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Hands-on Lab: 2234

Integrating IBM Watson IoT Platform and IBM Blockchain

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Download Lab Instructions From

http://ibm.biz/iciotlab

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Overview

IBM Watson IoT Platform enables IoT devices to send data to private blockchain ledgers for inclusion in shared transactions with tamper-resistant records. Blockchain's distributed replication allows your business partners to access and supply IoT data without the need for central control and management.

All business partners can verify each transaction, preventing disputes and ensuring each partner is held accountable for their individual roles in the overall transaction.

Integrate Watson IoT Platform with Blockchain:

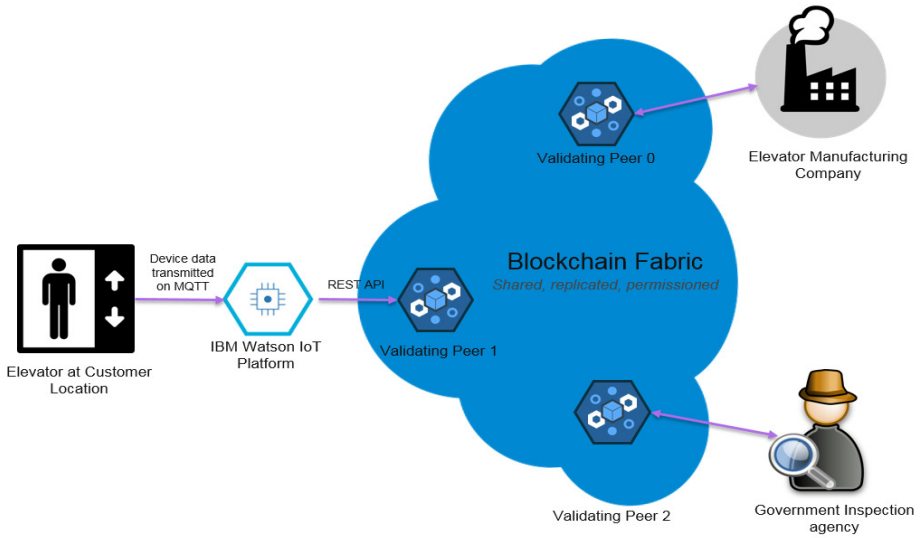
The Watson IoT Platform has a built-in capability that lets you add selected IoT data to a private blockchain. The protected data is shared among only the business partners involved with the transaction.

IBM Blockchain provides the private blockchain infrastructure of distributed peers that replicates the device data and validates the transaction through secure contracts. IBM Watson IoT Platform translates existing device data, from one or more device types, into the format needed by the Blockchain contract APIs. The Blockchain contract doesn't need to know the specifics of your device data. Watson IoT Platform filters device events and sends only the required data to the contract.

Hands on Lab overview:

In this hands-on lab, you will create a Blockchain network for an elevator manufacturing company. The company allows its customers and government agencies to participate in this Blockchain network. The elevator manufacturing company installs elevators at their customer location and configures the elevator device data to be sent into IBM Blockchain using the IBM Watson IoT Platform. Once the data reaches Blockchain it cannot be changed.

Elevator manufacturer can use this data for customer service and detecting any malfunctions. The Government agencies can use the data in blockchain for inspection and security compliance. None of the parties have to request data from each other and the data is available in unchangeable format in the Blockchain network.



If you require assistance during the lab, please ask an instructor.

Section 1: Setup IBM Bluemix

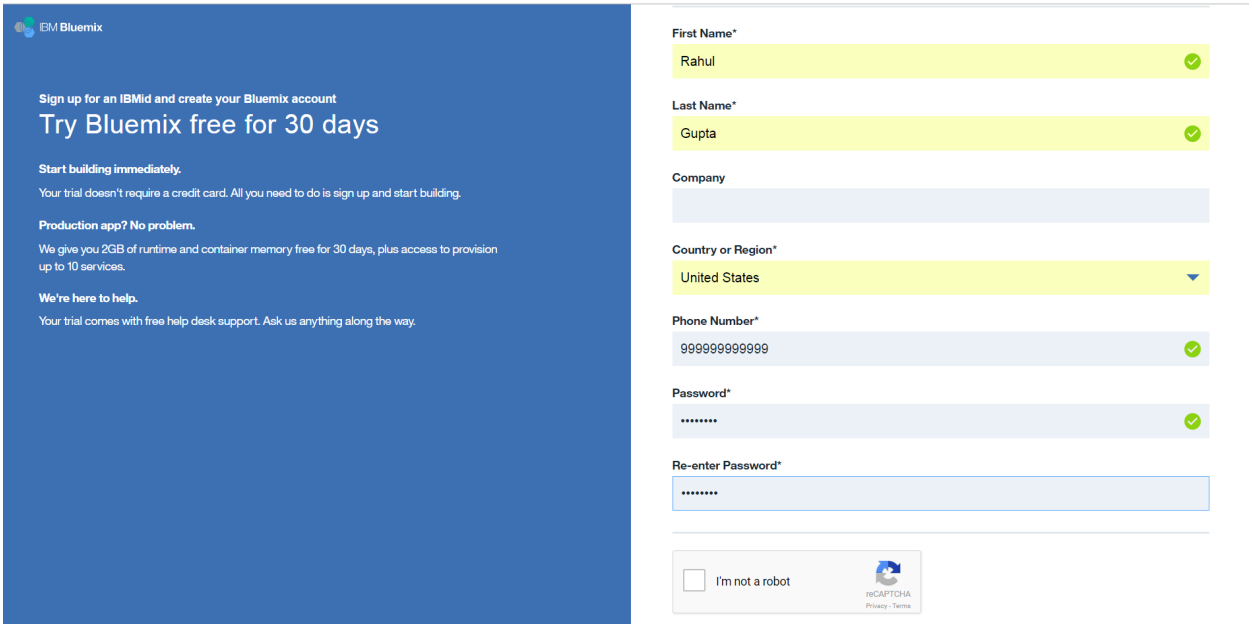
Signup for Bluemix: New User

- This lab requires a IBM Bluemix account. If you don't have access to IBM Bluemix already, you can register for a 30-day free trial at the following URL:

  https://console.ng.bluemix.net/registration

- Fill all the details and then click on ***Create Account*** to complete the registration process. Check your email inbox to complete the registration as shown in figure below.

Note: Please check the Junk folder if you don't see email from ***The Bluemix Team*** in your email inbox.

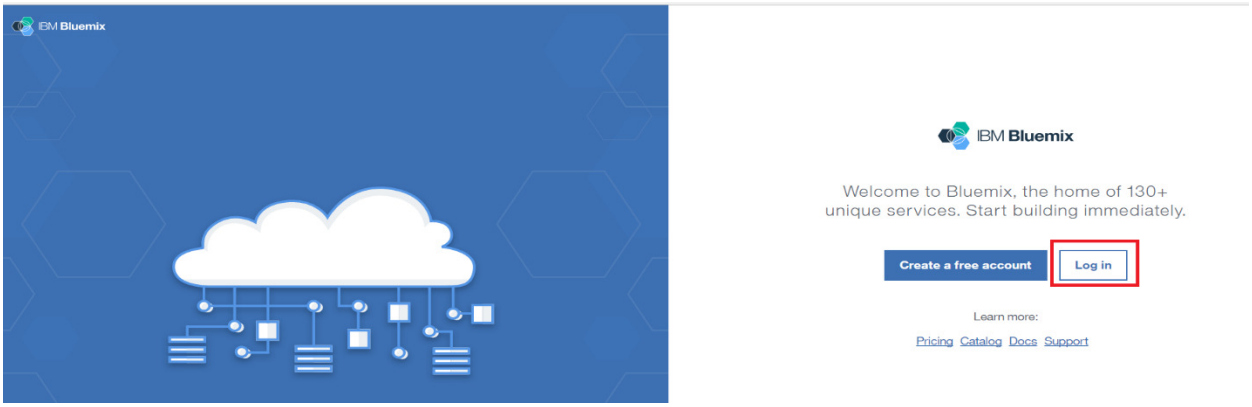


Log-In Bluemix: New and existing users

- If you already have a IBM Bluemix account, you can directly login using the URL below:

https://console.ng.bluemix.net/

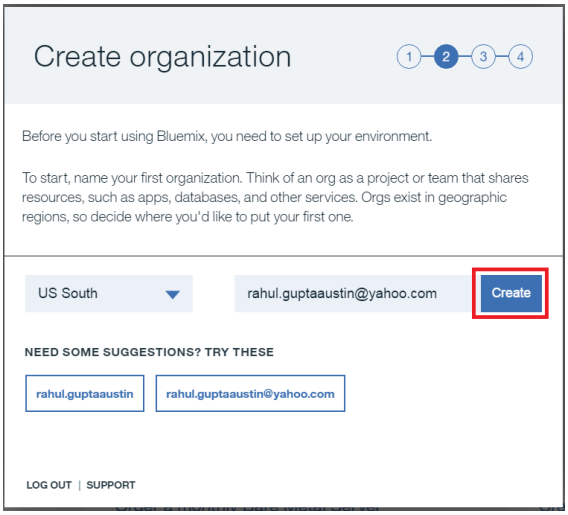
- Click on the **Log-In** button to login.



Create Bluemix organization: New user

- Once you have logged into IBM Bluemix create a Bluemix organization following the steps in the image below. Create an organization with your Bluemix account email id.

Note: *Existing Bluemix users can ignore this step*

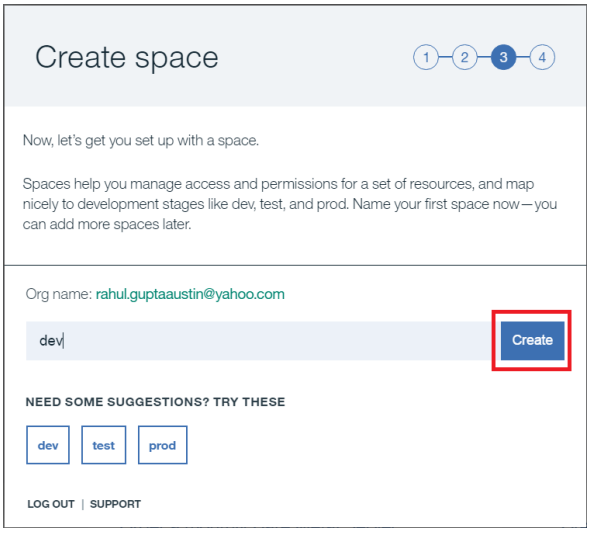


An organization is the highest concept. When you create an Dashboard will be opened *IBM Bluemix account you get your own "organization". You can invite others to your organization, can get invited to join other organizations or create organizations.*

Create Bluemix space: New user

- Create a space with name **dev**

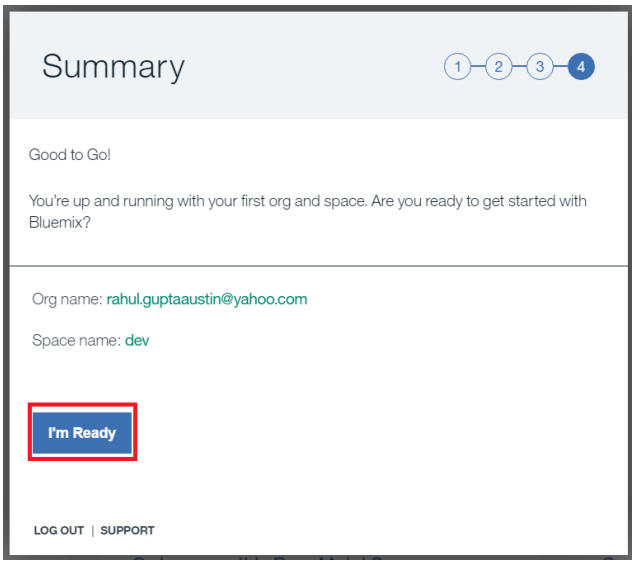
Note: *Existing Bluemix users can ignore this step*



Spaces are used to group related applications and services together. There can be multiple spaces within an organization. When an application or service is created they are assigned a specific space.

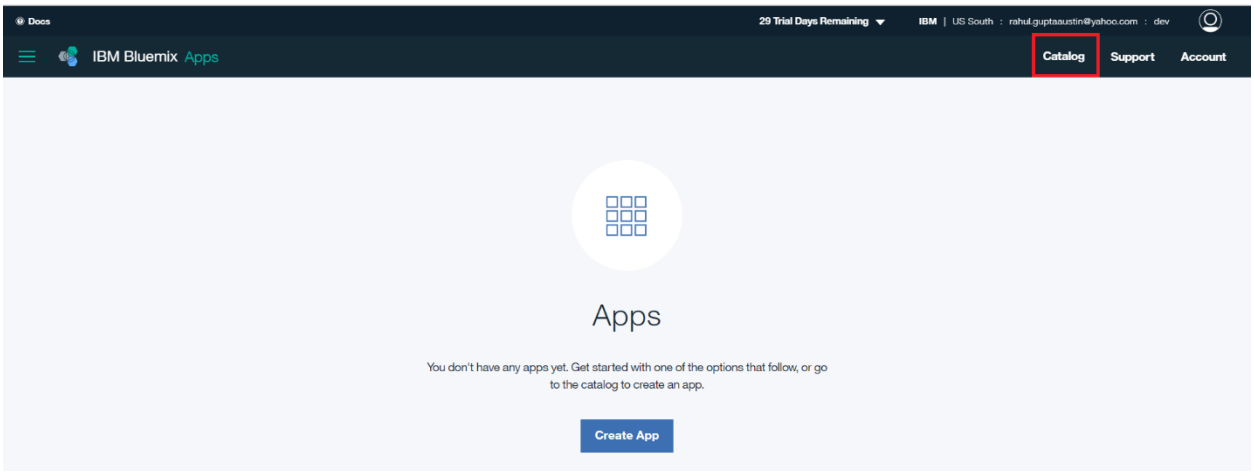
Complete creation of Bluemix organization and space: New user

- This step completes the setup of Bluemix organization and space. You can now proceed with creation of IBM Watson IoT Platform and IBM Blockchain services in the next step.

