Tracking Temperature with Watson IoT Starter Boilerplate

Hands-On Lab

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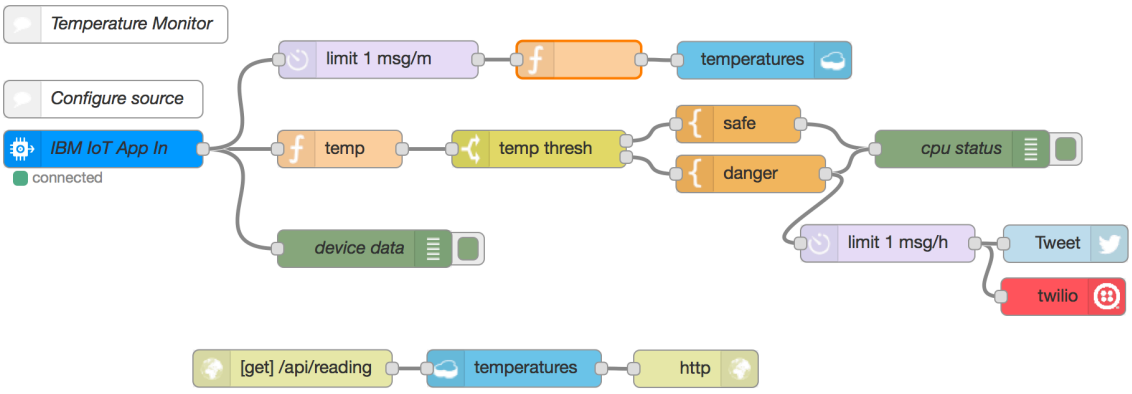
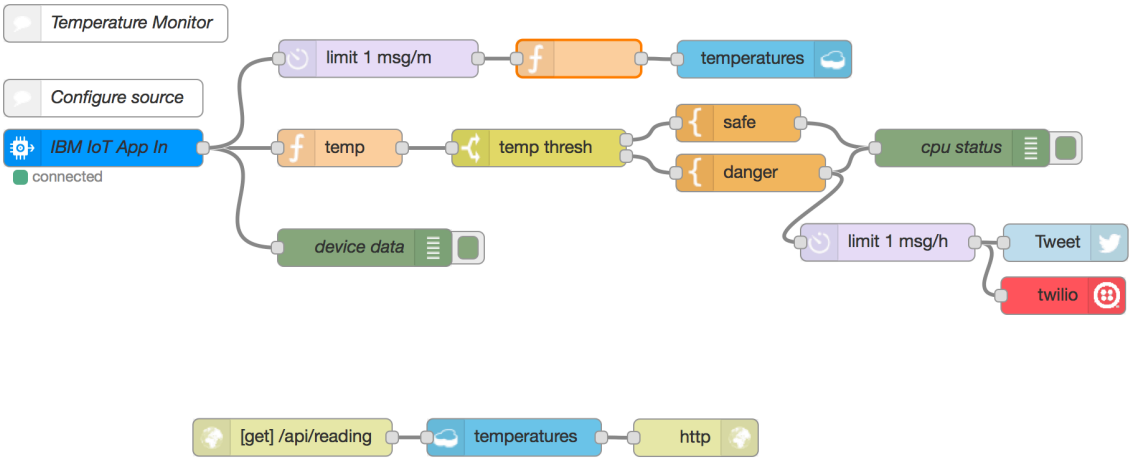
Node-RED application running on IBM Bluemix responds to incoming high temperature (pg. 3) by tweeting (pg. 9) and texting (pg. 11) alerts. Temperature is also stored for historical analysis in a Cloudant NoSQL database (pg 12 & 15).

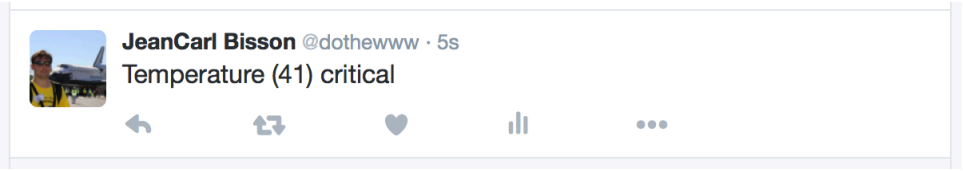


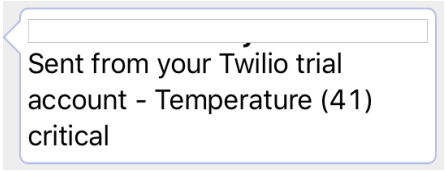
A digital copy of this lab and completed flows can be found at:
`http://ibm.biz/lab-temperature-sensor-with-iot-starer`

Topics covered: Node-RED, Watson Internet of Things Platform, Cloudant NoSQL Database, Twitter, and Twilio.

In this lab, we will use the Internet of Things Boilerplate in the IBM Bluemix Catalog to listen for IoT events from a simulated Quickstart IoT device. The temperature will be sent via Watson's Internet of Things Platform service to the Node-RED application hosted on IBM Bluemix. If the temperature reaches 40°C, we'll send a tweet via Twitter and/or a text message via Twilio. We'll store the temperature in a Cloudant NoSQL database so we can track patterns. Finally, we'll create an HTTP endpoint that exposes the historical temperatures that third-party applications could consume and perform analysis or other fun stuff.







