A CONSENSYS DILIGENCE AUDIT REPORT

rICO

Date	April 2020
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Co-auditors	Gonçalo Sá

1 Executive Summary

This report presents the results of our engagement with **Lukso rICO** to review the *Reversible Initial Coin Offering*, a version of an ICO that gives investors the ability to reverse their investment in different stages.

The review was conducted over the course of two weeks, from **April 13th, 2020** to **April 27th, 2020** by Shayan Eskandari and Gonçalo Sá. A total of 15 person-days were spent.

During the first week, we reviewed the documentation and attended several code walkthrough sessions with the developers. Initial issues were discussed and resulted in a new commit to be the base of the audit by mid-week. In an effort to understand the system, we produced several ancillary visualizations (that can be seen throughout the audit report) over the course of the week.

During the second week we reviewed the codebase with the aid of the aforementioned visualizations and looked attentively for breaches of the invariants described in the Security Properties section.

2 Scope

Our review focused on the commit hash **~~dc6b22ba8991d77560e574eac7f4f1e17f643115~~ 77517a4dceed53ff7c5a7f7580cb805831a7f8d5** (tree/audit). The list of files in scope can be found in the Appendix.

2.1 Documentations

The following documentation was provided by the client:

- rICO — The Reversible ICO
    - RICO - Making ICOs Fair, By Making Them Reversible by Fabian Vogelsteller (Devcon4)
- Inline comments and Github README
- Code walk through meeting

2.2 Objectives

Together with the **Lukso rICO** team, we identified the following priorities for our review

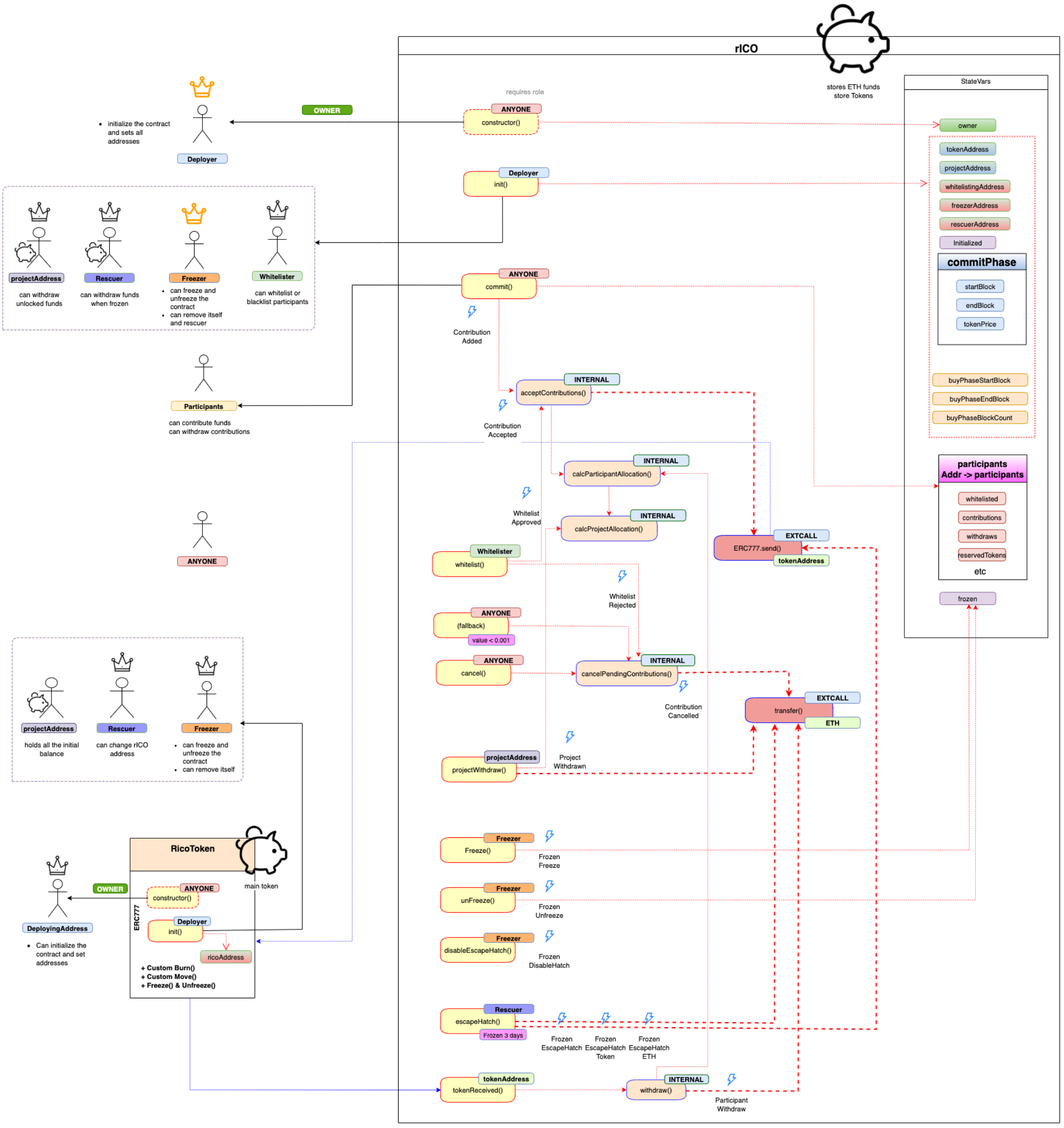
1. Ensure that the system is implemented consistently with the intended functionality, and without unintended edge cases, according to the specification derived from the documentation that was provided to us.
2. Identify known vulnerabilities particular to smart contract systems, as outlined in our Smart Contract Best Practices, and the Smart Contract Weakness Classification Registry.
3. The implementation of the mathematical relationships in the rICO smart contract corresponds to the specification in the documentation.
4. The flow of funds occurs as specified in the documentation. No undocumented flow of native or ERC20 tokens exists.

3 System Overview

The Reversible Initial Coin Offering, or rICO, for short, has two main contracts:

- ReversibleICO
  - Main functionality for swapping ETH with Token, and the other way around
- RicoToken
  - ERC777 with modified functions to consider the available unlocked balance in the rICO

Bellow you can see the visualization of the rICO system.



UPDATE: The above chart has been updated to reflect the new changes in the mitigation phase to the Token contract. However, it might lack some details, such as proper visualization of freezing functionality and the new roles.

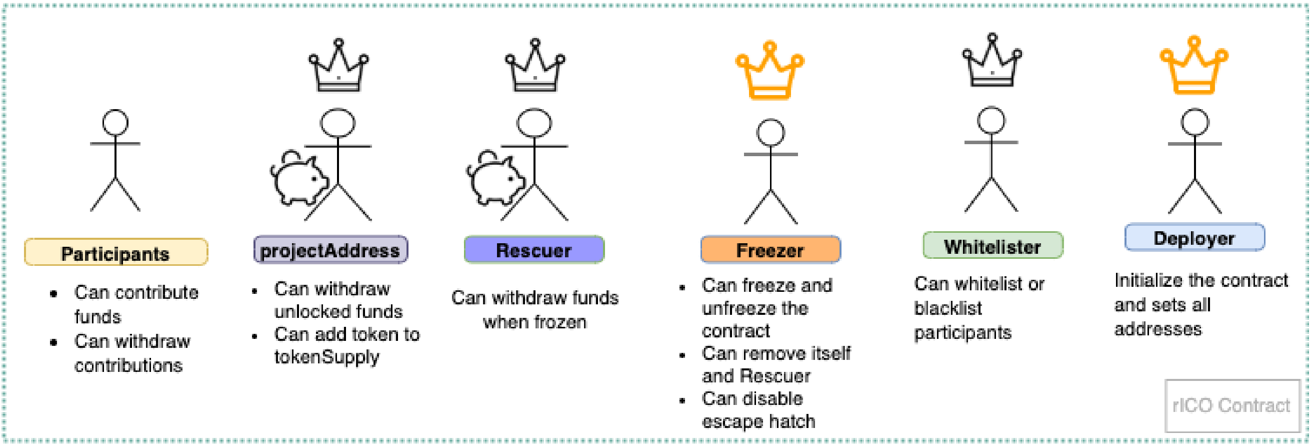
More details about the Actors and their permissions can be found in Actors.

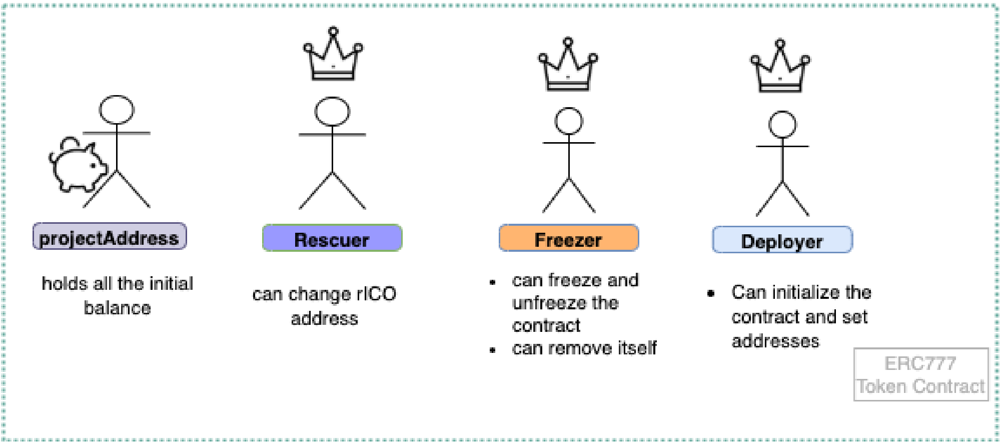
4 Security Specification

This section describes, **from a security perspective**, the expected behavior of the system under audit. It is not a substitute for documentation. The purpose of this section is to identify specific security properties that were validated by the audit team.

4.1 Actors

The relevant actors are listed below with their respective abilities:


Participants
• Can contribute funds
• Can withdraw contributions
projectAddress
• Can withdraw unlocked funds
• Can add token to tokenSupply
Rescuer
Can withdraw funds when frozen
Freezer
• Can freeze and unfreeze the contract
• Can remove itself and Rescuer
• Can disable escape hatch
Whitelister
Can whitelist or blacklist participants
Deployer
Initialize the contract and sets all addresses
rICO Contract


projectAddress
holds all the initial balance
Rescuer
can change rICO address
Freezer
• can freeze and unfreeze the contract
• can remove itself
Deployer
• Can initialize the contract and set addresses
ERC777 Token Contract

rICO

- **deployingAddress** : Only this address is allowed to **set all other addresses and stage** details when initializing the rICO contract. after the initial setup the details of the rICO cannot be changed by any actor.

- **whitelistingAddress** : Only this address can **whitelist or blacklist participants** in the rICO.
- **freezerAddress**: Freezer address is designed for emergency scenarios, when the rICO must be frozen. This address can:
    - **Freeze the contract** to stop all functionalities in the contract, such as:
        - *Receiving Eth or Tokens*
        - *canceling* pending contributions
        - *accepting* pending contributions
        - withdrawing any tokens or contributions by either participants or project address
        - whitelisting addresses
    - **Unfreeze the contract** to resume all functionalities
        - As mentioned in issue 6.2 this results in extension to the rICO time frame
    - **Disable Escape hatch**: to remove *freezerAddress* and *rescuerAddress* from the system. This is design to be called when the smart contract is presumably secure. The smart contract cannot be frozen if this function is used.
- **rescuerAddress** : This address based on client discussion, will be held by a *trusted third party*, and only will be used in case of emergency. *After the contract has been frozen for 3 days *(18000 blocks), this address can **transfer all the funds and tokens** to the specified address.
- **Participant** : Any entity sending more than `minContribution` (0.001 ether) to the rICO smart contract, while the rICO is running, will be added as participants. The purchase of the committed tokens, however, depends if the participant is whitelisted or not.
    - Participants can also withdraw their contributions by returning the purchased tokens
- **projectAddress**: The project wallet
    - Can *withdraw ETH* contributions (Unlocked ETH)

    - *Add tokens to tokenSupply* of the rICO by sending tokens to rICO contract
    - Holds all the initial balance of the token

- **tokenAddress**: The address of the ERC777 token used in the rICO

    - ~~**manager**: is the address deploying the RicoToken (`LYXeToken`) contract.~~
    - **UPDATE:**: TokenManager has been removed and its permissions has been separated into the new roles, described below.

Token

- **deployingAddress** : Only this address is allowed to **set all other addresses** when initializing the token contract.

- **freezerAddress**: Freezer address is designed for emergency scenarios, when the token must be frozen. This address can:

    - **Freeze the contract** to stop all functionalities in the contract, such as:
        - *Burn Tokens*
        - *Move Tokens* All token transfers will be frozen
    - **Unfreeze the contract** to resume all functionalities
        - As mentioned in issue 6.2 this results in extension to the rICO time frame
    - **Remove Freezer Address**: to remove *freezerAddress* from the system. This is design to be called when the smart contract is presumably secure. The smart contract cannot be frozen if this function is used.

- **rescuerAddress** : This address based on client discussion, will be held by a *trusted third party*, and only will be used in case of emergency. This address can change the rICO address when the token is frozen. No grace period is implemented for this functionality.

Note: The addresses with the same name in rICO and Token contract can be different entities. However, as for Lukso rICO, it is assumed that they will be deployed and initialized for the same addresses.

4.2 Trust Model

In any smart contract system, it's important to identify what trust is expected/required between various actors. For this audit, we established the following trust model:

- **deployingAddress** is initially in full control of setting the actors in the system. However after the initialization, the deployer does not have any special access.
- **freezerAddress** has the most control over the rICO system, although no ability to withdraw or steal funds. freezerAddress can freeze and unfreeze the contract, resulting in total system halt or restore.
  - It should be noted that this entity can completely deny itself and **rescuerAddress** the opportunity to withdraw funds.
- **rescuerAddress** after the contract has been frozen for more than 3 days (18000 blocks), rescuerAddress can withdraw the funds and tokens to any address of choosing.
- Manager of the token (ERC777), can also freeze the underlying token.
- Due to ERC777 callbacks (e.g. tokenReceived) must be verified in order to consider the rICO to be safe to be used in DeFi.

4.3 Important Security Properties

The following is a non-exhaustive list of security properties that were verified in this audit.

Rico Token Flow

- During the commit and buy phases of the reversible ICO, locked tokens cannot be transferred by participants unless the receiver is the Reversible ICO contract address itself.
- With the exception of the privileged actors described above, no other actor should be able to withdraw ETH from the Reversible ICO contract.

ETH Flow

- No participant can withdraw other participant's committed ETH.
- With the exception of the privileged actors described above, no other actor should be able to withdraw ETH from the Reversible ICO contract.

Lockup Conditions

- No lockup conditions arise from incorrect usage of SafeMath.
  - *Note*: The obvious exception to this being the issue reported regarding the, incorrectly, unchecked subtraction of the frozen period, which the audit team expects to be resolved ASAP. (issue 6.4)
- No lockup condition arises from the incorrect calculation of a stage number.

Reentrancy Instances

- Both the reentrancy instances accessible by participants pose no problem to the correct functioning of the rICO. The only and obvious exception to this being the transfer of tokens present in the `escapeHatch()` method (this last one is called by a privileged actor that has the ability to drain the contract at any point in time as per the specification).

