# Watson Internet of Things Platform – Home Simulator

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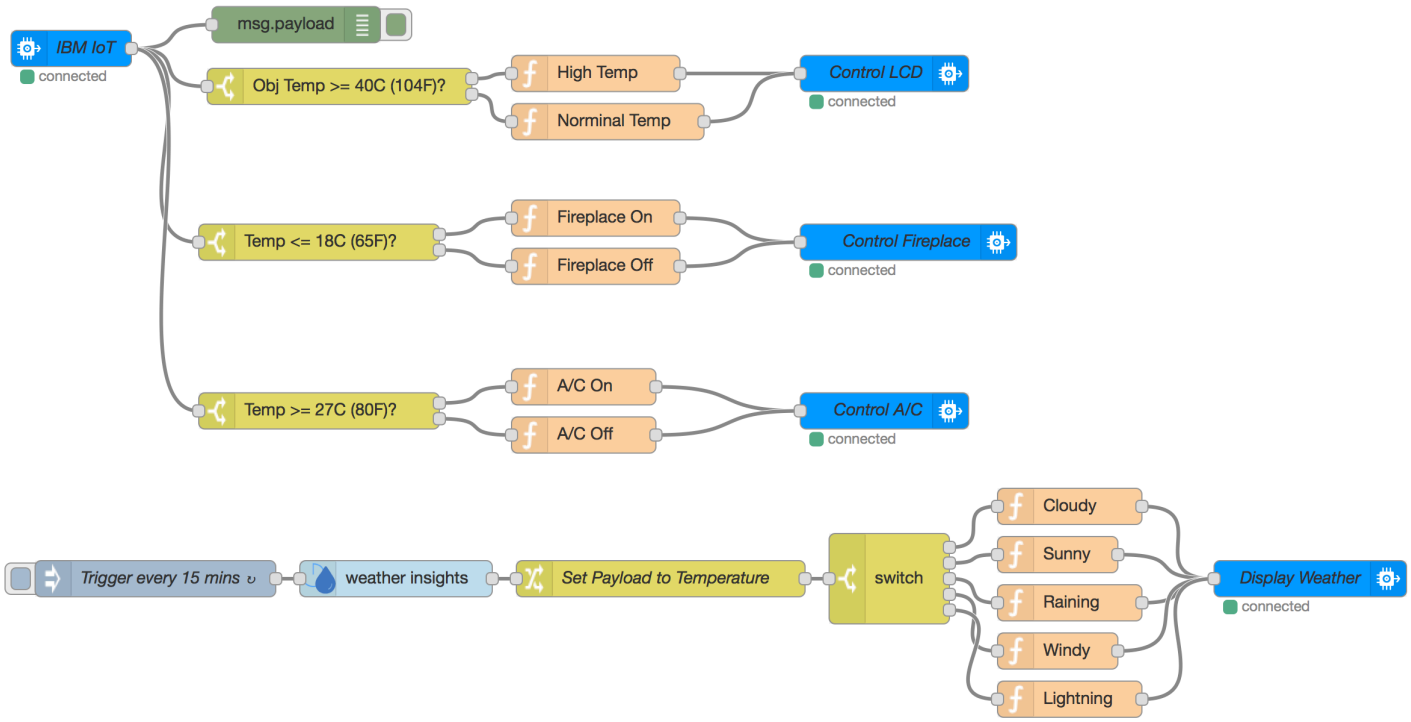


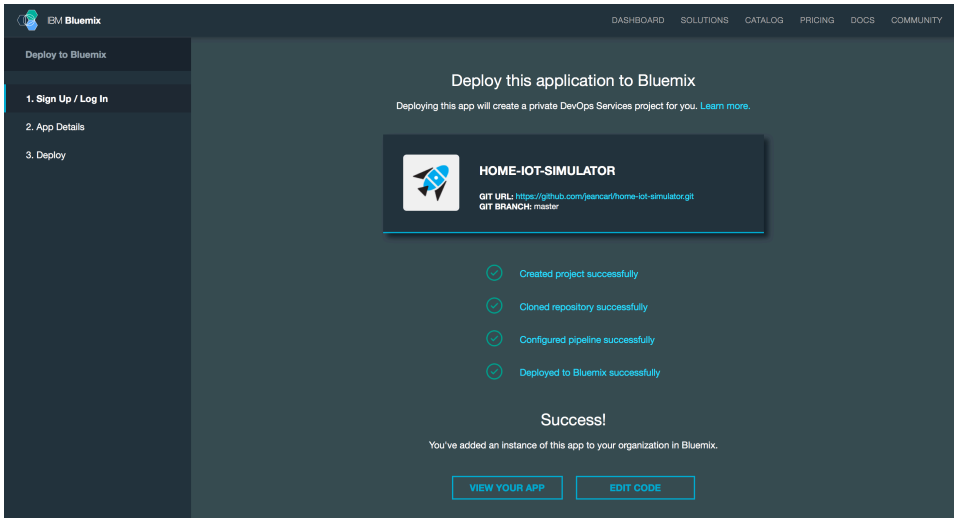

A digital copy of this lab and completed flows can be found at:
`http://ibm.biz/home-iot`

# Setting up an IoT application in IBM Bluemix

In this lab, we will deploy two applications in IBM Bluemix. The first will be a simulator which contains environment sensors, including temperature, humidity, and object temperature, and several devices tha `t will be commanded in different scenarios. With access to real hardware and sensors, such as a Raspberry Pi or the Intel Edison with Seeed Grove sensors, for example, this lab can be expanded and used in the real world environment.

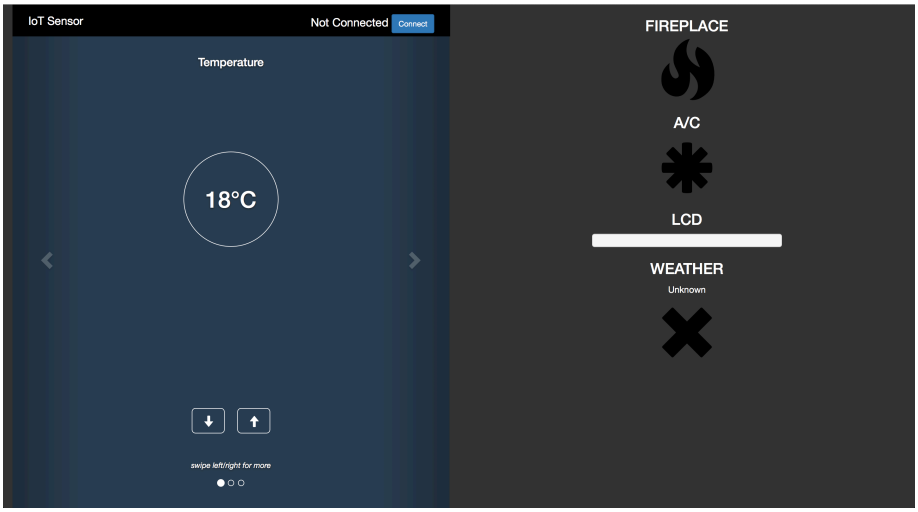
1. Deploy the simulator by visiting the following URL:
   `ibm.biz/home-iot-simulator`

2. Select an application name, a Bluemix region, organization, and space to deploy the simulator application. Once deployed, click on the **View Your App** button.




3. This application contains several simulated things that can be commanded via the Watson IoT Platform. There are three input sensors: temperature, humidity, and object temperature. You can increase and decrease the values by clicking on the up and down arrows. Later on, we'll simulate an unsafe temperature by increasing these values above a threshold.

