI64-0080E1030...	relativeHumidity	Device	7 Dec 2018 14:12	FLOOR 27, ZONE 3
809646_EUI64-0080E1030...	temperatureK	Device	7 Dec 2018 14:22	FLOOR 27, ZONE 3

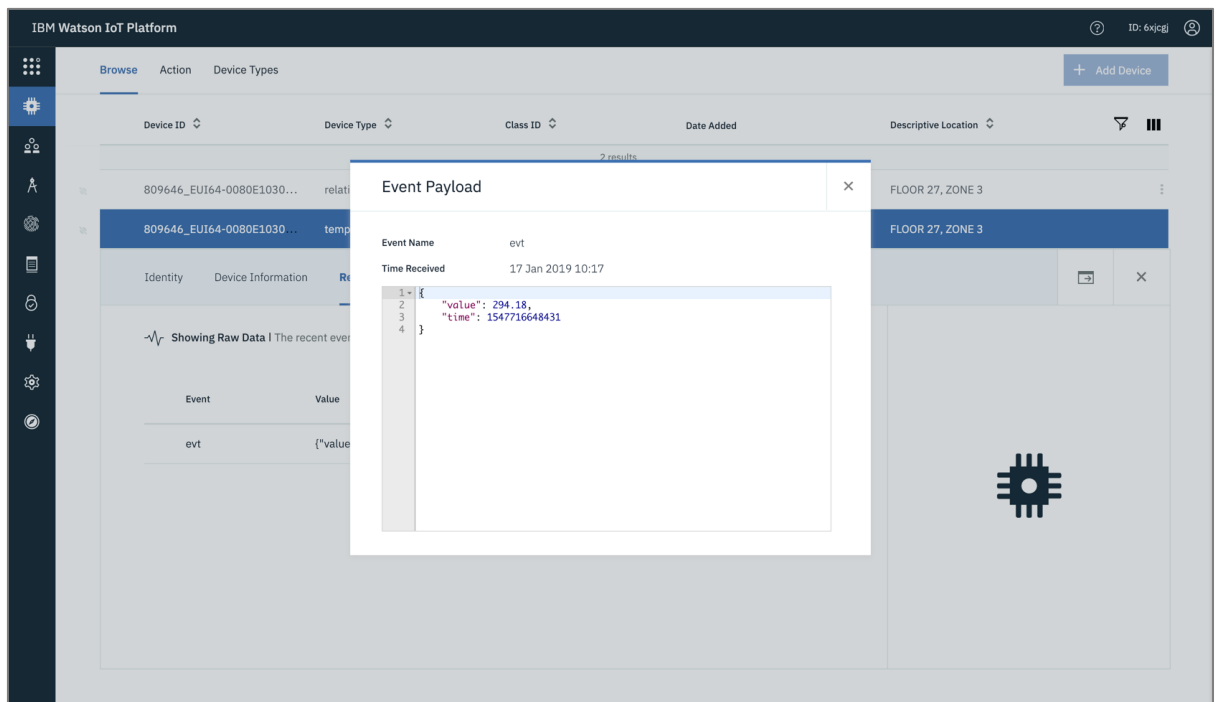
Identity Device Information **Recent Events** State

Showing Raw Data | The recent events listed show the live stream of data that is coming and going from this device.

Event	Value	Format	Last Received
evt	{"value":294.18,"time":1547716648431}	json	a few seconds ago

4. Click on an event in the recent event list to view the event payload.

The JSON payload is shown with Value and Time data.



Note: The data payload from a temperatureK sensor has a *Value* element that contains the temperature level expressed in Kelvin degrees. The Kelvin temperature scale uses the absolute zero (0 K) as is equivalent to -273.15°C or -459.67°F . The *Time* element is the time-stamp when the value sample was taken.

3.5 Exploring Device State

The Watson IoT Platform provides transformation and normalization event data into a single logical view called *device state*. This feature greatly simplifies application development as applications can rely on a common interface abstraction and be independent of device event type schema variations across devices of different versions, variants and brands.

To view the device state of a temperature sensor

1. Choose a device in the device table, for example the previously explored temperature sensor 809646_EUI64-0080E10300045A93-3.
2. Choose the **State** tab.

The current state of the selected temperature sensor is shown.

The screenshot shows the IBM Watson IoT Platform interface. At the top, there's a navigation bar with 'Browse', 'Action', and 'Device Types' tabs. Below this is a table listing devices. The table has columns for Device ID, Device Type, Class ID, Date Added, and Descriptive Location. Two results are shown:

Device ID	Device Type	Class ID	Date Added	Descriptive Location
809646_EUI64-0080E1030...	relativeHumidity	Device	7 Dec 2018 14:12	FLOOR 27, ZONE 3
809646_EUI64-0080E1030...	temperatureK	Device	7 Dec 2018 14:22	FLOOR 27, ZONE 3

Below the table, there's a detailed view of the selected device's state. It includes tabs for Identity, Device Information, Recent Events, and State. The State tab is active, showing a table of data items:

Property	Value	Type	Event	Last Received
value	294.18	Number	evt	a few seconds ago
time	1547716766350	Number	evt	a few seconds ago

Note: By default, the Raw Data interface is shown. Note that these are the data items delivered in the device event. Also note the Last Received property that indicated the time period since this event was received.

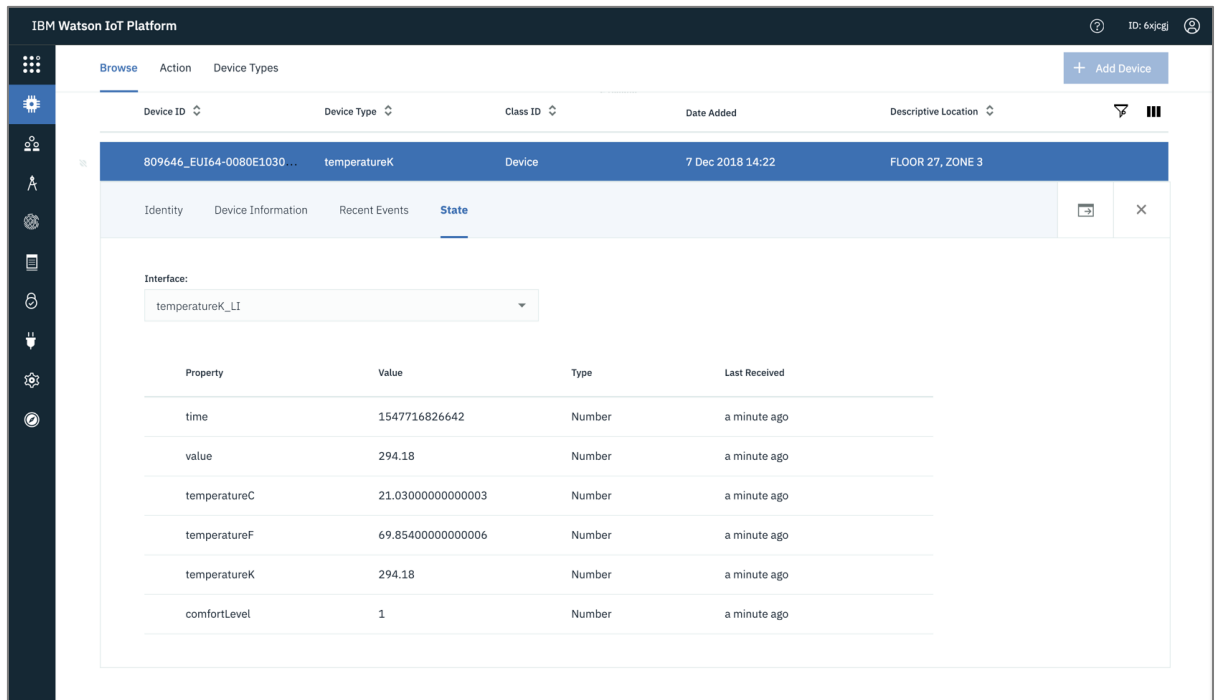
- From the Interface drop down, choose the **TemperatureK_LI** interface.

The screenshot shows the same detailed view of the device's state, but with the 'Interface' dropdown menu open. The dropdown menu lists 'Raw Data' and 'temperatureK_LI'. The 'temperatureK_LI' interface is selected, and the table below it shows normalized data:

Property	Value	Type	Event	Last Received
value	294.18	Number	evt	a few seconds ago
time	1547716766350	Number	evt	a few seconds ago

The table now shows a normalized of the temperature sensor, including the raw event data items, value and time, and the temperature transformed to Celsius, Fahrenheit and Kelvin temperatures. The interface also concludes a comfort level value. We will return to the analysis of comfort levels in an later section.

These data transformations are defined on the Device Type and apply to all devices of the type.



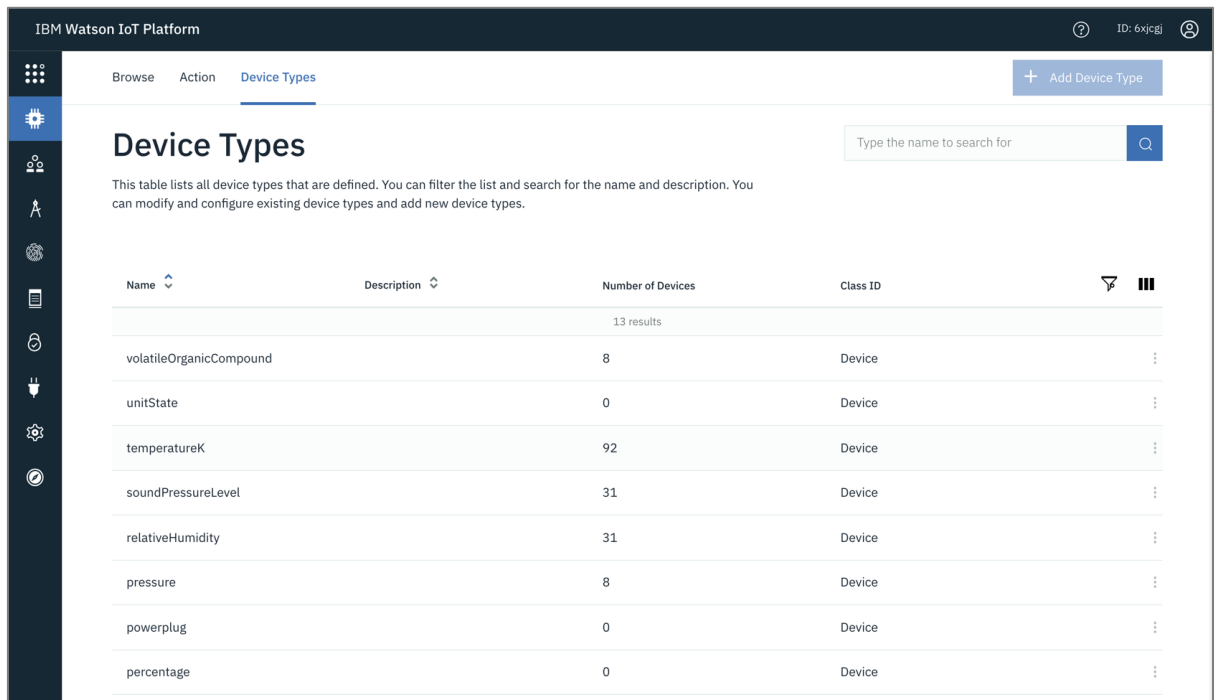
By using an interface, devices of a type may provide a common abstraction with defined data names and values. An application can trust that any temperature sensor type will provide a Celsius, Fahrenheit and Kelvin temperature regardless of its event types and payload data structures.

4. Select devices of other types to explore their data items, JONN payload structures and interface definitions. For example,
 - The **motion** device type that defines isOccupied and lastOccupied properties for workspace occupancy.
 - The **soundPressureLevel**, **relativeHumidity** and **carbonDioxide** device types that each defines a comfortLevel property based on sensor values and regulated office comfort levels.

3.6 Exploring Interfaces

To view *device types* registered in the IoT platform service

1. In the navigation bar, choose **Devices**.
2. On the Devices section, choose the **Device Type** tab



IBM Watson IoT Platform

Browse Action **Device Types** + Add Device Type

Device Types

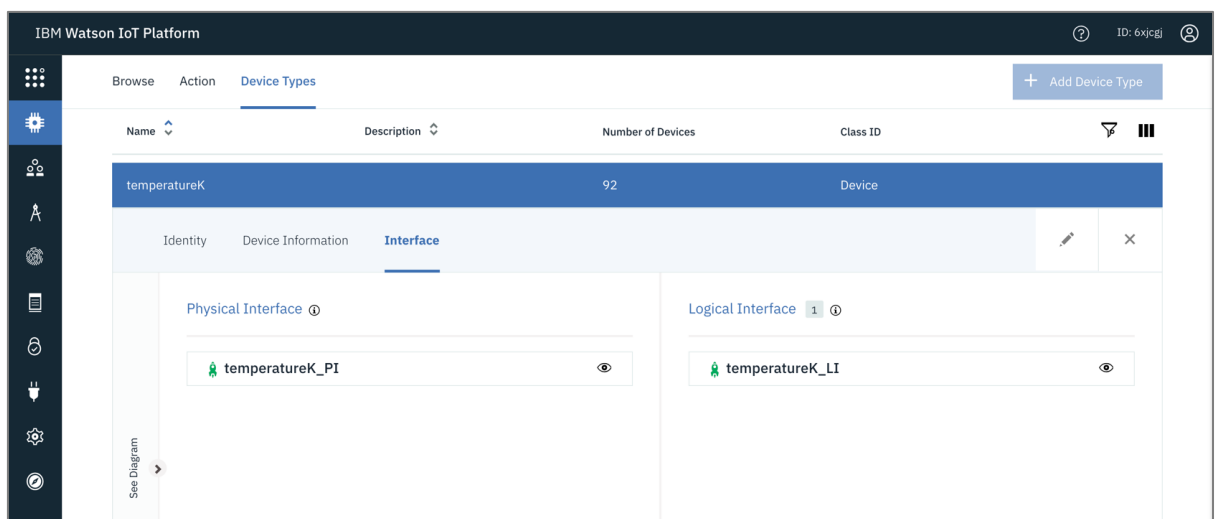
Type the name to search for

This table lists all device types that are defined. You can filter the list and search for the name and description. You can modify and configure existing device types and add new device types.

Name	Description	Number of Devices	Class ID
13 results			
volatileOrganicCompound		8	Device
unitState		0	Device
temperatureK		92	Device
soundPressureLevel		31	Device
relativeHumidity		31	Device
pressure		8	Device
powerplug		0	Device
percentage		0	Device

3. In the Device Type list, select the “temperatureK” device type.
4. Select the **Interface** tab.

The interface tab shows the interfaces defined for the type.



IBM Watson IoT Platform

Browse Action **Device Types** + Add Device Type

temperatureK 92 Device

Identity Device Information **Interface**

Physical Interface 1


temperatureK_PI

Logical Interface 1

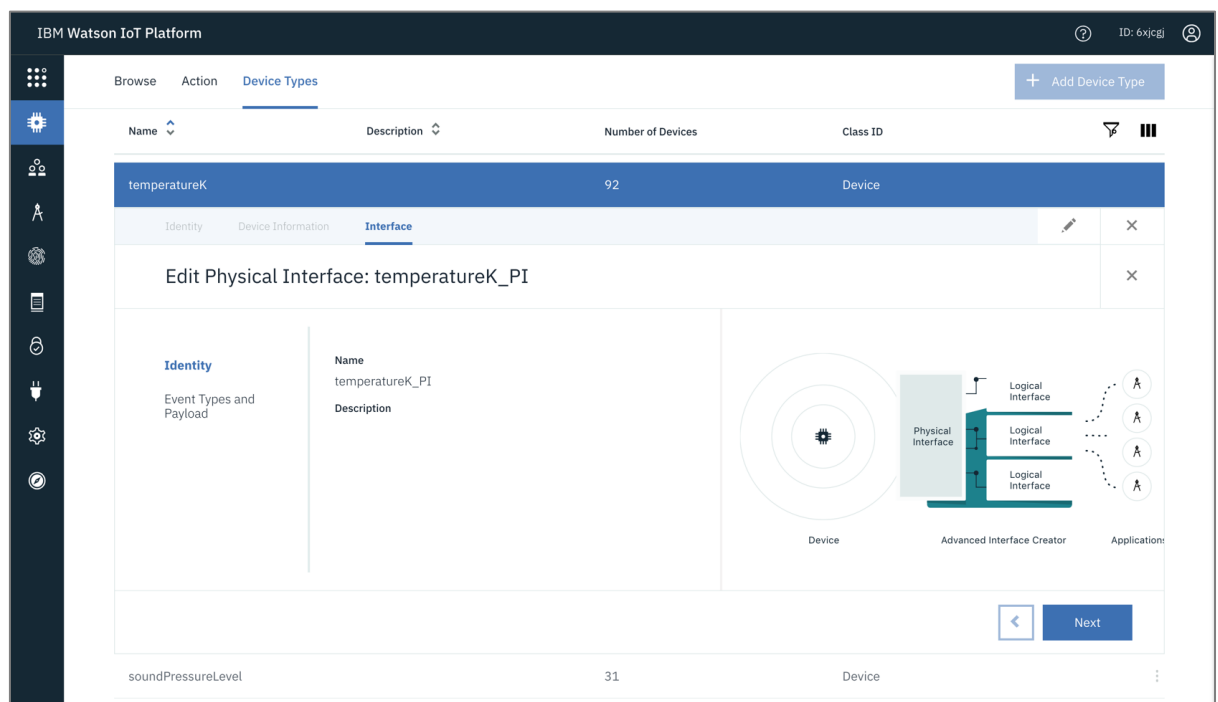
temperatureK_LI

The Watson IoT Platform uses two types of interfaces for filtering, normalizing, transforming and abstracting event data into a device state.

- temperature_PI – *Physical Interface* – A physical interface represents the event types that a device of a particular device type can send. Events types not included in the physical interface will be filtered and discarded by the IoT platform
- temperatureK_LI – A *Logical Interface* represents the state of a device. It's a canonical view which can be shared across multiple device types.
- A device type also provides *mapping expressions* that computes the state in the logical interface from received events declared in the physical interface.

5. Click on the view icon  to explore the temperature_PI physical interface.

The physical interface editor opens on the Identity page



6. Click **Next**. The Event Types and Payload page opens.

7. In the Event Types list, expand the **evt** event type to view its event properties

IBM Watson IoT Platform

Browse Action Device Types

+ Add Device Type

Name Description Number of Devices Class ID

temperatureK 92 Device

Identity Device Information Interface

Edit Physical Interface: temperatureK_PI

You can use properties to define the interface behavior and the format of the data that is presented on devices.

