

Running Smart Contracts and DApps featuring HyperLedger Fabric



Module Objectives:

- Hyperledger Fabric product architecture, including the EVM/Solidity components.
- Deconstructing a Distributed Application (DApp).
- Announcement of the Fabric-EVM-Lab
- Why use the EVM for HyperLedger Fabric applications
- EVM for HyperLedger Fabric applications
- Distributed Application (DApp) demonstration
- Next Steps.



EVM Hyperledger Fabric

- Scan QR Code:
 - Register:
 - Take free courses
 - Get the document
 - Take the Hands-on workshop with snapshotted virtual desktops
 - Take live Workshop
-
- Access Code: **MS-dApp-HLF**
 - Access Code: MS-dApp-HLF



<https://on360.io/morgan-state-university-registration-form/>

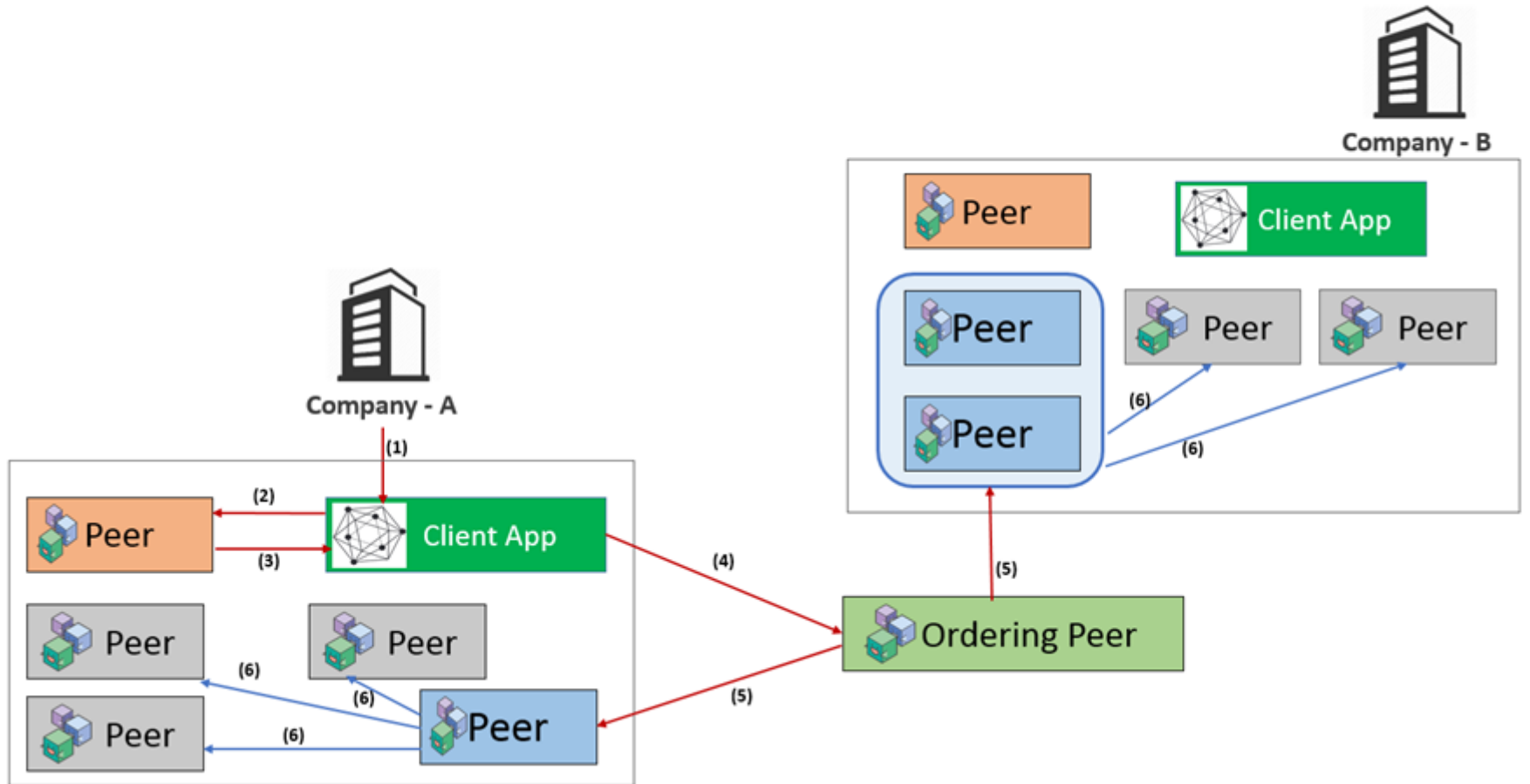
or

<https://qrco.de/be3Do4>



Hyperledger Fabric Architecture

Hyperledger Fabric Work Flow



EVM Hyperledger Fabric Architecture

- Developer Solidity Smart Contracts Book

The screenshot shows the Amazon Kindle Store interface. At the top, there's a navigation bar with the Amazon Prime logo, delivery location (Yardley 19067), and search bar. Below that, a horizontal menu lists various categories like Prime Video, Customer Service, Today's Deals, etc. The main content area features the book cover for 'Programming in Solidity' by