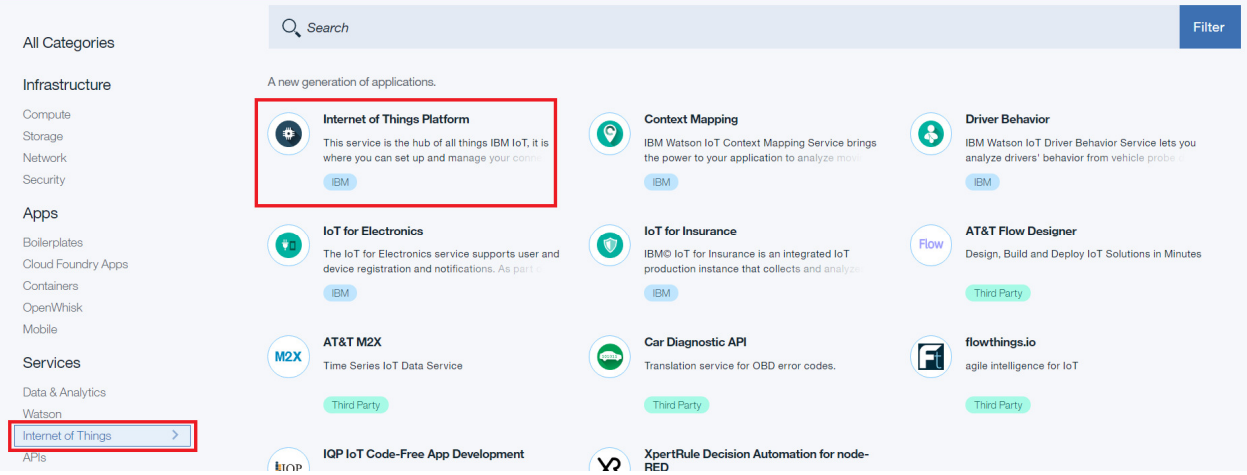


Create IBM Watson IoT Platform Organization

- Once you have logged in IBM Bluemix, click on the **Catalog** to browse the different services offered in IBM Bluemix platform.

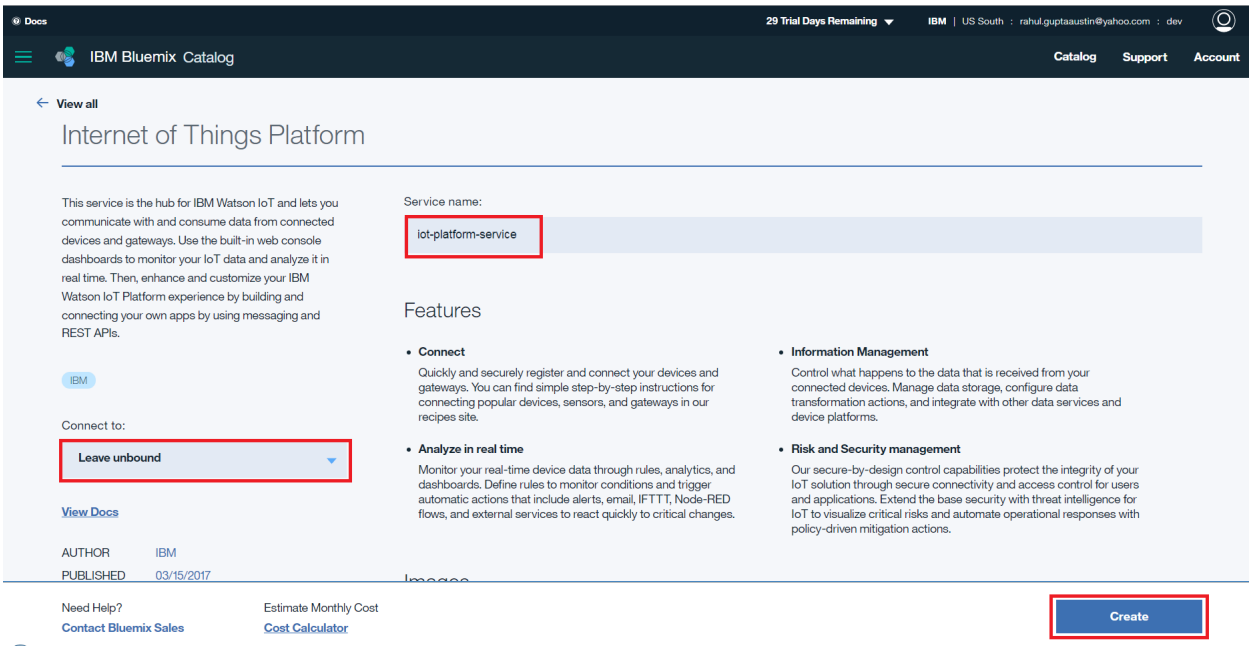


- In the services catalog select **Internet of Things** in the left menu and then click on **Internet of Things Platform** service

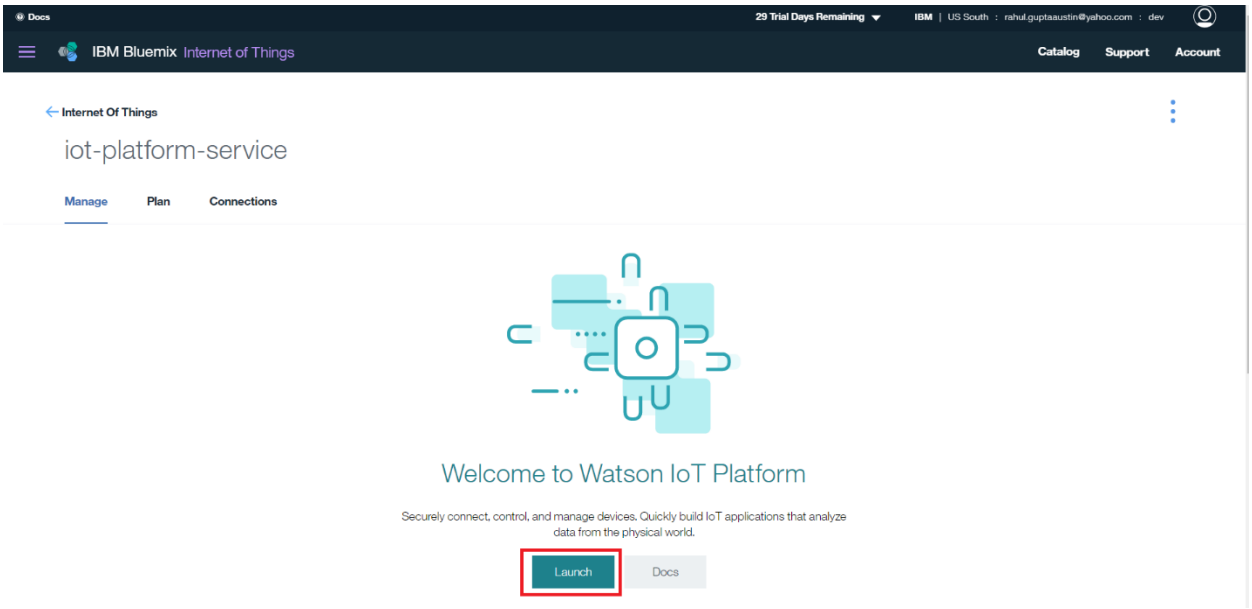


- To create the IBM Watson Internet of Things Platform service, enter following details or something easier which could be remembered:
  - **Service Name:** *iot-platform-service*
  - **Pricing Plans –** *Lite*

- Click on the **Create** button the create a new instance of IBM Watson IoT Platform service in your IBM Bluemix space.



- Once the service is created you can launch the IBM Watson IoT Platform dashboard by clicking the **Launch** button.

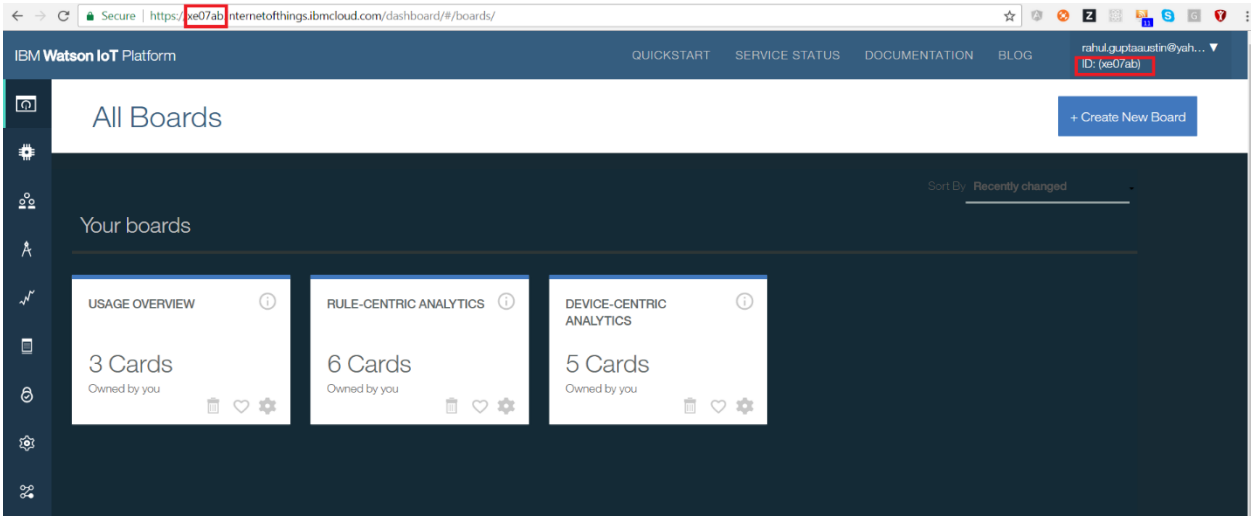


- Watson IoT Dashboard will open in a new browser tab. Familiarize yourself with the dashboard and specifically the IoT Platform organization ID.

Note: The Watson IoT Platform organization ID is different from the IBM Bluemix organization ID

- Copy the Organization ID in a notepad.

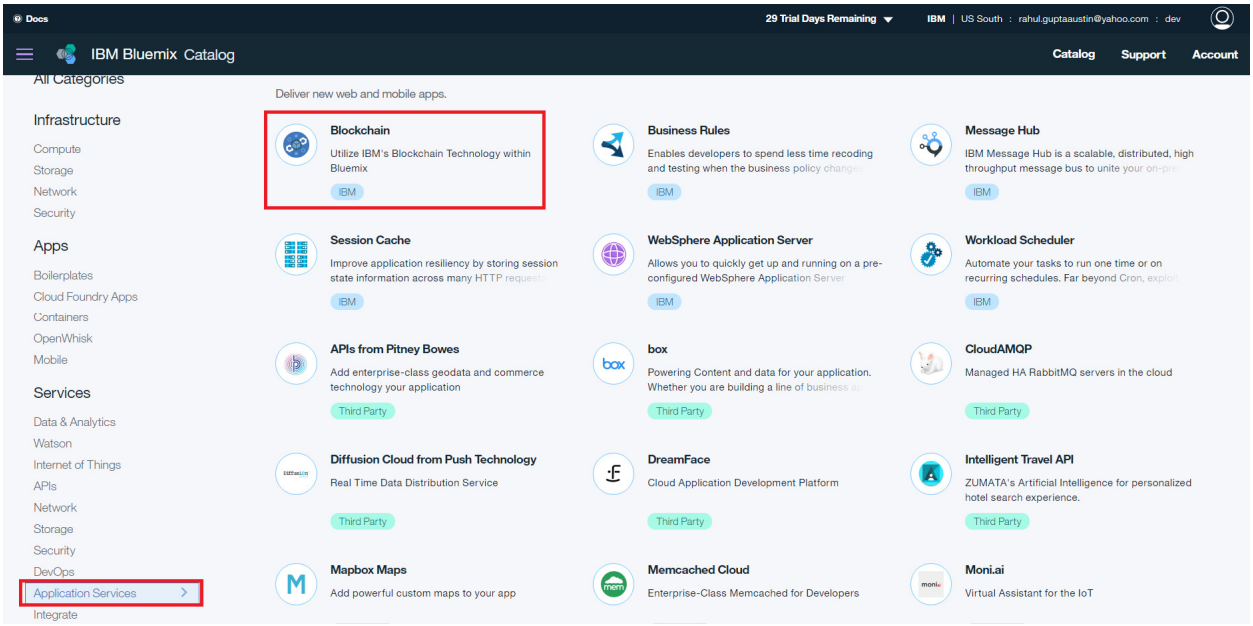
Note: In the image below the organization ID is highlighted in the rectangular box in Red, every IoT Platform service has a unique organization ID.



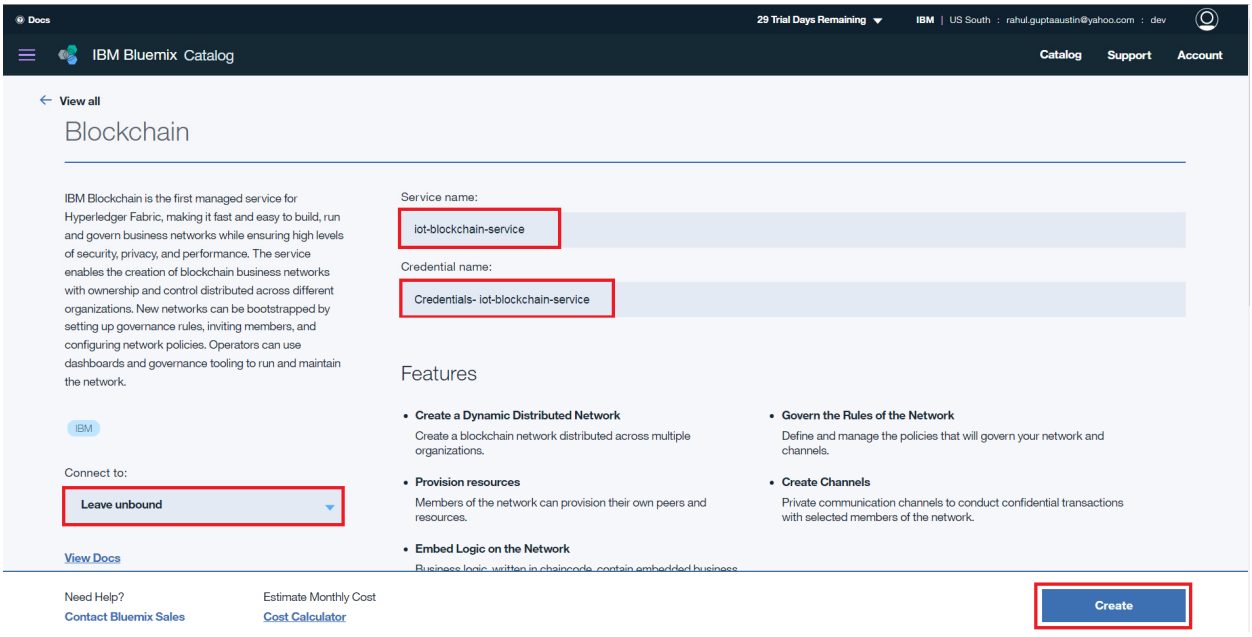
- This completes the creation of IBM Watson IoT Platform service and we can now proceed with creation of IBM Blockchain service.

