



dallas texas



2016 Banking and Financial Markets Industry Workshop

IBM Blockchain Fundamentals Hands-on Lab

Intro: Getting Started – *overview of the lab exercise*

Estimated Duration: 5 minutes

Part A: IBM Blockchain as a Service – *create a blockchain service, explore the capabilities and features, and invoke some sample code*

Estimated Duration: 15 minutes

Part B: Open Points Application – *use a loyalty points application to create blockchain transactions and examine smart contract functionality*

Estimated Duration: 15 minutes

Part C: Creating Smart Contracts – *using the Open Points application, create new travel offers and add them to the blockchain as smart contracts*

Estimated Duration: 15 minutes

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Intro: Getting started - overview of the lab exercise

What you need:

- Bluemix account** – to deploy the loyalty points application and to create a blockchain service
Note: you may use your own ID (if already signed up with Bluemix) or one assigned by the instructor
- Laptop with a web browser** – to login to Bluemix and use Bluemix services
Note: Google Chrome or Firefox browser is recommended
- Internet Connectivity**

Pre-requisites setup:

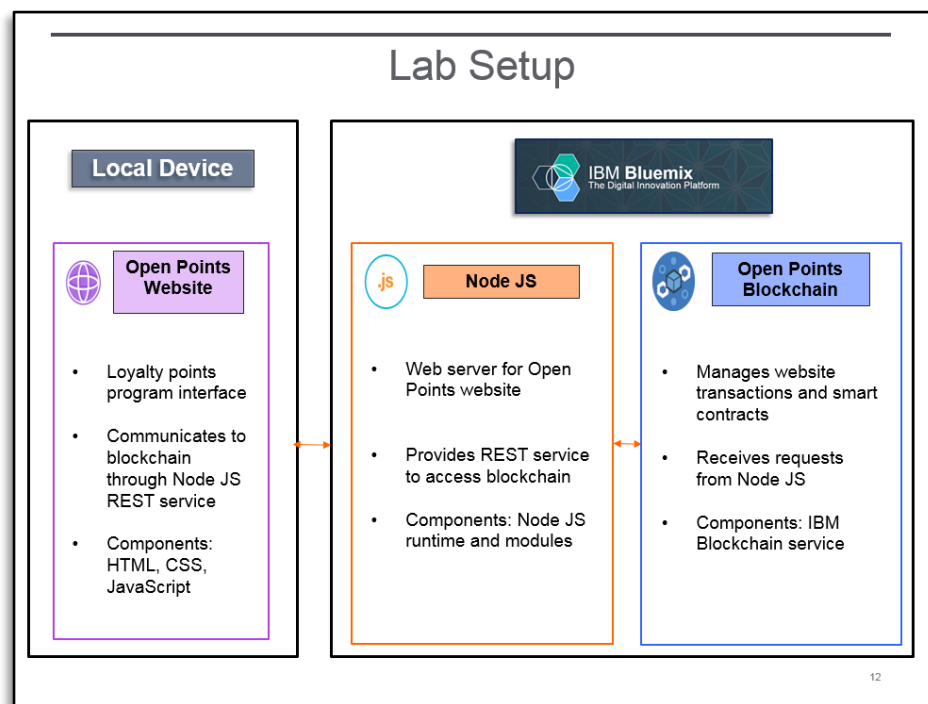
The pre-requisite steps will guide you through the setup of a Bluemix account, the setup of a JazzHub ID, and the deployment of a financial services application with the associated blockchain service.

If you have not completed the prerequisites, then ask your lab instructors about the availability of temporary accounts to use during this lab (limited availability). If you have completed the prerequisites for this lab OR you have received a temporary Bluemix account/password from the instructors, then proceed to the next section (**What you will be building**).

Link to the pre-requisite: <https://ibm.biz/Bdrp5r>

What you will be building:

In this lab you will be building a financial services application that relies on a blockchain network to manage its transactions. As shown in the diagram below, the blockchain service runs on IBM Bluemix and relies on a Node JS runtime to communicate with the financial application. The application itself, which is a loyalty points program for travel customers, runs on the local client web browser.



Each part of the lab will introduce and explain blockchain fundamentals. The primary activities of each lab section are as follows:

- Part A:** You will be creating a blockchain service that runs on IBM Bluemix. You will use this service to better understand blockchain technology by exploring its primary features, including the blockchain network and the chaincode deployment process.
- Part B:** You will use the loyalty points application and blockchain service that you deployed in the prerequisites to create blockchain transactions and examine the functionality of smart contracts. The application is a Node JS app that runs a website called Open Points. This website allows you to transfer loyalty points to other users and purchase travel packages using points. Some of these travel packages have travel offers associated with them, and these offers are applied to purchases as smart contracts that run on the blockchain. All transactions for this website are managed by the blockchain service.
- Part C:** You will use the loyalty points application from Part B to create your own travel offers for travel packages. You will add these travel offers to the blockchain as smart contracts, and test them by purchasing their corresponding travel packages.

Blockchain Terminology:

Blockchain: A distributed system of record (ledger) that stores and manages transactions as a single chain of blocks. Each block contains one or more transactions, and is linked to the previous block of transactions.

Chaincode: Software that controls the behavior of the blockchain network. Common functionality for this software includes adding transactions, retrieving data about existing transactions, and implementing smart contracts.

Network: The collection of computer nodes that run and operate a blockchain. These nodes provide the distributed functionality of blockchain technology. Each node can perform a variety roles, including validating transactions that are submitted to the blockchain or providing user authentication.

Membership Service: The network node that provides user authentication to the blockchain network.

Validating Peer: A network node that validates transactions that are submitted to the blockchain

Smart Contract: Business contract logic that is executed automatically using software.

Part A: IBM Blockchain as a Service – *create a blockchain service, explore the capabilities and features, and deploy some sample code*

Pre-Reqs:

- You have read the 'Intro: Getting Started' section and completed the prerequisites listed there.

This part of the lab explains how to complete the following tasks:

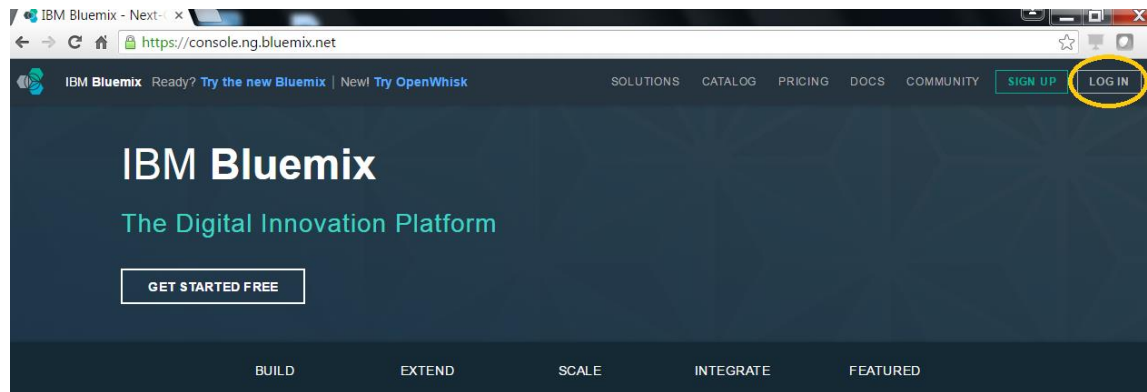
- Create a blockchain service using IBM Bluemix
- Use IBM Blockchain to monitor the blockchain network and deploy sample chaincode

Estimated Duration: 15 minutes

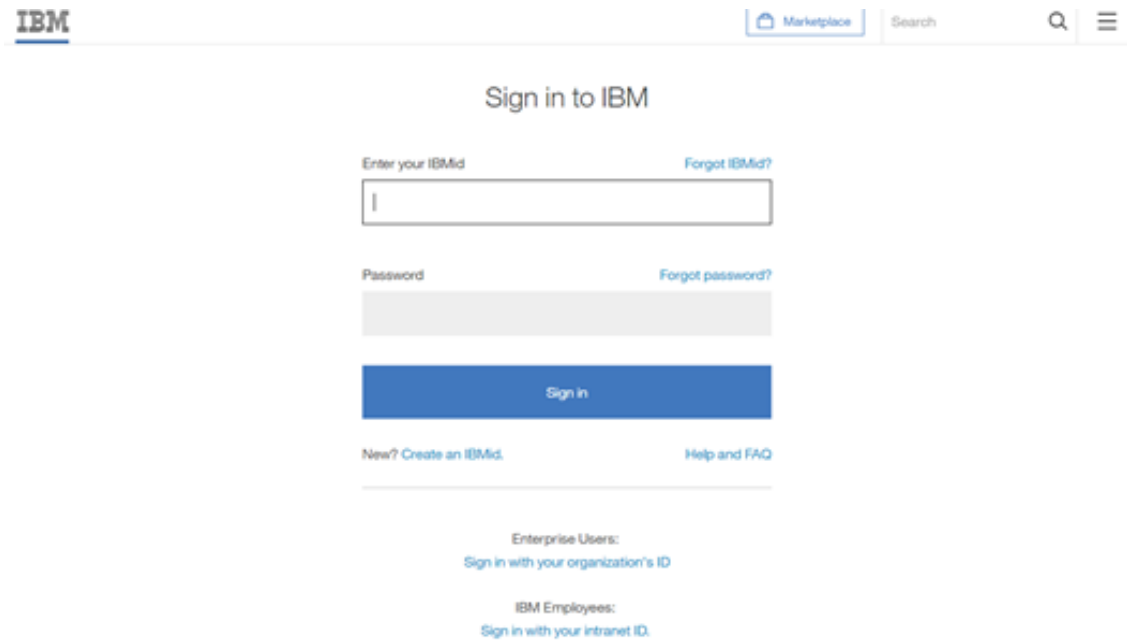
1. Creating a blockchain service

In this section, you will create a new blockchain service running on IBM Bluemix.

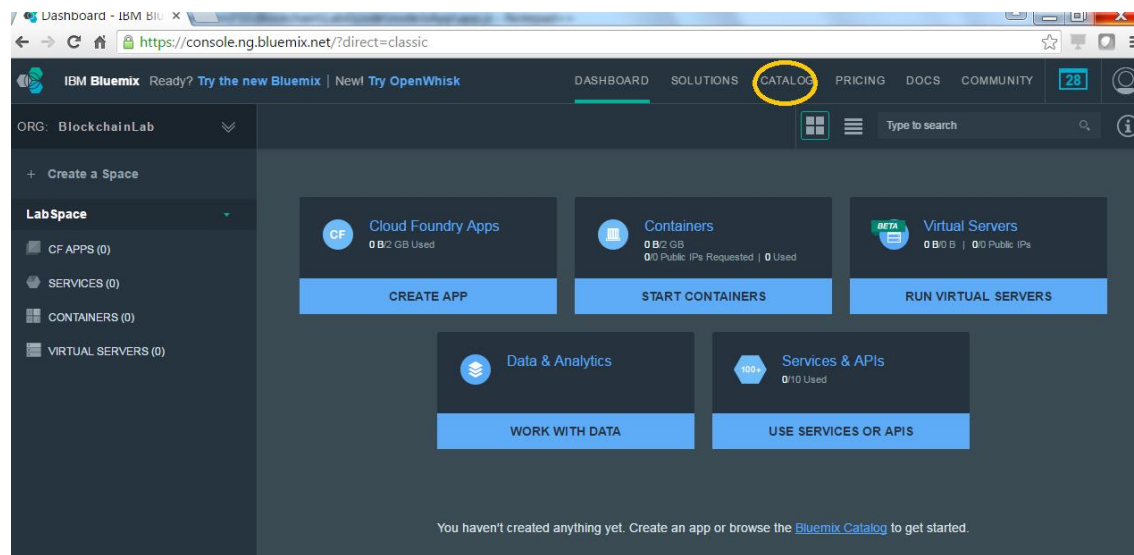
- a) Open a new browser window
- b) Go to the URL <https://bluemix.net/> and click **LOG IN**.