James J. Sullivan. The cover is white with a grid of dots and the title in large, bold letters. To the right of the cover, the book title and author are displayed, along with a 'Kindle Edition' label and a 4-star rating. Below this, there are two format options: Kindle at \$29.99 (with 150 Prime points) and Paperback at \$29.99. A 'Kindle Rewards Beta' section offers book credit. On the right side, a sidebar contains pricing information, a 'Buy now with 1-Click' button, an option to use Amazon Rewards Visa Card points, and a 'Buy for others' section.

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Look inside

PROGRAMMING IN SOLIDITY
YOUR GUIDE TO SMART CONTRACT DEVELOPMENT
JAMES J. SULLIVAN

Programming in Solidity: Your Guide to Building Smart Contracts
Kindle Edition
by James J. Sullivan (Author) | Format: Kindle Edition
★★★★☆ 4 ratings

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Explore Solidity examples and basics. Get hands-on learning with control structures, function calls, and object orientation.
Explore tools for building a development environment. Then use the development tools for building, testing, and deploying, and running blockchain applications.
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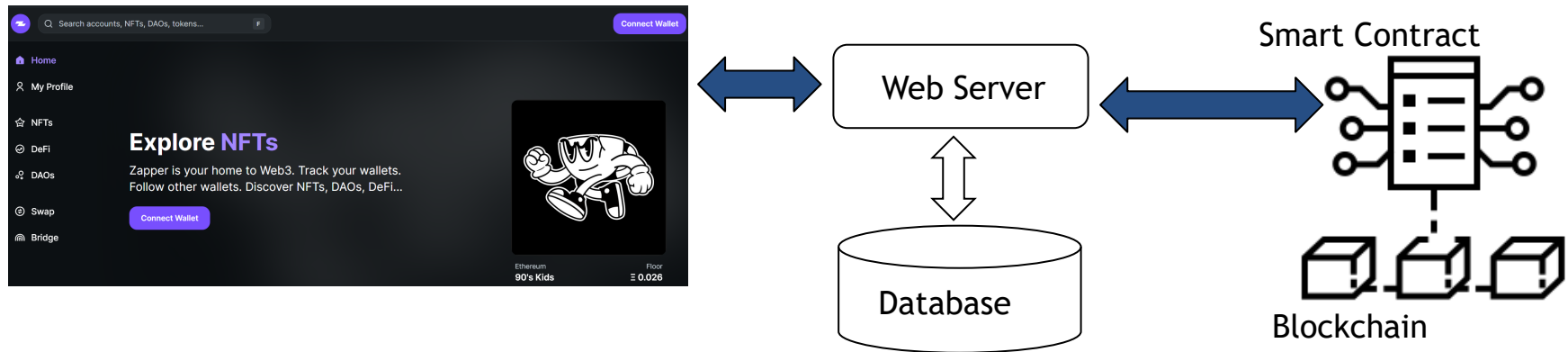
Add to List



