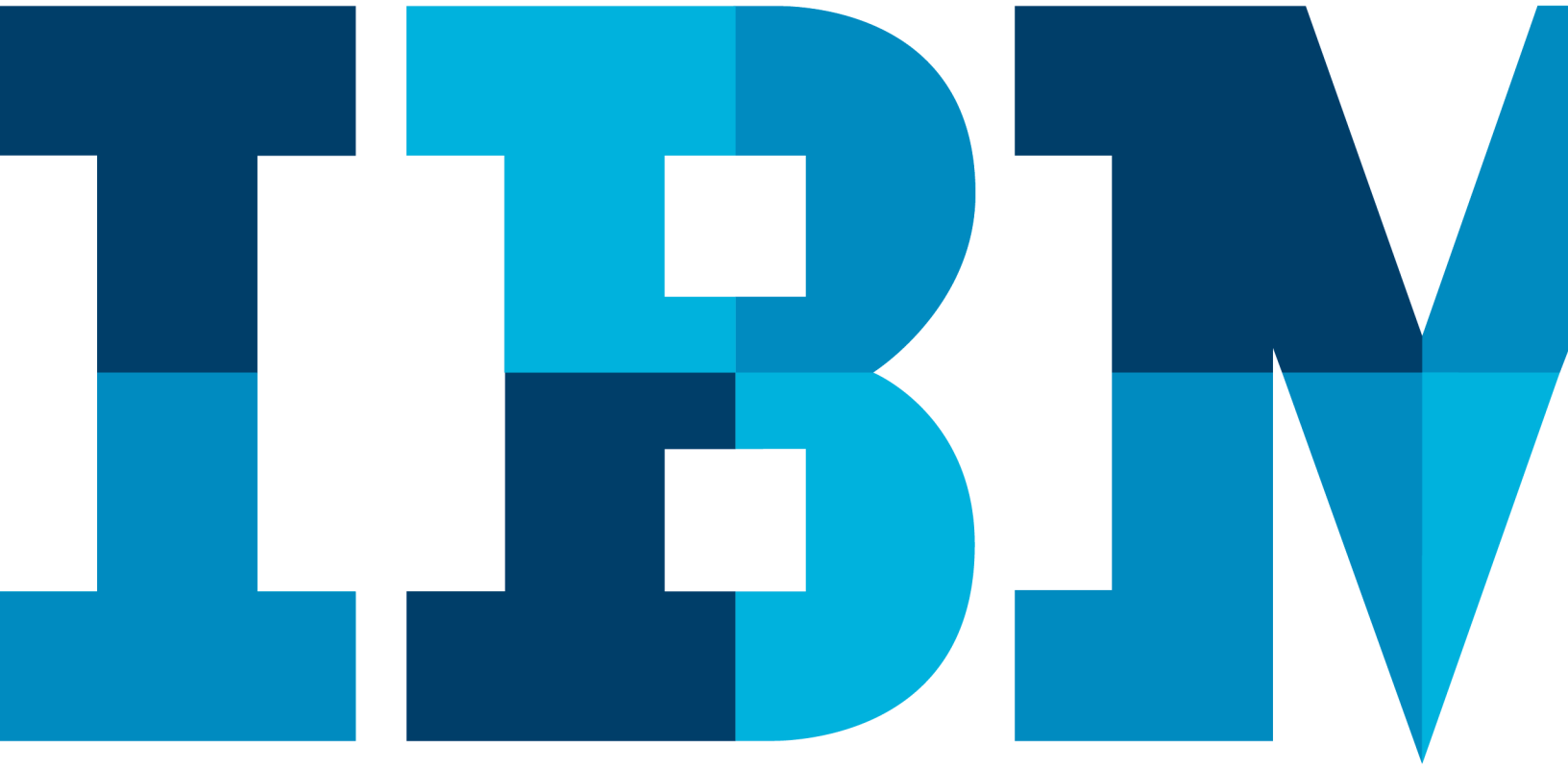
# IBM Blockchain Hands-On Composer SDK

*Lab Four*



IBM

# Contents

# 1 Overview

The aim of this lab is to get you familiar with developing Hyperledger Composer business networks. We will do this by exploring the Composer modelling language, how to write transaction processor functions in JavaScript and lastly examine how Access Control is managed in Composer.

The lab will also familiarize you with the Composer Playground, a web-based tool that allows for rapid development and testing of Composer business networks.

It should be noted that while the contents of this lab will predominantly occur within Composer Playground (for the sake of accelerating the learning and development process), the Lab can easily be completed offline and using a text editor such as Visual Studio Code or Atom. In this case please refer to the next Lab for instructions on how to use the command line tools available in Composer.

# 2 Installation

## 2.1 Prerequisite

This lab requires to have previously a Hyperledger Fabric (at least v1.1) and Composer (at least 0.19.9) installed.

