

# Internet of Things

## Beginners Lab using a device simulator

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Content for this lab can be found at <http://ibm.biz/iotLabs>

# Getting Started with Watson IoT Platform

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This workshop details a Developer Experience creating a Bluemix Watson IoT application. You will create an IoT application that analyses simulated sensor data using Quickstart and Node-RED. Data will also be analysed using the Watson IoT Rules Engine. Sensor data will be visualized using Watson IoT Dashboard and Cards.

In this workshop, we will connect a simulated IoT Sensor device to the IBM Bluemix 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 analyse if the temperature is above the threshold and send SMS alerts.

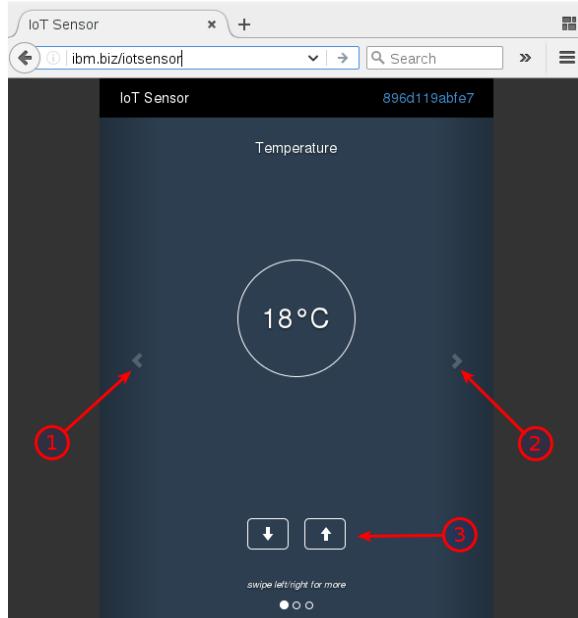
# Section 1 – Create an IoT Sensor Simulator

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

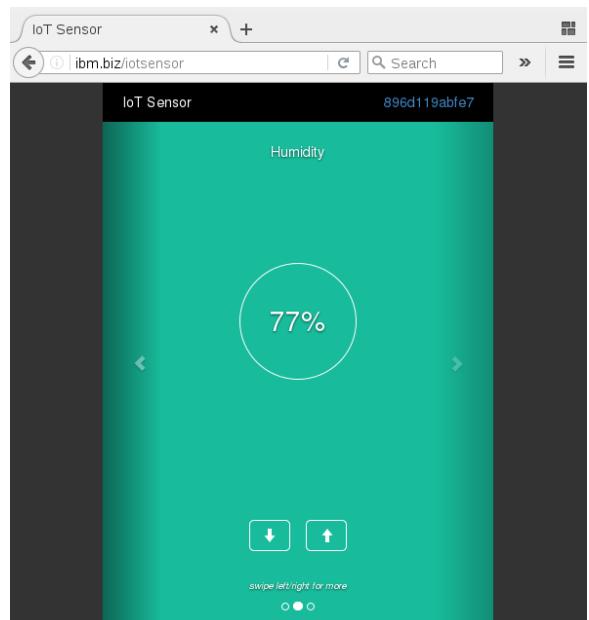
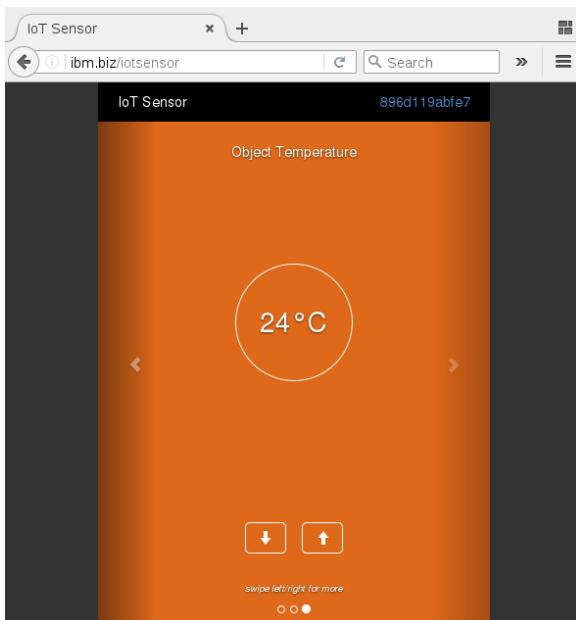
## Step 1 – On your laptop, open a Firefox or Chrome browser window

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>



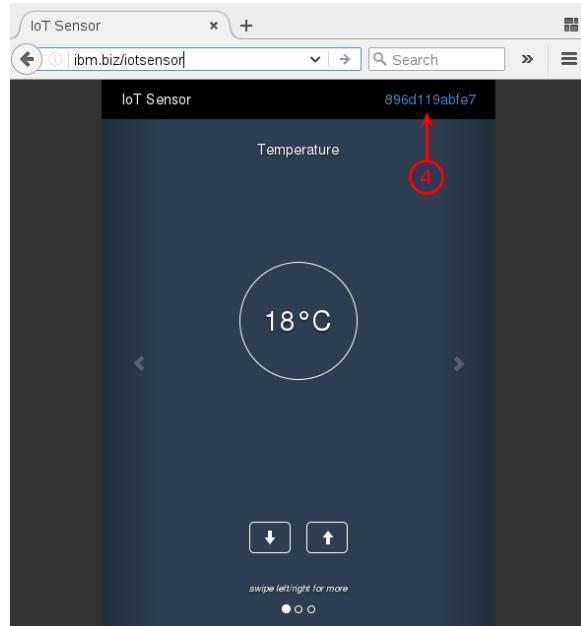
- Swipe left (1) or right (2) to view additional Object Temperature or Humidity simulated sensors.
- Use the Arrow buttons (3) to increase / decrease the simulated sensor value.



## 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).

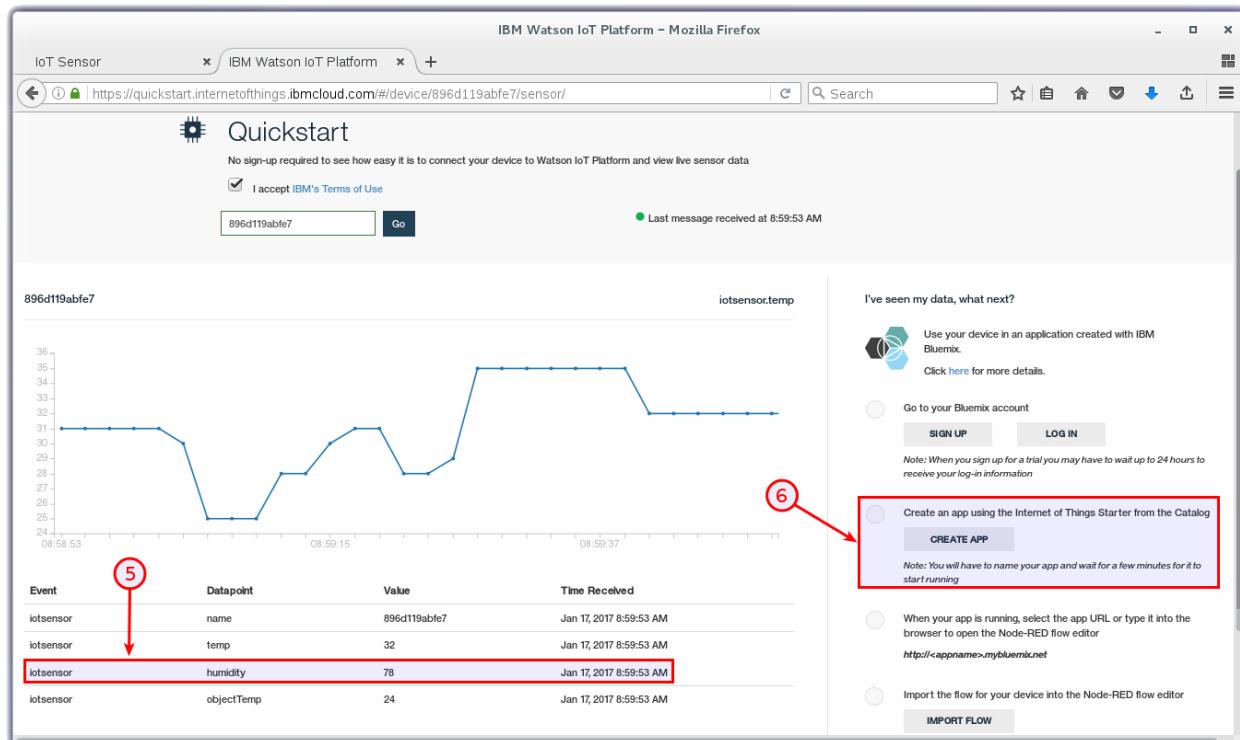
**Note the unique Device ID.** This Device ID will be used in Section 2.