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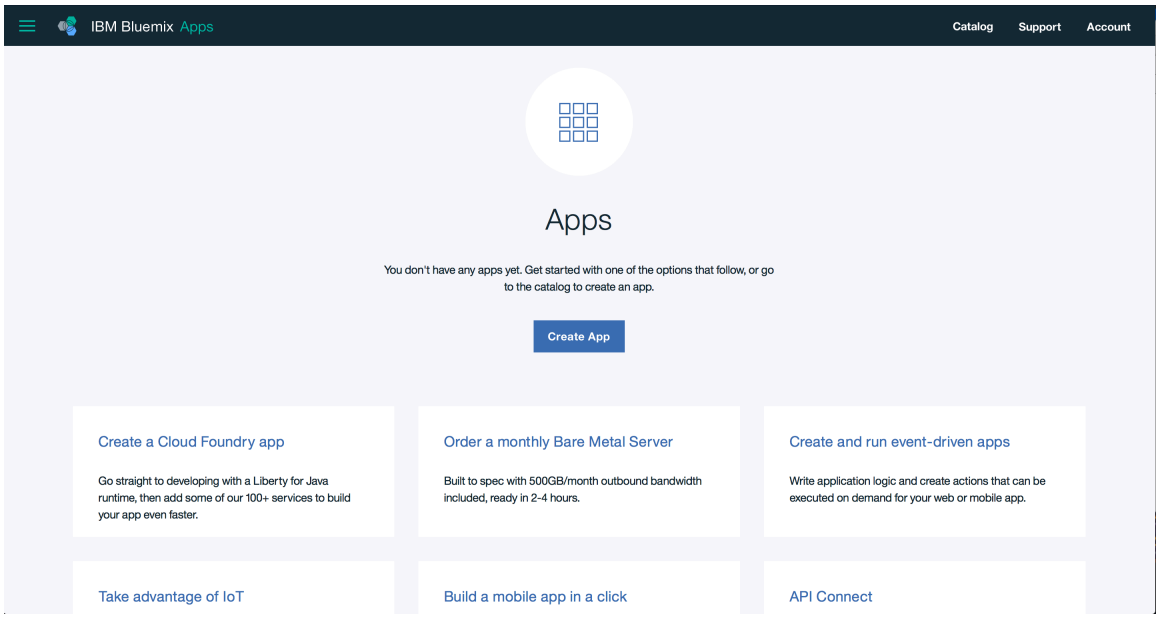
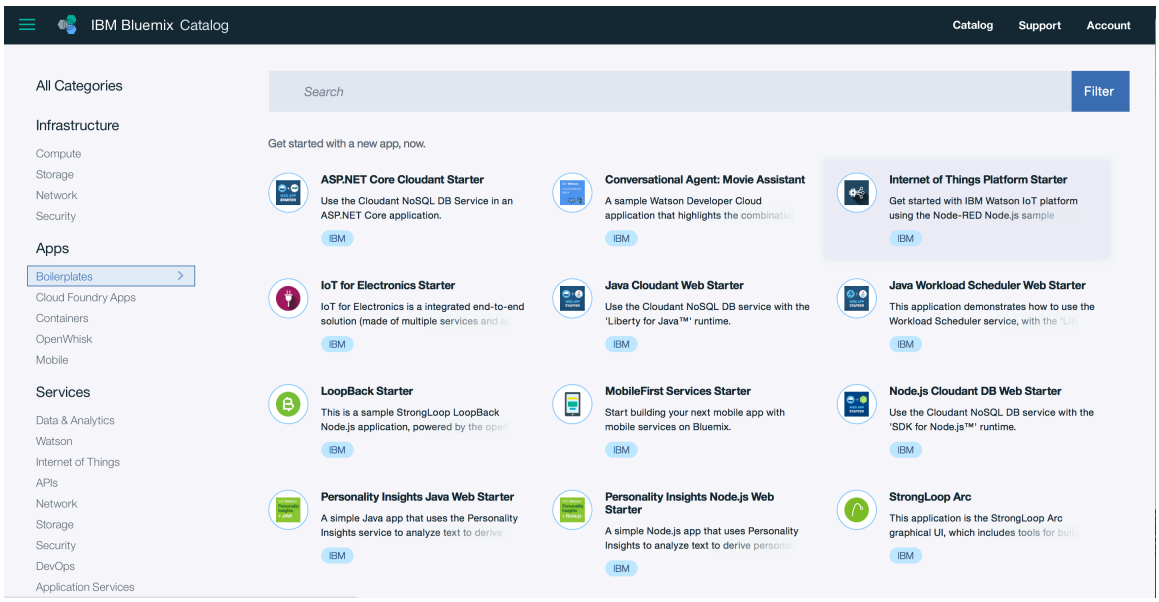
Creating an IoT application in IBM Bluemix

In this section, we will create an Internet of Things boilerplate application in IBM Bluemix and use it to receive temperature values from a simulated IoT temperature sensor.

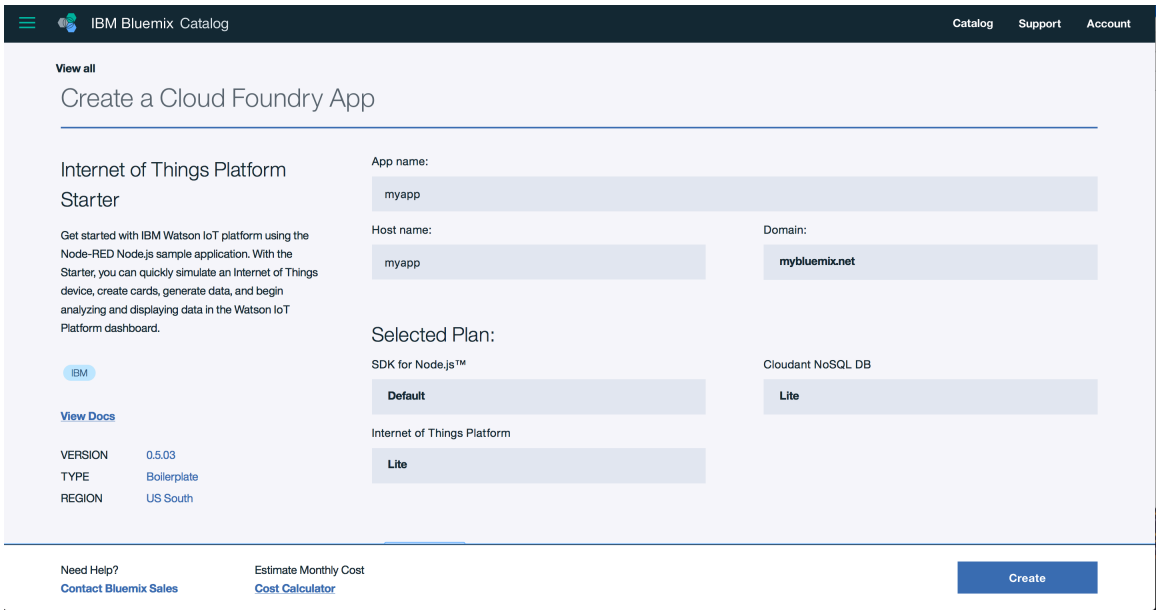
1. Open a web browser and go to your IBM Bluemix dashboard, `http://bluemix.net`. This is the IBM Bluemix dashboard where you have access to creating Cloud Foundry apps, IBM Containers, Virtual Machines, and a variety of Services. We are going to create a Cloud Foundry application today. To access the catalog, click on the **All Items tab** and then the blue **+** hexagon on the top right.



