

Build with Watson: Construct Watson IoT Applications using Node-RED

Think 2018 - Hands-On Lab #2296

Download this PDF and Node-RED flows at

<https://github.com/johnwalicki/Think2018-Lab>

Author:

John Walicki | walicki@us.ibm.com

| @johnwalicki



Getting Started with Watson IoT Platform

This workshop details a Developer Experience creating a IBM Cloud Watson IoT application. You will create an IoT application that analyzes simulated sensor data using Quickstart and Node-RED. Sensor data will be visualized using Node-RED Dashboard and stored for historical time series data analysis.

In this workshop, we will connect a simulated IoT Sensor device to the IBM Cloud and Watson IoT Platform. We will send and graph temperature data to the Watson IoT Quickstart and registered devices. Watson IoT Platform will report the temperature and compare the temperature value in each event with a threshold. Using Node-RED, the application will analyze if the temperature is above the threshold and send alerts.

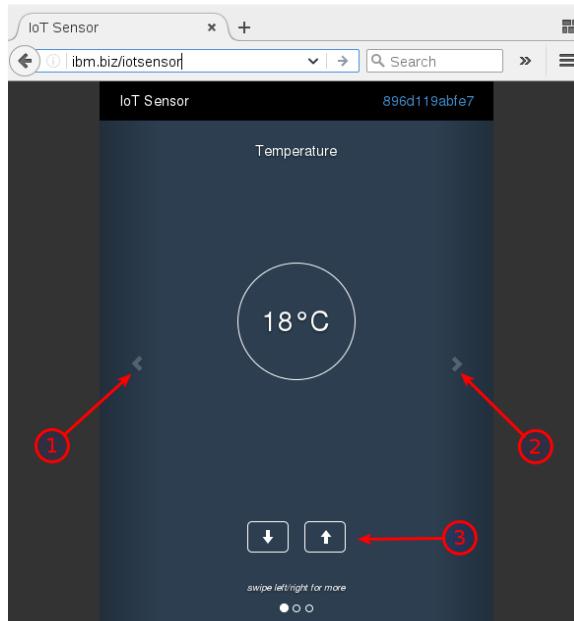
Section 1 – Create an IoT Sensor Simulator

In this Section, we will create an IoT Sensor device simulator and demonstrate sending data to the Watson IoT Platform.

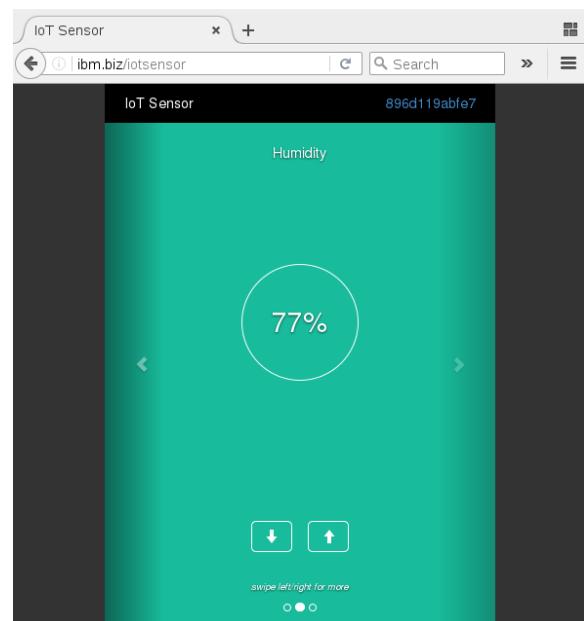
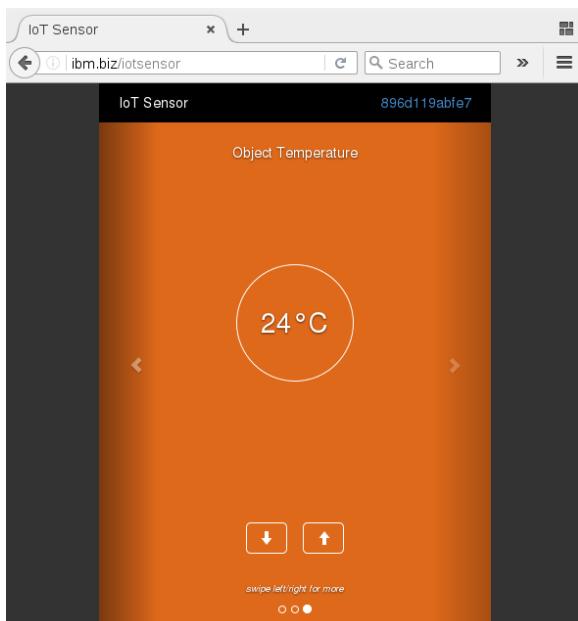
Step 1 – On your laptop, open a Firefox or Chrome browser window

An IoT Sensor Simulator is available to demonstrate sending data to the Watson IoT Platform. It sends one simulated sensor data reading per second. There are simulated Temperature, Humidity and Object Temp sensor readings. It automatically sends the simulated data to the IBM Watson IoT Platform Quickstart.

- Open a browser tab to <http://ibm.biz/iotsensor>



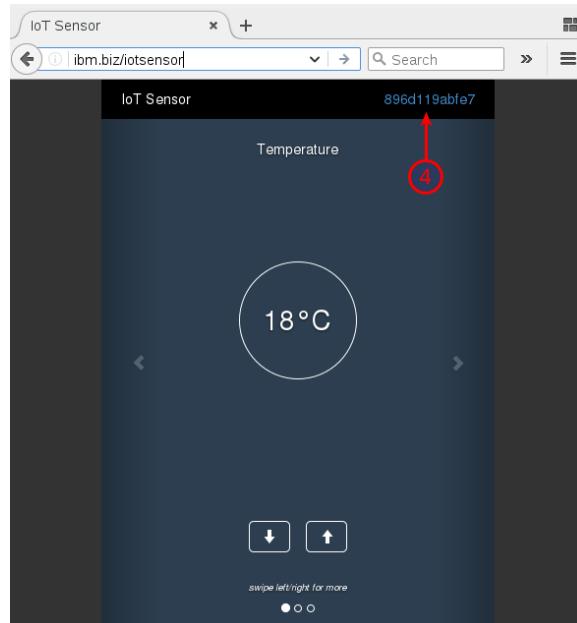
- Swipe left (1) or right (2) to view additional Object Temperature or Humidity simulated sensors.
- Use the Arrow buttons (3) to increase / decrease the simulated sensor value.



Step 2 – View the simulated data in the IBM Watson IoT Platform Quickstart

- To view this simulated data in the IBM Watson IoT Platform Quickstart, click on the generated Device ID in the upper right corner (4).

Note the unique Device ID. This Device ID will be used in Section 2.



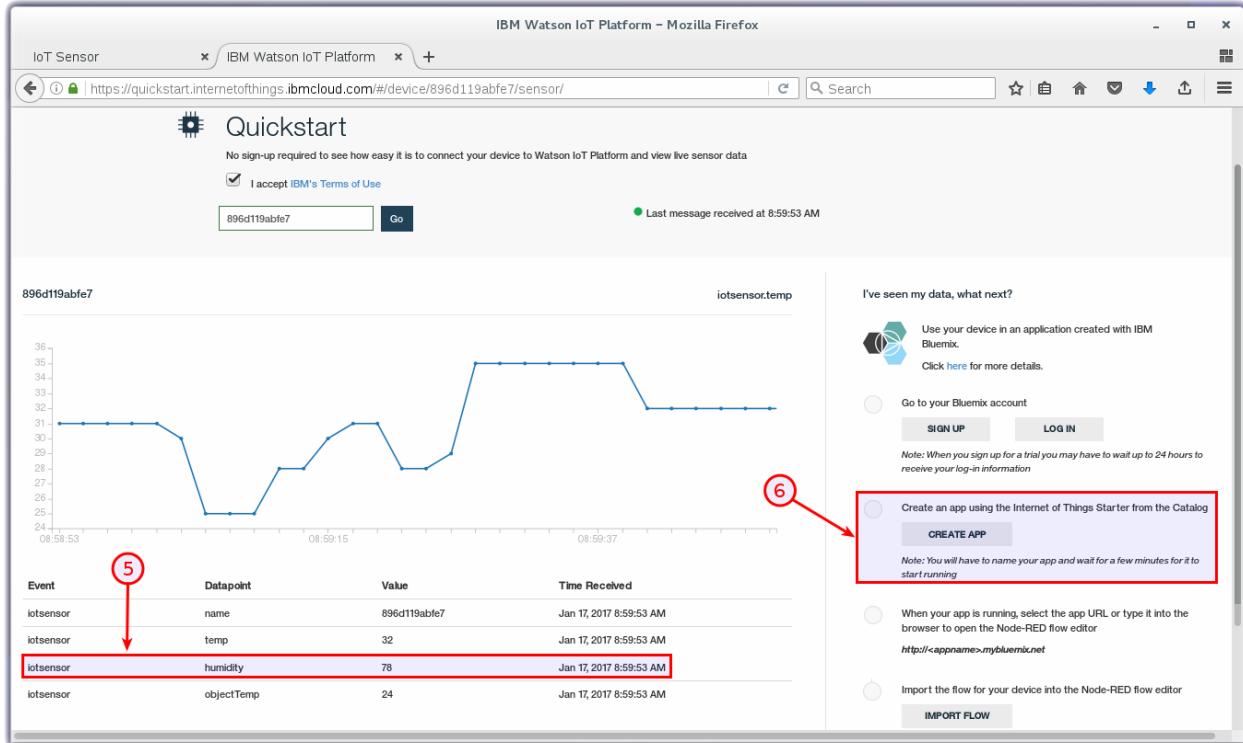
- A new browser tab will open to

<http://quickstart.internetofthings.ibmcloud.com/?deviceId=<device id>>

The screenshot shows a desktop browser window titled 'IBM Watson IoT Platform - Mozilla Firefox'. The address bar shows the URL 'https://quickstart.internetofthings.ibmcloud.com/#/device/896d119abfe7/sensor/'. The main content area is titled 'Quickstart' and contains a message: 'No sign-up required to see how easy it is to connect your device to Watson IoT Platform and view live sensor data'. There is a checked checkbox for 'I accept IBM's Terms of Use'. Below this is a button labeled 'Go' and a timestamp 'Last message received at 8:59:53 AM'. On the left, there is a line graph for '896d119abfe7' showing the data point 'iotsensor.temp'. The graph shows a series of data points starting at 31, dropping to 25, rising to 32, dropping to 27, rising to 34, and finally dropping to 31. On the right side, there is a sidebar titled 'I've seen my data, what next?'. It includes several options:

- 'Use your device in an application created with IBM Bluemix.' with a 'Click here for more details.' link.
- 'Go to your Bluemix account' with 'SIGN UP' and 'LOG IN' buttons. A note says 'Note: When you sign up for a trial you may have to wait up to 24 hours to receive your log-in information.'
- 'Create an app using the Internet of Things Starter from the Catalog' with a 'CREATE APP' button. A note says 'Note: You will have to name your app and wait for a few minutes for it to start running.'
- 'When your app is running, select the app URL or type it into the browser to open the Node-RED flow editor' with a link 'Http://<appname>.mybluemix.net'.
- 'Import the flow for your device into the Node-RED flow editor' with a 'IMPORT FLOW' button.

- Experiment with the up / down arrows (3) on the simulated Temperature sensor to plot different readings on the Quickstart graph.
- To view the other simulated sensor readings, select the Datapoints (5) in the table below the graph. You can click on any of the three datapoints to plot them.
- Congratulations! You have successfully sent simulated sensor data to the Watson IoT Platform.