Define the Physical Interface

Event Type	Event ID	Format
evt	evt	application/json
Property	Data Type	Required
value	Number	No
time	Number	No

Note: The evt event type with the value and time properties are the event that we explored in the previous sections of this lab.

8. Click **Done** to close the physical interface editor and return to the Interface tab.

9. Click on the view icon  to explore the temperature_LI logical interface

The logical interface editor opens with the Identity page.

IBM Watson IoT Platform

Browse Action Device Types

+ Add Device Type

Name Description Number of Devices Class ID

temperatureK 92 Device

Identity Device Information Interface

Edit Logical Interface: temperatureK_LI

Identity

State Model

Notification Preference

ID
5c0ac786acf90e002b4693cd

Name
temperatureK_LI

Description

Device

Advanced Interface Creator

Application

Physical Interface

Logical Interface

Logical Interface

Logical Interface


Next

10. Click **Next**. The State Model page opens.

The screenshot shows the IBM Watson IoT Platform interface. The top navigation bar includes 'Browse', 'Action', and 'Device Types'. A sidebar on the left contains various icons. The main content area is titled 'Edit Logical Interface: temperatureK_LI'. It features a table with columns: 'Property', 'Mapped Payloads', and 'Data Type'. The table lists five properties: 'value', 'time', 'temperatureK', 'temperatureC', and 'temperatureF'. Each property has a corresponding mapped payload and data type (all are 'Number'). A 'View' icon (eye) is visible next to each row. The 'temperatureK' row is highlighted.

Property	Mapped Payloads	Data Type
value	value [evt]	Number
time	time [evt]	Number
temperatureK	value [evt]	Number
temperatureC	value - 273.15	Number
temperatureF	value - 273.15) * 9 ÷ 5 + 32	Number

Note: The properties in the list corresponds to the state properties we previously explored in the temperatureK device state.

11. Click on the view icon  on the temperatureK row to explore the expression computing the Kelvin temperature value.

The screenshot shows the 'View Property' dialog box open over the 'temperatureK' row of the table. The dialog displays the property name 'temperatureK' and type 'number'. It also shows the 'Mapping' section with the event type 'evt' and the expression 'value'. The 'Advanced Editor' is disabled. The 'Close' button is at the bottom right. The background shows the same table as the previous screenshot, with the 'temperatureK' row highlighted.

View Property

Name: temperatureK
Type: number

Advanced: ☐

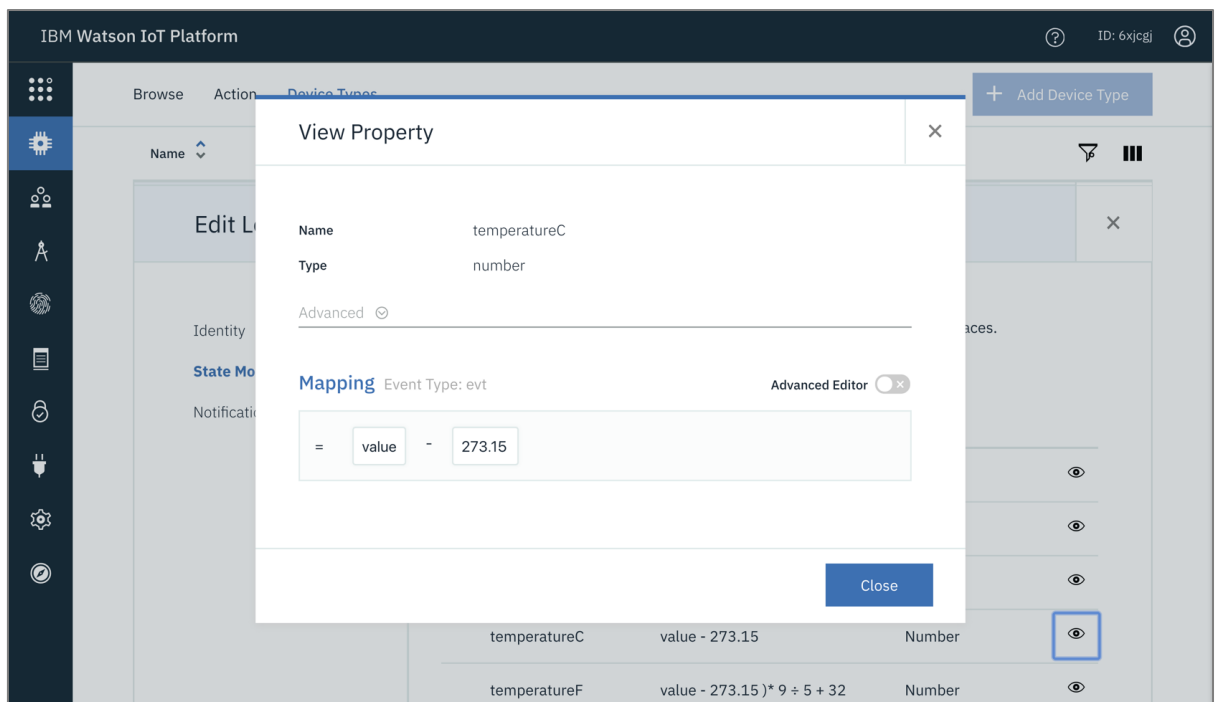
Mapping: Event Type: evt
= value

Advanced Editor: ☐

Close

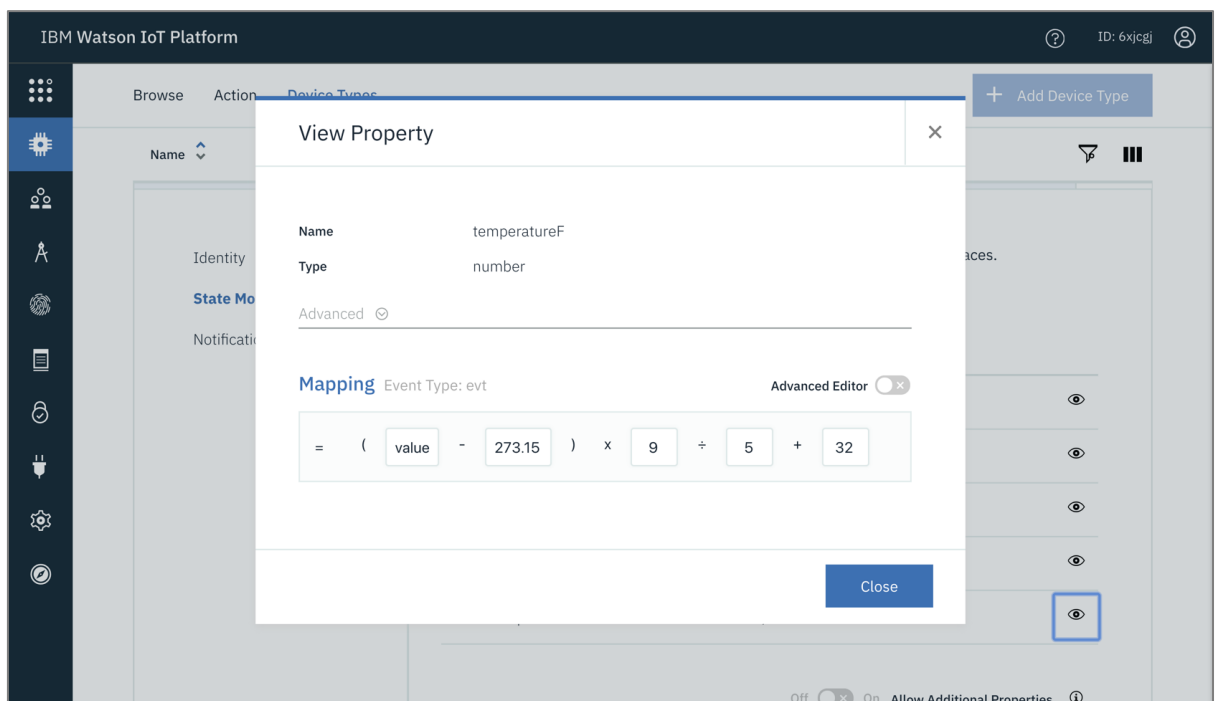
Note: The temperatureK expression is just returning the value property from the evt event.

12. Close the dialog and view the expression for temperatureC.



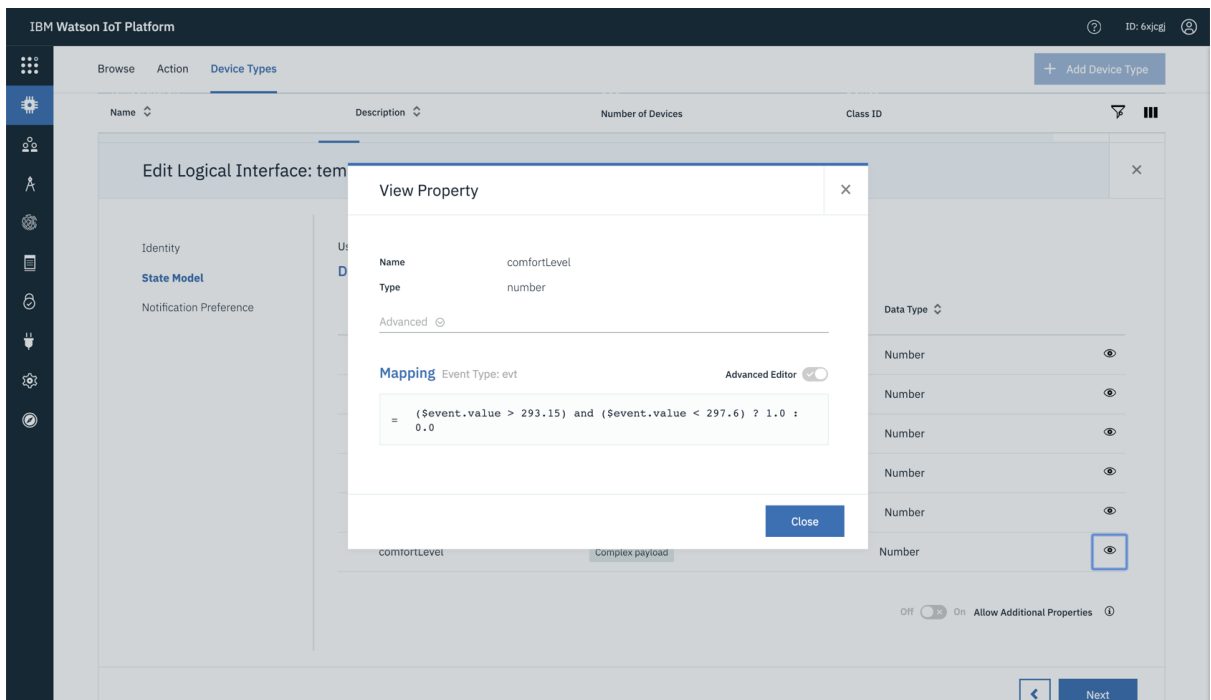
Note: The temperatureC expression is computing the Celsius temperature by subtracting -273.15 from the Kelvin value.

13. Close the dialog and view the expression for temperatureF.



Note: The temperatureF expression is computing the Fahrenheit temperature by subtracting -273.15, multiplying by 9/5 and adding 32 to the Kelvin value.

14. Close the dialog and view the expression for comfortLevel.



Note: The comfortLevel is a conditional expression that return a 100% comfort if the Kelvin temperature is within the 293.15 to 297.6 range (68-76 degrees Fahrenheit). The function will return 1.0 (100%) if the temperature is comfortable, 0.0 (0%) if the temperature is uncomfortable. We will in a later section see how analytics are applied to such comfort levels.

3.7 Exploring Other Device Types

We have now explored the Device Types and Devices views in Watson IoT Platform Service and learned how to view, filter and search @scale across connected devices. We explored the event data from the temperature devices and the transformations performed by the Watson IoT Platform using interfaces and mapping expressions.

Before completing this section of the lab, you can proceed and explore some of the other devices and device types connected to the IoT platform.

For example

- Carbon Dioxide sensors that measures the concentration of CO₂ in PPM (parts per million)
- Pressure sensors that measure the air pressure in Pa (Pasqual)
- Relative Humidity sensors that measure the humidity in %
- Sound Pressure Level sensors that measure the noise level in mBA (milli Bell A-rated)
- Motion sensors that measure movement and provide a value for timeLastMotion

Explore the logical interfaces for the device types, for example,

- The **motion** device type that defines `isOccupied` and `lastOccupied` properties for workspace occupancy.
- The **soundPressureLevel**, **relativeHumidity** and **carbonDioxide** device types that each defines a `comfortLevel` property based on sensor values and regulated office comfort levels.

You have now completed the exploration of the Watson IoT Platform Service.

4 Exploring the Watson IoT Platform Connection Service

The Watson IoT Platform includes a powerful set of tools to leverage the data that you ingested from your devices. By using the Watson IoT Platform Connection Service and Analytics Service, you can run analytics in real time as data is available and stored in Db2® Warehouse on Cloud. The Watson IoT Platform Analytics is an optional, built-in analytics tool that we will explore in the next section of this lab.

The connection service, in Watson IoT Platform includes

- **Watson IoT Platform Service** (explored in the previous section of this lab)
- **Event Streams.** The Event Streams service is a high-performance messaging service that lets your applications receive device messaging from Watson IoT Platform Service close to real time. The Event Streams service is used to consume IoT device data in time-critical applications such as real-time analytics and live data dashboards.
- **Db2 Warehouse on Cloud.** The Db2 Warehouse data component provides intermediate length storage of IoT data. Db2 Warehouse on Cloud also includes a set of powerful tools to analyze that data. Db2 Warehouse on Cloud also makes up the data lake which is used as input for the analytics service. Watson IoT Platform Analytics writes function output to the data lake.
- **Cloudant NoSQL DB** - The Cloudant NoSQL DB stores the entire IoT data set in one database for all connected device types. The Cloudant NoSQL DB API can be used to extract the IoT data needed, or for integrations with IoT business applications.
- **Cloud Object Storage.** The Object Storage stores the entire Watson IoT Platform IoT data set in day-sized JSON objects for all connected device types.

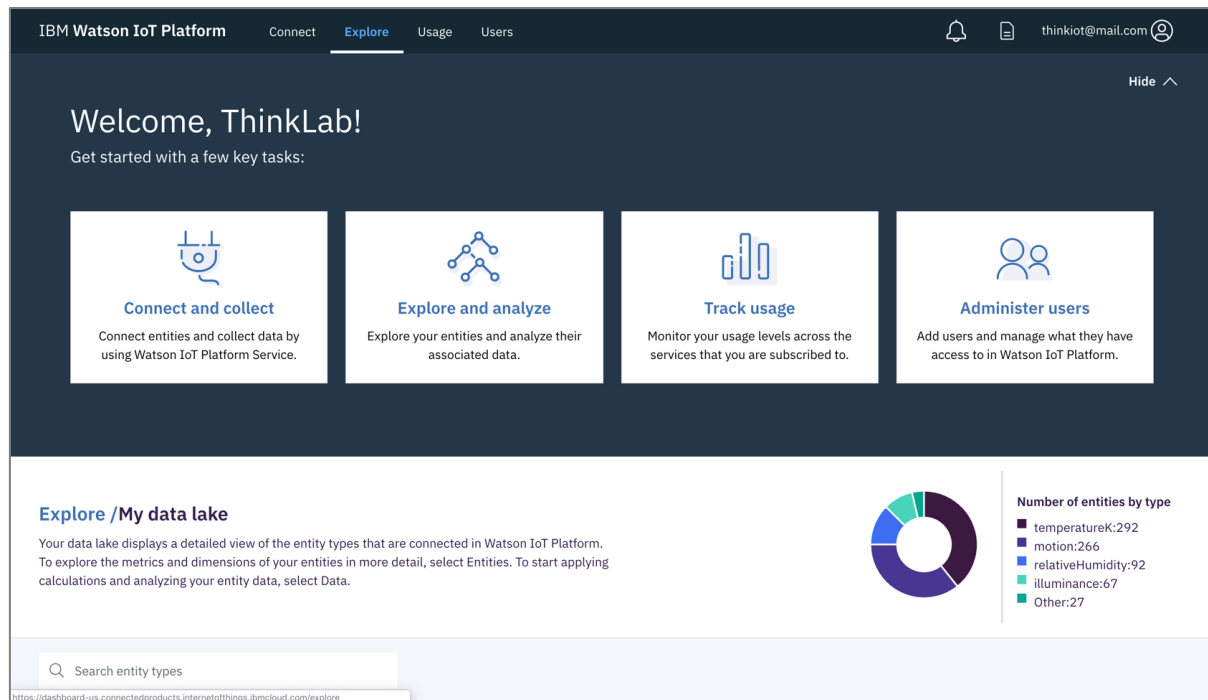
All services in Watson IoT Platform are provisioned and pre-configured in a Watson IoT Platform *tenant*. In the previous section of this lab we logged into **Think-2019** tenant of the Watson IoT Platform. The tenant name is also shown in the top-right corner of the Watson IoT Platform dashboard.

We will now explore the device data streaming from the Watson IoT Platform service, through the Event Streams service, into the data lake in Db2 Warehouse.

4.1 Exploring Entity Type Data

Return to the web browser tab with the Watson IoT Platform.