We recommend to utilize Visual Studio Code as text editor to write the code of your Blockchain application (smartcontract as well as client application)

## 2.2 Configure the access to the Hyperledger Fabric hlfv1

ssh blockchain@<ip address of your hlfv1 environment>

Retrieve the tools to start your Fabric and the Composer

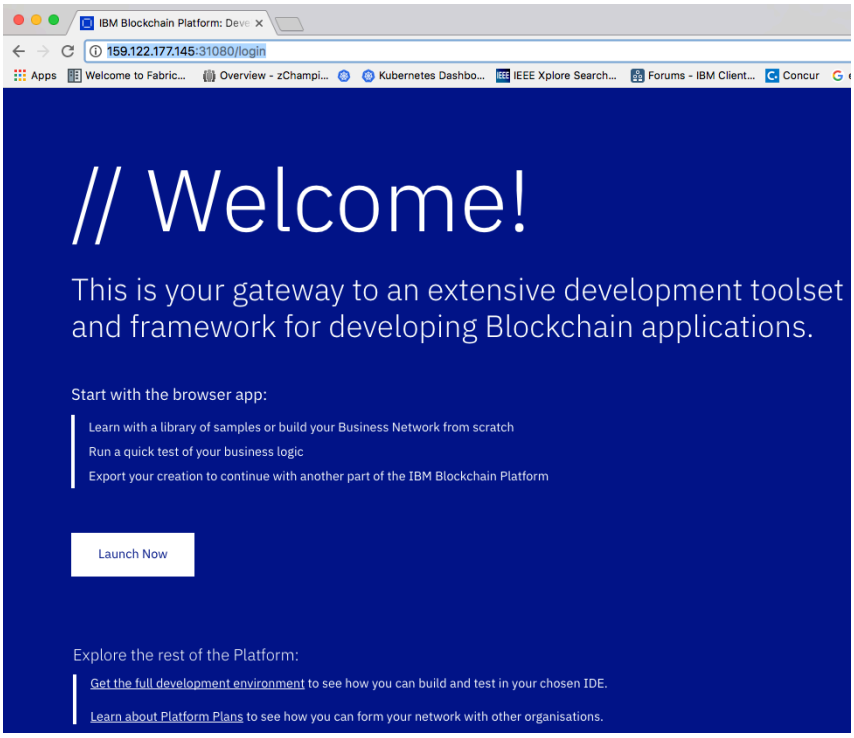
```
cd
mkdir ~/fabric-tools && cd ~/fabric-tools
curl -O https://raw.githubusercontent.com/hyperledger/composer-tools/master/packages/fabric-dev-servers/fabric-dev-servers.tar.gz
tar -xvf fabric-dev-servers.tar.gz
export FABRIC_VERSION=hlfv11
echo "export FABRIC_VERSION=hlfv11" >> $HOME/.profile
echo "export NODE_PATH=/usr/local/ibm-node8/lib/node_modules/composer-cli/node_modules/:/usr/local/ibm-node8/lib/node_modules/" >>~/.profile

docker rm -f $(docker ps -aq)
./startFabric.sh
./createPeerAdminCard.sh
mkdir ~/.composer/
mkdir ~/.composer/logs/
nohup composer-playground >~/.composer/logs/playground.stdout 2>~/.composer/logs/playground.stderr & disown
```

Let's open the Composer Playground (using Firefox browser):

< IP ADDRESS OF YOUR VM>:8080

Launch Firefox and open the playground web UI, and then press Launch Now:



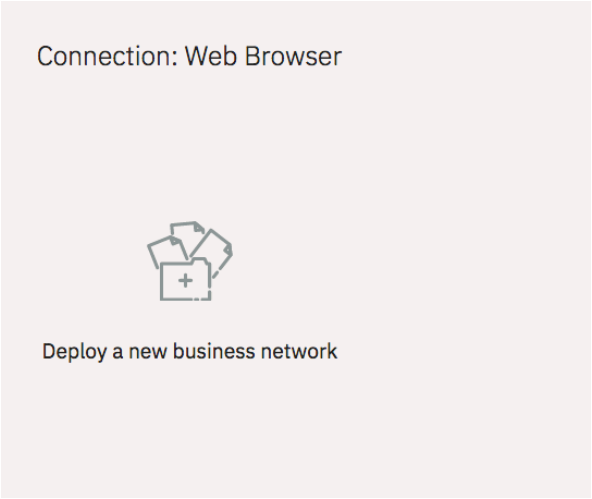

## 2.3 Create the Business Network (marble-network)

In the Lab 3, we have seen that the Composer Playground allows to create a Business Network and test it.
This business network can be exported as a Business Network Archive (.bna).
This archive file can also be generated from flat file using the composer command.
We are describing both approaches here.

