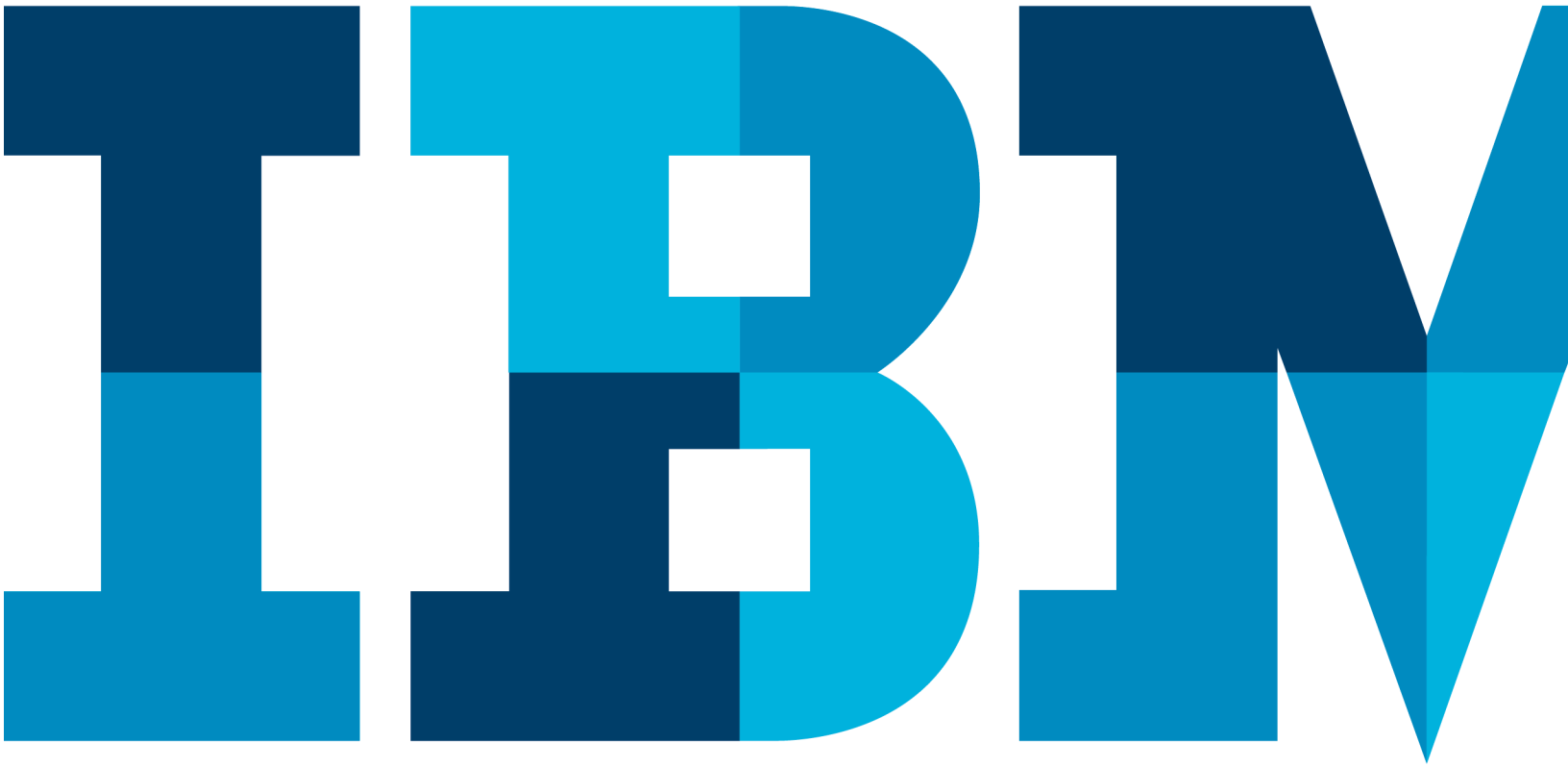
IBM Blockchain Hands-On

IBM Blockchain Platform Visual Studio Code Extension:

Add a Loopback API to your Smart Contract

Lab Seven



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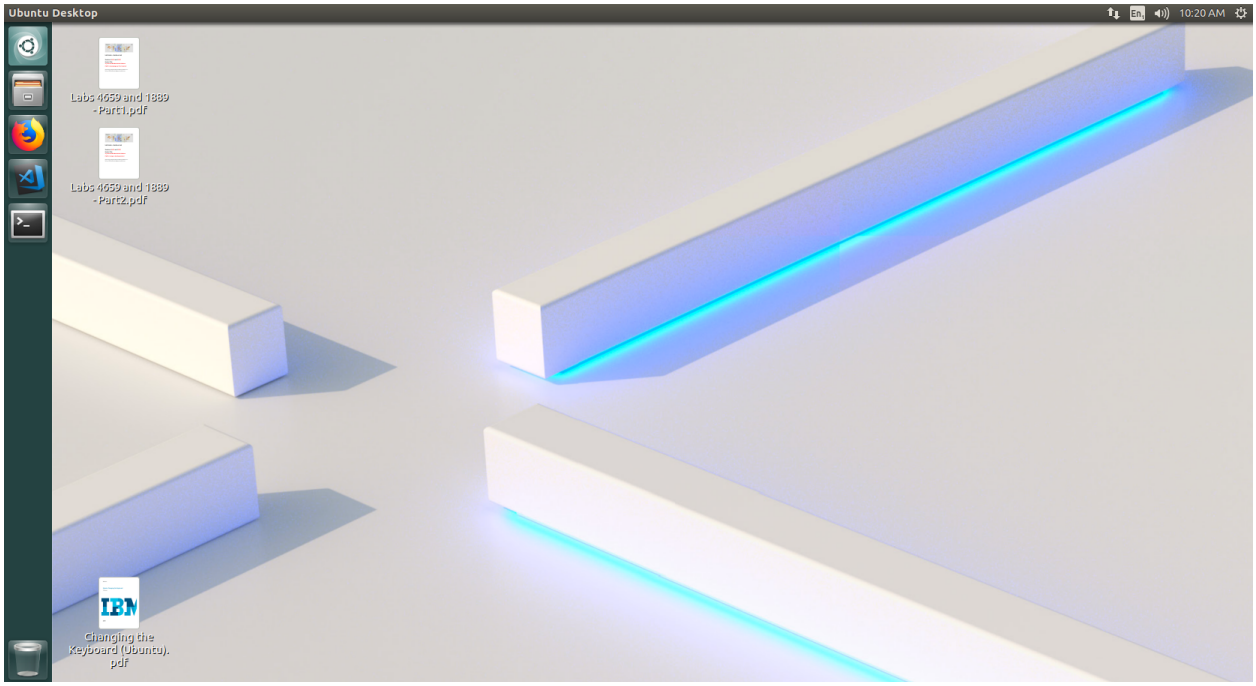
1 Overview of the lab 7 environment and scenario

This lab is a technical introduction to blockchain, specifically smart contract development using the latest developer enhancements in the Linux Foundation's Hyperledger Fabric v1.4 and shows you how IBM's Blockchain Platform's developer experience can accelerate your pace of development.
***Note**: The screenshots in this lab guide were taken using version **1.31.1** of **VSCode**, and version **0.3.0** of the **IBM Blockchain Platform** plugin. If you use different versions, you may see differences those shown in this guide.*
Start here. Instructions are always shown on numbered lines like this one:

__ 1. If it is not already running, start the virtual machine for the lab. The instructor will tell you how to do this if you are unsure.

__ 2. Wait for the image to boot and for the associated services to start. This happens automatically but might take several minutes. The image is ready to use when the desktop is visible as per the screenshot below.