Observations:

Step 3 – Create an app using the Internet of Things Starter

- **Important: If you have not yet logged into IBM Cloud with your IBM Cloud account and password, please do so at this point:**

<http://bluemix.net>

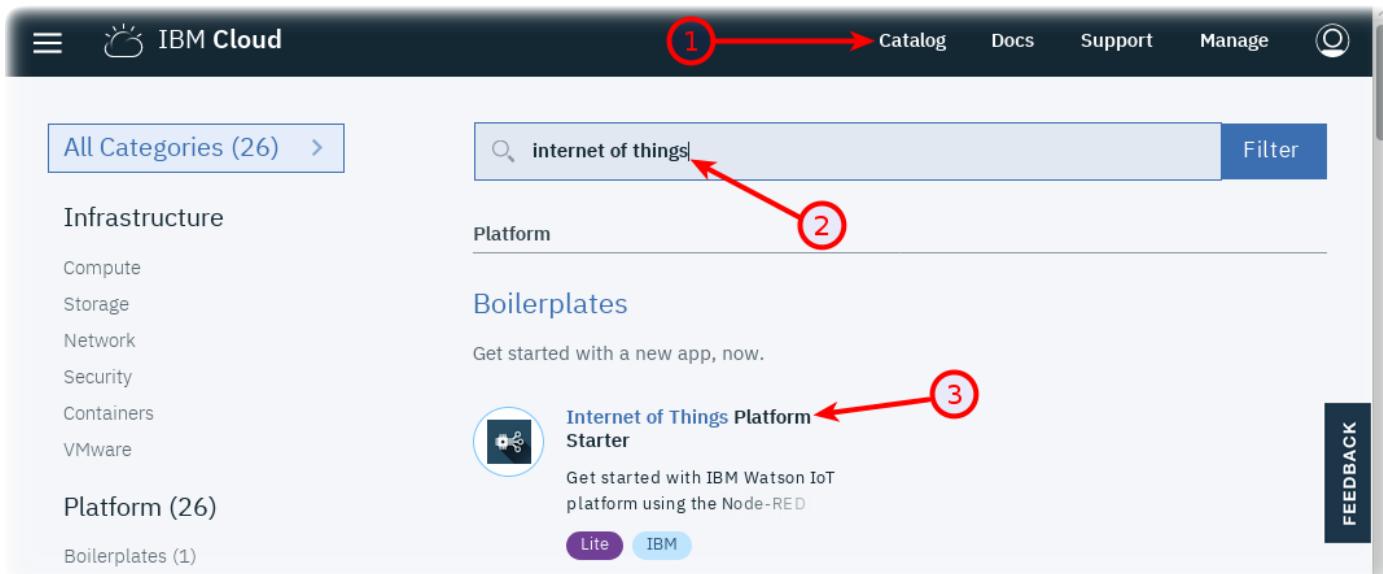
- On the right hand side of the Quickstart graph there are instructions (6) to create an app using the Internet of Things Starter.
- If you have already logged into Bluemix with your new account, click on the CREATE APP button (6)
- Proceed to Section 2 on the next page.

Section 2 – Create an Internet of Things Starter App

Step 1 – Create an IoT Starter Application

Now that we have sent the simulated IoT Sensor data readings to Watson IoT Quickstart, in this Section we will create an IoT Starter Application to ingest and analyze the Quickstart data.

- Create an account and log into [IBM Cloud](#)
- Click on the **Catalog** (1) and search for **internet of things** (2)
- The **Internet of Things Platform Starter** boilerplate (3) is designed with pre-assembled services that work together. The Internet of Things Platform Starter includes a Node-RED Node.js web server, Cloudant database to store the sensor data, and the IoT platform service so you can connect devices.



- Name your application something unique (4). If you choose ***myapp***, your application will be located at <http://myapp.mybluemix.net>. There can only be one “***myapp***” application and URL registered in IBM Cloud. You might name your application **think2018-yourname**
- Press the **Create** button (5).

The screenshot shows the 'Create a Cloud Foundry App' interface. At the top, there's a navigation bar with 'IBM Cloud' and links for Catalog, Docs, Support, and Manage. Below the title 'Create a Cloud Foundry App', there's a section for the 'Internet of Things Platform Starter'. It includes a brief description of the starter, deployment options (Region: US South, Organization: walicki@us.ibm.com, Space: dev), and a 'Selected Plan' section. The plan details include 'SDK for Node.js™' (Default), 'Cloudant NoSQL DB' (Lite), 'Internet of Things Platform' (Lite), and region 'US South, United Kingdom, Germany'. At the bottom, there are links for 'Need Help?' and 'Estimate Monthly Cost'.

- IBM Cloud will create an application in your account based on the services in the boilerplate. This is called staging an application. It can take a few minutes for this process to complete. While you wait, you can click on the **Logs** tab and see activity logs from the platform and Node.js runtime.

Step 2 - Launch the IoT Starter Application

- Once the Green “**Running**” icon appears, Click the **View App URL** button (6).

The screenshot shows the 'Cloud Foundry apps /' page. On the left, there's a sidebar with 'Getting started' and 'Overview' (which is selected). The main area shows an application named 'force4good-medSupply-asset-...' with a green 'Running' status icon. Below it, it says 'Org: walicki@us.ibm.com', 'Location: US South', and 'Space: AssetTracking'. To the right of the application card are buttons for 'Routes', 'Logs', 'Monitoring', and 'API Management'. At the bottom, there's a summary of the runtime environment: 'Runtime' (Buildpack: Internet of Things Platform Starter, Instances: 1, MB Memory per Instance: 512, Total MB Allocation: 13.25 GB), 'Health' (All instances are running, Health is 100%), and a 'Feedback' button.

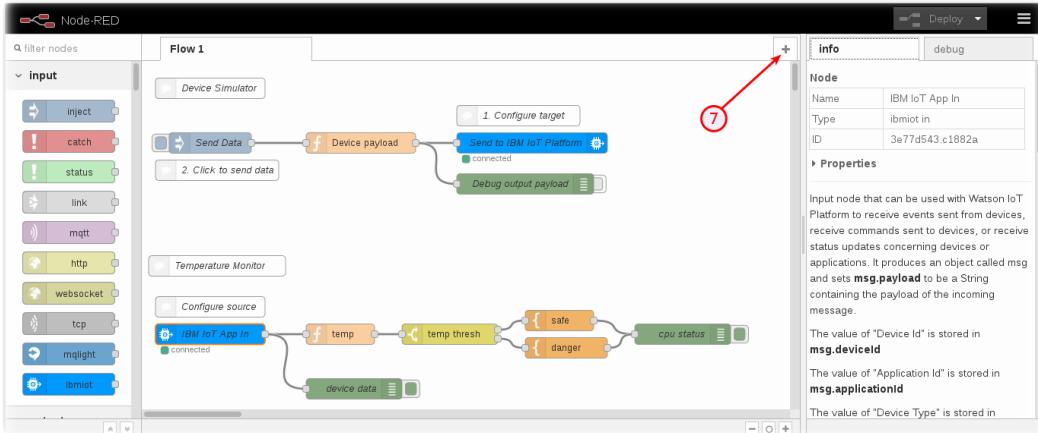
Step 3 – Open the Node-RED visual programming editor

- A new browser tab will open to the Node-RED start page. Node-RED is an open-source Node.js application that provides a visual programming editor that makes it easy to wire together flows. Select a username / password to access the Node-RED editor. Remember your username / password. Click the red button **Go to your Node-RED flow editor** to launch the editor.

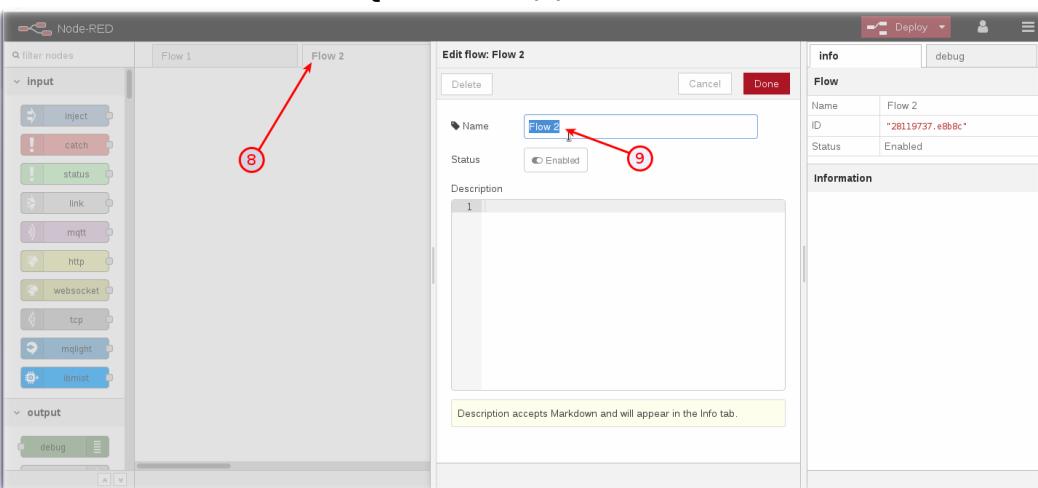
The image consists of four screenshots arranged in a 2x2 grid, illustrating the configuration process for Node-RED on IBM Bluemix.

- Screenshot 1:** Welcome screen for the Internet of Things Platform (IoTP) boilerplate application on IBM Bluemix. It displays a progress bar with three steps completed and one step remaining. Buttons for "Previous" and "Next" are at the bottom.
- Screenshot 2:** Security configuration screen titled "Secure your Node-RED editor". It shows a radio button selected for "Secure your editor so only authorised users can access it". Fields for "Username" and "Password" are present, with a note that the password must be at least 8 characters. A checkbox for "Allow anyone to view the editor, but not make any changes" is also shown. A note at the bottom states "Not recommended: Allow anyone to access the editor and make changes". Buttons for "Previous" and "Next" are at the bottom.
- Screenshot 3:** Configuration summary screen titled "Finish the configuration". It lists the selected security setting: "Secure your editor so only authorised users can access it". It also lists environment variables: "NODE_RED_USERNAME" (username), "NODE_RED_PASSWORD" (password), and "NODE_RED_GUEST_ACCESS" (set to "true", allowing anyone read-only access). A note says these settings will be persisted in CloudantDB. A progress bar shows all four steps completed. Buttons for "Previous" and "Finish" are at the bottom.
- Screenshot 4:** Node-RED start page titled "Node-RED on IBM Bluemix for IBM Watson IoT Platform". The main heading is "Node-RED: Flow-based programming for the Internet of Things". Below the heading, a paragraph describes Node-RED as a tool for wiring together hardware devices, APIs, and online services. A red button labeled "Go to your Node-RED flow editor" is prominent. Smaller text links include "Learn how to customise Node-RED" and "Customising your instance of Node-RED". A note at the bottom states "This instance of Node-RED is enough to get you started creating flows." followed by the URL "https://sensortile-walicki.mybluemix.net/red/".

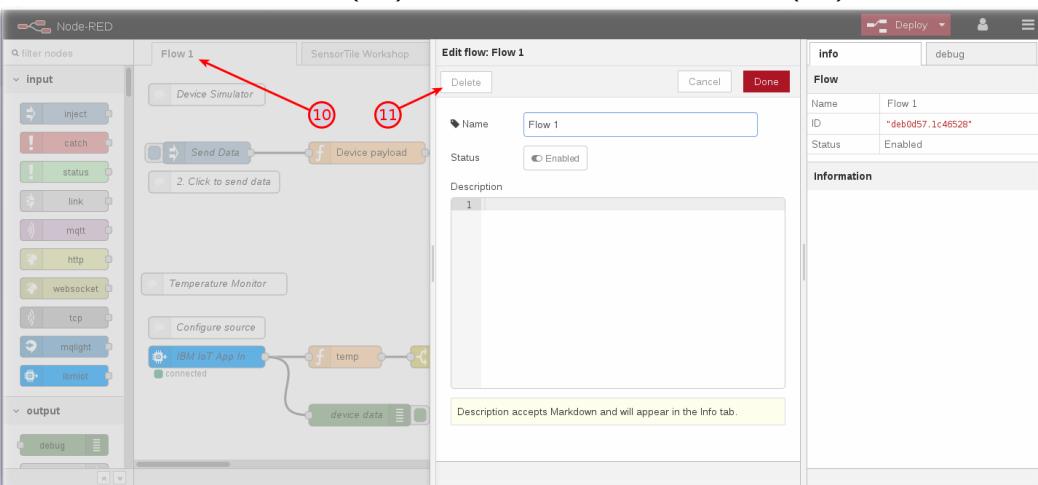
- The Node-RED Visual Programming Editor will open with a default flow.
- On the left side is a palette of nodes that you can drag onto the flow.
- You can wire nodes together to create a program.
- The sample IoT Starter flow is not applicable to this workshop and can be deleted.