EVM Hyperledger Fabric Architecture

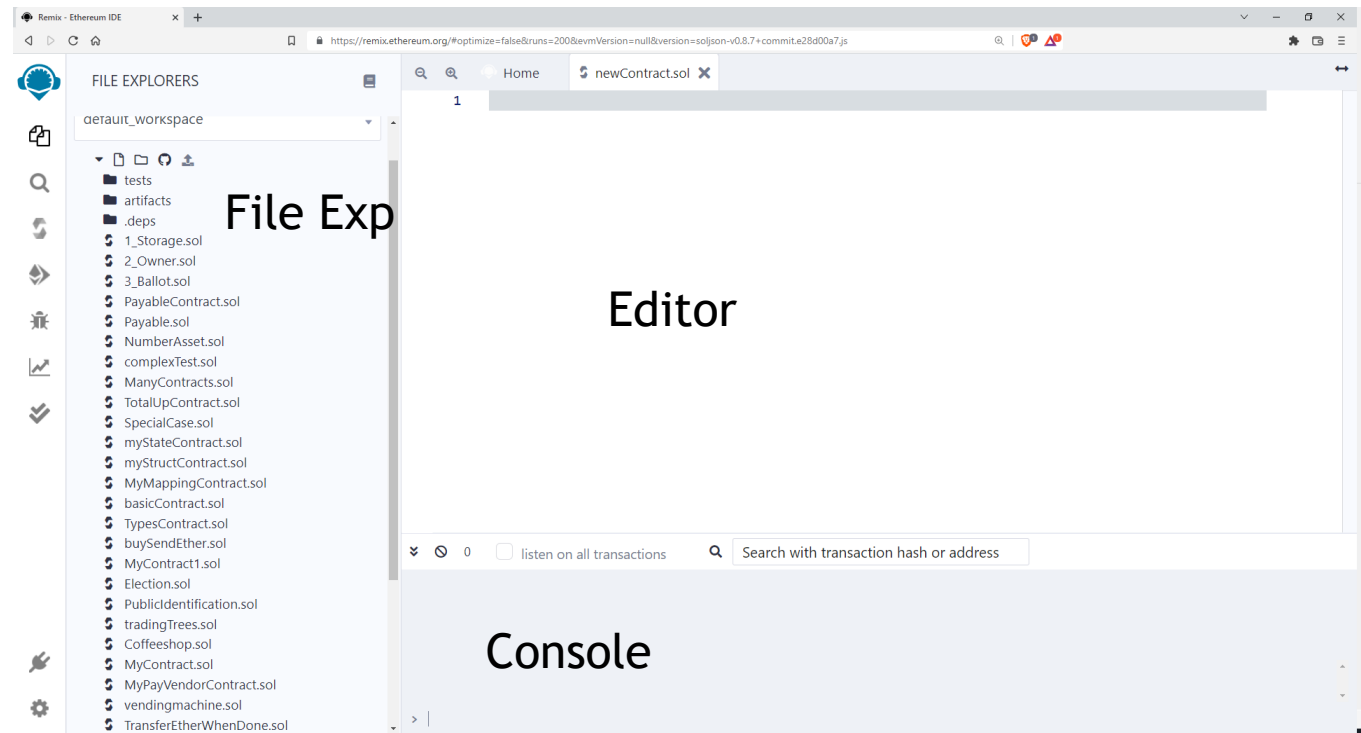
Distributed Applications

- A DApp has its backend code running on a decentralized peer-to-peer network. Contrast this with an **app** (central application) where the backend code is running on centralized servers.
- Identical to an app, a DApp can have web or mobile user interfaces written in many supported languages to make calls to its backend.
- In most cases a Smart Contract is part of a DApp's backend. Furthermore, attachment data can be stored in distributed repositories such as IPFS.



EVM Hyperledger Fabric

- Deconstruct a Distributed Application.
- Remix Development Environment: <https://remix.ethereum.org>
- Browser Based IDE
- Editor
- Console
- Module Selector



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TRUFFLE SUITE Documentation

Learn how to use the full **Truffle Suite** with Ethereum, Quorum, Hyperledger EVM, and other EVM-based chains

TRUFFLE
SMART CONTRACTS MADE SWEETER Compile, test, debug and deploy with the most popular smart contract development tool.

Ganache
ONE CLICK BLOCKCHAIN Fast, easy, local development blockchain in UI and CLI flavors. Introspection of contract data and events.

drizzle
FRESH CHAIN-DATA FOR FRONT-ENDS Standards-compliant wallet connection, account and contract state management. Turn-key React component library.

TRUFFLE FOR VSCODE
DAPP DEVELOPMENT SIMPLIFIED Truffle for VSCode simplifies how you create, connect to, build and deploy smart contracts on an EVM-based blockchain.