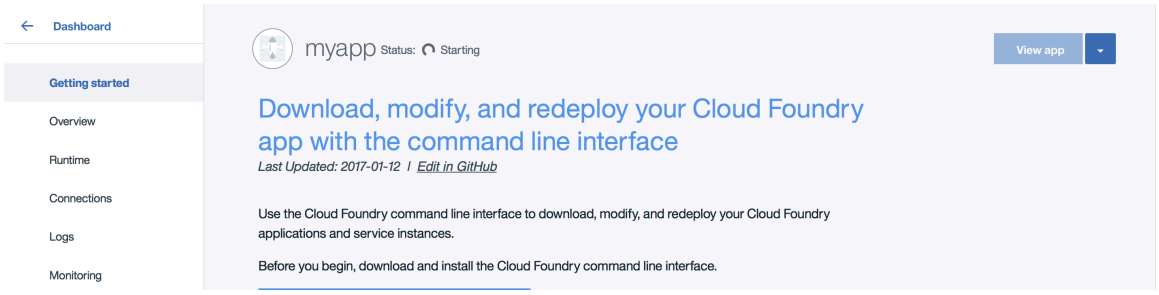
2. IBM Bluemix offers a handful of boilerplate applications that you can create and get started quickly. The Internet of Things Starter boilerplate includes Node-RED, a Cloudant NoSQL database, and the SDK for Node.js. Under Boilerplates, select the **Internet of Things Platform Starter** boilerplate tile.



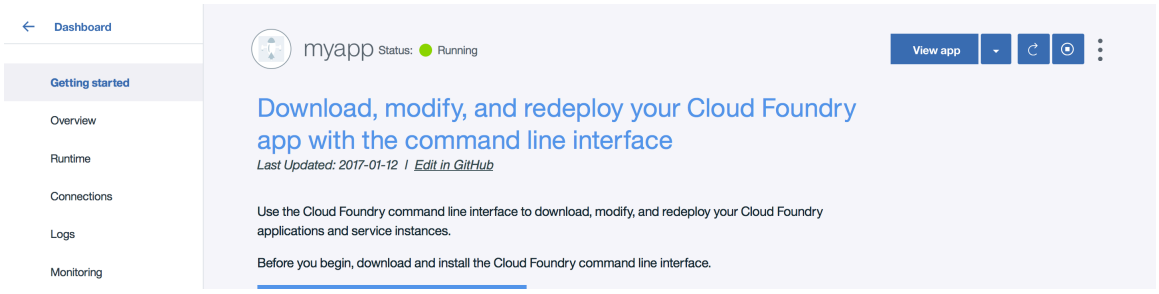
3. Pick a unique name for your application. If you choose ***myapp***, your application will be located at `http://myapp.mybluemix.net`. There can only be one "***myapp***" application registered in IBM Bluemix. You can try adding your initials in front of the host if the host you choose is already taken by someone else. Click on **Create** to create the application instance.



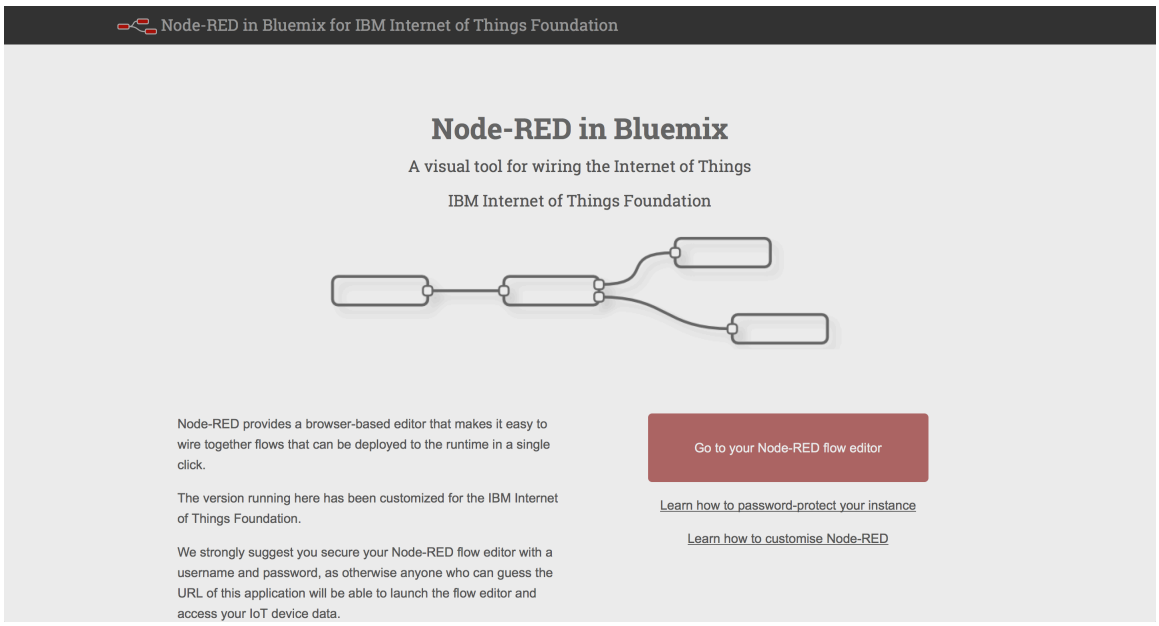
4. IBM Bluemix will create an application in your account based on the services in the boilerplate. This is called staging an application. It can take a few minutes for this process to complete. While you wait, you can click on the **Logs** tab and see activity logs from the platform and Node.js runtime.



5. When the application is running, click on the **View App** button to open the application in a new browser tab.

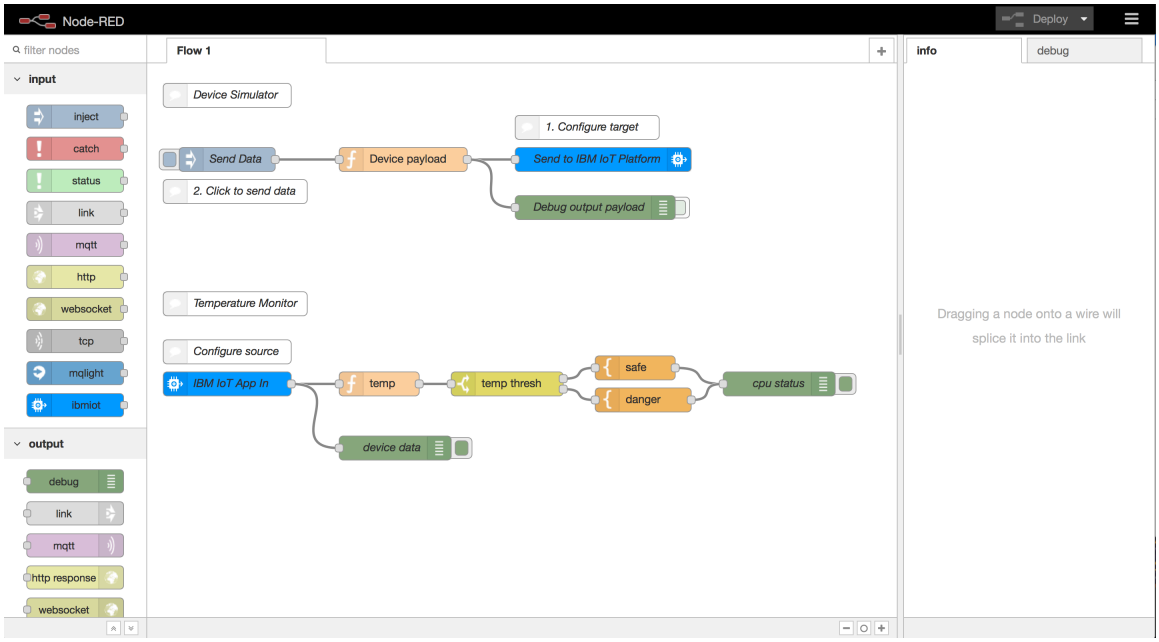


6. This is Node-RED start page. Node-RED is an open-sourced Node.js application that provides a visual editor that makes it easy to wire together flows. Click on the red button **Go to your Node-RED flow editor** to launch the editor.

