

Call an API with HTTP Query Parameters

This tutorial shows you how to send a request to a Decentralized Oracle Network to call the [Cryptocompare GET /data/pricemultifull API](#). After OCR completes offchain computation and aggregation, it returns the asset price for ETH/USD to your smart contract. This guide also shows you how to configure HTTP query parameters to request different asset prices.

note

Chainlink Functions is a self-service solution. You must ensure that the data sources or APIs specified in requests are of sufficient quality and have the proper availability for your use case. You are responsible for complying with the licensing agreements for all data providers that you connect with through Chainlink Functions. Violations of data provider licensing agreements or the [terms](#) can result in suspension or termination of your Chainlink Functions account.

Prerequisites

note

You might skip these prerequisites if you have followed one of these [guides](#). You can check your subscription details (including the balance in LINK) in the [Chainlink Functions Subscription Manager](#). If your subscription runs out of LINK, follow the [Fund a Subscription](#) guide.

Set up your environment

You must provide the private key from a testnet wallet to run the examples in this documentation. Install a Web3 wallet, configure [Node.js](#), clone the [smartcontractkit/smart-contract-examples](#) repository, and configure a `.env` file with the required environment variables.

Install and configure your Web3 wallet for Polygon Mumbai:

1. [Install Deno](#) so you can compile and simulate your Functions source code on your local machine.
2. [Install the MetaMask wallet](#) or other Ethereum Web3 wallet.
3. Set the network for your wallet to the Polygon Mumbai testnet. If you need to add Mumbai to your wallet, you can find the chain ID and the LINK token contract address on the [LINK Token Contracts](#) page.
4. [Polygon Mumbai testnet and LINK token contract](#)
5. Request testnet MATIC from the [Polygon Faucet](#) .
6. Request testnet LINK from [faucets.chain.link/mumbai](#) .

Install the required frameworks and dependencies:

1. [Install the latest release of Node.js 20](#). Optionally, you can use the [nvm package](#) to switch between Node.js versions with `nvm use 20`

Note: To ensure you are running the correct version in a terminal, type `node -v`.

node-v\$node-vv20.9.0 2. In a terminal, clone the [smart-contract examples](#) repository and change directories. This example repository imports the [Chainlink Functions Toolkit NPM package](#). You can import this package to your own projects to enable them to work with Chainlink Functions.

gitclone <https://github.com/smartcontractkit/smart-contract-examples.git>&&'cd./smart-contract-examples/functions-examples/ 3. Runnpm installto install the dependencies

npm install 4. For higher security, the examples repository encrypts your environment variables at rest.

1. Set an encryption password for your environment variables

Run `npmx env-enc set-pw 2`. Run `npmx env-enc set` to configure a `.env.enc` file with the basic variables that you need to send your requests to the Polygon Mumbai network.

- **POLYGON_MUMBAI_RPC_URL:** Set a URL for the Polygon Mumbai testnet. You can sign up for a personal endpoint from [Alchemy, Infura](#), or another node provider service.
- **PRIVATE_KEY:** Find the private key for your testnet wallet. If you use MetaMask, follow the instructions to [Export a Private Key](#). Note: Your private key is needed to sign any transactions you make such as making requests.

```
npx env-encset
```

Configure your onchain resources

After you configure your local environment, configure some onchain resources to process your requests, receive the responses, and pay for the work done by the DON.

Deploy a Functions consumer contract onPolygon Mumbai

1. Open the `FunctionsConsumerExample.sol` contract in Remix.

[Open in Remix](#) **What is Remix?** 2. Compile the contract. 3. Open MetaMask and select the Polygon Mumbai network. 4. In Remix under the Deploy & Run Transaction tab, select Injected Provider - MetaMask in the Environment list. Remix will use the MetaMask wallet to communicate with Polygon Mumbai. 5. Under the Deploy section, fill in the router address for your specific blockchain. You can find both of these addresses on the [Supported Networks](#) page. For Polygon Mumbai, the router address is `0x6E2dc0F9DB014aE1988F539E59285D2Ea04244C`. 6. Click the Deploy button to deploy the contract. MetaMask prompts you to confirm the transaction. Check the transaction details to make sure you are deploying the contract to Polygon Mumbai. 7. After you confirm the transaction, the contract address appears in the Deployed Contracts list. Copy the contract address.

Create a subscription

Follow the [Managing Functions Subscriptions](#) guide to accept the Chainlink Functions Terms of Service (ToS), create a subscription, fund it, then add your consumer contract address to it.

You can find the Chainlink Functions Subscription Manager at functions.chain.link.

