

**DApp micro-financing (m3Loan)
using
Hyperledger Fabric v2.2**

By Group 3

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There are 4 parts in this user guide. Please skip to Part 3 if Hyperledger Fabric is already installed on your Ubuntu VMware.

Part 1 – How to install VMware and Ubuntu on Windows 10.

Part 2 – How to install Hyperledger Fabric (HLF) version 2.2 on Ubuntu VMware.

Part 3 – Installing Group 3 Project files into Hyperledger Fabric (HLF) folders.

- A. Installing pre-requisite dependencies used in project m3Loan DApp.
- B. Copying project folders from GitHub onto HLF folders.
- C. Executing m3Loan DApp application.
- D. Workflow.

Part 1 - How to install VMware and Ubuntu on Windows 10.

1. Download VMware Workstation Player from VMware site.

Note: VMware site has different edition of VMware. It is important that we download the Workstation Player. At the time of this documentation, VMware workstation player is version 16.0

<https://www.vmware.com/go/getplayer-win>

2. After downloading and before installing VMware, we may need to restart our Windows in order for Windows VC distributable to be installed. Go ahead and restart.

3. After windows restarted, we should be able to proceed with VMware installation. Follow the screen prompt to accept T&C and complete the installation. Enabled "Enhanced Keyboard Driver ..." option and accept default for the rest of the installation prompt.

4. Click Finish and restart your Windows.

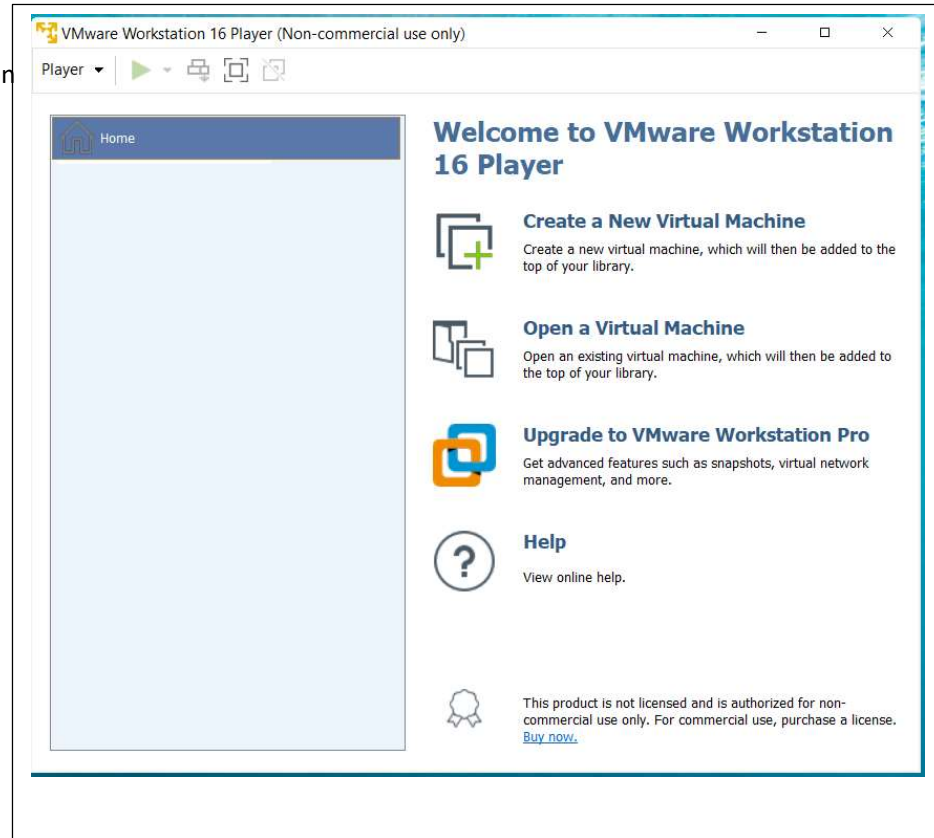
5. When Windows restarted, we should be able to find VMware player on the Windows Start menu and on the desktop. Go ahead and launch VMware.



6. When we first launch VMware, it will ask us how we wish to use VMware Workstation Player. Select "Use VMware Workstation Player for free for non-commercial use".

7. We will see the VMware workstation player starting screen when we launch VMware.

8. Proceed to next section on how to install Ubuntu on VMware.



How to install Ubuntu 20.04 LTS on VMware Workstation Player on Windows 10.

1. Download Ubuntu 20.04.1 LTS version from Ubuntu site. LTS stands for Long Term Support. The detailed explanation of LTS can be found on Ubuntu site. At the time of creating this user guide, LTS version of Ubuntu is 20.04.1.

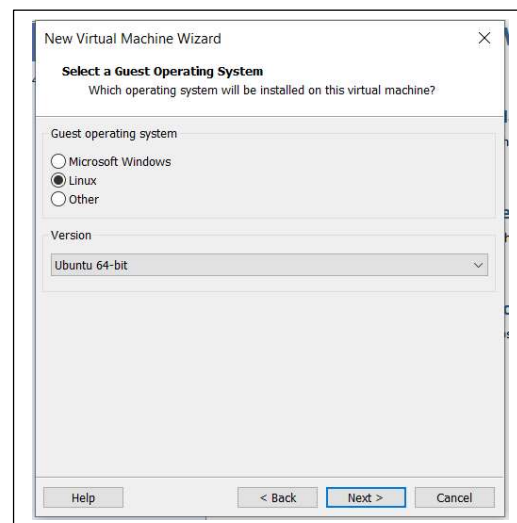
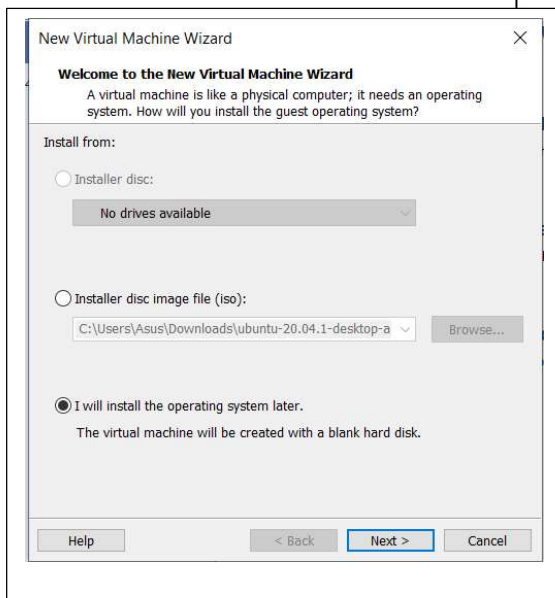
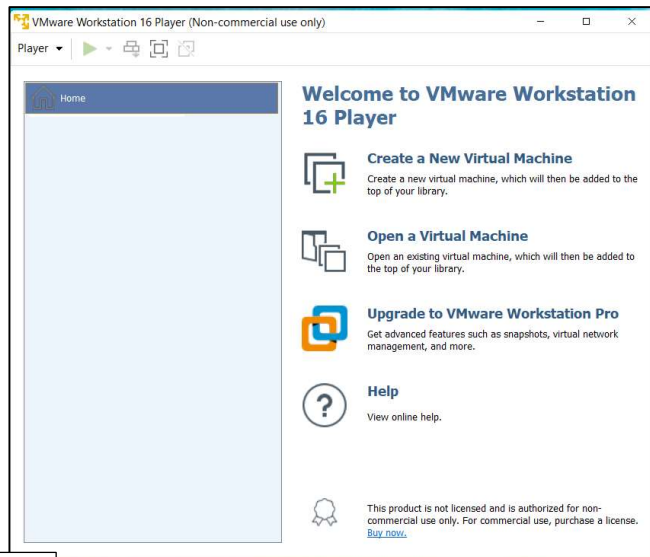
<https://ubuntu.com/download/desktop/thank-you?version=20.04.2.0&architecture=amd64>

2. Unlike VMware, Ubuntu is downloaded as an ISO image file. The file size is in GB so it may take some time for download to complete. Remember the location where our Ubuntu image file is downloaded.

3. Start our VMware Workstation Player.

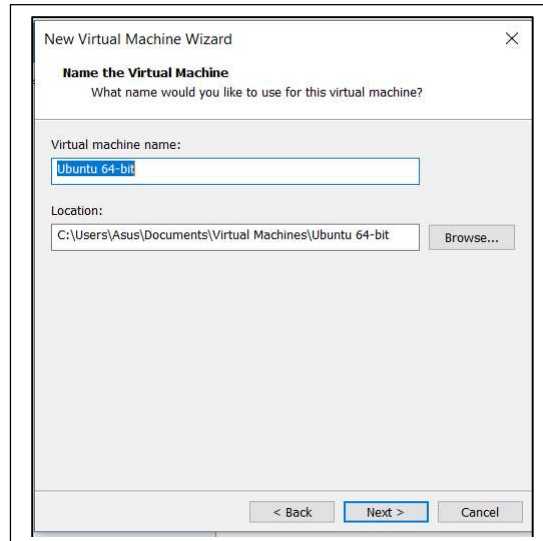
4. Click on “Create a New Virtual Machine” and select “I will install the operating system later”. Click “Next”.

5. Select “Linux” as the Guest Operating System and choose “Ubuntu 64-bit” from the Version dropdown list.



6. Choose a name for our Virtual Machine.

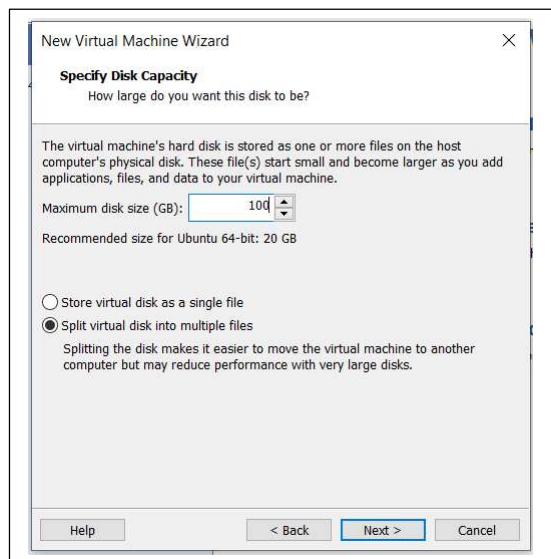
7. Click “Browse” and specify the location where our Virtual Machine will be saved.



