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**IBM Cloud**

**Detecting Anomalous IoT**

**Behaviors with Predictive Analytics**

Watson Data Platform

**Lab Guide**

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**Table of Contents**

[Lab Environment Overview 5](#_Toc507164297)

[Lesson 1: IBM Cloud Signup 6](#_Toc507164298)

[Lab 1 Workflow Overview 7](#_Toc507164299)

[Lesson 1 Instructions 8](#_Toc507164300)

[Lesson 2: IBM DSX Signup 15](#_Toc507164301)

[Lesson 2: Workflow Overview 16](#_Toc507164302)

[Lesson 2: Instructions 17](#_Toc507164303)

[Lesson 3: Detect Anomalies using Z-Score 22](#_Toc507164304)

[Lesson 3: Workflow Overview 23](#_Toc507164305)

[Lesson 3: Instructions 24](#_Toc507164306)

[Lesson 4: Creating Cloud Rules in the IoT Platform 44](#_Toc507164307)

[Lesson 5: Visualizing Data in the IoT Platform 53](#_Toc507164308)

[Lesson 5: Workflow Overview 54](#_Toc507164309)

[Lesson 5: Instructions 55](#_Toc507164310)

[Lesson 6: Streaming Analytics 68](#_Toc507164311)

[Lesson 6: Workflow Overview 69](#_Toc507164312)

[Lesson 6: Instructions 70](#_Toc507164313)

# Lab Environment Overview

**Software and Tools**

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| **Software** | **Link** |
| **IBM Data Science Experience (DSX)** | https://datascience.ibm.com/ |
| **GitHub** | https://github.com/team-wolfpack |
| **IBM Cloud** | https://www.ibm.com/cloud/ |

# Lesson 1: IBM Cloud Signup

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| Purpose: | This lab introduces the subject of Cloud. After completing the lab, you should be able to:   * Understand Cloud * Navigate IBM Cloud Platform |
|  |  |
| Tasks: | Tasks you will complete in this lab exercise include:   * Signing up for IBM Cloud * Navigating the IBM Cloud Platform |

## Lab 1 Workflow Overview

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## Lesson 1 Instructions

| Action |
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| **1.Signing up for IBM Cloud**   1. Go to <https://www.ibm.com/cloud/> 2. We are going to sign up for a free IBM Cloud account.   ­­­   1. Click “Sign up”.      1. Fill in the required boxes. 2. Click “Create Account”. |
| **2.Navigating the IBM Cloud Platform**   1. 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 introduction window will appear, feel free to read it. Otherwise, click through.   1. Click “Next”, Click “Finish”.      1. We are now looking at the IBM Cloud Dashboard. 2. Click on the “Catalog” button found in the upper right hand corner of the screen.      1. The Catalog is a compilation of the services offered on the IBM Cloud.       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.  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 either a blue or green oval.   1. IBM Cloud supports both IBM products and services, as well as third-party. They are indicated by the small ovals below each service description.     Going along the same navigation bar as we found the catalog, we can see docs, support and manage.     1. Click on “Docs”.   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.     1. 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.     1. 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.   1. 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.     1. Return to the catalog     **End of Lesson 1** |