Tutorial

This tutorial is configured to get the ETH/USD price. For a detailed explanation of the code example, read the [Examine the code](#) section.

You can locate the scripts used in this tutorial in the [examples/2-call-apidirectory](#).

To run the example:

1. Open the `filerequest.js`, which is located in the `2-call-api` folder.
2. Replace the consumer contract address and the subscription ID with your own values.

const consumerAddress="0x8dFf78B7EE3128D00E90611FBED20A71397064D9"// REPLACE this with your Functions consumer address
const subscriptionId=3// REPLACE this with your subscription ID
3. Make a request:

`nodeexamples/2-call-api/request.is` The script runs your function in a sandbox environment before making an onchain transaction.

\$ node examples/2-call-api/request.js secp256k1 unavailable, reverting to browser version Start simulation... Performing simulation with the following versions: deno 1.36.3 (release, aarch64-apple-darwin) v8 11.6.189.12 typescript 5.1.6

[illegible]

Estimate request costs... Duplicate definition of Transfer (Transfer(address,address,uint256,bytes). Transfer(address,address,uint256)) Fulfillment cost estimated to 0.0000000000000215 LINK

Make request...

✓ Functions request sent! Transaction hash 0x0b628b0cf4c59456ec00829235f589012b0101dbda26e5b9efd7ce610add6790. Waiting for a response... See your request in the explorer <https://mumbai.polygonscan.com/tx/0x0b628b0cf4c59456ec00829235f589012b0101dbda26e5b9efd7ce610add6790>

[illegible]

✓ Decoded response to uint256: 163319nThe output of the example gives you the following information:

- [illegible]

Examine the code

FunctionsConsumerExample.sol

```
SPDX-License-Identifier: MIT
pragma solidity ^0.8.19; import {FunctionsClient} from "chainlink/contracts/src/v0.8/functions/dev/v1_0_0/FunctionsClient.sol"; import {ConfirmedOwner} from "chainlink/contracts/src/v0.8/shared/access/ConfirmedOwner.sol";

// * 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 FunctionsConsumerExampleIsFunctionsClient, ConfirmedOwner {
    using FunctionsRequest for FunctionsRequest.Request;
    bytes32 public _lastRequestId;
    bytes public _lastResponse;

    // @notice Send a simple request
    // @param source JavaScript source code
    // @param encryptedSecretsUrls Encrypted URLs where to fetch user secrets
    // @param donHostedSecretsSlotID Don hosted secrets slotID
    // @param donHostedSecretsVersion Don hosted secrets version
    // @param args List of arguments accessible from within the source code
    // @param bytesArgs Array of bytes arguments, represented as hex strings
    // @param subscriptionId Billing ID

    function sendRequest(string memory source, bytes memory encryptedSecretsUrls, uint8 donHostedSecretsSlotID, uint64 donHostedSecretsVersion, string[] memory args, bytes[] memory bytesArgs, uint64 subscriptionId) public returns (uint32 requestId, bytes response) {
        FunctionsRequest req = FunctionsRequest(req.initializeRequestForInlineJavaScript(source), if(encryptedSecretsUrls.length > 0) req.addSecretsReference(encryptedSecretsUrls); else if(donHostedSecretsVersion > 0) req.addDONHostedSecrets(donHostedSecretsSlotID, donHostedSecretsVersion));
        if(args.length > 0) req.setArgs(args);
        if(bytesArgs.length > 0) req.setBytesArgs(bytesArgs);
        s._lastRequestId = _sendRequest(req);
        // @notice Send a pre-encoded CBOR request
        // @param request CBOR-encoded request data
        // @param subscriptionId Billing ID
        // @param gasLimit The maximum amount of gas the request can consume
        // @param donId ID of the job to be invoked
        // @return requestId The ID of the sent request

        function sendRequestCBOR(bytes memory request, uint64 subscriptionId, uint32 gasLimit, bytes32 donId) external onlyOwner returns (bytes32 requestId) {
            s._lastRequestId = _sendRequest(request, subscriptionId, gasLimit, donId);
            return s._lastRequestId;
        }

        // @notice Store latest result/error
        // @param requestId The request ID, returned by sendRequest()
        // @param response Aggregated response from the user code
        // @param err Aggregated error from the user code or from the execution pipeline
        // Either response or error parameter will be set, but never both
        function fulfillRequest(bytes32 requestId, bytes memory response, bytes memory err) internal override {
            if(s._lastRequestId != requestId) {
                revert UnexpectedRequestId(requestId);
            }
            s._lastResponse = response;
            s._lastError = err;
            emit Response(requestId, s._lastResponse, s._lastError);
        }

        Open in Remix What is Remix?
        To write a Chainlink Functions consumer contract, your contract must import FunctionsClient.sol and FunctionsRequest.sol . You can read the API references FunctionsClient and FunctionsRequest .
    }
}
```

