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How to decode an eth_call response

Learn how to decode the overwhelmingly large hex strings returned by the [eth_call](#) method.

Introduction

The [eth_call](#) method is commonly used to call the read-only functions of smart contracts, like reading the owner off an NFT smart contract. The values returned by these functions are in the hex format.

To convert these values to a human-readable format, we need to decode them. In this guide, we will show you how to decode the responses of the `eth_call` method so that you can easily read them.

Prerequisites

To continue with this guide you need to about the [eth_call](#) method and how it works.

Making an

eth_call request

For the sake of this tutorial, we will be using the `eth_call` method on an ERC20 token contract (USDT) to get the balance of a particular address and also get the symbol of the token. We will be calling the `eth_call` method through [Alchemy SDK](#).

NOTE

It would be way easier to get the the token balance of an address and the symbol of the token using Alchemy's [getTokenBalances](#) and [getTokenMetadata](#) APIs as you won't have to deal with decoding the response in that case.

Step 1: Install Node and npm

In case you haven't already, [install node and npm](#) on your local machine.

Make sure that node is at least v14 or higher by typing the following in your terminal:

Shell node -v

Step 2: Create an Alchemy app

In case you haven't already [sign up for a free Alchemy account](#).

Alchemy's account dashboard where developers can create a new app on the Ethereum blockchain. Next, navigate to the [Alchemy Dashboard](#) and [create a new app](#). Make sure you set the chain to Ethereum and the network to Mainnet. Once the app is created, click on your app's View Key button on the dashboard. Take note of the HTTP URL .

The URL will be in this form: `https://eth-mainnet.g.alchemy.com/v2/xxxxxxxxxx`

You will need this later.

Step 3: Create a node project

Let's now create an empty repository and install all node dependencies.

Shell mkdir eth-call-decoder &&cd eth-call-decodernpm init-y npm install alchemy-sdk ethers touch main.js This will create a repository named eth-call-decoder that holds all your files and dependencies. Next, open this repo in your favorite code editor. We will be writing all our code in the main.js file.

In order to get the balance of a token for a wallet address and its symbol, we need to leverage the `eth_call` method. This will allow us to query USDT contract's `balanceOf` method and the symbol state variable.

Add the following code to the `main.js` file. Here's an overview of what the code is doing (also explained in comments):

- Imports the required objects from Alchemy SDK.
- Sets the config object (setting API key and the network).
- Makes an
- alchemy
- variable using the config object for making the calls.
- Defines a main function that gets executed when the script runs.
- In the main function it defines the wallet address whose balance we want to query.
- Defines the contract address for the ERC20 token.
- Defines the number of decimals of the ERC20 token.
- Defines the abi for the ERC20 token that will be used for making an
- eth_call
- request.
- Creates function call data for getting the symbol and balance using the abi and Utils object of Alchemy SDK.
- Makes an
- eth_call
- request using Alchemy SDK for getting the symbol value in the hex format.
- Makes an
- eth_call
- request using Alchemy SDK for getting the balance value in the hex format.
- Logs the hex values of both symbol and balance.

```
main.js const [Alchemy, Network, Utils] = require ("alchemy-sdk");const config = {apiKey: "<-- ALCHEMY_API_KEY -->";network: Network.Ethereum.MAINNET;};const alchemy = new Alchemy (config);const main = async (=> { // Wallet address whose balance you want to query const walletAddress = "0xfed0cc839ce1490c6bc7209baa11f46cfe83805ab"; // USDT contract address const contractAddress = "0xdAC17F958D2ee523a2206206994597C13D831ec7";const numDecimals = 6; // You can find out how many decimal places any currency has by reading the decimals value from the contract's page on Etherscan. // ABI -- defining the functions in the ABI that we want to call using the eth_call method. let abi = [function balanceOf(address account) ,function symbol()]; // Create function call data for getting the symbol and balance -- eth_call let iface = new Utils.Interface (abi);let symbolData = iface.encodeFunctionData ("symbol");let balanceData = iface.encodeFunctionData ("balanceOf", [walletAddress]); // Get symbol of the token in hex format -- usage of eth_call let symbolInHex = await alchemy.core.call ({to: contractAddress, data: symbolData,}); // Get balance for the wallet address in hex format -- usage of eth_call let balanceInHex = await alchemy.core.call ({to: contractAddress, data: balanceData,});console.log ("Balance:", balanceInHex);console.log ("Symbol:", symbolInHex);};const runMain = async (=> {try {await main ();process.exit (0);} catch (error) {console.log (error);process.exit (1);}});runMain (); Run the script using the following command:
```

`node node main .js` If all goes well, you should see an output that looks like this:

[illegible]

Decoding the response

There are two ways to decode an `eth_call` response depending upon the return type of the call. Two key data types get passed over the response: [quantities](#) (integers, numbers) and [unformatted byte arrays](#) (account addresses, hashes, bytecode arrays) . Both are passed with a hex encoding but with different requirements for decoding.

Decoding Quantities

In order to format quantities(integers, numbers) into human-readable form, you simply convert the hexadecimal result received from the API response into a decimal.

Furthermore, if it's the value of an ERC20 token, for example, ERC20 balance of an address. You need to divide the decimal form by the number of decimal places that that particular token has. USDT, for instance, has 6. You can find out how many decimal places any currency has by reading the decimals value from the contract's page on Etherscan.

Solidity does not support decimal point numbers. So, If you want an ERC20 token to have the ability to be subdivided with a precision of 2 decimal places, you need to represent 1 token as 100 (set its decimal places to 2). Similarly if you want an ERC20 token to have the ability to be subdivided with a precision of 18 decimal places, you need to represent 1 token as 1000000000000000000 (set its decimal places to 18).