Alternatively, repeat the steps in the previous section to log into the platform using the tenant URL <http://ibm.biz/thinkiotplatform>, or the full tenant URL <https://dashboard-us.connectedproducts.internetofthings.ibmcloud.com/preauth?tenantid=Think-2019>



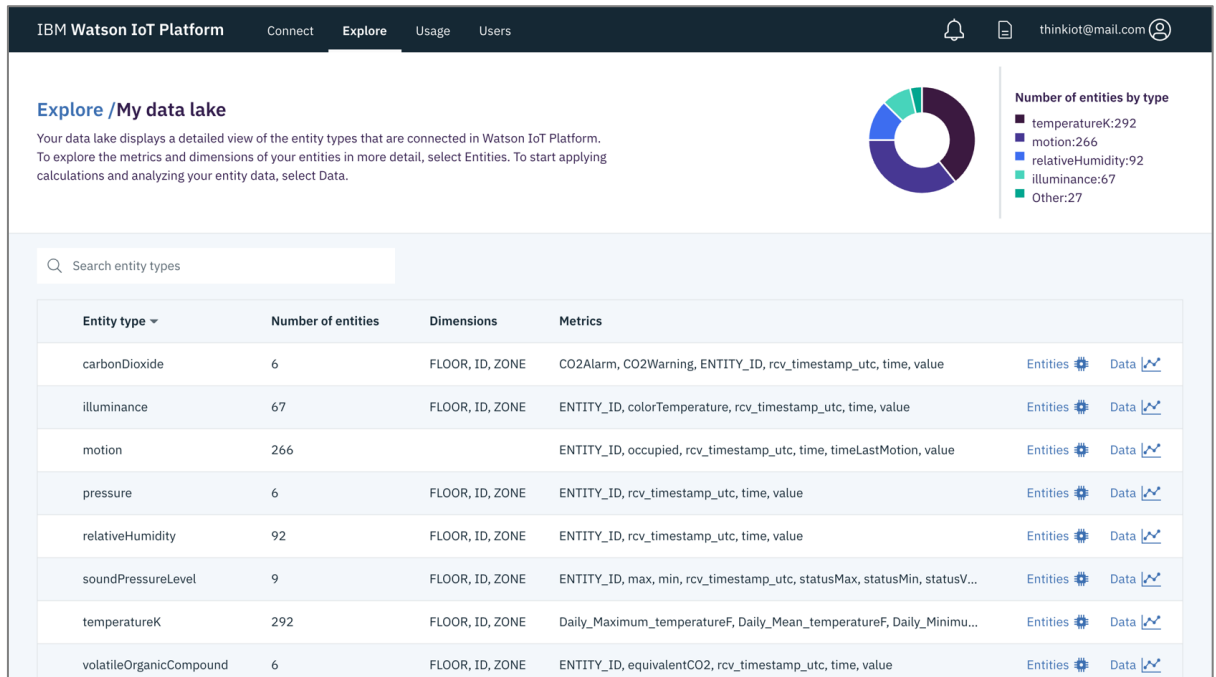
Entities are the digital representation of items in your IoT solution that either produce data, or that you would like to track by using data. In typical cases, like in this lab, Entities are the devices registered in the Watson IoT Platform Service.

The Data Lake in the Connection Service is organized around Entities and their time-series data from corresponding devices. Each entity takes its name from the corresponding Device. An Entity is of an *Entity Type*, corresponding to the Device Type.

Entities can be monitored by *metrics*, such as temperature, humidity, weight, or load. These metrics can be calculated to produce new and useful data. Entities can also have additional data attributed to them as dimensions.

To view the Entities Types in the Watson IoT Platform Data Lake

1. Choose the **Explore** tab on the Watson IoT Platform banner.



Note: The list shows the Entity Types, the number of Entities of each type and the metrics in the data lake of each type.

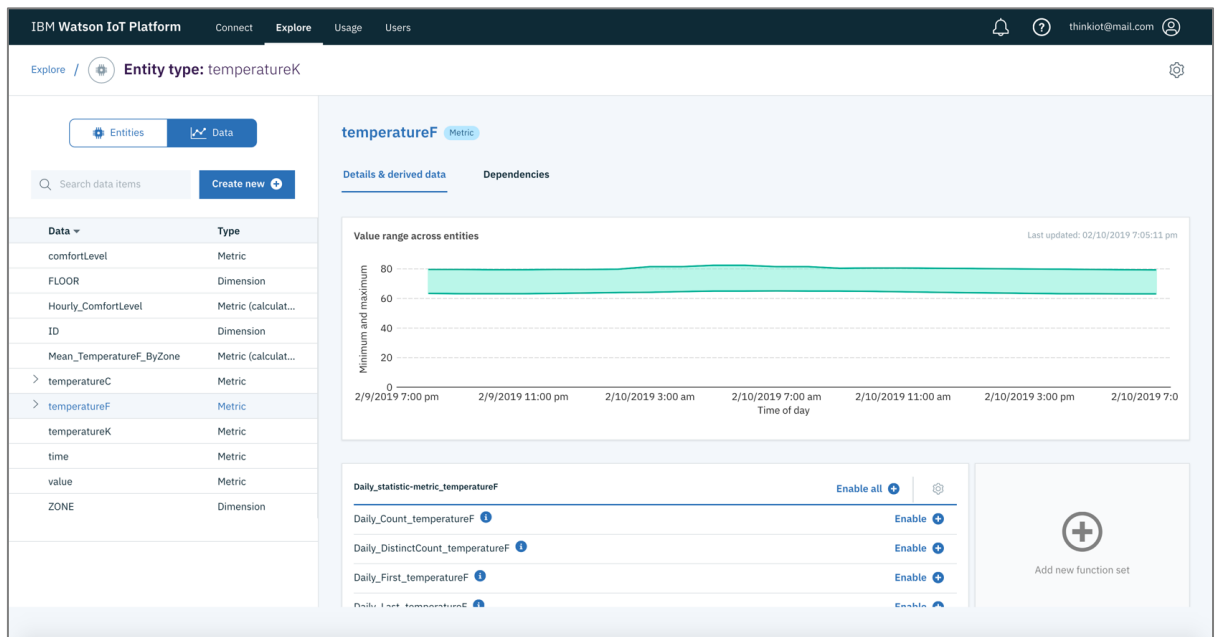
Metrics are data items derived from the properties of the Logical Interface and hence the device state. The state properties of a device are expected to vary, as will the metric values on an entity.

Dimensions are typically static values that do not change over time. For example, a dimension might be the equipment's manufacturer, location, or an associated customer. Some dimensions are subject to change, for example, the operator of a piece of equipment can vary from one day to the next. In this lab we will use dimensions to holds metadata like ID, Floor and Zone for the sensors in the IoT Center in Munich.

Each entity type row provides two navigation buttons at the right-hand side of the table.

- The **Entity** button opens a page with all entities of a type and their metrics.
- The **Data** button opens a page with an overview of statistics on all entities of the type

2. In the list of Entity Types, locate the **temperatureK** entity type, and click on **Data**.
The entity type data page opens. Wait for the data to be loaded.



Note: The left-hand side navigator provides an overview of the available metrics on the entity type. Note that these are the property names we recognize from the temperatureK_LI interface with Time, Value, Celsius, Fahrenheit and Kelvin state properties.

3. In the left-hand side **Data** explorer, click on the **temperatureF** property.
The graph loads the Fahrenheit temperature time-series values with upper and lower value bounds.

Note: In the graph above we see that the upper bound of temperature values are varying and that the max temperatures are slightly higher at office days as compared to weekends. Mouse over the graph to see data values.

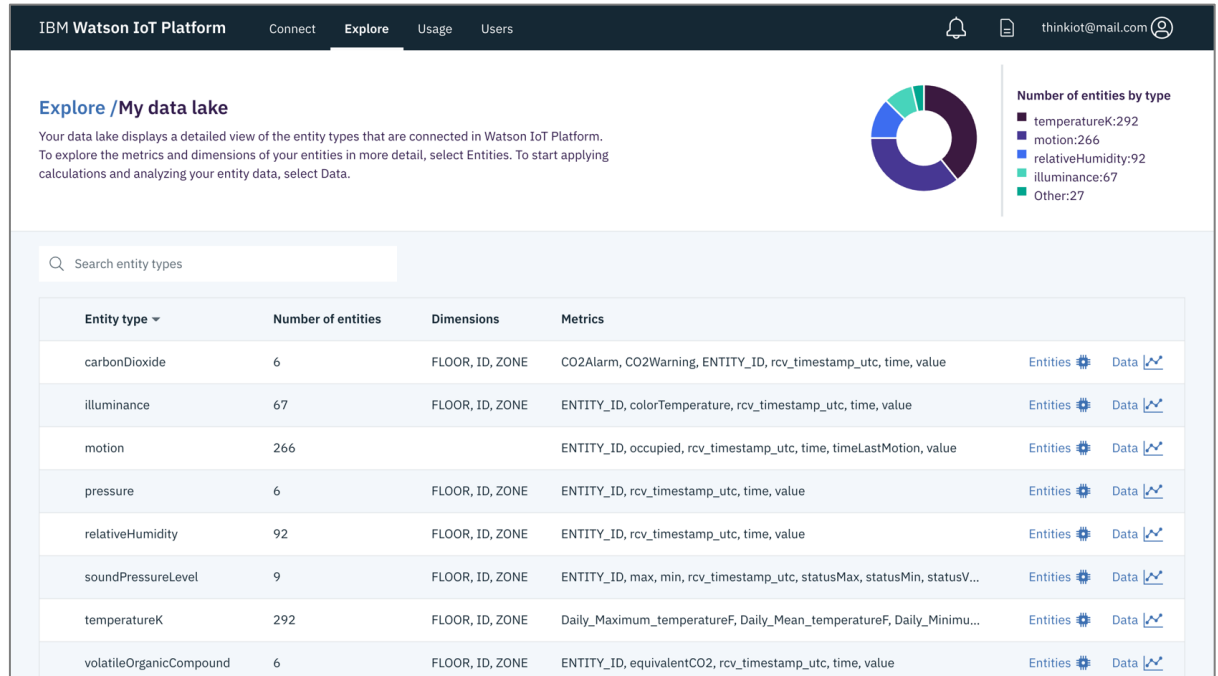
7. Click on the **temperatureC** property.
The graph updates with Celsius temperature values.

Note: The data values are the time-series data of the temperature values calculated in the temperatureK_LI interface that we explored in section 3.5 Exploring Device State above.

4.2 Exploring Entity Data

To view the Entities Types in the Watson IoT Platform Data Lake

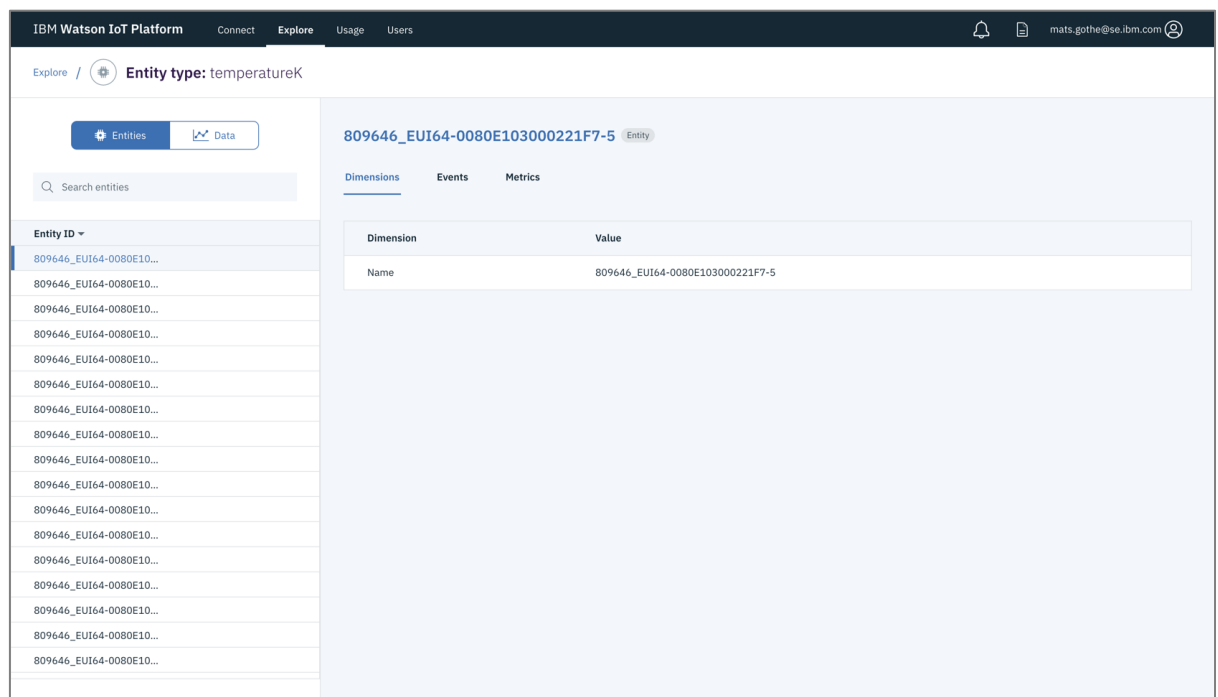
1. Choose the **Explore** tab on the Watson IoT Platform banner.



2. In the list of Entity Types, locate the **temperatureK** entity type, and click on the **Entities** button.

Alternatively, click on the **Entities** tab on the Data page open from the previous section in this lab.

The Entity page opens showing the list of temperatureK Entities



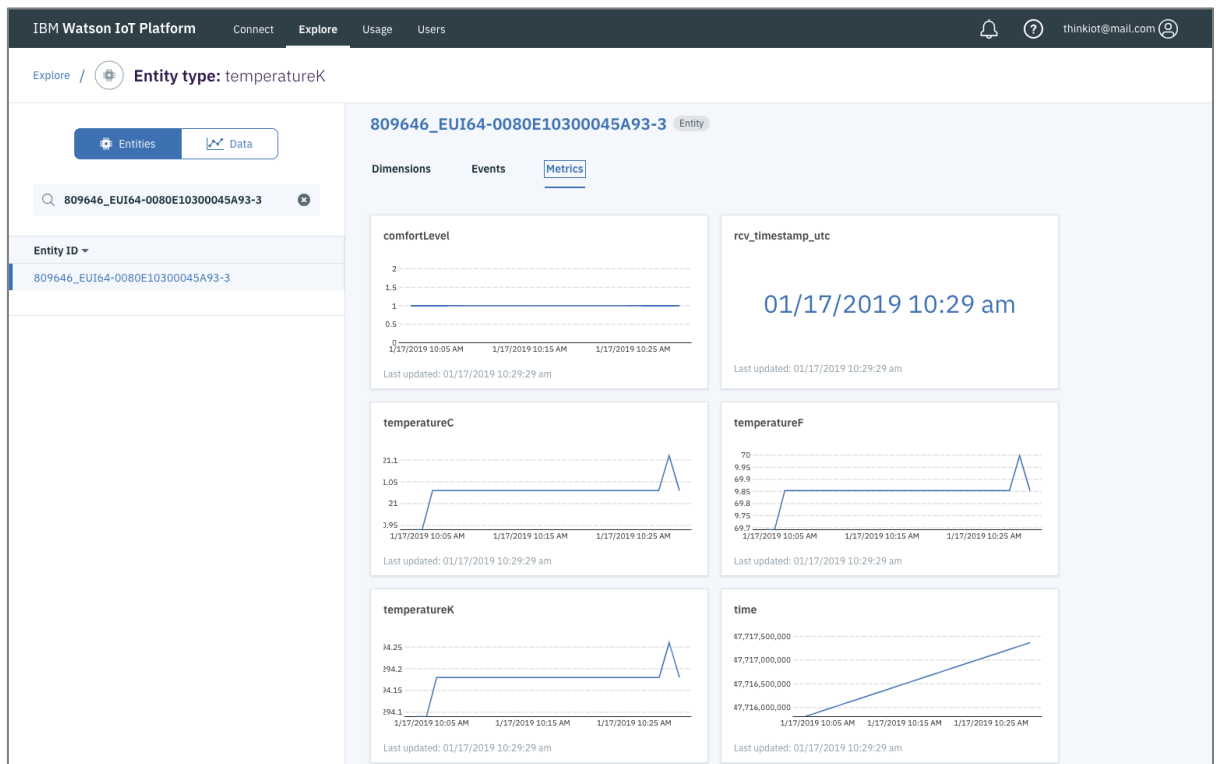
- Search for entity “809646_EUI64-0080E10300045A93-3”, or just “93-3” in the list. This is the temperature sensor in zone 3, floor 27.

The screenshot shows the IBM Watson IoT Platform interface. The top navigation bar includes 'Connect', 'Explore', 'Usage', and 'Users'. The main header indicates 'Entity type: temperatureK'. On the left, a search bar contains the entity ID '809646_EUI64-0080E10300045A93-3'. Below the search bar, a list of entities is shown, with the selected entity '809646_EUI64-0080E10300045A93-3' highlighted. The main content area displays the 'Dimensions' tab for this entity. It shows a table with the following data:

Dimension	Value
Name	809646_EUI64-0080E10300045A93-3
FLOOR	27
ENTITY_ID	809646_EUI64-0080E10300045A93-3
ZONE	3
ID	3
Rcv_timestamp_utc	2018-12-17T11:29:02.221+0000
Timestamp	1545046142221

Note: The **Dimension** tab (see above) shows the metadata for the temperature sensor entity, for example it's **ID**, the **FLOOR** it's located on, and the **ZONE** it's a part of.

- Select the **Metrics** tab.



Note: Each metric is shown as an individual time-series graph.

You have now completed the exploration of Entity Types and Entries. In the next section we will deepen the exploration and look at Analytics on the Entity Types and Entries.

To learn more about Entity Types and Entries, optionally browse and explore the other types of entities and their data.

5 Exploring the Watson IoT Platform Analytics Service

5.1 Exploring Derived Metrics

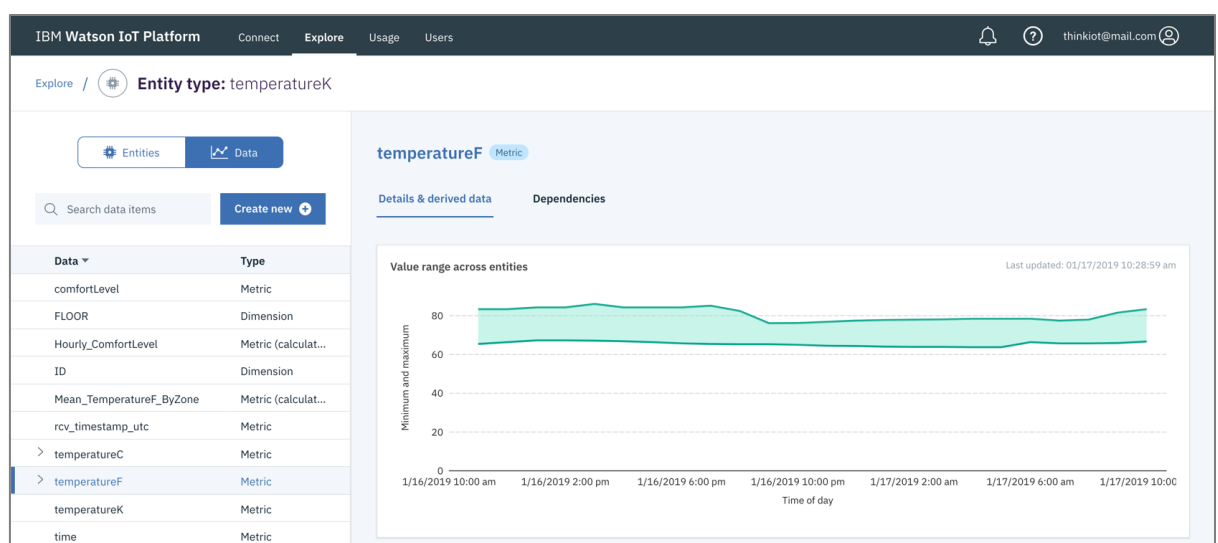
The Watson IoT Platform Analytics Service is an optional add-on component that extends the functionality of Watson IoT Platform Connection Service to include analytics features on entities. Using these capabilities, Line-of-business users can use Watson IoT Platform to interact with their IoT data and derive essential performance indicators.

