

Blockchain Implementation

Presented by: Masoud Barati
November 2019

Implementation of smart contracts in Ethereum



ethereum

Solidity

<https://solidity.readthedocs.io/en/v0.5.5/>

- **Solidity**: is an object-oriented, high-level language for implementing smart contracts

```
contract SimpleStorage {  
    uint storedData;  
  
    function set(uint x) {  
        storedData = x;  
    }  
  
    function get() constant returns (uint retVal) {  
        return storedData;  
    }  
}
```

The screenshot shows the Solidity v0.5.5 documentation page. The left sidebar contains a navigation menu with links to various sections: Introduction to Smart Contracts, Installing the Solidity Compiler, Solidity by Example, Solidity in Depth, Security Considerations, Resources, Using the compiler, Contract Metadata, Contract ABI Specification, Yul, Style Guide, Common Patterns, List of Known Bugs, Contributing, LLL, and Keyword Index. The main content area features a 'Note' box stating that the user is not reading the most recent version (v0.5.7) and a large Solidity logo. Below the logo, there is a description of Solidity as an object-oriented, high-level language for implementing smart contracts, followed by a list of features and a section on 'Language Documentation'.

Staff | Micro | Mail | JBBA | Creati | Remi | Remi | Ropst | Rinke | Rinke | Test E | Coun | https | Kova | comp | 0681 | Ropsi | Micro | Is GD | solidi | Sx | X | Truffi | Data | Servi | + | - | X

← → ↻ <https://solidity.readthedocs.io/en/v0.5.5/> ☆ 🌟 📄 🔍

Solidity
v0.5.5


Search docs

Introduction to Smart Contracts
Installing the Solidity Compiler
Solidity by Example
Solidity in Depth
Security Considerations
Resources
Using the compiler
Contract Metadata
Contract ABI Specification
Yul
Style Guide
Common Patterns
List of Known Bugs
Contributing
LLL
Keyword Index

Note

You are not reading the most recent version of this documentation. v0.5.7 is the latest version available.

Solidity



Solidity is an object-oriented, high-level language for implementing smart contracts. Smart contracts are programs which govern the behaviour of accounts within the Ethereum state.

Solidity was influenced by C++, Python and JavaScript and is designed to target the Ethereum Virtual Machine (EVM).

Solidity is statically typed, supports inheritance, libraries and complex user-defined types among other features.

With Solidity you can create contracts for uses such as voting, crowdfunding, blind auctions, and multi-signature wallets.

When deploying contracts, you should use the latest released version of Solidity. This is because breaking changes as well as new features and bug fixes are introduced regularly. We currently use a 0.x version number to indicate this fast pace of change.

Language Documentation

If you are new to the concept of smart contracts we recommend you start with an [example smart contract](#) written in Solidity. When you are ready for more detail, we recommend you read the "Solidity by Example" and "Solidity in Depth" sections to learn the core concepts of the language.

[Read the Docs](#) v: v0.5.5

New: DigitalOcean Marketplace Self-host Gitlab, Grafana, 1-Click Apps.
Sponsored - Ads served ethically

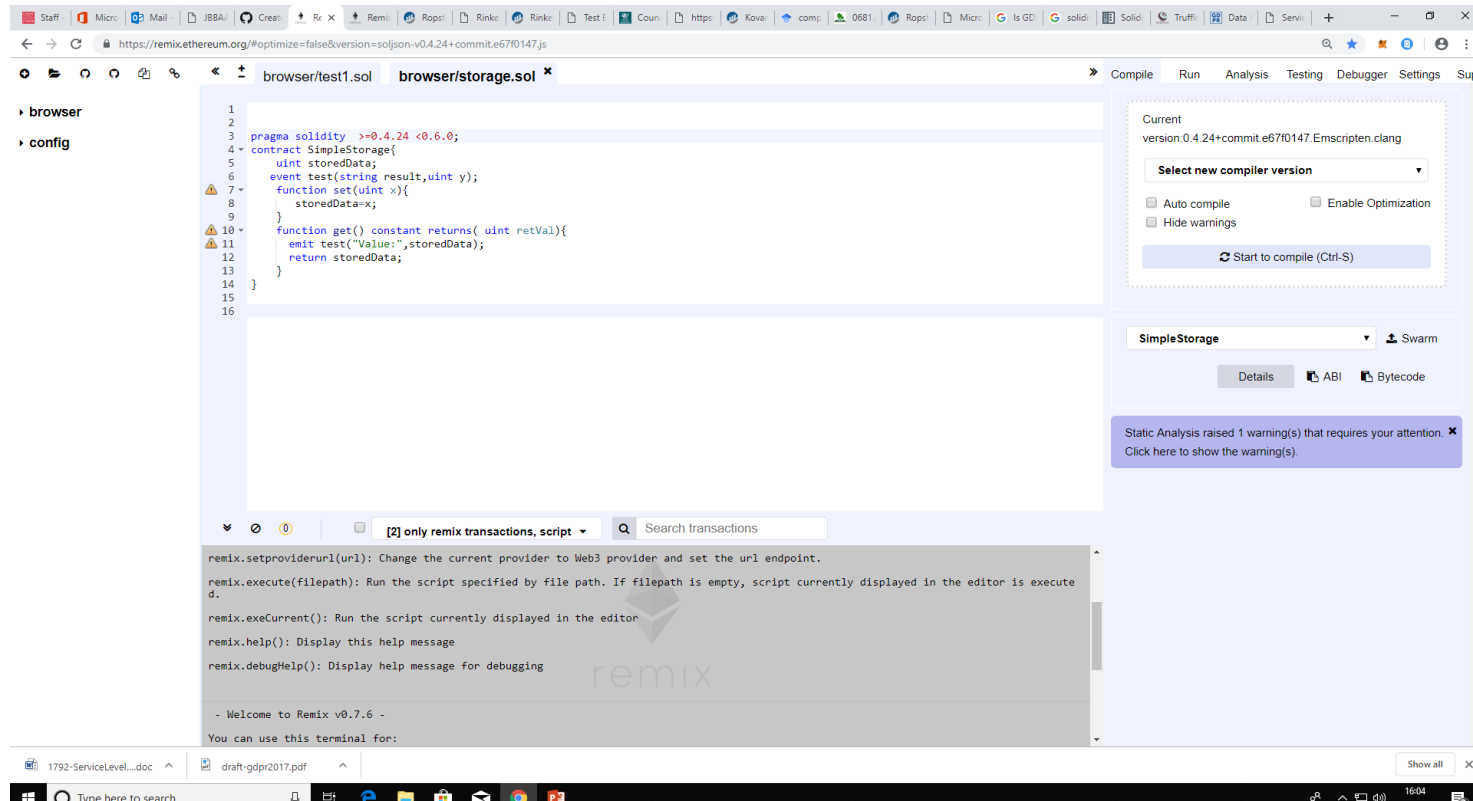
1792-ServiceLevel...doc ^ draft-gdpr2017.pdf ^