Create IBM Watson IoT Blockchain Service

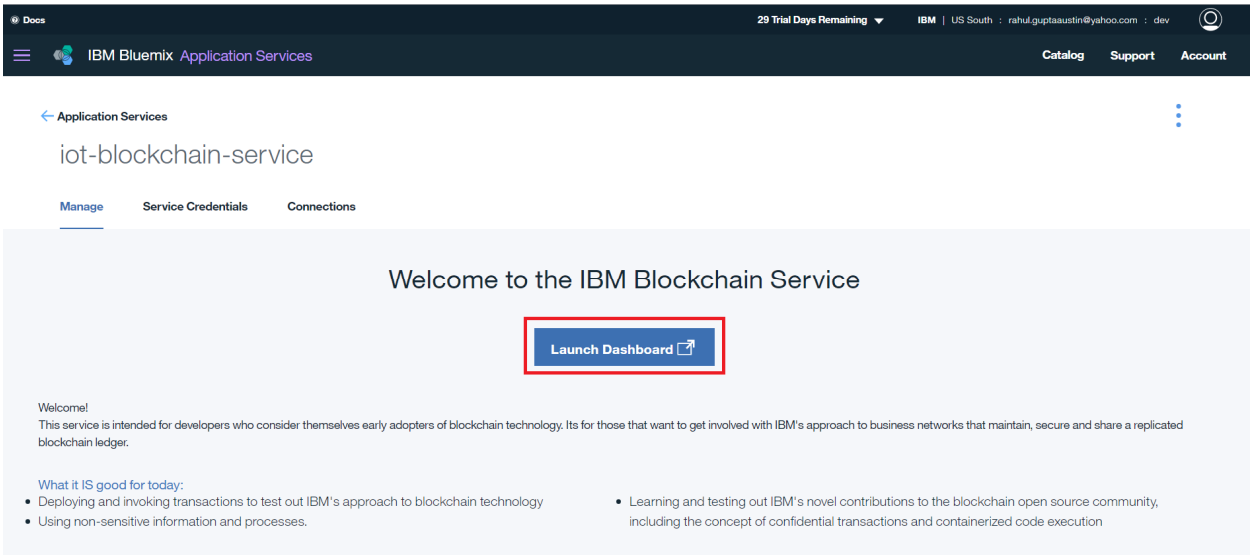
- To create IBM Blockchain service, go back the IBM Bluemix **Catalog**
- Click on the **Application Service** in the catalog menu
- Select **IBM Blockchain** service as shown in the image on next page.



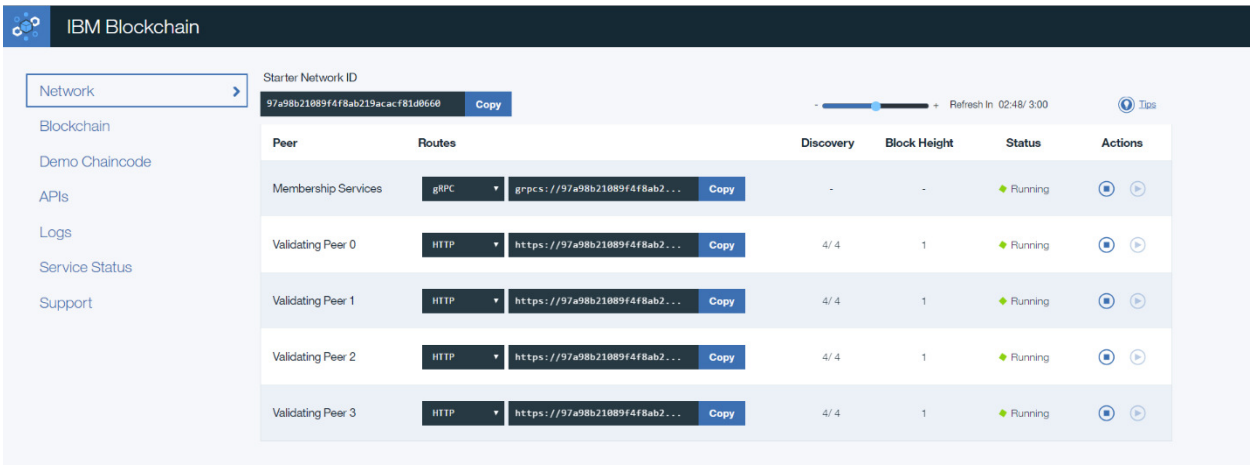
- To create the IBM Blockchain service, enter following details or something easier which could be remembered:
  - **Service Name:** *iot-blockchain-service*
  - **Credentials Name:** *Credentials- iot-blockchain-service*
  - **Pricing Plans –** *Starter Developer Plan (Beta)*



- Once the IBM Blockchain service is created, click on the **Launch Dashboard** button and that will launch the IBM Blockchain service dashboard in a new browser tab window.



- IBM Blockchain service is now instantiated and ready to be used.
- This service is provisioned with four validating peers and one membership CA (certificate authority) server.



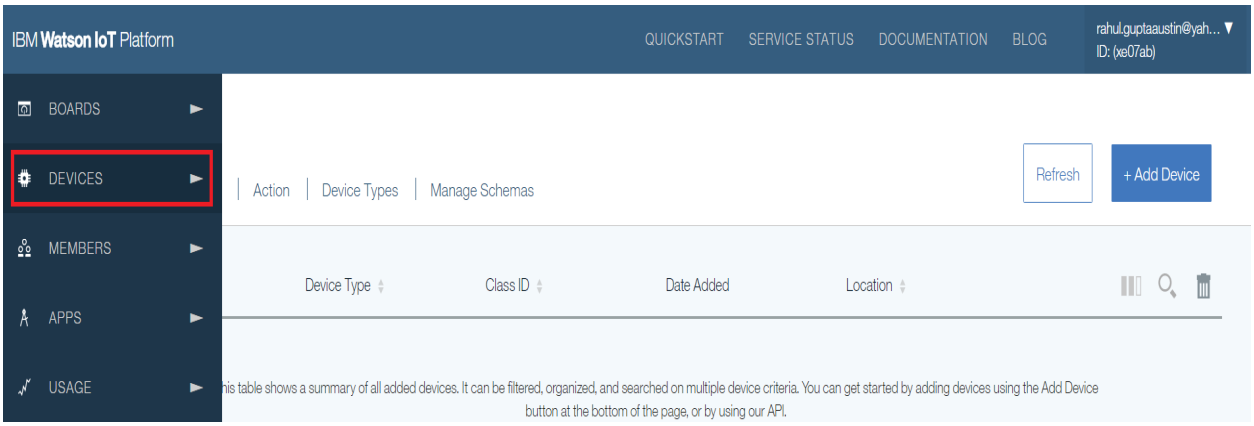
So far we have created the IBM Bluemix account for the new users and later created the IBM Watson IoT Platform and IBM Blockchain service in this Bluemix account.

Note – Please don't close the browser tabs for IBM Watson IoT Platform dashboard and IBM Blockchain dashboard services. They will be used in the later sections.

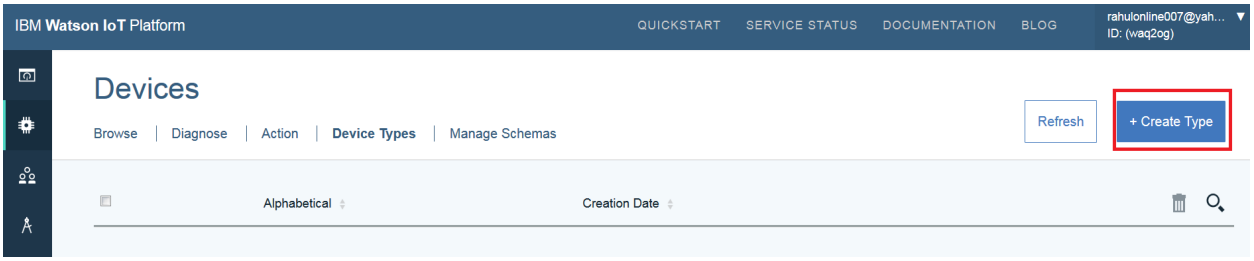
Section 2: Configure IBM Watson IoT Platform devices and application access

Create ELEVATOR device type

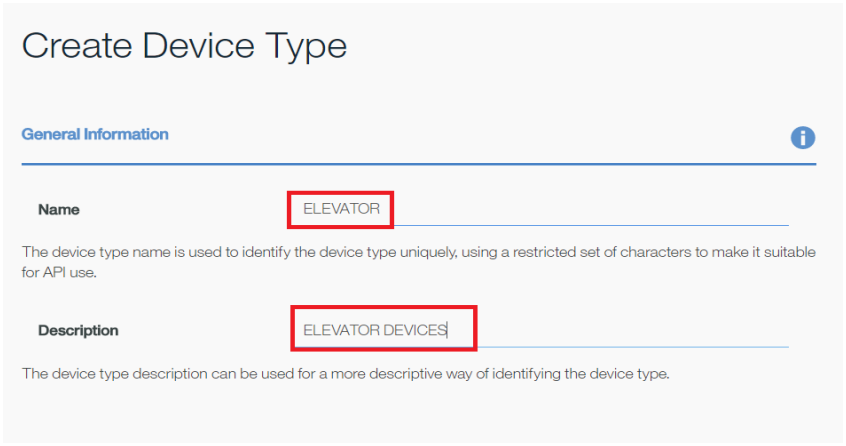
- Go to the IBM Watson IoT Platform dashboard tab in the browser window and expand the menu on the left
- Click on **Devices**



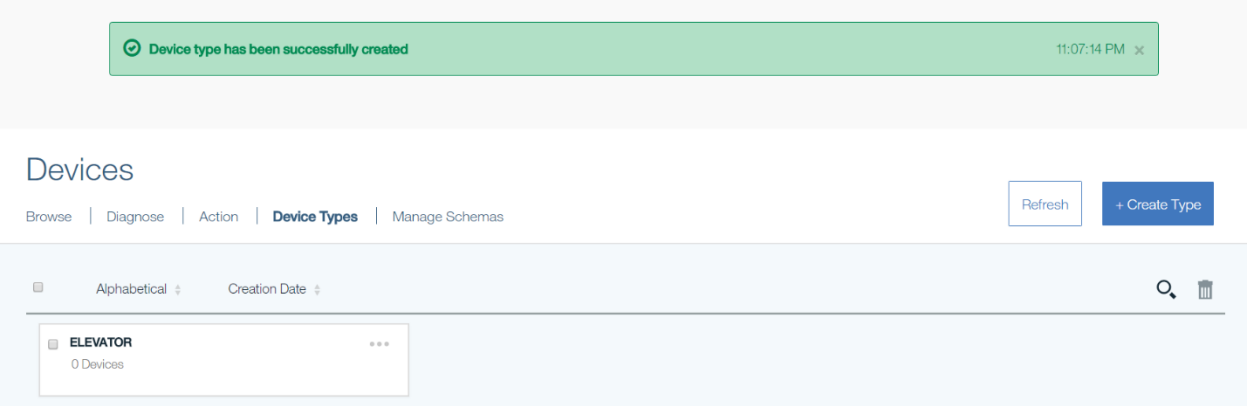
- Click on **Device Types** tab and then click **Create Type** button



- In the Create Device Type wizard, enter device type **Name** as ***ELEVATOR*** and **Description** as ***ELEVATOR DEVICES***

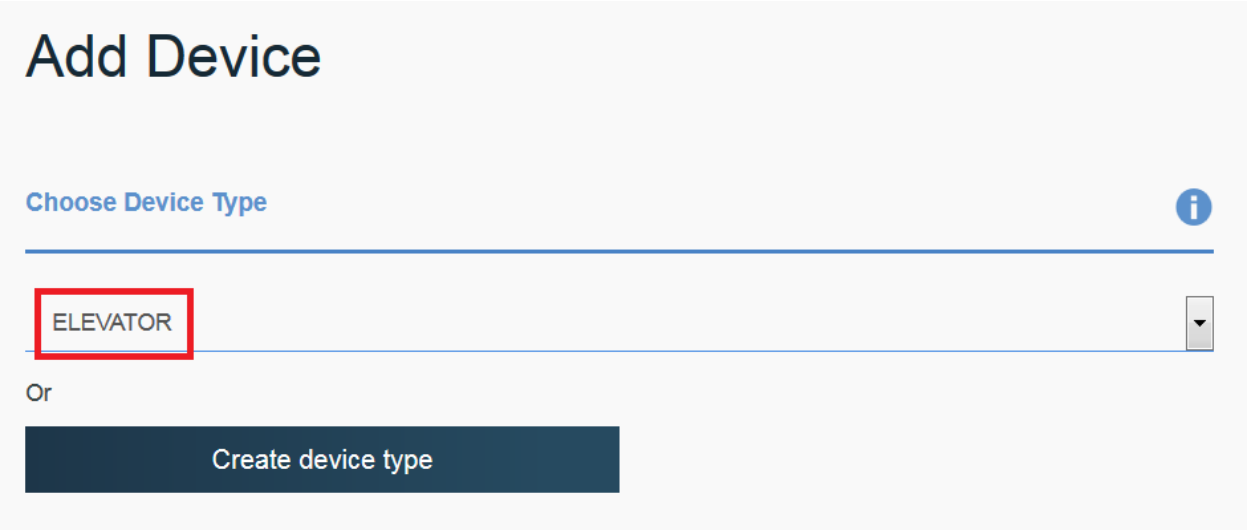


- Click on the **Next** button
- Click **Next** on templates without selecting anything
- Click **Next** button in Submit Information
- Click **Create** button to create the ELEVATOR device type
- If device type ELEVATOR is successfully created, you will see a device type ELEVATOR in the dashboard as shown in image below