5 Recommendations

5.1 Sanity check for addresses

Even though the `init` function is called by the address deployer and possibly using scripts, it is recommended to have sanity checks inside the function to prevent some common mistakes, such as :

```
require(tokenAddress != address(0));
require(whitelistingAddress != address(0));
require(projectAddress != address(0));
require(freezerAddress != address(0));
require(rescuerAddress != address(0));
```

These checks can be extended to other security specifications such as to prevent *projectAddress* and *freezerAddress* to be the same, and so on.

Update: The proper checks were added in lukso-network/rICO-smart-contracts@`edb880c`.

5.2 Separate currentBlock from currentEffectiveBlock

In rICO contract, the current block number is gotten from `getCurrentBlockNumber()` and the context it is used might mean different block numbers.

It is used to get *actual current block* in the following functions:

- `init()`
- The first time `freeze()` and `unfreeze()` are called

However, it is used to get the *effective block number* (currentBlock - frozenPeriod) in the following functions:

- `getCurrentStage()` (adds frozenPeriod for fixing the math)
- `getCurrentPrice()` (adds frozenPeriod for fixing the math)
- The second+ time `freeze()` and `unfreeze()` are called
- Other functions

The point is, even though, the mathematics behind the stages (e.g. multiple frozen periods) works out, it adds unnecessary complexity to the code and makes future updates and modifications tricky. It is suggested (similar to issue 6.3), to define two different functions, for example `getCurrentBlockNumber()` for actual current block number, and `getCurrentEffectiveBlockNumber()` for effective block number (deducting `frozenPeriod`).

UPDATE: The new function `getCurrentEffectiveBlockNumber()` was added in lukso-network/rICO-smart-contracts@ `e4c9ed5` .

5.3 Shadowed variable `stages`

In the `acceptContributions()` a variable is defined as `stages` that shadows a global variable with the same name. It is verified that within the scope of this function, there are no issues with this shadowing, however it might result in confusion or possible bugs in future updates. It is suggested to use a new name for the variable to prevent shadowing global variables.

```
mapping(uint8 => Stage) public stages;
```

```
ParticipantStageDetails storage stages = participantStats.stages[stageId];
```

UPDATE: The shadowed variable was renamed to `byStage` in lukso-network/rICO-smart-contracts@`e4c9ed5`.

5.4 Limit the length of the stages

Currently there are no limits in how many stages can there be in a given rICO instance. Given that any participant can contribute in every stage, and there are many functions that iterate through the stages each participant has contributed in (e.g. `cancelPendingContributions()` and `acceptContributions()`), there must be an upper limit to the number of stages before it reaches the gasBlockLimit. It is recommended to calculate and add such a limit to `init()` function.

UPDATE: This limitation has been acknowledged by Lukso team. The number of stages are limited for Lukso rICO, however for future reference a note was added to the README file and an inline comment (in lukso-network/rICO-smart-contracts@`e4c9ed5`) as a warning for future deployemnets.

```
**NOTE** Its not recommended to choose more than 50 stages!
9 stages require ~650k GAS when whitelisting contributions,
the whitelisting function could run out of gas with a high number of stages,

Test before using the `/test/solc_tests/flows/random_tests.js`
```

5.5 Usage of variables under 32 bytes in size

Variable types smaller than 32 bytes in size are almost always (and also counterintuitively!) more gas intensive than 32-bytes-sized ones.

The audit team therefore recommends the sole use of 32-byte-sized variables (i.e. uint256) except in the situations where these can be tightly packed, like in the `Participant` or `Stage` struct, illustrated below.

```
//ReversibleICO.sol#L139-L140
    struct Stage {
        uint128 startBlock;
        uint128 endBlock;
        uint256 tokenPrice;
    }
```

6 Issues

Each issue has an assigned severity:

- Minor issues are subjective in nature. They are typically suggestions around best practices or readability. Code maintainers should use their own judgment as to whether to address such issues.
- Medium issues are objective in nature but are not security vulnerabilities. These should be addressed unless there is a clear reason not to.
- Major issues are security vulnerabilities that may not be directly exploitable or may require certain conditions in order to be exploited. All major issues should be addressed.
- Critical issues are directly exploitable security vulnerabilities that need to be fixed.

6.1 Test code present in the code base Medium ✓ Fixed

Resolution

Fixed in lukso-network/rICO-smart-contracts@`edb880c`.

Description

Test code are present in the code base. This is mainly a reminder to fix those before production.

Examples

`rescuerAddress` and `freezerAddress` are not even in the function arguments.

code/contracts/ReversibleICO.sol:L243-L247

```
whitelistingAddress = _whitelistingAddress;
projectAddress = _projectAddress;
freezerAddress = _projectAddress; // TODO change, here only for testing
rescuerAddress = _projectAddress; // TODO change, here only for testing
```

Recommendation

Make sure all the variable assignments are ready for production before deployment to production.

6.2 `FreezerAddress` has more power than required Medium

Acknowledged

Resolution

This issue is acknowledged by the client and the behaviour has been documented in security measurements.

Description

FreezerAddress is designed to have the ability of freezing the contract in case of emergency. However, indirectly, there are other changes in the system that can result from the freeze.

Examples

1. FreezerAddress can extend the rICO time frame. Given that the `frozenPeriod` is deducted from the blockNumber in stage calculations, the `buyPhaseEndBlock` is technically equals to `buyPhaseEndBlock + frozenPeriod`
2. FreezerAddress can call `disableEscapeHatch()`, which disables the escape hatch and rendering `RescuerAddress` useless.

Recommendation

If these behaviors are intentional they should be well documented and specified. If not, they should be removed.

In the case they are, indeed, intentional the audit team believes that, for *Example 1.*, there should be some event fired to serve as notification for the participants (possibly followed by off-chain infrastructure to warn them through email or other communication channel).

6.3 `frozenPeriod` is subtracted twice for calculating the current price Medium ✓ Fixed

Resolution

Found in parallel to the audit team and has been mitigated in lukso-network/rICO-smart-contracts@ `ebc4bce` . The issue was further simplified by adding `getCurrentEffectiveBlockNumber()` in lukso-network/rICO-smart-contracts@ `e4c9ed5` to remove ambiguity when calculating current block number.

Description

If the contract had been frozen, the current stage price will calculate the price by subtracting the `frozenPeriod` twice and result in wrong calculation.

`getCurrentBlockNumber()` subtracts `frozenPeriod` once, and then `getStageAtBlock()` will also subtract the same number again.

Examples

code/contracts/ReversibleICO.sol:L617-L619

```
function getCurrentStage() public view returns (uint8) {
    return getStageAtBlock(getCurrentBlockNumber());
}
```

code/contracts/ReversibleICO.sol:L711-L714

```
function getCurrentBlockNumber() public view returns (uint256) {
    return uint256(block.number)
    .sub(frozenPeriod); // make sure we deduct any frozenPeriod from calculat
}
```

code/contracts/ReversibleICO.sol:L654-L656

```
function getStageAtBlock(uint256 _blockNumber) public view returns (uint8) {

    uint256 blockNumber = _blockNumber.sub(frozenPeriod); // adjust the bloc
```

Recommendation

Make sure `frozenPeriod` calculation is done correctly. It could be solved by renaming `getCurrentBlockNumber()` to reflect the calculation done inside the function.

e.g. :

- `getCurrentBlockNumber()` : gets current block number
- `getCurrentEffectiveBlockNumber()` : calculates the effective block number deducting `frozenPeriod`

6.4 Lockup condition in `getStageAtBlock()` Minor ✓ Fixed

Resolution

Even though the freeze pattern does indeed create a lot of additional complexity to the protocol, the particular `require` mentioned in the issue corpus by the audit team was found to never be triggered in a harmful way by rICO's development team.

In the light of this new discovery, we are greatly reducing the severity of the issue to "Minor". The reason why it is still kept as an issue is that the implementation of the freezing mechanism could still be greatly improved as we saw in the presented fixes here:

lukso-network/rICO-smart-contracts@`e4c9ed5`

The changes resulted in a much more resilient rICO implementation.

Description

Given that the contract has been frozen at least once, if the `frozenPeriod` is longer than the period before the freeze event (starting from `commitPhaseStartBlock` till the `freezeStart`), the following require in `getStageAtBlock()` will revert due to the fact that `blockNumber < commitPhaseStartBlock`:

```
uint256 blockNumber = _blockNumber.sub(frozenPeriod); // adjust the block by

require(blockNumber >= commitPhaseStartBlock && blockNumber <= buyPhaseEndBl
```

Note that the issue here is also related to the way currentBlockNumber is calculated (See issue 6.3 and Separate currentBlock from currentEffectiveBlock.

`getCurrentStage()` is called for every accept or cancelation of contributions and this lockup can result in total system halt.

Recommendation

Given that in the `init` function, the following condition is checked:

```
require(_commitPhaseStartBlock > getCurrentBlockNumber(), "Start block canno
```

The check in the `getStageAtBlock()` can be removed. However this is assuming that the correct calculation of the `currentEffectiveBlockNumber` is used.

6.5 emit events for significant state changes Minor ✓ Fixed

Resolution

This issue was discussed in the code walk through meeting and was fixed, by adding proper events to the code base in lukso-network/rICO-smart-contracts@ `77517a4` , before the end of the audit.

Description

Events are useful for UI changes and user notifications. The code base overall can use more use of events to update the UI and participants.

One of the most important aspects that must emit events, are when system state and functionality are changed. These functions require to emit events for better visibility to the participants:

- `freeze()`
- `unfreeze()`
- `disableEscapeHatch()`
- `escapeHatch()`

Recommendation

emit events when system state is changed.

Appendix 1 - Agent-based Tests

Agent-based testing of the platform based on a modified version of the pre-existing random tests produced by the development team was ran. The results were adapted into graphs constructed with d3.js and were used to validate both the implementation of the mathematical models being used and their implementations, and the presence of subtle and nuanced nefarious effects coming from the interactions in an environment with many non-rational actors.

Presented below is a summarized version of the full graph. Please find the full, interactive version here.

The data presented in the charts stems from a simulation with the following parameters:

- Total participants: **20**
- Blocks per day: **25**
- Number of days of the *Commit* stage: **3**
- Number of days of each *Buy Phase* stage: **5**
- Total number of stages (including the *Commit* stage): **10**
- Price of token in the *Commit* stage: **0.002 ETH**
- Price increment per stage: **0.0001 ETH**

The ***project*** address agent withdraws ETH as often as it cans and the ***whitelister*** agent whitelists and blacklists randomly.

The ***participant*** agents have a total random strategy within the domain of valid actions (i.e., *valid* in this context means a transaction that won’t revert).

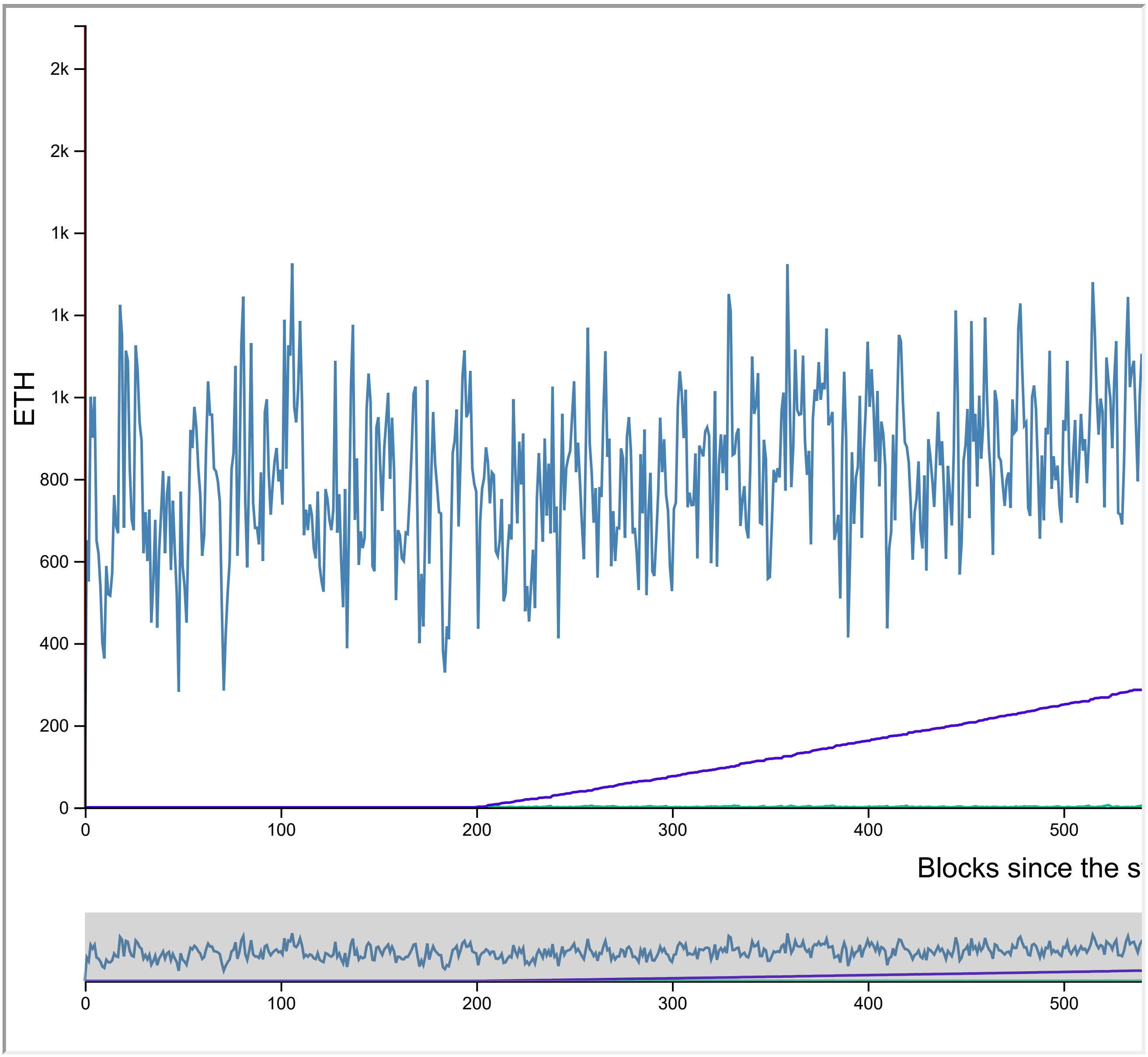
There are also two flavors of the *commit ETH* action being randomized. Sending the full ETH balance or sending half of it.

The code was adapted from the, already well-constructed, random tests present in the rICO repository.

A second test, with a different strategy for participants, was ran and can be found here.

In this version, the participants can commit any amount of their available balance and not just half or all of it. The number of days per stage also changed from 5 to **3**.

Note: The chart is zoomable. If there are ratio problems with the *iframe* below, please refresh the page.



7 Document Change Log

Version	Date	Description
1.0	2020-04-27	Initial report
1.1	2020-05-09	Reflect fixes

Appendix 2 - Files in Scope

This audit covered the following files:

File	SHA-1 hash
contracts/ReversibleICO.sol	3d5bf2c18b1ffa10b50eaac4cc62eaf43a40b6c2
contracts/RicoToken.sol	7d500809f2d14e4ea728ae126d4711239dffc422

Appendix 3 - Artifacts

This section contains some of the artifacts generated during our review by automated tools, the test suite, etc. If any issues or recommendations were identified by the output presented here, they have been addressed in the appropriate section above.

A.3.1 MythX

MythX is a security analysis API for Ethereum smart contracts. It performs multiple types of analysis, including fuzzing and symbolic execution, to detect many common vulnerability types. The tool was used for automated vulnerability discovery for all audited contracts and libraries. More details on MythX can be found at mythx.io.