Type here to search

15:38 27/03/2019

Implementation environment

- **Ethereum blockchain:** is a public and permissionless blockchain supporting smart contracts
- **Remix-IDE Ethereum:** is a browser-based compilers that test and analysed deployed smart contracts



Remix-IDE environment

The screenshot displays the Remix-IDE interface in a web browser. The top bar shows the URL: `https://remix.ethereum.org/#optimize=false&evmVersion=null&version=soljson-v0.4.24+commit.e67f0147.js`. The interface is divided into several panels:

- Left Panel (Tools):** Includes icons for file management, environment selection, account selection, gas limit, value, and deployment options.
- Environment:** Set to "Injected Web3".
- Account:** Selected account is "0xa17...5b0b".
- Gas limit:** Set to "3000000".
- Value:** Set to "0" in "wei" units.
- Contract:** "Container_Submission" is selected for deployment.
- Deploy Button:** An orange button labeled "Deploy".
- At Address:** A blue button labeled "At Address" with a sub-label "Load contract from Address".
- Transactions recorded:** A dropdown menu showing "1" transaction.
- Deployed Contracts:** A list showing "Container_Submission at 0xba5..." with a "Access" button.

The main editor displays a Solidity contract named "Container_Submission":`1
2 pragma solidity >=0.4.24 <0.6.0;
3
4 contract Container_Submission{
5
6 struct Status{
7 bool auth_access;
8 bytes32 country;
9 uint age;
10 }
11 mapping (address => Status) statusTerms;
12 mapping (address => bytes32[]) ProOP;
13 mapping (address => uint[]) deg;
14 mapping (address => bytes32[]) public Personal;
15 bytes32 [] data;
16 function Logs(address Provider,bytes32 OP, uint degCompliance) public{
17 ProOP[Provider].push(OP);
18 deg[Provider].push(degCompliance);`

The bottom panel shows the transaction details for the deployment:

- Transaction:** [block:6098500 txIndex:4] from:0xa17...5b0b7 to:Container_Submission.(constructor) value:0 logs:0 hash:0xad4...9d1e9
- Status:** 0x1 Transaction mined and execution succeed
- Transaction hash:** 0xad42d06038b659cee01ce95e352b75cf1046c674b5b4518666e1547039e9d1e9
- From:** 0xa17fd7efe72e6a748e62b90796edf9206815b0b7
- To:** Container_Submission.(constructor)
- Gas:** 773721 gas
- Transaction cost:** 773721 gas
- Hash:** 0xad42d06038b659cee01ce95e352b75cf1046c674b5b4518666e1547039e9d1e9
- Input:** 0x608...b0029
- Decoded input:** {}
- Decoded output:** -

The right panel shows the "Ropsten Test Network" status, including the account balance "1.768 ETH" and a transaction history:

- #571 - 7/31/2019 at 15:43: Contract Deployment -0 ETH (CONFIRMED)
- #570 - 7/31/2019 at 15:31: Contract Deployment -0 ETH (CONFIRMED)
- #569 - 6/28/2019 at 12:37: Contract Interaction -0 ETH

The bottom status bar shows the system clock at 15:47 on 31/07/2019.