8. Specify the maximum disk size in GB. Recommended size is 100GB.

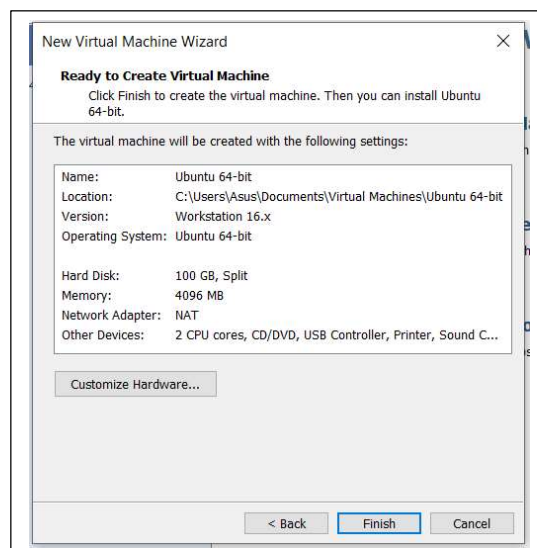
9. Select “Split virtual disk into multiple files ...”

10. Click “Next”.



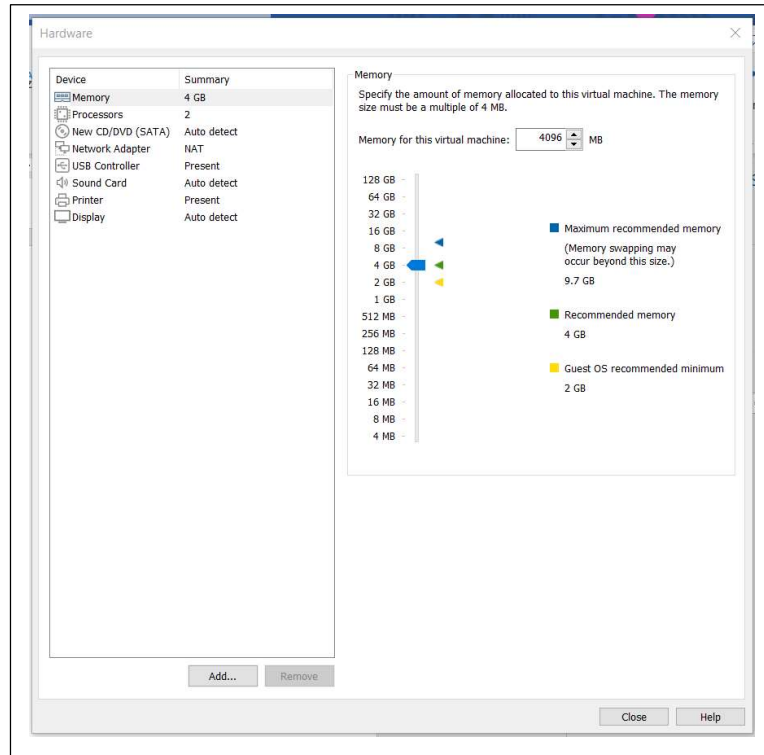
11. The setting of the Virtual Machine will be shown.

12. Click on “Customizer Hardware ...”



13. By default, 2GB of memory is allocated. Recommended to increase the memory size to 4GB (minimum) or 8GB.

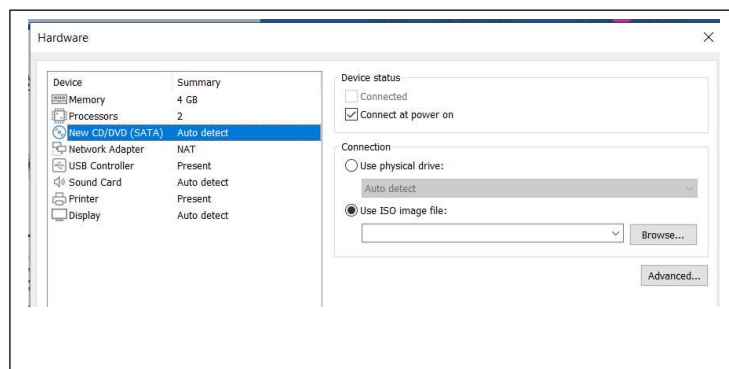
14. Set “New CD/DVD (SATA)” to Auto detect and select “use ISO image file” on the right.



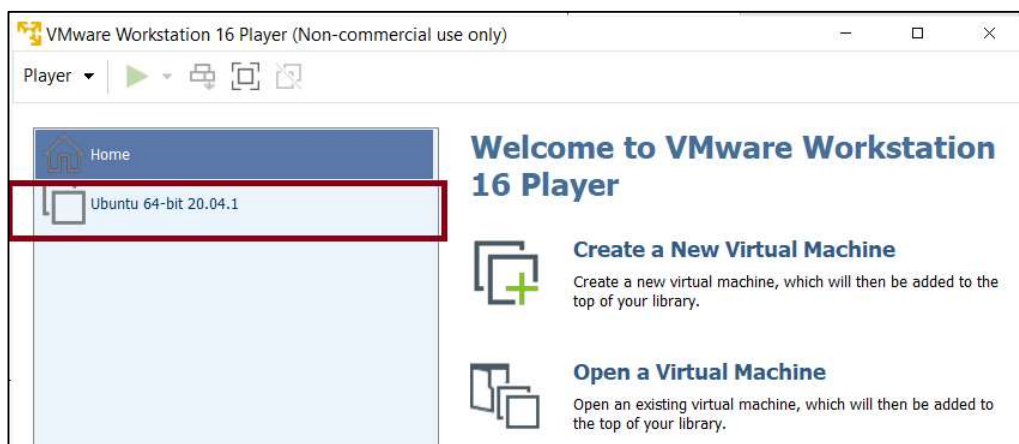
15. Click on “Browse” and locate the Ubuntu ISO image file that we have downloaded.

16. We can proceed to change other hardware setting.

17. Click on “Close” and return to the “Customize Hardware” setting dialogbox and click on “Finish”.



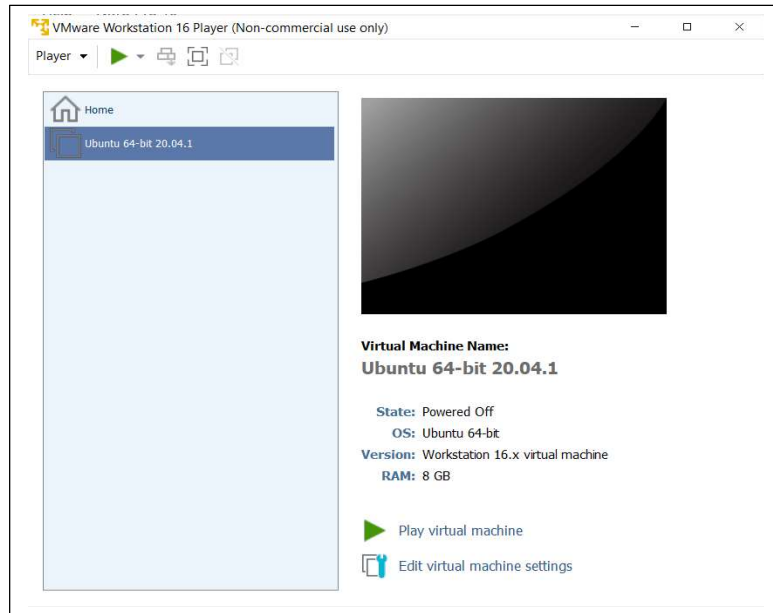
18. The name of our VM (Ubuntu 64-bit in this case) will be displayed on the VMware workstation player screen.



19. Click to select our Virtual Machine (Ubuntu 64-bit in this case) and click on the “Play virtual machine” to start installing Ubuntu.

20. A software update dialog box will popup, select “Download and Install”.

21. On the next screen, select the language of our Ubuntu.



22. On the next screen, we will select our keyboard layout. Please note that English US and English UK are different. # will be used in US English Keyboard while £ will be used in UK English Keyboard.

23. On the next screen, we will be prompted to install additional apps. Select “Normal installation”, “Download updates while installing Ubuntu” and “Install third-party software ...”.

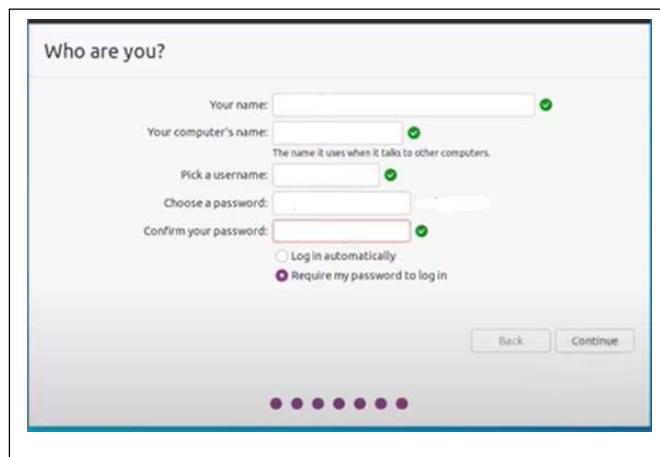
24. On the next screen, select “Erase disk and install Ubuntu”. Click on “Continue” or “Next” until we see the world map that prompt “Where are you?”

25. Select a location from the dropdown list where our VM computer is physically located. If we can’t find our country in the list, pick one that is closest. Click “Continue” or “Next” to continue.