   On the right side are several "things" we'll control, depending on the conditions:
   - a fireplace that can be turned on and off. The color of the fire can be set.
   - an air conditioner that can be turned on and off.
   - an LCD screen that can display messages. The text color and background color can also be set. A real world device might be a digital display on a refrigerator, a security system, or a thermostat, for example.
   - a Weather indicator. This thing has a weather icon and a temperature representing the current weather condition at a location.



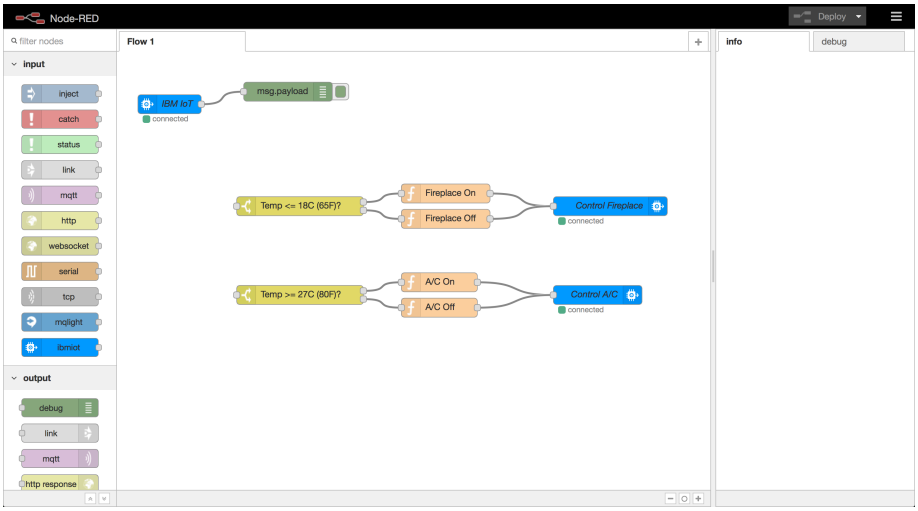

As you proceed through this lab, imagine other things that could be connected to your application and how these things can interact with each other.

Some things might have little to no processing power to keep costs down. We will create a Node-RED application in IBM Bluemix to control these devices. Node-RED is a visual interface of drag and drop nodes, written in the Node.js runtime. Node-RED makes it easy to connect together logic that takes various actions based on events.

4. Deploy the Node-RED application by visiting the following URL:
`ibm.biz/home-iot-application`

5. When the application is finished, click on **View Your App** at the bottom of the page. Click on the red **Go to your Node-RED flow editor**.

   On the left side is a list of nodes, each with a specified behavior. Some take inputs (grey knob of the left), some have outputs (grey knob on the right) and some have multiple grey knobs (called processing nodes). Connect the grey knob from one node to the next, in a left-to-right fashion to create what are called flows. On the right side are the info tab, which displays documentation on how to use a node when selected, and the debug tab which displays messages passed into debug nodes.



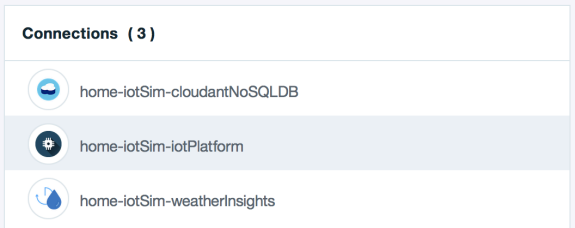

## TIP!

Keep the simulator and Node-RED editor open in separate browser tabs. You will be switching between the Node-RED editor and the simulator throughout this lab.

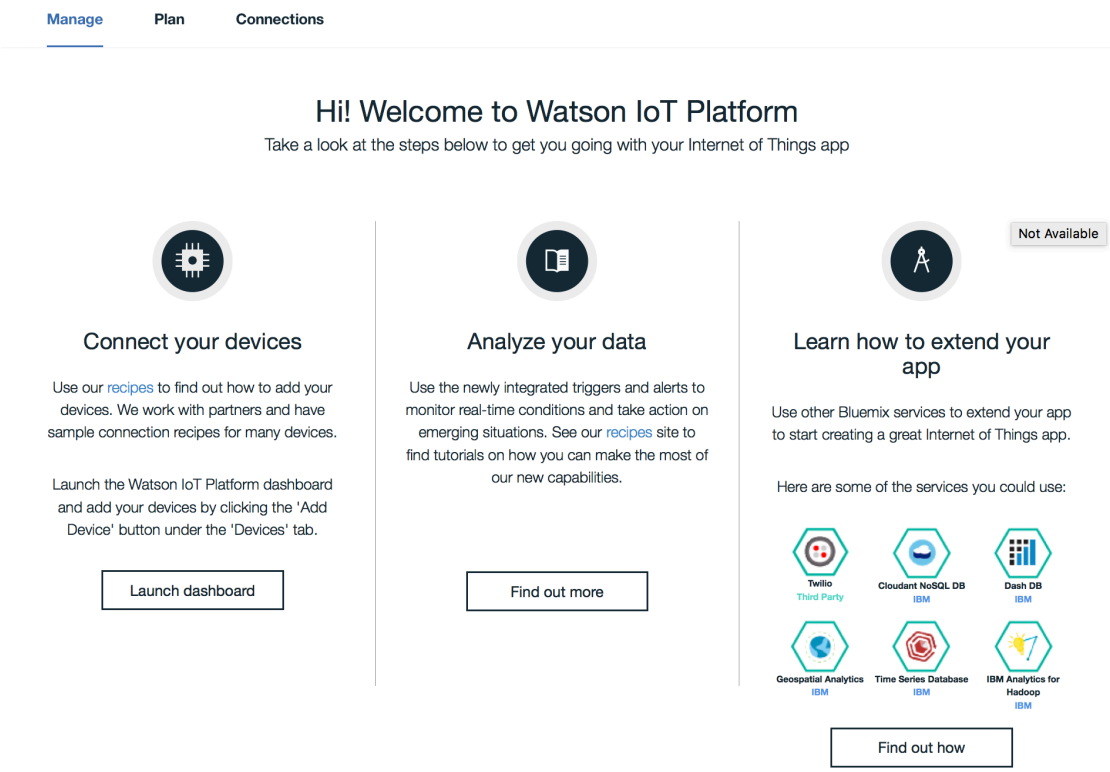
# Create a Device in Watson IBM IoT Platform

The Watson IoT Platform authenticates and manages things that connect to the Cloud. You can connect nearly anything that has Internet Connectivity and can communicate to the MQTT broker. In this section, we will create a device type and five devices that the simulator will use to connect to the Watson IoT Platform.

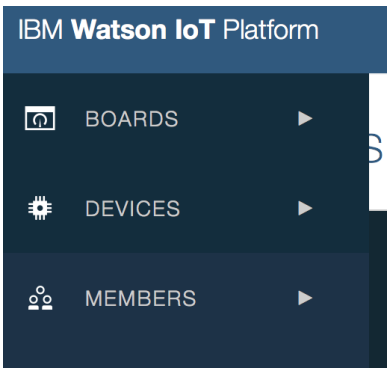
1. We'll start by accessing the Watson IoT Platform dashboard. In the IBM Bluemix dashboard, select your Node-RED application (the second application you deployed).
2. Under the **Connections** section, click on the **Internet of Things Platform (home-iotSim-iotPlatform)** service.




