

IBM Cloud



Detecting Anomalous IoT Behaviors with Predictive Analytics

Watson Data Platform

Lab Guide





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Document Revision History

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Lab Environment Overview

Software and Tools

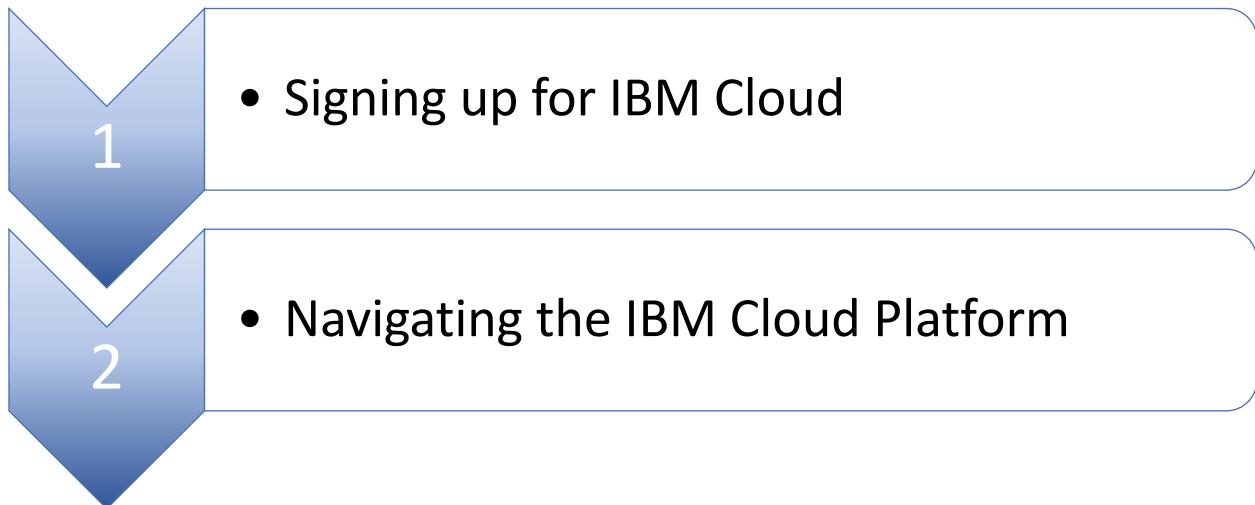
Software	Link
Watson Studio	https://datascience.ibm.com/
GitHub	https://github.com/team-wolfpack
IBM Cloud	https://www.ibm.com/cloud/



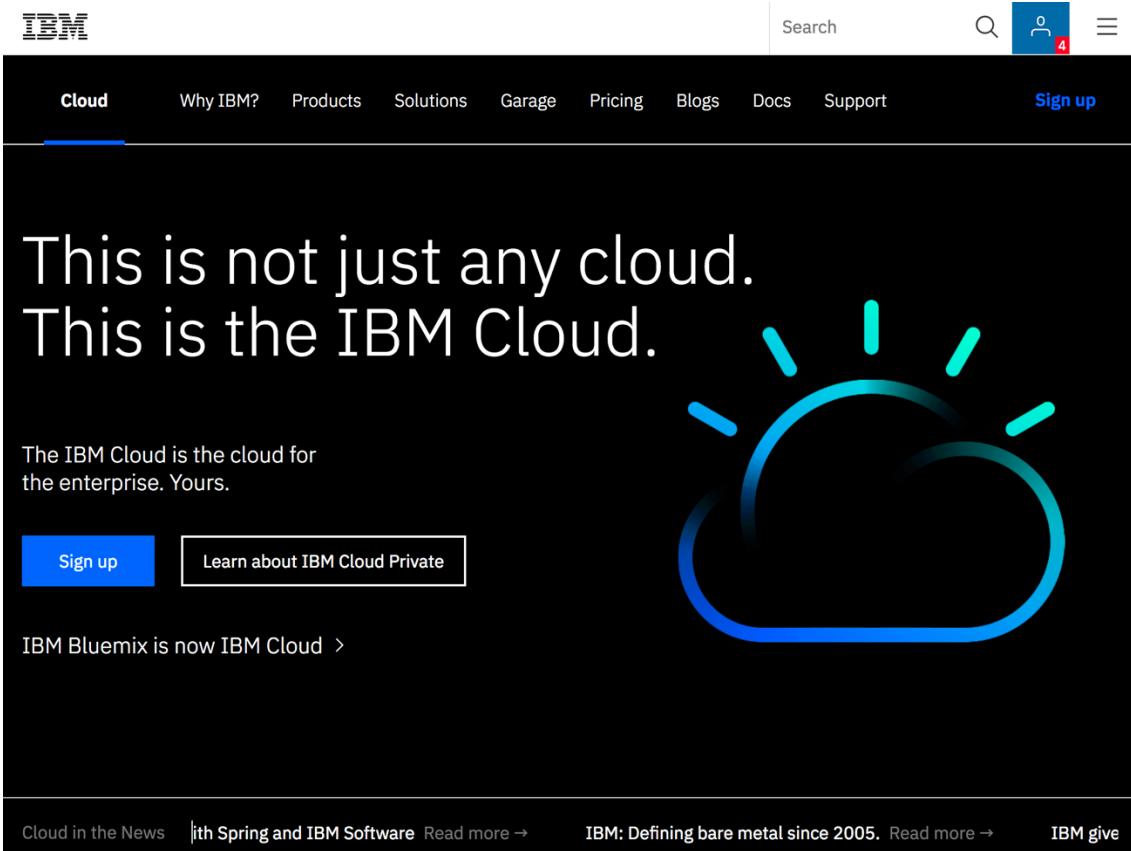
Lesson 1: IBM Cloud Signup

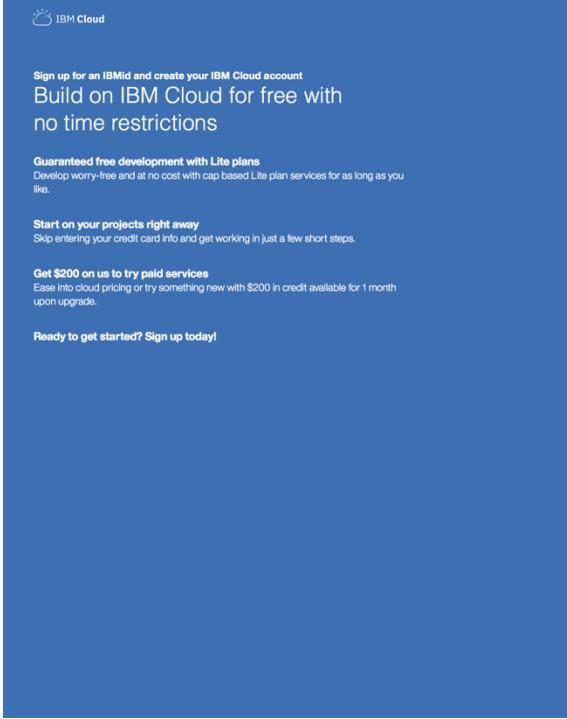
Purpose:	This lab introduces the subject of Cloud. After completing the lab, you should be able to: <ul style="list-style-type: none">• Understand Cloud• Navigate IBM Cloud Platform
Tasks:	Tasks you will complete in this lab exercise include: <ul style="list-style-type: none">• Signing up for IBM Cloud• Navigating the IBM Cloud Platform

Lab 1 Workflow Overview



Lesson 1 Instructions

Action
<p><u>1.Signing up for IBM Cloud</u></p> <ol style="list-style-type: none">Go to https://www.ibm.com/cloud/We are going to sign up for a free IBM Cloud account.Click "Sign up". 

Action
<p>d. Fill in the required boxes.</p> <p>e. Click “Create Account”.</p> 
<p>2.Navigating the IBM Cloud Platform</p> <ol style="list-style-type: none"> Log into IBM Cloud at https://console.bluemix.net/dashboard/apps/ If this is the first time you are using IBM Cloud (formerly Bluemix), an “About your IBMid Account Privacy” window will appear. Select Proceed We are now looking at the IBM Cloud Dashboard. Click on the “Catalog” button found in the upper right hand corner of the screen.

Action

☰ IBM Cloud

Catalog
Docs
Support
Manage

Dashboard

RESOURCE GROUP
CLOUD FOUNDRY ORG
CLOUD FOUNDRY SPACE
LOCATION
CATEGORY

All Resources
All Organizations
All Spaces
All Locations
All Categories

Create resource

Fast-track your app development

Get a preview of what IBM Cloud can do for you. Go from prototype to production in minutes with our starter kits and solution tutorials. Check out some of our popular examples.

 **Build a chatbot**

Starter Kit · Lite Services · IBM

e. The Catalog is a compilation of the services offered on the IBM Cloud.

☰ IBM Cloud

Catalog
Docs
Support
Manage
1522119 - Loren Murp...

Catalog

Search
Filter

All Categories >
Featured Offerings

Compute
Containers
Networking
Storage
AI
Analytics
Databases
Developer Tools
Integration
Internet of Things
Security and Identity
Starter Kits
Web and Mobile
Application Services

Virtual Server
IBM

Our virtual servers deliver a higher degree of transparency, predictability, and automation for all workload types. Virtual servers are guaranteed not to be oversubscribed, unless noted and offer...

Watson Assistant (formerly Conversation)
Lite + IBM

Add a natural language interface to your application to automate interactions with your end users. Common applications include virtual agents and chat bots that can integrate and communicate on any...

Compute

Infrastructure

Auto-Scaling
IBM

Automatically increase or decrease the number of application instances based on a policy you define.

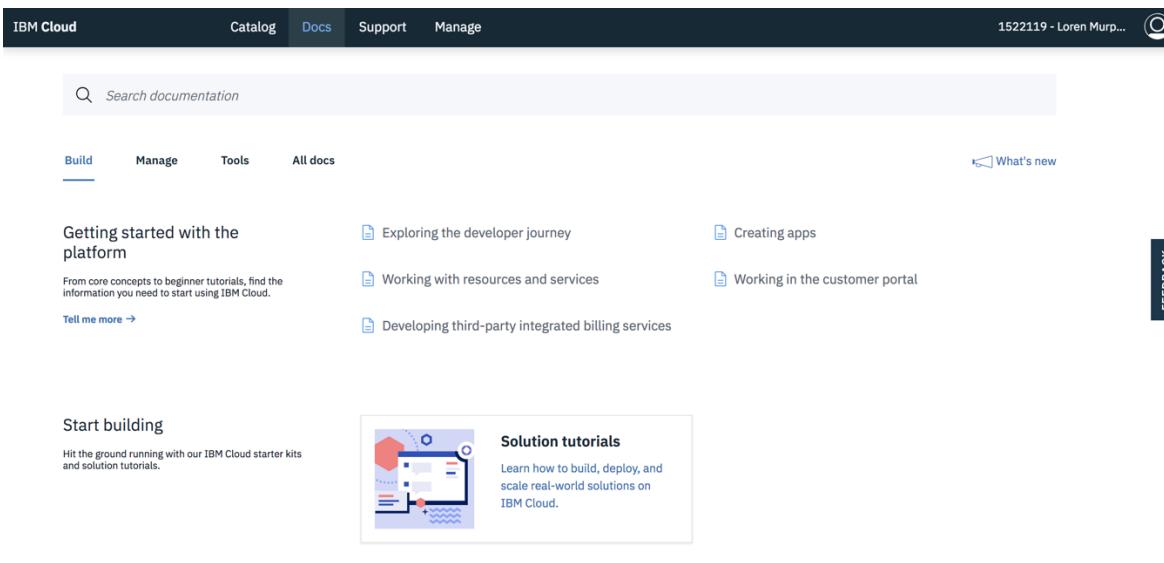
Bare Metal Server
IBM

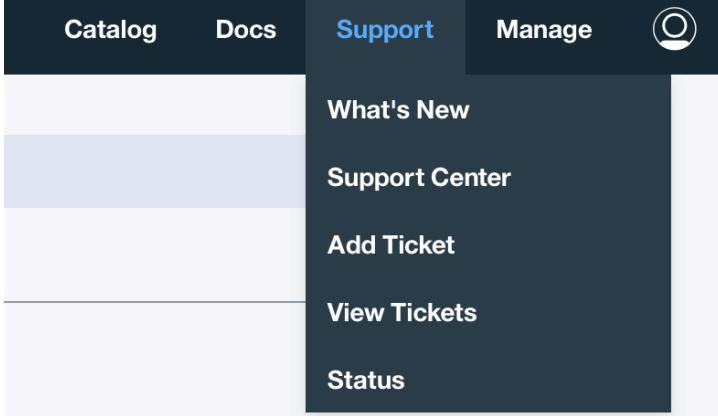
Bare metal servers provide the raw horsepower you demand for your processor-intensive and disk I/O-intensive workloads. These servers come with the most complete package of...

Virtual Server
IBM

Our virtual servers deliver a higher degree of transparency, predictability, and automation for all workload types. Virtual servers are guaranteed not to be oversubscribed, unless note...

As you look around the catalog, there are a few places to observe. The page is laid out for simple navigation. We already selected the Catalog button to open the Catalog. The Docs link provides details on each of the services. We will touch on this when we initialize our service here in a bit. The Support page is available to answer any questions that cannot be found in Docs. And lastly Manage is where you can manager your account Space and Organization. You can have multiple Spaces. This is a way to keep different projects organized.

Action
<p>Services are organized in categories. These include Infrastructure, Compute, Storage, Watson, etc. Each service will have a title, icon, brief explanation of the service, and a label (“IBM”, “Third Party”, “Lite”)</p> <p>f. IBM Cloud supports both IBM products and services, as well as third-party. A “Lite” label indicates that you can provision a free version of the service using your Lite Cloud account.</p> <h3>IBM Third Party Lite</h3> <p>Going along the same navigation bar as we found the catalog, we can see docs, support and manage.</p>  <p>g. Click on “Docs”.</p> <p>This is the first “go to” resource if you have questions about any of the services. IBM Cloud Docs houses tutorials, demo’s, videos, starter kits...if you have questions about a service, this is a great resource. Scrolling down you can see that there are numerous links. Each service has a link. Click on one to look at the type of documentation. The documentation ranges from “getting started” and high level “what is this service” to technical details about deploying the services.</p> 

Action
h. Click on “ Support ”.
Support is a next level of information and help. When you click on it, it will display a drop down menu. If the answers cannot be solved by looking for Docs OR if an emergency situation arises with one of the services, this is where you go to open a ticket. Once the ticket is open, this is also where you can see the status of your tickets. The “What’s new” tab will show you what is new on IBM Cloud. This is where you can go to see recent updates or releases on services.

i. Click on “ Manage ”.
Manage is where you can keep track of your own account, billing and usage and security. Within the account tab, you can monitor users, groups, organizations, etc.
j. Click on the head icon .
Finally, the head icon will bring you to your personal account page. This is another way to access and manage your accounts such as organizations you are a part of or spaces you are working in.

k. Return to the catalog

Action

IBM Cloud Catalog Docs Support Manage 1522119 - Loren Murp... 

Catalog

Search  Filter 

All Categories >

Featured Offerings

Virtual Server IBM Our virtual servers deliver a higher degree of transparency, predictability, and automation for all workload types. Virtual servers are guaranteed not to be oversubscribed, unless noted and offer...		Watson Assistant (formerly Conversation) Lite + IBM Add a natural language interface to your application to automate interactions with your end users. Common applications include virtual agents and chat bots that can integrate and communicate on any...	
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Compute

Auto-Scaling IBM Automatically increase or decrease the number of application instances based on a policy you define.		Bare Metal Server IBM Bare metal servers provide the raw horsepower you demand for your processor-intensive and disk I/O-intensive workloads. These servers come with the most complete package of...	
Virtual Server IBM Our virtual servers deliver a higher degree of transparency, predictability, and automation for all workload types. Virtual servers are guaranteed not to be oversubscribed, unless note...			

Infrastructure

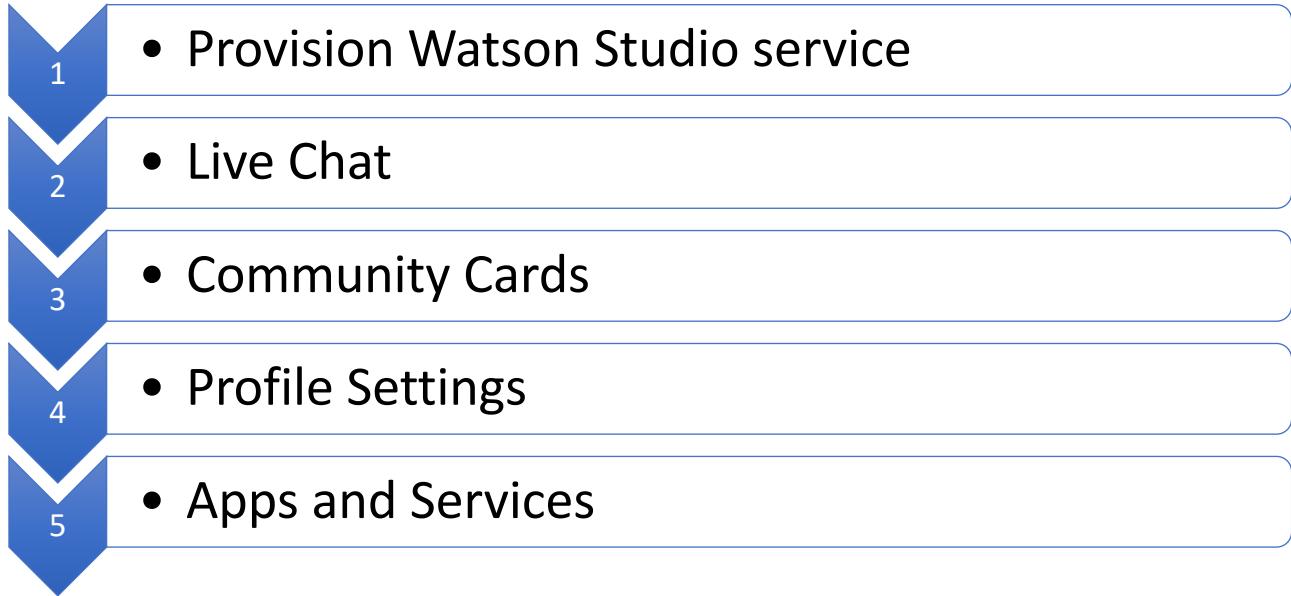
End of Lesson 1



Lesson 2: IBM Watson Studio Signup

Purpose:	This lab introduces Watson Studio, its sign up and walk-through of the features and functions.
Tasks:	<p>Tasks you will complete in this lab exercise include:</p> <ul style="list-style-type: none">• Provision Watson Studio Service• Engage Live Chat• Differentiate Four Types of Community Cards• Explore Personal Profile, Apps/Services, and Integrations

Lesson 2: Workflow Overview

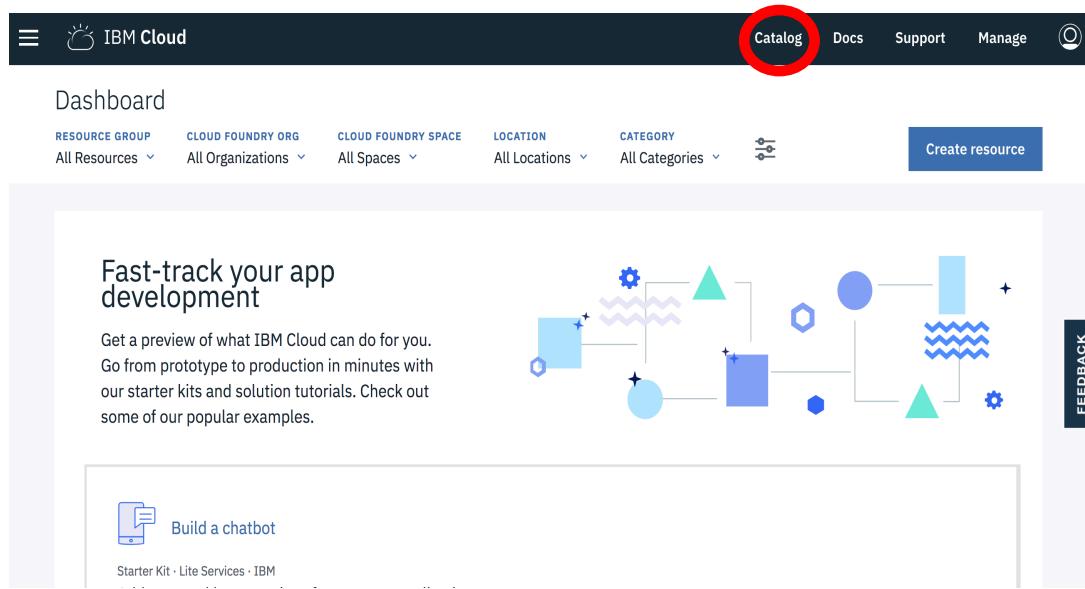


Lesson 2: Instructions

Action

1. Provision Watson Studio Service

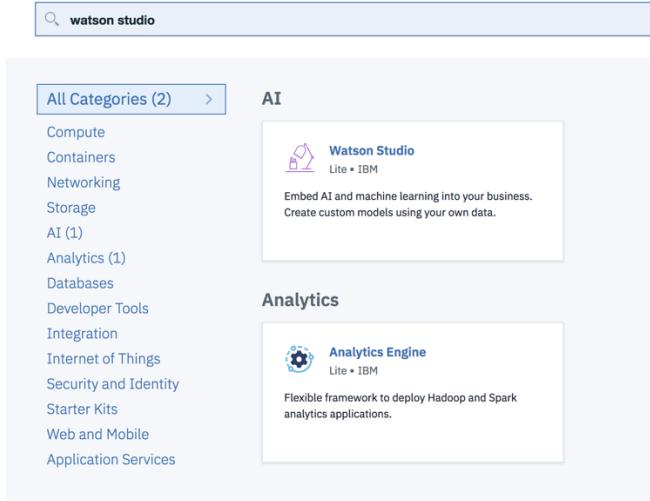
- a. Log into IBM Cloud at <https://console.bluemix.net/dashboard/apps/>
- b. Click the “Catalog” button found in the upper right hand corner of the screen.



The screenshot shows the IBM Cloud dashboard. At the top, there is a dark header bar with the "IBM Cloud" logo, a "Catalog" button (which is circled in red), and other links like "Docs", "Support", and "Manage". Below the header is a "Dashboard" section with filters for "RESOURCE GROUP", "CLOUD FOUNDRY ORG", "CLOUD FOUNDRY SPACE", "LOCATION", and "CATEGORY", along with a "Create resource" button. The main area features a "Fast-track your app development" section with a graphic of interconnected icons (gear, triangle, circle) and text about previewing services. At the bottom left, there is a card for "Build a chatbot" with a "Starter Kit - Lite Services - IBM" link. A "FEEDBACK" button is located on the right side of the main content area.