Watson IoT Platform Analytics delivers a range of functions that you can use to calculate your entity data and derive insights. Functions are stored in a catalog, where you can browse the full range of calculations available. When you are applying calculations to your entity data, you can configure the functions to combine both metrics and dimensions. You can also stage calculations using the output of one function as input to the next computation stage. In essence, the complexity of your calculations is controlled by you. The output of a function is saved in the data lake as a derived metric. Secondary calculations can be applied to the results of the first, so that you can conduct deeper analyses.

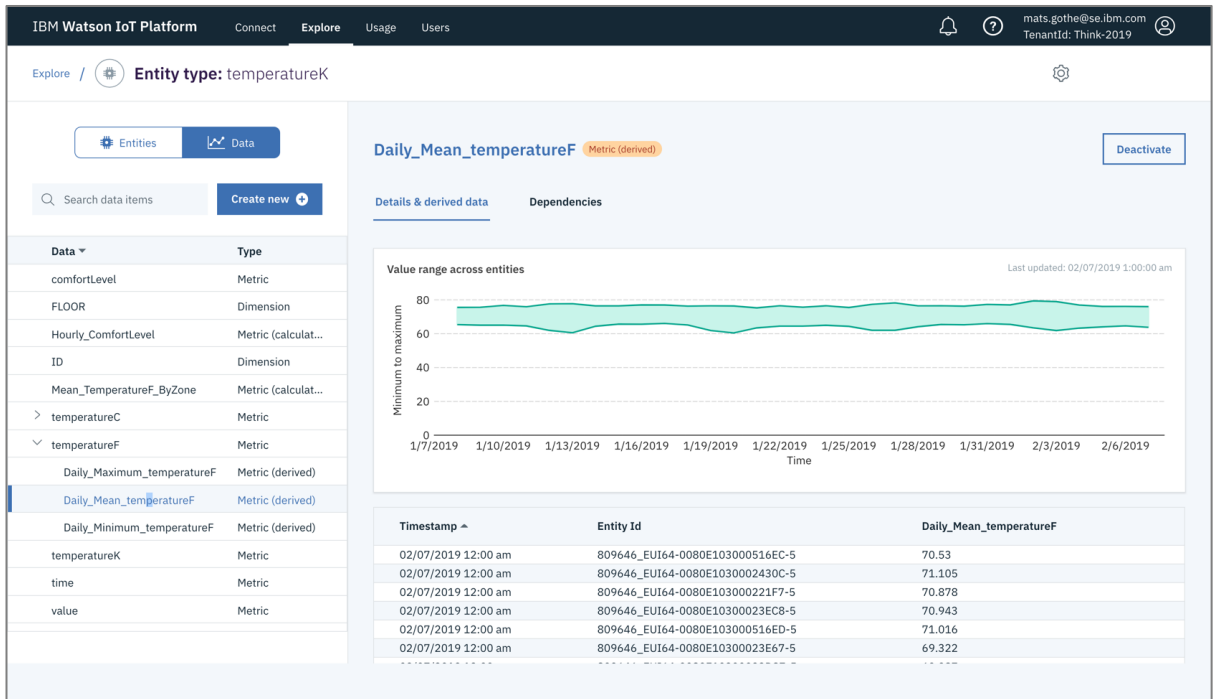
To streamline your data analysis, function sets can be created and configured. Function sets run multiple functions simultaneously and provide a broader set of data as their output. By applying calculations to your data, you can view a summary of specific activity. From that summary, you can define KPIs and aggregate the data as you want.

To view computed metrics on an entity

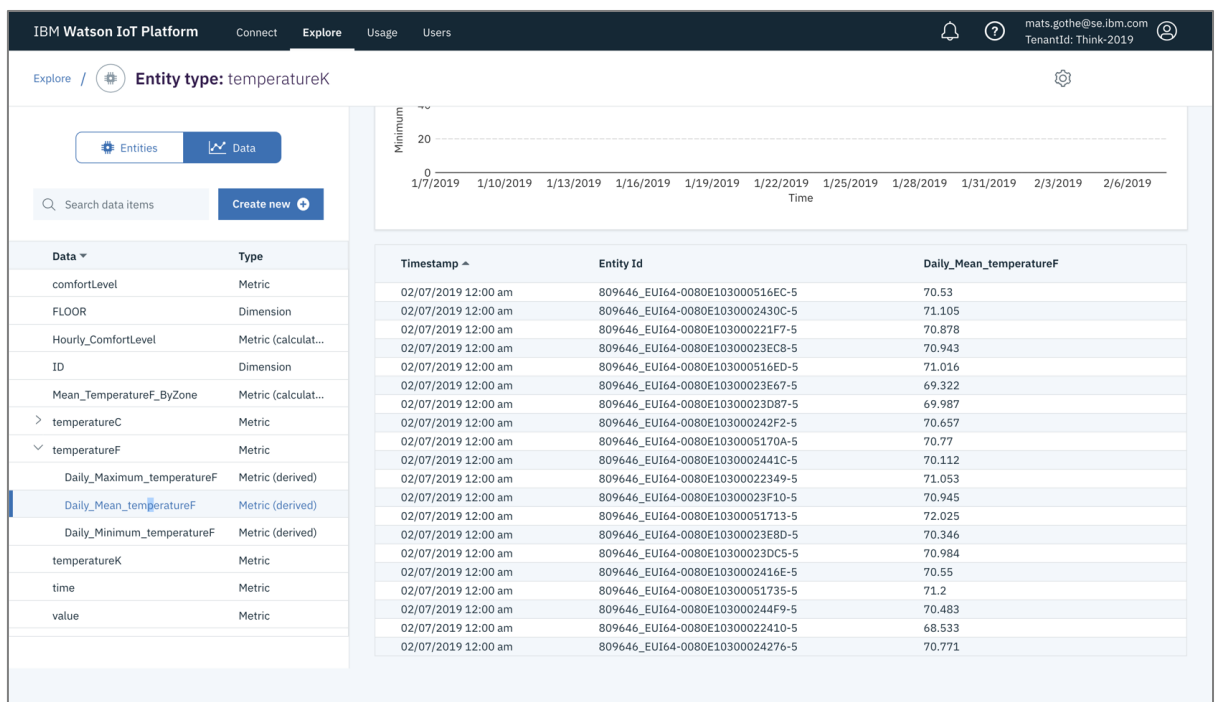
1. Repeat the steps from previous section to open the **temperatureK** entity data page
 - Choose **Browse** from the navigation bar
 - Click the **Data** button on the temperatureK entity type table row



- In the left-hand **Data** explorer, click on > to expand the temperatureF data section. Three derived metrics are shown
 - Daily Maximum Fahrenheit temperatures
 - Daily Average / Mean Fahrenheit temperatures
 - Daily Minimum Fahrenheit temperatures



- Scroll down on the page to view the daily statistical values for the temperature sensor recently delivering new IoT data.



5.2 Exploring Analytics on Temperature Comfort Levels

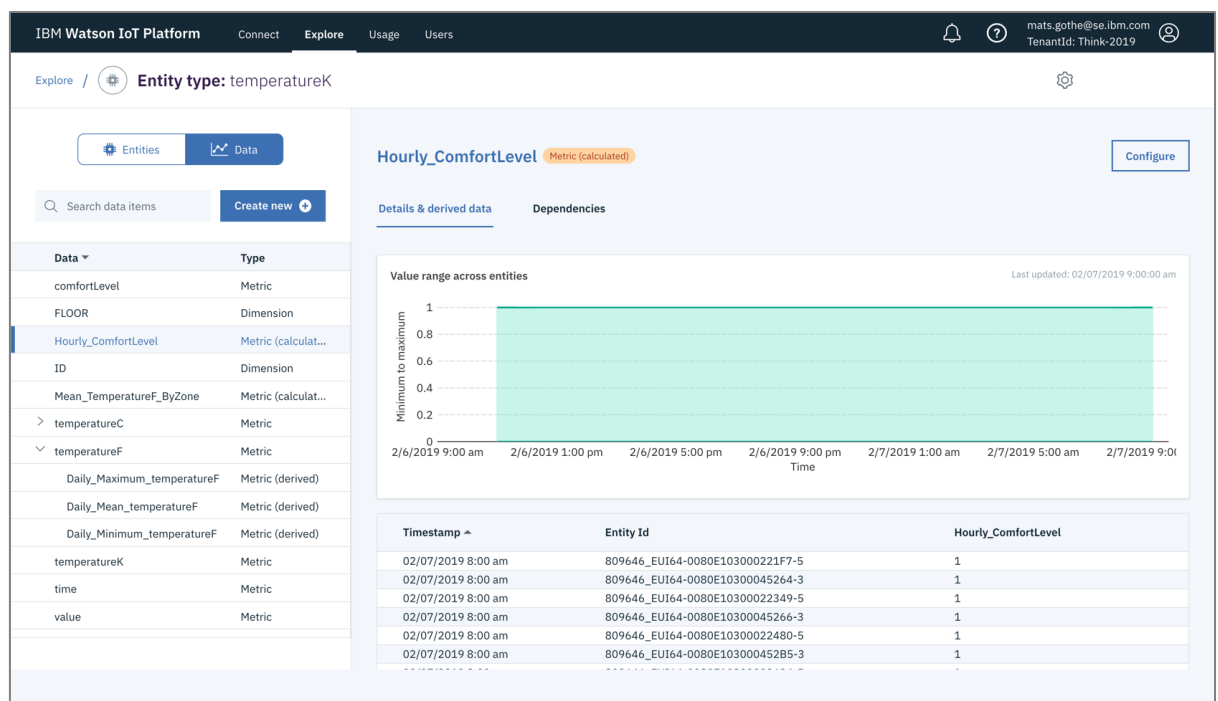
The temperatureK devices are providing compliance to comfort levels as part of the temperatureK_LI. This comfortLevel property is computed by the logical interface using the following expression:

```
($event.value > 293.15) and ($event.value < 297.6)? 1.0 : 0.0
```

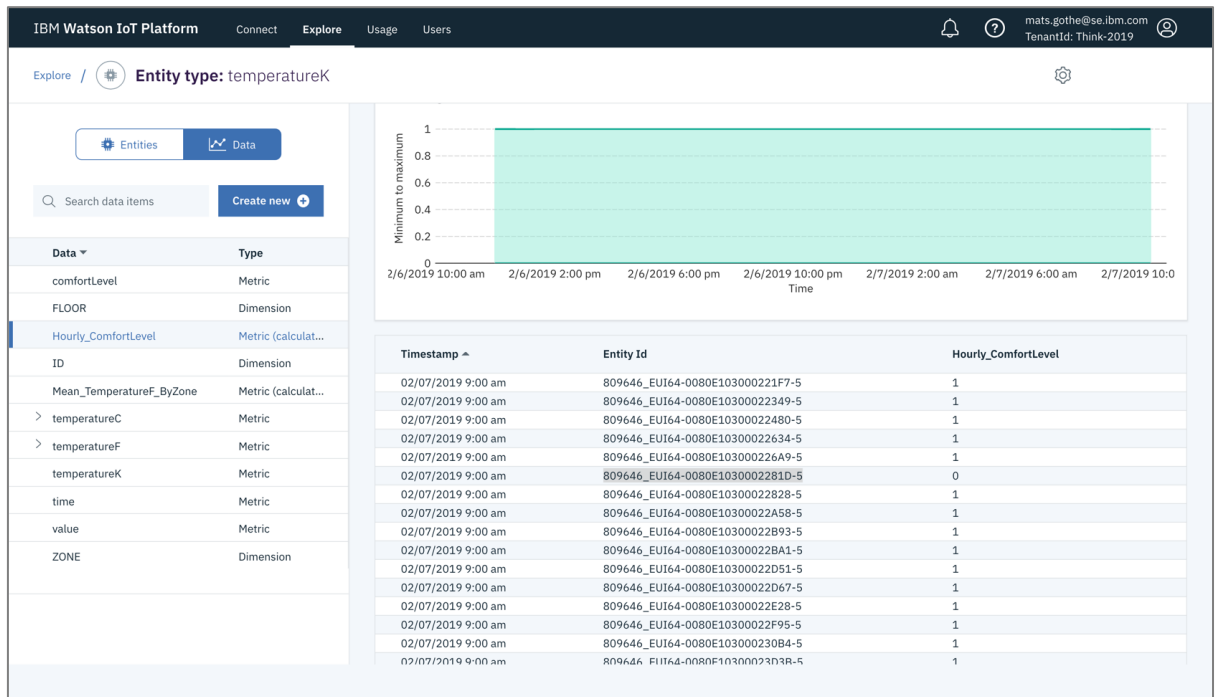
The logic of this expression is that the property will be set to the value 1.0 if the temperature is in range 68-76 degrees Fahrenheit. (Note that the temperatures in the expression are given in Kelvin degrees). If the temperature is outside of this range the comfortLevel is set to 0.0. The value 1.0 is given as a percentage (%) of compliance to the comfort level. While this value makes little sense as a single value of a single sensor it becomes valuable raw data for metric aggregation and statistics. For example, as an average over a time period, computing a statement of comfort level over a day. Or as an average over sensors, computing a statement of compliance across sensors in a zone or a floor.

To view the compliance of the temperature comfort level

1. Select the **Hourly_ComfortLevel** metric from the **Data** explorer on the **temperatureK** entity type.
2. View the graph on the daily variance of comfort levels



3. Scroll down the page and view the comfort levels across the various sensors. View the computed comfort Level for the last hour.



Note: On the day of capturing these notes, uncomfortable temperatures were detected by the 809646_EUI64-0080E1030002281D-5 sensor.

5.3 Exploring CO₂ Alerts and Analytics on Worker Safety

The Watson IoT Platform Analytics Service can create and configure alerts to produce events. The events are saved in the data lake and can be viewed in the Watson IoT Platform Analytics Such. Events can be pushed as messages to IBM Event Streams for IBM Cloud service running in the Watson IoT Platform tenant. Alerts can be configured to trigger when your data exceeds specific thresholds.

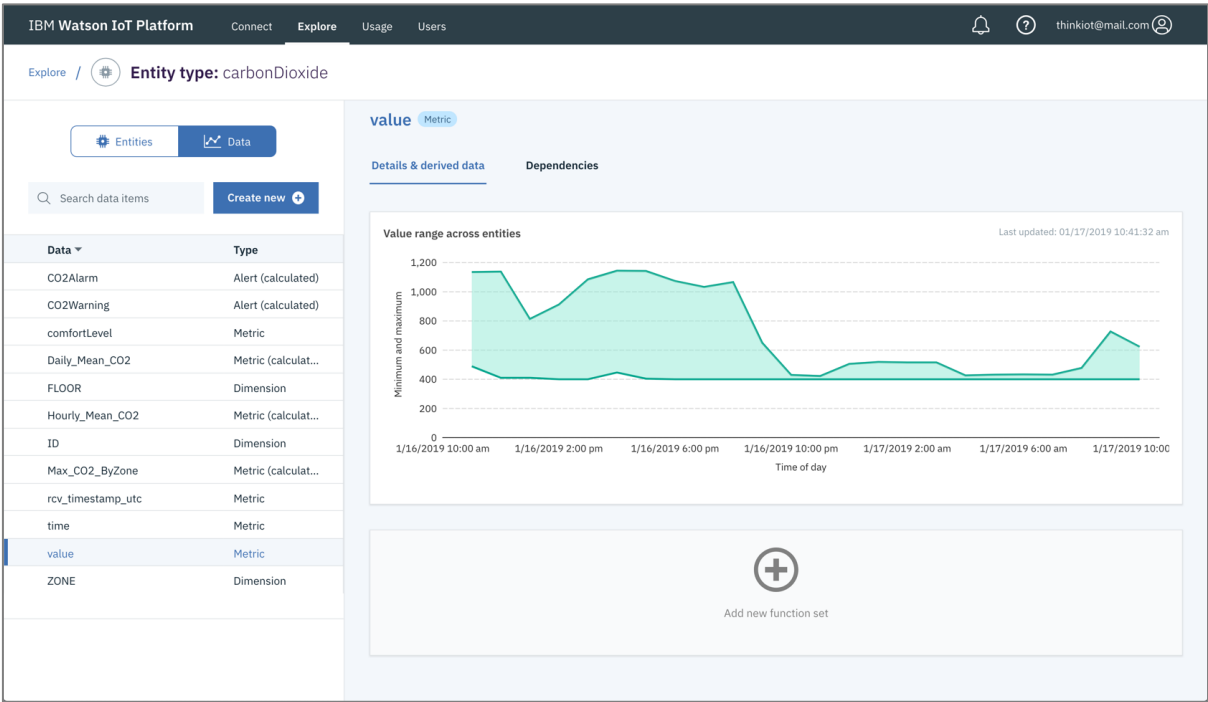
To configure alerts in Watson IoT Platform Analytics, you must author custom Python expressions. An expression is a combination of values, variables, operators, and calls to functions. Expressions can contain operations, such as addition or subtraction.

Note: Watson IoT Platform Analytics supports Pandas libraries for building expressions.