From Solidity to deployment in test network

Write smart
contracts by
Solidity

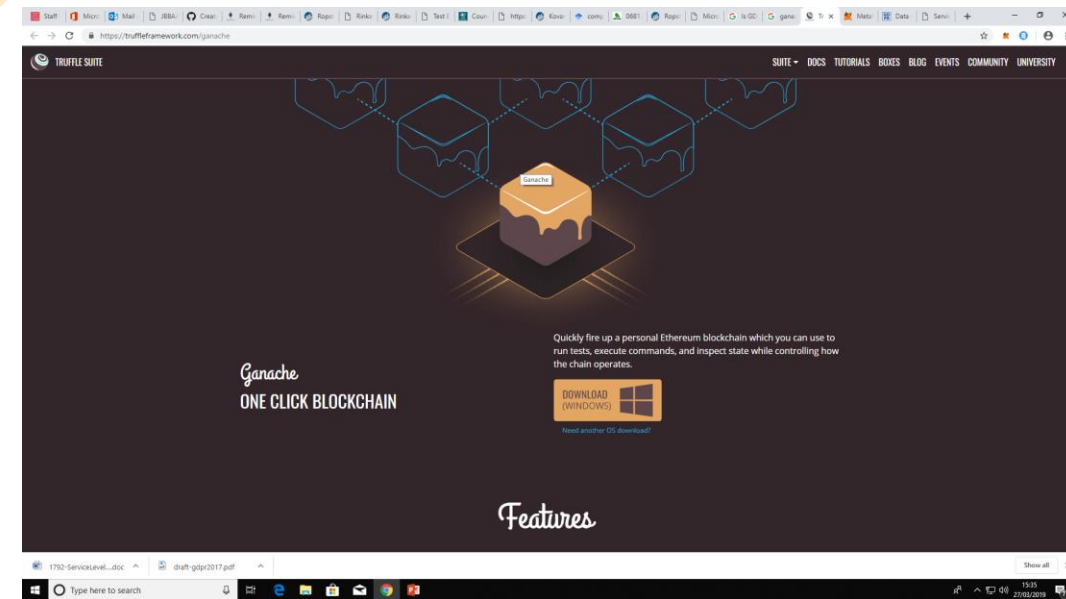
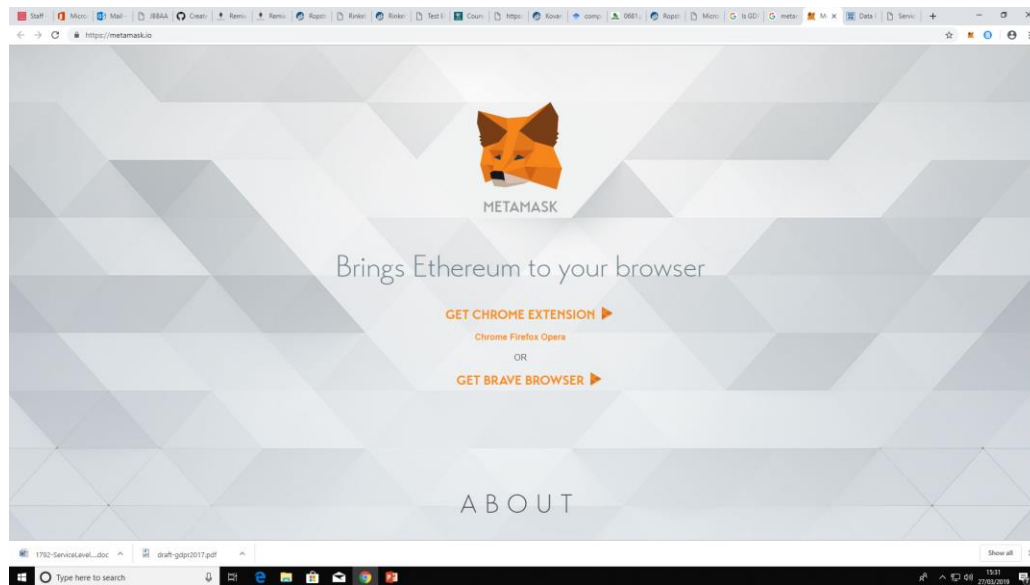
Compile by
Remix-IDE

Deploy on test
networks

Ropsten
RPC
Kovan
Rinkeby
Ganache

MetaMask
<https://metamask.io>

<https://truffleframework.com/ganache>



Test network

- **Ropsten:** is a public Ethereum test network that allows the deployment of smart contracts
 - gives some details about mining process (e.g., miner and mining time)
 - accepts deployment of contracts with a gas limit under 4712388
 - user has an account with usually a small amount of Ether as a simulated money to run smart contracts
- **Ganache:** is a local test network creating a virtual Ethereum blockchain
 - accepts deployment of contracts without any gas limitation
 - provides as default 10 fake accounts, each of which has 100 Ether
 - creates blocks without any miner (no information about mining process)