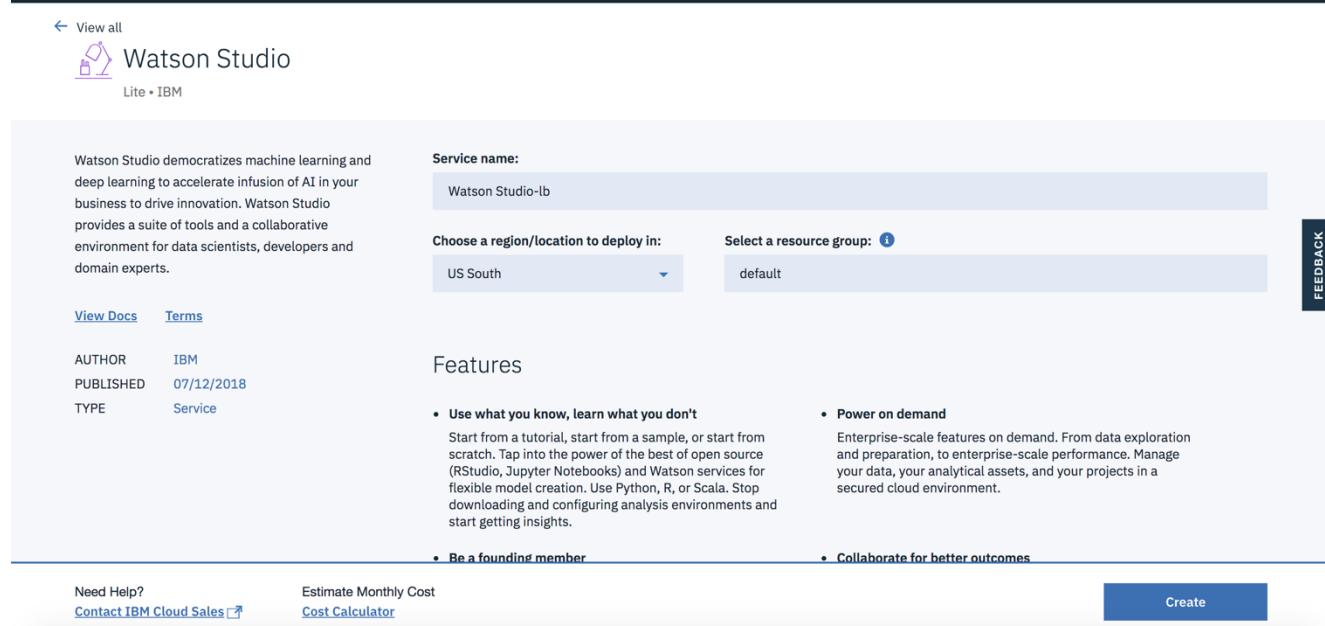
- c. Within the catalog, search for “**Watson Studio**”

Catalog



The screenshot shows the IBM Cloud Catalog interface. A search bar at the top contains the text "watson studio". On the left, a sidebar lists "All Categories (2)" and various service categories: Compute, Containers, Networking, Storage, AI (1), Analytics (1), Databases, Developer Tools, Integration, Internet of Things, Security and Identity, Starter Kits, Web and Mobile, and Application Services. The main area displays two service cards: "Watson Studio" under the "AI" category and "Analytics Engine" under the "Analytics" category.

- d. Click the **Watson Studio** tile
- e. Rename the Watson Studio service name or keep the default name. Click **Create** to provision the service. Resource group should be default.



The screenshot shows the detailed view of the Watson Studio service. At the top, there's a "View all" link and a "Watson Studio" card with a "Lite" badge. Below this, a description states: "Watson Studio democratizes machine learning and deep learning to accelerate infusion of AI in your business to drive innovation. Watson Studio provides a suite of tools and a collaborative environment for data scientists, developers and domain experts." To the right, there are fields for "Service name:" (set to "Watson Studio-lb"), "Choose a region/location to deploy in:" (set to "US South"), and "Select a resource group:" (set to "default"). On the far right, there's a "FEEDBACK" button. Under the service details, there are sections for "View Docs" and "Terms". Below that, author information (AUTHOR: IBM, PUBLISHED: 07/12/2018, TYPE: Service) and features (such as "Use what you know, learn what you don't", "Power on demand", "Be a founding member", and "Collaborate for better outcomes"). At the bottom, there are links for "Need Help?", "Estimate Monthly Cost", "Contact IBM Cloud Sales", and "Cost Calculator", along with a prominent blue "Create" button.

- f. Once the service is provisioned, click **Get Started** to open Watson Studio.

IBM Cloud Catalog Docs Support Manage 1522119 - Loren Murp... 

Manage Plan

Watson /
 Watson Studio-lb
 Resource Group: default Location: US South



Watson Studio

Welcome to Watson Studio. Let's get started!

[Get Started](#)

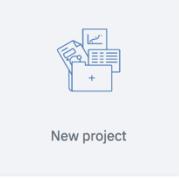
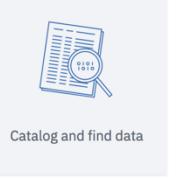
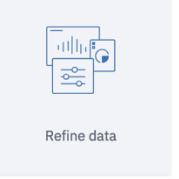
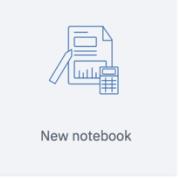
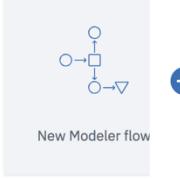
g. You should now see the Watson Studio Homepage

IBM Watson Projects Tools Catalog Community Services Docs Support Manage  

[Get started](#)

 Welcome Watson!
 Watson Studio and Watson Knowledge Catalog are both part of IBM Watson.

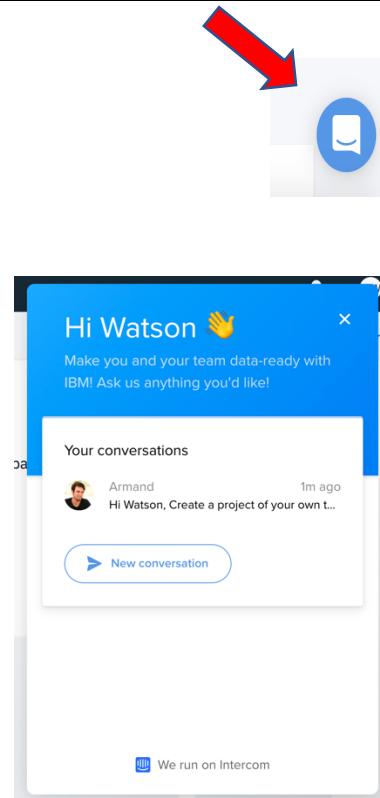
Get started with key tasks

 New project  Catalog and find data  Refine data  New notebook  Deep learning  New Modeler flow

2. Live Chat

This is the home page of Watson Studio. Here you have all the tools that you need in a single place to **Learn, Create, and Collaborate**.

- On the bottom right-hand corner, you will see a **Live Chat** feature. Click on the **Chat** icon to launch Live Chat:



If you need assistance, start typing your message in the box to connect with a live person. Through this Live Chat feature, you can also continue conversations the next time you log into Watson Studio.

We use feedback captured through [Live Chat](#) and the offerings instrumentation to guide our decisions in designing and developing [Watson Studio](#).

3. Community Cards

At the top of the Home Page click on [Community](#)



Featured

Sort by: [Featured](#) ▾

ARTICLE	Apple, IBM add machine learning to...	ARTICLE	Introducing IBM Watson Studio	ARTICLE	Webinar: April 11 - Thinking inside the box:...
AUTHOR	TechCrunch	AUTHOR	Armand Ruiz	AUTHOR	RStudio
TOPIC	Watson	TOPIC	Watson	TOPIC	Data Science
DATE	Mar 20, 2018	DATE	Mar 20, 2018	DATE	Apr 02, 2018
FORMAT	Web page	FORMAT	Web page	FORMAT	Web page

1

8

0

All content

ARTICLE	Webinar: April 11 - Thinking inside the box:...	NOTEBOOK	Watson Assistant Workspace Analysis with...	TUTORIAL	Build Deep Learning Architectures With...	NOTEBOOK	Connect to Db2 Warehouse on Cloud and Db2...
AUTHOR	RStudio	AUTHOR	IBM	AUTHOR	developerWorks TV	AUTHOR	IBM
TOPIC	Data Science	TOPIC	Communications	LEVEL	Beginner	TOPIC	Economy & Business
DATE	Apr 02, 2018	DATE	Apr 02, 2018	DATE	Apr 02, 2018	DATE	Mar 29, 2018
FORMAT	Web page	FORMAT	Web page	FORMAT	Web page	FORMAT	Web page

0

4

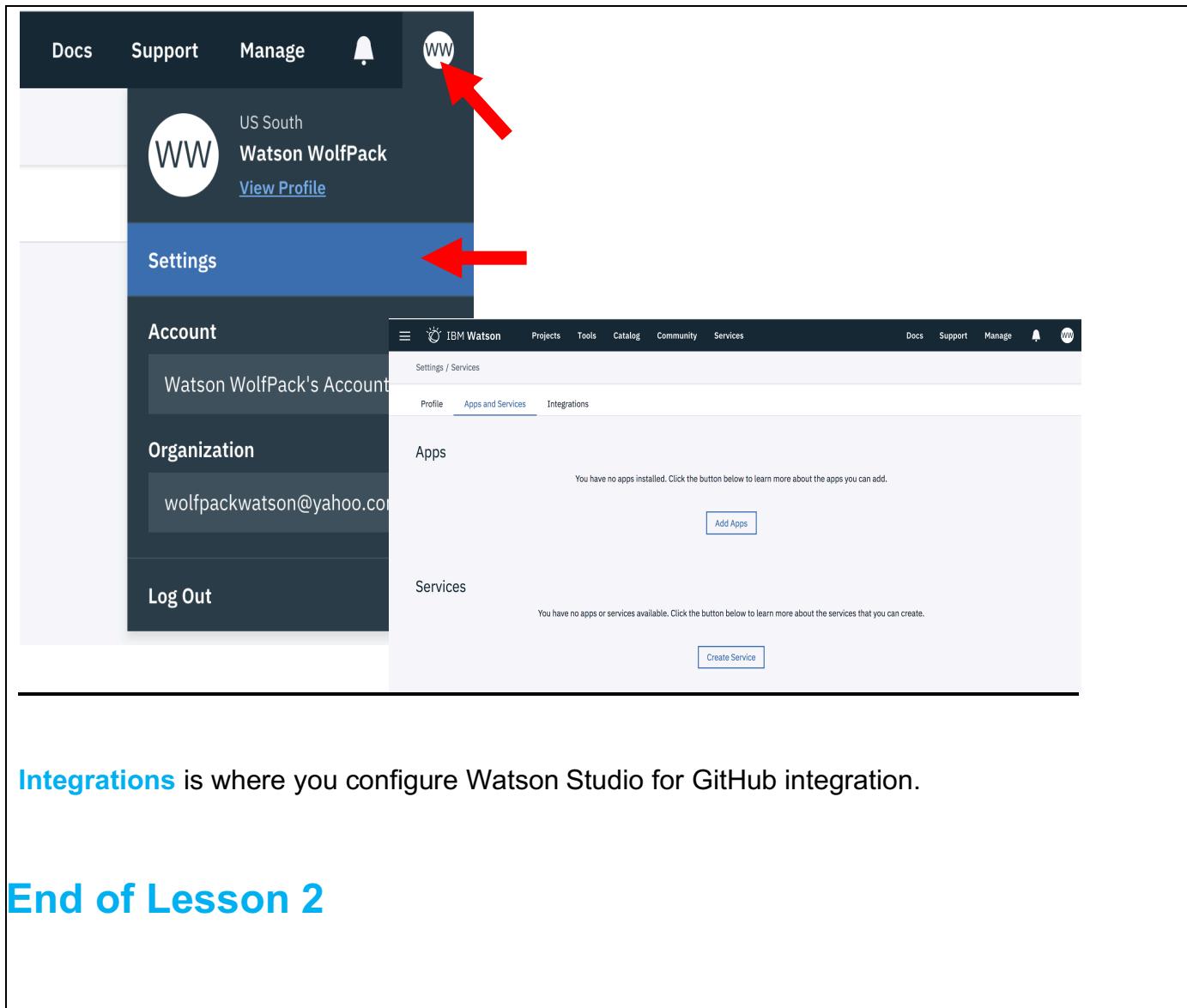
0

8

There are four types of cards – **Articles**, **Data Sets**, **Notebooks**, and **Tutorials**. These are designed to make it easier for you to learn about data science and experiment with its various tools and techniques.

4. Profile Settings

- Click on **Settings** to look at your **Profile, Apps and Services, and Integrations**. This is where you see the details of your IBM Cloud Account:



The screenshot shows the Watson Studio interface. At the top left, there are links for 'Docs', 'Support', and 'Manage'. A red arrow points to a user icon (WW) in the top right corner. Another red arrow points to the 'Settings' link in the main navigation bar. The sidebar on the left contains sections for 'Account' (Watson WolfPack's Account), 'Organization' (wolfpackwatson@yahoo.com), and 'Log Out'. The main content area has a header 'IBM Watson' with links for 'Projects', 'Tools', 'Catalog', 'Community', and 'Services'. Below this, there are tabs for 'Profile', 'Apps and Services' (which is selected), and 'Integrations'. Under 'Apps', it says 'You have no apps installed.' with a 'Add Apps' button. Under 'Services', it says 'You have no apps or services available.' with a 'Create Service' button.

Integrations is where you configure Watson Studio for GitHub integration.

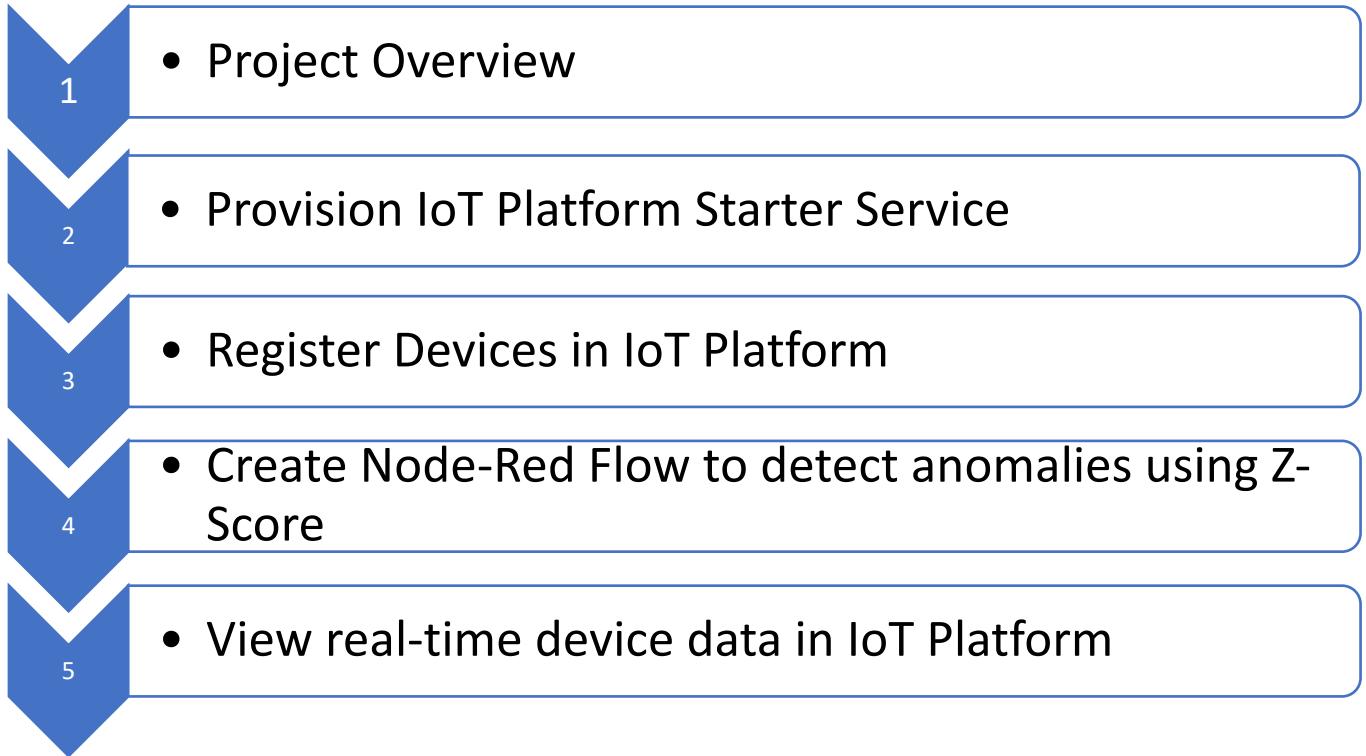
End of Lesson 2



Lesson 3: Detect Anomalies using Z-Score

Purpose:	This lesson introduces the Internet of Things (IoT) Platform Starter on IBM Cloud, how to create a Node-RED flow to simulate IoT devices, and how to use z-score to detect anomalies on edge devices.
Tasks:	<p>Tasks you will complete in this lab exercise include:</p> <ul style="list-style-type: none">• Provision Internet of Things Platform Starter Service on IBM Cloud• Create Node-RED Flow to detect anomalies using z-score• Register devices in IoT Platform and view real-time data

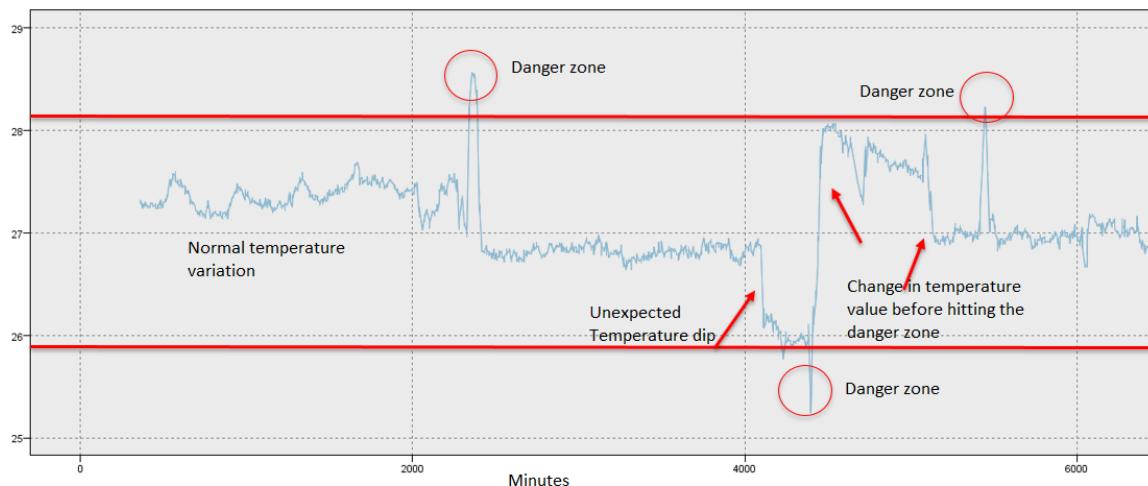
Lesson 3: Workflow Overview



Lesson 3: Instructions

1. Project Overview

The total amount of data produced by IoT devices and systems is humongous and arriving with a very high velocity. However more than 90% of this data gets lost unless it is analyzed. One way of performing this analysis is by setting threshold which would trigger an action to be taken once it is breached. This can be seen by the danger zone readings as shown in the time-series data shown below.



However, this approach is at best a reactive approach and at worst simply futile (as the event has already occurred).

The real benefit of this massive amount of data, produced by IoT, lies in performing a real-time analysis on it so to discover trends and patterns and to use these patterns to predict the failures in a timely manner (as can be seen by the unexpected temperature dip above). One of the mechanisms of performing this analysis is through the usage of Predictive analytics.

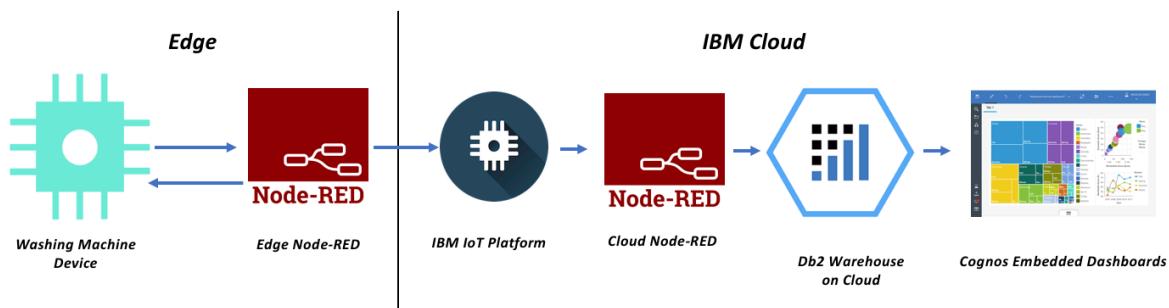
Predictive analytics encompasses a variety of statistical techniques from predictive modeling, machine learning, and data mining that analyze current and historical facts to make predictions about future. The core of predictive analytics relies on capturing relationships between explanatory variables and the predicted variables from past occurrences, and exploiting them to predict the unknown outcome. It is important to note, however, that the accuracy and usability of results will depend greatly on the level of data analysis and the quality of assumptions.

In cognitive IoT solutions, predictive analytics or machine learning can take place in an edge computing architecture. Edge computing basically means that you push computing

away from the cloud or data center out toward the sensors. Two common reasons for edge computing are Latency and Transfer cost.

- **Latency** impacts some critical decisions that make a cloud route trip untenable. Think of a smart-connected car. If the car in front of you brakes suddenly, you want your car to respond immediately.
- **Transfer cost** can be too high if the amount of data that is created by a sensor is too much to transfer to the cloud completely. Either it is technically impossible due to link speed, or it is just too expensive, or both.

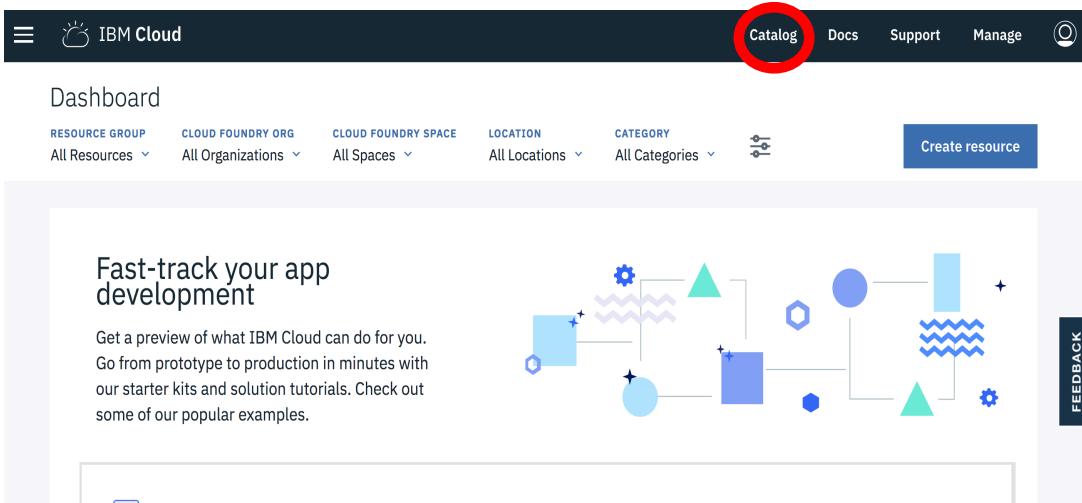
In this lab, you will simulate a Washing Machine IoT Device that is publishing voltage sensor events to the IBM Watson IoT Platform. We will use z-score to predict when an anomaly will occur and send the device a command to immediately shutdown. The predictive analytics will be performed on the edge device thus reducing the latency. In addition, we will visualize the data being sent to the Watson IoT Platform. We will then create a Node-RED flow in the IBM cloud to persist the data from the IoT Platform to a Db2 Warehouse on Cloud instance. Lastly, we will visualize the sensor data in Watson Studio using the Cognos Dashboard Embedded Service.