To view warnings and alerts on CO₂ levels

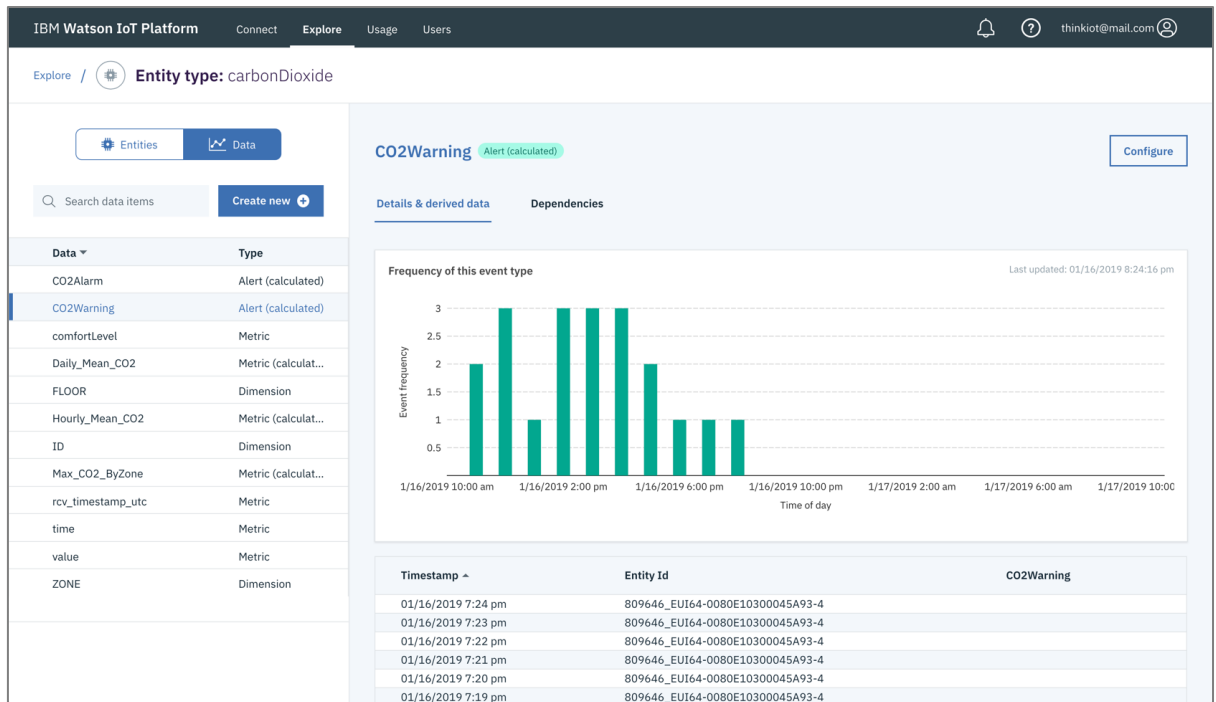
1. Open the carbonDioxide entity data page
 - a. Choose **Browse** from the IoT Platform navigation bar
 - b. Click **Data** on the **carbonDioxide** entity type table row
 - c. Click on the **value** property

The carbonDioxide entity data page is loaded showing the CO₂ levels.



Note: On the day of capturing these notes, high CO₂ levels was detected at office hours and less at non-office hours. Levels were right and above the comfort levels of 1000 PPM.

- In the **Data** browse, click on the alert **CO2Warning**.



Note: Comparing the time of alarms and warning we see that these are reached early in the from sensors 809646_EUI64-0080E10300045A93-4. This is sensors in zone 3 meeting room indicating presence of multiple people in the room.

To view the configuration of warning and alarm rules on the CO₂ levels.

- Select the **CO2Alarm** or **CO2Warning** alerts in the data table.
- Click on the **Configure** button to the left above the graph
- The alert definition is shown.

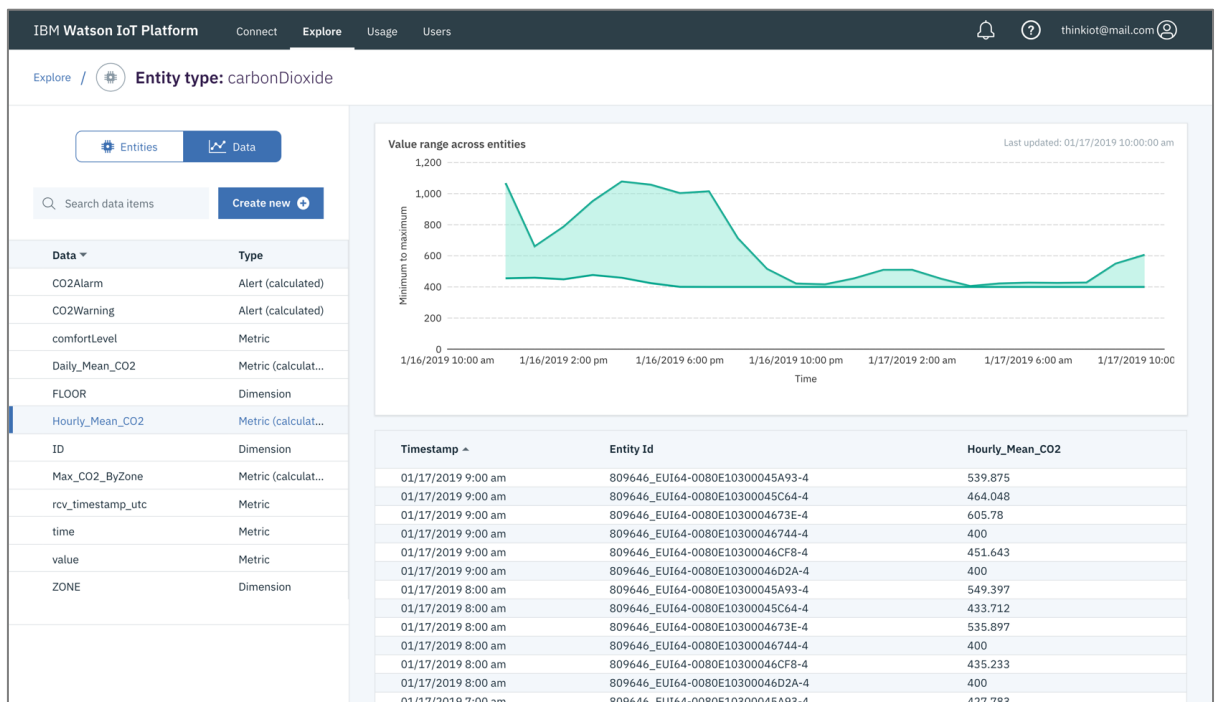
The screenshot shows the 'Alert' configuration dialog box. It includes a 'Configuration' tab and an 'Output' tab. The 'sources' section shows 'Data Items' selected. The 'expression' section contains the formula '\$(value)>1000'. At the bottom, there are 'Remove', 'Cancel', and 'Next' buttons.

Note: The alert expression for the CO2Alarm is “ $\${value}>1000$ ”. Hence, any sensor reading of the CO₂ level that has a value above 1000 PPM will cause an alarm to be raised. Level of CO₂ above 1000 PPM causes headaches and drowsiness and impacts worker safety.

4. Click **Cancel** to close the alert function dialog.

To gain deeper insights into the hourly and daily CO₂ levels

1. In the **Data** explorer, click on the **Hourly_Mean_CO2** metric and view the max – min level values. For details, view the hourly mean CO₂ levels in the table below.
2. In the **Data** explorer, click on the **Daily_Mean_CO2** metric and view the max – min level values. For details, view the daily mean CO₂ levels in the table below
3. Look for sensors that are showing levels impacting worker safety. Are the levels consistent, or peaking at any special day or hour?



To gain deeper insights into the CO₂ levels and impact on Zones.

5. Click on the **Entities** tab to switch to the entities.
6. Type or paste the carbonDioxide entity id into the search box.

The screenshot shows the IBM Watson IoT Platform interface. The top navigation bar includes 'Connect', 'Explore', 'Usage', and 'Users'. The main header indicates 'Entity type: carbonDioxide'. On the left, there's a search bar with the entity ID '809646_EUI64-0080E10300045A93-4' and a dropdown menu for 'Entity ID' showing the same ID. The main content area displays the entity details for '809646_EUI64-0080E10300045A93-4'. It includes tabs for 'Dimensions', 'Events', and 'Metrics'. The 'Dimensions' tab is active, showing a table with the following data:

Dimension	Value
Name	809646_EUI64-0080E10300045A93-4
FLOOR	27
ENTITY_ID	809646_EUI64-0080E10300045A93-4
ZONE	3
ID	3
Rcv_timestamp_utc	2018-12-14T07:42:39.834+0000
Timestamp	1544773359834

Note: The Dimension table shows that the “809646_EUI64-0080E10300045A93-4” carbonDioxide sensor is located on floor 27 in Zone 3.

To further deeper insights into the CO₂ levels in Zone 17.

7. Click on the **Metrics** tab to switch to the time series data for the entity.
- The metrics data and graphs are loaded.

The screenshot shows the IBM Watson IoT Platform interface with the 'Metrics' tab selected. The main content area displays four graphs for the entity '809646_EUI64-0080E10300045A93-4'. The graphs are:

- comfortLevel**: A line graph showing a constant value of 1.0 over time. The y-axis ranges from 0 to 2. The x-axis shows time from 1/17/2019 10:20 AM to 1/17/2019 10:40 AM. Last updated: 01/17/2019 10:47:36 am.
- rcv_timestamp_utc**: A text display showing the timestamp '01/17/2019 10:47 am'. Last updated: 01/17/2019 10:47:36 am.
- time**: A line graph showing a constant value of 47,718,500,000 over time. The y-axis ranges from 47,717,000,000 to 47,718,500,000. The x-axis shows time from 1/17/2019 10:20 AM to 1/17/2019 10:40 AM. Last updated: 01/17/2019 10:47:36 am.
- value**: A line graph showing fluctuating values between 548 and 558 over time. The y-axis ranges from 548 to 558. The x-axis shows time from 1/17/2019 10:20 AM to 1/17/2019 10:40 AM. Last updated: 01/17/2019 10:47:36 am.

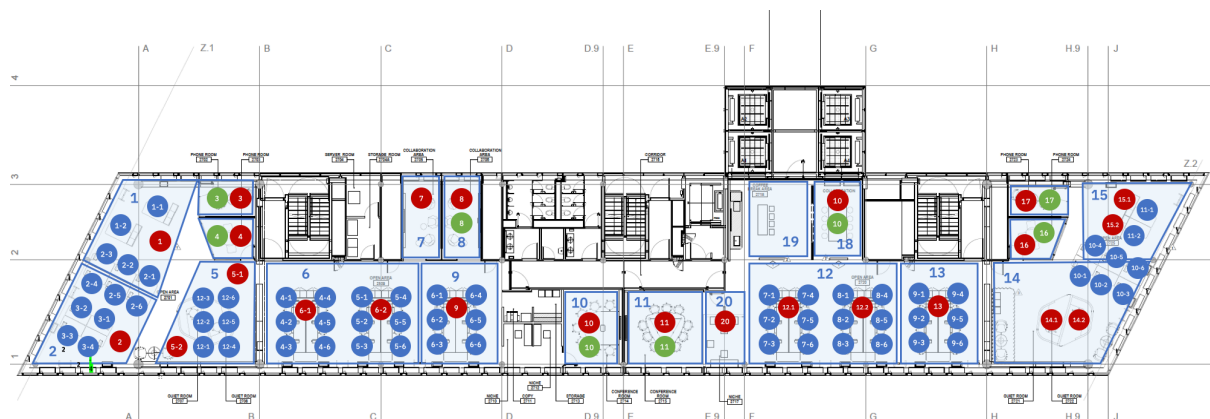
We can now conclude that this is a meeting room with generally bad air quality throughout the day. This may cause an action to be triggered in creating a Work Order to the facility manager to check up the room ventilation.

If your data reaches a range that activates an alert, the alert is published to an Event Streams topic. Watson IoT Platform Analytics provides an Event Streams topic called `analytics-alerts-<tenantId>`, where `<tenantId>` is your own tenant ID. When an alert is triggered, Watson IoT Platform Analytics publishes a message to the `analytics-alerts-<tenantId>` topic. This lab does not cover the developer experience to integrate with Event Streams and handle events and actions.

5.4 Exploring Analytics on Occupancy and Utilization

The Watson IoT Platform Analytics Service can perform advanced data science analytics on entity data using analytics functions out-of-the-box in the function catalog, or add custom functions extending the catalog. To extend the functions in Watson IoT Platform Analytics, you must author custom Python code. In this lab we will only use predefined functions from the function catalog.

To exemplify more advanced analytics functions we will explore the utilization of zones at the 27th floor in the IoT Center in Munich.



Most all zones in the IoT Center in Munich has been equipped with motion sensors, as indicated by blue and red circles in the floor plan below. The motion and motion+ sensors send periodic events to the IoT platform with three motion properties; value, time and timeLastMotion. The *value* property is the amplitude or size of motion detected near the sensor. The *time* is a time-stamp expressed in milliseconds. and the *timeLastMotion* is the time-stamp of the last previous event when motion was detected.

Using the time and timeLastMotion, the IoT platform can compute occupancy in the workspace. The assumption made is that a workspace is occupied if motion is detected within a 1 ½ minute interval. Hence, “isOccupied” is a state property computed by motion_LI logical interface using the expression below. The time since last motion detected is less than 90.000 milliseconds. The property is set to 1.0 if the space is occupied, or 0.0 if the space is unoccupied. Similar to the comfort level this property can be used for time-series and aggregation metrics.

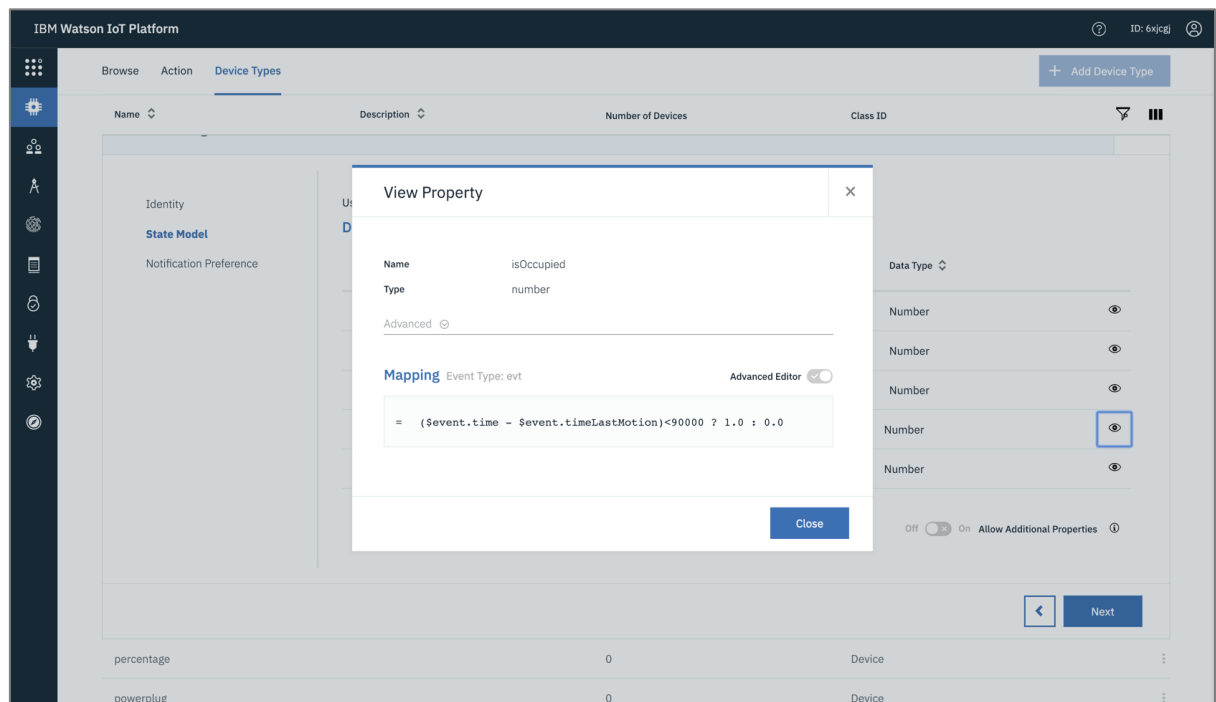
```
($event.time - $event.timeLastMotion)<90000 ? 1.0 : 0.0
```

Also, a lastOccupied property is computed for the time interval in minutes since motion was last detected. This property is capped to a day, i.e. no more than 1440 minutes, equal to a day of unoccupancy.

```
($event.time - $event.timeLastMotion) / 60000 > 1440 ? 1440 :  
$round(($event.time - $event.timeLastMotion) / 60000)
```

Optionally, return to the Watson IoT Platform Service to view the motion_LI logical interface

1. Return to the Watson IoT Platform Service
2. Select the **Devices** section, the **Data Type** tab and the **motion** data type
3. Select the **Interface** tab and click **Next** to view the **State Model** page
4. Click in the eye-icon to view the property expression for **isOccupied** and **lastOccupied**



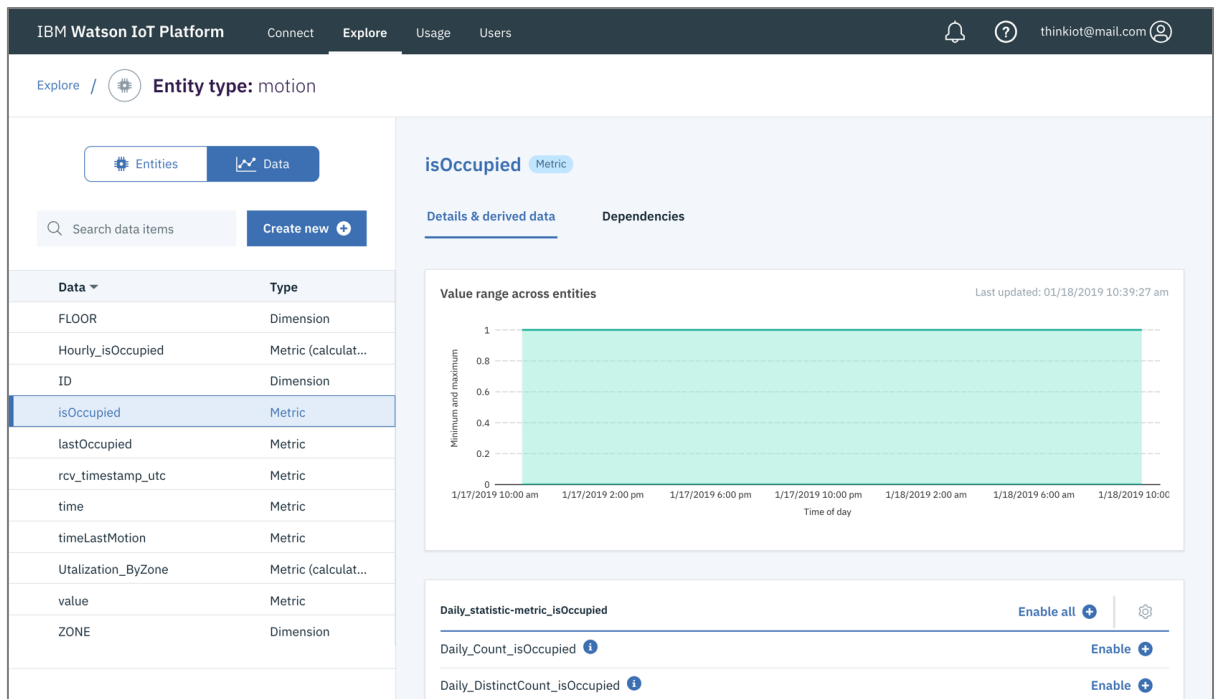
Note: there are two editors for property expression; a simple expression building and an advanced code editor. The **isOccupied** property above is using the advanced editor and the JSONata expression language to encode the function.