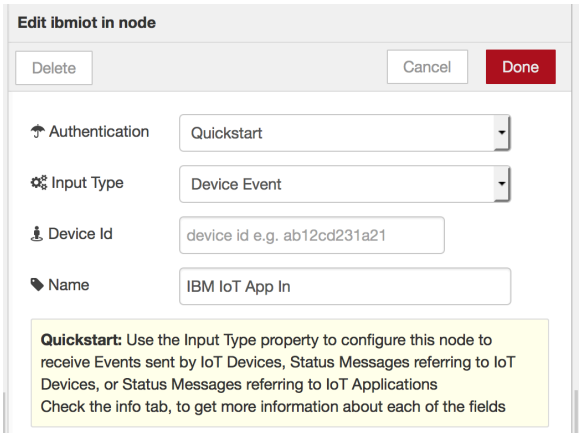


7. On the left side is a palette of nodes. Each node performs a defined function, configurable by dialog windows or by modifying the msg input. You can click on a node in the palette and find out what it does in the info tab on the right side of the screen. Drag and drop nodes and connect them together in the middle pane, called a canvas. Double click on nodes in the canvas to customize settings used by the node. Connect two or more nodes via the grey knobs on the left and right sides of the node, constructing what is called a flow. A flow is executed from left to right and is completed when the last node is reached. A flow can split off into two or more flows, for example, with a switch node. Two flows can also share a node or a flow, reusing the same logic in multiple scenarios by connecting their grey output knobs to the shared node's left grey input knob.

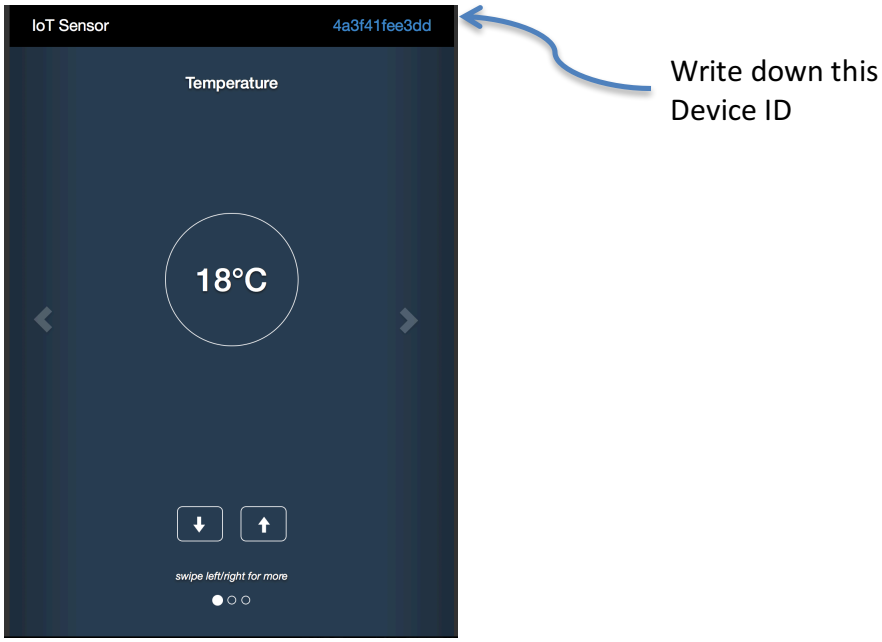
   Let's begin by configuring the IBM IoT App In node. Double click on the IBM IoT App In node.



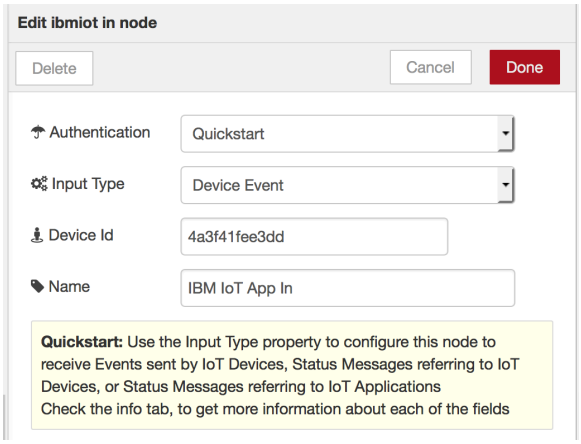
Nodes can be customized in different ways depending on what they do. The IBM IoT node begins a flow when a message is received from a specific device via the Watson IoT Platform. We need a Device Id of a device that is connected to the IoT Platform. We could use a real device, or we can simulate devices.



8. To get a device ID from a simulated device, visit `http://ibm.biz/iotsensor`. In the upper right is an alphanumeric value. This simulated temperature sensor sends the temperature to the Watson Internet of Things Platform service using this device ID.

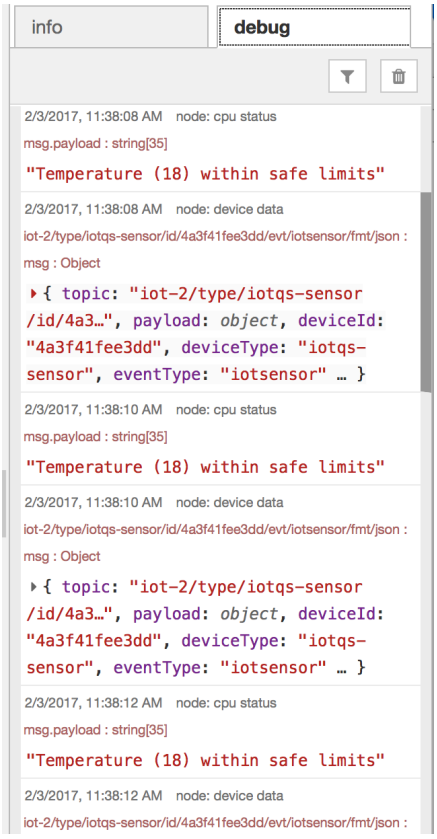


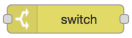
9. Copy this alphanumeric device ID into the **Device ID** field in the Node-RED application as shown below. Click **Done**.