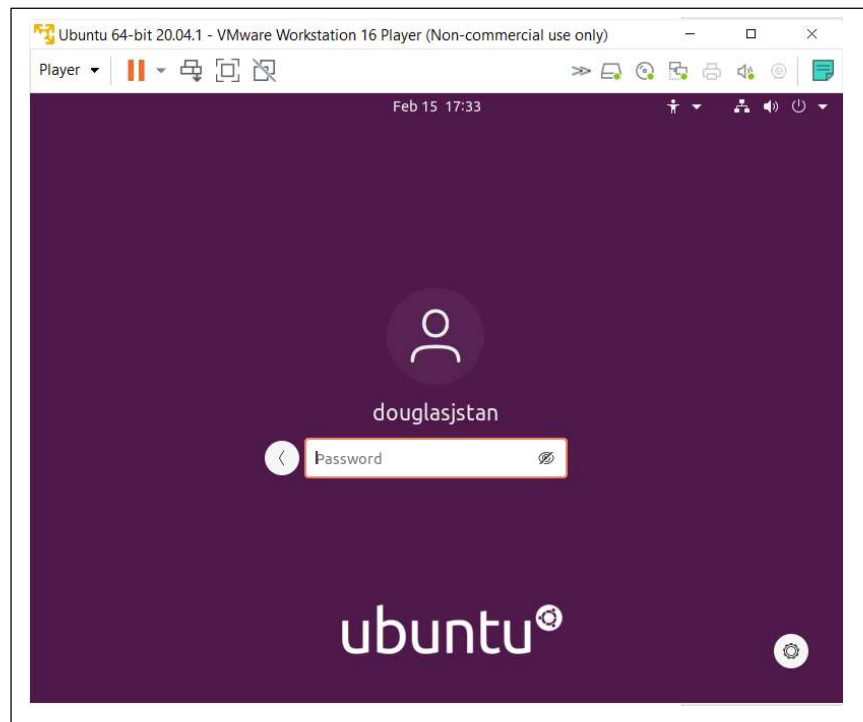
26. On this screen, we will need to specify our name, our computer’s name, our username and a password. The username and password will be needed whenever we restart Ubuntu.

27. Ubuntu installation will continue to install. Once finished, click on restart to reboot Ubuntu.

28. We will be prompted to remove the installation medium and since we are using an ISO image instead of CD/DVD ROM, we can press ENTER to continue.

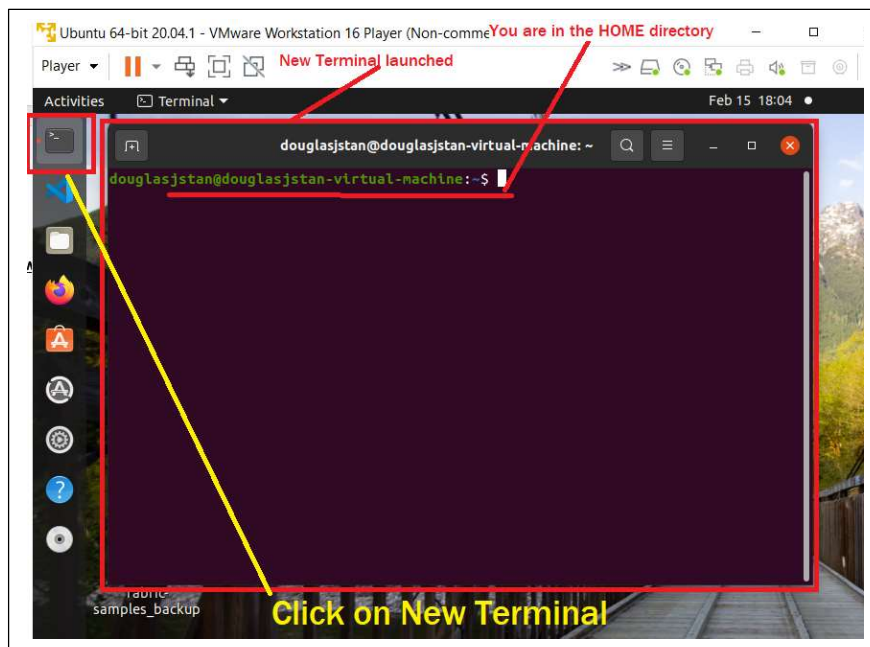


29. Every time Ubuntu starts, we will be prompted to login. In the login screen below, “douglasjstan” is the username and password is the login password that we have specified in the previous “Who are you?” screen.



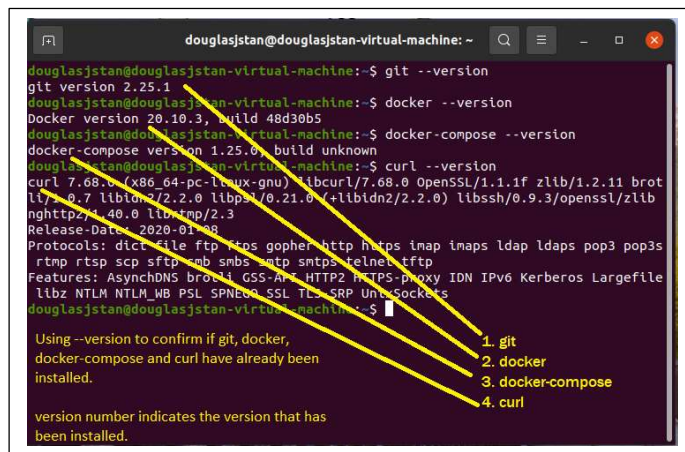
Part 2 - How to install Hyperledger Fabric (HLF) version 2.2 on Ubuntu VMware.

1. Make sure we are in the directory that we want our HLF to be installed. In this case, we are installing HLF on our HOME directory.
 - a. In Ubuntu, click on “New Terminal”.
 - b. A new terminal window appears on the right.
 - c. The command line prompt shows we are in the HOME directory. This is where our HLF will be installed. If we wish to install HLF on a different folder or directory, we will need to change directory (cd ..) to the respective folder and directory before continuing.



HLF requires some pre-requisites to be installed on our Ubuntu. Before continuing, make sure we have all these dependencies previously installed. To check if we have them, use the --version command.

If we do not have the necessary pre-requisite, go to the next topic to follow the installation then use the command line -- version to confirm again before continuing.



To install any pre-requisite dependencies, we will need administrator rights and this is usually done by preceding a command with the keyword “sudo”. Ubuntu will then prompt us for password to proceed. If the password entered is correct, Ubuntu will ask us [y/n] to confirm.

Command to install the needed pre-requisites:

```
sudo apt-get install curl
```

```
sudo apt-get install git
```

```
sudo apt-get install -y docker-ce
```

```
sudo apt-get install docker-compose
```

```
sudo apt-get install nodejs
```

```
sudo apt-get install npm
```

```
sudo apt-get upgrade
```

Installing HLF v2.2

Installing HLF has been simplified by the consortium developers of Hyperledger. A batch command has been written to automatically download and install the binaries and images files. The batch command can be found in <https://hyperledger-fabric.readthedocs.io/en/release-2.2/install.html>

```
curl -sSL https://bit.ly/2ysb0FE | bash -s
```

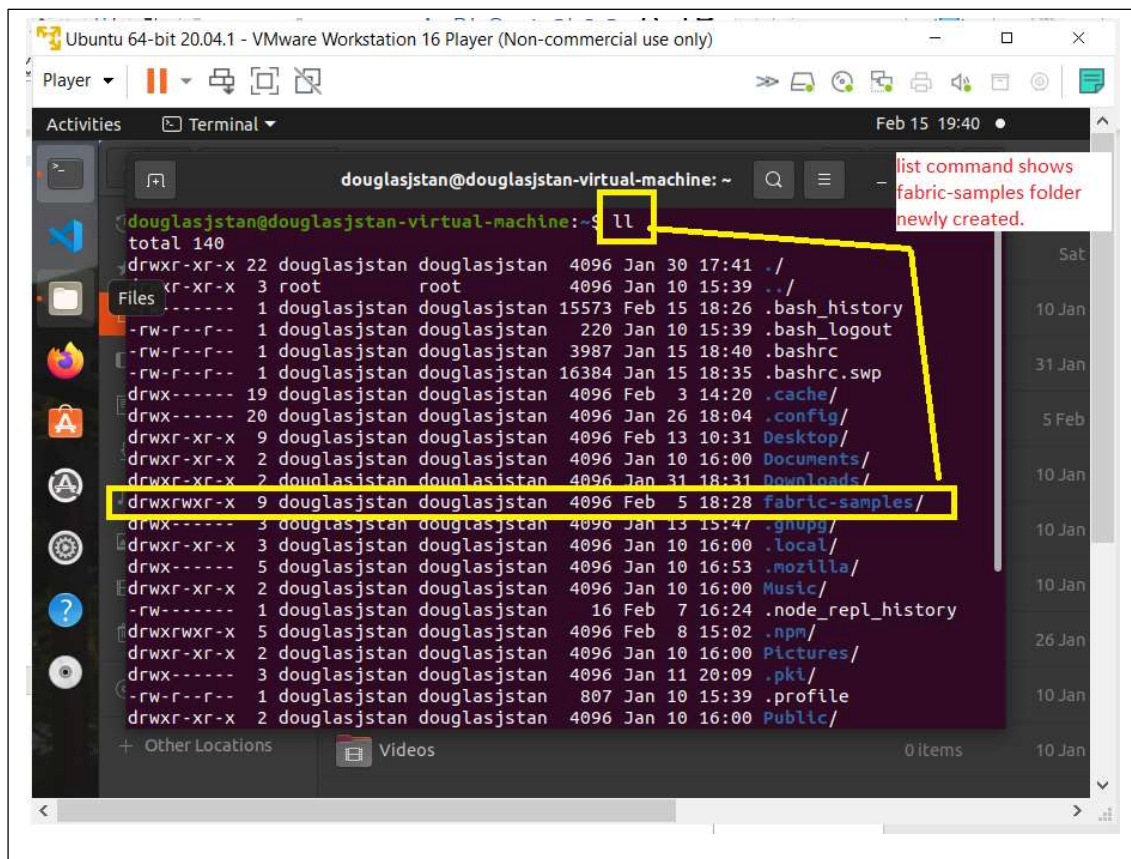
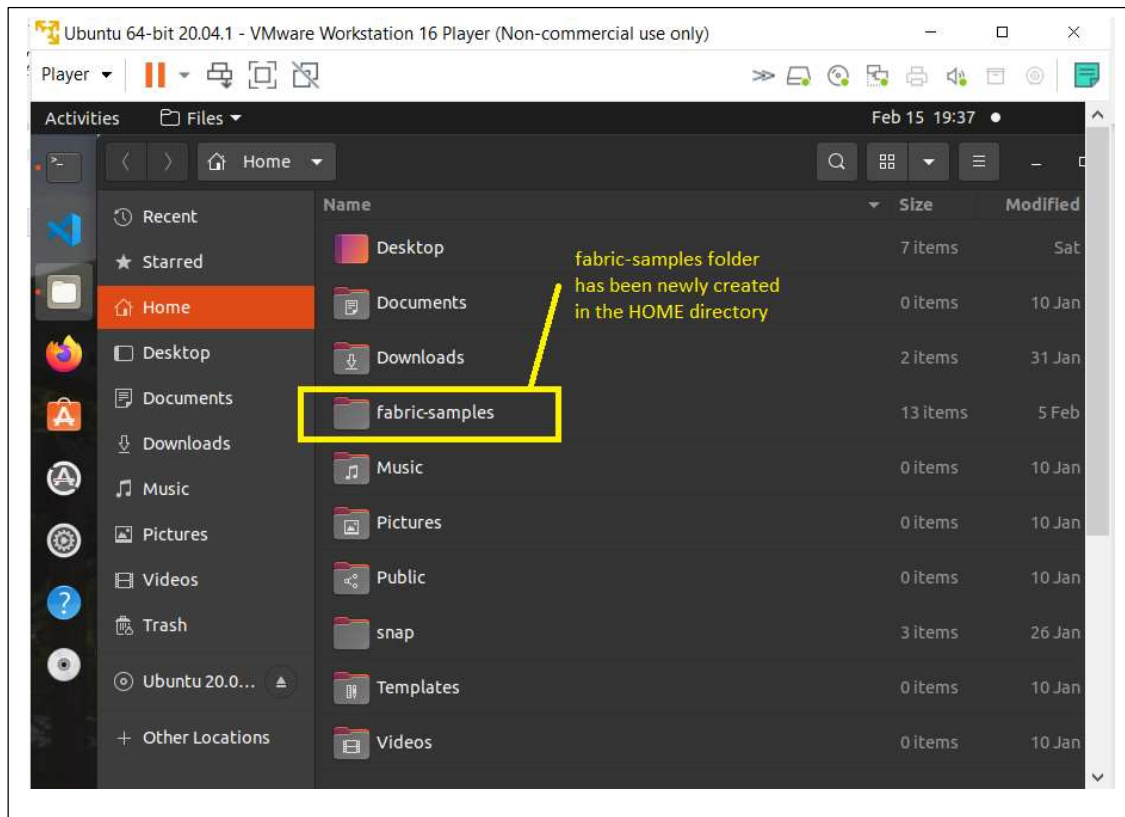
will ensure that the latest version of HLF will be installed. We can also find the pre-requisites in the same website.