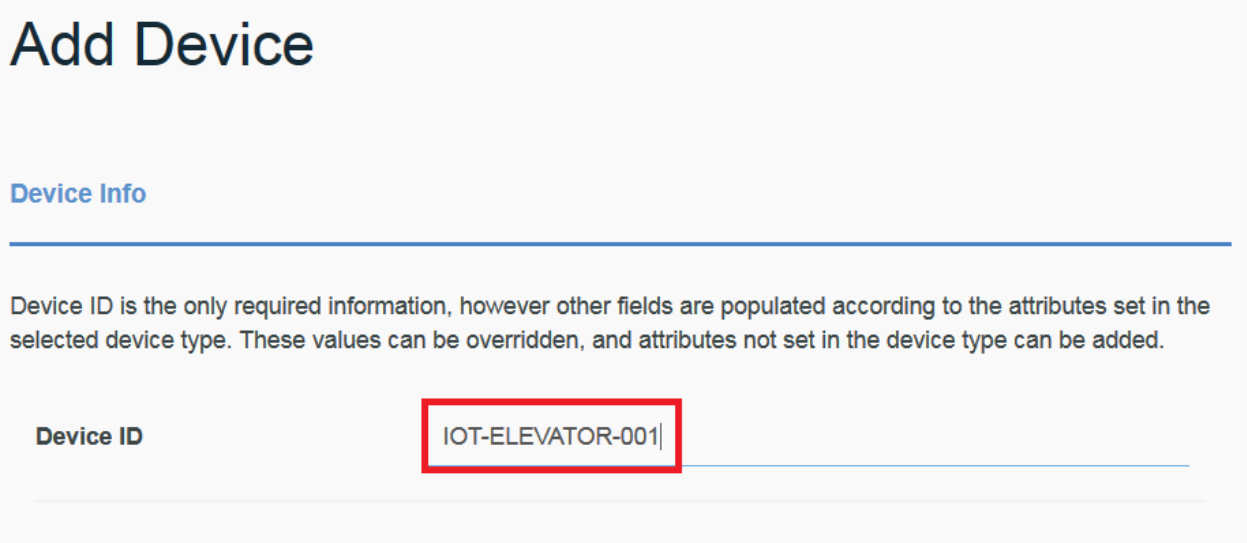


Add a device IOT-ELEVATOR-001 of device type ELEVATOR

- Go to the IBM Watson IoT Platform dashboard and expand the menu on the left
- Click on **Devices**
- Click on the **Browse** tab and then click on **Add Device** button
- To add a device, select the device type previously created: ***ELEVATOR***



- Click **Next**
- Enter Device ID as: ***IOT-ELEVATOR-001***

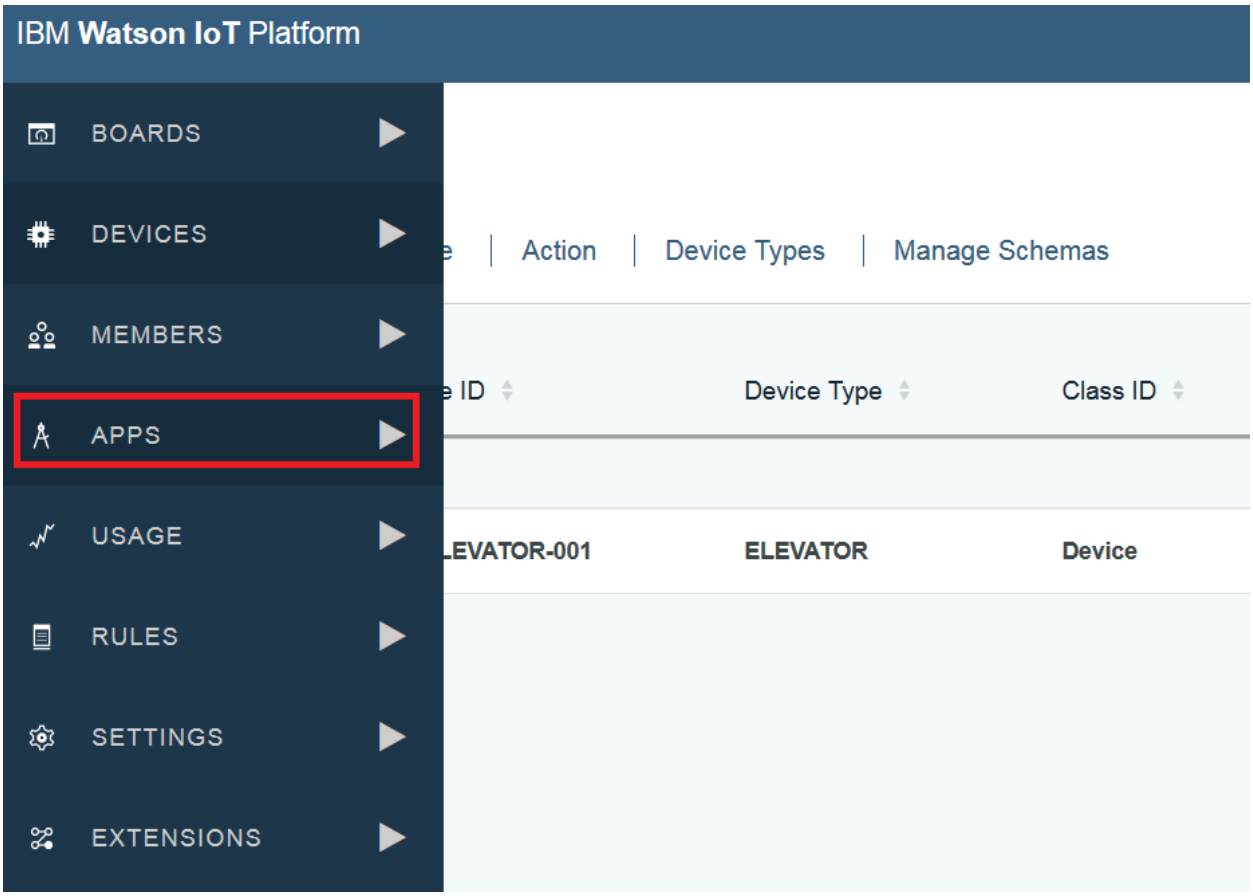


- Click **Next** on the Device Information page
- Click **Next** on the Metadata page
- Click **Next** on the Security page
- Click **Next** on the Summary page
- Copy Organization ID, Device Type, Device ID into a notepad. This information will be required later.

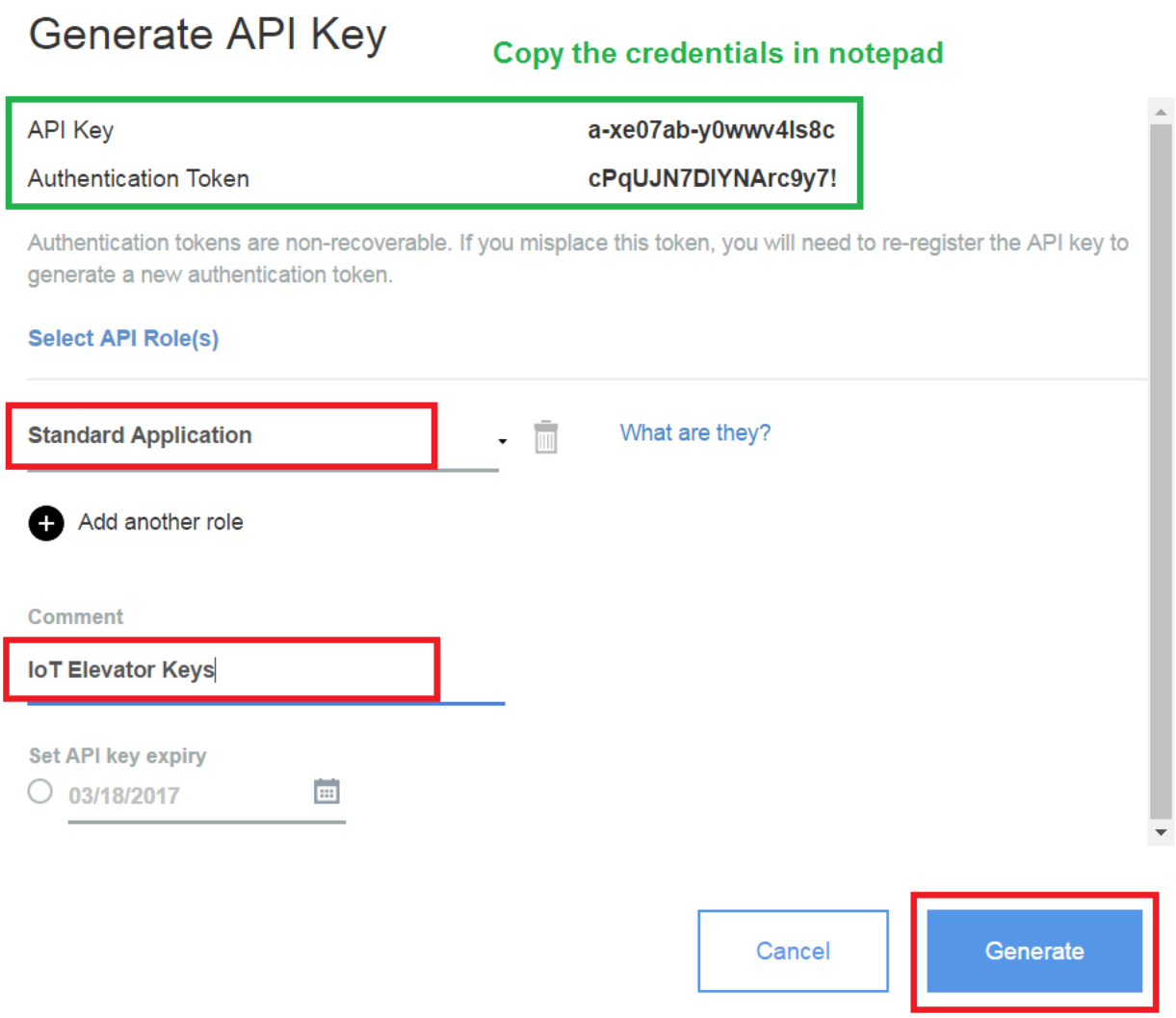
- **IOT-ELEVATOR-001** device of device type **ELEVATOR** is now created. Close the device creation wizard and this device will now be visible in the dashboard.

Generate API Keys to access this device from Elevator simulator application

- Application credentials created in this step will be used by the elevator simulator in later sections
- Go to the IBM IoT Watson Platform dashboard and click on **APPS**



- Click on **Generate API Key**
- Select **Standard Application** and add comments for the keys
- Before clicking **Generate**, *copy* the API Keys and Authentication Token in a notepad. These credentials will be used later in the elevator simulator



This completes the basic configuration on IBM Watson IoT Platform. We will revisit the Blockchain specific configurations after deploying the smart contract and completing the Blockchain configuration in the next section.

Section 3: Configure and connect Elevator simulator to IoT Watson IoT Platform

This section will help you configure a virtual elevator simulator. This elevator connects to the IBM Watson IoT Platform and sends data with following JSON elements:

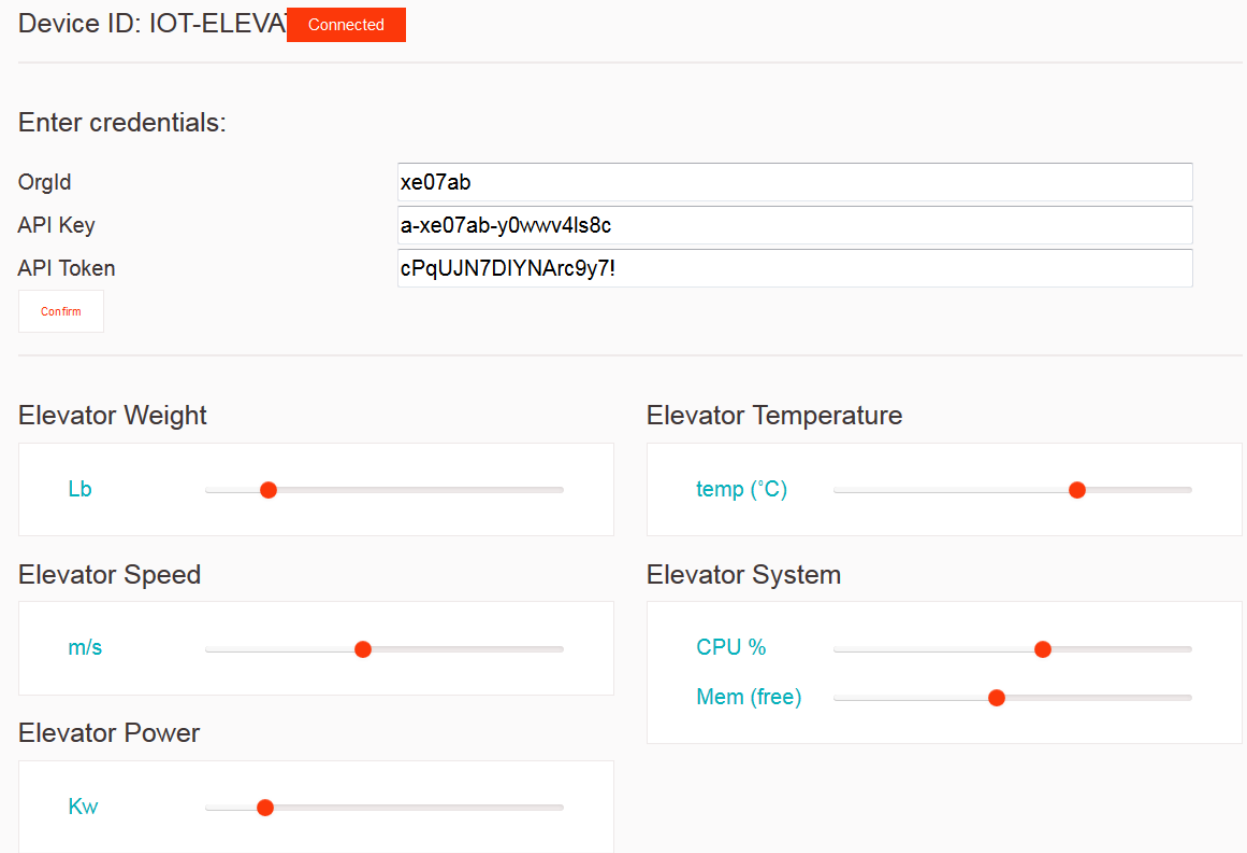
AssetID	This element in the data shows the ID of the elevator
Weight	This element in the data shows the weight of passengers in the elevator
Speed	This element in the data shows the speed of the elevator wagon
Power	This element in the data shows the power consumption by the elevator
Temperature	This element in the data shows the temperature of the elevator
System	This element in the data shows the CPU and memory consumed by a microcomputer inside the elevator