- Click the + icon (7) to add a new tab. Click on the **Flow 2** tab header (8).
- Rename this tab from **Flow 2** to **Quickstart** (9)

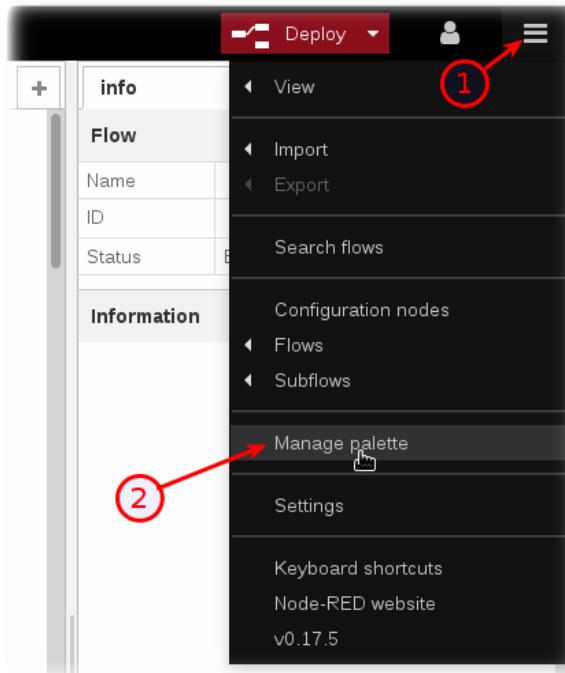


- Click on the **Flow 1** tab header (10). Press the **Delete** button. (11)

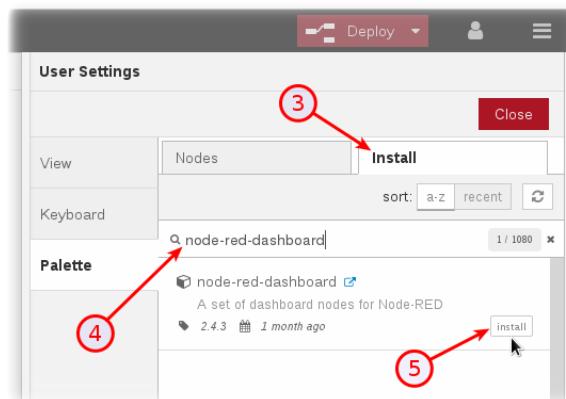


Step 4 – Install Additional Node-RED nodes

- The IoT Starter Application deployed into IBM Cloud includes just a small subset of Node-RED nodes. The Node-RED palette can be extended with over one thousand additional nodes for different devices and functionality. These NPM nodes can be browsed at <http://flows.nodered.org>
- In this Step, you will add the **Node-RED Dashboard** nodes to your Internet of Things Starter Application.
- Click on the Node-RED **Menu (1)** in the upper right corner, then **Manage palette (2)**



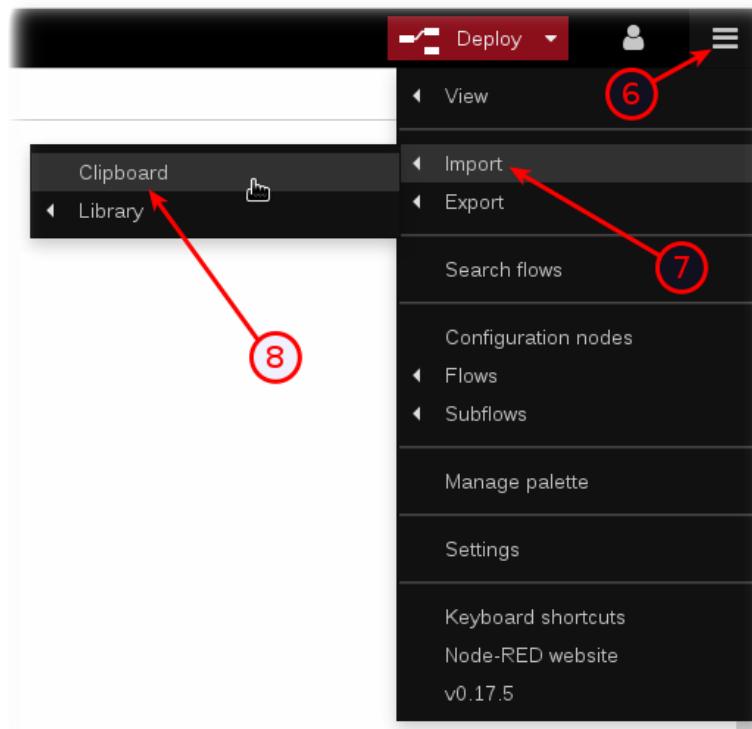
- Turn to the **Install tab (3)**, type *node-red-dashboard* (4) and press the **Install button (5)**.



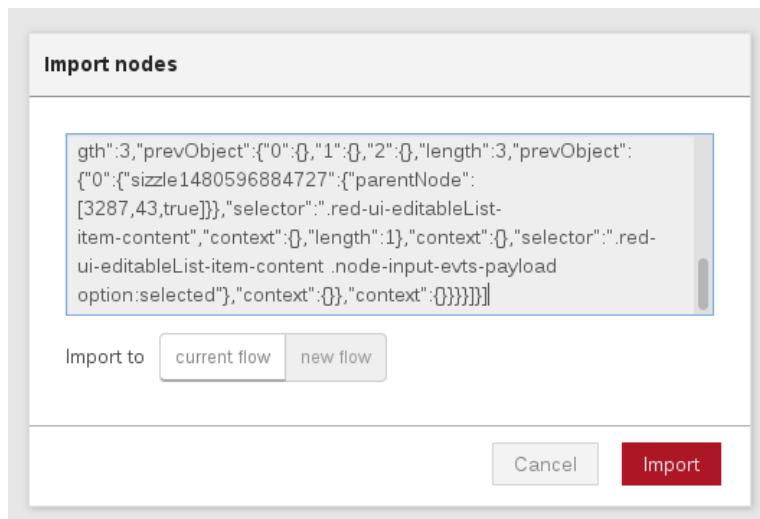
- Press the **Install** button in the next dialog.

Step 5 – Import a prebuilt flow from GitHub

- Since configuring Node-RED nodes and wiring them together requires many steps to document in screenshots, there is an easier way to build a flow by importing a prebuilt flow into your IoT Starter Application.
- Some of the sections below will have a **Get the Code** link.
- When instructed, open the **Get the Code** github URL, mark or Ctrl-A to select all of the text, and copy the text for the flow to your Clipboard.
- Click on the Node-RED Menu (6), then Import (7), then Clipboard (8).



- Paste the text of the flow into the **Import nodes** dialog and press the red **Import** button.



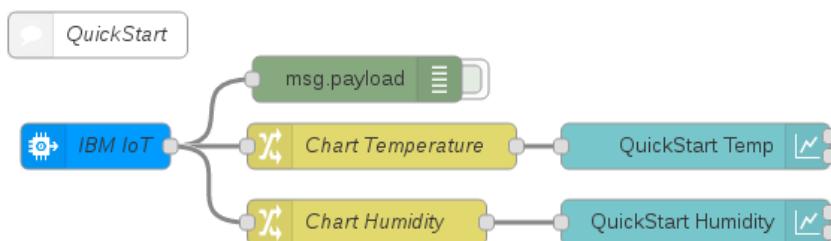
- The new flow will be imported into new tabs in the Node-RED Editor.
- Click the Deploy button on the top of menu bar to deploy the Node-RED flow.

Section 3: Receive IoT Sensor data sent to QuickStart

Step 1 – Receive IoT Sensor data sent to Quickstart

Earlier in the workshop we sent the virtual IoT Sensor data to Watson IoT Quickstart. In this Section we will use the IoT Starter Application we just created to ingest and display the Quickstart data.

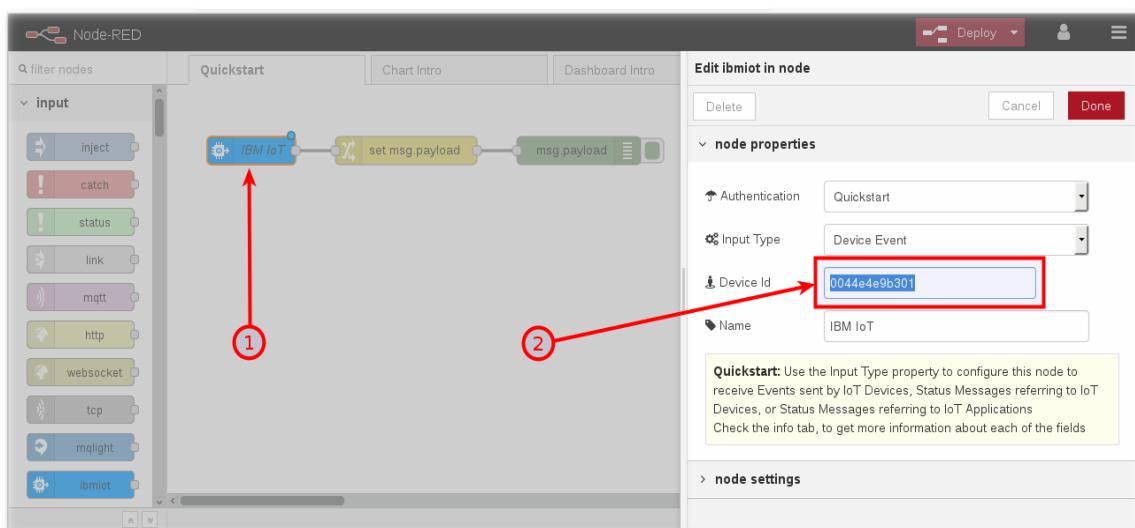
- Open the “**Get the Code**” github URL listed below, mark or Ctrl-A to select all of the text, and copy the text for the flow to your Clipboard. Click on the Node-RED Menu, then Import, then Clipboard. Paste the text of the flow into the Import nodes dialog and press the red Import button.



Get the Code:

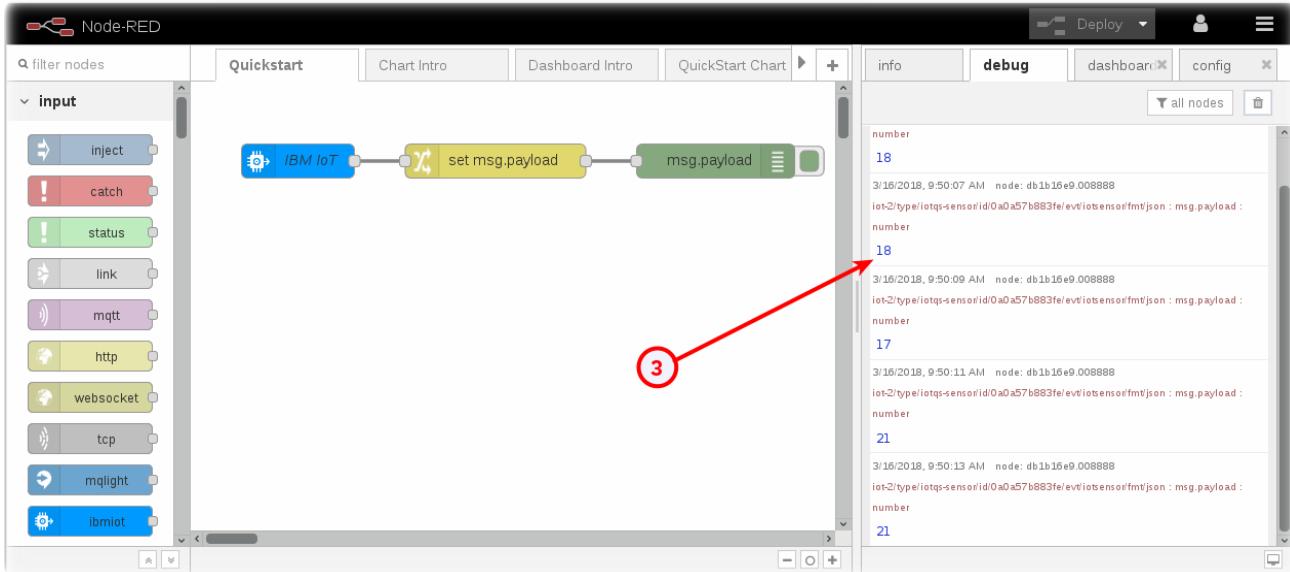
<http://ibm.biz/ThinkLabQuickStart>
[ChartIntro](#)

- Double click on the **IBM IoT in** node (1) and configure the node with your Quickstart **Device Id** (2) You can find the Quickstart Device Id at the top of the <http://ibm.biz/IoTSensor> web page if you do not remember it.
- Click on the **Done** button.