Test on Ropsten: transaction details

IoT GDPR

Normative

Normative

Remix - Eth

IEEE Xplore

Normative

Normative

Blockchain

A Decentral

[PDF] A Dec

A Decentral

Remix - Eth

Ropsten Tra

https://ropsten.etherscan.io/tx/0xad42d06038b659cee01ce95e352b75cf1046c674b5b4518666e1547039e9d1e9

HomeBlockchain

Ropsten Test Network

Transaction Details

Sponsored: Advertise to blockchain developers - sponsored slots available. [Book your slot here!](#)

Overview

State Changes New

[This is a Ropsten **Testnet** Transaction Only]

Transaction Hash:

0xad42d06038b659cee01ce95e352b75cf1046c674b5b4518666e1547039e9d1e9

Status:

Success

Block:

6098500 42 Block Confirmations

Timestamp:

6 mins ago (Jul-31-2019 02:43:36 PM +UTC)

From:

0xa17fd7efe72e6a748e62b90796edf9206815b0b7

To:

[Contract 0xba538a0e30adfc08c27d1f16f757bb082508eae2 Created]

Value:

0 Ether (\$0.00)

Transaction Fee:

0.000773721 Ether (\$0.000000)

Click to see More

Ropsten Test Network

Mass
0xa17f...b0b7

1.768 ETH

DepositSend

History

#571 - 7/31/2019 at 15:43
 Contract Deployment -0 ETH
CONFIRMED

#570 - 7/31/2019 at 15:31
 Contract Deployment -0 ETH
CONFIRMED

#569 - 6/28/2019 at 12:37
 Contract Interaction -0 ETH
CONFIRMED

1-s2.0-S02673649....pdfSECRYPT_2018_10....pdfIoT-GDPR3.pdf

Type here to search

15:50
31/07/2019

Test on Ganache: free accounts

ACCOUNTS

BLOCKS

TRANSACTIONS

LOGS

UPDATE AVAILABLE

SEARCH FOR BLOCK NUMBERS OR TX HASHES

CURRENT BLOCK
2

GAS PRICE
2000000000

GAS LIMIT
6721975

HARDFORK
CONSTANTINOPLE

NETWORK ID
5777

RPC SERVER
HTTP://127.0.0.1:7545

MINING STATUS
AUTOMINING

MNEMONIC

curtain since base pumpkin glue betray first seminar off mask ribbon fire

HD PATH
m/44'/60'/0'/0/account_index

Type here to search

15:55
06/08/2019

Test on Ganache: created blocks

ACCOUNTS

BLOCKS

TRANSACTIONS

LOGS

UPDATE AVAILABLE

SEARCH FOR BLOCK NUMBERS OR TX HASHES

CURRENT BLOCK
6

GAS PRICE
2000000000

GAS LIMIT
6721975

HARDFORK
CONSTANTINOPLE

NETWORK ID
5777

RPC SERVER
HTTP://127.0.0.1:7545

MINING STATUS
AUTOMINING

TX HASH
0xc538f7b76fe7f666f41b568cbdb0b2d5633b9ca230f5396f70e39526e56a611

CONTRACT CALL

FROM ADDRESS
0x960fa2B8Ad56393bb9c6CE1da59eE9B10917A482

TO CONTRACT ADDRESS
0xC25Af008DEB5033F66810E2F9a9Dd1e25F674F68

GAS USED
21762

VALUE
0

TX HASH
0x3cecc53bd59c8504d36de9e5b0dd3f48d96aa1d41545a9e42a73b49b3ea00dba

CONTRACT CALL

FROM ADDRESS
0x960fa2B8Ad56393bb9c6CE1da59eE9B10917A482

TO CONTRACT ADDRESS
0xc9096ae02fAb2224f26d4F717bba129F52dc3361

GAS USED
44651

VALUE
0

TX HASH
0x1885dc2151e6b5cef41e16079419e01005d2c9e84f5cbd861e86caddde744ccf

CONTRACT CALL

FROM ADDRESS
0x960fa2B8Ad56393bb9c6CE1da59eE9B10917A482

TO CONTRACT ADDRESS
0xc9096ae02fAb2224f26d4F717bba129F52dc3361

GAS USED
23692

VALUE
0

TX HASH
0x11cc22f76680da051a15be45fa5a22111ab6d8cd9ac2dbc700ca9b0c89d5d968

CONTRACT CREATION

FROM ADDRESS
0x960fa2B8Ad56393bb9c6CE1da59eE9B10917A482

CREATED CONTRACT ADDRESS
0xA8A8Ae54182bb1EfffFd503Da6c1ED0241038AD8E

GAS USED
365597

VALUE
0

TX HASH
0xc4760e7db004070fb538c6c43b523b205dc2666cc523e4840cce62b8fddf87a0

CONTRACT CREATION

FROM ADDRESS
0x960fa2B8Ad56393bb9c6CE1da59eE9B10917A482

CREATED CONTRACT ADDRESS
0xC25Af008DEB5033F66810E2F9a9Dd1e25F674F68

GAS USED
1797314

VALUE
0

TX HASH
0x5764e9094baf2aa170e96b9b264e7a792e0606b3cdab72ed7d322e91d01f70e0

CONTRACT CREATION

FROM ADDRESS
0x960fa2B8Ad56393bb9c6CE1da59eE9B10917A482

CREATED CONTRACT ADDRESS
0xc9096ae02fAb2224f26d4F717bba129F52dc3361

GAS USED
773721

VALUE
0

Type here to search

16:29
01/08/2019

Test on Ganache: transaction details

Ganache

ACCOUNTS

BLOCKS

TRANSACTIONS

LOGS

UPDATE AVAILABLE

SEARCH FOR BLOCK NUMBERS OR TX HASHES

⚙

CURRENT BLOCK
6

GAS PRICE
2000000000

GAS LIMIT
6721975

HARDFORK
CONSTANTINOPLE

NETWORK ID
5777

RPC SERVER
HTTP://127.0.0.1:7545

MINING STATUS
AUTOMINING

← BACK

TX 0x3cecc53bd59c8504d36de9e5b0dd3f48d96aa1d41545a9e42a73b49b3ea00dba

SENDER ADDRESS
0x960fa2B8Ad56393bb9c6CE1da59eE9B10917A482