- Data from the virtual elevator is sent in following JSON format

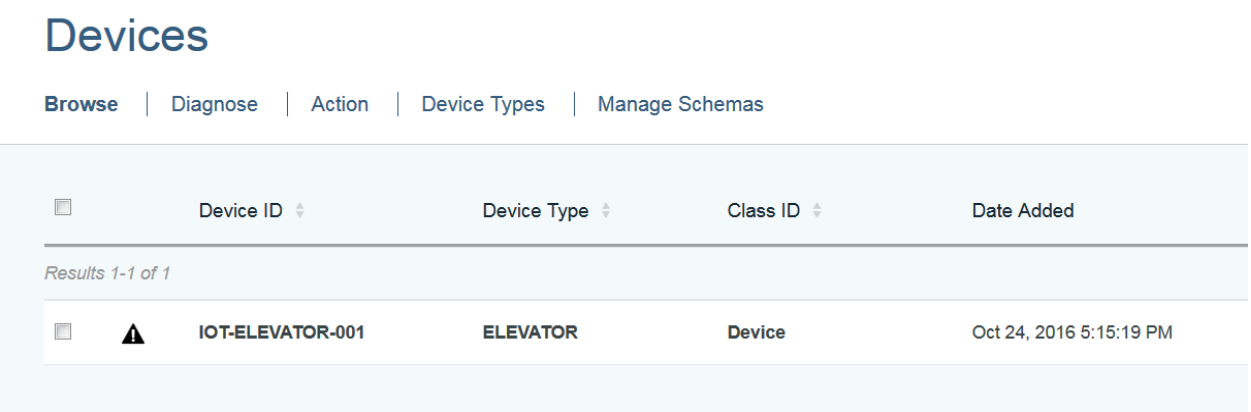
```
{

        "d": {
                "assetID": "IOT-ELEVATOR-001",
                "weight": 96,
                "speed": 7,
                "power": 78,
                "temperature": 34,
                "system": {
                        "cpu": 0.51,
                        "memory": 459990484
                }
        }
}
```

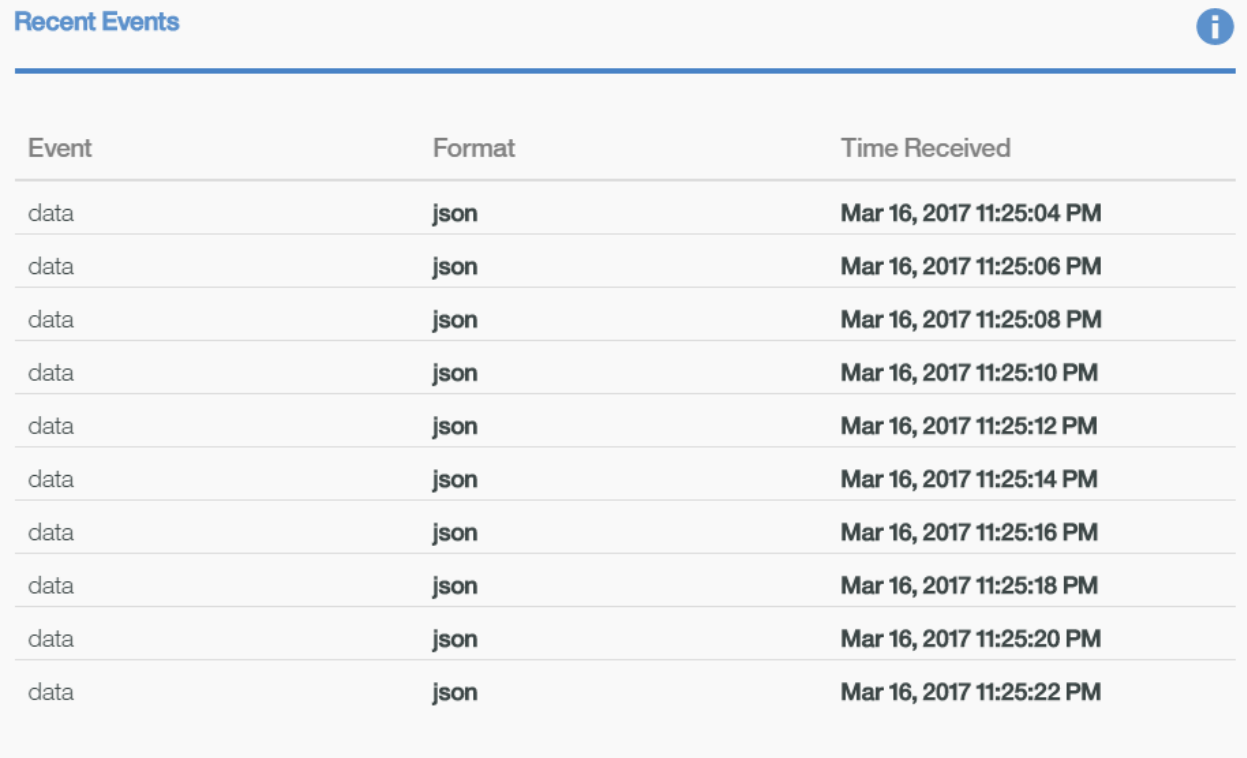
- To access the simulator, open a new tab in the browser window and go to URL https://ibm.biz/icsimulator
- Then click on **Elevator Device Simulator**
- Enter the IBM Watson Platform Org ID in the **OrgID** text box
- Enter the application API key in **API Key** text box. (This key was copied in notepad previously)
- Enter the application API Token in the **API Token** text box (This token was copied in notepad previously)
- Click on **Confirm** button
- This will connect the virtual elevator IOT-ELEVATOR-001 to IBM Watson IoT Platform
- Messages from the simulator will be sent at a frequency of every two seconds



- You can validate if the messages are reaching the IBM Watson IoT Platform by going back to the device IOT-ELEVATOR-001 created previously.



- Double click on device IOT-ELEVATOR-001 and under recent events you can see all the events from the elevator transmitted every two seconds



Recent Events

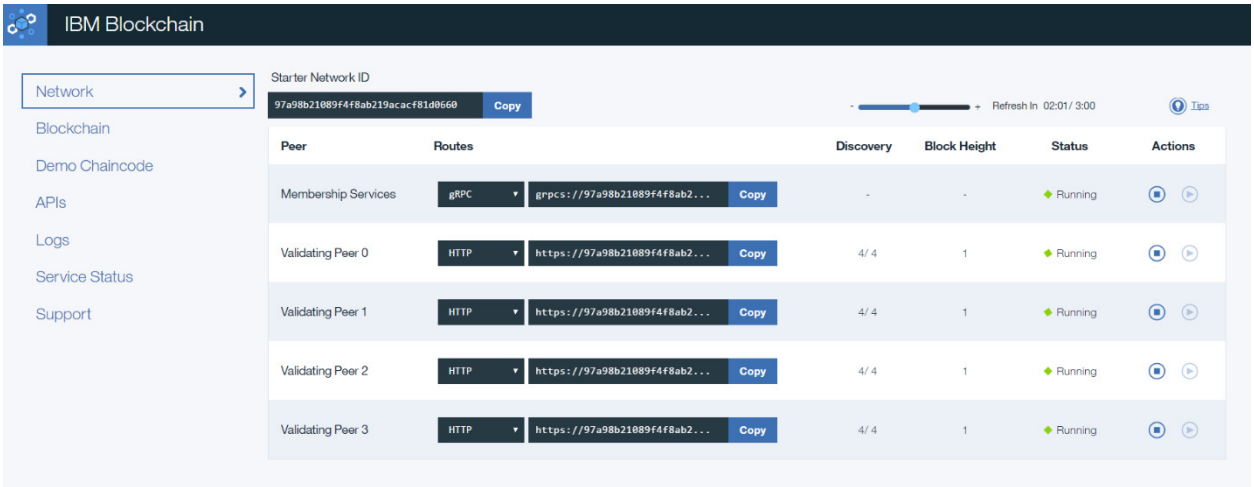
Event	Format	Time Received
data	json	Mar 16, 2017 11:25:04 PM
data	json	Mar 16, 2017 11:25:06 PM
data	json	Mar 16, 2017 11:25:08 PM
data	json	Mar 16, 2017 11:25:10 PM
data	json	Mar 16, 2017 11:25:12 PM
data	json	Mar 16, 2017 11:25:14 PM
data	json	Mar 16, 2017 11:25:16 PM
data	json	Mar 16, 2017 11:25:18 PM
data	json	Mar 16, 2017 11:25:20 PM
data	json	Mar 16, 2017 11:25:22 PM

- Data is now getting transmitted from the virtual elevator simulator to IBM Watson IoT Platform service

Section 4: Register Blockchain users and deploy smart contract

Blockchain Peer assignment and roles

- Go back to the IBM Blockchain dashboard
- In the network tab in the IBM Blockchain dashboard, you will observe five peers



In this lab, we will use three validating peers by three different organizations:

Validating Peers	Business Organizations
Validating Peer 0	This peer will be used by the elevator manufacturing company to have access to the data transmitted by the elevator to capture any anomalies and compliance
Validating Peer 1	This peer will be used by the customer who has purchased an elevator from the Elevator Company
Validating Peer 2	This peer will be used by the government agency, which must audit the elevators for safety and compliance

Note: The IoT Blockchain Service and IoT Watson IoT Platform service is created on behalf of the elevator manufacturing company

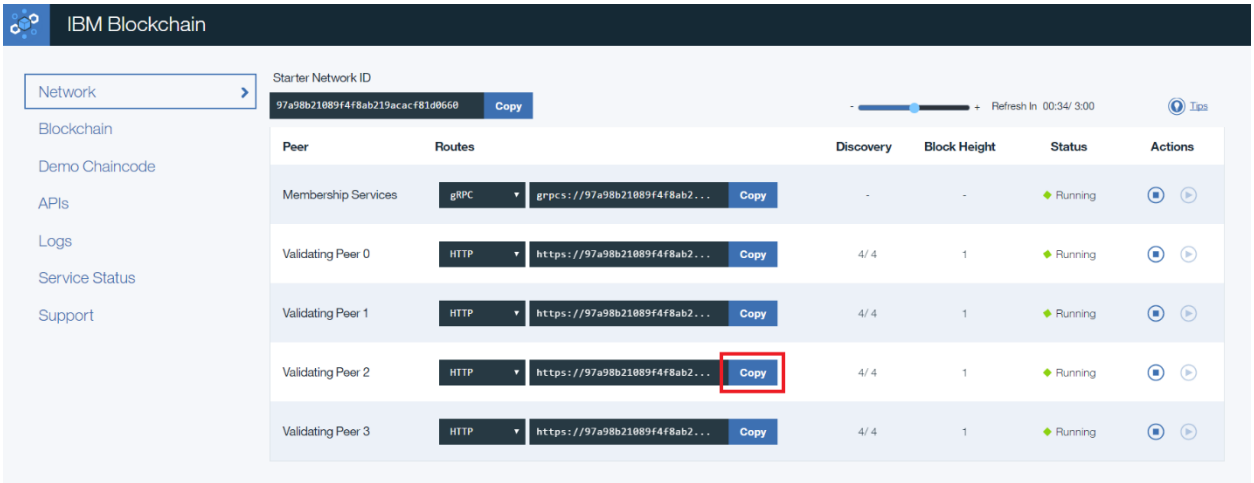
Register users from different organization with validating peers.

Note: IBM Blockchain service provides REST API for user registration, but in this lab, we will use a user interface for user registration.

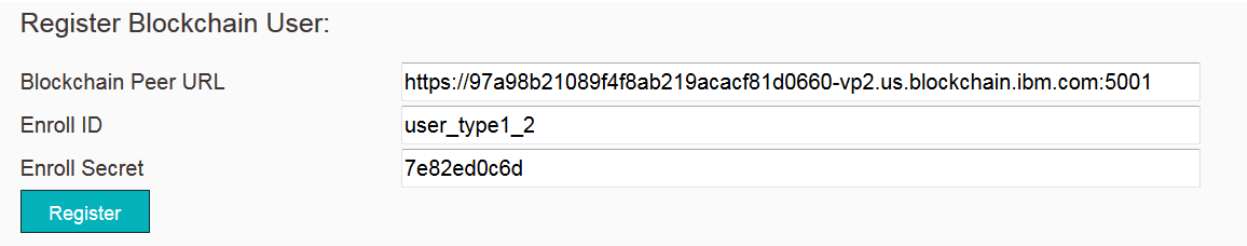
- In a new browser tab, open URL https://ibm.biz/icsimulator
- Click on **Register Users and Deploy Contract**

Register a user from the government organization

- Go to the Networks tab in IBM Blockchain Dashboard and copy the URL for Validation Peer 2



- At the right bottom of Network tab, right click and open **service credentials** in a new tab
- Find the secret of user **"user_type1_2".** This secret will be needed for user registration with Validating Peer 2 of Blockchain
- Go back to the Register Users and Deploy Contract page in simulator application
- Enter the URL for Validating Peer 2 in **Block Chain Peer URL** text field
- Enter the username ***user_type1_2*** in **Enroll ID** text field
- Enter the secret for user_type1_2 in **Enroll Secret** text field



- Once the user is registered you will see the success message, as shown in the image on next page

Register a user from the customer organization who purchased an Elevator

- Go to the Networks tab in IBM Blockchain Dashboard and copy the URL for Validation Peer 1
- At the right bottom of Network tab, right click and open **service credentials** in a new tab
- Find the secret of user **"user_type1_1".** This secret will be needed for user registration with Validating Peer 1 of Blockchain
- Go back to the Register Users and Deploy Contract page in simulator application
- Enter the URL for Validating Peer 1 in **Block Chain Peer URL** text field
- Enter the username ***user_type1_1*** in **Enroll ID** text field
- Enter the secret for user_type1_1 in **Enroll Secret** text field
- Once the user is registered you will see the success message, as shown in the image on next page

Register a user from Elevator manufacturing company

- Go to the Networks tab in IBM Blockchain Dashboard and copy the URL for Validation Peer 0
- At the right bottom of Network tab, right click and open **service credentials** in a new tab
- Find the secret of user **"user_type1_0".** This secret will be needed for user registration with Validating Peer 0 of Blockchain
- Go back to the Register Users and Deploy Contract page in simulator application
- Enter the URL for Validating Peer 0 in **Block Chain Peer URL** text field
- Enter the username ***user_type1_0*** in **Enroll ID** text field
- Enter the secret for user_type1_0 in **Enroll Secret** text field
- Once the user is registered you will see the success message, as shown in the image on next page

Deploy the Elevator contract

In this lab as the Blockchain network is owned by the Elevator manufacturing company, we will deploy the smart contract to the Validating Peer 0. The Smart Contract or often called as Chaincode, it will be deployed to each validating peer in this network.