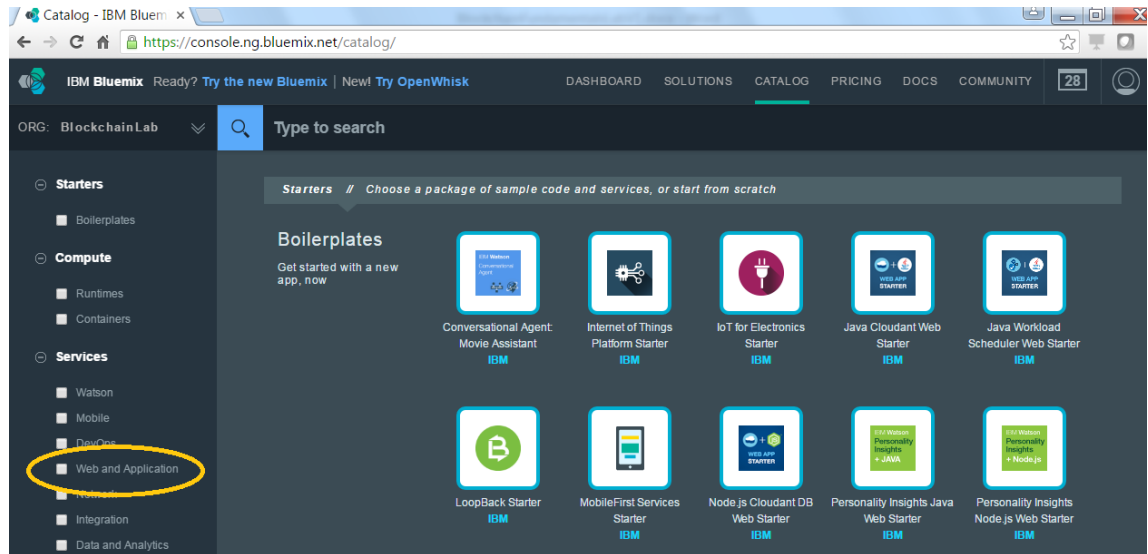
- c) If you are prompted to sign in, enter your IBMid (e.g. *jsmith@us.ibm.com*) and password, and then click **Sign in**.



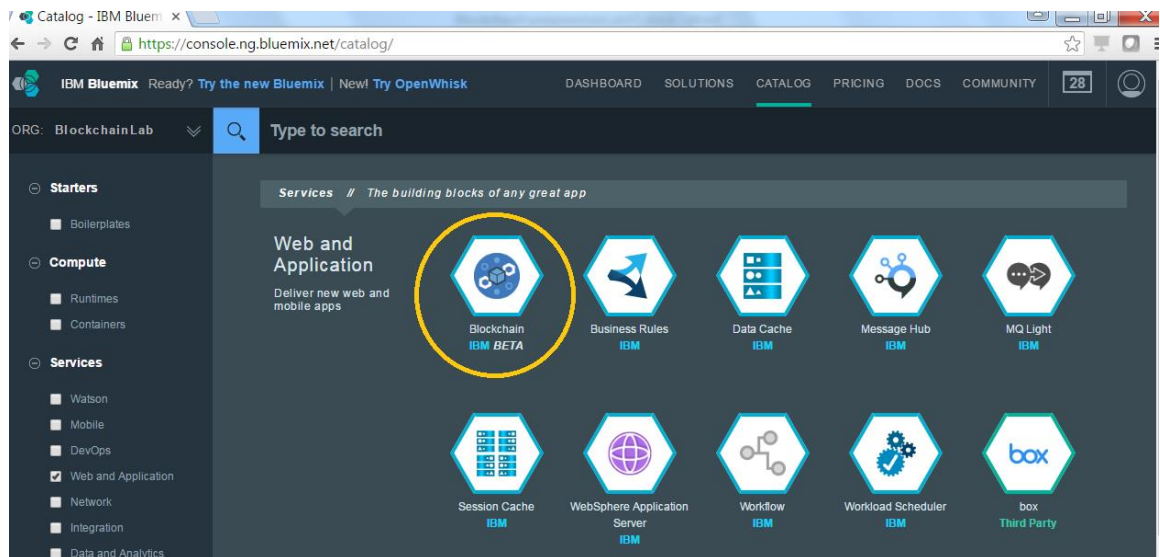
- d) Once logged in, you will see a page similar to the screen below. Click the **Catalog** button to see all available Bluemix services.



- e) From the side panel on the left of the screen, click the **Web and Application** category.



- f) Click the Blockchain icon from the list of Web and Application Services to create a new blockchain service.



- g) Change the blockchain service name to be *BlockchainLabPartA*. Leave all other fields with their default value. Click the **Create** button.

The screenshot shows the IBM Bluemix Catalog page for the Blockchain service. The service name is set to 'BlockchainLabPartA'. The 'Create' button is highlighted with a yellow circle.

Blockchain
IBM

PUBLISH DATE
08/10/2016

AUTHOR
IBM

TYPE
Service

[VIEW DOCS](#)

BETA Blockchain is a peer-to-peer distributed ledger technology for a new generation of transactional applications that establishes trust, accountability and transparency while streamlining business processes. Think of it as an operating system for interactions. With the potential to vastly reduce the cost and complexity of getting things done. The distributed ledger makes it easier to create cost-efficient business networks where virtually anything of value can be tracked and traded, without requiring a central point of control. This service is built on top of the Linux Foundation's Hyperledger Project open source code. IBM has recently launched a new plan for High Security business networks which features a 4 node network running on dedicated infrastructure. Due to limited capacity during the Beta, your ability to see this plan and provision a network is by invitation only. If you are interested, you can fill out a form to request access at http://www.ibm.com/blockchain/beta_signup.html.

- Spin up a test Blockchain Network in one click**
Spend less time creating and managing a blockchain network and more time focusing on writing your applications.
- Create confidential digital assets**
Create digital transactions in your test applications that are processed quickly.
- Membership services**
Take advantage of our first implementation of the membership services module, which encompasses many of the latest advances in cryptography.
- Work with chaincode**
Smart contracts, written in chaincode, contain embedded business logic that

Add Service

Space:
LabSpace

App:
Leave unbound

Service name:
BlockchainLabPartA

Credential name:
Credentials-1

Selected Plan:
Starter Developer plan

CREATE

- h) If the service was created successfully, you will see a welcome page similar to the one below. Congratulations, you have created an IBM Bluemix Blockchain service!

The screenshot shows the IBM Bluemix Dashboard page for the BlockchainLabPartA service. The page includes a 'LAUNCH' button and a list of 'What it IS good for today:'.

BlockchainLabPartA

Manage >

Service Credentials

Service Access Authorization

APPS USING SERVICE

Welcome to the Starter Developer network beta!

Welcome, ctablockchain@gmail.com!

This service is intended for developers who consider themselves early adopters and want to get involved with IBM's approach to business networks that maintain, secure and share a replicated ledger using blockchain technology.

What it IS good for today:

- Deploying and invoking transactions to test out IBM's approach to blockchain technology
- Using non-sensitive information and processes.
- Learning and testing out IBM's novel contributions to the blockchain open source community, including the concept of confidential transactions and containerized code execution.

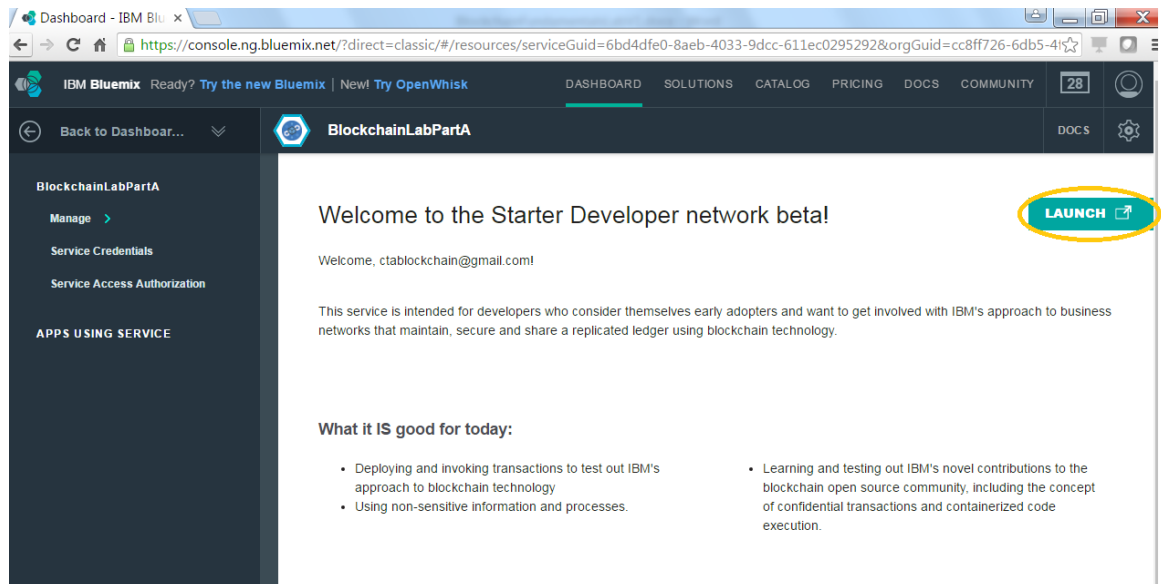
Get Started

- Manage your instance of the network: Click **LAUNCH** to see the blockchain monitor for your Blockchain network.
- The blockchain monitor displays network details, logs,
- Read the [documentation](#) to learn more about IBM Blockchain built on top of the Hyperledger Project
- Learn more about chaincode with our samples
 - Beginner [Learn Chaincode](#)

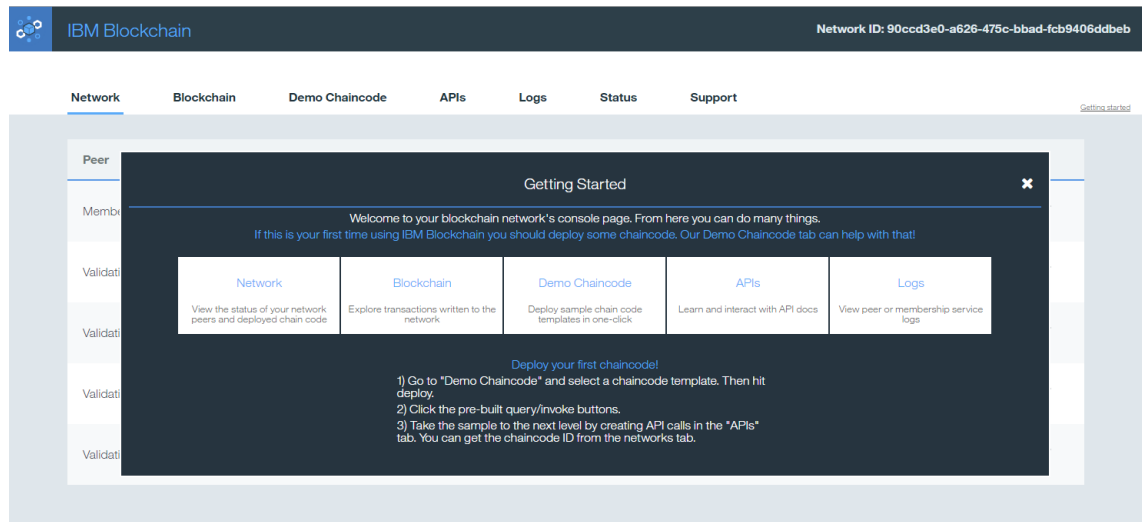
2. Exploring the capabilities of IBM Blockchain on Bluemix