Action

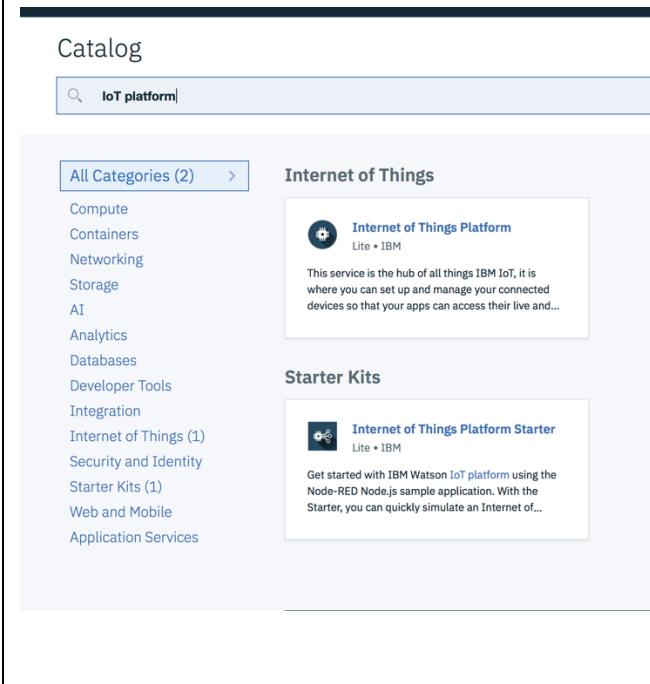
2. Provision Internet of Things Platform Service

- a. Log into IBM Cloud at <https://console.bluemix.net/dashboard/apps/>
- b. Click the “Catalog” button found in the upper right hand corner of the screen.



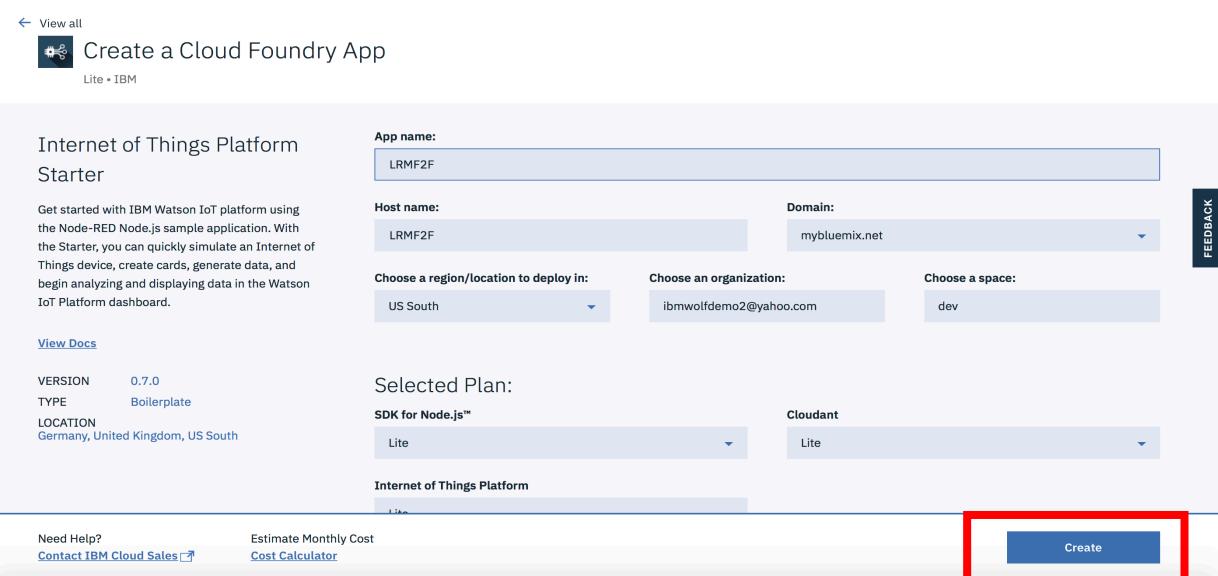
The screenshot shows the IBM Cloud dashboard. At the top, there's a dark header bar with the "IBM Cloud" logo and several navigation links: Catalog (which is circled in red), Docs, Support, Manage, and a user profile icon. Below the header is a search bar and some filter options: RESOURCE GROUP (All Resources), CLOUD FOUNDRY ORG (All Organizations), CLOUD FOUNDRY SPACE (All Spaces), LOCATION (All Locations), and CATEGORY (All Categories). A "Create resource" button is also visible. The main content area features a "Fast-track your app development" section with a preview of various services represented by icons like gears, triangles, and waves. On the right side of this section is a "FEEDBACK" button.

- c. In the search bar, type **IoT Platform** and select **Internet of Things Platform Starter**, which is located under the Starter Kits section. The Starter kit will provision the IBM IoT Platform, a Node-RED sample application, and Cloudant.



The screenshot shows the Catalog page with a search bar containing "IoT platform". The left sidebar lists categories: All Categories (2) > Internet of Things. Under "Internet of Things", there is a card for "Internet of Things Platform" by IBM, which is described as the hub of all things IBM IoT. Below this is the "Starter Kits" section, which contains a card for "Internet of Things Platform Starter" by IBM, described as getting started with the Node-RED sample application.

- | Action |
|--|
| d. Give the app a unique name. Once you type in an app name, it automatically becomes the host name as well. Keep the default values for all the other fields. Click Create |
- d. Give the app a unique name. Once you type in an app name, it automatically becomes the host name as well. Keep the default values for all the other fields. Click **Create**



View all  Create a Cloud Foundry App
Lite + IBM

Internet of Things Platform Starter

Get started with IBM Watson IoT platform using the Node-RED Node.js sample application. With the Starter, you can quickly simulate an Internet of Things device, create cards, generate data, and begin analyzing and displaying data in the Watson IoT Platform dashboard.

[View Docs](#)

VERSION 0.7.0
TYPE Boilerplate
LOCATION Germany, United Kingdom, US South

App name: LRMF2F

Host name: LRMF2F Domain: mybluemix.net

Choose a region/location to deploy in: US South Choose an organization: ibmwolfdemo2@yahoo.com Choose a space: dev

Selected Plan:
SDK for Node.js™ Cloudant
Lite Lite

Internet of Things Platform

Need Help? [Contact IBM Cloud Sales](#) Estimate Monthly Cost [Cost Calculator](#)

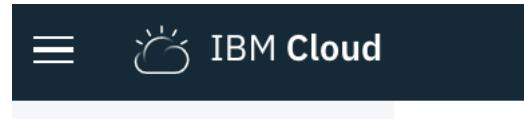
Create

- | |
|--|
| e. The app will take a few minutes to start, as indicated by the icon next to the apps name. Your app is ready once the Visit App URL becomes active. |
|--|
- e. The app will take a few minutes to start, as indicated by the icon next to the apps name. Your app is ready once the **Visit App URL** becomes active.

 This app is awake. [Visit App URL](#)

3. Register Devices in IoT Platform

- | |
|--|
| a. Select the IBM Cloud icon in the upper left corner. This will take you back to your dashboard. |
|--|
- a. Select the **IBM Cloud** icon in the upper left corner. This will take you back to your dashboard.



- | |
|--|
| b. Notice the Internet of Things Platform Starter provisioned three items: a Cloud Foundry App, a Cloudant NoSQL DB Service and the Internet of Things Platform Service. |
|--|
- b. Notice the Internet of Things Platform Starter provisioned three items: a Cloud Foundry App, a Cloudant NoSQL DB Service and the Internet of Things Platform Service.

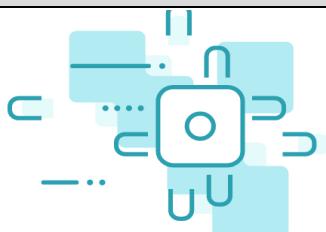
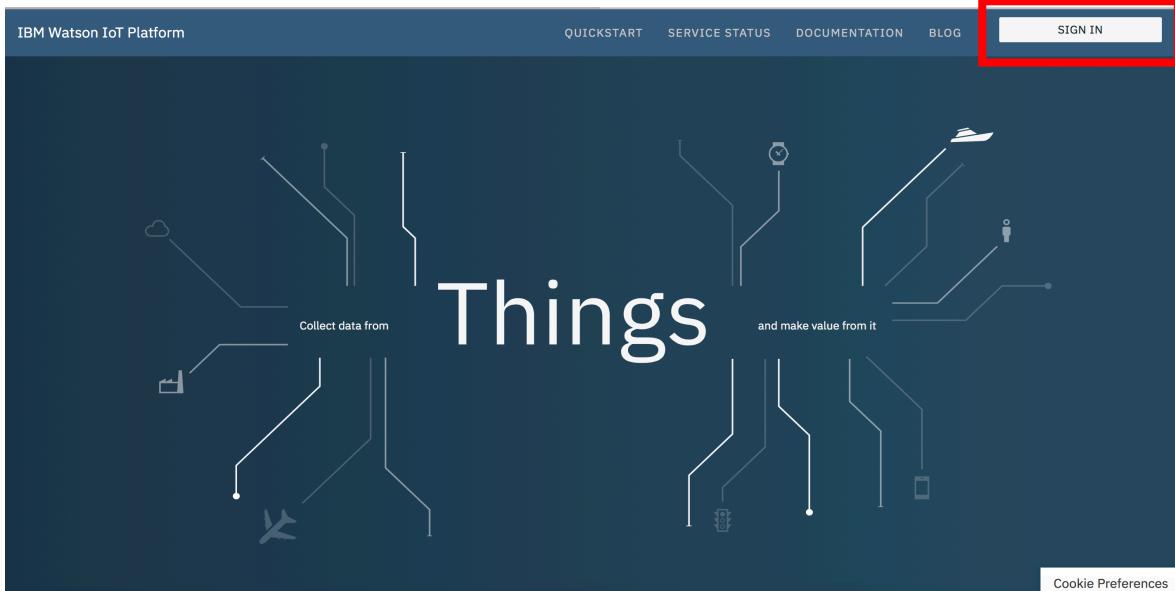


Action					
Cloud Foundry Applications					
Name	Region	CF Org	CF Space	Memory (MB)	Status
LRMF2F	US South	ibmwolfdemo2@...	dev	256	● Running
Cloud Foundry Services					
Name	Region	CF Org	CF Space	Plan	Service Offering
LRMF2F-cloudantNoSQLDB	US South	ibmwolfdemo2@...	dev	Lite	Cloudant NoSQL ...
LRMF2F-iotf-service	US South	ibmwolfdemo2@...	dev	Lite	Internet of Thing...

c. Under the “Cloud Foundry Services” section, click the **Internet of Things Platform** service. It will be named “**xxxx – iotf – service**,” where xxxx is the name of your app.

Cloud Foundry Applications					
Name	Region	CF Org	CF Space	Memory (MB)	Status
LRMF2F	US South	ibmwolfdemo2@...	dev	256	● Running
Cloud Foundry Services					
Name	Region	CF Org	CF Space	Plan	Service Offering
LRMF2F-cloudantNoSQLDB	US South	ibmwolfdemo2@...	dev	Lite	Cloudant NoSQL ...
LRMF2F-iotf-service	US South	ibmwolfdemo2@...	dev	Lite	Internet of Thing...

d. Select **Launch** to enter into the IBM Watson IoT Platform organization space

Action
 <p>Let's get started with Watson IoT Platform</p> <p>Securely connect, control, and manage devices. Quickly build IoT applications that analyze data from the physical world.</p> <p>Launch Docs</p> <p>e. You should now see the IBM Watson IoT Platform welcome screen. In the upper right corner, click Sign In and login with your IBM Cloud ID and password</p>  <p>f. Click your IBM Cloud ID in the upper right corner and select the Bluemix Free Org ID. The IoT organization is a space used for connecting and managing devices to the IoT Platform so your applications can access their live and historical data.</p>

Action

g. You should now see your Browse Devices page.

In the lab we will simulate a Washing Machine Sensor Device connecting to the IoT Platform. Each device connected to the IBM Watson IoT Platform is associated with a device type. Device types are intended to be groups of devices which share common characteristics. In order to add devices in IBM Watson IoT Platform, you need to create a device type.

Action

- h. From the Browse Devices page, select the Device Types tab in the upper left menu

- i. Select **Add Device Type**, from the upper right corner

[+ Add Device Type](#)

Observe there are 2 options provided: Device type and Gateway type. This lab will focus on adding devices not a gateway. Gateways are a specialized class of devices in the IBM Watson IoT Platform which serve as access points to the Platform for other devices. Gateway devices can register new devices and can send and receive data on behalf of devices connected to them.

- j. For Type, select **Device**. For Name, type **VoltageSensor**. Click **Next**.

Type	Device	Or	Gateway	
Name	VoltageSensor	<small>The device type name is used to identify the device type uniquely and uses a restricted set of characters to make it suitable for API use.</small>		
Description				

Action				
<p>k. Leave Device Information blank. Select Done. You have successfully added a new device type. Now we need to register Devices of that type.</p> <div style="background-color: #f0f0f0; padding: 10px;"> <p>You added the new device type: VoltageSensor</p> <p>Register Device Advanced Flow</p> <hr/> <p>Optional Register Devices, Define Interfaces</p> <p>Now that you added a device type, you can register and connect devices for this type.</p> <p>Register Devices</p> </div> <p>l. Select Register Devices. Device Type should be VoltageSensor. For Device ID, type Sensor01. Click Next.</p> <div style="background-color: #f0f0f0; padding: 10px;"> <p>IBM Watson IoT Platform QUICKSTART SERVICE STATUS DOCUMENTATION BLOG wolfpackwatson@yahoo... ▾ ID: (aj4fer)</p> <p>Browse Action Device Types</p> <p>Add Device Identity Device Information Groups Security Summary X</p> <p>Identity Select a device type for the device that you are adding and give the device a unique ID.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Device Type</td> <td style="padding: 5px;">VoltageSensor</td> </tr> <tr> <td style="padding: 5px;">Device ID</td> <td style="padding: 5px;">Sensor01</td> </tr> </table> <p>Cancel Next</p> </div> <p>m. Leave Device Information blank. Select Next.</p>	Device Type	VoltageSensor	Device ID	Sensor01
Device Type	VoltageSensor			
Device ID	Sensor01			

Action																				
<p>Add Device Identity Device Information Security Summary</p> <p>Device Information</p> <p>You can modify the default device information and enter more information about the device for identification purposes.</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Serial Number</td> <td style="width: 70%;"><input type="text" value="Enter Serial Number"/></td> <td style="width: 30%;">Manufacturer</td> <td style="width: 70%;"><input type="text" value="Enter Manufacturer"/></td> </tr> <tr> <td>Model</td> <td><input type="text" value="Enter Model"/></td> <td>Device Class</td> <td><input type="text" value="Enter Device Class"/></td> </tr> <tr> <td>Description</td> <td><input type="text" value="Enter Description"/></td> <td>Firmware Version</td> <td><input type="text" value="Enter Firmware Version"/></td> </tr> <tr> <td>Hardware Version</td> <td><input type="text" value="Enter Hardware Version"/></td> <td>Descriptive Location</td> <td><input type="text" value="Enter Descriptive Location"/></td> </tr> <tr> <td colspan="4" style="text-align: center; padding-top: 10px;"> + Add Metadata </td> </tr> </table> <p style="text-align: right; margin-top: 20px;"> < Next </p>	Serial Number	<input type="text" value="Enter Serial Number"/>	Manufacturer	<input type="text" value="Enter Manufacturer"/>	Model	<input type="text" value="Enter Model"/>	Device Class	<input type="text" value="Enter Device Class"/>	Description	<input type="text" value="Enter Description"/>	Firmware Version	<input type="text" value="Enter Firmware Version"/>	Hardware Version	<input type="text" value="Enter Hardware Version"/>	Descriptive Location	<input type="text" value="Enter Descriptive Location"/>	+ Add Metadata			
Serial Number	<input type="text" value="Enter Serial Number"/>	Manufacturer	<input type="text" value="Enter Manufacturer"/>																	
Model	<input type="text" value="Enter Model"/>	Device Class	<input type="text" value="Enter Device Class"/>																	
Description	<input type="text" value="Enter Description"/>	Firmware Version	<input type="text" value="Enter Firmware Version"/>																	
Hardware Version	<input type="text" value="Enter Hardware Version"/>	Descriptive Location	<input type="text" value="Enter Descriptive Location"/>																	
+ Add Metadata																				
<p>n. Type VoltSensor as the authentication token. Select Next.</p> <p>Device Security</p> <p>There are two options for selecting a device authentication token.</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"> <p>Auto-generated authentication token (default)</p> <p>Allow the service to generate an authentication token for you. Tokens are 18 characters and contain a mix of alphanumeric characters and symbols. The token is returned to you at the end of the device registration process.</p> </td> <td style="width: 50%;"> <p>Self-provided authentication token</p> <p>Provide your own authentication token for this device. The token must be between 8 and 36 characters and contain a mix lowercase and uppercase letters, numbers, and symbols, which can include hyphens, underscores, and periods. Do not use repeated characters, dictionary words, user names, or other predefined sequences.</p> </td> </tr> <tr> <td colspan="2" style="text-align: center; padding-top: 10px;"> <input style="border: 1px solid #ccc; width: 150px; height: 25px; border-radius: 5px; margin-right: 10px;" type="text" value="Authentication Token"/> <input style="border: 1px solid #ccc; width: 150px; height: 25px; border-radius: 5px;" type="text" value="VoltSensor"/> ① </td> </tr> <tr> <td colspan="2" style="text-align: center; padding-top: 10px;"> <small>Make a note of the generated token. Lost authentication tokens cannot be recovered. Tokens are encrypted before being stored.</small> </td> </tr> <tr> <td colspan="2" style="text-align: center; padding-top: 10px;"> <small>Authentication token are encrypted before we store them.</small> </td> </tr> </table> <p style="text-align: right; margin-top: 20px;"> < Next </p>		<p>Auto-generated authentication token (default)</p> <p>Allow the service to generate an authentication token for you. Tokens are 18 characters and contain a mix of alphanumeric characters and symbols. The token is returned to you at the end of the device registration process.</p>	<p>Self-provided authentication token</p> <p>Provide your own authentication token for this device. The token must be between 8 and 36 characters and contain a mix lowercase and uppercase letters, numbers, and symbols, which can include hyphens, underscores, and periods. Do not use repeated characters, dictionary words, user names, or other predefined sequences.</p>	<input style="border: 1px solid #ccc; width: 150px; height: 25px; border-radius: 5px; margin-right: 10px;" type="text" value="Authentication Token"/> <input style="border: 1px solid #ccc; width: 150px; height: 25px; border-radius: 5px;" type="text" value="VoltSensor"/> ①		<small>Make a note of the generated token. Lost authentication tokens cannot be recovered. Tokens are encrypted before being stored.</small>		<small>Authentication token are encrypted before we store them.</small>												
<p>Auto-generated authentication token (default)</p> <p>Allow the service to generate an authentication token for you. Tokens are 18 characters and contain a mix of alphanumeric characters and symbols. The token is returned to you at the end of the device registration process.</p>	<p>Self-provided authentication token</p> <p>Provide your own authentication token for this device. The token must be between 8 and 36 characters and contain a mix lowercase and uppercase letters, numbers, and symbols, which can include hyphens, underscores, and periods. Do not use repeated characters, dictionary words, user names, or other predefined sequences.</p>																			
<input style="border: 1px solid #ccc; width: 150px; height: 25px; border-radius: 5px; margin-right: 10px;" type="text" value="Authentication Token"/> <input style="border: 1px solid #ccc; width: 150px; height: 25px; border-radius: 5px;" type="text" value="VoltSensor"/> ①																				
<small>Make a note of the generated token. Lost authentication tokens cannot be recovered. Tokens are encrypted before being stored.</small>																				
<small>Authentication token are encrypted before we store them.</small>																				
<p>o. Click Done to add your device and to receive your device credentials. Be sure to write down the credentials and save for later use.</p>																				

Action

Add Device Identity Device Information Security **Summary**

Summary Verify that the following information is correct then select Done

Device Type
VoltageSensor

Device ID
Sensor01

[View Metadata](#)

Security Token
VoltSensor

[Back](#) **Done**

p. Click **Back** in the upper left corner. Your device should now be listed under “Browse Devices”.