TO CONTRACT ADDRESS
0xc9096ae02fAb2224f26d4F717bba129F52dc3361

CONTRACT CALL

VALUE
0.00 ETH

GAS USED
44651

GAS PRICE
2000000000

GAS LIMIT
44651

MINED IN BLOCK
5

TX DATA
0xbb8ac28f00000000000000000000000000960fa2b8ad56393bb9c6ce1da59ee9b10917a482

EXAMPLE



ethereum

Example 1—search user

The screenshot displays the Remix Ethereum IDE interface. The top browser tabs include 'Mail - Masoud Barati - Outlook', 'https://ieeexplore.ieee.org/xpl/cc...', and 'Remix - Ethereum IDE'. The address bar shows 'remix.ethereum.org/#optimize=false&evmVersion=null&version=soljson-v0.4.24+commit.e67f0147.js'. The left sidebar contains the 'DEPLOY & RUN TRANSACTIONS' panel with settings for Environment (JavaScript VM), Account (0xCA3...a733c), Gas limit (3000000), and Value (0 wei). It also shows a 'Deploy' button, 'At Address' options, and a list of 'Deployed Contracts' including 'Search at 0xbBF...732dB (memory)'. The main editor displays a Solidity contract named 'Search' with the following code:

```
1 pragma solidity >=0.4.24 <0.6.0;
2 contract Search{
3     event Result( address addr, string a);
4     address[] public addresses;
5     function Insert(address New_addr) public{
6         addresses.push(New_addr);
7     }
8     function Find(address Seek_addr) public{
9         bool flag=false;
10        for (uint i=0; i<addresses.length;i++){
11            if (addresses[i]==Seek_addr){
12                flag=true;
13            }
14        }
15        if (flag==true)
16            emit Result(Seek_addr,"Found");
17        else
18            emit Result(Seek_addr,"Not found");
19    }
20 }
21
```

The bottom panel shows the 'listen on network' status and a search bar. A log entry indicates a successful deployment: '[vm] from:0xca3...a733c to:Search.(constructor) value:0 wei data:0x608...f0029 logs:0 hash:0x18a...af421'.

Example 1--Insert

The screenshot displays the Remix Ethereum IDE interface. On the left, the 'DEPLOY & RUN TRANSACTIONS' sidebar is visible. The 'Account' dropdown shows '0xCA3...a733c (99)'. The 'Gas limit' is set to '3000000' and the 'Value' is '0 wei'. The 'Search - browser/course.sol' dropdown is selected, and the 'Deploy' button is highlighted with a red circle. Below it, the 'At Address' button is also visible. The 'Transactions recorded' section shows '2' transactions. The 'Deployed Contracts' section shows a contract named 'Search' at address '0xbBF...732dB (memory)'. The 'Find' button is highlighted with a red circle. The 'Insert' button is also visible, and the 'New_addr' field contains '0xCA35b7d915458EF540aDe6068dF'. The main editor shows the Solidity code for the 'Search' contract, with the 'Insert' function highlighted. The bottom panel shows the transaction details for the 'Insert' function, with the 'gas' field highlighted by a red circle. The transaction details include: status: 0x1 Transaction mined and execution succeed, transaction hash: 0xc0e4755165aa9899408e1f913ff02db5234308264276cd3826577211513bcf0f, from: 0xca35b7d915458ef540ade6068dfe2f44e8fa733c, to: Search.Insert(address) 0xbbf289d846208c16edc8474705c748aff07732db, gas: 3000000 gas, transaction cost: 63486 gas, execution cost: 40806 gas, hash: 0xc0e4755165aa9899408e1f913ff02db5234308264276cd3826577211513bcf0f, input: 0x903...a733c, decoded input: { "address New_addr": "0xCA35b7d915458EF540aDe6068dFe2F44E8fa733c" }.

```
1 pragma solidity >=0.4.24 <0.6.0;
2 contract Search{
3     event Result( address addr, string a);
4     address[] public addresses;
5     function Insert(address New_addr) public{
6         addresses.push(New_addr);
7     }
8     function Find(address Seek_addr) public{
9         bool flag=false;
10        for (uint i=0; i<addresses.length;i++){
11            if (addresses[i]==Seek_addr){
12                flag=true;
13            }
14        }
15        if (flag==true)
16            emit Result(Seek_addr,"Found");
17        else
18            emit Result(Seek_addr,"Not found");
19    }
20 }
```