Below is the raw output of the MythX vulnerability scan:

```
/code/contracts/mocks/erc777mock.sol
  1:0  warning  A floating pragma is set  SWC-103

/code/contracts/mocks/emptyreceiver.sol
  9:0  warning  A floating pragma is set  SWC-103

/code/contracts/reversibleico.sol
    9:0   warning  A floating pragma is set
  485:8   warning  Call with hardcoded gas amount
  712:23  warning  Potential use of a weak source of randomness "block.numbe
  848:12  warning  Local variable shadows a state variable
  869:8   warning  Call with hardcoded gas amount

/code/contracts/mocks/reversibleicomock.sol
  5:42  warning  A floating pragma is set                 SWC-103
  9:9   warning  The state variable visibility is not set  SWC-108

/code/contracts/mocks/reversibleicomock777.sol
   5:42  warning  A floating pragma is set                  SWC-103
  24:15  warning  Unused function parameter "operator"      SWC-131
  24:41  warning  Unused function parameter "from"          SWC-131
  24:63  warning  Unused function parameter "to"            SWC-131
  25:9   warning  Unused function parameter "amount"        SWC-131
  25:33  warning  Unused function parameter "userData"      SWC-131
  25:66  warning  Unused function parameter "operatorData"  SWC-131

/code/contracts/ricotoken.sol
  1:0  warning  A floating pragma is set  SWC-103

/code/contracts/mocks/safemathmock.sol
  1:0  warning  A floating pragma is set  SWC-103

✕ 18 problems (0 errors, 18 warnings)
```

A.3.2 Ethlint

Ethlint is an open source project for linting Solidity code. Only security-related issues were reviewed by the audit team.

Below is the raw output of the Ethlint vulnerability scan:

```
contracts/Gnosis/CreateCall.sol
  23:9    error    Only use indent of 8 spaces.    indentation

contracts/Gnosis/GnosisSafe.sol
  427:4    warning    Line contains trailing whitespace         no-trailing-
  480:2    error      Only use indent of 4 spaces.              indentation
  480:2    error      Only use indent of 4 spaces.                indentation
  485:6    error      Only use indent of 8 spaces.                indentation
  489:4    warning    Provide an error message for require()     error-reasor
  492:0    error      Only use indent of 4 spaces.                indentation
  497:2    error      Only use indent of 4 spaces.                indentation
  498:4    warning    Provide an error message for require()     error-reasor
  503:0    error      Only use indent of 4 spaces.                indentation
  508:2    error      Only use indent of 4 spaces.                indentation
  509:4    warning    Provide an error message for require()     error-reasor
  513:0    error      Only use indent of 4 spaces.                indentation
  518:2    error      Only use indent of 4 spaces.                indentation
  520:4    warning    Provide an error message for require()     error-reasor
  523:0    error      Only use indent of 4 spaces.                indentation
  529:2    error      Only use indent of 4 spaces.                indentation
  530:4    warning    Provide an error message for require()     error-reasor
  532:0    error      Only use indent of 4 spaces.                indentation
  739:1    warning    Line contains trailing whitespace          no-trailing-

contracts/ReversibleICO.sol
  313:45    error      String literal must be quoted with double quotes.
  542:67    error      String literal must be quoted with double quotes.
  680:23    warning    There should be no whitespace or comments between arg
  681:10    error      Only use indent of 12 spaces.
  771:12    error      String literal must be quoted with double quotes.
  777:12    error      String literal must be quoted with double quotes.
  793:12    error      String literal must be quoted with double quotes.
  979:42    error      String literal must be quoted with double quotes.

contracts/mocks/ERC777Mock.sol
  3:7    error    "../zeppelin/token/ERC777/ERC777.sol": Import statements m

contracts/mocks/ERC777SenderRecipientMock.sol
  9:7      error      "../zeppelin/token/ERC777/ERC777.sol": Import statemer
  54:12    warning    Provide an error message for revert()
  85:12    warning    Provide an error message for revert()
  143:8    warning    Consider using 'transfer' in place of 'send'.

contracts/mocks/MathMock.sol
  3:7    error    "../zeppelin/math/Math.sol": Import statements must use do

contracts/mocks/ReversibleICOMock.sol
  11:7    error    "../ReversibleICO.sol": Import statements must use double

contracts/mocks/ReversibleICOMock777.sol
  11:7    error    "./ReversibleICOMock.sol": Import statements must use dou

contracts/mocks/SafeMathMock.sol
  3:7    error    "../zeppelin/math/SafeMath.sol": Import statements must us

contracts/zeppelin/crowdsale/Crowdsale.sol
  149:89    warning    Code contains empty block    no-empty-blocks
  179:85    warning    Code contains empty block    no-empty-blocks
```

```
contracts/zeppelin/crowdsale/distribution/FinalizableCrowdsale.sol
  48:38    warning    Code contains empty block    no-empty-blocks

contracts/zeppelin/crowdsale/emission/MintedCrowdsale.sol
  21:16    error    Only use indent of 12 spaces.    indentation

contracts/zeppelin/crowdsale/price/IncreasingPriceCrowdsale.sol
  64:30    warning    Avoid using 'block.timestamp'.    security/no-block-me

contracts/zeppelin/crowdsale/validation/TimedCrowdsale.sol
  38:31    warning    Avoid using 'block.timestamp'.    security/no-block-me
  65:15    warning    Avoid using 'block.timestamp'.    security/no-block-me
  65:50    warning    Avoid using 'block.timestamp'.    security/no-block-me
  74:15    warning    Avoid using 'block.timestamp'.    security/no-block-me

contracts/zeppelin/cryptography/ECDSA.sol
  42:8    error    Avoid using Inline Assembly.    security/no-inline-assemb

contracts/zeppelin/drafts/SignatureBouncer.sol
  46:28    warning    Code contains empty block    no-empty-blocks

contracts/zeppelin/drafts/TokenVesting.sol
  55:38     warning    Avoid using 'block.timestamp'.    security/no-block-m
  166:12    warning    Avoid using 'block.timestamp'.    security/no-block-m
  168:19    warning    Avoid using 'block.timestamp'.    security/no-block-m
  171:36    warning    Avoid using 'block.timestamp'.    security/no-block-m

contracts/zeppelin/introspection/ERC165Checker.sol
  102:8    error    Avoid using Inline Assembly.    security/no-inline-assem

contracts/zeppelin/token/ERC20/SafeERC20.sol
  33:16    error      Only use indent of 12 spaces.             indentation
  67:65    warning    Avoid using low-level function 'call'.    security/no-

contracts/zeppelin/token/ERC20/TokenTimelock.sol
  29:30    warning    Avoid using 'block.timestamp'.    security/no-block-me
  61:16    warning    Avoid using 'block.timestamp'.    security/no-block-me

contracts/zeppelin/token/ERC721/ERC721.sol
  91:16    error    Only use indent of 12 spaces.    indentation

contracts/zeppelin/token/ERC721/IERC721.sol
  27:1    warning    Line contains trailing whitespace    no-trailing-whites

contracts/zeppelin/token/ERC721/IERC721Full.sol
  11:68    warning    Code contains empty block    no-empty-blocks

contracts/zeppelin/token/ERC721/IERC721Receiver.sol
  24:0    error    Only use indent of 4 spaces.    indentation

contracts/zeppelin/token/ERC777/ERC777.sol
  44:0      error      Only use indent of 4 spaces.
  48:0      error      Only use indent of 4 spaces.
  471:12    warning    Error message exceeds max length of 76 characters

contracts/zeppelin/utils/Address.sol
  21:8    warning    Line contains trailing whitespace    no-trailing-whites
  28:8    error      Avoid using Inline Assembly.         security/no-inline

✕ 34 errors, 31 warnings found.
```

A.3.3 Surya

Surya is a utility tool for smart contract systems. It provides a number of visual outputs and information about the structure of smart contracts. It also supports querying the function call graph in multiple ways to aid in the manual inspection and control flow analysis of contracts.

Below is a complete list of functions with their visibility and modifiers:

Sūrya's Description Report

File Name	SHA-1 Hash
contracts/Gnosis/CreateCall.sol	e33c0ec5bcbeeb3ea221073e37b594a490863679
contracts/Gnosis/GnosisSafe.sol	af2dbf4f80b63f0edf1ebaba8c632fa2cc0c8e74
contracts/Migrations.sol	6eddef3c09c6eae9042600a1e73310183e0c6f5d
contracts/ReversibleICO.sol	b40a2464c0fc24a5c1b8d59eb2e5f344f5618211
contracts/RicoToken.sol	7d500809f2d14e4ea728ae126d4711239dffc422
contracts/mocks/ERC777Mock.sol	679dfee5742c44d8c2bc4bb3da866f5f89b51af5
contracts/mocks/ERC777SenderRecipientMock.sol	990ec041972850ba2fc1cdde3fad10cb442d6557

File Name	SHA-1 Hash
contracts/mocks/EmptyReceiver.sol	f4f7155b6c24f385be55da67f84840bb60d5cb25
contracts/mocks/MathMock.sol	147138b16a7e5fa032f92cc53e73ff0d1cc6cb9e
contracts/mocks/ReversibleICOMock.sol	8e15fa7194b65d306183d5af996d4c6c09b2598f
contracts/mocks/ReversibleICOMock777.sol	87c2bf80a0fdd630995c3b7f48892c19726133aa
contracts/mocks/SafeMathMock.sol	906a40c436b2315f8204f99896503c87e1ee5c7a
contracts/zeppelin/access/Roles.sol	2c85acf184ae36f96ebafd8f6e26232ea459a711
contracts/zeppelin/access/roles/CapperRole.sol	c5b388b416565361625c86a41d14c4148053be2b
contracts/zeppelin/access/roles/MinterRole.sol	81ba1a5f8f3585e6fd7da0bc520cbb61d1ba96f9
contracts/zeppelin/access/roles/PauserRole.sol	eac20163f361a7362b520d1b0da3e638cf19b63b
contracts/zeppelin/access/roles/SignerRole.sol	0d6c043d90f3b47361c169947c1cd7bf5842ea73
contracts/zeppelin/access/roles/WhitelistAdminRole.sol	db13ff3d51ba7d7055bdad630e7c7677a3592c77
contracts/zeppelin/access/roles/WhitelistedRole.sol	adf6a7f1fc136aa63e0d31a2c36422d540b0c65f
contracts/zeppelin/crowdsale/Crowdsale.sol	9b929f34f8c7db0b20d528c8fee2ca5d66502d9a
contracts/zeppelin/crowdsale/distribution/FinalizableCrowdsale.sol	d4edf528c6aa439a08a5a0e0f92463c0662b8538
contracts/zeppelin/crowdsale/distribution/PostDeliveryCrowdsale.sol	c2ea0fe336ddd0b66803d0dd2849cbd6020f64d6

File Name	SHA-1 Hash
contracts/zeppelin/crowdsale/distribution/RefundableCrowdsale.sol	34f79575607b323d9e773db58b83efa233b653a0
contracts/zeppelin/crowdsale/distribution/RefundablePostDeliveryCrowdsale.sol	a46bf27427e2f2821925f8107731f5a20f2c5642
contracts/zeppelin/crowdsale/emission/AllowanceCrowdsale.sol	3eef5da8f50519e61c4a688a65ebce5d4197932e
contracts/zeppelin/crowdsale/emission/MintedCrowdsale.sol	6e9c7fae7f84ecb25eda1f4874db98cd2ce622c1
contracts/zeppelin/crowdsale/price/IncreasingPriceCrowdsale.sol	323bf9fee7e541f27bc3dd6802b501cffe2f6875
contracts/zeppelin/crowdsale/validation/CappedCrowdsale.sol	bac0582e3d142ab6bcd2621394c7c39d9deee338
contracts/zeppelin/crowdsale/validation/IndividuallyCappedCrowdsale.sol	1475fb9401a71f65e06e0a0b6874aa52f001b8f3
contracts/zeppelin/crowdsale/validation/PausableCrowdsale.sol	f363c66635ca748b976a5772503c83ce2220b7d3
contracts/zeppelin/crowdsale/validation/TimedCrowdsale.sol	3348207385ff898a06f73c90719c6cb94eaa5616
contracts/zeppelin/crowdsale/validation/WhitelistCrowdsale.sol	54e5b7619d2f5f532ce2ada4b9cfdb81926fbef3
contracts/zeppelin/cryptography/ECDSA.sol	76a85bee5b53d94cbbb27cf2e64d093e63fbf383
contracts/zeppelin/cryptography/MerkleProof.sol	9cf3346b959339f76bbedf4fdd7eb4c89f9d708b
contracts/zeppelin/drafts/Counters.sol	9afb0abd3c2203bdebfb099ba312ae1aa3491ef1
contracts/zeppelin/drafts/ERC1046/ERC20Metadata.sol	90bd87618009ef859d6042e9f9652b7d381a88b6
contracts/zeppelin/drafts/ERC20Migrator.sol	7b276d54e8b48abd3e6f6a1dce3f2bc6dace7559

File Name	SHA-1 Hash
contracts/zeppelin/drafts/ERC20Snapshot.sol	2d87241a7d52337394b145f0aa2e4492386e9353
contracts/zeppelin/drafts/SignatureBouncer.sol	8688cb091305ac4c9223dd0c279a193d415c19ae
contracts/zeppelin/drafts/SignedSafeMath.sol	cbb5a1dd1395fe442f1a65e7ea363f59024bc568
contracts/zeppelin/drafts/Strings.sol	191552acdf0666a4d5a22434618f604ac2e78f1a
contracts/zeppelin/drafts/TokenVesting.sol	aae2625bcc1061f910792d66448171854c10a12a
contracts/zeppelin/examples/SampleCrowdsale.sol	8a9795357ba9baddbdd08f89ffa521e5dedb8c56
contracts/zeppelin/examples/SimpleToken.sol	b7cac40dfc7f81f4f3112bdc05d70cf7f4109b22
contracts/zeppelin/introspection/ERC165.sol	0ffad990866bbae84334c199da3beac4b023c40b
contracts/zeppelin/introspection/ERC165Checker.sol	70e4597cea01643d48b2c4331a3a1a7ccb6312e5
contracts/zeppelin/introspection/ERC1820Implementer.sol	ccdcb76ed593fed5d896d80d5ce2d85494a21ce8
contracts/zeppelin/introspection/IERC165.sol	3e4132a066a6508ca5d1bdad1c6aefaf65f0f417
contracts/zeppelin/introspection/IERC1820Implementer.sol	f5ed2d06bcd8e04750bc08298511e24a2c1b18e1
contracts/zeppelin/introspection/IERC1820Registry.sol	7043ec16917c1c320773519e15c0a157b5eb622d
contracts/zeppelin/lifecycle/Pausable.sol	b0fa9243a2861ec124501a274ff27dc96d62045c
contracts/zeppelin/math/Math.sol	ab515a94d340aa89ddc03c67e6fc2fdb4b6b3a18