# Lesson 2: IBM DSX Signup

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| --- | --- |
| Purpose: | This lab introduces IBM Cloud, Data Science Experience (DSX), its sign up and walk-through of the features and functions. |
|  |  |
| Tasks: | Tasks you will complete in this lab exercise include:   * Create/Sign-In to DSX Account * 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. Create Account/Sign In to DSX**   * Open web browser and navigate to: **https://datascience.ibm.com**   J:\Projects\DSX Hands-on Lab\Images\Picture1.jpg   * Click on “Sign Up” and you will be prompted for several items of information. After a few moments of self-configuration, you will be brought to your new Home Page:     **2. Live Chat**  This is the home page of IBM Data Science Experience(DSX). 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, you need only click on **New Conversation** to connect with a live person. Through this Live Chat feature, you can also continue conversations the next time you log into DSX.  We use feedback captured through **Live Chat** and the offerings instrumentation to guide our decisions in designing and developing **Data Science Experience**. We perform this analysis using DSX.  **3. Community Cards**  At the top of the Home Page click on **Community Cards**:  A screenshot of a cell phone  Description generated with very high confidence  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 Bluemix Account:   A screenshot of a cell phone  Description generated with very high confidence  **5. Apps and Services**   * Click on **Apps and Services** to view all your current IBM Cloud Apps and Services:     Above is the default for the brand-new account, there are no services or apps deployed.  **Integrations** is where you configure DSX for GitHub integration.  **End of Lesson 2** |

# Lesson 3: Detect Anomalies using Z-Score

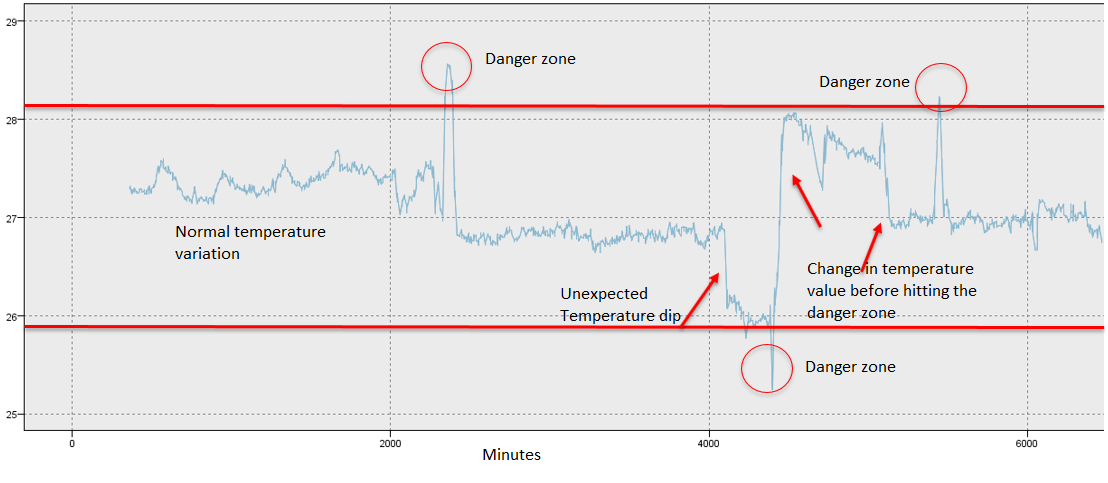
|  |  |
| --- | --- |
| Purpose: | This lesson introduces the Internet of Things (IoT) Platform Starter on IBM Cloud, how to create a Node-RED flow to simulate IoT devices, and how to use z-score to detect anomalies on edge devices. |
|  |  |
| Tasks: | Tasks you will complete in this lab exercise include:   * 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).