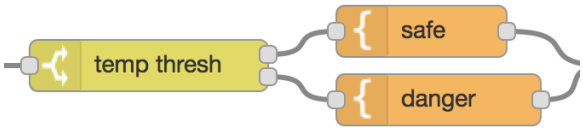
10. Click on the 

button in the top right of the screen to save and deploy your changes.
11. Click on the debug tab in the right-hand pane. Every second, the simulator emits a device event to the Watson IoT platform with temperature and other data. The Node-RED application subscribes to these events and the IBM IoT in node triggers the flow with the temperature data in the message. When the debug nodes are processed, contents of the message object are in the debug tab. Adding debug nodes can be helpful when something doesn't work right and you want to see the values being passed around.

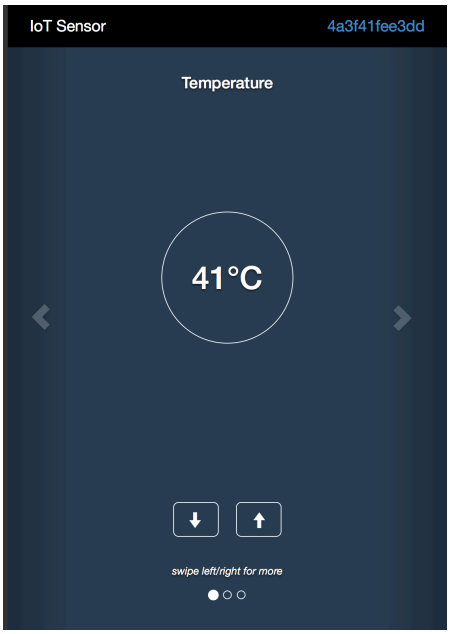


12. The yellow node is called a 

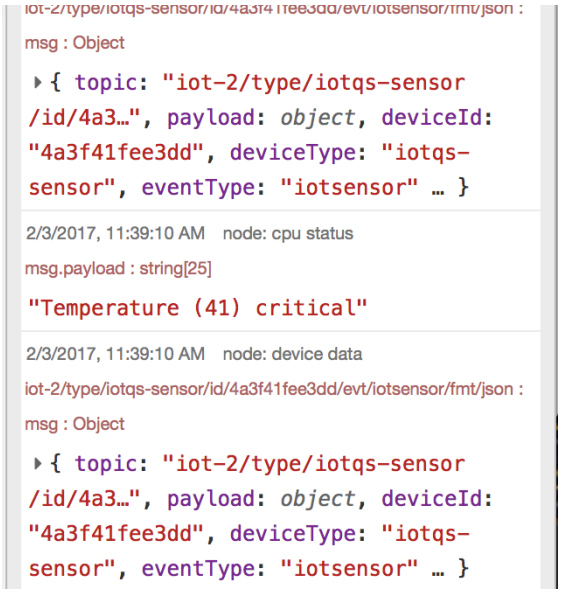
node. You can program logic using a switch node and split a flow into two or more flows based on a property's value. In this example, if the temperature is less than or equal to 40°C, it is considered "safe" and continues with the flow to the template labeled safe. If the temperature is greater than 40°C, it is considered "danger[ous]" and continues with the flow to the template labeled danger.



13. To trigger the flow labeled danger, increment the temperature using the up arrow on the simulated temperature gauge.



The message in the debug tab should change.



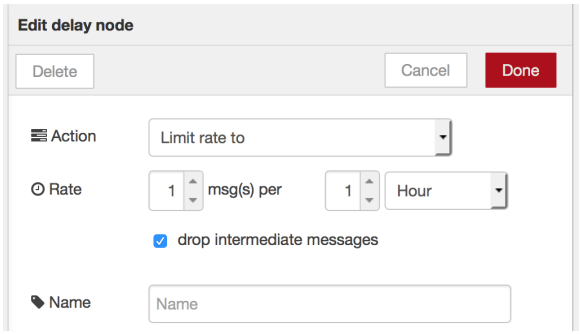
Connect to Twitter and Tweet High Temperature

In this section, we will connect a Twitter account and use the Twitter account to tweet when the temperature from the temperature sensor is “dangerous”. This section is optional and may be skipped.

1. Sign up for a Twitter account at `http://twitter.com`. If you already have a Twitter account, proceed to step 2.

2. Add a 

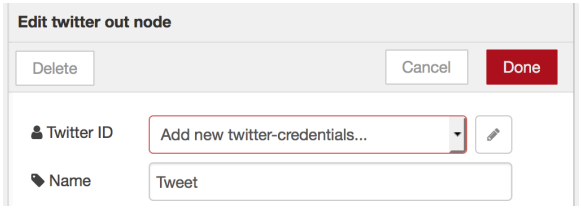
node as shown below.

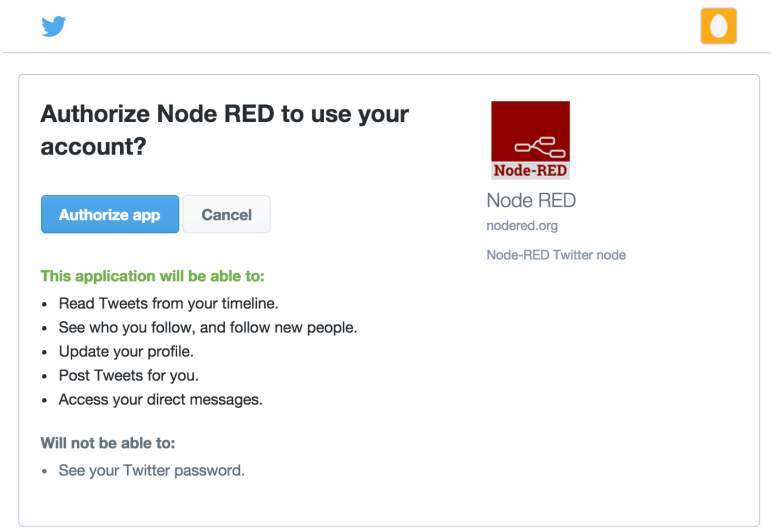


   The delay node limits how often the flow is run. Since the temperature is dangerous every second, without this node, a tweet would be sent every second. With this node limiting messages to once an hour, the Twitter node will send a tweet once an hour, dropping any additional messages during the hour timeframe.

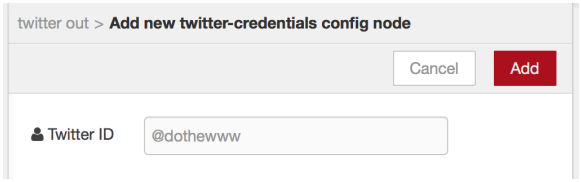
3. Add a 

node. Click on the pencil button and authenticate with Twitter. The account you sign in with will be used to send tweets.