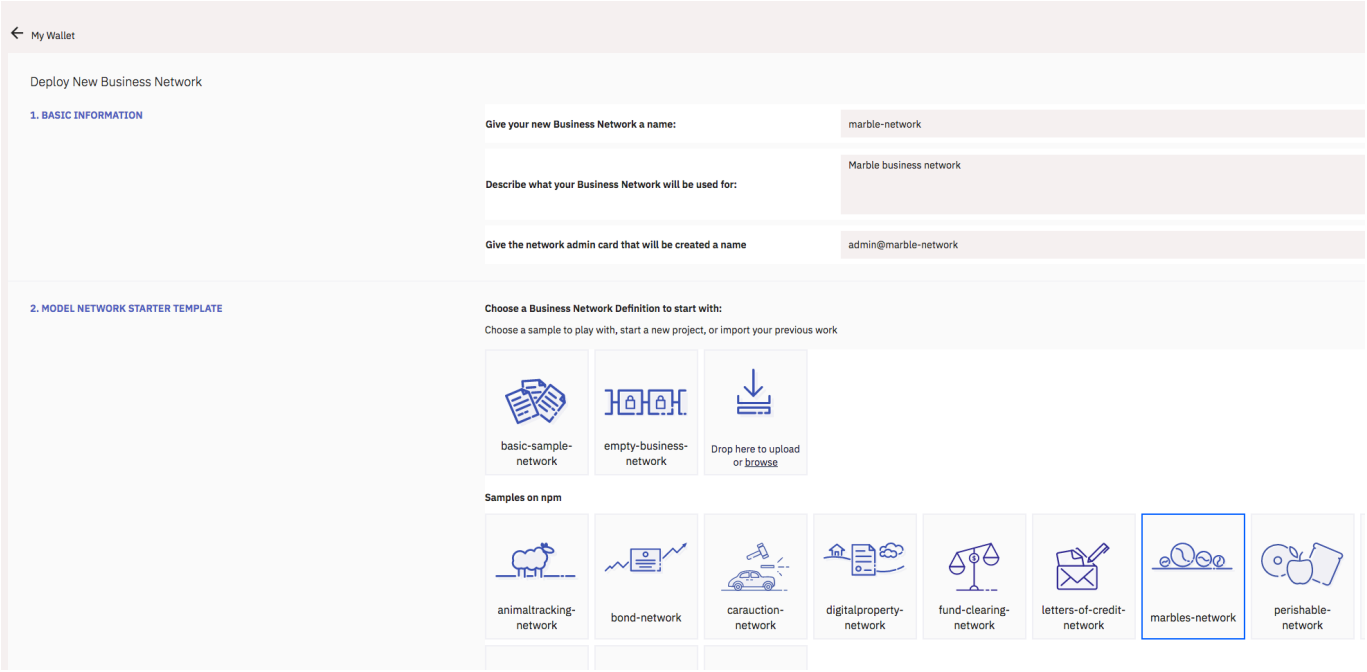
### 2.3.1 Create the Business Network (marble-network) with composer-playground

Open the Composer Playground (using Firefox browser):

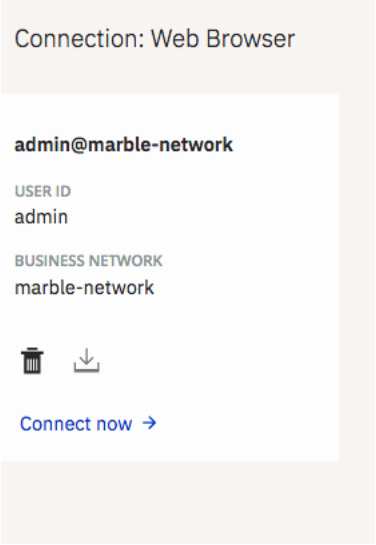
<YOUR PUBLIC IP ADDRESS>:31080
Click on “Connection : Web Browser”> Deploy a new business network



Then fill in the information (name : marble-network, network admin card : admin@marble-network) and choose marbles-network as Business Network Definition. Then click on DEPLOY.

