CONTENT DEVELOPMENT
ON

BLOCKCHAIN

CONFIGURATION, BUILDING, & USE-CASE

By

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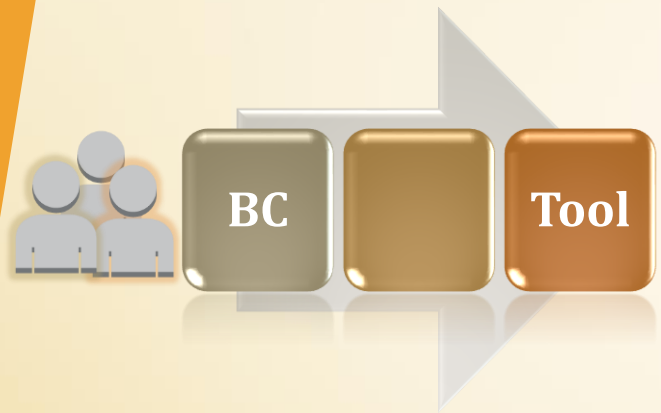
Blockchain : TOC

Content Development



Vision

- Building and Understanding Ethereum Working Environment

Objectives

Building Environment

- On-Premise
- Off-Premise
- Hybrid & Multi Environment

Part 1	• Understanding Building Environment and Pre-requisite • Requirement and Compatibility
Part 2	• Building Ethereum using On-Premise Environment • Building Ethereum using Off-Premise Environment
Part 3	• Building Ethereum using Hybrid Environment (On with Off-Premise) • Building Ethereum using Multiple Environment (Adoption Strategy)
Aim	• Configuration, Building Snap-Shots • Hands-On Process & Use-Cases

HOL *Demo's* *Use Cases* *Architecture* *Prototype*

On-Premise: Setting up the Development Environment

Solidity is the most popular smart contract language for Ethereum. So now we have chosen our language for smart contract development, let us see what is required to get started.

In order to set up the environment for developing a Smart Contract, two choices are available.

1. Remix Online IDE
2. Local Set Up

On-Premise: Setting up the Development Environment (Cont.)

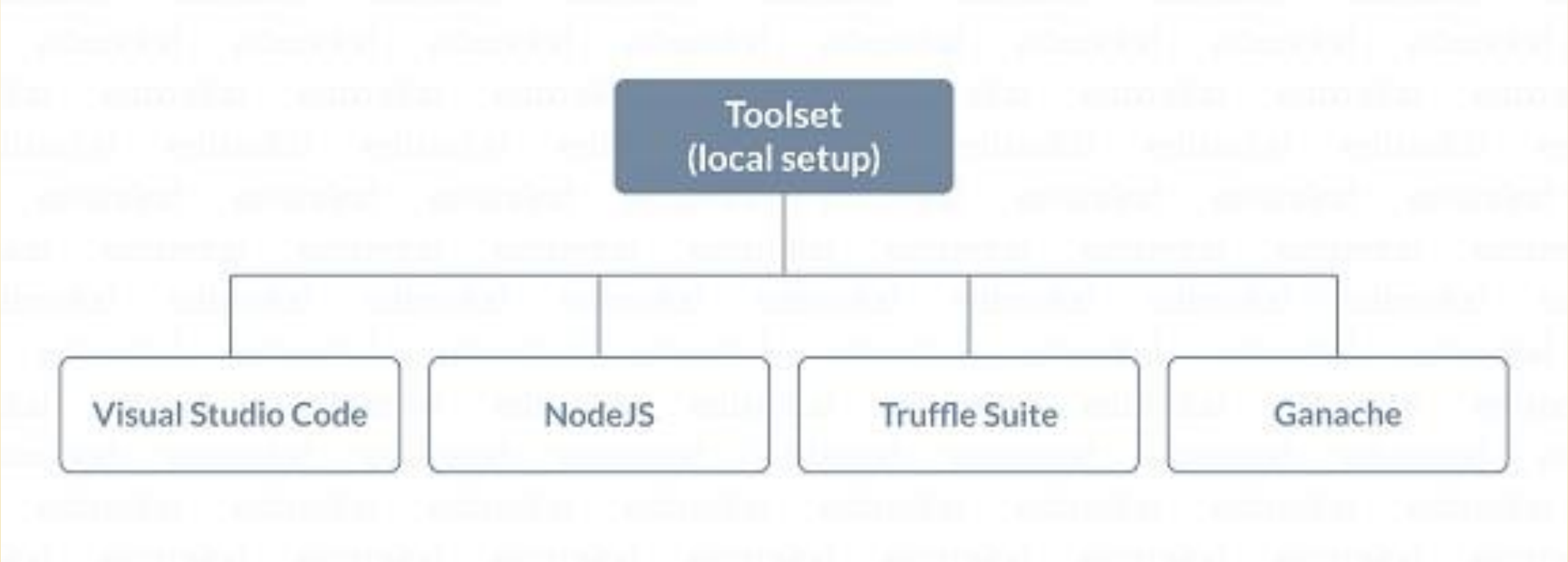
Remix IDE
The first choice is to use online remix IDE (integrated development environment) to build and test the smart contract. This is a quick, easy and recommended way for beginners.

Pros:
No installation required, completely online
Get started without any challenges, quick for prototyping and validating Smart Contract
Provides a local Ethereum virtual network

Cons:
As the progression goes from building Smart Contract, to consuming the smart contract in DApp (Distributed Application) Remix IDE has serious limitations.

On-Premise: Setting up the Development Environment (Cont.)

Local Setup



On-Premise: Setting up the Development Environment (Cont.)

Toolset required for smart contract development is as follows:

Node
The latest version of the node can be downloaded here.

Using NVM (Node Version Manager)

Windows Installation
Download installer from here
Download and run the installer, this should install the nvm
Open up a windows terminal and run "nvm –version"
nvm --version

This should return the current version on nvm.

Mac Installation
Run the following script, this should automatically install nvm on the machine.
curl -o- https://raw.githubusercontent.com/creationix/nvm/v0.33.0/install.sh | bash

In order to validate the installation run the following command "nvm --version"

On-Premise: Setting up the Development Environment (Cont.)

Post-Installation

1. Once the nvm is installed run the following command.
2. Run the following command "nvm list". This will list down the node version installed locally-> **nvm list**
3. To list down the node version available for download please run the following command-> **nvm ls-remote**
4. In order to install a specific version of node run the following command "nvm install <node-version" e.g. "nvm install 10.15.0" this will install node version 10.15.0.-> **nvm install 10.15.0**
5. Check the current version of the node being used by following command
   node --version
1. For further details on nvm or node, please look at details here.

On-Premise: Setting up the Development Environment (Cont.)

Visual Studio Code

Visual Studio Code has been one of the best IDE provided by Microsoft for solidity smart contract development. Visual Studio code can be downloaded from here.

Truffle Suite

Truffle suite provides an excellent framework for Smart Contract. Installation of truffle is done via npm (node package manager), which is installed with node. In order to install truffle, open up the terminal window or command prompt window. In the terminal window run the following command,

npm install -g truffle

(g flag in the command stands for global)

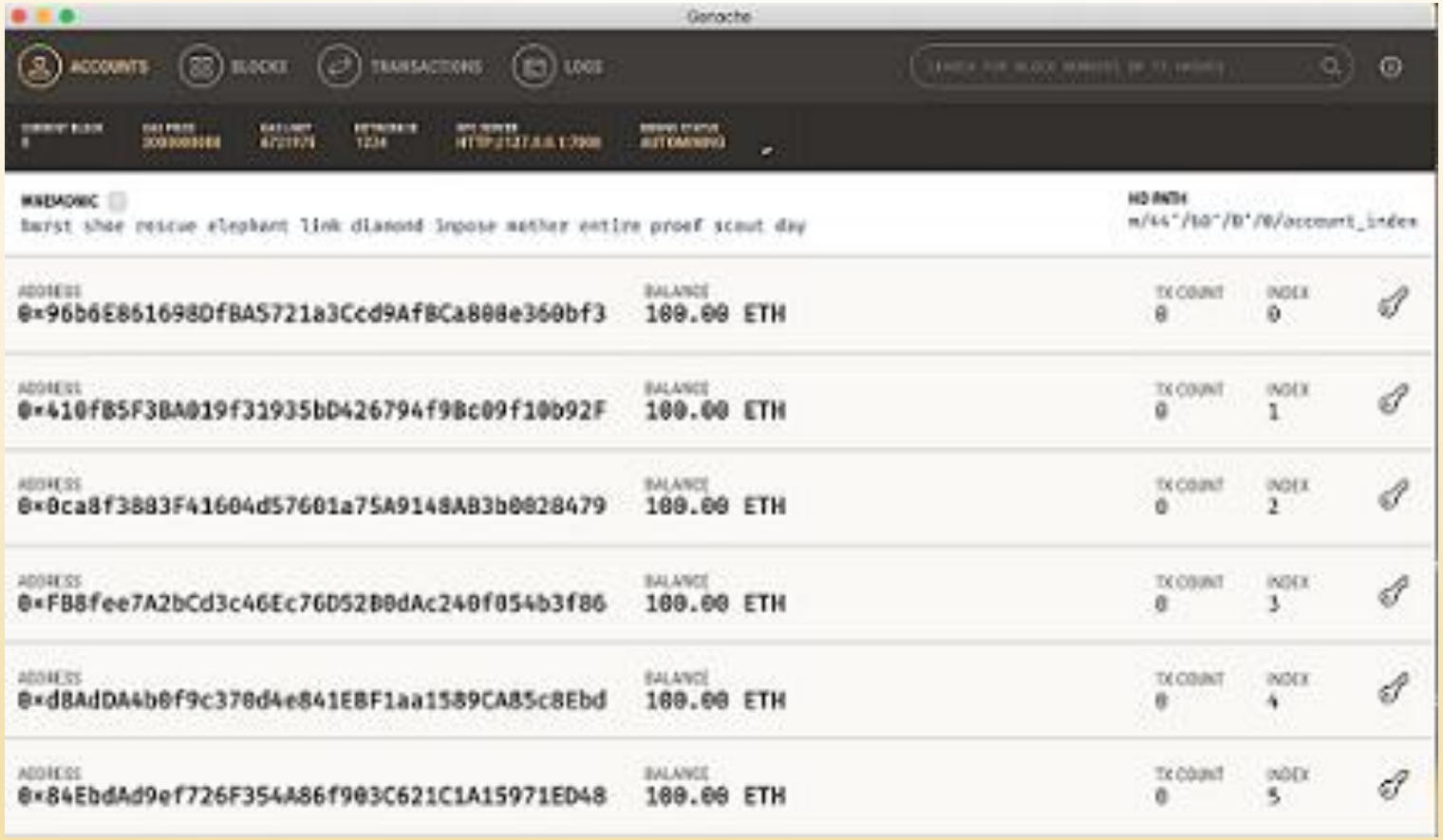
Post installation of truffle is completed, run the following command to verify the version installed

truffle --version

On-Premise: Setting up the Development Environment (Cont.)

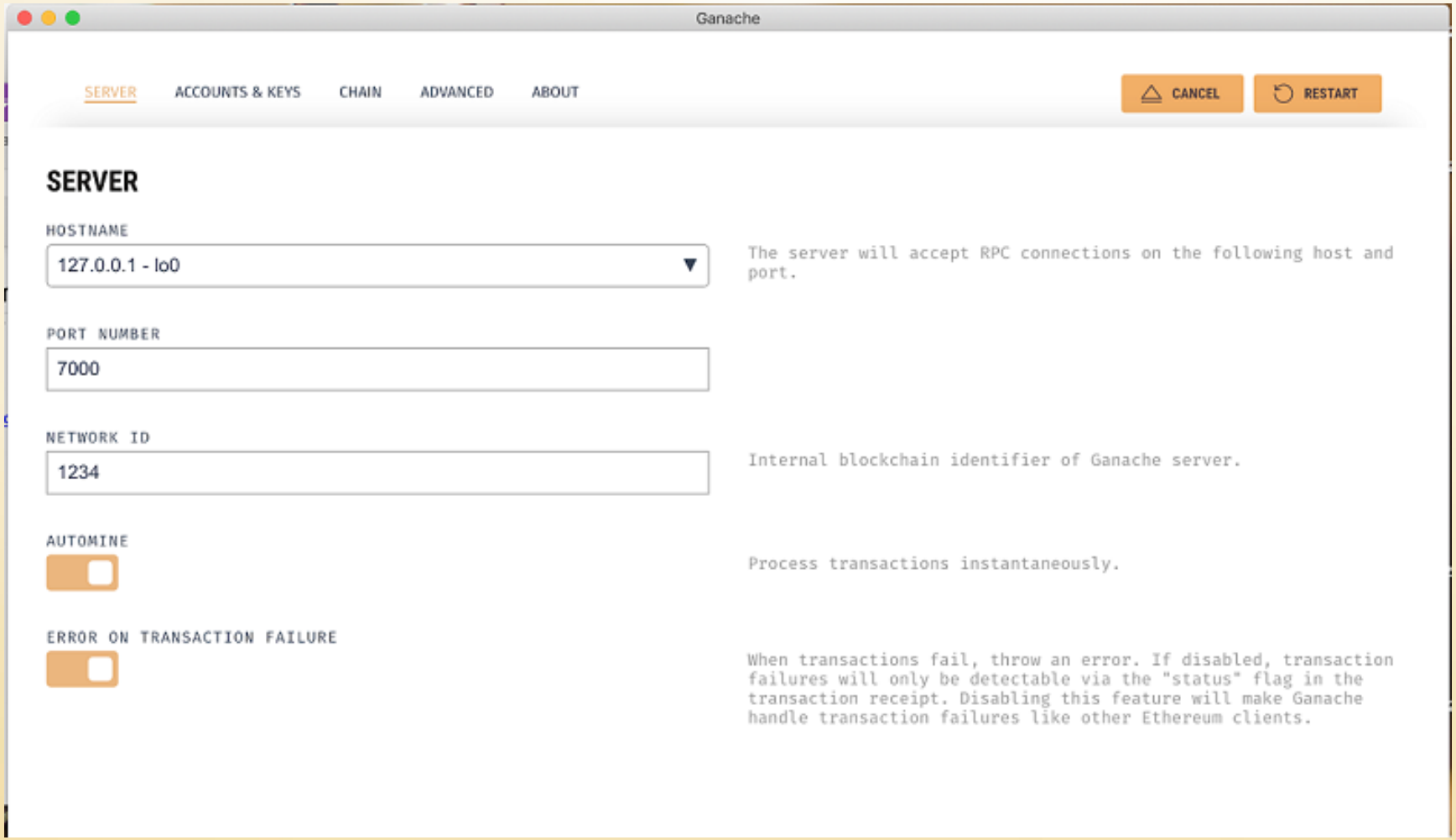
Ganache (Single node local Ethereum network)

1. The setup file for ganache can be downloaded here
2. Select the installation package based on the operating system.
3. Run the installer, once the installation is completed following screen should appear



On-Premise: Setting up the Development Environment (Cont.)

In order to customize the ganache test Ethereum node running, please click on the gear icon on the right corner of the ganache tool, the following screen should be visible.



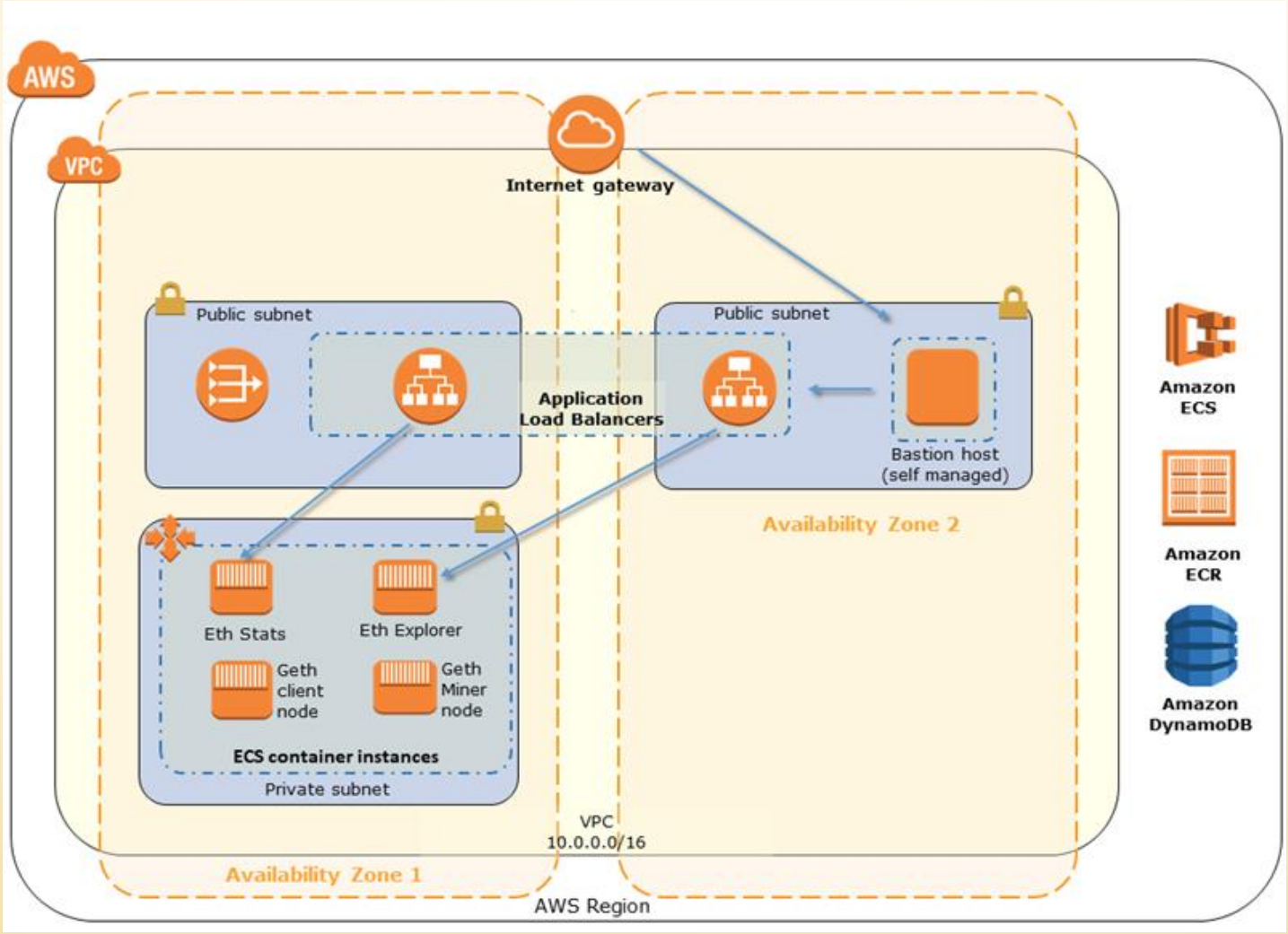
On-Premise: Setting up the Development Environment (Cont.)

- Port and network id can be customized, post customization, please click on the restart button on the top left corner.
- This will reinitialize the node and RPC location will be http://[host-name]:[port]. In case of the setting as seen in the above screen the RPC endpoint will be http://127.0.0.1:7000
- Ganache installation is running and can be interacted with using the above-mentioned RPC endpoint.

AWS Blockchain Framework for Ethereum

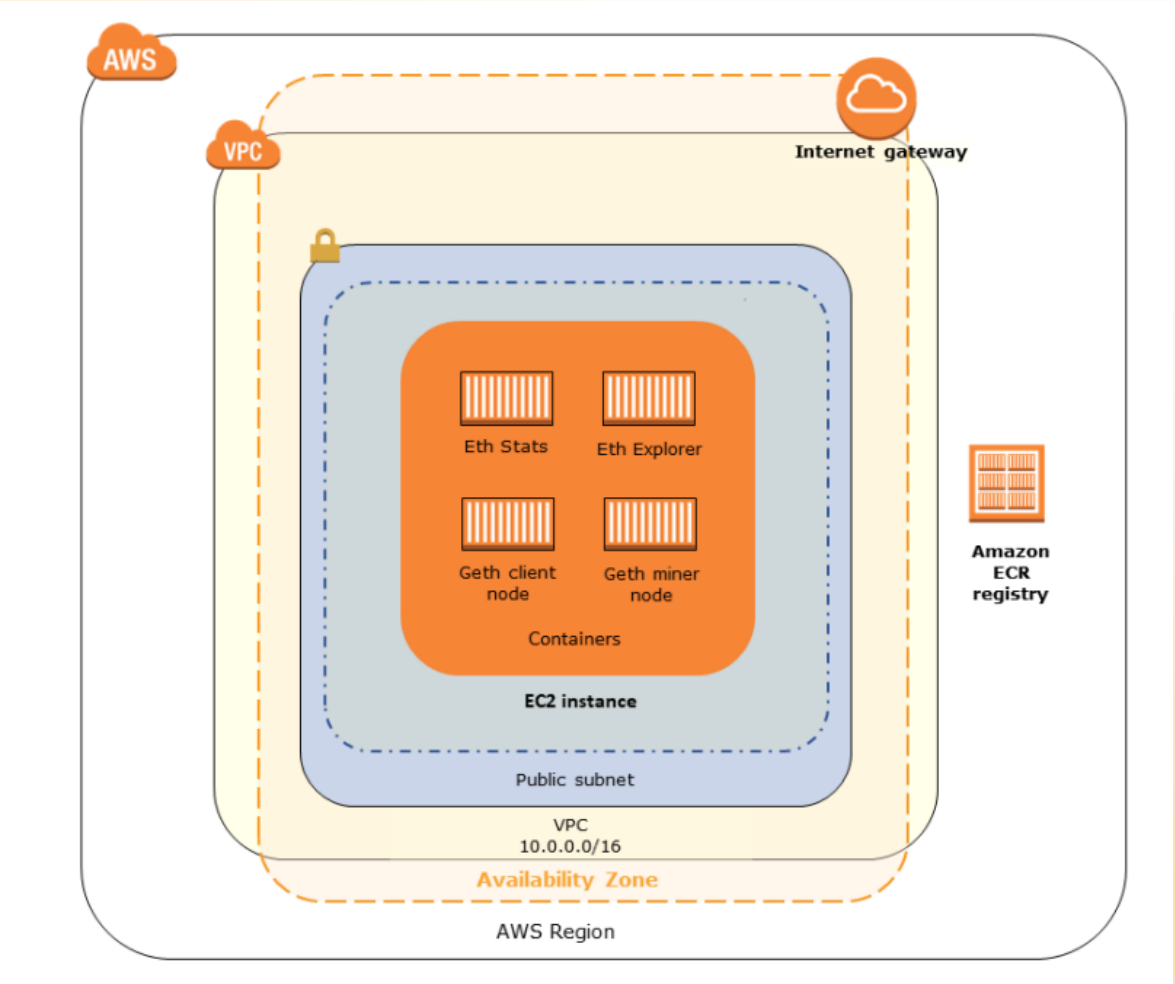
With Amazon ECS, you create your Ethereum network on an ECS cluster composed of multiple EC2 instances, with an Application Load Balancer and related resources.

