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Subject Name: Cryptography & Blockchain
Subject Code: CS601
Assignment: Skill – 2

Title: Installing Truffle and connecting Ganache with MetaMask.

For this assignment, I've taken reference from the following pages:

- https://www.geeksforgeeks.org/how-to-set-up-ganche-with-metamask/
- https://ethereum-blockchain-developer.com/050-supply-chain-project/04-install-truffle/

What is Truffle Suite?

Truffle Suite is basically a collection of tools which allows you to develop and deploy smart contracts on the Ethereum blockchain. Truffle Suite includes the Truffle development framework. This provides tools needed to build and test smart contracts, as well as Truffle Boxes, which are pre-built smart contract templates. These can be used as a boilerplate while beginning with new projects.

What is Ganache?

Ganache is basically a local blockchain, which is a part of the Truffle Suite. It will allow you to easily set up a personal blockchain, on which you can test and experiment. This can be done without the need for an external network.

It is an Ethereum client, that is based on Node.js. It allows you to develop smart contracts. Since it's based on Node.js, it should be installed using NPM (Node Package Manager).

What is MetaMask?

MetaMask is basically a digital wallet which allows you to interact with the Ethereum blockchain. It allows you to securely store your private keys, as well as manage your Ethereum. It's like a middleware between the Ethereum blockchain and you. This enables you to easily make transactions (sending and receiving Ether) without running a full Ethereum node on your machine.

MetaMask can be installed as a browser extension. It supports various browsers, such as Chrome, Firefox, Brave, Edge and Opera. It's also available on iOS and Android devices.

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Installing MetaMask

To install MetaMask, go to https://metamask.io/ and install it to your preferred browser. I've already done the installation and created a wallet.
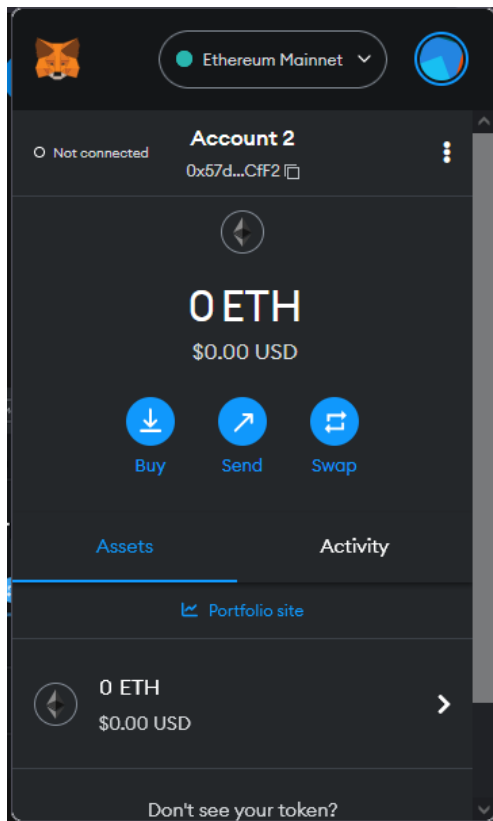
Installing Truffle

To install Truffle, make sure you have access to NPM (Node Package Manager). I already have NPM (and Node.js) installed on my machine, so I will execute the following command in CMD to install Truffle:

```
npm install -g truffle
```

The `-g` flag stands for "global" installation.