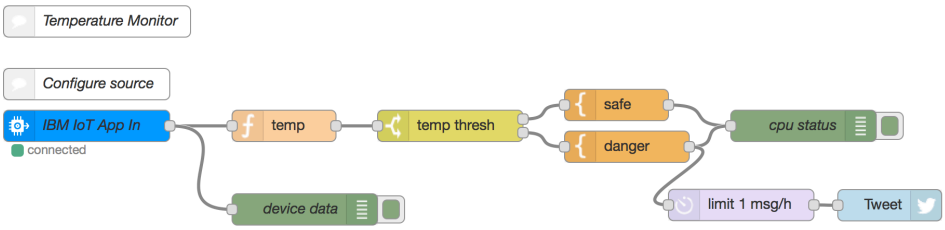




Return back to the node configuration. The settings for the Twitter node should have your username set. Click **Add**.



4. Connect the nodes as shown below.



Get the code:
`ibm.biz/BdsCN2`

5. Click on 

to save and deploy the changes.

6. Since the temperature is above 40°C, the switch statement will continue to the “danger[ous]” function, compose a message, and pass it to the Twitter node. The Twitter node uses this message as the content for the tweet.

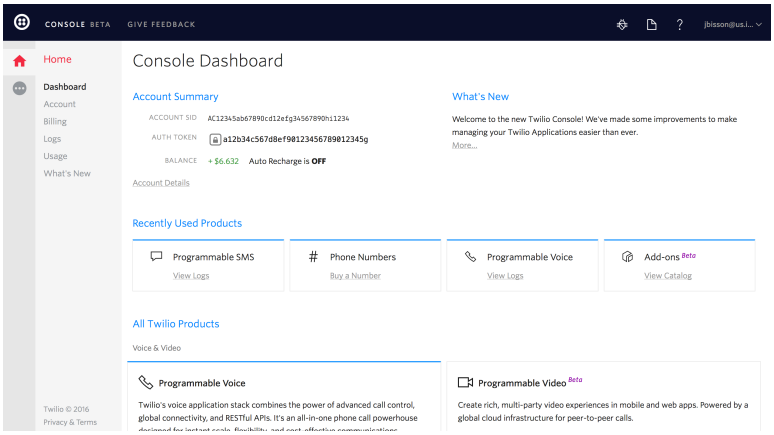
7. Visit the Twitter timeline for the user you authenticated with and verify the message has been tweeted.

Connect to Twilio and Text High Temperature

In this section, we will connect a Twilio phone number to the application and send a text message notification when the temperature is at least 40°C. This section is optional and may be skipped.

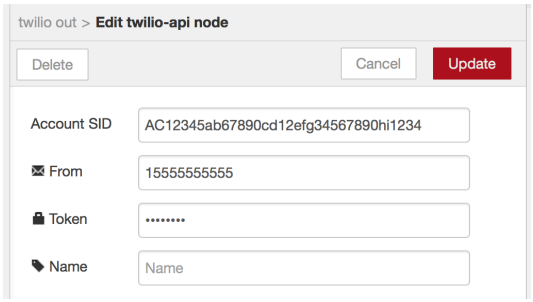
1. Sign up for a Twilio account at `http://twilio.com`. If you already have a Twilio account, sign in. Create a Twilio phone number that will be used in step #3.

2. In the Console Dashboard, click on the lock icon next to Auth Token. Copy the **Account SID** and **Auth Token**.

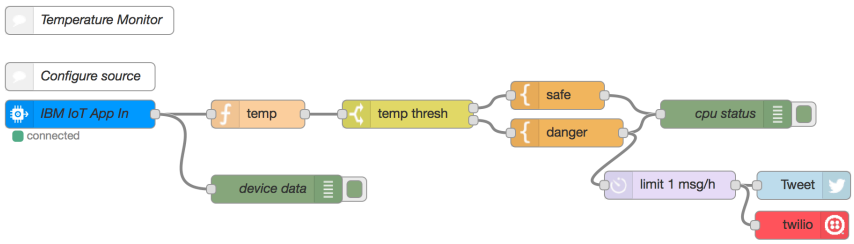


3. Add a 

node. Click on the Pencil to provide your **Account SID** and **Auth Token** from step #2, and **From** phone number using the Twilio phone number from step #1. Fill in the **SMS to** textbox with a phone number that will be texted to.



4. Connect the nodes together as shown.



Get the code:
`ibm.biz/BdsCNP`

5. Click on 

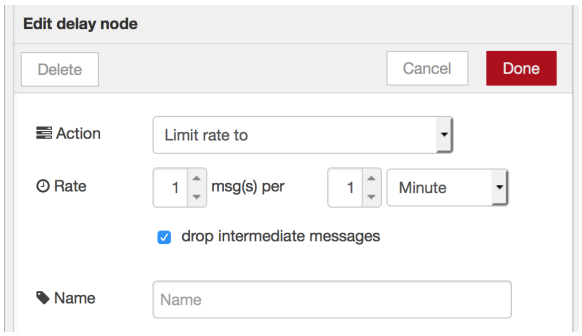
to save and deploy the changes. You should receive a text message shortly.

Store Temperature Into Cloudant NoSQL Database

This section will show how to add a Cloudant NoSQL database to the Node-RED application and store temperatures reported (one per minute). This functionality can be useful to run historical analysis (outside the scope of this lab) or find patterns over time. This section is optional and can be skipped. However, it is a prerequisite for the **Retrieve Temperatures From Cloudant NoSQL Database** section.

1. Add a 

node as shown below. This node will limit this flow to execute once per minute.

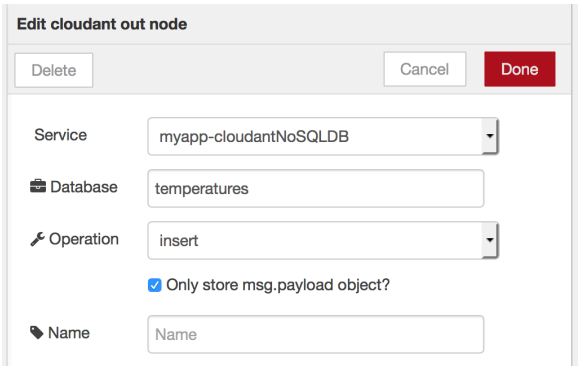


2. Add a 

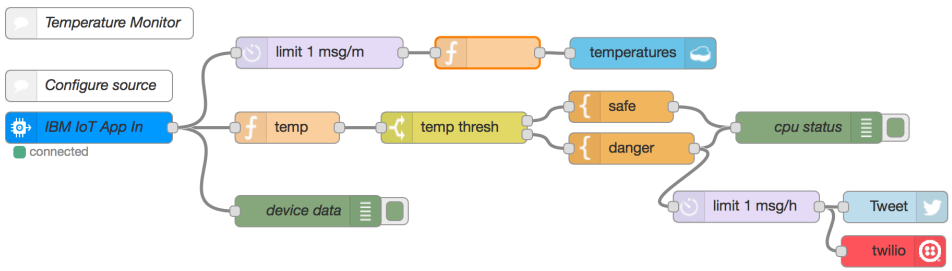
node as shown below.