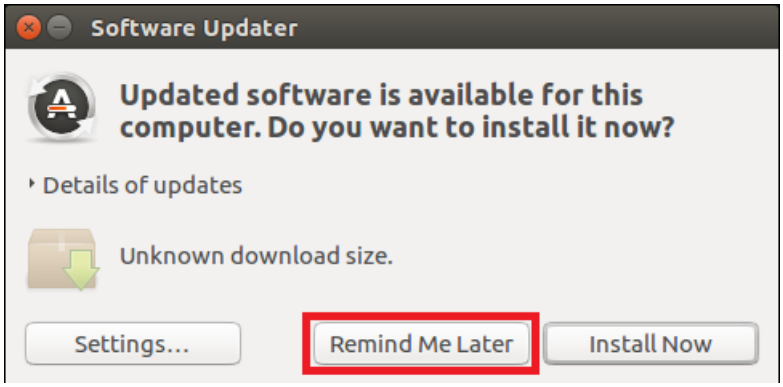
If it asks you to login, the userid and password are both "blockchain".



1.1 Lab 6 Scenario

In this lab, we will examine how loopback can be used to expose chaincode transaction methods as RESTful APIs.

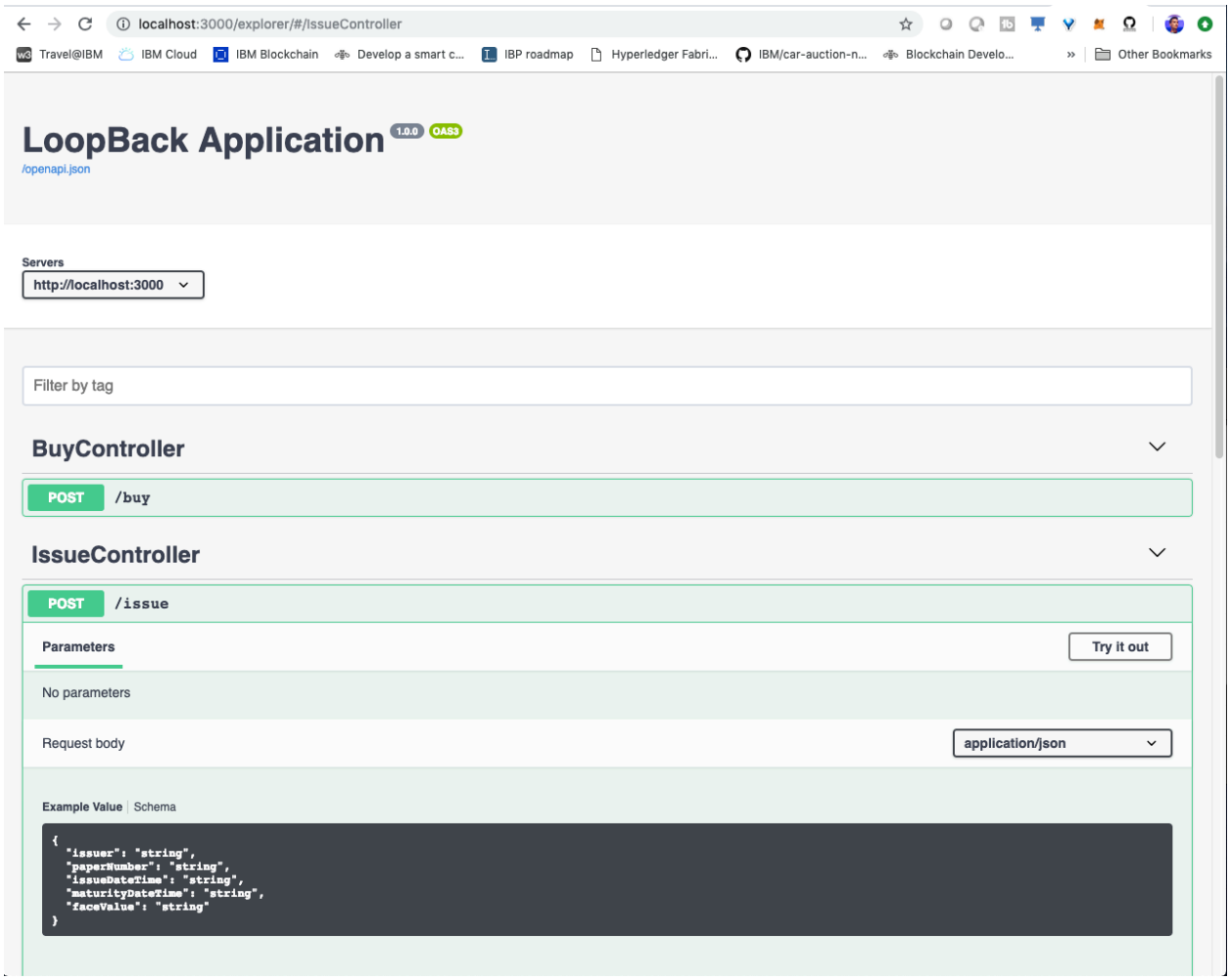
Note *that if you get an "Software Updater" pop-up at any point during the lab, please click "****Remind Me Later****":*