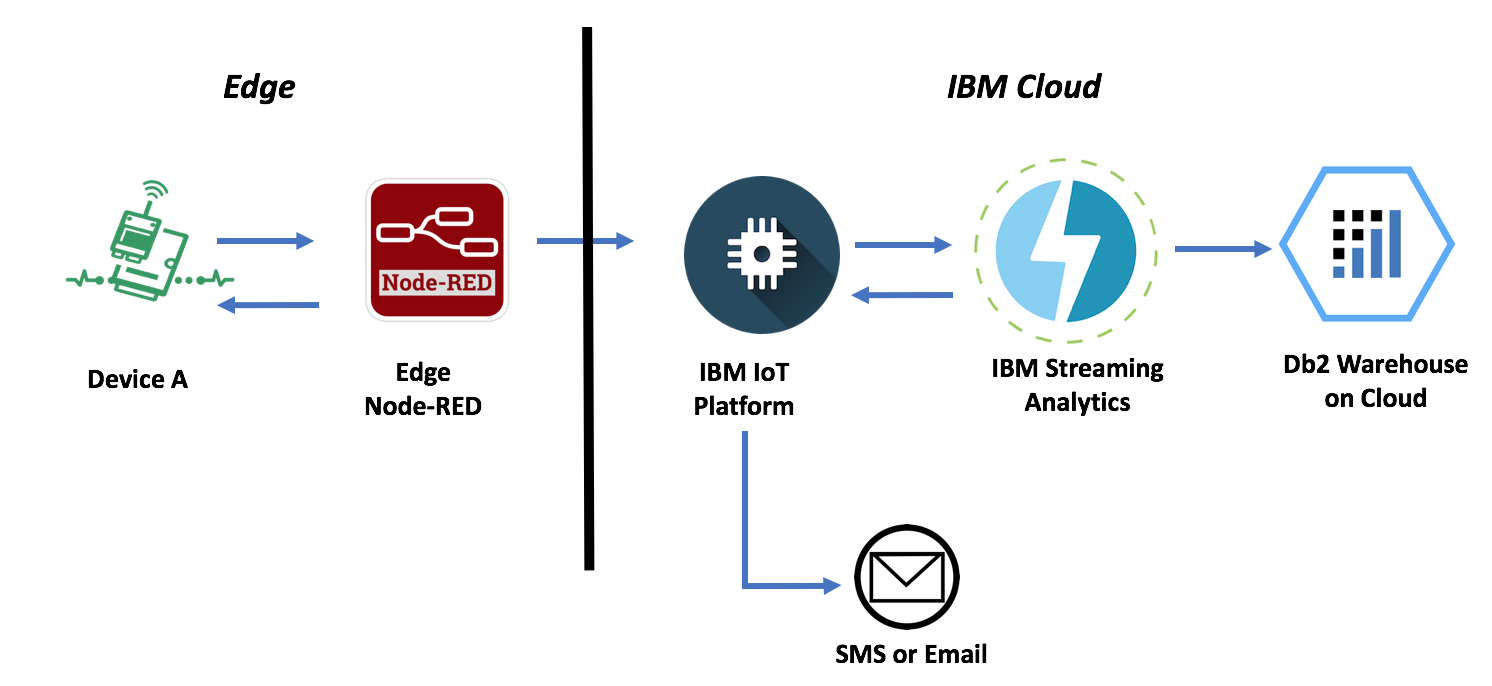
The real benefit of this massive amount of data, produced by IoT, lies in performing a real-time analysis on it so to discover trends and patterns and to use these patterns to predict the failures in a timely manner (as can be seen by the unexpected temperature dip above). One of the mechanisms of performing 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 and create rules to determine when a technician should be alerted. We will then integrate IBM Streaming Analytics with the Watson IoT Platform to perform real-time analysis on data in motion and store the data in Db2 Warehouse on Cloud. Lastly, we will see how the data in Db2 can be visualized and leveraged for further analytics and analysis.