In this section, you will explore the features and capabilities of IBM Blockchain and deploy some sample chaincode

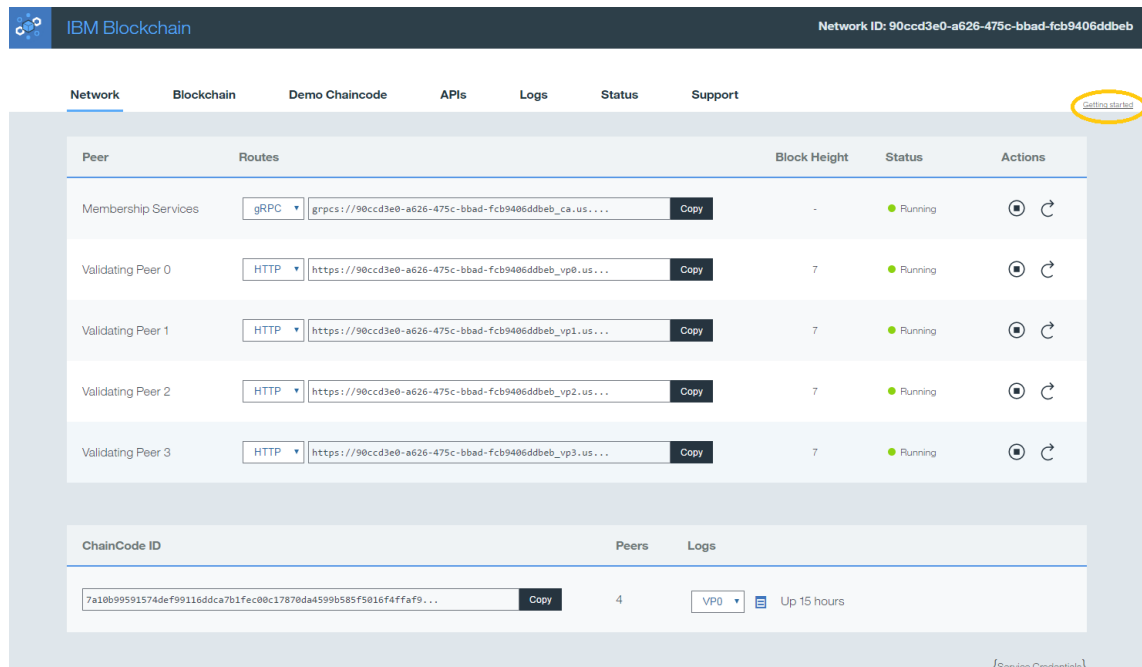
- a) Launch the blockchain service you created in the previous section by clicking on the green **Launch** button.



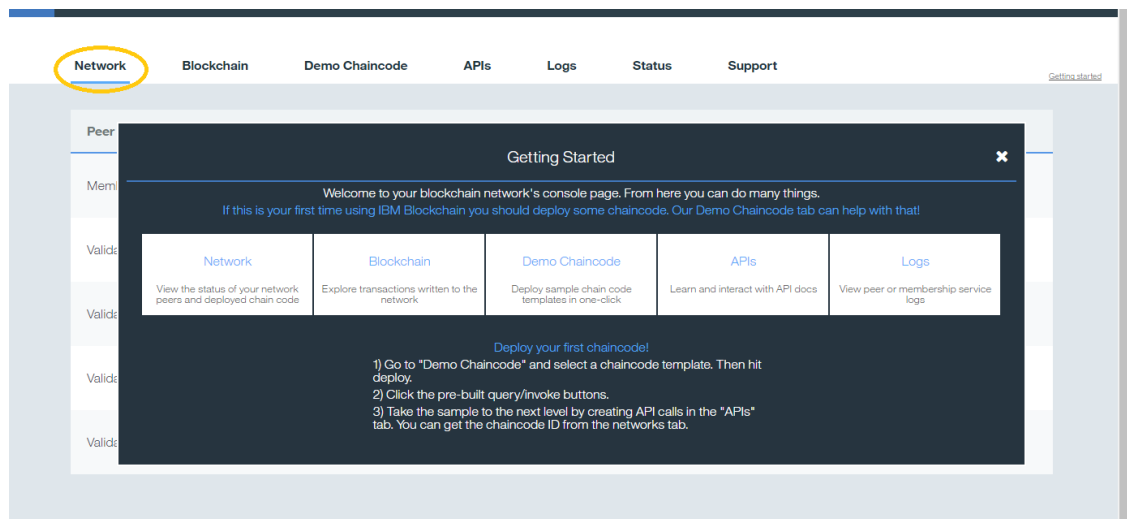
- b) After the service launches you will see a welcome page similar to the one shown below. This page describes the blockchain service features. Take a moment to read each feature description and what it offers.



If you do not see the **Getting Started** section that describes each component as shown above, click on the **Getting Started** link to open the section.



c) Click on the **Network** tab.



- d) The **Network** tab shows the status of the blockchain network peers and membership service. This network includes the status of the peers that monitor and approve transactions that are submitted to the blockchain. It also includes the membership service that provides user authentication to the blockchain network. Each of these network members can be stopped and restarted using this status page. The bottom of the network page lists the chaincode IDs of each blockchain that is running on this network. Note that the chaincode ID list is empty because no chaincode has been deployed to the service yet. Now click on the **Blockchain** tab.

The screenshot shows the IBM Blockchain Network tab interface. The 'Blockchain' tab is highlighted with a yellow circle. The interface displays a table of network peers and their status.

Peer	Routes	Block Height	Status	Actions
Membership Services	<div>gRPC <input type="text" value="grpc://fa52f62d-e3d8-4e11-a9d3-c904e9742e09"/></div>	-	Running	
Validating Peer 0	<div>HTTP <input type="text" value="https://fa52f62d-e3d8-4e11-a9d3-c904e9742e09"/></div>	1	Running	
Validating Peer 1	<div>HTTP <input type="text" value="https://fa52f62d-e3d8-4e11-a9d3-c904e9742e09"/></div>	1	Running	
Validating Peer 2	<div>HTTP <input type="text" value="https://fa52f62d-e3d8-4e11-a9d3-c904e9742e09"/></div>	1	Running	
Validating Peer 3	<div>HTTP <input type="text" value="https://fa52f62d-e3d8-4e11-a9d3-c904e9742e09"/></div>	1	Running	

Below the table, there is a section for ChainCode ID, Peers, and Logs. The ChainCode ID section shows 'no chaincode found'.

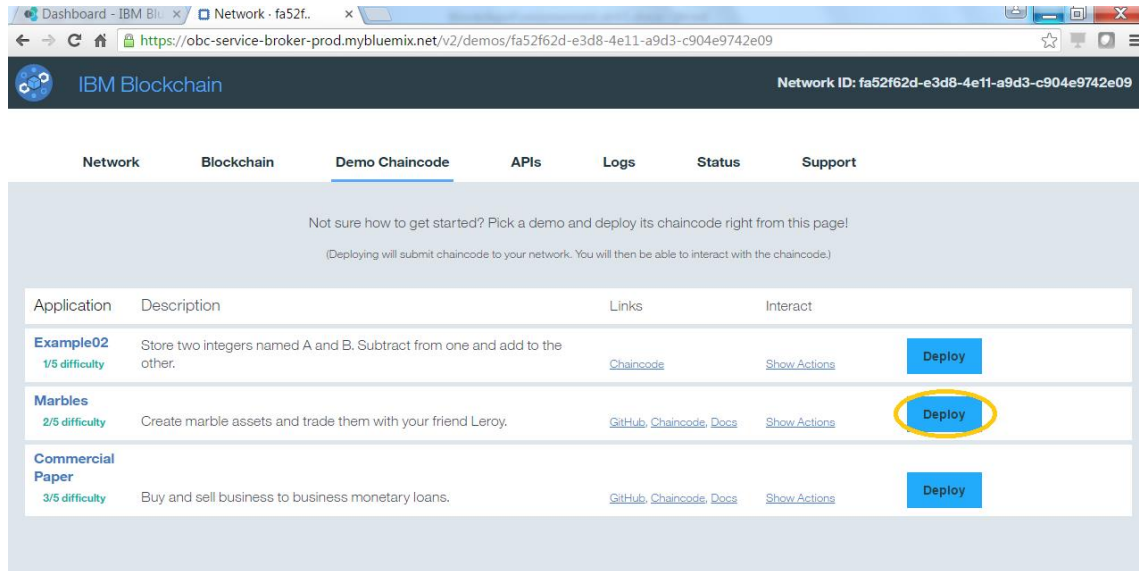
- e) The blockchain tab provides block-level details about the blockchain itself. This includes the number of blocks in the chain, the block creation rate, the number of chaincode deployments, and the number of chaincode invocations. From this page, you can also see information about each block on the blockchain by clicking the individual blocks in the chain (more on this later). Now click on the **Demo Chaincode** tab.

The screenshot shows the IBM Blockchain dashboard interface. The top navigation bar includes tabs for Network, Blockchain, Demo Chaincode (highlighted with a yellow circle), APIs, Logs, Status, and Support. The main content area displays several metrics:

- 0 Blocks (all time)
- 0 blks/hour (last 0 blocks)
- 0 trans/blk (last 0 blocks)
- 0 Deployments (last 0 blocks)
- 0 Invocations (last 0 blocks)

Below these metrics is a 'Genesis' button. At the bottom, there is a table header with the following columns: DATE, TYPE, UUID, CHAINCODE ID, and PAYLOAD.

- f) The **Demo Chaincode** tab provides one-click access to some sample applications that run on blockchain. Links to the code repositories and documentation for each sample application are also provided. To test that the blockchain service you created is working correctly, deploy the code for the Marbles sample application by clicking the middle **Deploy** button.



The screenshot shows the IBM Blockchain dashboard with the 'Demo Chaincode' tab selected. The dashboard header includes the IBM Blockchain logo and the Network ID: fa52f62d-e3d8-4e11-a9d3-c904e9742e09. The main navigation bar has tabs for Network, Blockchain, Demo Chaincode, APIs, Logs, Status, and Support. Below the navigation bar, a message states: 'Not sure how to get started? Pick a demo and deploy its chaincode right from this page! (Deploying will submit chaincode to your network. You will then be able to interact with the chaincode.)' A table lists three sample applications: Example02 (1/5 difficulty), Marbles (2/5 difficulty), and Commercial Paper (3/5 difficulty). Each application has a description, links to Chaincode, GitHub, Chaincode, Docs, and Show Actions, and a Deploy button. The Deploy button for the Marbles application is highlighted with a yellow circle.

Application	Description	Links	Interact
Example02 1/5 difficulty	Store two integers named A and B. Subtract from one and add to the other.	Chaincode	Show Actions Deploy
Marbles 2/5 difficulty	Create marble assets and trade them with your friend Leroy.	GitHub , Chaincode , Docs	Show Actions Deploy
Commercial Paper 3/5 difficulty	Buy and sell business to business monetary loans.	GitHub , Chaincode , Docs	Show Actions Deploy

- g) The deployment process takes approximately 30 seconds to complete. During this process, status messages are shown in the status box below the sample application list. If the chaincode is deployed successfully, a status message with a green checkmark will appear as shown below.