3. Add a 

node as shown below.



4. Connect the nodes together as shown below.

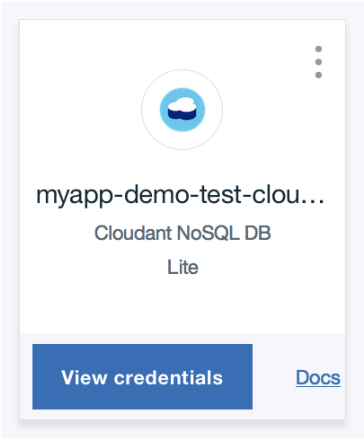


Get the code:
ibm.biz/BdsCNS

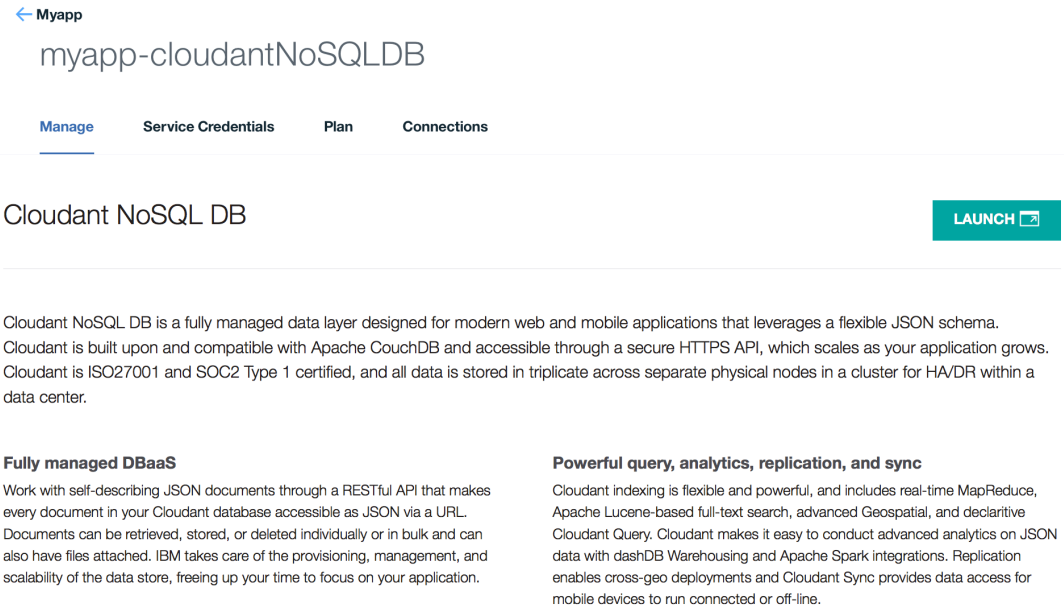
5. Click on 

to save and deploy your changes.

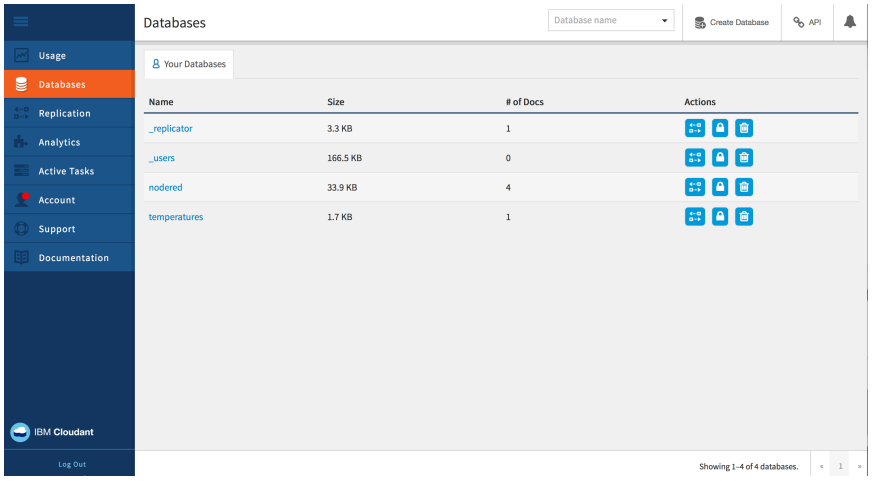
6. Go back to the IBM Bluemix dashboard and the **Connections** tab. Click on the **Cloudant NoSQL DB** service tile.



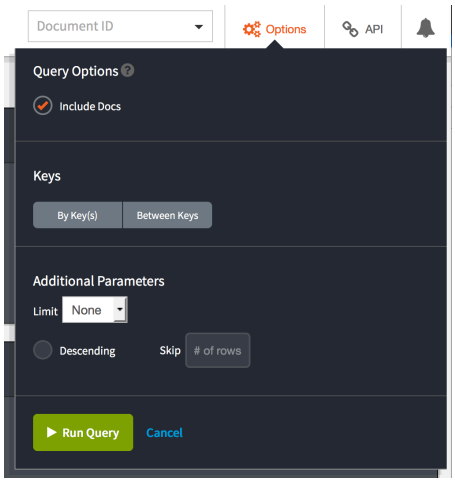
7. Click on the green **Launch** button.



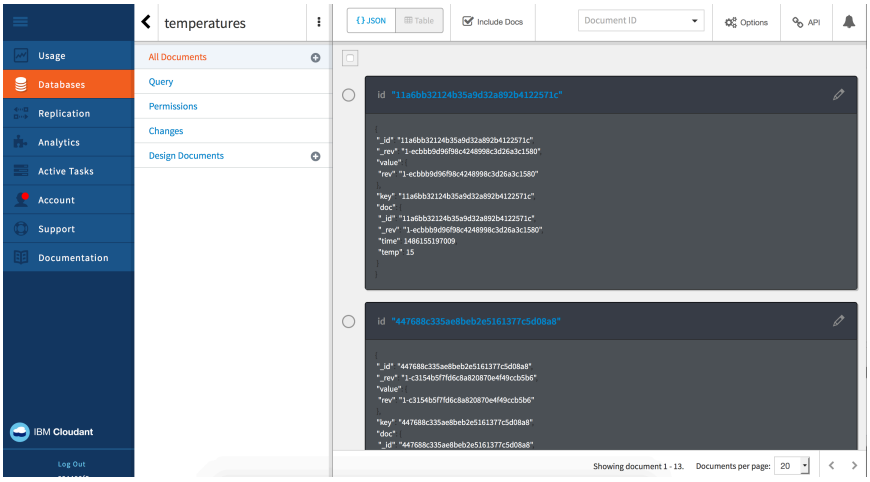
8. This is the Cloudant NoSQL database dashboard. A list of databases is displayed under the **Databases** tab. The database named temperatures contains documents representing each temperature event that has been stored by the Node-RED application. Click on the database named **temperatures.**



9. To see the expanded view of the documents, click on **Query Options**, check the box next to **Include Docs**, and click on the blue **Query** button.