On the function above the `$event` object is holding the data payload from the event. The `= ? :` expression is the JSONata syntax for an if-statement.

To learn more about JSONata, visit the <http://jsonata.org> home page.

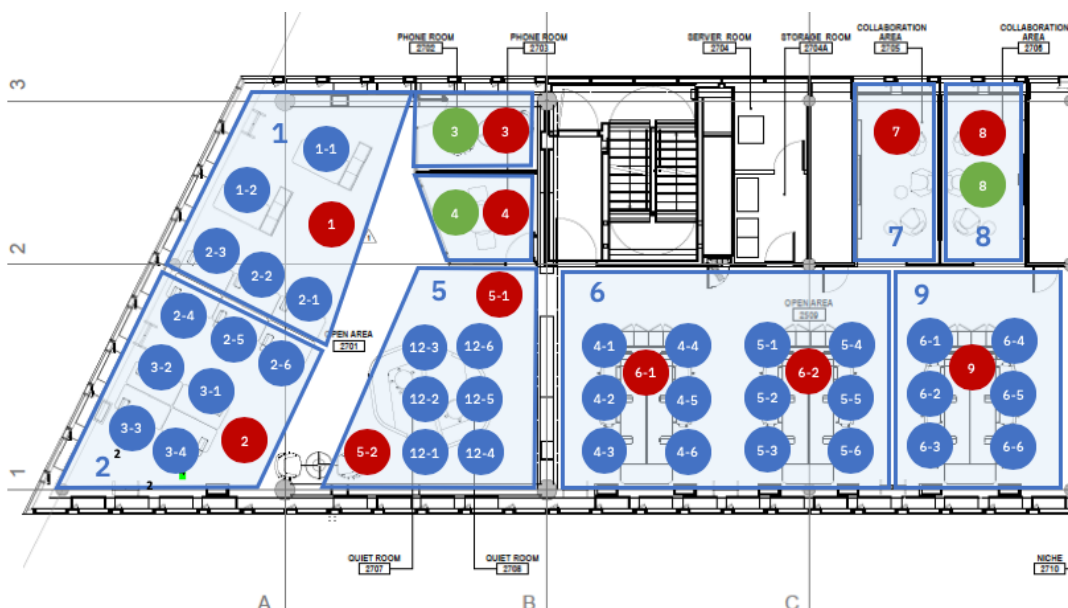
To view motion entity data

1. Open the **motion** entity data page
2. Select the **isOccupied** metric



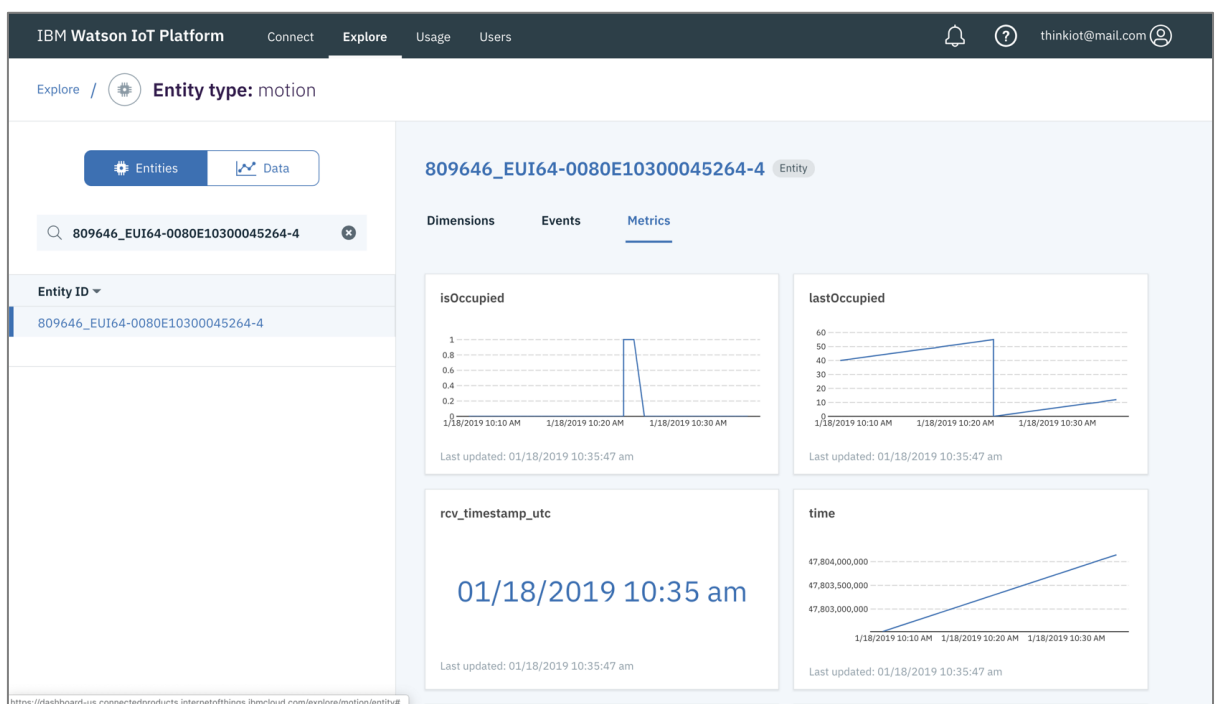
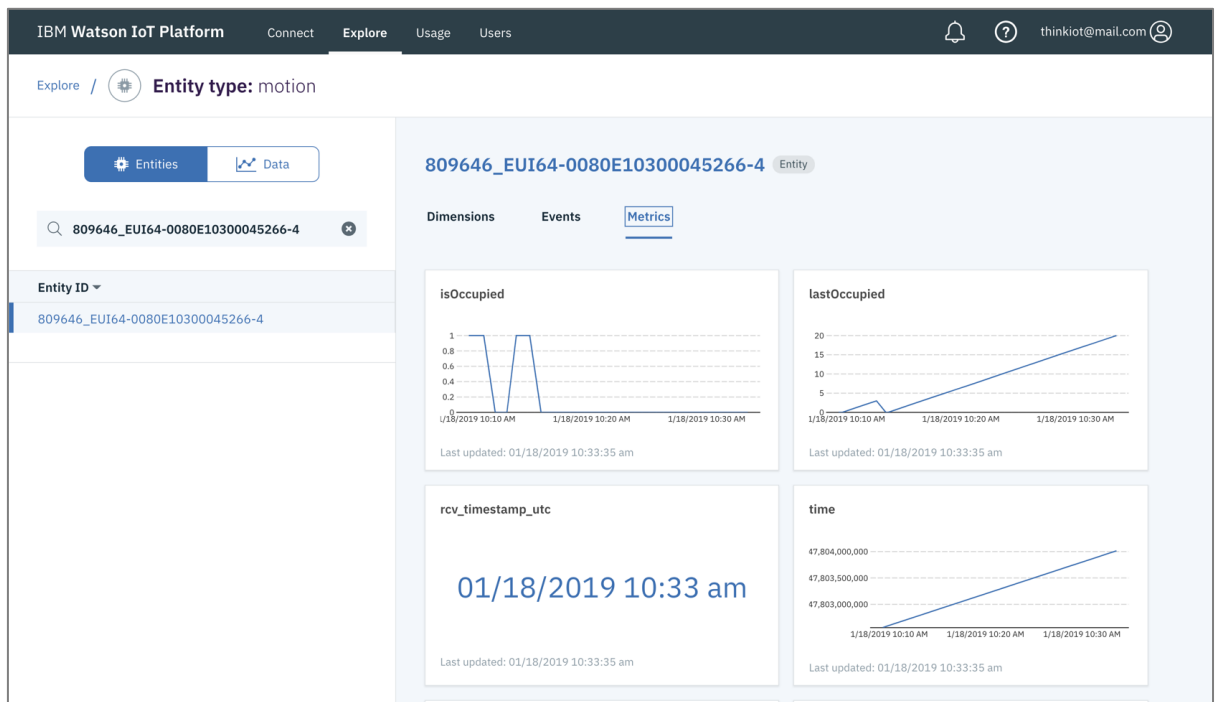
Note: The graph shows the daily occupancy across all motion sensors. As previously discussed, the sensors send a numeric 0.0 or 1.0 value, and the graph will show values between these min and max numbers. This may not be that interesting, but analytics on groups of sensors will be more descriptive of the utilization. We will explore that later in this section.

We will now explore occupancy by zone in the west wing of floor 27.



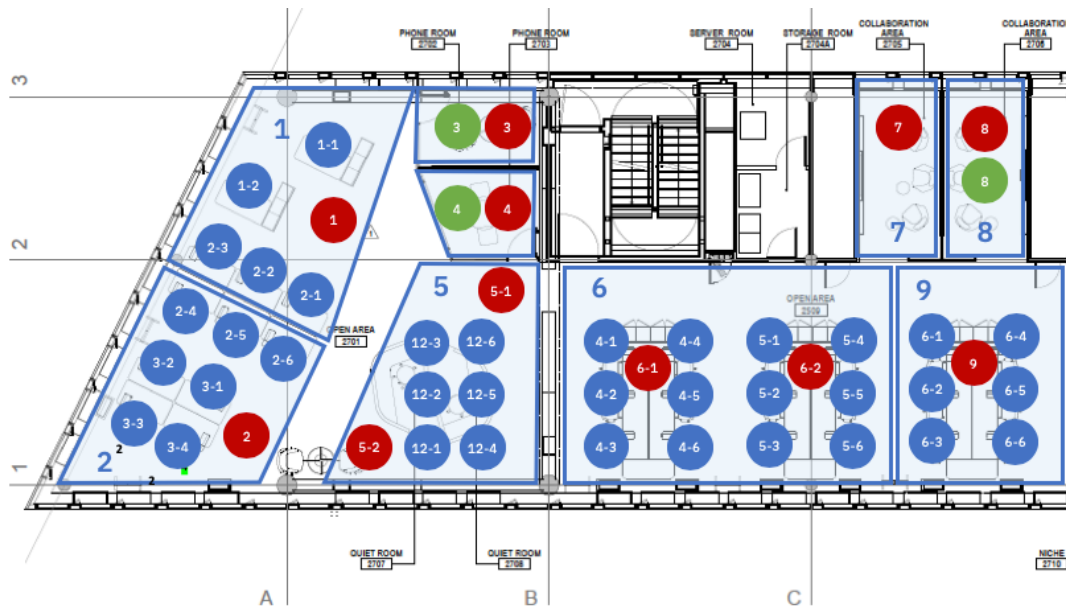
To view occupancy by individual sensor

1. Click on **Entities** to switch to the entity page of motion sensors
2. Use the search field to locate the motion sensors in the west wing of floor 27.
 - Motion sensor in zone 3: 809646_EUI64-0080E10300045266-4
 - Motion sensor in zone 4: 809646_EUI64-0080E10300045264-4
3. Select the found entity in **Entity ID** list, and select the **Metrics** graph



Note: The isOccupied graph shows the occupancy of the workspace.

Using the isOccupied metric, the Watson IoT platform Analytics Service can be used to compute utilization of workspace. The assumption is made that the average of occupancy is a utilization percentage 0-100% of the zone over a given time window. The utilization applies to both aggregates over time-series, sensor aggregates in a zone, or sensor aggregates over multiple zones. The utilization will in itself be an hourly, daily time series with Max, Min and Average metrics.



To view utilization by workstation

4. Use the search field to locate the motion sensors in the west wing of floor 27.
(see index of devices on next page)
5. Use the search field to locate the motion sensors in the East wing of floor 27.
 - Motion sensor in zone 1: 809646_EUI64-0080E10300045607-4
 - Motion sensor in zone 2: 809646_EUI64-0080E103000451D3-4
 - Motion sensor in zone 3: 809646_EUI64-0080E10300045266-4
 - Motion sensor in zone 4: 809646_EUI64-0080E10300045264-4
 - Motion sensor in zone 5: 809646_EUI64-0080E103000451A3-4
 - Motion sensor in zone 6: 809646_EUI64-0080E103000451A5-4
 - Motion sensor in zone 7: 809646_EUI64-0080E103000452B7-4
 - Motion sensor in zone 8: 809646_EUI64-0080E1030004507E-4
 - Motion sensor in zone 9: 809646_EUI64-0080E1030004542F-4

Note: Use the device table in Appendix A to list and find devices by zone. Alternatively, browse the devices in the Watson IoT Platform and filter by the **device type** and **descriptive location** columns.

6. View the **Hourly_isOccupied** utilization metrics

The screenshot shows the IBM Watson IoT Platform interface. The top navigation bar includes 'Connect', 'Explore', 'Usage', and 'Users'. The main header indicates 'Entity type: motion'. On the left, a sidebar lists various data items with their types. The main content area displays a table of data for the 'Hourly_isOccupied' metric.

Timestamp	Entity Id	Hourly_isOccupied
02/12/2019 3:00 pm	809646_EUI64-0080E10300052752-4	0.939
02/12/2019 3:00 pm	809646_EUI64-0080E10300052817-4	0
02/12/2019 3:00 pm	809646_EUI64-0080E1030005241D-4	0.571
02/12/2019 3:00 pm	809646_EUI64-0080E103000221F7-4	0
02/12/2019 3:00 pm	809646_EUI64-0080E10300052774-4	0.154
02/12/2019 3:00 pm	809646_EUI64-0080E103000510F6-4	0
02/12/2019 3:00 pm	809646_EUI64-0080E10300051963-4	0.588
02/12/2019 3:00 pm	809646_EUI64-0080E10300022349-4	0.264
02/12/2019 3:00 pm	809646_EUI64-0080E10300052780-4	0
02/12/2019 3:00 pm	809646_EUI64-0080E10300022480-4	0
02/12/2019 3:00 pm	809646_EUI64-0080E10300052784-4	0
02/12/2019 3:00 pm	809646_EUI64-0080E10300022634-4	0
02/12/2019 3:00 pm	809646_EUI64-0080E1030005279E-4	0.419
02/12/2019 3:00 pm	809646_EUI64-0080E103000226A9-4	0.944
02/12/2019 3:00 pm	809646_EUI64-0080E103000527B7-4	0.2
02/12/2019 3:00 pm	809646_EUI64-0080E1030002281D-4	0
02/12/2019 3:00 pm	809646_EUI64-0080E103000527C8-4	0.609
02/12/2019 3:00 pm	809646_EUI64-0080E10300022828-4	0.108
02/12/2019 3:00 pm	809646_EUI64-0080E10300052804-4	0.731
02/12/2019 3:00 pm	809646_EUI64-0080E103000228A4-4	0

Note: The hourly mean value of isOccupied is presented for each sensor. Workspaces fully used during the hour will average to 1.0, workspaces with no occupancy will average to 0.0, and workspaces with partial occupancy will compute as a percentage of utilization, for example 0.25 as 25% utilization.

7. View the **Utalization_ByZone** utilization metrics

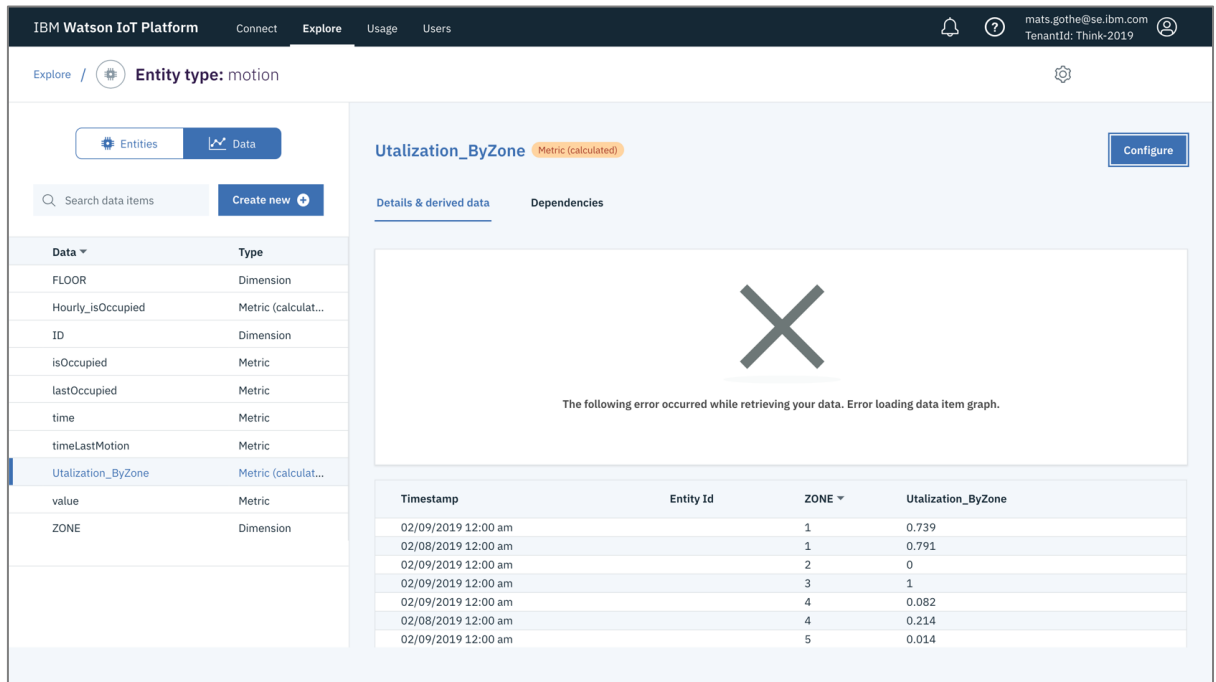
The screenshot shows the IBM Watson IoT Platform interface. The top navigation bar includes 'Connect', 'Explore', 'Usage', and 'Users'. The main header indicates 'Entity type: motion'. On the left, a sidebar lists various data items with their types. The main content area displays a table of data for the 'Utalization_ByZone' metric.