status	0x1 Transaction mined and execution succeed
transaction hash	0xc0e4755165aa9899408e1f913ff02db5234308264276cd3826577211513bcf0f
from	0xca35b7d915458ef540ade6068dfe2f44e8fa733c
to	Search.Insert(address) 0xbbf289d846208c16edc8474705c748aff07732db
gas	3000000 gas
transaction cost	63486 gas
execution cost	40806 gas
hash	0xc0e4755165aa9899408e1f913ff02db5234308264276cd3826577211513bcf0f
input	0x903...a733c
decoded input	{ "address New_addr": "0xCA35b7d915458EF540aDe6068dFe2F44E8fa733c" }

Show all

Example 1—Change environment

The screenshot displays the Remix Ethereum IDE interface. The left sidebar contains various tool icons. The main panel is titled 'DEPLOY & RUN TRANSACTIONS' and features a dropdown menu for the 'Environment' set to 'JavaScript VM'. Below this, there are fields for 'Account' (set to 'Injected Web3 Web3 Provider'), 'Gas limit' (set to '3000000'), and 'Value' (set to '0' with a unit dropdown set to 'wei'). A search bar contains the text 'Search - browser/course.sol'. Below the search bar are buttons for 'Deploy' and 'At Address'. The right panel shows the Solidity code for a contract named 'Search'. The bottom panel displays transaction logs, including a successful transaction for 'Search.Insert' and a pending transaction for 'Search.Find'.

remix

DEPLOY & RUN TRANSACTIONS

Environment JavaScript VM

Account + Injected Web3 Web3 Provider

Gas limit 3000000

Value 0 wei

Search - browser/course.sol

Deploy

or

At Address Load contract from Address

Transactions recorded: 0

Deployed Contracts

Currently you have no contract instances to interact with.

Home test.sol Art2.sol UCC2019.sol course.sol 5 tabs

```
1 pragma solidity >=0.4.24 <0.6.0;
2 contract Search{
3   event Result( address addr, string a);
4   address[] public addresses;
5   function Insert(address New_addr) public{
6     addresses.push(New_addr);
7   }
8   function Find(address Seek_addr) public{
9     bool flag=false;
10    for (uint i=0; i<addresses.length;i++){
11      if (addresses[i]==Seek_addr){
12        flag=true;
13      }
14    }
15    if (flag==true)
16      emit Result(Seek_addr,"Found");
17 }
```

0 listen on network Search with transaction hash or address

transact to Search.Insert pending ...

✓ [vm] from:0x583...40225 to:Search.Insert(address) 0xa5a...51d57 value:0 wei data:0x903...40225 logs:0 hash:0xda5...fd3a2 Debug

transact to Search.Find pending ...

✓ [vm] from:0x583...40225 to:Search.Find(address) 0xa5a...51d57 value:0 wei data:0x149...40225 logs:1 hash:0x02e...0cb5f Debug

status 0x1 Transaction mined and execution succeed

transaction hash 0x02e3e91ce0d2a1ca14ac92278912d03954c3bb0657718ff1057a6fcedd20cb5f

from 0x583031d1113ad414f02576bd6afabfb302140225

to Search.Find(address) 0xa5a2075994ca25397b8dab82e4834c1b09051d57

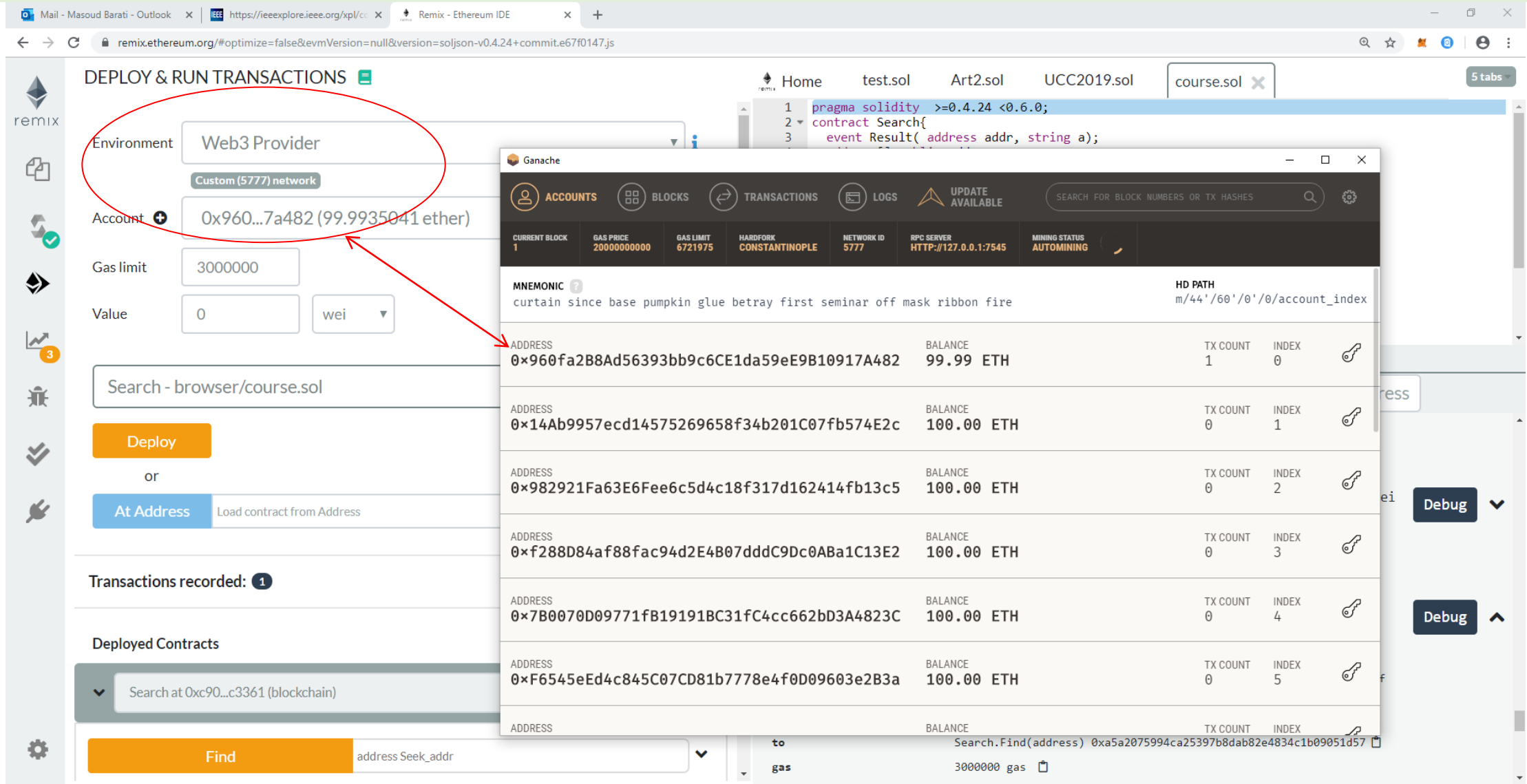
gas 3000000 gas

Global-BlockChain...jpg

Type here to search

13:38 06/11/2019

Example 1—connected to Ganache



The screenshot shows the Remix IDE interface with the 'DEPLOY & RUN TRANSACTIONS' panel on the left. The 'Environment' dropdown is set to 'Web3 Provider', which is circled in red. Below it, the 'Account' dropdown shows '0x960...7a482 (99.9935041 ether)'. A red arrow points from this account to the Ganache window. The Ganache window displays a list of accounts with their addresses and balances.

ADDRESS	BALANCE	TX COUNT	INDEX
0x960fa2B8Ad56393bb9c6CE1da59eE9B10917A482	99.99 ETH	1	0
0x14Ab9957ecd14575269658f34b201C07fb574E2c	100.00 ETH	0	1
0x982921Fa63E6Fee6c5d4c18f317d162414fb13c5	100.00 ETH	0	2
0xf288D84af88fac94d2E4B07dddC9Dc0ABa1C13E2	100.00 ETH	0	3
0x7B0070D09771fB19191BC31fC4cc662bD3A4823C	100.00 ETH	0	4
0xF6545eEd4c845C07CD81b7778e4f0D09603e2B3a	100.00 ETH	0	5

Example 1—connected to Ropsten

The screenshot displays the Remix Ethereum IDE interface. The top navigation bar includes tabs for 'Home', 'test.sol', 'Art2.sol', 'UCC2019.sol', and 'course.sol'. The main workspace shows a Solidity contract named 'Search' with the following code:

```
1 pragma solidity >=0.4.24 <0.6.0;
2 contract Search{
3     event Result(address addr, string a);
4     mapping(address => string) public addresses;
5     function insert(address New_addr) public{
6         addresses[New_addr] = "Found";
7     }
8     function find(address Seek_addr) public{
9         for(uint i=0; i<addresses.length; i++){
10             if(addresses[i]==Seek_addr){
11                 emit Result(Seek_addr, "Found");
12             }
13         }
14     }
15 }
```

The left sidebar contains the 'DEPLOY & RUN TRANSACTIONS' panel. The 'Environment' dropdown is set to 'Injected Web3', which is circled in red. Below it, the 'Account' is '0xa17...5b0b7 (1.76804963 ether)'. The 'Gas limit' is set to '3000000' and the 'Value' is '0 wei'. A 'Deploy' button is visible. Below the deployment options, there is a search bar and a list of transactions recorded.

A MetaMask Notification dialog is open in the center, titled 'New Contract'. It shows the 'CONTRACT DEPLOYMENT' details for the 'Ropsten Test Network'. The 'GAS FEE' is '0.000276' and the 'TOTAL' is '0.000276'. The dialog has 'Reject' and 'Confirm' buttons.

