Quickstart: Deploy an Arbitrum Orbit rollup

This guide covers deploying a rollup using the Celestia Orbit chain deployment portal.

After completing this tutorial, you will have a local development network rollup capable of hosting EVM-compatible smart contracts. This rollup will process transactions locally, settle on the public Arbitrum Sepolia testnet, and post data to Celestia's Mocha testnet.

If you're looking to learn more about the integration of Celestia and Orbit, read the Arbitrum Orbit integration overview. If you're looking to learn more about Orbit, read A gentle introduction: Orbit chains.

Thank you, Offchain Labs!

This guide was made possible with the support and information provided by thou fisher Labs team, the creators of Arbitrum. For more detailed information and support, visitArbitrum documentation and the original deployment guide.

Prerequisites

- · Familiarity with Ethereum, Ethereum's testnets, Arbitrum, and Celestia
- · A gentle introduction: Orbit chains
- Arbitrum Orbit integration overview
- Docker
- · running on your machine
- Docker Compose
- · A fully synced and funded Mocha testnetlight node
- onv0.13.2
- .
 - Mocha testnet faucet
- A browser-based Ethereum wallet (like<u>MetaMask</u>
-)
- At least 1 Arbitrum Sepolia testnet ETH (for custom gas token chains, 0.6 ETH and 0.4 native tokens)

Setup

This section was adapted from Arbitrum's Orbit quickstart.

Step 1: Acquire Arbitrum Sepolia ETH

You'll need at least 1 testnet ETH for a regular Orbit rollup or 0.6 ETH plus 0.4 of your desired native token for Orbit rollups with a custom gas token. The funds will cover the cost of deploying the base contracts to the base chain, in this case, Arbitrum Sepolia.

The simplest way to do this is to:

- 1. Use an L1 testnet ETH faucet likesepoliafaucet.com
- 2. to acquire some testnet ETH on Ethereum Sepolia testnet.
- 3. Bridge your L1 testnet ETH to L2 Arbitrum Sepolia using the Arbitrum bridge
- 4. .

Step 2: Pick your deployment type

Visit the Celestia Orbit chain deployment portal . This portal offers the following options:

- 1. Celestia Rollup: Transaction data is posted to Celestia
- 2. Rollup: Transaction data is posted to Ethereum
- 3. AnyTrust: Transaction data is posted by a Data Availability Committee

Connect your wallet to the deployment portal. You may be prompted to add the Arbitrum Sepolia network to your wallet and/or switch your wallet to this network; approve this.

In this guide, we will selectCelestia % and deploy a rollup which posts data to Celestia (1 above).

ClickNext . In the next step, we will configure the deployment.

Step 3: Configure your Orbit chain's deployment

The deployment portal will then display a form that looks like this:

Parameter descriptions can be found in the table below (more in-depth descriptions can be found in the deployment UI). We recommend sticking to the defaults; to learn more about customizing your Orbit chain's deployment configuration, visitHow to customize your Orbit chain's deployment configuration:

Parameter Description Chain ID This is a unique integer identifier for your chain's network, primarily used on chain indexes likehainlist.org. It's not crucial for development networks, but in production, you'll need to choose a unique ID. Chain Name The name you assign to your Orbit chain, which helps users and developers distinguish it from other chains. It should be memorable and recognizable. Challenge Period Blocks Determines the time frame within which validators can dispute the state of the chain posted to the base chain. It's measured in blocks on the underlying L1 chain. A longer period allows more time for disputes but also delays withdrawals. Stake Token Specifies the token that validators must stake to participate in the validation process, using the token's contract address on the base chain. This can be ETH or another token, defined by its address. Base Stake The minimum amount of stake token required for validators to post state assertions. A lower base stake lowers the barrier to entry but increases vulnerability to attacks, whereas a higher stake encourages honest participation but raises the entry barrier. Owner The account address that has the authority to deploy, own, and update the base contracts of your Orbit chain on its base chain. In production, this is usually a high-stakes address controlled by a DAO or a multisig setup. For development chains, it's a lower-stakes administrative account. Gas Token The token used for gas payments on the network, which must be natively deployed on the parent chain. There are specific requirements for custom gas tokens, such as having 18 decimals and not being a rebasing or fee-on-transfer token. This feature is primarily for Orbit AnyTrust chains. Validators This is the number of validators for your chain, including their addresses. The first validator is auto-generated and immutable. Validators are crucial for maintaining the integrity of the chain and posting state assertions to the base chain. Batch Poster Responsible for posting transaction batches from your Orbit chain to the base chain. An address for this role is automatically generated, with the private key stored in a configuration file. In the Configure Validators section, specify the number of validators and their addresses for your chain. The initial validator's address is pre-generated and immutable, with its key stored in a JSON file. Validators ensure transaction integrity and state assertions on the base chain. They're added to an allow-list for validation and staking Base contracts refer to your Orbit chain's L2 contracts, andbase chain to the L2 chain they're deployed on.

