



Workbook: Ethereum Basics

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Document Purpose

This document is a **workbook** to help accomplish the Smart-Contract demo activity showcased during the [Women Who Code Blockchain - Ethereum Basics session](#) on [October 20, 2021](#)

The audience of this event are expected to be participants who are fairly new to the Blockchain development world, hence the workbook covers the smart-contract implementation using an online IDE.

Github

The source code of this demo smart-contract along with the web UI can be found at - <https://github.com/crpdev/wwcb-ethereum-basics>

Presentation Deck

The presentation deck used during the event can be found at [wwc-ethereum-basics-deck](#)

Pre-requisites

The pre-requisites to proceed further with this workbook are

- Desktop or Laptop with a stable Internet connection
- Access to the online IDE - [Remix](#)

Writing a Smart-Contract

To get started with smart-contract development in Solidity, let's assume a hypothetical use-case scenario and implement it.

Requirements

The Admin or Moderator of Women Who Code Blockchain community approaches you to develop a DApp (Decentralised Application) to manage Events organised in the community. They approach you so you could help them in writing a smart-contract and a front-end that wires to the smart-contract.

Actors

The actors who interact with the smart-contract are the Admin or Moderator of the community and the community members who vote for events proposed.

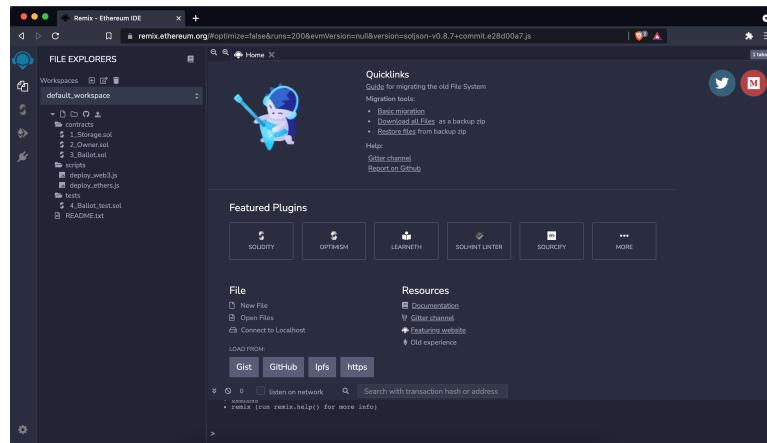
Scenarios

The smart-contract should cover the following scenarios. This is however the initial version and could be extended as needed.

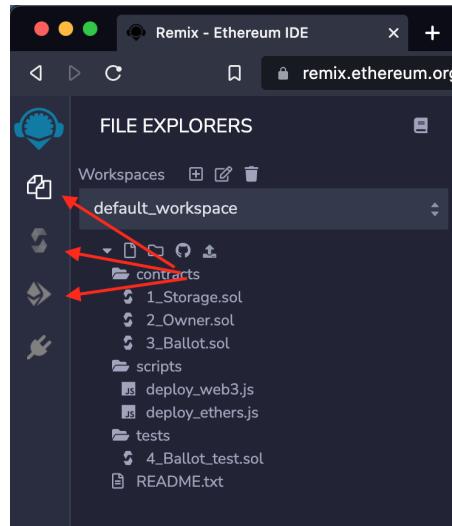
- Only the Admin or Moderator should be able to add event proposals
- The Admin or Moderator should not have the permission to vote for a proposed event
- Participants should be able to vote for an event proposal
- Participant can vote for an event only once
- Anyone should be able to view the total votes
- The smart-contract address and owner details must be available to the public

Let's start coding our smart-contract

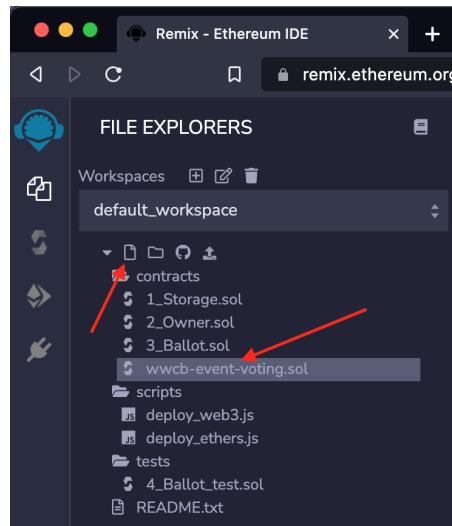
1. Head over to <https://remix.ethereum.org/> - an online IDE that helps you write smart contracts, compile to check for errors and test