Installing Ganache

Ganache has a GUI version, as well as a CLI version. To install the GUI version, visit the link https://trufflesuite.com/ganache/ and download the file. To install the CLI version, simply type and execute the following command in CMD or PowerShell:

```
npm install -g ganache-cli
```
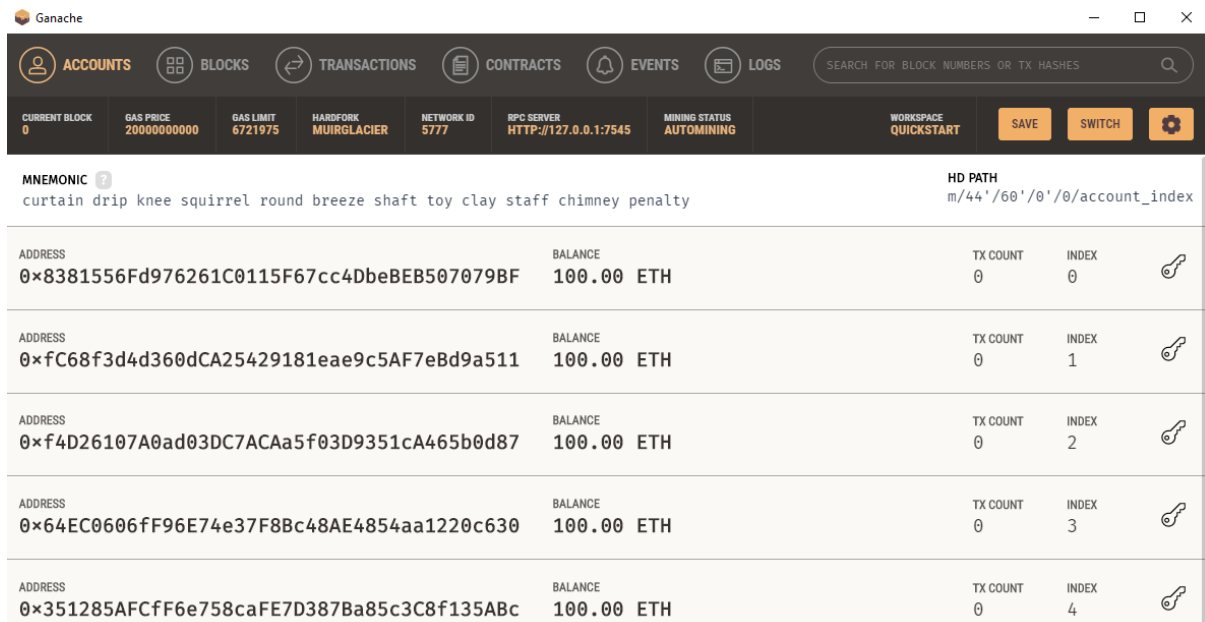
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Using Ganache

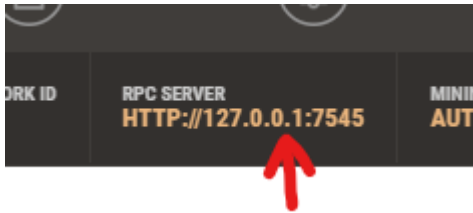After installing, I am now able to launch Ganache.
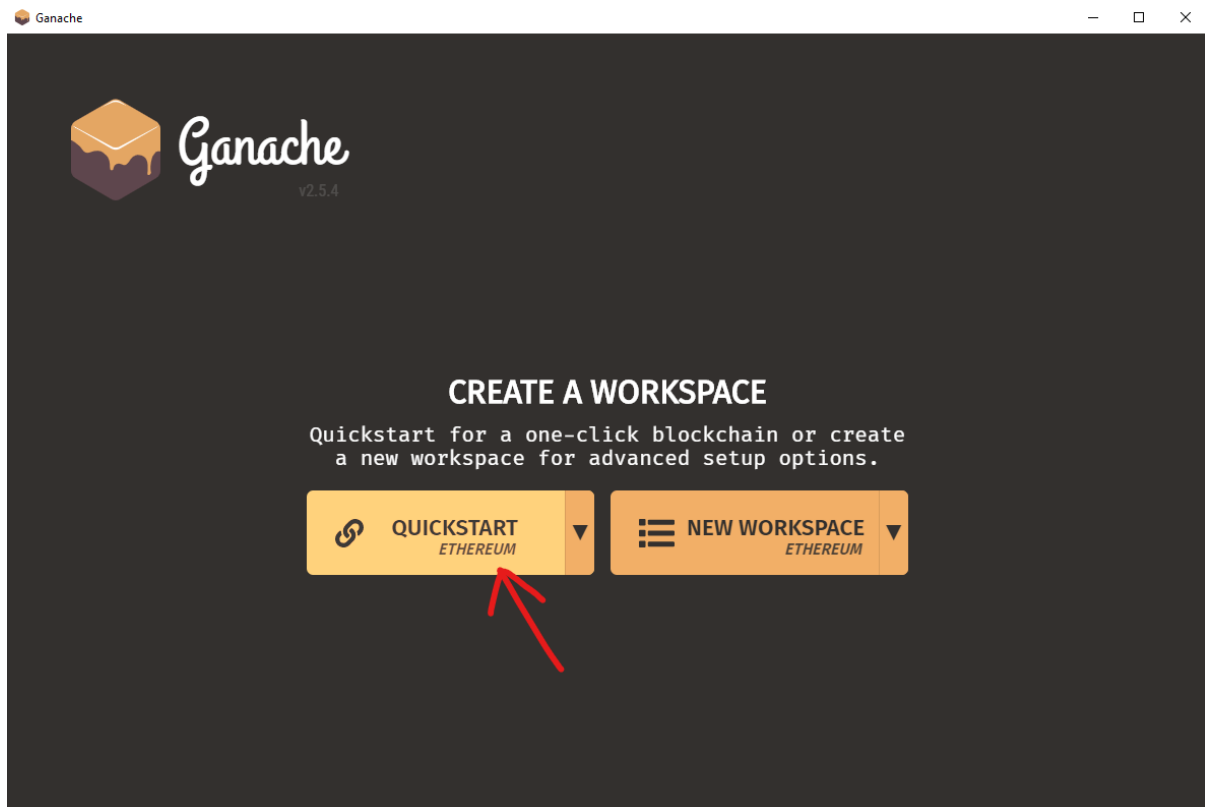
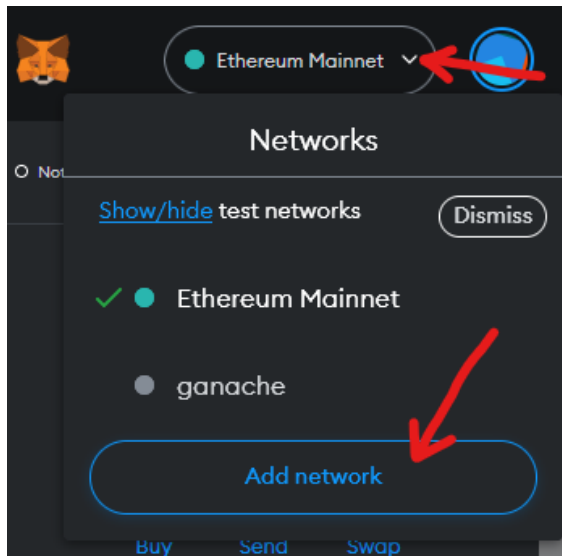Click on the "Quickstart" button, and you will see the following:

