XRPL EVM Sidechain

Hazard Cookie
Developer Advocate
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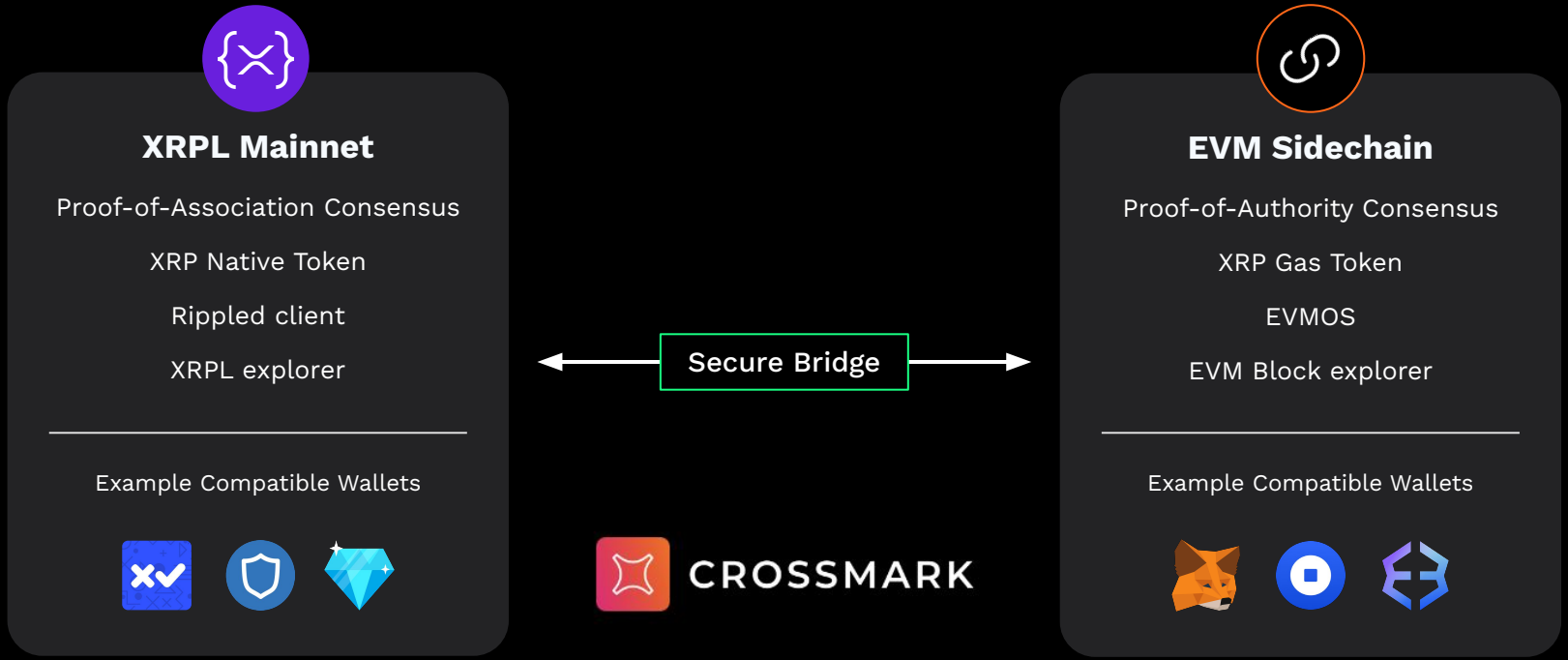
XRP LEDGER

Intro to the EVM Sidechain

What is the “EVM Sidechain”

The EVM Sidechain enables the ability to interact or deploy smart contracts written in Solidity with a secure bridge to XRPL Mainnet



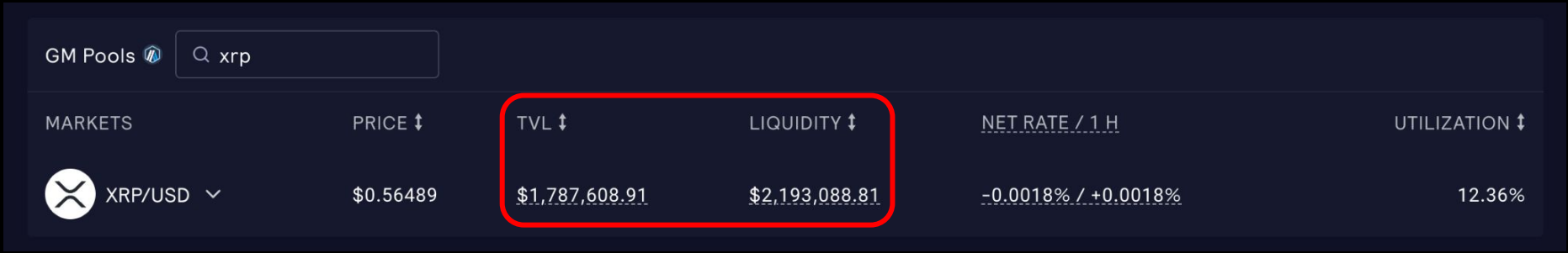
EVM Compatibility on different blockchains

Blockchain Ecosystem	EVM Compatibility Solution/Project
Ethereum	Native
Solana	Neon
Polkadot	Moonbeam
Cosmos	Evmos
Polygon	zkEVM
BNB Chain	BNB Smart chain
Avalanche	Avalanche C-chain
XRPL	**EVM Sidechain**

Network Details

- Consensus
  - Powered by CometBFT
  - Tendermint fork
  - Byzantine fault tolerance engine
  - 1 block finalization time
- Execution
  - Cosmos SDK
  - EVMOS
- Validators
  - POA Cosmos SDK

Why a EVM Sidechain for XRPL?



Why a EVM Sidechain for XRPL?

PancakeSwap XRP Stats

TVL
$744.61K
↓1.01%

VOLUME 24H
$684.33K
↑46.50%

VOLUME 7D
$10.58M

TRANSACTIONS 24H
1,292.00

XRPL All Tokens Stats

Benefits of EVM Sidechain for Developers

Interact with XRPL

EVM applications can interact with XRPL via the bridge

Faster Go Live

EVM applications can be launched without the need of an amendment

Use App As-Is

Any contract written for Ethereum/EVM can be used as-is without code changes

EVM ecosystem

XRPL community will have access to more EVM apps and developers who build on the sidechain

Dev Tooling

Languages

- Solidity
- Vyper
- Huff
- Yul
- Assembly

Frameworks

- Remix
- Hardhat
- Foundry

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Connecting it all together!

How will it connect to mainnet?

What is “Axelar”

Interoperability Platform: Axelar acts as a bridge between chains, enabling token transfers and general message passing.

Bridging Process:

- **Outbound**: Locks XRPL assets, issues wrapped assets on other chains.
- **Inbound**: Burns tokens on other chains, releases locked assets on XRPL.

Security:

- Secured by a multisig XRPL account
- Managed by top 32 Axelar validators.

Key Components:

- **On-Chain**: XRPL multisig account, Gateway, Voting Verifier, Multisig Prover.
- **Off-Chain**: Relayer processes (Event Monitor, TX Broadcaster, Axelar Validator).

Why a EVM Sidechain for XRPL?