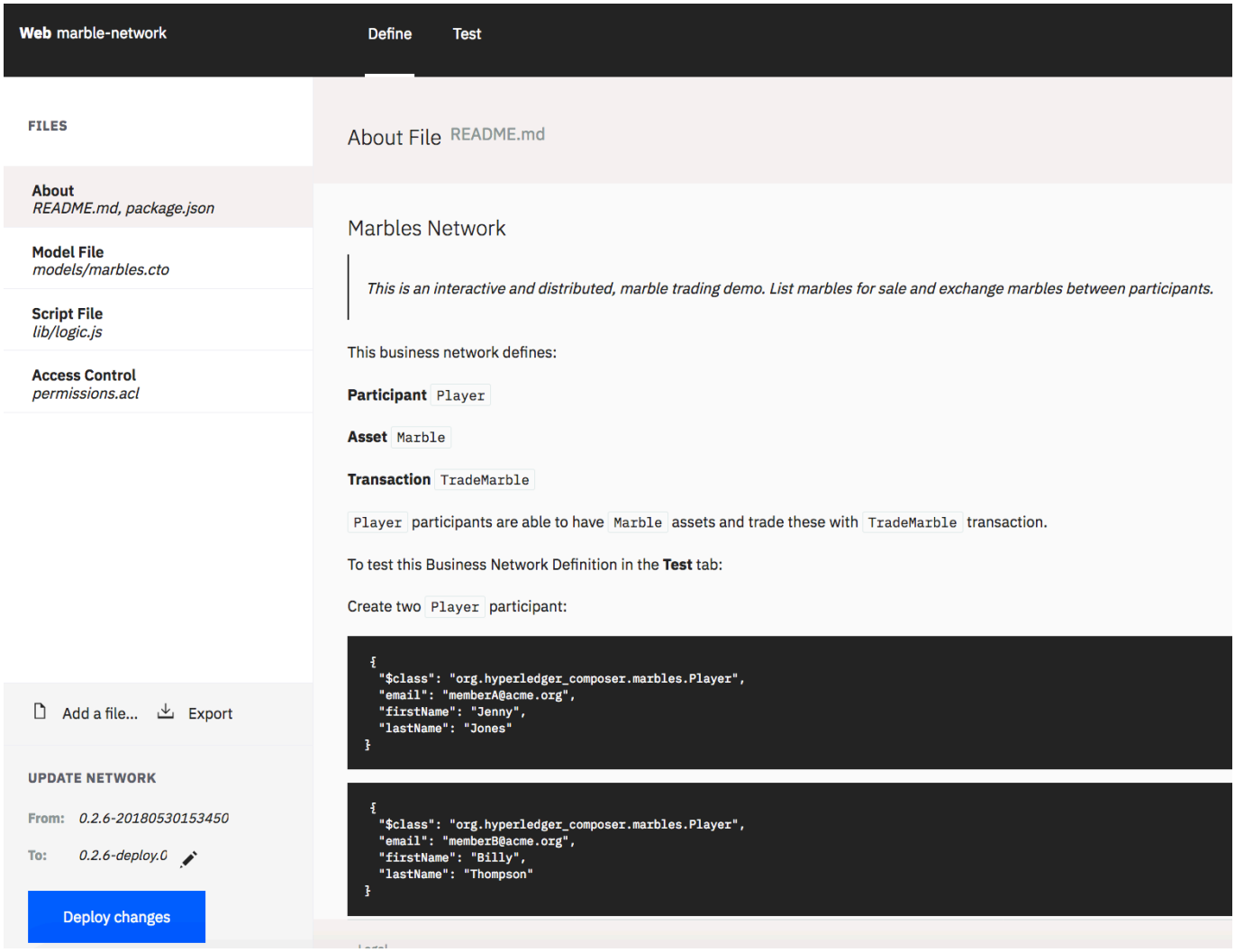



On the My business Networks page, click on Connect now on the marble-network.




Update the Model.cto, and logic.js (retrieve the content given at the chapter 2.4.2).
Then click on Deploy Changes.

Finally, click on export to retrieve the Business Network Archive (.bna) that you will use to deploy on the Hyperledger Fabric in IBM Cloud.




### 2.3.2 Create the Business Network (marble-network) with composer-cli

This is the approach described here.
Create a folder called **marble-network**.

```
cd ~/git
mkdir marble-network
cd marble-network
```

Create a file called **package.json** in this folder, and put the following content.

```
{
    "engines": {
        "composer": "^0.19.9"
    },
    "name": "marbles-network",
    "version": "0.1.1-deploy.0",
    "description": "Marble Trading Network",
    "scripts": {
        "prepublish": "mkdirp ./dist && composer archive create --sourceType dir --sourceName
. -a ./dist/marbles-network.bna",
        "pretest": "npm run lint",
```

```
        "lint": "eslint .",
        "postlint": "npm run licchk",
        "licchk": "license-check-and-add",
        "postlicchk": "npm run doc",
        "doc": "jsdoc --pedantic --recurse -c jsdoc.json",
        "test": "mocha -t 0 --recursive",
        "deploy": "./scripts/deploy.sh"
    },
    "repository": {
        "type": "git",
        "url": "https://github.com/hyperledger/composer-sample-networks.git"
    },
    "keywords": [
        "marbles",
        "trading",
        "composer",
        "composer-network"
    ],
    "author": "Hyperledger Composer",
    "license": "Apache-2.0",
    "devDependencies": {
        "chai": "^3.5.0",
        "composer-admin": "^0.19.9",
        "composer-cli": "^0.19.9",
        "composer-client": "^0.19.9",
        "composer-common": "^0.19.9",
        "composer-connector-embedded": "^0.19.9",
        "eslint": "^3.6.1",
        "istanbul": "^0.4.5",
        "jsdoc": "^3.5.5",
        "license-check-and-add": "~2.3.0",
        "mkdirp": "^0.5.1",
        "mocha": "^3.2.0",
        "moment": "^2.17.1"
    }
}
```

Create a file called permissions.acl

```
/**
 * Sample access control list.
 */
rule Default {
    description: "Allow all participants access to all resources"
    participant: "ANY"
    operation: ALL
    resource: "org.hyperledger_composer.marbles.*"
    action: ALLOW
}
```

```
rule SystemACL {
    description:  "System ACL to permit all access"
    participant: "org.hyperledger.composer.system.Participant"
    operation: ALL
    resource: "org.hyperledger.composer.system.**"
    action: ALLOW
}

rule NetworkAdminUser {
    description: "Grant business network administrators full access to user resources"
    participant: "org.hyperledger.composer.system.NetworkAdmin"
    operation: ALL
    resource: "**"
    action: ALLOW
}

rule NetworkAdminSystem {
    description: "Grant business network administrators full access to system resources"
    participant: "org.hyperledger.composer.system.NetworkAdmin"
    operation: ALL
    resource: "org.hyperledger.composer.system.**"
    action: ALLOW
}
```

Create a subfolder called **models**.

```
mkdir models && cd models
```

Create a file called **marble.cto** in this folder, and put the following content. It consists of the assets, participants and transactions of the Business Network.

```
/**
 * Defines a data model for a marble trading network
 */
namespace org.hyperledger_composer.marbles

enum MarbleColor {
  o RED
  o GREEN
  o BLUE
  o PURPLE
  o ORANGE
}
enum MarbleSize {
  o SMALL
  o MEDIUM
  o LARGE
}
asset Marble identified by marbleId {
  o String marbleId
  o MarbleSize size
  o MarbleColor color
```

```
  --> Player owner
}
participant Player identified by email {
  o String email
  o String firstName
  o String lastName
}
transaction TradeMarble {
  --> Marble marble
  --> Player newOwner
}
transaction ChangeMarbleSize {
  --> Marble marble
  o MarbleSize newSize
}
```