The following diagram depicts an Ethereum network created using the template with the ECS container platform option:



Using the Docker-Local Platform

Alternatively, you can launch Ethereum containers within a single Amazon EC2 instance. All containers run on a single EC2 instance. This is a simplified setup.
The following diagram depicts an Ethereum network created using the template with the docker-local container platform option:



AWS: Building Ethereum Environment

1. Create an IAM User
2. Create a Key Pair
3. Getting Started: Set Up Prerequisites
4. Create a VPC and Subnets
5. Create Security Groups
6. Create an IAM Role for Amazon ECS and an EC Instance Profile
7. Create a Bastion Host
8. Create the Ethereum Network
9. Connect to EthStats and EthExplorer Using the Bastion Host
10. Clean Up Resources
11. AWS Blockchain Templates and Features
12. AWS Blockchain Template for Ethereum
13. Links to Launch
14. Ethereum Options
15. Prerequisites
16. Connecting to Ethereum Resources
17. AWS Blockchain Template for Hyperledger Fabric
18. Links to Launch
19. AWS Blockchain Template for Hyperledger Fabric Components
20. Prerequisites
21. Connecting to Hyperledger Fabric Resources

Create a VPC and Subnets

Use the Amazon VPC console (https://console.aws.amazon.com/vpc/) to create the Elastic IP address, the VPC, and the subnet as described below.

To create an Elastic IP address

1. Open the Amazon VPC console at https://console.aws.amazon.com/vpc/.
2. Choose Elastic IPs, Allocate new address, Allocate.
3. Make a note of the Elastic IP address that you create and choose Close.
4. In the list of Elastic IP addresses, find the Allocation ID for the Elastic IP address created earlier. You use this when you create the VPC.

Create a VPC and Subnets

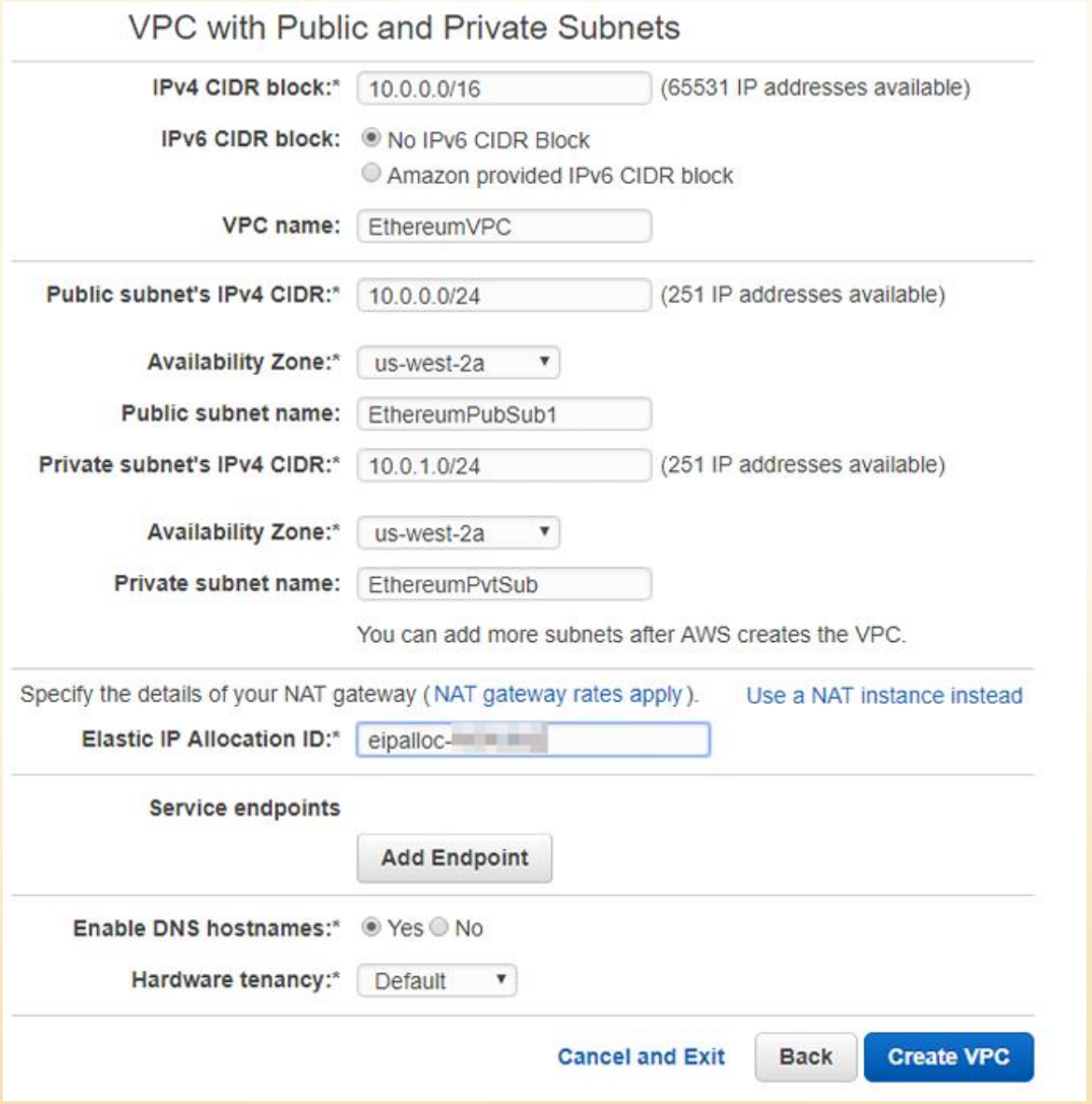
To create the VPC

1. From the navigation bar, select a Region for the VPC. VPCs are specific to a Region, so select the
same Region in which you created your key pair in and where you are launching the Ethereum stack.
For more information, see Create a Key Pair (p. 5).
2. On the VPC dashboard, choose Start VPC Wizard.
3. On the Step 1: Select a VPC Configuration page, choose VPC with Public and Private Subnets, Select.
4. On the Step 2: VPC with Public and Private Subnets page, leave IPv4 CIDR block and IPv6 CIDR
block to their default values. For VPC name, enter a friendly name.

Create a VPC and Subnets

5. For Public subnet's IPv4 CIDR, leave the default value. For Availability Zone, choose a zone. For Public subnet name, enter a friendly name.
You specify this subnet as one of the first of two subnets for the Application Load Balancer when you use the template.
Note the Availability Zone of this subnet because you select the same Availability Zone for the private subnet, and a different one for the other public subnet.
6. For Private subnet's IPv4 CIDR, leave the default value. For Availability Zone, select the same Availability Zone as in the previous step. For Private subnet name, enter a friendly name.
7. For Elastic IP Allocation ID, select the Elastic IP address that you created earlier.
8. Leave the default values for other settings.
9. Choose Create VPC

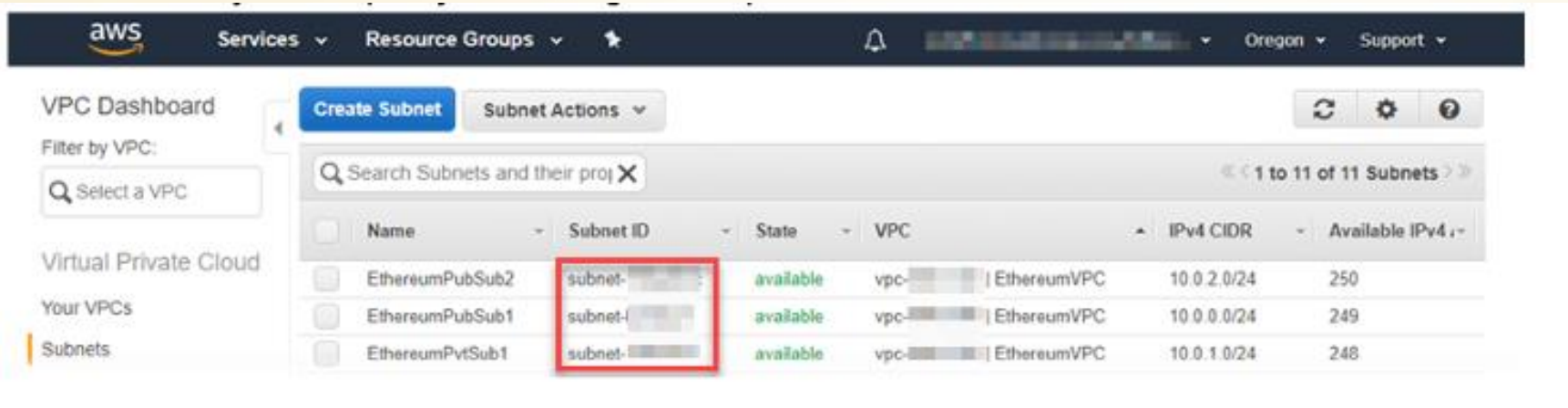
Create a VPC and Subnets



Create the second public subnet in a different Availability Zone

To create the second public subnet in a different Availability Zone
1. Choose Subnets and then select the public subnet that you created earlier from the list. Select the Route Table tab and note the Route table ID. You specify this same route table for the second public subnet below.
2. Choose Create Subnet.
3. For Name tag, enter a name for the subnet. You use this name later when you create the bastion host in this network.
4. For VPC, select the VPC that you created earlier.
5. For Availability Zone, select a different zone from the zone that you selected for the first public subnet.
6. For IPv4 CIDR block, enter 10.0.2.0/24.
7. Choose Yes, Create. The subnet is added to the list of subnets.
8. With the subnet selected from the list, choose Subnet Actions, Modify auto-assign IP settings. Select Auto-assign IPs, Save, Close. This allows the bastion host to obtain a public IP address when you create it in this subnet.
9. On the Route Table tab, choose Edit. For Change to, select the route table ID that you noted earlier and choose Save.

To create the second public subnet in a different Availability Zone

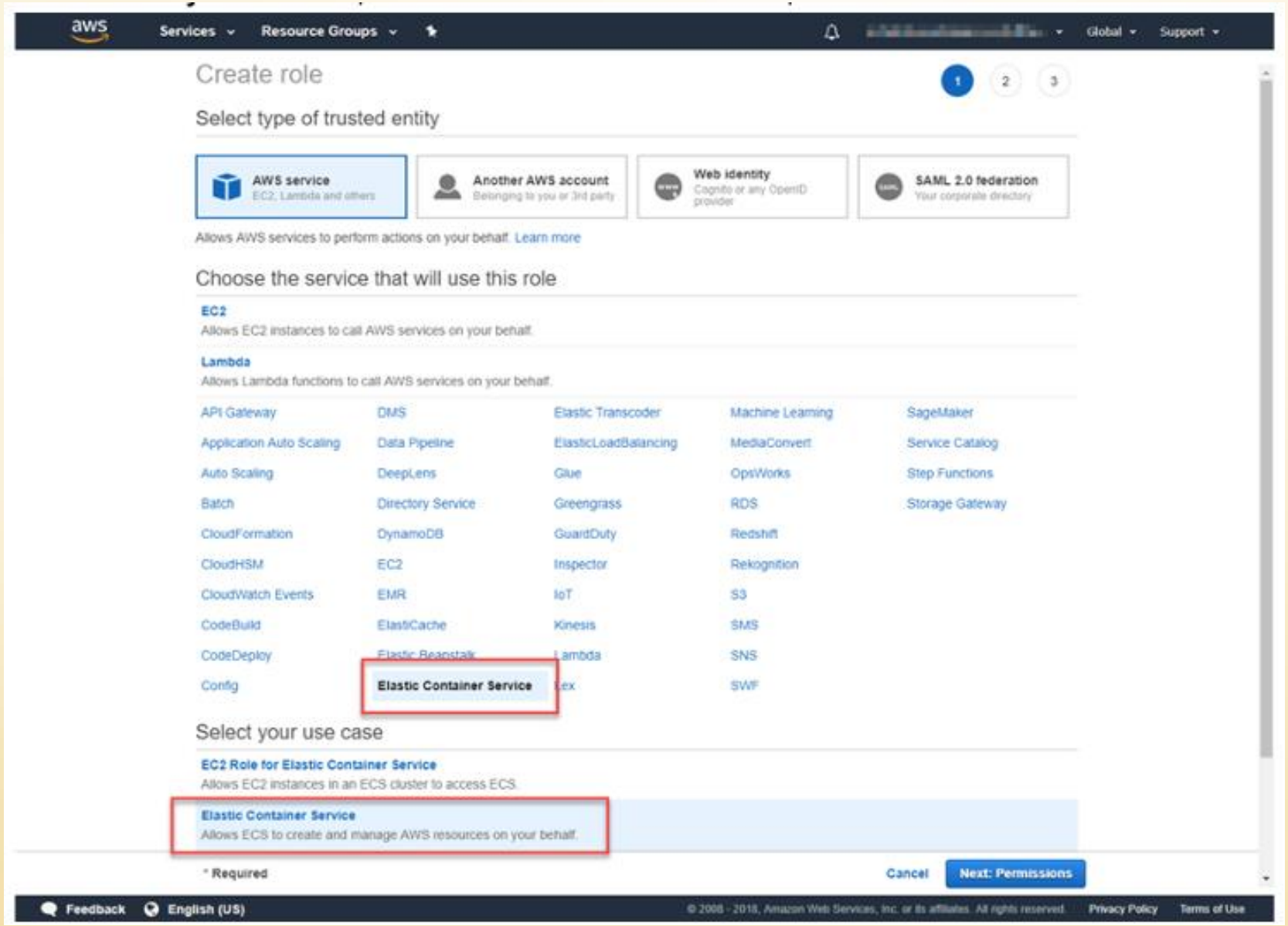


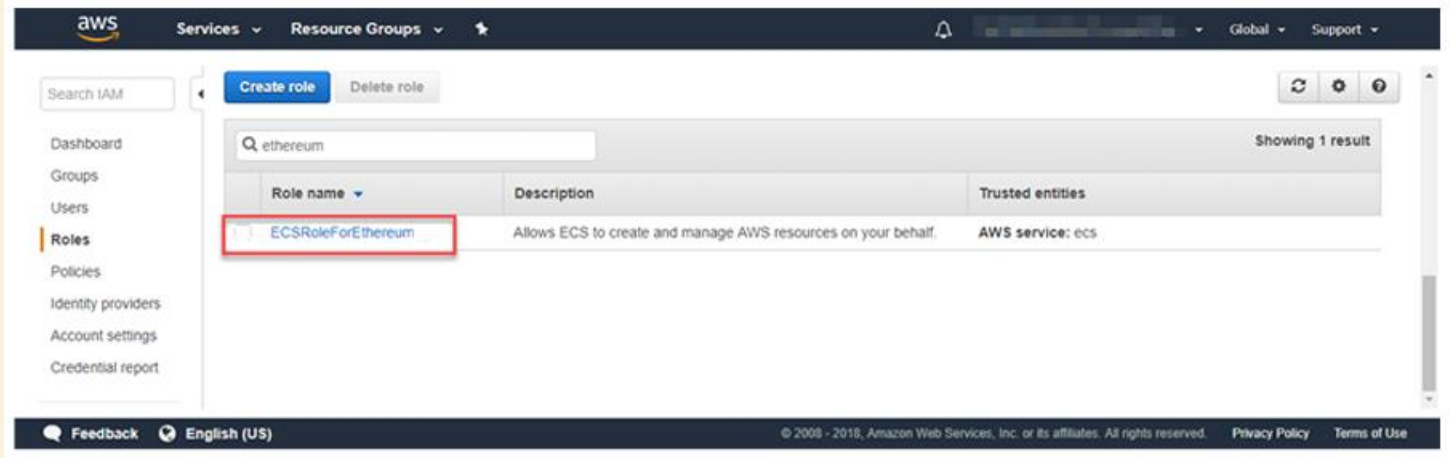
To create the IAM role for Amazon ECS

To create the IAM role for Amazon ECS

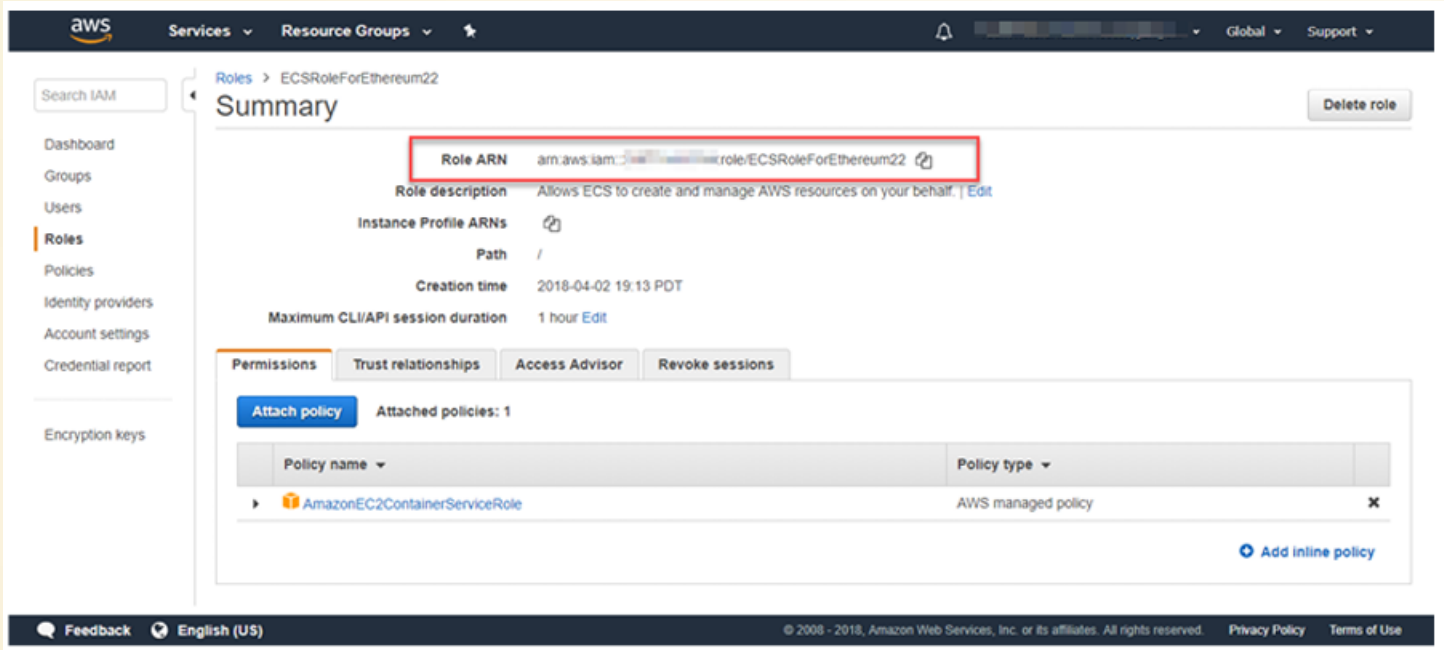
1. Open the IAM console at https://console.aws.amazon.com/iam/.
2. In the navigation pane, choose Roles, Create Role.
3. Under Select type of trusted entity, choose AWS service.
4. For Choose the service that will use this role, choose Elastic Container Service.
5. Under Select your use case, choose Elastic Container Service, Next: Permissions.
6. For Permissions policy, leave the default policy (AmazonEC2ContainerServiceRole) selected, and choose Next: Review.
7. For Role name, enter a value that helps you identify the role, such a ECSRoleForEthereum. For Role Description, enter a brief summary. Note the role name for later.
8. Choose Create role.
9. Select the role that you just created from the list. If your account has many roles, you can search for the role name.

To create the IAM role for Amazon ECS





Select the role that you just created from the list. If your account has many roles, you can search for the role name.

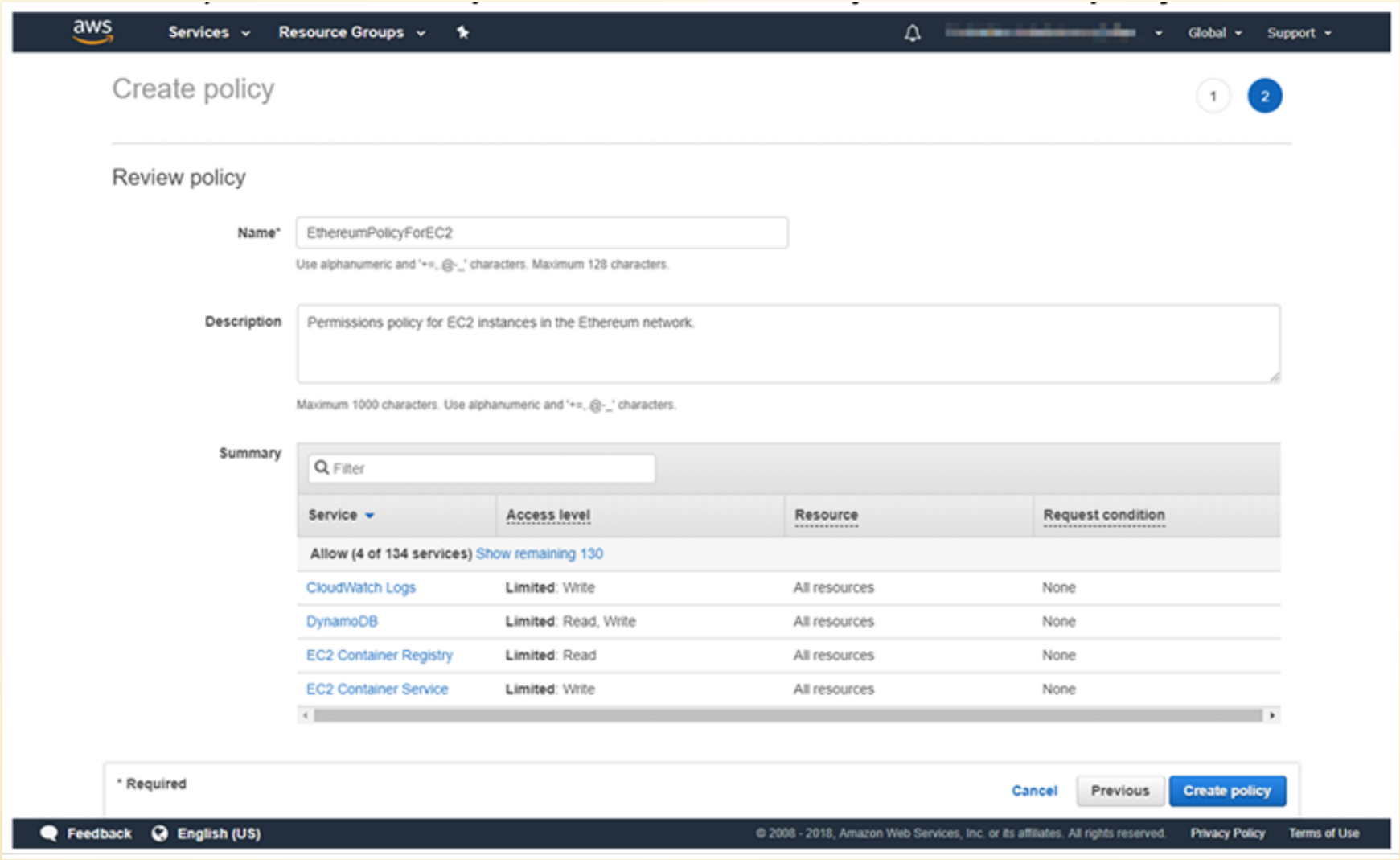


Select the role that you just created from the list. If your account has many roles, you can search for the role name.