- A new browser tab will open to

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

- 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 Data points (5) in the table below the graph. You can click on any of the three data points 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 Bluemix with your Bluemix 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

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### Step 1 – Create an IoT Starter Application

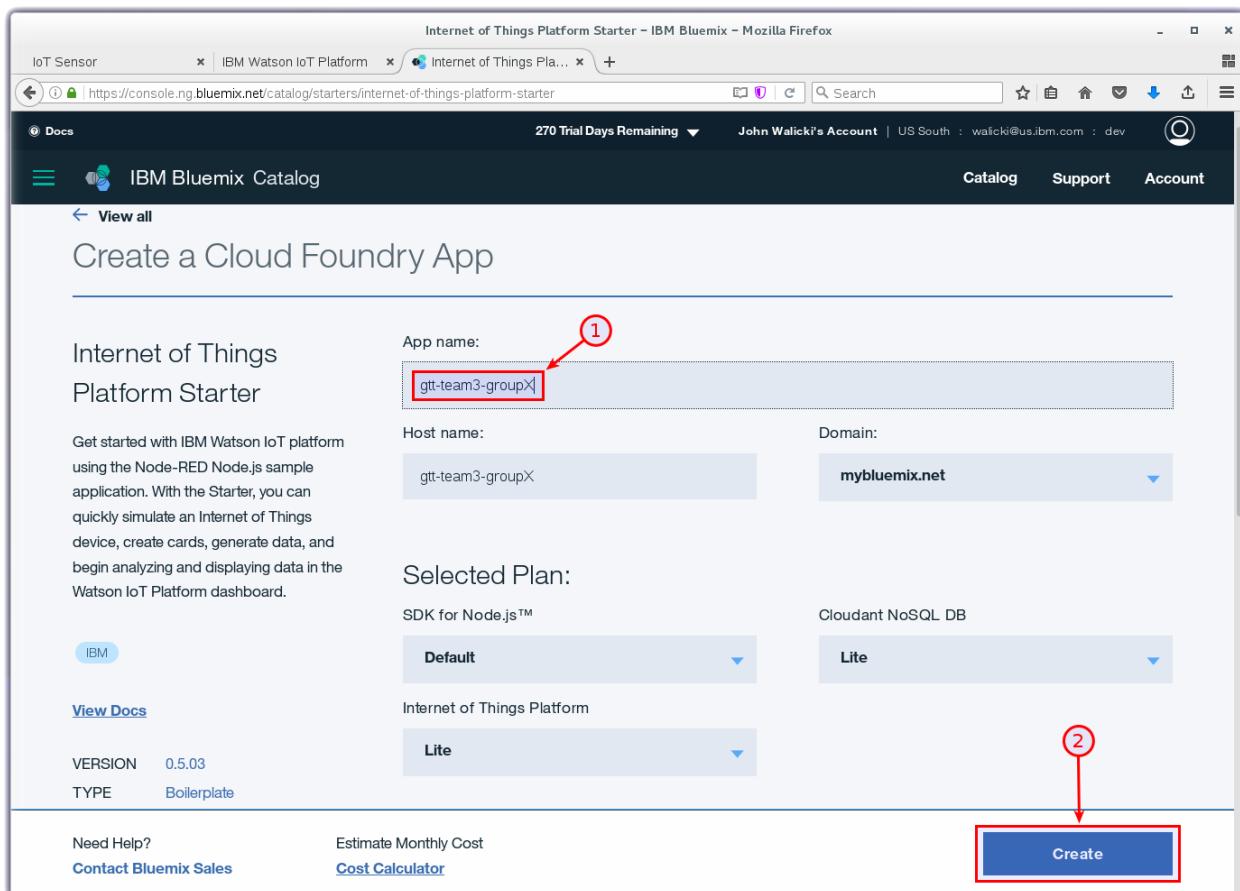
Now that we have sent the simulated IoT Sensor data readings to Watson IoT Quickstart, in this Section we will create an IoT Starter Application to ingest and analyse the Quickstart data.

- The **Internet of Things Platform Starter** boilerplate 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 (1). If you choose ***myapp***, your application will be located at:
  - UK Region - <http://myapp.eu-gb.mybluemix.net>
  - Germany Region - <http://myapp.eu-de.mybluemix.net>
  - US South Region - <http://myapp.mybluemix.net>

There can only be one “***myapp***” application and URL registered in the IBM Bluemix region.

- Give the application a unique name (1)

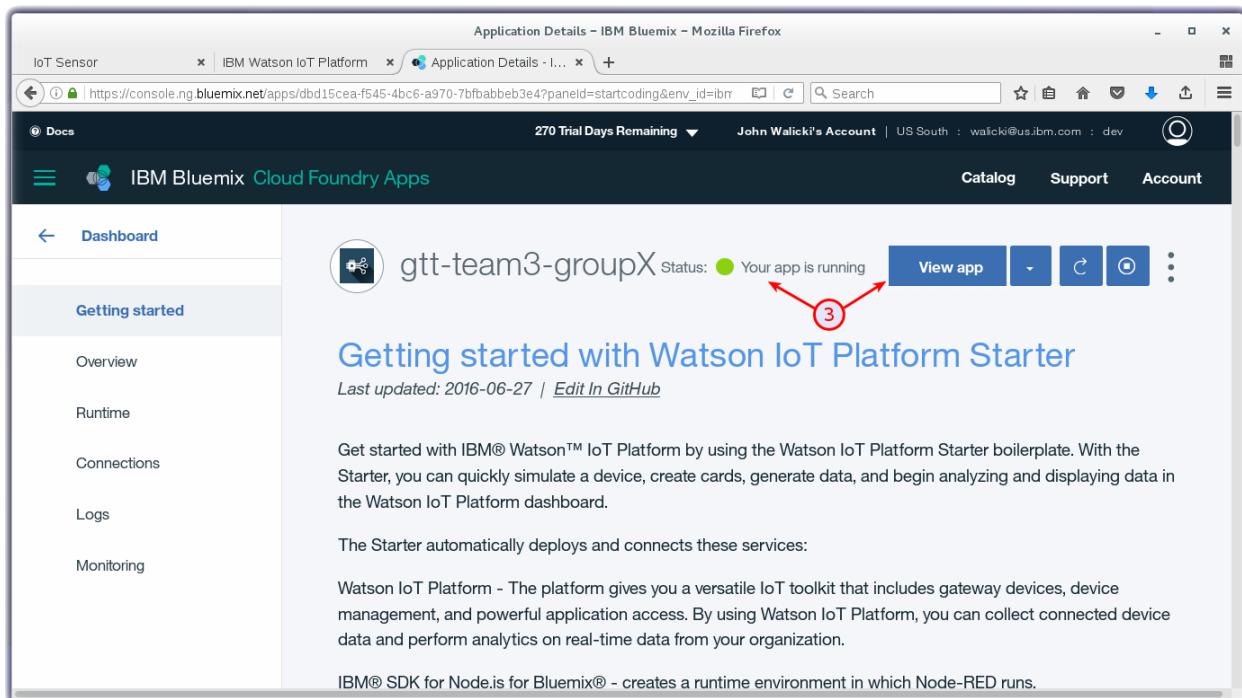
- Press the Create button (2).



- IBM Bluemix 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 “Your app is running” appears, Click the **View app** View App button (3).



## 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. Click the red button **Go to your Node-RED flow editor** (4) to launch the editor.
- The very first time you launch the application you will be asked to enter user details to protect the online Node-RED editor. Enter the details and remember the details, as these will be needed every time you launch the editor and want to make changes to the Node-RED application

