

# Integrate with Blobstream contracts

## Getting started

### Prerequisites

Make sure to have the following installed:

- [Foundry](#)

### Installing Blobstream X contracts

We will be using the Blobstream X implementation of Blobstream, so we can install its repo as a dependency:

Install the Blobstream X contracts repo as a dependency:

```
sh forge
```

```
install
```

```
succinctlabs/blobstreamx
```

```
--no-commit forge
```

```
install
```

```
succinctlabs/blobstreamx
```

--no-commit Make sure that the directory you're running this command from is an initialized git repository. If not, just initialize the repo using:

```
sh git
```

```
init git
```

init Note that the minimum Solidity compiler version for using the Blobstream contracts is 0.8.19 .

### Example usage

Example minimal Solidity contract for a stub ZK rollup that leverages the BlobstreamX.sol contract to check that data has been posted to Celestia:

```
solidity // SPDX-License-Identifier: Apache-2.0 pragma
```

```
solidity
```

```
^0.8.19 ;
```

```
TBD import
```

```
"blobstream-contracts/IDAOracle.sol" ; import
```

```
"blobstream-contracts/DataRootTuple.sol" ; import
```

```
"blobstream-contracts/lib/tree/binary/BinaryMerkleProof.sol" ;
```

```
contract MyRollup { IDAOracle immutable blobstreamX; bytes32 [] public rollup_block_hashes;
```

```
constructor ( IDAOracle _blobstreamX) { blobstreamX = _blobstreamX; }
```

```
function
```

```
submitRollupBlock ( bytes32 _rollup_block_hash, bytes
```

```
calldata _zk_proof, uint256 _blobstreamX_nonce, DataRootTuple
```

```
calldata _tuple, BinaryMerkleProof
```

```
calldata _proof ) public { // Verify that the data root tuple (analog. block header) has been // attested to by the Blobstream contract. require ( blobstreamX.verifyAttestation ( _blobstreamX_nonce, _tuple, _proof) );
```

```

// Verify the ZKP (zero-knowledge proof). // _tuple.dataRoot is a public input, leaves (shares) are private inputs. require (
verifyZKP (_rollup_block_hash, _zk_proof, _tuple.dataRoot));

// Everything checks out, append rollup block hash to list. rollup_block_hashes. push (_rollup_block_hash); }

function

verifyZKP ( bytes32 _rollup_block_hash, bytes

calldata _zk_proof, bytes32 _data_root ) private

pure

returns ( bool ) { return

true ; } } // SPDX-License-Identifier: Apache-2.0 pragma

solidity

^0.8.19 ;

TBD import

"blobstream-contracts/IDAOracle.sol" ; import

"blobstream-contracts/DataRootTuple.sol" ; import

"blobstream-contracts/lib/tree/binary/BinaryMerkleProof.sol" ;

contract MyRollup { IDAOracle immutable blobstreamX; bytes32 [] public rollup_block_hashes;

constructor ( IDAOracle _blobstreamX) { blobstreamX = _blobstreamX; }

function

submitRollupBlock ( bytes32 _rollup_block_hash, bytes

calldata _zk_proof, uint256 _blobstreamX_nonce, DataRootTuple

calldata _tuple, BinaryMerkleProof

calldata _proof ) public { // Verify that the data root tuple (analog. block header) has been // attested to by the Blobstream
contract. require ( blobstreamX. verifyAttestation (_blobstreamX_nonce, _tuple, _proof) );

// Verify the ZKP (zero-knowledge proof). // _tuple.dataRoot is a public input, leaves (shares) are private inputs. require (
verifyZKP (_rollup_block_hash, _zk_proof, _tuple.dataRoot));

// Everything checks out, append rollup block hash to list. rollup_block_hashes. push (_rollup_block_hash); }

function

verifyZKP ( bytes32 _rollup_block_hash, bytes

calldata _zk_proof, bytes32 _data_root ) private

pure

returns ( bool ) { return

true ; } }

```

## Data structures

Each [DataRootTuple](#) is a tuple of block height and data root. It is analogous to a Celestia block header. [DataRootTuple](#) s are relayed in batches, committed to as a [DataRootTuple](#) s root (i.e. a Merkle root of [DataRootTuple](#) s).

The [BinaryMerkleProof](#) is an [RFC-6962](#) -compliant Merkle proof. Since [DataRootTuple](#) s are Merkleized in a binary Merkle tree, verifying the inclusion of a [DataRootTuple](#) against a [DataRootTuple](#) s root requires verifying a Merkle inclusion proof.

## Interface

The [IDAOracle](#) (Data Availability Oracle Interface) interface allows L2 contracts on Ethereum to query the [BlobstreamX.sol](#)

contract for relayedDataRootTuples. The single interface method verifyAttestation verifies a Merkle inclusion proof that aDataRootTuple is included under a specific batch (indexed by batch nonce). In other words, analogously it verifies that a specific block header is included in the Celestia chain.

## Querying the proof

To prove that the data was published to Celestia, check out the [proof queries documentation](#) to understand how to query the proofs from Celestia consensus nodes and make them usable in the Blobstream X verifier contract.

## Verifying data inclusion for fraud proofs

A high-level overview of how a fraud-proof based L2 would interact with Blobstream can be found in the [inclusion proofs documentation](#).

The [DAVerifier](#) library is available at `blobstream-contracts/lib/verifier/DAVerifier.sol`, and provides functions to verify the inclusion of individual (or multiple) shares against aDataRootTuple. The library is stateless, and allows to pass anIDAOracle interface as a parameter to verify inclusion against it.

In the DAVerifier library, we find functions that help with data inclusion verification and calculating the square size of a Celestia block. These functions work with the Blobstream X smart contract, using different proofs to check and confirm the data's availability. Let's take a closer look at these functions:

- [verifySharesToDataRootTupleRoot](#)
  - : This function verifies that the shares, which were posted to Celestia, were committed to by the Blobstream X smart contract. It checks that the data root was committed to by the Blobstream X smart contract and that the shares were committed to by the rows roots.
- [verifyRowRootToDataRootTupleRoot](#)
  - : This function verifies that a row/column root, from a Celestia block, was committed to by the Blobstream X smart contract. It checks that the data root was committed to by the Blobstream X smart contract and that the row root commits to the data root.
- [verifyMultiRowRootsToDataRootTupleRoot](#)
  - : This function verifies that a set of rows/columns, from a Celestia block, were committed to by the Blobstream X smart contract. It checks that the data root was committed to by the Blobstream X smart contract and that the rows roots commit to the data root.
- [computeSquareSizeFromRowProof](#)
  - : This function computes the Celestia block square size from a row/column root to data root binary Merkle proof. It is the user's responsibility to verify that the proof is valid and was successfully committed to using the `verifyRowRootToDataRootTupleRoot()` method.
- [computeSquareSizeFromShareProof](#)
  - : This function computes the Celestia block square size from a shares to row/column root proof. It is the user's responsibility to verify that the proof is valid and that the shares were successfully committed to using the `verifySharesToDataRootTupleRoot()` method.

For an overview of a demo rollup implementation, head to [the next section](#). [[Edit this page on GitHub](#)] Last updated: [Previous page Overview of Blobstream](#) [Next page Integrate with Blobstream client](#) []