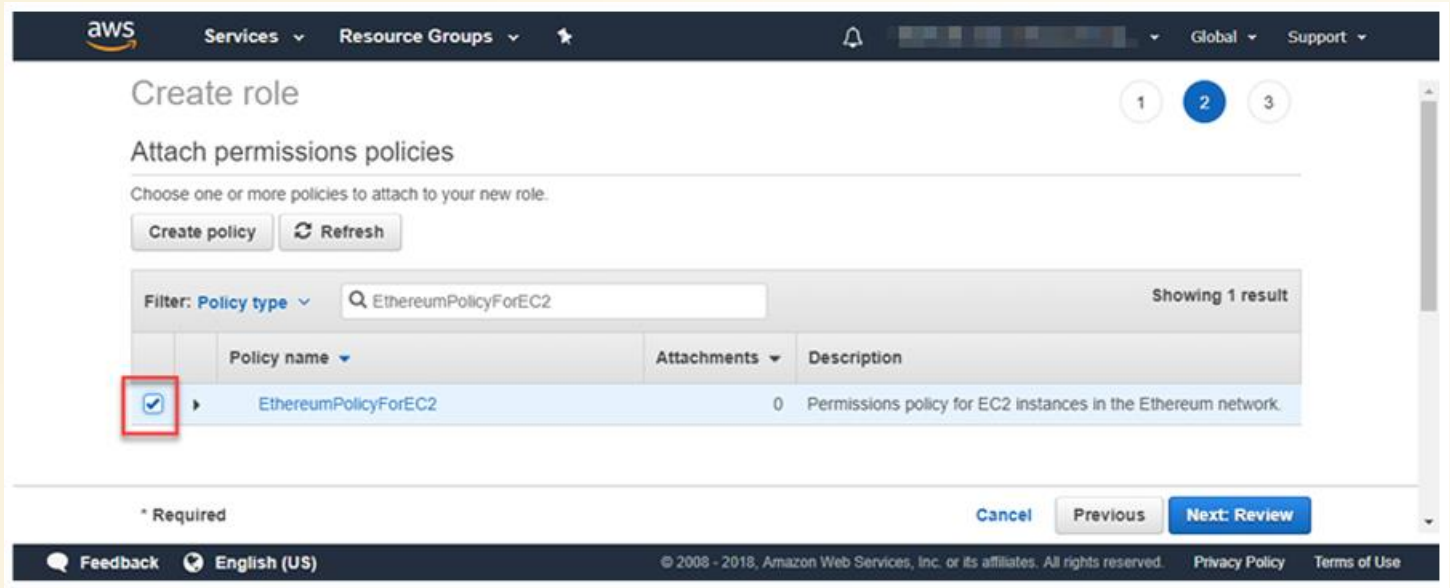
To create an EC2 instance profile

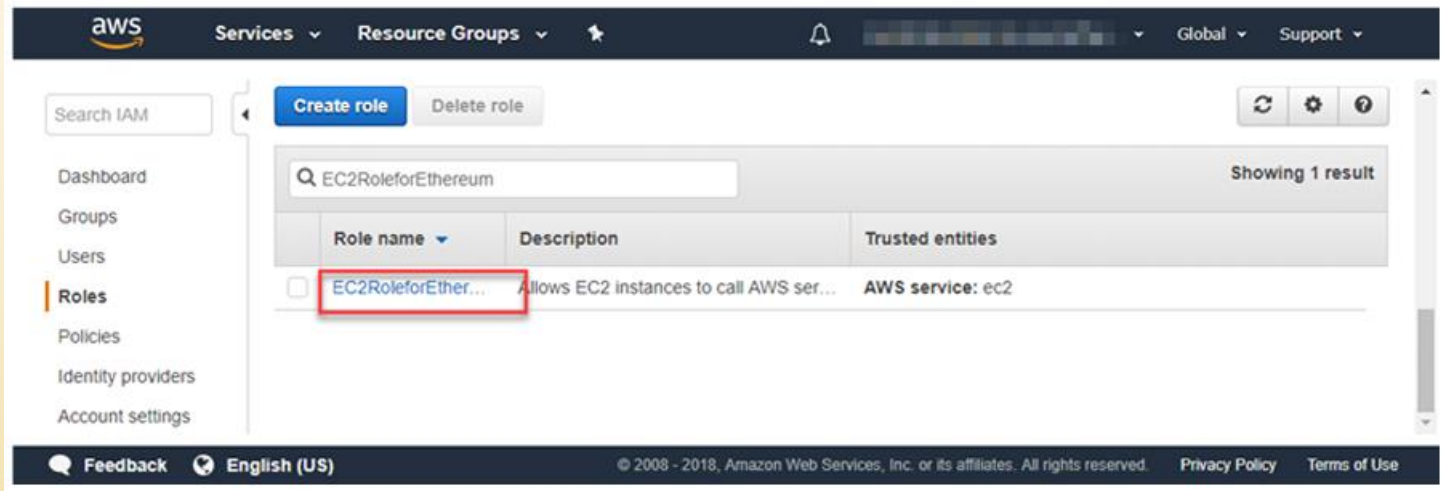
1. In the navigation pane, choose Policies, Create policy.
2. 2. Choose JSON and replace the default policy statement with the following JSON policy:

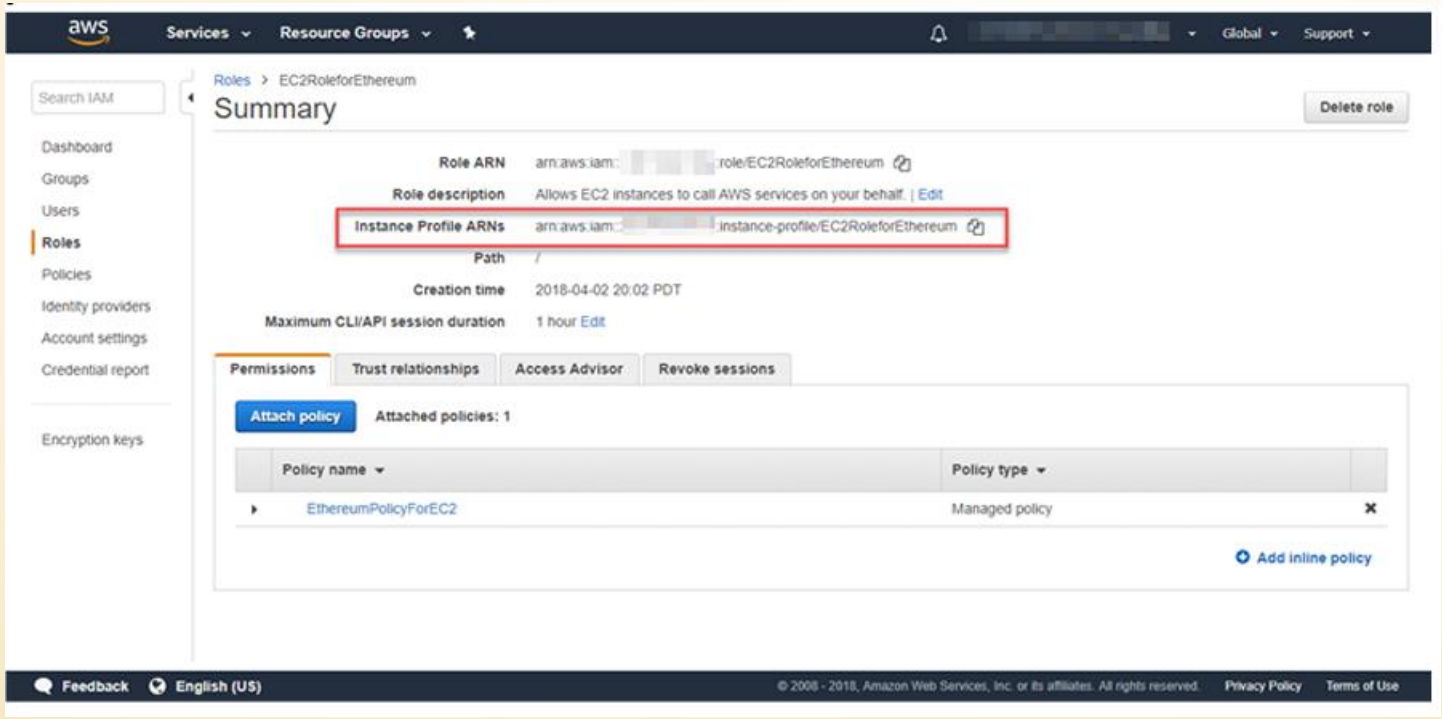
```
{    "Version": “Date",
"Statement": [
{
"Effect": "Allow",
"Action": [
"ecs:CreateCluster",
"ecs:DeregisterContainerInstance",
"ecs:DiscoverPollEndpoint",
"ecs:Poll",
"ecs:RegisterContainerInstance",
"ecs:StartTelemetrySession",
"ecs:Submit*",
"ecr:GetAuthorizationToken",
 "ecr:BatchCheckLayerAvailability",
"ecr:GetDownloadUrlForLayer",
"ecr:BatchGetImage",
"logs:CreateLogStream",
"logs:PutLogEvents",
"dynamodb:BatchGetItem",
"dynamodb:BatchWriteItem",
"dynamodb:PutItem",
"dynamodb:DeleteItem",
"dynamodb:GetItem",
"dynamodb:Scan",
"dynamodb:Query",
"dynamodb:UpdateItem"
],
"Resource": "*"
}    ]}
```



In the above process, choose Review policy.
For Name, enter a value that helps you identify this permissions policy, for example EthereumPolicyForEC2. For Description, enter a brief summary. Choose Create policy



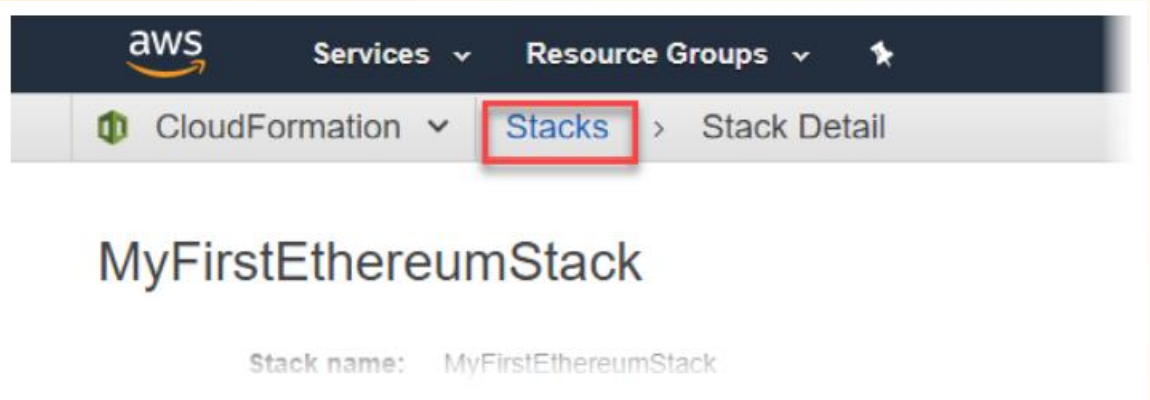




To Create a Bastion Host

1. Follow the first five steps to Launch an Instance in the Amazon EC2 User Guide for Linux Instances.
2. Choose Edit Instance Details. For Network, choose the VPC you created earlier, for Subnet select the second public subnet that you created earlier. Leave all other settings to their defaults.
3. Confirm the change when prompted, and then choose Review and Launch.
4. Choose Edit Security Groups. For Assign a security group, choose Select an existing security group.
5. From the list of security groups, select the security group for the Application Load Balancer that you created earlier, and then choose Review and Launch.
6. Choose Launch.
7. Note the instance ID. You need it later when you

Create the Ethereum Network

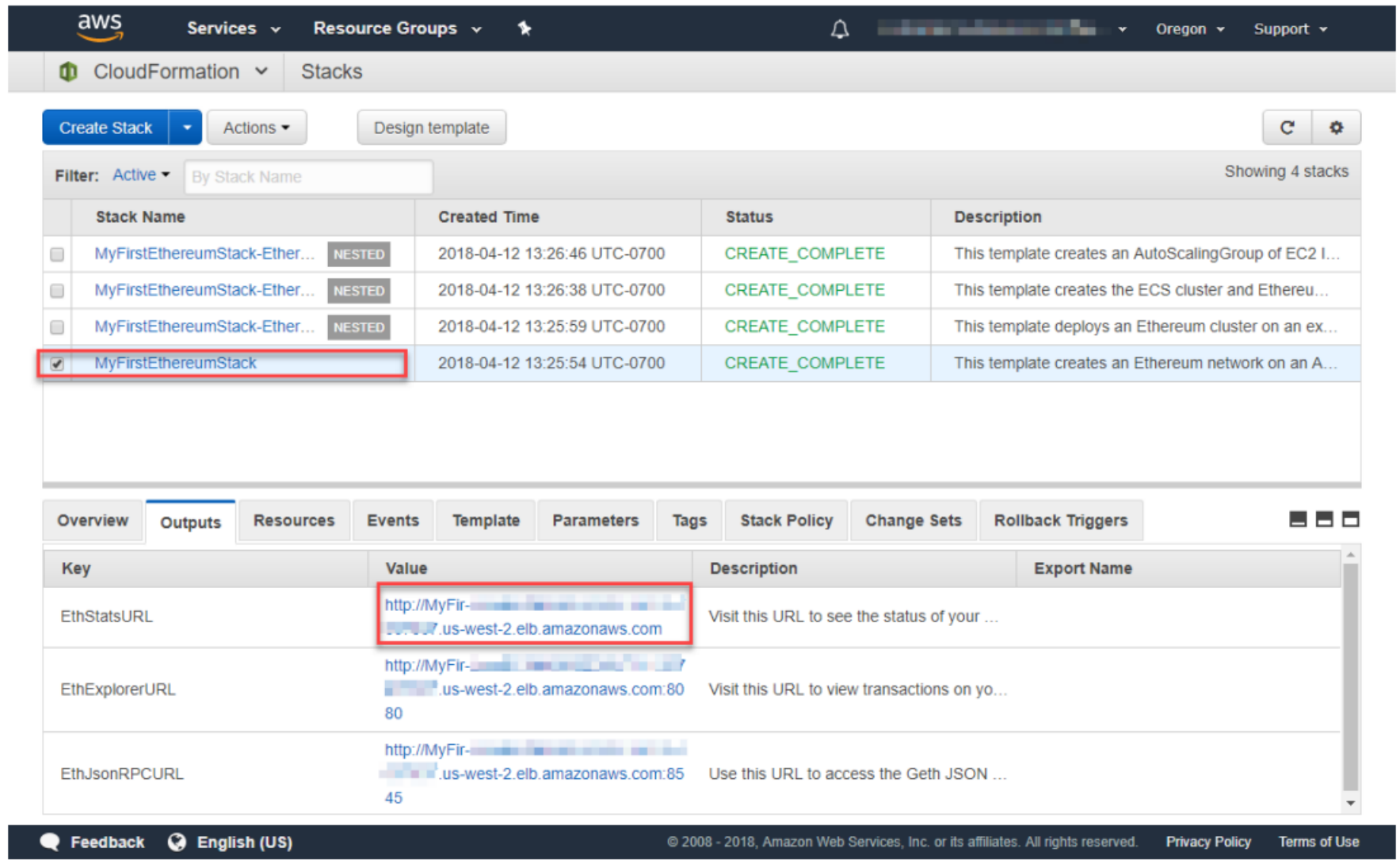


Cloud Formation: Stack

When all stacks show CREATE_COMPLETE for Status, you can connect to Ethereum user interfaces to verify that the network is running and accessible. When you use the ECS container platform, URLs for connecting to EthStats, EthExplorer, and EthJsonRPC through the Application Load Balancer are available on the Outputs tab of the root stack.

Important
You won't be able to connect directly to these URLs or SSH directly until you set up a proxy connection through the bastion host on your client computer

Cloud Formation: Stack



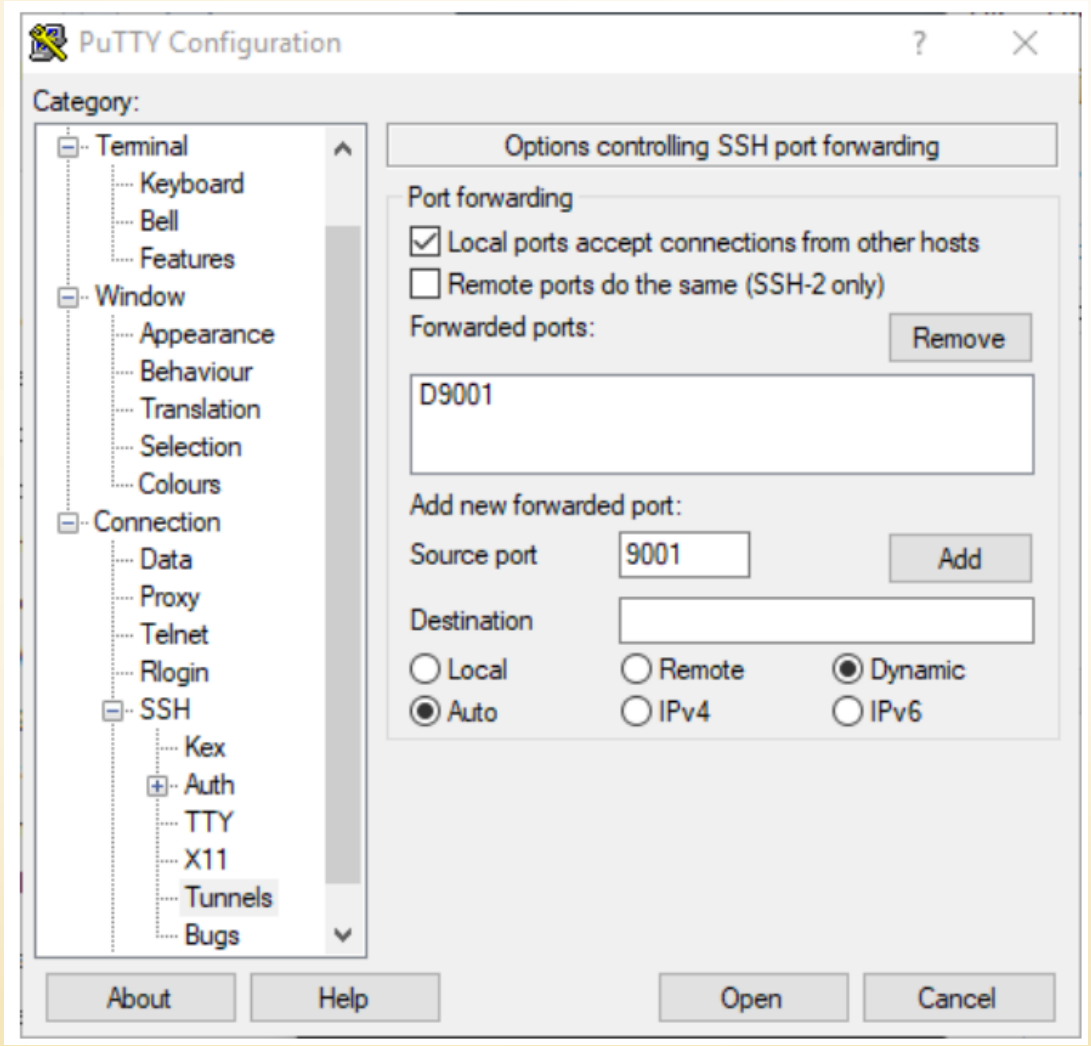
Connect to EthStats and EthExplorer Using the Bastion Host

To connect to the bastion host with SSH port forwarding using PuTTY (Windows)

1. Follow the procedures in Connecting to Your Linux Instance from Windows Using PuTTY in the Amazon EC2 User Guide for Linux Instances through step 7 of the Starting a PuTTY Session procedure, using the same key pair that you specified in the AWS Blockchain Template for Ethereum configuration.
2. In PuTTY, under Category, choose Connection, SSH, Tunnels.
3. For Port forwarding, choose Local ports accept connections from other hosts.
4. Under Add new forwarded port:
    a. For Source port, enter 9001. This is an arbitrary unused port that we chose, and you can choose a different one if necessary.
    b. Leave Destination blank.
    c. Select Dynamic.
    d. Choose Add.