The screenshot displays the 'Demo Chaincode' tab in the IBM Blockchain interface. At the top, a navigation bar includes 'Network', 'Blockchain', 'Demo Chaincode' (selected), 'APIs', 'Logs', 'Status', and 'Support'. Below this, a message states: 'Not sure how to get started? Pick a demo and deploy its chaincode right from this page! (Deploying will submit chaincode to your network. You will then be able to interact with the chaincode.)'.

The main content area features a table with columns: 'Application', 'Description', 'Links', and 'Interact'. The table lists three applications: 'Example02' (1/5 difficulty), 'Marbles' (2/5 difficulty), and 'Commercial Paper' (3/5 difficulty). Each application has a 'Deploy' button. Below the table, there is a section for 'Marbles' with a dropdown menu to 'Select the correct chaincode' (showing 'marbles: d827db00...') and buttons for 'Create marble', 'Trade away marble', 'Delete marble', and 'Query marble'.

A yellow oval highlights a green checkmark icon and a message box that reads: 'Demo Chaincode successfully deployed: Now you can hit an action button below "Actions" to invoke a chaincode function.' Below this message, a log area shows the following text: 'Registering enrollID dashboarduser_type1_51115b54e7', 'Success - registering enrollID', 'Deploying chaincode https://github.com/ibm-blockchain/marbles-chaincode/hyperledger/part2', 'Success - deployment (wait for the cc to start up)...', and 'done'.

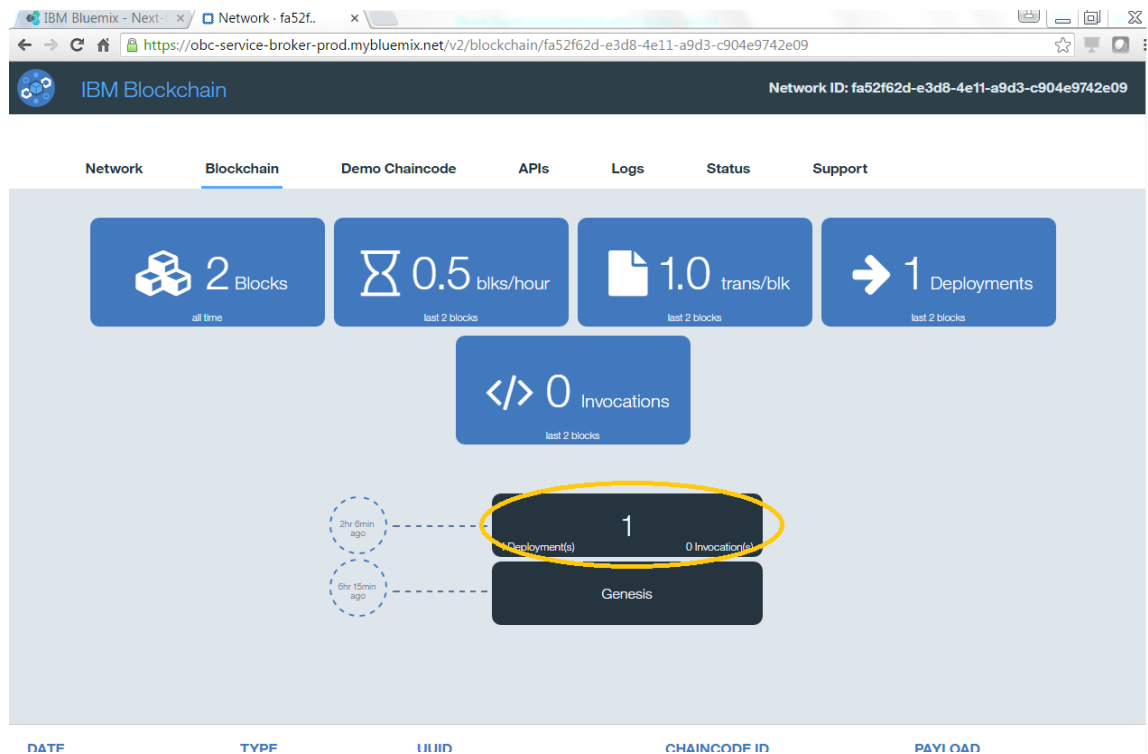
- h) Click on the **Network** tab again. Notice that the chaincode ID section at the bottom now has an entry because the Marbles sample chaincode was deployed, and a chaincode is now running on the service.

The screenshot shows the IBM Blockchain interface with the 'Network' tab selected. The top header displays the IBM Blockchain logo and the Network ID: fa52f62d-e3d8-4e11-a9d3-c904e9742e09. Below the header, there are tabs for Network, Blockchain, Demo Chaincode, APIs, Logs, Status, and Support. The 'Network' tab is active, showing a table of peers and a section for ChainCode ID.

Peer	Routes	Block Height	Status	Actions
Membership Services	gRPC <input type="text" value="grpc://fa52f62d-e3..."/> Copy	-	Running	Stop Refresh
Validating Peer 0	HTTP <input type="text" value="https://fa52f62d-e3..."/> Copy	2	Running	Stop Refresh
Validating Peer 1	HTTP <input type="text" value="https://fa52f62d-e3..."/> Copy	2	Running	Stop Refresh
Validating Peer 2	HTTP <input type="text" value="https://fa52f62d-e3..."/> Copy	2	Running	Stop Refresh
Validating Peer 3	HTTP <input type="text" value="https://fa52f62d-e3..."/> Copy	2	Running	Stop Refresh

Below the peers table, there is a section for ChainCode ID, which is circled in yellow. It shows the ChainCode ID: d827db009bcbfd840b2197345d878a6fad03f375e7d61... with a [Copy](#) button. To the right, it shows 4 peers, a dropdown menu set to VP0, and a status of Up About an hour.

- i) Click on the **Blockchain** tab again. Notice that there are two blocks on the chain now: the first block is a genesis block that is created for every blockchain automatically. The second block represents the deployment of the Marbles sample chaincode. Click on the block that has the number **1** to view more information about its contents.



- j) After clicking on the block, details including the date, type, and payload of the block are shown in the pane below the blockchain. By looking at the payload details, we can see that this block represents an initialization of the chaincode since it contains an 'init' function call to the blockchain.



- k) **Optional Challenge:** This blockchain service contains many other features that are beyond the scope of this lab. If you have finished the entire lab ahead of schedule, return to this section and explore the API, Logs, Status, and Support tabs on your own to learn more about these features and what they offer.

Part B: Open Points Application – *use a loyalty points application to create blockchain transactions and examine smart contracts*

Pre-Reqs:

- You have completed Part A.
- You have followed the instructions for deploying the application to your Bluemix account, as described in the 'Intro: Getting Started' section

This part of the lab explains how to complete the following tasks:

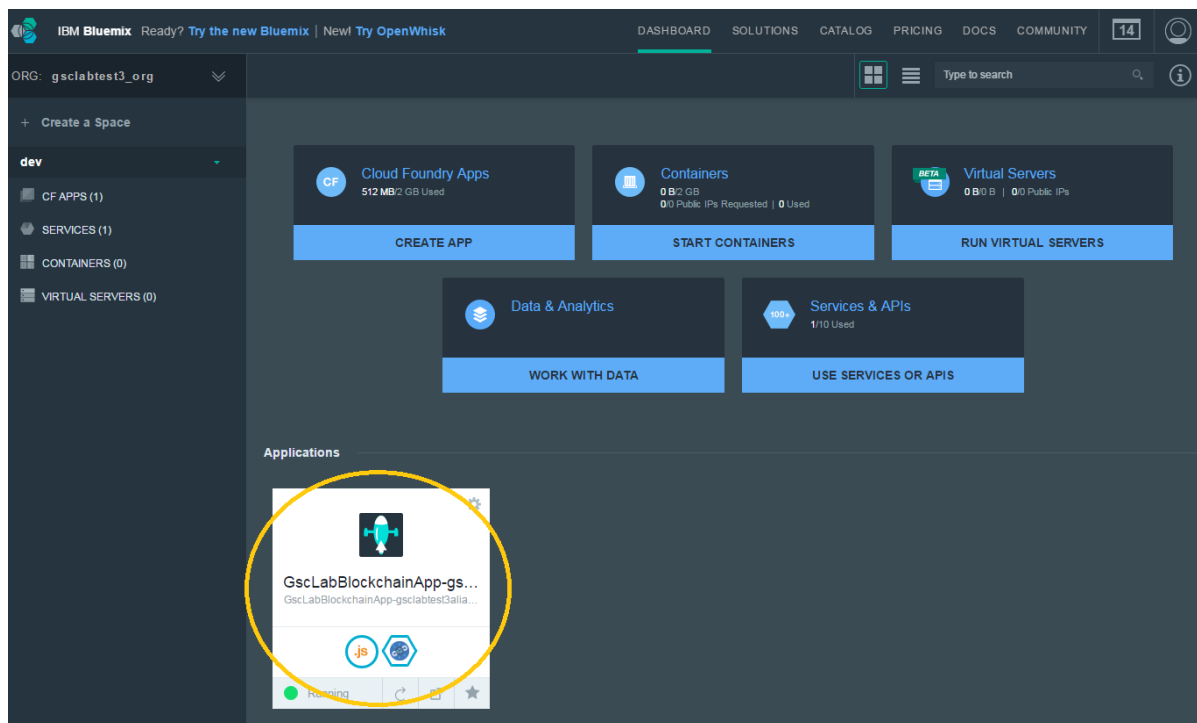
- Use an application that runs on IBM Blockchain to create transactions and submit them to the blockchain
- Apply smart contracts that impact transaction values
- Monitor application behavior on the blockchain service

Estimated Duration: 15 minutes

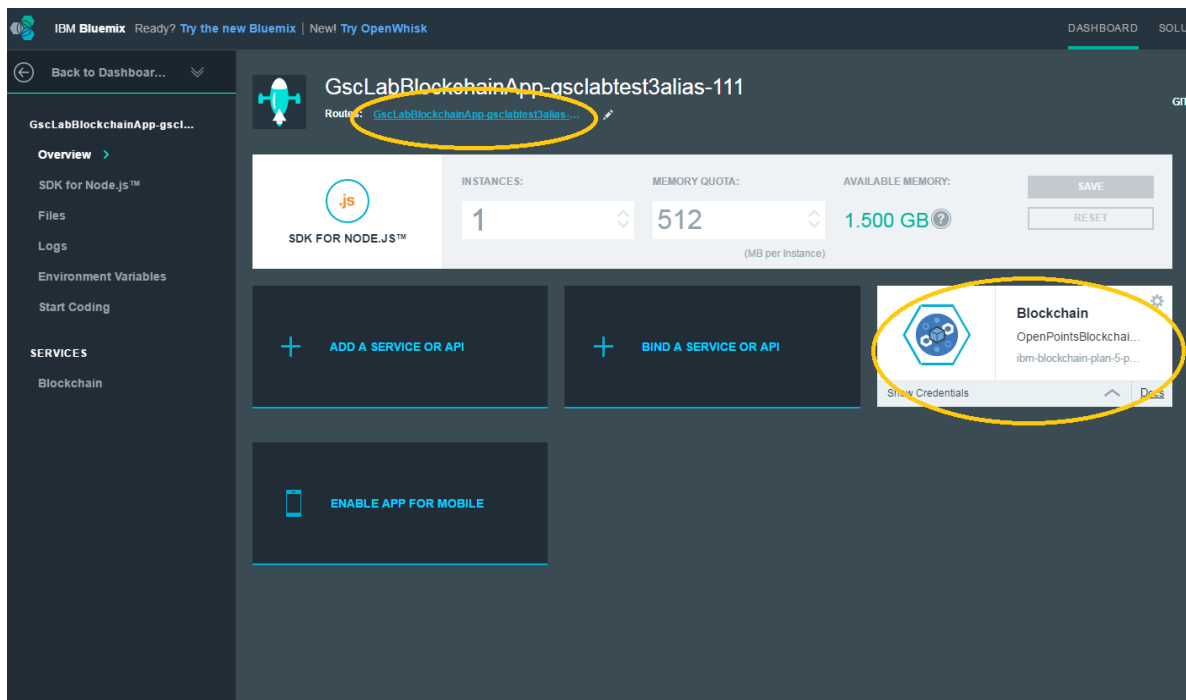
1. Exploring the Open Points application

In this section, you will familiarize yourself with the Open Points application and use it to perform basic financial transactions through a blockchain service.

