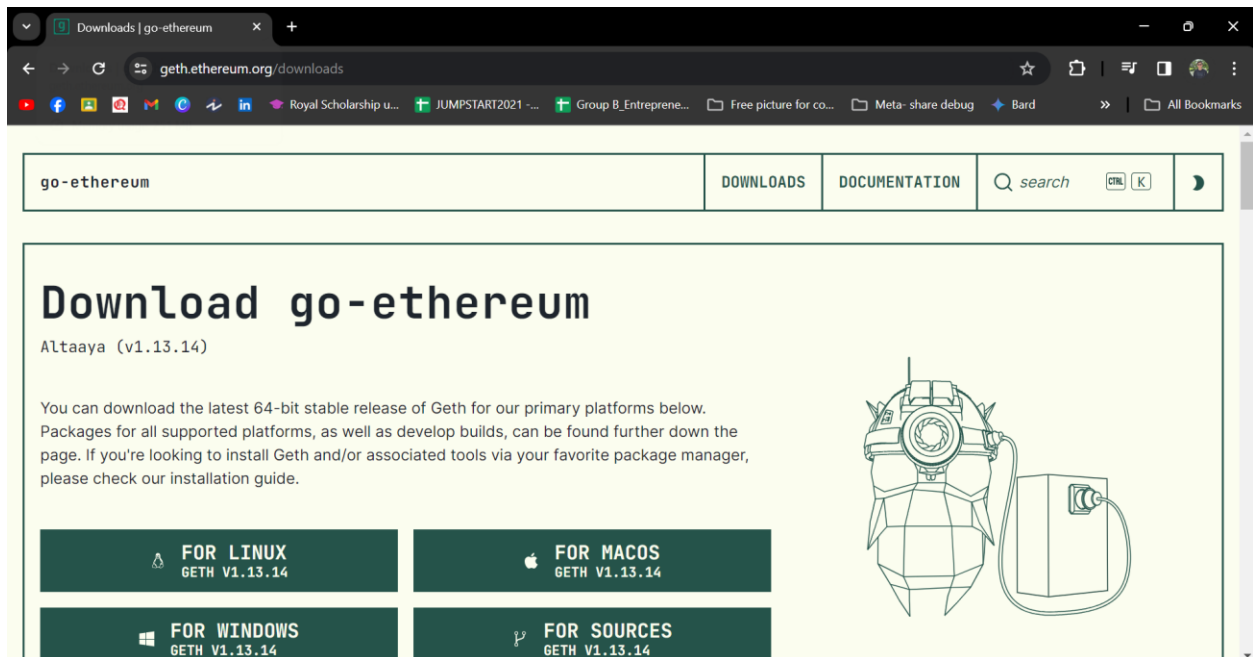


9.3 Create Blockchain with **Geth** and **Ganache**



The screenshot shows the 'Downloads' page of the go-ethereum website. The browser's address bar displays 'geth.ethereum.org/downloads'. The page features a navigation bar with 'go-ethereum', 'DOWNLOADS', 'DOCUMENTATION', a search bar, and social media icons. The main heading is 'Download go-ethereum' with the version 'Altaaya (v1.13.14)'. A paragraph explains that the latest 64-bit stable release of Geth is available for primary platforms, with links to download for Linux, MacOS, Windows, and Sources. To the right, there is a line drawing of a robot head connected to a power source.

go-ethereum

DOWNLOADS DOCUMENTATION search

Download go-ethereum

Altaaya (v1.13.14)

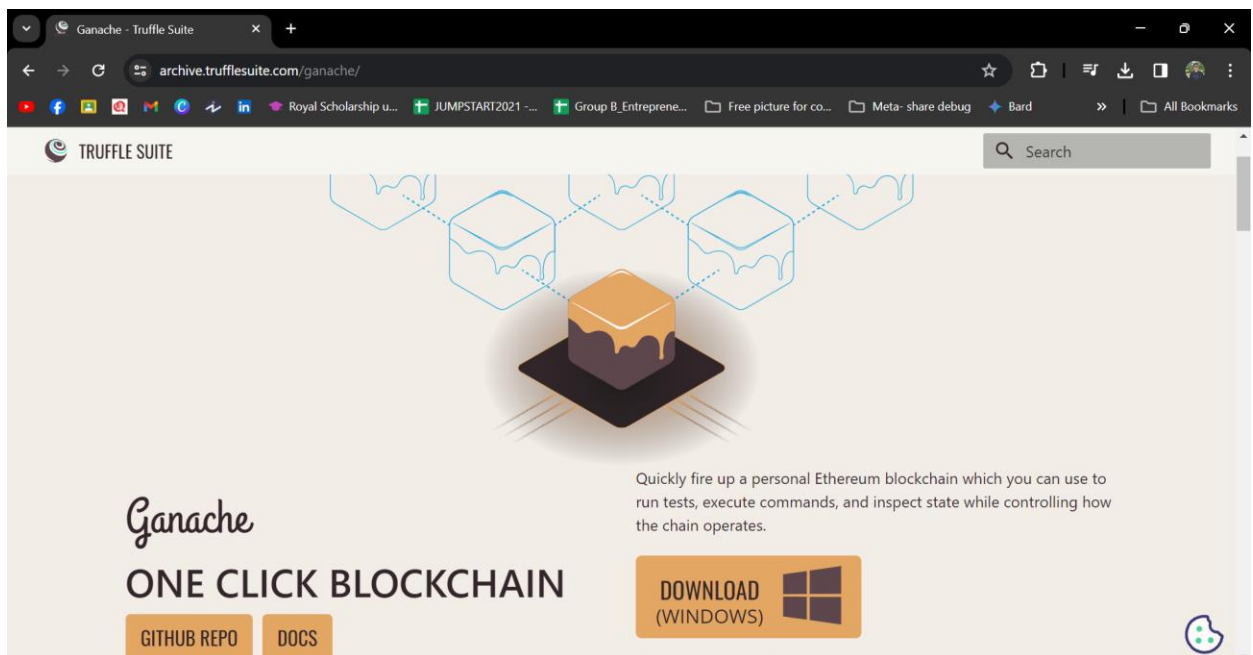
You can download the latest 64-bit stable release of Geth for our primary platforms below. Packages for all supported platforms, as well as develop builds, can be found further down the page. If you're looking to install Geth and/or associated tools via your favorite package manager, please check our installation guide.