Note: The installation will take a significant amount of time to complete.

When our HLF installation is completed, we can use the following docker command to check all the docker containers and images that are installed. Use zoom out to view the list if it is too crowded on the screen.

docker images

If we view our folder using Ubuntu Files Explorer or type the Linux List (l) command on the command line, we will see a newly created folder called fabric-samples. This is an important folder which all subsequent instructions mentioned in this guide will refer to. It is imperative that fabric-samples have been correctly installed before continuing.



Part 3 – Installing Group 3 Project files into Hyperledger Fabric (HLF) folders.

The project of Group 3 is called m3Loan. This section explains how to install and run m3Loan on HLF. It consists of several parts.

A. Installing pre-requisite dependencies required by project.

Some dependencies are required to be installed before running Group's 3 m3Loan DApp on HLF.

- a. Open a New Terminal
- b. Change directory to fabric-samples/fabcar/javascript directory.
- c. This is the working directory that we will install all the dependencies needed.
- d. Install the following dependencies:

- i. install node_modules

```
npm install
```

- ii. install ExpressJS and related modules.

```
npm install express
```

```
npm install body-parser
```

```
npm install ejs
```

```
npm install express-layout
```

- iii. install Niceware (module for generating password)

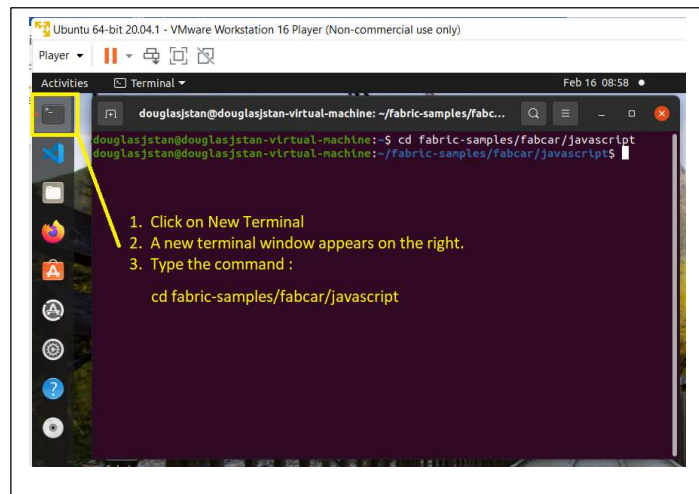
```
npm install niceware
```

- iv. install Nodemailer (module for sending email)

```
npm install nodemailer
```

- v. install Path (needed for the project code)

```
npm install node_modules-path
```



B. Copying project folders from GitHub onto HLF folders.

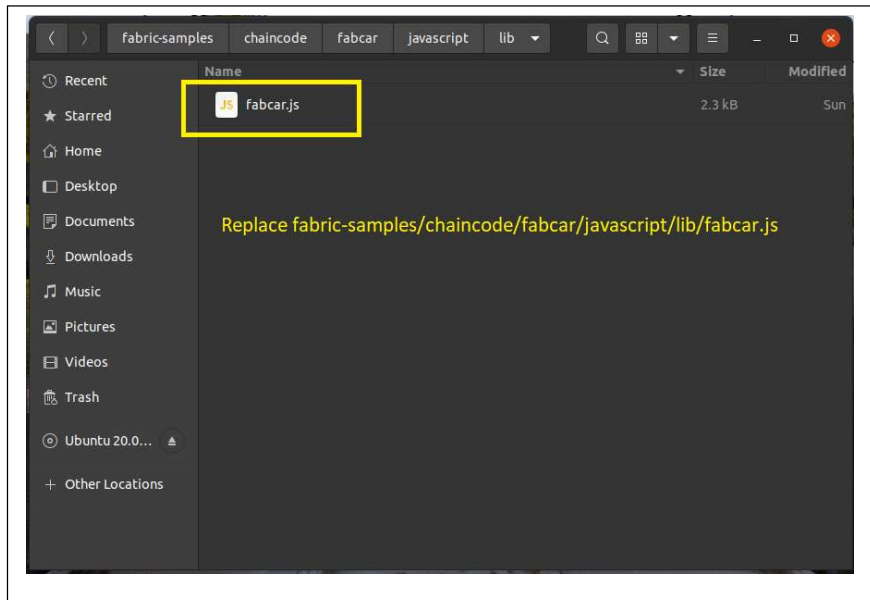
The working folders and files of the project can be found at <https://github.com/BCI1Group3/Blockchain.git>

Make sure we are running in Ubuntu VMware environment and accessing the GitHub URL from the browser in Ubuntu. After we have downloaded the m3Loan from GitHub, change directory to Fabric-Samples folder and replace the folders with the working folder that we have downloaded.

a. Replace the file fabcar.js

in

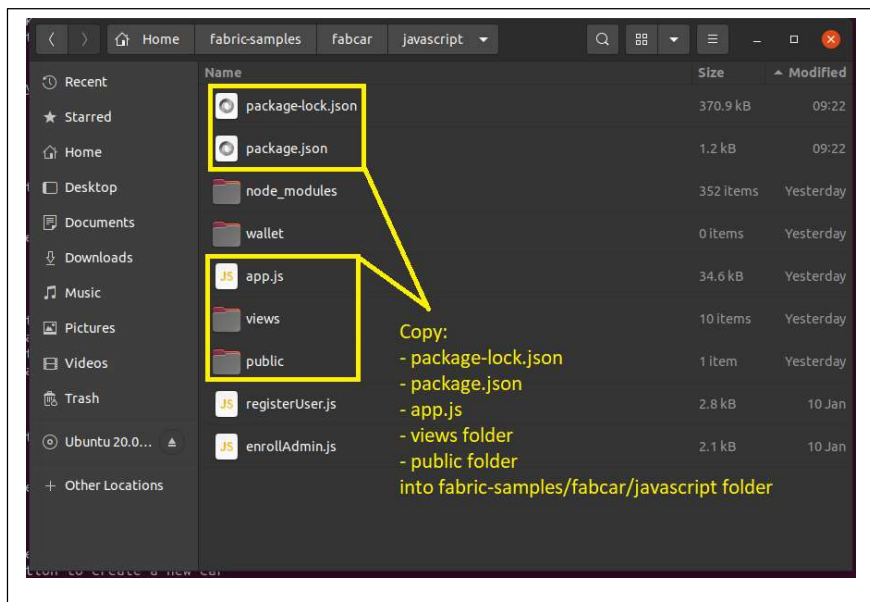
fabric-samples/chaincode/fabcar/javascript/lib/ folder



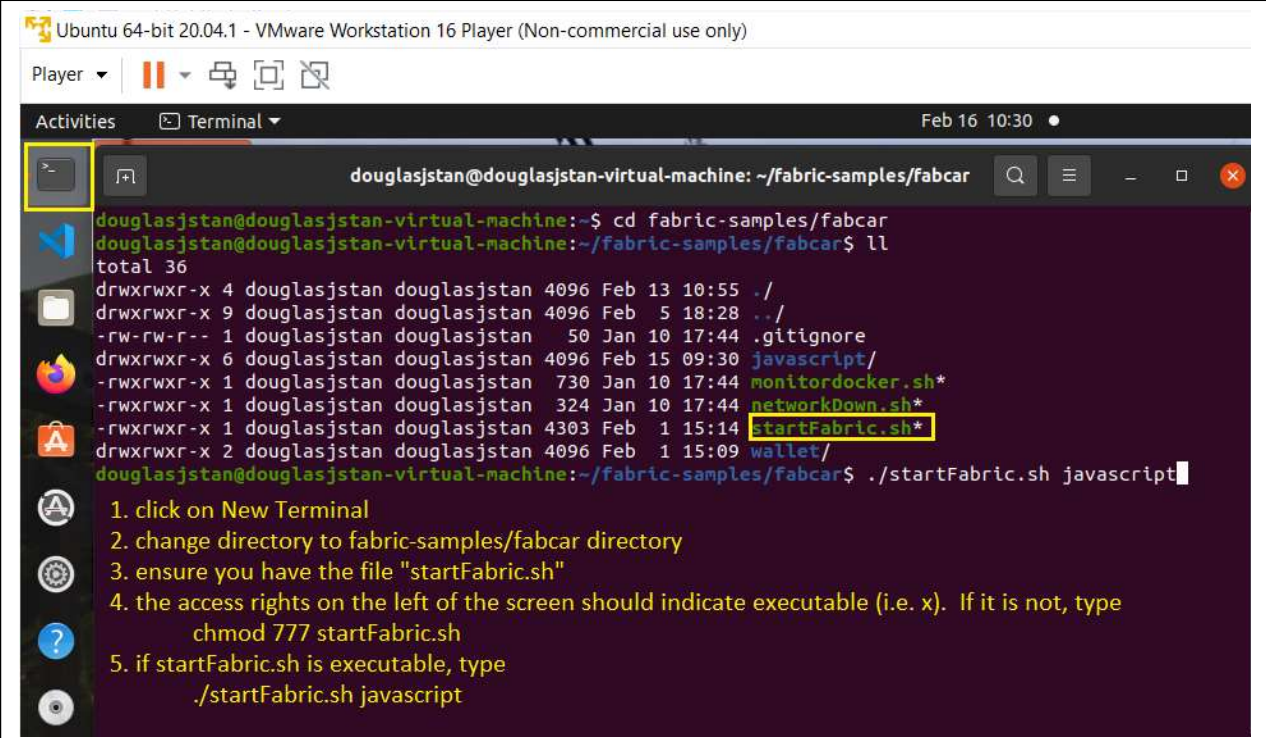
b. Copy file app.js, package-lock.json, package.json and folders views and public