See documentation for **select blockchains**

- Ethereum
- Tezos
- Quorum
- Hyperledger Fabric (EVM)
- Corda
- Filecoin

Account 2
0x644...117E

99.9254 ETH

Buy Send Swap

Assets Activity

Vote May 18 - localhost:3000 -0 ETH

Vote May 18 - localhost:3000 -0 ETH

Ganache

ACCOUNTS BLOCKS TRANSACTIONS CONTRACTS EVENTS LOGS

SEARCH FOR BLOCK NUMBERS OR TX HASHES

MNEMONIC	HD PATH		
duty trend slot early topic rival market friend game badge neck thought	m/44'/60'/0'/0'/0/account_index		
ADDRESS	BALANCE	TX COUNT	INDEX
0x118e27e4CD53BD270f8C12a1FDfB38Cee4366315	98.76 ETH	325	0
ADDRESS	BALANCE	TX COUNT	INDEX
0x2e10cC81afD377d867207Ee5EbDcbD4c5BC9f9Cb	100.00 ETH	0	1
ADDRESS	BALANCE	TX COUNT	INDEX
0xF0780CC15F38BE469c7708655271AE2db5dc40B5	100.00 ETH	0	2
ADDRESS	BALANCE	TX COUNT	INDEX
0xe29CF09B55f862280819922C5d8e53A254156a07	100.00 ETH	0	3
ADDRESS	BALANCE	TX COUNT	INDEX
0x0fC8dAeb11967Afce7ed3E08F7b858d7EBff180F	100.00 ETH	0	4
ADDRESS	BALANCE	TX COUNT	INDEX
0xCb072Ae08ea8e24Ad628158f926FEf4B453ee8a	100.00 ETH	0	5
ADDRESS	BALANCE	TX COUNT	INDEX
0x2C1b24079744539e46d00Ad169e486a235C7B138	100.00 ETH	0	6



EVM Hyperledger Fabric

- Deconstruct a Distributed Application.

```
App = {
  web3Provider: null,
  contracts: {},
  account: '0x0',
  hasVoted: false,

  init: function() {
    return App.initWeb3();
  },

  initWeb3: function() {
    // TODO: refactor conditional
    if (typeof web3 !== 'undefined') {
      // If a web3 instance is already provided by Meta Mask.
      App.web3Provider = web3.currentProvider;
      web3 = new Web3(web3.currentProvider);
    } else {
      // Specify default instance if no web3 instance provided
      App.web3Provider = new Web3.providers.HttpProvider('http://localhost:8545');
      web3 = new Web3(App.web3Provider);
    }
    return App.initContract();
  },

  initContract: function() {
    $.getJSON("Election.json", function(election) {
      // Instantiate a new truffle contract from the artifact
      App.contracts.Election = TruffleContract(election);
    });
  }
};
```

```
initContract: function() {
  $.getJSON("Election.json", function(election) {
    // Instantiate a new truffle contract from the artifact
    App.contracts.Election = TruffleContract(election);
    // Connect provider to interact with contract
    App.contracts.Election.setProvider(App.web3Provider);

    App.listenForEvents();

    return App.render();
  });
},

// Listen for events emitted from the contract
listenForEvents: function() {
  App.contracts.Election.deployed().then(function(instance) {
    // Restart Chrome if you are unable to receive this event
    // This is a known issue with Metamask
    // https://github.com/MetaMask/metamask-extension/issues/2393
    instance.votedEvent({}, {
      fromBlock: 0,
      toBlock: 'latest'
    }).watch(function(error, event) {
      console.log("event triggered", event);
      // Reload when a new vote is recorded
      App.render();
    });
  });
};
```



EVM on Hyperledger Fabric



<https://github.com/theblockchainacademy/electiondapp>



Announcement !

- The on360.io team, powered by the Blockchain Academy, is the new maintainers of the Fabric EVM Lab (Fabric-EVM-Library)
- We look forward to working with the Fabric EVM Lab community.



Hey it's the Fabric EVM Lab !



EVM Hyperledger Fabric Architecture

- Why use the Ethereum Virtual Machine (EVM) on Hyperledger Fabric
- Reuse, Commonality, Community, Resources, more ...



CONFIGURE THE CORE PEER

Next, we need to configure the peer CLI to operate on the core peer for your organization. To do this, select a peer that you want to act as the core peer (this is an arbitrary selection), then define the following environment variables:

(NOTE: This is just an example; you'll need to set your peer accordingly.)

```
`` bash
export FABRIC_CFG_PATH=<path to directory containing the core.yaml configuration>
export CORE_PEER_TLS_ENABLED=<true | false>
export CORE_PEER_LOCALMSPID=<your org's MSP ID>
export CORE_PEER_TLS_ROOTCERT_FILE=<path to core peer's TLS CA cert>
export CORE_PEER_MSPCONFIGPATH=<path to core peer admin user's msp>
export CORE_PEER_ADDRESS=<peer address>
export ORDERER_CA=<path to orderer's /msp/tlscacerts/tlsca.pem>
``
```