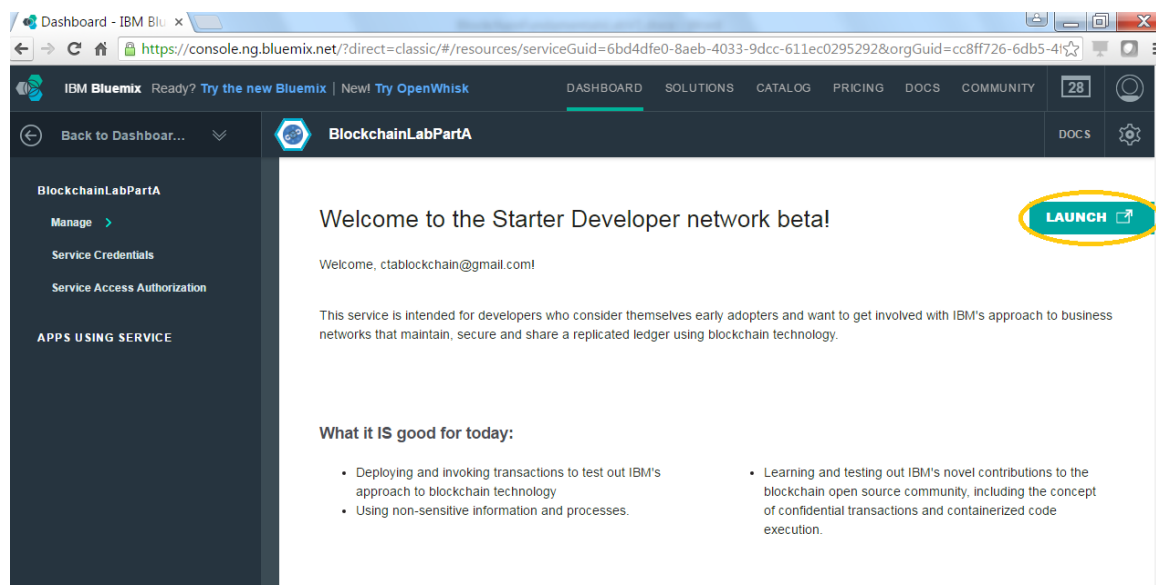
- From your Bluemix dashboard, click on the app tile that you created as part of the prerequisites for the lab.



- b) Clicking on the app tile opens the status page for the application, as shown below. From this page, you can determine if the app is running, restart it, view any associated services, and launch the webpage for the app. Click on the URL below the app name to launch the Open Points website. After the Open Points website opens, return to this page and click on the blockchain service tile to open the blockchain service status page.



Click on the green **Launch** button to open the blockchain service status page. Keep the blockchain service page open because you will refer back to it often during the remainder of the lab.

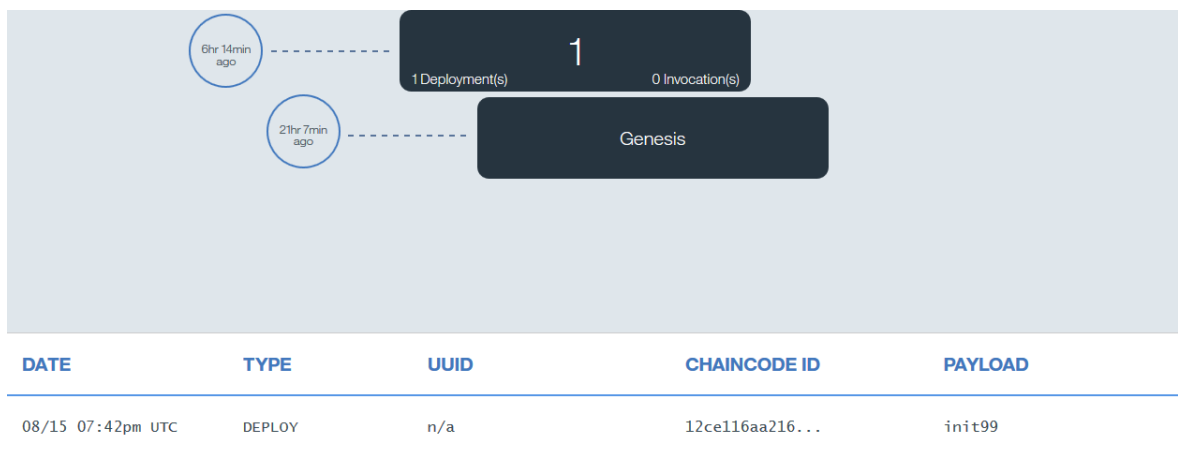


- c) From the blockchain service page you just launched, click on the **Network** tab. There should be at least one chaincode ID listed at the bottom of the page.

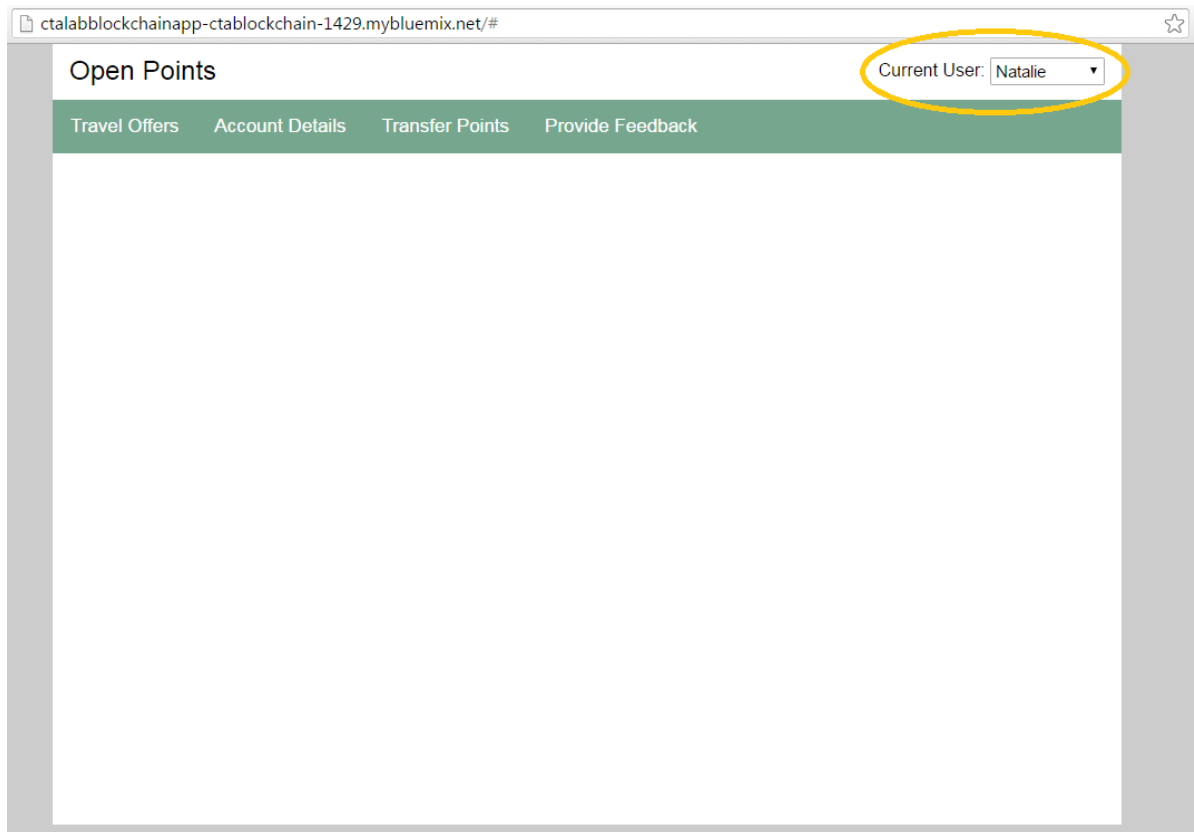
The screenshot displays the 'Network' tab of the IBM Blockchain service. It shows a list of services and peers. At the bottom, there is a section for 'ChainCode ID' with a table of active chaincodes.

ChainCode ID	Peers	Logs
5c9e5fad6c791bc70a908b9dbf58f34052...	4	VP0 Up 2 hours

- d) Click on the **Blockchain** tab. The blocks on the blockchain represent the transactions that have taken place since the blockchain was created. Notice that the only block that exists for the Open Points blockchain is a deployment block, which was created when the chaincode for the application was deployed.



- e) Return to the browser tab or window that contains the Open Points website. The current user that is logged into the site is shown in the upper right corner. The Open Points network has two business users: **OpenFN** is the banking institution that supports the Open Points network and converts points to cash equivalency, and **Open Travel** is a travel agency that sells travel packages to customers. This network also has two customers that perform banking services with **OpenFN** and buy travel packages from **Open Travel**: Natalie and Anthony. When the website first launches, notice that the default user is Natalie.



- f) Click on the **Account Details** tab. From this page we see that Natalie has a starting balance of 1000 points and that she currently has no transactions with the Open Points network.