into

fabric-samples/fabcar/javascript/ folder



C. Executing the application.



The screenshot shows a terminal window titled "douglassjstan@douglassjstan-virtual-machine: ~/fabric-samples/fabcar". The terminal output shows the user navigating to the directory and listing files. The file permissions for startFabric.sh are shown as -rwxrwxr-x, indicating it is executable. The user then runs the command ./startFabric.sh javascript. On the left side of the terminal window, there is a sidebar with icons for various applications, including a terminal icon which is highlighted with a yellow box.

```
douglassjstan@douglassjstan-virtual-machine:~$ cd fabric-samples/fabcar
douglassjstan@douglassjstan-virtual-machine:~/fabric-samples/fabcar$ ll
total 36
drwxrwxr-x 4 douglassjstan douglassjstan 4096 Feb 13 10:55 ./
drwxrwxr-x 9 douglassjstan douglassjstan 4096 Feb  5 18:28 ../
-rw-rw-r-- 1 douglassjstan douglassjstan  50 Jan 10 17:44 .gitignore
drwxrwxr-x 6 douglassjstan douglassjstan 4096 Feb 15 09:30 javascript/
-rwxrwxr-x 1 douglassjstan douglassjstan  730 Jan 10 17:44 monitordocker.sh*
-rwxrwxr-x 1 douglassjstan douglassjstan  324 Jan 10 17:44 networkDown.sh*
-rwxrwxr-x 1 douglassjstan douglassjstan 4303 Feb  1 15:14 startFabric.sh*
drwxrwxr-x 2 douglassjstan douglassjstan 4096 Feb  1 15:09 wallet/
douglassjstan@douglassjstan-virtual-machine:~/fabric-samples/fabcar$ ./startFabric.sh javascript
```

1. click on New Terminal
2. change directory to fabric-samples/fabcar directory
3. ensure you have the file "startFabric.sh"
4. the access rights on the left of the screen should indicate executable (i.e. x). If it is not, type
chmod 777 startFabric.sh
5. if startFabric.sh is executable, type
./startFabric.sh javascript

1. Open a New Terminal.
2. Change directory to fabric-samples/fabcar
3. Type command ll to list the directory. Make sure there is a file called startFabric.sh
4. On the left of the screen, we should startFabric.sh has read/write executable access rights i.e. we should see x. If it is not executable i.e. does not have x, change the access mode by typing the command:

```
chmod 777 startFabric.sh
```

```
ll
```

Type command ll again and we should see the access rights have been changed.

5. Type the command to start HLF. Note there is a spacing before "javascript".

```
./startFabric.sh javascript
```

6. It will take some time for HLF to be configured and launched. When it is executed successfully, we should not see any error (in red) displayed on the screen.

7. Change directory to javascript directory by typing command:

```
cd javascript
```

8. Type command ll to list the javascript directory

```
ll
```

9. We should see 2 javascript files: enrollAdmin.js and registerUser.js

10. Execute enrollAdmin.js by typing command:

```
node enrollAdmin.js
```

this will create Administrator login in HLF.

11. With administrator created, we can create users next by typing command:

```
node registerUser.js
```

```
Then run the following applications to enroll the admin user, and register a new user called appUser which will be used by the other applications to interact with the deployed FabCar contract:
node dist/enrollAdmin
node dist/registerUser

You can run the invoke application as follows. By default, the invoke application will create a new car, but you can update the application to submit other transactions:
node dist/invoke

You can run the query application as follows. By default, the query application will return all cars, but you can update the application to evaluate other transactions:
node dist/query

Java:
Start by changing into the "java" directory:
cd java

Then, install dependencies and run the test using:
mvn test

The test will invoke the sample client app which perform the following:
- Enroll admin and appUser and import them into the wallet (if they don't already exist there)
- Submit a transaction to create a new car
- Evaluate a transaction (query) to return details of this car
- Submit a transaction to change the owner of this car
- Evaluate a transaction (query) to return the updated details of this car

Go:
Start by changing into the "go" directory:
cd go

Then, install dependencies and run the test using:
go run fabcar.go

The test will invoke the sample client app which perform the following:
- Import user credentials into the wallet (if they don't already exist there)
- Submit a transaction to create a new car
- Evaluate a transaction (query) to return details of this car
- Submit a transaction to change the owner of this car
- Evaluate a transaction (query) to return the updated details of this car

If successfully executed startFabric.sh, you should not see any error in red.
```

```
Then, install dependencies and run the test using:
go run fabcar.go

The test will invoke the sample client app which perform the following:
- Import user credentials into the wallet (if they don't already exist there)
- Submit a transaction to create a new car
- Evaluate a transaction (query) to return details of this car
- Submit a transaction to change the owner of this car
- Evaluate a transaction (query) to return the updated details of this car

1. change directory to javascript directory
2. type command ll to list directory
3. you should see enrollAdmin.js and registerUser.js
4. type command node enrollAdmin.js
5. type command node registerUser.js

douglassjstan@douglassjstan-virtual-machine:~/fabric-samples/fabcar/javascript$ cd javascript
douglassjstan@douglassjstan-virtual-machine:~/fabric-samples/fabcar/javascript$ ll
total 444
drwxrwxr-x 6 douglassjstan douglassjstan 4096 Feb 15 09:30 ./
drwxrwxr-x 4 douglassjstan douglassjstan 4096 Feb 13 10:55 ../
-rw-rw-r-- 1 douglassjstan douglassjstan 34593 Feb 15 09:44 app.js
-rw-rw-r-- 1 douglassjstan douglassjstan 2112 Jan 10 17:44 enrollAdmin.js
drwxrwxr-x 355 douglassjstan douglassjstan 12288 Feb 15 19:53 node_modules/
-rw-rw-r-- 1 douglassjstan douglassjstan 1242 Feb 16 09:22 package.json
-rw-rw-r-- 1 douglassjstan douglassjstan 370878 Feb 16 09:22 package-lock.json
drwxr-xr-x 3 douglassjstan douglassjstan 4096 Feb 15 09:25 public/
-rw-rw-r-- 1 douglassjstan douglassjstan 2822 Jan 10 17:44 registerUser.js
drwxr-xr-x 3 douglassjstan douglassjstan 4096 Feb 15 09:30 views/
drwxrwxr-x 2 douglassjstan douglassjstan 4096 Feb 15 10:00 wallet/
douglassjstan@douglassjstan-virtual-machine:~/fabric-samples/fabcar/javascript$ node enrollAdmin.js
Wallet path: /home/douglassjstan/fabric-samples/fabcar/javascript/wallet
Successfully enrolled admin user "admin" and imported it into the wallet
douglassjstan@douglassjstan-virtual-machine:~/fabric-samples/fabcar/javascript$ node registerUser.js
Wallet path: /home/douglassjstan/fabric-samples/fabcar/javascript/wallet
Successfully registered and enrolled admin user "appUser" and imported it into the wallet
douglassjstan@douglassjstan-virtual-machine:~/fabric-samples/fabcar/javascript$
```

12. If both Administrator and User are created correctly, we should see their ID in the wallet directory.

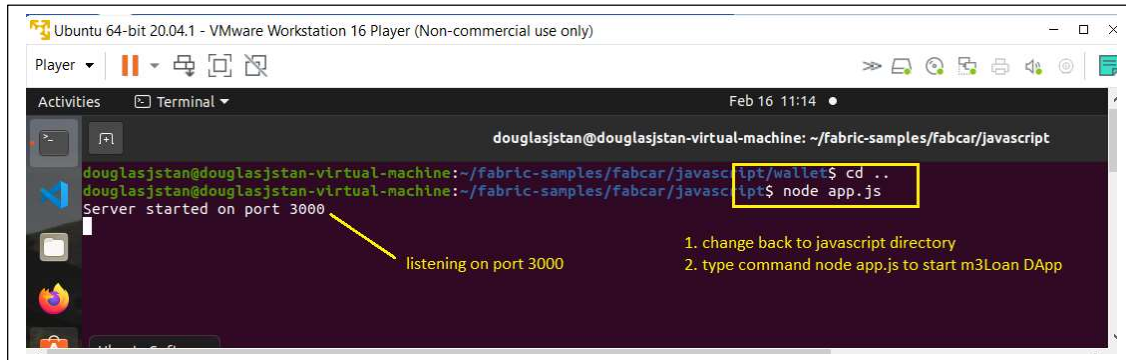
13. Type command cd wallet followed by command ll to list.

```
drwxrwxr-x 2 douglassjstan douglassjstan 4096 Feb 16 10:53 wallet/
douglassjstan@douglassjstan-virtual-machine:~/fabric-samples/fabcar/javascript$ cd wallet
douglassjstan@douglassjstan-virtual-machine:~/fabric-samples/fabcar/javascript/wallet$ ll
total 16
drwxrwxr-x 2 douglassjstan douglassjstan 4096 Feb 16 10:53 ./
drwxrwxr-x 6 douglassjstan douglassjstan 4096 Feb 15 09:30 ../
-rw-rw-r-- 1 douglassjstan douglassjstan 1101 Feb 16 10:53 admin.id
-rw-rw-r-- 1 douglassjstan douglassjstan 1299 Feb 16 10:53 appUser.id
-rw-rw-r-- 1 douglassjstan douglassjstan 0 Jan 10 17:44 .gitkeep
douglassjstan@douglassjstan-virtual-machine:~/fabric-samples/fabcar/javascript/wallet$
```