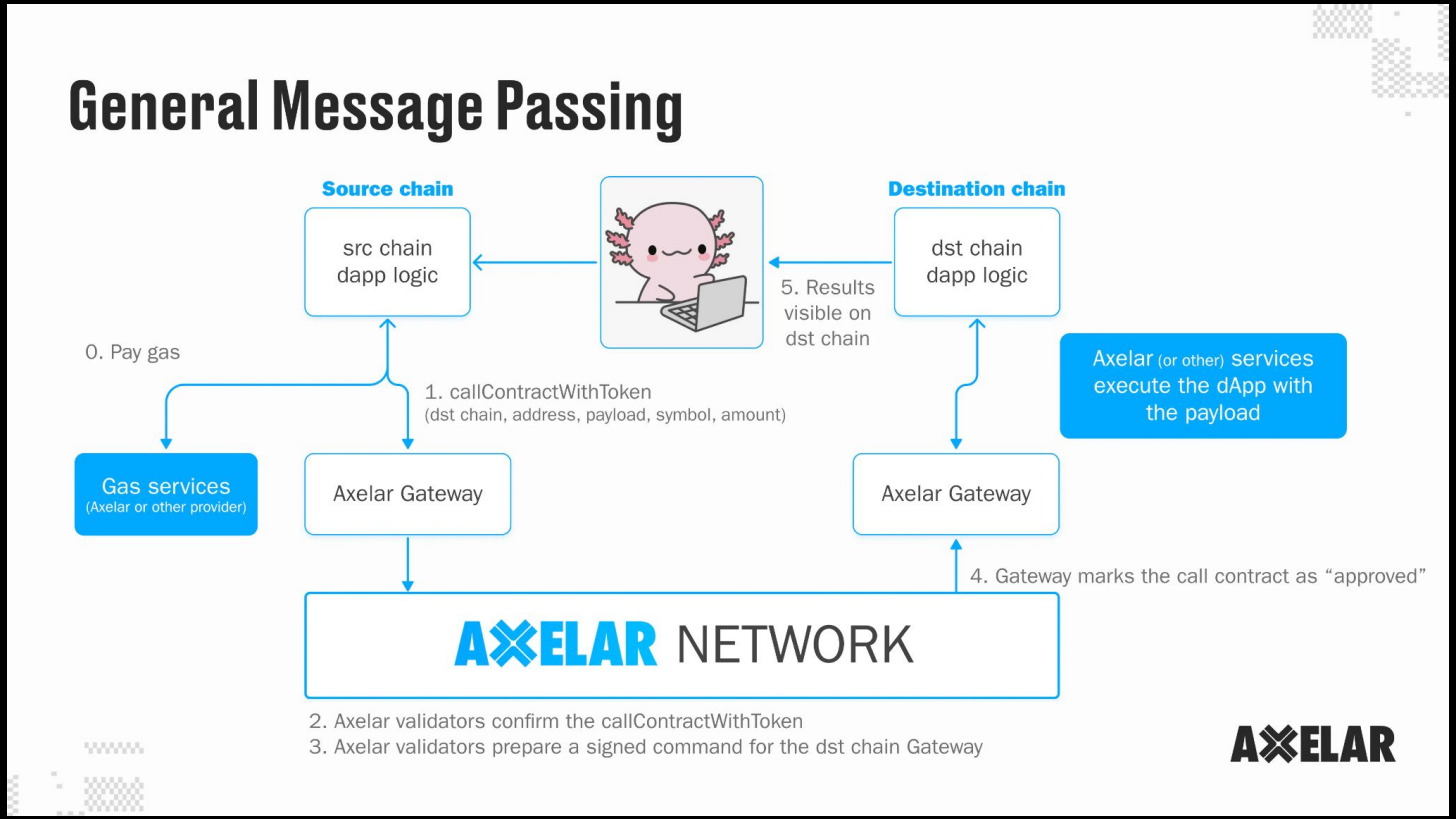
#	DEXes	Pairs	Price	Volume	Confidence	Liquidity	Liquidity score
1	KLAYswap	OXRP/KLAY	$0.5267	$46.98K	High	$1.4M	436
2	PancakeSwap v2 (BSC)	XRP/WBNB	$0.5637	$39.04K	High	$576.78K	377
3	PancakeSwap v3 (BSC)	XRP/ETH	$0.5638	$97.21K	High	$405.88K	354
4	KLAYswap	OXRP/OETH	$0.5256	$3.67K	High	$232.89K	317
5	Uniswap v3 (BSC)	XRP/USDT	$0.5630	$35.11K	High	$121.52K	273
6	PancakeSwap v3 (BSC)	XRP/USDT	$0.5634	$42.13K	High	$64.49K	231
7	THENA FUSION	XRP/WBNB	$0.5636	$18.8K	High	$64.12K	231
8	Biswap v2	XRP/WBNB	$0.5627	$1.13K	High	$52.67K	218
9	KLAYswap	OXRP/OUSDT	$0.5272	$1.81K	High	$47.06K	210

How it works

- XRPL wallets such as Xaman, Crossmark
- XRPL libraries
- XRPL Consensus

- EVM wallets such as Metamask
- EVM libraries and SDKs such as Openzeppelin
- PoA Consensus

What is GMP?


General Message Passing
Source chain
Destination chain
src chain dapp logic
dst chain dapp logic
5. Results visible on dst chain
0. Pay gas
1. callContractWithToken
(dst chain, address, payload, symbol, amount)
Axelar (or other) services execute the dApp with the payload
Gas services
(Axelar or other provider)
Axelar Gateway
Axelar Gateway
4. Gateway marks the call contract as “approved”
AXELAR NETWORK
2. Axelar validators confirm the callContractWithToken
3. Axelar validators prepare a signed command for the dst chain Gateway
AXELAR

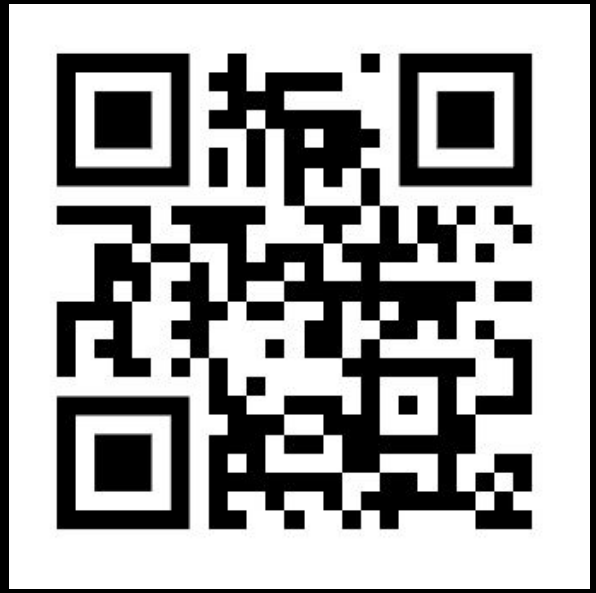
Example of Axelar GMP Smart Contract

```sol
// SPDX-License-Identifier: MIT
pragma solidity ^0.8.0;

import { AxelarExecutable } from '../AxelarExecutable.sol';
import { IAxelarGateway } from '../../interfaces/IAxelarGateway.sol';

contract ExecutableSample is AxelarExecutable {
    string public sourceChain;
    string public sourceAddress;
    string public message;
    string public tokenDenom;
    uint256 public tokenAmount;

    event Executed(string _sourceChain, string _sourceAddress, string _message, string _tokenSymbol,
uint256 _tokenAmount);

    constructor(address gateway_) AxelarExecutable(gateway_) {
    }

    function _execute(
        string calldata sourceChain_,
        string calldata sourceAddress_,
        bytes calldata payload_
    ) internal override {
        bytes memory gmpPayload;
        (tokenDenom, tokenAmount, gmpPayload) = abi.decode(payload_, (string, uint256, bytes));
        (message) = abi.decode(gmpPayload, (string));
        sourceChain = sourceChain_;
        sourceAddress = sourceAddress_;

        emit Executed(sourceChain, sourceAddress, message,
IAxelarGateway(gateway).tokenSymbol(tokenDenom), tokenAmount);
    }
}
```

Example of GMP Call From XRPL

```
import * as xrpl from "xrpl";

const XRPL_RPC_URL = "wss://s.altnet.rippletest.net:51233";
async function gmp() {
    const client = new xrpl.Client(XRPL_RPC_URL);
    await client.connect();

    // const user = xrpl.Wallet.fromSeed(SEED); // Read XRPL wallet seed from environment or generate
and fund new wallet:
    const user = xrpl.Wallet.generate();
    await client.fundWallet(user);

    const paymentTx: xrpl.Transaction = {
        TransactionType: "Payment",
        Account: user.address,
        Amount: "1",
        Destination: "rfEf91bLxrTVC76vw1W3Ur8Jk4Lwujskmb",
        SigningPubKey: "",
        Flags: 0,
        Fee: "30",
        Memos: [
            {
                Memo: {
                    MemoData: "143669292488bd98a0F14F1c73829572f2c25773", // the `ExecutableSample`
contract
                    MemoType: Buffer.from("destination_address").toString('hex').toUpperCase(),
                },
            },
            {
                Memo: {
                    MemoData: Buffer.from("ethereum").toString('hex').toUpperCase(),
                    MemoType: Buffer.from("destination_chain").toString('hex').toUpperCase(),
                },
            },
            {
                Memo: {
                    MemoData: "df031b281246235d0e8c8254cd731ed95d2caf4db4da67f41a71567664a1fae8", //
keccak256(abi.encode(gmpPayload)), in this example, keccak256(abi.encode(['string'], ['Just transferred
XRP to Ethereum!']))
                    MemoType: Buffer.from("payload_hash").toString('hex').toUpperCase(),
                },
            },
        ],
    };

    const signed = user.sign(await client.autofill(paymentTx));
    console.log(signed);
    await client.submitAndWait(signed.tx_blob);
    await client.disconnect();
}

gmp();
```

Join the Discord to get Started on Devnet



Useful Axelar <> XRPL Docs

Axelar XRPL Bridge Docs

Axelar XRPL GMP Docs

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Band Oracle Workshop

What is an Oracle?

- Oracles connect blockchain with external data.
- They ensure accurate, tamper-proof information.
- Use Cases:
  - Price feeds,
  - Weather data
  - Event outcomes
  - Etc

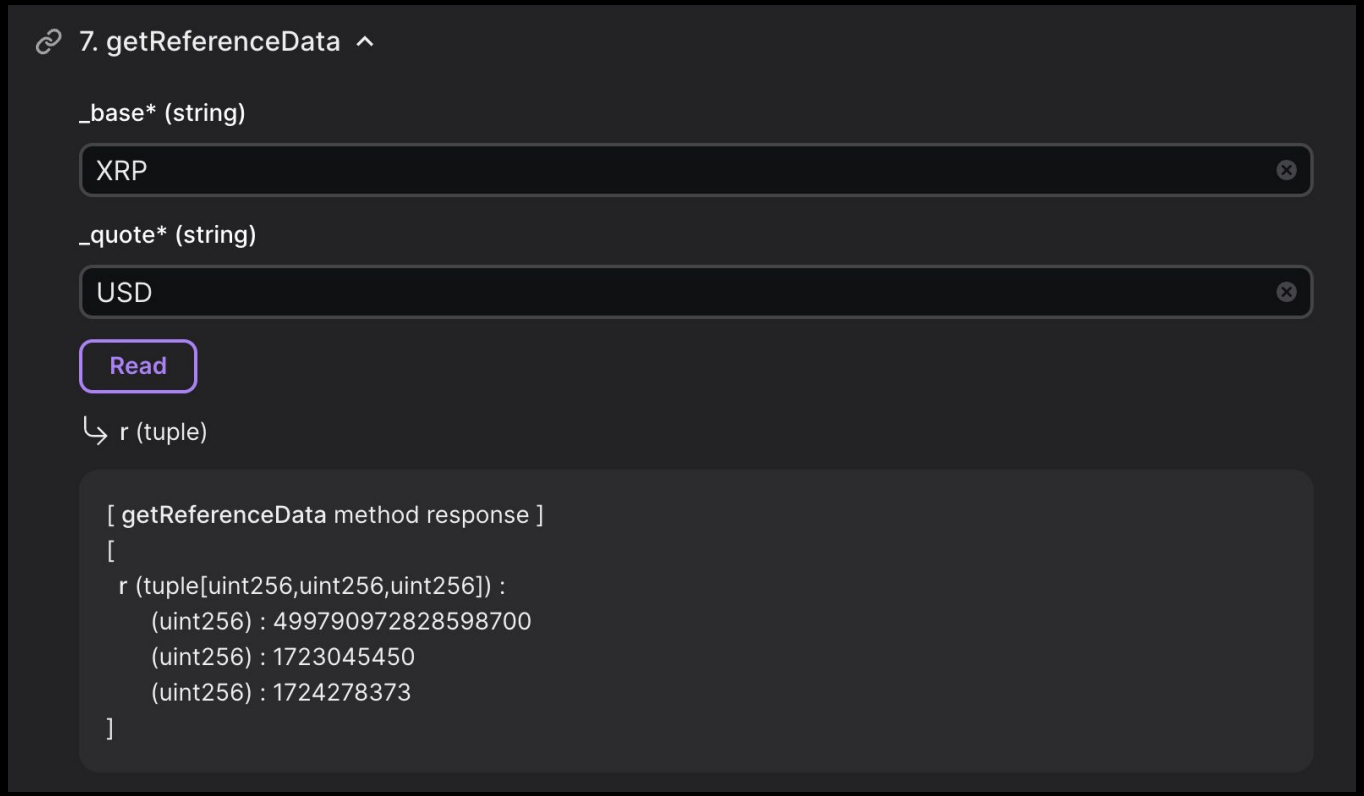
This workshop we will explore Band Oracle

- For this workshop, we'll focus on price feed oracles, specifically Band Oracle.
- Band Oracle provides reliable, scalable, and cross-chain price data.
- Band Oracle is currently deployed on the XRPL EVM Devnet and is providing limited price feed data.
- This can enable the development of multiple defi primitives that are dependent on outside price data.

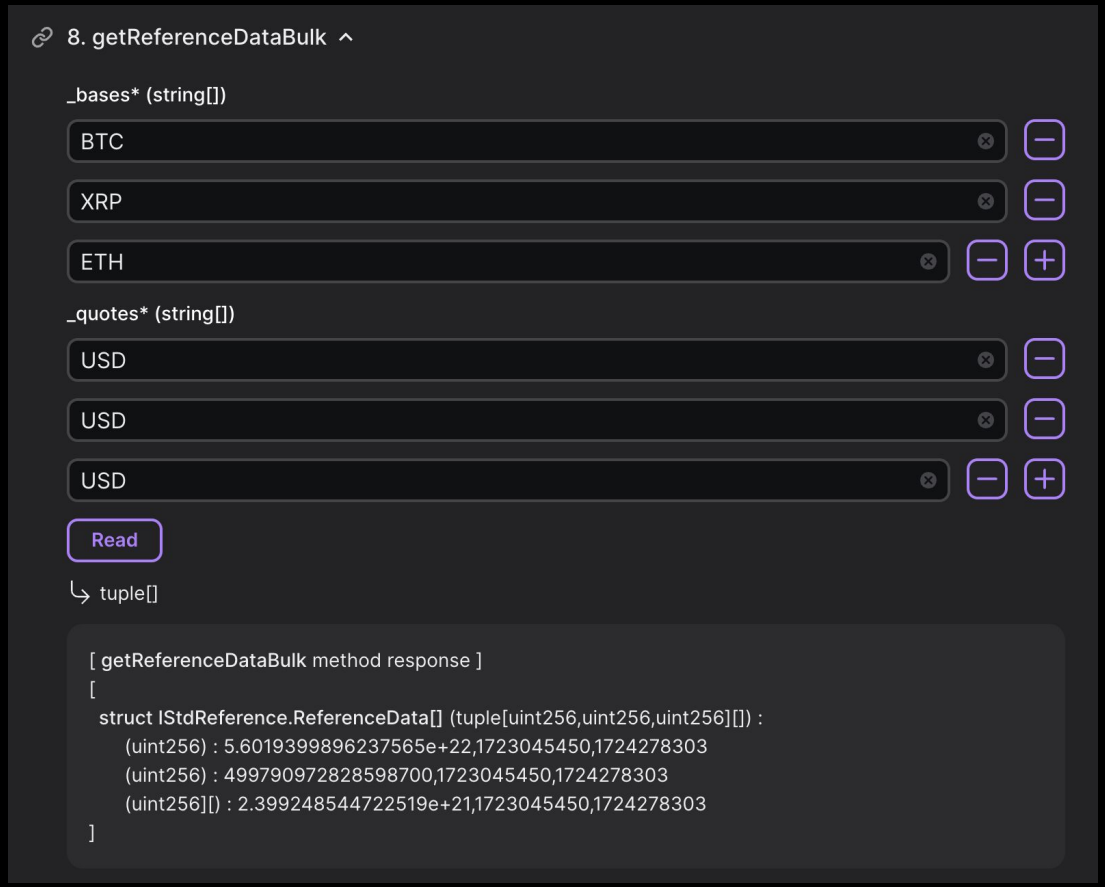
Go to the Band Oracle contract

- Explorer: https://explorer.xrplevm.org/
- Contract Address: 0xdE2022A8aB68AE86B0CD3Ba5EFa10AaB859d0293
- Click on the Contract tab
- Click on Read Contract
- We will be working with the getReferenceData and getReferenceDataBulk functions.
- Currently the only supported price feeds on devnet are XRP, BTC & ETH

Example: Get a single price feed



Example: Get multiple price feeds at once



Band Oracle
Integration

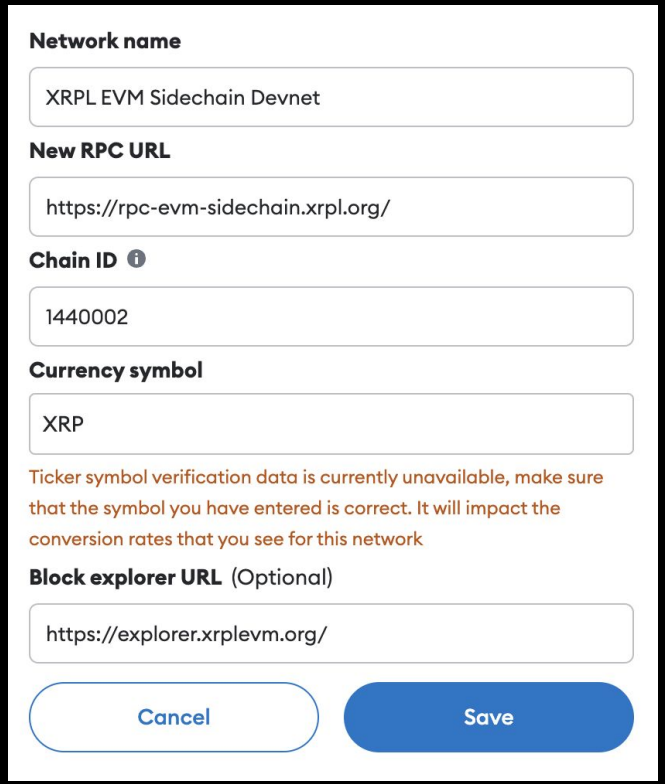
Setting up

- We will be working with Foundry
  - Please visit the foundry docs for installation instructions
  - https://book.getfoundry.sh/getting-started/installation
- Clone this repo: https://github.com/hazardcookie/Band-Oracle-Foundry-Workshop
- Create a fresh metamask wallet and
- Connect to the XRPL EVM Sidechain Devnet
- Fund the wallet with devnet XRP and bridge to the sidechain
- Export the private key from metamask and save it in a .env file in your repo

Metamask Setup

Setting up Metamask

Add a custom network using the details below:



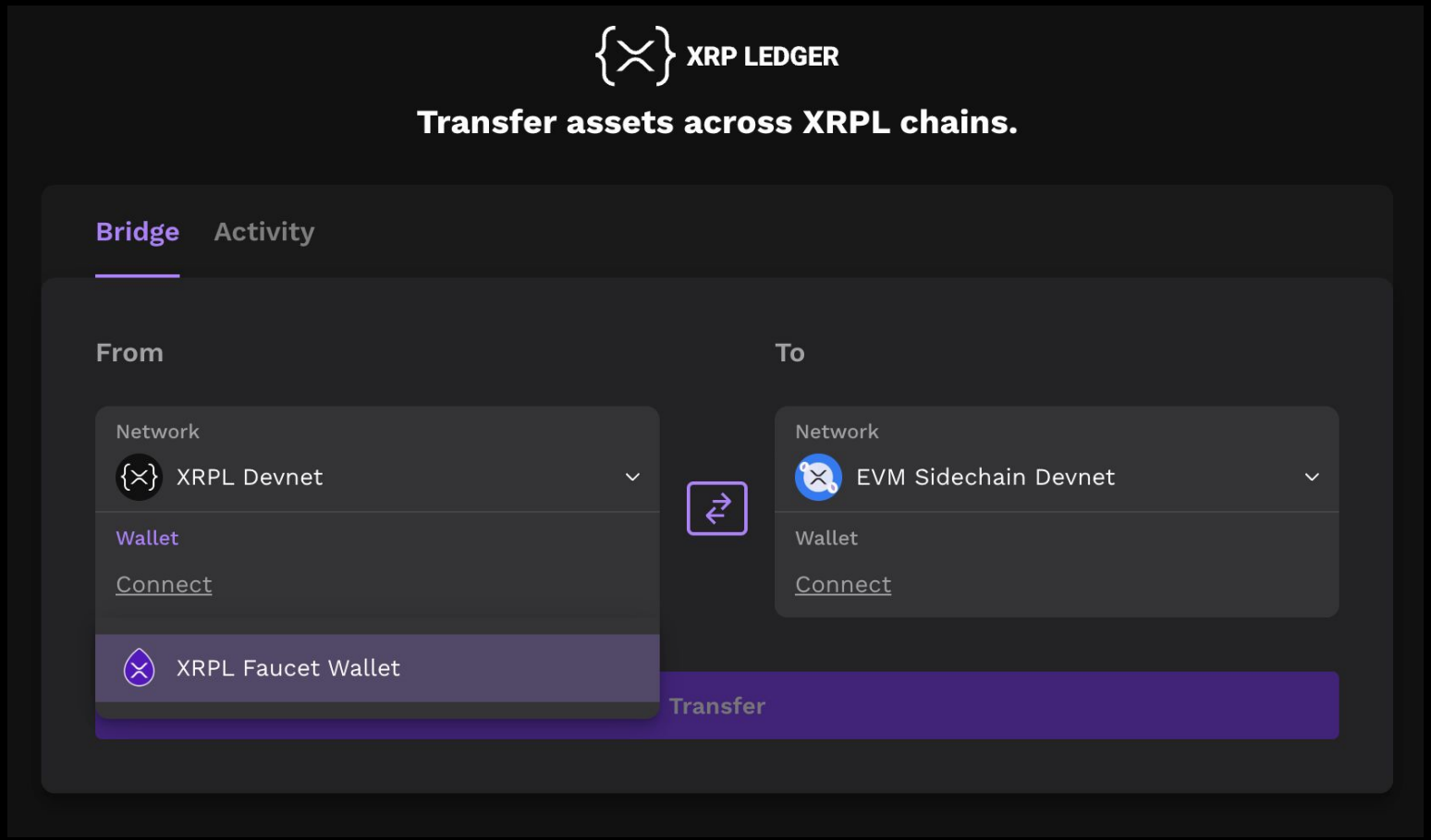
Getting Devnet XRP

Getting Devnet XRP Checklist

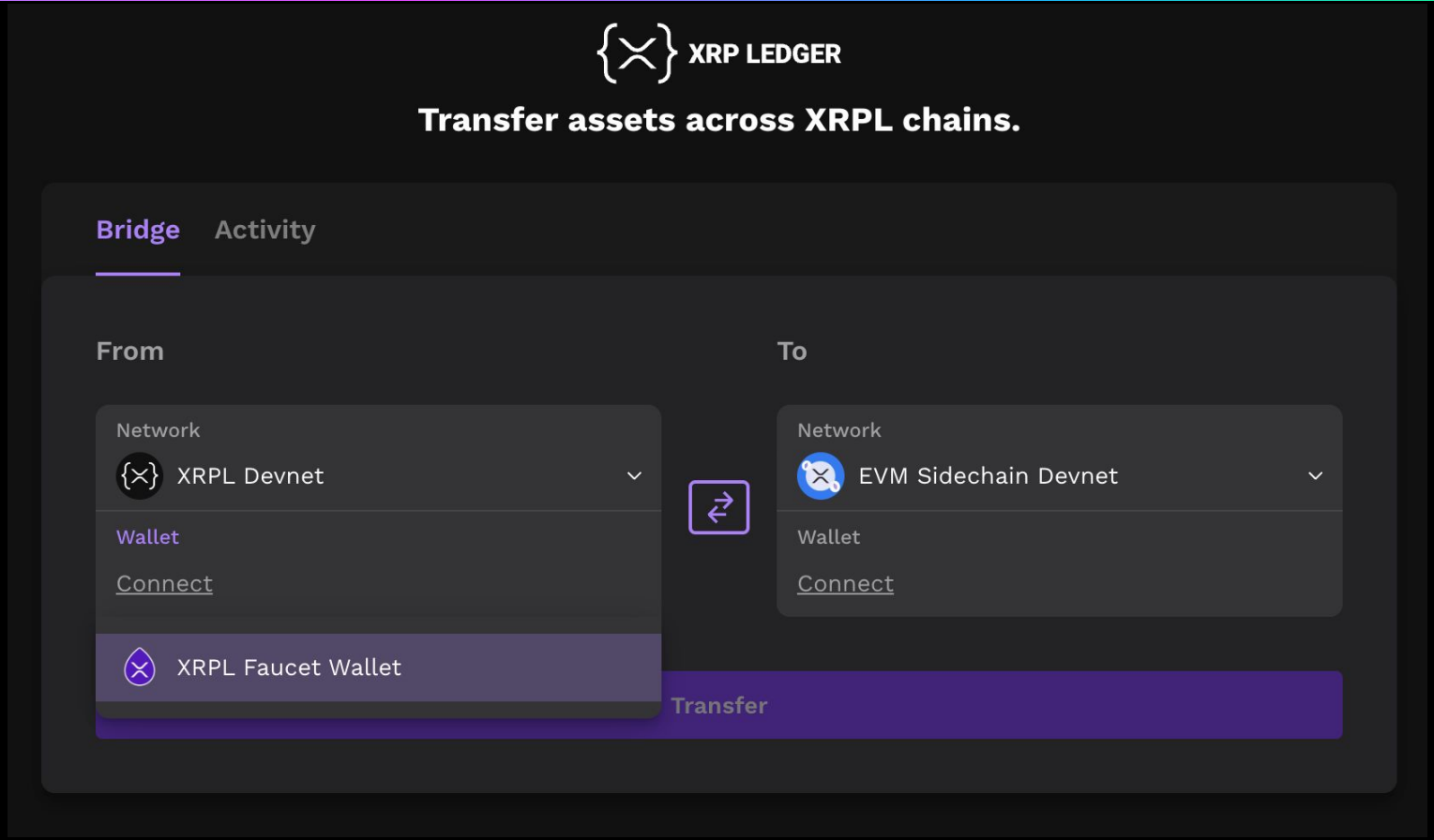
- Go to the combined bridge & faucet website:

  https://bridge.xrplevm.org
- Ensure Metamask is installed
- Create a fresh Metamask account
  - We will be extracting private keys later on
  - Do not use a wallet that contains real funds
- Fund the XRPL Devnet faucet wallet
- Connect the Metamask wallet
- Bridge XRP from the faucet wallet to the Metamask wallet

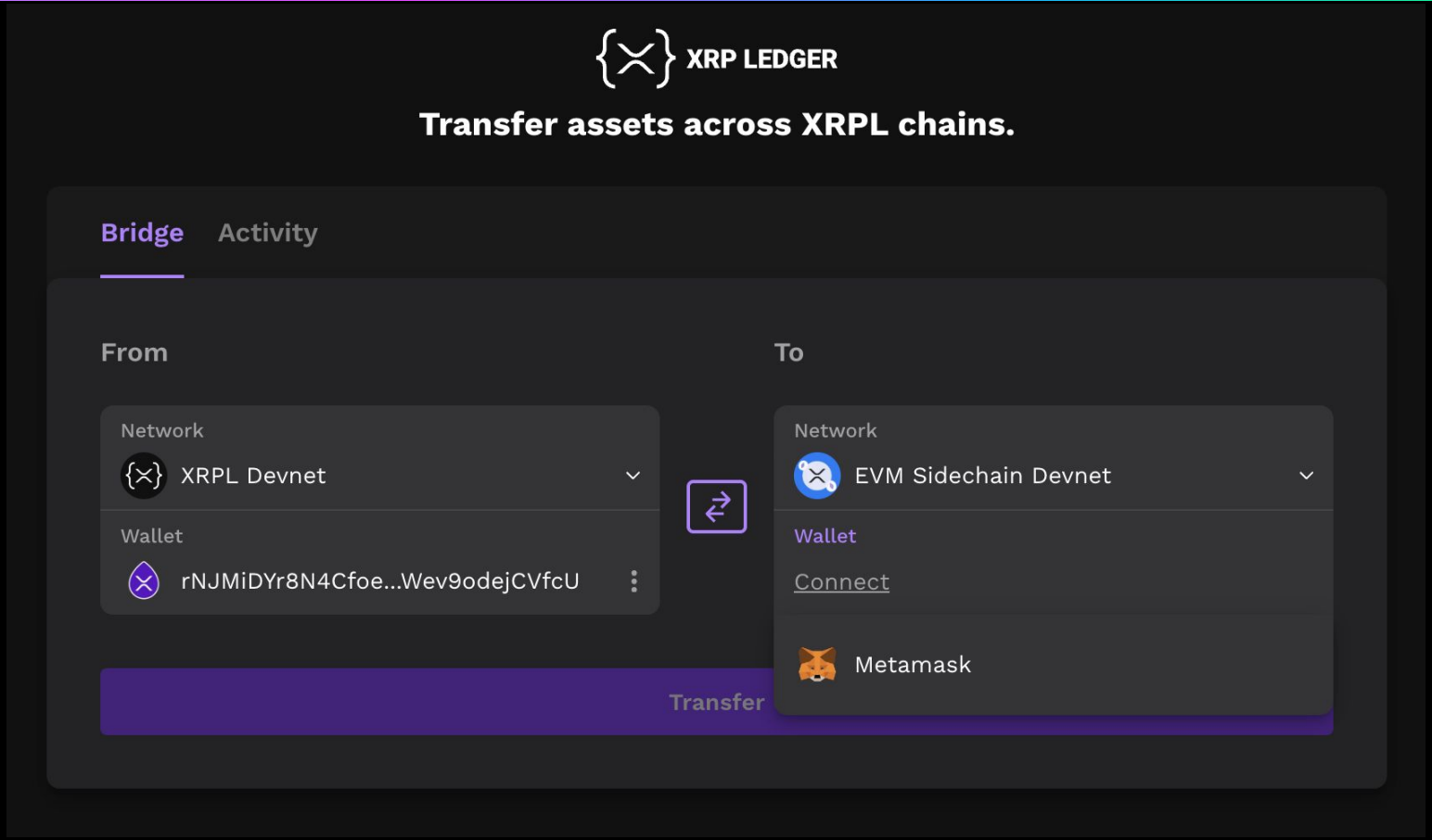
Click on *Connect* - Then press XRPL Faucet Wallet



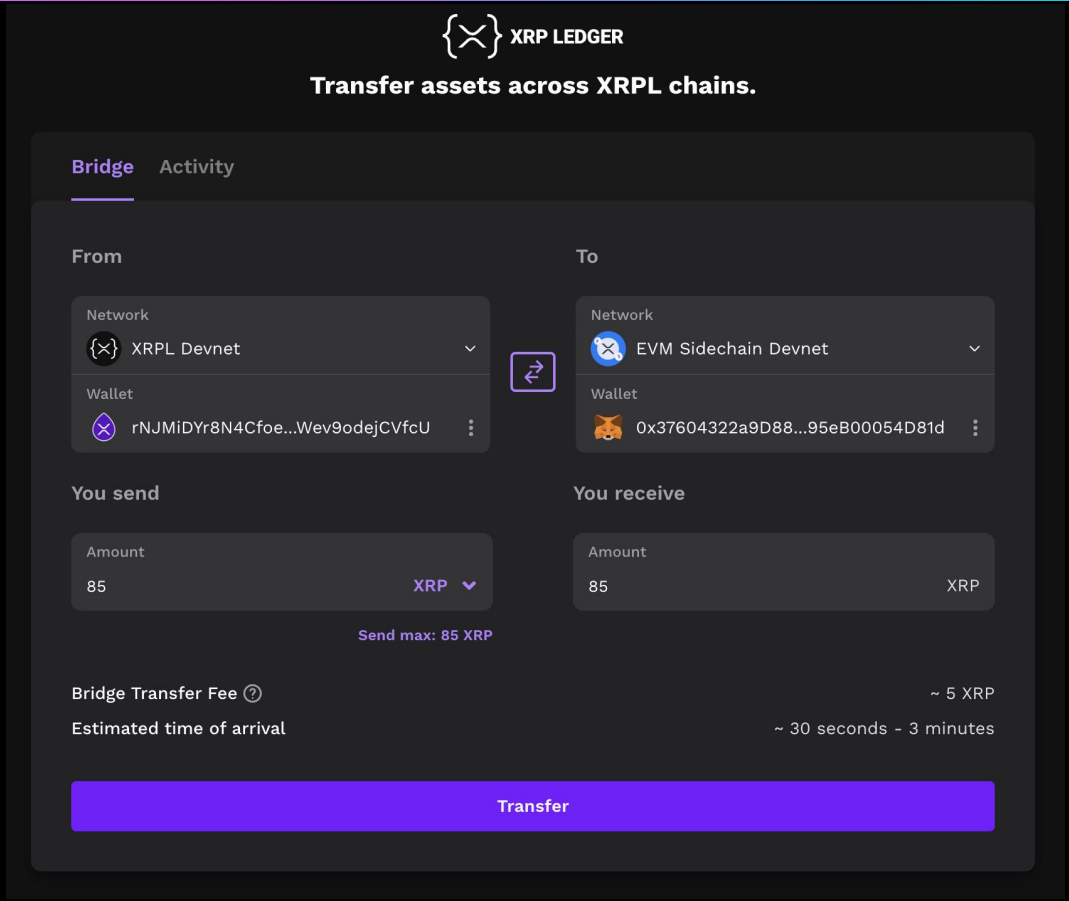
Click on *Connect* - Then press XRPL Faucet Wallet



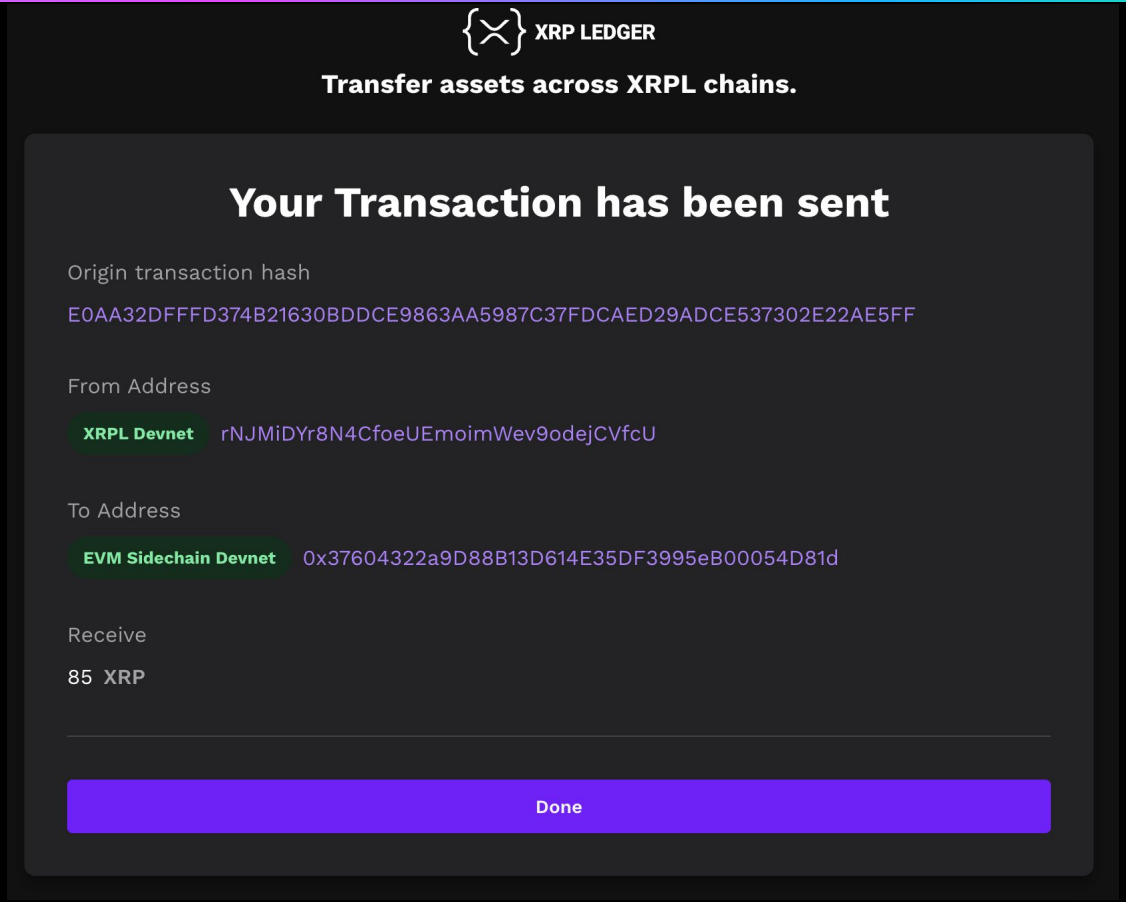
Click on *Connect* - Then press Metamask



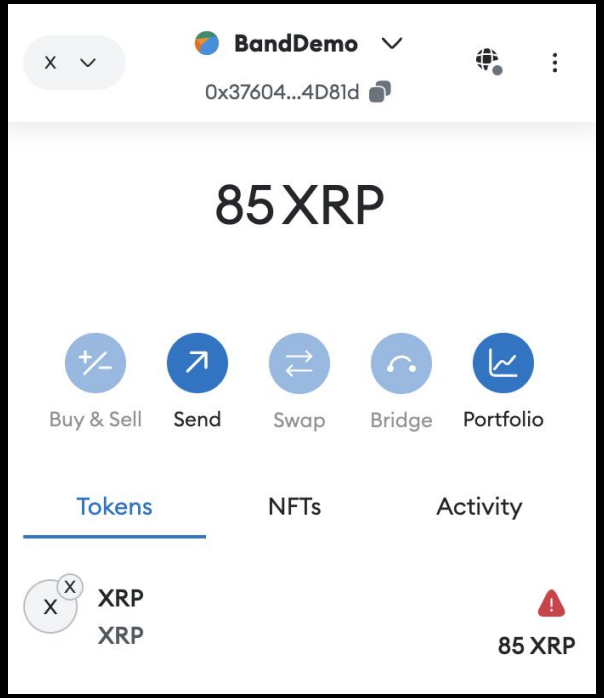
Bridge over some XRP



Bridge over some XRP

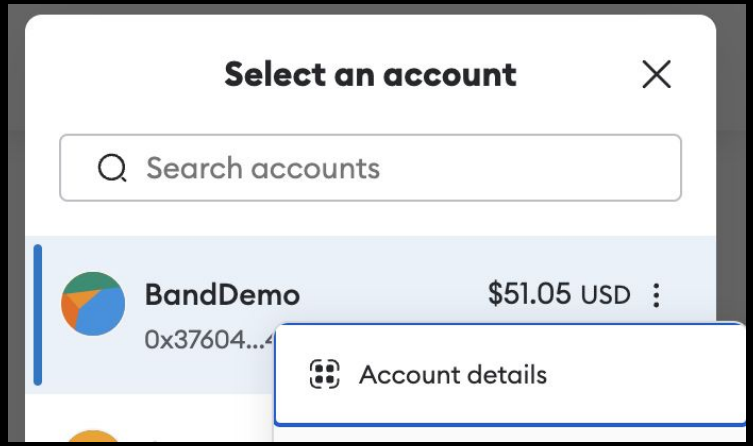


Soon you should see your XRP in your MetaMask Wallet



Extracting the private key

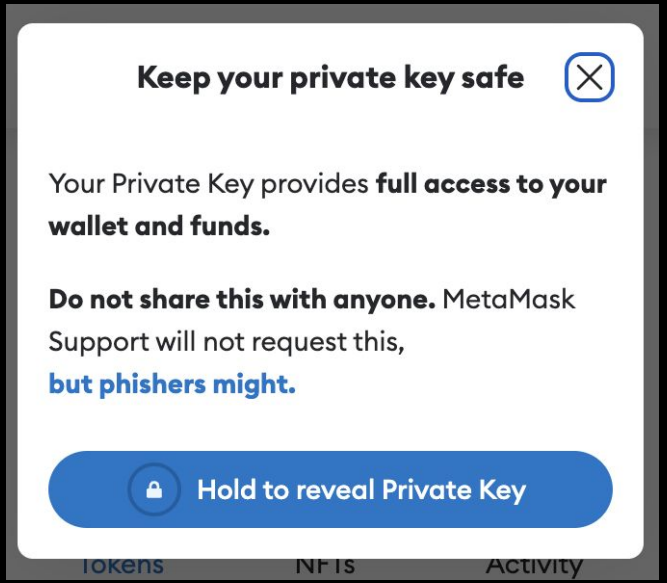
Step 1: Select your account and click account details