Timestamp	Entity Id	ZONE	Utalization_ByZone
02/12/2019 12:00 am		17	0.14
02/12/2019 12:00 am		1	0.87
02/12/2019 12:00 am		6	0.457
02/12/2019 12:00 am		2	0.577
02/12/2019 12:00 am		18	0.608
02/12/2019 12:00 am		3	0.997
02/12/2019 12:00 am		7	0.024
02/12/2019 12:00 am		4	0.575
02/12/2019 12:00 am		8	0.057
02/12/2019 12:00 am		5	0.358
02/12/2019 12:00 am		9	0.575
02/12/2019 12:00 am		10	0.211
02/12/2019 12:00 am		11	0.298
02/12/2019 12:00 am		12	0.259
02/12/2019 12:00 am		13	0.189
02/12/2019 12:00 am		14	0.539
02/12/2019 12:00 am		15	0.714
02/11/2019 12:00 am		1	0.75
02/11/2019 12:00 am		3	0.998
02/11/2019 12:00 am		13	0.194

Note: The utilization by zone function is computing an aggregated mean value from all sensors with a common Dimension, hence all sensors in a Zone.

To view the function definition of the **Utalization_ByZone** metrics

8. Select the **Utalization_ByZone** utilization metrics



Entity type: motion

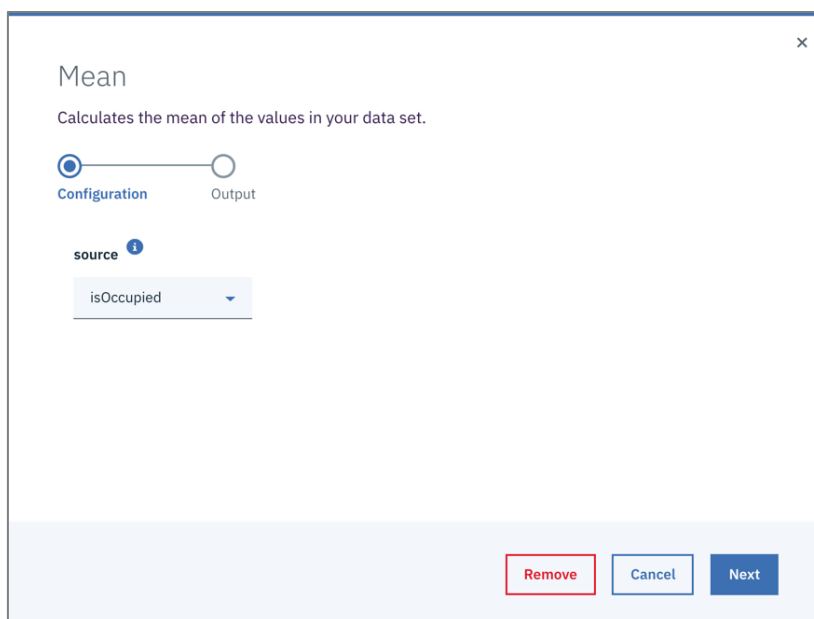
Utalization_ByZone Metric (calculated)

Details & derived data Dependencies

The following error occurred while retrieving your data. Error loading data item graph.

Timestamp	Entity Id	ZONE	Utalization_ByZone
02/09/2019 12:00 am		1	0.739
02/08/2019 12:00 am		1	0.791
02/09/2019 12:00 am		2	0
02/09/2019 12:00 am		3	1
02/09/2019 12:00 am		4	0.082
02/08/2019 12:00 am		4	0.214
02/09/2019 12:00 am		5	0.014

9. On the metric side card, click on the **Configure** button



Mean

Calculates the mean of the values in your data set.

Configuration Output

source

isOccupied

Remove Cancel Next

Note: On this page we select the metric used as the source for the Mean function.

10. Click on **Next**

The screenshot shows a configuration window titled 'Mean' with a close button in the top right. Below the title is a description: 'Calculates the mean of the values in your data set.' There are two tabs: 'Configuration' (selected) and 'Output'. Under 'Configuration', there is a 'Granularity' dropdown set to 'ByZone' and a 'Manage' gear icon. To the right is an 'Auto schedule' toggle which is turned on. Below this is a table with three columns: 'Output', 'Output metric', and 'Transient'. The table has one row with 'name' in the 'Output' column, 'Utalization_ByZone' in the 'Output metric' column, and an unchecked checkbox in the 'Transient' column. At the bottom are four buttons: 'Remove' (red), 'Cancel', 'Previous', and 'Update'.

Output	Output metric	Transient
name	Utalization_ByZone	<input type="checkbox"/>

Note: On this page we name the new metric to **Utalization_ByZone**

11. Click on **Manage** to view the granularity definition for this function

The screenshot shows a window titled 'Manage granularity' for 'ENTITY TYPE MOTION'. It has a close button in the top right. Below the title is the instruction: 'Configure existing grains or add new grains for this entity type.' There is an 'Add new' button with a plus icon. Below is a table with the header 'Grains'. The table has three rows: 'ByZone', 'Hourly', and 'Daily'. Each row has a pencil icon for editing and a trash icon for deleting. The 'ByZone' row's pencil icon is highlighted with a blue box.

Grains
ByZone
Hourly
Daily

12. Click on the **pen** icon to edit the ByZone granularity.

ENTITY TYPE MOTION

×

Edit custom grain

Custom grains can be created to set the time basis, the aggregation options, and the dimensions that you want to include in your function.

Aggregation options

☐ Aggregate data for each entity (default) ⓘ

☒ Aggregate data by dimension ⓘ

<input type="checkbox"/>	Dimension ▾	Type
<input type="checkbox"/>	FLOOR	Dimension
<input type="checkbox"/>	ID	Dimension
<input checked="" type="checkbox"/>	ZONE	Dimension

Remove

Cancel

Save

Note: The **Utilization_ByZone** metric defined to aggregate the data from all entities with a common ZONE.

Other aggregated metrics are component for CO² and Temperature.

13. Select the carbonDioxide entity type and view the Max_CO2_ByZone.

The screenshot shows the IBM Watson IoT Platform interface. The top navigation bar includes 'Connect', 'Explore', 'Usage', and 'Users'. The main header indicates 'Entity type: carbonDioxide'. On the left, there is a sidebar with 'Entities' and 'Data' tabs, a search bar, and a 'Create new' button. The main content area displays a table with the following data:

Timestamp	Entity Id	ZONE	Max_CO2_ByZone
02/09/2019 6:00 am		4	430
02/09/2019 7:00 am		4	429
02/09/2019 8:00 am		4	431
02/09/2019 9:00 am		4	431
02/09/2019 6:00 am		8	400
02/09/2019 7:00 am		8	400
02/09/2019 8:00 am		8	400
02/09/2019 9:00 am		8	400
02/09/2019 6:00 am		16	412
02/09/2019 7:00 am		16	412
02/09/2019 8:00 am		16	412
02/09/2019 9:00 am		16	400
02/09/2019 6:00 am		17	542
02/09/2019 7:00 am		17	540
02/09/2019 8:00 am		17	540
02/09/2019 9:00 am		17	539
02/09/2019 6:00 am		18	401
02/09/2019 7:00 am		18	403
02/09/2019 8:00 am		18	400
02/09/2019 9:00 am		18	400

14. Select the temperatureK entity type and view the Mean_TemperatureF_ByZone.

The screenshot shows the IBM Watson IoT Platform interface. The top navigation bar includes 'Connect', 'Explore', 'Usage', and 'Users'. The main header indicates 'Entity type: temperatureK'. On the left, there is a sidebar with 'Entities' and 'Data' tabs, a search bar, and a 'Create new' button. The main content area displays a table with the following data:

Timestamp	Entity Id	ZONE	Mean_TemperatureF_ByZone
01/15/2019 4:00 pm		1	74.009
01/15/2019 4:00 pm		1	74.602
01/15/2019 4:00 pm		2	78.366
01/15/2019 4:00 pm		2	77.607
01/15/2019 4:00 pm		3	73.894
01/15/2019 4:00 pm		3	74.097
01/15/2019 4:00 pm		4	74.962
01/15/2019 4:00 pm		4	74.613
01/15/2019 4:00 pm		5	74.951
01/15/2019 4:00 pm		5	74.707
01/15/2019 4:00 pm		6	73.824
01/15/2019 4:00 pm		6	73.992
01/15/2019 4:00 pm		11	71.2
01/15/2019 4:00 pm		12	73.507
01/15/2019 4:00 pm		13	72.043
01/15/2019 4:00 pm		14	71.156
01/15/2019 4:00 pm		15	72.691
01/15/2019 4:00 pm		16	71.096
01/15/2019 4:00 pm		17	70.427
01/15/2019 4:00 pm		18	71.588

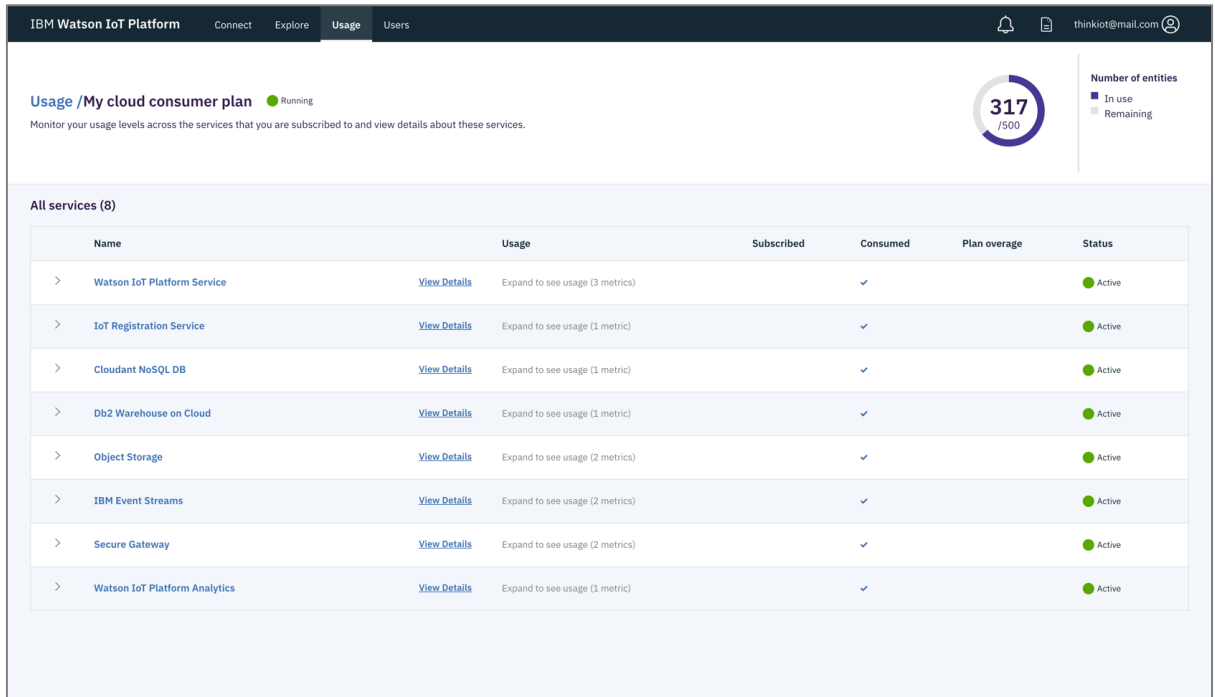
We have now completed the exploration of the Watson IoT Platform Analytics Service. In the following section we will look at platform administration and user management.

6 Exploring the Watson IoT Platform Administration

In this last section of the lab we will look at platform administration and user management.

To view the configured services, their health status and connection credentials

1. Select the **Usage** tab on the Watson IoT Platform banner.



Usage / My cloud consumer plan Running

Monitor your usage levels across the services that you are subscribed to and view details about these services.

Number of entities
■ In use
■ Remaining

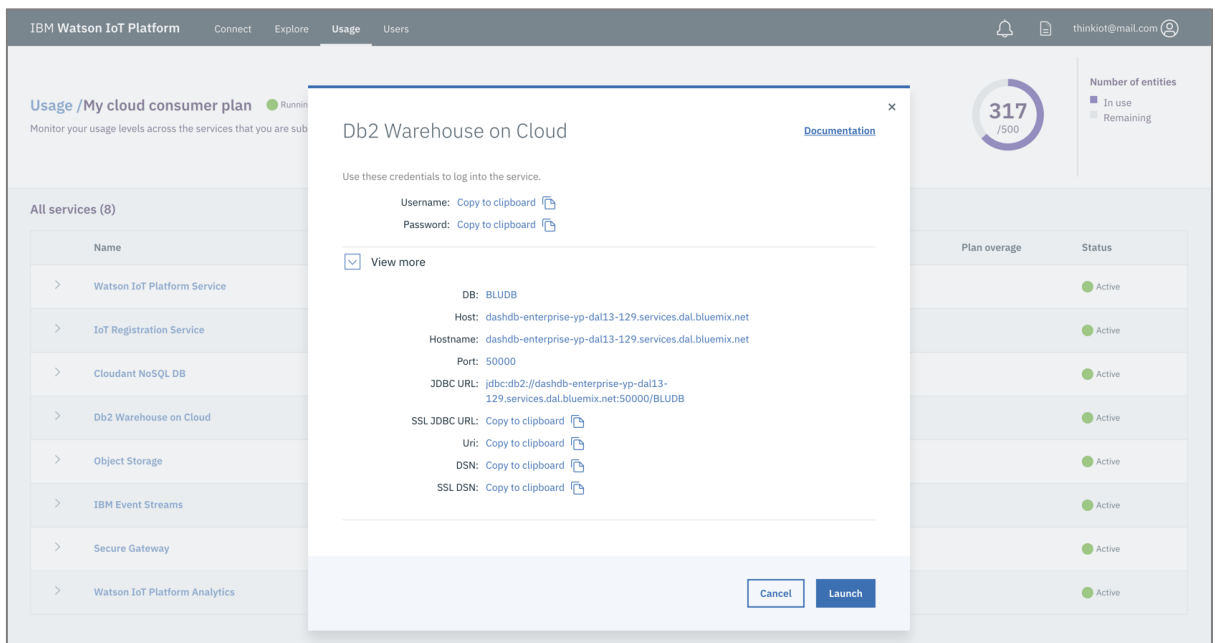
317 / 500

All services (8)

Name	Usage	Subscribed	Consumed	Plan overage	Status
> Watson IoT Platform Service	View Details	Expand to see usage (3 metrics)	✓		Active
> IoT Registration Service	View Details	Expand to see usage (1 metric)	✓		Active
> Cloudant NoSQL DB	View Details	Expand to see usage (1 metric)	✓		Active
> Db2 Warehouse on Cloud	View Details	Expand to see usage (1 metric)	✓		Active
> Object Storage	View Details	Expand to see usage (2 metrics)	✓		Active
> IBM Event Streams	View Details	Expand to see usage (2 metrics)	✓		Active
> Secure Gateway	View Details	Expand to see usage (2 metrics)	✓		Active
> Watson IoT Platform Analytics	View Details	Expand to see usage (1 metric)	✓		Active

Note: View the status for the individual service preconfigured for this IoT platform tenant.

2. Click on **View Details** on Db2 Warehouse on the Cloud row in the list of services.



Usage / My cloud consumer plan Running

Monitor your usage levels across the services that you are subscribed to and view details about these services.

Number of entities
■ In use
■ Remaining

317 / 500

All services (8)

Name	Usage	Subscribed	Consumed	Plan overage	Status
> Watson IoT Platform Service	View Details	Expand to see usage (3 metrics)	✓		Active
> IoT Registration Service	View Details	Expand to see usage (1 metric)	✓		Active
> Cloudant NoSQL DB	View Details	Expand to see usage (1 metric)	✓		Active
> Db2 Warehouse on Cloud	View Details	Expand to see usage (1 metric)	✓		Active
> Object Storage	View Details	Expand to see usage (2 metrics)	✓		Active
> IBM Event Streams	View Details	Expand to see usage (2 metrics)	✓		Active
> Secure Gateway	View Details	Expand to see usage (2 metrics)	✓		Active
> Watson IoT Platform Analytics	View Details	Expand to see usage (1 metric)	✓		Active

Db2 Warehouse on Cloud [Documentation](#)

Use these credentials to log into the service.

Username: [Copy to clipboard](#)

Password: [Copy to clipboard](#)

☒ View more

DB: BLUDB

Host: dashdb-enterprise-yp-dal13-129.services.dal.bluemix.net

Hostname: dashdb-enterprise-yp-dal13-129.services.dal.bluemix.net

Port: 50000

JDBC URL: jdbc:db2://dashdb-enterprise-yp-dal13-129.services.dal.bluemix.net:50000/BLUDB

SSL JDBC URL: [Copy to clipboard](#)

Uri: [Copy to clipboard](#)

DSN: [Copy to clipboard](#)

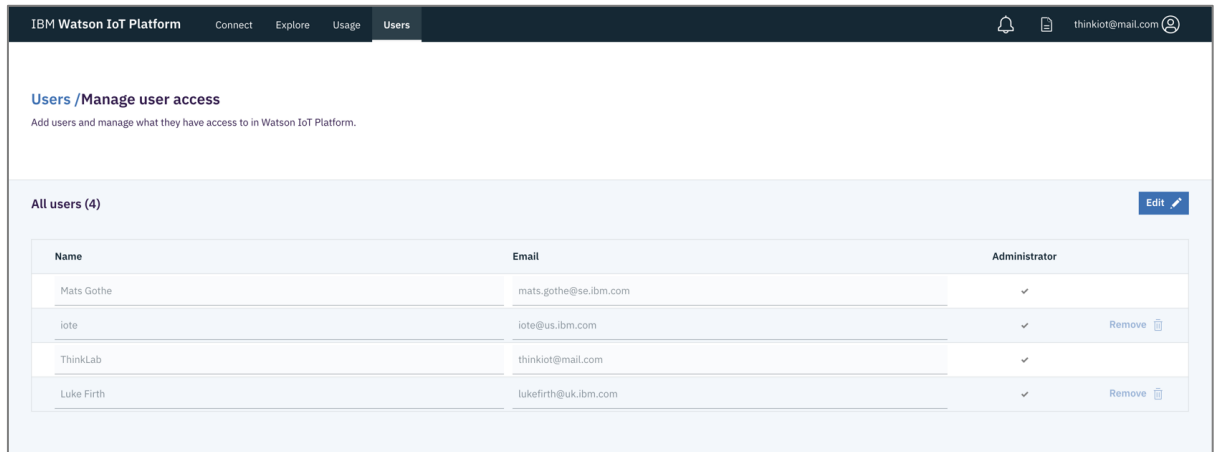
SSL DSN: [Copy to clipboard](#)

[Cancel](#) [Launch](#)

Note: The dialog shows the credential for the Db2 web administration tool and other properties on the data service.