Create a subfolder of marble-network called lib.

```
cd ..
mkdir lib
cd lib
```

Create a file called **logic.js** in this folder and put the following content. It consists of the code of the transactions.

```
/* global getAssetRegistry */

/**
 * Trade a marble to a new player
 * @param  {org.hyperledger_composer.marbles.TradeMarble} tradeMarble - the trade marble
transaction
 * @transaction
 */
async function tradeMarble(tradeMarble) {   // eslint-disable-line no-unused-vars
    tradeMarble.marble.owner = tradeMarble.newOwner;
    const assetRegistry = await getAssetRegistry('org.hyperledger_composer.marbles.Marble');
    await assetRegistry.update(tradeMarble.marble);
}

**
 * Change the size of a Marble
 * @param  {org.hyperledger_composer.marbles.ChangeMarbleSize} changeMarbleSize - the change
marble size transaction
 * @transaction
 */
async function changeMarbleSize(changeMarbleSize) {   // eslint-disable-line no-unused-vars
    changeMarbleSize.marble.size = changeMarbleSize.newSize;
    const assetRegistry = await getAssetRegistry('org.hyperledger_composer.marbles.Marble');
    await assetRegistry.update(changeMarbleSize.marble);
}
```

**Now we are generating the Business Network Archive.**

Go to the folder marble-network and run the following command :

```
composer archive create -t dir -n .
```

You should get an error :

```
Input directory: /home/blockchain/git/marble-network
SyntaxError: Failed to parse /home/blockchain/git/marble-network/lib/logic.js: Unexpected
token (14:0)

Command failed
```

Fix it and redo the archive creation.
Expected result:

```
Creating Business Network Archive


Looking for package.json of Business Network Definition
     Input directory: /Users/ovallod/git/marbles-network

Found:
     Description: Marble Trading Network
     Name: marbles-network
     Identifier: marbles-network@0.1.1-deploy.0

Written Business Network Definition Archive file to
     Output file: marbles-network@0.1.1-deploy.0.bna

Command succeeded
```

## 2.4 Deploy the Business Network

We first install the business network based on the Business Network archive:

```
cd ~/git/marble-network
composer network install -a marbles-network@0.1.1-deploy.0.bna -c PeerAdmin@hlfv1
```

```
✔ Installing business network. This may take a minute...
Successfully installed business network marbles-network, version 0.1.1-deploy.0

Command succeeded
```

Then we start the business network and generate the business network card for the administration of this BN:

```
composer network start -c PeerAdmin@hlfv1 -n marbles-network -V 0.1.1-deploy.0 -A
admin -S adminpw
```

Expected result:

```
Starting business network marbles-network at version 0.1.1-deploy.0

Processing these Network Admins:
     userName: admin

✔ Starting business network definition. This may take a minute...
Successfully created business network card:
     Filename: admin@marbles-network.card

Command succeeded
```

Finally, we import the BN card of the admin user:

```
composer card import --file admin@marbles-network.card
```

Ping the BN in order to check it is up running and to do the enrollment of the admin user:

```
composer network ping -c admin@marbles-network
```

Expected result:

```
The connection to the network was successfully tested: marbles-network
    Business network version: 0.1.1-deploy.0
    Composer runtime version: 0.19.5
    participant: org.hyperledger.composer.system.NetworkAdmin#admin
    identity:
org.hyperledger.composer.system.Identity#7c680cf85063a9f8b1082acd5e0a31daf856cf2fb6a8e55f
0eb288529ba2218d

    Command succeeded
```

Export the business card in order to retrieve the credentials

```
composer card export -c admin@marbles-network  --file adminmrbl.card
```

Then delete the existing BN card (which does not include the credentials – ie certificates)

```
composer card delete -c admin@marbles-network
```

Then import the BN card exported previously

```
composer card import --file adminmrbl.card
```

At this stage, we have prepared the local environment (composer cli) to access to the Hyperledger Fabric environment and we have deployed the Business Network archive of the Marble Smartcontract.

# 3 Manipulating and Adding Resources with the SDK

*In this section, we will first look at how to connect to a running fabric instance with the composer node.js SDK and secondly follow this by looking at to adding and updating resources.*

## 3.1 Getting Started

First, create a folder **marble-client** where the application files will be added.

```
cd ~/git && mkdir marble-client && cd marble-client
```

## 3.2 Create the participants and assets

In this part, we are creating a simple NodeJS application which will create participants and asset of the marble-network.

Use a text editor and create a file called add-resources.js

First we reference the NodeJS lib that we are using : composer-client, then we put the squeleton of our application : an asynchronous function ‘createResources()’ and the call to this function. The result (t) will be displayed (‘console.log(t)’).

```
const BusinessNetworkConnection = require('composer-client').BusinessNetworkConnection;

async function createResources() {
    try {
       …
    } catch (error) {
        console.log(error);
        process.exit(1);
    }
}
createResources().then((t) => {
    console.log(t);
});
```

Then in the core of the function, replace the ‘…’ by the connection to the Business Network.

```
        // Connect to the Business Network
        let bizNetConnection = new BusinessNetworkConnection();
        let bizNetDef = await bizNetConnection.connect("admin@marbles-network");
```

Then just after, retrieve the description of the Business Network.

```
        // Retrieve the description of the Business Network
        let factory = bizNetDef.getFactory();
```

Then we are creating the first resource which is a participant of type Player.

```
        // Create a resource of type Player
        let player1 = factory.newResource('org.hyperledger_composer.marbles', 'Player',
'email:olivier2@mele');
        player1.lastName = 'Truc';
        player1.firstName = 'Olivier2';
```

Create other Player resources, replicating this code and changing the values: create player2 and player3.