2. On the left panel, you'll find the explorer, solidity compiler and deploy & run windows



3. In the **File Explorer** panel, click the new file icon or right click on "contracts" folder create a new file "wwcb-event-voting.sol"



4. We start by declaring the SPDX and the pragma declarations, followed by the contract name. For the purposes of this workbook, we'll use the contract name as "[EventVoting](#)", however you're free to choose any. As you write the declarations and save the file, you'll notice some changes in the IDE:

- An **artifacts** folder pops up with json files. These are the compiled contract ABIs
- The compiler checks the contract and displays the result

```
// SPDX-License-Identifier: UNLICENSED
pragma solidity ^0.8.0;
contract EventVoting {
```

5. We now start writing the global primitive variables that will be used within the smart-contract

- owner - Address of the contract owner who deploys the smart-contract

```
1 // SPDX-License-Identifier: UNLICENSED
2 pragma solidity ^0.8.0;
3 contract EventVoting {
```

6. Declare the events that will be emitted from the smart-contract

- newEventAdded** - emit when a new event is added by the Admin
- newVoteForEvent** - emit when a participant votes for an event

```

1+ /*
2
3 1. Declare SPDX license information
4 2. Declare the pragma statement and the solidity version that must be used to compile the code
5 3. Declare the contract
6 4. Declare the global primitive variables
7 4. Declare the events that must be emitted from the smart-contract
8 5. Declare custom function modifiers that enforces restrictions
9 6. Declare complex data structures such as struct, arrays or enums
10 7. Define the constructor of the smart-contract
11 8. Define functions that stores information to the variables and retrieves them back to be sent
12 */
13
14
15 // SPDX-License-Identifier: UNLICENSED
16
17 pragma solidity ^0.8.0;
18
19+ contract EventVoting {
20
21     // Declare Global variables
22
23     // owner is the address which deploys the code to the network
24     address public owner;
25
26     // emit when a new event is added by the contract owner
27     event newEventAdded(string _eventName);
28
29     // emit when a participant votes for an event
30     event newVoteForEvent(string _eventName, address participant);
31 }
32

```

7. Declare modifiers that enforces restrictions on function calls

- a. **onlyAdmin** - modifier that restricts only the contract owner to call the add event function

```

1+ /*
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23     // owner is the address which deploys the code to the network
24     address public owner;
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26     // emit when a new event is added by the contract owner
27     event newEventAdded(string _eventName);
28
29     // emit when a participant votes for an event
30     event newVoteForEvent(string _eventName, address participant);
31
32     // modifier that restricts only the contract owner to call the add event function
33     modifier onlyAdmin() {
34         require(owner == msg.sender);
35     }
36 }
37
38

```

8. Declare complex data structures such as structs, arrays or enums to be used

- a. **eventList** - holds all the events that are tracked for voting
- b. **votesReceivedPerEvent** - map to track votes per event
- c. **voteTracker** - map to track of addresses that had votes for an event

```

// SPDX-License-Identifier: UNLICENSED
pragma solidity ^0.8.0;

contract EventVoting {
    // Declare Global variables
    // owner is the address which deploys the code to the network
    address public owner;

    // emit when a new event is added by the contract owner
    event newEventAdded(string eventName);

    // emit when a participant votes for an event
    event newVoteForEvent(string eventName, address participant);

    // modifier that restricts only the contract owner to call the add event function
    modifier onlyAdmin() {
        require(owner == msg.sender);
        _;
    }

    // holds all the events that are tracked for voting
    string[] public eventList;

    // map to track votes per event
    mapping (string => uint256) public votesReceivedPerEvent;

    // map to track of addresses that had votes for an event
    mapping (address => string) public voteTracker;
}


```

9. Define the constructor that will be called during contract creation. Constructor will be called only once in the contract life-cycle. In our smart-contract, we store the owner variable with the address that deploys the smart-contract

```

// SPDX-License-Identifier: UNLICENSED
pragma solidity ^0.8.0;

contract EventVoting {
    // Declare Global variables
    // owner is the address which deploys the code to the network
    address public owner;

    // emit when a new event is added by the contract owner
    event newEventAdded(string eventName);

    // emit when a participant votes for an event
    event newVoteForEvent(string eventName, address participant);

    // modifier that restricts only the contract owner to call the add event function
    modifier onlyAdmin() {
        require(owner == msg.sender);
        _;
    }

    // holds all the events that are tracked for voting
    string[] public eventList;

    // map to track votes per event
    mapping (string => uint256) public votesReceivedPerEvent;

    // map to track of addresses that had votes for an event
    mapping (address => string) public voteTracker;

    // upon deployment, capture the address which deploys the contract and store to owner variable
    constructor() {
        owner = msg.sender;
    }
}


```

10. Define the functions

- getContractDetails** - to return the contract details such as owner and eventList
- totalVotesForEvent** - returns the total number of votes for a specific event
- addNewEvent** - called only by admin to add a new event to capture voting
- voteForCandidate** - called only by the participants to vote for an event

```

FILE EXPLORERS
default_workspace
  contracts
    EventVoting.json
    EventVoting_metadata.json
    EventStorage.sol
    Owner.sol
    Storage.sol
    Balot.sol
  artifacts
    EventVoting.json
    EventVoting.sol
  scripts
    deploy_web3.js
    deploy_ether.js
  tests
    Balot_test.sol
  README.txt

38   // holds all the events that are tracked for voting
39   string[] public eventList;
40
41   // map to track votes per event
42   mapping (string => uint256) public votesReceivedPerEvent;
43
44   // map to track of addresses that had votes for an event
45   mapping (address => string) public voteTracker;
46
47   // upon deployment, capture the address which deploys the contract and store to owner variable
48   constructor() {
49     owner = msg.sender;
50   }
51
52   // to return the contract details such as owner and eventList
53   function getContractDetails() public view returns(address, string[] memory){
54     return(owner, eventList);
55   }
56
57   // returns the total number of votes for a specific event
58   function totalVotesForEvent(string memory _eventName) view public returns (uint256) {
59     return votesReceivedPerEvent[_eventName];
60   }
61
62   // to add a new event to capture voting
63   function addNewEvent(string memory _eventName) public onlyAdmin {
64     eventList.push(_eventName);
65     emit newEventAdded(_eventName);
66   }
67
68   // to vote for an event
69   function voteForCandidate(string memory _eventName) public {
70     require(msg.sender != owner, "Admin cannot vote for an event");
71     require(keccak256(abi.encodePacked(voteTracker[msg.sender])) != keccak256(abi.encodePacked(_eventName)), "You've already voted for this event");
72     voteTracker[msg.sender] = _eventName;
73     votesReceivedPerEvent[_eventName] += 1;
74     emit newVoteForEvent(_eventName, msg.sender);
75   }
76
77 }

```

11. As you save, the smart-contract code is compiled and the status is display on the compiler menu.

Code

```

/*
1. Declare SPDX license information
2. Declare the pragma statement and the solidity version that must be used to compile the code
3. Declare the contract
4. Declare the global primitive variables
5. Declare the events that must be emitted from the smart-contract
6. Declare custom function modifiers that enforces restrictions
7. Define the constructor of the smart-contract
8. Define functions that stores information to the variables and retrieves them back to be sent

*/
// SPDX-License-Identifier: UNLICENSED

pragma solidity ^0.8.0;

contract EventVoting {

    // Declare Global variables

    // owner is the address which deploys the code to the network
    address public owner;

    // emit when a new event is added by the contract owner
    event newEventAdded(string _eventName);

    // emit when a participant votes for an event
    event newVoteForEvent(string _eventName, address participant);

    // modifier that restricts only the contract owner to call the add event function
    modifier onlyAdmin() {
        require(owner == msg.sender);
        _;
    }

    // holds all the events that are tracked for voting
    string[] public eventList;
}

```

```

// map to track votes per event
mapping (string => uint256) private votesReceivedPerEvent;

// map to track of addresses that had votes for an event
mapping (address => string) private voteTracker;

// upon deployment, capture the address which deploys the contract and store to owner variable
constructor() {
    owner = msg.sender;
}

// to return the contract details such as owner and eventList
function getContractDetails() public view returns(address, string[] memory){
    return(owner, eventList);
}

// returns the total number of votes for a specific event
function totalVotesForEvent(string memory _eventName) view public returns (uint256) {
    return votesReceivedPerEvent[_eventName];
}

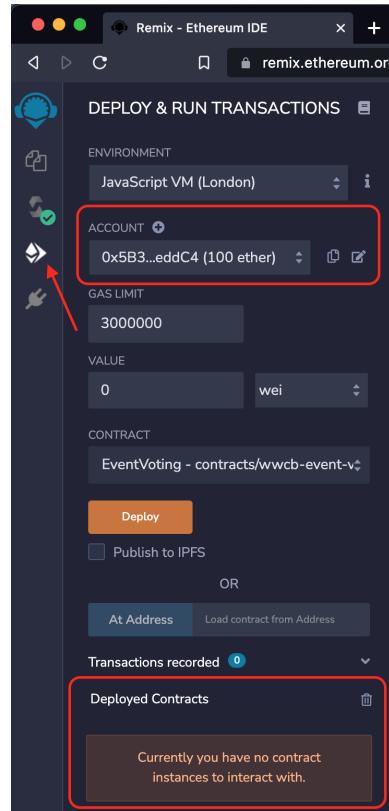
// to add a new event to capture voting
function addNewEvent(string memory _eventName) public onlyAdmin {
    eventList.push(_eventName);
    emit newEventAdded(_eventName);
}

// to vote for an event
function voteForCandidate(string memory _eventName) public {
    require(msg.sender != owner, "Admin cannot vote for an event");
    require(keccak256(abi.encodePacked(voteTracker[msg.sender])) != keccak256(abi.encodePacked(_eventName)), "You've already voted for this event");
    voteTracker[msg.sender] = _eventName;
    votesReceivedPerEvent[_eventName] += 1;
    emit newVoteForEvent(_eventName, msg.sender);
}
}

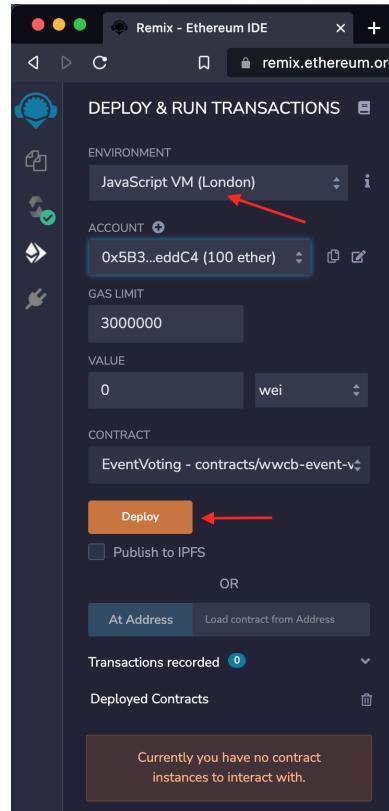
```

12. It's now time to deploy and test the smart-contract

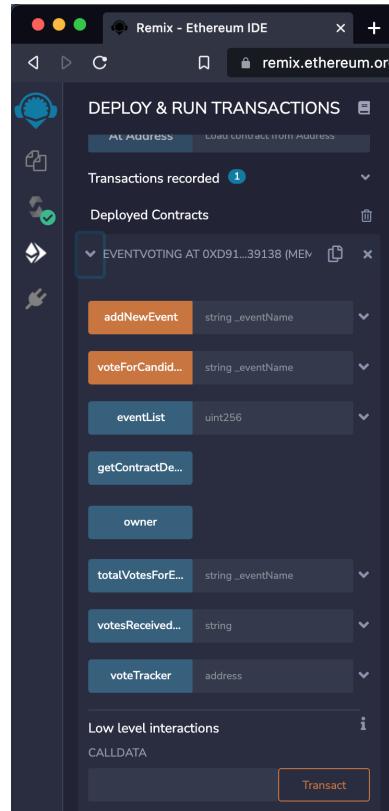
13. Remix IDE comes with features that provides 10 test accounts that can be used to verify the smart-contract. Click on the "Deploy and run transactions" menu. Right now there are no contracts deployed



14. Make sure the JavaScript VM environment is selected. Select the 1st account - which will be the owner of the contract and click "Deploy"

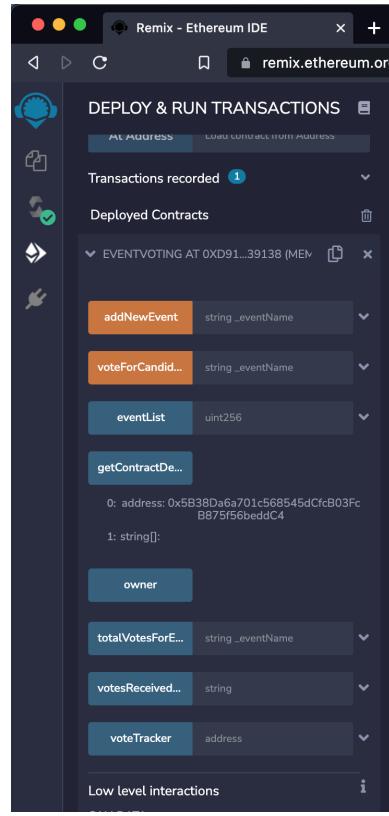


15. You'll notice that the **Deployed Contracts** tab now has the details of the newly deployed contract. You'll also see the functions available to perform testing

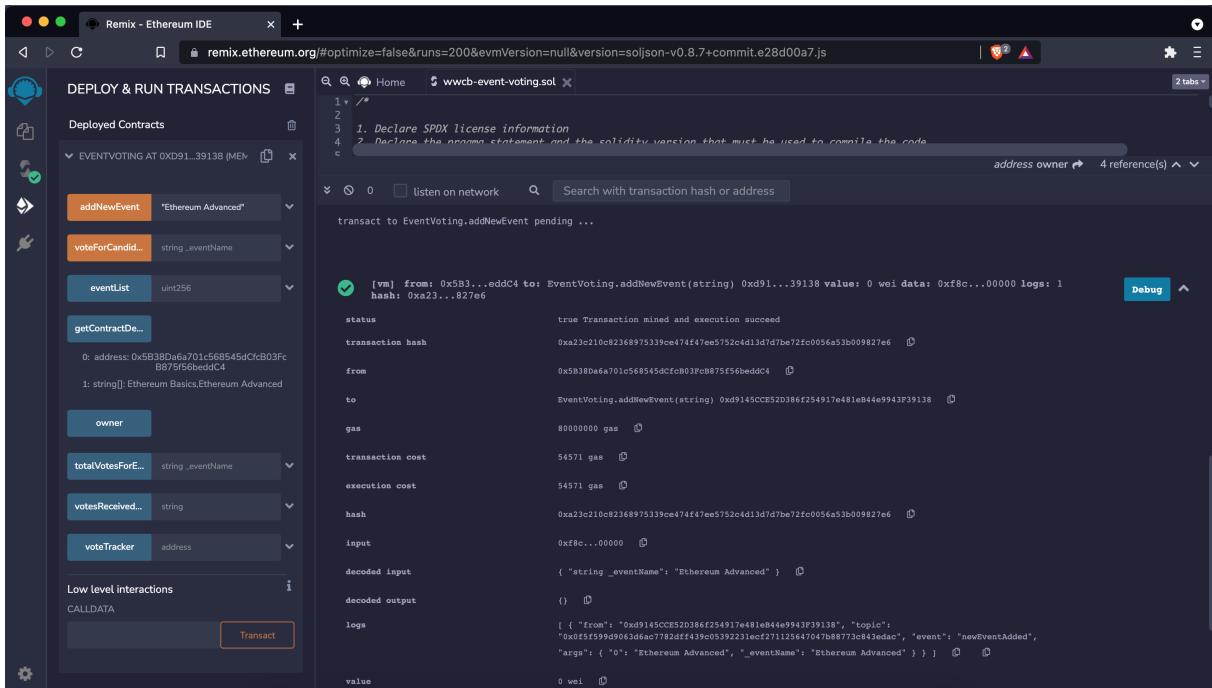


16. Click on getContractDetails method

- a. `getContractDetails` returns only the owner as there are no events yet



17. With the 1st account selected (owner), you can add new events. As new events are added, the details of the transaction can be viewed in the console window. As part of the `addNewEvent` function, we also emit an event and the same is visible in the console log