Back

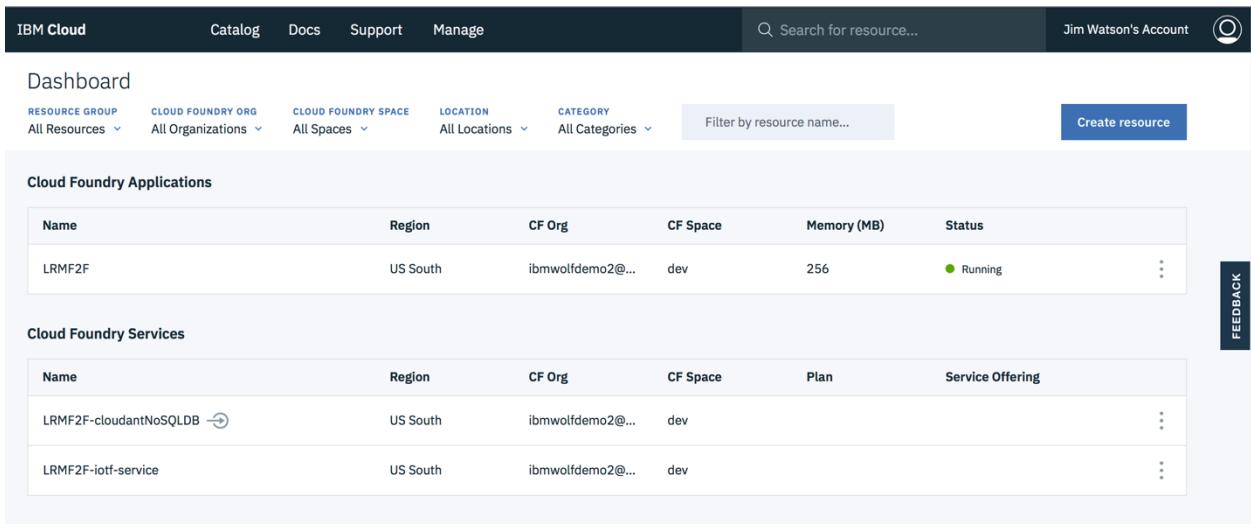
DEVICE DRILLDOWN

- Device Credentials**
- Connection Information
- Recent Events
- State
- Device Information

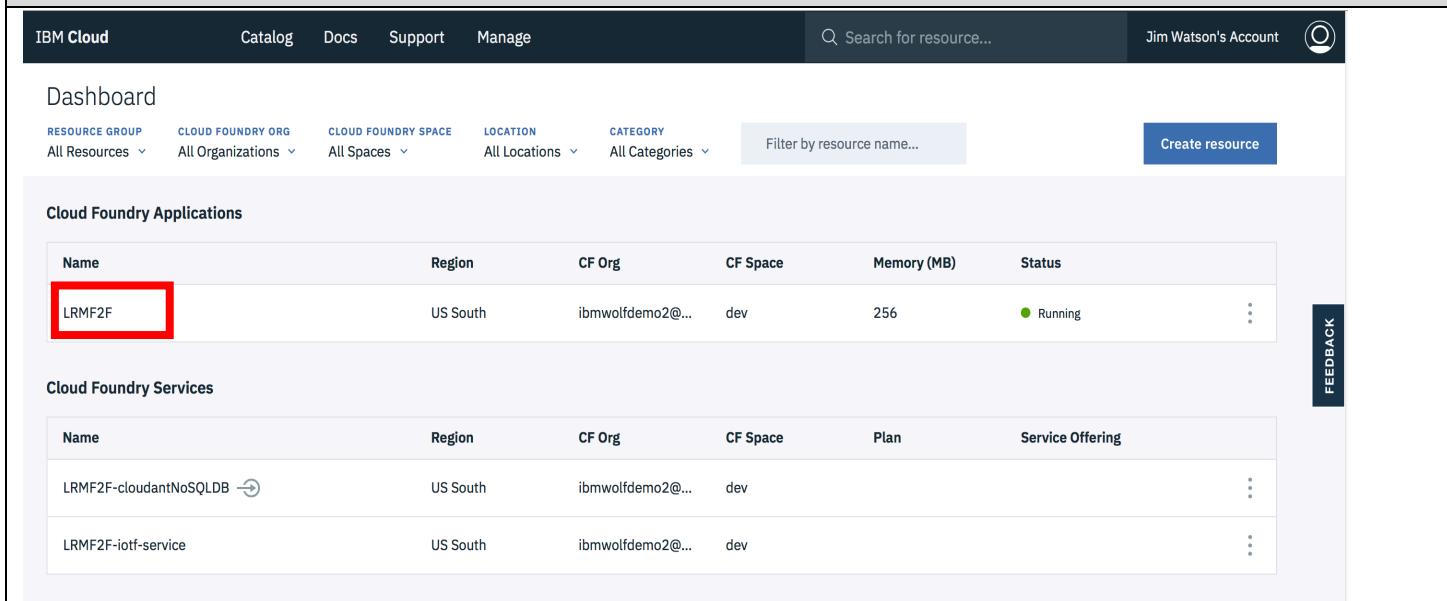
Connection Information

Browse Devices

Device ID	Device Type	Class ID	Date Added	Descriptive Location	
Sensor01	VoltageSensor	Device	Jul 17, 2018 3:50 PM		

Action
<p><u>4.Create Node-RED Flow to Detect Anomalies using Z-Score</u></p> <p>Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways. It provides a browser-based editor that makes it easy to wire together flows using the wide range of nodes in the palette that can be deployed to its runtime in a single-click.</p> <p>Z-Score, or standard score, is one of the simplest anomaly detection algorithms. It indicates how many standard deviations an element is from the mean. It tells how abnormal a reading is comparing to all the values in history.</p> <p>In this lab, we will use Node-RED to create a flow that simulates a Washing Machine Device that has a voltage sensor. The Z-score will be calculated for the incoming voltage values to detect anomalies. If an anomaly is found an alert/shutdown command will be issued to the device. All incoming voltage values will also be sent to the IoT Platform for further visualization and analysis.</p> <p>a. Go to your IBM Cloud account dashboard at https://console.bluemix.net/dashboard/apps/</p>  <p>The screenshot shows the IBM Cloud dashboard with the following sections:</p> <ul style="list-style-type: none"> Cloud Foundry Applications: A table listing one application named "LRMF2F" with details: Region: US South, CF Org: ibmwolfdemo2@..., CF Space: dev, Memory (MB): 256, Status: Running. Cloud Foundry Services: A table listing two services: "LRMF2F-cloudantNoSQLDB" and "LRMF2F-iotf-service", both associated with the same org and space.
<p>b. From the dashboard, click on your IoT Cloud Boundary Application.</p>

Action



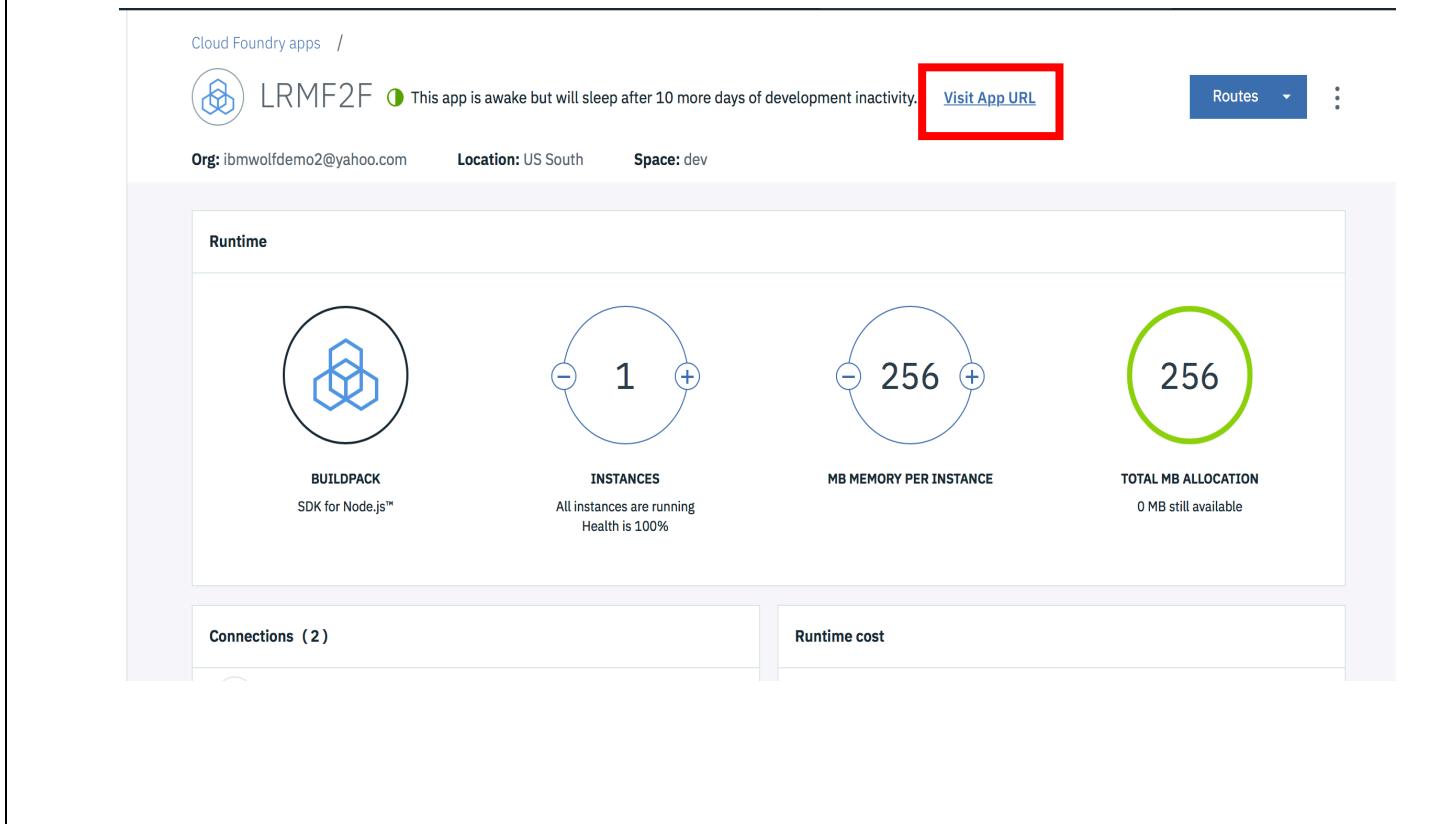
Cloud Foundry Applications

Name	Region	CF Org	CF Space	Memory (MB)	Status
LRMF2F	US South	ibmwolfdemo2@...	dev	256	Running

Cloud Foundry Services

Name	Region	CF Org	CF Space	Plan	Service Offering
LRMF2F-cloudantNoSQLDB	US South	ibmwolfdemo2@...	dev		
LRMF2F-iotf-service	US South	ibmwolfdemo2@...	dev		

- c. From the cloud foundry application homepage, click [Visit App URL](#). This will open the Node-RED sample application.



Cloud Foundry apps /

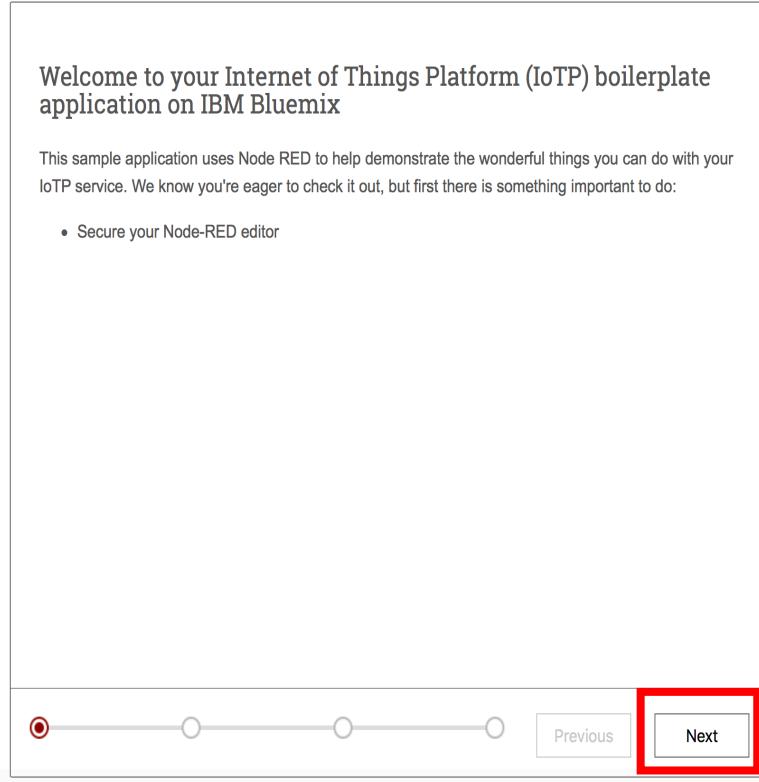
LRMF2F ⓘ This app is awake but will sleep after 10 more days of development inactivity. [Visit App URL](#) Routes ⋮

Org: ibmwolfdemo2@yahoo.com Location: US South Space: dev

Runtime

BUILDPACK SDK for Node.js™	INSTANCES 1 All instances are running Health is 100%	MB MEMORY PER INSTANCE 256	TOTAL MB ALLOCATION 256 0 MB still available
-------------------------------	---	-------------------------------	--

Connections (2) Runtime cost

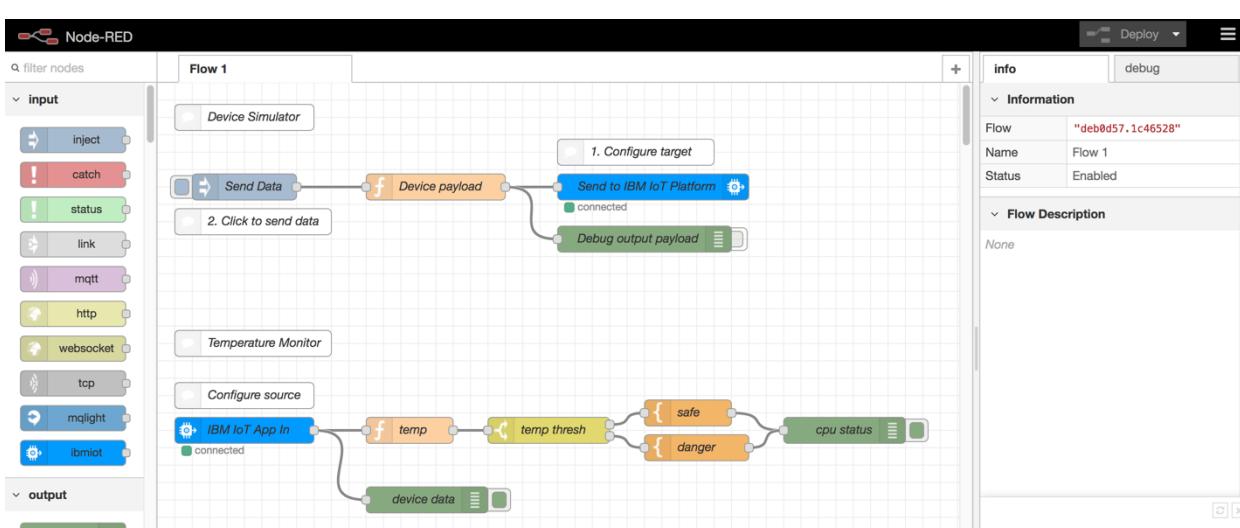
Action
d. The Node-Red editor will give you a few options, make your selections and click Next through them. (<i>Example: fill in name and password for security, select “node-red-dashboard”, finish the install</i>)


- e. Click **Finish** to complete the Node-RED configuration.

Applying your settings and starting Node-RED

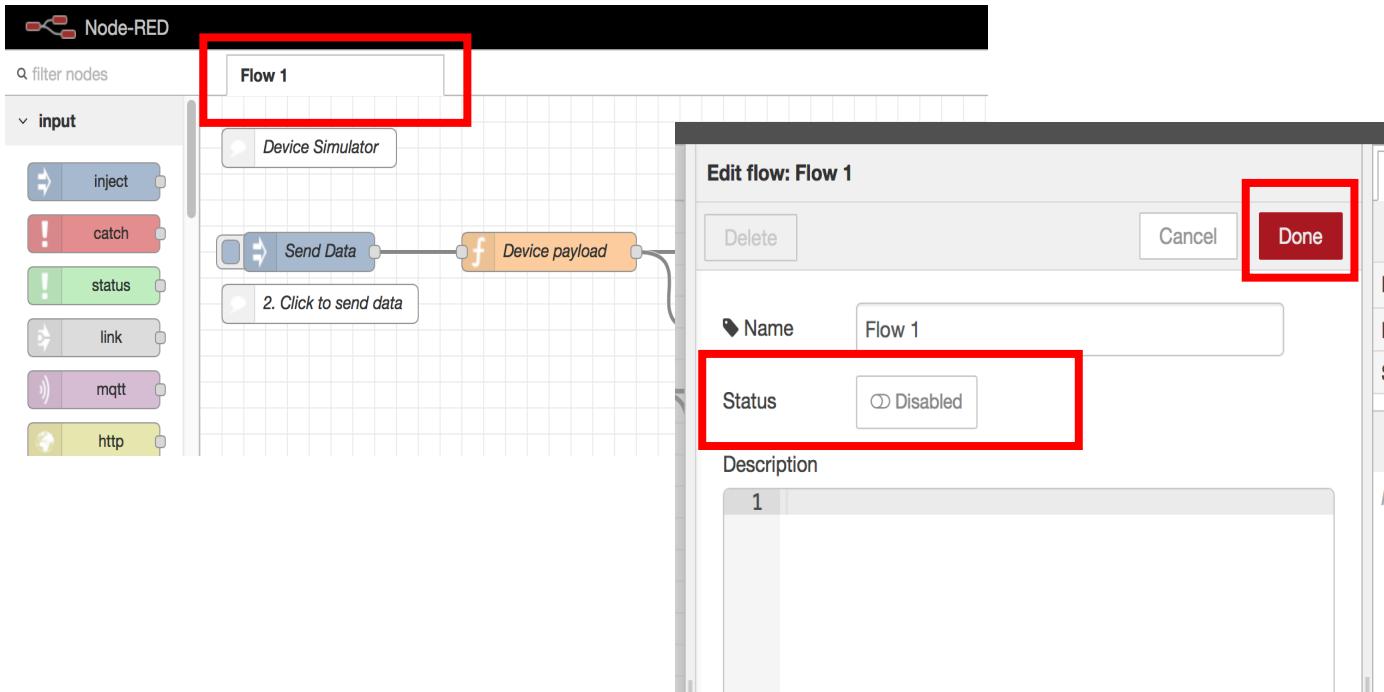


- f. Click **Go to your Node-RED flow editor** to open Node-RED

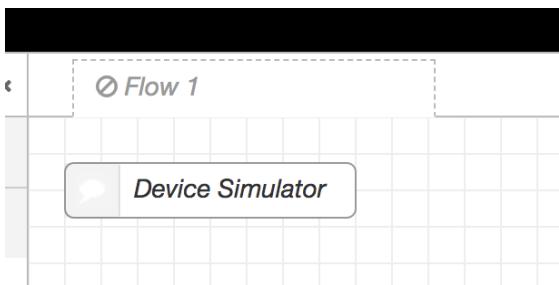
Action
<p>Node-RED on IBM Bluemix</p> <h1>Node-RED</h1> <p>Flow-based programming for the Internet of Things</p> <p>Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways.</p> <p>This instance is running as an IBM Bluemix application, giving it access to the wide range of services available on the platform.</p> <p>More information about Node-RED, including documentation, can be found at nodered.org.</p> <p>Go to your Node-RED flow editor</p> <p>Learn how to customise Node-RED</p>
<p>g. A sample Node-RED flow will appear on the canvas. The left panel, the Palette, lists all of the nodes available to build a Node-RED flow. The right panel, displays information about the Flow.</p>  <p>The screenshot shows the Node-RED interface with the following components:</p> <ul style="list-style-type: none"> Palette (Left): Lists various node categories: input (inject, catch, status, link, mqtt, http, websocket, tcp, mqlight, ibmiot), output, and others. Canvas (Center): Displays a flow named "Flow 1". It starts with a "Device Simulator" node, followed by a "Send Data" node connected to a "Device payload" node. This is followed by a "Configure target" node and a "Send to IBM IoT Platform" node. A "Debug output payload" node is also present. Below this, there's a "Temperature Monitor" node, a "Configure source" node, and an "IBM IoT App In" node. The flow continues through a "temp" node, a "temp thresh" node branching into "safe" and "danger" nodes, and finally a "cpu status" node. Info Panel (Right): Shows flow details: Flow ID: "deb0d57.1c46528", Name: "Flow 1", Status: "Enabled". Description Panel (Bottom Right): Shows "None" under "Flow Description".

Action

- h. Double click the **Flow 1** tab. Change the status of the Flow to **disabled**. Click **Done**

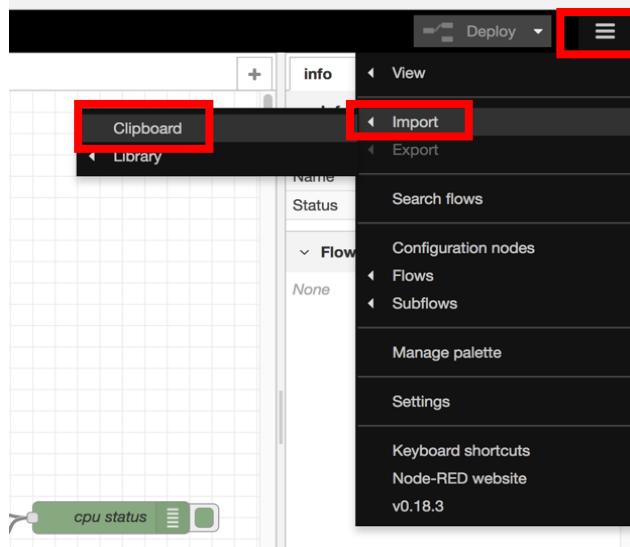


- i. The **Flow 1** tab should now have a **disabled icon** beside it

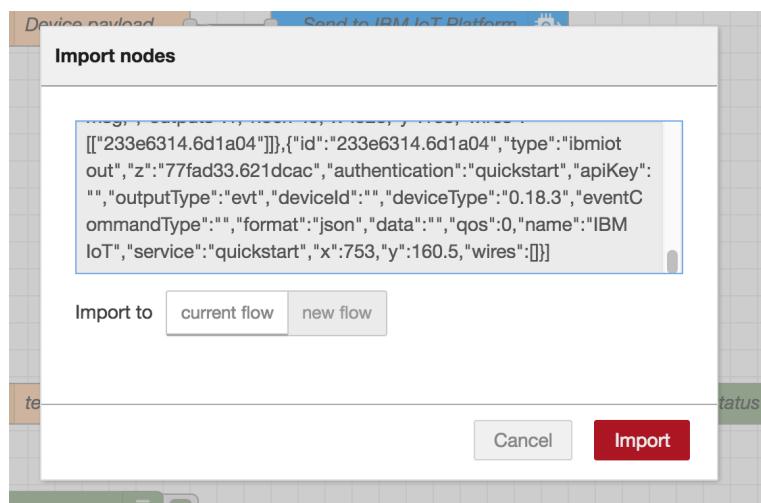


- j. A starter flow, **IoTLab_StarterFlow.json**, has been provided to you for the lab. Open the file and copy its contents.
k. Select the **3-bar menu tile** in the upper right corner, select **Import -> Clipboard**

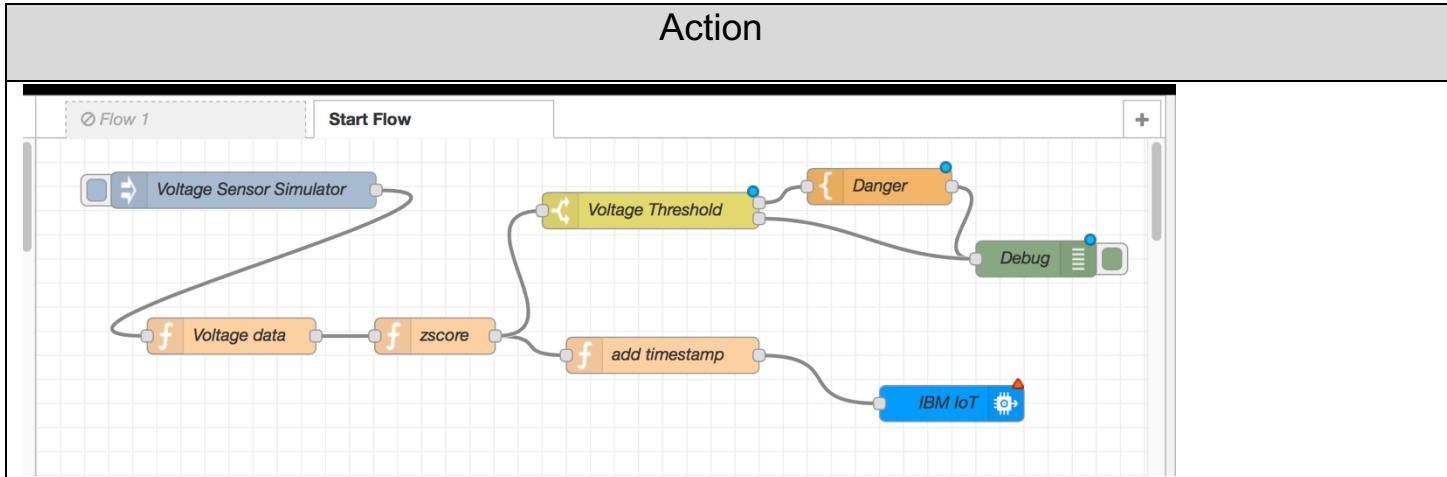
Action



- I. Paste the contents from the IoTLab_StarterFlow.json file into the clipboard. Select import to **New Flow** and click **Import**



- m. The new flow called, **Start Flow**, has been imported



The flow simulates voltage sensor data, calculates a Z-Score, determines if Z-Score is above threshold, and sends the data to the IoT Platform after a timestamp has been added to the data. Double click the following nodes to open and explore.