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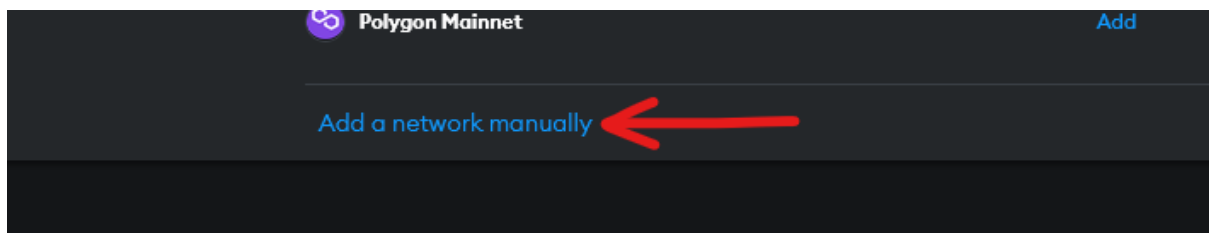## Adding local network to MetaMask

Now, copy the RPC URL.

Go to MetaMask and click on the following:

This is to add the local blockchain network into MetaMask. Scroll all the way down, and click on "Add a network manually".

Finally, fill in the following fields:

- Network name
- New RPC URL
- Chain ID
- Currency symbol

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Click on the "Save" button.