These contracts are available in an NPM package, so you can import them from within your project.

```
import {FunctionsClient} from "@chainlink/contracts/src/v0.8/functions/dev/v1_0_0/FunctionsClient.sol"; import {FunctionsRequest} from
"@chainlink/contracts/src/v0.8/functions/dev/v1_0_0/libraries/FunctionsRequest.sol"; * Use the FunctionsRequest.sol library to get all the functions needed for building a Chainlink Functions request.
```

using FunctionsRequest for FunctionsRequest.Request; * The latest request id, latest received response, and latest received error (if any) are defined as state variables:

```
bytes32 public s_lastRequestId; bytes public s_lastResponse; bytes public s_lastError; * We define theResponseevent that your smart contract will emit during the callback
```

event Response(bytes32 indexed requestId, bytes response, bytes err); * Pass the router address for your network when you deploy the contract:

constructor(address router) FunctionsClient(router) * The three remaining functions are:

- `sendRequest` for sending a request. It receives the JavaScript source code, encrypted secrets URLs (in case the encrypted secrets are hosted by the user), DON hosted secrets slot id and version (in case the encrypted secrets are hosted by the DON), list of arguments to pass to the source code, subscription id, and callback gas limit as parameters. Then:
- It uses the `FunctionsRequest` library to initialize the request and add any passed encrypted secrets reference or arguments. You can read the API Reference for [initializing a request](#), [adding user hosted secrets](#), [adding DON hosted secrets](#), [adding arguments](#), and [adding bytes arguments](#).

```

FunctionsRequest.Request memory req; req.initializeRequestForInlineJavaScript(source); if (encryptedSecretsUrls.length > 0) req.addSecretsReference(encryptedSecretsUrls); else if
(donHostedSecretsVersion > 0) { req.addDONHostedSecrets( donHostedSecretsSlotID, donHostedSecretsVersion ); } if (args.length > 0) req.setArgs(args); if (bytesArgs.length > 0)
req.setBytesArgs(bytesArgs); * It sends the request to the router by calling theFunctionsClientsendRequestfunction. You can read the API reference forsending a request . Finally, it stores the request
id ins_ lastRequestIdthen return it.

```

`s.lastRequestId` → `sendRequest(req.encodeCBOR(subscriptionId, gasLimit, jobId) ; return s.lastRequestId; Note: sendRequest accepts requests encoded in bytes. Therefore, you must encode it, using encodeCBOR .` `sendRequestCBOR` for sending a request already encoded in bytes. It receives the request object encoded in bytes, subscription id, and callback gas limit as parameters. Then, it sends the request to the router by calling the `FunctionsClient.sendRequest` function. Note: This function is helpful if you want to encode a request offchain before sending it, saving gas when submitting the request. * `fulfillRequest` be invoked during the callback. This function is defined in `FunctionsClient` as `virtual(readfulfillRequest` [API reference](#)). So, your smart contract must override the function to implement the callback. The implementation of the callback is straightforward: the contract stores the latest response and error in `s.lastResponse` and `s.lastError` before emitting the `ResponseEvent`.

```
s_lastResponse = response; s_lastError = err; emit Response(requestId, s_lastResponse, s_lastError);
```

JavaScript example

[source.js](#)

The Decentralized Oracle Network will run the [JavaScript code](#) . The code is self-explanatory and has comments to help you understand all the steps.

note

Functions requests with custom source code can use vanilla [Deno](#) . Import statements and imported modules are supported only on testnets. You cannot use any require statements.

It is important to understand that importing an NPM package into Deno does not automatically ensure full compatibility. Deno and Node.js have distinct architectures and module systems. While some NPM packages might function without issues, others may need modifications or overrides, especially those relying on Node.js-specific APIs or features Deno does not support.