| Action |
| --- |
| **2. Provision Internet of Things Platform Service**   1. Login into your BM Cloud account 2. Select **Catalog** from the upper right corner      1. In the search bar, type **IOT** and select **Internet of Things Platform Starter.**   Internet of Things Platform Starter fall under the boilerplates section of the catalog.     1. Fill in the required categories. (once you type in an app name, it automatically becomes the host name as well). 2. Click **Create**     f. The app will take a few minutes to start, as indicated by the icon next to the apps name  **3. Register Devices in IoT Platform**   1. Select the **IBM Cloud icon** in the upper left corner. This will take you back to your dashboard.     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.     1. Under the “Cloud Foundry Services” section, click the **Internet of Things Platform** Service Offering.      1. Select **Launch** to enter into the IBM Watson IoT Platform organization space     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.   1. Observe that a new Organization is created where you can add, connect and manage IoT devices.     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. So in order to add devices in IBM Watson IoT Platform, one need to create a device type.   1. On the left-hand side of the dashboard, click the **Devices** tab, then click on the **Device Type** tab      1. Select **Add Device Type,** from the upper right corner     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.   1. For Type, select **Device.** For Name, type **VoltageSensor.** Click **Next.**      1. You can enter in additional Device Information, but we will leave it blank. Select **Done.** You have successfully added a new device type. Now we need to register Devices of that type.      1. Select **Register Devices.** For Device ID, type **Sensor01.** Click **Next.**      1. You can enter additional Device Information, but we will leave it blank. Select **Next.** 2. Type **VoltSensor** as the authentication token. For purposes of this lab, we will provide our own authentication token versus having one auto-generated. Select **Next.**        1. Click **Done** to receive your device credentials. Be sure to **write down the credentials and save** for later use. 2. Select **Back**. Your device should now be listed.     **4.Create Node-RED Flow to Detect Anomalies using Z-Score**  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.  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.  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.   1. Within your IBM Cloud account, go to your **Dashboard** and click on the route link for your **Cloud Foundry App**.   ../../../Desktop/Screen%20Shot%202018-02-21%20at%201.31.33%20PM.   1. The Node-Red editor will give you a few options, make your selections and click **Next** through them.   (Example: fill in name and password for security, select “node-red-dashboard”, finish the install)   1. Click **Finish**      1. Click **Go to your Node-RED flow editor**     ../../../Desktop/Screen%20Shot%202018-02-21%20at%201.47.01%20PM.  When you open the flow, you can see on the left all the nodes available in the palette that can contribute to a flow and a sample flow.   1. A starter flow (**[IOTLab\_StarterFlow.json](https://github.com/team-wolfpack/Detecting-IoT-Anomalies)**) has been provided to you for the lab. Open the file and copy its contents. 2. Select the 3-bar menu tile in the upper right corner, select **Import** -> **Clipboard**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%202.48.07%20PM.   1. Copy and paste the contents from the json file into the clipboard. Select import to **New Flow** and click **Import**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%204.52.01%20PM.   1. Notice a new flow, called **Start Flow**, has been imported   ../../../Desktop/Screen%20Shot%202018-02-21%20at%204.55.20%20PM.  The flow simulates voltage sensor data, calculates a Z-Score 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. * **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 extend the node-RED flow to send an alert if the Z-Score is above the threshold.   1. Within the palette search, type **Switch**. Drag and Drop the Switch node onto the canvas.   ../../../Desktop/Screen%20Shot%202018-02-21%20at%205.20.52%20PM.   1. Connect the **Switch** node to the **ZScore** node.   ../../../Desktop/Screen%20Shot%202018-02-21%20at%205.25.56%20PM.   1. Double click the Switch node, and input in the following properties. Select **Done.**   We are setting the z-score threshold to 0.3. If the score is above 0.3, an anomaly has occurred.  ../../../Desktop/Screen%20Shot%202018-02-21%20at%205.27.48%20PM.   1. Within the palette search, type **Template**. Drag and Drop the **Template** node onto the canvas and connect it to the **Voltage Thres** node.   ../../../Desktop/Screen%20Shot%202018-02-21%20at%205.37.42%20PM.   1. Double click the **Template** node, and input the following properties. Select **Done**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%205.39.26%20PM.   1. Within the palette search, type **Debug**. Drag and Drop the **Debug** node onto the canvas and connect it to the **Danger** node.   ../../../Desktop/Screen%20Shot%202018-02-21%20at%206.46.28%20PM.   1. Lastly, also connect the **Voltage Thres** node to the **Debug** node.   ../../../Desktop/Screen%20Shot%202018-02-21%20at%206.47.16%20PM.  Finally, we need to input the credentials for our IoT Platform Service so we can connect to it.   1. Double Click the **IBM IoT** node and input the following. Notice the Device Type and Device ID are what we previously registered within the IoT Platform. Click **Done**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%205.55.08%20PM.   1. Your Node-RED Flow should look like the following:   ../../../Desktop/Screen%20Shot%202018-02-21%20at%206.47.54%20PM.   1. Double click the **Voltage Sensor Simulator** node. Change the repeat value to “**interval, every 1 second**”. Click **Done**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%206.04.27%20PM.   1. In the upper right corner, click **Deploy** button   ../../../Desktop/Screen%20Shot%202018-02-21%20at%206.07.11%20PM.   1. 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.   ../../../Desktop/Screen%20Shot%202018-02-21%20at%206.14.48%20PM.  Congratulations! Your node-RED Flow is complete!  **6.View Real-time Device Data in IoT Platform**  Next we need to validate that the voltage sensor data is being received within the IoT Platform.   1. Go back to your IoT Platform Service   ../../../Desktop/Screen%20Shot%202018-02-21%20at%206.56.28%20PM.   1. Select the **device tab** from the left-hand menu. You will be taken to **the Browse Devices** list   ../../../Desktop/Screen%20Shot%202018-02-21%20at%206.58.06%20PM.   1. Click **Sensor01** to see additional information about the device. Click the **Recent Events** tab. You should see the real-time sensor events coming in.   ../../../Desktop/Screen%20Shot%202018-02-21%20at%207.00.39%20PM.  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-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** |