3. In the left column, click on **Launch Dashboard**.

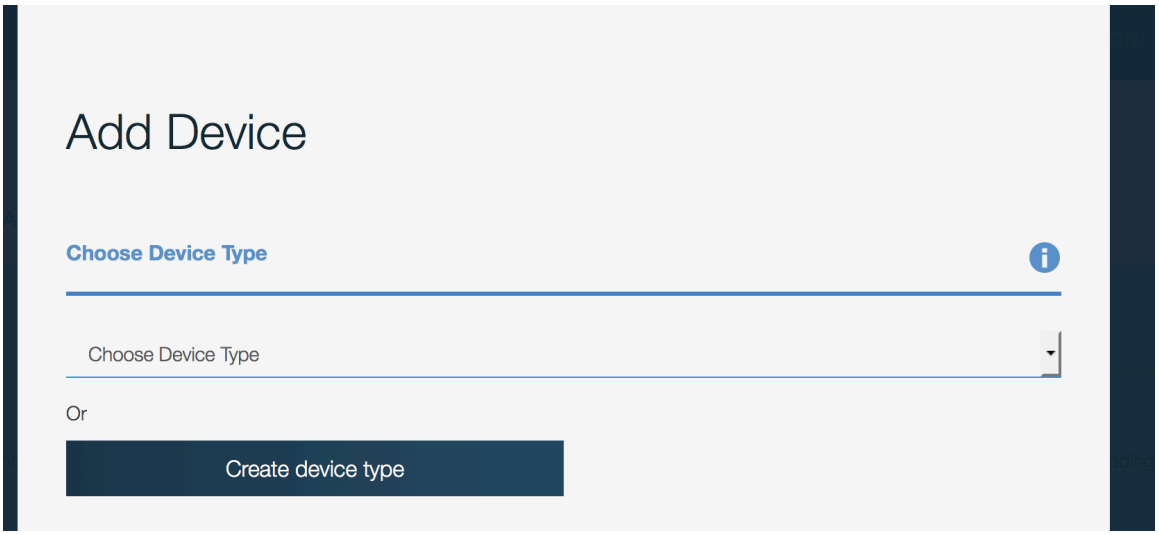


4. The Watson IoT Platform dashboard is where you can work with any registered devices that your organization has. Let's create a device type. Click on **Devices** in the left toolbar.

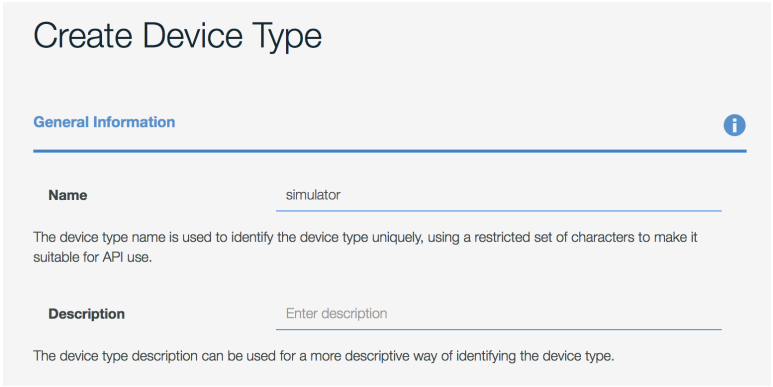



5. Click on the **Add Device** button on the right side.

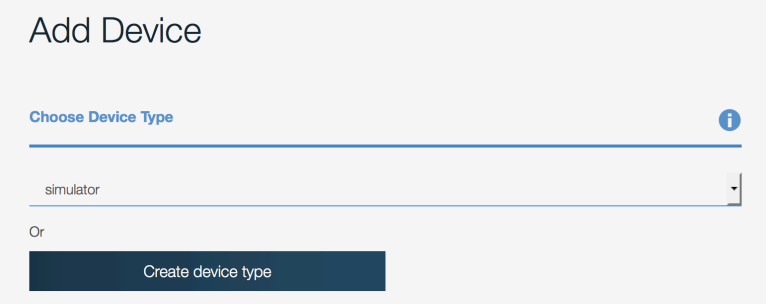

6. Click on **Create device type**.



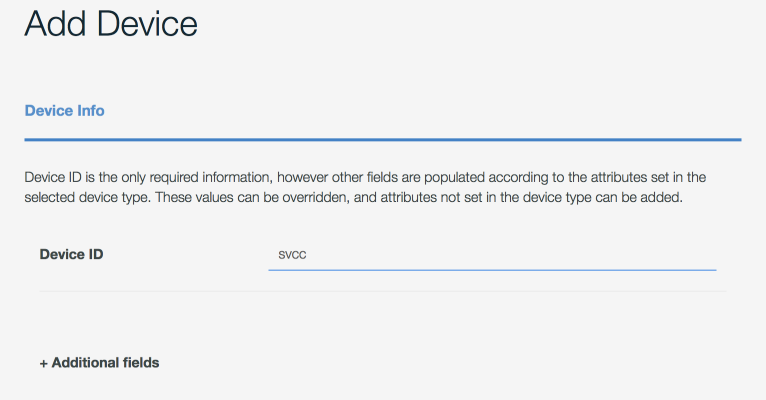

7. Select **Create device type** again.
8. A device type is a basically a label for a group of devices of the same type. Enter a device type name of `simulator`. Click on **Next** three times and **Create**.



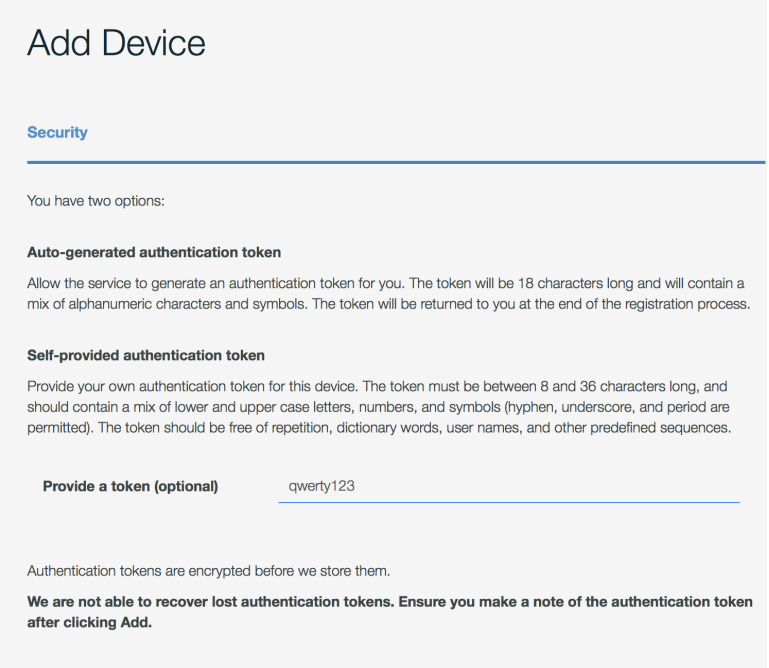
9. You will return back to the list of device types. Your new device type should be listed in the drop down. Click on **Next** to create a specific device of the device type `simulator`.



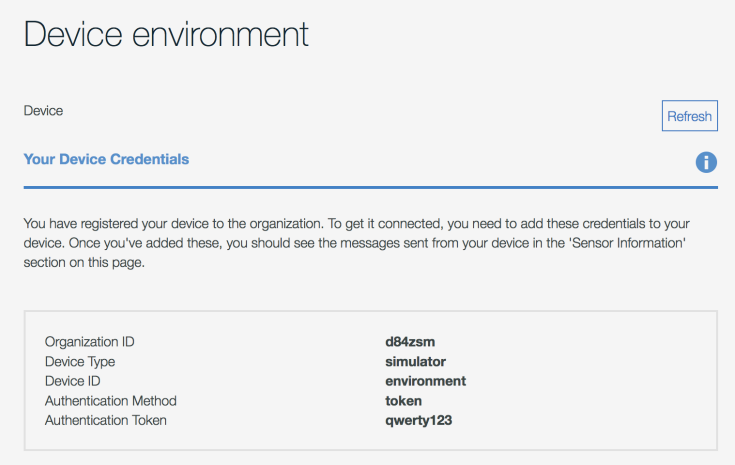

10. Enter a Device ID `environment`. This will create a device of type `simulator`, identified by the ID `environment`. Click **Next** twice until you get to the **Security** section.