Secure your Node-RED editor

Secure your editor so only authorised users can access it

Username: brian

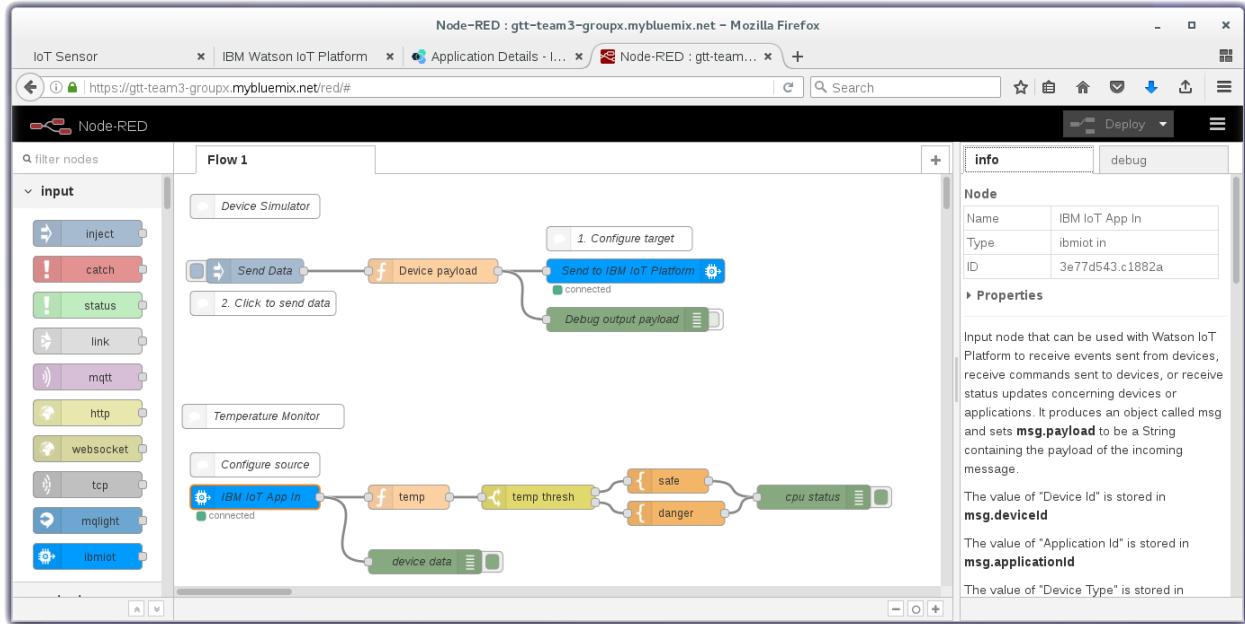
Password: \*\*\*\*\* strong

Allow anyone to view the editor, but not make any changes

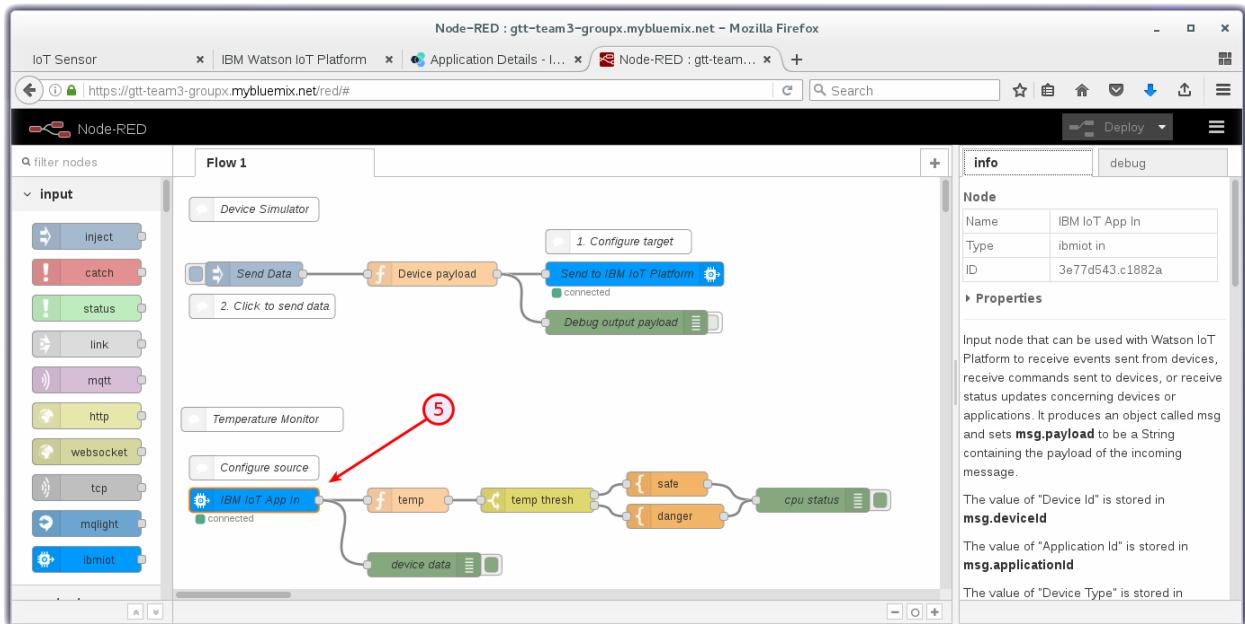
Not recommended: Allow anyone to access the editor and make changes

Previous Next

- Once you have entered the credentials 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.



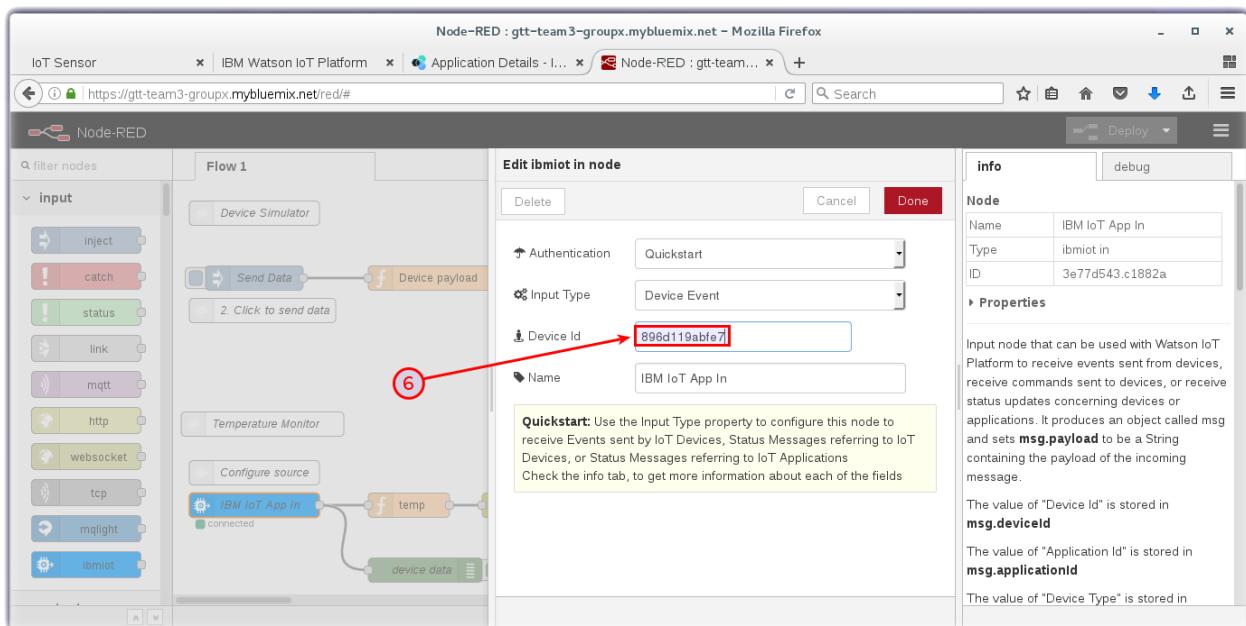
- The top half of the sample IoT Starter flow is not applicable to this workshop.
- The bottom half of the sample will be modified to send email alerts.
- Double Click on the IBM IoT App In (5) node.



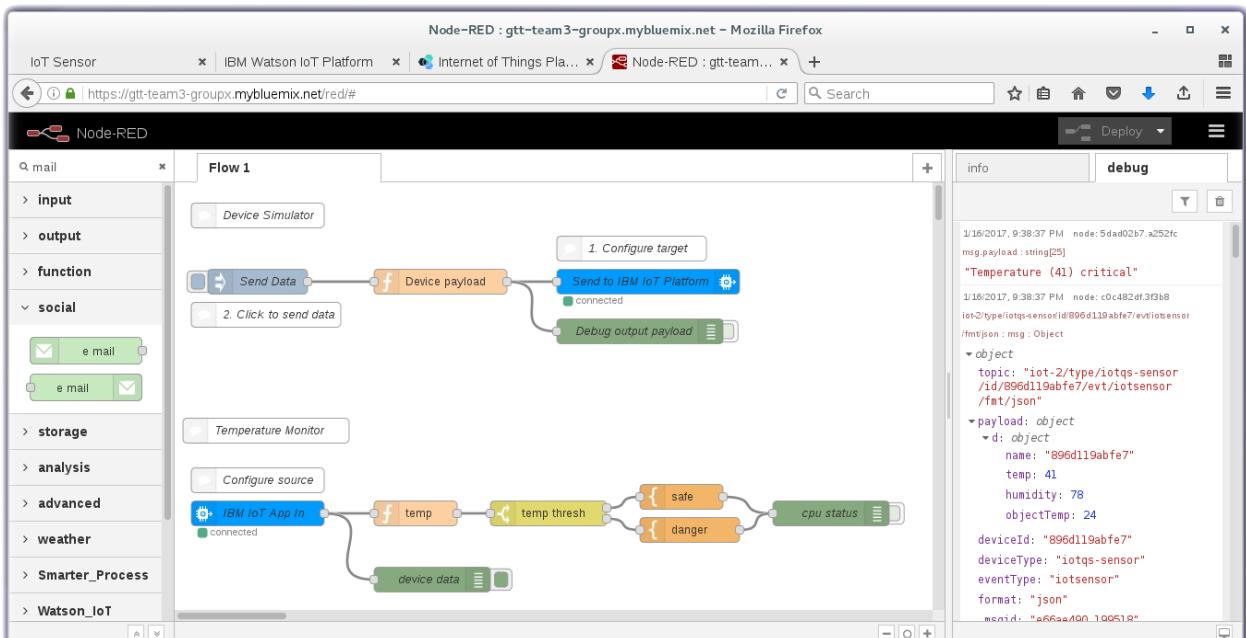
Observations:

## Step 4 – Connect the IBM IoT Node to your IoT Sensor device simulator

- An ibmiot in node configuration panel will open. Paste the Simulator Device ID from Section 1 Step 2 into the “Device ID” field (6) and click on the Done button. You can Copy and Paste the Device Id between browser tabs.



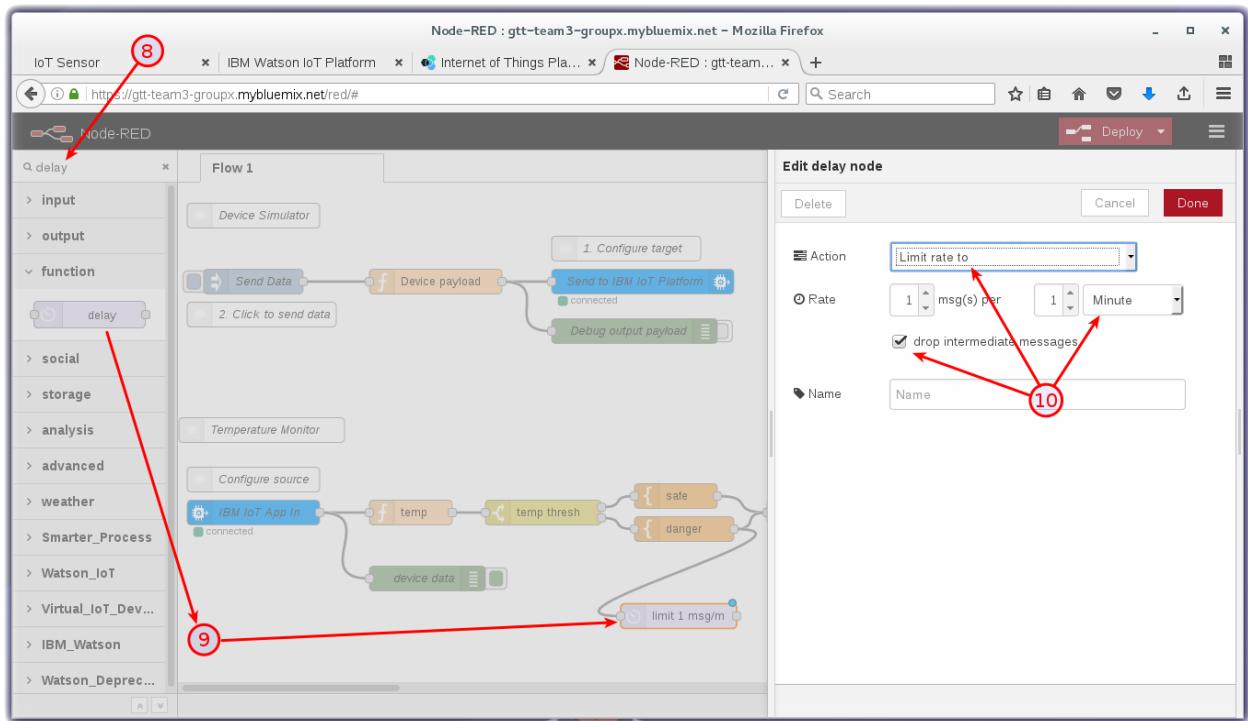
- Click the Deploy button on the top of menu bar to deploy the Node-RED flow.
- Turn to the “debug” tab to see the sensor data flowing through your Node-RED application.
- Switch to the IoT Sensor browser tab and increase / decrease the simulated values.
- Increase the temperature above 41
- If you see a debug alert “Temperature (41) critical”
- Expand the twisties in the JSON object to see the payload values.