To connect to the bastion host with SSH port forwarding using PuTTY (Windows)

Connect to EthStats and EthExplorer Using the Bastion Host



To connect to the bastion host with SSH port forwarding using PuTTY (Windows)

Connect to EthStats and EthExplorer Using the Bastion Host

Choose Open and then authenticate to the bastion host as required by your key configuration. Leave the connection open. With the PuTTY connection open, you now configure your system or a browser extension to use the forwarded port for your Ethereum network URLs.
The following instructions are based on using FoxyProxy Standard to forward connections based on the URL pattern of EthStats and EthExplorer and port 9001, which you established earlier as the forwarded port, but you can use any method that you prefer.

To configure FoxyProxy to use the SSH tunnel for Ethereum network URLs

This procedure was written based on Chrome. If you use another browser, translate the settings and sequence to the version of FoxyProxy for that browser.

1. Download and install the FoxyProxy Standard browser extension, and then open **Options** according to the instructions for your browser.
2. Choose **Add New Proxy**.
3. On the **General** tab, make sure that the proxy is **Enabled** and enter a **Proxy Name** and **Proxy Notes** that help you identify this proxy configuration.
4. On the **Proxy Details** tab, choose **Manual Proxy Configuration**. For **Host or IP Address** (or **Server or IP Address** in some versions), enter *localhost*. For **Port**, enter *9001*. Select **SOCKS Proxy?**.
5. On the **URL Pattern** tab, choose **Add New Pattern**.

Using the AWS Blockchain Template for Ethereum

Using the AWS Blockchain Template for Ethereum

- AWS Blockchain Templates helps you quickly create and deploy blockchain networks on AWS using different blockchain frameworks. Blockchain is a decentralized database technology that maintains a continually growing set of transactions and smart contracts hardened against tampering and revision using cryptography.
- A blockchain network is a peer-to-peer network that improves the efficiency and immutability of transactions for business processes like international payments, supply chain management, land registration, crowd funding, governance, financial transactions, and more. This allows people and organizations who may not know one another to trust and independently verify the transaction record.
- You use AWS Blockchain Templates to configure and launch AWS CloudFormation stacks to create blockchain networks

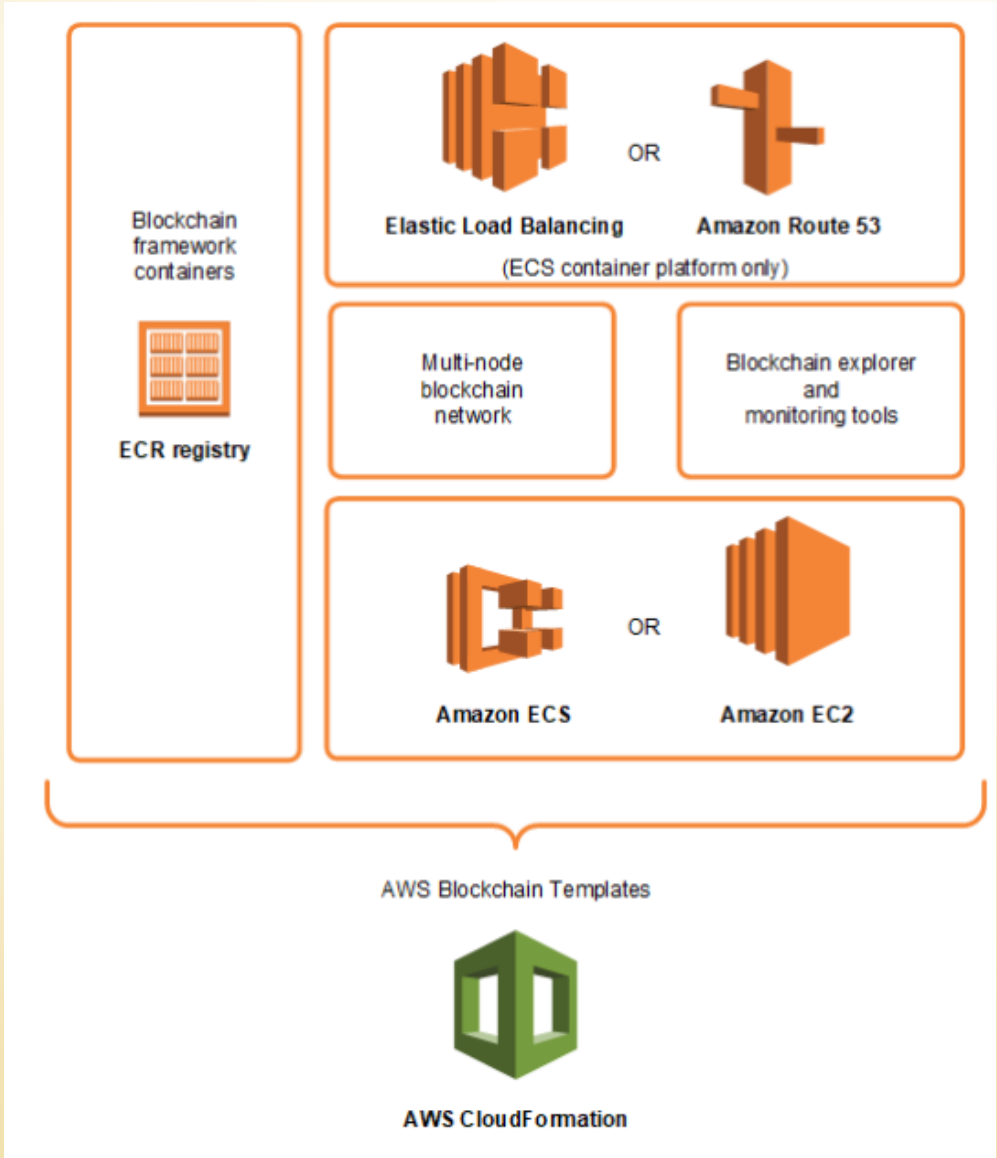
Using the AWS Blockchain Template for Ethereum

Requirements and Process:

- Choosing the Container Platform
- Choosing a Private or Public Ethereum Network
- Changing the Default Accounts and Mnemonic Phrase

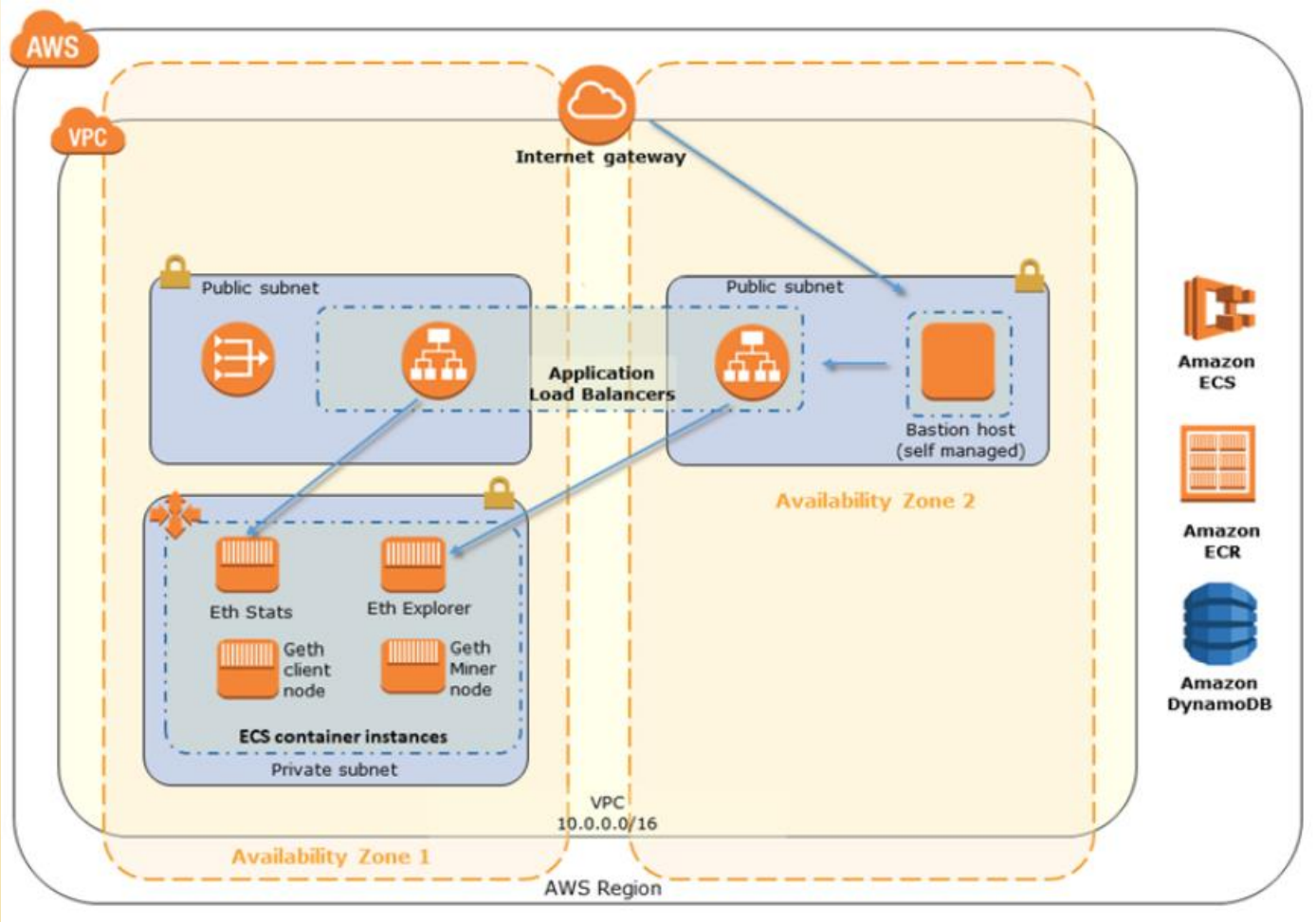
Using the AWS Blockchain Template for Ethereum

The fundamental components of a blockchain network on AWS created using AWS Blockchain Templates are shown in the following diagram.



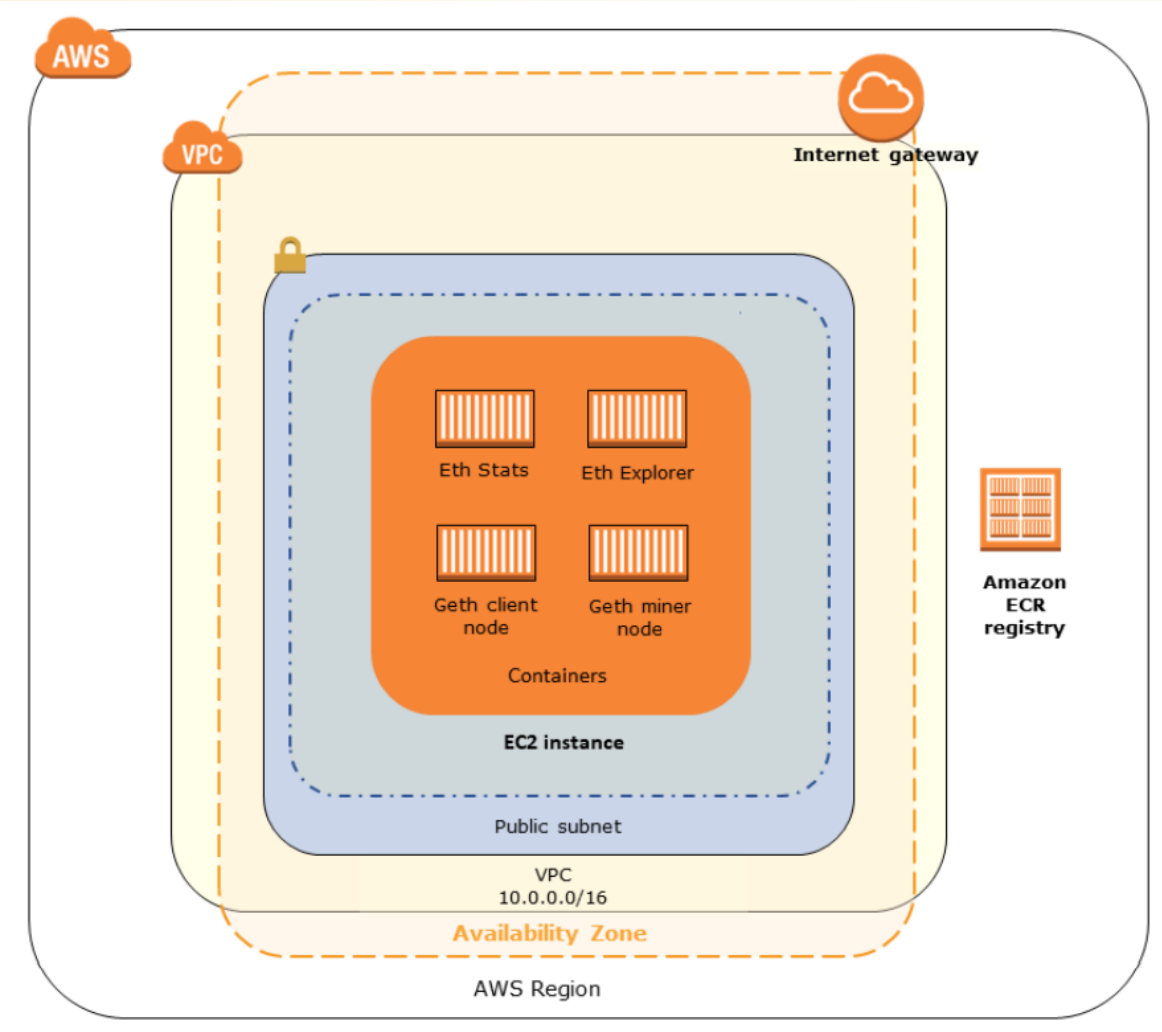
Choosing the Container Platform

Using the Amazon ECS Container Platform

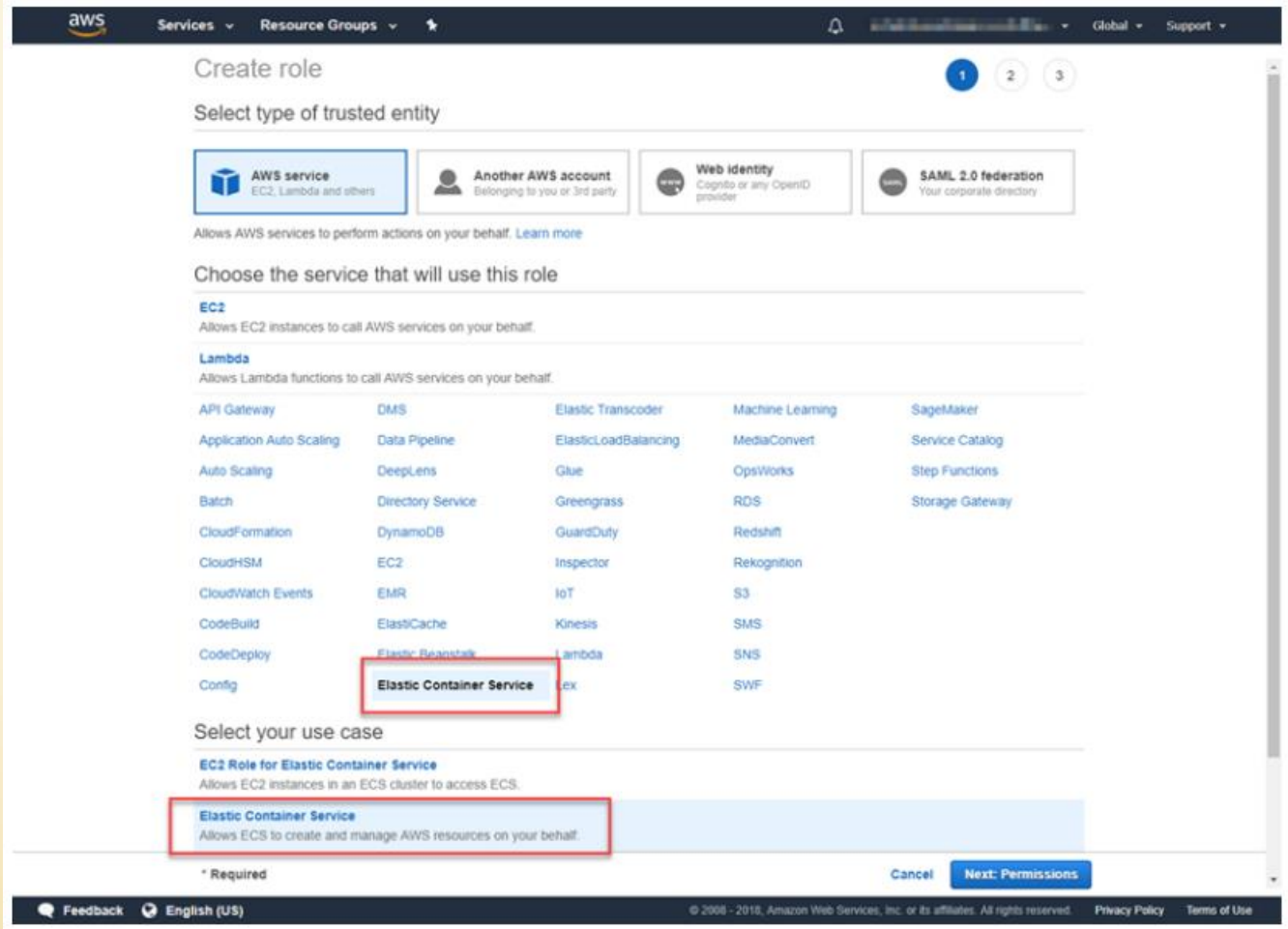


Choosing the Container Platform

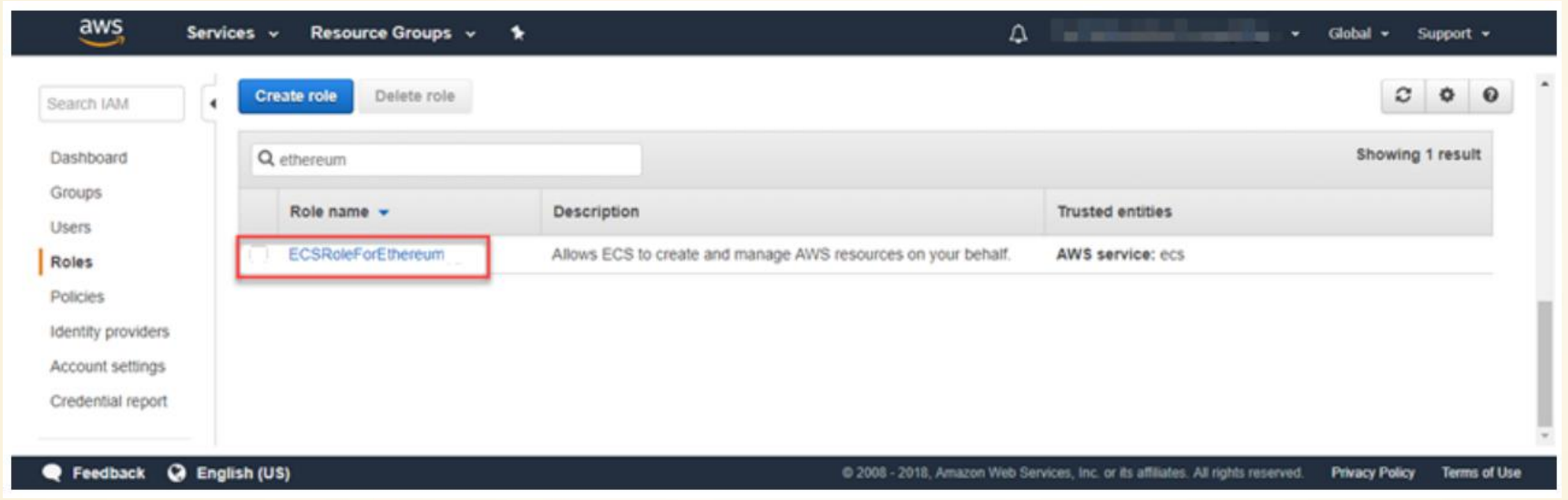
Using the Docker-Local Platform

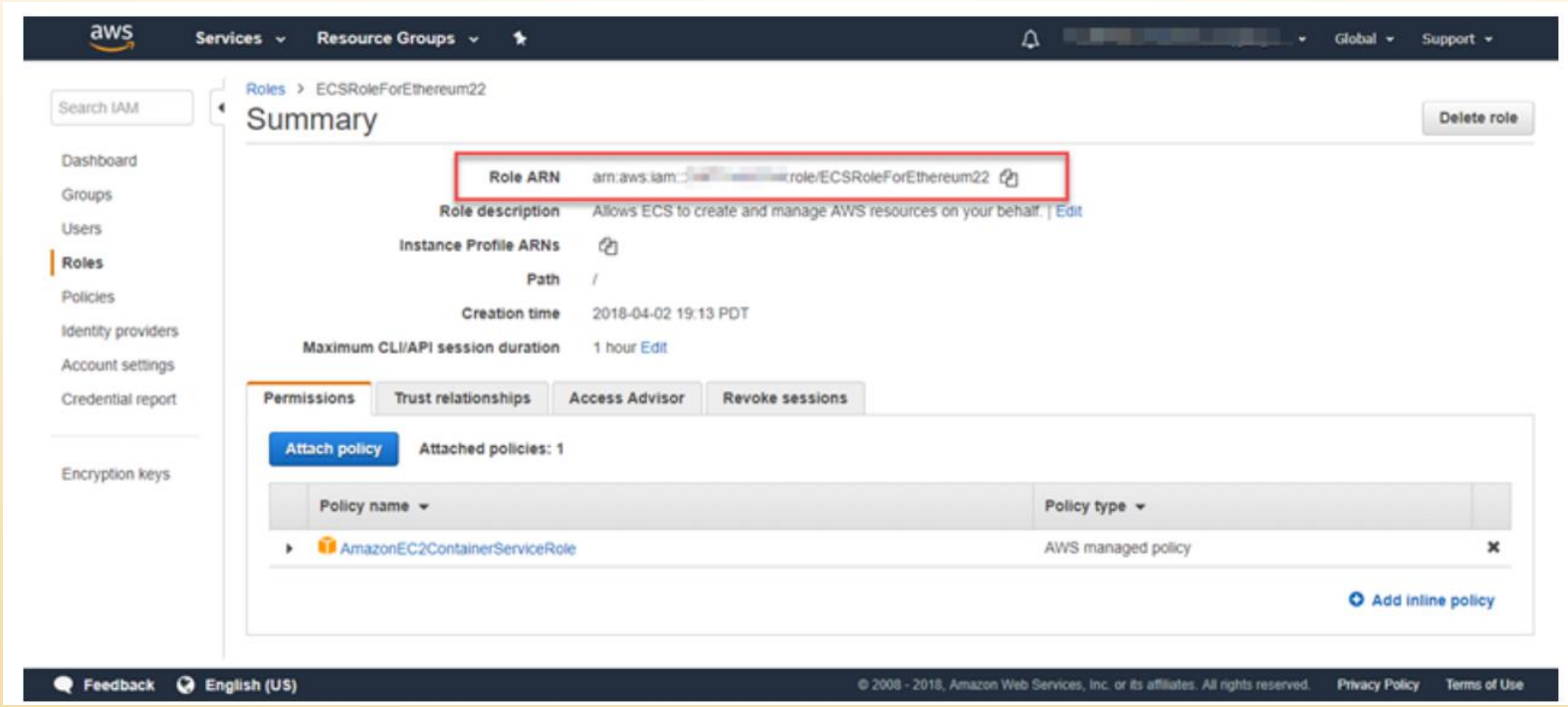


Creating the ECS Role and Permissions



Create Role and ARN





Ethereum Blockchain

Solidity is a contract-oriented, high-level language for implementing smart contracts. It was influenced by C++, Python and JavaScript and is designed to target the Ethereum Virtual Machine (EVM).

Ethereum Blockchain

Blockchain technologies consist of three main components:

1. An immutable ledger database
2. A consensus mechanism
3. A smart-contract execution environment.

Every member in a blockchain network owns a copy of the ledger database, allowing the transaction history to be independently verifiable.
The ledger database contains two components: a journal that holds the cryptographically immutable history of all transactions and the world state that shows the current state of the data derived from these transactions.

Ethereum Blockchain Network on AWS

Scenario: Deploy smart contracts to your private Ethereum blockchain network on AWS

Building Steps: Ethereum Blockchain Network on AWS

Step 1 & 2
- Deploy the CloudFormation template
- Review the genesis block

Step 3 & 4
- Create a static node mapping
- Initialize the Ethereum client

Step 5 & 6
- Start geth
- Interact with your network by using the Ethereum Wallet app

Step 7 & 8
- Add an account
- Start mining

Step 9 & 10
- See the accounts that you have registered
- Start mining with two threads

Step 11
- Create, deploy, and test your smart contract

AWS Blockchain Templates

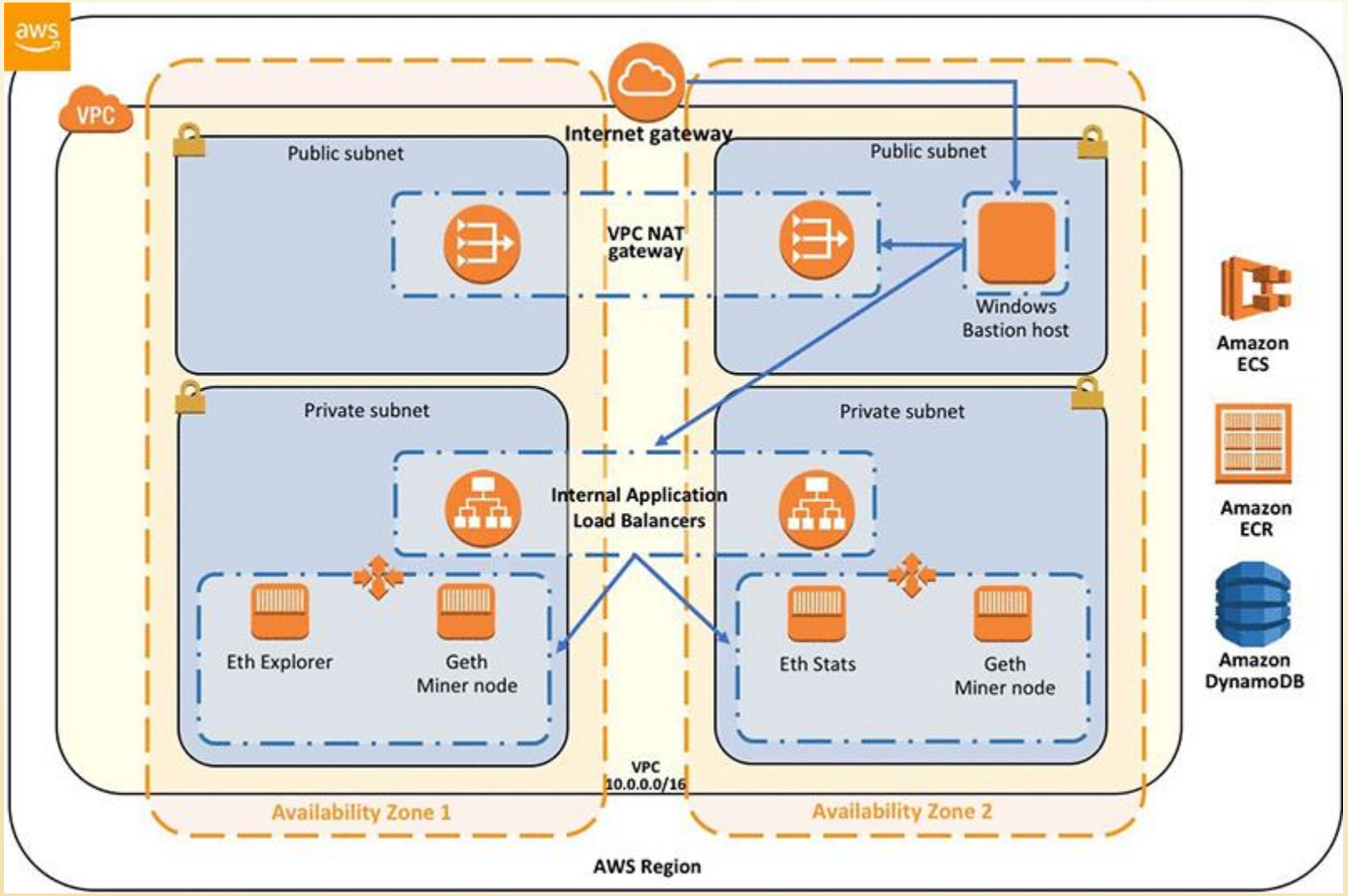
- AWS Blockchain Templates provide a fast and easy way to create and deploy blockchain networks using popular open-source frameworks.
- Components required in the building Blockchain Template are as below:
- Ethereum Network Status – a web-based application to monitor the health of your Ethereum network.
- Ethereum Explorer – a block explorer for Ethereum.
- Ethereum JSON-RPC – a stateless, lightweight remote procedure call (RPC) protocol.

Prerequisites: Building Ethereum blockchain

Below topic knowledge is required on:

1. AWS Blockchain Templates
2. Ethereum
3. Solidity
4. Smart contracts.

AWS Blockchain Templates with a Windows Bastion Host.



Step 1: Deploy the CloudFormation template

To start, deploy the CloudFormation template from below Link: Click Here

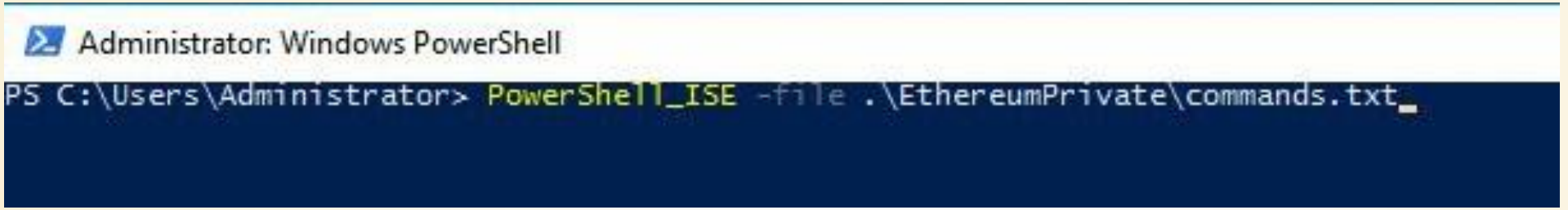
- This template which installs a Private Ethereum Blockchain network with preconfigured defaults and associated software for you to use for further implementation process.
- After the templates are deployed, log in to your Windows Bastion Host by using Remote Desktop Protocol (RDP).

The Windows Bastion Host has two client tools preinstalled that we use to connect to the blockchain:

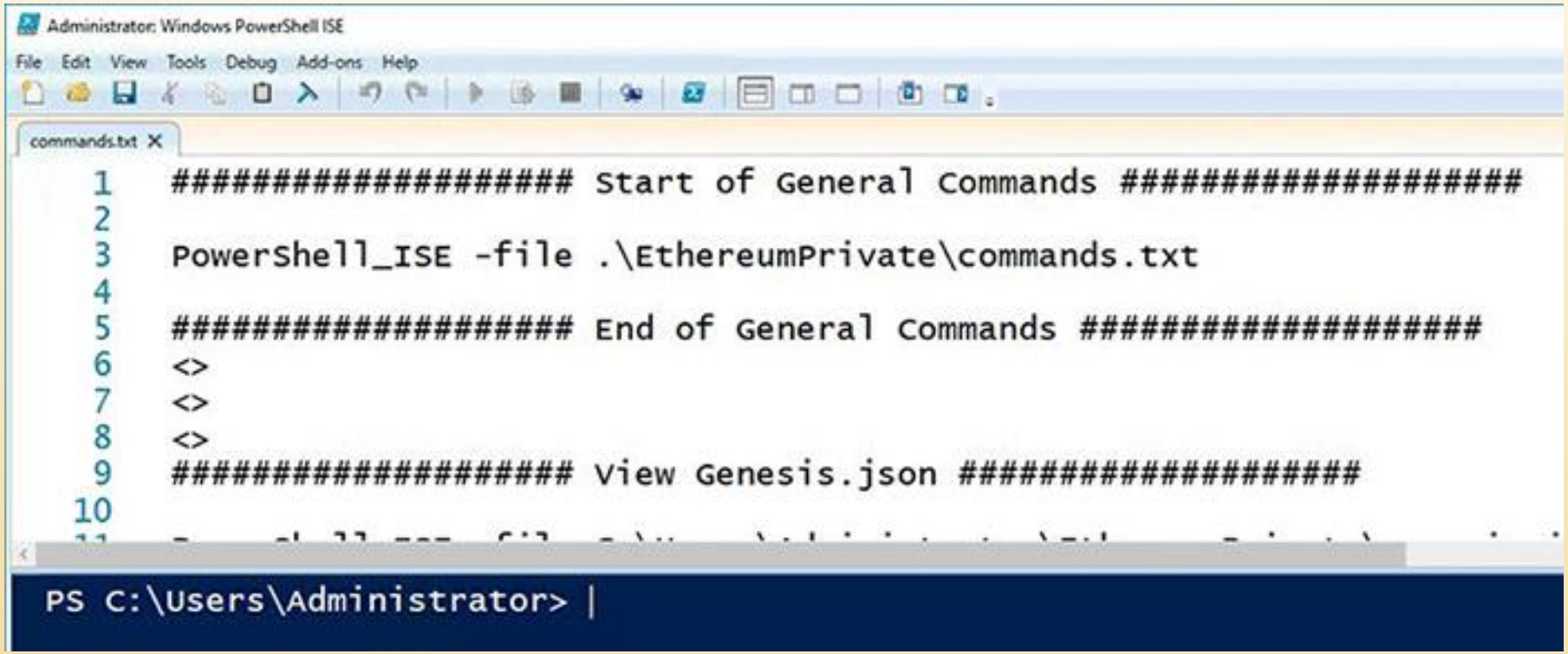
1. **Ethereum Wallet** – the Ethereum GUI that enables you to hold and secure ether and other cryptoassets built on Ethereum, and also write, deploy, and use smart contracts.
2. **geth** – the command line interface for running a full Ethereum node implemented in Go. You can launch geth with an interactive console that provides a JavaScript runtime environment, exposing a JavaScript API to interact with your node.

Step 1: Deploy the CloudFormation template (Cont.)

Running commands



Accessing your commands.txt file.



Step 2: Review the genesis block

Every blockchain starts with the genesis block. When you run **geth** with default settings for the first time, the main net genesis block is committed to the database. For a private network, you usually want a different genesis block.

- A folder called C:\Users\Administrator\EthereumPrivate has been created to store your private blockchain files. Inside this folder is a file called genesis.json.
- This file is used to create a genesis block that is compatible with the private network you've built using the AWS Blockchain Templates.
- Doing this enables you to synchronize your node with the private network hosted on Amazon ECS.

Open the file and review its contents. It should look similar to the following.

```
{
"config":{
"chainId":1234,
"homesteadBlock":0,
"eip155Block":0,
"eip158Block":0},
"nonce":"0x0000000000000001",
"mixhash":"0x0000000000000000000000000000000000000000000000000000000000000000",
"difficulty":"0x1",
"coinbase":"0x0000000000000000000000000000000000000000",
"timestamp":"0x00",
"parentHash":"0x0000000000000000000000000000000000000000000000000000000000000000",
"gasLimit":"0x7a1200",

"alloc":{
"0x0ADfCCa4B2a1132F82488546AcA086D7E24EA324":
{"balance":"10000000000000000000"},

"0x0bd5EebDC3E53973dDF236D43906C776a5fE3784":
{"balance":"10000000000000000000"},

"0x9537cb86f5a03C8CCB52c44b49757861eCA0004b":
{"balance":"10000000000000000000"},

"0x1Fbc353788338F902630E5494aD7FaC7dF8dBb29":
{"balance":"10000000000000000000"},

"0x5ccBe3B9B15eFB62bB2696051091Ee7C1Eb4c7E6":
{"balance":"10000000000000000000"}

}
}
```

Step 3: Create a Static Node Mapping

A static node mapping tells your node what other nodes to communicate with in the network. A file for doing this has already been created for you, but you still need to edit it.

1. In our setup, we set the static nodes as the ones currently running as tasks in Amazon ECS. Doing this allows your local node to participate in the same network as the one hosted on AWS.

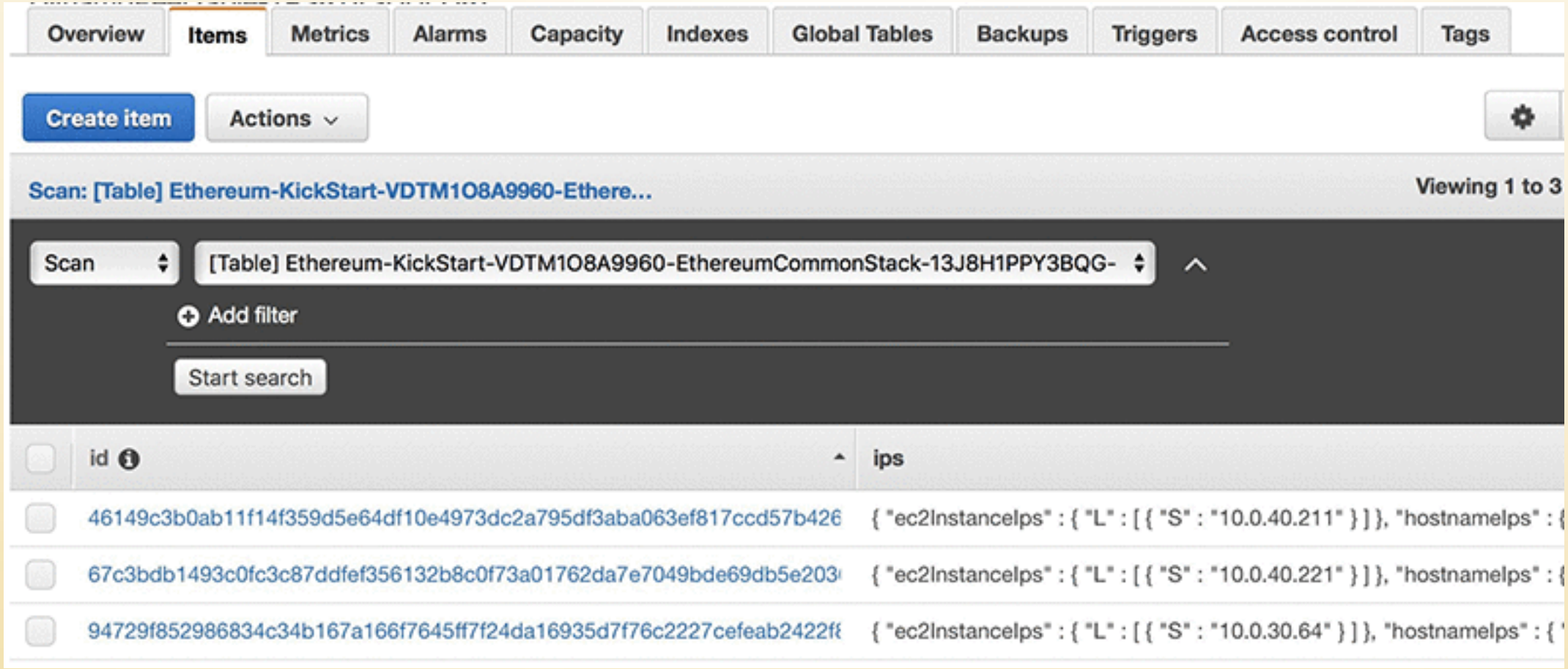
2. Browse to the following file directory on your Windows Bastion Server:

3. C:\Users\Administrator\EthereumPrivate\geth\

4. Now open the file called static-nodes.json in this directory and populate it with the following node information from your Amazon DynamoDB table.

Step 3: Create a Static Node Mapping (Cont.)

The following screenshot shows an Ethereum node and IP information.



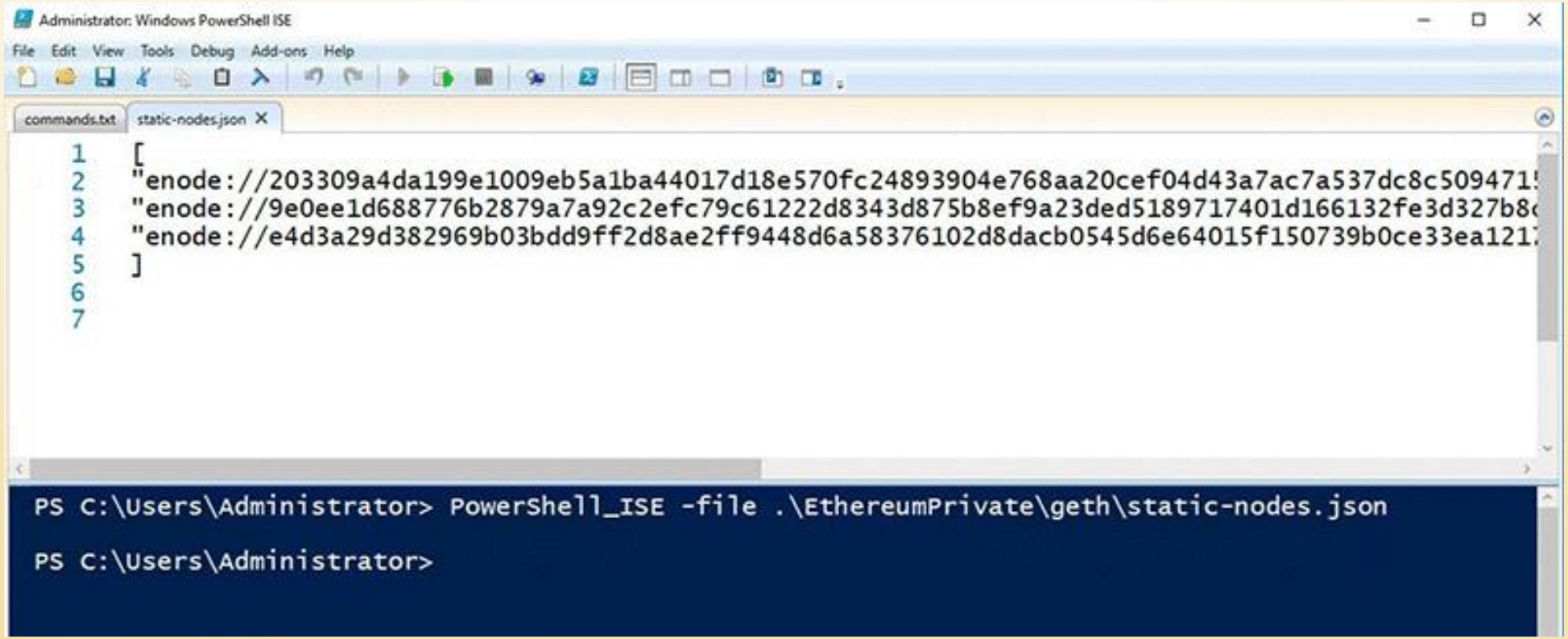

```
[
"enode://<id>@<ip address>:30303",
"enode://<id>@<ip address>:30303",
"enode://<id>@<ip address>:30303"
]
```

Step 3: Create a Static Node Mapping (Cont.)

We assume that you are still logging in to Windows with your Administrator account. As a best practice, we recommend that you set up an alternate non-Administrator user after you are familiar with the steps outlined in this blog post.

To edit the file static-nodes.json, run the following PowerShell command:

PowerShell_ISE -file .\EthereumPrivate\geth\static-nodes.json



Step 3: Create a Static Node Mapping (Cont.)

As part of the CloudFormation stack deployment, you look up your enode ID and accompanying IP address in the DynamoDB table created. In addition, make the necessary changes to your static-node.json file. Remember to save your changes before closing the file.

You should now have a file with corresponding configuration information relevant to your environment. Your file is located here:

C:\Users\Administrator\EthereumPrivate\geth\static-nodes.json

Note: Don't use the configuration file following, which we provide only as an example.

An example static-nodes.json file is shown following.

```
[
"enode://18c1c4869d9e54b75ce968c1726b4ada18732ab5b577c2d0a35d85384e03def3e61a948dd0a1ba968d675c849
"enode://681867148e14ee9c6f1fb839e9f0674651e3e27eb1f1e15d3b2ae7e3de1640e6af3441cc06ea686db7f75b07a
"enode://8ac49be3a5da121ca7dffd74e613a2d490771d0328da05f8c686192d6dbf8f9055e935101498451a48c13d7e
]
```

Step 4: Initialize the Ethereum client

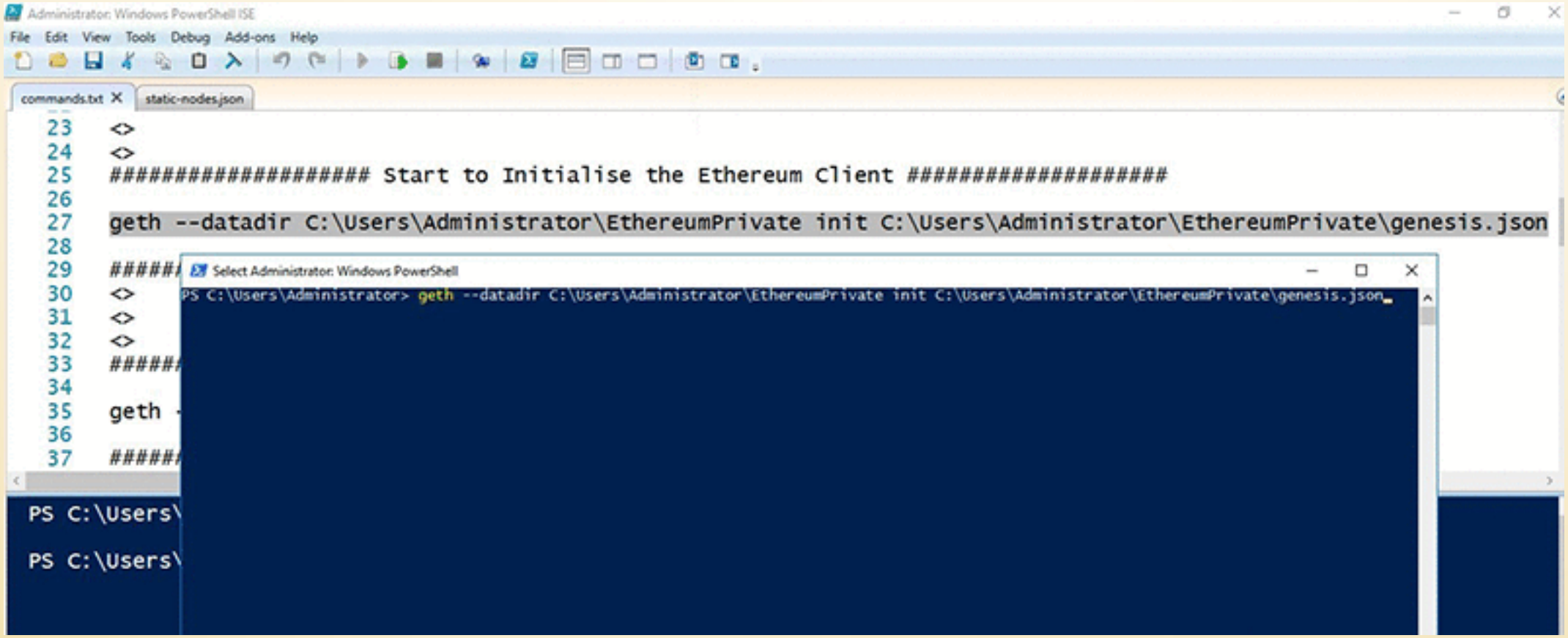
Now with your genesis.json and static-nodes.json files in place, it's time to initialize the Ethereum client.

First, you need to initialize your geth client to use the genesis block defined in genesis.json. To do so, open PowerShell and run the following command:

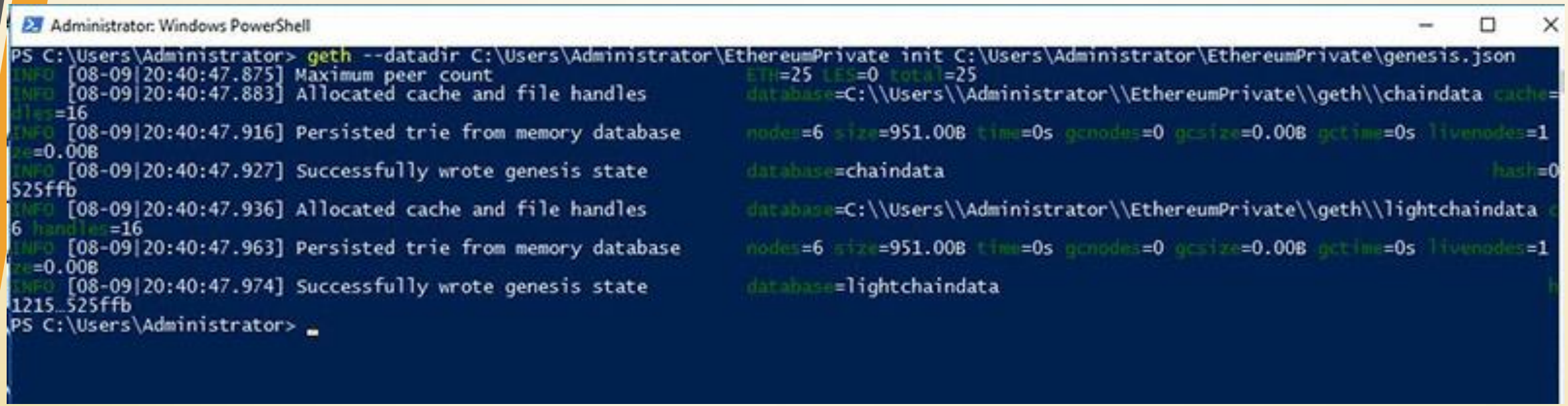
```
geth --datadir C:\Users\Administrator\EthereumPrivate init C:\Users\Administrator\EthereumPrivate\
```

Note: Don't run geth commands within PowerShell_ISE but only within your standard PowerShell interface.

Step 4: Initialize the Ethereum client (Cont.)



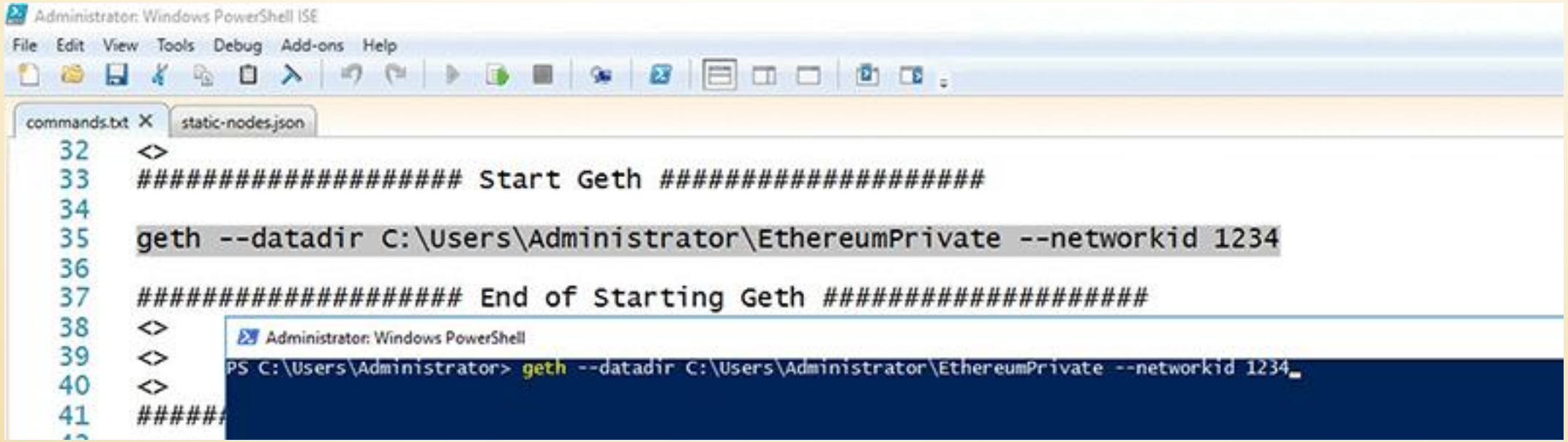
Step 4: Initialize the Ethereum client (Cont.)



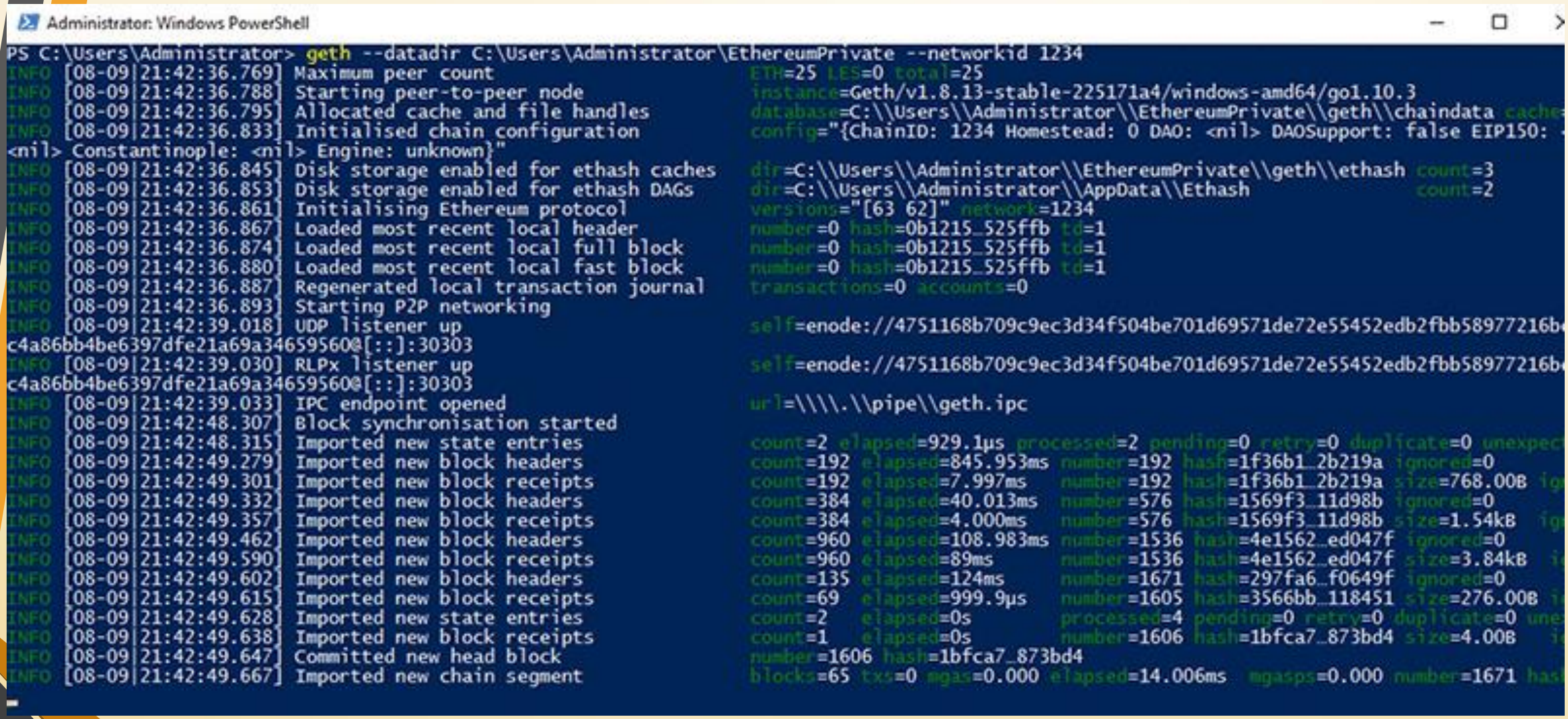
Step 5: Start geth

Now your genesis block and peer nodes are configured. It's time to start the Ethereum client and configure it to communicate with your private network. You do so by running the following command.

geth --datadir C:\Users\Administrator\EthereumPrivate —networkid 1234
Note: Don't run geth commands within PowerShell_ISE but only within your standard PowerShell interface.



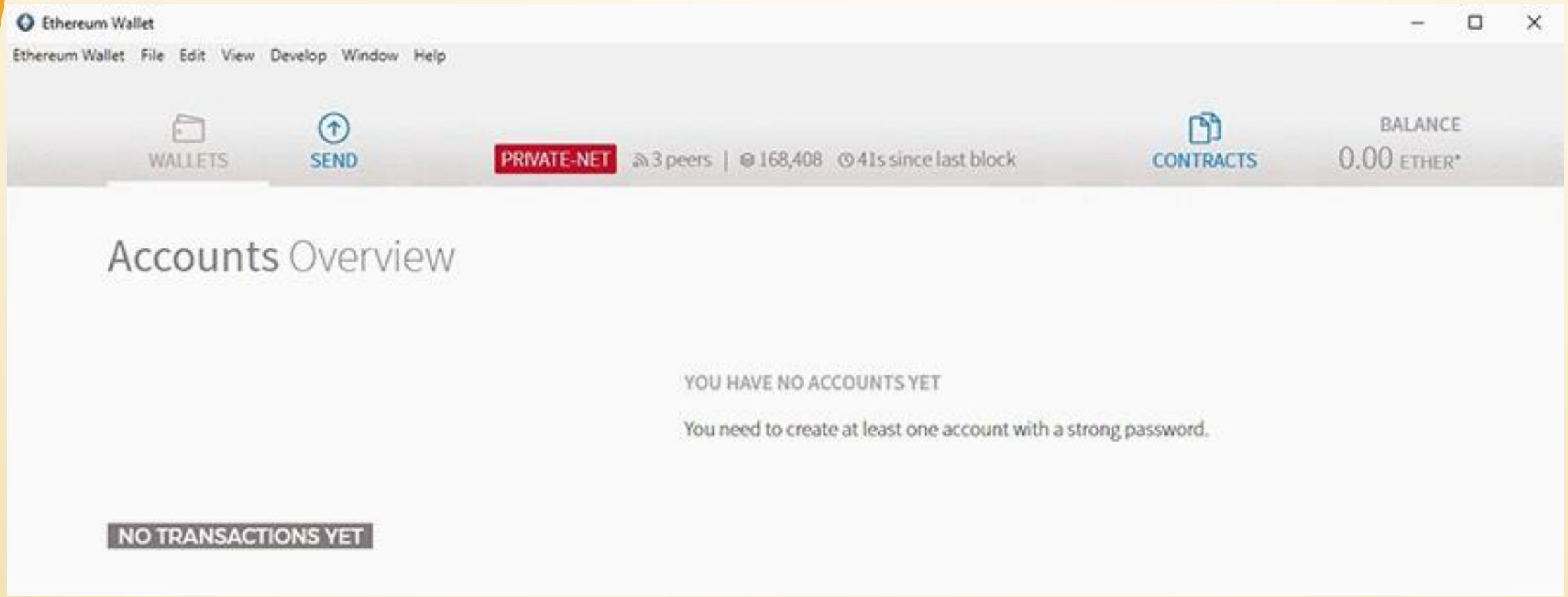
Step 5: Start geth (Cont.)



Step 6: Interact with your network by using the Ethereum Wallet app

- To interact with your network, you start by opening the Ethereum Wallet app.
- A wallet is where you can store your keys and associated ether, contracts, and tokens. Your assets are not actually stored on your machine but rather on the blockchain.
- Your public key can have assets assigned to it. Your private key is used to sign transactions that enable you to create and interact with contracts and send assets to others.
- You should see an Ethereum Wallet icon on the desktop. Double-click this icon to open the app. Doing so connects to your private Ethereum network, and you see a screen like the following.

Step 6: Interact with your network by using the Ethereum Wallet app

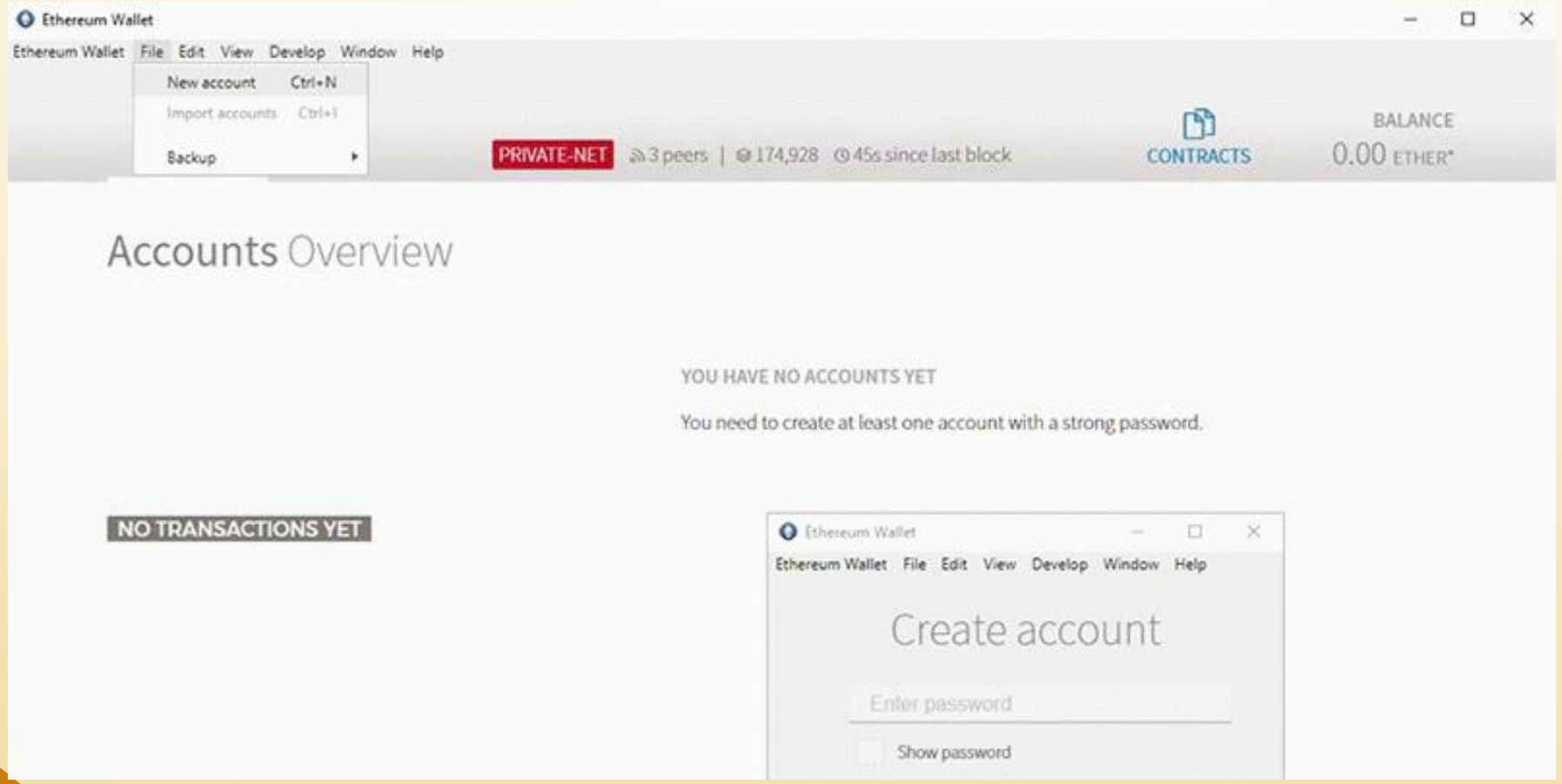


Private-Net indicates that you're using a nonpublic network ID such as 1234.

Step 7: Add an account

- To start testing transactions and smart contracts, you add an account. Accounts are password-protected keys that can hold ether, secure ethereum-based tokens or coins, and control contracts.

- In the Ethereum Wallet, go to File, New Account, enter a password, and press Enter. Confirm your password, and press Enter. You have now created an account.



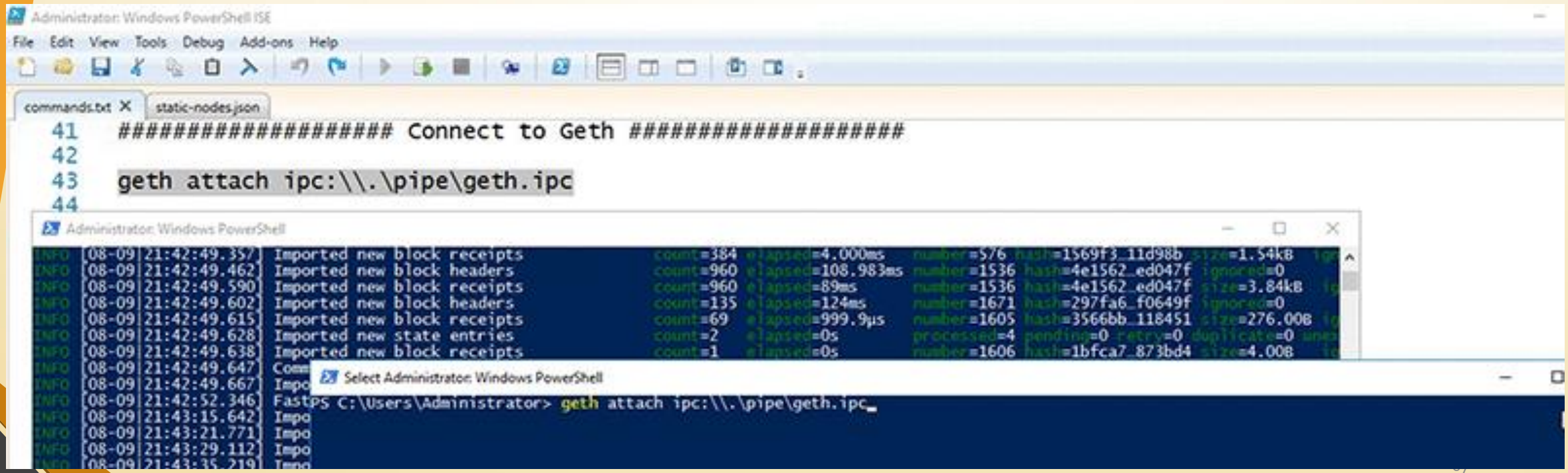
Step 8: Start Mining

Mining is the process of confirming blocks to the network by solving a mathematical problem.

- With proof of work, the aim is to take the combination of the previous block hash, timestamp, and transactions, and a nonce value to produce a hash with a certain number of leading zeros.
- All members of the network have the first three variables, so it's essentially a race to find the nonce value that produces the desired result.
- The first node to find the answer broadcasts it to the network for confirmation. After the other nodes have verified the answer, the block is committed and ether is rewarded to the miner.
- Mining on the public Ethereum network is a complex task because it's only feasible using GPUs, requiring an OpenCL or CUDA enabled ethminer instance.
- In a private network setting, however, a single CPU miner instance is more than enough for practical purposes.
- A single instance can produce a stable stream of blocks at the correct intervals without needing heavy resources.