# Lesson 4: Creating Cloud Rules in the IoT Platform

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| Purpose: | This lesson introduces Cloud Rules in the IoT Platform. |
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| Tasks: | Tasks you will complete in this lab exercise include:   * Create Device Schema * Create Cloud Rule and Action |

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| **1.Create Device Schema**  To be able to create rules that are triggered based on the datapoints from your device properties, you must first map these properties in a device type schema.   1. In the Watson IoT Platform dashboard, select **Devices** from the menu pane, then select **Manage Schemas**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%207.18.50%20PM.   1. Select **Add Schema** and select **VoltageSensor** as the Device Type. Click **Next**   **../../../Desktop/Screen%20Shot%202018-02-21%20at%207.20.42%20PM.**   1. Click **Add Property**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%207.22.11%20PM.   1. Select **From Connected**. Select the following properties. Click **OK** to save the schema.   The “From Connected” option, automatically detects the schema that is being received from the device.  ../../../Desktop/Screen%20Shot%202018-02-21%20at%207.24.42%20PM.   1. Click **Finish.** Click **Close** if promoted with notification.   ../../../Desktop/Screen%20Shot%202018-02-21%20at%207.28.37%20PM.   1. Your schema should now be listed in the Schema List.   ../../../Desktop/Screen%20Shot%202018-02-21%20at%207.29.56%20PM.  **2.Create Device Rules and Actions**  We will now create rules and actions which will trigger based on data from the Sensor.   1. In the Watson IoT Platform Dashboard, select **Rules** from the menu pane. You will be taken to the Browse Rules list.   ../../../Desktop/Screen%20Shot%202018-02-21%20at%207.36.16%20PM.   1. Select **Create Cloud Rule** from the upper right corner. Input the following information. Click **Next**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%207.41.14%20PM.   1. Click **New Condition** and input the following properties. Click **OK**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%207.43.02%20PM.   1. Click **New Action**.   ../../../Desktop/Screen%20Shot%202018-02-21%20at%207.44.17%20PM.   1. Click **Add Action** and input the following information. Click **Next**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%207.45.47%20PM.   1. Select **Specific People** in the To field, and input the yopmail email address that was given to you. Click **Finish**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%207.52.22%20PM.   1. Click the action you just created and click **OK**   **../../../Desktop/Screen%20Shot%202018-02-21%20at%208.00.09%20PM.**  We have just created rule that will email a technician if an anomaly occurs *(Z-Score > 0.3*).   1. Click **Activate** to implement the rule   ../../../Desktop/Screen%20Shot%202018-02-21%20at%207.55.17%20PM.   1. Go to [yopmail.com](http://www.yopmail.com/en/) and check your inbox   ../../../Desktop/Screen%20Shot%202018-02-21%20at%207.56.38%20PM.   1. You should start seeing emails appear when an anomaly has occurred.   ../../../Desktop/Screen%20Shot%202018-02-21%20at%208.02.48%20PM.  Congratulations! You have created rules and actions within the IoT Platform.  **End of Lesson 4** |