FOR LINUX
GETH V1.13.14

FOR MACOS
GETH V1.13.14

FOR WINDOWS
GETH V1.13.14

FOR SOURCES
GETH V1.13.14



The screenshot shows the 'Ganache - Truffle Suite' page. The browser's address bar displays 'archive.trufflesuite.com/ganache/'. The page features a navigation bar with the 'TRUFFLE SUITE' logo and a search bar. The main heading is 'Ganache' with the tagline 'ONE CLICK BLOCKCHAIN'. Below this, there are links for 'GITHUB REPO' and 'DOCS'. A large illustration of a chocolate cake with a single slice being served is centered on the page. To the right, a paragraph describes Ganache as a tool to quickly fire up a personal Ethereum blockchain for testing and development. A 'DOWNLOAD (WINDOWS)' button with a Windows logo is also present.

TRUFFLE SUITE

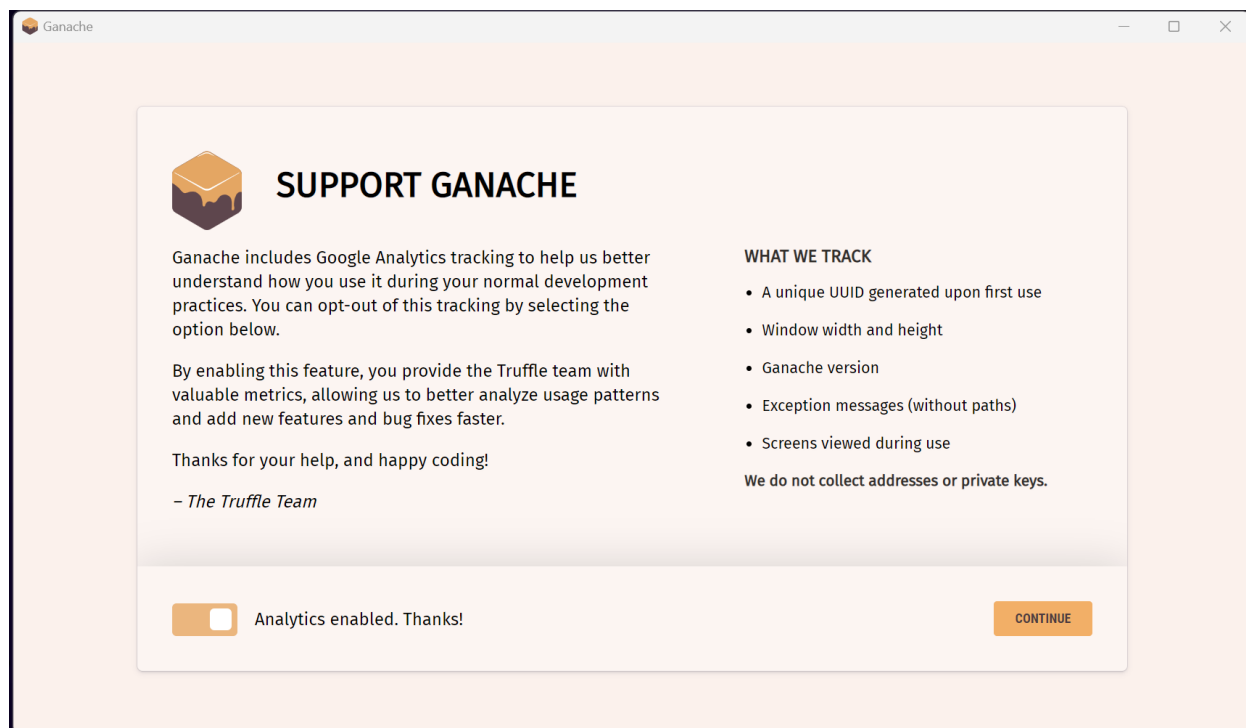
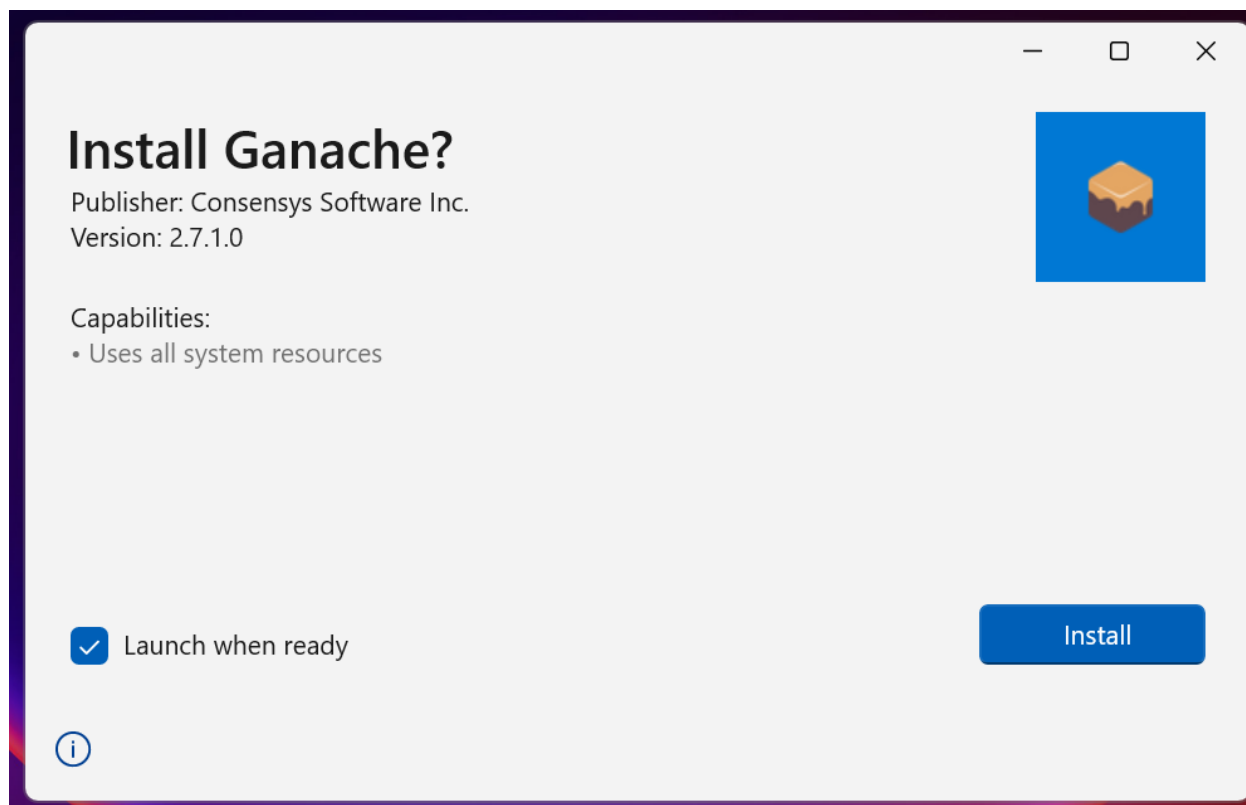
Ganache

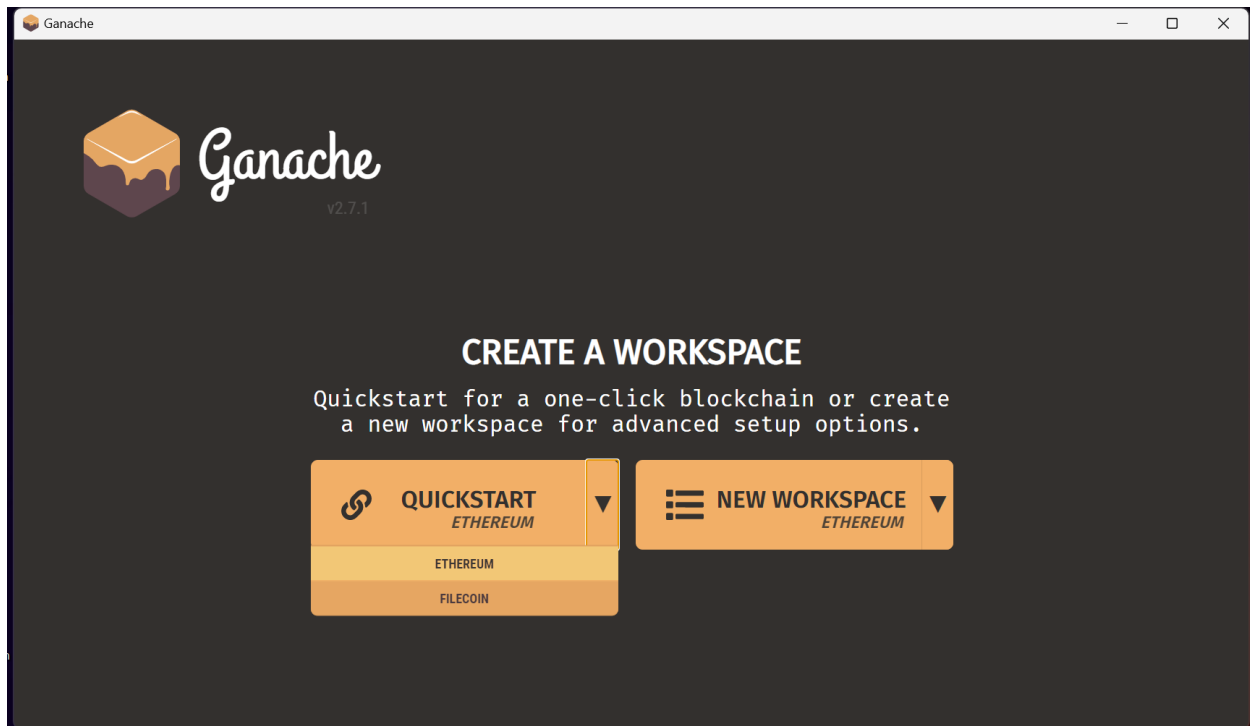
ONE CLICK BLOCKCHAIN

GITHUB REPO DOCS

DOWNLOAD (WINDOWS)

Quickly fire up a personal Ethereum blockchain which you can use to run tests, execute commands, and inspect state while controlling how the chain operates.





ACCOUNTS

BLOCKS

TRANSACTIONS

CONTRACTS

EVENTS

LOGS

SEARCH FOR BLOCK NUMBERS OR TX HASHES

CURRENT BLOCK
0

GAS PRICE
20000000000

GAS LIMIT
6721975

HARDFORK
MERGE

NETWORK ID
5777

RPC SERVER
HTTP://127.0.0.1:7545

MINING STATUS
AUTOMINING

WORKSPACE
QUICKSTART

SAVE

SWITCH

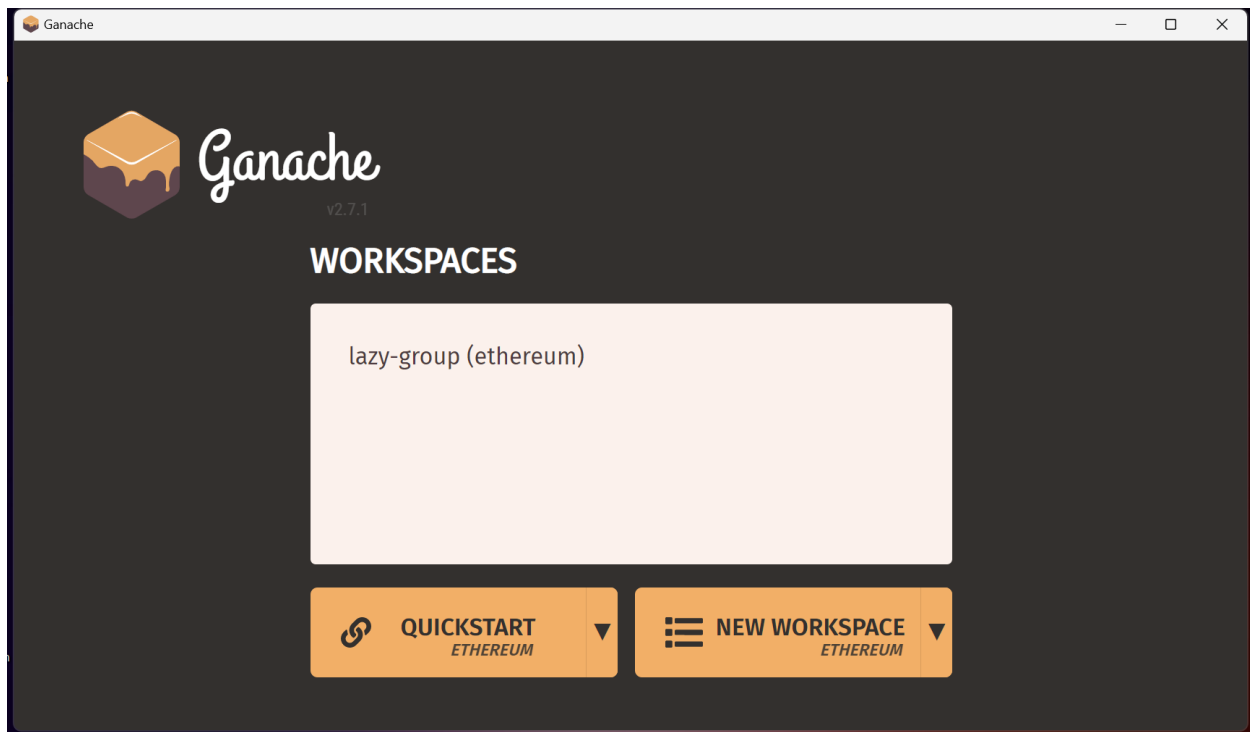
MNEMONIC

divide amazing comfort rubber blanket ritual bird miss alcohol deliver reason eight

HD PATH

m44'60'0'0'account_index

ADDRESS	BALANCE	TX COUNT	INDEX	
0xa0a4ddA88d3078A95B407A7859b038DD16797881	100.00 ETH	0	0	
0xf40AcD63AFD26a02b8883AAB31E8054ff07Bf816	100.00 ETH	0	1	
0x84E55998405D4609EA03ed550ff1135946eb6844	100.00 ETH	0	2	
0x251bD4dfAB32f1574f32CFFcA82703095740D32f	100.00 ETH	0	3	
0xC47A0E75354dA41Da5fDB11f2c0523D07DaC46b5	100.00 ETH	0	4	
0x1C2342075636803F7D3215C433705F4DE530033	100.00 ETH	0	5	



9.4 Build smart contracts with *Truffle Suite*

The screenshot shows the Node.js download page on a web browser. The address bar shows 'nodejs.org/en/download'. The page has a dark header with the Node.js logo and navigation links: LEARN, ABOUT, DOWNLOAD, BLOG, DOCS, CERTIFICATION. The main content area is titled 'Downloads' and states 'Latest LTS Version: 20.11.1 (includes npm 10.2.4)'. Below this, it says 'Download the Node.js source code or a pre-built installer for your platform, and start developing today.' There are two main sections: 'LTS Recommended For Most Users' and 'Current Latest Features'. Under 'LTS', there are three download options: 'Windows Installer' (node-v20.11.1-x64.msi), 'macOS Installer' (node-v20.11.1.pkg), and 'Source Code' (node-v20.11.1.tar.gz). Under 'Current', there are three download options: 'Windows Installer' (node-v20.11.1-x64.msi), 'macOS Installer' (node-v20.11.1.pkg), and 'Source Code' (node-v20.11.1.tar.gz). Below these, there is a table showing the available architectures for each platform.

Platform	Architecture	Download Link
Windows	32-bit	node-v20.11.1-x64.msi
	64-bit	node-v20.11.1-x64.msi
macOS	32-bit	node-v20.11.1.pkg
	64-bit	node-v20.11.1.pkg
Source Code	32-bit	node-v20.11.1.tar.gz
	64-bit	node-v20.11.1.tar.gz

Windows Installer (.msi)
Windows Binary (.zip)
<https://nodejs.org/dist/v20.11.1/node-v20.11.1-x64.msi>




Because I already installed the node, so I prefer to skip the installation guideline.

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\std64> node -v
v21.2.0
PS C:\Users\std64> |
```

Allowing PowerShell to install program.

 Administrator: Windows PowerShell

Windows PowerShell

Copyright (C) Microsoft Corporation. All rights reserved.

Install the latest PowerShell for new features and improvements! <https://aka.ms/PSWindows>

PS C:\WINDOWS\system32> Set-ExecutionPolicy RemoteSigned

Execution Policy Change

The execution policy helps protect you from scripts that you do not trust. Changing the execution policy might expose you to the security risks described in the [about_Execution_Policies](#) help topic at

<https://go.microsoft.com/fwlink/?LinkID=135170>. Do you want to change the execution policy?

[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "N"): y

Installing *truffle* library

 Administrator: Windows PowerShell

PS C:\WINDOWS\system32> npm install -g truffle

```
npm WARN deprecated testrpc@0.1.1: testrpc has been renamed to ganache-cli, please use this package from now on.
npm WARN deprecated @truffle/source-map-util@1.3.119: Package no longer supported. Contact Support at https://www.npmjs.com/support for more info.
npm WARN deprecated mkdirp-promises@5.0.1: This package is broken and no longer maintained. 'mkdirp' itself supports promises now, please switch to that.
npm WARN deprecated @truffle/db-loader@2.3.6: Package no longer supported. Contact Support at https://www.npmjs.com/support for more info.
npm WARN deprecated @truffle/promise-tracker@0.1.7: Package no longer supported. Contact Support at https://www.npmjs.com/support for more info.
npm WARN deprecated har-validator@5.1.5: this library is no longer supported
npm WARN deprecated @truffle/error@0.2.2: Package no longer supported. Contact Support at https://www.npmjs.com/support for more info.
npm WARN deprecated apollo-datasource@3.3.2: The 'apollo-datasource' package is part of Apollo Server v2 and v3, which are now deprecated (end-of-life October 22nd 2023 and October 22nd 2024, respectively). See https://www.apollographql.com/docs/apollo-server/previous-versions/ for more details.
npm WARN deprecated apollo-server-errors@3.3.1: The 'apollo-server-errors' package is part of Apollo Server v2 and v3, which are now deprecated (end-of-life October 22nd 2023 and October 22nd 2024, respectively). This package's functionality is now found in the '@apollo/server' package. See https://www.apollographql.com/docs/apollo-server/previous-versions/ for more details.
npm WARN deprecated @truffle/provider@0.3.13: Package no longer supported. Contact Support at https://www.npmjs.com/support for more info.
npm WARN deprecated apollo-server-plugin-base@3.7.2: The 'apollo-server-plugin-base' package is part of Apollo Server v2 and v3, which are now deprecated (end-of-life October 22nd 2023 and October 22nd 2024, respectively). This package's functionality is now found in the '@apollo/server' package. See https://www.apollographql.com/docs/apollo-server/previous-versions/ for more details.
npm WARN deprecated apollo-server-types@3.8.0: The 'apollo-server-types' package is part of Apollo Server v2 and v3, which are now deprecated (end-of-life October 22nd 2023 and October 22nd 2024, respectively). This package's functionality is now found in the '@apollo/server' package. See https://www.apollographql.com/docs/apollo-server/previous-versions/ for more details.
npm WARN deprecated @truffle/spinners@0.2.5: Package no longer supported. Contact Support at https://www.npmjs.com/support for more info.
npm WARN deprecated @truffle/dashboard-message-bus-common@0.1.7: Package no longer supported. Contact Support at https://www.npmjs.com/support for more info.
npm WARN deprecated multicodec@1.0.4: This module has been superseded by the multiformats module
npm WARN deprecated uuid@2.0.1: Please upgrade to version 7 or higher. Older versions may use Math.random() in certain circumstances, which is known to be problematic. See https://v8.dev/blog/math-random for details.
npm WARN deprecated @truffle/events@0.1.25: Package no longer supported. Contact Support at https://www.npmjs.com/support for more info.
npm WARN deprecated apollo-reporting-protobuf@3.4.0: The 'apollo-reporting-protobuf' package is part of Apollo Server v2 and v3, which are now deprecated (end-of-life October 22nd 2023 and October 22nd 2024, respectively). This package's functionality is now found in the '@apollo/usage-reporting-protobuf' package. See https://www.apollographql.com/docs/apollo-server/previous-versions/ for more details.
npm WARN deprecated uuid@3.4.0: Please upgrade to version 7 or higher. Older versions may use Math.random() in certain circumstances, which is known to be problematic. See https://v8.dev/blog/math-random for details.
npm WARN deprecated request@2.88.2: request has been deprecated, see https://github.com/request/request/issues/3142
npm WARN deprecated @truffle/code-utils@3.0.4: Package no longer supported. Contact Support at https://www.npmjs.com/support for more info.
npm WARN deprecated multibase@0.6.1: This module has been superseded by the multiformats module
npm WARN deprecated multibase@0.7.0: This module has been superseded by the multiformats module
npm WARN deprecated apollo-server-env@4.2.1: The 'apollo-server-env' package is part of Apollo Server v2 and v3, which are now deprecated (end-of-life October 22nd 2023 and October 22nd 2024, respectively). This package's functionality is now found in the '@apollo/utils.fetcher' package. See https://www.apollographql.com/docs/apollo-server/previous-versions/ for more details.
npm WARN deprecated @truffle/config@1.3.61: Package no longer supported. Contact Support at https://www.npmjs.com/support for more info.
npm WARN deprecated multicodec@0.5.7: This module has been superseded by the multiformats module
```

Getting started the *Truffle*

```
Administrator: Windows PowerShell
PS D:\personal-project\blockchain\blockchain-with-truffle> truffle init

Starting init...
=====

> Copying project files to D:\personal-project\blockchain\blockchain-with-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

PS D:\personal-project\blockchain\blockchain-with-truffle>
```

Create metacoin box

```
PS D:\personal-project\blockchain\blockchain-with-truffle> truffle unbox metacoin D:\personal-project\blockchain\blockchain-with-truffle\metabox

Starting unbox...
=====

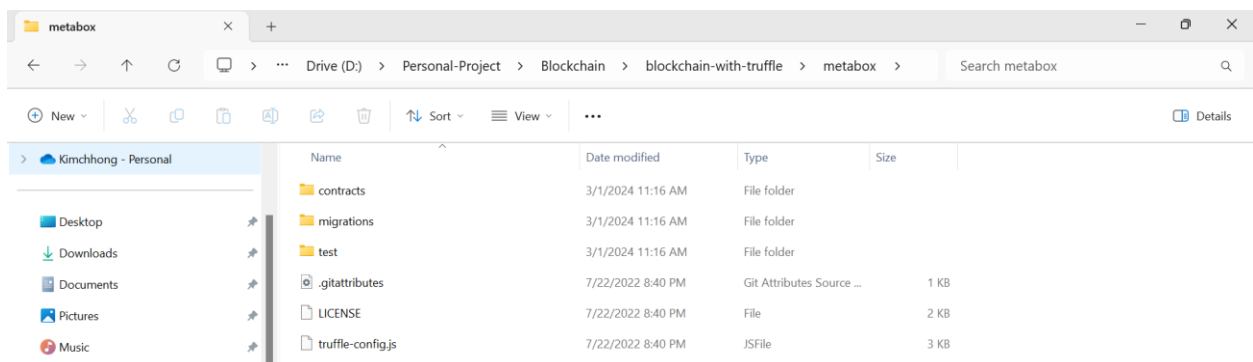
✓ Preparing to download box
✓ Downloading
✓ Cleaning up temporary files
✓ Setting up box

Unbox successful, sweet!

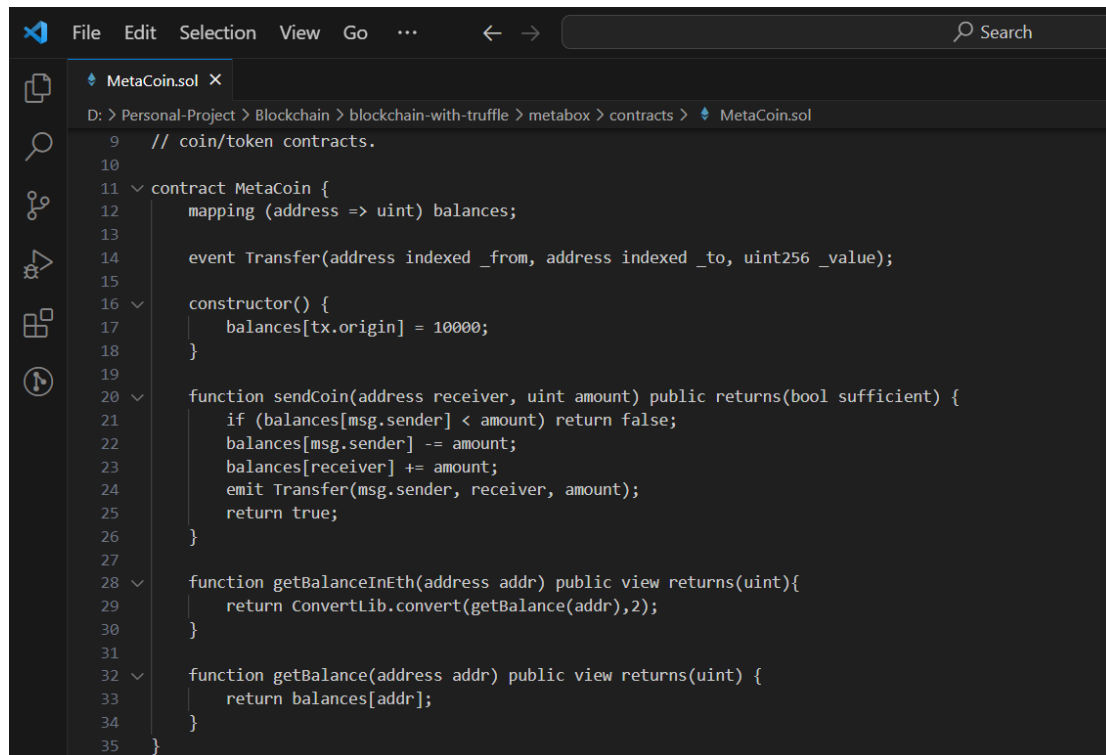
Commands:

Compile contracts: truffle compile
Migrate contracts: truffle migrate
Test contracts:    truffle test
```

Folder Structure of MetaCoin box



D:\Personal-Project\Blockchain\blockchain-with-truffle\metabox\contracts\MetaCoin.sol



```
9 // coin/token contracts.
10
11 contract MetaCoin {
12     mapping (address => uint) balances;
13
14     event Transfer(address indexed _from, address indexed _to, uint256 _value);
15
16     constructor() {
17         balances[tx.origin] = 10000;
18     }
19
20     function sendCoin(address receiver, uint amount) public returns(bool sufficient) {
21         if (balances[msg.sender] < amount) return false;
22         balances[msg.sender] -= amount;
23         balances[receiver] += amount;
24         emit Transfer(msg.sender, receiver, amount);
25         return true;
26     }
27
28     function getBalanceInEth(address addr) public view returns(uint){
29         return ConvertLib.convert(getBalance(addr),2);
30     }
31
32     function getBalance(address addr) public view returns(uint) {
33         return balances[addr];
34     }
35 }
```

Truffle compile

```
PS D:\personal-project\blockchain\blockchain-with-truffle\metabox> truffle compile

Compiling your contracts...
=====
✓ Fetching solc version list from solc-bin. Attempt #1
✓ Downloading compiler. Attempt #1.
> Compiling .\contracts\ConvertLib.sol
> Compiling .\contracts\MetaCoin.sol
> Artifacts written to D:\personal-project\blockchain\blockchain-with-truffle\metabox\build\contracts
> Compiled successfully using:
   - solc: 0.8.13+commit.abaa5c0e.Emscripten.clang
```

Truffle test command

Select Administrator: Windows PowerShell

```
> Compiling .\contracts\ConvertLib.sol
> Compiling .\contracts\MetaCoin.sol
> Compiling .\test\TestMetaCoin.sol
> Compiling truffle\Assert.sol
> Compiling truffle\AssertAddress.sol
> Compiling truffle\AssertAddressArray.sol
> Compiling truffle\AssertBalance.sol
> Compiling truffle\AssertBool.sol
> Compiling truffle\AssertBytes32.sol
> Compiling truffle\AssertBytes32Array.sol
> Compiling truffle\AssertGeneral.sol
> Compiling truffle\AssertInt.sol
> Compiling truffle\AssertIntArray.sol
> Compiling truffle\AssertString.sol
> Compiling truffle\AssertUint.sol
> Compiling truffle\AssertUintArray.sol
> Compiling truffle\DeployedAddresses.sol
> Artifacts written to C:\Users\std64\AppData\Local\Temp\test--8336-zkbuf1qXJcTS
> Compiled successfully using:
  - solc: 0.8.13+commit.abaa5c0e.Emscripten.clang
```

TestMetaCoin

```
✓ testInitialBalanceUsingDeployedContract (116ms)
✓ testInitialBalanceWithNewMetaCoin (98ms)
```

Contract: MetaCoin

```
✓ should put 10000 MetaCoin in the first account (75ms)
✓ should call a function that depends on a linked library (97ms)
✓ should send coin correctly (172ms)
```

5 passing (7s)

Config *truffle-config.js*

```

1  ...
2  module.exports = {
3    networks: {
4      development: {
5        host: "127.0.0.1",      // Localhost (default: none)
6        port: 8545,            // Standard Ethereum port (default: none)
7        network_id: "*",       // Any network (default: none)
8      },
9      // goerli: {
10     //   provider: () => new HDWalletProvider(mnemonic, `https://goerli.infura.io/v3/${infuraProjectId}`),
11     //   network_id: 5,        // Goerli's id
12     //   chain_id: 5
13     // }
14   },
15
16   // Set default mocha options here, use special reporters etc.
17   mocha: {
18     // timeout: 100000
19   },
20
21   // Configure your compilers
22   compilers: {
23     solc: {
24       version: "0.8.13",      // Fetch exact version from solc-bin
25     }
26   }
27 };
28

```

Truffle compile command

```

Administrator: Windows PowerShell
PS D:\personal-project\blockchain\blockchain-with-truffle\metabox> truffle compile

Compiling your contracts...
=====
> Compiling .\contracts\ConvertLib.sol
> Compiling .\contracts\MetaCoin.sol
> Artifacts written to D:\personal-project\blockchain\blockchain-with-truffle\metabox\build\contracts
> Compiled successfully using:
   - solc: 0.8.13+commit.abaa5c0e.Emscripten.clang

```

Truffle migrate

```
Administrator: Windows PowerShell

Deploying 'MetaCoin'
-----
> transaction hash: 0xeda806af87f5d7da66dfcf29ec436db9cebe743d0215d2e7ab8b64d068b032d
> Blocks: 0 Seconds: 0
> contract address: 0xf9C67664b7cBD38B32Cc577c3A06Ae805A5A1C50
> block number: 5
> block timestamp: 1709267650
> account: 0xa0a4ddA88d3078A95B407A7859b038DD16797881
> balance: 99.996187919271288746
> gas used: 416594 (0x65b52)
> gas price: 3.030182049 gwei
> value sent: 0 ETH
> total cost: 0.001262355660521106 ETH