Then retrieve the participant registry of our BN ('org.hyperledger_composer.marbles.Player') and add the created resources - player1, player2 and player3 - in this registry

```
       //retrieve the participant registry and add the Player resources
        let playerRegistry = await
bizNetConnection.getParticipantRegistry('org.hyperledger_composer.marbles.Player');
        await playerRegistry.addAll([player1, player2, player3]);
```

At this stage, you can run this application which will create 3 Participants: in the folder, you can run the following command:

```
       node add-resources.js
```

To check the added resources, use the command:

```
       composer network list -c admin@marbles-network
```

Pay attention to comment the line “await playerRegistry.addAll …” after running the application to avoid an error with duplicate resource. (You can also change the value of the emailId of each Player).

Now we are going to add the assets. Create a new resource of type Marble. Then assign the values to each field (size, color). Then, create a relationship with the selected Player giving his email.

```
        let marble = factory.newResource('org.hyperledger_composer.marbles', 'Marble',
'marbleId:1');
        marble.size = 'MEDIUM';
        marble.color = 'ORANGE';
        marble.owner = factory.newRelationship('org.hyperledger_composer.marbles', 'Player',
'email:olivier1@mele');
```

Create marble1 and marble2 resources replicating the previous code and changing the values.

Then retrieve the marble registry of our BN ('org.hyperledger_composer.marbles.Marble') and add the created resources - marble, marble1 and marble2 - in this registry

```
        let marbleRegistry = await
bizNetConnection.getAssetRegistry('org.hyperledger_composer.marbles.Marble');
        await marbleRegistry.add(marble);
        await marbleRegistry.add(marble1);
        await marbleRegistry.add(marble2);
```

## 3.3 Get and display the list of Marbles

Now we are displaying the list of marbles:

```
        marbleRegistry.getAll()
        let marbles = await marbleRegistry.getAll();
        let tMarbles = new Array({
            head: ['MarbeId', 'Owner', 'Size', 'Color']
        });
        let arrayLength = tMarbles.length;
        marbles.forEach((marble) => {
            let tableLine = [];
            tableLine.push(marble.marbleId);
            tableLine.push(marble.owner);
            tableLine.push(marble.size);
            tableLine.push(marble.color);
            tMarbles.push(tableLine);
        })

        bizNetConnection.disconnect();

        // Put to stdout - as this is really a command line app
        return tMarbles;
```

Retrieve the Nodejs dependencies :

```
        npm install
```

Run this application with the following command:

```
        node add-resources.js
```

# 4 Using the composer rest server

In this chapter, we will use the Composer Rest server to publish the transactions as Rest API.

Then we will develop a web application to use these API.

## 4.1 Start the Composer Rest server

We will complete the installation done in Lab 1, installing the composer rest server on the blockchain cluster in IBM Cloud.
The Business Network card of the admin user of the marble-network will be used to install the Composer Rest Server. Issue the following commands in a Linux terminal:

```
      COMPOSER_CARD=admin@marbles-network nohup composer-rest-server >~/.composer/logs/rest-server.stdout 2>~/.composer/logs/rest-server.stderr & disown
```

Check the server, looking at the log in the container :

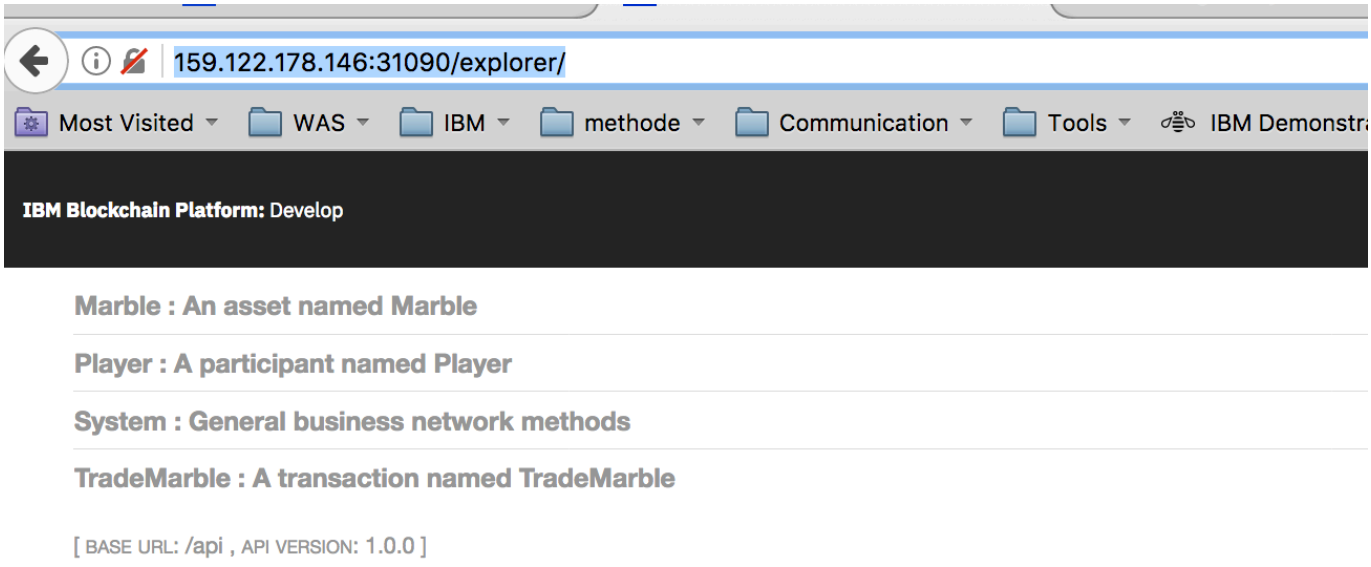
```
      cat ~/.composer/logs/rest-server.stdout
```