File Name	SHA-1 Hash
contracts/zeppelin/math/SafeMath.sol	996fa9bc77d307e5841e95836a6f3e70a47b56dc
contracts/zeppelin/ownership/Ownable.sol	52faef44a79929eb5829b44037bd7e6aeb5886a4
contracts/zeppelin/ownership/Secondary.sol	effa2a1d4e5b89ca9ba0972a1821efb7c6751301
contracts/zeppelin/payment/PaymentSplitter.sol	cd09d63330e8fac61c3e31977d74a62ec05f2b4b
contracts/zeppelin/payment/PullPayment.sol	6de15ad8c8a87054c03cec5c87c9ad9e3749b7dd
contracts/zeppelin/payment/escrow/ConditionalEscrow.sol	741bc063096b0d3fe7721dac32cfcfdfe26bffec
contracts/zeppelin/payment/escrow/Escrow.sol	89814623bf0a582764a7ed11aca0626bd0497469
contracts/zeppelin/payment/escrow/RefundEscrow.sol	f356bb993dc108b56b22fbc198bfc1943b83a0c4
contracts/zeppelin/token/ERC20/ERC20.sol	090e794a02cb360fd29f4fae86cc9beebe8c19fe
contracts/zeppelin/token/ERC20/ERC20Burnable.sol	53604981ed22f52fa49276c7494a01fbd8b5cbba
contracts/zeppelin/token/ERC20/ERC20Capped.sol	bec55d19afae1b673fbfa89a74e0c323d0ac9a65
contracts/zeppelin/token/ERC20/ERC20Detailed.sol	e87b9ea40a0fa3a6a3b61c0d8b028dd50abd2c17
contracts/zeppelin/token/ERC20/ERC20Mintable.sol	9702a8bc622ecd20754103e90f2624d69a657ff0
contracts/zeppelin/token/ERC20/ERC20Pausable.sol	9c2bdb2452c4b5424cb55278b87d2855dd1ab954
contracts/zeppelin/token/ERC20/IERC20.sol	071386690ad9e56d7f22ec461644611e9f46c531

File Name	SHA-1 Hash
contracts/zeppelin/token/ERC20/SafeERC20.sol	638ff9747c02c5a405a38c53fcc627066146d5ba
contracts/zeppelin/token/ERC20/TokenTimelock.sol	56ff72e3930bc1ef6f949c5be41a77b0b4c6f59a
contracts/zeppelin/token/ERC721/ERC721.sol	14a1fd7b8f9aee634ea1b3d550ae0f93a32452bf
contracts/zeppelin/token/ERC721/ERC721Burnable.sol	18e971a658a4ceed9f6cd4aae2a62a19d15b7f21
contracts/zeppelin/token/ERC721/ERC721Enumerable.sol	5d56a89a03af60edce2020f9b5babc35d94a96e9
contracts/zeppelin/token/ERC721/ERC721Full.sol	004e3919a168f167a21724e367b14062a80fcce5
contracts/zeppelin/token/ERC721/ERC721Holder.sol	9ae70830aa2c02885b90f254821ba87544b70f51
contracts/zeppelin/token/ERC721/ERC721Metadata.sol	f15e429094d7331c5c83e43c919d2b9ac16f994f
contracts/zeppelin/token/ERC721/ERC721MetadataMintable.sol	d79b2f0327909f367817053002557994a644d7c8
contracts/zeppelin/token/ERC721/ERC721Mintable.sol	3e7f8614328532a74bf7e1889df0f5f94598ad12
contracts/zeppelin/token/ERC721/ERC721Pausable.sol	5781706f3e601b9dd04e89b036980438e0e1c000
contracts/zeppelin/token/ERC721/IERC721.sol	a031de37de0bdcd6f652442f6d5a98e28ad0bc7b
contracts/zeppelin/token/ERC721/IERC721Enumerable.sol	d68cee9914f8b5b1a6d7565d77c63d21008ffc0f
contracts/zeppelin/token/ERC721/IERC721Full.sol	d383b8f1941b7c768ded744aa22f1283a82fc0f1
contracts/zeppelin/token/ERC721/IERC721Metadata.sol	8be425d35abba3b5570535d7c517035e001c012d

File Name	SHA-1 Hash
contracts/zeppelin/token/ERC721/IERC721Receiver.sol	259fda3fb13a4dbcde0821ec6f17dd98311486f1
contracts/zeppelin/token/ERC777/ERC777.sol	4f6d1ba87477d5fe7dae32bafe26ff93a140d883
contracts/zeppelin/token/ERC777/IERC777.sol	31e168dfd70b2c8d2682cced1b204c0a89cd7aa9
contracts/zeppelin/token/ERC777/IERC777Recipient.sol	e5cc170671b166d18dad336cf09df5dba734c803
contracts/zeppelin/token/ERC777/IERC777Sender.sol	05af02d35e333afc31602d0a85d965386b63c06d
contracts/zeppelin/utils/Address.sol	5e025b5b3244d65ad36dfdceca7b968b012a76ed
contracts/zeppelin/utils/Arrays.sol	3487917d053c7fb108d5e5de9972dff52405a385
contracts/zeppelin/utils/ReentrancyGuard.sol	b419b7ac13283c6a860430e269947340ee24cd49

Contract	**Type**	**Bases**		
└	**Function Name**	**Visibility**	**Mutability**	**Modifiers**
CreateCall	Implementation			
└	performCreate2	Public ❗	🛑	NO❗
└	performCreate	Public ❗	🛑	NO❗
Executor	Implementation			
└	execute	Internal 🔒	🛑	

Contract	Type	Bases		
L	executeCall	Internal 🔒	🛑	
L	executeDelegateCall	Internal 🔒	🛑	
Enum	Implementation			
SecuredTokenTransfer	Implementation			
L	transferToken	Internal 🔒	🛑	
SelfAuthorized	Implementation			
FallbackManager	Implementation	SelfAuthorized		
L	internalSetFallbackHandler	Internal 🔒	🛑	
L	setFallbackHandler	Public ❗	🛑	authorized
L		External ❗	💵	NO❗
ModuleManager	Implementation	SelfAuthorized, Executor		
L	setupModules	Internal 🔒	🛑	
L	enableModule	Public ❗	🛑	authorized

Contract	Type	Bases		
L	disableModule	Public ❗️	🛑	authorized
L	execTransactionFromModule	Public ❗️	🛑	NO❗️
L	getModules	Public ❗️		NO❗️
OwnerManager	Implementation	SelfAuthorized		
L	setupOwners	Internal 🔒	🛑	
L	addOwnerWithThreshold	Public ❗️	🛑	authorized
L	removeOwner	Public ❗️	🛑	authorized
L	swapOwner	Public ❗️	🛑	authorized
L	changeThreshold	Public ❗️	🛑	authorized
L	getThreshold	Public ❗️		NO❗️
L	isOwner	Public ❗️		NO❗️
L	getOwners	Public ❗️		NO❗️
MasterCopy	Implementation	SelfAuthorized		
L	changeMasterCopy	Public ❗️	🛑	authorized

Contract	Type	Bases		
Module	Implementation	MasterCopy		
L	setManager	Internal 🔒	🛑	
SignatureDecoder	Implementation			
L	recoverKey	Internal 🔒		
L	signatureSplit	Internal 🔒		
SafeMath	Library			
L	mul	Internal 🔒		
L	div	Internal 🔒		
L	sub	Internal 🔒		
L	add	Internal 🔒		
L	mod	Internal 🔒		
ISignatureValidatorConstants	Implementation			
GnosisSafe	Implementation	MasterCopy, ModuleManager, OwnerManager, SignatureDecoder, SecuredTokenTransfer, ISignatureValidatorConstants, FallbackManager		

Contract	Type	Bases		
L	setup	External ❗️	🛑	NO❗️
L	execTransaction	External ❗️	🛑	NO❗️
L	handlePayment	Private 🔐	🛑	
L	checkSignatures	Internal 🔒	🛑	
L	requiredTxGas	External ❗️	🛑	authorized
L	approveHash	External ❗️	🛑	NO❗️
L	signMessage	External ❗️	🛑	authorized
L	isValidSignature	External ❗️	🛑	NO❗️
L	getMessageHash	Public ❗️		NO❗️
L	encodeTransactionData	Public ❗️		NO❗️
L	getTransactionHash	Public ❗️		NO❗️
ISignatureValidator	Implementation	ISignatureValidatorConstants		
L	isValidSignature	Public ❗️		NO❗️
Migrations	Implementation			

Contract	Type	Bases		
Reversible ICO	Implementation	IERC777Recipient		
└		Public ❗	🛑	NO❗
└	init	Public ❗	🛑	onlyDeployingAddress isNotInitialized
└		External ❗	💵	isInitialized isNotFrozen
└	tokensReceived	External ❗	🛑	isInitialized isNotFrozen
└	commit	External ❗	💵	isInitialized isNotFrozen isRunning
└	cancel	External ❗	💵	isInitialized isNotFrozen
└	whitelist	External ❗	🛑	onlyWhitelistingAddress isInitialized isNotFrozen isRunning

Contract	Type	Bases		
L	projectWithdraw	External ❗	🛑	onlyProjectAddress isInitialized isNotFrozen
L	freeze	External ❗	🛑	onlyFreezerAddress isNotFrozen
L	unfreeze	External ❗	🛑	onlyFreezerAddress isFrozen
L	disableEscapeHatch	External ❗	🛑	onlyFreezerAddress isNotFrozen
L	escapeHatch	External ❗	🛑	onlyRescuerAddress isFrozen
L	getUnlockedProjectETH	Public ❗		NO❗
L	getAvailableProjectETH	Public ❗		NO❗
L	getParticipantReservedTokens	Public ❗		NO❗
L	getParticipantUnlockedTokens	Public ❗		NO❗

Contract	Type	Bases		
L	getCurrentStage	Public ❗		NO❗
L	getCurrentPrice	Public ❗		NO❗
L	getPriceAtBlock	Public ❗		NO❗
L	getPriceAtStage	Public ❗		NO❗
L	getStageAtBlock	Public ❗		NO❗
L	committableEthAtStage	Public ❗		NO❗
L	getTokenAmountForEthAtStage	Public ❗		NO❗
L	getEthAmountForTokensAtStage	Public ❗		NO❗
L	getCurrentBlockNumber	Public ❗		NO❗
L	calcUnlockedAmount	Public ❗		NO❗
L	sanityCheckProject	Internal 🔒		
L	sanityCheckParticipant	Internal 🔒		

Contract	Type	Bases		
L	calcProjectAllocation	Internal 🔒	🛑	
L	calcParticipantAllocation	Internal 🔒	🛑	
L	cancelPendingContributions	Internal 🔒	🛑	isInitialized isNotFrozen
L	acceptContributions	Internal 🔒	🛑	isInitialized isNotFrozen isRunning
L	withdraw	Internal 🔒	🛑	isInitialized isNotFrozen isRunning
ReversibleICO	Interface			
L	getParticipantReservedTokens	External ❗		NO❗
RicoToken	Implementation	ERC777		
L		Public ❗	🛑	ERC777
L	setup	Public ❗	🛑	requireNotInitialized onlyManager

Contract	Type	Bases		
L	changeManager	Public ❗	🛑	onlyManager
L	setFrozen	Public ❗	🛑	onlyManager
L	getLockedBalance	Public ❗		NO❗
L	getUnlockedBalance	Public ❗		NO❗
L	_burn	Internal 🔒	🛑	requireNotFrozen
L	_move	Internal 🔒	🛑	requireNotFrozen requireInitialized
ERC777Mock	Implementation	ERC777		
L		Public ❗	🛑	ERC777
L	mintInternal	Public ❗	🛑	NO❗
ERC777SenderRecipientMock	Implementation	IERC777Sender, IERC777Recipient, ERC1820Implementer		
L	tokensToSend	External ❗	🛑	NO❗
L	tokensReceived	External ❗	🛑	NO❗
L	senderFor	Public ❗	🛑	NO❗

Contract	Type	Bases		
L	registerSender	Public ❗	🛑	NO❗
L	recipientFor	Public ❗	🛑	NO❗
L	registerRecipient	Public ❗	🛑	NO❗
L	setShouldRevertSend	Public ❗	🛑	NO❗
L	setShouldRevertReceive	Public ❗	🛑	NO❗
L	send	Public ❗	🛑	NO❗
L	burn	Public ❗	🛑	NO❗
EmptyReceiver	Implementation			
MathMock	Implementation			
L	max	Public ❗		NO❗
L	min	Public ❗		NO❗
L	average	Public ❗		NO❗
ReversibleICOMock	Implementation	ReversibleICO		
L	getCurrentBlockNumber	Public ❗		NO❗

Contract	Type	Bases		
L	increaseCurrentBlockNumber	Public ❗	🛑	NO❗
L	jumpToBlockNumber	Public ❗	🛑	NO❗
ReversibleICOMock777	Implementation	ReversibleICOMock		
L	setreservedTokenAmount	External ❗	🛑	NO❗
L	getParticipantReservedTokens	Public ❗		NO❗
L	tokensReceived	External ❗	🛑	NO❗
SafeMathMock	Implementation			
L	mul	Public ❗		NO❗
L	div	Public ❗		NO❗
L	sub	Public ❗		NO❗
L	add	Public ❗		NO❗
L	mod	Public ❗		NO❗
Roles	Library			
L	add	Internal 🔒	🛑	
L	remove	Internal 🔒	🛑	
L	has	Internal 🔒		

Contract	Type	Bases		
CapperRole	Implementation			
L		Internal 🔒	🛑	
L	isCapper	Public ❗️		NO❗️
L	addCapper	Public ❗️	🛑	onlyCapper
L	renounceCapper	Public ❗️	🛑	NO❗️
L	_addCapper	Internal 🔒	🛑	
L	_removeCapper	Internal 🔒	🛑	
MinterRole	Implementation			
L		Internal 🔒	🛑	
L	isMinter	Public ❗️		NO❗️
L	addMinter	Public ❗️	🛑	onlyMinter
L	renounceMinter	Public ❗️	🛑	NO❗️
L	_addMinter	Internal 🔒	🛑	
L	_removeMinter	Internal 🔒	🛑	
PauserRole	Implementation			
L		Internal 🔒	🛑	
L	isPauser	Public ❗️		NO❗️

Contract	Type	Bases		
L	addPauser	Public ❗️	🛑	onlyPauser
L	renouncePauser	Public ❗️	🛑	NO❗️
L	_addPauser	Internal 🔒	🛑	
L	_removePauser	Internal 🔒	🛑	
SignerRole	Implementation			
L		Internal 🔒	🛑	
L	isSigner	Public ❗️		NO❗️
L	addSigner	Public ❗️	🛑	onlySigner
L	renounceSigner	Public ❗️	🛑	NO❗️
L	_addSigner	Internal 🔒	🛑	
L	_removeSigner	Internal 🔒	🛑	
WhitelistAdminRole	Implementation			
L		Internal 🔒	🛑	
L	isWhitelistAdmin	Public ❗️		NO❗️
L	addWhitelistAdmin	Public ❗️	🛑	onlyWhitelistAdmin
L	renounceWhitelistAdmin	Public ❗️	🛑	NO❗️

Contract	Type	Bases		
L	_addWhitelistAdmin	Internal 🔒	🛑	
L	_removeWhitelistAdmin	Internal 🔒	🛑	
WhitelistedRole	Implementation	WhitelistAdminRole		
L	isParticipantWhitelisted	Public ❗		NO❗
L	addWhitelisted	Public ❗	🛑	onlyWhitelistAdmin
L	removeWhitelisted	Public ❗	🛑	onlyWhitelistAdmin
L	renounceWhitelisted	Public ❗	🛑	NO❗
L	_addWhitelisted	Internal 🔒	🛑	
L	_removeWhitelisted	Internal 🔒	🛑	
Crowdsale	Implementation	ReentrancyGuard		
L		Public ❗	🛑	NO❗
L		External ❗	💵	NO❗
L	token	Public ❗		NO❗
L	wallet	Public ❗		NO❗
L	rate	Public ❗		NO❗

