Lesson Type: Practical | Estimated Time: 15-20 minutes | Current Score: 0%

Build your first dApp with ethers.js

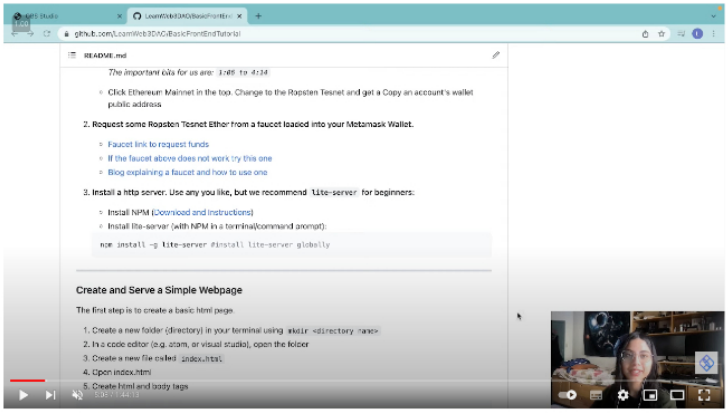
This is a step-by-step tutorial on how to create a front end, deploy a Solidity smart contract, and connect them together. We will use Metamask, Remix IDE and Ethers.js.

By the end of this tutorial you will be able to create a simple HTML front end with buttons that can interact with smart contract functions. The tutorial takes place in 3 stages

- Create a basic HTML web page
- Create a basic Solidity smart contract
- Connect the web page with the smart contracts using Ethers.js.

Prefer a Video?

If you would rather learn from a video, we have a recording available of this tutorial on our YouTube. Watch the video by clicking on the screenshot below, or go ahead and read the tutorial!



Preparation

1.

Download and Install MetaMask

- Never used Metamask? Watch this explainer video

  The important bits for us are: `1:06 to 4:14`

- Click Ethereum Mainnet in the top. Change to the Goerli Tesnet and get a copy of the account's public address on your Metamask Wallet.

2.

Request some Goerli Tesnet Ether from a faucet loaded into your Metamask Wallet.

- Faucet link to request funds

- Blog explaining a faucet and how to use one

3.

Install a http server. Use any you like, but we recommend `lite-server` for beginners:

- Install Node.js (Download and Instructions)
- Install lite-server (with NPM in a terminal/command prompt):

```
# This installs `lite-server` globally (-g) on your computer
npm install -g lite-server
```

Create and Serve a Simple Webpage

The first step is to create a basic HTML page.

1. Create a new folder (directory) in your terminal using `mkdir <directory name>`
2. In a code editor (e.g. Atom, or Visual Studio Code), open the folder
3. Create a new file called `index.html`
4. Open index.html
5. Create HTML boilerplate

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="UTF-8" />
    <meta http-equiv="X-UA-Compatible" content="IE=edge" />
    <meta name="viewport" content="width=device-width, initial-scale=1.0" />
    <title>My First dApp</title>
  </head>
  <body></body>
</html>
```

We will create an app that simply reads and writes a value to the blockchain. We will need a label, an input, and buttons.

6. Inside the body tag, add some text, a label and input.

```
<body>
  <div>
    <h1>This is my dApp!</h1>
    <p>Here we can set or get the mood:</p>
    <label for="mood">Input Mood:</label> <br />
    <input type="text" id="mood" />
  </div>
</body>
```

7. Inside the div tag add some buttons.

```
<button onclick="getMood()">Get Mood</button>
<button onclick="setMood()">Set Mood</button>
```

OPTIONAL: Inside the `<head>` tag, add some styles to make it look nicer

```
<style>
  body {
    text-align: center;
    font-family: Arial, Helvetica, sans-serif;
  }

  div {
    width: 20%;
    margin: 0 auto;
    display: flex;
    flex-direction: column;
  }

  button {
    width: 100%;
    margin: 10px 0px 5px 0px;
  }
```

```
</style>
```

8.

Serve the webpage via terminal/command prompt from the directory that has `index.html` in it and run:

```
lite-server
```

9.

Go to http://127.0.0.1:3000/ in your browser to see your page!

10.

Your front end is now complete!

Create a Basic Smart Contract

Now it's time to create a Solidity smart contract.

1.

You can use any editor you like to make the contract. For this tutorial we recommend the online IDE **Remix**

2.

Go to **Remix**

3.

Check out the "Solidity Compiler", and "Deploy and Run Transactions" tabs. If they are not present, enable them in the plugin manager

4.

Create a new solidity file in remix, named `mood.sol`

5.

Write the contract

- Specify the solidity version and add a license

```
// SPDX-License-Identifier: MIT
 pragma solidity ^0.8.1;
```

- Define the contract

```
contract MoodDiary{

 }
```

- Inside the contract create a variable called mood

```
string mood;
```

- Next, create Read and Write functions

```
//create a function that writes a mood to the smart contract
 function setMood(string memory _mood) public{
     mood = _mood;
 }

 //create a function the reads the mood from the smart contract
 function getMood() public view returns(string memory){
     return mood;
 }
```

- And that's it! Your code should look like **this**

6.

Deploy the contract on the Ropsten Testnet.

- Make sure your Metamask is connected to the Ropsten Testnet.
- Make sure you select the right compiler version to match the solidity contract. (In the compile tab)
- Compile the code using the "Solidity Compiler" tab. *Note that it may take a moment to load the compiler*
- Deploy the contract under the "Deploy and Run Transactions" tab
- Under the Deployed Contracts section, you can test out your functions on the Remix Run tab to make sure your contract works as expected!

Be sure to deploy on Ropsten via Remix under the `Injected Web3` environment and confirm the deployment transaction in Metamask

Make a new temporary file to hold:

- The deployed contract's address
  - Copy it via the copy button next to the deployed contracts pulldown in remix's **Run** tab
- The contract ABI (what is that?)
  - Copy it via the copy button under to the contract in remix's **Compile** tab (also in Details)

Connect Your Webpage to Your Smart Contract

Back in your local text editor in `index.html`, add the following code to your html page:

1. Import the Ethers.js source into your `index.html` page inside a new set of script tags:

```
<script
  src="https://cdn.ethers.io/lib/ethers-5.2.umd.min.js"
  type="application/javascript"
></script>

<script>
  ////////////////////
  //ADD YOUR CODE HERE
  ////////////////////
</script>
```

2. Inside the script tag, import the contract ABI (what is that?) and specify the contract address on our provider's blockchain:

```
const MoodContractAddress = "<contract address>";
  const MoodContractABI = <contract ABI>
  let MoodContract;
  let signer;
```

For the contract ABI, we want to specifically navigate to the JSON Section. We need to describe our smart contract in JSON format.

Since we have two methods, this should start as an array, with 2 objects:

```
const MoodContractABI = [{}, {}]
```

From the above page, each object should have the following fields: `constant`, `inputs`, `name`, `outputs`, `payable`, `stateMutability` and `type`.

For `setMood`, we describe each field below:

- name: `setMood`, self explanatory
- type: `function`, self explanatory
- outputs: should be `[]` because this does not return anything
- stateMutability: This is `nonpayable` because this function does not accept Ether
- inputs: this is an array of inputs to the function. Each object in the array should have `internalType`, `name` and `type`, and these are `string`, `_mood` and `string` respectively

For `getMood`, we describe each field below:

- name: `getMood`, self explanatory
- type: `function`, self explanatory

- outputs: this has the same type as `inputs` in `setMood`. For `internalType`, `name` and `type`, this should be `string`, `""`, and `string` respectively
- stateMutability: This is `view` because this is a view function
- inputs: this has no arguments so this should be `[]`

Your end result should look like this:

```
const MoodContractABI = [
	{
		"inputs": [],
		"name": "getMood",
		"outputs": [
			{
				"internalType": "string",
				"name": "",
				"type": "string"
			}
		],
		"stateMutability": "view",
		"type": "function"
	},
	{
		"inputs": [
			{
				"internalType": "string",
				"name": "_mood",
				"type": "string"
			}
		],
		"name": "setMood",
		"outputs": [],
		"stateMutability": "nonpayable",
		"type": "function"
	}
]
```

3. Next, Define an ethers provider. In our case it is Ropsten:

```
const provider = new ethers.providers.Web3Provider(window.ethereum, "ropsten");
```

4. Request access to the user's wallet and connect the signer to your metamask account (we use `[0]` as the default), and define the contract object using your contract address, ABI, and signer

```
provider.send("eth_requestAccounts", []).then(() => {
  provider.listAccounts().then((accounts) => {
    signer = provider.getSigner(accounts[0]);
    MoodContract = new ethers.Contract(
      MoodContractAddress,
      MoodContractABI,
      signer
    );
  });
});
```

5. Create asynchronous functions to call your smart contract functions

```
async function getMood() {
  const getMoodPromise = MoodContract.getMood();
  const Mood = await getMoodPromise;
  console.log(Mood);
}

async function setMood() {
  const mood = document.getElementById("mood").value;
  const setMoodPromise = MoodContract.setMood(mood);
  await setMoodPromise;
}
```

6. Connect your functions to your html buttons

```
<button onclick="getMood()">Get Mood</button>
<button onclick="setMood()">Set Mood</button>
```

Test Your Work Out!

1. Got your webserver up? Go to http://127.0.0.1:3000/ in your browser to see your page!
2. Test your functions and approve the transactions as needed through Metamask. Note block times are ~15 seconds... so wait a bit to read the state of the blockchain
3. See your contract and transaction info via https://goerli.etherscan.io/
4. Open a console (`Ctrl + Shift + i`) in the browser to see the magic happen as you press those buttons

DONE!

Celebrate! You just made a webpage that interacted with *a real live Ethereum testnet on the internet*! That is not something many folks can say they have done!

If you had trouble with the tutorial, you can try out the example app provided.

```
git clone https://github.com/LearnWeb3DAO/BasicFrontEndTutorial.git
cd BasicFrontEndTutorial
lite-server
```

Try and use the following information to interact with an existing contract we published on the Ropsten testnet:

- We have a `MoodDiary` contract instance created at this transaction
- Here is the contract (on etherscan)
  - We also verified our source code to ropsten.etherscan.io as an added measure for you to verify what the contract is exactly, and also the ABI is available to *the world*!
- The ABI is also in this file

This illustrates an important point: you can also build a dApp *without needing to write the Ethereum contract yourself*! If you want to use an existing contract written and already on Ethereum, you can!

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Verify your smart contract address to pass the assessment for this level.

Ethereum Rinkeby | 0x... | Submit