Step 8: Start Mining (Cont.)

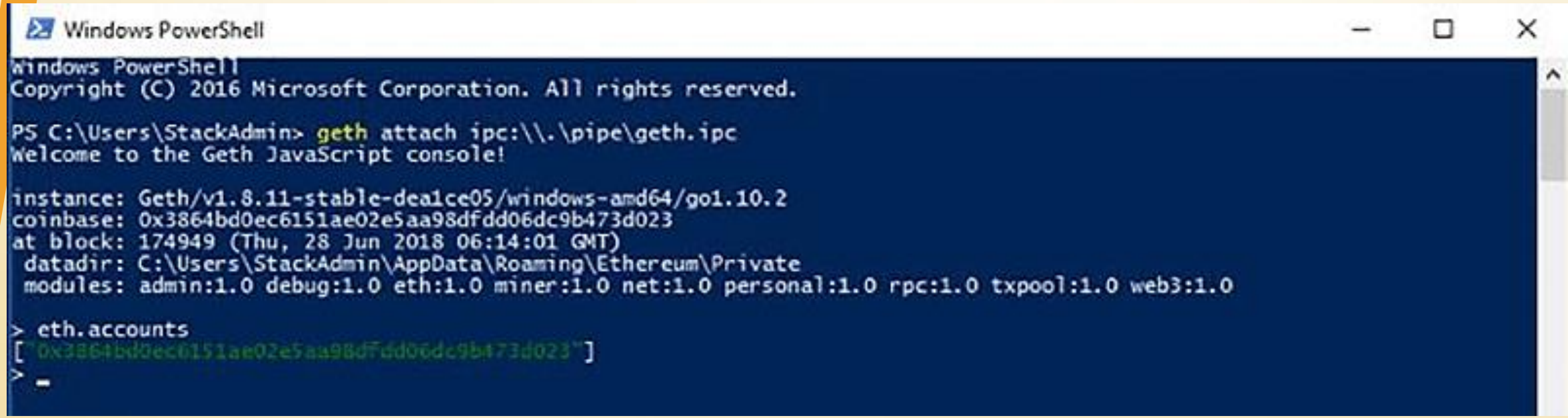
You need to start mining some ether so you have funds available for transactions such as creating smart contracts.
To do this, you need to open another PowerShell window and attach to the geth instance with geth attach **ipc:\\.\pipe\geth.ipc so you can run commands.**



Step 9: See the accounts that you have registered

Type eth.accounts to see the accounts that you have registered.

You should see the same account you just created in Ethereum Wallet.

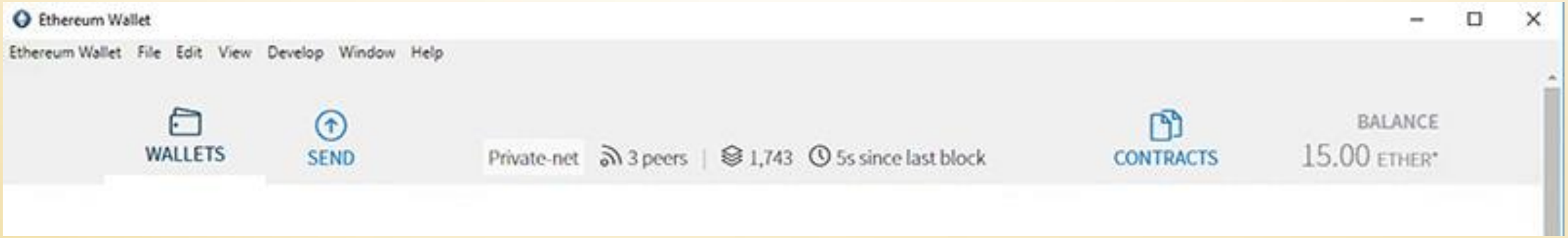


Step 10: Start mining with two threads

Type miner.start(2) to start mining with two threads.

```
at block: 1733 (Thu, 09 Aug 2018 21:51:13 AEST)
 datadir: C:\Users\Administrator\EthereumPrivate
 modules: admin:1.0 debug:1.0 eth:1.0 miner:1.0 net:1.0 personal:1.0 rpc:1.0 txpool:1.0 web3:1.0

> miner.start(2)
```

You should now see your account within the Ethereum wallet start accumulating ether from the mining activities.



Step 11: Create, deploy, and test your smart contract

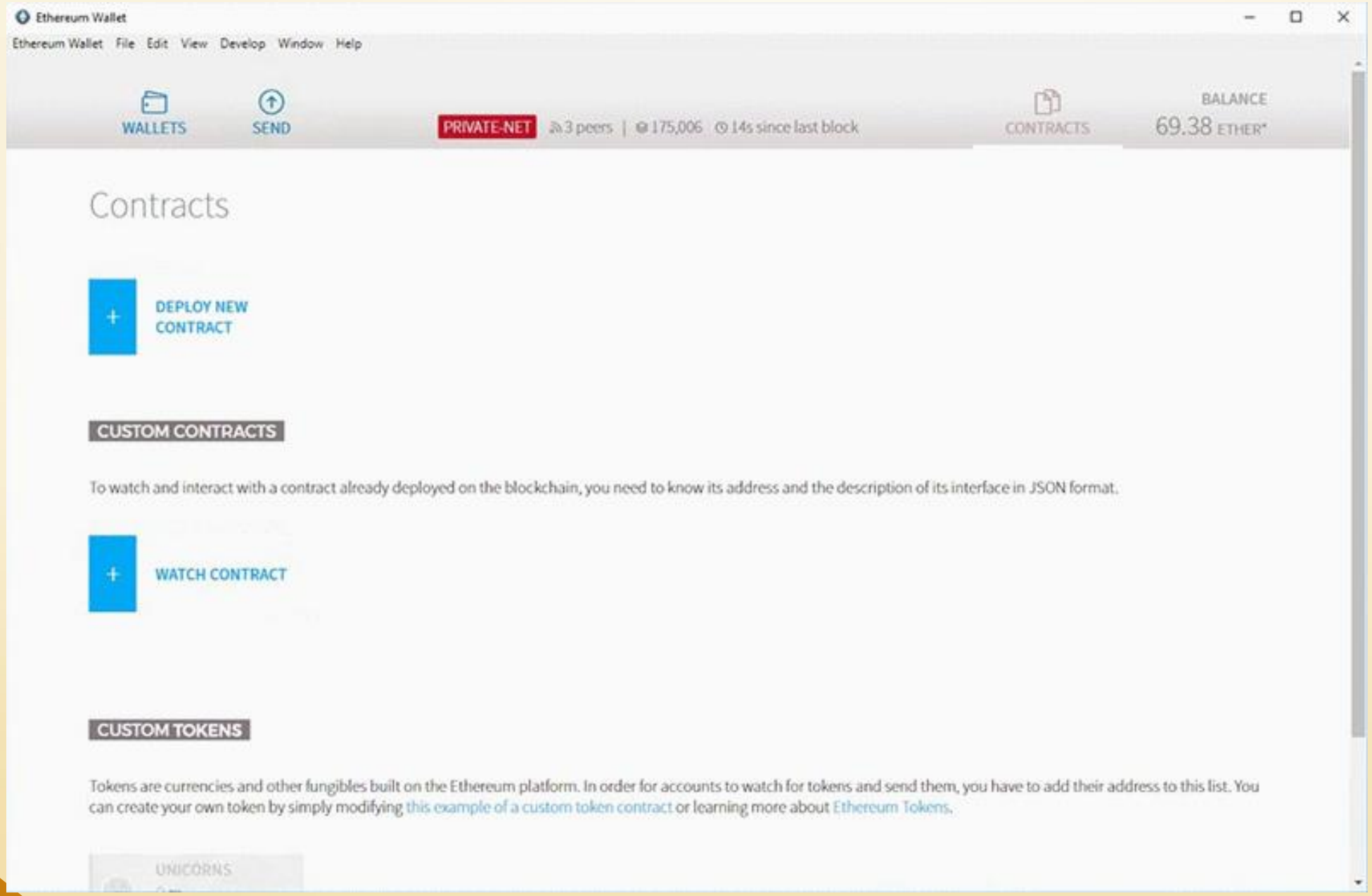
As a next step, create a smart contract.

Tokens in the Ethereum ecosystem can represent any fungible tradable good: coins, loyalty points, gold certificates, IOUs, in-game items, and so on. All tokens implement some basic features in a standard way. Because of this, your token is instantly compatible with the Ethereum wallet and any other client or contract that uses the same standards.

We're now going to build a basic contract that deploys a token or coin. For a bit of fun, I'm going to create my own basic currency called MattCoin. Feel free to modify the name from MattCoin to whatever makes sense for you. You can have a bit of fun and tell your friends you now have your own cryptocurrency too!

To deploy this contract, click CONTRACTS in the Ethereum Wallet, then select DEPLOY NEW CONTRACT.

Step 11: Create, deploy, and test your smart contract (Cont.)



Step 11: Create, deploy, and test your smart contract (Cont.)

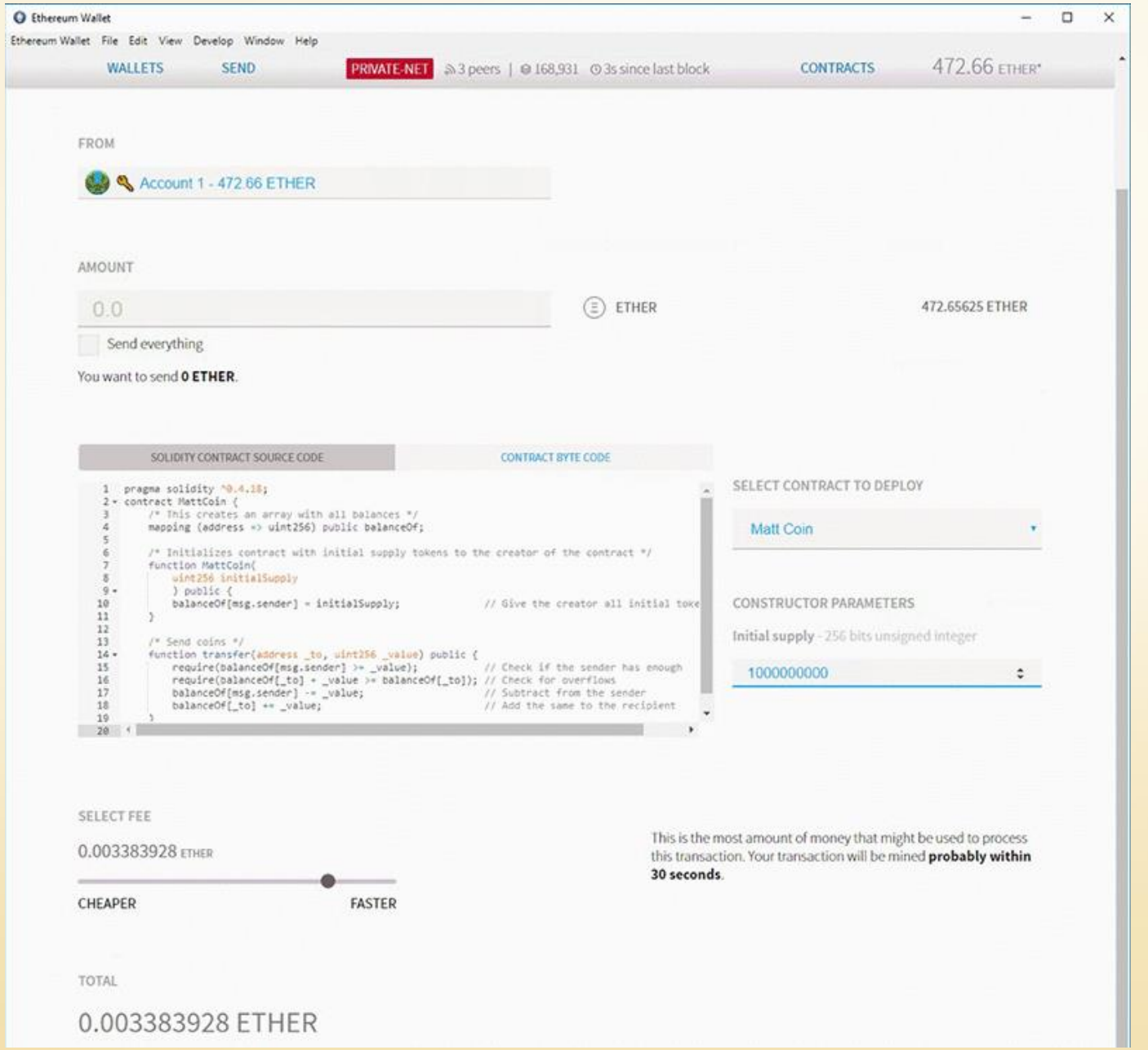
Following is the code for the contract we're going to deploy to build MattCoin. Paste this code into the SOLIDITY CONTRACT SOURCE CODE section. Next, select the contract to deploy and also the initial number of tokens to create. Then, click DEPLOY and enter the password you created with the account.

This code creates a smart contract for a simple coin or token. First, it creates a mapping of all possible Ethereum addresses and gives them a balance. The variables allow any address to hold a value of MattCoin. Next, in the constructor we specify that the entire initial supply should go to the creator of the contract. Then finally, we define a function called **transfer**, which allows us to send MattCoin from one Ethereum address to another.

Step 11: Create, deploy, and test your smart contract (Cont.)

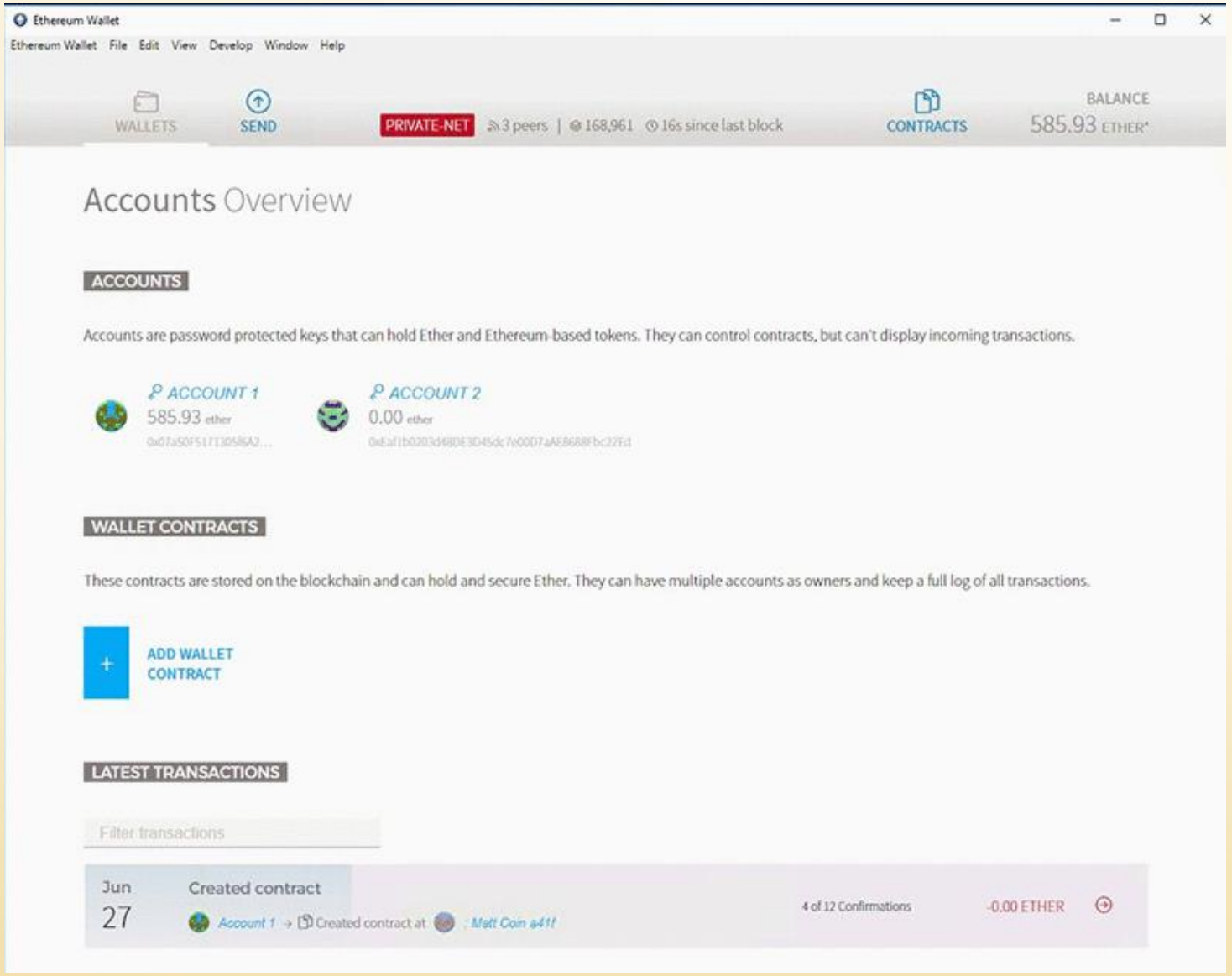
```
pragma solidity ^0.4.18;
contract MattCoin {
    /* This creates an array with all balances */
    mapping (address => uint256) public balanceOf;

    /* Initializes contract with initial supply tokens to the creator of the contract */
    constructor(
        uint256 initialSupply
        ) public {
        balanceOf[msg.sender] = initialSupply;              // Give the creator all initial tokens
    }

    /* Send coins */
    function transfer(address _to, uint256 _value) public {
        require(balanceOf[msg.sender] >= _value);           // Check if the sender has enough
        require(balanceOf[_to] + _value >= balanceOf[_to]); // Check for overflows
        balanceOf[msg.sender] -= _value;                    // Subtract from the sender
        balanceOf[_to] += _value;                           // Add the same to the recipient
    }
```

Step 11: Create, deploy, and test your smart contract (Cont.)



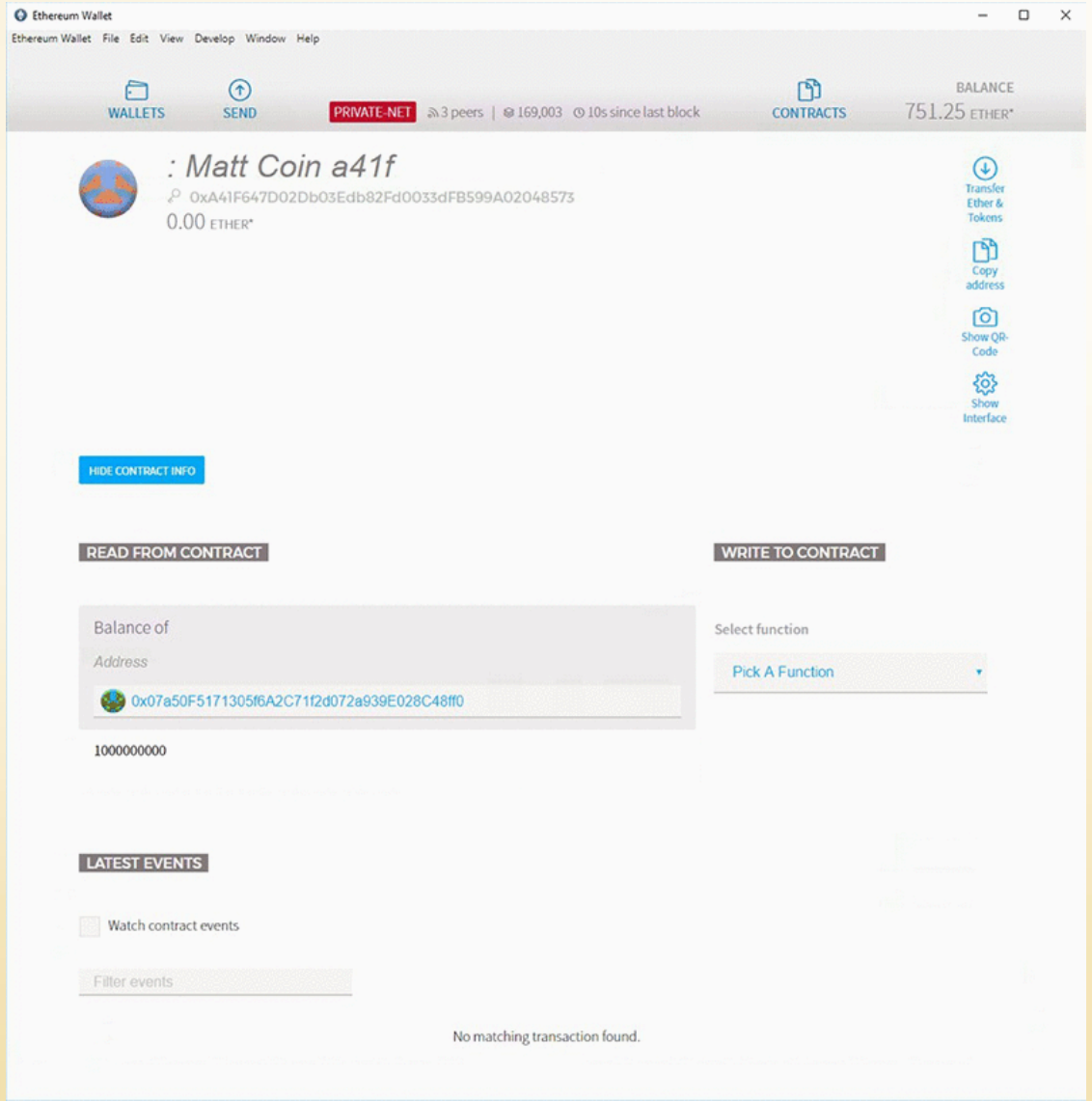
Step 11: Create, deploy, and test your smart contract (Cont.)

You now see the contract being created. The process finishes after it's been mined into the next block.