Contract	Type	Bases		
└	weiRaised	Public ❗️		NO❗️
└	buyTokens	Public ❗️	💵	nonReentrant
└	_preValidatePurchase	Internal 🔒		
└	_postValidatePurchase	Internal 🔒		
└	_deliverTokens	Internal 🔒	🛑	
└	_processPurchase	Internal 🔒	🛑	
└	_updatePurchasingState	Internal 🔒	🛑	
└	_getTokenAmount	Internal 🔒		
└	_forwardFunds	Internal 🔒	🛑	
FinalizableCrowdsale	Implementation	TimedCrowdsale		
└		Internal 🔒	🛑	
└	finalized	Public ❗️		NO❗️
└	finalize	Public ❗️	🛑	NO❗️
└	_finalization	Internal 🔒	🛑	
PostDeliveryCrowdsale	Implementation	TimedCrowdsale		

Contract	Type	Bases		
L		Public ❗️	🛑	NO❗️
L	withdrawTokens	Public ❗️	🛑	NO❗️
L	balanceOf	Public ❗️		NO❗️
L	_processPurchase	Internal 🔒	🛑	
unstableTokenVault	Implementation	Secondary		
L	transfer	Public ❗️	🛑	onlyPrimary
RefundableCrowdsale	Implementation	FinalizableCrowdsale		
L		Public ❗️	🛑	NO❗️
L	goal	Public ❗️		NO❗️
L	claimRefund	Public ❗️	🛑	NO❗️
L	goalReached	Public ❗️		NO❗️
L	_finalization	Internal 🔒	🛑	
L	_forwardFunds	Internal 🔒	🛑	
RefundablePostDeliveryCrowdsale	Implementation	RefundableCrowdsale, PostDeliveryCrowdsale		

Contract	Type	Bases		
L	withdrawTokens	Public ❗	🛑	NO❗
AllowanceCrowdsale	Implementation	Crowdsale		
L		Public ❗	🛑	NO❗
L	tokenWallet	Public ❗		NO❗
L	remainingTokens	Public ❗		NO❗
L	_deliverTokens	Internal 🔒	🛑	
MintedCrowdsale	Implementation	Crowdsale		
L	_deliverTokens	Internal 🔒	🛑	
IncreasingPriceCrowdsale	Implementation	TimedCrowdsale		
L		Public ❗	🛑	NO❗
L	rate	Public ❗		NO❗
L	initialRate	Public ❗		NO❗
L	finalRate	Public ❗		NO❗
L	getCurrentRate	Public ❗		NO❗
L	_getTokenAmount	Internal 🔒		

Contract	Type	Bases		
CappedCrowdsale	Implementation	Crowdsale		
└		Public ❗️	🛑	NO❗️
└	cap	Public ❗️		NO❗️
└	capReached	Public ❗️		NO❗️
└	_preValidatePurchase	Internal 🔒		
IndividuallyCappedCrowdsale	Implementation	Crowdsale, CapperRole		
└	setCap	External ❗️	🛑	onlyCapper
└	getCap	Public ❗️		NO❗️
└	getContribution	Public ❗️		NO❗️
└	_preValidatePurchase	Internal 🔒		
└	_updatePurchasingState	Internal 🔒	🛑	
PausableCrowdsale	Implementation	Crowdsale, Pausable		
└	_preValidatePurchase	Internal 🔒		whenNotPaused
TimedCrowdsale	Implementation	Crowdsale		
└		Public ❗️	🛑	NO❗️

Contract	Type	Bases		
└	openingTime	Public ❗️		NO❗️
└	closingTime	Public ❗️		NO❗️
└	isOpen	Public ❗️		NO❗️
└	hasClosed	Public ❗️		NO❗️
└	_preValidatePurchase	Internal 🔒		onlyWhileOpen
└	_extendTime	Internal 🔒	🛑	
WhitelistCrowdsale	Implementation	WhitelistedRole, Crowdsale		
└	_preValidatePurchase	Internal 🔒		
ECDSA	Library			
└	recover	Internal 🔒		
└	toEthSignedMessageHash	Internal 🔒		
MerkleProof	Library			
└	verify	Internal 🔒		
Counters	Library			
└	current	Internal 🔒		
└	increment	Internal 🔒	🛑	
└	decrement	Internal 🔒	🛑	

Contract	Type	Bases		
ERC20Metadata	Implementation			
L		Public ❗️	🛑	NO❗️
L	tokenURI	External ❗️		NO❗️
L	_setTokenURI	Internal 🔒	🛑	
ERC20Migrator	Implementation			
L		Public ❗️	🛑	NO❗️
L	legacyToken	Public ❗️		NO❗️
L	newToken	Public ❗️		NO❗️
L	beginMigration	Public ❗️	🛑	NO❗️
L	migrate	Public ❗️	🛑	NO❗️
L	migrateAll	Public ❗️	🛑	NO❗️
ERC20Snapshot	Implementation	ERC20		
L	snapshot	Public ❗️	🛑	NO❗️
L	balanceOfAt	Public ❗️		NO❗️
L	totalSupplyAt	Public ❗️		NO❗️
L	_transfer	Internal 🔒	🛑	
L	_mint	Internal 🔒	🛑	
L	_burn	Internal 🔒	🛑	
L	_valueAt	Private 🔐		

Contract	Type	Bases		
L	_updateAccountSnapshot	Private 🔐	🛑	
L	_updateTotalSupplySnapshot	Private 🔐	🛑	
L	_updateSnapshot	Private 🔐	🛑	
L	_lastSnapshotId	Private 🔐		
SignatureBouncer	Implementation	SignerRole		
L		Internal 🔒	🛑	
L	_isValidSignature	Internal 🔒		
L	_isValidSignatureAndMethod	Internal 🔒		
L	_isValidSignatureAndData	Internal 🔒		
L	_isValidDataHash	Internal 🔒		
SignedSafeMath	Library			
L	mul	Internal 🔒		
L	div	Internal 🔒		
L	sub	Internal 🔒		
L	add	Internal 🔒		

Contract	**Type**	**Bases**		
Strings	Library			
L	fromUint256	Internal 🔒		
TokenVesting	Implementation	Ownable		
L		Public ❗️	🛑	NO❗️
L	beneficiary	Public ❗️		NO❗️
L	cliff	Public ❗️		NO❗️
L	start	Public ❗️		NO❗️
L	duration	Public ❗️		NO❗️
L	revocable	Public ❗️		NO❗️
L	released	Public ❗️		NO❗️
L	revoked	Public ❗️		NO❗️
L	release	Public ❗️	🛑	NO❗️
L	revoke	Public ❗️	🛑	onlyOwner
L	_releasableAmount	Private 🔐		
L	_vestedAmount	Private 🔐		
SampleCrowdsaleToken	Implementation	ERC20Mintable, ERC20Detailed		
L		Public ❗️	🛑	ERC20Detailed

Contract	Type	Bases		
SampleCrowdsale	Implementation	CappedCrowdsale, RefundableCrowdsale, MintedCrowdsale		
L		Public ❗️	🛑	Crowdsale CappedCrowdsale TimedCrowdsale RefundableCrowdsale
SimpleToken	Implementation	ERC20, ERC20Detailed		
L		Public ❗️	🛑	ERC20Detailed
ERC165	Implementation	IERC165		
L		Internal 🔒	🛑	
L	supportsInterface	External ❗️		NO❗️
L	_registerInterface	Internal 🔒	🛑	
ERC165Checker	Library			
L	_supportsERC165	Internal 🔒		

Contract	Type	Bases		
L	_supportsInterface	Internal 🔒		
L	_supportsAllInterfaces	Internal 🔒		
L	_supportsERC165Interface	Private 🔐		
L	_callERC165SupportsInterface	Private 🔐		
ERC1820Implementer	Implementation	IERC1820Implementer		
L	canImplementInterfaceForAddress	External ❗		NO❗
L	_registerInterfaceForAddress	Internal 🔒	🛑	
IERC165	Interface			
L	supportsInterface	External ❗		NO❗
IERC1820Implementer	Interface			

Contract	Type	Bases		
L	canImplementInterfaceForAddress	External ❗		NO❗
IERC1820 Registry	Interface			
L	setManager	External ❗	🛑	NO❗
L	getManager	External ❗		NO❗
L	setInterfaceImplementer	External ❗	🛑	NO❗
L	getInterfaceImplementer	External ❗		NO❗
L	interfaceHash	External ❗		NO❗
L	updateERC165Cache	External ❗	🛑	NO❗
L	implementsERC165Interface	External ❗		NO❗
L	implementsERC165InterfaceNoCache	External ❗		NO❗
Pausable	Implementation	PauserRole		

Contract	Type	Bases		
└		Internal 🔒	🛑	
└	paused	Public ❗		NO❗
└	pause	Public ❗	🛑	onlyPauser whenNotPaused
└	unpause	Public ❗	🛑	onlyPauser whenPaused
Math	Library			
└	max	Internal 🔒		
└	min	Internal 🔒		
└	average	Internal 🔒		
SafeMath	Library			
└	add	Internal 🔒		
└	sub	Internal 🔒		
└	mul	Internal 🔒		
└	div	Internal 🔒		
└	mod	Internal 🔒		
Ownable	Implementation			
└		Internal 🔒	🛑	
└	owner	Public ❗		NO❗
└	isOwner	Public ❗		NO❗
└	renounceOwnership	Public ❗	🛑	onlyOwner

Contract	Type	Bases		
L	transferOwnership	Public ❗	🛑	onlyOwner
L	_transferOwnership	Internal 🔒	🛑	
Secondary	Implementation			
L		Internal 🔒	🛑	
L	primary	Public ❗		NO❗
L	transferPrimary	Public ❗	🛑	onlyPrimary
PaymentSplitter	Implementation			
L		Public ❗	💵	NO❗
L		External ❗	💵	NO❗
L	totalShares	Public ❗		NO❗
L	totalReleased	Public ❗		NO❗
L	shares	Public ❗		NO❗
L	released	Public ❗		NO❗
L	payee	Public ❗		NO❗
L	release	Public ❗	🛑	NO❗
L	_addPayee	Private 🔐	🛑	
PullPayment	Implementation			
L		Internal 🔒	🛑	

Contract	Type	Bases		
L	withdrawPayments	Public ❗	🛑	NO❗
L	payments	Public ❗		NO❗
L	_asyncTransfer	Internal 🔒	🛑	
ConditionalEscrow	Implementation	Escrow		
L	withdrawalAllowed	Public ❗		NO❗
L	withdraw	Public ❗	🛑	NO❗
Escrow	Implementation	Secondary		
L	depositsOf	Public ❗		NO❗
L	deposit	Public ❗	💵	onlyPrimary
L	withdraw	Public ❗	🛑	onlyPrimary
RefundEscrow	Implementation	ConditionalEscrow		
L		Public ❗	🛑	NO❗
L	state	Public ❗		NO❗
L	beneficiary	Public ❗		NO❗
L	deposit	Public ❗	💵	NO❗
L	close	Public ❗	🛑	onlyPrimary

Contract	Type	Bases		
L	enableRefunds	Public ❗️	🛑	onlyPrimary
L	beneficiaryWithdraw	Public ❗️	🛑	NO❗️
L	withdrawalAllowed	Public ❗️		NO❗️
ERC20	Implementation	IERC20		
L	totalSupply	Public ❗️		NO❗️
L	balanceOf	Public ❗️		NO❗️
L	transfer	Public ❗️	🛑	NO❗️
L	allowance	Public ❗️		NO❗️
L	approve	Public ❗️	🛑	NO❗️
L	transferFrom	Public ❗️	🛑	NO❗️
L	increaseAllowance	Public ❗️	🛑	NO❗️
L	decreaseAllowance	Public ❗️	🛑	NO❗️
L	_transfer	Internal 🔒	🛑	
L	_mint	Internal 🔒	🛑	
L	_burn	Internal 🔒	🛑	
L	_approve	Internal 🔒	🛑	
L	_burnFrom	Internal 🔒	🛑	
ERC20Burnable	Implementation	ERC20		

Contract	Type	Bases		
L	burn	Public ❗	🛑	NO❗
L	burnFrom	Public ❗	🛑	NO❗
ERC20Capped	Implementation	ERC20Mintable		
L		Public ❗	🛑	NO❗
L	cap	Public ❗		NO❗
L	_mint	Internal 🔒	🛑	
ERC20Detailed	Implementation	IERC20		
L		Public ❗	🛑	NO❗
L	name	Public ❗		NO❗
L	symbol	Public ❗		NO❗
L	decimals	Public ❗		NO❗
ERC20Mintable	Implementation	ERC20, MinterRole		
L	mint	Public ❗	🛑	onlyMinter
ERC20Pausable	Implementation	ERC20, Pausable		
L	transfer	Public ❗	🛑	whenNotPaused
L	transferFrom	Public ❗	🛑	whenNotPaused
L	approve	Public ❗	🛑	whenNotPaused
L	increaseAllowance	Public ❗	🛑	whenNotPaused

Contract	Type	Bases		
L	decreaseAllowance	Public ❗	🛑	whenNotPaused
IERC20	Interface			
L	totalSupply	External ❗		NO❗
L	balanceOf	External ❗		NO❗
L	transfer	External ❗	🛑	NO❗
L	allowance	External ❗		NO❗
L	approve	External ❗	🛑	NO❗
L	transferFrom	External ❗	🛑	NO❗
SafeERC20	Library			
L	safeTransfer	Internal 🔒	🛑	
L	safeTransferFrom	Internal 🔒	🛑	
L	safeApprove	Internal 🔒	🛑	
L	safeIncreaseAllowance	Internal 🔒	🛑	
L	safeDecreaseAllowance	Internal 🔒	🛑	
L	callOptionalReturn	Private 🔐	🛑	

Contract	Type	Bases		
TokenTimelock	Implementation			
L		Public ❗️	🛑	NO❗️
L	token	Public ❗️		NO❗️
L	beneficiary	Public ❗️		NO❗️
L	releaseTime	Public ❗️		NO❗️
L	release	Public ❗️	🛑	NO❗️
ERC721	Implementation	ERC165, IERC721		
L		Public ❗️	🛑	NO❗️
L	balanceOf	Public ❗️		NO❗️
L	ownerOf	Public ❗️		NO❗️
L	approve	Public ❗️	🛑	NO❗️
L	getApproved	Public ❗️		NO❗️
L	setApprovalForAll	Public ❗️	🛑	NO❗️
L	isApprovedForAll	Public ❗️		NO❗️
L	transferFrom	Public ❗️	🛑	NO❗️
L	safeTransferFrom	Public ❗️	🛑	NO❗️
L	safeTransferFrom	Public ❗️	🛑	NO❗️
L	_exists	Internal 🔒		

Contract	Type	Bases		
L	_isApprovedOrOwner	Internal 🔒		
L	_mint	Internal 🔒	🛑	
L	_burn	Internal 🔒	🛑	
L	_burn	Internal 🔒	🛑	
L	_transferFrom	Internal 🔒	🛑	
L	_checkOnERC721Received	Internal 🔒	🛑	
L	_clearApproval	Private 🔐	🛑	
ERC721Burnable	Implementation	ERC721		
L	burn	Public ❗	🛑	NO❗
ERC721Enumerable	Implementation	ERC165, ERC721, IERC721Enumerable		
L		Public ❗	🛑	NO❗
L	tokenOfOwnerByIndex	Public ❗		NO❗
L	totalSupply	Public ❗		NO❗
L	tokenByIndex	Public ❗		NO❗
L	_transferFrom	Internal 🔒	🛑	

Contract	Type	Bases		
L	_mint	Internal 🔒	🛑	
L	_burn	Internal 🔒	🛑	
L	_tokensOfOwner	Internal 🔒		
L	_addTokenToOwnerEnumeration	Private 🔐	🛑	
L	_addTokenToAllTokensEnumeration	Private 🔐	🛑	
L	_removeTokenFromOwnerEnumeration	Private 🔐	🛑	
L	_removeTokenFromAllTokensEnumeration	Private 🔐	🛑	
ERC721Full	Implementation	ERC721, ERC721Enumerable, ERC721Metadata		
L		Public ❗	🛑	ERC721Metadata
ERC721Holder	Implementation	IERC721Receiver		
L	onERC721Received	Public ❗	🛑	NO❗

Contract	Type	Bases		
ERC721Metadata	Implementation	ERC165, ERC721, IERC721Metadata		
L		Public ❗️	🛑	NO❗️
L	name	External ❗️		NO❗️
L	symbol	External ❗️		NO❗️
L	tokenURI	External ❗️		NO❗️
L	_setTokenURI	Internal 🔒	🛑	
L	_burn	Internal 🔒	🛑	
ERC721MetadataMintable	Implementation	ERC721, ERC721Metadata, MinterRole		
L	mintWithTokenURI	Public ❗️	🛑	onlyMinter
ERC721Mintable	Implementation	ERC721, MinterRole		
L	mint	Public ❗️	🛑	onlyMinter
ERC721Pausable	Implementation	ERC721, Pausable		
L	approve	Public ❗️	🛑	whenNotPaused
L	setApprovalForAll	Public ❗️	🛑	whenNotPaused
L	transferFrom	Public ❗️	🛑	whenNotPaused

Contract	Type	Bases		
IERC721	Implementation	IERC165		
L	balanceOf	Public ❗️		NO❗️
L	ownerOf	Public ❗️		NO❗️
L	safeTransferFrom	Public ❗️	🛑	NO❗️
L	transferFrom	Public ❗️	🛑	NO❗️
L	approve	Public ❗️	🛑	NO❗️
L	getApproved	Public ❗️		NO❗️
L	setApprovalForAll	Public ❗️	🛑	NO❗️
L	isApprovedForAll	Public ❗️		NO❗️
L	safeTransferFrom	Public ❗️	🛑	NO❗️
IERC721Enumerable	Implementation	IERC721		
L	totalSupply	Public ❗️		NO❗️
L	tokenOfOwnerByIndex	Public ❗️		NO❗️
L	tokenByIndex	Public ❗️		NO❗️

Contract	Type	Bases		
IERC721Full	Implementation	IERC721, IERC721Enumerable, IERC721Metadata		
IERC721Metadata	Implementation	IERC721		
L	name	External ❗		NO❗
L	symbol	External ❗		NO❗
L	tokenURI	External ❗		NO❗
IERC721Receiver	Implementation			
L	onERC721Received	Public ❗	🛑	NO❗
ERC777	Implementation	IERC777, IERC20		
L		Public ❗	🛑	NO❗
L	name	Public ❗		NO❗
L	symbol	Public ❗		NO❗
L	decimals	Public ❗		NO❗
L	granularity	Public ❗		NO❗
L	totalSupply	Public ❗		NO❗
L	balanceOf	Public ❗		NO❗
L	send	External ❗	🛑	NO❗
L	transfer	External ❗	🛑	NO❗
L	burn	External ❗	🛑	NO❗

Contract	Type	Bases		
L	isOperatorFor	Public ❗️		NO❗️
L	authorizeOperator	External ❗️	🛑	NO❗️
L	revokeOperator	External ❗️	🛑	NO❗️
L	defaultOperators	Public ❗️		NO❗️
L	operatorSend	External ❗️	🛑	NO❗️
L	operatorBurn	External ❗️	🛑	NO❗️
L	allowance	Public ❗️		NO❗️
L	approve	External ❗️	🛑	NO❗️
L	transferFrom	External ❗️	🛑	NO❗️
L	_mint	Internal 🔒	🛑	
L	_send	Private 🔐	🛑	
L	_burn	Internal 🔒	🛑	
L	_move	Internal 🔒	🛑	
L	_approve	Private 🔐	🛑	
L	_callTokensToSend	Private 🔐	🛑	
L	_callTokensReceived	Private 🔐	🛑	
IERC777	Interface			
L	name	External ❗️		NO❗️

Contract	Type	Bases		
L	symbol	External ❗		NO❗
L	granularity	External ❗		NO❗
L	totalSupply	External ❗		NO❗
L	balanceOf	External ❗		NO❗
L	send	External ❗	🛑	NO❗
L	burn	External ❗	🛑	NO❗
L	isOperatorFor	External ❗		NO❗
L	authorizeOperator	External ❗	🛑	NO❗
L	revokeOperator	External ❗	🛑	NO❗
L	defaultOperators	External ❗		NO❗
L	operatorSend	External ❗	🛑	NO❗
L	operatorBurn	External ❗	🛑	NO❗
IERC777Recipient	Interface			
L	tokensReceived	External ❗	🛑	NO❗
IERC777Sender	Interface			
L	tokensToSend	External ❗	🛑	NO❗

Contract	Type	Bases		
Address	Library			
L	isContract	Internal 🔒		
L	toPayable	Internal 🔒		
Arrays	Library			
L	findUpperBound	Internal 🔒		
ReentrancyGuard	Implementation			
L		Internal 🔒	🛑	

Legend

Symbol	Meaning
🛑	Function can modify state
💵	Function is payable

A.3.4 Tests Suite

Below is the output generated by running the test suite:

```
> ricopoc@0.0.1 test /Users/gnsps/lukso-rico-audit-2020-04/code
> npm run test-validator && npm run test-solc


> ricopoc@0.0.1 test-validator /Users/gnsps/lukso-rico-audit-2020-04/code
> scripts/run_js.sh all refresh js

Connection to localhost port 8545 [tcp/*] succeeded!
Killing existing ganache-cli instance at port 8545
Starting new ganache-cli instance at port 8545
exchange neither monster ethics bless cancel ghost excite business record wa

--------------------------------------------------------------------
 Running all tests in "test/js_validator_tests" folder:
--------------------------------------------------------------------
You can improve web3's peformance when running Node.js versions older than 1
```

```
----------------------------------------------------------------
Step 1 - Setting up helpers and globals
----------------------------------------------------------------
----------------------------------------------------------------
Step 2 - Run tests
----------------------------------------------------------------



Javascript Validator - Tests
  Integrity checking
    Settings are assigned correctly
      ✓ commitPhaseStartBlock is correct
      ✓ commitPhaseBlockCount is correct
      ✓ commitPhaseEndBlock is correct
      ✓ buyPhaseStartBlock is correct
      ✓ buyPhaseEndBlock is correct
      ✓ buyPhaseBlockCount is correct
      ✓ blocksPerDay is correct
      ✓ commitPhaseDays is correct
      ✓ stageDays is correct
      ✓ commitPhasePrice is 0.002
      ✓ stagePriceIncrease is 0.0001
    getCurrentBlockNumber()
      ✓ returns default block correctly
    setBlockNumber()
      ✓ sets block correctly
  Initialization
    stage generation
      ✓ stageCount is correct
      ✓ pricing increases by 10% for each stage
  Stage Methods
    getStageAtBlock(_blockNumber)
      stage 0
        ✓ should return correct stageId using startBlock
        ✓ should return correct stageId using endBlock
      stage 1
        ✓ should return correct stageId using startBlock
        ✓ should return correct stageId using endBlock
      stage 6
        ✓ should return correct stageId using startBlock
        ✓ should return correct stageId using endBlock
      last stage
        ✓ should return correct stageId using startBlock
        ✓ should return correct stageId using endBlock
      1 block before 0
        ✓ should throw "Block outside of rICO period."
      1 block after last stage
        ✓ should throw "Block outside of rICO period."
  Price Methods
    getPriceAtBlock(_blockNumber)
      edge of commit and buy block range
        before commitPhaseStartBlock
          ✓ should throw "Block outside of rICO period."
          ✓ should throw "Block outside of rICO period."
        at commitPhaseStartBlock
          ✓ should return commitPhasePrice
        at buyPhaseEndBlock
          ✓ should return commitPhasePrice
        after buyPhaseEndBlock
          ✓ should throw "Block outside of rICO period."
      first stage
        startBlock
          ✓ should return commitPhasePrice
        endBlock
          ✓ should return commitPhasePrice
        StartBlock price and EndBlock price
          ✓ should be higher than 0 and match
      stage 6
        startBlock
          ✓ should return stage tokenPrice
        endBlock
          ✓ should return stage tokenPrice
        StartBlock price and EndBlock price
          ✓ should be higher than 0 and match
      last stage
        startBlock
          ✓ should return stage tokenPrice
        endBlock
          ✓ should return stage tokenPrice
        StartBlock price and EndBlock price
          ✓ should be higher than 0 and match
    getTokenAmountForEthAtStage()
      1 eth
        stage 0
          ✓ should return 500 tokens
        stage 1
          ✓ should return 476.190476190476190476 tokens
        stage 6
          ✓ should return 384.615384615384615384 tokens
        last stage
          ✓ should return 312.5 tokens
    getEthAmountForTokensAtStage()
      1 eth worth of tokens
        stage 0
          ✓ should return 1 eth
        stage 1
          ✓ should return 1 eth minus 1 wei
        stage 6
          ✓ should return 1 eth minus 1 wei
        last stage
          ✓ should return 1 eth
    getUnlockPercentage(_currentBlock, _startBlock, _endBlock, precisionPo
      precisionPow = 2 ( 10 ** 2 => 100 )
        _currentBlock in range
          _currentBlock = 1, _startBlock = 1, _endBlock = 100
            ✓ should return 0.01
            ✓ should return 0.01
          _currentBlock = 101, _startBlock = 101, _endBlock = 200
            ✓ should return 0.01
          _currentBlock = 2, _startBlock = 1, _endBlock = 100
            ✓ should return 0.02
          _currentBlock = 102, _startBlock = 101, _endBlock = 200
            ✓ should return 0.02
          _currentBlock = 50, _startBlock = 1, _endBlock = 100
            ✓ should return 0.5
          _currentBlock = 100, _startBlock = 1, _endBlock = 100
            ✓ should return 1
        _currentBlock ouside range
          before range => _currentBlock = 0, _startBlock = 1, _endBlock = 
            ✓ should return 0
          after range => _currentBlock = 101, _startBlock = 1, _endBlock =
            ✓ should return 1
      precisionPow = 20 ( 10 ** 20 => 100000000000000000000 )
        _currentBlock in range
          _currentBlock = 1, _startBlock = 1, _endBlock = 100
            ✓ should return 0.01
          _currentBlock = 101, _startBlock = 101, _endBlock = 200
            ✓ should return 0.01
          _currentBlock = 2, _startBlock = 1, _endBlock = 100
            ✓ should return 0.02
          _currentBlock = 102, _startBlock = 101, _endBlock = 200
            ✓ should return 0.02
          _currentBlock = 50, _startBlock = 1, _endBlock = 100
            ✓ should return 0.5
          _currentBlock = 100, _startBlock = 1, _endBlock = 100
            ✓ should return 1
        _currentBlock ouside range
          before range => _currentBlock = 0, _startBlock = 1, _endBlock = 
            ✓ should return 0
          after range => _currentBlock = 101, _startBlock = 1, _endBlock =
            ✓ should return 1
    getParticipantReservedTokensAtBlock(_tokenAmount, _blockNumber, precis
      _blockNumber in range
        _tokenAmount = 100, _blockNumber = startBlock
          ✓ should return 99
        _tokenAmount = 100, _blockNumber = (range * 0.25) - 1
          ✓ should return 75
        _tokenAmount = 100, _blockNumber = (range * 0.50) - 1 ( middle of
          ✓ should return 50
        _tokenAmount = 100, _blockNumber = (range * 0.75) - 1
          ✓ should return 25
        _tokenAmount = 100, _blockNumber = endBlock
          ✓ should return 0
      _blockNumber outside range
        block before buyPhaseStartBlock
          ✓ should return full amount
        block after buyPhaseEndBlock
          ✓ should return 0
    getUnockedTokensForBoughtAmountAtBlock(_tokenAmount, _blockNumber, pre
      _blockNumber in range
        _tokenAmount = 100, _blockNumber = startBlock
          ✓ should return 1
        _tokenAmount = 100, _blockNumber = (range * 0.25) - 1
          ✓ should return 25
        _tokenAmount = 100, _blockNumber = (range * 0.50) - 1 ( middle of
          ✓ should return 50
        _tokenAmount = 100, _blockNumber = (range * 0.75) - 1
          ✓ should return 75
        _tokenAmount = 100, _blockNumber = endBlock
          ✓ should return 100
      _blockNumber outside range
        block before buyPhaseStartBlock
          ✓ should return 0
        block after buyPhaseEndBlock
          ✓ should return full amount

Javascript Validator - Tests
  Stage initialisation
    Settings:
     startBlock:       100
     startBlockDelay:  10
     blocksPerDay:     10
     commitPhaseDays:  10
     stageCount:       12
     stageDays:        10
    Stage[0]
      ✓ stage[0] startBlock is 110
      ✓ stage[0] duration is 99 ( endBlock - startBlock )
      ✓ stage[0] endBlock is 209 ( startBlock=110 + duration ) => 209
      ✓ stage[0] stagePriceIncrease is correct
    Stage[1]
      ✓ stage[1] startBlock is 210
      ✓ stage[1] duration is 99 ( endBlock - startBlock )
      ✓ stage[1] endBlock is 309 ( startBlock=110 + duration ) => 309
      ✓ stage[1] stagePriceIncrease is correct
    Stage[12]
      ✓ stage[12] startBlock is 1310
      ✓ stage[12] duration is 99 ( endBlock - startBlock )
      ✓ stage[12] endBlock is 1409 ( startBlock=110 + duration ) => 1409
      ✓ stage[12] stagePriceIncrease is correct
  Stage Methods
    ✓ stage count matches for both test instances
    getStageAtBlock(_blockNumber)
      stage 0
        ✓ should return 0 when called using using stage[0].startBlock
        ✓ should return 0 when called using using stage[0].endBlock
      stage 1
        ✓ should return 1 when called using using stage[1].startBlock
        ✓ should return 1 when called using using stage[1].endBlock
      stage 6
        ✓ should return 6 when called using using stage[6].startBlock
        ✓ should return 6 when called using using stage[6].endBlock
        ✓ should return 6 when called using using stage[6].endBlock
      last stage
        ✓ should return stageCount when called using using stage[stageCoun
        ✓ should return stageCount when called using using stage[stageCoun
      1 block before 0
        ✓ should throw "Block outside of rICO period."
      1 block after last stage
        ✓ should throw "Block outside of rICO period."

Javascript Validator - Contract - commit()
  Participant - commits 1 eth
    State changes after first contribution by a Participant
      ✓ Contract.participantsById indexes the participant id => address
      ✓ Contract.participantCount increases by 1
      ParticipantRecord
        ✓ contributions is 1
    State changes after a new contribution
      ✓ Contract.totalSentETH increases by commited value
      ParticipantRecord
        ✓ contributions increases by 1
        ✓ totalSentETH increases by commited value
        ✓ returnedETH does not change
        ✓ withdrawnETH does not change
        ✓ allocatedETH does not change
        ✓ returnedTokens does not change
        ✓ committedETH does not change
        ✓ boughtTokens does not change
        ✓ pendingTokens increases by getTokenAmountForEthAtStage(value)
        currentStageRecord
          ✓ totalSentETH increases by commited value
          ✓ returnedETH does not change
          ✓ committedETH does not change
          ✓ withdrawnETH does not change
          ✓ allocatedETH does not change
          ✓ pendingTokens increases by getTokenAmountForEthAtStage(value)
          ✓ boughtTokens does not change
          ✓ returnedTokens does not change
      ETH Balances:
        ✓ Contract ETH balance increases by commit value
        ✓ Participant ETH balance decreases by commit value
  Participant - commits 1 eth - second time
    Contract State changes after contribution from existing Participant
      ✓ Contract.participantCount does not change
    State changes after a new contribution
      ✓ Contract.totalSentETH increases by commited value
      ParticipantRecord
        ✓ contributions increases by 1
        ✓ totalSentETH increases by commited value
        ✓ returnedETH does not change
        ✓ withdrawnETH does not change
        ✓ allocatedETH does not change
        ✓ returnedTokens does not change
        ✓ committedETH does not change
        ✓ committedETH does not change
        ✓ boughtTokens does not change
        ✓ pendingTokens increases by getTokenAmountForEthAtStage(value)
        currentStageRecord
          ✓ totalSentETH increases by commited value
          ✓ returnedETH does not change
          ✓ committedETH does not change
          ✓ withdrawnETH does not change
          ✓ allocatedETH does not change
          ✓ pendingTokens increases by getTokenAmountForEthAtStage(value)
          ✓ boughtTokens does not change
          ✓ returnedTokens does not change
      ETH Balances:
        ✓ Contract ETH balance increases by commit value
        ✓ Participant ETH balance decreases by commit value
  Participant - commits 1 eth - third time
    Contract State changes after contribution from existing Participant
      ✓ Contract.participantCount does not change
    State changes after a new contribution
      ✓ Contract.totalSentETH increases by commited value
      ParticipantRecord
        ✓ contributions increases by 1
        ✓ totalSentETH increases by commited value
        ✓ returnedETH does not change
        ✓ withdrawnETH does not change
        ✓ allocatedETH does not change
        ✓ returnedTokens does not change
        ✓ committedETH does not change
        ✓ boughtTokens does not change
        ✓ pendingTokens increases by getTokenAmountForEthAtStage(value)
        currentStageRecord
          ✓ totalSentETH increases by commited value
          ✓ returnedETH does not change
          ✓ committedETH does not change (5ms)
          ✓ withdrawnETH does not change
          ✓ allocatedETH does not change
          ✓ pendingTokens increases by getTokenAmountForEthAtStage(value)
          ✓ boughtTokens does not change
          ✓ returnedTokens does not change
      ETH Balances:
        ✓ Contract ETH balance increases by commit value
        ✓ Participant ETH balance decreases by commit value
  Participant 2 - commits 1 eth
    ✓ Contract.participantCount is 2
    State changes after first contribution by a Participant
      ✓ Contract.participantsById indexes the participant id => address
      ✓ Contract.participantCount increases by 1
      ParticipantRecord
        ✓ contributions is 1
    State changes after a new contribution
      ✓ Contract.totalSentETH increases by commited value
      ParticipantRecord
        ✓ contributions increases by 1
        ✓ totalSentETH increases by commited value
        ✓ returnedETH does not change
        ✓ withdrawnETH does not change
        ✓ allocatedETH does not change
        ✓ returnedTokens does not change
        ✓ committedETH does not change
        ✓ boughtTokens does not change
        ✓ pendingTokens increases by getTokenAmountForEthAtStage(value)
        currentStageRecord
          ✓ totalSentETH increases by commited value
          ✓ returnedETH does not change
          ✓ committedETH does not change
          ✓ withdrawnETH does not change
          ✓ allocatedETH does not change
          ✓ pendingTokens increases by getTokenAmountForEthAtStage(value)
          ✓ boughtTokens does not change
          ✓ returnedTokens does not change
      ETH Balances:
        ✓ Contract ETH balance increases by commit value
        ✓ Participant ETH balance decreases by commit value

Javascript Validator - Contract - whitelist()
  Scenario: Stage:0, Participant gets whitelisted then contributes
    - Participant gets whitelisted
      Contract State changes after whitelisting of Participant with no cor
        ParticipantRecord
          ✓ whitelisted is true
        ETH Balances:
          ✓ Contract ETH balance does not change
          ✓ Participant ETH balance does not change
    - Participant commits 1 eth
      State changes after first contribution by a Participant
        ✓ Contract.participantsById indexes the participant id => address
        ✓ Contract.participantCount increases by 1
        ParticipantRecord
          ✓ contributions is 1
      State changes after a new contribution
        ✓ Contract.totalSentETH increases by commited value
        ParticipantRecord
          ✓ contributions increases by 1
          ✓ totalSentETH increases by commited value
          ✓ returnedETH does not change
          ✓ withdrawnETH does not change
          ✓ allocatedETH does not change
          ✓ returnedTokens does not change
          ✓ committedETH increases by commit value
          ✓ pendingTokens is 0
          ✓ boughtTokens increases by getTokenAmountForEthAtStage(value)
          currentStageRecord
            ✓ totalSentETH increases by commited value
            ✓ returnedETH does not change
            ✓ committedETH increases by commit value
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     ✓ withdrawnETH does not change
     ✓ allocatedETH does not change
     ✓ pendingTokens is 0
     ✓ boughtTokens increases by getTokenAmountForEthAtStage(value
     ✓ returnedTokens does not change
   ETH Balances:
    ✓ Contract ETH balance increases by commit value
    ✓ Participant ETH balance decreases by commit value
Scenario: Stage:0, Participant contributes then gets whitelisted
 - Participant commits 1 eth
  State changes after first contribution by a Participant
   ✓ Contract.participantsById indexes the participant id => address
   ✓ Contract.participantCount increases by 1
   ParticipantRecord
    ✓ contributions is 1
  State changes after a new contribution
   ✓ Contract.totalSentETH increases by commited value
   ParticipantRecord
    ✓ contributions increases by 1
    ✓ totalSentETH increases by commited value
    ✓ returnedETH does not change
    ✓ withdrawnETH does not change
    ✓ allocatedETH does not change
    ✓ returnedTokens does not change
    ✓ committedETH does not change
    ✓ boughtTokens does not change
    ✓ pendingTokens increases by getTokenAmountForEthAtStage(value)
    currentStageRecord
     ✓ totalSentETH increases by commited value
     ✓ returnedETH does not change
     ✓ committedETH does not change
     ✓ withdrawnETH does not change
     ✓ allocatedETH does not change
     ✓ pendingTokens increases by getTokenAmountForEthAtStage(value
     ✓ boughtTokens does not change
     ✓ returnedTokens does not change
   ETH Balances:
    ✓ Contract ETH balance increases by commit value
    ✓ Participant ETH balance decreases by commit value
 - Participant gets whitelisted
  ✓ Participant token balance is 500
  State changes after whitelist mode: true
   ParticipantRecord
    ✓ whitelisted is true
   acceptContributions()
    Contract:
     ✓ returnedETH does not change
     ✓ committedETH increases by commit value
    ParticipantRecord:
     ✓ whitelisted is true
     ✓ ParticipantAvailableETH is commit value
     ✓ committedETH increases by commit value
    Tokens:
            Tokens:
              ✓ Participant token balance is oldState.ParticipantRecord.pend
              ✓ ParticipantRecord.pendingTokens is 0
          ETH Balances:
            ✓ Contract ETH balance does not change
            ✓ Participant ETH balance does not change
    Scenario: Stage:6, Participant contributes then gets rejected
      - Participant commits 1 eth
        State changes after first contribution by a Participant
          ✓ Contract.participantsById indexes the participant id => address
          ✓ Contract.participantCount increases by 1
          ParticipantRecord
            ✓ contributions is 1
        State changes after a new contribution
          ✓ Contract.totalSentETH increases by commited value
          ParticipantRecord
            ✓ contributions increases by 1
            ✓ totalSentETH increases by commited value
            ✓ returnedETH does not change
            ✓ withdrawnETH does not change
            ✓ allocatedETH does not change
            ✓ returnedTokens does not change
            ✓ committedETH does not change
            ✓ boughtTokens does not change
            ✓ pendingTokens increases by getTokenAmountForEthAtStage(value)
            currentStageRecord
              ✓ totalSentETH increases by commited value
              ✓ returnedETH does not change
              ✓ committedETH does not change
              ✓ withdrawnETH does not change
              ✓ allocatedETH does not change
              ✓ pendingTokens increases by getTokenAmountForEthAtStage(value
              ✓ boughtTokens does not change
              ✓ returnedTokens does not change
            Each Previous StageRecord (5)
              ✓ totalSentETH does not change
              ✓ returnedETH does not change
              ✓ committedETH does not change
              ✓ withdrawnETH does not change
              ✓ pendingTokens does not change
              ✓ boughtTokens does not change
              ✓ returnedTokens does not change
              ✓ allocatedETH does not change
          ETH Balances:
            ✓ Contract ETH balance increases by commit value
            ✓ Participant ETH balance decreases by commit value
      - Participant gets rejected
        State changes after whitelist mode: false
          ParticipantRecord
            ✓ whitelisted is false
          cancelContributionsForAddress()
            Contract:
              ✓ committedETH does not change
              ✓ returnedETH increases by oldState.ParticipantAvailableETH va
            ParticipantRecord:
              ✓ ParticipantAvailableETH is 0
              ✓ whitelisted is false
              ✓ pendingTokens is 0
              ✓ withdrawnETH increases by oldState.ParticipantAvailableETH
            Tokens:
              ✓ Participant token balance does not change
              ✓ ParticipantRecord.pendingTokens is 0
            ETH Balances:
              ✓ Contract ETH balance decreases by oldState.ParticipantAvaila
              ✓ Participant ETH balance increases by oldState.ParticipantAva


  290 passing (625ms)

Done
--------------------------------------------------------------------


Killing existing ganache-cli instance at pid 44589.



> ricopoc@0.0.1 test-solc /Users/gnsps/lukso-rico-audit-2020-04/code
> scripts/run_solc.sh all refresh

Starting new ganache-cli instance at port 8545
exchange neither monster ethics bless cancel ghost excite business record wa

--------------------------------------------------------------------
 Running all tests in "test" folder:
--------------------------------------------------------------------
You can improve web3's peformance when running Node.js versions older than 1
You can improve web3's peformance when running Node.js versions older than 1

Compiling your contracts...
===========================
✔ Fetching solc version list from solc-bin. Attempt #1
✔ Downloading compiler. Attempt #1.
> Compiling ./contracts/Gnosis/CreateCall.sol
> Compiling ./contracts/Gnosis/GnosisSafe.sol
> Compiling ./contracts/Migrations.sol
> Compiling ./contracts/ReversibleICO.sol
> Compiling ./contracts/RicoToken.sol
> Compiling ./contracts/mocks/ERC777Mock.sol
> Compiling ./contracts/mocks/ERC777SenderRecipientMock.sol
> Compiling ./contracts/mocks/EmptyReceiver.sol
> Compiling ./contracts/mocks/MathMock.sol
> Compiling ./contracts/mocks/ReversibleICOMock.sol
> Compiling ./contracts/mocks/ReversibleICOMock777.sol
> Compiling ./contracts/mocks/SafeMathMock.sol
> Compiling ./contracts/zeppelin/access/Roles.sol
> Compiling ./contracts/zeppelin/access/roles/CapperRole.sol
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 > Compiling ./contracts/zeppelin/access/roles/MinterRole.sol
 > Compiling ./contracts/zeppelin/access/roles/PauserRole.sol
 > Compiling ./contracts/zeppelin/access/roles/SignerRole.sol
 > Compiling ./contracts/zeppelin/access/roles/WhitelistAdminRole.sol
 > Compiling ./contracts/zeppelin/access/roles/WhitelistedRole.sol
 > Compiling ./contracts/zeppelin/crowdsale/Crowdsale.sol
 > Compiling ./contracts/zeppelin/crowdsale/distribution/FinalizableCrowdsale
 > Compiling ./contracts/zeppelin/crowdsale/distribution/PostDeliveryCrowdsal
 > Compiling ./contracts/zeppelin/crowdsale/distribution/RefundableCrowdsale.
 > Compiling ./contracts/zeppelin/crowdsale/distribution/RefundablePostDelive
 > Compiling ./contracts/zeppelin/crowdsale/emission/AllowanceCrowdsale.sol
 > Compiling ./contracts/zeppelin/crowdsale/emission/MintedCrowdsale.sol
 > Compiling ./contracts/zeppelin/crowdsale/price/IncreasingPriceCrowdsale.so
 > Compiling ./contracts/zeppelin/crowdsale/validation/CappedCrowdsale.sol
 > Compiling ./contracts/zeppelin/crowdsale/validation/IndividuallyCappedCrow
 > Compiling ./contracts/zeppelin/crowdsale/validation/PausableCrowdsale.sol
 > Compiling ./contracts/zeppelin/crowdsale/validation/TimedCrowdsale.sol
 > Compiling ./contracts/zeppelin/crowdsale/validation/WhitelistCrowdsale.sol
 > Compiling ./contracts/zeppelin/cryptography/ECDSA.sol
 > Compiling ./contracts/zeppelin/cryptography/MerkleProof.sol
 > Compiling ./contracts/zeppelin/drafts/Counters.sol
 > Compiling ./contracts/zeppelin/drafts/ERC1046/ERC20Metadata.sol
 > Compiling ./contracts/zeppelin/drafts/ERC20Migrator.sol
 > Compiling ./contracts/zeppelin/drafts/ERC20Snapshot.sol
 > Compiling ./contracts/zeppelin/drafts/SignatureBouncer.sol
 > Compiling ./contracts/zeppelin/drafts/SignedSafeMath.sol
 > Compiling ./contracts/zeppelin/drafts/Strings.sol
 > Compiling ./contracts/zeppelin/drafts/TokenVesting.sol
 > Compiling ./contracts/zeppelin/examples/SampleCrowdsale.sol
 > Compiling ./contracts/zeppelin/examples/SimpleToken.sol
 > Compiling ./contracts/zeppelin/introspection/ERC165.sol
 > Compiling ./contracts/zeppelin/introspection/ERC165Checker.sol
 > Compiling ./contracts/zeppelin/introspection/ERC1820Implementer.sol
 > Compiling ./contracts/zeppelin/introspection/IERC165.sol
 > Compiling ./contracts/zeppelin/introspection/IERC1820Implementer.sol
 > Compiling ./contracts/zeppelin/introspection/IERC1820Registry.sol
 > Compiling ./contracts/zeppelin/lifecycle/Pausable.sol
 > Compiling ./contracts/zeppelin/math/Math.sol
 > Compiling ./contracts/zeppelin/math/SafeMath.sol
 > Compiling ./contracts/zeppelin/ownership/Ownable.sol
 > Compiling ./contracts/zeppelin/ownership/Secondary.sol
 > Compiling ./contracts/zeppelin/payment/PaymentSplitter.sol
 > Compiling ./contracts/zeppelin/payment/PullPayment.sol
 > Compiling ./contracts/zeppelin/payment/escrow/ConditionalEscrow.sol
 > Compiling ./contracts/zeppelin/payment/escrow/Escrow.sol
 > Compiling ./contracts/zeppelin/payment/escrow/RefundEscrow.sol