Extracting the private key (part 1)

Step 2:

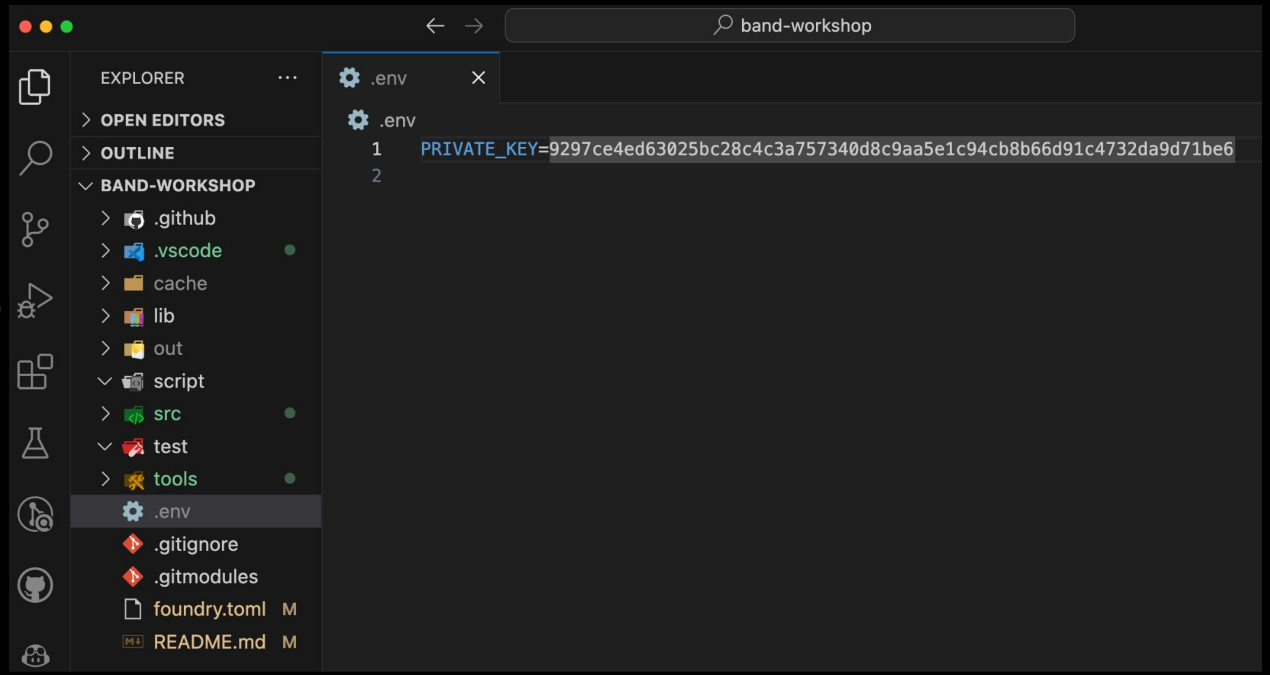
- Click show private key
- Enter password
- Press and hold to reveal
- Copy private key to clipboard
- Paste into .env file (see part 2)



Extracting the private key

Step 2:

- Paste into .env file
- This is so you don't commit them to github by mistake
- We will need this key later to deploy the contract



Contract Deployment

Contract Deployment Checklist

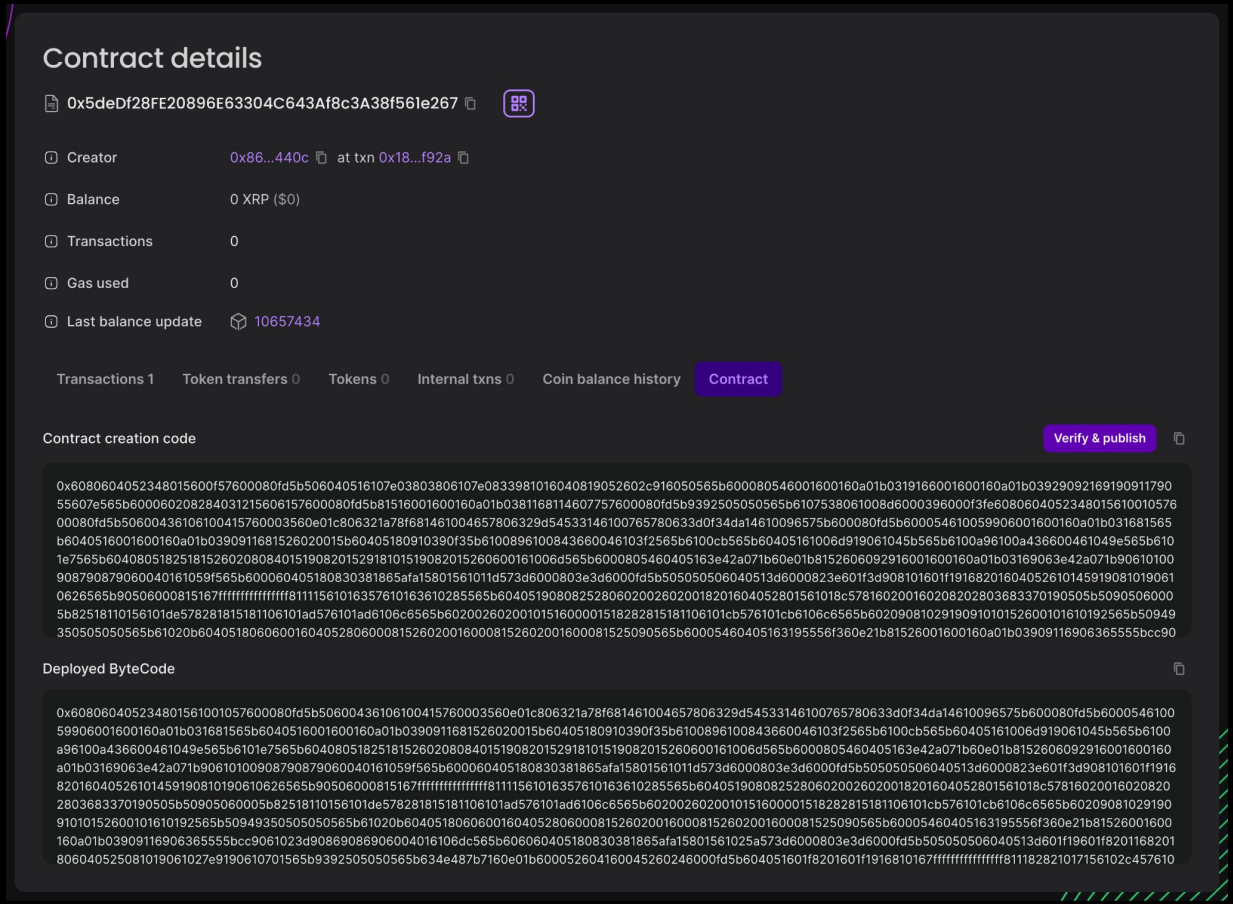
- Clone the Github repo
- Assuming Foundry is installed, jump into the project folder
- Extract the private key from metamask
- Run the cli command to deploy the example contract
- Run the cli command to verify the contract on the explorer

Deploy the Contract

- Make sure to include your private key in the deploy cli command
- Copy the cli command into your terminal and run it
- Grab your private key from your .env file and pass it through the private-key flag
    - Do not save this command with your keys in it to your readme file
    - DO NOT COMMIT KEYS TO GITHUB

```
(base) ➜  band-workshop git:(master) ✗ forge create --rpc-url https://rpc-evm-sidechain.xrpl.org \
    --constructor-args 0xdE2022A8aB68AE86B0CD3Ba5EFa10AaB859d0293 \
    --private-key 9[redacted]6 \
    src/BandWorkshop.sol:BandWorkshop
[⠊] Compiling...
[⠊] Compiling 2 files with Solc 0.8.26
[⠊] Solc 0.8.26 finished in 306.37ms
Compiler run successful!
Deployer: 0x86Db6b33e7f76733aDC7071910EEfa61Ef62440c
Deployed to: 0x5deDf28FE20896E63304C643Af8c3A38f561e267
Transaction hash: 0x182e153b022d39243eb9901bf72b65065a65ddf2fe0816695b4526b1001cf92a
```