The network is now added to MetaMask.
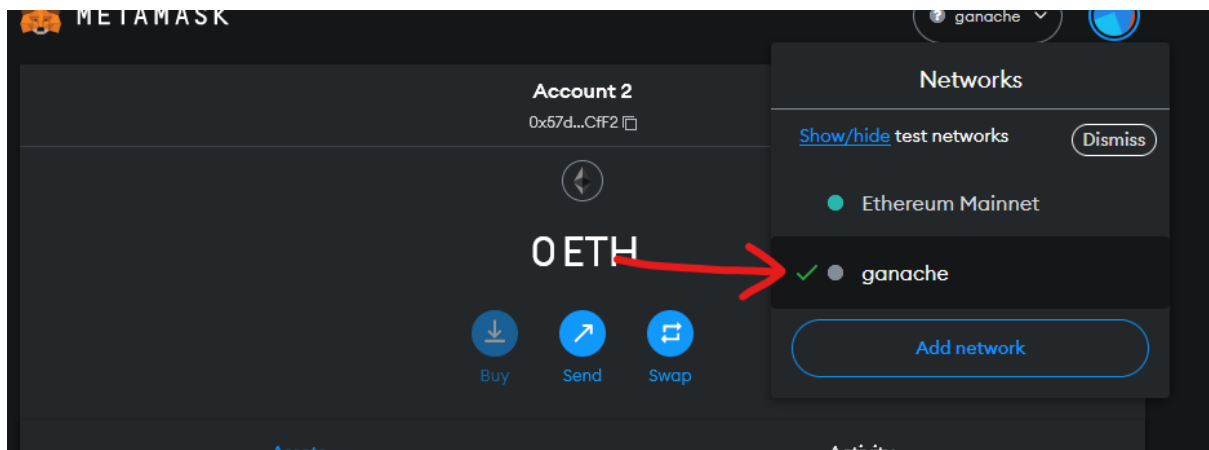
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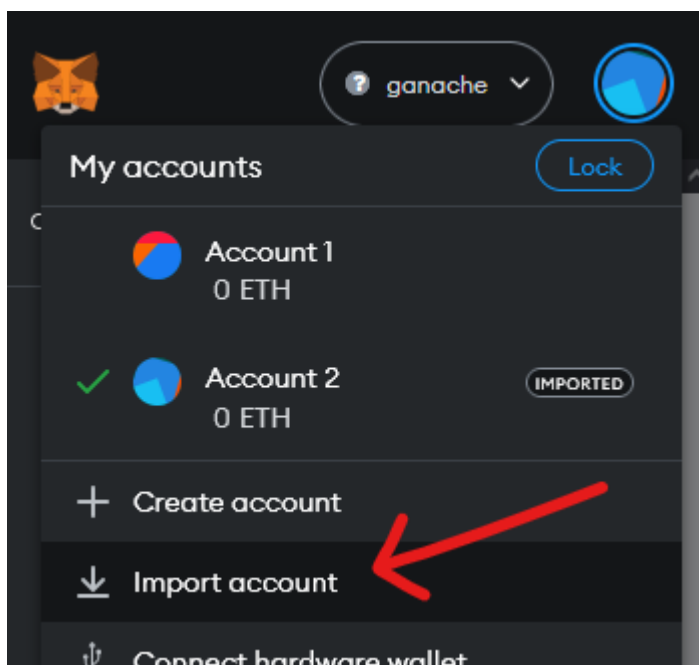## Importing a Ganache account into MetaMask

We need to import a local account in Ganache, to MetaMask. To do so, go back to Ganache and click on the little key icon of any account.
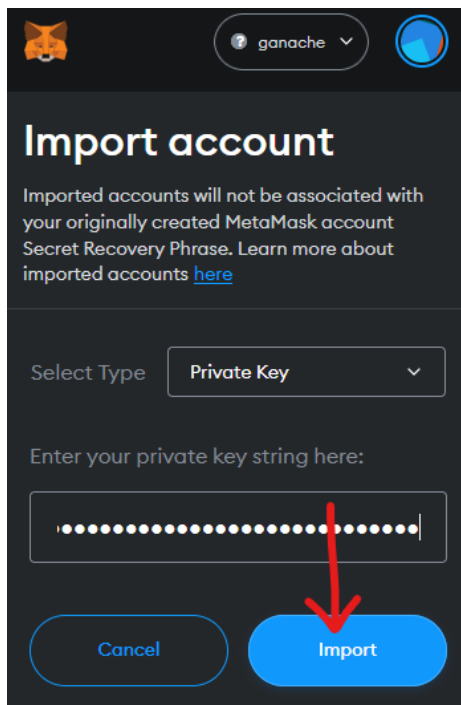

Now, copy the private key.

Go back to MetaMask, click on your profile picture, and then, click on the "Import account" button.
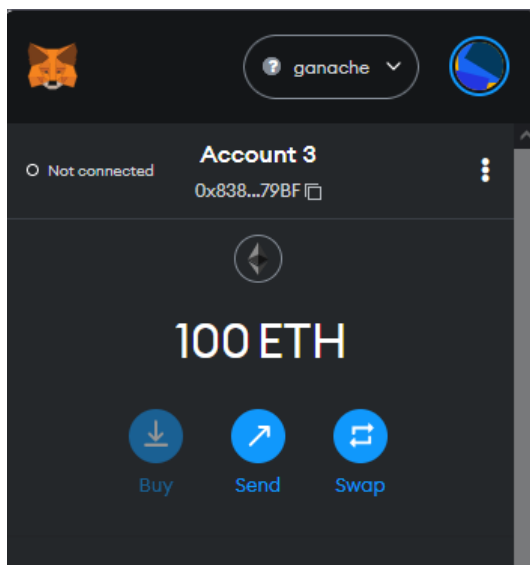
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Then, paste the private key you copied and click on the "Import" button.