In the Configure Batch Poster section, a batch poster address is auto-generated for posting transaction batches to the base contracts on the base chain. The address and its private key are also stored in a JSON configuration file. After configuring, proceed to review and deploy your Orbit chain.

After configuring your batch poster, proceed to the next step.

Step 4: Review & Deploy your Orbit chain

Now, deploy your chain's base contracts to Arbitrum Sepolia!

Click the Deploy button on the Review & Deploy page. Your wallet should prompt you to submit a transaction to the Arbitrum testnet. You'll have to pay a little gas; your wallet may denominate this in ETH; as long as you see your chosen Arbitrum testnet in the transaction details, this gas fee will be paid in testnet ETH.

Before proceeding, let's briefly review what just happened:

- 1. You submitted a deployment transaction to an Orbit "factory" smart contract on the Arbitrum testnet, the public L2 chain that your local Orbit chain will settle transactions to
- 2. This Orbit smart contract then initialized your Orbit chain's base contracts with the values that you specified in the previous step, and deployed these base contracts to the Arbitrum testnet.

Your Orbit chain's base contracts are responsible for facilitating the exchange of information between your chain's node(s) and its base chain's nodes. This includes the batch posting of transactions from your Orbit chain to its base chain, the staking of tokens by your Orbit chain's validators the challenge mechanism, bridging mechanisms, and more.

Once your transaction is complete, continue to Step 4 to download your chain's configuration files and launch your chain.

Step 5: Download your chain's configuration files and launch your chain

After configuring your chain, you will need to download the necessary configuration files to launch your chain. Click the Download zip files button to download both the Rollup Config and L3 Config in a single ZIP file.

- · Rollup Config
- : This is thenodeConfig.json
- file, encapsulating your chain's node configuration. It is crucial as it contains the private keys for your validator and batch poster, essential for signing transactions for RBlocks and batch postings to your chain's base contracts on the L2 chain.
- · L3 Config
- : This is theorbitSetupScriptConfig.json
- file, which holds your chain's configuration, including configurations needed for your Token Bridge contracts.

Ensure to securely store these downloaded files as they contain sensitive information crucial for your chain's operation.

Step 6: Clone the setup script repository and add your configuration files

- 1. Clone the orbit-setup-script
- 2. repository:
- 3. bash
- 4. git
- 5. clone
- 6. https://github.com/celestiaorg/orbit-setup-script.git 7. ait
- 8 clone
- 9. https://github.com/celestiaorg/orbit-setup-script.git
- 10. Move thenodeConfig.json
- 11. andorbitSetupScriptConfig.json
- 12. files that you downloaded into theconfig
- 13. directory in the root of your clonedorbit-setup-script
- 14. repository
- 15. Install dependencies by runningyarn install
- 16. from the root of theorbit-setup-script
- 17. repository.

Step 7: Pick an L2 RPC URL for the Batch Poster

In order for the Batch Poster, which is responsible for posting batches of data, to subscribe to Blobstream's smart contract events, the node must use a WebSocket connection, since an HTTP one will not support subscriptions. This RPC URL is different from theparent-chain connection url object used in the node config, and is not necessary when running a full node. WebSocket (WSS) URLs which are essential for real-time data fetching and interaction with the Arbitrum Sepolia network.

To establish a WebSocket connection for your rollup to Arbitrum Sepolia, it's recommended to an RPC provider with WSS connections from Arbitrum's docs.

For this example, we will make an account on Alchemy. Follow these steps to set up your account and obtain a WSS URL using Alchemy:

- 1. VisitAlchemy's website
- and sign up for an account.
- 3. Once logged in, create a new app by selecting the Arbitrum network, specifically targeting the Arbitrum Sepolia testnet.
- After creating your app, navigate to the "API key" section to find your WebSocket (WSS) URL.
- 5. In the next step, use this WSS URL in yournodeConfig.json
- 6. under thecelestia-cfg.eth-rpc
- 7. object to ensure your node can establish a WebSocket connection to the Arbitrum Sepolia network and successfully subscribe to Blobstream events.