## Step 5 – Wire additional nodes into the flow

- Since we don't want to send a Critical Temperature email alert every second, Node-RED has a rate limit node.
- Search for delay node (8).
- Drag the delay node from the palette to the flow and wire it to the “danger” template node (9).

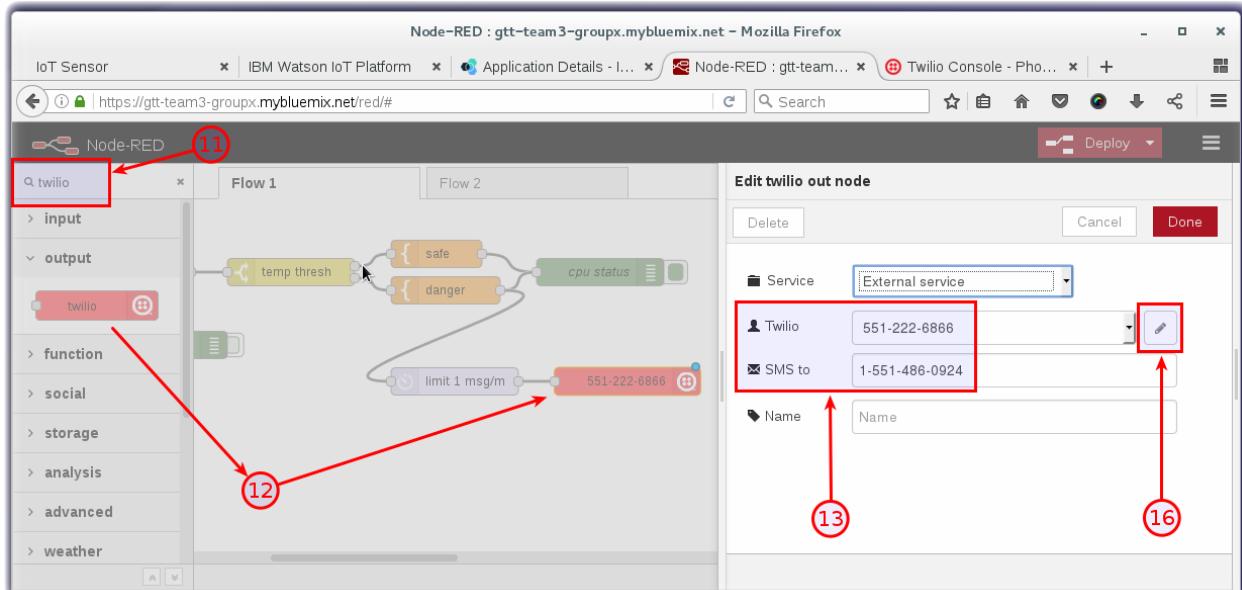
- Double click on the delay node and configure the node to **Limit the rate to 1 message per Minute** and to **drop intermediate messages** (10).
- Press the Done button.



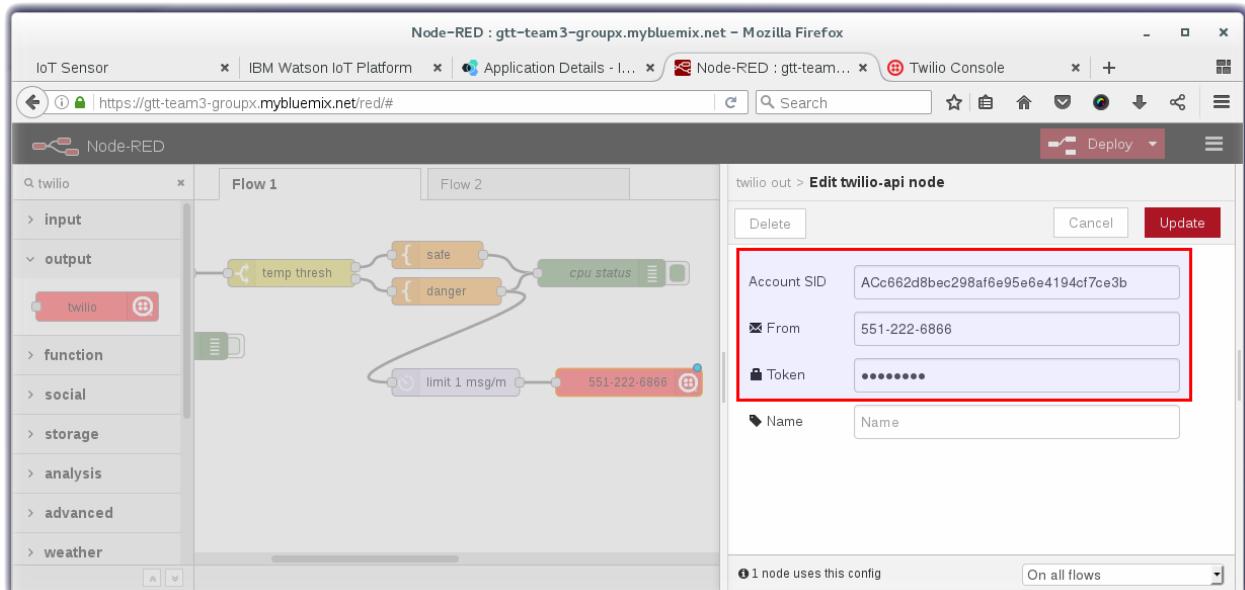
Observations:

## Step 6 – Send a SMS alert (optional if you have or create a Twilio account)

- Search for the “twilio” node (11).
- Drag the twilio node from the palette to the flow and wire it to the limit node (12).
- Double click on the twilio node and enter the twilio settings (13).



- Click on (16) to configure your Twilio credentials.



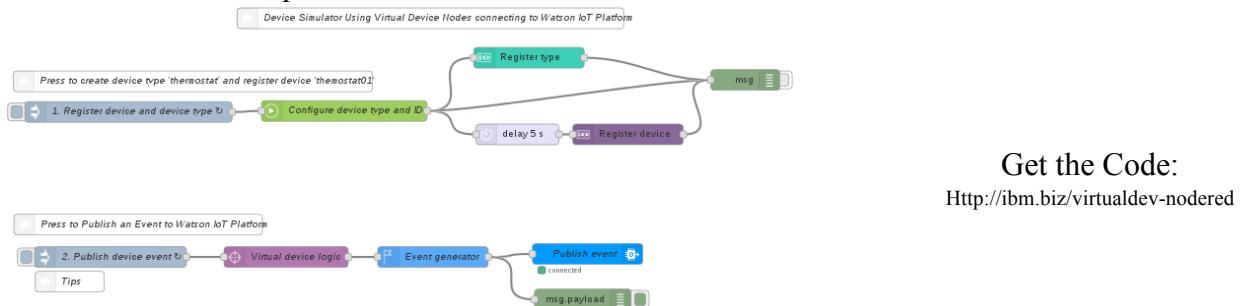
- Press the Done button.
- Click the Deploy button on the top of menu bar to deploy the Node-RED flow.

# Section 3– Create a Watson IoT Dashboard Card

In this Section, you will create several Cards on the Watson IoT dashboard that graph the sensor data arriving from the IoT Sensor device simulator.

## Step 1 – Create a registered IoT device simulator

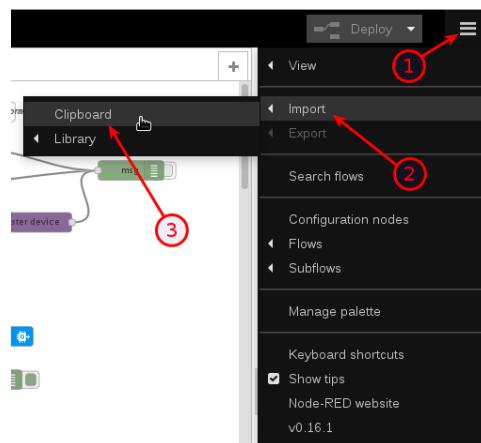
- To receive data from a registered device within the Watson IoT Platform, we need to create a virtual device. This flow can be pasted into Node-RED.



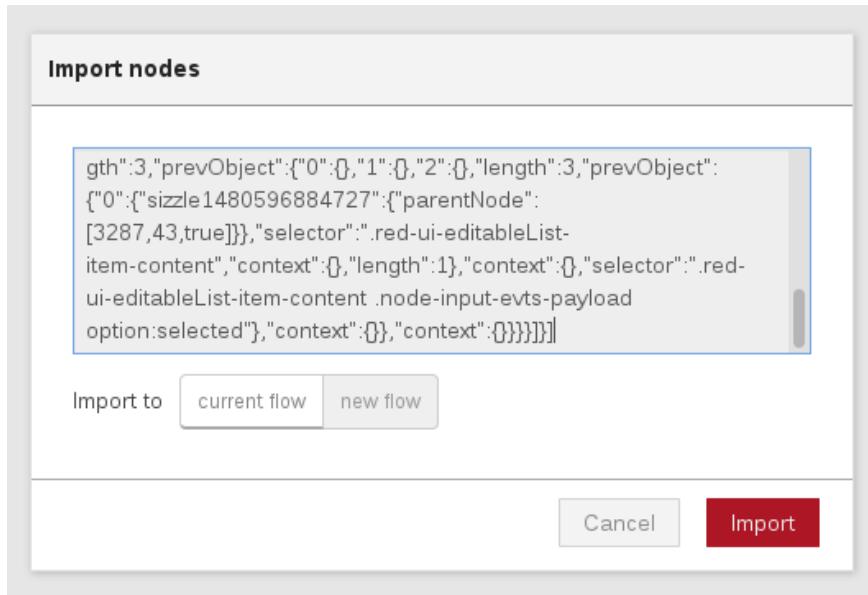
- First, open the “Get the Code” URL listed above and copy the text for the flow to your Clipboard.
- Within the browser Node-RED tab, create a new flow tab.