The balance is now visible in my MetaMask wallet, meaning that the import was successful.

The next step is to create smart contracts.

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Creating a smart contract

To create a smart contract, I first created a new separate folder. Here, I ran the following commands in order:

```
truffle init
truffle create contract Kshitij
```

```
C:\Users\kshit\Documents\University\semester-6\CS601 - Cryptography & Blockchain>cd truffle

C:\Users\kshit\Documents\University\semester-6\CS601 - Cryptography & Blockchain\truffle>truffle init

Starting init...
================
> Copying project files to C:\Users\kshit\Documents\University\semester-6\CS601 - Cryptography & Blockchain\truffle

Init successful, sweet!

Try our scaffold commands to get started:
  $ truffle create contract YourContractName # scaffold a contract
  $ truffle create test YourTestName         # scaffold a test

http://trufflesuite.com/docs


C:\Users\kshit\Documents\University\semester-6\CS601 - Cryptography & Blockchain\truffle>truffle create contract Kshitij


C:\Users\kshit\Documents\University\semester-6\CS601 - Cryptography & Blockchain\truffle>ls
contracts  migrations  test  truffle-config.js

C:\Users\kshit\Documents\University\semester-6\CS601 - Cryptography & Blockchain\truffle>ls contracts
Kshitij.sol
```

I opened the "Kshitij.sol" file and added the following code to it:

```
pragma solidity >=0.4.22 <0.9.0;

contract Kshitij {
  uint256 public counter = 0;

  constructor() public {
    incrementCounter();
  }

  function incrementCounter() public {
    counter++;
  }
}
```
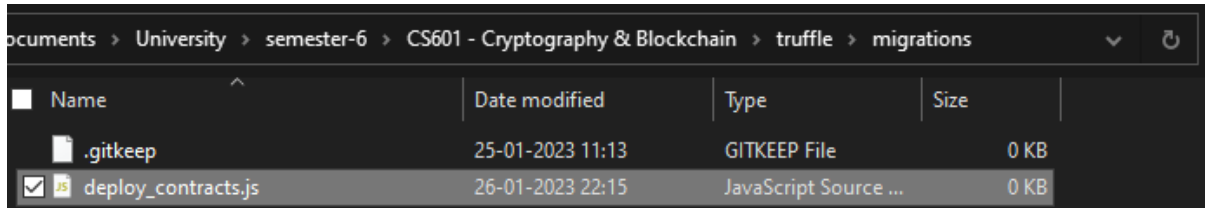
The next step is to make a piece of JavaScript code that will allow deploying the smart contract.

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JavaScript snippet to deploy the contract

In the "migrations" folder, I created a new file called "deploy_contracts.js".

In this file, I added the following piece of code:

```javascript
module.exports = function (deployer) {
  deployer.deploy(artifacts.require("./Kshitij.sol"));
};
```

Compiling and deploying the contract

Go back to CMD and type the following command:

```
truffle compile
```


To deploy, type the following command:

```
truffle migrate
```

```
    > Blocks: 0              Seconds: 0
    > contract address:      0x588A3255AFfa262D519d3fd7E9C862e75eDb303b
    > block number:          1
    > block timestamp:       1674752005
    > account:               0x8381556Fd976261C0115F67cc4DbeBEB507079BF
    > balance:               99.99692724
    > gas used:              153638 (0x25826)
    > gas price:             20 gwei
    > value sent:            0 ETH
    > total cost:            0.00307276 ETH

    > Saving artifacts
    -------------------------------------
    > Total cost:            0.00307276 ETH

Summary
=======
> Total deployments:   1
> Final cost:          0.00307276 ETH



C:\Users\kshit\Documents\University\semester-6\CS601 - Cryptography & Blockchain\truffle>_
```
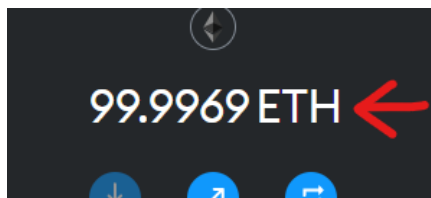
After a transaction, we can see that the Ether is now reduced:

On Ganache, if we go to the "Blocks" tab, we can see the block along with the amount of gas that was used.
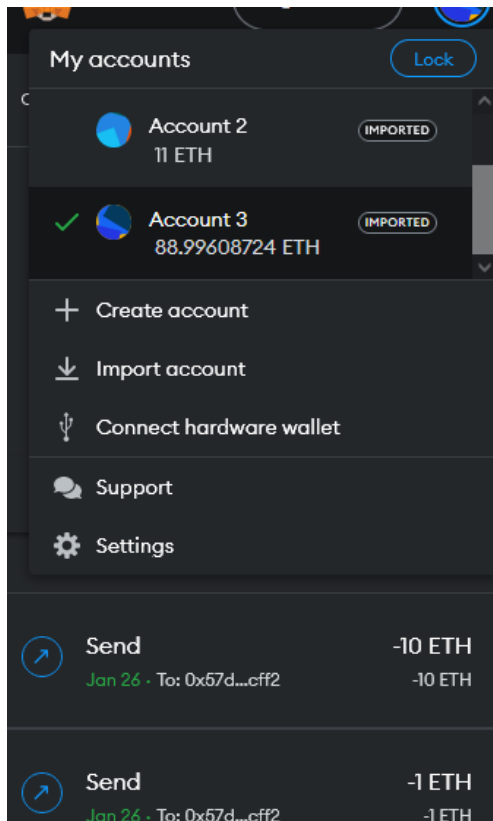
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Sending ether to another imported account

I can try sending some money from one local account to the other.
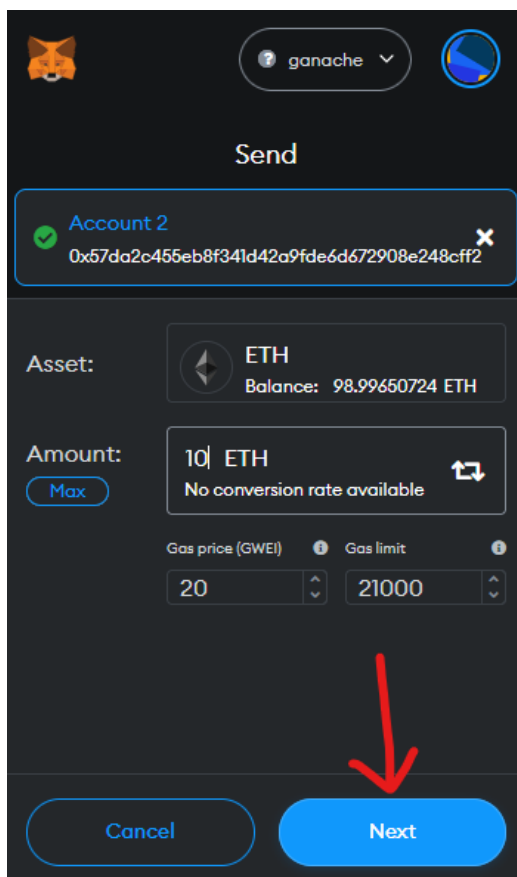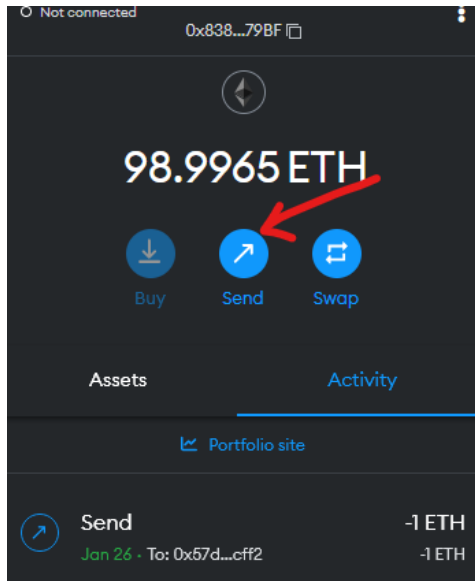
After I click on "Next" button and the "Confirm" button, 10 ethers will be deducted from my account and sent to another account.

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And if I go back to Ganache, I can see that a block for the latest transaction has been added: