

# LegacyOracle

- [Source code](#)
- [Deployed contract](#)

warning LegacyOracle will be maintained till the end of 2023. Afterwards, it will be discontinued and external integrations should rely on [AccountingOracle](#) .

## What is LegacyOracle?

LegacyOracle is an Aragon app previously known as LidoOracle , used to track changes on the Beacon Chain. Following the Lido V2 upgrade, this was replaced by the [AccountingOracle](#) and the oracle workflow was redesigned to deliver synchronized historical data chunks for the same reference slot both for the Consensus and Execution Layer parts.

## Key changes

In Lido V2, LegacyOracle only supports a subset of view functions and events. AccountingOracle interacts with it to push data changes on each report.

## How does LegacyOracle receive the AccountingOracle reports anyway (flow)

The LegacyOracle contract receives the data changes on each AccountingOracle report using two stages (still within the same transaction):

1. Invoke [handleConsensusLayerReport](#)
2. providing the reference slot and validators data from AccountingOracle
3. itself.
4. Invoke [handlePostTokenRebase](#)
5. from [Lido](#)
6. .

## Rebase and APR

To calculate the protocol's daily rebase and APR projections one would use the old LidoOracle APIs for a while. Although the old way of calculating the APR would still result in relevant numbers, the math might be off in case of significant withdrawals.

### How it was with LidoOracle

note The formula is outdated and inaccurate since the [Lido V2 upgrade](#) happened.  $\text{protocolAPR} =$

$(\text{postTotalPooledEther} - \text{preTotalPooledEther})$

$\times \text{secondsInYear} /$

$(\text{preTotalPooledEther} \times \text{timeElapsed}) \times \text{lidoFeeAsFraction} = \text{lidoFee} / \text{basisPoint}$   $\text{userAPR} = \text{protocolAPR} \times$

$(1$

$- \text{lidoFeeAsFraction})$

### What's new from Lido V2

See the new Lido API docs with regards to [APR](#) .

// Emits when token rebased (total supply and/or total shares were changed) event TokenRebased ( uint256 indexed reportTimestamp , uint256 timeElapsed , uint256 preTotalShares , uint256 preTotalEther ,

$/ \text{preTotalPooledEther} / \text{uint256 postTotalShares} , \text{uint256 postTotalEther} ,$

$/ \text{postTotalPooledEther} / \text{uint256 sharesMintedAsFees} / \text{fee part included in postTotalShares} / ) ;$

## preShareRate

$\text{preTotalEther} \times$

$1\text{e}27$

$\text{preTotalShares} \cdot \text{postShareRate} = \text{postTotalEther} \cdot$

$1e27$

$\text{postTotalShares}$

## userAPR

$\text{secondsInYear} \cdot$

$( (\text{postShareRate} - \text{preShareRate})$

$\text{preShareRate})$

$\text{timeElapsed}$  In short, the new formula takes into account both  $\text{preTotalShares}$  and  $\text{postTotalShares}$  values, while, in contrast, the old formula didn't use them. The new formula also doesn't require to calculate  $\text{lidoFee}$  at all (because the fee distribution works by changing the total shares amount under the hood).

### Why does it matter

When Lido V2 protocol finalizes withdrawal requests, the Lido contract sends ether to  $\text{WithdrawalQueue}$  (excluding these funds from  $\text{totalPooledEther}$ , i.e., decreasing TVL) and assigns to burn underlying locked requests' stETH shares in return.

In other words, withdrawal finalization decreases both TVL and total shares.

Old formula isn't suitable anymore because it catches TVL changes, but skips total shares changes.

Illustrative example (using smallish numbers far from the real ones for simplicity):

## preTotalEther

1000

ETH  $\text{preTotalShares} =$

1000

\*

$10^{18}$

// 1 share : 1 wei

## postTotalEther

999

ETH  $\text{postTotalShares} =$

990

\*

$10^{18}$

## timeElapsed

24

\*

60

\*

60

// 1 day, or 86400 seconds

//!!! using the old (imprecise) method

// protocolAPR = (postTotalPooledEther - preTotalPooledEther) \* secondsInYear / (preTotalPooledEther \* timeElapsed)  
protocolAPR =

( 999ETH - 1000ETH )

\*

31557600

/

( 1000ETH \*

86400 )

=

- 0.36525 //lidoFeeAsFraction = lidoFee / basisPoint = 0.1 //userAPR = protocolAPR \* (1 - lidoFeeAsFraction) = protocolAPR  
\* (1 - 0.1)

## userAPR

- 0.36525

\*

( 1

-

0.1 )

=

- 0.328725

//!!! i.e, userAPR now is ~minus 32.9%

//!!! using the updated (proper) method

## preShareRate

1000

ETH

\*

1e27

/

1000

\*

10 ^ 18

=

1e27 postShareRate =

999

ETH

\*

```

1e27
/
990
*
10 ^ 18
=
1.009090909090909e+27 userAPR =
31557600
*
( ( postShareRate - preShareRate )
/ preShareRate )
/
86400
=
3.320454545454529
//!!! i.e., userAPR now is ~plus 332%

```

## View Methods

### getLido()

Returns theLido contract address.

function

getLido ( )

returns

( address ) note Always returns theLido address stated in the [deployed addresses](#) list.

### getAccountingOracle()

Returns theAccountingOracle contract address.

function

getAccountingOracle ( )

returns

( address ) note Always returns theAccountingOracle address stated in the [deployed addresses](#) list.

### getContractVersion()

Returns the current contract version.

function

getContractVersion ( )

returns

( uint256 ) note Always returns4 .