- Click the Deploy button on the top of menu bar to deploy the Node-RED flow.
- Turn to the **debug tab** on the right sidebar of your Node-RED flow.

- You should observe Quickstart Temperature data (3) arriving from the IoT Sensor into your IBM Cloud application.



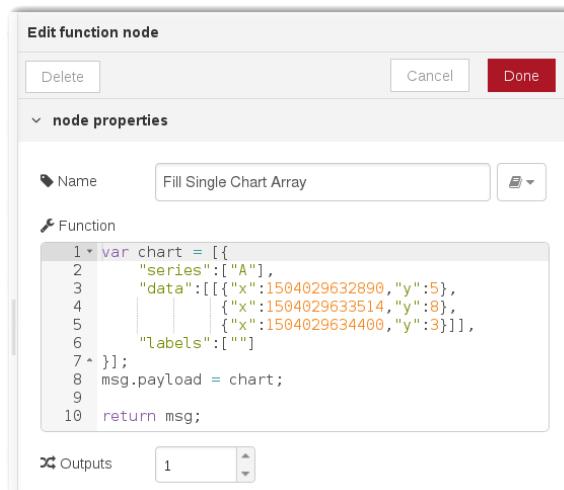
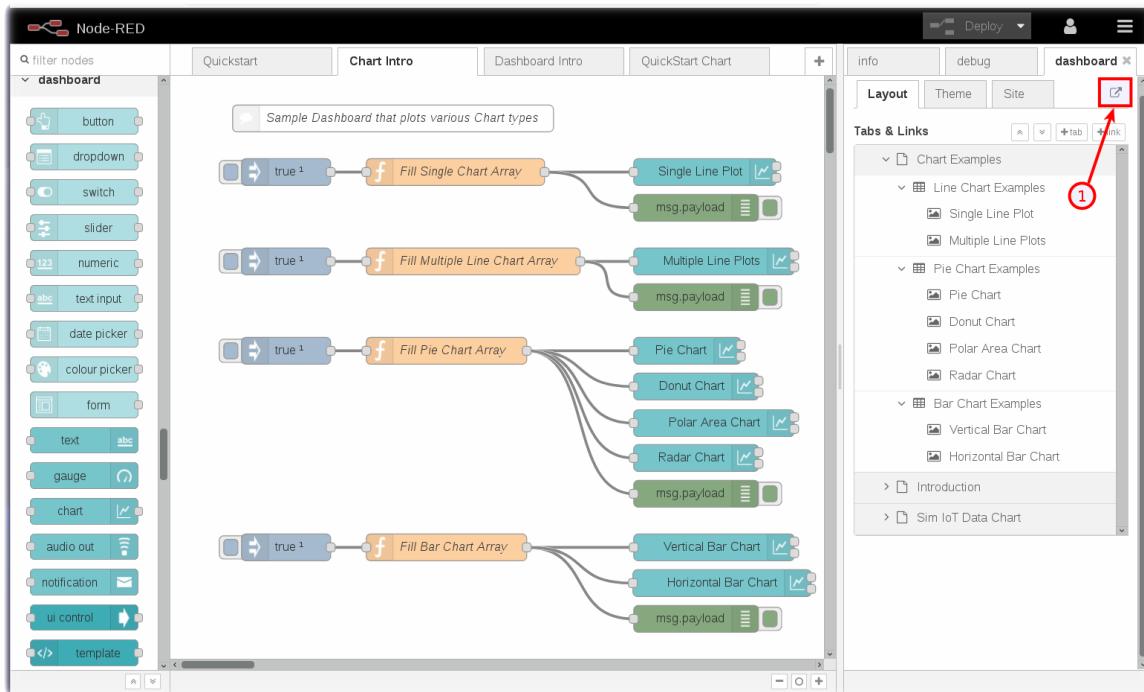
Section 4– Create a Watson IoT Dashboard Chart

In this Section you will learn about Node-RED Dashboard Charts and then create a chart to graph the sensor data arriving from the IoT Sensor device simulator.

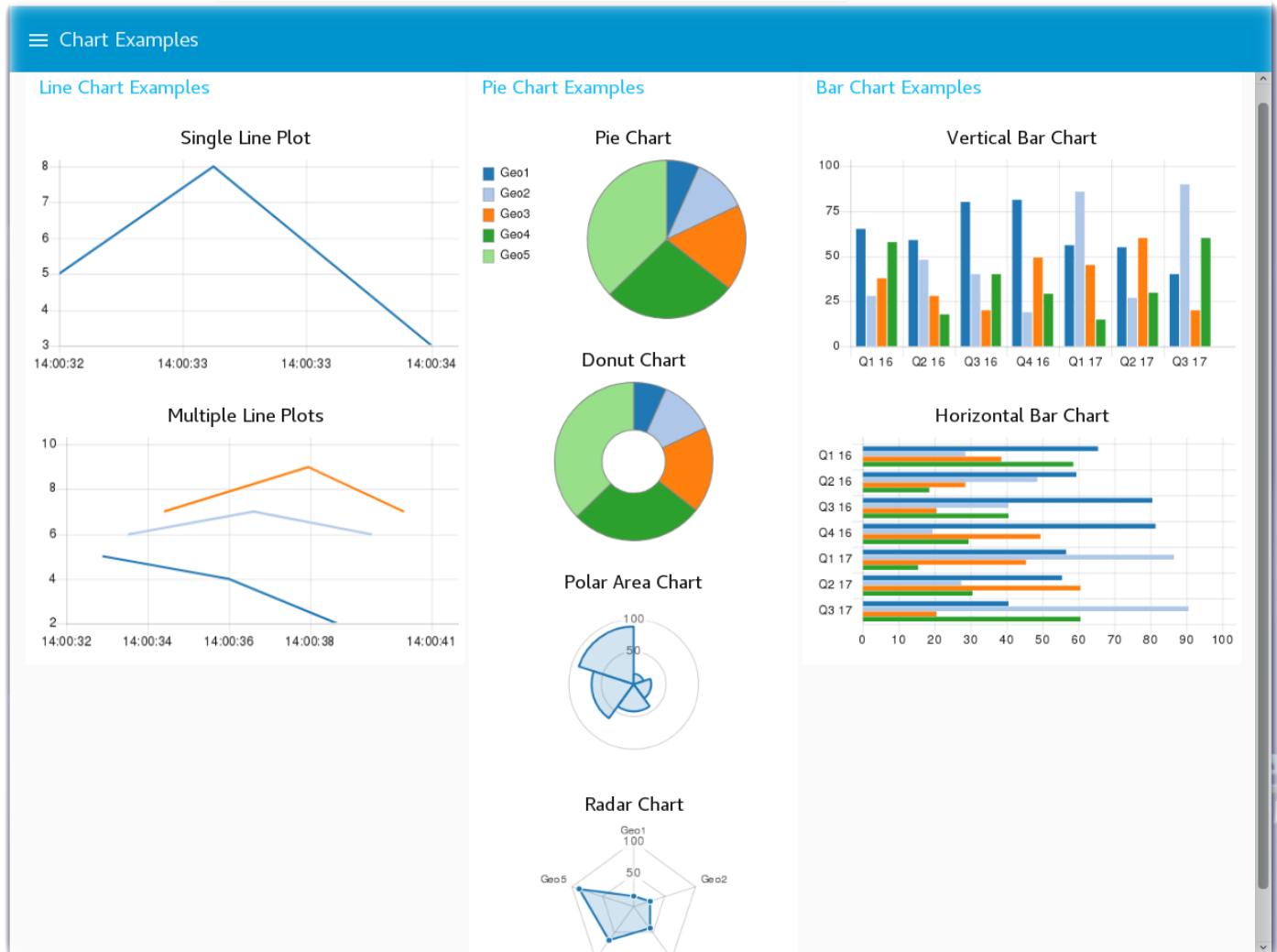
You might have noticed that the flow import in the prior section actually created four tabs. These are called Node-RED flows.

Step 1 – Learn about various Node-RED Dashboard Chart types

- The second tab – **Chart Intro** - introduces you to the various Node-RED Dashboard Chart types that are available. You can create Line charts, various Pie chart styles – Pie, Donut, Polar Area, Radar - and vertical and horizontal Bar charts. For illustration, the function nodes fill arrays of static sample data and send the data to the **Chart** node to visualize.

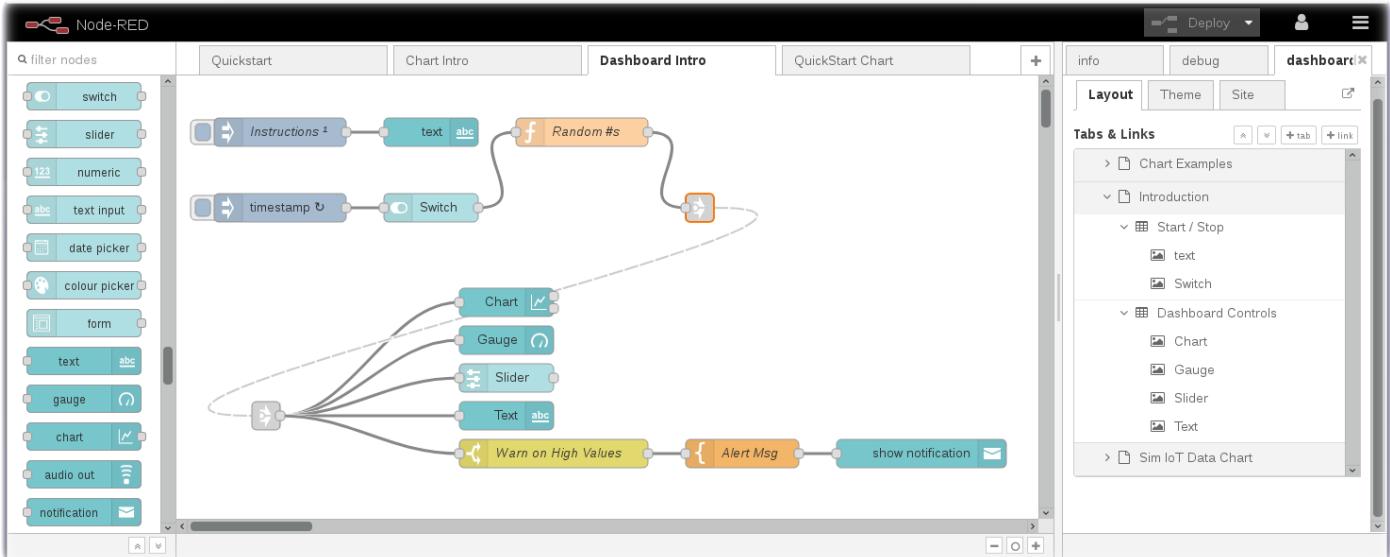


- Node-RED flow is not nearly as interesting as the charts that it renders. To launch the Node-RED Dashboard, in the Node-RED sidebar, turn to the **dashboard** tab and click on the **Launch** button (1).