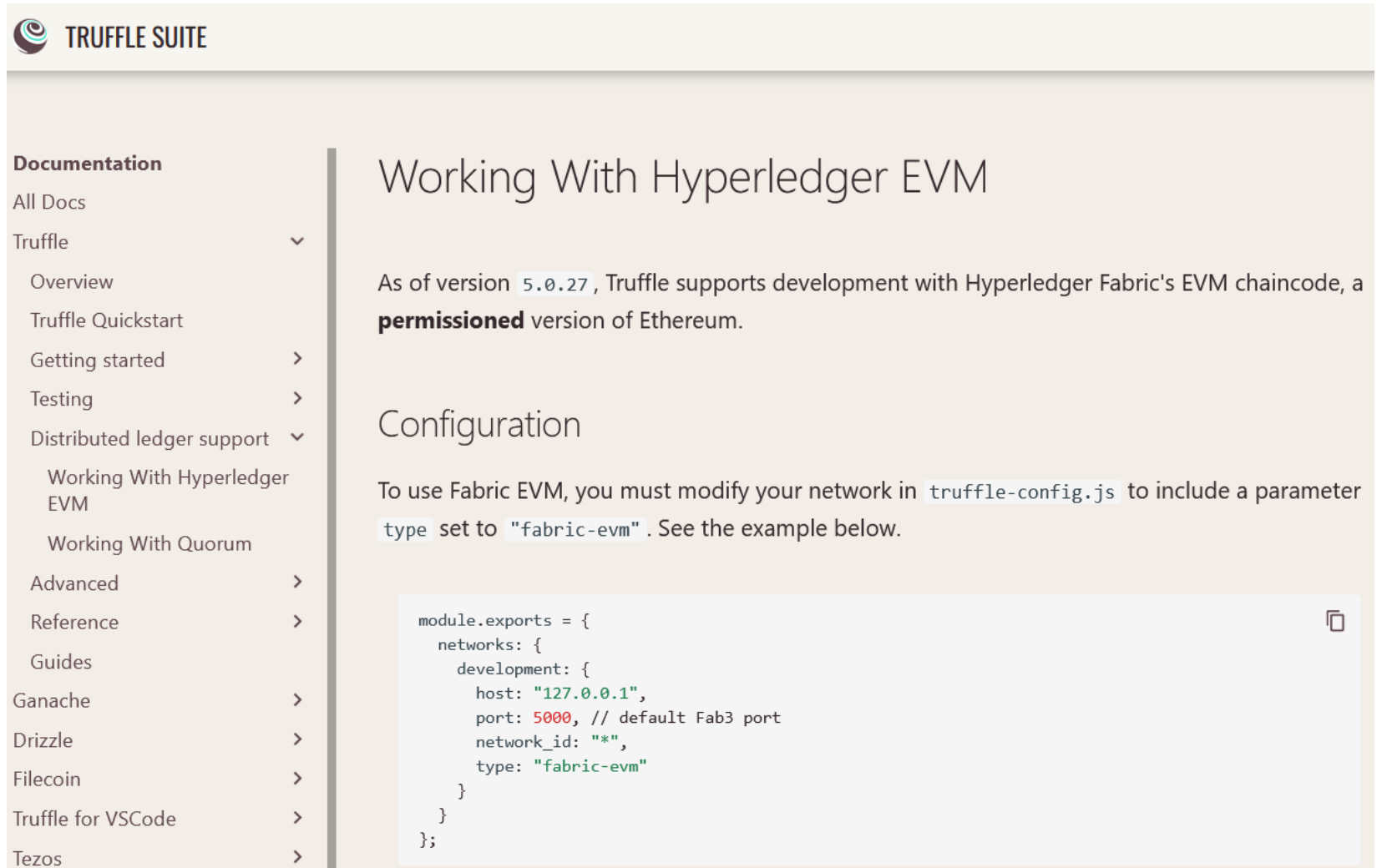
(HINT: If you are using the sample-network, then you will need to create organizations will have its own core peer. My suggestion would be to create a switch between environments. This way you can run the peer cli command again to target the other peer.)

The screenshot shows the Truffle Suite interface with a search bar and a list of blockchain options. The options are: Ethereum, Quorum, Tezos, Hyperledger Fabric (EVM), Corda, and Filecoin. The 'Hyperledger Fabric (EVM)' option is highlighted with a red box.



EVM Hyperledger Fabric Architecture

- Truffle Configuration for Hyperledger Fabric.



The screenshot shows the Truffle Suite documentation interface. On the left is a navigation sidebar with a 'Documentation' section containing links for 'All Docs', 'Truffle', 'Overview', 'Truffle Quickstart', 'Getting started', 'Testing', 'Distributed ledger support', 'Working With Hyperledger EVM', 'Working With Quorum', 'Advanced', 'Reference', 'Guides', 'Ganache', 'Drizzle', 'Filecoin', 'Truffle for VSCode', and 'Tezos'. The main content area is titled 'Working With Hyperledger EVM' and contains the following text:

As of version `5.0.27`, Truffle supports development with Hyperledger Fabric's EVM chaincode, a **permissioned** version of Ethereum.

Configuration

To use Fabric EVM, you must modify your network in `truffle-config.js` to include a parameter `type` set to `"fabric-evm"`. See the example below.

```
module.exports = {
  networks: {
    development: {
      host: "127.0.0.1",
      port: 5000, // default Fab3 port
      network_id: "*",
      type: "fabric-evm"
    }
  }
};
```



EVM Hyperledger Fabric Architecture

- Installing the Ethereum Virtual Machine (EVM)
- Part I: Deploy the EVM Smart Contract to Hyperledger Fabric
- Part II: Use NodeJS and Web3 and run the Smart Contract with Node and Web3.

```
jimmys@jimmys-VirtualBox:~/go/src/github.com/hyperledger/fabric-chaincode-evm$ docker ps
```

CONTAINER ID	IMAGE	STATUS	PORTS	NAMES	COMMAND
077c5cb0b60f	dev-peer0.org1.example.com-vmcc-0-aaf37d90d8d396f179cf05229debb5f1c9d24e5737db406a2af8112b9f7b7c75	Up About an hour		dev-peer0.org1.example.com	"chaincode"
6ece723d0a2a	hyperledger/fabric-tools:latest	Up 2 hours		cli	"/bin/bash"
11ba21977865	dev-peer1.org2.example.com-mycc-1.0-26c2ef32838554aac4f7ad6f100aca865e87959c9a126e86d764c8d01f8346ab	Up 3 hours		dev-peer1.org2.example.com	"chaincode"
3c310abfc7ae	dev-peer0.org1.example.com-mycc-1.0-384f11f484b9302df90b453200cfb25174305fce8f53f4e94d45ee3b6cab0ce9	Up 3 hours		dev-peer0.org1.example.com	"chaincode"
40217773770	dev-peer0.org2.example.com-mycc-1.0-15b571b5c0049000b7cc74437d3a3b27e54e0df1345daff3951b94245ce09c42b	Up 3 hours		dev-peer0.org2.example.com	"chaincode"
27c3ed41ddad	hyperledger/fabric-peer:latest	Up 3 hours	0.0.0.0:7051->7051/tcp, :::7051->7051/tcp	peer0.org1.example.com	"peer node"
7d1ac8c0ffb6	hyperledger/fabric-orderer:latest	Up 3 hours	0.0.0.0:7050->7050/tcp, :::7050->7050/tcp	orderer.example.com	"orderer"
7990d3ad436f	hyperledger/fabric-peer:latest	Up 3 hours	0.0.0.0:9051->9051/tcp, :::9051->9051/tcp	peer0.org2.example.com	"peer node"
a7d5a031ebcf	hyperledger/fabric-peer:latest	Up 3 hours	0.0.0.0:10051->10051/tcp, :::10051->10051/tcp	peer1.org2.example.com	"peer node"
2e75dc5228fa	hyperledger/fabric-peer:latest	Up 3 hours	0.0.0.0:8051->8051/tcp, :::8051->8051/tcp	peer1.org1.example.com	"peer node"
b52959c11721	hyperledger/fabric-ca	Up 3 hours	0.0.0.0:7054->7054/tcp, :::7054->7054/tcp	ca.example.com	"sh -c"



EVM Hyperledger Fabric Architecture

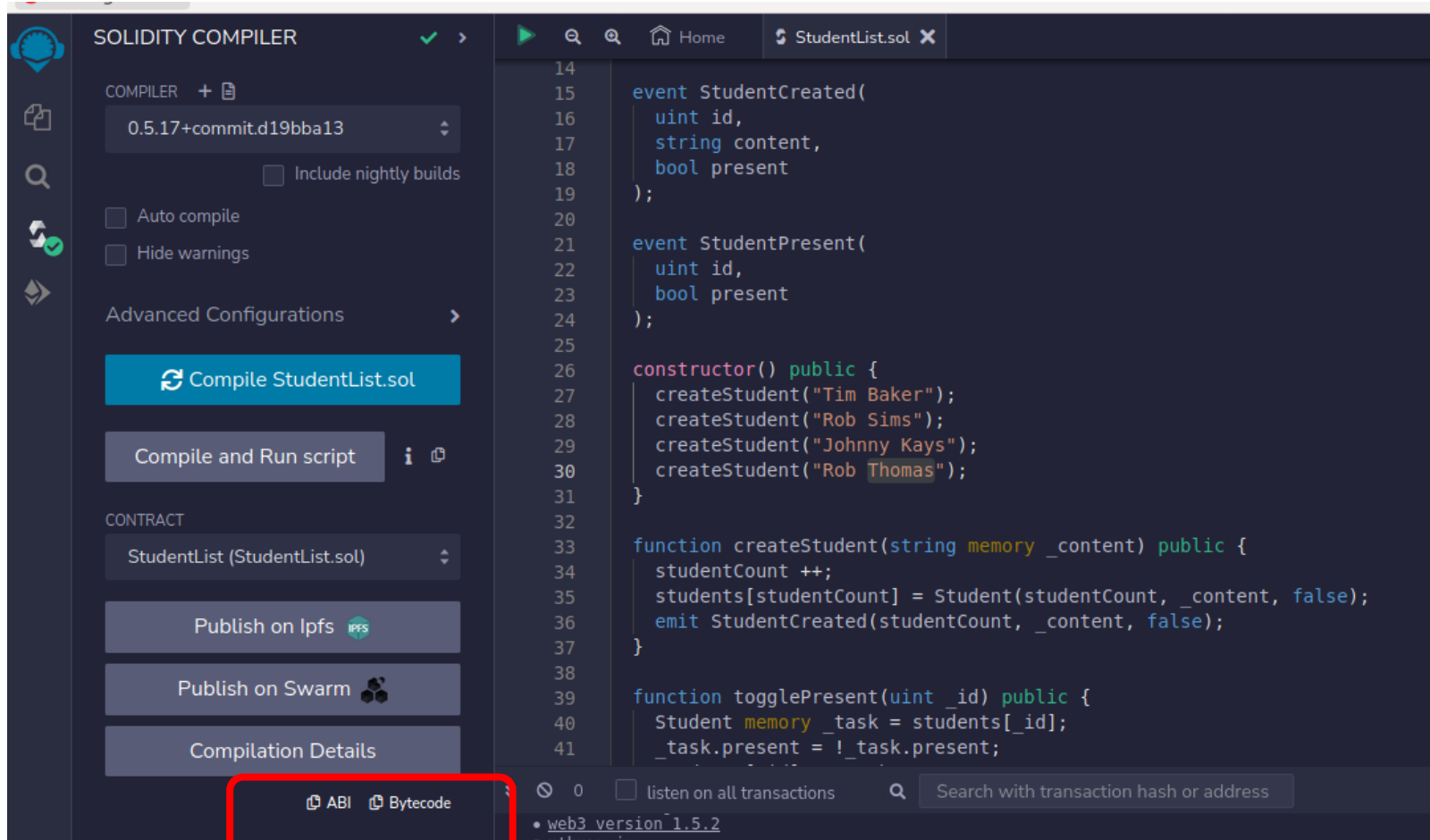
- Installing the Ethereum Virtual Machine (EVM)
- Part II: Deploy the EVM Smart Contract to Hyperledger Fabric

```
File Edit View Search Terminal Help
root@d626eb9602f5:/opt/gopath/src/github.com/hyperledger/fabric/peer# peer chaincode instantiate -n evmcc -v 0 -C mychannel -c '{"Args":[]}' -o o
rderer.example.com:7050 --tls --cafile /opt/gopath/src/github.com/hyperledger/fabric/peer/crypto/ordererOrganizations/example.com/orderers/order
r.example.com/msp/tlscacerts/tlsca.example.com-cert.pem
2022-10-28 13:03:56.124 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 001 Using default escc
2022-10-28 13:03:56.124 UTC [chaincodeCmd] checkChaincodeCmdParams -> INFO 002 Using default vscc
root@d626eb9602f5:/opt/gopath/src/github.com/hyperledger/fabric/peer#
```