- Next, click on the Node-RED Menu (1), then Import (2), then Clipboard (3).



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



- Drag the new flow nodes to Flow 2 and click the left mouse button to drop it.
- Click on the Deploy button in the top right of the screen to save and deploy your changes.
- The flow creates a Device Type, registers a Device ID and starts to publish virtual device data.

Observations:

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## Step 2 – Open the Watson IoT Platform service page

- From Bluemix, return to the Internet of Things Starter application that you created in Section 1 Step 3.

The screenshot shows the 'Runtime' section of the IBM Bluemix Cloud Foundry Apps dashboard. It displays the following information:

- BUILDPACK:** SDK for Node.js™
- INSTANCES:** 1 (All instances are running, Health is 100%)
- MB MEMORY PER INSTANCE:** 512
- TOTAL MB ALLOCATION:** 512 (6.375 GB still available)

In the 'Connections (2)' section, there is a list of connections. One connection, 'gtt-team3-groupX-iotf-service', is highlighted with a red box and a red arrow pointing to it from the left margin. The other connection listed is 'gtt-team3-groupX-cloudantNoSQLDB'.

- Click on the iotf service Connection (4).
- Your browser will open to the Watson IoT Platform service page where you can interact with Devices and Analyse your device data. Click on Launch Dashboard (5).

The screenshot shows the 'Service Details' page for the 'gtt-team3-groupX-iotf-service' application. The 'Manage' tab is selected. The page features three main sections:

- Connect your devices:** Includes a 'Launch dashboard' button, which is highlighted with a red box and a red arrow pointing to it from the left margin.
- Analyze your data:** Includes a 'Find out more' button.
- Learn how to extend your app:** Includes a list of services: Watson Assistant, Watson Tone Analyzer, Watson Language Model, Watson Discovery, Watson Knowledge Studio, Watson Assistant, Watson Tone Analyzer, Watson Language Model, Watson Discovery, Watson Knowledge Studio, Watson Assistant, Watson Tone Analyzer, Watson Language Model, Watson Discovery, Watson Knowledge Studio.

The top of the page displays the message: "Hi! Welcome to Watson IoT Platform" and "Take a look at the steps below to get you going with your Internet of Things app".

- Under the Devices (7) you should see your thermostat device (6).

The screenshot shows the 'Devices' page of the IBM Watson IoT Platform. The sidebar on the left has a 'Devices' button with a gear icon, circled in red and labeled '7'. The main area lists devices with columns for Device ID, Device Type, Class ID, Date Added, and Location. A device named 'thermostat343' is highlighted with a red box and labeled '6'. A red arrow points from the bottom towards this device entry.

- Double Click on the thermostat device and you will see Event data (8) arriving.

The screenshot shows the detail view for the device 'thermostat343'. The top section displays connection information: Device ID (thermostat343), Device Type (thermostat), Date Added (Wednesday, January 18, 2017), Added By (a-caesp0-ucjeosfeei), and Connection State (Registered Refresh). Below this, the 'Recent Events' section is shown, containing a table with columns for Event, Format, and Time Received. The first row of the table is highlighted with a red box and labeled '8'.

Event	Format	Time Received
stat	json	Jan 18, 2017 11:59:01 AM
stat	json	Jan 18, 2017 11:59:02 AM
stat	json	Jan 18, 2017 11:59:03 AM
stat	json	Jan 18, 2017 11:59:04 AM

- Click on the Boards menu (9) and then click on the Device-Centric Analytics card (10).

The screenshot shows the 'Boards' page of the IBM Watson IoT Platform. The sidebar on the left has a 'All Boards' button with a gear icon, circled in red and labeled '9'. The main area displays three cards: 'USAGE OVERVIEW' (3 Cards, Owned by you), 'DEVICE-CENTRIC ANALYTICS' (5 Cards, Owned by you), and 'RULE-CENTRIC ANALYTICS' (6 Cards, Owned by you). The 'DEVICE-CENTRIC ANALYTICS' card is highlighted with a red box and labeled '10'.

- The generated values of the simulated device (11) appear in the Device Properties card (12)

- Click on the Add New Card (13).

The screenshot shows the IBM Watson IoT Platform Device-Centric Analytics interface. At the top, there's a navigation bar with links like QUICKSTART, SERVICE STATUS, DOCUMENTATION, and BLOG. On the right, it shows the user's email (walicki@us.ibm.com) and ID (caesp0). Below the navigation, the main title is 'Device-Centric Analytics'. On the left, there's a sidebar with various icons. The central area has two main sections: 'Devices I Care About' and 'Device Info'. In 'Devices I Care About', a table lists a single device: 'thermostat343' (Device ID) and 'thermostat' (Device type). In 'Device Info', detailed information is provided for the same device, including its name, type, client ID, creator, creation time, and alerts. At the bottom, there are sections for 'Rule Alerts For That Device' and 'Rule Alert Info'. A red box labeled 11 points to the 'thermostat343' entry in the devices table. A red box labeled 12 points to the 'Device Properties' section showing 'humidity 53.1'. A red box labeled 13 points to the '+ Add New Card' button in the top right.

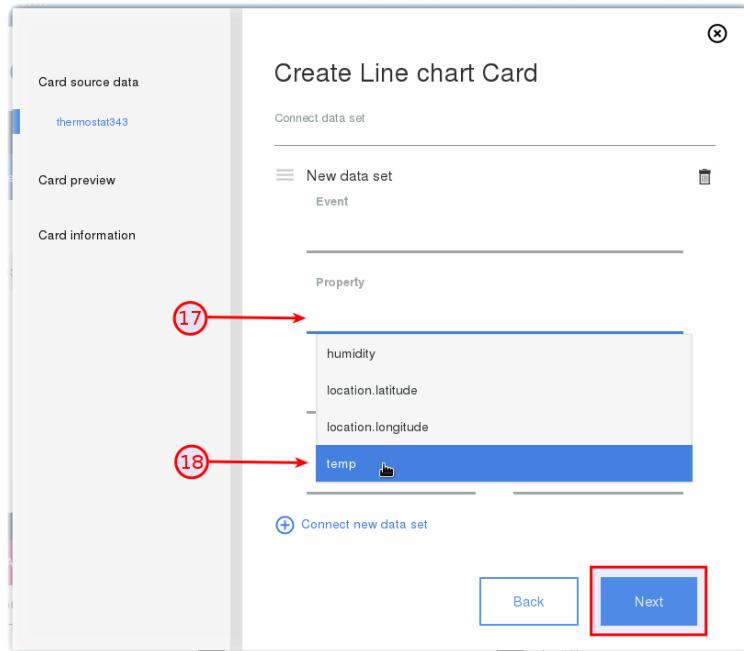
- Click on Line chart (14).

The screenshot shows the 'Create Card' dialog box. On the left, there's a sidebar with tabs: 'Card source data' (selected), 'Card preview', and 'Card information'. The main area is titled 'Create Card' and has a sub-section 'Card type' with a placeholder 'Select card type'. Below that is a 'Devices' section. It shows two options: 'Generic visualisation' and 'Line chart'. A red box labeled 14 points to the 'Line chart' option. A red box labeled 15 points to the 'Devices' tab in the sidebar.

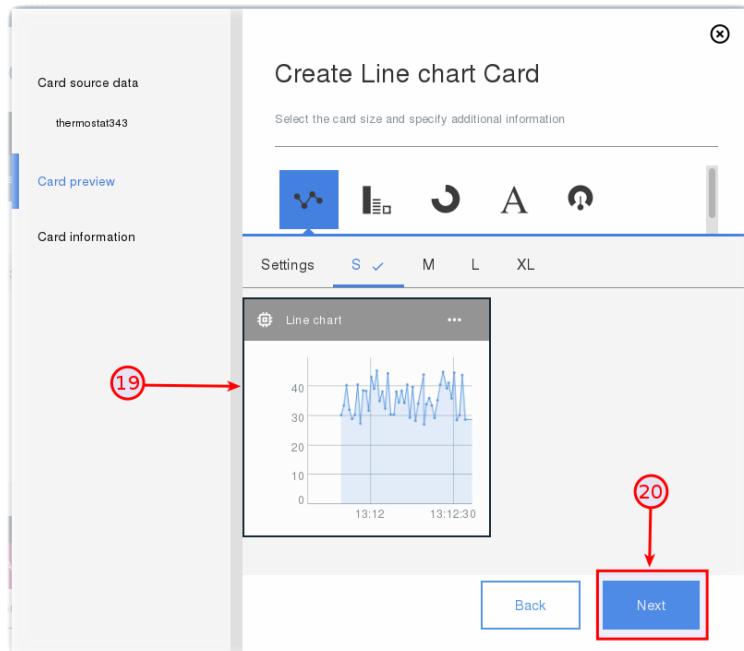
- Click on Devices (15) and then check the thermostat Device ID (16) and then press the Next button.

The screenshot shows the 'Create Line chart Card' dialog box. On the left, there's a sidebar with tabs: 'Card source data' (selected), 'Card preview', and 'Card information'. The main area is titled 'Create Line chart Card' and has a sub-section 'Specify the data source for the card'. It shows a 'Devices' tab (highlighted by a red box labeled 15) and a 'Cards' tab. Below that is a search bar 'Search for data sources using the filter'. At the bottom, there are fields for 'Device ID' (containing 'thermostat343') and 'Device Type' (containing 'thermostat'). A red box labeled 16 points to the 'thermostat343' entry in the 'Device ID' field.