Open Points

Current User: Natalie

Travel Offers

Account Details

Transfer Points

Provide Feedback

Account Balance

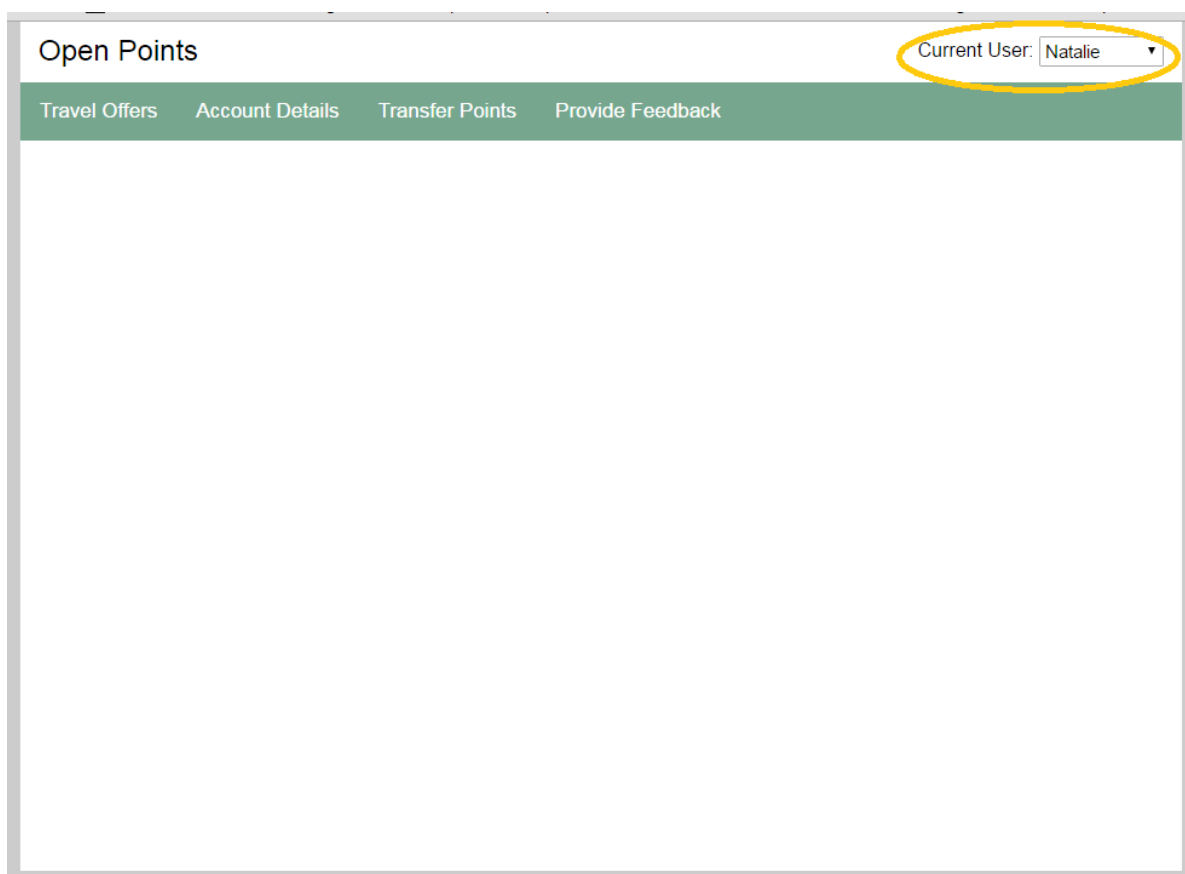
Name	Balance	Number Of Transactions
Natalie	1000	0

Transaction History

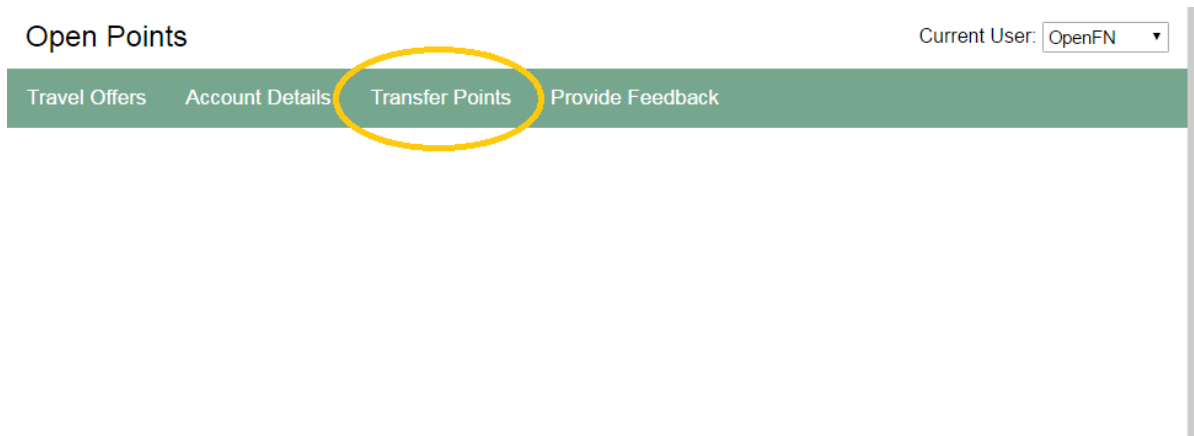
2. Transfer Points between Open Points Members

In this section you will create blockchain transactions to transfer points between members of the Open Points network.

- a) Natalie has just joined the Open Points network as a new banking customer of OpenFN. As a reward for being a new customer, OpenFN would like to use the Open Points website to award Natalie with a one-time bonus of 99,000 points. In order to begin this point transfer to Natalie, go to the window for the Open Points website and change the current user to OpenFN using the drop-down menu.

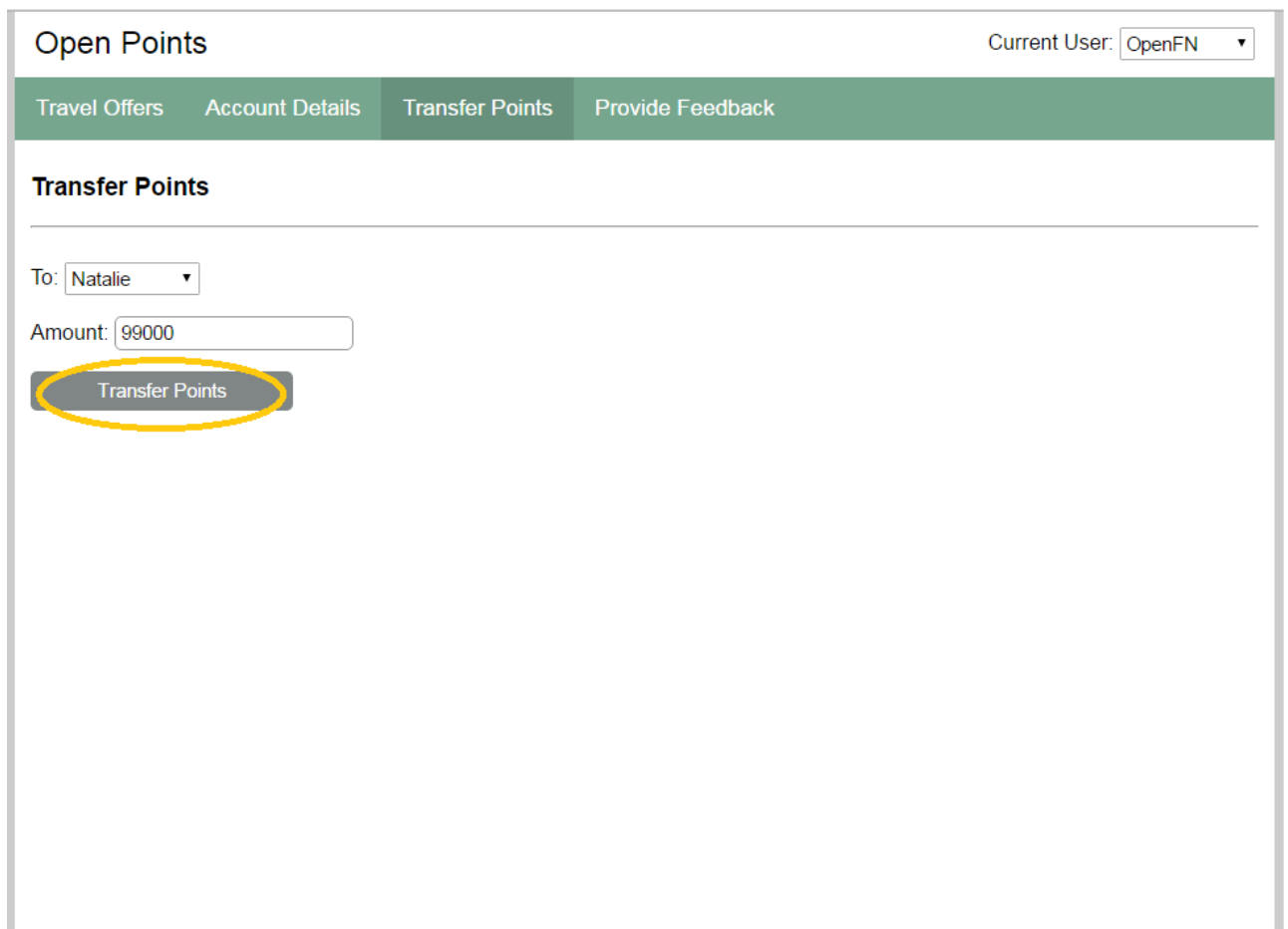


- b) Click on the **Transfer Points** tab.



The screenshot shows the 'Open Points' application interface. At the top right, it says 'Current User: OpenFN'. Below this is a green navigation bar with four tabs: 'Travel Offers', 'Account Details', 'Transfer Points', and 'Provide Feedback'. The 'Transfer Points' tab is highlighted with a yellow circle.

- c) In the **Amount** field, enter '99000' as the number of points to transfer from OpenFN to Natalie.
Click the **Transfer Points** button.



The screenshot shows the 'Open Points' application interface with the 'Transfer Points' tab selected. The 'Current User' is 'OpenFN'. Below the navigation bar, the 'Transfer Points' section is visible. It contains a 'To:' dropdown menu with 'Natalie' selected, an 'Amount:' text input field containing '99000', and a 'Transfer Points' button highlighted with a yellow circle.

- d) Verify that the points were transferred from OpenFN to Natalie. Click on the **Account Details** tab and notice the balance and transaction history for OpenFN. The current balance should be 901,000 points, and there should be a single transaction listed for the point transfer you just created. The transfer amount is listed in red with a minus sign since this transfer represents a debit to the OpenFN account.

Open Points

Current User: OpenFN ▼

Travel Offers

Account Details

Transfer Points

Provide Feedback

Account Balance

Name	Balance	Number Of Transactions
OpenFN	901000	1

Transaction History

Date	Description	To/From	Amount
2016-08-16 00:13	Points Transfer	Natalie	-99000

- e) Verify that Natalie's account also contains the correct transaction information. Change the current user to Natalie using the drop down menu, and click on the **Account Details** tab again to refresh the account profile. Natalie should have a balance of 100000 points, with a single transaction from OpenFN. This transaction is shown in black since it represents a credit to Natalie's account.

Open Points

Current User: Natalie ▼

Travel Offers

Account Details

Transfer Points

Provide Feedback

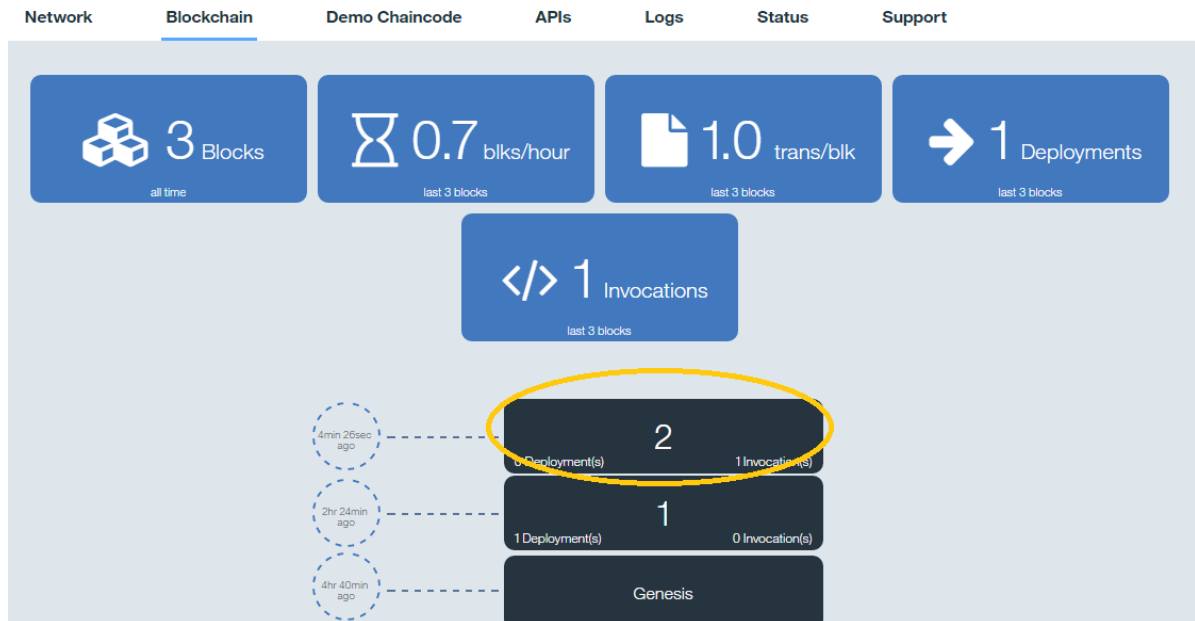
Account Balance

Name	Balance	Number Of Transactions
Natalie	100000	1

Transaction History

Date	Description	To/From	Amount
2016-08-16 00:13	Points Transfer	OpenFN	99000

- f) Verify that this transaction was added to the blockchain. Return to the browser window that contains the blockchain service status page, and click on the **Blockchain** tab. The last block on the chain, which is the block at the top of the list, is a non-deployment block. Click on the block to see the details of the transaction within the lower panel.