Expected result:

```
Discovering types from business network definition ...
Discovered types from business network definition
Generating schemas for all types in business network definition ...
Generated schemas for all types in business network definition
Adding schemas for all types to Loopback ...
Added schemas for all types to Loopback
Web server listening at: http://localhost:3000
Browse your REST API at http://localhost:3000/explorer
```

## 4.2 Check the REST API

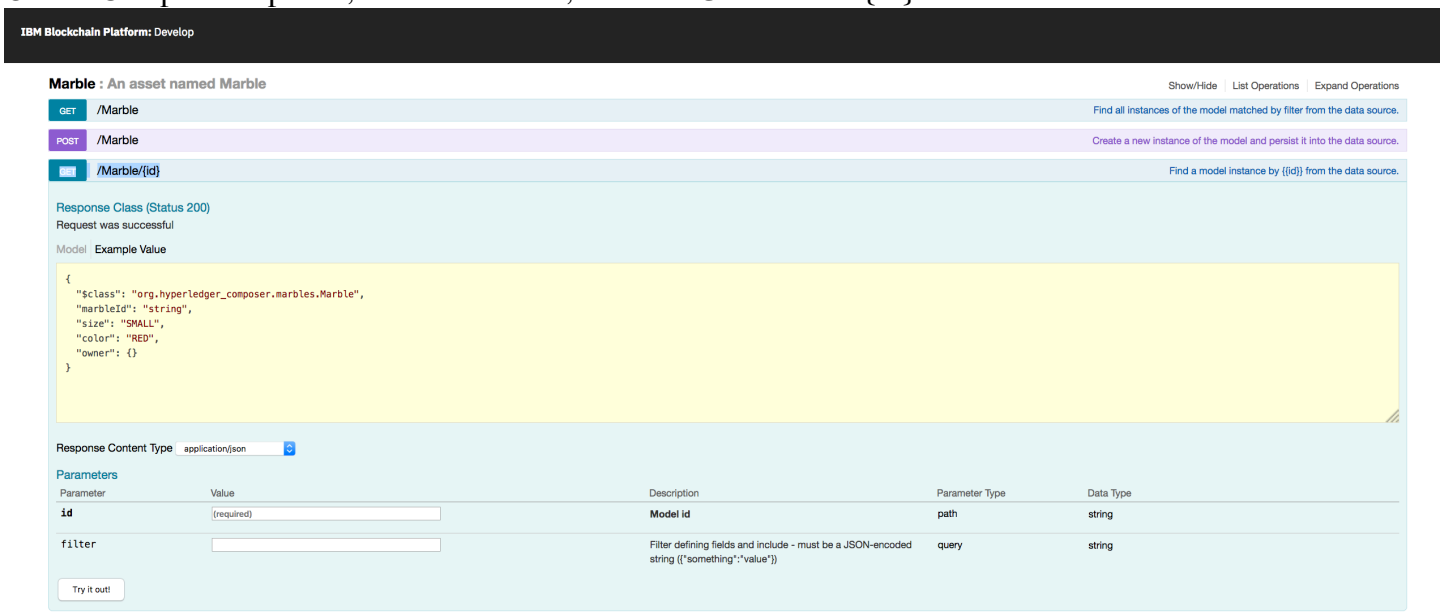
To access the Rest explorer, use the port 000 with the external ip address.
Open your internet browser and access the explorer: http://<external IP Address:3000/explorer/




Now you are ready to access to your Business Network through Rest API.
We are going to explore these API.

### 4.2.1 Display a marble

On the Composer explorer, click on Marble, then on “Get /Marble/{id}”




In the field id, put “marbleId:1” then click on the “Try it out” button. It will display the content of the asset Marble 1 as shown in the following picture.