Without a WSS connection, the Batch Poster won't be able to subscribe to Blobstream events, and thus will fall back to posting data to parent chain.

Step 8: Run your light node for Mocha testnet

First, be sure that your light node is running, using a command similar to:

TIP

If you are on Linux (or are not using Docker desktop), you may need to add the extra flags:--rpc.addr 0.0.0.0 and--rpc.port 26658 to your start command for your light node.

Additionally, you will need to addhost, docker, internal as a host in your docker-compose, vml:

yaml extra_hosts : - "host.docker.internal:host-gateway" extra_hosts : - "host.docker.internal:host-gateway" bash celestia

light

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p2p.network
mocha
core.ip
< RPC_UR L
celestia
light .
start
p2p.network
mocha
core.ip
< RPC_UR L
To set your light node's auth token, you will use the auth token that returns when you run:
bash celestia
light
auth
admin
p2p.network
mocha celestia
light
auth
admin
p2p.network
mocha Since the contracts deployed through the factories above are already configured to communicate with Blobstream, you now only have to configure your
node accordingly. First understand the different variables that will be set in the config:
enable:
 set it to true if you are using Celestia DA ⊕ rpc
RPC endpoint forcelestia-node
• tendermint-rpc
 : a celestia-core endpoint from a full node (NOTE:
 only needed for a batch poster node) eth-rpc
 : Ethereum Client WSS RPC endpoint, only used when the node is a batch poster. The eth-rpc must be WSS. Otherwise, it won't be able to subscribe to events
for Blobstream.
 namespace-id :
 namespace being used to post data to Celestia auth-token
:auth token for your Celestia Node
• is-poster
:is the node with Celestia DA the batch poster, set to true if so.
gas-price:
 how much to pay for gas (in uTIA) event-channel-size
•:
 size of the events channel used by the batch poster to wait for a range of headers that contains the header for the block in which it posted a blob, before posting the batch to the base layer for verification on Blobstream X. blobstreamx-address
 : address of the Blobstream X contract on the base chain.* Note that the SequencerInbox
contract for each chain has a constant address for theBlobstreamX
 contract, thus make sure that the Blobstream X address in theSequencerInbox
 being used for the templates inRollupCreator
matches the one in your config.

Now enable Celestia DA in your Arbitrum chain params inconfig/nodeConfig.json . If you'd like to use your own namespace, use a custom 10 byte value or random value usingopenssl rand -hex 10 fornamespace-id :

WARNING

The Orbit contracts depend on the existing Blobstream X deployments. Before using these addresses, please verify the contract addresses on the official source below to avoid any issues due to incorrect addresses. This is crucial to protect against potential misuse by copy-paste errors. ts "celestia-cfg": { "enable": true, "rpc": "http://host.docker.internal:26658", "tendermint-rpc": "http://consensus-full-mocha-4.celestia-mocha.com:26657", "eth-rpc": "wss://", "namespace-id": "", "auth-token": "", "is-poster": true, "gas-price": 0.3, "event-channel-size": 100, "blobstreamx-address": "0xc3e209eb245Fd59c8586777b499d6A665DF3ABD2", } "celestia-cfg": { "enable": true, "rpc": "http://host.docker.internal:26658", "tendermint-rpc": "http://consensus-full-mocha-4.celestia-mocha.com:26657", "eth-rpc": "wss://", "namespace-id": "", "auth-token": "", "is-poster": true, "gas-price": 0.3, "event-channel-size": 100, "blobstreamx-address": "0xc3e209eb245Fd59c8586777b499d6A665DF3ABD2", } See the compatibility matrix in the appendix to verify you're using the right versions.

Step 9: Run your chain's node and block explorer

Start Docker, then rundocker-compose up -d from the root of theorbit-setup-script repository.

A Nitro node and BlockScout explorer instance will be started. Visihttp://localhost/ to access your BlockScout explorer instance - this will allow you to view your chain's transactions and blocks, which can be useful for debugging.

After you have some activity on your rollup, it will look more like this:

Step 10: Finish setting up your chain

The Offchain Labs team has provided a Hardhat script that handles the following tasks:

- 1. Fund thebatch-poster
- 2. andvalidator

on

- 3. (staker) accounts on your underlying L2 chain.
- 4. Deposit ETH into your account on the chain using your chain's newly deployed bridge.
- 5. Deploy your Token Bridge contracts on both L2 and local Orbit chains.
- 6. Configure parameters on the chain.