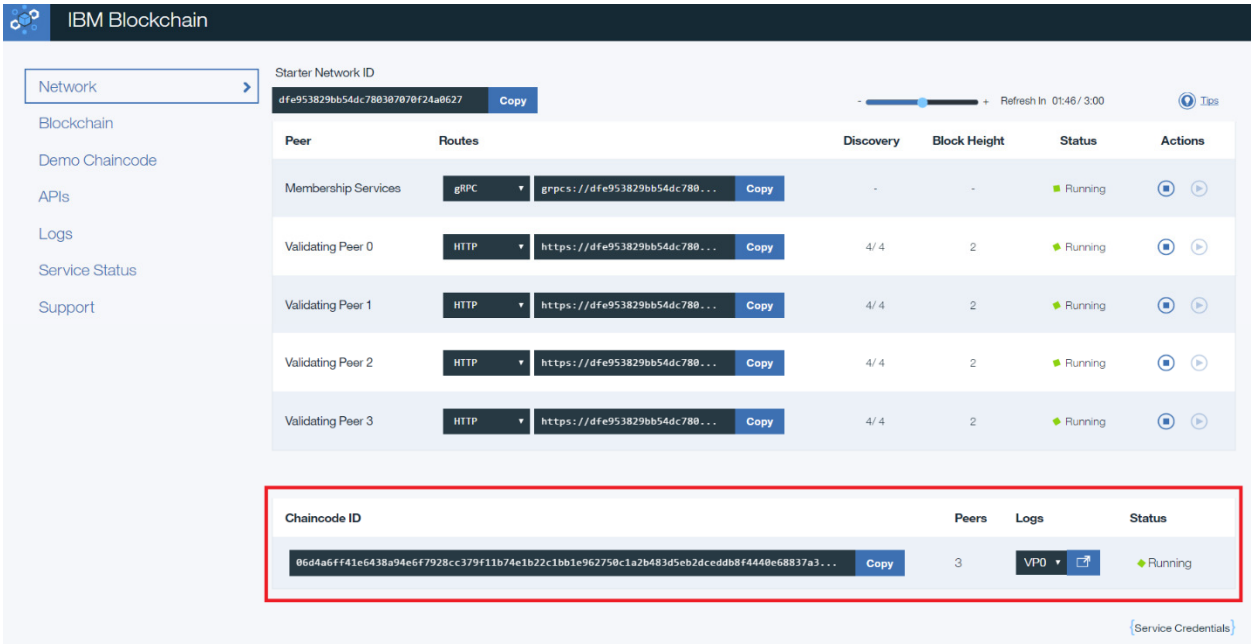
Elevator contract is already created and hosted in a public GitHub repository for you to review later: https://github.com/iot-ic-2017/lab2234/tree/master/elevator_simple_contract

- Go to the Networks tab in IBM Blockchain Dashboard and copy the URL for Validation Peer 0
- At the right bottom of Network tab, right click and open **service credentials** in a new tab
- Find the secret of user **"user_type1_0".** This secret will be needed for user registration with Validating Peer 0 of Blockchain
- Go back to the Register Users and Deploy Contract page in simulator application
- Enter the URL for Validating Peer 0 in **Block Chain Peer URL** text field
- Enter the username ***user_type1_0*** in **Enroll ID** text field
- Enter the secret for user_type1_0 in **Enroll Secret** text field
- Click on the **Deploy** Button

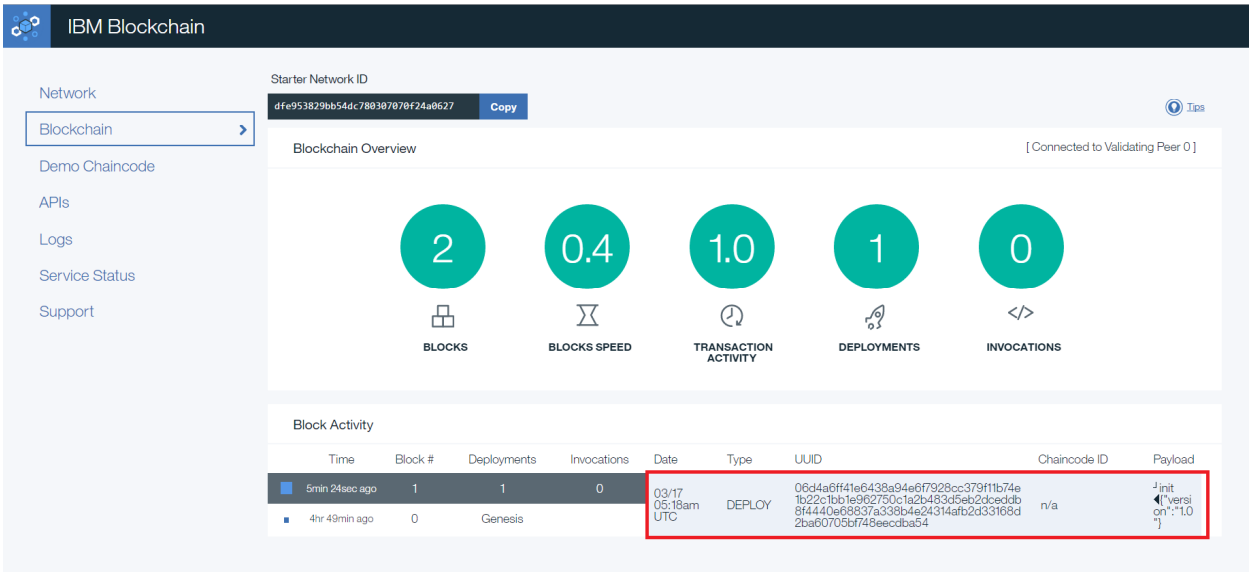
Note: The REST API's to deploy the smart contract/chaincode are asynchronous and the deployment of the contract may take two – three minutes to complete on all the four validating peers in the Blockchain network.

The response message contains the Chaincode ID. Every deployed chaincode gets a unique chaincode id in the Blockchain network. This Chaincode ID will be needed for integration with Watson IoT Platform service, but this could be obtained from the IBM Blockchain dashboard later.

- In the Networks tab of Blockchain dashboard, observe the deployed chaincode on all the four validating peers in this Blockchain network.



- The ChainCode ID can be copied when needed using the Copy button of the deployed contract
- Go to the Blockchain tab in IBM Blockchain dashboard and you will observe the first Block in the Blockchain network.
- This Block is for the chaincode just deployed in the previous step.


IBM Blockchain
Network
Blockchain
Demo Chaincode
APIs
Logs
Service Status
Support
Starter Network ID
dfe953829bb54dc78030707 0f24a0627
Copy
Tips
Blockchain Overview
[Connected to Validating Peer 0]
2
BLOCKS
0.4
BLOCKS SPEED
1.0
TRANSACTION ACTIVITY
1
DEPLOYMENTS
0
INVOCATIONS
Block Activity
Time
Block #
Deployments
Invocations
Date
Type
UUID
Chaincode ID
Payload
5min 24sec ago
1
1
0
03/17 05:18am UTC
DEPLOY
06d4a6ff41e6438a94e6f7928cc379f11b74e1b22c1bb1e962750c1a2b483d5eb2dceddb8f4440e688837a338b4a24314afb2d33168d2ba60705bf748eecdba54
n/a
init {"version":"1.0"}
4hr 49min ago
0
Genesis

Section 5: Activate Blockchain features in IBM Watson IoT Platform

Note: The IBM Watson IoT Blockchain features used in this lab are still under development and are unsupported.

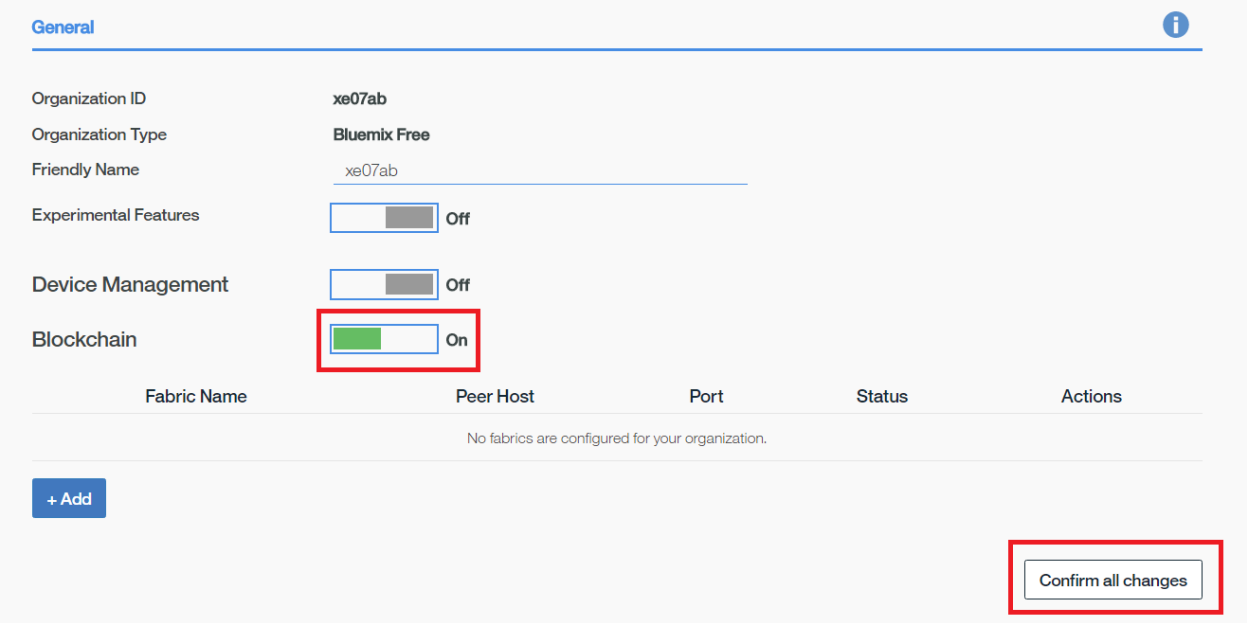
- To activate the IBM Blockchain integration in IBM Watson IoT Platform, open the simulator (https://ibm.biz/icsimulator) in a new browser tab
- Click on **Activate and Enable Blockchain**
- To activate Blockchain features in IBM Watson IoT Platform, enter the IoT Platform Organization ID and click **Activate Blockchain**.

- This will activate Blockchain and you will see following JSON in the browser

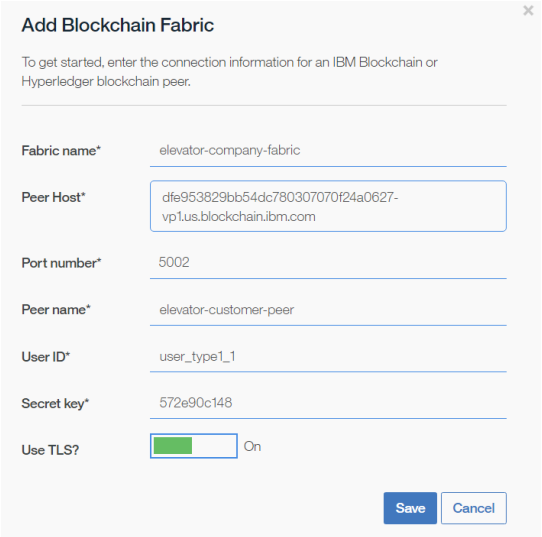
```
{"activated":true,"enabled":false}
```

- Click back button in the browser and you will reach the same page again and can continue with configuration
- Enter your name in the **User Name** text box
- Enter your email in the **User Email** text box
- Click on **Configure Blockchain**

- Now you will be navigated to the IBM Watson IoT Platform to configure Blockchain
- Enable Blockchain by clicking on the toggle button and Confirm all changes



- Click on the Add button to add the Blockchain validating peer details of the Elevator manufacturing company
- In the Add Blockchain Fabric wizard and enter following details
  - **Fabric Name** – *elevator-company-fabric*
  - **Peer Host** – Copy the host name for Validating Peer 1 from the IBM Blockchain dashboard, use just the hostname **remove https://** and port **5002**
  - **Port Number** – *5002*
  - **Peer Name** – *elevator-customer-peer*
  - **User Id -** *user_type1_1* (Use the user ID used earlier for registration with Validating Peer 1**)**
  - **User Secret –** Enter the secret key for user user_type1_1