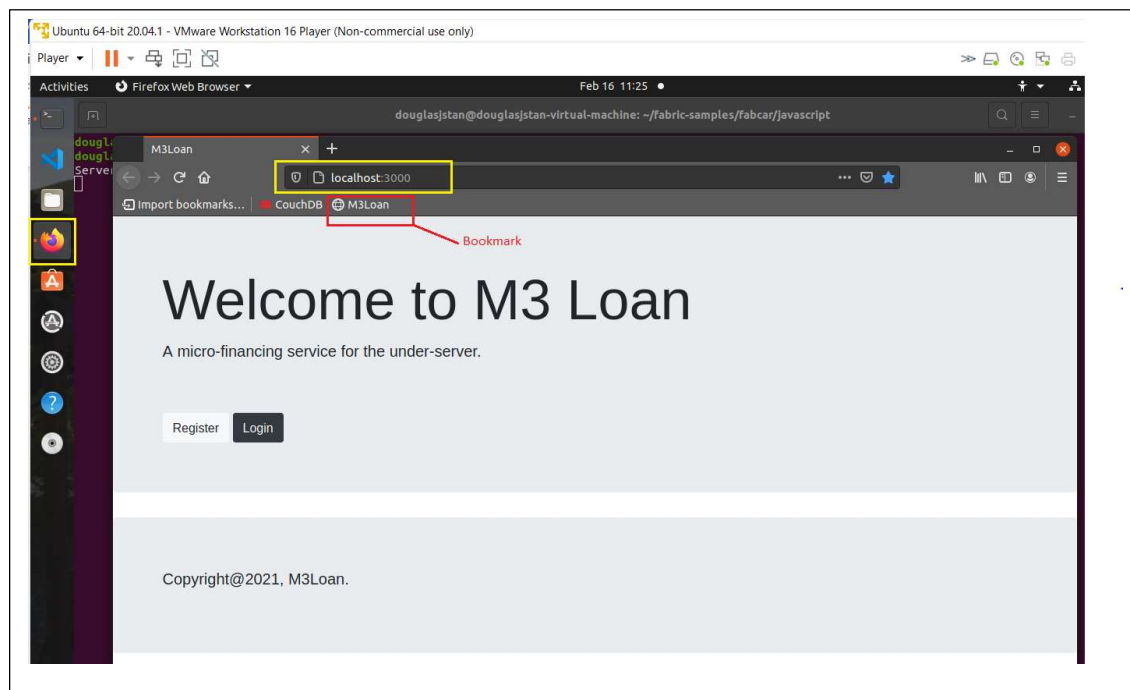
14. Now we are ready to start m3Loan DApp. Change directory back to javascript directory and start the m3Loan DApp.

```
cd ..
```

```
node app.js
```

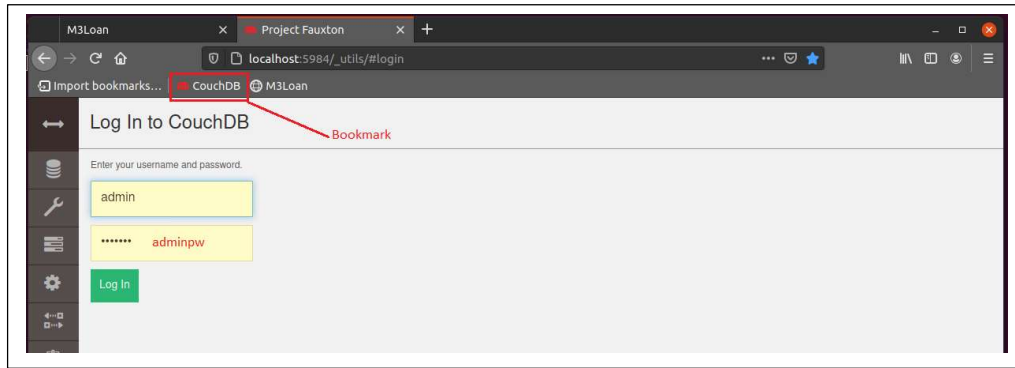


15. Open firefox browser and browse to localhost:3000. As we will be visiting this home page regularly, we will bookmark the URL.

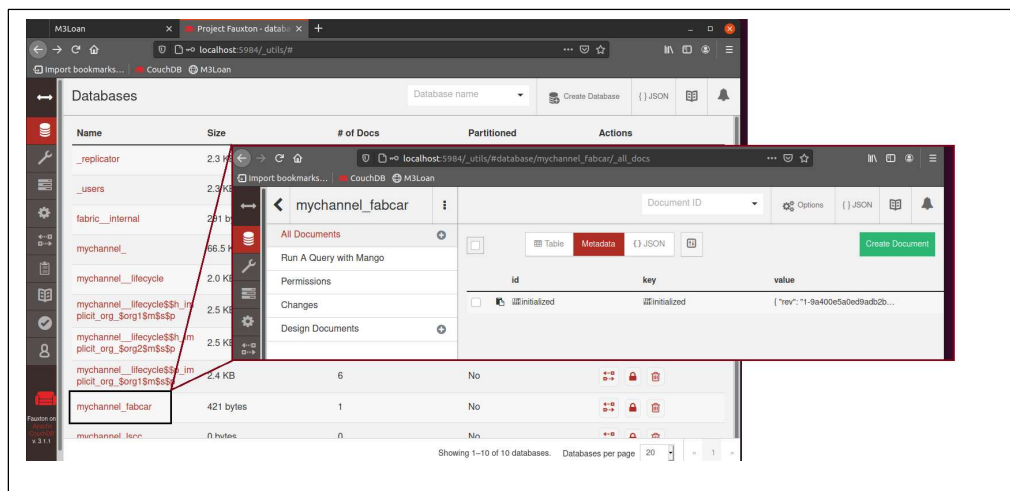


16. Hyperledger provides a browser access to its CouchDB where we can view data that are written after each transaction. Open a new tab and browse to localhost:5984/_utils. Again, we will bookmark this URL since we will also be accessing this CouchDB regularly.

The username is admin and the password is adminpw. The Username and Password are created by default when we install HLF using startFabric.

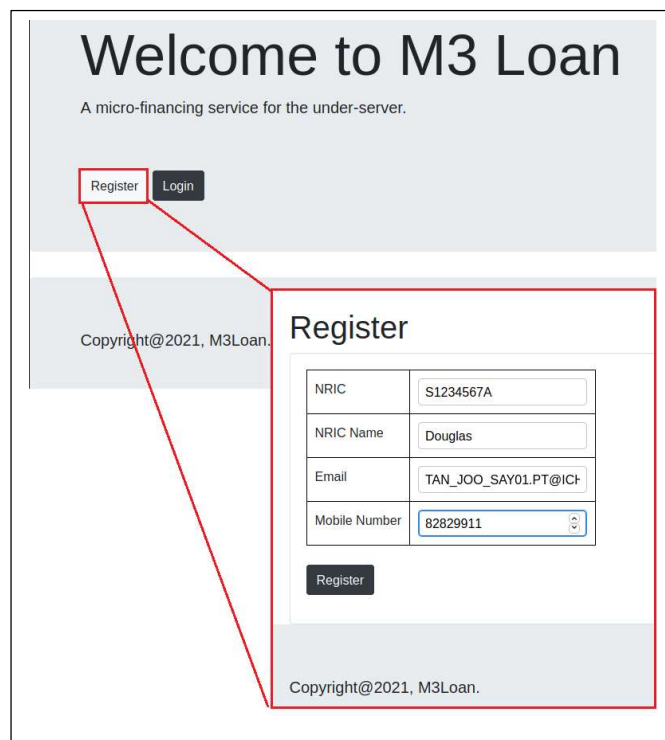


17. After login, click on mychannel_fabcar. The next screen show the CouchDB database is empty since there is no user created yet.