This JavaScript source code uses [Functions.makeHttpRequest](#) to make HTTP requests. To request the ETH/USD price, the source code calls the `https://min-api.cryptocompare.com/data/pricemultifull?fsyms=ETH&tsyms=USDURL`. If you read the [Functions.makeHttpRequest](#) documentation, you see that you must provide the following parameters:

- url: <https://min-api.cryptocompare.com/data/pricemultifull>
- params: The query parameters object:

```
{ fsyms: fromSymbol, tsyms: toSymbol }
```

To check the expected API response, you can directly paste the following URL in your browser <https://min-api.cryptocompare.com/data/pricemultifull?fsyms=ETH&tsyms=USD> or run the `curl` command in your terminal:

`curl -X'GET' "https://min-api.cryptocompare.com/data/pricemultifull?fsyms=ETH&tsyms=USD" -H'accept: application/json'` The response should be similar to the following example:

```
{ "RAW": {"ETH": {"USD":  
  ("TYPE": "5", "MARKET": "CCCAGG", "FROMSYMBOL": "ETH", "TOSYMBOL": "USD", "FLAGS": "2049", "PRICE": 2867.04, "LASTUPDATE": 1650896942, "MEDIAN": 2866.2, "LASTVOLUME": 0.16533939, "LAST
```

The main steps of the scripts are:

- `FetchfromSymbolandtoSymbolfrommags.`
- Construct the HTTP object `cryptoCompareRequestusingFunctions.makeHttpRequest.`
- Make the HTTP call.
- Read the asset price from the response.
- Return the result as [a buffer](#) using the `Functions.encodeUint256helper` function. Because solidity doesn't support decimals, multiply the result by 100 and round the result to the nearest integer. **Note:** Read [this article](#) if you are new to Javascript Buffers and want to understand why they are important.

[request.js](#)

This explanation focuses on the [request.js](#) script and shows how to use the [Chainlink Functions NPM package](#) in your own JavaScript/TypeScript project to send requests to a DON. The code is self-explanatory and has comments to help you understand all the steps.

The script imports:

- [path](#) and [fs](#) : Used to read the [source file](#) .
- [ethers](#) : Ethers.js library, enables the script to interact with the blockchain.
- [@chainlink/functions-toolkit](#): Chainlink Functions NPM package. All its utilities are documented in the [NPM README](#) .
- [@chainlink/env-enc](#): A tool for loading and storing encrypted environment variables. Read the [official documentation](#) to learn more.
- [../abi/functionsClient.json](#): The abi of the contract your script will interact with. Note: The script was tested with this [FunctionsConsumerExample contract](#) .

The script has two hardcoded values that you have to change using your own Functions consumer contract and subscription ID:

`const consumerAddress = "0x8dFf78B7EE3128D00E90611FBeD20A71397064D9"// REPLACE this with your Functions consumer address`
`const subscriptionId = 3// REPLACE this with your subscription ID`
 The primary function that the script executes is `makeRequestMumbai`. This function consists of five main parts:

1. Definition of necessary identifiers:
2. `routerAddress`: Chainlink Functions router address on Polygon Mumbai.
3. `donId`: Identifier of the DON that will fulfill your requests on Polygon Mumbai.
4. `explorerUrl`: Block explorer url of Polygon Mumbai.
5. `source`: The source code must be a string object. That's why we use `fs.readFileSync` to read `source.js` and then `callToString()` to get the content as a string object.
6. `args`: During the execution of your function, These arguments are passed to the source code. The `args` value is `["ETH", "USD"]`, which fetches the current ETH/USD price. You can adapt `args` to fetch another asset price. See the [CryptoCompare API docs](#) to get the list of supported symbols.
7. `gasLimit`: Maximum gas that Chainlink Functions can use when transmitting the response to your contract.
8. Initialization of `ethers signer` and `provider` objects. The signer is used to make transactions on the blockchain, and the provider reads data from the blockchain.
9. Simulating your request in a local sandbox environment:
10. Use `simulateScript` from the Chainlink Functions NPM package.
11. Read the `response` of the simulation. If successful, use the Functions NPM package `decodeResult` function and `ReturnType` enum to decode the response to the expected returned type (`ReturnType.uint256` in this example).
12. Estimating the costs:
13. Initialize a `SubscriptionManager` from the Functions NPM package, then call the `estimateFunctionsRequestCost`.
14. The response is returned in `Juels` (1 LINK = 10^{18} Juels). Use the `ethers.utils.formatEther` utility function to convert the output to LINK.
15. Making a Chainlink Functions request:
16. Initialize your functions consumer contract using the contract address, abi, and ethers signer.
17. Call the `sendRequest` function of your consumer contract.
18. Waiting for the response:
19. Initialize a `ResponseListener` from the Functions NPM package and then call the `listenForResponseFromTransaction` function to wait for a response. By default, this function waits for five minutes.
20. Upon reception of the response, use the Functions NPM package `decodeResult` function and `ReturnType` enum to decode the response to the expected returned type (`ReturnType.uint256` in this example).