10. Each box represents one document (in our case one temperature event) that contains the payload (time and temperature) we stored earlier.



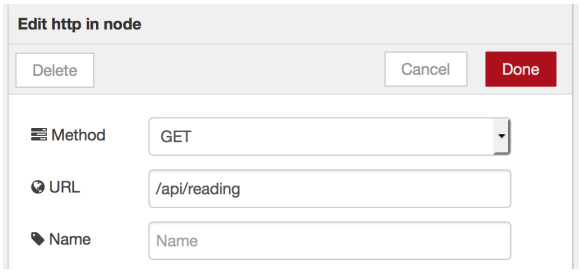
Retrieve Temperatures From Cloudant NoSQL DB

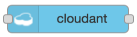
This section shows how to retrieve temperature data from a Cloudant NoSQL database and exposes it as a HTTP endpoint. This functionality can be useful to run historical analysis (outside of the scope of this lab) or find usage patterns over time. This section is optional and can be skipped. Completion of the section titled **Store Temperature Into Cloudant NoSQL Database** is required before beginning this section.

Now that we have a Cloudant NoSQL database containing reported temperatures, let's expose the data as an HTTP endpoint.

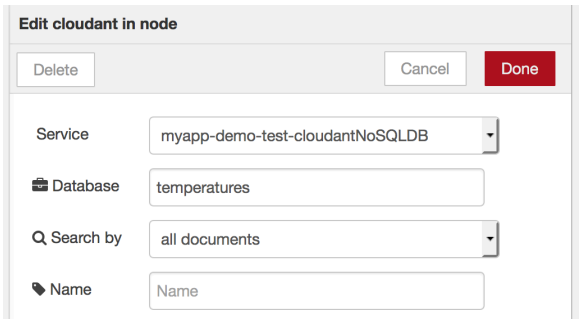
1. Add a 

node as shown below.



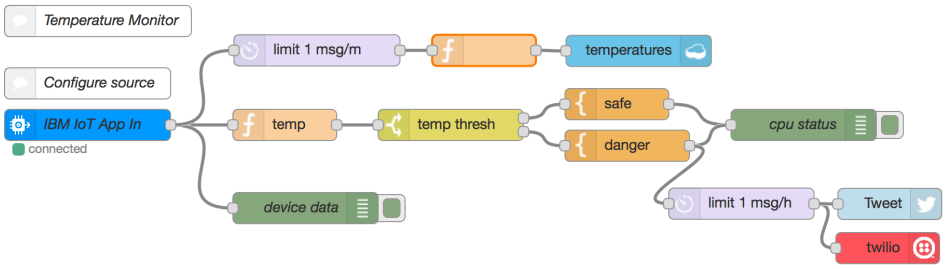
2. Add a 

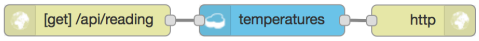
node as show below.



3. Finally, add a 

node. Connect the nodes together as shown below.





Get the code:
`ibm.biz/BdsCNv`

4. Click on  to save and deploy your changes.

5. Open a browser tab and visit your application's URL, appended by `/api/reading`. If you chose ***myapp*** when setting up your application, the URL would be:

   `https://myapp.mybluemix.net/api/reading`

   You should see data returned similar to the following:


```
[{"_id":"11a6bb32124b35a9d32a892b4122571c","_rev":"1-ecbbb9d96f98c4248998c3d26a3c1580","time":1486155197009,"temp":15},
{"_id":"447688c335ae8beb2e5161377c5d08a8","_rev":"1-c3154b5f7fd6c8a820870e4f49ccb5b6","time":1486155136924,"temp":15},
{"_id":"882dba86d6998d0c235ff300f85a85ef","_rev":"1-064ef1bf95af88f6f16fdb23eccf1f57","time":1486154582161,"temp":15},
{"_id":"882dba86d6998d0c235ff300f887cef0","_rev":"1-bc465c323da7ad309e91c7abf48aa919","time":1486155327100,"temp":15},
{"_id":"882dba86d6998d0c235ff300f88bc343","_rev":"1-9b6bd76aa16ca5e185ec4f622962748e","time":1486155395104,"temp":15},
{"_id":"b35c4054bcb1a9ba2b4c7e5a64bc9a3f","_rev":"1-7d78d5c5393b697dc6d40ba4302d0ba5","time":1486154644158,"temp":15},
{"_id":"b35c4054bcb1a9ba2b4c7e5a64bfcc78","_rev":"1-d3e2ba96acdbdf331a4e13e904a91194","time":1486154704679,"temp":15},
{"_id":"b35c4054bcb1a9ba2b4c7e5a64ce9bd9","_rev":"1-98d98c81f578d97ae3f6d910d69cb10b","time":1486154947876,"temp":15},
{"_id":"c6f6f38546325ccb4be45f634d3cd463","_rev":"1-cfc64d79f1e07dbfa5ccbf387aeeb30a","time":1486154765575,"temp":15},
{"_id":"c6f6f38546325ccb4be45f634d43d8fb","_rev":"1-aa3fcd04359a5e06dee46512c2c1fa47","time":1486154887868,"temp":15},
{"_id":"c6f6f38546325ccb4be45f634d5c3a9e","_rev":"1-60a48899bfaf3d7a214f38963d39fddd","time":1486155265598,"temp":15},
{"_id":"dfd1a36d4ad4b7eb8acd9f47987daf29","_rev":"1-d1f49550a1361c9844d07ed7b1b316b6","time":1486155010420,"temp":15},
{"_id":"e5d8cd63363bece3182ec5c492097577","_rev":"1-7f3ee772550d4c67c6ae2c1306669bd2","time":1486155074620,"temp":15},
{"_id":"e5d8cd63363bece3182ec5c4921e73ed","_rev":"1-bc1355f2a4ee46b9210e6337815c6437","time":1486155387100,"temp":15},
{"_id":"f5fe86659597c38185715790d7c9edc1","_rev":"1-67d3e8c092887f7ae7e5a6e17df2286b","time":1486154827500,"temp":15}]
```


   The temperature values are returned in a JSON array. You can use this data in web applications or analytical tools. As you inject more data in the IoT example in Node-RED, this dataset will expand to include that data.