### getVersion()

Returns the current contract version (compatibility method).

function

getVersion ( )

returns

( uint256 ) note Always returns 4 , calls getContractVersion() internally.

## getBeaconSpec()

Returns the AccountingOracle frame period together with Ethereum Beacon Chain specification constants.

function

getBeaconSpec ( )

returns

( uint64 epochsPerFrame , uint64 slotsPerEpoch , uint64 secondsPerSlot , uint64 genesisTime ) note Always returns (225, 32, 12, 1606824023) for Mainnet and (225, 32, 12, 1616508000) for Görli.

## Returns

Name	Type	Description
epochsPerFrame	uint64	Beacon Chain epochs per single AccountingOracle report frame
slotsPerEpoch	uint64	Beacon Chain slots per single Beacon Chain epoch
secondsPerSlot	uint64	Seconds per single Beacon Chain slot
genesisTime	uint64	Beacon Chain genesis timestamp

## getCurrentEpochId()

Returns the Beacon Chain epoch id calculated from the current timestamp using the [beacon chain spec](#) .

function

getCurrentEpochId ( )

returns

( uint256 )

## getCurrentFrame()

Returns the first epoch of the current AccountingOracle reporting frame as well as its start and end times in seconds.

function

getCurrentFrame ( )

returns

( uint256 frameEpochId , uint256 frameStartTime , uint256 frameEndTime )

## Returns

Name	Type	Description
frameEpochId	uint256	The first epoch of the current AccountingOracle reporting frame
frameStartTime	uint256	The start timestamp of the current reporting frame
frameEndTime	uint256	The end timestamp of the current reporting frame

## getLastCompletedEpochId()

Returns the starting epoch of the last frame in which the last AccountingOracle report was received and applied.

function

getLastCompletedEpochId ( )

returns

( uint256 )

## getLastCompletedReportDelta()

Returns the total supply change occurred with the last completedAccountingOracle report.

function

getLastCompletedReportDelta ( )

returns

( uint256 postTotalPooledEther , uint256 preTotalPooledEther , uint256 timeElapsed )

### Returns

Name	Type	Description
postTotalPooledEther	uint256	Post-report `stETH` total pooled ether (i.e., total supply)
preTotalPooledEther	uint256	Pre-reportstETH total pooled ether (i.e., total supply)
timeElapsed	uint256	Time elapsed since the previously completed report, seconds

## Methods

### handlePostTokenRebase()

Handles astETH token rebase incurred by the succeededAccountingOracle report storing the total ether and time elapsed stats.

Emits[PostTotalShares](#)

function

handlePostTokenRebase ( uint256 reportTimestamp , uint256 timeElapsed , uint256 preTotalShares , uint256 preTotalEther , uint256 postTotalShares , uint256 postTotalEther , uint256 totalSharesMintedAsFees ) note The caller must beLido .

### Parameters

Name	Type	Description
reportTimestamp	uint256	The reference timestamp corresponding to the moment of the oracle report calculation
timeElapsed	uint256	Time elapsed since the previously completed report, seconds
preTotalShares	uint256	Pre-reportstETH total shares
preTotalEther	uint256	Pre-reportstETH total pooled ether (i.e., total supply)
postTotalShares	uint256	Post-reportstETH total shares
postTotalEther	uint256	Post-reportstETH total pooled ether (i.e., total supply)
totalSharesMintedAsFees	uint256	Total shares amount minted as the protocol fees on top of the accrued rewards

### handleConsensusLayerReport()

Handles a new completedAccountingOracle report storing the corresponding Beacon Chain epoch id.

Emits[Completed](#) .

function

handleConsensusLayerReport ( uint256 \_refSlot , uint256 \_clBalance , uint256 \_clValidators ) note The caller must beAccountingOracle .

### Parameters

Name	Type	Description
_refSlot	uint256	The reference slot corresponding to the moment of the oracle report calculation
_clBalance	uint256	Lido-participating validators balance on the Beacon Chain side
_clValidators	uint256	Number of the Lido-participating validators on the Beacon Chain side

## Events

### Completed()

Emits whenever theAccountingOracle report landed.

This event is still emitted after oracle committee reaches consensus on a report, but only for compatibility purposes. The values in this event are not enough to calculate APR or TVL anymore due to withdrawals, Execution Layer rewards, and Consensus Layer rewards skimming.

event

Completed ( uint256 epochId , uint128 beaconBalance , uint128 beaconValidators ) ; note Emits inside the [handleConsensusLayerReport](#) methods.

### Parameters

Name	Type	Description
epochId	uint256	Report reference epoch identifier
beaconBalance	uint128	The balance of the Lido-participating validators on the Consensus Layer side
beaconValidators	uint128	The number of the ever appeared Lido-participating validators

### PostTotalShares()

Emits whenever theAccountingOracle report landed.

This event is still emitted after each rebase but only for compatibility purposes. The values in this event are not enough to correctly calculate the rebase APR since a rebase can result from shares burning without changing total ETH held by the protocol.

event

PostTotalShares ( uint256 postTotalPooledEther , uint256 preTotalPooledEther , uint256 timeElapsed , uint256 totalShares )  
note The new [TokenRebased](#) event emitted from the main Lido contract should be used instead because it provides the pre-report total shares amount as well which is essential to properly estimate a token rebase and its projected APR.

### Parameters

Name	Type	Description
postTotalPooledEther	uint256	Post-report total pooled ether
preTotalPooledEther	uint256	Pre-report total pooled ether
timeElapsed	uint256	Time elapsed since the previous report, seconds
totalShares	uint256	Post-report total shares

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