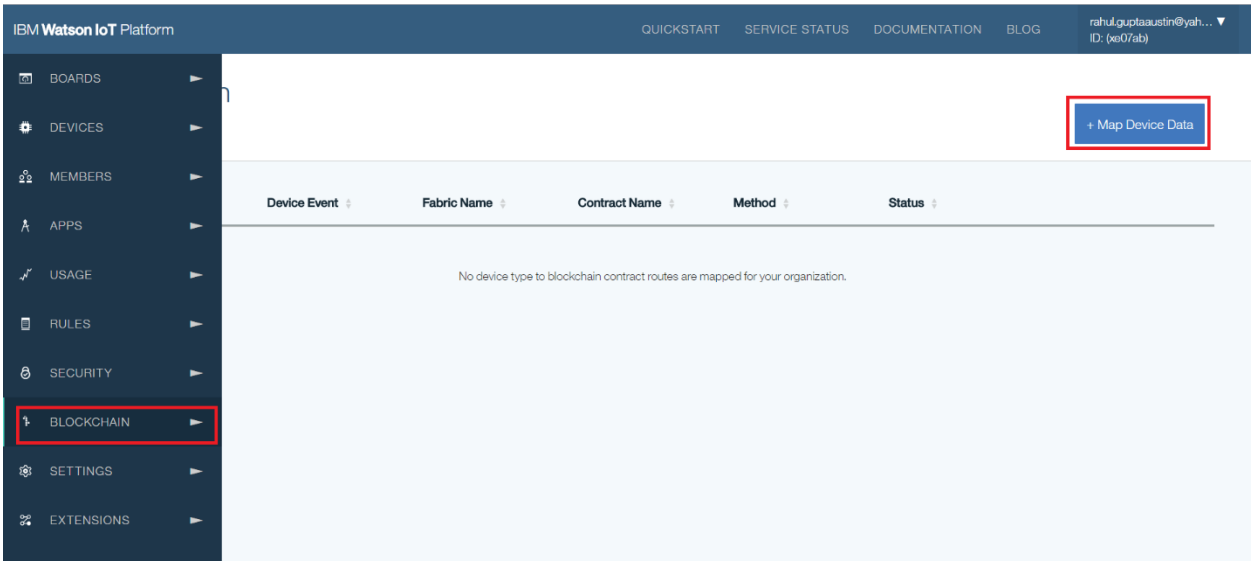


- Click **Save**
- Click again on **Confirm All Changes**

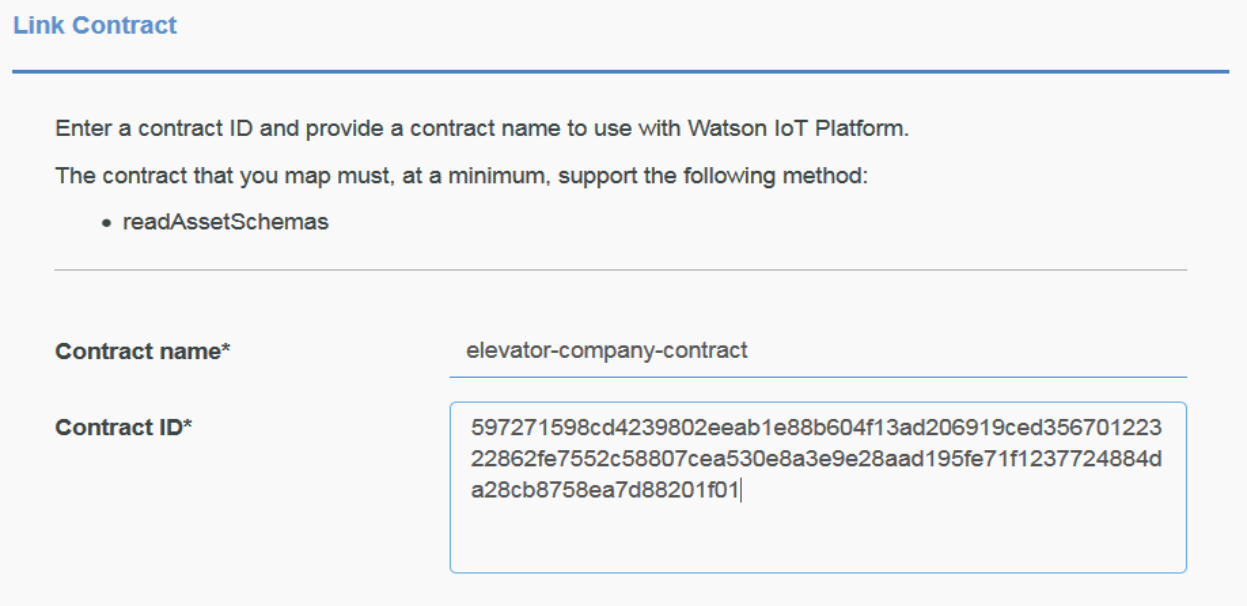
Section 6: Configure Integration routes between IBM Watson IoT Platform and IBM Blockchain

In this section, we will create routes to transmit data received on IBM Watson IoT Platform to IBM Blockchain service.

- Go to the IBM Watson IoT Platform dashboard and click on Blockchain icon in the left menu as shown in image below



- Click on the **Map Device Data** button
- Add Route wizard will open
- In the Device type and Event form enter
  - **Device type**: *ELEVATOR*
  - **Event:** *data*
- Click Next
- In the Select Fabric form
  - **Fabric Name**: *elevator-company-fabric*
- Click Next
- In the Link Contract form
  - **Contract name:** *elevator-company-contract*
  - **Contract ID:** Copy the chaincode ID from the IBM Blockchain networks tab and paste it here in this form



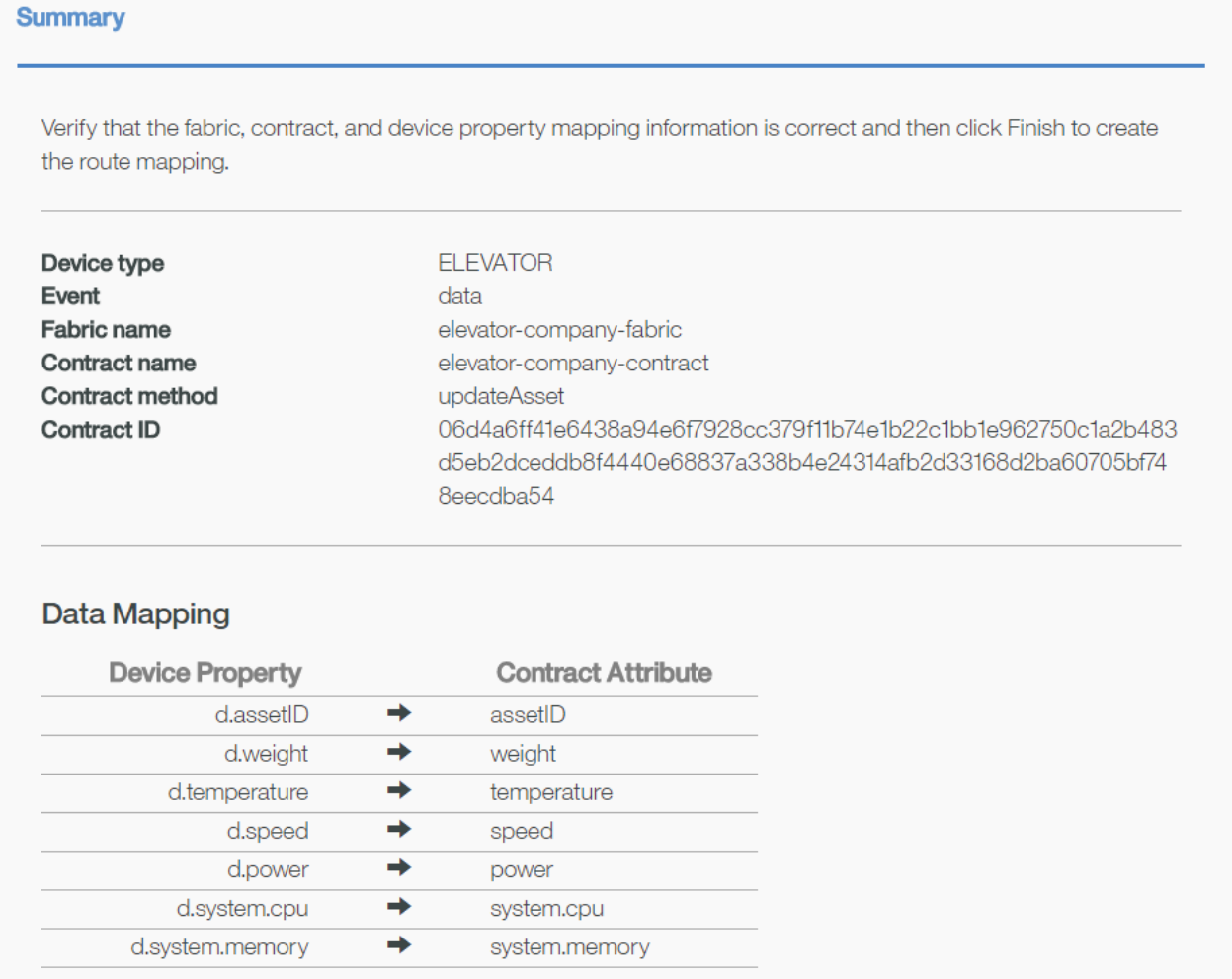
- Click Next
- In the Device data mapping form select the Contract method as **updateAsset**.

Note: The schema for the updateAsset method is pulled from the Elevator contract. The incoming data event for the simulator will now be mapped to this schema.

- Enter following details to complete the schema mapping

Schema Property	Map to incoming JSON data
assetID	d.assetID
weight	d.weight
temperature	d.temperature
speed	d.speed
power	d.power
System	
cpu	d.system.cpu
memory	d.system.memory

- Click Next
- Click Finish on summary page to complete the device data mapping to Blockchain



Summary

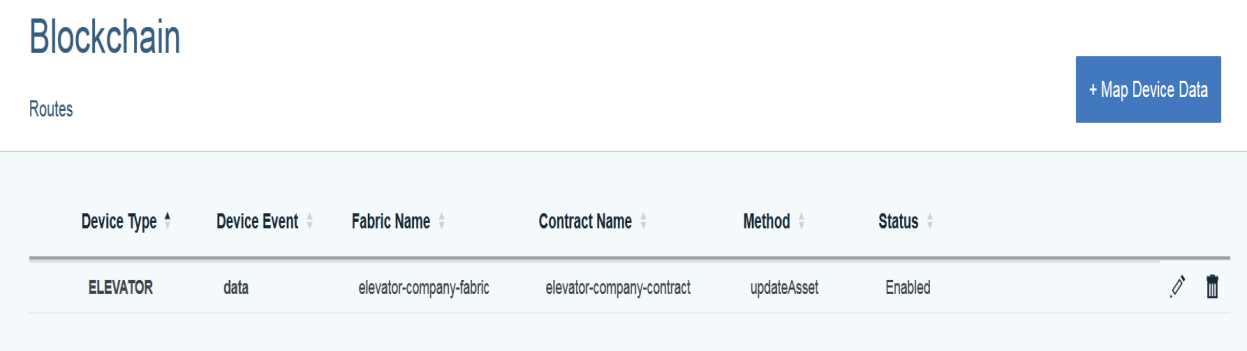
Verify that the fabric, contract, and device property mapping information is correct and then click Finish to create the route mapping.

Device type	ELEVATOR
Event	data
Fabric name	elevator-company-fabric
Contract name	elevator-company-contract
Contract method	updateAsset
Contract ID	06d4a6ff41e6438a94e6f7928cc379f11b74e1b22c1bb1e962750c1a2b483d5eb2dceddb8f4440e68837a338b4e24314afb2d33168d2ba60705bf748eecdba54

Data Mapping

Device Property		Contract Attribute
d.assetID	→	assetID
d.weight	→	weight
d.temperature	→	temperature
d.speed	→	speed
d.power	→	power
d.system.cpu	→	system.cpu
d.system.memory	→	system.memory

- You must now see a Blockchain route created in IBM Watson IoT Platform



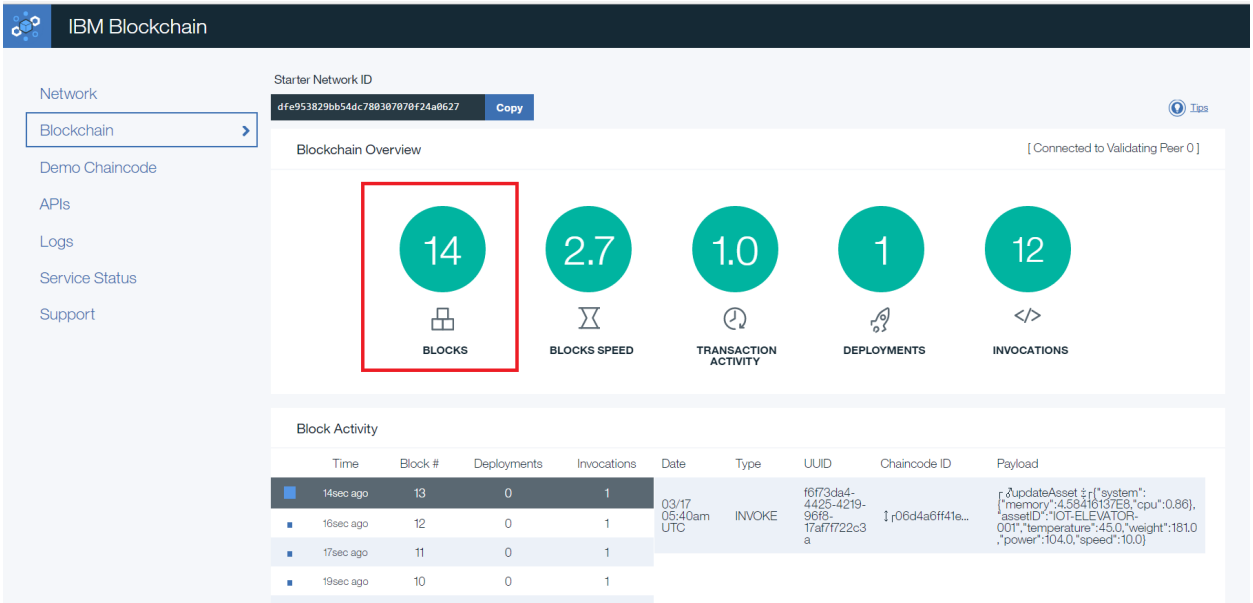
Blockchain

Routes

+ Map Device Data

Device Type	Device Event	Fabric Name	Contract Name	Method	Status
ELEVATOR	data	elevator-company-fabric	elevator-company-contract	updateAsset	Enabled

- To validate if the events from Elevator device IOT-ELEVATOR-001 are reaching the IBM Blockchain, go to the IBM Blockchain service dashboard and click on Blockchain tab
- You shall see the new blocks of data getting created
- Click on one of the blocks to see the data coming from the elevator device IOT-ELEVATOR-001



- Now we have the data coming from Elevator IOT-ELEVATOR-001 installed at a customer location into Blockchain. In the next sections, we will configure how the Elevator company and Government agency can access this data from Blockchain network for audits, compliance and customer service.