- **Voltage Sensor Simulator** – Simulates a voltage sensor device that is sending voltage and frequency data
- **Voltage data** – Randomizes voltage and frequency values so anomalies can occur
- **Z-Score** – Calculates the z-score for voltages
- **Add timestamp** – Adds a timestamp to each event so you know when the event occurred.
- **Voltage Threshold** – Determines if the Z-Score is above a particular threshold.
- **Danger** – If Z-Score is above the danger threshold, send a Danger alert.
- **Debug** – Sends events to the debug panel
- **IBM IoT** – Connection node to the IoT Platform. Each event is sent to the platform for future analysis.

Anomalies will be detected if the Z-Score is above a certain threshold. We will now modify a couple of the nodes to complete the flow.

- Double click the **Voltage Threshold** node.



- Input the following properties. Set the z-score threshold to 0.3. If the score is above 0.3, an anomaly has occurred. Select **Done**.

Action

Edit switch node

Delete
Cancel
Done

node properties

Name	Voltage Thres
Property	msg.payload.zscore

0.3

0.3

+ add

checking all rules

recreate message sequences

p. Double click the **IBM IoT** node and input the following: Once complete, click **Done**

- **Authentication** = Bluemix Service
- **Output Type** = Device Event
- **Device Type** = VoltageSensor
- **Device ID** = Sensor01
- **Event Type** = status
- **Format** = json
- **Data** = msg.payload
- **QoS** = 0
- **Name** = IBM IoT

Note: The Device Type and Device ID should be the same name that was registered within the IoT Platform.

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Action

Edit ibmiot out node

Delete Cancel Done

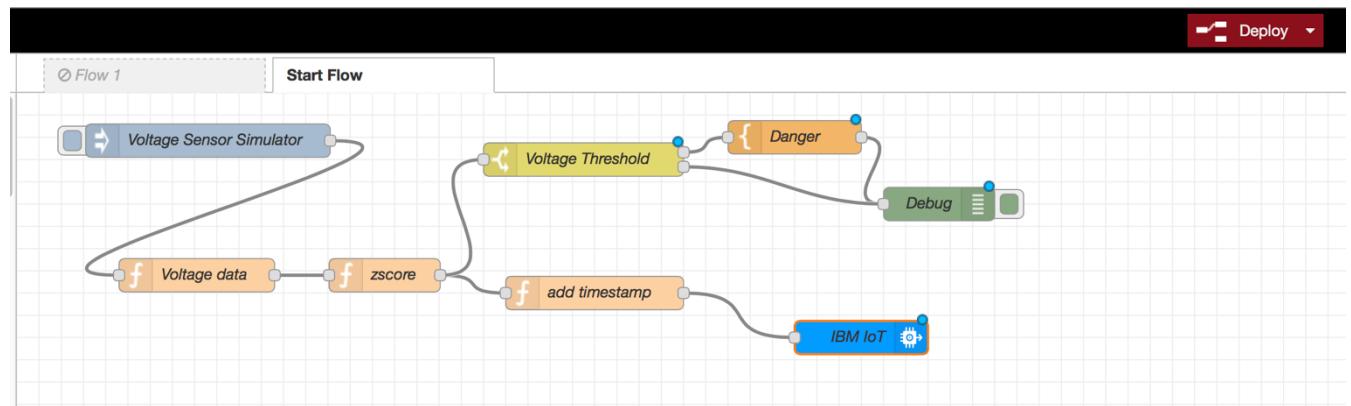
node properties

- Authentication: Bluemix Service
- Output Type: Device Event
- Device Type: VoltageSensor
- Device Id: Sensor01
- Event Type: status
- Format: json
- Data: msg.payload
- QoS: 0
- Name: Sensor01

Note: If there is a property in the message that corresponds to any of the values entered above, then the property in the message takes precedence. See the Info tab for more details.

> node settings

q. Your Node-RED Flow should look like the following:



r. Double click the **Voltage Sensor Simulator** node. Change the repeat value to “**interval, every 1 second**”. Click **Done**

Action

Edit inject node

Delete Cancel Done

node properties

Payload: { "d": { "voltage": 240, "frequency": 50 } } ...

Topic:

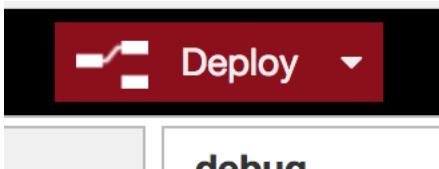
Inject once after 0.1 seconds, then

C Repeat: interval
every 1 seconds

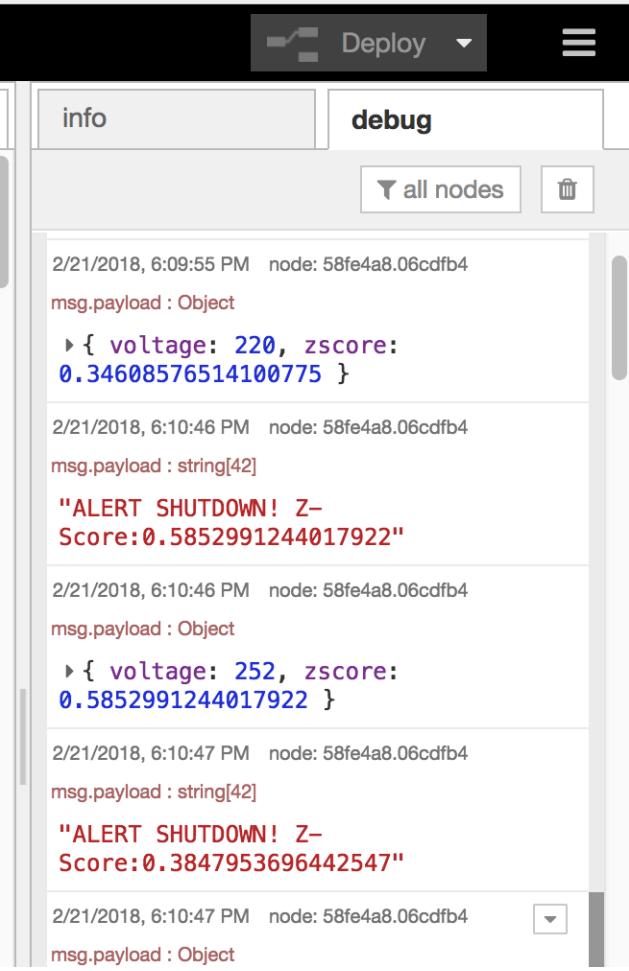
Name: Voltage Sensor Simulator

Note: "interval between times" and "at a specific time" will use cron.
"interval" should be less than 596 hours.
See info box for details.

s. In the upper right corner, click **Deploy** button



t. After about 30 seconds, you will start seeing voltage values and alerts appear within the Debug Window. If the zscore is above 0.3, an alert will appear. The 30 second delay is because the 1st 30 events are being used to create the sliding window for the z-score calculation.

Action
 <pre> 2/21/2018, 6:09:55 PM node: 58fe4a8.06cdfb4 msg.payload : Object ▶ { voltage: 220, zscore: 0.34608576514100775 } 2/21/2018, 6:10:46 PM node: 58fe4a8.06cdfb4 msg.payload : string[42] "ALERT SHUTDOWN! Z- Score:0.5852991244017922" 2/21/2018, 6:10:46 PM node: 58fe4a8.06cdfb4 msg.payload : Object ▶ { voltage: 252, zscore: 0.5852991244017922 } 2/21/2018, 6:10:47 PM node: 58fe4a8.06cdfb4 msg.payload : string[42] "ALERT SHUTDOWN! Z- Score:0.3847953696442547" </pre>

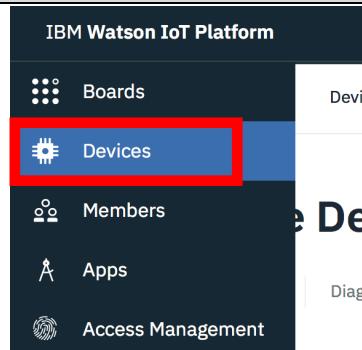
Congratulations! Your node-RED Flow is complete!

6. View Real-time Device Data in IoT Platform

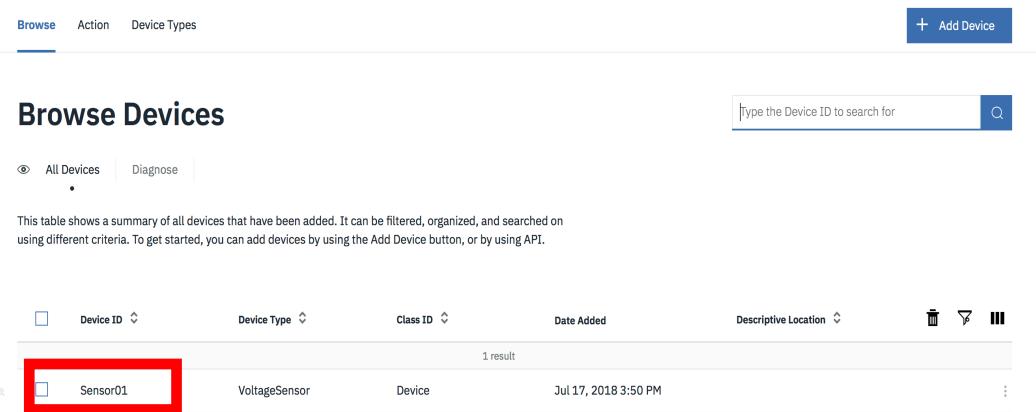
Next we need to validate the voltage sensor data is being sent the IoT Platform.

- a. Open your IoT Platform Service and select the **Devices** tab from the menu on the left hand-side.

Action

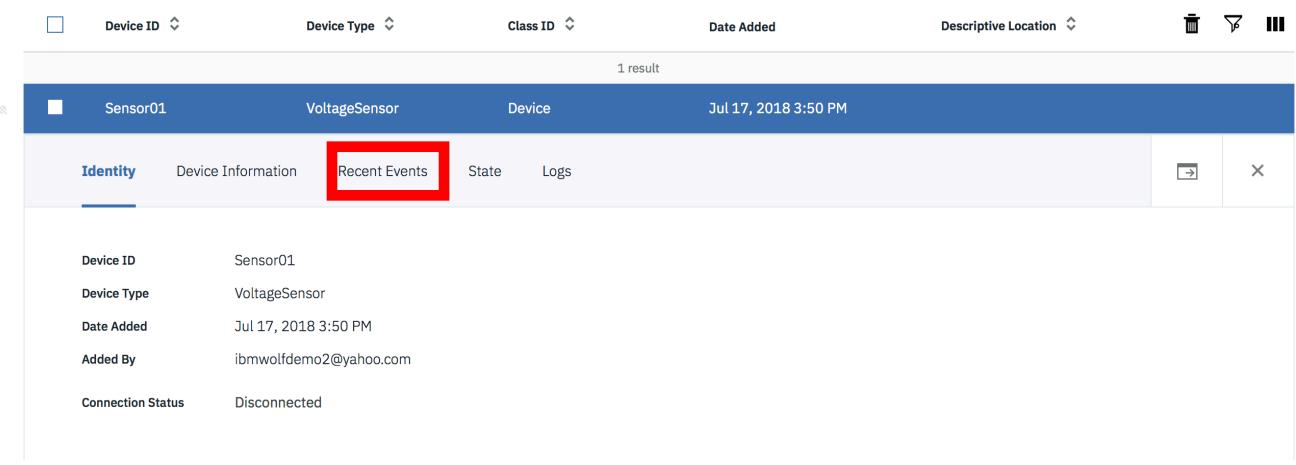


- b. Click **Sensor01** to see additional information about the device.



Device ID	Device Type	Class ID	Date Added	Descriptive Location	Actions
Sensor01	VoltageSensor	Device	Jul 17, 2018 3:50 PM		⋮

- c. Click the **Recent Events** tab. You should see the real-time sensor events coming in from your Node-RED flow.



Identity	Device Information	Recent Events	State	Logs
Sensor01	VoltageSensor	Device	Jul 17, 2018 3:50 PM	

Device ID: Sensor01
 Device Type: VoltageSensor
 Date Added: Jul 17, 2018 3:50 PM
 Added By: ibmwolfdemo2@yahoo.com
 Connection Status: Disconnected

Action

Sensor01 VoltageSensor Device Jul 17, 2018 3:50 PM

Identity Device Information **Recent Events** State Logs X

 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
voltage	{"voltage":236,"zscore":0.1940901807438...}	json	a few seconds ago
voltage	{"voltage":223,"zscore":0.1755997241563...}	json	a few seconds ago
voltage	{"voltage":226,"zscore":0.1000819468767...}	json	a few seconds ago
voltage	{"voltage":239,"zscore":0.2733719845245...}	json	a few seconds ago
voltage	{"voltage":224,"zscore":0.1425744011402...}	json	a few seconds ago



Congratulations! You have successfully created an edge node-RED flow that simulates a washing machine voltage sensor. You detected event anomalies using Z-score and if an anomaly occurred ($Z\text{-score} > 0.3$) an alert/command was sent to the device. You also registered the device within the IBM Watson IoT Platform and sent all device events to the Platform for further analysis.

End of Lesson 3

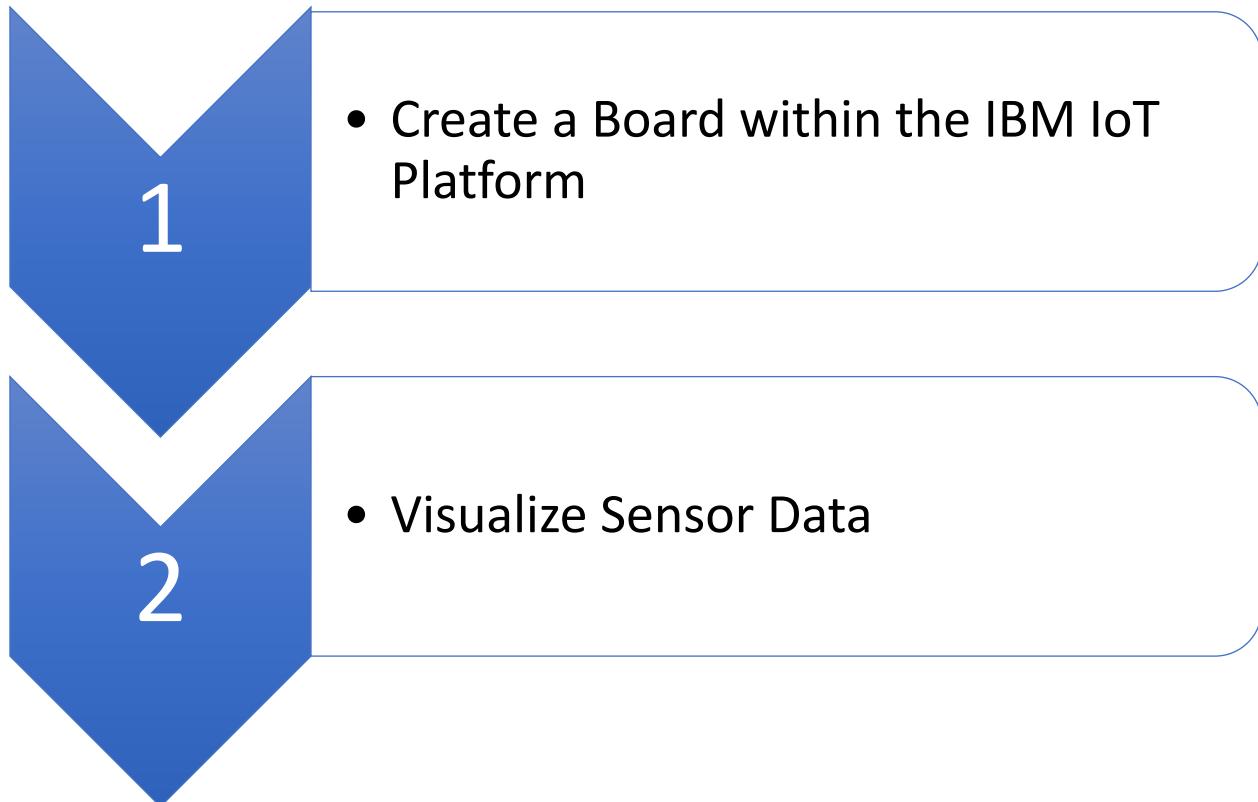
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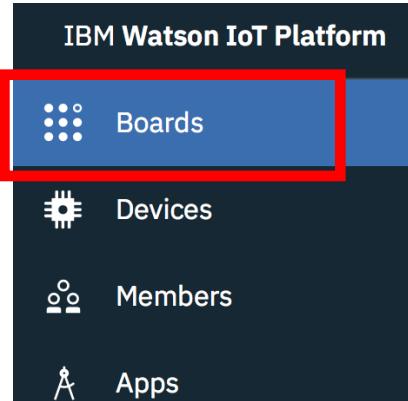
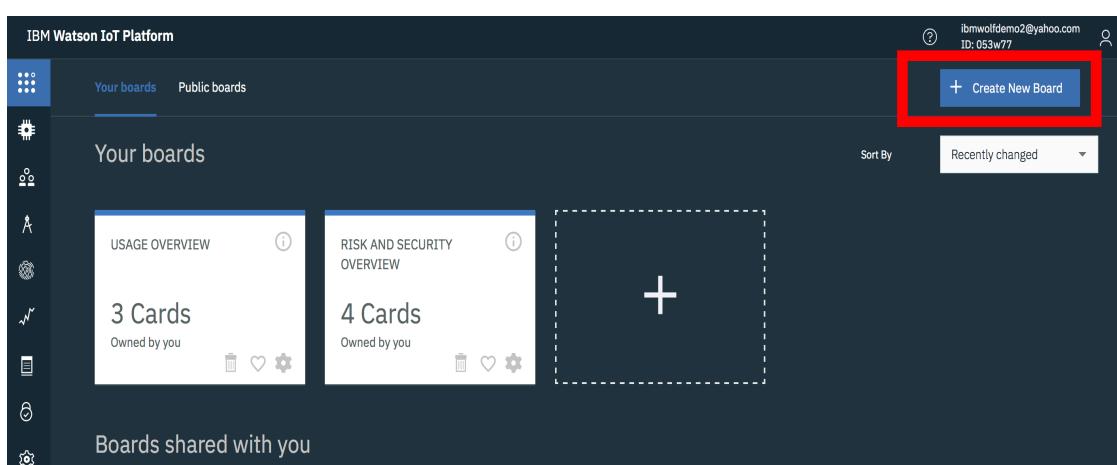
Lesson 4: Visualizing Data in the IoT Platform

Purpose:	This lesson introduces boards within the IBM IoT Platform which are used to visualize data.
Tasks:	<p>Tasks you will complete in this lab exercise include:</p> <ul style="list-style-type: none">• Create a Board within the IBM IoT Platform• Visualize sensor data

Lesson 4: Workflow Overview



Lesson 4: Instructions

Action
1. Create Board
<p>a. In the Watson IoT Platform, select Boards from the menu on the left hand-side.</p> 
<p>b. Click Create New Board, from the upper right corner.</p> 
<p>c. Name the board, IoT Lab, and provide a short description. Click Next</p>

Action

Information

Members

Board settings

Provide a name and description for your new board.

Board name

IoT Lab

Description

board for IoT lab|

Make this board my landing page.

Favorite (this also adds this board to your navbar)

Next

- d. Keep the default Board Settings and click **Submit**.

Information

Members

Board settings

Adding viewers allows them to see your dashboard.

Owner

ibmwolfdemo2@yahoo.com (YOU)

Members

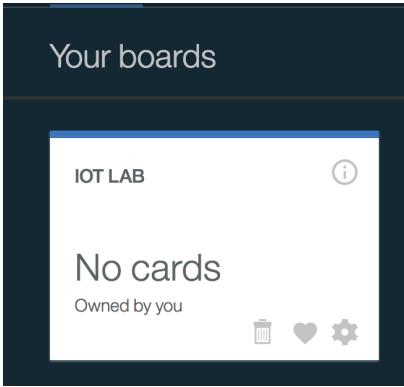
Share as read-only with everyone?

+ add user ID

Name	Editor?