18. With the 1st account selected, if you try to vote for an event, you must get an error.

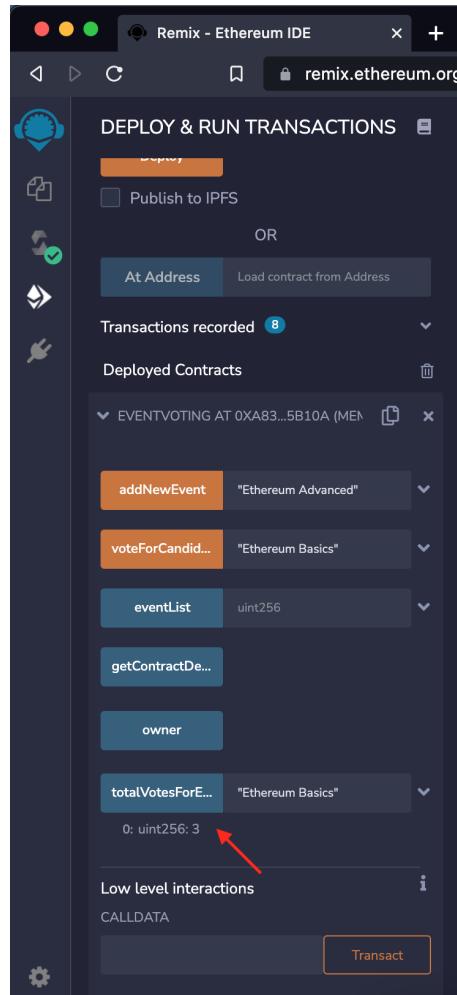
The screenshot shows the Remix Ethereum IDE interface. On the left, the 'DEPLOY & RUN TRANSACTIONS' sidebar lists deployed contracts, with 'EventVoting' selected. The main code editor contains the Solidity source code for the EventVoting contract. In the bottom right pane, a transaction is being debugged. The transaction details show a revert message: 'The transaction has been reverted to the initial state. Reason provided by the contract: "Admin cannot vote for an event". Debug the transaction to get more information.'

19. Select any account from the other 9 accounts in the **Account** drop-down list and vote for an event and now the transaction must pass

The screenshot shows the Remix Ethereum IDE interface. The 'EventVoting' contract is deployed. A transaction is shown in the bottom right pane, indicating a successful execution with the message: 'true Transaction mined and execution succeed'.

20. When you try to vote for the same event again, it should fail with an error

21. Add new events and cast votes using multiple accounts. Call `totalVotesForEvent` method to check the votes received for an event



22. Notice that the mappings `votesReceivedPerEvent` and `voteTracker` which has the visibility "public" is open for everyone, delete the contract from the Deployed Contracts menu, change the visibility to private and redeploy the contract. Be aware that, when you re-deploy the contract, you'll lose all previous data

```

// owner is the address which deploys the code to the network
address public owner;

// emit when a new event is added by the contract owner
event newEventAdded(string _eventName);

// emit when a participant votes for an event
event newVoteForEvent(string _eventName, address participant);

// modifier that restricts only the contract owner to call the add event function
modifier onlyAdmin() {
    require(owner == msg.sender);
}

// holds all the events that are tracked for voting
string[] public eventList;

// map to track votes per event
mapping (string => uint256) private votesReceivedPerEvent;

// map to track of addresses that had votes for an event
mapping (address => string) private voteTracker;

// upon deployment, capture the address which deploys the contract and store to owner variable
constructor() {
    owner = msg.sender;
}

// to return the contract details such as owner and eventlist
function getContractDetails() public view returns(address, string[] memory){
    return(owner, eventList);
}

// returns the total number of votes for a specific event
function totalVotesForEvent(string memory _eventName) view public returns (uint256) {
    return votesReceivedPerEvent[_eventName];
}

// to add a new event to capture voting

```

23. The tests conclude that the smart-contract is implemented with all the requirements