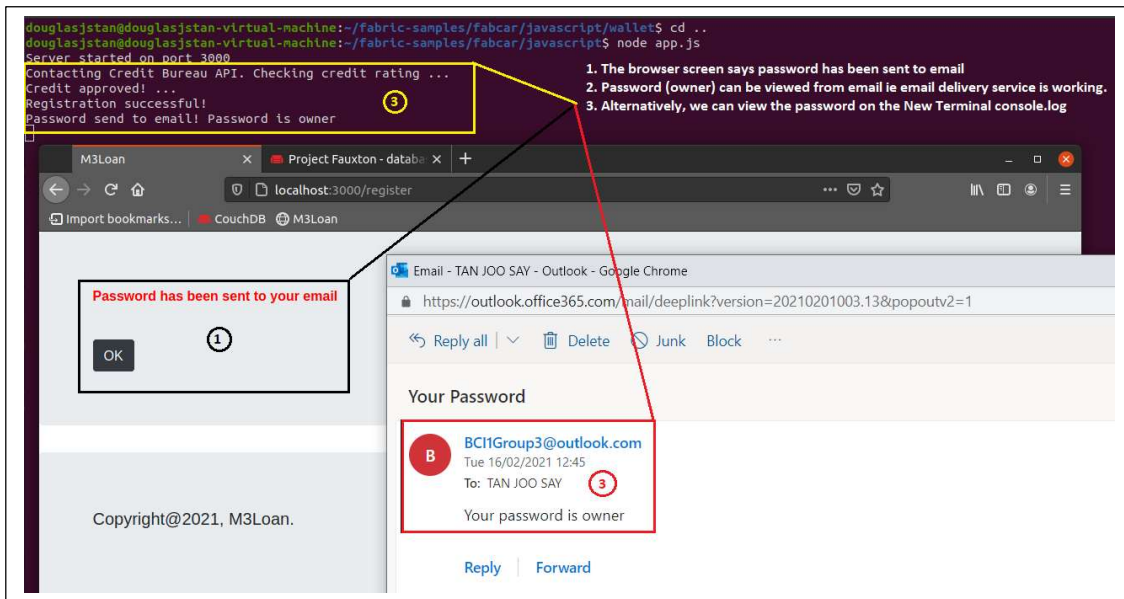


18. Go back to the m3Loan page and click on “Register” to register as a new customer. The registration page will appear.

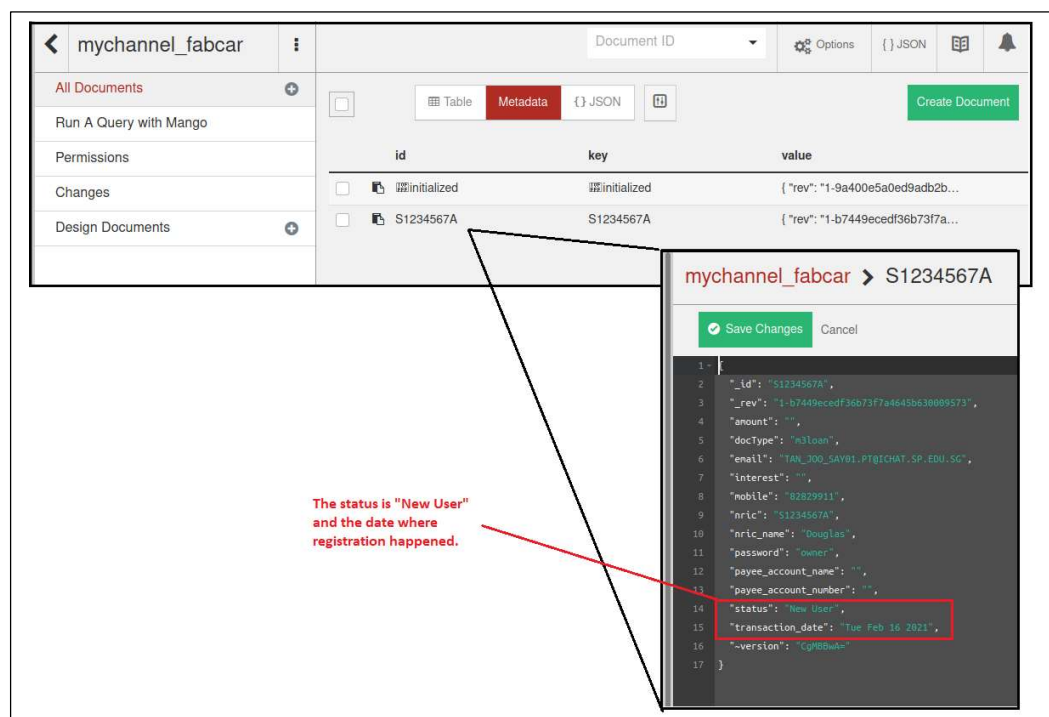
Since the m3Loan DApp will not access the Credit Bureau credit rating database in this guide, we can fill in a fake NRIC, NRIC Name and Mobile Number. However, we need to provide a real Email address because m3Loan DApp will generate a password and send it to the email address. Without a valid email address, we will not be able to see the password created and confirm if the email service is working. Alternatively, we can see the app.js console.log in the New Terminal.



19. After registration and assuming that the credit rating is fine, the screen will say that the password has been sent to our email. The password is generated using a simple algorithm of niceware node-module. It can be modified to create a complex password if needed.



20. We can now head over to HLF CouchDB to view our newly created user record. Note: we may need to re-login to CouchDB again since it will automatically timeout if there is no access activity. We see a new NRIC record created. On clicking the record, we can see the details of the registration. We can see the password is the same password that was sent to our email. Also notice the status is New User indicating it is a new user (customer). At this point in time, we don't know if this new user or customer is a borrower or a lender (ie depositor). Nevertheless, we can confirm that the transaction is correctly written into the Hyperledger Fabric Blockchain Digital Ledger.



21. Clicking on the “OK” button will bring us back to the Login screen. We can now login using our NRIC and the password that was sent to our email.

22. If we forget or deleted our email password, we can click on the Reset Password button and a newly generated password will be sent to our email again.

Change Password

Please change your password

NRIC	S1234567A
NRIC Name	Douglas
Old Password
New Password	1

Update Password

Login

NRIC S1234567A

Password

Login Reset Password

Copyright@2021, M3Loan.

23. If we enter the Login credentials correctly, the DApp will recognize that we are login in for the first time and automatically redirected us to change our Password.

For simplicity, we will use the number 1 as our new password and click on “Update Password” to change.

24. Now we head over to CouchDB to see if our new password has been updated in the digital ledger.

Not only the password has changed from “owner” to “1”, the status has also changed from “New User” to “Registration”. It indicated that registration has successfully completed for this new user.

The new user can now borrow or deposit.

25. On the previous “Change Password – Updated” screen, click on “OK” to return to the Login screen again.

Login

NRIC S1234567A

Password 1

Login Reset Password

```
mychannel_fabcar > S1234567A
Save Changes Cancel
{
  "_id": "S1234567A",
  "_rev": "2-af5d5328b18d700297ea3027ed00fb5c",
  "amount": "",
  "docType": "m3loan",
  "email": "TAN_JOO_SAY01.PT@ICHA.TSP.EDU.SG",
  "interest": "",
  "mobile": "82829911",
  "nr": "S1234567A",
  "nr": "Douglas",
  "password": "1",
  "payee_account_name": "",
  "payee_account_number": "",
  "status": "Registration",
  "transaction_date": "Tue Feb 16 2021",
  "-version": "CgMBCAA="
}
```

26. We now use the new password (ie the number 1) to login again. The DApp recognizes that we have successfully registered but have not indicated our intention. It redirects us to indicate if we wish to borrow or deposit fund.

Your Registration

NRIC	S1234567A	NRIC Name	Douglas
Email	TAN_JOO_SAY01.PT@ICHAT.SP.EDU.SG	Mobile Number	82829911
Registration on Tue Feb 16 2021			

If you are borrowing :	
Amount (\$500 to \$2000) - Please enter amount you wish to borrow	<input type="text" value="0"/> <div>▲▼</div>
Interest - Chargeable interest depends on current market board rate. - Payment term is monthly.	5% p.a.
Please enter your bank account name and number. - Monthly deduction will be made from this account for the next 6 months.	<input type="text" value="Douglas"/> Bank Account Name to deduct
	<input type="text" value="0"/> <div>▲▼</div> Bank Account Number to deduct
If you are depositing :	
Amount - Please enter amount you wish to deposit (\$5,000 to \$30,000).	<input type="text" value="0"/> <div>▲▼</div>
Interest - Payable interest depends on current market board rate. - Payout term is annually upon maturity.	3% p.a.
Please enter your bank account name and number. - Interest amount will be returned to this account upon maturity.	<input type="text" value="Douglas"/> Bank Account Name to deposit
	<input type="text" value="0"/> <div>▲▼</div> Bank Account Number to deposit

Once approved, a copy of the agreement will be sent to your email.

Submit

27. This screen consist of 3 portions: (a) Common information (b) Borrower's details (c) Depositor's details.

a. Common information shows the existing information that was provided by the user during registration and it cannot be changed currently.

b. If the user wishes to borrow, s/he will complete the Borrower's details which comprises the amount to loan (minimum \$500 to maximum \$2,000), the Bank Account name and number which the computed interest and a fraction of the principal borrowed sum will be automatically deducted from every month for the next 6 months. The interest chargeable is computed based on the current board rate and is usually lower than the interest charged by the bank if the borrower chooses to borrow from the bank.

c. If the user wishes to deposit, s/he will complete the Depositor's details which comprises the amount to deposit (minimum \$5,000 to maximum \$30,000), the Bank Account name and number which the computed interest plus the deposited principal amount will be automatically credited to when the tenure of 1 year matured. The interest payable is computed based on the current board rate and is usually higher than the interest offered by the bank if the depositor chooses to deposit in the bank.

Note: the DApp program will reject if user chooses both Borrower and Depositor or specified an amount that is outside the permissible range.

Your Registration

NRIC	S1234567A	NRIC Name	Douglas
Email	TAN_JOO_SAY01.PT@ICHAT.SP.EDU.SG	Mobile Number	82829911
Registration on Tue Feb 16 2021			

NRIC, NRIC Name, Email and Mobile Number are information that cannot be changed here.

If you are borrowing :

Amount (\$500 to \$2000) - Please enter amount you wish to borrow	<input type="text" value="0"/>
Interest - Chargeable interest depends on current market board rate. - Payment term is monthly.	5% p.a.
Please enter your bank account name and number. - Monthly deduction will be made from this account for the next 6 months.	<input type="text" value="Douglas"/> Bank Account Name to deduct
	<input type="text" value="0"/> Bank Account Number to deduct

Borrower needs to indicate the loan amount, Bank Account Name and Number which monthly collection will automatically be deducted from.

By default, the Bank Account Name will be the same as the NRIC Name.

If you are depositing :	
Amount - Please enter amount you wish to deposit (\$5,000 to \$30,000).	<input type="text" value="0"/>
Interest - Payable interest depends on current market board rate. - Payout term is annually upon maturity.	3% p.a.
Please enter your bank account name and number. - Interest amount will be returned to this account upon maturity.	<input type="text" value="Douglas"/> Bank Account Name to deposit
	<input type="text" value="0"/> Bank Account Number to deposit

Depositor needs to indicate the deposit amount, Bank Account Name and Number which the total amount will be returned to upon tenure maturity.

By default, the Bank Account Name will be the same as the NRIC Name.

28. In this screen, we will become the depositor and deposit \$30,000 at 3% interest. The Bank Account Name remains the same as NRIC and Bank Account Number is 999-888-777-1

If you are depositing :	
Amount - Please enter amount you wish to deposit (\$5,000 to \$30,000).	<input type="text" value="30000"/>
Interest - Payable interest depends on current market board rate. - Payout term is annually upon maturity.	3% p.a.
Please enter your bank account name and number. - Interest amount will be returned to this account upon maturity.	<input type="text" value="Douglas"/> Bank Account Name to deposit
	<input type="text" value="9998887771"/> Bank Account Number to deposit

Note: m3Loan DApp will reject entry with hyphen on Bank Account Number. It will only accept numbers because different banks will use different numbering format for their Account Number.

29. After the new user indicated whether s/he is a borrower or a depositor, DApp will return the user to the Login Screen. We will now head over to CouchDB and see our digital ledger.