11. Each device has a security token that the device must present to authenticate with the Watson IoT Platform. If you leave this blank, a randomized token will be generated. For simplicity, choose a token you can remember. Click **Next** and **Add** on the following screens.

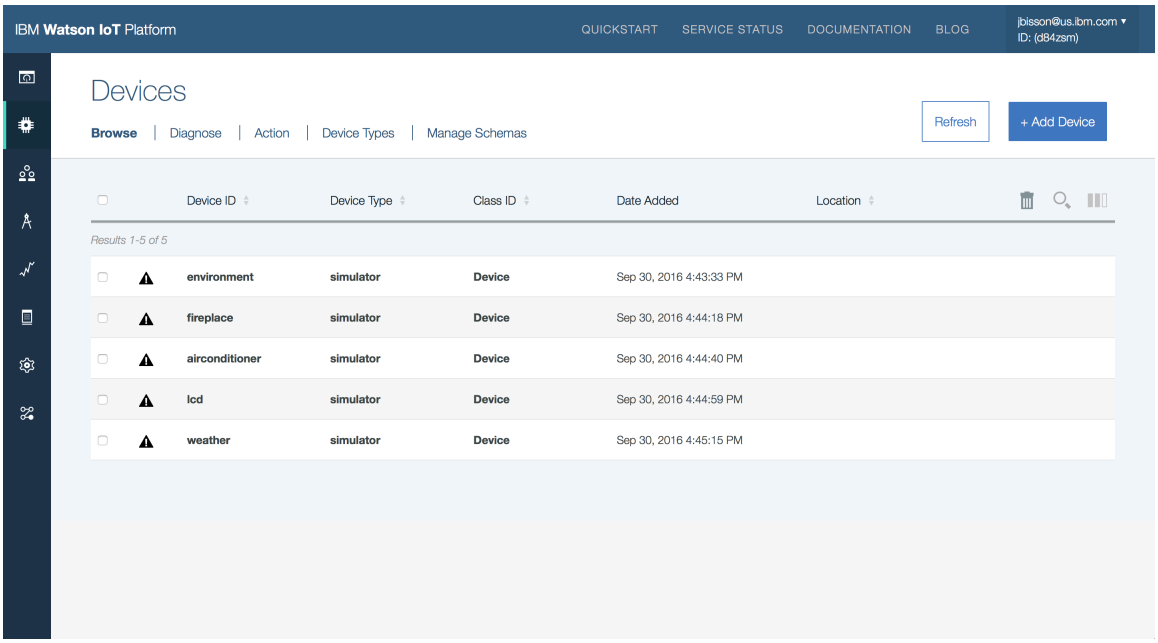


12. The summary of credentials is displayed on the last screen. Copy these values as the Authentication Token cannot be retrieved again.




13. Repeat steps #9 to #12 to create devices with IDs of:
    - `fireplace`
    - `airconditioner`
    - `lcd`
    - `weather`

    The device list in the Watson IoT Platform dashboard should look like the one shown below:




## TIP!

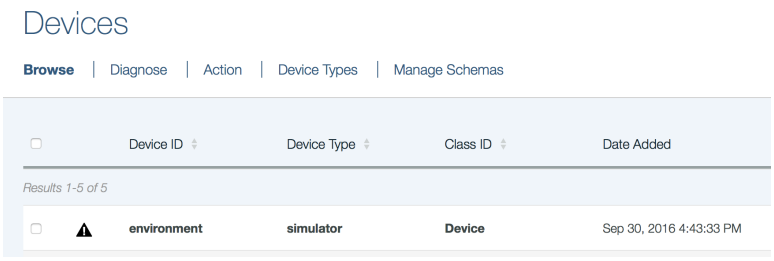
Keep the Watson IoT Platform dashboard open. In the next section you will look at the sensor data coming in.

# Connect Simulator

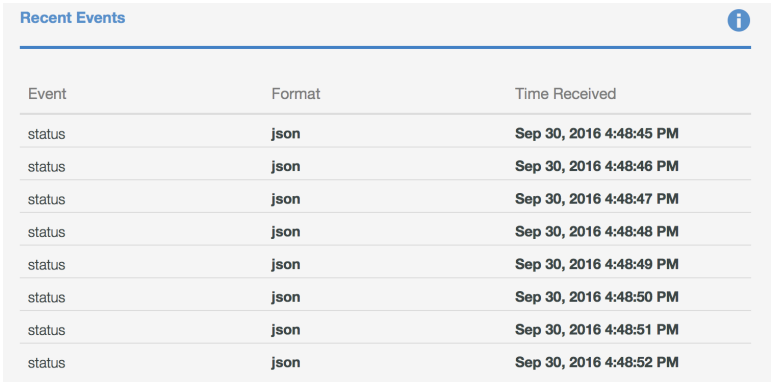
Now that we have the devices registered, we'll connect the simulator to use these devices.

1. Return to the simulator application and click on the **Connect** button above the Environment sensors.

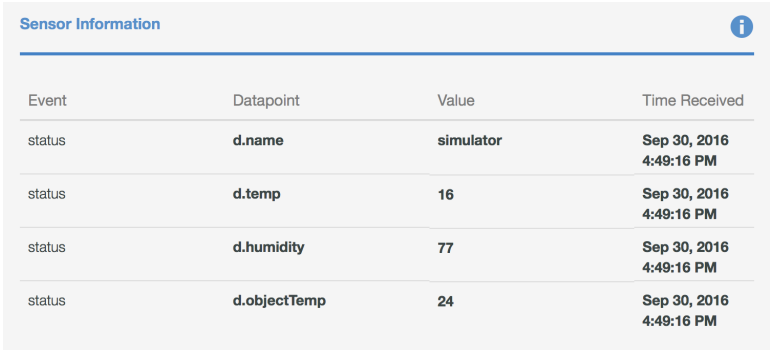

2. In the Watson IoT Platform dashboard, click on the device with the ID `environment` in the list of devices.




3. You can see the events that are being emitted by the simulator under the **Recent Events** section.

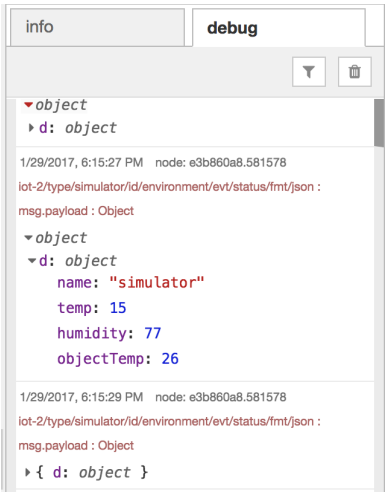



4. You can also see the sensor values that are being emitted by the simulator under the **Sensor Information** section.



5. Switch to the Node-RED application. The 

node has been configured to subscribe to device events from this device. Select the **Debug** tab on the right side of the editor. When the simulator sends a device event to the Watson IoT Platform, the Node-RED application receives these events. The debug node displays the event in the Debug tab. We'll use these values in the next section.