To run this script, issue the following command from the root of theorbit-setup-script repository, replacing Your Private Key with the private key of the Owner account you used to deploy your chain's contracts, and replacing http://localhost:8449 with the RPC URL of your chain's node.

First, export your private key as a variable: bash PRIVATE_KEY = "YourPrivateKey" \ L2_RPC_URL = "https://sepolia-rollup.arbitrum.io/rpc" \L3 RPC URL = "http://localhost:8449" yarn run setup PRIVATE_KEY = "YourPrivateKey" \ L2 RPC URL = "https://sepolia-rollup.arbitrum.io/rpc" \L3_RPC_URL = "http://localhost:8449" yarn run setup Successful logs will appear similar to: bash Funding batch-poster accounts on parent chain with 0.3 **ETH Transaction** hash on parent chain: 0x6c7360a96165c570dcb7ce609d748d612c5fa5b76e229cd81ba5f5c93c00f805 Transaction was mined block 28217647

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on	
TX:	
0x97b50f60b60d0e658fdbf185969db0a0327bd0ae9e57c	d65af2a7f9be0eeb5b0 Executing
removeChainOwner	
through	
the	
UpgradeExecutor	
contract Transaction	
complete,	
rollup	
owner	
removed	
from	
chain	

owners

on

TX:

0x019850732270d8c436585c7921219252422228b5d0f559da0da219f0fa2b7216 %

Done

in

58.49 s. Find your PFB on Celenium by looking at the namespace or account you posted from.

See anexample blob that was posted while making this guide.

Congratulations with Celestia underneath

Your local Orbit rollup is now running. You'll see anoutputInfo.json file in the main directory of your script folder - this contains more information about your chain, including the addresses of your chain's base contracts.

In the next guides, learn how toun a full and validating full node orbridge in and out of your rollup.

Appendix

Extra resources in Arbitrum documentation:

- Logging
- Depositing ETH/native token
- Troubleshooting:error getting latest batch count

Compatibility matrix

Component Version Details Nitro v2.3.1-rc.1 Includes the replay binary for the WASM root0x10c65b27d5031ce2351c719072e58f3153228887f027f9f6d65300d2b5b30152 .Read the overview for overall changes . Contracts v1.2.1 Integrates Blobstream X functionality into nitro-contracts v1.2.1 Orbit SDK v0.8.2 Orbit SDK for Celestia DA This is not compatible with Orbit SDK v0.8.2 or with the latest changes to nitro-contracts for the Atlas upgrade. The Orbit SDK itself is in Alpha. celestia-node v0.13.1 This integration has only been tested with celestia-node 0.13.1 and only works with said version, and with future versions after that. Under the hood, the Nitro node usesthis commit of celestia-openrpc.

Blobstream X contract deployments

The Orbit contracts depend on the following Blobstream X deployments. The current deployments, which can be found at0xc3e209eb245Fd59c8586777b499d6A665DF3ABD2 in both chains, relays headers from theMocha-4 testnet to the chains below:

- · Arbitrum Sepolia
- · Base Sepolia

Arbitrum Sepolia

- RollupCreator:0x79751B011BCc20F413a2c4E3AF019b6E2a9738B9
- TokenBridgeCreator:0xaAe3A04931345Df5AC6e784bB6bDeb29B1fF0286
- TokenBridgeRetryableSender:0x22a6580faECA49cF86Cbb2F18f2B7f98031FC6Ad
- Find additional Arbitrum Sepolia deployments below

Base Sepolia

- RollupCreator:0x1Bb8ADd5e878b12Fa37756392642eB94C53A1Cf4
- TokenBridgeCreator:0xAa3b8B63cCCa3c98b948FD1d6eD875d378dE2C6c
- TokenBridgeGreator.0xAa3bbBb3cCCa3c3bb346r BridgeBo73d376dE2C6c
 TokenBridgeRetryableSender:0x4270889AdcB82338C5FF5e64B45c0A3d31CFd08C
- Find additional Base Sepolia deployments below