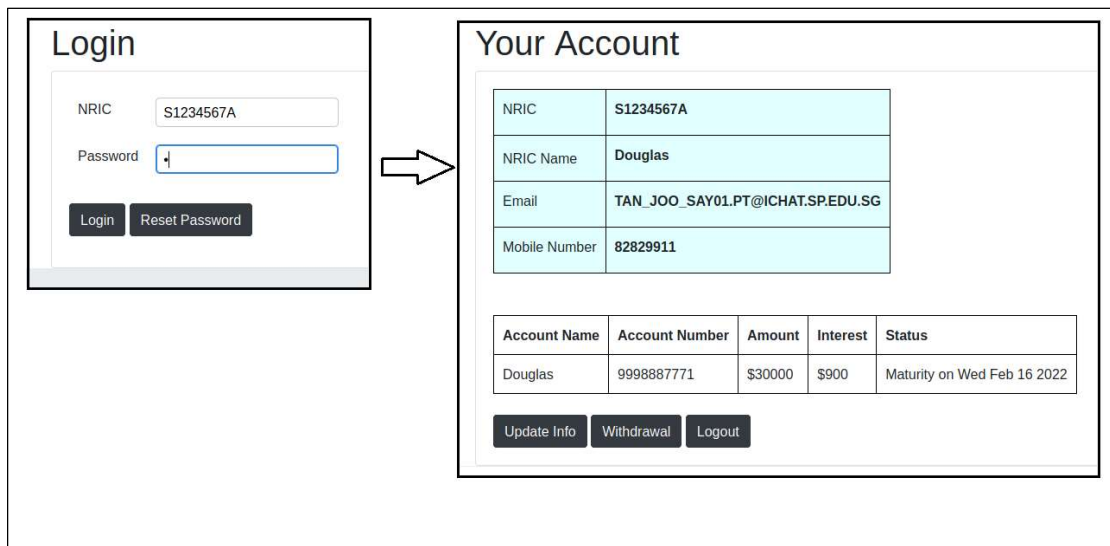
30. The Amount is \$30,000. Interest is 3% or \$900. The Bank Account Name and Number which the total amount will be payable to are updated correctly in the digital ledger. Also notice the status now show “Maturity” and the transaction date show the maturity date 1 year from now.

Now that we have registered ourselves as a depositor, we will try to login again and see what m3Loan DApp will show us.



31. This time, it recognizes that we are a depositor and show us the status of our account by retrieving them from the digital ledger. Notice we are now given the option to update our information or withdraw our deposit before the tenure matured.

We will click on “Update Info” to change our information then perform premature withdrawal after that.



32. NRIC and NRIC Name are information that cannot be changed because these are information that are required when checking for credit rating with Credit Bureau service.

Email, mobile number, password, Bank Account Name and Number are changeable. The current password is mandatory to make any changes. We will make the following changes indicated on the screen and change the password from ‘1’ to ‘11’. Let’s head over to the CouchDb to see the update.

Update Information

Current password is mandatory to update new information

NRIC and NRIC Name cannot be changed

Please update your information.

Note: You need to enter your current password in order to update your new information.

NRIC	S1234567A	NRIC Name	Douglas
Email	TAN_JOO_SAY01.PT@ICHAT.SP.EDU.SG	New Email	Douglasjstan@hotmail.com
Mobile	82829911	New Mobile Number	12345678
Bank Account Name	Douglas	New Bank Account Name	Douglas Tan
Bank Account Number	9998887771	New Bank Account Number	1234567890
Current Password	•	New Password (if required)	**

Update Information

New information update

33. CouchDB shows the information has been updated.

34. We will now login using our new password and perform a premature withdrawal.

mychannel_fabcar > S1234567A

Save Changes Cancel

```

1 {
2   "_id": "S1234567A",
3   "_rev": "4-a45befacd28c37f3ad9a27532bd8ce78",
4   "amount": "30000",
5   "docType": "m3loan",
6   "email": "Douglasjstan@hotmail.com",
7   "interest": "900",
8   "mobile": "12345678",
9   "nric": "S1234567A",
10  "nric_name": "Douglas",
11  "password": "11",
12  "payee_account_name": "Douglas Tan",
13  "payee_account_number": "1234567890",
14  "status": "Maturity",
15  "transaction_date": "Wed Feb 16 2022",
16  "-version": "CgMBCgA="
17 }

```

information updated

Login

new password is 11

NRIC

Password

Your Account

NRIC	S1234567A
NRIC Name	Douglas
Email	Douglasjstan@hotmail.com
Mobile Number	12345678

updated information displayed

Account Name	Account Number	Amount	Interest	Status
Douglas Tan	1234567890	\$30000	\$900	Maturity on Wed Feb 16 2022

35. Our account now displayed with the updated information.

36. Click on "Withdrawal" to withdraw our deposit.

37. m3Loan DApp notified us that our interest amount will be forfeited. Click "Confirm" to continue.

Withdrawal

Note: Interest will be forfeited for prematured withdrawal.

NRIC	S1234567A
NRIC Name	Douglas
Amount	30000
Interest (This amount will be forfeited)	900
Bank Number Amount will be returned to this account	1234567890
Bank Name Amount will be returned to this account	Douglas Tan

Withdraw successful

38. Click "OK" to go back to login screen and login again to see our Account status. We will also take a look at our CouchDB to see the new status.

mychannel_fabcar > S1234567A

Save Changes Cancel

```

1 - {
2   "_id": "S1234567A",
3   "_rev": "5-79b1f01600fbab84618c25c8e38a4115",
4   "amount": "30000",
5   "docType": "m3loan",
6   "email": "Douglasjstan@hotmail.com",
7   "interest": "900",
8   "mobile": "12345678",
9   "nric": "S1234567A",
10  "nric_name": "Douglas",
11  "password": "11",
12  "payee_account_name": "Douglas Tan",
13  "payee_account_number": "1234567890",
14  "status": "Prematured withdrawal",
15  "transaction_date": "Tue Feb 16 2021",
16  "~version": "CgHBCwA="
17 }
```

Status shows "Prematured withdrawal"

Your Account

NRIC	S1234567A
NRIC Name	Douglas
Email	Douglasjstan@hotmail.com
Mobile Number	12345678

Account Name	Account Number	Amount	Interest	Status
Douglas Tan	1234567890	\$30000	\$900	Prematured withdrawal on Tue Feb 16 2021

Update Info Logout

Withdrawal option no longer available

Both CouchDB and Account ledger shows deposit has been withdrawn prematurely. The Account ledger no longer has "Withdrawal" option since it has already been withdrawn. However, the record will remain in the digital ledger for immutable record tracking.

Click on Logout to return back to the Login screen. Click on our m3Loan URL bookmark to go to the m3Loan home screen.

40. Our CouchDB still contain 1 previously created user i.e. depositor. We will now create another new user but this time as a borrower. However, we will skip the repetitive steps that are already shown previously when we create a depositor.

mychannel_fabcar

- All Documents
- Run A Query with Mango
- Permissions
- Changes
- Design Documents

Document ID

Table Metadata { } JSON

id	key	value
<input type="checkbox"/> initialized	initialized	{ "rev": "1-9a400e5a0ed9adb2b496f76c..." }
<input type="checkbox"/> S1234567A	S1234567A	{ "rev": "5-79b1f01600fbab84618c25c8..." }

Create Document

41. A new user is created. CrouchDB now shows 2 users.

Register

NRIC	S1234567B
NRIC Name	Mary
Email	MaryChinSL@gmail.com
Mobile Number	87614421

Register

mychannel_fabcar

- All Documents
- Run A Query with Mango
- Permissions
- Changes
- Design Documents

Document ID

Table Metadata { } JSON

id	key
<input type="checkbox"/> initialized	initialized
<input type="checkbox"/> S1234567A	S1234567A
<input type="checkbox"/> S1234567B	S1234567B

42. Mary's password has been generated and sent to her email address.

43. We login using the generated password (crookery).

44. Since this is the first time we login, we are prompted to change our password.

45. For simplicity, we changed our password from crookery to the number "2".

Change Password

Please change your password

NRIC	S1234567B
NRIC Name	Mary
Old Password	*****
New Password	•

Update Password

```
Contacting Credit Bureau API. Checking credit rating ...
Credit approved! ...
Registration successful!
Password send to email! Password is owner
Contacting Credit Bureau API. Checking credit rating ...
Credit approved! ...
Registration successful!
Password send to email! Password is crookery
```

Login

NRIC	S1234567B
Password	*****

Login Reset Password



46. We will register Mary as Borrower. The loan amount is \$2,000. The chargeable interest is 5% which is \$100.

The total sum will be \$2,100.

If this amount is to be repaid in 6 months, then every month, the payable amount is $\$2,100 / 6 = \350 .

Your Registration

NRIC	S1234567B	NRIC Name	Mary
Email	MaryChinSL@gmail.com	Mobile Number	87614421

Registration on Tue Feb 16 2021

If you are borrowing :

Amount (\$500 to \$2000) - Please enter amount you wish to borrow	2000
Interest - Chargeable interest depends on current market board rate. - Payment term is monthly.	5% p.a.
Please enter your bank account name and number. - Monthly deduction will be made from this account for the next 6 months.	Mary Bank Account Name to deduct 1112223334 Bank Account Number to deduct

47. When we login again, the account ledger shows us the total balance amount is \$2,100 and a monthly payment amount of \$350 will be deducted automatically from the Account Name and Number provided during registration. Notice the status shows the date of the collection which is 1 month from the date of registration. Also notice that unlike depositor, there is no withdraw option for borrower to prematurely terminate the loan tenure.

mychannel_fabcar > S1234567B

Save Changes

Cancel

```
1 {
2   "_id": "S1234567B",
3   "_rev": "3-cf410919075d42a1ad5d1af0df1cefa",
4   "amount": "2100",
5   "docType": "m3loan",
6   "email": "MaryChinSL@gmail.com",
7   "interest": "350",
8   "mobile": "87614421",
9   "nric": "S1234567B",
10  "nric_name": "Mary",
11  "password": "2",
12  "payee_account_name": "Mary",
13  "payee_account_number": "1112223334",
14  "status": "next payment date and amount",
15  "transaction_date": "Tue Mar 16 2021",
16  "~version": "Cgn809A="
17 }
```

Your Account

NRIC	S1234567B
NRIC Name	Mary
Email	MaryChinSL@gmail.com
Mobile Number	87614421

Account Name	Account Number	Amount	Interest	Status
Mary	1112223334	\$2100	\$350	next payment date and amount on Tue Mar 16 2021

Update Info

Logout

48. Likewise, clicking on "Update Info" will allow Borrower to change his/her information and clicking on "Logout" will return to the login screen.

D. Workflow.

This section shows the complete workflow.