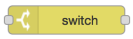



# TIP!

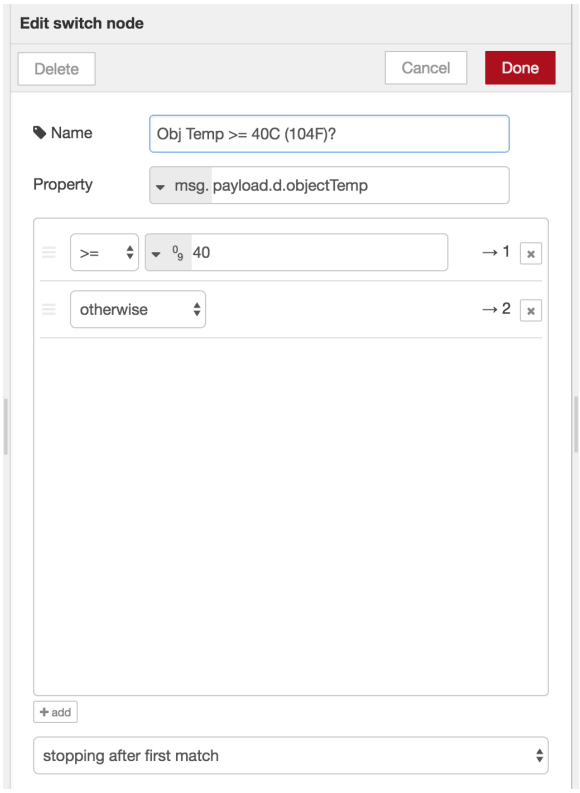
Keep the simulator and Node-RED editor open in separate browser tabs. You will be switching between the Node-RED editor and the simulator throughout this lab.

# Display a Warning On LCD Screen

In this section, we'll use the simulated LCD screen. An LCD screen can be used to show a notification to someone nearby the device. For example, imagine this LCD screen is placed in the front display of a connected refrigerator, warning of a high temperature which could spoil food.

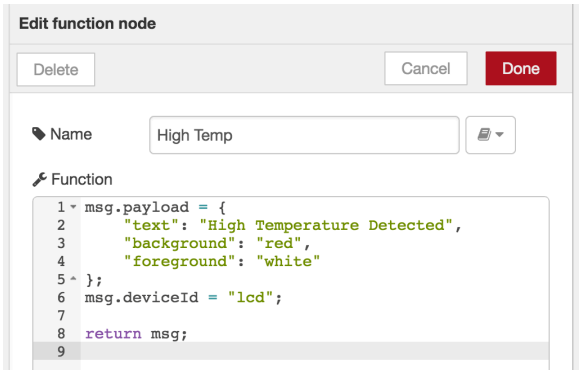
1. Add a 

node as shown below.




2. For the case when the temperature is too high, add a 

node that constructs a message for the LCD screen we will command.



The LCD in the simulator responds to an IoT command in the following format:

```
{
        "text": "High Temperature Detected",
        "background": "red",
        "foreground": "white"
}
```

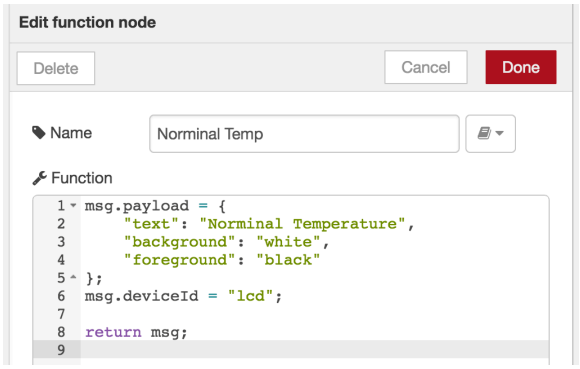
`text`
: the text can be a multiline message (lines can be separated by a new-line character, \n).

`background`
: the color of the background (a hexadecimal value like #000000, or an HTML named color*)*

`foreground`
: the color of the text (a hexadecimal value like #000000, or an HTML named color*)*

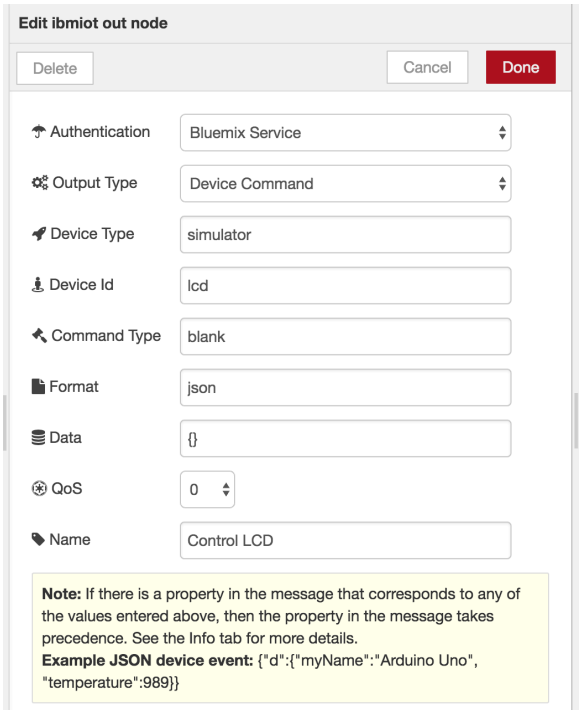
3. For the case when the temperature is normal, add a 

node that constructs a nominal message for the LCD screen we will command.

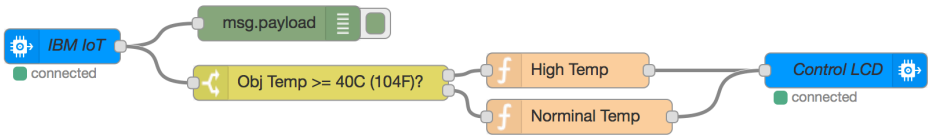



4. Send this command via a 

node to the device ID `lcd` as shown below.



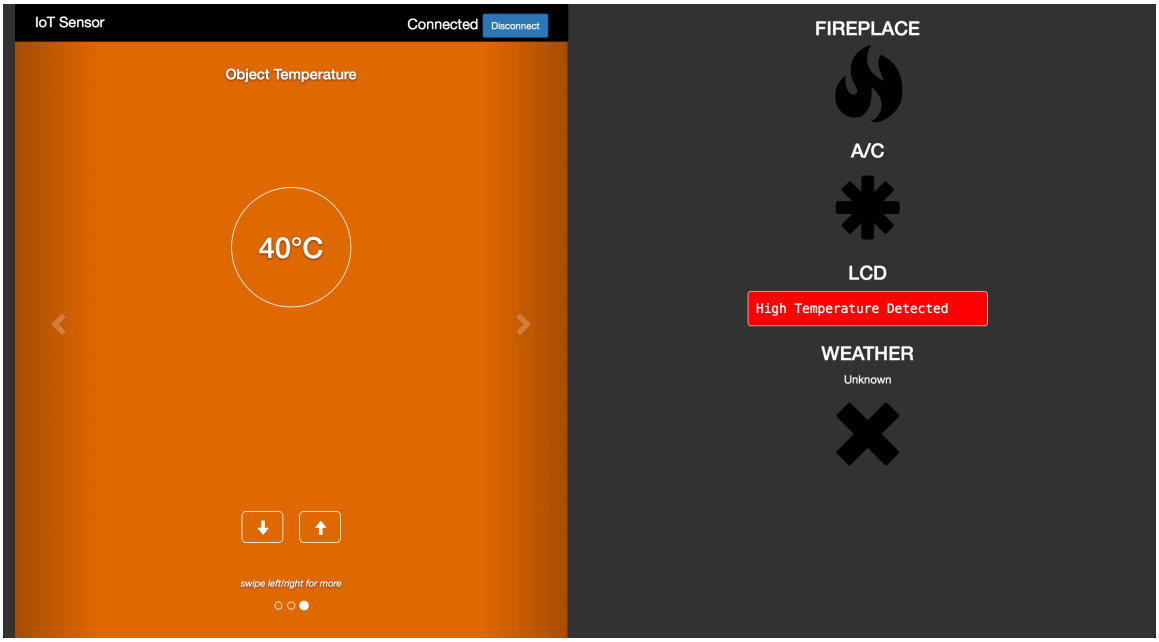
5. Connect the nodes together as shown below.