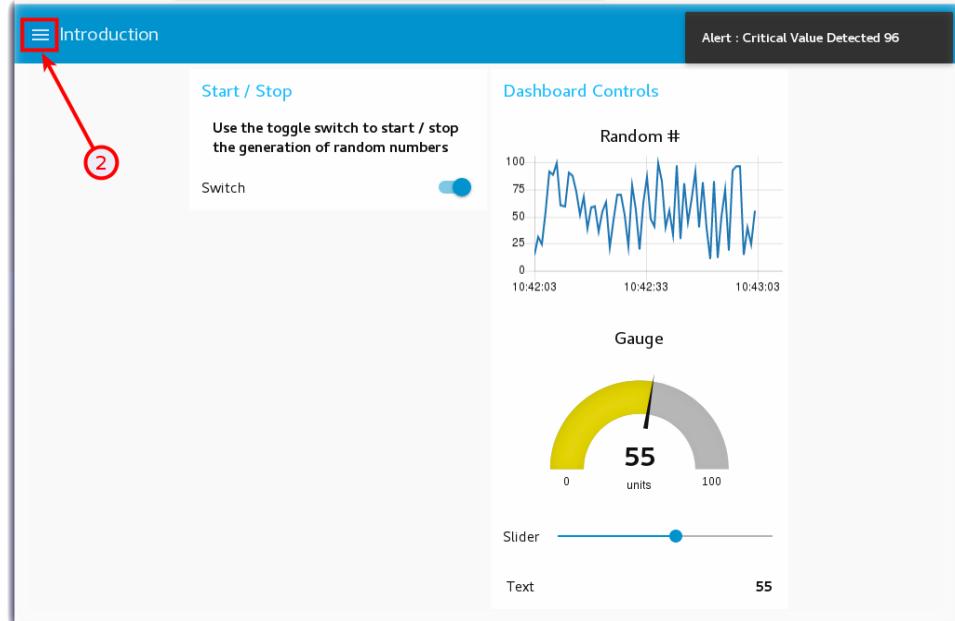


Step 2 – Generating and Displaying data in Node-RED Dashboards

- The third Node-RED flow - **Dashboard Intro** - uses a variety of UI widgets to display data in the Node-RED Dashboard. There is a Switch node that turns On/Off the random number generator. The simple random numbers are sent to a line Chart node, a Gauge node, a Slider node, a Text node and, if the number exceeds a threshold, will display an alert notification message.



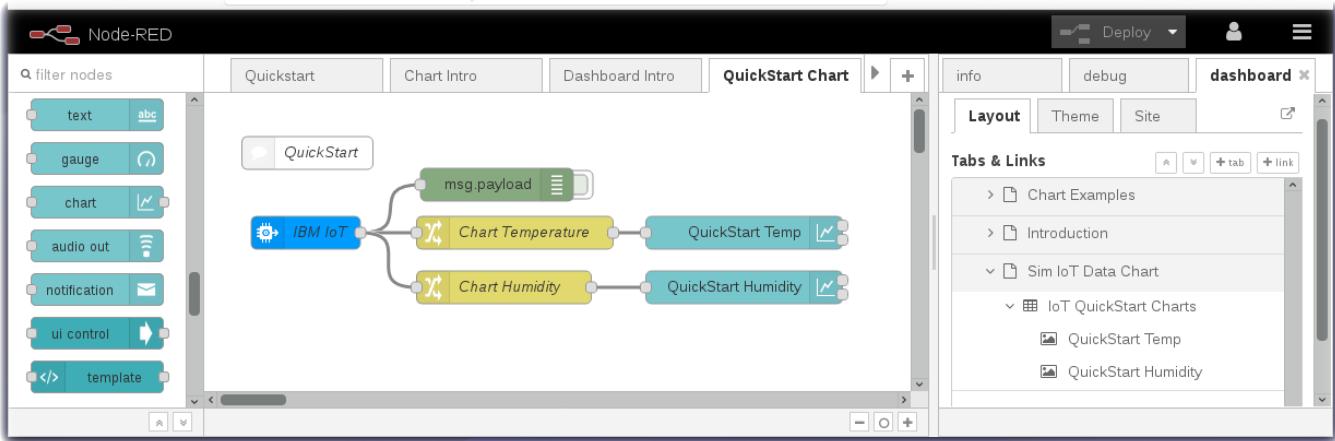
- Turn the dashboard tab (2) to the Introduction tab and turn on the switch.
- Experiment with / observe the Dashboard controls.



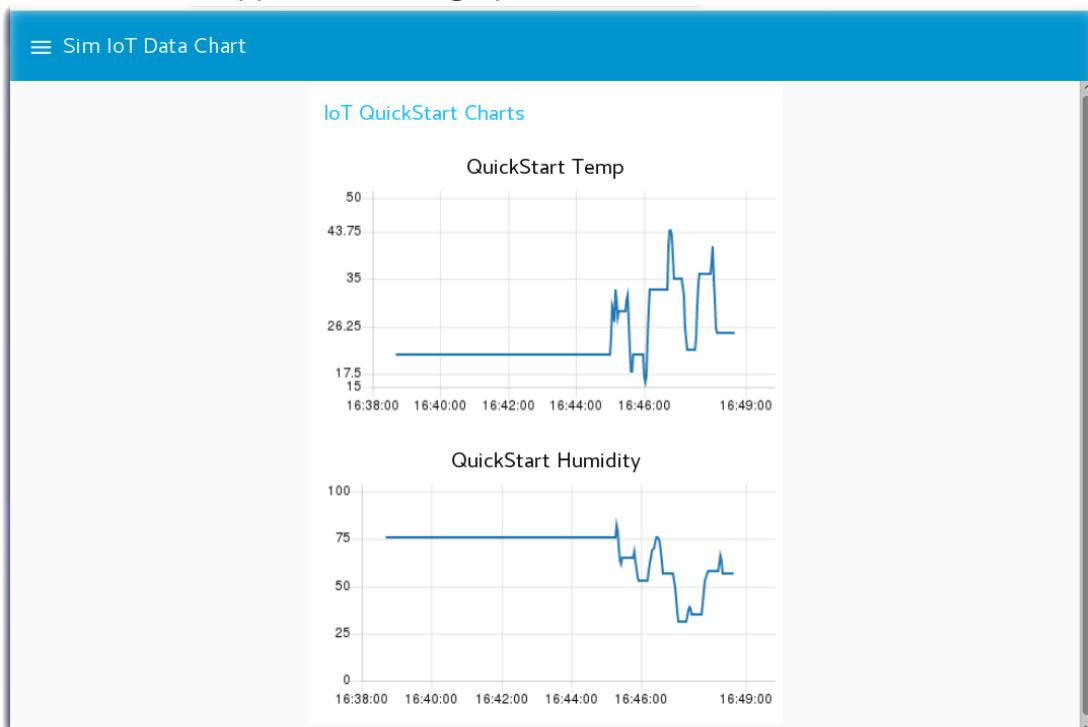
- Now that you have seen how Node-RED Dashboard nodes work and how they can be assembled to construct a reporting dashboard, let's start building dashboards for our IoT sensor data.

Step 3 – QuickStart IoT Sensor Node-RED Dashboard Chart

- The fourth Node-RED flow - **QuickStart Chart** – takes the IoT Sensor temperature and humidity data and sends it to Node-RED Charts.



- Double click on the **IBM IoT in** node and configure the node with your Quickstart **Device Id**. You can find the Quickstart Device Id at the top of the <http://ibm.biz/IoTSensor> web page if you do not remember it.
- Click on the **Done** button.
- Click the Deploy button on the top of menu bar to deploy the Node-RED flow.
- Turn to the **Node-RED Dashboard** browser tab and switch to the **Sim IoT Data Chart** tab.
- Find your Quickstart IoT Sensor browser tab and increase / decrease the temp / humidity.
- You should observe Quickstart Temperature and Humidity data arriving from the IoT Sensor into your IBM Cloud application and graphed on the Node-RED Dashboard chart.



Section 5: Watson IoT Platform Simulated Devices

In this Section, we will launch the Watson IoT Platform and create simulated devices.

Step 1 – Open the Watson IoT Platform service page

- From IBM Cloud, return to the Internet of Things Starter application that you created in Section 2.

The screenshot shows the IBM Cloud dashboard with the app 'think2018a-walicki' selected. On the left, there's a sidebar with 'Overview' highlighted. The main panel displays runtime details: Buildpack (Internet of Things Platform Starter), Instances (1), MB Memory per Instance (256), and Total MB Allocation (256). Below this, the 'Connections' section is shown, with a red box and arrow pointing to the 'iotf-service' entry. The 'Runtime cost' section shows \$0.00 for both actual and estimated costs.

- Click on the iotf service Connection (1).
- Your browser will open to the Watson IoT Platform service page. Click on the **Launch** button.

The screenshot shows the Watson IoT Platform service page for the app 'think2018a-walicki-iotf-service'. The top bar includes 'Catalog', 'Docs', 'Support', 'Manage', and a user icon. The main area features a large IoT device icon. Below it, a call-to-action button says 'Let's get started with Watson IoT Platform'. At the bottom, a sub-description reads 'Securely connect, control, and manage devices. Quickly build IoT applications that analyze data from the physical world.' There are 'Launch' and 'Docs' buttons at the very bottom.

- From the left navigation menu, Click on the **Settings** menu (2).

The screenshot shows the IBM Watson IoT Platform dashboard. On the left, there is a vertical navigation menu with the following items: BOARDS, DEVICES, MEMBERS, APPS, ACCESS MANAGEMENT, USAGE, RULES, SECURITY, SETTINGS, and EXTENSIONS. The 'SETTINGS' item is highlighted with a red box and has a red circle with the number 2 above it. In the center, there is a 'USAGE OVERVIEW' card showing '3 Cards' owned by you. A large dashed box with a plus sign is overlaid on the right side of the dashboard.

- Click on the **Experimental Features** (3) setting.

The screenshot shows the 'Experimental Features' page. On the left, there is a sidebar with sections for PLATFORM (About, Identity, **Experimental Features**), DATA AND DEVICES (Custom Device, Management Packages), and SECURITY (Connection Security, CA Certificates, Messaging Server Certificates). The 'Experimental Features' item is highlighted with a red box and circled with a red number 3. In the main content area, there is a heading 'Experimental Features' with a sub-section 'Activate Experimental Features' and a toggle switch. Below this, there is a list of 'Current Features' including Watson IoT Edge (Preview), *The Weather Company* visualization, Custom Cards, Advanced Security: Policies drill down reporting, Redesigned API keys, roles, and application bindings pages, and Advanced Security: New Dashboard cards for overall policy compliance and violations. The 'Activate Device Simulator' toggle is highlighted with a red box and circled with a red number 4. At the bottom, there is a floating tab '0 Simulations running' highlighted with a red box and circled with a red number 5.

- Click on the **Activate Device Simulator** (4) toggle.
- Click on the **0 Simulations running** (5) floating bottom tab that appears.

- Simulating devices and data in the Platform allows you to use the Platform as if you had Devices actually sending data. There is the option of simulating entire devices, or just simulating data for a device already registered in the Platform.
- Click on **Create New Device Type** (6) button.

IBM Watson IoT Platform

QUICKSTART SERVICE STATUS DOCUMENTATION BLOG

instructor0600@ibm... ID: (27nwqf)

PLATFORM

- About
- Identity
- Experimental Features**
- Last Event Cache

DATA AND DEVICES

- Custom Device
- Management Packages

SECURITY

- Connection Security
- CA Certificates
- Messaging Server Certificates

Experimental Features

Experimental features let you test the latest and before they are available for general consumption unexpected behavior.

Activate Experimental Features

Current Features

- Watson IoT Edge (Preview)
- The Weather Company* visualization
- Custom Cards
- Advanced Security: Policies drill down reporting
- Redesigned API keys, roles, and applications
- Advanced Security: New Dashboard cards

Activate Device Simulator

Last Event Cache

The last event cache (LEC) stores information about more information, see the last event cache documentation.

Activate Last Event Cache

Simulations

To simulate a device you first need to register a Device Type

- Enter **simDeviceType** (7) as the Name and press the **Next** (8) button.

IBM Watson IoT Platform

QUICKSTART SERVICE STATUS DOCUMENTATION BLOG

instructor0600@ibm... ID: (27nwqf)

Browse Action **Device Types**

Add Type Identity Device Information

Select Type

Type Device Or Gateway

Name 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.

Description

Cancel

0 Simulations running

- On the next panels, click on **Done** and then **Cancel** (to avoid registering devices)

- Click on the **0 Simulations Running** bottom tab again.
- Click on **Add First Simulation** and then Pick **simDeviceType** from the drop down menu.