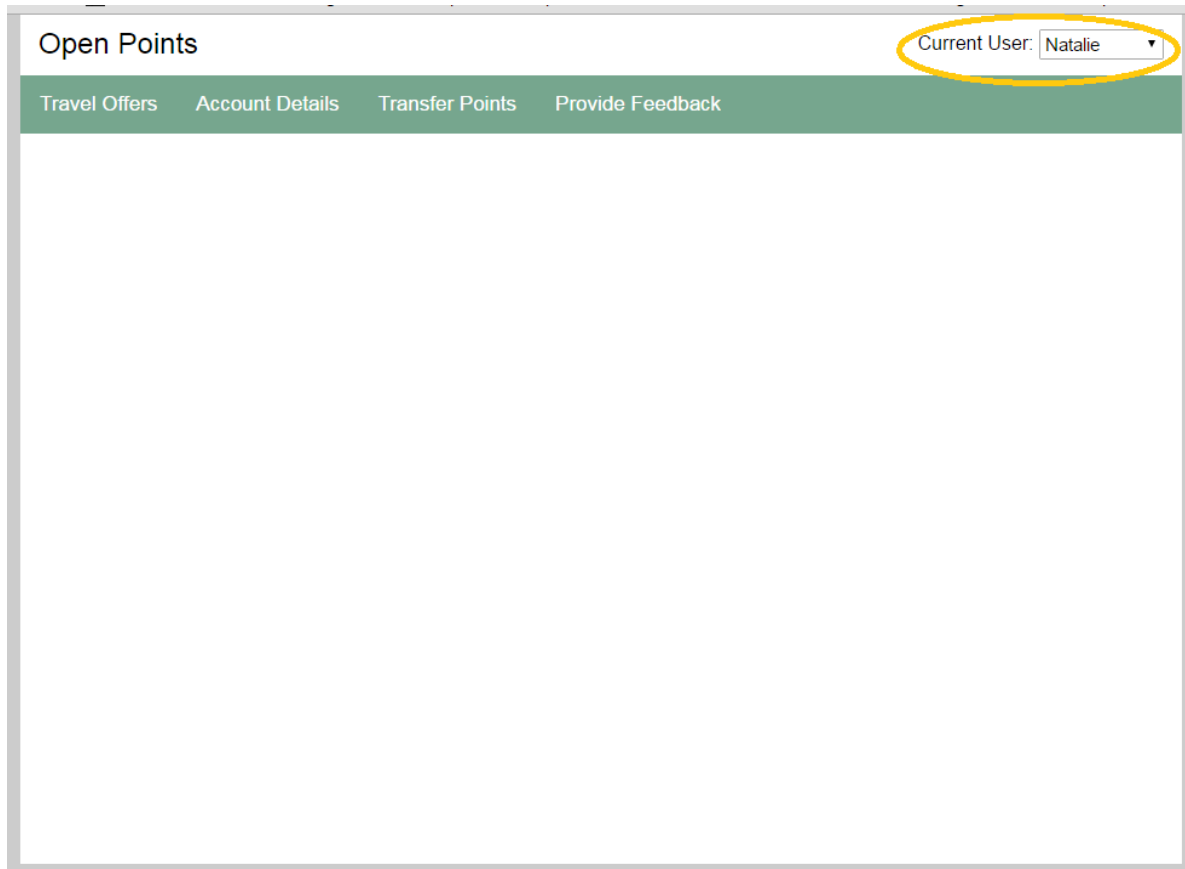
- g) The type of transaction is an **INVOKE** because it is changing the state of the blockchain information. The payload of the transaction describes a point transfer of 99000 points.



3. *Purchase Travel Packages using Smart Contracts*

In this section you will purchase some travel packages that use smart contracts running on blockchain to manage the travel offers.

- a) Return to the browser window that contains the Open Points website. Change the current user to be **Natalie** using the drop down menu.



- b) Click on the **Travel Offers** tab. The top section of the page contains two travel offers and their associated terms: *Paris for Less* and *Points for Feedback*. These offers represent smart contracts that are deployed on the blockchain within the chaincode itself. When any transaction that is related to an offer is executed, the corresponding smart contract is also executed and the transaction is modified according to the conditions of that contract.

Open Points

Current User: Natalie

Travel Offers

Account Details

Transfer Points

Provide Feedback

Travel Offers

Offer	Terms
Paris for Less	<ul style="list-style-type: none">• Half off dining and travel activities in Paris• Valid from May 11, 2016
Points for Feedback	<ul style="list-style-type: none">• 1,000 points for travel package• Valid from May 24, 2016

Purchase Travel Package

☒ Paris: 10k Points

☐ New York City: 15k Points

☐ London: 20k Points

☐ Tokyo: 25k Points

☐ Rio de Janeiro: 30k Points

Purchase Travel Package

- c) To see how smart contracts can affect transactions, let's first purchase a travel package to London as Natalie and observe how the transaction is executed. Note that there are NO travel offers for London, so the transaction should be processed for the stated point price of 20k points. Select the radio button for the London package, and click the **Purchase Travel Package** button.

Open Points

Current User: Natalie

Travel Offers

Account Details

Transfer Points

Provide Feedback

Travel Offers

Offer	Terms
Paris for Less	<ul style="list-style-type: none">Half off dining and travel activities in ParisValid from May 11, 2016
Points for Feedback	<ul style="list-style-type: none">1,000 points for travel packageValid from May 24, 2016

Purchase Travel Package

☐ Paris: 10k Points

☐ New York City: 15k Points

☒ London: 20k Points

☐ Tokyo: 25k Points

☐ Rio de Janeiro: 30k Points

Purchase Travel Package

- d) Click on the **Account Details** tab. Natalie now has two transactions. The top transaction in the list shows her purchase for the London travel package at a price of 20000 points. This is the expected price since no smart contracts were applied to this transaction that affected the purchase price.

Open Points

Current User: Natalie

Travel Offers

Account Details

Transfer Points

Provide Feedback

Account Balance

Name	Balance	Number Of Transactions
Natalie	80000	2

Transaction History

Date	Description	To/From	Amount
2016-08-16 01:12	Purchased Travel Package to London	Open Travel	-20000
2016-08-16 00:13	Points Transfer	OpenFN	99000

- e) Click on the **Travel Offers** tab. This time, Natalie wants to take advantage of a travel offer instead of paying the full price for a travel package. She sees the *Paris for Less* offer and likes the idea of paying only half of the original point price for a travel package to Paris. Select the radio button for the Paris travel package, and click the **Purchase Travel Package** button.

Open Points

Current User: Natalie ▼

Travel Offers

Account Details

Transfer Points

Provide Feedback

Travel Offers

Offer	Terms
Paris for Less	<ul style="list-style-type: none">• Half off dining and travel activities in Paris• Valid from May 11, 2016
Points for Feedback	<ul style="list-style-type: none">• 1,000 points for travel package• Valid from May 24, 2016

Purchase Travel Package

☒ Paris: 10k Points

☐ New York City: 15k Points

☐ London: 20k Points

☐ Tokyo: 25k Points

☐ Rio de Janeiro: 30k Points

Purchase Travel Package

- f) Click on the **Account Details** tab, and notice that Natalie now has three transactions. The first transaction in the list shows her purchase for the Paris travel package. Instead of the original package price of 10,000 points, this transaction shows that Natalie purchased the Paris package for only 5,000 points, which is half of the original price. This is because the Paris travel package is covered by the *Paris for Less* travel offer and its associated smart contract, which guaranteed that all Paris-related purchases are half of the original price.

Open Points

Current User: Natalie ▼

Travel Offers
Account Details
Transfer Points
Provide Feedback

Account Balance

Name	Balance	Number Of Transactions
Natalie	75000	3

Transaction History

Date	Description	To/From	Amount
2016-08-16 01:55	Purchased Travel Package to Paris	Open Travel	-5000
2016-08-16 01:12	Purchased Travel Package to London	Open Travel	-20000
2016-08-16 00:13	Points Transfer	OpenFN	99000

- g) **Optional Challenge:** If you finish the entire lab early, return to this section and take advantage of the *Points for Feedback* travel offer to rate Natalie's travel experience in Paris using the **Provide Feedback** tab. After you submit your travel feedback, review your account details to check if you received the advertised reward of 1,000 points. Also, check the blockchain service page to ensure that your feedback transaction was submitted to the blockchain.

Part C: Creating Smart Contracts – *using the Open Points application, create new travel offers and add them to the blockchain as smart contracts*

Pre-Reqs:

- You have completed Part A and B
- You have followed the instructions for deploying the application to your Bluemix account, as described in the 'Intro: Getting Started' section

This part of the lab explains how to complete the following tasks:

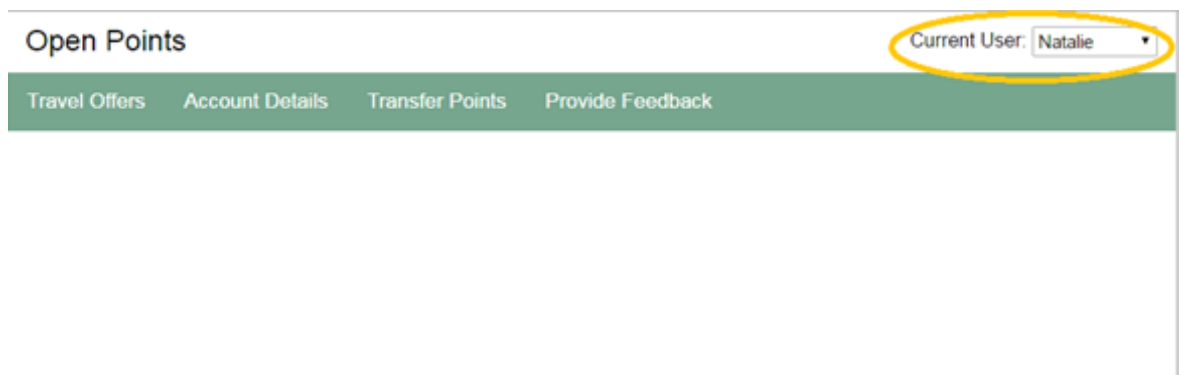
- Create new travel offers for existing travel packages and add them to the blockchain as smart contracts
- Test the functionality of the new travel offers by purchasing travel packages