6. Click on 

in the top-right corner to save and deploy your changes.

7. Return to the simulator and increase the object temperature (the third environment sensor) to a value greater than or equal to 40°C. The LCD screen changes and displays a warning.



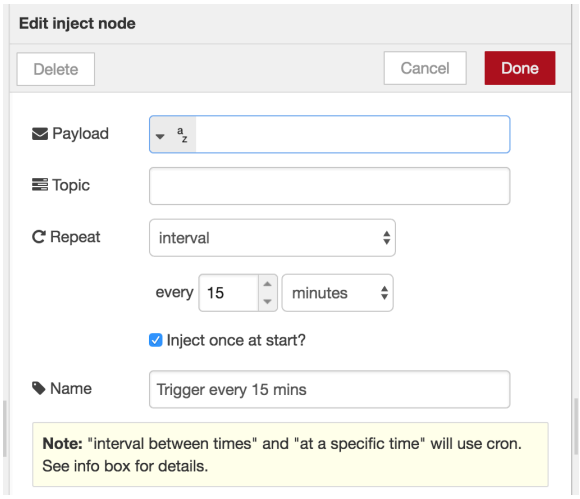
# Weather Company Data for IBM Bluemix

The Weather Company Data for IBM Bluemix API provides access to a variety of weather data for over two million locations worldwide. In this section, we'll retrieve the weather observation for a specified location and command the simulator to display the weather condition.

Using weather could be useful when deciding if our application should turn on an air conditioner or if it would be more efficient to open a window or an air vent.

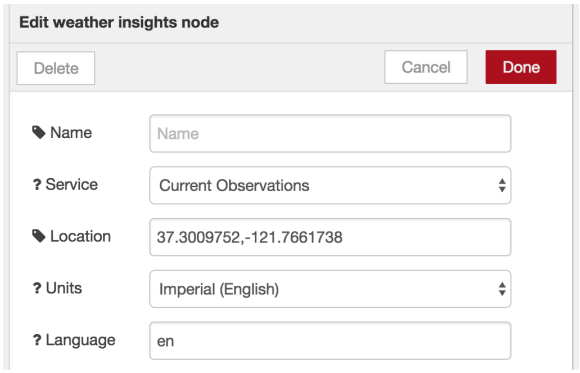
1. Add a 

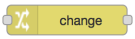
node as shown below. This node will trigger this flow every fifteen minutes.



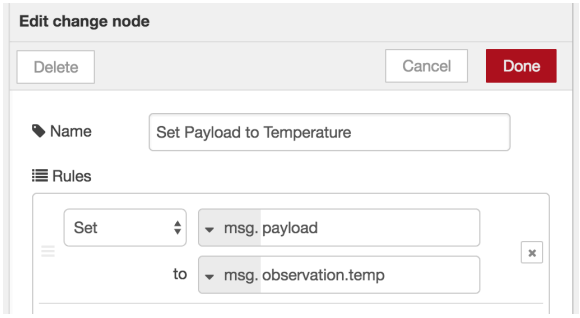

2. Add a 

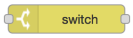
node as shown below.



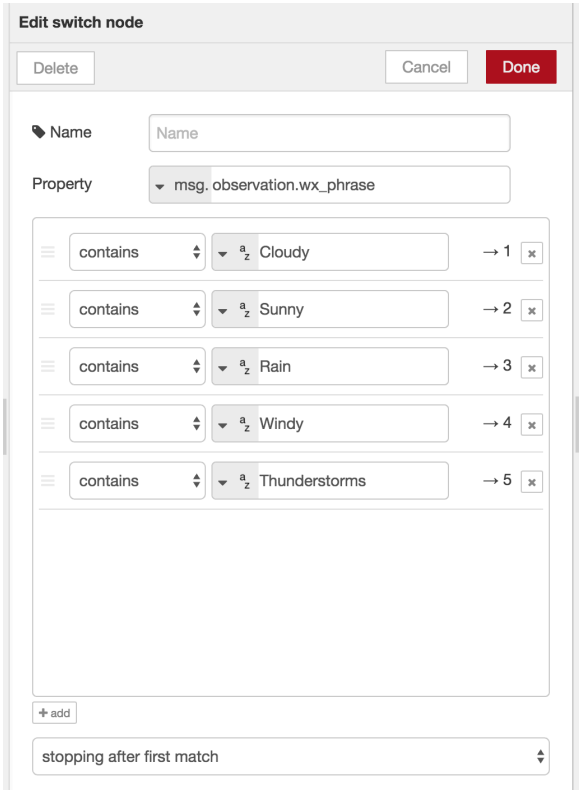

3. Add a 

node to set the `msg.payload` to the temperature value from the weather observation.



4. Add a 

node to test the weather phrase for cloudy, sunny, raining, windy, or lightning.




5. The Weather indicator in the simulator responds to an IoT command in the following format:

```
{
    "text": "Cloudy "+msg.payload+"*F",
    "condition": "cloudy",
    "color": "#C0C0C0"
}
```

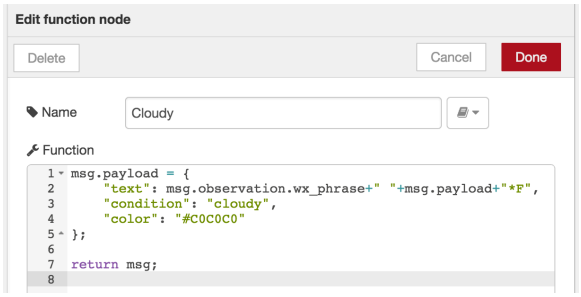
`text`
: the weather condition to be displayed above weather icon.

`condition`
: one of the following conditions that are associated with weather icons in the simulator:
cloudy, sunny, raining, windy, lightning

`color`
: the color of the weather icon (a hexadecimal value like #000000, or an HTML named color*)*

6. Add five 

nodes to set values for the command we'll send to the simulator.

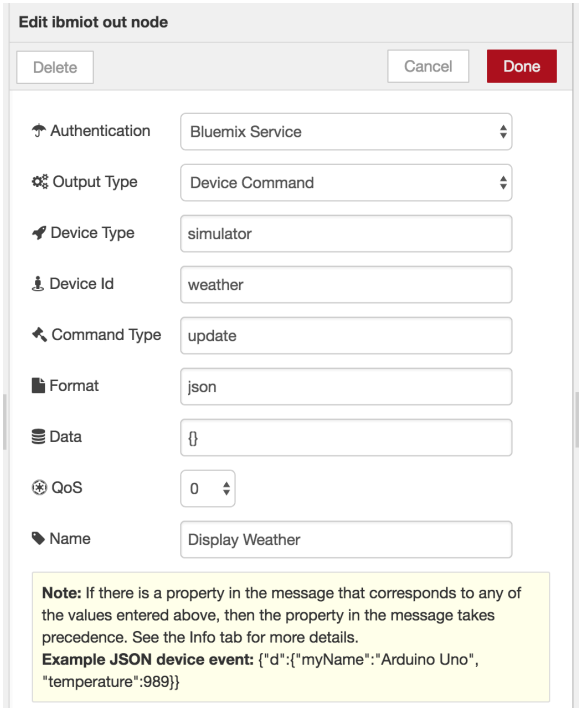




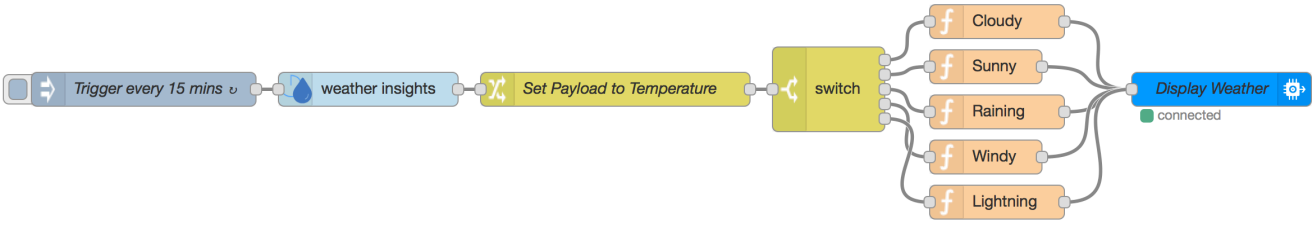


7. Add a 

node as shown below. This node will command the weather device to display the current observation.