Simulating devices and data in the Platform allows you to use the Platform as if you had Devices actually sending data. There is the option of simulating entire devices, or just simulating data for a device already registered in the Platform.

+ Add First Simulation

Pick Device Type

simDeviceType

- Select and delete the default text in the **Payload** edit dialog. Replace it with the following:

Device Type: simDeviceType

Events 1 + Event Type

Event Type Name event_1 Send

Schedule

Payload

```
{
  "randomNumber": random(0, 100),
  "sampledObject": {
    "xcord": 32.514,
    "ycord": 151.521
  }
}
```

Cancel Save

Device Type: simDeviceType

Events 1 + Event Type

Event Type Name event_1 Send

Schedule

Payload

```
{
  "d": {
    "temp": random(0, 100),
    "humidity": random(50, 100)
  }
}
```

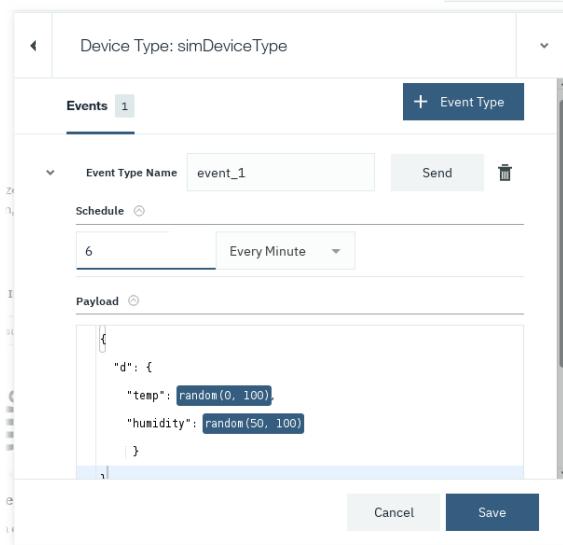
What functions can I do? You can edit the values sent from this Device ID

Cancel Save

```
{
  "d": {
    "temp": random(0, 100),
    "humidity": random(50, 100)
  }
}
```

- You can edit the values sent from this Device ID. Similar to the Quickstart IoT Sensor simulator, these simulated registered devices send sensor data for temperature and humidity. For consistency with Quickstart, the definitions use d.temp and d.humidity values.
- Simulator values in a variety of json formats can be defined here. The values can be static or set to generate random values in a range. The value **d.temp** will be a random number in the 0-100 range. The value **d.humidity** will be a random number in the 50-100 range.

- To edit the frequency of the events, click on the **Schedule** editor and change 20 to **6** events every minute.



- Click on the **Save** button.
- Click on the **New Device** button three times to create simDeviceType_1 / simDeviceType_2 / simDeviceType_3.

<p>Simulations Import/Export</p> <p>0/50 Simulations Running + New Type</p> <p>Device Type simDeviceType 1 Event Type </p> <p>No simulations yet for this Device Type</p> <p>1 x New Device Use Registered Device</p> <p>19 events sent 701 bytes sent</p>	<p>Simulations Import/Export</p> <p>3/50 Simulations Running + New Type</p> <p>Device Type simDeviceType 1 Event Type </p> <p>3 Devices</p> <ul style="list-style-type: none"> S simDeviceType_3 S simDeviceType_2 S simDeviceType_1 <p>1 x New Device Use Registered Device</p> <p>19 events sent 701 bytes sent</p>
--	--

- The toggle to activate the 3 simulated devices should already be on.
- These registered simulated devices are now sending **events** to your Watson IoT Platform.

- Turn to the Watson IoT Platform **Devices** tab to see the simDeviceType_* devices.

The screenshot shows the 'Browse' tab selected in the Watson IoT Platform interface. The main area is titled 'Browse Devices'. A table lists three devices:

Device ID	Device Type	Class ID	Date Added
simDeviceType_1	simDeviceType	Device	Mar 17, 2018 11:42 PM
simDeviceType_2	simDeviceType	Device	Mar 17, 2018 11:42 PM
simDeviceType_3	simDeviceType	Device	Mar 17, 2018 11:42 PM

A message at the bottom indicates '3 Simulations running'.

- Click on **simDeviceType_1** to see Event data arriving.

The screenshot shows the details for the selected device 'simDeviceType_1'. The 'Recent Events' tab is active, displaying four simulated events:

Event	Value	Format	Last Received
event_1	{"d":{"temp":78,"humidity":63}}	json	a few seconds ago
event_1	{"d":{"temp":15,"humidity":99}}	json	a few seconds ago
event_1	{"d":{"temp":6,"humidity":55}}	json	a few seconds ago
event_1	{"d":{"temp":47,"humidity":93}}	json	a few seconds ago

A message at the bottom indicates '3 Simulations running'.

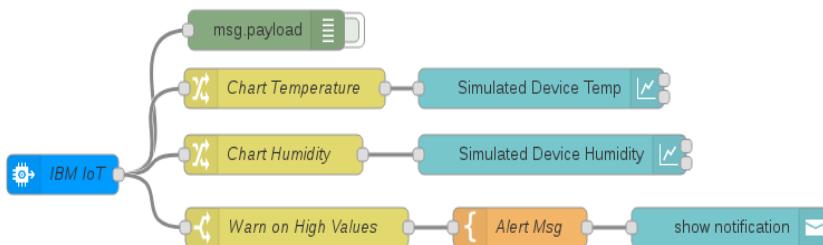
- By using the IBM Watson™ IoT Platform device simulator, you can set up simulated events for devices. You can use the simulated event data to learn about, test, and demonstrate fully functioning Watson IoT Platform features.
- You can use existing device types and devices and the simulator enables you to generate new devices for existing types. You can configure the event details for each device or set a default configuration that is applied to all devices. You can export a simulated event configuration so that it can be reused or shared to set up other simulations.
- For additional information about simulated devices, review the [Experimental Features documentation](#).

Section 6 – Chart / Analyze your Data with Node-RED

In this Section you will use Node-RED to ingest data from the three simulated IoT Sensors just created in the Watson IoT Platform, graph the data in a Chart, analyze the incoming data and take actions based on thresholds defined.

Step 1 – Receive IoT Sensor data sent from Watson IoT Platform

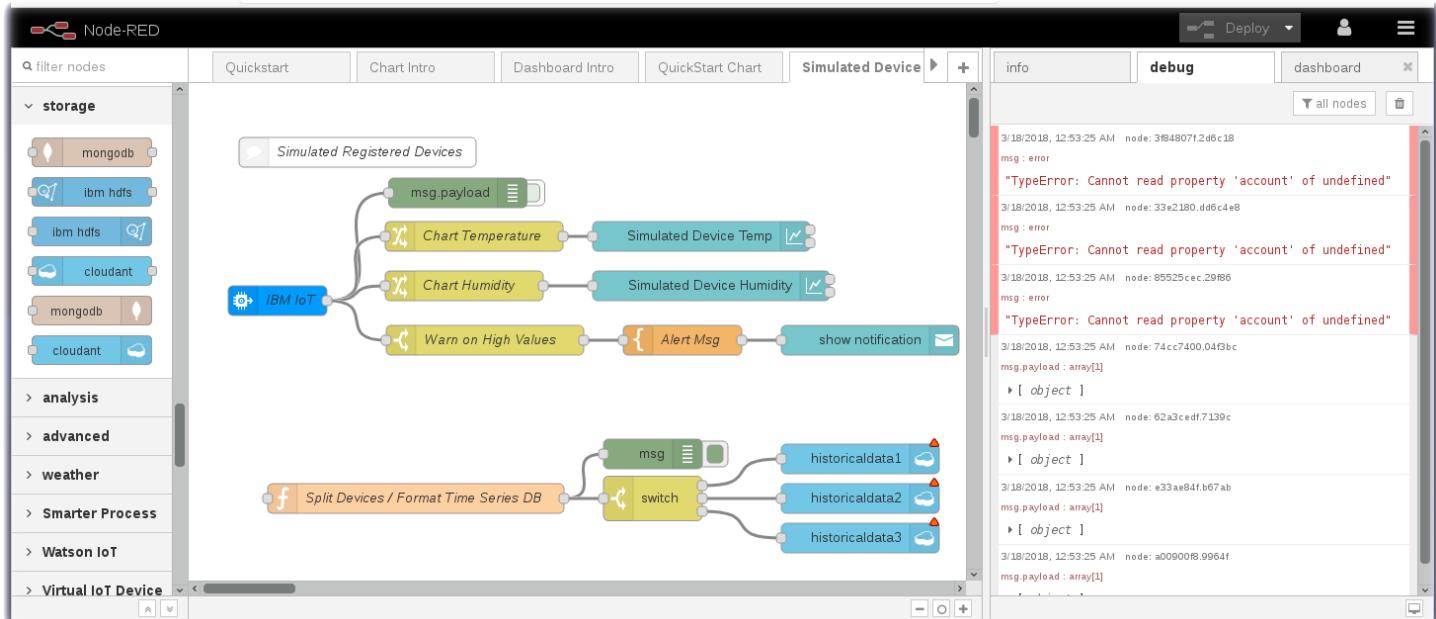
- Open the “**Get the Code**” github URL listed below, mark or Ctrl-A to select all of the text, and copy the text for the flow to your Clipboard. Return to the Node-RED browser tab. Click on the Node-RED Menu, then Import, then Clipboard. Paste the text of the flow into the Import nodes dialog and press the red Import button.



Get the Code:

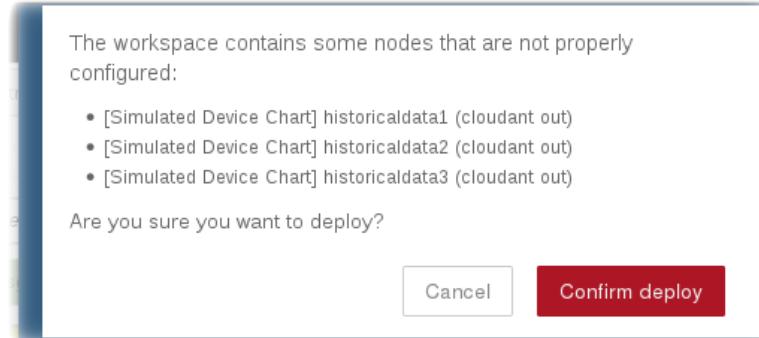
<http://ibm.biz/ThinkLabChartSimDevices>

- An additional Node-RED flow will be added to your Node-RED editor.

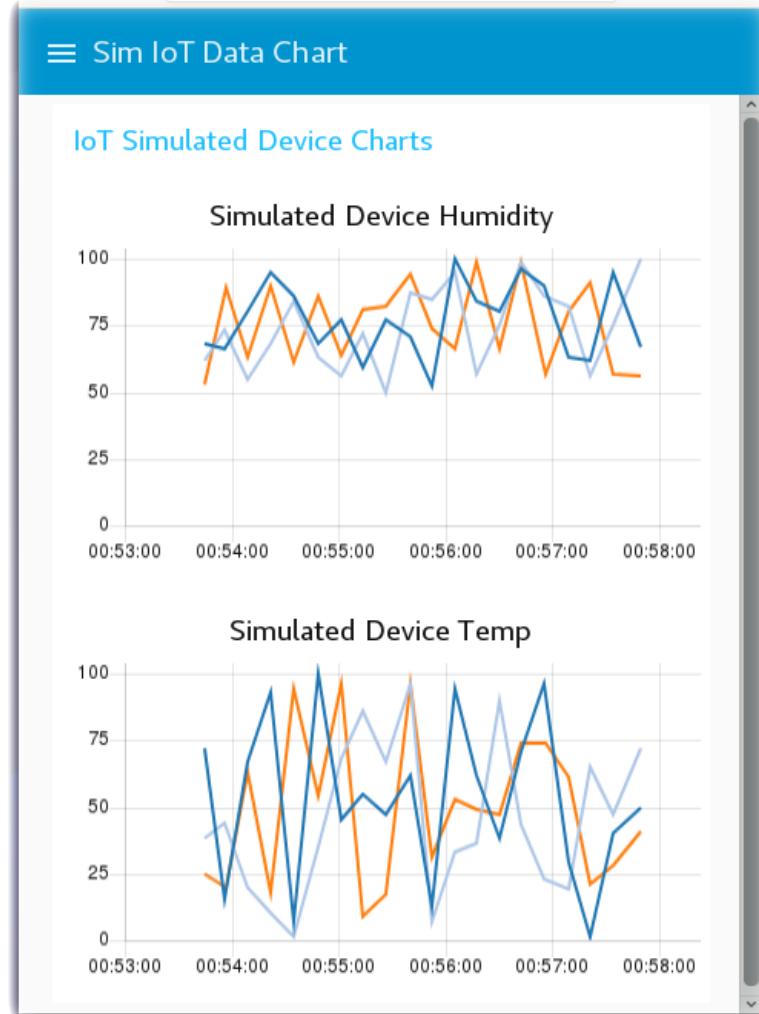


- Click the Deploy button on the top of menu bar to deploy the Node-RED flow.