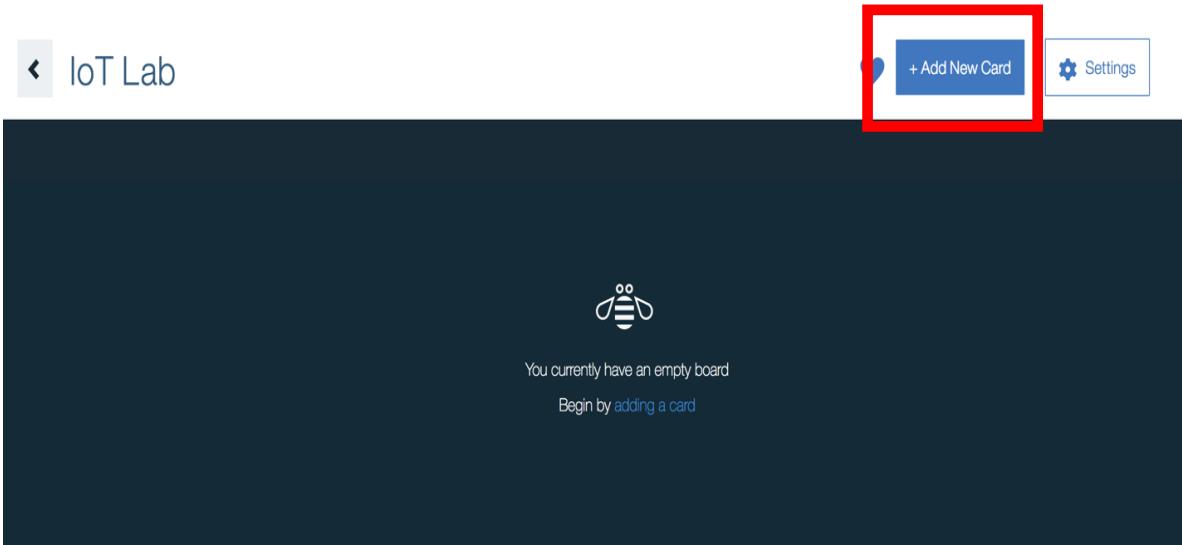
Back

Submit

Action
e. Your board should now appear under Your Boards .
 <p>Your boards</p> <p>IOT LAB</p> <p>No cards Owned by you</p> <p>trash heart gear</p>

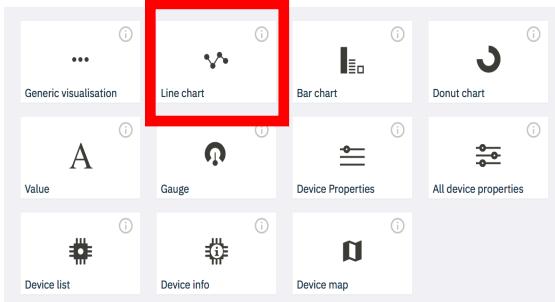
2. Visualize Sensor Data

- a. First, we will visualize our voltage data. Click on the **IOT LAB** board and select **Add New Card** from the upper right corner



- b. Select **Line Chart** as the card type and select **Sensor01** as the Device. Click **Next**

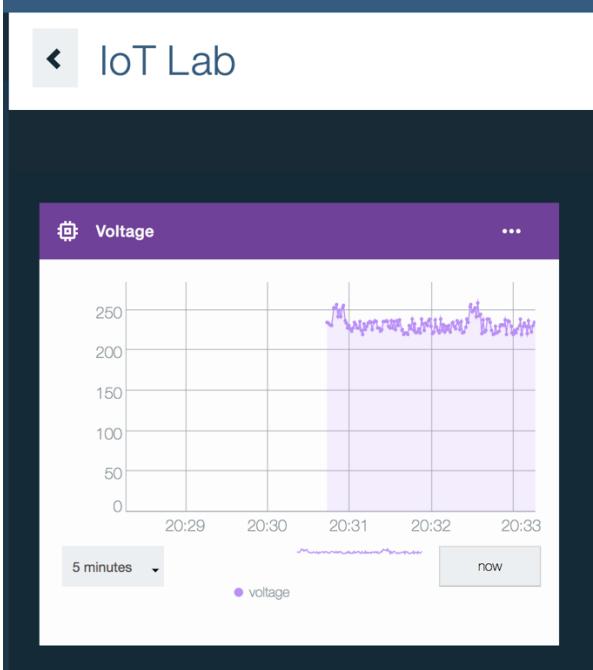
Action

<p>Create Card</p> <p>Card type Select card type</p> <p>Devices</p>  <p>Risk Management</p>	<p style="text-align: right;">×</p> <p>Create Line chart Card</p> <p>Specify the data source for the card</p> <p>Card source data</p> <p>Sensor01</p> <p>Devices</p> <p>Search for card data sources using the filter:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px; width: 10%;">Sensor01</td> <td style="padding: 5px;">VoltageSensor</td> </tr> </table> <p style="text-align: right;">Next</p>	Sensor01	VoltageSensor
Sensor01	VoltageSensor		

c. Click **Connect new data set** and input the following properties. Click **Next**

- **Event** = voltage
- **Property** = voltage
- **Name** = voltage
- **Type** = Text

Action
<p>Create Line chart Card</p> <p>Connect data set</p> <p>+ Connect new data set</p> <p>Create Line chart Card</p> <p>Connect data set</p> <p>voltage</p> <p>Event</p> <p>voltage</p> <p>Property</p> <p>voltage</p> <p>Name</p> <p>voltage</p> <p>Type</p> <p>Text</p> <p>Unit</p> <p>+ Connect new data set</p> <p>Back Next</p>
<p>d. Select L as the chart size. Click Next</p> <p>Select the card size and specify additional information</p> <p>Settings S M L XL</p> <p>Line chart</p> <p>250 200 150 100 50 0</p> <p>20:23 20:24 20:25 20:26 20:27</p> <p>5 minutes now</p> <p>voltage</p>
<p>e. Name the chart Voltage and click Submit.</p>

Action
<p>Create Line chart Card</p> <p>Enter title and description of the card</p> <p>Title Voltage</p> <p>Color scheme</p>  <p>A line chart to display time series information with historic and live data</p> <p>Back Submit</p> <p>f. You should now see your voltage values displayed in Real-time.</p>  <p>g. Next, we will visualize our z-score data. Click Add New Card in the upper right corner.</p>

Action
<p>h. Select Value for card type and select Sensor01 as the device. Click Next</p>

Action

- i. Select **Connect new data set** and input the following properties. Click **Next**

- **Event** = voltage
- **Property**= zscore
- **Name** = zscore
- **Type** = Text

Create Value Card

Connect data set

 Connect new data set

Create Value Card

Connect data set

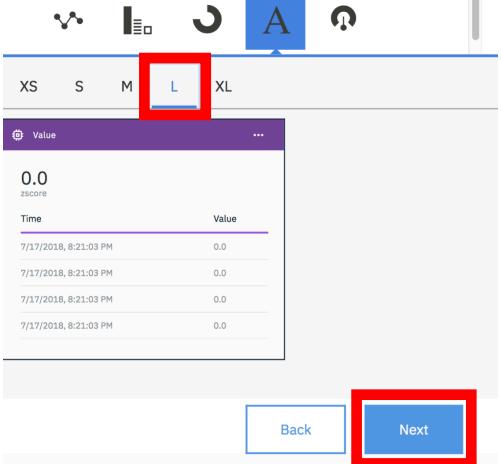
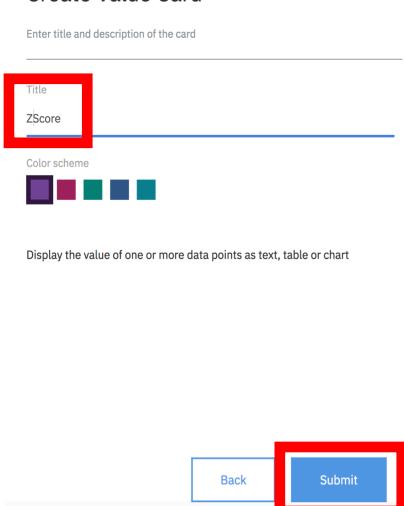
 zscore	
Event	
voltage	
Property	
zscore	
Name	
zscore	
Type	Unit
Text	

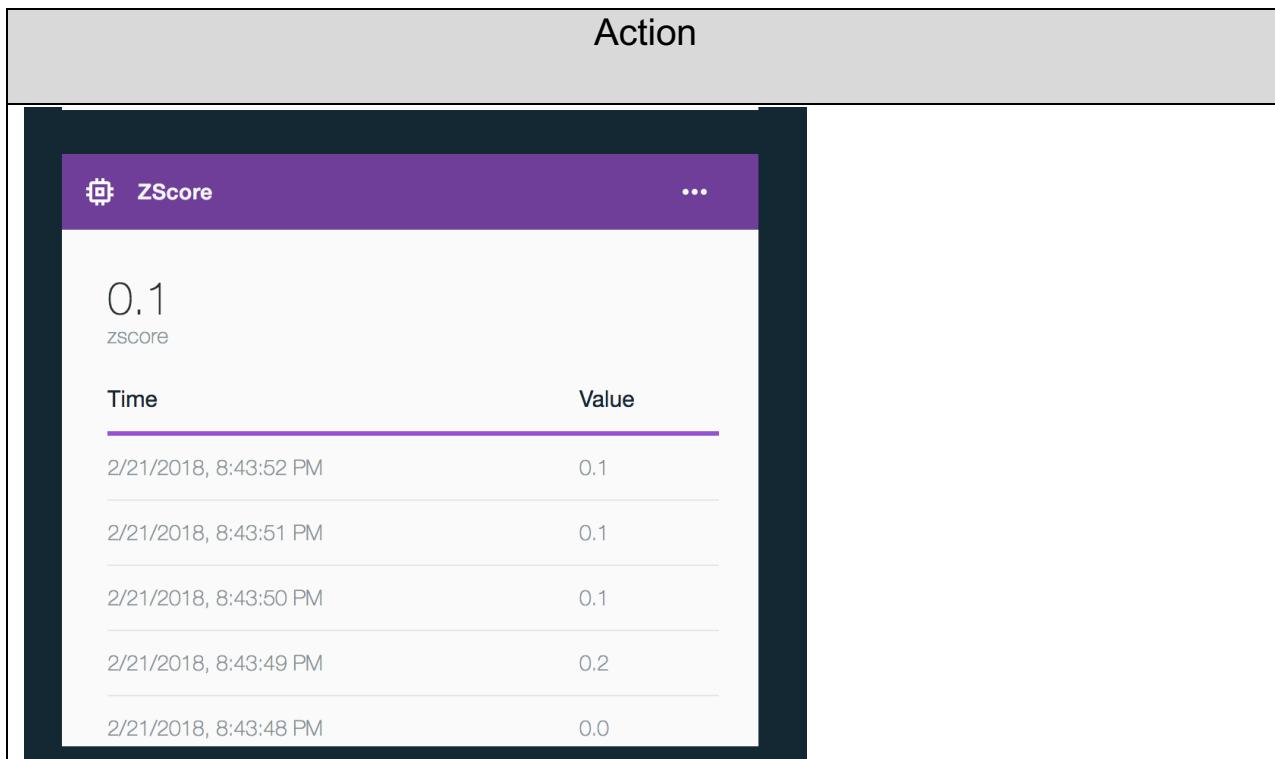
 Connect new data set

Back

Next

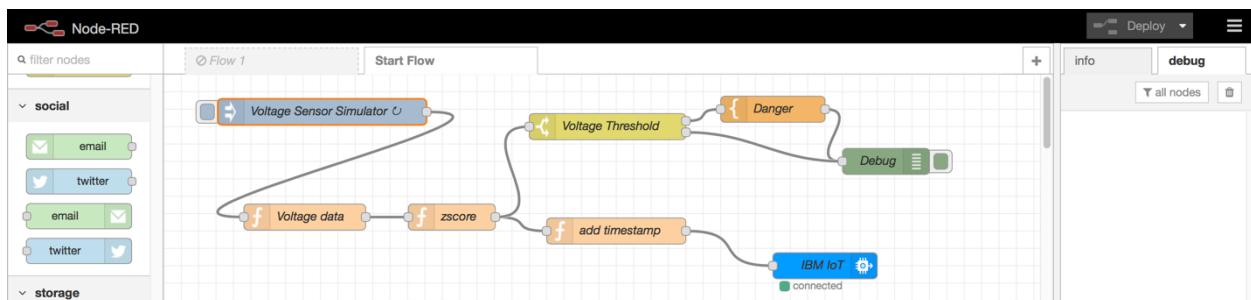
- j. Select **L** as the card size. Click **Next**

Action
<p>Create Value Card</p> <p>Select the card size and specify additional information</p>  <p>k. Name the card, ZScore. Click Submit</p> <p>Create Value Card</p> <p>Enter title and description of the card</p> <p>Title ZScore</p> <p>Color scheme</p>  <p>Display the value of one or more data points as text, table or chart</p> <p>I. You should now see your zscore values displayed in Real-time</p>



Congratulations! You have successfully visualized your sensor data.

- m. To stop the data coming into the platform, navigator back to your Node-RED flow.



- n. Double click the **Voltage Sensor Simulator** node. Change the repeat interval to **None**. Click **Done**

Action

Edit inject node

Delete Cancel Done

node properties

Payload: `{ "d": { "voltage": 240, "frequency": 50 } }`

Topic:

Inject once after seconds, then

Repeat: ▼

Name: Voltage Sensor Simulator

Note: "interval between times" and "at a specific time" will use cron.
"interval" should be less than 596 hours.
See info box for details.

o. Click the **Deploy** button in the upper right corner to deploy the changes.



Congratulations! You have successfully stopped your Node-RED Flow

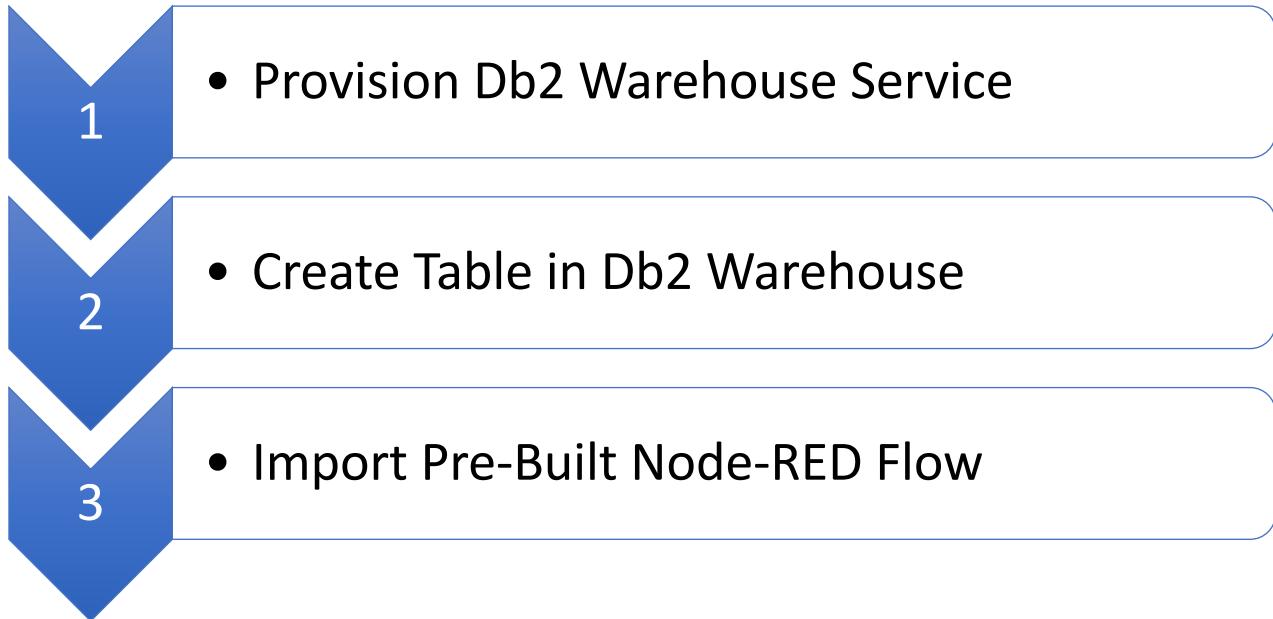
End of Lesson 4



Lesson 5: Persist IoT Data to Db2 Warehouse

Purpose:	This lab introduces how a Node-RED flow developed in IBM Cloud can be used to persist sensor data into Db2 Warehouse House.
Tasks:	<p>The Instructor will demonstrate this section of the lab. Free, lite IBM Cloud accounts cannot use Node-RED to persist data into Db2 Warehouse due to a cloud foundry application memory constraint</p> <ul style="list-style-type: none">• Provision Db2 Warehouse Service• Create Table in Db2 Warehouse• Import Pre-Built Node-RED Flow

Lesson 5: Workflow Overview

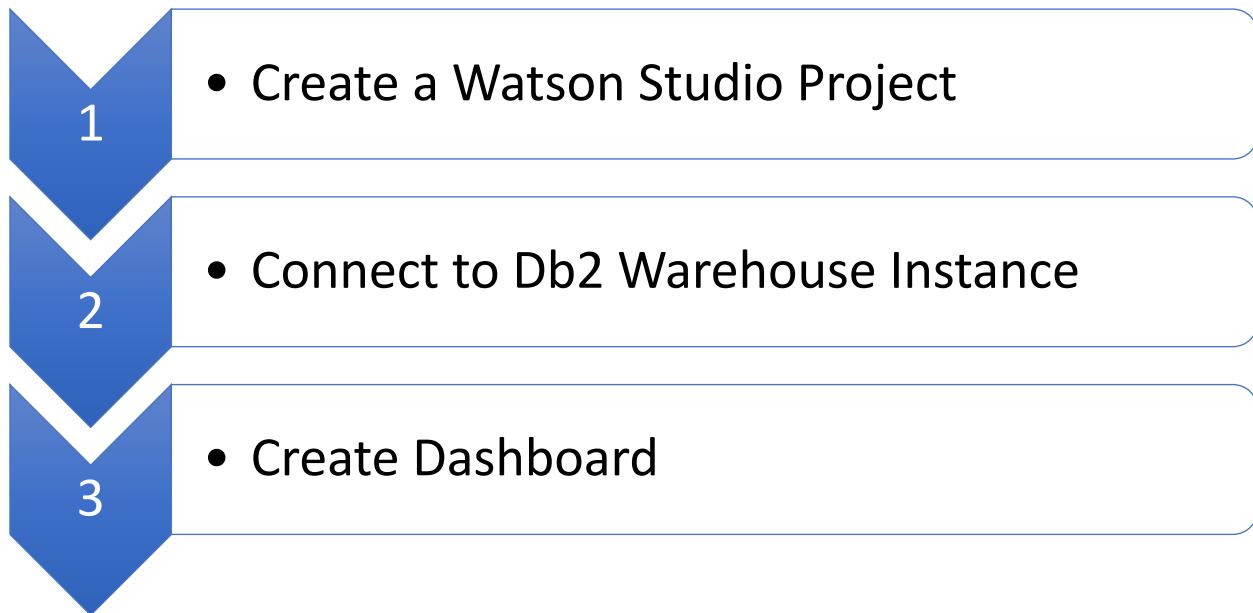




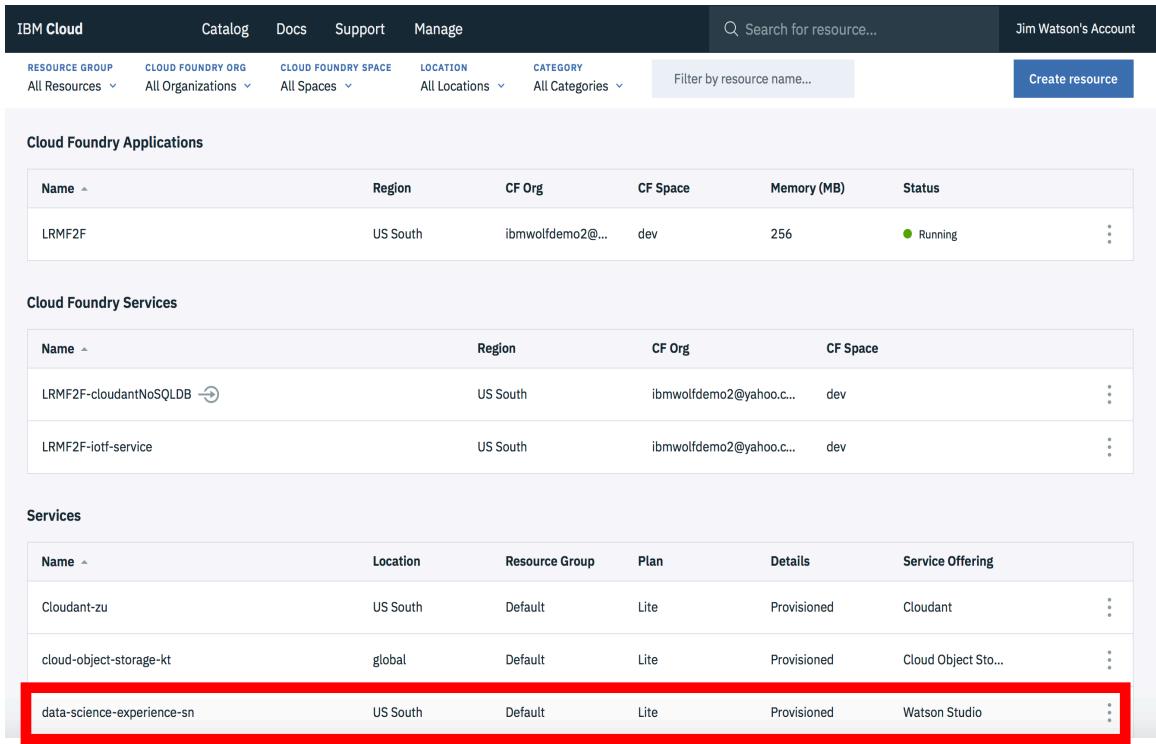
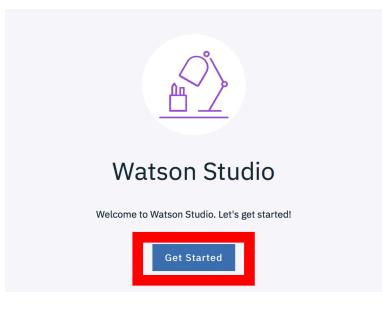
Lesson 6: Visualize Data in IBM Cognos Dashboard Embedded

Purpose:	This lab introduces how to visualize sensor data using IBM Cognos Dashboard Embedded within Watson Studio.
Tasks:	<p>Tasks you will complete in this lab exercise include:</p> <ul style="list-style-type: none">• Create a Watson Studio Project• Connect to Db2 Warehouse Instance• Create Dashboard

Lesson 6: Workflow Overview

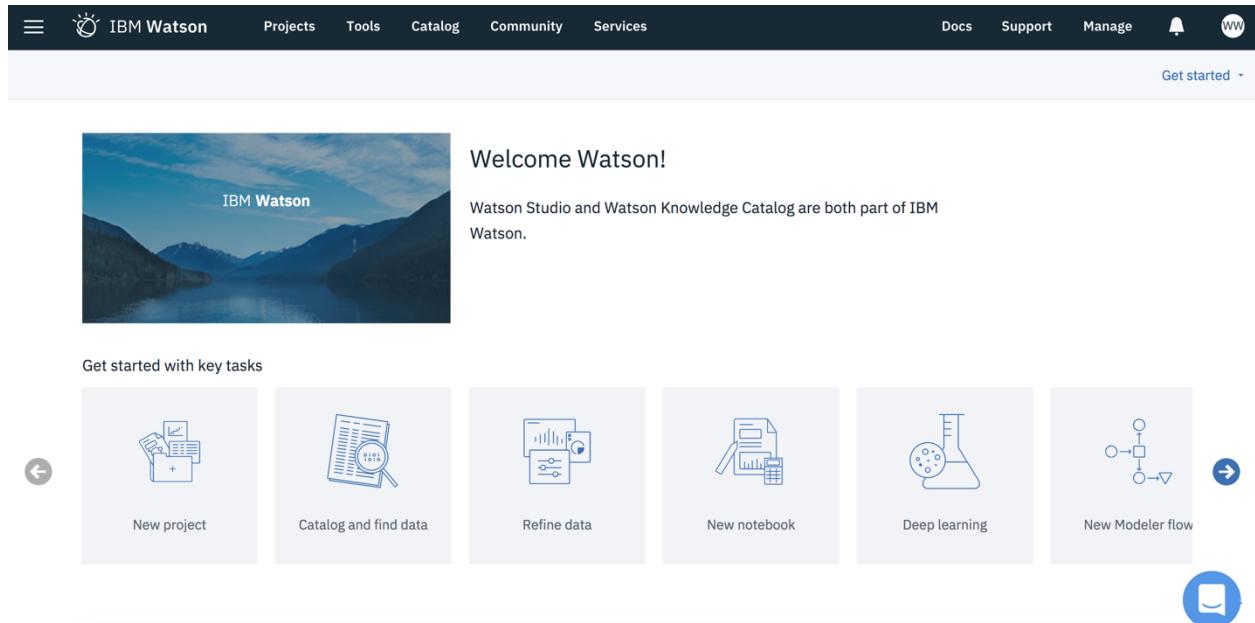


Lesson 6: Instructions

Action
<p>1. Create Watson Studio Project</p> <ol style="list-style-type: none"> Log into IBM Cloud at https://console.bluemix.net/dashboard/apps/ Select the previously provisioned Watson Studio service from your IBM Cloud Dashboard  <p>The screenshot shows the IBM Cloud dashboard interface. At the top, there's a navigation bar with links for IBM Cloud, Catalog, Docs, Support, and Manage, along with a search bar and a user account dropdown. Below the navigation is a filter bar with dropdowns for Resource Group (All Resources), Cloud Foundry Org (All Organizations), Cloud Foundry Space (All Spaces), Location (All Locations), Category (All Categories), and a search input field. A blue 'Create resource' button is on the right. The main content area is divided into sections: 'Cloud Foundry Applications' (listing one application named 'LRMF2F' with details like Region: US South, CF Org: ibmwolfdemo2@..., CF Space: dev, Memory (MB): 256, Status: Running), 'Cloud Foundry Services' (listing two services: 'LRMF2F-cloudantNoSQLDB' and 'LRMF2F-iotf-service', both in US South, CF Org: ibmwolfdemo2@yahoo.c..., CF Space: dev), and 'Services' (listing three services: 'Cloudant-zu', 'cloud-object-storage-kt', and 'data-science-experience-sn'. The 'data-science-experience-sn' row is highlighted with a red box. Each service entry includes columns for Name, Location, Resource Group, Plan, Details, and Service Offering).</p> <p>c. Click Get Started to launch Watson Studio</p>  <p>The screenshot shows the Watson Studio welcome screen. It features a circular icon with a stylized figure working at a desk. Below the icon, the text 'Watson Studio' is displayed. Underneath that, a small message reads 'Welcome to Watson Studio. Let's get started!'. At the bottom, there is a blue 'Get Started' button, which is also highlighted with a red box.</p>