So, the formula for number of tokens becomes:

That is why we need to divide the decimal value by the number of decimal places, to get the actual token value.

- Imports the required objects from Alchemy SDK.
- Sets the config object (setting API key and the network).
- Makes an
- alchemy
- variable using the config object for making the calls.
- Defines a main function that gets executed when the script runs.
- In the main function it defines the wallet address whose balance we want to query.
- Defines the contract address for the ERC20 token.
- Defines the number of decimals of the ERC20 token.
- Defines the abi for the ERC20 token that will be used for making an
- eth_call
- request.
- Creates function call data for getting the symbol and balance using the abi and Utils object of Alchemy SDK.
- Makes an
- eth_call
- request using Alchemy SDK for getting the symbol value in the hex format.
- Makes an
- eth_call
- request using Alchemy SDK for getting the balance value in the hex format.
- Converts the balance in the hex format to decimal format and logs it.
- Logs the symbol in the hex format.

node node main .js You should see an output like this:

But the value of the symbol will be a string and not a number, so we have to use the other approach to decode its value. Let's take a look at how to do that.

In order to convert unformatted data(byte arrays, account addresses, hashes, bytecode arrays) into human-readable format, you need to convert its hex value to utf8 value.

Decoding using

Here's an overview of what the code is doing (also explained in comments):

- Imports the required objects from Alchemy SDK.
- Sets the config object (setting API key and the network).
- Makes an
- alchemy
- variable using the config object for making the calls.
- Defines a main function that gets executed when the script runs.
- In the main function it defines the wallet address whose balance we want to query.
- Defines the contract address for the ERC20 token.
- Defines the number of decimals of the ERC20 token.
- Defines the abi for the ERC20 token that will be used for making an
- eth_call
- request.
- Creates function call data for getting the symbol and balance using the abi and Utils object of Alchemy SDK.
- Makes an
- eth_call
- request using Alchemy SDK for getting the symbol value in the hex format.
- Makes an
- eth_call
- request using Alchemy SDK for getting the balance value in the hex format.
- Converts the balance in the hex format to decimal format and logs it.
- Converts the symbol value in the hex format to utf8 format, which is readable by humans, and logs it.

node node main .js You should see an output like this:

Let's also take a look at how to decode unformatted data (byte arrays, account addresses, hashes, bytecode arrays) using pure javascript:

If for some reason you don't want to use ethers for decoding the symbol hex value, here's the pure javascript way of doing it.

- Imports the required objects from Alchemy SDK.
- Sets the config object (setting API key and the network).
- Makes an
- alchemy
- variable using the config object for making the calls.
- Defines a main function that gets executed when the script runs.

- In the main function it defines the wallet address whose balance we want to query.
- Defines the contract address for the ERC20 token.
- Defines the number of decimals of the ERC20 token.
- Defines the abi for the ERC20 token that will be used for making an
- eth_call
- request.
- Creates function call data for getting the symbol and balance using the abi and Utils object of Alchemy SDK.
- Makes an
- eth_call
- request using Alchemy SDK for getting the symbol value in the hex format.
- Makes an
- eth_call
- request using Alchemy SDK for getting the balance value in the hex format.
- Converts the balance in the hex format to decimal format and logs it.
- Converts the symbol value in the hex format to utf8 format, which is readable by humans, and logs it.

```
main.js const {Alchemy ,Network ,Utils }= require ("alchemy-sdk" );const config = {apiKey :"<- ALCHEMY API KEY ->" ,network :Network .ETH_MAINNET , };const alchemy = new Alchemy (config );const main = async ()=> { // Wallet address whose balance you want to query const walletAddress = "0xef0dcc839c1490cebc7209baa1f146cfe83805ab" ; // USDT contract address const contractAddress = "0xdAC17F958D2ee523a2206206994597C13D831ec7" ;const numDecimals = 6 ; // You can find out how many decimal places any currency has by reading the decimals value from the contract's page on Etherscan. // ABI -- defining the functions in the ABI that we want to call using the eth_call method. let abi = ["function balanceOf(address account)" ,"function symbol()" ]; // Create function call data for getting the symbol and balance -- eth_call let iface = new Utils .Interface (abi );let symbolData = iface .encodeFunctionData ("symbol" );let balanceData = iface .encodeFunctionData ("balanceOf" , [walletAddress ]); // Get symbol of the token in hex format -- usage of eth_call let symbolInHex = await alchemy .core .call ({to :contractAddress ,data :symbolData , }); // Get balance for the wallet address in hex format -- usage of eth_call let balanceInHex = await alchemy .core .call ({to :contractAddress ,data :balanceData , }); // Using parseInt we convert the hex value into decimal and then dividing it by number of decimals of the token. // .toFixed(2) means that we are only interested in the first two decimal places. balance = (parseInt (balanceInHex ) / 10 ** numDecimals ).toFixed (2 );console .log ("Decoded Balance:" ,balance , "USDT" ); // Using the decodeURIComponent function in combination with regex to convert the hex value into utf8 value let symbol = decodeURIComponent (symbolInHex .replace (/s+/g ,"" ).replace (/ [0-9a-f] {2} /g ,"%&" ) ); // The output is appened with this string: "0x " // So slicing the first 3 characters and only printing the characters after that as the final value. console .log ("Decoded Symbol:" ,symbol .slice (3 )); };const runMain = async ()=> {try {await main ();}process .exit (0 );}catch (error ) {console .log (error );}process .exit (1 );} };runMain ();
```

node node main .js And you will see the same output as before:

Decoded Balance: 61900000.01 USDT Decoded Symbol: USDT Congratulations! You now know how to decode an eth_call response to understand it!

Updated 5 months ago

[Ethereum Developer Guide to the Merge](#)How do I distinguish between a contract address and a wallet address?Did this page help you?Yes No