- There will be an error dialog warning of misconfigured cloudant database nodes. Click on the red **Confirm deploy** button. The cloudant out nodes will be repaired in the next Section.

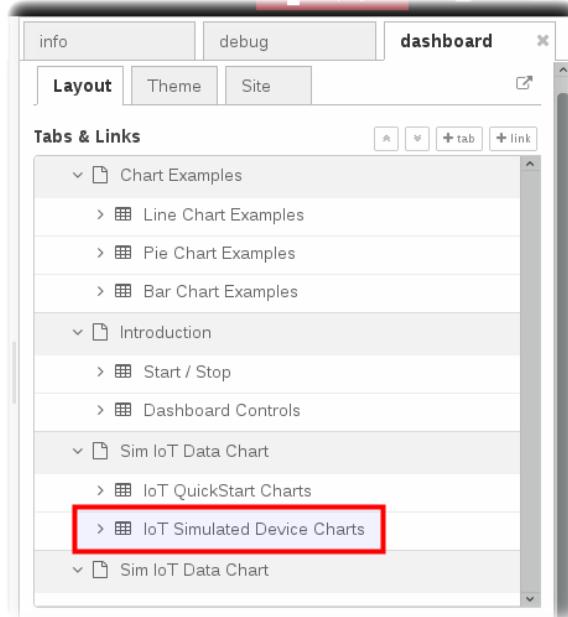


- Return to the Node-RED Dashboard browser tab and turn to the second **Sim IoT Data Chart** tab.
- Data from the three simDeviceType_1, simDeviceType_2, simDeviceType_3 will be displayed.

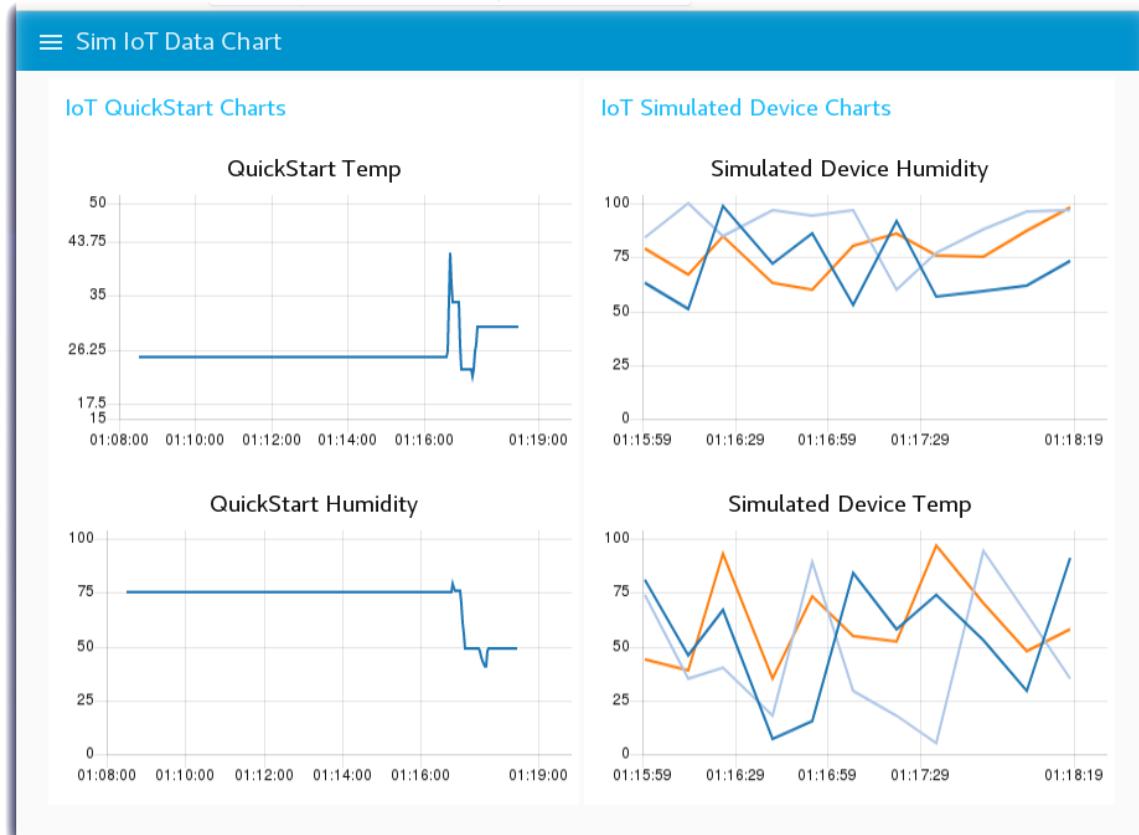


- You will also see notifications when the registered device simulator exceeds the threshold alert value.

- The charts from Quickstart and the Registered devices can be merged by dragging the sidebar groups up into the first Sim IoT Data Chart tab.



- Merged charts on the Node-RED Dashboard browser tab will be displayed in two columns. If you can find the Quickstart IoT Sensor browser tab, manually adjust the Temp and Humidity values.

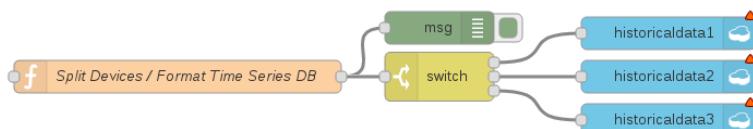


Section 7 – Store IoT Sensor Data with Node-RED

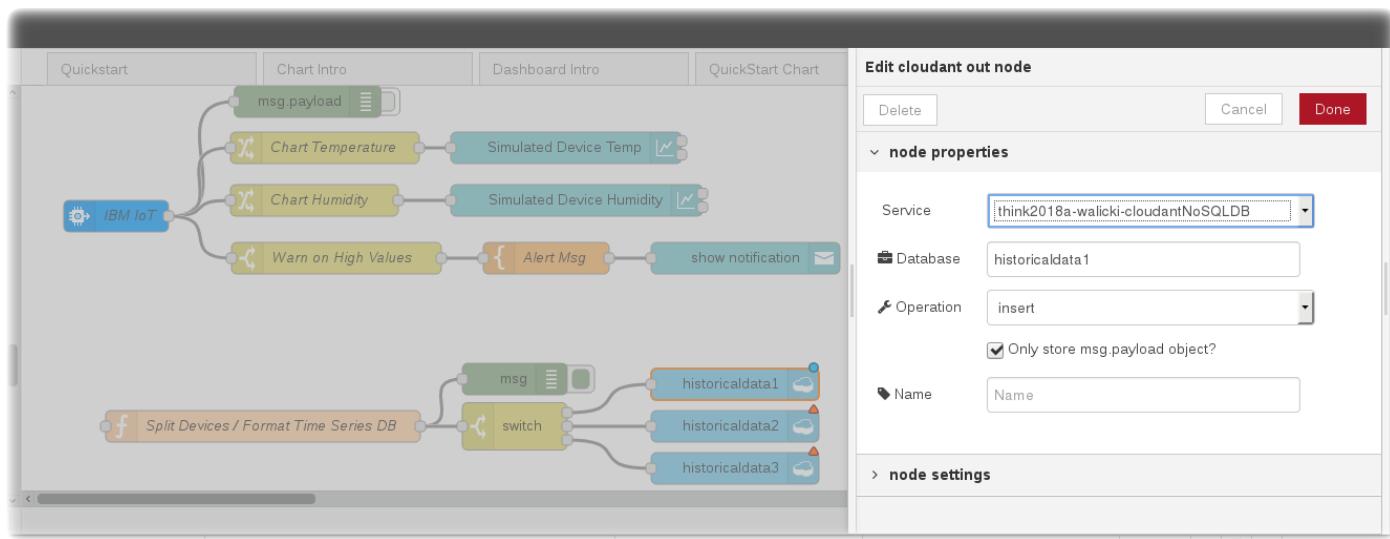
In this Section you will use Node-RED to store IoT Sensor data from the three simulated IoT Sensors in Cloudant databases.

Step 1 – Store IoT Sensor data sent from Watson IoT Platform

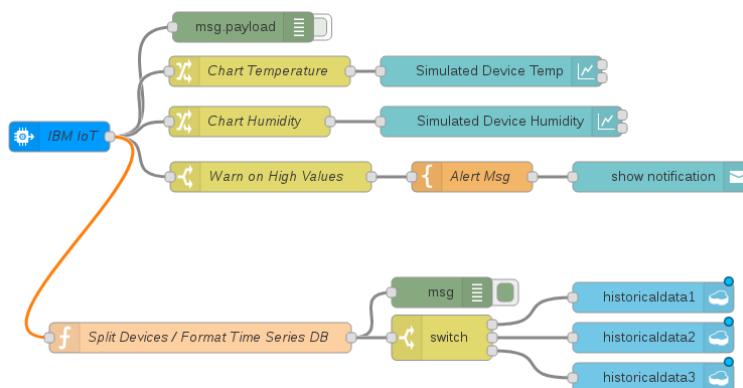
- Recall that there were misconfigured Cloudant nodes – indicated by red triangles



- To associate the historical databases with your IBM Cloud instance, click on each of the historicaldata **Cloudant** nodes and press the red **Done** button. The red error triangles will turn blue.



- After all three Cloudant out nodes have been repaired, drag a wire from the IBM IoT node to the function node.



- Click the Deploy button on the top of menu bar to deploy the Node-RED flow.

- The simulated IoT Sensor device data is now being recorded in Cloudant databases.
- Return to the IBM Cloud dashboard. Click on the **cloudantNoSQLDB (1)** service connection.

IBM Cloud

Cloud Foundry apps / think2018a-walicki

Org: instructor0600@ibmlearning.org Location: US South Space: dev

Runtime

Runtime

BUILDPACK Internet of Things Platform Starter	INSTANCES 1	MB MEMORY PER INSTANCE 256	TOTAL MB ALLOCATION 256
All instances are running Health is 100%		0 MB still available	

Connections (2)

- think2018a-walicki-cloudantNoSQLDB
- think2018a-walicki-iotf-service

Runtime cost

\$0.00	\$0.00
--------	--------

- Click on the **Launch** button.

IBM Cloud

Data & Analytics / think2018a-walicki-cloudantNoSQLDB

Location: US South Org: instructor0600@ibmlearning.org Space: dev

Cloudant NoSQL DB

LAUNCH

Cloudant NoSQL DB is a fully managed data layer designed for modern web and mobile applications that leverages a flexible JSON schema. Cloudant is built upon and compatible with Apache CouchDB and accessible through a secure HTTPS API, which scales as your application grows. Cloudant is ISO27001 and SOC2 Type 1 certified, and all data is stored in triplicate across separate physical nodes in a cluster for HA/DR within a data center.

Fully managed DBaaS

Work with self-describing JSON documents through a RESTful API that makes every document in your Cloudant database accessible as JSON via a URL. Documents can be retrieved, stored, or deleted individually or in bulk and can also have files attached. IBM takes care of the provisioning, management, and scalability of the data store, freeing up your time to focus on your application.