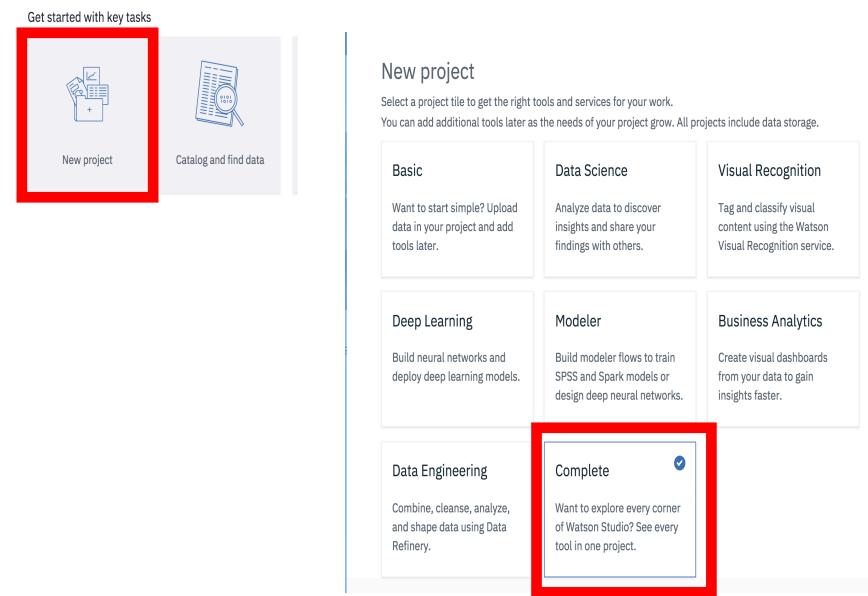
Action

d. You will be brought to your **Home Page**



The screenshot shows the IBM Watson Home Page. At the top, there's a navigation bar with links for Projects, Tools, Catalog, Community, Services, Docs, Support, Manage, and a user icon. Below the navigation is a "Get started" button. The main content area features a large image of a lake with mountains in the background, labeled "IBM Watson". To the right of the image is the text "Welcome Watson!" and "Watson Studio and Watson Knowledge Catalog are both part of IBM Watson.". Below this, a section titled "Get started with key tasks" displays six cards: "New project", "Catalog and find data", "Refine data", "New notebook", "Deep learning", and "New Modeler flow". Each card has a small circular arrow icon at its ends.

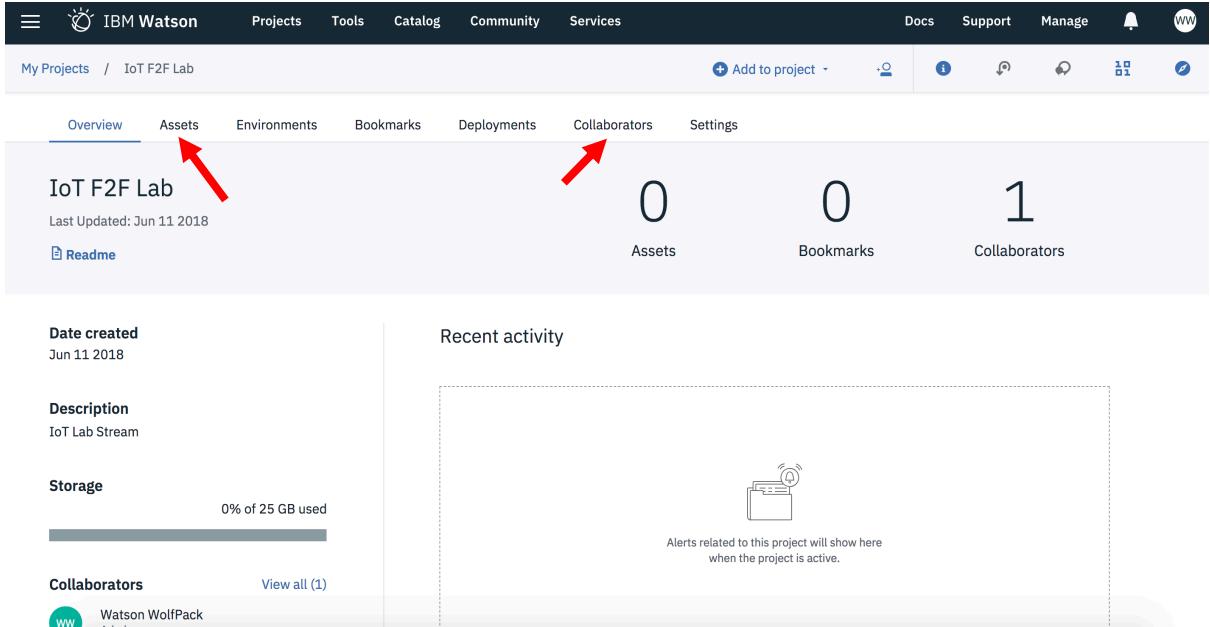
e. Click **New Project** and select **Complete**. Click **OK**.



The screenshot shows the "New project" selection screen. On the left, there's a "Get started with key tasks" section with two cards: "New project" (highlighted with a red box) and "Catalog and find data". On the right, there are several project categories: Basic, Data Science, Visual Recognition, Deep Learning, Modeler, Business Analytics, Data Engineering, and Complete. The "Complete" category is highlighted with a red box. It contains the text: "Want to explore every corner of Watson Studio? See every tool in one project." and a "Complete" button with a checkmark icon.

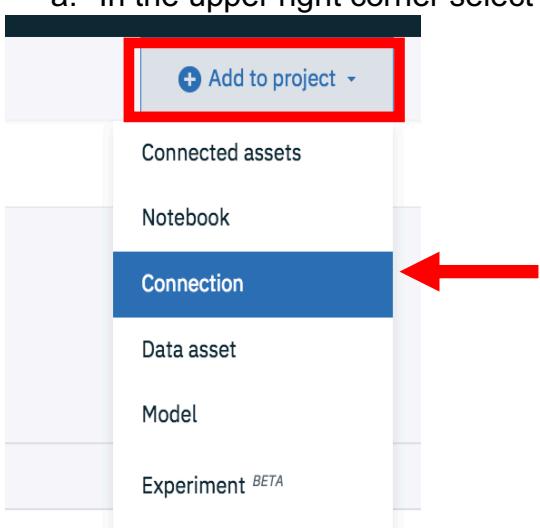
f. Name the project **IoT F2F Lab** and add a meaningful description

Action
New project
Define project details
Name IoT F2F Lab
89
Description <div style="border: 1px solid black; padding: 5px;">IoT Lab</div>
2993
Choose project options
<input checked="" type="checkbox"/> Restrict who can be a collaborator (i)
Project will include integration with Cloud Object Storage for storing project assets.
Define Storage:
<ul style="list-style-type: none">Under Define Storage, click AddChoose “Lite” plan then “Create”Verify your options then “Confirm”Refresh
Storage
<div style="background-color: #f0f0f0; padding: 5px;">cloud-object-storage-rk</div>

Action
<p>g. Click Create</p> <p>h. You now have a Project that is empty. You can use the tabs along the top to add assets to your project such as Connections, Notebooks, Data Assets, etc. You can also add collaborators to the Project.</p> 

2. Connect to Db2 Warehouse

- In the upper right corner select **Add to Project**, then **Connection**



Action												
<p>b. Under IBM Services, select Db2 on Cloud</p>  <p>c. Name the connection "IoT DB2 Warehouse" and enter the following connection details. Click Create</p> <pre>{ "hostname": "dashdb-entry-yp-dal10-01.services.dal.bluemix.net", "password": "pq_33II_BicQ", "db": "BLUDB", "username": "dash8059", }</pre> <hr/> <p>New connection (IoT DB2 Warehouse - Db2 on Cloud)</p> <table border="1"> <tr> <td>Connection overview</td> <td colspan="3">Connection details</td> </tr> <tr> <td> Name IoT DB2 Warehouse </td> <td> Hostname or IP Address * ⓘ dashdb-entry-yp-dal10-01.services.dal.blu </td> <td> Username * ⓘ dash8059 </td> <td> Secure Gateway ⓘ <input type="checkbox"/> Use a secure gateway </td> </tr> <tr> <td> Description IBM Db2 fully-managed cloud SQL database </td> <td> Database * ⓘ BLUDB </td> <td> Password * ⓘ </td> <td></td> </tr> </table> <p>d. The connection to Db2 Warehouse now appears under Data Assets</p>	Connection overview	Connection details			Name IoT DB2 Warehouse	Hostname or IP Address * ⓘ dashdb-entry-yp-dal10-01.services.dal.blu	Username * ⓘ dash8059	Secure Gateway ⓘ <input type="checkbox"/> Use a secure gateway	Description IBM Db2 fully-managed cloud SQL database	Database * ⓘ BLUDB	Password * ⓘ	
Connection overview	Connection details											
Name IoT DB2 Warehouse	Hostname or IP Address * ⓘ dashdb-entry-yp-dal10-01.services.dal.blu	Username * ⓘ dash8059	Secure Gateway ⓘ <input type="checkbox"/> Use a secure gateway									
Description IBM Db2 fully-managed cloud SQL database	Database * ⓘ BLUDB	Password * ⓘ										

Action

Overview **Assets** Environments Bookmarks Deployments Collaborators Settings

What assets are you looking for?

▼ Data assets

0 asset selected.

NAME	TYPE	SERVICE	CREATED BY	LAST MODIFIED	ACTIONS
IoT DB2 Warehouse	Connection	Project	Loren Murphy	13 Jun 2018, 2:12:32 pm	⋮

a. Click the **Assets** tab, then **New Dashboard**

Overview **Assets** Environments Bookmarks Deployments Collaborators Settings

What assets are you looking for?

▼ Data assets

NAME	TYPE	SERVICE	CREATED BY	LAST MODIFIED	ACTIONS
You currently have no data assets					

▼ Visual recognition models

NAME	MODEL ID	SERVICE INSTANCE	LAST MODIFIED	ACTIONS
You currently have no visual recognition models				

▼ Notebooks

NAME	SHARED	SCHEDULED	STATUS	LANGUAGE	LAST EDITOR	LAST MODIFIED	ACTIONS
You currently have no notebooks							

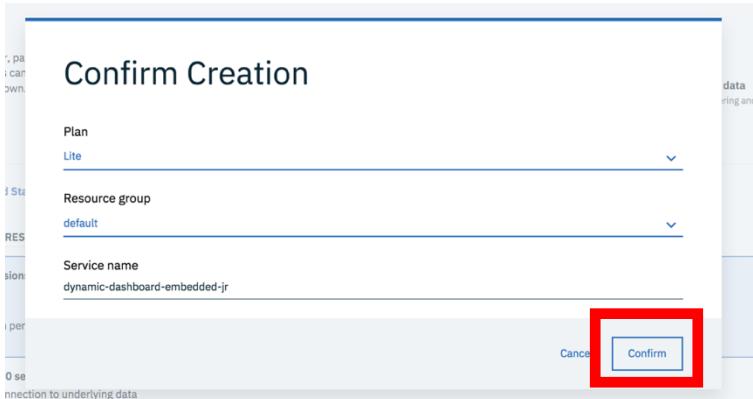
▼ Dashboards

NAME	SHARED	LAST EDITOR	LAST MODIFIED	ACTIONS
You currently have no dashboards				

a. Click **Associate a Cognos Dashboard Embedded Service instance**. You will be taken to a page to provision the service. Select the **Lite** Plan and click **Create**

Action									
<p>IBM Cognos Dashboard Embedded</p> <p>Existing New</p> <p>IBM Cognos Dashboard Embedded</p> <p>The IBM Cognos Dashboard Embedded lets you, the developer, painlessly add end-to-end data visualization capabilities to your application so your users can easily drag and drop to quickly find valuable insight and create visualizations on their own.</p> <p>Features</p> <ul style="list-style-type: none"> Live connection to underlying data Interactive dashboards produce visualizations directly from your data in real-time. Smart creation of visualizations Smart data analysis and visualization capabilities help users discover underlying patterns and meanings in their data. Interactive exploration of data Data can be explored using filtering and navigation paths. <p>Pricing Plan: Monthly Process shown above reflect the: United States</p> <table border="1"> <thead> <tr> <th>PLAN</th> <th>FEATURES</th> <th>PRICING</th> </tr> </thead> <tbody> <tr> <td><input checked="" type="radio"/> Lite</td> <td>50 sessions/month A session is a 60 minute period where end-users can perform unlimited interactions with an embedded dashboard.</td> <td>Free</td> </tr> <tr> <td><input type="radio"/> Pay as you go</td> <td>After 50 sessions Live connection to underlying data Embed dashboards where users are without losing interactivity Smart Creation of Visualizations Interactive exploration of data through filtering and navigation paths</td> <td>-</td> </tr> </tbody> </table>	PLAN	FEATURES	PRICING	<input checked="" type="radio"/> Lite	50 sessions/month A session is a 60 minute period where end-users can perform unlimited interactions with an embedded dashboard.	Free	<input type="radio"/> Pay as you go	After 50 sessions Live connection to underlying data Embed dashboards where users are without losing interactivity Smart Creation of Visualizations Interactive exploration of data through filtering and navigation paths	-
PLAN	FEATURES	PRICING							
<input checked="" type="radio"/> Lite	50 sessions/month A session is a 60 minute period where end-users can perform unlimited interactions with an embedded dashboard.	Free							
<input type="radio"/> Pay as you go	After 50 sessions Live connection to underlying data Embed dashboards where users are without losing interactivity Smart Creation of Visualizations Interactive exploration of data through filtering and navigation paths	-							

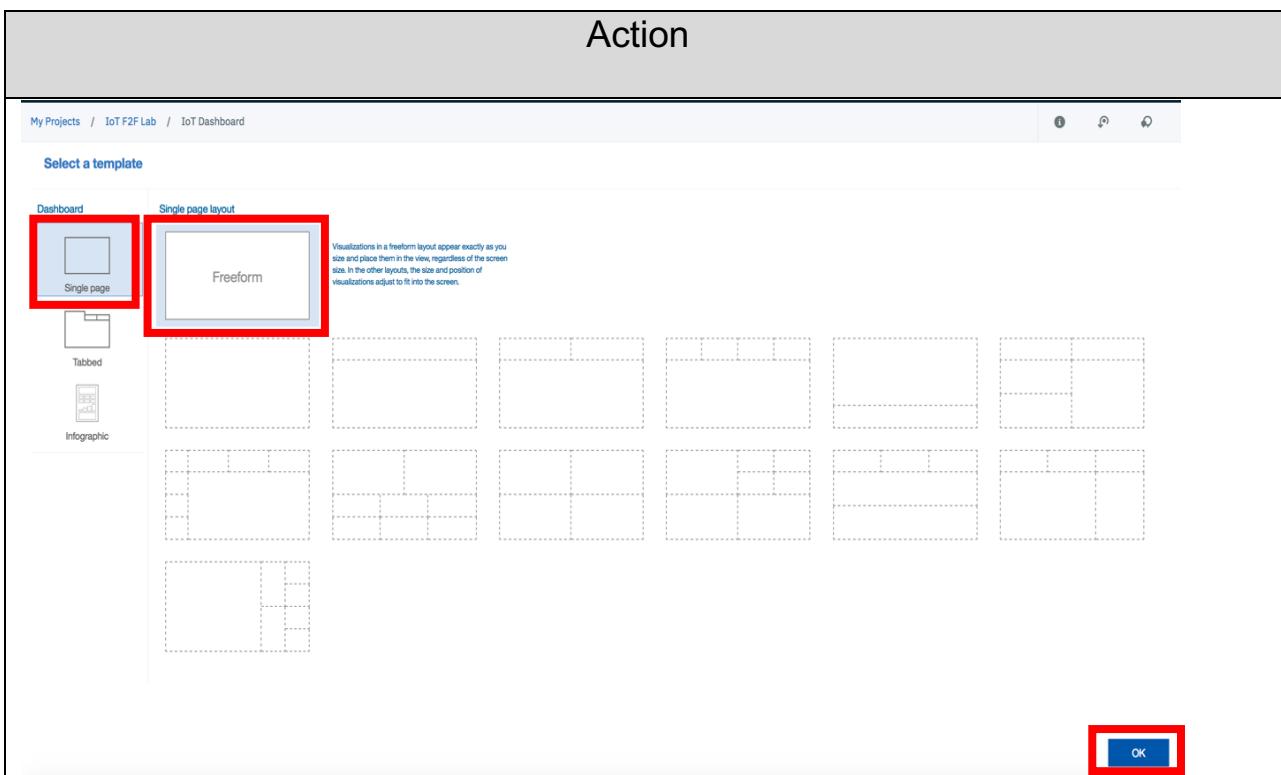
- b. Keep the default Resource group and service name values and select **Confirm**

 <p>Confirm Creation</p> <p>Plan Lite</p> <p>Resource group default</p> <p>Service name dynamic-dashboard-embedded-jr</p> <p>Cancel Confirm</p>

c. Click **Reload** and the newly provisioned **Cognos Dashboard Embedded Service** will appear.

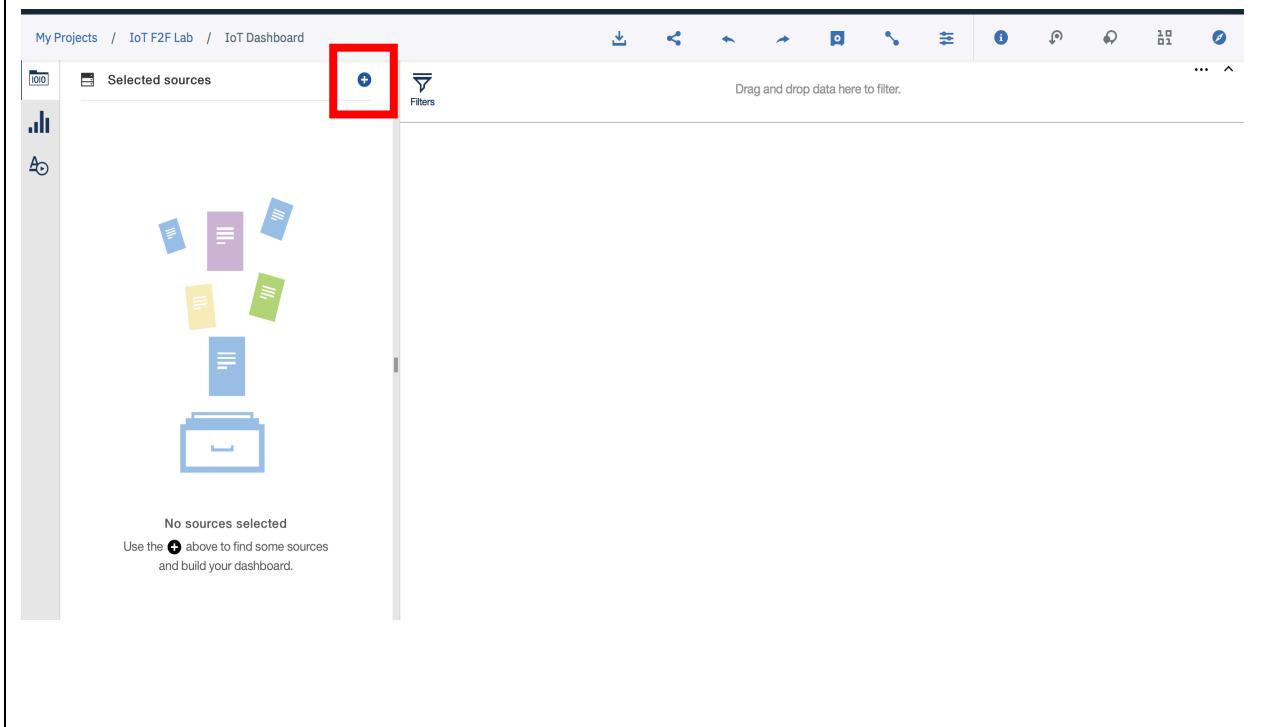
Action
<p>Associate a Cognos Dashboard Embedded service instance No Cognos Dashboard Embedded service instances associated with your project.</p> <p>Associate a Cognos Dashboard Embedded service instance with your project on the project settings page, then click the reload button below to refresh the instances available for association with your new model builder instance.</p> <p>Reload </p> <p>Cognos Dashboard Embedded Service cognos-dashboard-embedded-cw</p> <p>d. Name the dashboard IoT Dashboard and click Save</p> <p>New Dashboard</p> <p>Blank From file</p> <p>Name* IoT Dashboard </p> <p>Description Type your description here </p> <p>87 300</p> <p>Cognos Dashboard Embedded Service cognos-dashboard-embedded-cw</p> <p>Cancel Save </p> <p>e. On the Select a Template page, select Single Page dashboard and Freeform. Click OK</p>

Action

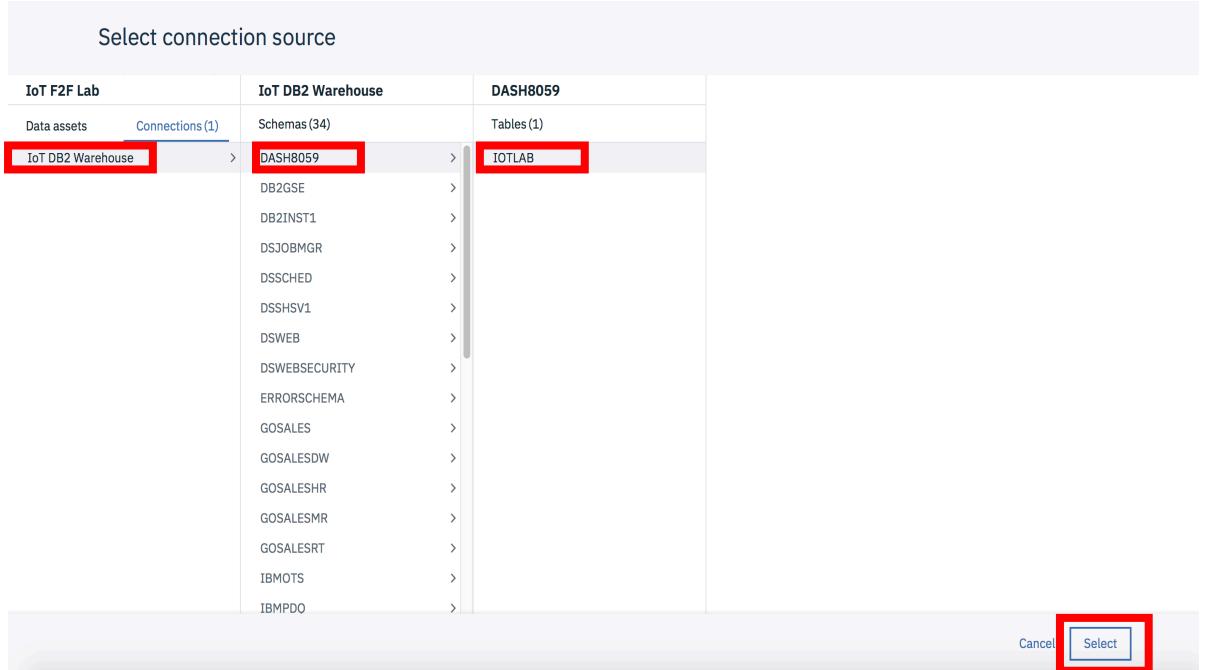
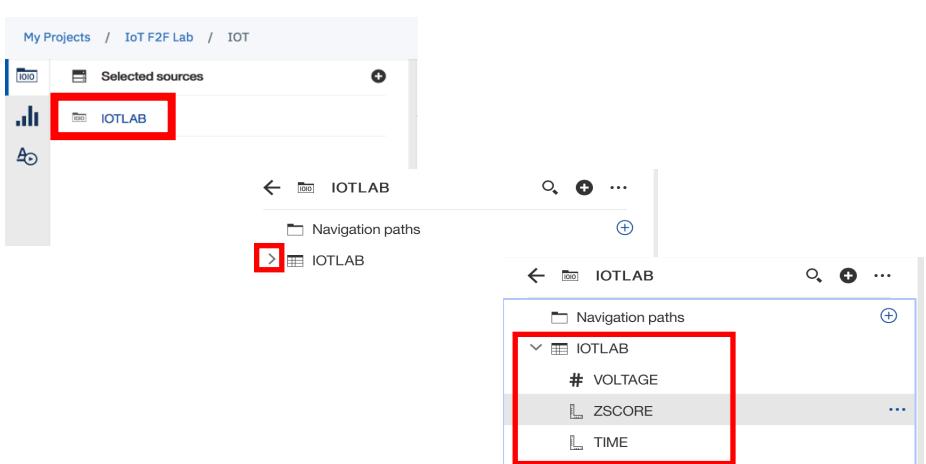


The screenshot shows the 'Select a template' step in the IBM Watson Studio interface. On the left, there are four categories: 'Dashboard', 'Single page layout', 'Tabbed', and 'Infographic'. The 'Single page layout' category is selected and highlighted with a red box. Under 'Single page layout', there are three options: 'Freeform' (selected), 'Tabbed', and 'Infographic'. To the right of the selection area is a grid of 12 different dashboard layout templates. At the bottom right of the dialog is an 'OK' button, which is also highlighted with a red box.

