

Get a Random Number

You are viewing the VRF v2 guide - Direct funding method.

To learn how to request random numbers with a subscription, see the [Subscription Method](#) guide.

Security Considerations

Be sure to review your contracts with the [security considerations](#) in mind.

This guide explains how to get random values using a simple contract to request and receive random values from Chainlink VRF v2 without managing a subscription. To explore more applications of VRF, refer to our [blog](#).

Requirements

This guide assumes that you know how to create and deploy smart contracts on Ethereum testnets using the following tools:

- [The Remix IDE](#)
- [MetaMask](#)
- [Sepolia testnet ETH](#)

If you are new to developing smart contracts on Ethereum, see the [Getting Started](#) guide to learn the basics.

Create and deploy a VRF v2 compatible contract

For this example, use the [VRFv2DirectFundingConsumer.sol](#) sample contract. This contract imports the following dependencies:

- [VRFV2WrapperConsumerBase.sol](#) ([link](#))
- [ConfirmedOwner.sol](#) ([link](#))

The contract also includes pre-configured values for the necessary request parameters such as `callbackGasLimit`, `requestConfirmations`, the number of random words `numWords`, the VRF v2 Wrapper `addressWrapperAddress`, and the LINK token `addressLinkAddress`. You can change these parameters if you want to experiment on different testnets.

Build and deploy the contract on Sepolia.

1. Open the [VRFv2DirectFundingConsumer.sol](#) contract in Remix.

[Open in Remix](#) **What is Remix?** 2. On the `Compile` tab in Remix, compile the `VRFv2DirectFundingConsumer` contract. 3. Configure your deployment. On the `Deploy` tab in Remix, select the `Injected Web3 Environment` and select the `VRFv2DirectFundingConsumer` contract from the contract list. 4. Click the `Deploy` button to deploy your contract on chain. MetaMask opens and asks you to confirm the transaction. 5. After you deploy your contract, copy the address from the `Deployed Contracts` list in Remix. Before you can request randomness from VRF v2, you must fund your consuming contract with enough LINK tokens in order to request for randomness. Next, [fund your contract](#).

Fund Your Contract

Requests for randomness will fail unless your consuming contract has enough LINK.

1. [Acquire testnet LINK](#).
2. [Fund your contract with testnet LINK](#). For this example, funding your contract with 2 LINK should be sufficient.

Request random values

The deployed contract requests random values from Chainlink VRF, receives those values, builds a `struct RequestStatus` containing them, and stores the struct in a `mappings_requests`. Run `therequestRandomWords()` function on your contract to start the request.

1. Return to Remix and view your deployed contract functions in the `Deployed Contracts` list.
2. Click `therequestRandomWords()` function to send the request for random values to Chainlink VRF. MetaMask opens and asks you to confirm the transaction.

Set your gas limit in MetaMask

Remix IDE doesn't set the right gas limit, so you must [edit the gas limit in MetaMask](#) within the `Advanced` gas controls settings.

For this example to work, set the gas limit to 400,000 in MetaMask.

First, [enable Advanced gas controls](#) in your MetaMask settings.

Before confirming your transaction in MetaMask, navigate to the screen where you can edit the gas limit: `Select Site` suggested > `Advanced` > `Advanced gas controls` and select `Edit` next to the `Gas limit` amount. Update the `Gas limit` value to 400,000 and select `Save`. Finally, confirm the transaction. After you approve the transaction, Chainlink VRF processes your request. Chainlink VRF fulfills the request and returns the random values to your contract in a callback to the `fulfillRandomWords()` function. At this point, a new `keyrequestId` is added to the `mappings_requests`. Depending on current testnet conditions, it might take a few minutes for the callback to return the requested random values to your contract. 3. To fetch the request ID of your request, call `lastRequestId()`. 4. After the oracle returns the random values to your contract, the `mappings_requests` is updated. The received random values are stored in `s_requests[_requestId].randomWords`. 5. Call `getRequestStatus()` and specify `therequestId` to display the random words.

Note on Requesting Randomness

Do not re-request randomness. For more information, see the [VRF Security Considerations](#) page.