To view the users of the IoT platform

1. Select the **Users** tab on the Watson IoT Platform banner.
2. The User page opens



IBM Watson IoT Platform Connect Explore Usage **Users** thinkiot@mail.com

Users / Manage user access
Add users and manage what they have access to in Watson IoT Platform.

All users (4) [Edit](#)

Name	Email	Administrator
Mats Gothe	mats.gothe@se.ibm.com	✓
iote	iote@us.ibm.com	✓ Remove
ThinkLab	thinkiot@mail.com	✓
Luke Firth	lukefirth@uk.ibm.com	✓ Remove

Note: We advise to not make changes on the user list for this lab.

You have now completed overview of administration capabilities in the Watson IoT Platform. We will now proceed to explore the Watson IoT Platform and the connected devices in the IoT Center in Munich

7 Conclusions from this Watson IoT Platform lab

You have now completed this hands-on lab on Getting started with IoT Edge Gateways.

During this lab you have:

- Deepened your understanding of the Watson IoT Platform Service and how Device Types and Device are declared, registered and connected to send events to the IoT platform. You have also explored the definition of Interfaces and Device State transformations.
- Deepened your understanding of the Watson IoT Platform Connection Service and how Entity Types, Entities and Metrics are stored in the IoT platform data lake.
- Deepened your understanding of the Watson IoT Platform Analytics Service and how to create Computed Metrics using function in the Function Catalog.

We hope that you have found this lab informative, educational, and fun.

7.1 Further reading

To learn more about the Watson IoT Platform

- Watson Internet of Things
<https://www.ibm.com/internet-of-things>
- Watson IoT Platform on ibm.com
<https://www.ibm.com/internet-of-things/spotlight/watson-iot-platform>
- Watson IoT Platform blog
<https://developer.ibm.com/iotplatform/blog>
- Watson IoT Platform on IBM Developer Works
<https://www.ibm.com/developerworks/learn/iot/>

To further explore, sign up for a trial account on IBM Cloud, create the IBM Watson IoT Platform service, and start connecting your IoT devices

7.2 We Value Your Feedback!

- Don't forget to submit your Think 2019 session and speaker feedback! Your feedback is very important to us – we use it to continually improve the conference.
- Access the Think 2019 agenda tool to quickly submit your surveys from your smartphone, laptop or conference kiosk.

8 APPENDIX A

8.1 Device types and identities

Registered devices at 27th floor in the Munic IoT Center.

In the floor plan below

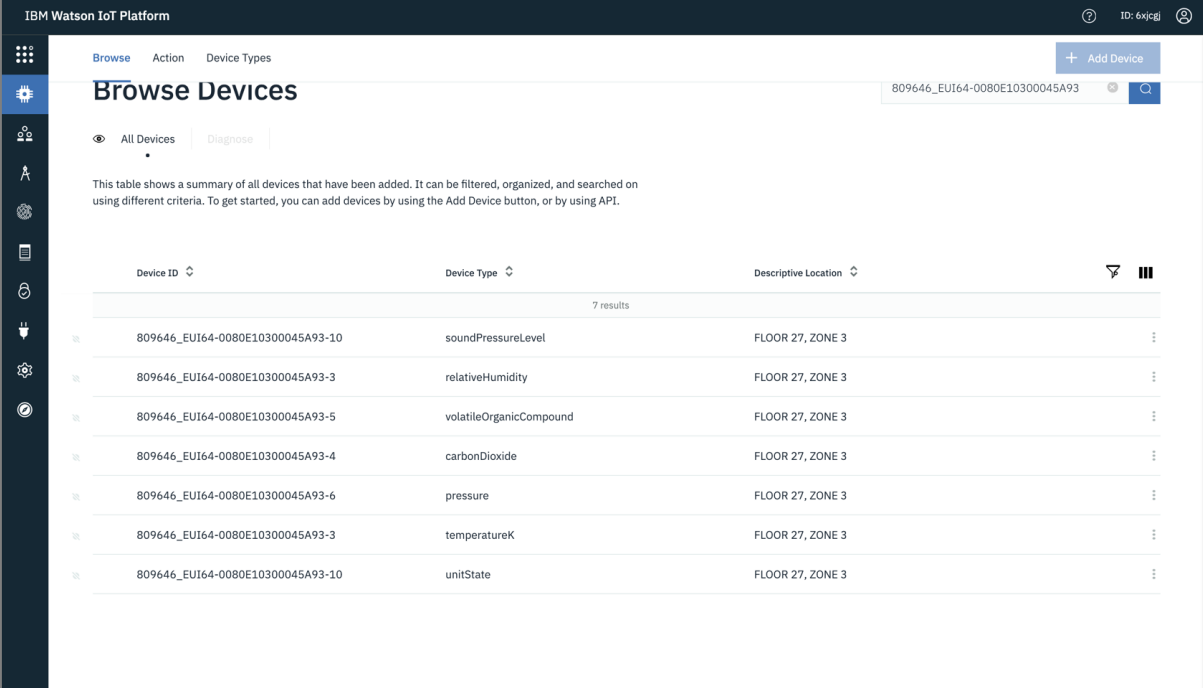
- **Zones** are indicated with numbered blue areas
- **Comfort** devices, red numbered circles
- **Motion plus** devices, green numbered circles
- **Motion** devices, blue numbered circles



As an example, Zone 1 has one Comfort device and Motion devices 1-1 , 1-2 and 2-1, 2-2, 2-3. For registered sensor id's reference the device table below.

8.2 Registered Sensors

In the table below, sensors are registered with an extension indicating their sensor type. For example, the device in Zone 3 with ID 3 is the Comfort device 809646_EUI64-0080E10300045A93 is registering six sensors; with extensions -3, -4, -5, -6 and -10



IBM Watson IoT Platform

Browse Action Device Types

+ Add Device

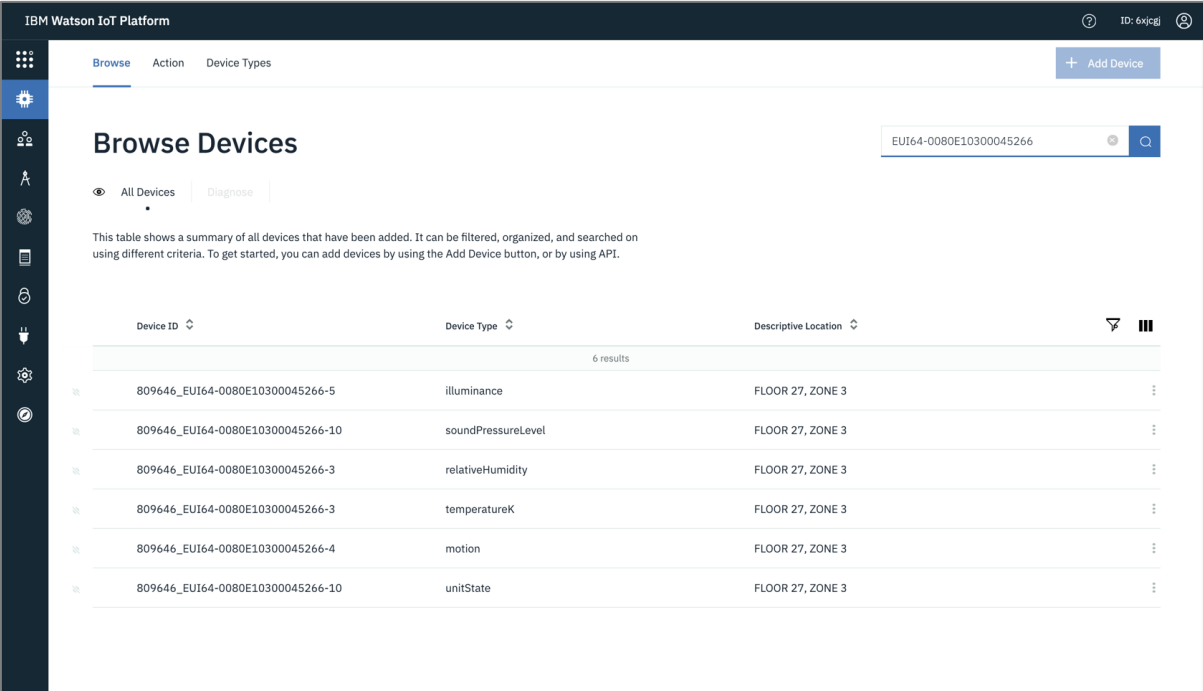
809646_EUI64-0080E10300045A93

All Devices Diagnose

This table shows a summary of all devices that have been added. It can be filtered, organized, and searched on using different criteria. To get started, you can add devices by using the Add Device button, or by using API.

Device ID	Device Type	Descriptive Location
7 results		
809646_EUI64-0080E10300045A93-10	soundPressureLevel	FLOOR 27, ZONE 3
809646_EUI64-0080E10300045A93-3	relativeHumidity	FLOOR 27, ZONE 3
809646_EUI64-0080E10300045A93-5	volatileOrganicCompound	FLOOR 27, ZONE 3
809646_EUI64-0080E10300045A93-4	carbonDioxide	FLOOR 27, ZONE 3
809646_EUI64-0080E10300045A93-6	pressure	FLOOR 27, ZONE 3
809646_EUI64-0080E10300045A93-3	temperatureK	FLOOR 27, ZONE 3
809646_EUI64-0080E10300045A93-10	unitState	FLOOR 27, ZONE 3

Another example is the Motion+ device EUI64-0080E10300045266, also in Zone 3, registering 5 sensors with extensions -3, -4, -5, -10



IBM Watson IoT Platform

Browse Action Device Types

+ Add Device

EUI64-0080E10300045266

All Devices Diagnose

This table shows a summary of all devices that have been added. It can be filtered, organized, and searched on using different criteria. To get started, you can add devices by using the Add Device button, or by using API.

Device ID	Device Type	Descriptive Location
6 results		
809646_EUI64-0080E10300045266-5	illuminance	FLOOR 27, ZONE 3
809646_EUI64-0080E10300045266-10	soundPressureLevel	FLOOR 27, ZONE 3
809646_EUI64-0080E10300045266-3	relativeHumidity	FLOOR 27, ZONE 3
809646_EUI64-0080E10300045266-3	temperatureK	FLOOR 27, ZONE 3
809646_EUI64-0080E10300045266-4	motion	FLOOR 27, ZONE 3
809646_EUI64-0080E10300045266-10	unitState	FLOOR 27, ZONE 3

All sensors on floor 27 are listed in the table below by Zone, ID, Type and Device ID. The sensor types registered are given in the columns to the right using the following short name.

T temperatureK
M motion
CO2 carbonDioxide
P pressure
SP soundPressureLevel
RM relativeHumidity
VOC volatileOrganicCompound
I illumination

For example, Comfort device EUI64-0080E10300045A93 in Zone 3 registers T, CO2, P, SP, RH, VOC sensors with the given extensions to the device name.

Use the table below to identify the devices and sensors you explore in your analytics.

ZONE	ID	YANZI	DEVICE	T	M	CO2	P	SP	RH	VOC	I
1	1	Motion Plus	EUI64-0080E10300045607	-3	-4			-10	-3		-5
1	1-1	Motion	EUI64-0080E1030005113E	-5	-4						
1	1-2	Motion	EUI64-0080E10300052476	-5	-4						
1	2-1	Motion	EUI64-0080E10300051D53	-5	-4						
1	2-2	Motion	EUI64-0080E10300052752	-5	-4						
1	2-3	Motion	EUI64-0080E103000516EC	-5	-4						
2	2	Motion Plus	EUI64-0080E103000451D3	-3	-4			-10	-3		-5
2	2-4	Motion	EUI64-0080E10300052215	-5	-4						
2	2-5	Motion	EUI64-0080E103000526DD	-5	-4						
2	2-6	Motion	EUI64-0080E1030002416E	-5	-4						
2	3-1	Motion	EUI64-0080E10300051973	-5	-4						
2	3-2	Motion	EUI64-0080E10300051B4B	-5	-4						
2	3-3	Motion	EUI64-0080E10300022634	-5	-4						
2	3-4	Motion	EUI64-0080E10300024510	-5	-4						
3	3	Comfort	EUI64-0080E10300045A93	-3		-4	-6	-10	-3	-5	
3	3	Motion Plus	EUI64-0080E10300045266	-3	-4			-10	-3		-5
4	4	Comfort	EUI64-0080E10300045C64	-3		-4	-6	-10	-3	-5	
4	4	Motion Plus	EUI64-0080E10300045264	-3	-4			-10	-3		-5
5	12-1	Motion	EUI64-0080E103000511B8	-5	-4						
5	12-2	Motion	EUI64-0080E10300051A82	-5	-4						
5	12-3	Motion	EUI64-0080E1030005241D	-5	-4						
5	12-4	Motion	EUI64-0080E103000510F6	-5	-4						
5	12-5	Motion	EUI64-0080E103000523F9	-5	-4						
5	12-6	Motion	EUI64-0080E10300051C50	-5	-4						
6	4-1	Motion	EUI64-0080E10300051735	-5	-4						
6	4-2	Motion	EUI64-0080E103000526E7	-5	-4						
6	4-3	Motion	EUI64-0080E1030005119E	-5	-4						
6	4-4	Motion	EUI64-0080E1030005112B	-5	-4						

6	4-5	Motion	EUI64-0080E103000526FB	-5	-4				
6	4-6	Motion	EUI64-0080E10300052816	-5	-4				
6	5-1	Motion	EUI64-0080E103000512F3	-5	-4				
6	5-1	Motion Plus	EUI64-0080E103000451A3	-3	-4		-10	-3	-5
6	5-2	Motion	EUI64-0080E103000511A2	-5	-4				
6	5-2	Motion Plus	EUI64-0080E10300045420	-3	-4		-10	-3	-5
6	5-3	Motion	EUI64-0080E10300051DF1	-5	-4				
6	5-4	Motion	EUI64-0080E10300052522	-5	-4				
6	5-5	Motion	EUI64-0080E103000516ED	-5	-4				
6	5-6	Motion	EUI64-0080E103000524B4	-5	-4				
7	7	Motion Plus	EUI64-0080E103000452B7	-3	-4		-10	-3	-5
8	8	Motion Plus	EUI64-0080E1030004507E	-3	-4		-10	-3	-5
9	9	Motion Plus	EUI64-0080E1030004542F	-3	-4		-10	-3	-5
9	6-1	Motion	EUI64-0080E1030005133F	-5	-4				
9	6-1	Motion Plus	EUI64-0080E103000451A5	-3	-4		-10	-3	-5
9	6-2	Motion	EUI64-0080E10300051301	-5	-4				
9	6-2	Motion Plus	EUI64-0080E10300045407	-3	-4		-10	-3	-5
9	6-3	Motion	EUI64-0080E10300051776	-5	-4				
9	6-4	Motion	EUI64-0080E1030005264A	-5	-4				
9	6-5	Motion	EUI64-0080E10300051647	-5	-4				
9	6-6	Motion	EUI64-0080E103000527B7	-5	-4				
10	10	Comfort	EUI64-0080E103000478EA	-3		-4	-6	-10	-3 -5
10	10	Motion Plus	EUI64-0080E103000454E9	-3	-4		-10	-3	-5
11	11	Comfort	EUI64-0080E1030004674E	-3		-4	-6	-10	-3 -5
11	11	Motion Plus	EUI64-0080E10300045154	-3	-4		-10	-3	-5
11	11-1	Motion	N/A	[DEVI CE]-5	[DEVI CE]-4				
12	8	Comfort	EUI64-0080E10300046CF8	-3		-4	-6	-10	-3 -5
12	12-1	Motion Plus	EUI64-0080E103000457A1	-3	-4		-10	-3	-5
12	12-2	Motion Plus	EUI64-0080E103000452CD	-3	-4		-10	-3	-5
12	7-1	Motion	EUI64-0080E10300052688	-5	-4				
12	7-2	Motion	EUI64-0080E103000519D8	-5	-4				
12	7-3	Motion	EUI64-0080E10300051B65	-5	-4				
12	7-4	Motion	EUI64-0080E10300051340	-5	-4				
12	7-5	Motion	EUI64-0080E10300051B04	-5	-4				
12	7-6	Motion	EUI64-0080E1030005146B	-5	-4				
12	8-1	Motion	EUI64-0080E10300052466	-5	-4				
12	8-2	Motion	EUI64-0080E103000511F9	-5	-4				
12	8-3	Motion	EUI64-0080E10300052789	-5	-4				
12	8-4	Motion	EUI64-0080E10300051A2F	-5	-4				
12	8-5	Motion	EUI64-0080E103000513A0	-5	-4				
12	8-6	Motion	EUI64-0080E1030005134D	-5	-4				
13	13	Motion Plus	EUI64-0080E1030004515F	-3	-4		-10	-3	-5
13	9-1	Motion	EUI64-0080E1030005171C	-5	-4				
13	9-2	Motion	EUI64-0080E103000527C8	-5	-4				

13	9-3	Motion	EUI64-0080E103000519ED	-5	-4					
13	9-4	Motion	EUI64-0080E10300051709	-5	-4					
13	9-5	Motion	EUI64-0080E10300051B3D	-5	-4					
13	9-6	Motion	EUI64-0080E103000527A8	-5	-4					
14	10-1	Motion	EUI64-0080E10300024525	-5	-4					
14	10-2	Motion	EUI64-0080E10300022551	-5	-4					
14	10-3	Motion	EUI64-0080E10300024598	-5	-4					
14	14-1	Motion Plus	EUI64-0080E103000452B9	-3	-4		-10	-3	-5	
14	14-2	Motion Plus	EUI64-0080E103000457D9	-3	-4		-10	-3	-5	
15	10-4	Motion	EUI64-0080E10300023C37	-5	-4					
15	10-5	Motion	EUI64-0080E10300022A58	-5	-4					
15	10-6	Motion	EUI64-0080E103000246CE	-5	-4					
15	11-2	Motion	EUI64-0080E10300022410	-5	-4					
15	15-1	Motion Plus	EUI64-0080E103000455C5	-3	-4		-10	-3	-5	
15	15-2	Motion Plus	EUI64-0080E10300045424	-3	-4		-10	-3	-5	
16	16	Comfort	EUI64-0080E103000476D5	-3		-4	-6	-10	-3	-5
16	16	Motion Plus	EUI64-0080E1030004553E	-3	-4			-10	-3	-5
17	17	Comfort	EUI64-0080E10300046744	-3		-4	-6	-10	-3	-5
17	17	Motion Plus	EUI64-0080E10300045452	-3	-4			-10	-3	-5
18	18	Comfort	EUI64-0080E10300046D2A	-3		-4	-6	-10	-3	-5