- f. You will be taken to the homepage. Click the **+ button** beside **Selected Sources** to add data and build your dashboard.

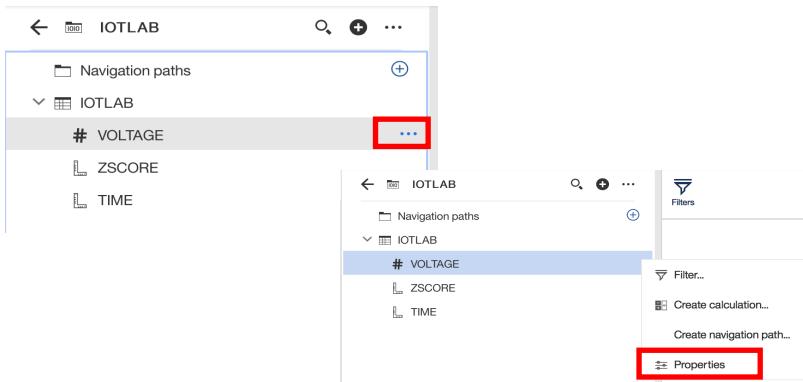


The screenshot shows the main dashboard interface of IBM Watson Studio. At the top, there's a navigation bar with 'My Projects / IoT F2F Lab / IoT Dashboard'. Below the navigation is a toolbar with various icons. The main area is titled 'Selected sources' and features a '+ button' (highlighted with a red box) and a 'Filters' icon. Below this, there are several small, colorful icons representing different data sources. A message at the bottom left says 'No sources selected' and provides instructions: 'Use the + above to find some sources and build your dashboard.'

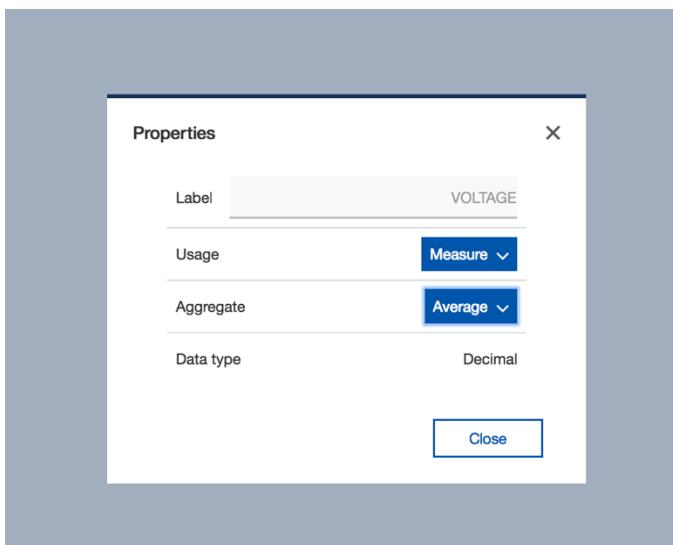
Action
<p>g. Click the Connections tab. Select IoT Db2 Warehouse as the connection, DASH8059 as the Schemas and IOTLAB as the Table. Click Select</p> 
<p>h. The IOTLAB table now appears under Selected source. Click IOTLab and select the dropdown arrow. The table columns are now listed.</p> 

Action

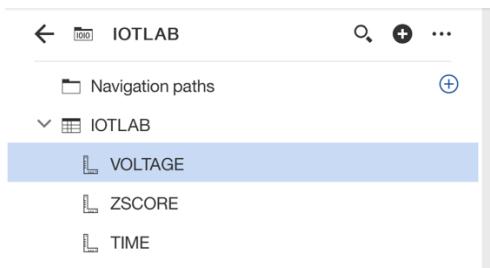
- i. Hover over the **Voltage** column and click the 3 buttons that appear. Select **Properties**



- j. Change the Usage Property to **Measure** and the Aggregate Property to **Average**. Click **Close**

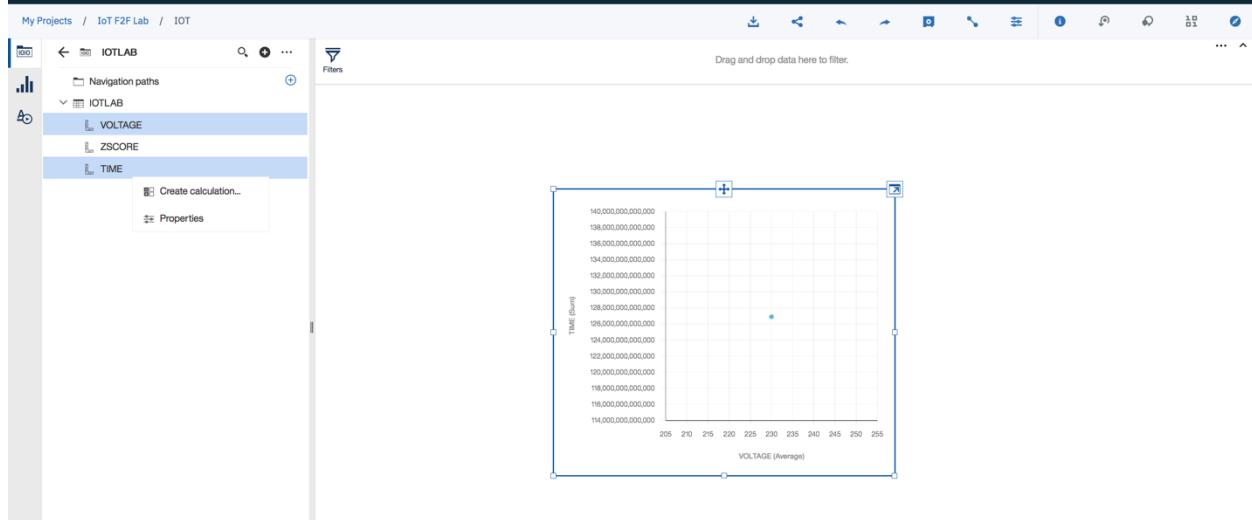


- k. The icon beside the Voltage column is now a ruler.

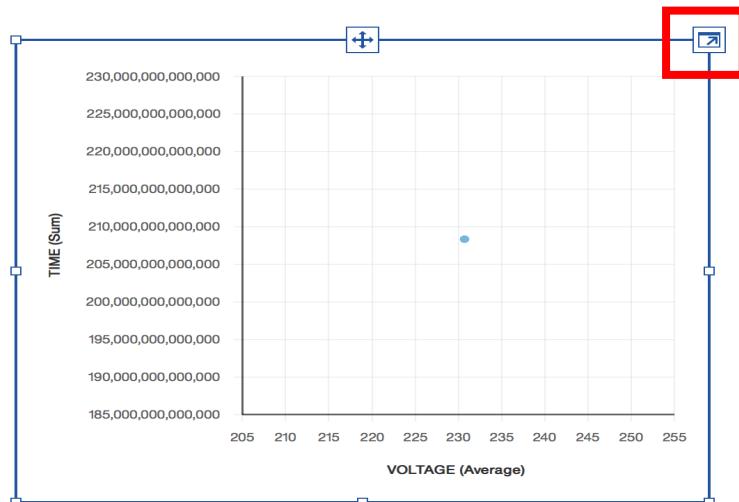


Action

- I. Select the **Voltage** and **Time** columns and drag them both onto the dashboard. You should see the following:

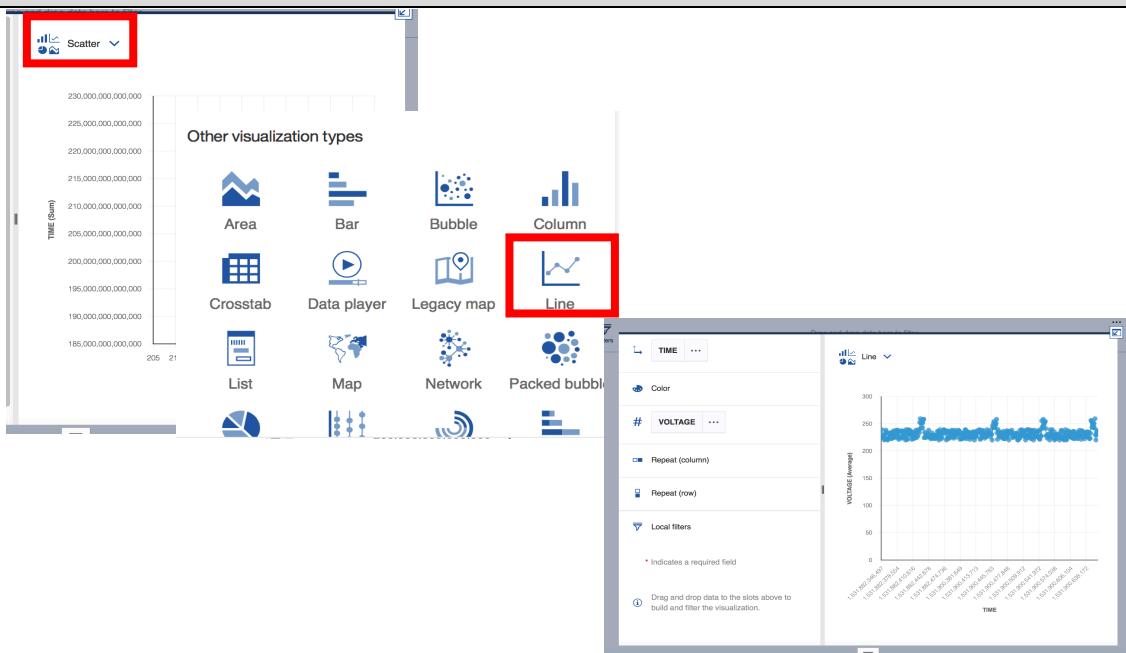


- m. Click the **expand icon** in the upper right corner of the visualization to enlarge the graph and modify properties.

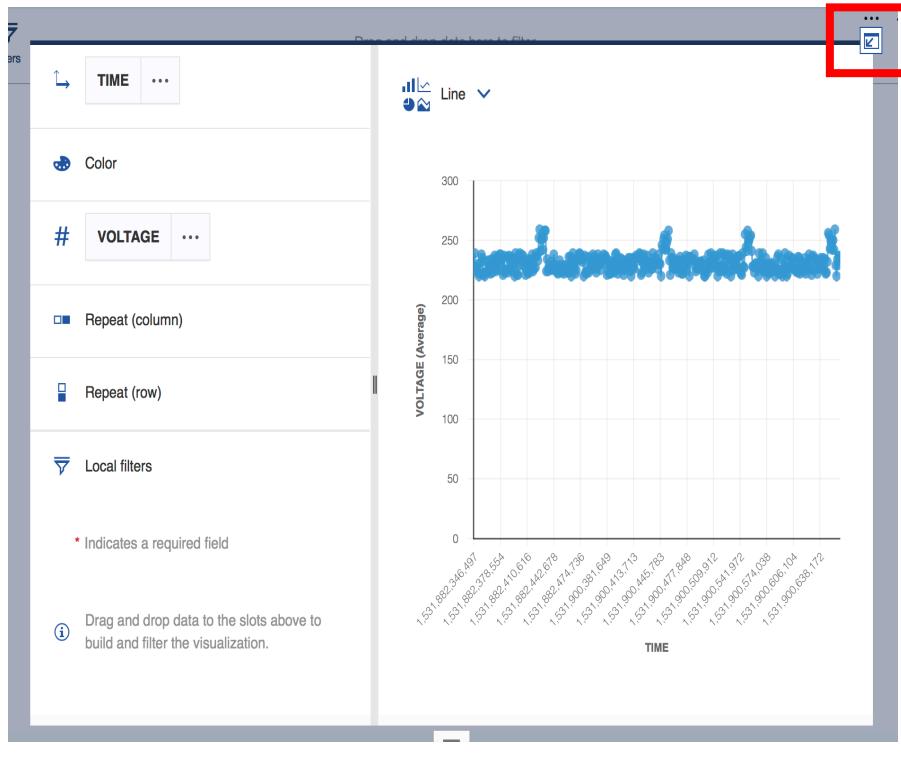


- n. Click the **dropdown arrow** beside Scatter and change the visualization type to **Line**.

Action

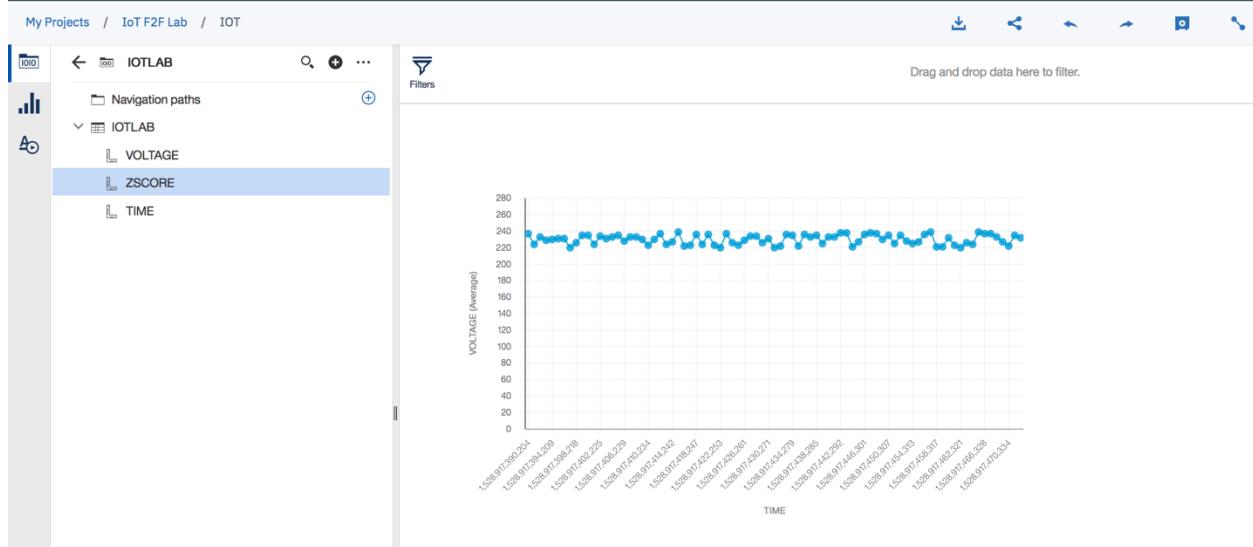


- Click the **minimize icon** in the upper right corner of the visualization to minimize the visualization.

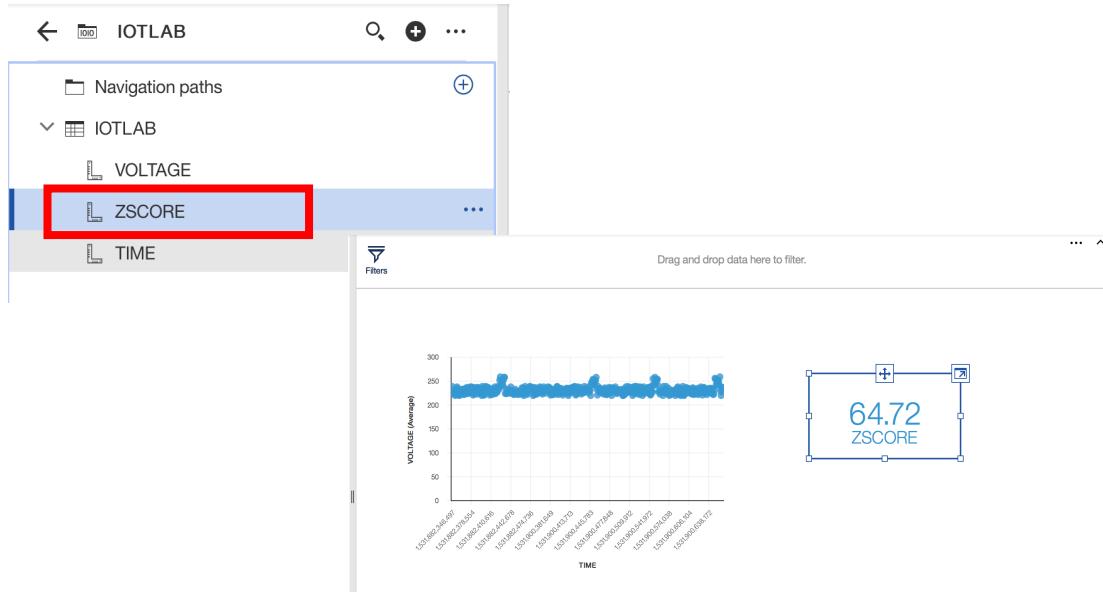


Action

- p. The line graph now appears on the dashboard.



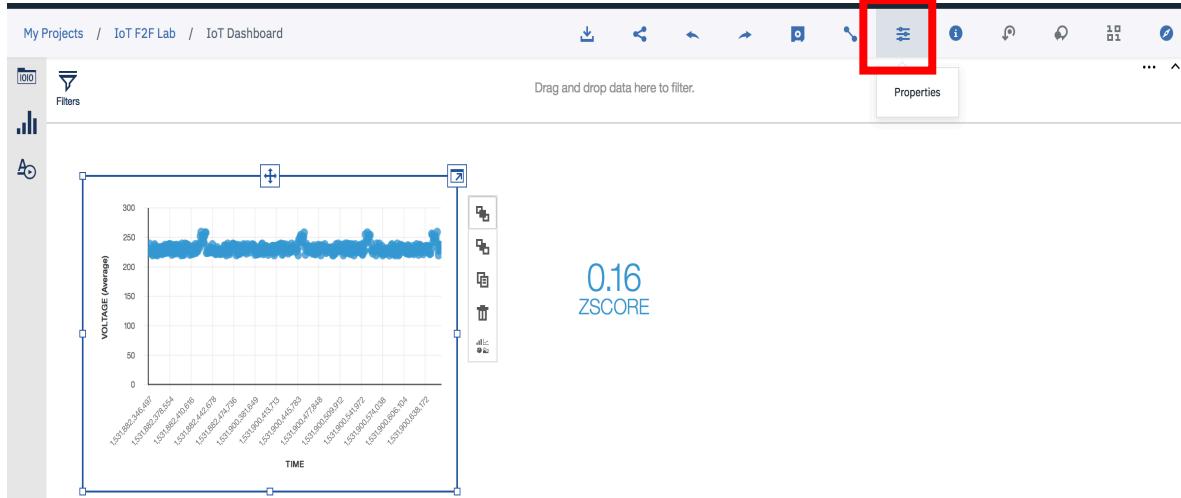
- q. Next, select the **ZScore column** and drag and drop it onto the dashboard.



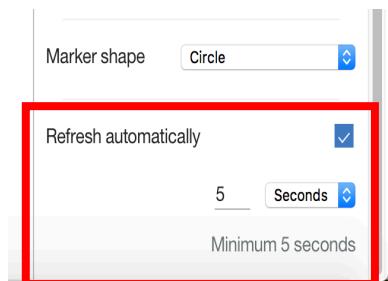
- r. Click on the zscore visualization and select the **Summarize icon**.

Action
<p>s. Select Average as the summarize type. The visualization will now display the average zscore.</p>
<p>t. Your dashboard should now look like the following:</p>
<p>u. To automatically refresh the voltage line graph visualization, click on the line graph and select the Properties icon in the upper right menu. The visualization properties panel will appear.</p>

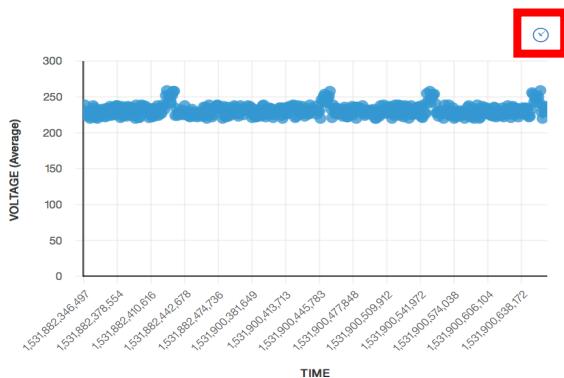
Action



- v. Under Visualization Properties, scroll to the bottom and check **Refresh automatically**. Select 5 seconds as the refresh interval.



- w. Notice a clock icon has appeared next to the voltage line graph visualization



End of Hands-on Workshop!