Estimated Duration: 15 minutes

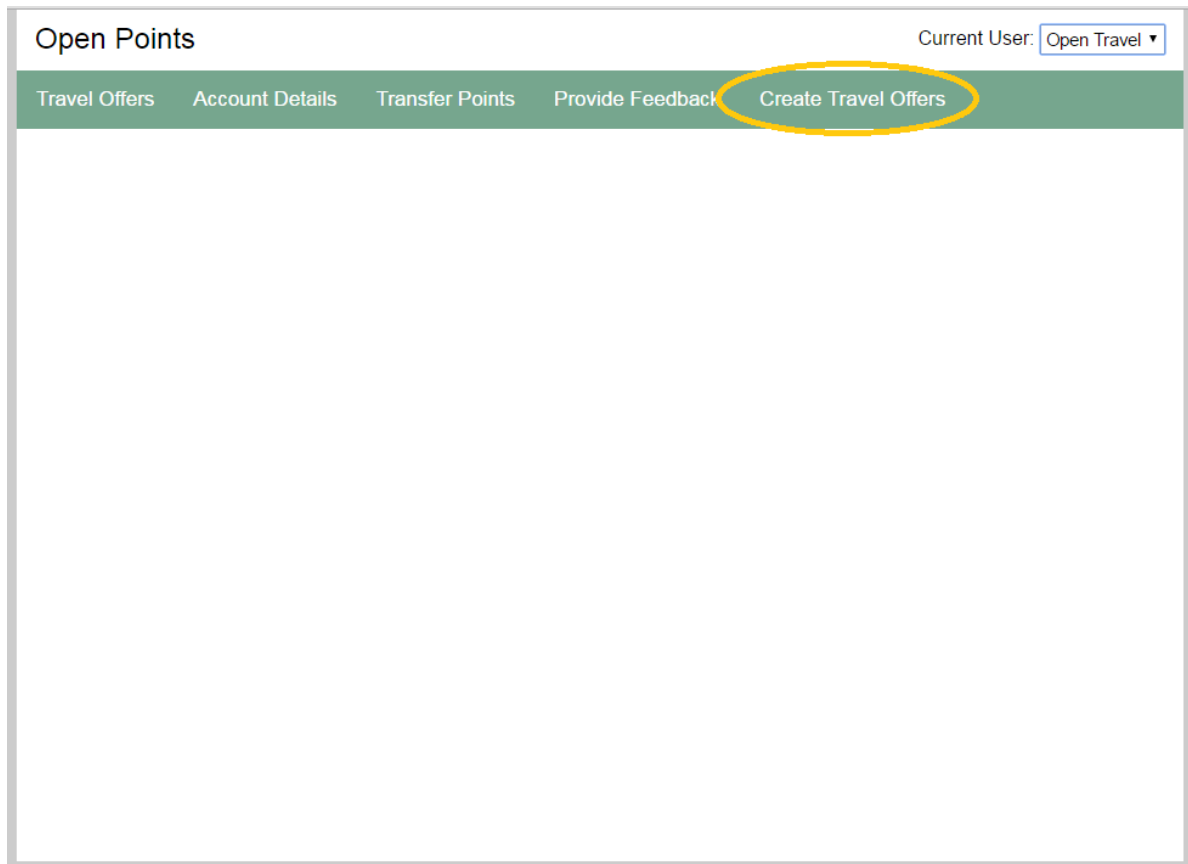
1. Create Smart Contracts for Travel Packages

In this section you will create travel offers for travel packages as smart contracts. These smart contracts will be added to the blockchain and will affect the outcome of travel purchases.

- a) Adding travel offers as smart contracts is a feature that the travel company **Open Travel** needs to use. Change the current website user from **Natalie** to **Open Travel**.



- b) After switching the user to be **Open Travel**, a new tab called **Create Travel Offers** appears as the rightmost tab on the website. Click on this tab to create your own smart contract for a travel package.



- c) This page allows you to create a smart contract for one of the travel packages provided by **Open Travel**. Let's create a smart contract for the London travel package that will give customers a 50% discount on the purchase price. To start, select the travel package for London from the travel package drop down menu

The screenshot shows the 'Open Points' application interface. At the top right, it says 'Current User: Open Travel'. Below this is a navigation bar with five tabs: 'Travel Offers', 'Account Details', 'Transfer Points', 'Provide Feedback', and 'Create Travel Offers'. The 'Create Travel Offers' tab is active. Below the navigation bar is the 'Create Travel Offer' form. The form contains the following fields:

- Package:** A dropdown menu currently showing 'Paris: 10k Points'. This field is circled in yellow.
- Title:** A text input field.
- Term 1:** A text input field.
- Term 2:** A text input field.
- Point Discount (%):** A text input field.

At the bottom of the form is a 'Create Offer' button.

- d) Enter a contract title and two terms that describe the contract for this travel package. For the **Title**, enter: *London for Less*. For **Term 1**, enter: *Half off London travel*. For **Term 2**, enter: *Offer valid today only*. For the **Point Discount** percentage, enter 50. Your travel offer should now look like the one shown below. Click on the **Create Offer** button to add your smart contract to the blockchain.

The screenshot shows the 'Open Points' web application interface. At the top, there is a header with the title 'Open Points' and a 'Current User' dropdown menu set to 'Open Travel'. Below the header is a navigation bar with five tabs: 'Travel Offers', 'Account Details', 'Transfer Points', 'Provide Feedback', and 'Create Travel Offers'. The 'Create Travel Offers' tab is currently selected. The main content area is titled 'Create Travel Offer' and contains the following form fields:

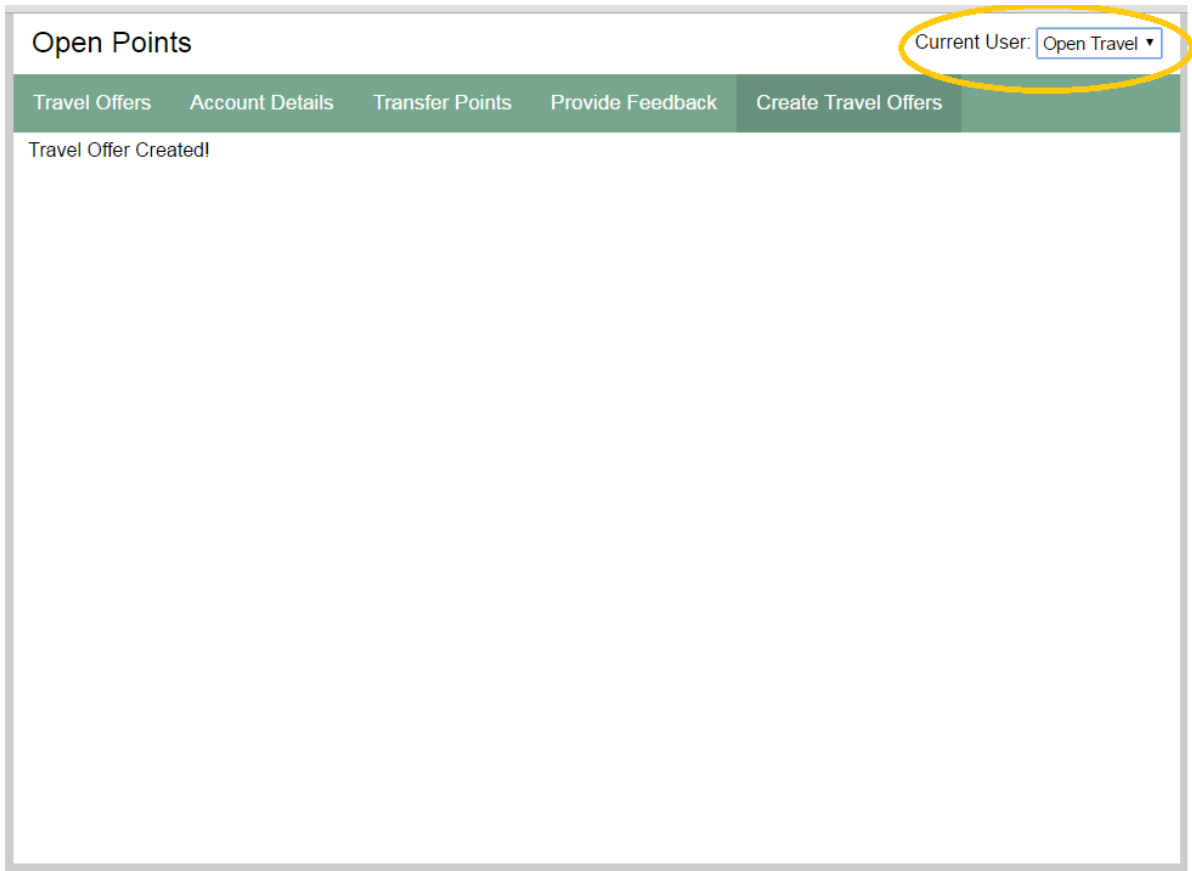
- Package:** A dropdown menu with 'London: 20k Points' selected.
- Title:** A text input field containing 'London for Less'.
- Term 1:** A text input field containing 'Half off London travel'.
- Term 2:** A text input field containing 'Offer valid today only'.
- Point Discount (%):** A text input field containing '50'.

At the bottom of the form is a grey button labeled 'Create Offer', which is circled in yellow.

- e) Verify that this transaction was added to the blockchain. Return to the browser window that contains the blockchain service status page, and click on the **Blockchain** tab. Click on the block at the top of the chain to see the details of the transaction it contains. The payload of the transaction describes the addition of a smart contract for the London travel package.



- f) Let's test the smart contract you just created by purchasing a travel package to London as **Natalie**.
Return to the Open Points website and change the current user to **Natalie**.



- g) Click on the **Travel Offers** tab. Your new smart contract for the London travel package appears in the table of travel offers. From the **Purchase Travel Package** section, select the London travel package and then click the **Purchase Travel Package** button.

Open Points

Current User: Open Travel ▼

Travel Offers

Account Details

Transfer Points

Provide Feedback

Create Travel Offers

Travel Offers

Offer	Terms
Paris for Less	<ul style="list-style-type: none">• Half off dining and travel activities in Paris• Valid from May 11, 2016
Points for Feedback	<ul style="list-style-type: none">• 1,000 points for travel package• Valid from May 24, 2016
London for Less	<ul style="list-style-type: none">• Half off London travel• Offer valid today only

Purchase Travel Package

☐ Paris: 10k Points

☐ New York City: 15k Points

☒ London: 20k Points

☐ Tokyo: 25k Points

☐ Rio de Janeiro: 30k Points

Purchase Travel Package

- h) Let's check to make sure that Natalie received the 50% discount on the London travel package that your smart contract guaranteed. Click on the **Account Details** tab and examine Natalie's transaction history. Her last transaction shows a purchase for the London travel package for 10,000 points instead of the 20,000 points that is stated in the purchase price because the smart contract discounted the package by 50%.

Open Points

Current User: Natalie

Travel Offers

Account Details

Transfer Points

Provide Feedback

Account Balance

Name	Balance	Number Of Transactions
Natalie	65000	4

Transaction History

Date	Description	To/From	Amount
2016-08-31 16:00:00	Purchased Travel Package to London	Open Travel	-10000
2016-08-31 15:58:00	Purchased Travel Package to Paris	Open Travel	-5000
2016-08-31 15:56:00	Purchased Travel Package to London	Open Travel	-20000
2016-08-31 15:56:00	Points Transfer	OpenFN	99000

- i) **Optional Challenge:** If there is time remaining in the lab, try to create a new smart contract for the Tokyo travel package that gives users a 10% discount. Review the blockchain service page to ensure that your smart contract was submitted to the blockchain. Verify that the smart contract is active by purchasing the Tokyo package and checking the account details.

Thank you for completing the IBM Blockchain Fundamentals hands-on lab!

For more information about IBM Blockchain:

- **IBM Blockchain Homepage:** <http://www.ibm.com/blockchain>
- **IBM Blockchain Community:** <https://ibm.biz/BdHW7Y>
- **Hyperledger Project:** <https://www.hyperledger.org>