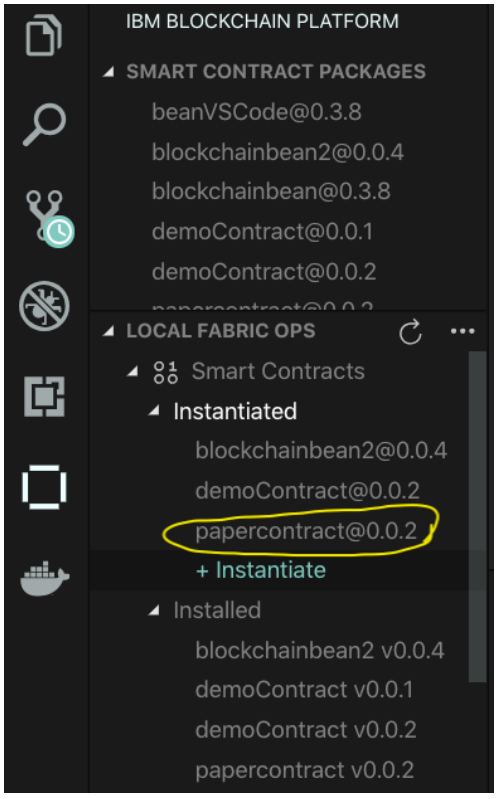
Article I. Commercial Paper Loopback

This is an application that acts as a front end for interacting with the [commercial paper smart contract tutorial] from the Hyperledger Fabric 1.4 documentation. Here is the [video tutorial] that accompanies this repo.

The finished application looks like this:



Note, to use this app, you must have the commercial paper contract deployed as **papercontract** on your Hyperledger Fabric network (Lab 6). I.e. If you are using the [IBM Blockchain VSCode extension], your instantiated contract list should look something like this (i.e. must have **papercontract**) instantiated:

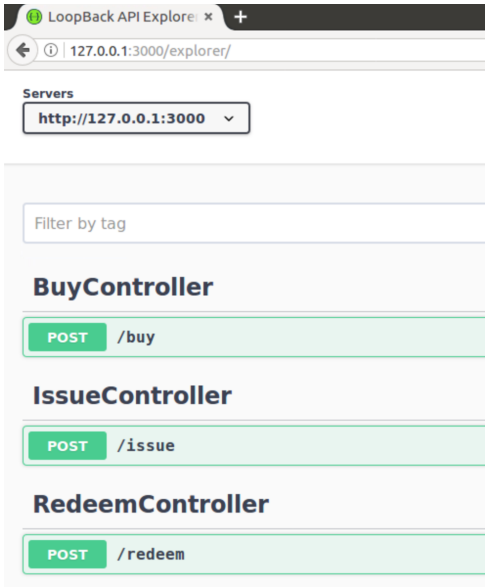


(a) Steps

1. From the left pane toolbar open up a new terminal (Right click for new terminal option).
2. From the newly opened terminal, `cd ~/workspace`
3. From the terminal run the command:

```
git clone https://github.com/horeaporutiu/commercialPaperLoopback.git
```