Analyzing the contract

In this example, the consuming contract uses static configuration parameters.

```
// SPDX-License-Identifier: MIT
// An example of a consumer contract that directly pays for each
request.pragmasolidity<0.8.7>:import{ConfirmedOwner}from"@chainlink/contracts/src/v0.8/shared/access/ConfirmedOwner.sol";import{VRFV2WrapperConsumerBase}from"@chainlink/contracts/src/v0.8/
* Request testnet LINK and ETH here: https://faucets.chain.link/ * Find information on LINK Token Contracts and get the latest ETH and LINK faucets here:
https://docs.chain.link/docs/link-token-contracts/ * // * THIS IS AN EXAMPLE CONTRACT THAT USES HARDCODED VALUES FOR CLARITY. * THIS IS AN EXAMPLE CONTRACT THAT USES
UN-AUDITED CODE. * DO NOT USE THIS CODE IN PRODUCTION.

/contract VRFv2DirectFundingConsumer is VRFV2WrapperConsumerBase, ConfirmedOwner {
    event RequestSent(uint256 requestId, uint32 numWords);
    event RequestFulfilled(uint256 requestId, uint256[] randomWords);
    mapping(uint256 => RequestStatus) public requests;

    // whether the request has been successfully fulfilled
    bool public fulfilled;

    // Depends on the number of requested values that you want sent to the fulfillRandomWords() function. Test and adjust this limit based on the network that you select, the size of the request, and the processing of the callback request in the fulfillRandomWords() function.
    uint32 public callbackGasLimit = 100000; // The default is 3, but you can set this higher.
    uint16 requestConfirmations = 3; // For this example, retrieve 2 random values in one request. // Cannot exceed VRFV2Wrapper.getConfig().maxNumWords
    uint32 numWords = 2; // Address LINK - hardcoded for Sepolia addressLinkAddress = 0x779877A7B0D9E8603169DdbD7836e478b4624789; // address WRAPPER - hardcoded for Sepolia addressWrapperAddress = 0xab18414CD93297B0d12ac29E63Ca20f515b3DB46;
    constructor(ConfirmedOwner msg.sender, VRFV2WrapperConsumerBase linkAddress, wrapperAddress) {}

    function requestRandomWords() external onlyOwner returns (uint256 requestId) {
        {requestId = requestRandomness(callbackGasLimit, requestConfirmations, numWords);
        s_requests[requestId] = RequestStatus({paid: VRF_V2_WRAPPER.calculateRequestPrice(callbackGasLimit), randomWords: randomWords, fulfilled: false});
        requestIds.push(requestId);
        lastRequestId = requestId;
        emit RequestSent(requestId, numWords);
        return requestId;
        }
        function fulfillRandomWords(uint256 requestId, uint256[] randomWords) memory {
            randomWords = randomWords;
            emit RequestFulfilled(requestId, randomWords);
            paid = request.paid;
            fulfilled = true;
            s_requests[requestId].randomWords = randomWords;
            emit RequestFulfilled(requestId, randomWords, s_requests[requestId].paid);
        }
        function getRequestStatus(uint256 requestId) public view returns (RequestStatus memory) {
            require(s_requests[requestId].paid > 0, "request not found");
            return s_requests[requestId];
        }
        function withdrawLink() public onlyOwner {
            LinkTokenInterface link = LinkTokenInterface(linkAddress);
            require(link.transfer(msg.sender, link.balanceOf(address(this))), "Unable to transfer");
        }
    }
}
```

- `uint32 callbackGasLimit`: The limit for how much gas to use for the callback request to your contract's `fulfillRandomWords()` function. It must be less than `maxGasLimit` limit on the coordinator contract minus the `wrapperGasOverhead`. See the [VRF v2 Direct funding limits](#) for more details. Adjust this value for larger requests depending on how your `fulfillRandomWords()` function processes and stores the received random values. If your `callbackGasLimit` is not sufficient, the callback will fail and your consuming contract is still charged for the work done to generate your requested random values.
- `uint16 requestConfirmations`: How many confirmations the Chainlink node should wait before responding. The longer the node waits, the more secure the random value is. It must be greater than the `minimumRequestBlockConfirmations` limit on the coordinator contract.

- `uint32 numWords`: How many random values to request. If you can use several random values in a single callback, you can reduce the amount of gas that you spend per random value. The total cost of the callback request depends on how your `fulfillRandomWords()` function processes and stores the received random values, so adjust your `callbackGasLimit` accordingly.

The contract includes the following functions:

- `requestRandomWords()`: Takes your specified parameters and submits the request to the VRF v2 Wrapper contract.
- `fulfillRandomWords()`: Receives random values and stores them with your contract.
- `getRequestStatus()`: Retrieve request details for a given `_requestId`.
- `withdrawLink()`: At any time, the owner of the contract can withdraw outstanding LINK balance from it.

Security Considerations

Be sure to review your contracts to make sure they follow the best practices on the [security considerations](#) page.

Clean up

After you are done with this contract, you can retrieve the remaining testnet LINK to use with other examples.

1. Call `withdrawLink()` function. MetaMask opens and asks you to confirm the transaction. After you approve the transaction, the remaining LINK will be transferred from your consuming contract to your wallet address.