> Saving artifacts
-----
> Total cost: 0.00175111446304949 ETH

Summary
=====
> Total deployments: 2
> Final cost: 0.00175111446304949 ETH
```

Set up smart contracts successfully

Ganache							SEARCH FOR BLOCK NUMBERS OR TX HASHES	
ACCOUNTS	BLOCKS	TRANSACTIONS	CONTRACTS	EVENTS	LOGS			
CURRENT BLOCK 5	GAS PRICE 20000000000	GAS LIMIT 6721975	HARDFORK MERGE	NETWORK ID 5777	RPC SERVER HTTP://127.0.0.1:7545	MINING STATUS AUTOMINING	WORKSPACE LAZY-GROUP	<button>SWITCH</button> <button>⚙</button>
BLOCK 5	MINED ON 2024-03-01 11:34:10				GAS USED 416594	1 TRANSACTION		
BLOCK 4	MINED ON 2024-03-01 11:34:10				GAS USED 157568	1 TRANSACTION		
BLOCK 3	MINED ON 2024-03-01 11:31:36				GAS USED 52285	1 TRANSACTION		
BLOCK 2	MINED ON 2024-03-01 11:31:29				GAS USED 416594	1 TRANSACTION		
BLOCK 1	MINED ON 2024-03-01 11:31:29				GAS USED 157568	1 TRANSACTION		
BLOCK 0	MINED ON 2024-03-01 10:36:32				GAS USED 0	NO TRANSACTIONS		

Set up smart contracts in blockchain successfully

Display transaction report that happen after created smart contracts

Transaction detail

```

Administrator: Windows PowerShell
PS D:\personal-project\blockchain\blockchain-with-truffle\metabox> truffle console
This version of μWS is not compatible with your Node.js build:

Error: Cannot find module '../binaries/uws_win32_x64_120.node'
Require stack:
- C:\Users\std64\AppData\Roaming\npm\node_modules\truffle\node_modules\ganache\node_modules\@trufflesuite\uws-js-unoff
- C:\Users\std64\AppData\Roaming\npm\node_modules\truffle\node_modules\ganache\dist\node\core.js
- C:\Users\std64\AppData\Roaming\npm\node_modules\truffle\build\console.bundled.js
- C:\Users\std64\AppData\Roaming\npm\node_modules\truffle\node_modules\original-require\index.js
- C:\Users\std64\AppData\Roaming\npm\node_modules\truffle\build\cli.bundled.js
Falling back to a NodeJS implementation; performance may be degraded.

truffle(development)> let instance = await MetaCoin.deployed()
undefined
truffle(development)> let accounts = await web3.eth.getAccounts()
undefined
truffle(development)>

```

let balance = await instance.getBalance(accounts[0])

balance.toNumber()

let ether = await instance.getBalanceInEth(accounts[0])

ether.toNumber()

```

truffle(development)> let instance = await MetaCoin.deployed()
undefined
truffle(development)> let accounts = await web3.eth.getAccounts()
undefined
truffle(development)> let balance = await instance.getBalance(accounts[0])
undefined
truffle(development)> balance.toNumber()
10000

```

```

truffle(development)> let ether = await instance.getBalanceInEth(accounts[0])
undefined
truffle(development)>

```

Instance.sendCoin(accounts[1], 500)

Administrator: Windows PowerShell

[illegible]

```
Let received = await instance.getBalance(accounts[1])
```

Received.toNumber()

Let `newBalance = await instance.getBalance(accounts[0])`

```
newBalance.toNumber()
```

```
truffle(development)> let recieved = await instance.getBalance(accounts[1])
undefined
```

```
truffle(development)> recieved.toNumber()
500
```

```
truffle(development)> let newBalance = await instance.getBalance(accounts[0])
undefined
```

```
truffle(development)> newBalance.toNumber()
9500
```

New block that created after transaction

Ganache

ACCOUNTS

BLOCKS

TRANSACTIONS

CONTRACTS

EVENTS

LOGS

SEARCH FOR BLOCK NUMBERS OR TX HASHES

CURRENT BLOCK6

GAS PRICE20000000000

GAS LIMIT6721975

HARDFORKMERGE

NETWORK ID5777

RPC SERVERHTTP://127.0.0.1:7545

MINING STATUSAUTOMINING

WORKSPACELAZY-GROUP

SWITCH

BLOCK6

MINED ON2024-03-01 11:48:34

GAS USED52297

1 TRANSACTION

Contract call type

Ganache

ACCOUNTS

BLOCKS

TRANSACTIONS

CONTRACTS

EVENTS

LOGS

SEARCH FOR BLOCK NUMBERS OR TX HASHES

CURRENT BLOCK6

GAS PRICE20000000000

GAS LIMIT6721975

HARDFORKMERGE

NETWORK ID5777

RPC SERVERHTTP://127.0.0.1:7545

MINING STATUSAUTOMINING

WORKSPACELAZY-GROUP

SWITCH

TX HASH

0x95a322a973c5d2e19daf8c8a9e92660cdf47ff4e97787184aef3a44a3c552212

CONTRACT CALL

FROM ADDRESS

TO CONTRACT ADDRESS

GAS USED

VALUE

0xa0a4ddA88d3078A95B407A7859b038DD16797881

0xf9C67664b7cBD38B32Cc577c3A06Ae805A5A1C50

52297

0