Powerful query, analytics, replication, and sync

Cloudant indexing is flexible and powerful, and includes real-time MapReduce, Apache Lucene-based full-text search, advanced Geospatial, and declarative Cloudant Query. Cloudant makes it easy to conduct advanced analytics on JSON data with dashDB Warehousing and Apache Spark integrations. Replication enables cross-geo deployments and Cloudant Sync provides data access for mobile devices to run connected or off-line.

- The IoT Sensor device data is stored in the Cloudant service.

The screenshot shows the Cloudant Databases interface. On the left is a sidebar with icons for Home, Databases, Views, Replicators, Users, Changes, Design Documents, and Log Out. The main area is titled "Databases" with a "Database name" dropdown and a "Create Database" button. Below is a table titled "Your Databases" with columns: Name, Size, # of Docs, and Actions. The databases listed are:

Name	Size	# of Docs	Actions
historicaldata1	2.9 KB	2	
historicaldata2	2.6 KB	2	
historicaldata3	2.4 KB	2	
nodered	175.9 KB	3	

At the bottom, it says "Showing 1–4 of 4 databases." and has navigation arrows.

- Click on historicaldata1 and then observe the table view of temperature data and timestamps.

The screenshot shows the historicaldata1 document view. The sidebar on the left includes icons for Home, Databases, Views, Replicators, Users, Changes, Design Documents, and Log Out. The main area has a title bar with "historicaldata1" and a "Document ID" dropdown. It features tabs for "All Documents" (selected), "Query", "Permissions", and "Changes". A "Create Document" button is visible. The central part displays a table with columns: "_id", "data", and "time". The data rows are:

_id	data	time
1ce0931396bef54bff...	43	1521352667873
20238cde9619c3618...	21	1521352632133
20238cde9619c3618...	23	1521352643509
3bd4f8817b158e30bf...	38	1521352655718
54504d4d2e554da29...	34	1521352617963
8100db3e20d870ab2...	70	1521352604767
8e2eafc1f574184a4ff...	91	1521345501745

At the bottom, it says "Showing 3 of 4 columns." and "Show all columns."

Section 8: Chart Historical IoT Sensor Device Data

Step 1 – Graph Historical IoT Sensor data stored in a database using Node-RED

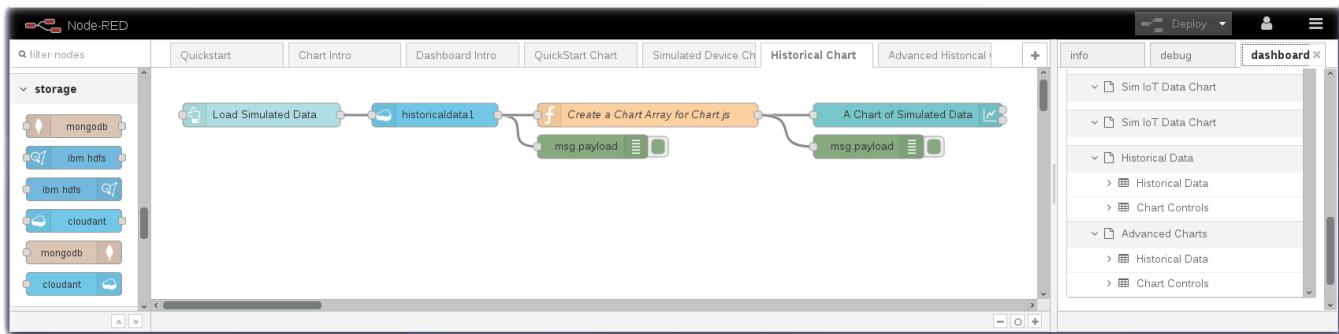
- Open the “**Get the Code**” github URL listed below, mark or Ctrl-A to select all of the text, and copy the text for the flow to your Clipboard. Click on the Node-RED Menu, then Import, then Clipboard. Paste the text of the flow into the Import nodes dialog and press the red Import button.



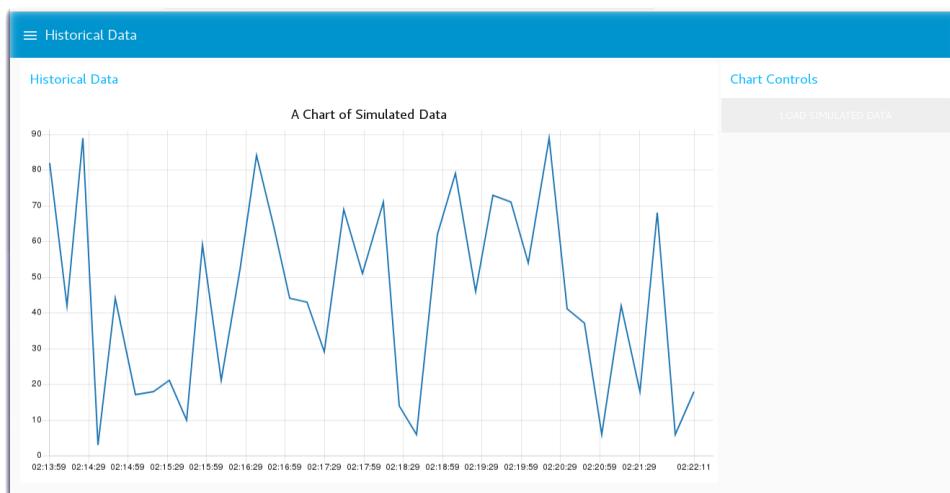
Get the Code:

<http://ibm.biz/ThinkLabHistoricalData>

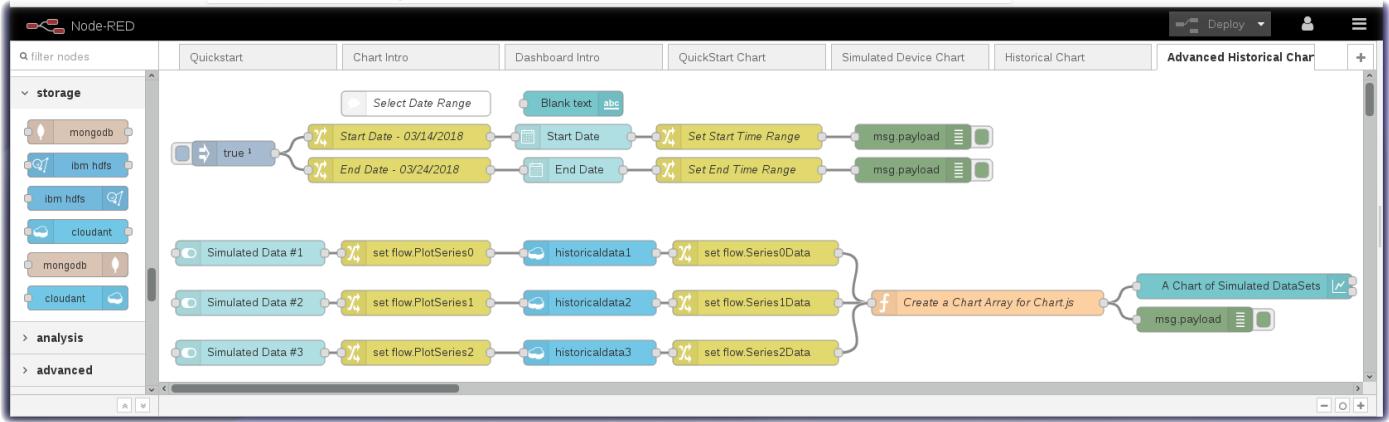
- Click on the **Cloudant** nodes on the Historical Chart and Advanced Historical Charts flows to confirm that they are configured to your IoT Platform Cloudant service instance.
- Click the Deploy button on the top of menu bar to deploy the Node-RED flow.
- The Historical Chart flow reads the IoT Sensor Device data from the Cloudant database and formats it into a Chart array before sending the data to a Node-RED Chart node.



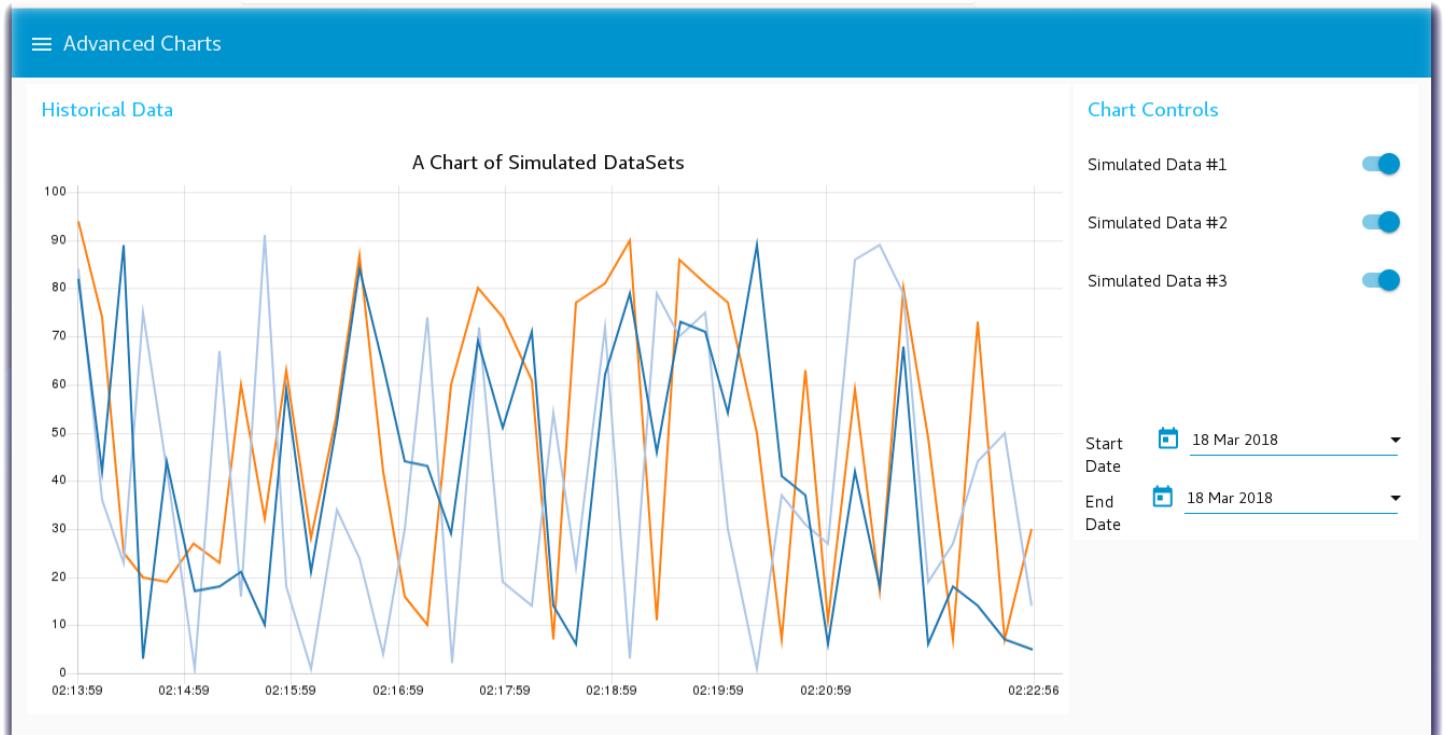
- Turn to the Node-RED Dashboard, turn to the Historical Data tab, click **Load Simulated Data**



- The last Node-RED flow displays all three simulated IoT Sensor Device data in one chart.



- Turn to the Node-RED Dashboard, turn to the **Advanced Charts** tab, click on the Chart Control switches to display the **Simulated Data**.



References

In this final section, we will challenge the workshop attendee to implement other projects using Watson IoT Platform, and Node-RED.

There are many Code Patterns available at:

[**https://developer.ibm.com/code/technologies/iot/**](https://developer.ibm.com/code/technologies/iot/)

Additional learning materials are available in Coursera:

[**https://www.coursera.org/learn/developer-iot**](https://www.coursera.org/learn/developer-iot)

[**https://www.coursera.org/learn/developer-nodered**](https://www.coursera.org/learn/developer-nodered)

[**https://www.coursera.org/learn/exploring-visualizing-iot-data**](https://www.coursera.org/learn/exploring-visualizing-iot-data)