Curl

```
curl -X GET --header 'Accept: application/json' 'http://159.122.178.146:31090/api/Marble/marbleId%3A1'
```

Request URL

```
http://159.122.178.146:31090/api/Marble/marbleId%3A1
```

Response Body


```
{
  "$class": "org.hyperledger_composer.marbles.Marble",
  "marbleId": "marbleId:1",
  "size": "MEDIUM",
  "color": "ORANGE",
  "owner": "resource:org.hyperledger_composer.marbles.Player#email:olivier1@mele"
}
```


Response Code

```
200
```

Response Headers


```
{
  "vary": "Origin, Accept-Encoding",
  "access-control-allow-credentials": "true",
  "x-xss-protection": "1; mode=block",
  "x-frame-options": "DENY",
  "x-download-options": "noopen",
  "x-content-type-options": "nosniff",
  "content-type": "application/json; charset=utf-8",
  "content-length": "188",
  "etag": "W/\"bc-Gv6r+ZDmEgVddhoiWFnzYsaFfeg\"",
  "date": "Sat, 02 Jun 2018 18:54:53 GMT",
  "connection": "keep-alive"
}
```


### 4.2.2 Execute a transaction

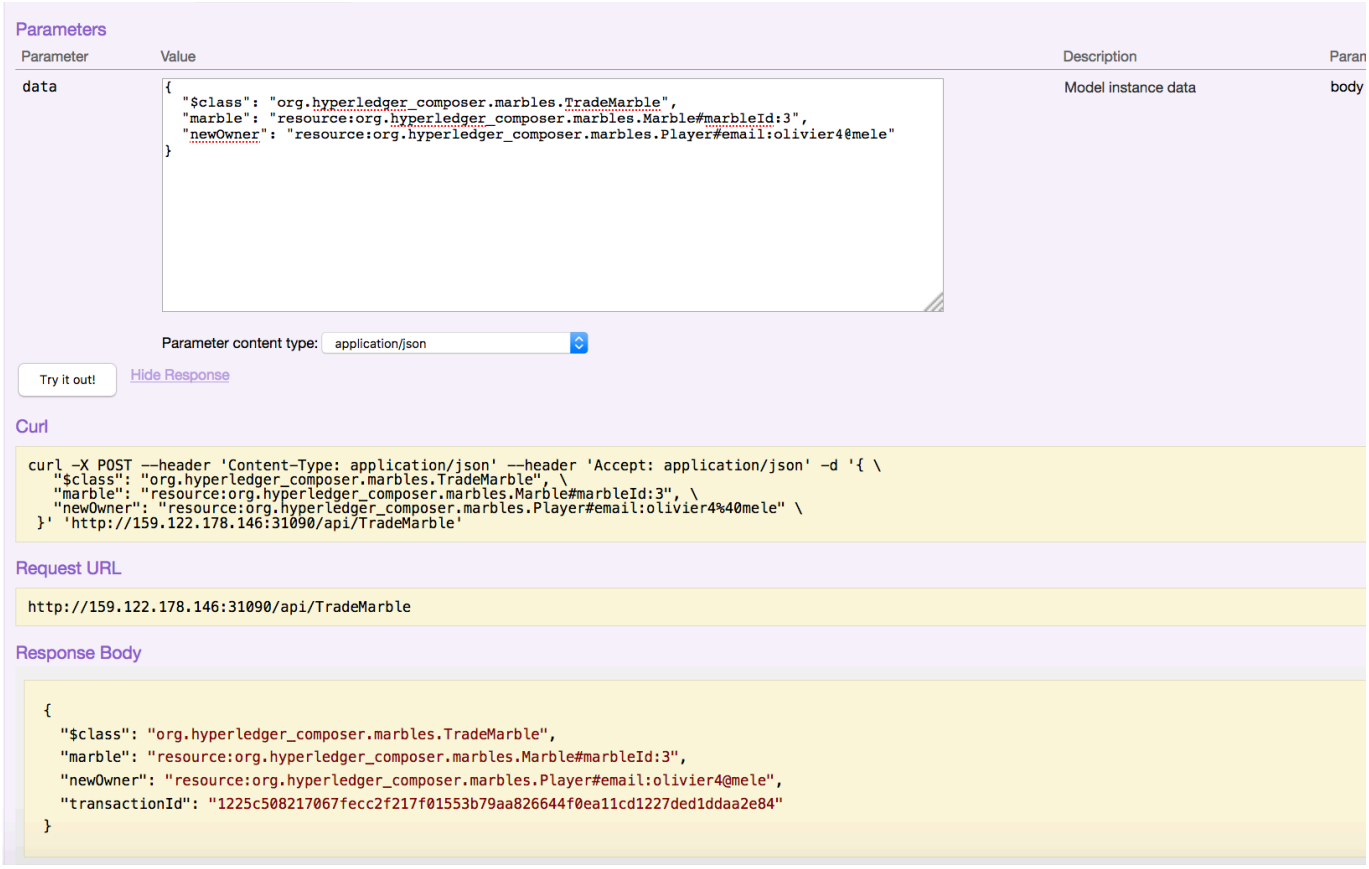
We are going to change the owner of the marbleId:3.

On the Composer explorer, click on TradeMarble, then on “POST /TradeMarble”.

In the field ‘data’, specify the transaction input data:

```
{
  "$class": "org.hyperledger_composer.marbles.TradeMarble",
  "marble": "resource:org.hyperledger_composer.marbles.Marble#marbleId:1",
  "newOwner": "resource:org.hyperledger_composer.marbles.Player#email:olivier4@mele"
}
```

Then click on the button” Try it out” to run the transaction




This concludes the lab on composer SDK development. More information on the SDK can be found here:

**https://hyperledger.github.io/composer/jsdoc/index.html**

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# NOTES

# NOTES



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