4. You should now have a newly created commercialPaperLoopback directory under ~/workspace.
5. cd to the new directory. Run `npm install` in the newly cloned directory.
6. run `npm start` in the newly cloned directory
7. From the left pane toolbar, open Firefox. Go to http://127.0.0.1:3000/explorer/ and interact with the contract. You should now see the buy, issue and redeem endpoints.

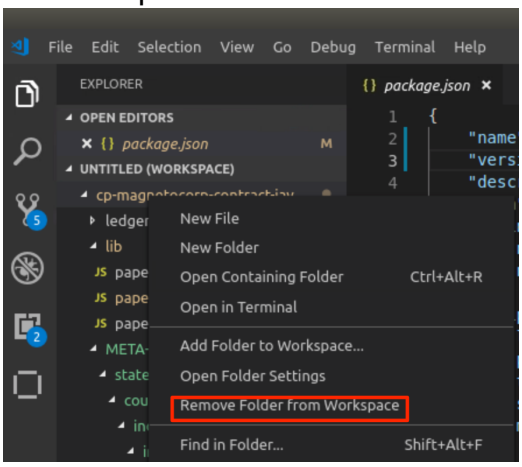


Section 1.02 Overview

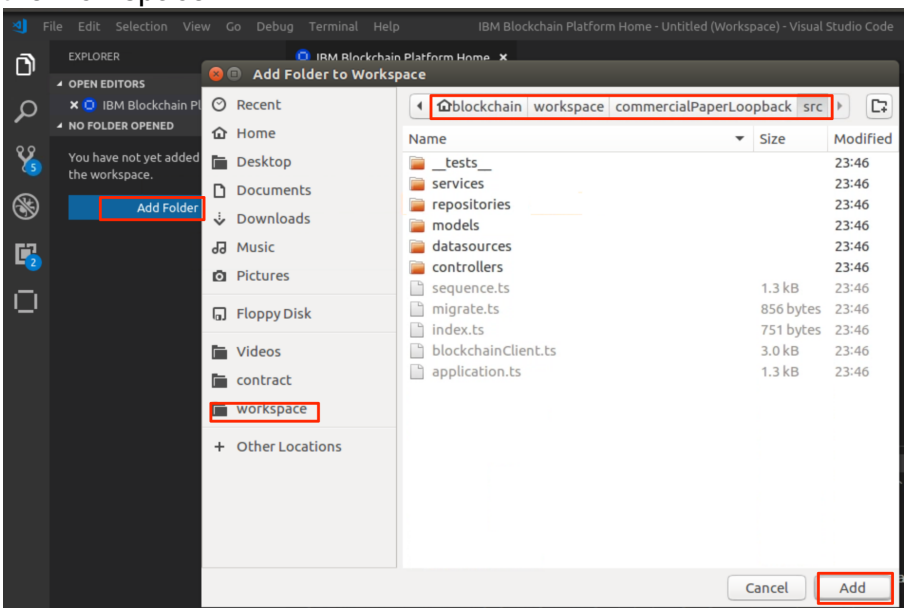
This application shows how to easily scaffold and get started creating a front-end application to interact with your deployed smart contract. This application is an extension to the Hyperledger paper contract developer tutorial, and adds on an extra layer (the UI) with the goal of enabling users that are not developers to interact with a smart contract.

The application has three main components - the models, the views, and the controllers. Since loopback (the lb4 tool) creates the UI for you, based on your models and controllers, I will focus on just those two components (the models and the controllers).