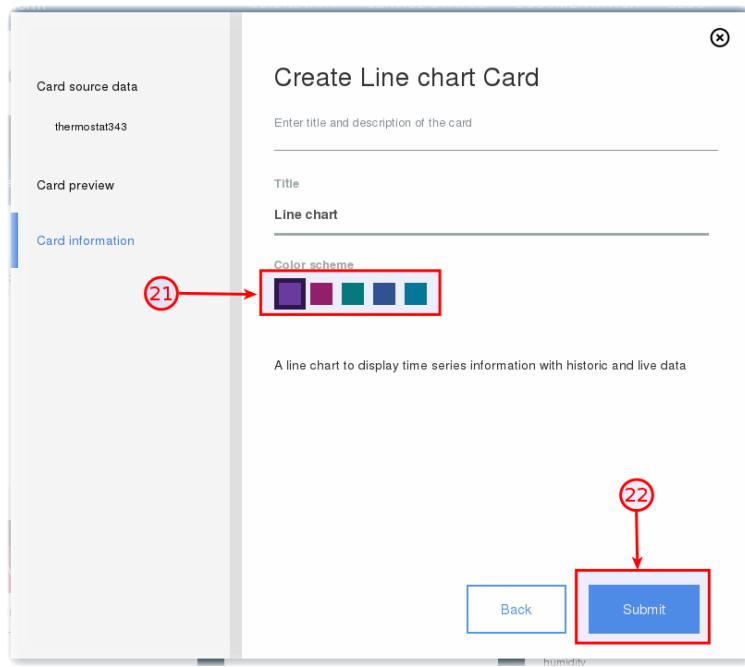
- Click on Connect new data set
- Click on the line under Property (17) and select temp (18). Press the Next button.



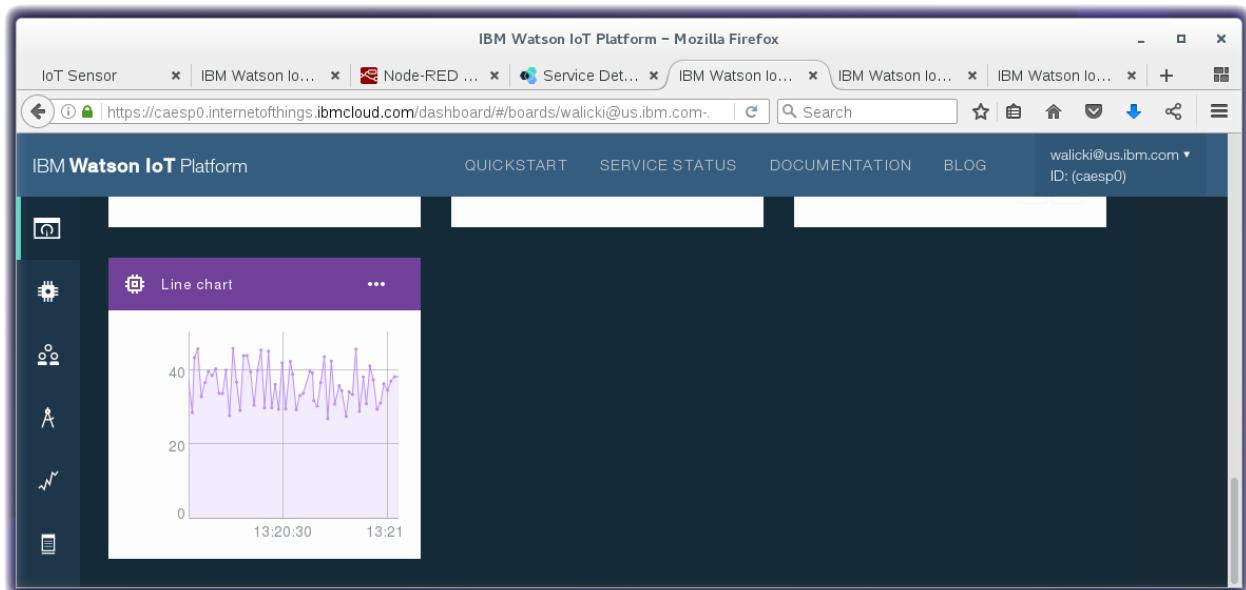
- After reviewing Line Chart preview (19), press the **Next** button (20).



- Pick a **Colour scheme** (21) for the Line chart and press the **Submit** button (22).



- Scroll down in the browser and you will see a Line chart for your data.

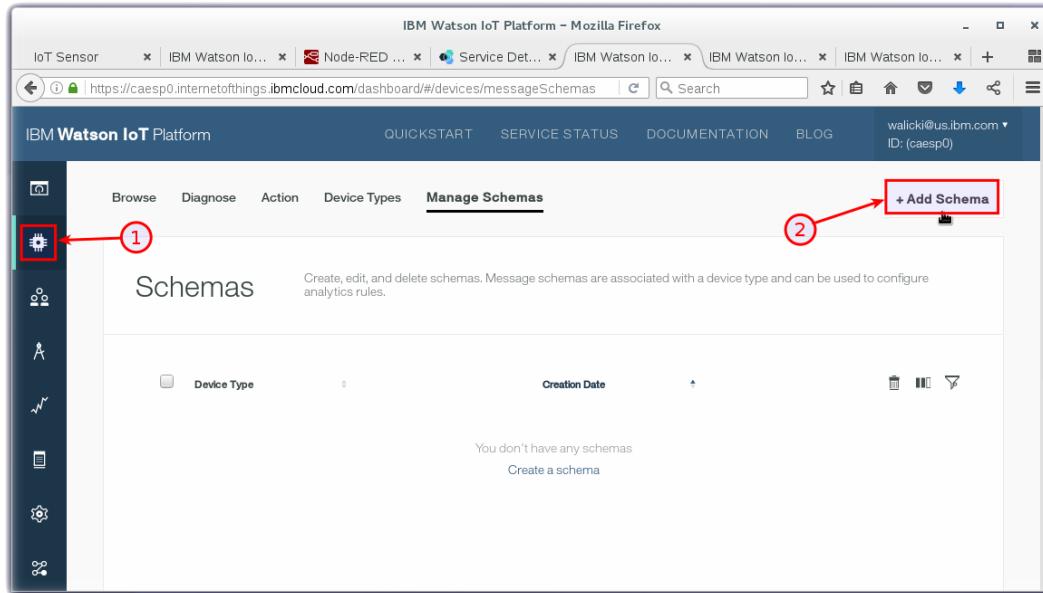


# Section 4 – Analyse your Data with Watson IoT Rules

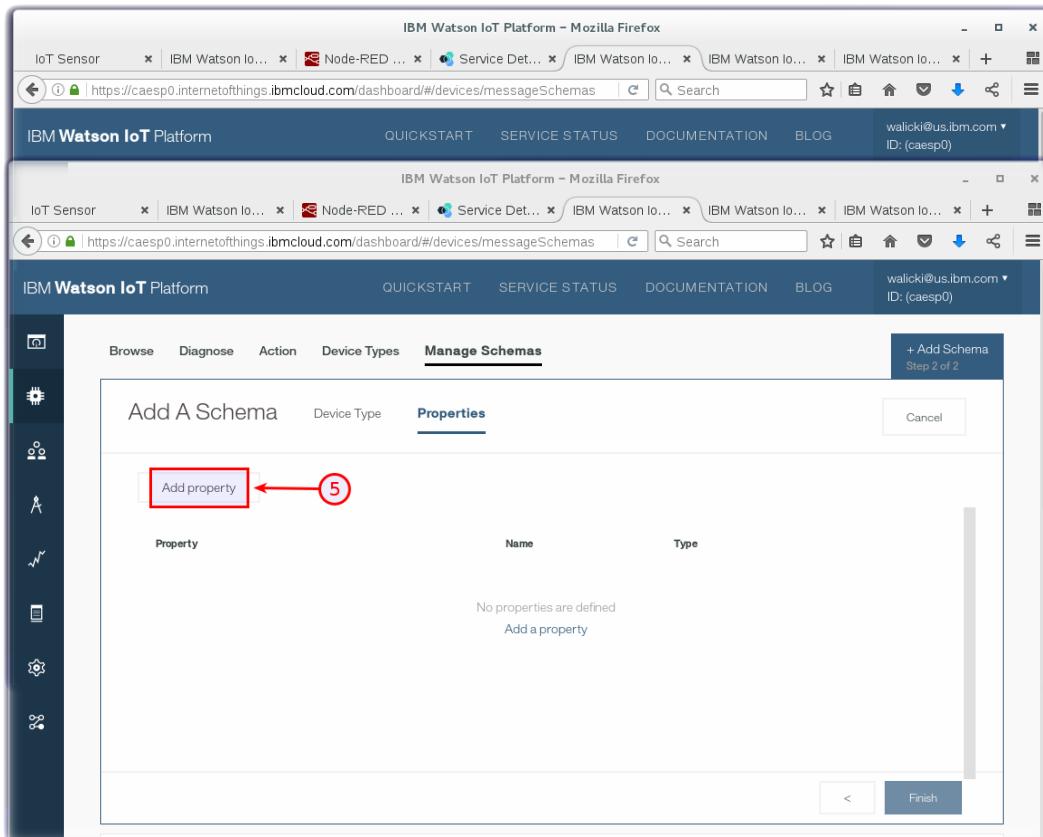
In this Section, you will use the Watson IoT Real Time Insights rules engine to analyse incoming data and take actions based on thresholds defined.