EVM Hyperledger Fabric Architecture

- Remix for Hyperledger Fabric.
- Remix can connect to Hyperledger Fabric

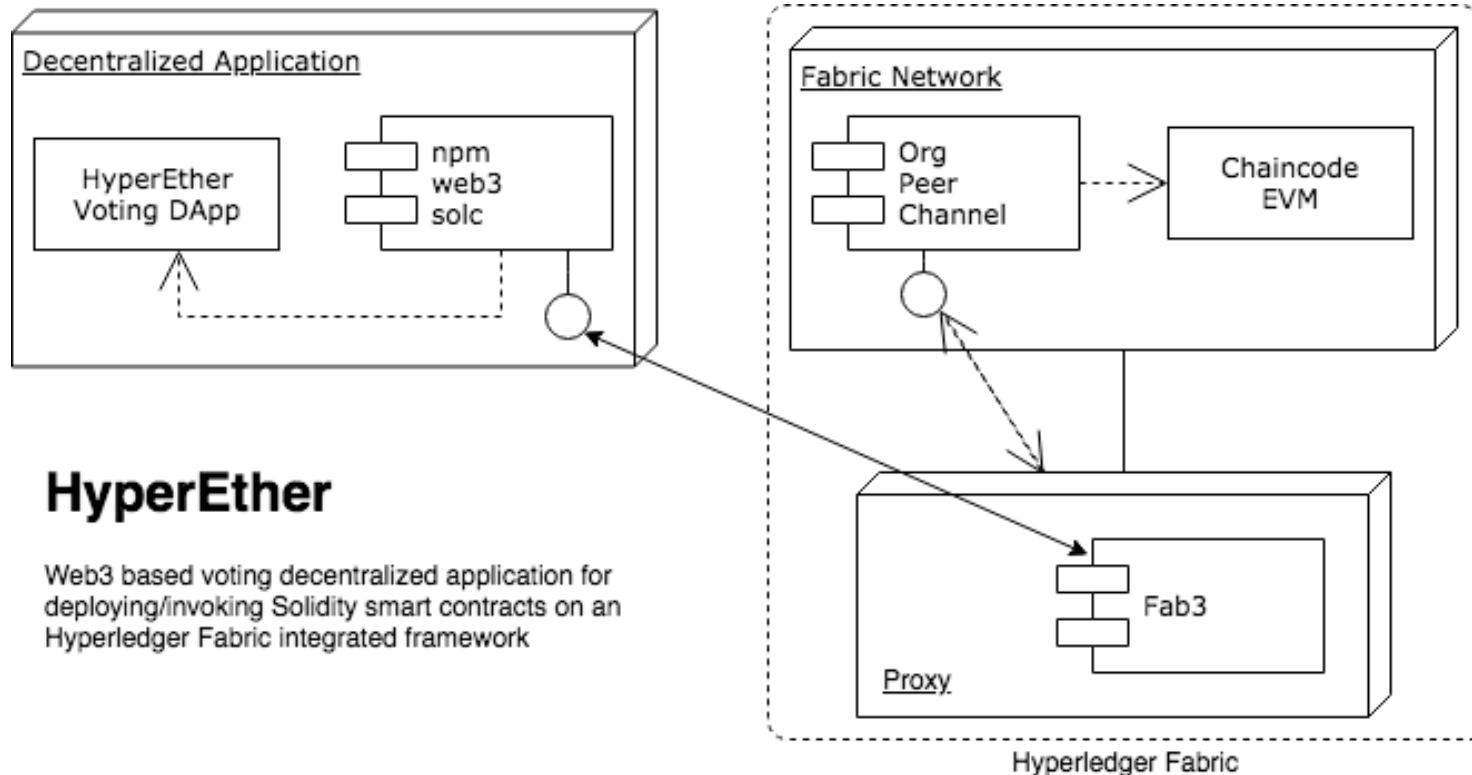


The screenshot displays the Remix IDE interface. On the left, the 'SOLIDITY COMPILER' panel is visible, showing the compiler version '0.5.17+commit.d19bba13' and options for 'Include nightly builds', 'Auto compile', and 'Hide warnings'. Below these are 'Advanced Configurations' and a 'Compile StudentList.sol' button. The main editor area shows the Solidity code for 'StudentList.sol', including events for 'StudentCreated' and 'StudentPresent', a constructor that creates four students, and functions for 'createStudent' and 'togglePresent'. At the bottom of the compiler panel, a red box highlights the 'ABI' and 'Bytecode' buttons. The bottom status bar shows 'web3 version 1.5.2' and a search field for transaction hashes or addresses.



EVM Hyperledger Fabric Architecture

- DApp



Fabric-EVM-Library



EVM Hyperledger Fabric

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