View the contract on the explorer



Contract Verification

- As we can see the contract is not readable on the explorer
- To fix this we must verify our contract to the explorer api
- Run the cli command provided in the Readme file
- Switch out the contract address with the address of the contract you deployed
- **Note:** If you haven't changed the the name of your contract, you might not need to verify
    - This is because i have verified this exact bytecode already
    - If you change the name of your contract pre-deployment, it will generate new bytecode and you can verify a fresh contract

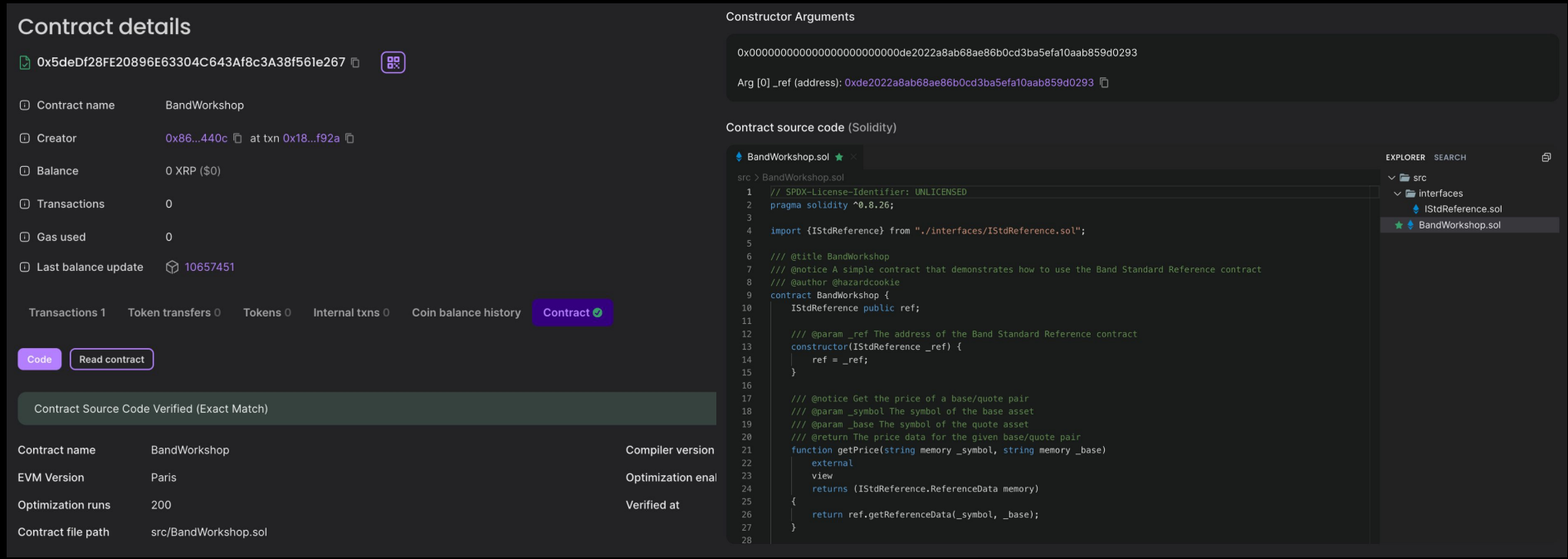
Verify the Contract

- Copy the “deployed to” contract address output from your terminal
- Paste this into the cli command to verify the contract and run it

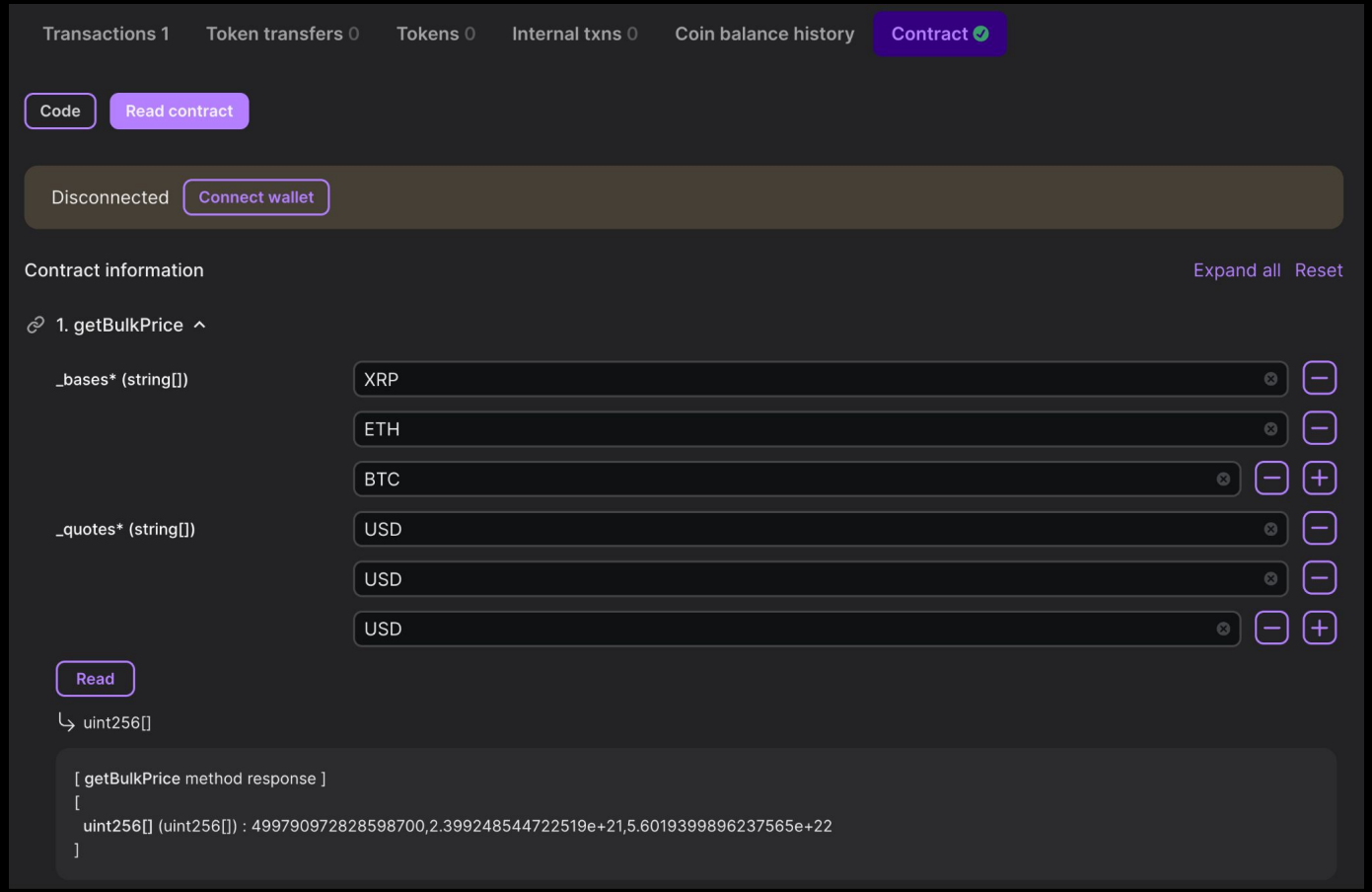
```
Deployer: 0x86Db6b33e7f76733aDC7071910EEfa61Ef62440c
Deployed to: 0x5deDf28FE20896E63304C643Af8c3A38f561e267
Transaction hash: 0x182e153b022d39243eb9901bf72b65065a65ddf2fe0816695b4526b1001cf92a
(base) ➜  band-workshop git:(master) ✗ forge verify-contract  --chain-id 1440002 --verifier=blockscout \
--verifier-url=https://explorer.xrplevm.org/api \
0x5deDf28FE20896E63304C643Af8c3A38f561e267  src/BandWorkshop.sol:BandWorkshop
Start verifying contract `0x5deDf28FE20896E63304C643Af8c3A38f561e267` deployed on 1440002

Submitting verification for [src/BandWorkshop.sol:BandWorkshop] 0x5deDf28FE20896E63304C643Af8c3A38f561e267.
Submitted contract for verification:
        Response: `OK`
        GUID: `5dedf28fe20896e63304c643af8c3a38f561e26766c68218`
        URL: https://explorer.xrplevm.org/address/0x5dedf28fe20896e63304c643af8c3a38f561e267
```

View the contract on the explorer



Test out your contract!



XRPL EVM Sidechain – Band Oracle Workshop

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