|  |  |
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| Purpose: | This lesson introduces boards within the IBM IoT Platform which are used to visualize data. |
|  |  |
| Tasks: | Tasks you will complete in this lab exercise include:   * Create Board * Visualize sensor data * Visualize Rules |

# Lesson 5: Visualizing Data in the IoT Platform

## Lesson 5: Workflow Overview

## Lesson 5: Instructions

| Action |
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| **1. Create Board**   1. In the Watson IoT Platform Dashboard, select **Boards** from the menu pane. You will be taken to Your Boards.   ../../../Desktop/Screen%20Shot%202018-02-21%20at%208.16.12%20PM.   1. Click **Create New Board**, from the upper right corner. Input the following information. Click **Next.**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%208.17.40%20PM.   1. Keep the default Board Setting user privileges. Click **Submit.** 2. Your board should now appear under **Your Boards**.   ../../../Desktop/Screen%20Shot%202018-02-21%20at%208.19.37%20PM.  **2.Visualize Sensor Data**   1. Click on the **IOT LAB**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%208.21.37%20PM.   1. Click **Add New Card** and click **Line Chart**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%208.23.36%20PM.   1. Select **Sensor01** as the Device ID. Click **Next** 2. Click **Connect new data set** and input the following properties:   ../../../Desktop/Screen%20Shot%202018-02-21%20at%208.26.44%20PM.   1. Select **L** as settings. Click **Next**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%208.27.23%20PM.   1. Name the chart **Voltage**. Click **Submit**.   ../../../Desktop/Screen%20Shot%202018-02-21%20at%208.30.16%20PM.   1. You should now see your voltage values displayed in Real-time.   ../../../Desktop/Screen%20Shot%202018-02-21%20at%208.33.13%20PM.   1. We will now visualize our z-score data. Click **Add New Card** 2. Select **Value** for card type and select **Sensor01**. Click **Next**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%208.36.15%20PM.   1. Select **Connect new data set** and input the following properties. Click **Next**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%208.40.39%20PM.   1. Select **L.** Click **Next**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%208.42.01%20PM.   1. Name the card, **ZScore**. Click **Submit**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%208.42.44%20PM.   1. You should now see your zscore values displayed in Real-time   ../../../Desktop/Screen%20Shot%202018-02-21%20at%208.43.49%20PM.  **3.Visualize Rules**   1. Click **Add New Card** 2. Under Analytics, select **Rule Alerts**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%208.48.22%20PM.   1. Select **S**, as Settings. Click **Next**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%209.21.03%20PM.   1. Name the card, **Voltage Alerts**. Click **Submit**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%209.37.04%20PM.   1. Your voltage alert card should now appear on your board.   ../../../Desktop/Screen%20Shot%202018-02-21%20at%209.39.41%20PM.   1. Lastly, we will create a visualization to display the details of each alert. Click **Add New Card** and select **Alert Info**   ../../../Desktop/Screen%20Shot%202018-02-21%20at%208.48.22%20PM.   1. Select the **Voltage Alerts** Card Name. Click **Next**   ../../../Desktop/Screen%20Shot%202018-02-22%20at%202.01.40%20AM.   1. Select the **S** setting. Click **Next**   ../../../Desktop/Screen%20Shot%202018-02-22%20at%202.06.12%20AM.   1. Type **Voltage Alert Info** as the card title. Click **Submit**   ../../../Desktop/Screen%20Shot%202018-02-22%20at%202.08.19%20AM.   1. Your Voltage Alert Info Card should now appear. Click an alert in the Voltage Alerts board and observe how the values in the Voltage Alert Info board change to reflect the selected value.   ../../../Desktop/Screen%20Shot%202018-02-22%20at%202.12.24%20AM.  Congratulations! You have successfully visualized your sensor data and rules.  **End of Lesson 5** |