## Step 1 – Create a Schema

- Return to the Devices page by clicking on **Devices** (1) in the left menu and then click on **Add Schema** (2)

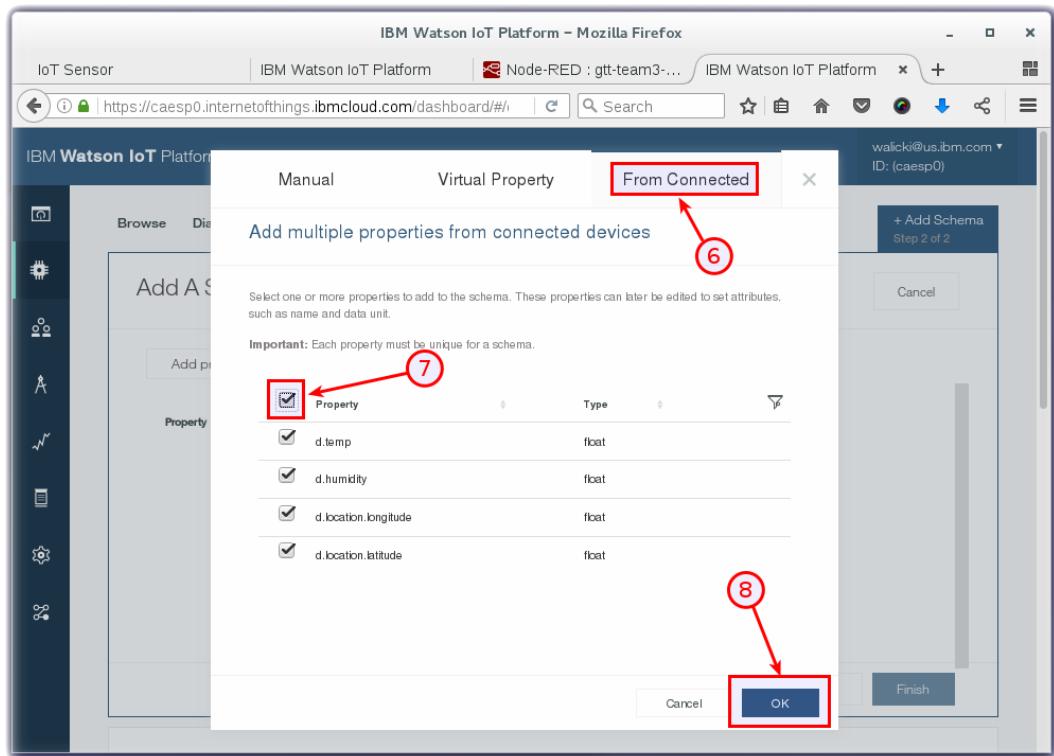


- Click on the **Select Type** drop down and choose thermostat (3) and then press the **Next** button (4).



- Click on **Add property** (5).

- Click on “From Connected” (6) and Check (7) to select all the property values. Then press Ok (8)



- Press the **Finish** button.

## Step 2 – Create a Cloud Rule

- Switch to the Rules page by clicking on **Rules** (9) in the left menu.
- Select **Create Cloud Rule** (10).

The screenshot shows the IBM Watson IoT Platform dashboard. On the left sidebar, the 'RULES' option is highlighted with a red box and circled with a red number 9. At the top right, there is a button labeled '+ Create Cloud Rule' which is also highlighted with a red box and circled with a red number 10.

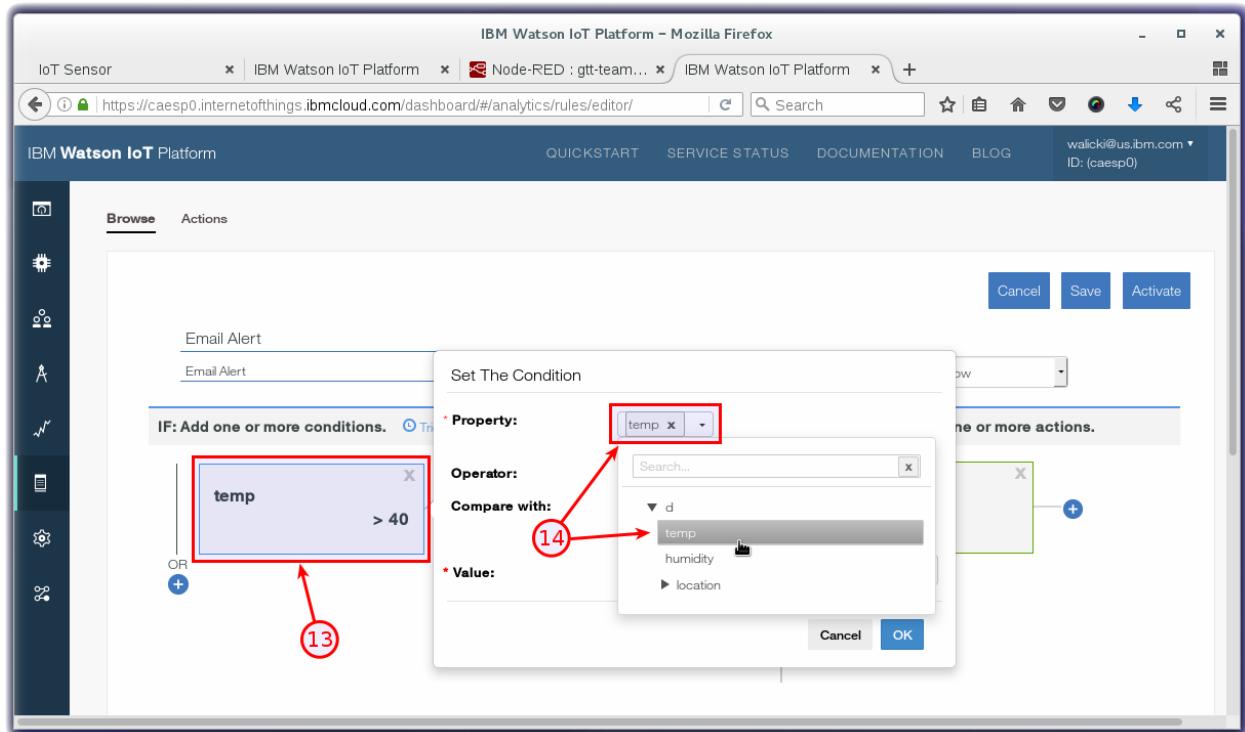
- Give this rule a **Name** of Email Alert (11) and select the thermostat schema (12) from the drop down. Press the **Next** button.

The dialog box is titled 'Add New Cloud Rule'. It contains three fields:

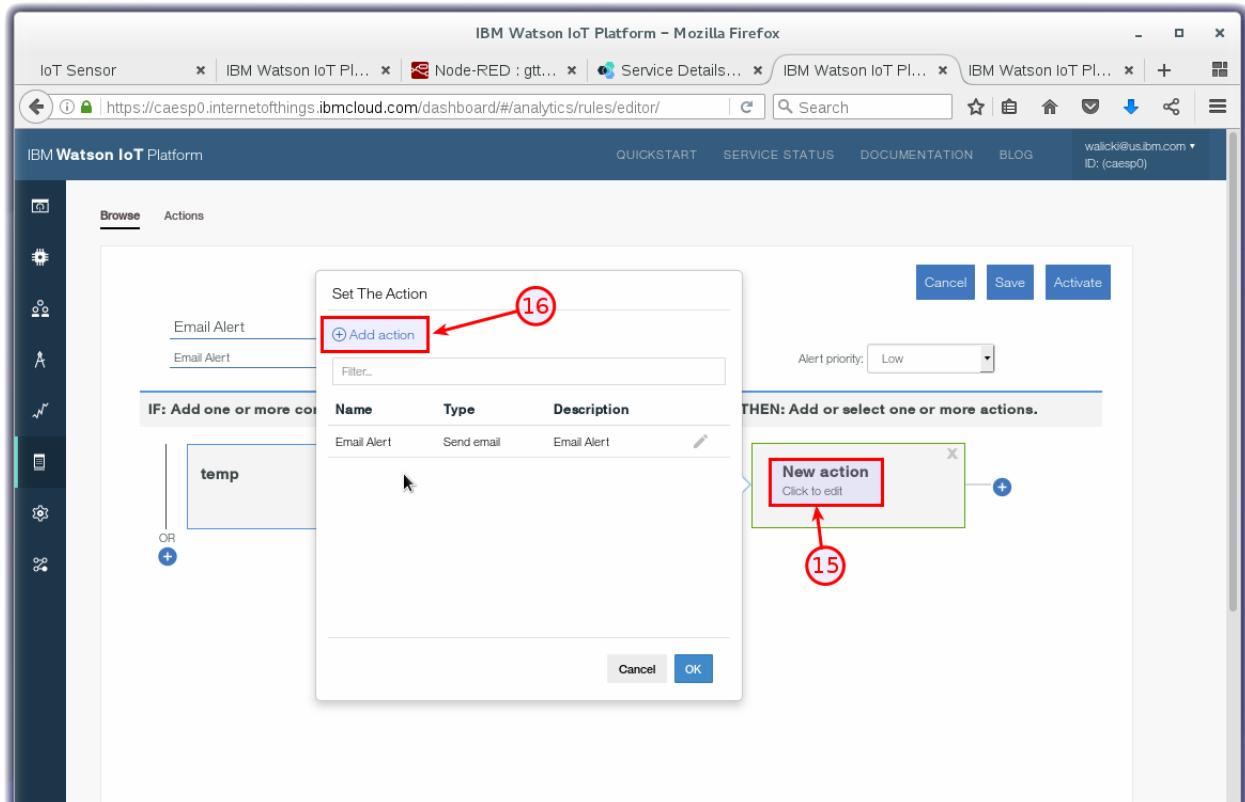
- 'Name:' input field with 'Email Alert' (circled with red number 11).
- 'Description:' input field with 'Email Alert'.
- 'Applies to:' dropdown menu with 'thermostat' selected (circled with red number 12).

At the bottom right are 'Cancel' and 'Next' buttons, with 'Next' highlighted with a red box and circled with a red number 13.

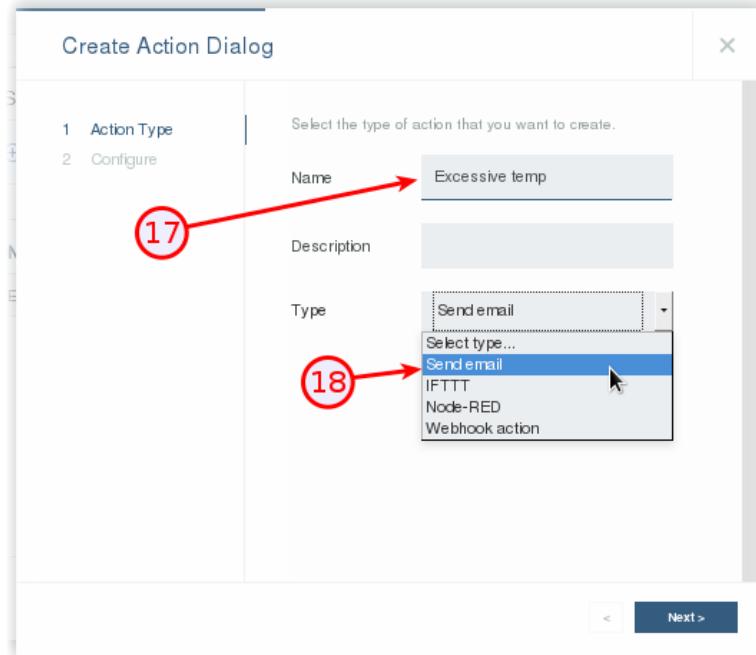
- Click on “New condition” (13) and select a property “temp” from the d.temp twistie (14). Enter a value of 40. Press the **Ok** button.