Section 7: Access Elevator data in Blockchain: Elevator manufacturing company

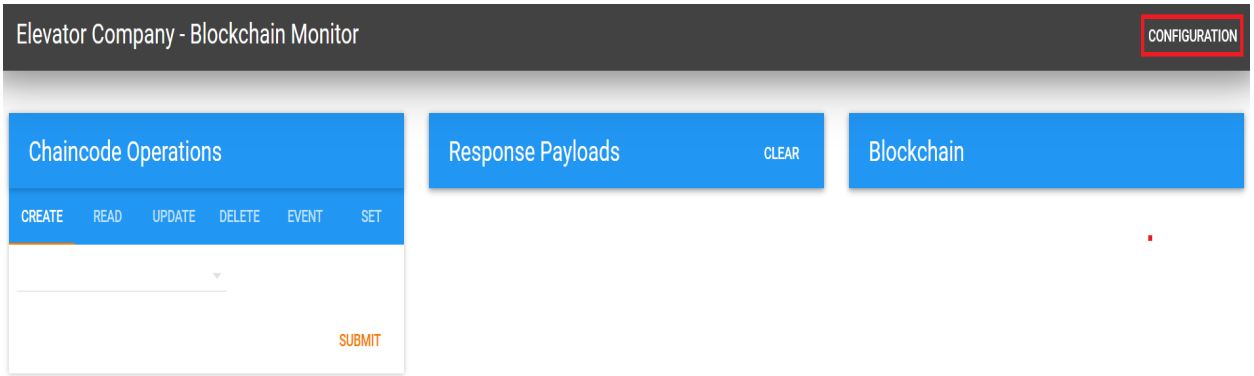
The Elevator manufacturing company needs access to the data from Elevator so it can have visibility for any malfunctioning in elevator and can take immediate actions. This will help them provide better service to their customers and clear any audits and compliance issues.

The Blockchain network is owned by the Elevator company and they have a registered user **user_type1_0** with **validating peer 0**.

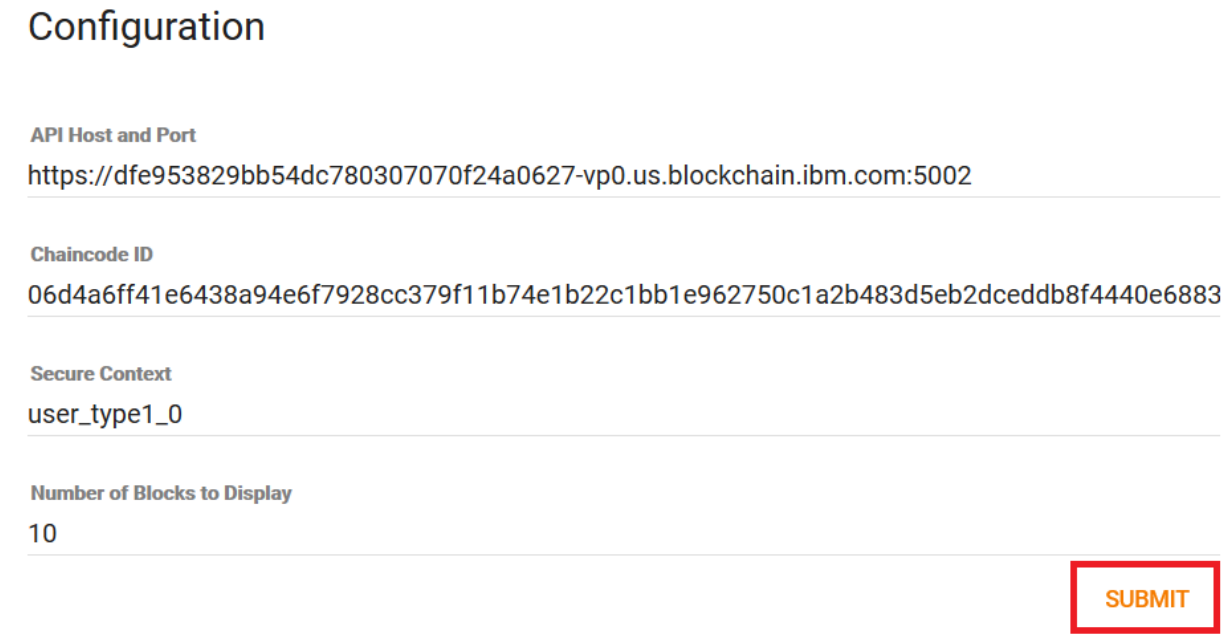
The elevator at the customer site is sending data directly to blockchain through validating peer 1 using the IBM Watson IoT Platform integration routes.

In this step, we will provide an ability for the Elevator company to watch the data transmitted by the elevator IOT-ELEVATOR-001 to the Blockchain network.

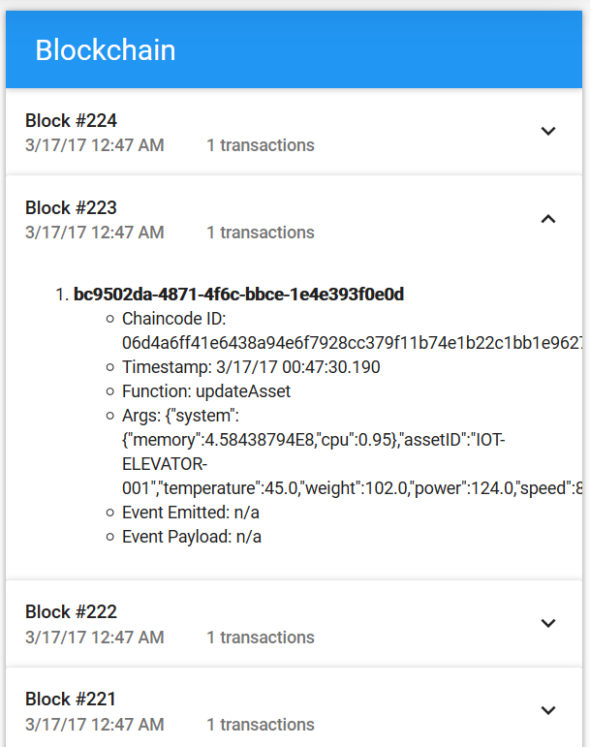
- In a new browser tab open this URL https://ibm.biz/icsimulator
- Click on **Elevator Company Blockchain Monitor**
- This will open a Blockchain monitoring application in a new tab
- Click on **Configuration** in the top right corner of this application



- In the configuration form enter the validating peer host and port for Validating Peer 0 (This information can be captured from the IBM Blockchain dashboard)
- Enter the Chaincode ID for the Elevator Contract (This information could be captured from the IBM Blockchain dashboard)
- In Secure Context enter: **user_type1_0**
- In Number of Block to display: 10
- Then click on SUBMIT as shown in the image on next page

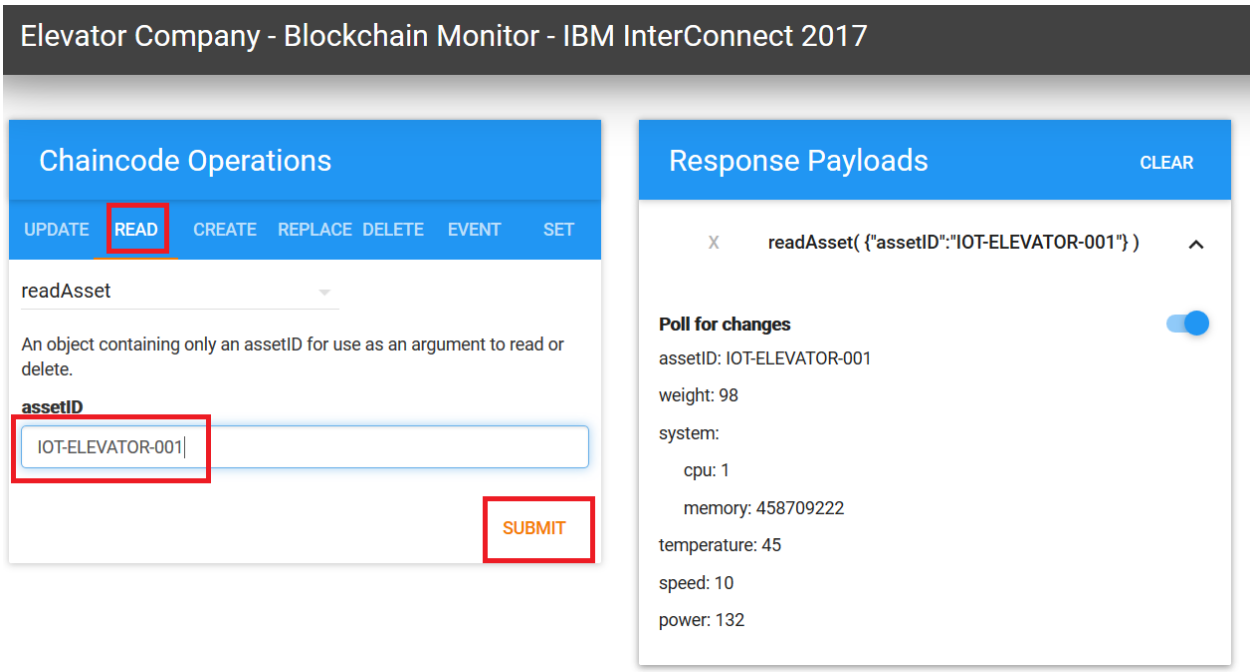


- This configuration will now start reading the last ten blocks of data on the Elevator contract
- Image below shows the latest blocks of data transmitted by the elevator at customer location to the elevator manufacturer



- You can also read the latest state of a specific elevator by providing the **assetID** of the elevator
- Select READ in Chaincode Operations portlet and enter the **assetID** as *IOT-ELEVATOR-001*

- Click **Submit**
- This will provide the latest state of the elevator IOT-ELEVATOR-001 in Blockchain



Section 8: Access Elevator data in Blockchain: Government agency

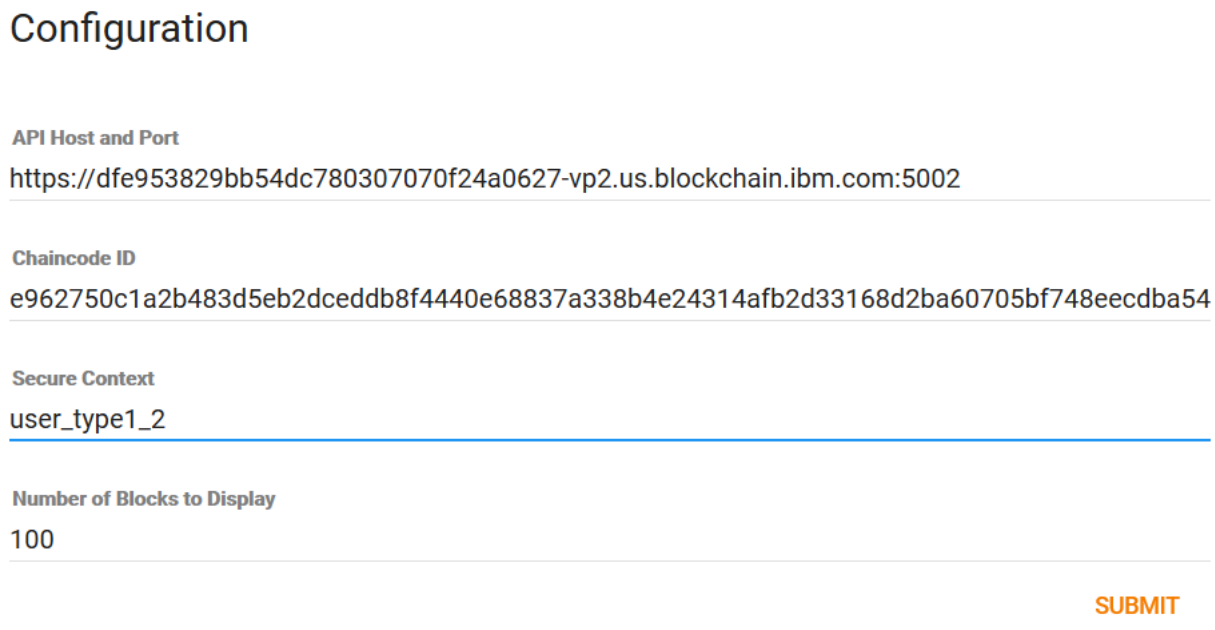
The Government agency needs access to the data from Elevator so it can have visibility for any malfunctioning in elevator and this information could be used for inspections and security certification. This will help the Government agency for the transparent inspection process and without asking the manufacturer or customer to share this information.

The Government agency is registered in Blockchain network through **Validating Peer 2** with user **user_type1_2**.

The elevator at the customer site is sending data directly to the blockchain through validating peer 1 using the IBM Watson IoT Platform integration routes.

In this step, we will provide an ability for the Government agency to watch the data transmitted by the elevator IOT-ELEVATOR-001 to the Blockchain network.

- In a new browser tab open this URL https://ibm.biz/icsimulator
- Click on **Government Blockchain Monitor**
- This will open a Blockchain monitoring application in a new tab
- Click on **Configuration** in the top right corner of this application
- In the configuration form enter the validating peer host and port for Validating Peer 2 (This information could be captured from the IBM Blockchain dashboard)
- Enter the Chaincode ID for the Elevator Contract (This information could be captured from the IBM Blockchain dashboard)
- In Secure Context enter: **user_type1_2**
- In Number of Block to display: 100
- Then click on SUBMIT as shown in the image below



- This configuration will now start reading the last hundred blocks of data from the Elevator contract

Summary

Blockchain is a technology for a new generation of transactional applications that establishes trust, accountability and transparency while streamlining business processes.

This lab demonstrated how data from IoT devices could be transmitted to the IBM Blockchain network using the IBM Watson IoT Platform and help enable business processes with trust and unchangeable and immutable records transmitted from IoT devices.