Arbitrum Sepolia additional deployments

Contract Address Bridge 0x95FEA00e689e8D1CBa909836E1Ef1b941D5f21b1 SequencerInbox 0x95CBDa89325db5529eAF1813E181f66B83A7d65a Inbox 0x3681Cbb0E95AB50b63F2FC524FbBcC78adEf8d33 RollupEventInbox 0x61e154128b6a1400ea8090B4431B4aA1DBb80Cc4 Outbox 0x5187a92539bB4A2befe1fc078745c84AB6d37171 ERC20Bridge 0xD0a6699Fc7519966685181c80BF98D35aFa1fC95 SequencerInbox 0x2588867F19E2DE51f90F0aB852C7Ad11228e3d83 ERC20Inbox 0x6cB49605f10831749c6090AD09918bC61439bacE ERC20RollupEventInbox 0x7fC4D9A24949680faD666FeEe7cD6a100E39C4F0 ERC20Outbox 0xA773e19DC9e822933A7e72Df9c87eD1578701D29 BridgeCreator 0x3Bc040EAca40b91FA06cf55Ea91842FaC88b1AF4 OneStepProver0 0x5810F0916BAE1067Ca1efcc00AaaF30301af001c OneStepProverMemory 0xaC3427E621C6F10dC2ABdAB00188D92690503914 OneStepProverMath 0xFB612fb83959b8ACD3E49540B29C93c5A67e05f1 OneStepProverHostlo 0x630093954CbF19Fe4532A2edD0bD3B10dEcA7A4D OneStepProverMeth 0xFB612fb83959b8ACD3E49540B29C93c5A67e05f1 OneStepProverHostlo 0x630093954CbF19Fe4532A2edD0bD3B10dEcA7A4D OneStepProverBethry 0x53DEA3A90Fd6C82840a1f7224F799D622f142Df4 ChallengeManager 0x01B5905B154F21a393F5B5a0C6d15B53a493C05e RollupAdminLogic 0xe371AFcb8437bF61bd831EF57Be7A2496D88488B RollupUserLogic 0xe2662ff9b41f39e63A850E50E013Ea66e60A4F37 RollupCreator 0x79751B011BCc20F413a2c4E3AF019b6E2a9738B9 DeployHelper 0xd2D353916B34a877793628049c99858f04123eE1

Base Sepolia additional deployments

Contract Address Bridge 0xb6052122545AACD2BDda0Ca9FA56416bD968cDbc SequencerInbox 0xcd9FCa5015b5ce2B06a2266e4a5dd54D9ca39F1a Inbox 0x44B412b291fEf00398501B2cA353EA912AD0fe13 RollupEventInbox 0x51D196e07a27DBA0F4461Dd6CC26108424F196f7 Outbox 0x5A48aDf22f526eBD06e3e8856cFEa2490923CC55 ERC20Bridge 0x9abC41fEfAe7E7543a01FA837AeC909F96147280 SequencerInbox 0x8f97Cb7c643Acd7f79f3B13841b24a243dA51242 ERC20Inbox 0x40f8c63e0a20B399bCd9631A22E57BB988a9400e ERC20RollupEventInbox 0x3B6e845fb9f0c8Ee4E9F6D44781f6547d9c6359a ERC20Outbox 0xc99eEA0B8e67D5b2226AB6D37882DAAf6dd7593b BridgeCreator 0xC7535F078CB3880a0FD5E54FA7A3B4EAf09b3924 OneStepProver0 0xf889a3174Fddd9f78E6cd250Ebf4c16F1bDd1b6a OneStepProverMemory 0x61254e43e5c1e9E801F9C56B47a9ac3EADF6d1E9 OneStepProverMath 0x55527d53fdA37Dbf1924482b40AcF8625E1cAA5B OneStepProverHostlo 0x03B43F7B61Fa100611191F481Ef48aa1fc98F434 OneStepProvefIntry 0x89b7c7970c13BB587893a70697AD6d2A335b6A15 ChallengeManager 0x04CAe899Fc0B7Ef45c529f8Bf075D54F6fB70eD9 RollupAdminLogic 0x99E9D2F04352B42C18F1DA5Dd93a970F82C08aFe RollupUserLogic 0x1ae3A8DC1e7eFD37F418B2987D3DF74c5a917a8B ValidatorUtils 0x1cc4551922C069A9aDE06756BF14bF0410eA44fF ValidatorWalletCreator 0x78f8B2941ddE5a8A312814Ebd29c2E2A36f25E91 RollupCreator 0x1Bb8ADd5e878b12Fa37756392642eB94C53A1Cf4 DeployHelper 0x20d8153AaCC4E6D29558fa3916BfF422BEDE9B5E [[_Edit this page on GitHub] Last updated: Previous page Introduction to Arbitrum rollups with Celestia as