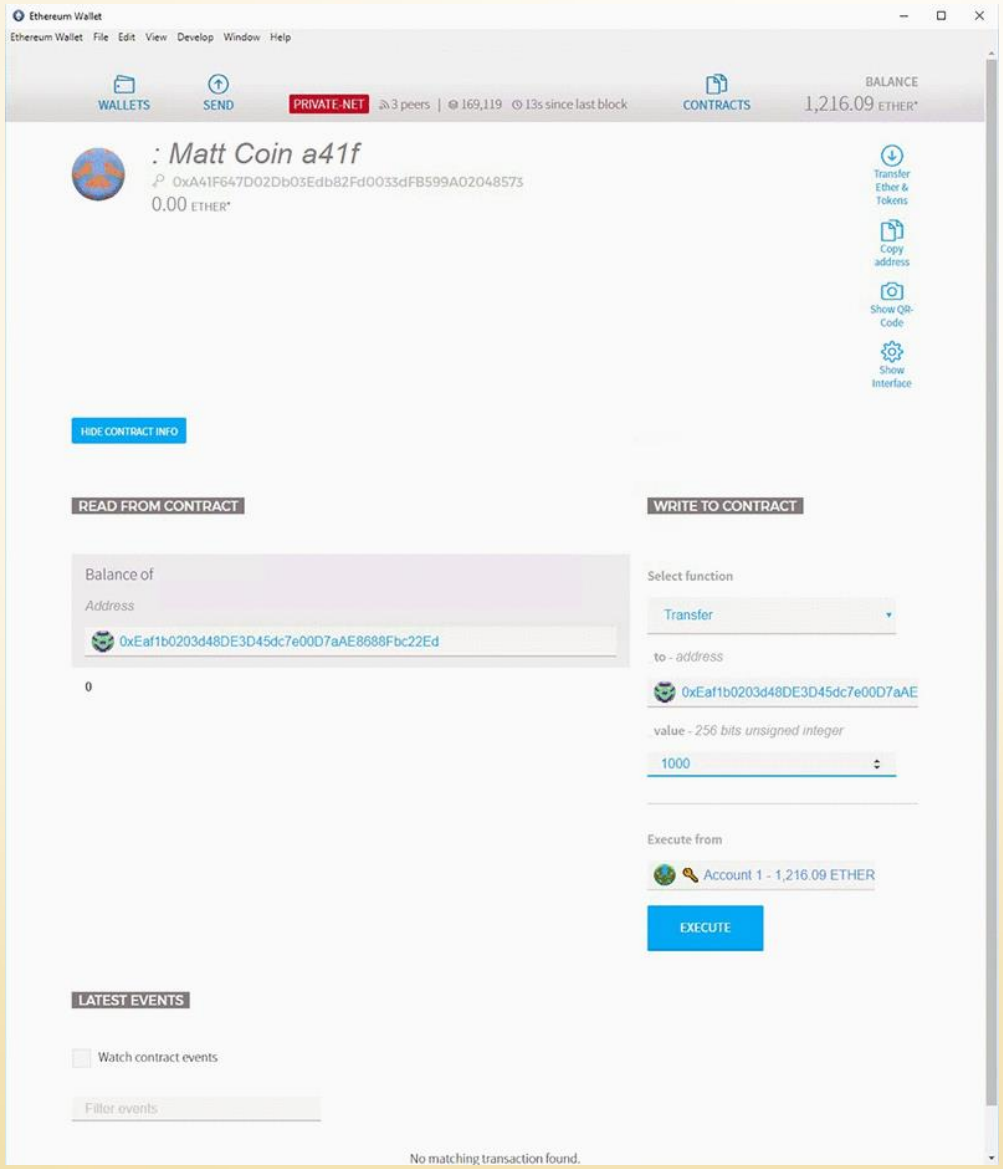
Step 11: Create, deploy, and test your smart contract (Cont.)

After the contract has been created, click it and enter your account address into the Balance of field. You should then see a balance equal to the amount you created with the contract.



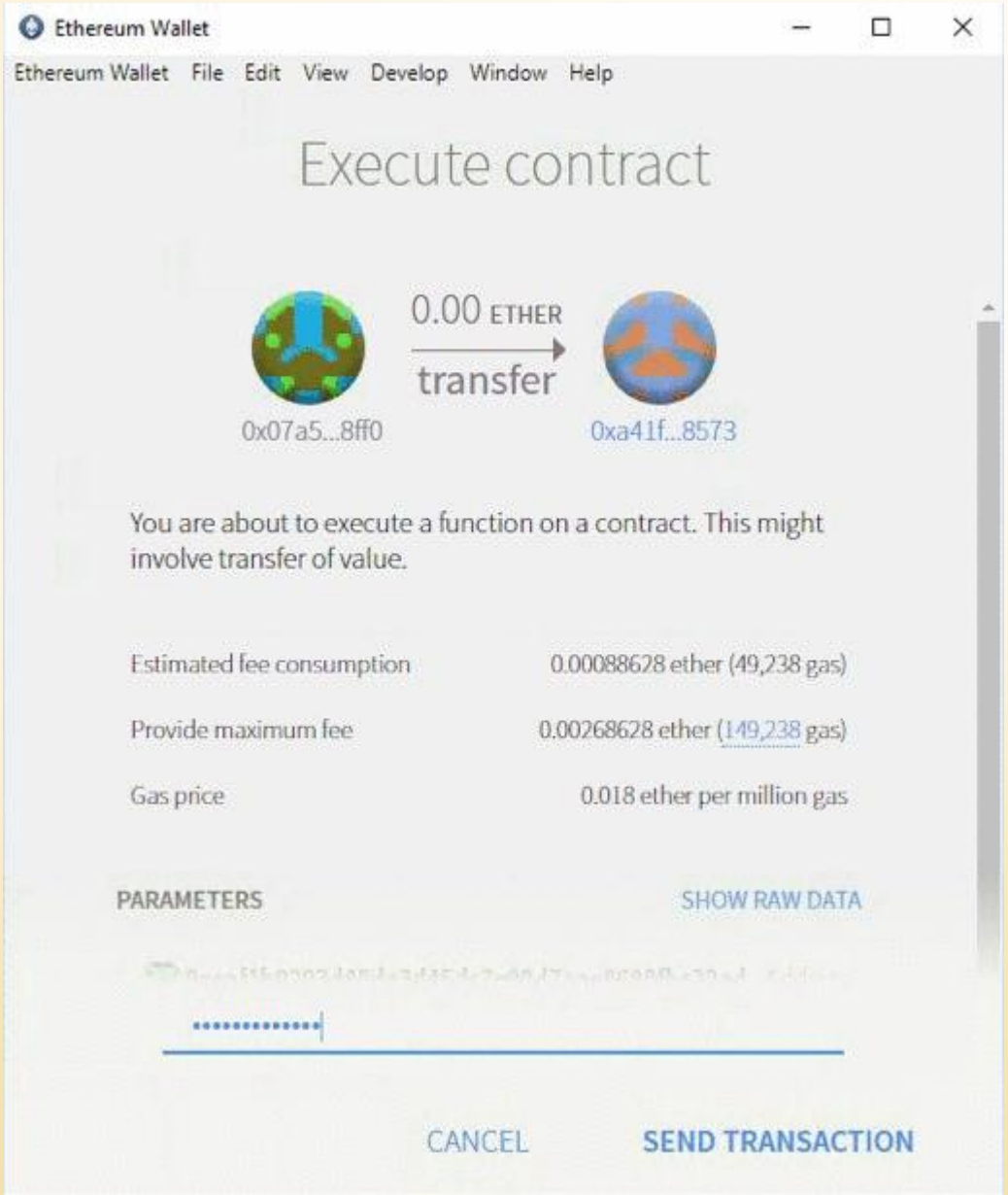
Step 11: Create, deploy, and test your smart contract (Cont.)

If you want to test sending your tokens to another Ethereum account, first create a second account. Then select the transfer function, provide a to address and the number of tokens to transfer, and click EXECUTE.



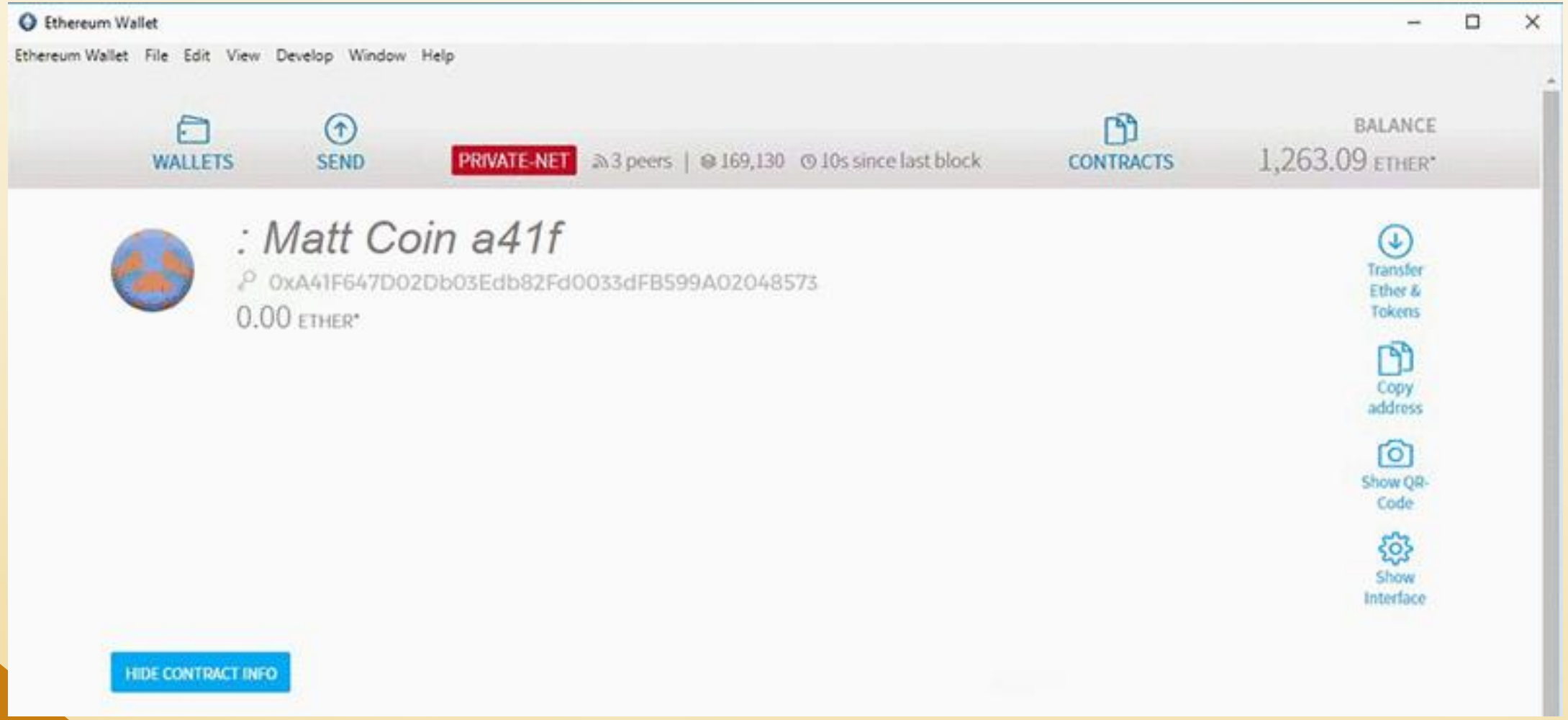
Step 11: Create, deploy, and test your smart contract (Cont.)

You are again asked to enter your password to sign the transaction.



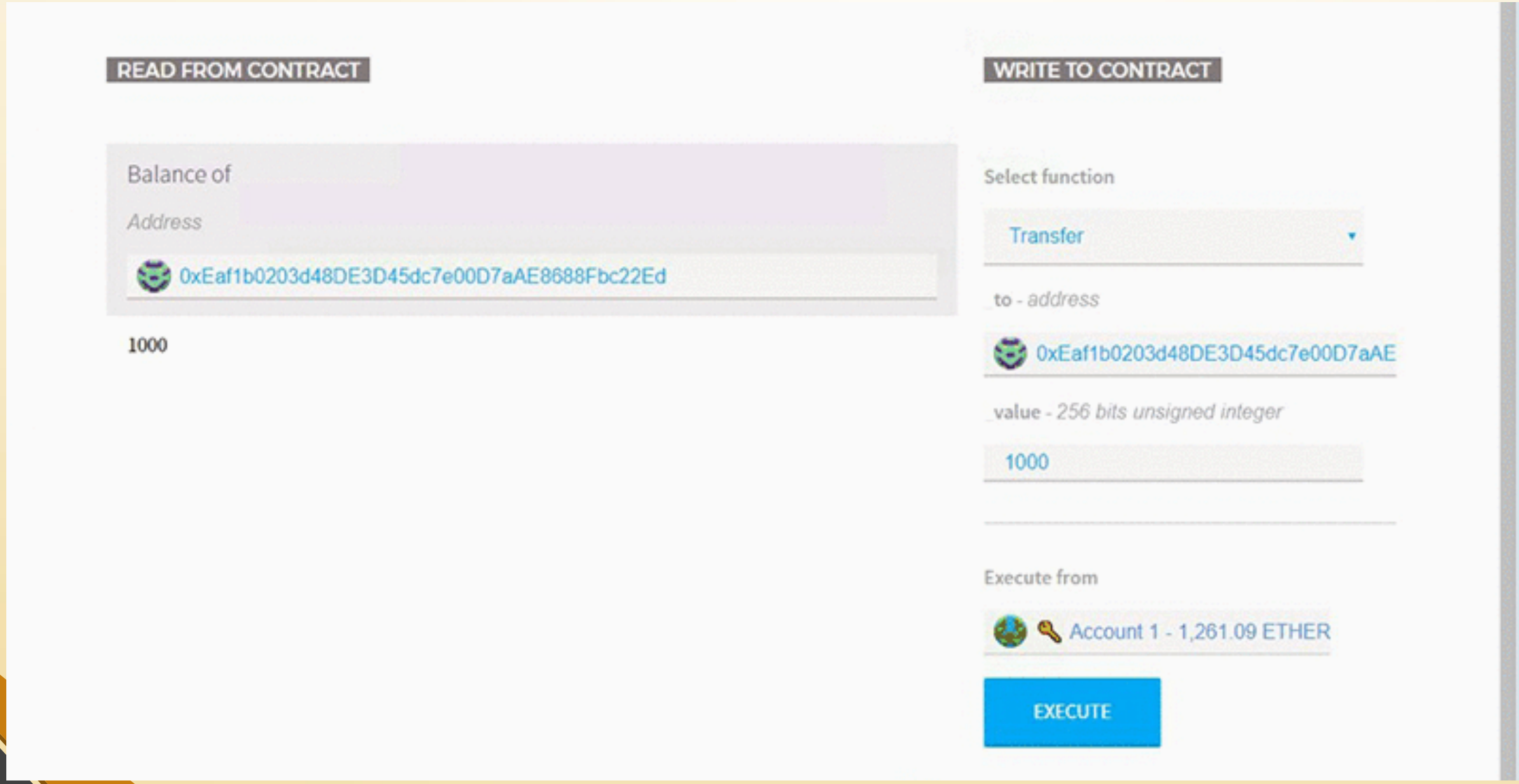
Step 11: Create, deploy, and test your smart contract (Cont.)

After the transaction is sent, enter the to address value into the Balance of field and you should see the amount of value you sent to this address.



Step 11: Create, deploy, and test your smart contract (Cont.)

After the transaction is sent, enter the to address value into the Balance of field and you should see the amount of value you sent to this address.



Scenario: Deploy smart contracts to your private Ethereum blockchain network on AWS

Conclusion

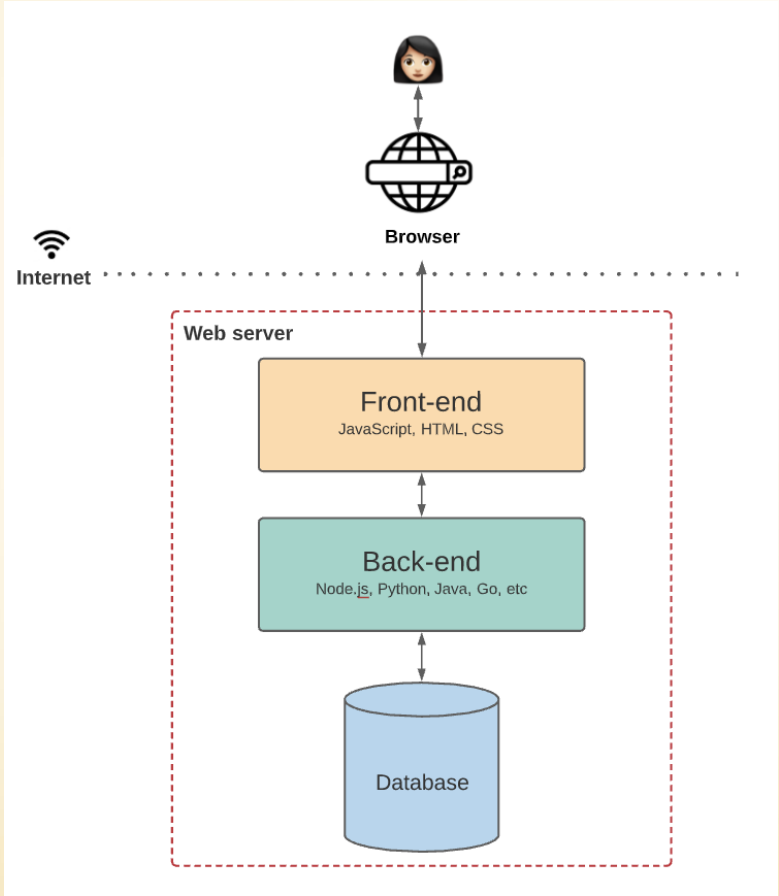
You've now set up your own private Ethereum network and deployed your first smart contract. By using the AWS Blockchain Template for Ethereum, it was easy to get started with your blockchain project and start testing use cases.

Ethereum Blockchain Web Application

Scenario: Ethereum Blockchain using the Architecture of a Web 3.0 Application

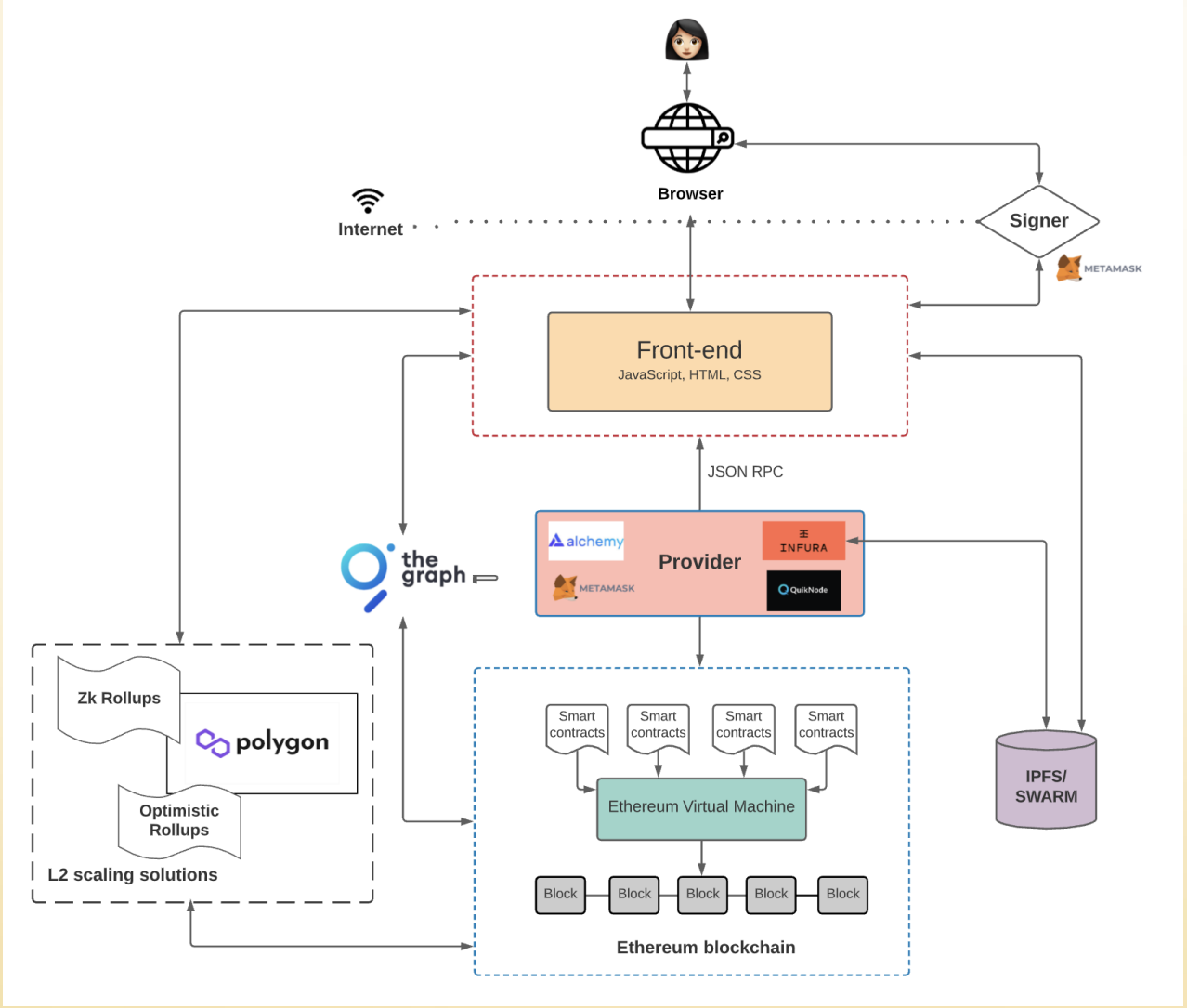
Use-Case

Building Block Chain Using Web 3.0 Application



Use-Case

Building Block Chain Using Web 3.0 Application



Smart contracts

```
// SPDX-License-Identifier: GPL-3.0

pragma solidity >=0.7.0 <0.9.0;

/**
 * @title Storage
 * @dev Store & retrieve value in a variable
 */
contract Storage {

    uint256 number;
    struct Jon{
        uint[] arr;
    }

    Jon private x;

    function foo() public {
        x.arr.push(5);
    }

    /**
     * @dev Store value in variable
     * @param num value to store
     */
    function store(uint256 num) public {
        number = num;
    }

    /**
     * @dev Return value
     * @return value of 'number'
     */
    function retrieve() public view returns (uint256){
        return number;
    }
}
```

Use-Case

Building Block Chain Using Web 3.0 Application

For use-case solution please refer/click the below URL:
Click Here

Thank You