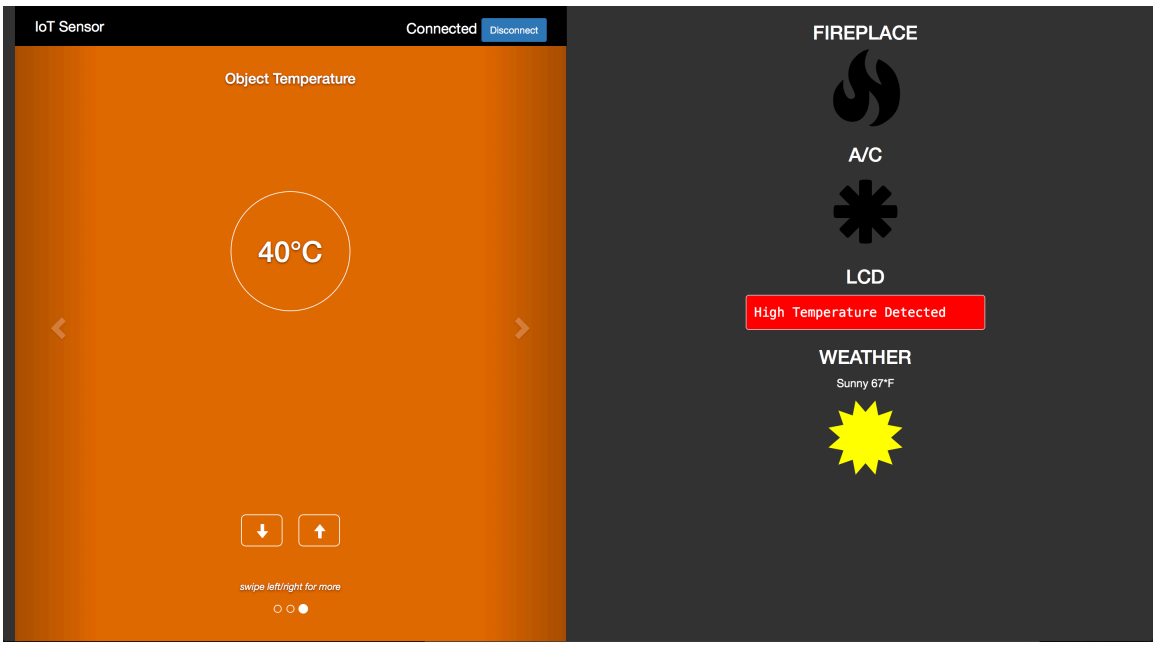

8. Connect the nodes together as shown below.




9. Click on 

in the top-right corner to save and deploy your changes.

10. Every 15 minutes, the inject node will trigger the flow to get the updated weather observation and send an IoT command to the simulator to update the weather indicator.



# Controlling Fireplace / Air Conditioner

With an ecosystem of connected Internet of Things, it becomes possible to have things interact with each other automatically and make decisions on what state the things should be in. In this section, we will use the temperature value from the environment sensors to control the fireplace when it is colder, and control the air conditioner when it is hotter.

The fireplace in the simulator responds to an IoT command in the following format:

Command: `turnOn` or `turnOff`
Payload:

```
{
        "color": "#FFFFFF"
}
```

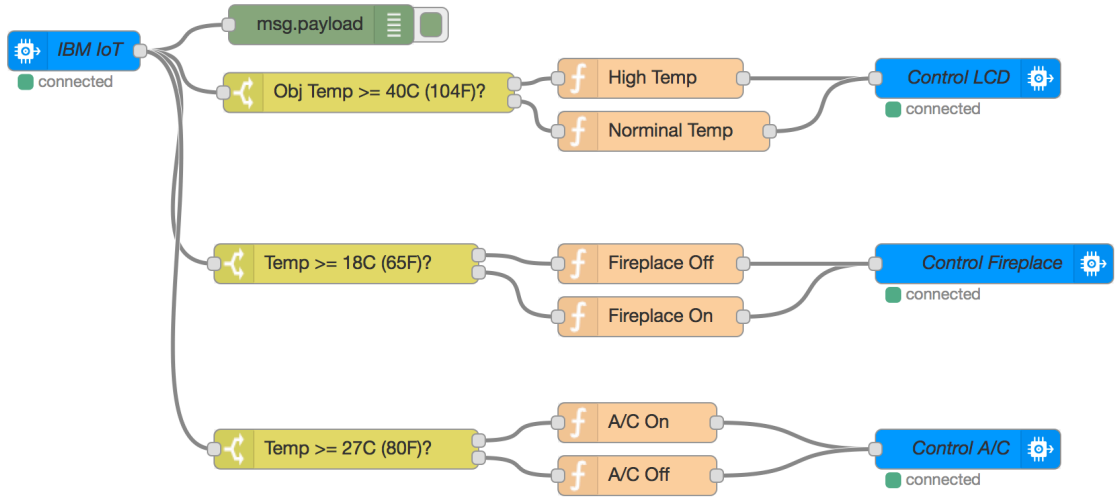
`color`
: the color (a hexadecimal value like #000000, or an HTML named color like yellow) of the flame (yes, it's a fancy fireplace), if the command is turnOn. Ignored if command is turnOff.

The air conditioner in the simulator responds to an IoT command in the following format:

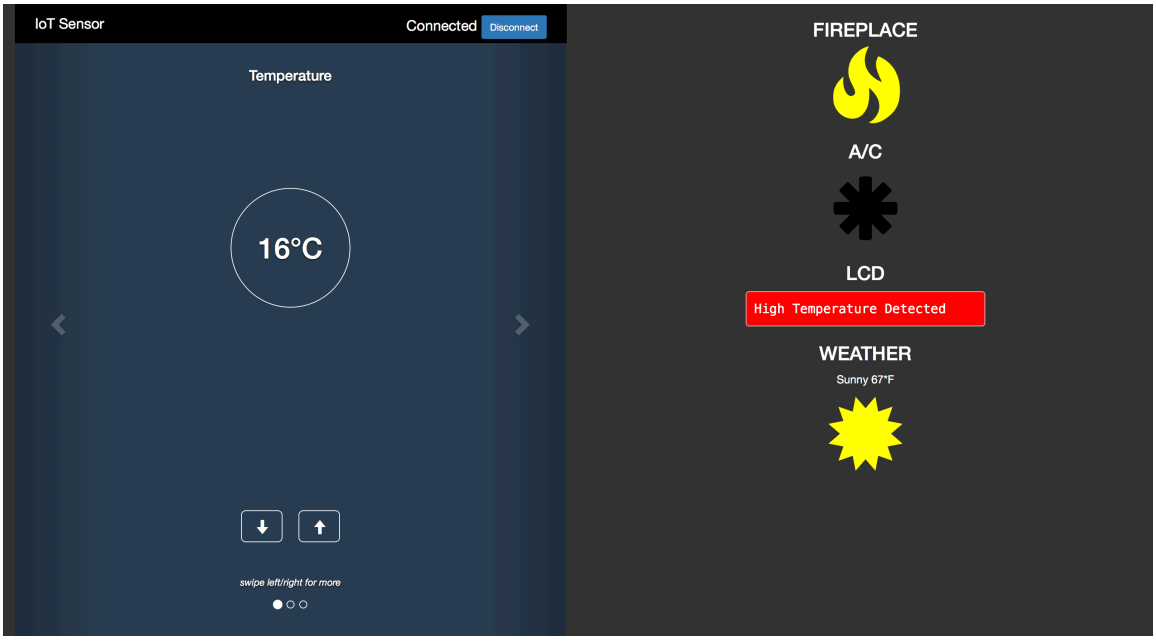
Command: `turnOn` or `turnOff`
Payload: `(empty object)`

```
{
}
```