The bottom right of the interface shows a list of transactions with details such as 'Transaction mined and execution succeed', 'hash:0xda5...fd3a2', and 'gas:3000000'.

Ropsten--contract deployment confirmed

The screenshot displays the Remix Ethereum IDE interface. On the left, the 'DEPLOY & RUN TRANSACTIONS' panel shows the environment set to 'Injected Web3' on the 'Ropsten (3) network'. The account selected is '0xa17...5b0b7' with a balance of '1.767773975 ether'. The gas limit is set to '3000000' and the value is '0 wei'. A 'Deploy' button is visible. Below this, a search bar contains 'Search - browser/course.sol'. The 'Transactions recorded' section shows one transaction. The 'Deployed Contracts' section lists a contract named 'Search' at address '0x2F0...16B70' on the blockchain. A 'Find' button is also present.

The central code editor shows the Solidity code for the 'Search' contract:

```
1 pragma solidity >=0.4.24 <0.6.0;
2 contract Search{
3     event Result( address addr, string a);
4     address[] public addresses;
5     function Insert(address New_addr) public{
6         addresses.push(New_addr);
7     }
8     function Find(address Seek_addr) public{
9         bool flag=false;
10        for (uint i=0; i<addresses.length;i++){
11            if (addresses[i]==Seek_addr){
12                flag=true;
13            }
14        }
15        if (flag==true)
16            emit Result(Seek_addr,"Found");
17    }
18 }
```

On the right, a transaction details popup is shown for a 'Contract Deployment' transaction. The transaction is confirmed and shows a value of '-0 ETH'. The transaction details include:

- Transaction: 0x17d7efef72e6a...
- Amount: 0 ETH
- Gas Limit (Units): 275655
- Gas Used (Units): 275655
- Gas Price (GWEI): 1

Red arrows indicate the flow of information: one arrow points from the account balance in the left panel to the '1.7678 ETH' displayed in the transaction popup, and another arrow points from the 'Contract Deployment' transaction in the popup to the corresponding transaction in the 'Transactions recorded' section of the left panel.

Example 2—buy energy

Mail - Masoud Barati - Outlook | https://ieeexplore.ieee.org/xpl/cc | Remix - Ethereum IDE | ethereum - Google Search | ethereum - Google Search | +

remix.ethereum.org/#optimize=false&evmVersion=null&version=soljson-v0.4.24+commit.e67f0147.js

DEPLOY & RUN TRANSACTIONS

Environment: JavaScript VM

Account: 0x147...C160C (9%)

Gas limit: 3000000

Value: 0 wei

EnergyUse - browser/course2.sol

Deploy

or

At Address Load contract from Address

Transactions recorded: 4

Deployed Contracts

EnergyUse at 0x692...77b3A (memory)

buyer

buyers: 0xCA35b7d915458EF540aDe6068d

money: 100000

transact

payment

EngTyp: solar

```
1 pragma solidity >=0.4.24 <0.6.0;
2 contract EnergyUse{
3     mapping(address => uint) public balanceOf;
4     event Transfer(address buyers, address sellers, uint amnt);
5     mapping(address=>uint)public sellAmountSollar;
6     mapping(address=>uint)public sellAmountWind;
7     function seller(address sellers,string EngTyp, uint share_amount) public{
8         if (keccak256(EngTyp)==keccak256("solar")){
9             sellAmountSollar[sellers]+=share_amount;
10        } else if (keccak256(EngTyp)==keccak256("wind")){
11            sellAmountWind[sellers]+=share_amount;
12        }
13    }
14    function buyer( address buyers, uint money) public{
15        balanceOf[buyers] += money;
16    }
17    function payment(string EngTyp, uint amount, address buyers, address sellers) public returns (uint){
18        uint price;
19        if (keccak256(EngTyp)==keccak256("solar")){
20            price= amount*2 ;
21            assert(sellAmountSollar[sellers]>=amount);
22            sellAmountSollar[sellers]-=amount;
23        } else if (keccak256(EngTyp)==keccak256("wind")){
24            price= amount*3;
25            assert ( sellAmountWind[sellers]>= amount);
26            sellAmountWind[sellers]-=amount;
27        }
28        assert (balanceOf[buyers]>price);
29        balanceOf[sellers] += price;
30        balanceOf[buyers] -= price;
31        emit Transfer(buyers,sellers,price);
32        return price;
33    }
34 }
```

0 listen on network Search with transaction hash or address

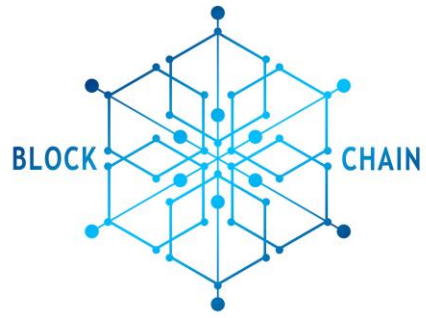
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Thank you for your attention



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