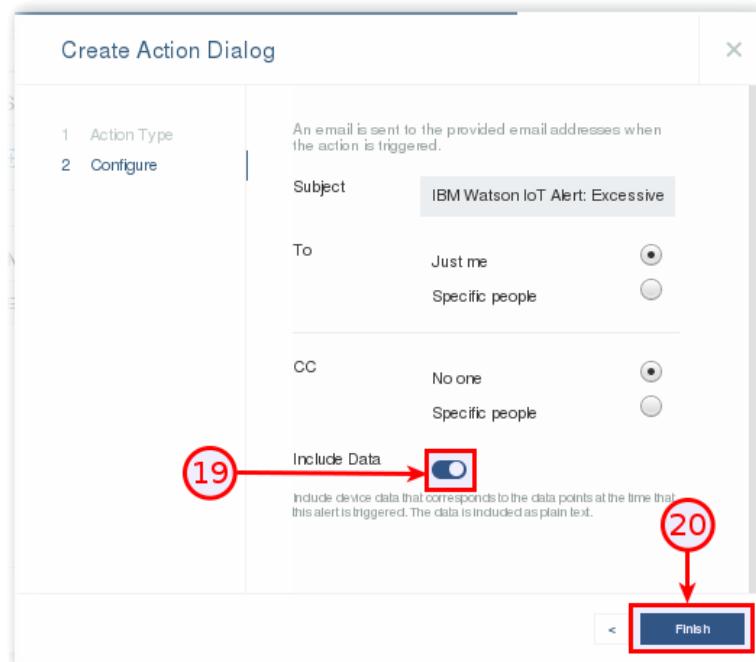
- Click on “New action” (15) and then Add Action (16).



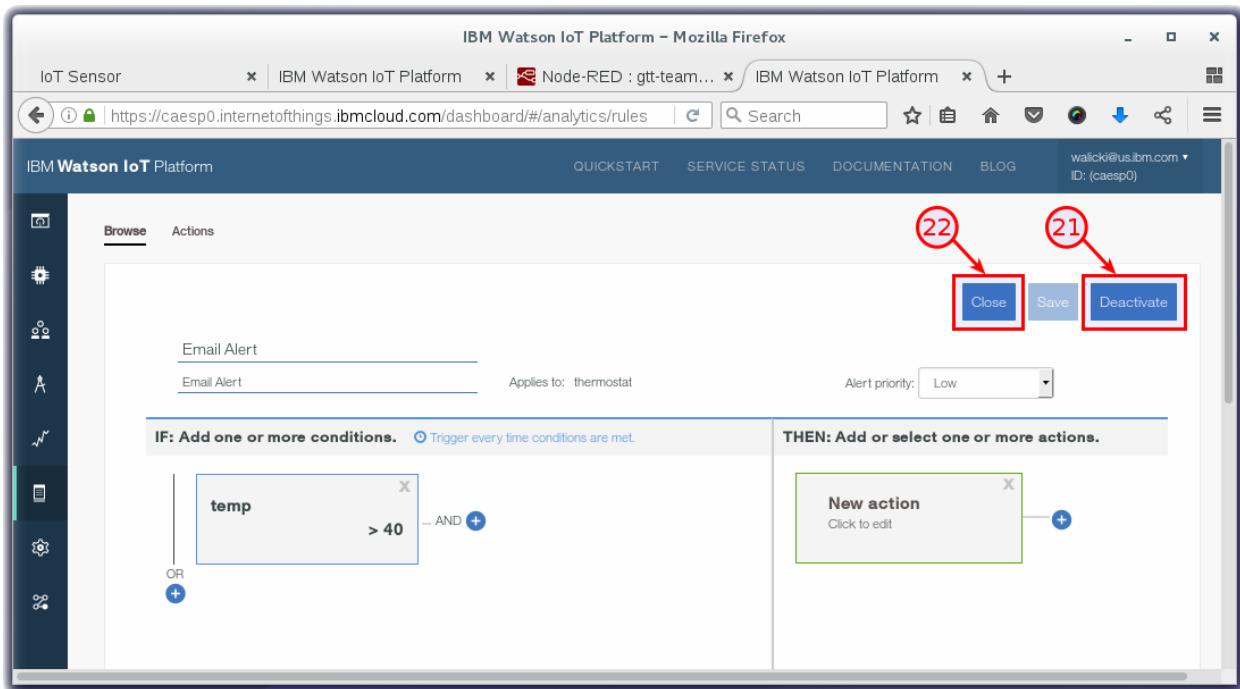
- Give this action a **Name** “Excessive Temp” (17) and a **Type** of “Send email” (18). Press the **Next** button.



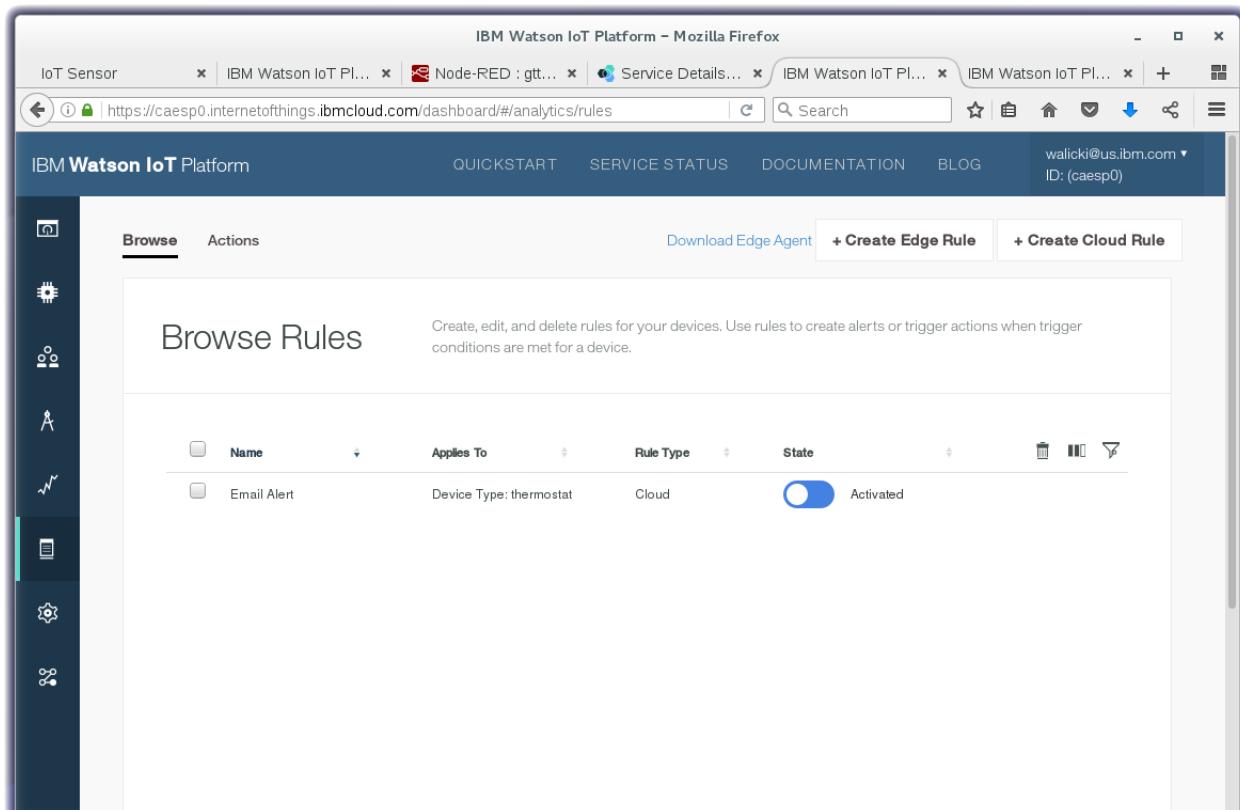
- On the **Create Action Dialog**, choose to **Include Data** (19) and press the **Finish** (20) button.



- Press the **Ok** button to set the Action.
- Press the **Activate** button (21) and finally press the **Close** button (22).



- You have created a Watson IoT Rule.



- The rule is activated.

- Email Alerts (23) are now being sent to your email address every time the temperature exceeds 40 degrees. Verify that you are receiving the Alerts and then deactivate the Rule.

The screenshot shows the IBM Watson IoT Platform dashboard. On the left, there's a sidebar with various icons. The main area has three panels:

- Rule Alerts For That Device**: Shows a summary of alerts: 0 Critical, 0 High, 0 Medium, 20 Low. Below is a list of alerts for the last 24 hours, each with a timestamp and a link icon. One alert from 9:33:06 PM on 1/18/2017 is highlighted with a red arrow pointing to the 'Email Alert' section in the middle panel.
- Rule Alert Info**: Details for the 'Email Alert' rule. It includes the rule name ('Email Alert'), description ('Email Alert'), device ID ('thermostat343'), device type ('thermostat'), severity ('Low'), and time ('21:33 18/01/2017'). A red circle labeled '23' is drawn around the condition line, which is also highlighted with a red arrow.
- Device Properties**: Shows device properties for 'thermostat343': humidity (65.2), location.latitude (12.901377), location.longitude (77.609342), and temp (29.9). A red arrow points from the 'temp' value to the circled '23' in the middle panel.

At the bottom, there's a line chart titled 'Linechart' showing data over time.

- Congratulations! You have completed the workshop.

## References

In this final section, we will challenge the workshop attendee to implement other projects using Watson IoT Platform, the Watson IoT Real Time Insights rules engine and alerts.

There are many recipes available at:

<https://developer.ibm.com/recipes>