__1. If VSCode isn't already open, Open VSCode using the left hand toolbar. From the explorer view, if there are any open folders, remove any open folders from the workspace



__2. Click **Add Folder** and add the ~/workspace/commercialPaperLoopback folder to the workspace.



(i) Models

To view the models of this application, in VSCode, go to `commercialPaperLoopback/src/models`. Let's first take a look at the `models/issue.model.ts` file. When you open the file, you will see the following code:

```
import {Entity, model, property} from '@loopback/repository';

@model()
export class Issue extends Entity {
```

```
  @property({
    type: 'string',
    required: true,
  })
  issuer: string;

  @property({
    type: 'string',
    required: true,
  })
  paperNumber: string;

  @property({
    type: 'string',
    required: true,
  })
  issueDateTime: string;

  @property({
    type: 'string',
    required: true,
  })
  maturityDateTime?: string;

  @property({
    type: 'string',
  })
  faceValue?: string; // address,city,zipcode

  constructor(data?: Partial<Issue>) {
    super(data);
  }
}
```

What you see here are the definitions of the properties of the Issue object. We can make the properties required - as you can see in the first two properties, or optional. Ok - time to move on to the controllers. Close the file.

(ii) Controllers

The controllers will take what we write into our request body (i.e. the UI of the loopback app) and pass that data to the `papernet` smart contract we have deployed on our local Hyperledger Fabric network. To get an idea of the controllers, from VSCode go to your `commercialPaperLoopback/src/controllers` directory and open the `issue.controller.ts` file. In there, you will see the following code:

```
import { BlockChainModule } from '../blockchainClient';

let blockchainClient = new BlockChainModule.BlockchainClient();

export class IssueController {
```

```
  constructor() {}

  @post('/issue', {
    responses: {
      '200': {
        description: 'Todo model instance',
        content: {'application/json': {schema: {'x-ts-type': Issue}}},
      },
    },
  })
  async createIssue(@requestBody() requestBody: Issue): Promise<Issue> {
    console.log('Buy, requestBody: ')
    console.log(requestBody)


    let networkObj = await blockchainClient.connectToNetwork();
    if (!networkObj) {
      let errString = 'Error connecting to network';
      let issue = new Issue({issuer: errString, paperNumber: errString,
issueDateTime: errString, maturityDateTime: errString });
      return issue;
    }
    console.log('network obj: ')
    console.log(networkObj)

    let dataForIssue = {
      function: 'issue',
      issuer: requestBody.issuer,
      paperNumber: requestBody.paperNumber,
      issueDateTime: requestBody.issueDateTime,
      maturityDateTime: requestBody.maturityDateTime,
      faceValue: requestBody.faceValue,
      contract: networkObj.contract
    };

    var resultAsBuffer = await blockchainClient.issue(dataForIssue);

    console.log('result from blockchainClient.submitTransaction in controller: ')
    let result = JSON.parse(Buffer.from(JSON.parse(resultAsBuffer)).toString())
    let issue = new Issue({issuer: result.issuer, paperNumber: result.paperNumber,
issueDateTime: result.issueDateTime,
      maturityDateTime: result.maturityDateTime
    });
    return issue;
  }

}
```

At the top of the file, we define our response schema - the data structure that will be returned to the UI after submitting a transaction to the smart contract. Notice that here we are returning an object of type `Issue` - which we have defined in our `issue.model.ts` file.

Next, we define the CRUD operations of our API. For simplicity - we have only defined the `/post/issue` method. Note that all CRUD methods can be implemented in a similar manner to `/post/issue`.

In our `async createIssue(@requestBody() requestBody: Issue): Promise<Issue> {` method, we first connect to our Hyperledger Fabric network by telling our application where our peers, orderers, and certificate authority are running - this is all done by calling the `blockchainClient.connectToNetwork()` function, which we have imported at the top of the file. (see blockchainClient.ts).

Next, we look for a deployed contract such as the paper net contract. Finally, we call the appropriate method in the deployed contract, and send that response back to the user.

Thanks for taking a quick tour of some sample Loopback code!