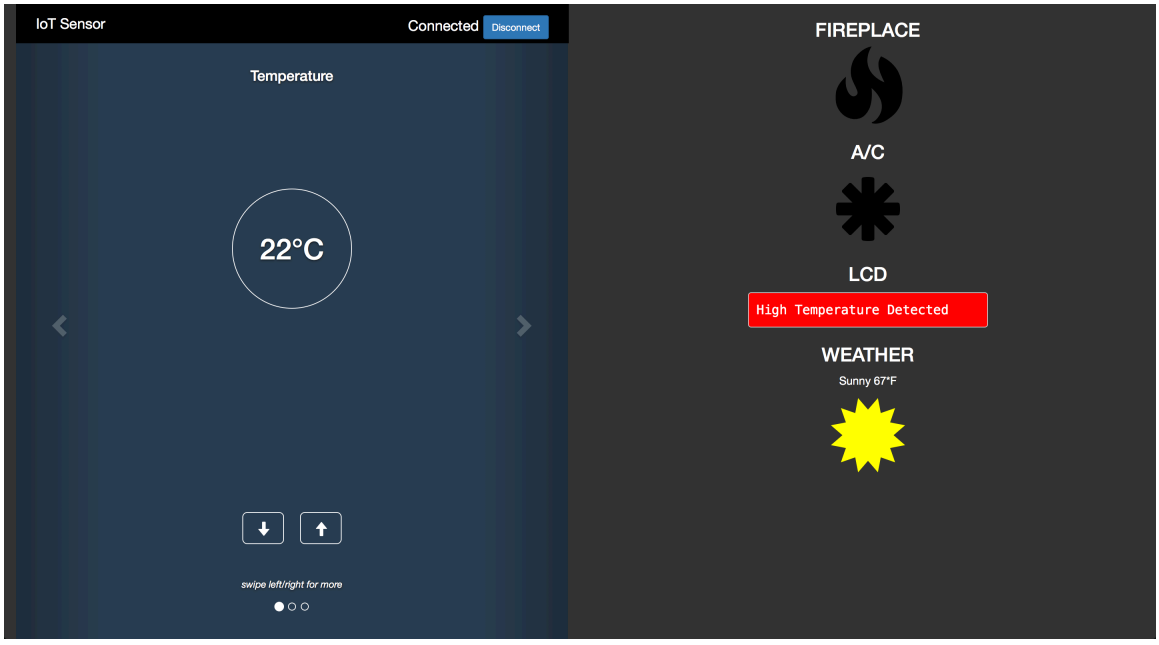
1. The two flows are already in the Node-RED editor. Connect the nodes together as shown below.



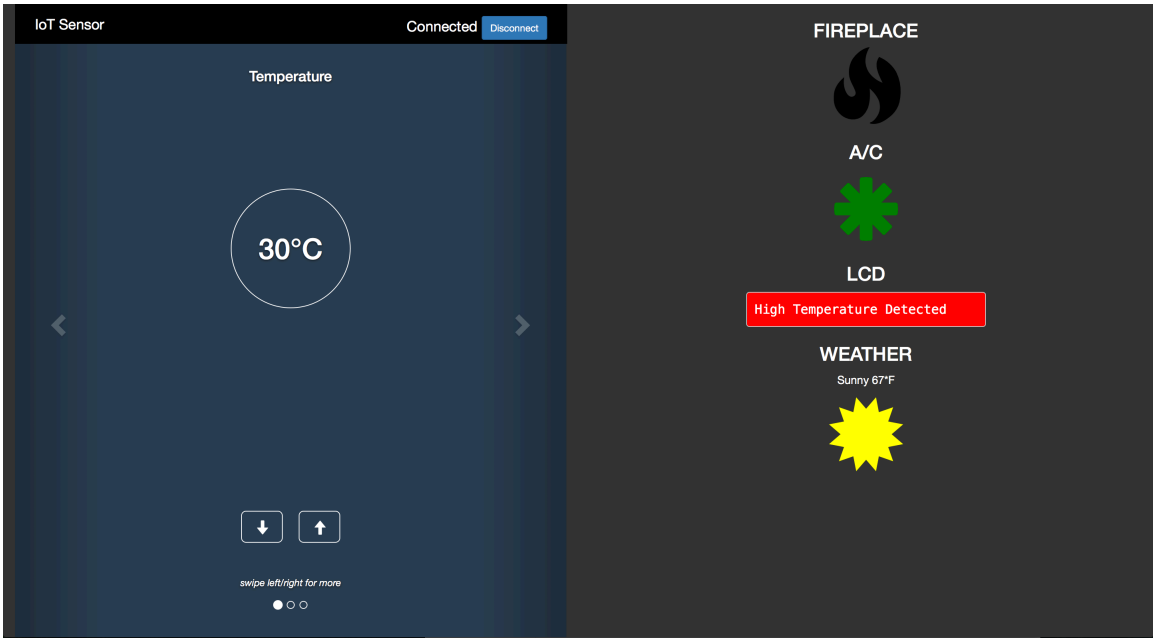
2. Click on Deploy in the top-right corner to save and deploy your changes.
3. Return to the simulator and decrease the temperature to 16°C. Brrr! The fireplace turns on.




4. Increase the temperature to 22°C. The fireplace turns off.



5. Increase the temperature to 30°C. The air conditioner turns on.



# Additional Resources

Using a simulator can help reduce costs in developing IoT solutions and help to refine the concept. Try commanding the things based on new factors. There is also a humidity environment sensor in the simulator. What can you control with high or low humidity? The Weather Company Data API makes available a variety of other weather conditions, such as wind speed, and the sunrise and sunset times. Turn on the fireplace at sunset.

If you're interested in connecting real sensors, disconnect the simulator and connect real sensors to the Watson IoT Platform. The Node-RED application can be used and modified without the simulator. For more information, please refer to the lab **Tracking Temperature with Intel Edison and Grove Sensors**, available at `ibm.biz/lab-temperature-sensor-with-intel-edison` and `ibm.com/iot`.

## Twilio and Twitter

You can also use Twilio and Twitter to send notifications. Node-RED has nodes to interact with these services. Please refer to the lab **Tracking Temperature with Intel Edison and Grove Sensors**, available at `ibm.biz/lab-temperature-sensor-with-intel-edison`.

## DeveloperWorks Recipes

Interested in more IoT. Check out IBM DeveloperWorks recipes that show tutorials on using Internet of Things in the real world. Please visit `developer.ibm.com/recipes` for more information.

## Watson

Watson isn't just IoT. Analyze unstructured data from other sources using the suite of Cognitive APIs. Please visit `ibm.com/watson` and `github.com/watson-developer-cloud` for more information.

## Node-RED

Node-RED is an open-source community project. Check out the other nodes and flows the community has developed and join the community to help make Node-RED even better. Please visit `nodered.org` for more information.