# Lesson 6: Streaming Analytics

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| Purpose: | This lab introduces Streaming Analytics and how it can be integrated with the IoT Platform. Streaming Analytics enables you to perform real-time analysis on data in motion |
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| Tasks: | Tasks you will complete in this lab exercise include:   * Generate IoT Platform API Key * Provision Cloud Object Storage * Create Streaming flow in Data Science Experience |

## Lesson 6: Workflow Overview

## Lesson 6: Instructions

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| Streaming Analytics enables you to perform real-time analysis on data in motion. The Streaming Analytics service is powered by IBM Streams, which is an advanced analytic platform that custom applications use to quickly ingest, analyze, and correlate information as it is produced by real-time data sources. IBM Streams can handle very high data rates and perform its analysis with predictable low-latency, so your application can operate at the speed of data.  **1.Generate IoT Platform API Key**  To connect the IBM IoT Platform to other applications, we need to create an API Key.   1. In the Watson IoT Platform Dashboard, select **Apps**.Then select **Generate API Key**   ../../../Desktop/Screen%20Shot%202018-02-22%20at%207.11.50%20AM.   1. **Copy** and **Save** the **API Key** & **Authentication Token** for later use. Note: You will not be able to view the authentication token again, so be sure to write it down. Click **Generate**   ../../../Desktop/Screen%20Shot%202018-02-22%20at%207.14.54%20AM.   1. Your new API Key should now be listed   ../../../Desktop/Screen%20Shot%202018-02-22%20at%207.16.58%20AM.  **2.Create Data Science Experience Project**   1. **Sign in** to [**https://datascience.ibm.com**](https://datascience.ibm.com)   J:\Projects\DSX Hands-on Lab\Images\Picture1.jpg   1. You will be brought to your Home Page      1. Create a **New Project** called **IoT F2F Lab**, and add a meaningful description   ../../../Desktop/Screen%20Shot%202018-02-22%20at%207.56.25%20AM.  Define Storage:   * Select **Object IBM Cloud Storage** * Click Add * Choose “Lite” plan then “Create” * Verify your options then “Confirm”   ../../../Desktop/Screen%20Shot%202018-02-22%20at%207.58.42%20AM.   1. Click **Create** 2. 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.   ../../../Desktop/Screen%20Shot%202018-02-22%20at%208.01.00%20AM.  **3.Create IOT Streams Flow**   1. Click **Assets**, then **New Streams Flow**   ../../../Desktop/Screen%20Shot%202018-02-22%20at%208.07.50%20AM.   1. Name the flow, **IOT Streams Flow** and add a meaningful description. Select **Manually** create the flow.   ../../../Desktop/Screen%20Shot%202018-02-22%20at%208.11.33%20AM. |
| 1. Click **Associate an IBM Streaming Analytics instance.** You will be taken to a page to provision the service   ../../../Desktop/Screen%20Shot%202018-02-22%20at%208.15.32%20AM.   1. Select the **Lite** Plan. Click **Create**   ../../../Desktop/Screen%20Shot%202018-02-22%20at%208.17.06%20AM.   1. Keep the default values and select **Confirm**   ../../../Desktop/Screen%20Shot%202018-02-22%20at%208.17.37%20AM.   1. Your Project should now look like the following: Click **Create**   ../../../Desktop/Screen%20Shot%202018-02-22%20at%208.19.29%20AM.   1. You will be taken to the homepage of your Streams Flow   ../../../Desktop/Screen%20Shot%202018-02-22%20at%208.23.54%20AM.   1. From the palette, on the left-hand side, drag and drop the **Watson IOT** node onto the canvas. It is found under Sources.   ../../../Desktop/Screen%20Shot%202018-02-22%20at%208.27.07%20AM.   1. Click on the WatsonIoT node, and select **Add Connection**   ../../../Desktop/Screen%20Shot%202018-02-22%20at%208.27.55%20AM.   1. Select the **IBM Watson IoT** Service and add the following properties:  * **Name** – type **Watson IoT** * **Description** – type Connection to Watson IoT Platform * **Organization** – Organization Space ID from Watson Platform. You wrote down this value in Lesson 3, Step 3 when you registered your IoT Device. * **API Key** – Watson IOT Platform API Key. You wrote down this value in Lesson 6, Step 1. * **Authentication Token** – Watson IoT Platform Authentication Token. You wrote down this value in Lesson 6, Step 1.  1. Click **Create**   ../../../Desktop/Screen%20Shot%202018-02-22%20at%208.36.20%20AM.   1. Add the following properties and click **Edit Output Schema**   ../../../Desktop/Screen%20Shot%202018-02-22%20at%208.41.00%20AM.   1. Select **Detect Schema** and expand **Show Preview**   ../../../Desktop/Screen%20Shot%202018-02-22%20at%208.45.48%20AM.   1. The schema will automatically be detected. In the preview section, you can also see the formatted and raw Stream Data. Click **Save** to save the schema, then **Close**   ../../../Desktop/Screen%20Shot%202018-02-22%20at%208.48.15%20AM.   1. From the palette, on the left-hand side, **drag** and **drop** the **Filter** node onto the canvas. It is found under Processing and Analytics. **Connect** the **Filter** node to the **WatsonIoT** Node.   ../../../Desktop/Screen%20Shot%202018-02-22%20at%208.52.36%20AM.   1. Click the **Filter** Node and input the following. For simplicity of the lab, we will only filter based upon voltage.   ../../../Desktop/Screen%20Shot%202018-02-22%20at%208.55.49%20AM.   1. From the palette, on the left-hand side, drag and drop the **Db2 Warehouse on Cloud** node onto the canvas. It is found under Targets. **Connect** the **Db2 Warehouse on Cloud** node to the **Filter** Node.      1. Click the **Db2 Warehouse** node to display General Settings. Click **Add Connection**      1. Click **Db2 Warehouse** on the connection page and then enter the following credentials and then click **“Create”.**   “Name”: Db2 Warehouse  "hostname": dashdb-entry-yp-dal09-08.services.dal.bluemix.net  “database”: BLUDB  “username": dash14416  "password": DqLhD74z\_bG\_   1. Once the Connection is created, click on the button on the right of the **“Schema/Table”** field and select schema **“DASH14416”** and table **“IOTLAB”**, as shown below, then click **“Select”**.      1. Click on **“Map Schema”** and confirm that the IoT and Db2 fields have been correctly mapped.      1. Your final Streams Flow should look like the following:      1. We are now ready to start streaming the data. From the menu, select the **Play button.** This will bring you to the streams execution status page, as shown below.   ../../../Desktop/Screen%20Shot%202018-02-22%20at%209.30.27%20AM.     1. The flow will take about 1-2 minutes to start, as the flow is scheduled for execution on your Streaming Analytics service on the IBM Cloud. Once started, an animation of the message traffic will start, as shown below.      1. We now have an historical view of anomalous voltage readings in a database that can be accessed by any analytic tool. Click on this [link](http://169.48.243.239:9300/bi/?perspective=dashboard&pathRef=.public_folders%2FIoT%2FIoT+Data+Analysis+Example&action=view&mode=dashboard) to see an example of how this data can be visualized by an analytic tool (in this case IBM Cognos). This visual is a dashboard that is updated every 5 seconds from our Db2 Warehouse database. The data can be visualized and used in many other ways.     **End of Lesson 6**  **End of Hands-on Workshop**  **Thank You!** |