 > Compiling ./contracts/zeppelin/token/ERC20/ERC20.sol
 > Compiling ./contracts/zeppelin/token/ERC20/ERC20Burnable.sol
 > Compiling ./contracts/zeppelin/token/ERC20/ERC20Capped.sol
 > Compiling ./contracts/zeppelin/token/ERC20/ERC20Detailed.sol
 > Compiling ./contracts/zeppelin/token/ERC20/ERC20Mintable.sol
 > Compiling ./contracts/zeppelin/token/ERC20/ERC20Pausable.sol
 > Compiling ./contracts/zeppelin/token/ERC20/IERC20.sol
```

```
> Compiling ./contracts/zeppelin/token/ERC20/IERC20.sol
> Compiling ./contracts/zeppelin/token/ERC20/SafeERC20.sol
> Compiling ./contracts/zeppelin/token/ERC20/TokenTimelock.sol
> Compiling ./contracts/zeppelin/token/ERC721/ERC721.sol
> Compiling ./contracts/zeppelin/token/ERC721/ERC721Burnable.sol
> Compiling ./contracts/zeppelin/token/ERC721/ERC721Enumerable.sol
> Compiling ./contracts/zeppelin/token/ERC721/ERC721Full.sol
> Compiling ./contracts/zeppelin/token/ERC721/ERC721Holder.sol
> Compiling ./contracts/zeppelin/token/ERC721/ERC721Metadata.sol
> Compiling ./contracts/zeppelin/token/ERC721/ERC721MetadataMintable.sol
> Compiling ./contracts/zeppelin/token/ERC721/ERC721Mintable.sol
> Compiling ./contracts/zeppelin/token/ERC721/ERC721Pausable.sol
> Compiling ./contracts/zeppelin/token/ERC721/IERC721.sol
> Compiling ./contracts/zeppelin/token/ERC721/IERC721Enumerable.sol
> Compiling ./contracts/zeppelin/token/ERC721/IERC721Full.sol
> Compiling ./contracts/zeppelin/token/ERC721/IERC721Metadata.sol
> Compiling ./contracts/zeppelin/token/ERC721/IERC721Receiver.sol
> Compiling ./contracts/zeppelin/token/ERC777/ERC777.sol
> Compiling ./contracts/zeppelin/token/ERC777/IERC777.sol
> Compiling ./contracts/zeppelin/token/ERC777/IERC777Recipient.sol
> Compiling ./contracts/zeppelin/token/ERC777/IERC777Sender.sol
> Compiling ./contracts/zeppelin/utils/Address.sol
> Compiling ./contracts/zeppelin/utils/Arrays.sol
> Compiling ./contracts/zeppelin/utils/ReentrancyGuard.sol
> Compilation warnings encountered:
,,
> Artifacts written to /Users/gnsps/lukso-rico-audit-2020-04/code/build/cont
> Compiled successfully using:
   - solc: 0.5.17+commit.d19bba13.Emscripten.clang

You can improve web3's peformance when running Node.js versions older than 1
  ---------------------------------------------------------------
  Step 1 - Setting up helpers and globals
  ---------------------------------------------------------------
  ---------------------------------------------------------------
  Step 2 - Run tests
  ---------------------------------------------------------------
Current Block:  11
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task: PROJECT WITHDRAW 3
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: PROJECT WITHDRAW 3
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  0
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  7
Current Block:  12
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task: WITHDRAW 2
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: WITHDRAW 2
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: PROJECT WITHDRAW 3
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task: CONTRIBUTE 1
Current Block:  13
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  8
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  6
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  5
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task: WITHDRAW 2
Current Block:  14
```

```
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  7
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  5
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  9
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  0
Current Block:  15
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task: CONTRIBUTE 1
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: WITHDRAW 2
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  0
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task: PROJECT WITHDRAW 3
Current Block:  16
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  0
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  5
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: CONTRIBUTE 1
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task: PROJECT WITHDRAW 3
Current Block:  17
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  7
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  6
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: PROJECT WITHDRAW 3
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  4
Current Block:  18
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  7
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: PROJECT WITHDRAW 3
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  8
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  9
Current Block:  19
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task: CONTRIBUTE 1
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  5
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: WITHDRAW 2
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  7
Current Block:  20
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  7
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  6
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  6
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  0
Current Block:  21
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  6
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  6
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  0
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task: PROJECT WITHDRAW 3
Current Block:  22
Current Block:  23
Current Block:  24
Current Block:  25
Current Block:  26
Current Block:  27
Current Block:  28
Current Block:  29
Current Block:  30
Current Block:  31
Current Block:  32
Current Block:  33
Current Block:  34
```

```
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  7
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  5
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  6
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  7
Current Block:  35
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  9
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  4
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  9
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  5
Current Block:  36
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  5
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  9
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  9
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  6
Current Block:  37
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  4
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  5
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  6
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  5
Current Block:  38
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task: WITHDRAW 2
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  5
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  0
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  9
Current Block:  39
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task: WITHDRAW 2
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  9
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  6
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  8
Current Block:  40
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  8
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  8
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  5
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  5
Current Block:  41
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  4
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  5
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  5
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  8
Current Block:  42
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task: WITHDRAW 2
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  4
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  4
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  9
Current Block:  43
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  9
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  9
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: PROJECT WITHDRAW 3
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  4
Current Block:  44
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  4
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  7
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: CONTRIBUTE 1
```

```
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: CONTRIBUTE 1
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  9
Current Block:  45
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  7
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: WITHDRAW 2
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: PROJECT WITHDRAW 3
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  7
Current Block:  46
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  0
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  7
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: WITHDRAW 2
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  8
Current Block:  47
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  8
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  9
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  0
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  5
Current Block:  48
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  8
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  9
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: CONTRIBUTE 1
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  9
Current Block:  49
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  5
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  4
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: PROJECT WITHDRAW 3
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task: CONTRIBUTE 1
Current Block:  50
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  7
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  6
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  0
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task: CONTRIBUTE 1
Current Block:  51
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  9
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  6
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  9
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  9
Current Block:  52
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  0
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  7
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  9
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  7
Current Block:  53
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  0
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: PROJECT WITHDRAW 3
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: CONTRIBUTE 1
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  9
Current Block:  54
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0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  6
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: PROJECT WITHDRAW 3
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  6
Current Block:  55
Current Block:  55
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  0
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  9
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: WITHDRAW 2
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  9
Current Block:  56
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  9
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  0
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  9
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  4
Current Block:  57
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task: WITHDRAW 2
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  4
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  8
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  6
Current Block:  58
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  8
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: WITHDRAW 2
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  6
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  7
Current Block:  59
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  4
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: WITHDRAW 2
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  4
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  6
Current Block:  60
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  7
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  5
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  0
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  4
Current Block:  61
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0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: PROJECT WITHDRAW 3
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: CONTRIBUTE 1
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task: CONTRIBUTE 1
Current Block:  62
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  4
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  4
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  4
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task: WITHDRAW 2
Current Block:  63
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task: WITHDRAW 2
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: WITHDRAW 2
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  0
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  9
Current Block:  64
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task: WITHDRAW 2
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: PROJECT WITHDRAW 3
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  0
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task: PROJECT WITHDRAW 3
Current Block:  65
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  7
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: PROJECT WITHDRAW 3
```

```
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  5
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  0
Current Block:  66
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  6
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: PROJECT WITHDRAW 3
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  8
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  5
Current Block:  67
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  9
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  5
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: CONTRIBUTE 1
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  5
Current Block:  68
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task: WITHDRAW 2
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  4
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  5
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task: CONTRIBUTE 1
Current Block:  69
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  7
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  9
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  6
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task: WITHDRAW 2
Current Block:  70
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task: PROJECT WITHDRAW 3
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: PROJECT WITHDRAW 3
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  8
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  4
Current Block:  71
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  5
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: CONTRIBUTE 1
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  9
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  8
Current Block:  72
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  4
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  7
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  0
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  9
Current Block:  73
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  8
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  5
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  8
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task: CONTRIBUTE 1
Current Block:  74
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  4
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: WITHDRAW 2
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: PROJECT WITHDRAW 3
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  5
Current Block:  75
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  0
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  8
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  4
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task: CONTRIBUTE 1
```

```
Current Block:  76
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  0
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  7
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  9
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  5
Current Block:  77
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  4
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  6
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  5
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  7
Current Block:  78
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task: PROJECT WITHDRAW 3
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: CONTRIBUTE 1
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: WITHDRAW 2
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  5
Current Block:  79
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task: CONTRIBUTE 1
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: WITHDRAW 2
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: CONTRIBUTE 1
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task: CONTRIBUTE 1
Current Block:  80
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task: PROJECT WITHDRAW 3
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  5
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  6
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task: CONTRIBUTE 1
Current Block:  81
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  0
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  0
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  4
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  9
Current Block:  82
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  7
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  5
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task: WITHDRAW 2
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  5
Current Block:  83
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  0
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  5
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  0
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  5
Current Block:  84
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  0
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  6
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  5
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task: CONTRIBUTE 1
Current Block:  85
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task: PROJECT WITHDRAW 3
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  0
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  9
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  7
Current Block:  86
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  0
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: WITHDRAW 2
```

```
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task: WITHDRAW 2
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  0
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task:  8
Current Block:  87
0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Task:  8
0x10a0717595A97A777F51f3ae542d4312edfD20FA Task:  5
0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Task:  5
0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Task: CONTRIBUTE 1
Number of Participants:  4


  SafeMath
    add
      ✓ adds correctly (93ms)
      ✓ reverts on addition overflow (110ms)
    sub
      ✓ subtracts correctly (52ms)
      ✓ reverts if subtraction result would be negative (40ms)
    mul
      ✓ multiplies correctly (52ms)
      ✓ multiplies by zero correctly (141ms)
      ✓ reverts on multiplication overflow (47ms)
    div
      ✓ divides correctly (32ms)
      ✓ divides zero correctly (26ms)
      ✓ returns complete number result on non-even division (32ms)
      ✓ reverts on division by zero (30ms)
    mod
      ✓ reverts with a 0 divisor (26ms)
      modulos correctly
        ✓ when the dividend is smaller than the divisor (28ms)
        ✓ when the dividend is equal to the divisor (27ms)
        ✓ when the dividend is larger than the divisor (24ms)
        ✓ when the dividend is a multiple of the divisor (24ms)

  ERC1820 - Token Registry
    Step 1 - Before deployment state
      ✓ Contract Code at address: 0x1820a4B7618BdE71Dce8cdc73aAB6C95905faD2
      ✓ Deployer address: 0xa990077c3205cbDf861e17Fa532eeB069cE9fF96 balanc
      ✓ Funds Supplier address: 0xFE6B56FdCF920382Af1493828E79C017EE090F2a b
    Step 2 - Deployment preparation
      New Account balances after Supplier sends value to SenderAddress
        ✓ FundsSupplier balance has deploymentCost + tx fee substracted
        ✓ SenderAddress balance is equal to deploymentCost
    Step 3 - ERC1820 Deployment
      Gas used for deployment: 711453
      Contract Address: 0x1820a4B7618BdE71Dce8cdc73aAB6C95905faD24

      Validation after ERC1820 Registry contract deployment
        Transaction
          ✓ status is true
          ✓ signature is valid
          ✓ from address is correct
          ✓ Contract address is 0x1820a4B7618BdE71Dce8cdc73aAB6C95905faD24
        Contract
          ✓ code at address exists (13ms)
          ✓ contract has the getManager method which can be called (51ms)
     * EVM snapshot[ERC1820_ready] saved

  ReversibleICO - Withdraw Token Balance
     * EVM snapshot[ERC1820_ready] restored
     * EVM snapshot[WithdrawTokenTests_Phase_2] start
      Contract deployed:   RicoToken
        Gas used:          4224630
        Contract Address:  0x88eC20080706B787C7BF684880f3d1899433f760
      Contract deployed:   ReversibleICOMock
        Gas used:          5661611
        Contract Address:  0x35C310d59E2b7f1F96A5e133Efb20538266e4053
     * EVM snapshot[WithdrawTokenTests_Phase_2] saved
    randomly contribute and exit
     * EVM snapshot[WithdrawTokenTests_Phase_2] restored
---> Project withdraw:  89207 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
---> Project withdraw:  59207 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
Stage: 0, Price: 25000000000000000
      ✓ Jump to the next block: 11 (142ms)
      ✓ 0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F: Return tokens (46ms)
      ✓ 0x10a0717595A97A777F51f3ae542d4312edfD20FA: Return tokens (44ms)
---> Project withdraw:  59207 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
---> Contribution : 150777 GAS
      ✓ 0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c: Buy tokens (295ms)
Stage: 0, Price: 25000000000000000
      ✓ Jump to the next block: 12 (120ms)
      ✓ 0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c: Return tokens (106ms)
Stage: 0, Price: 25000000000000000
      ✓ Jump to the next block: 13 (115ms)
Stage: 0, Price: 25000000000000000
      ✓ Jump to the next block: 14 (123ms)
---> Contribution : 120777 GAS
      ✓ 0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F: Buy tokens (290ms)
      ✓ 0x10a0717595A97A777F51f3ae542d4312edfD20FA: Return tokens (25ms)
---> Project withdraw:  59207 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
Stage: 0, Price: 25000000000000000
      ✓ Jump to the next block: 15 (145ms)
---> Contribution : 120777 GAS
      ✓ 0xeF6DCBB32a3263d35185993B608843E7A65e90f5: Buy tokens (250ms)
---> Project withdraw:  59207 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
Stage: 0, Price: 25000000000000000
      ✓ Jump to the next block: 16 (97ms)
---> Project withdraw:  59207 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
Stage: 1, Price: 2833333333333333
      ✓ Jump to the next block: 17 (97ms)
---> Project withdraw:  59207 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
Stage: 1, Price: 2833333333333333
      ✓ Jump to the next block: 18 (103ms)
---> Contribution : 65455 GAS
      ✓ 0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F: Buy tokens (219ms)
      ✓ 0xeF6DCBB32a3263d35185993B608843E7A65e90f5: Return tokens (17ms)
Stage: 1, Price: 2833333333333333
      ✓ Jump to the next block: 19 (148ms)
Stage: 1, Price: 2833333333333333
      ✓ Jump to the next block: 20 (221ms)
---> Project withdraw:  59207 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
Stage: 1, Price: 2833333333333333
      ✓ Jump to the next block: 21 (100ms)
      ✓ Freeze contract at block 22 (63ms)
Stage: 1, Price: 2833333333333333
      ✓ Jump to the next block: 22 (99ms)
Stage: 2, Price: 3166666666666666
      ✓ Jump to the next block: 23 (119ms)
Stage: 2, Price: 3166666666666666
      ✓ Jump to the next block: 24 (98ms)
Stage: 2, Price: 3166666666666666
      ✓ Jump to the next block: 25 (85ms)
Stage: 2, Price: 3166666666666666
      ✓ Jump to the next block: 26 (86ms)
Stage: 2, Price: 3166666666666666
      ✓ Jump to the next block: 27 (107ms)
Stage: 2, Price: 3166666666666666
      ✓ Jump to the next block: 28 (130ms)
Stage: 3, Price: 3499999999999999
      ✓ Jump to the next block: 29 (122ms)
Stage: 3, Price: 3499999999999999
      ✓ Jump to the next block: 30 (113ms)
Stage: 3, Price: 3499999999999999
      ✓ Jump to the next block: 31 (104ms)
Stage: 3, Price: 3499999999999999
      ✓ Jump to the next block: 32 (109ms)
      ✓ Unfreeze contract at block 33 (65ms)
Stage: 0, Price: 2500000000000000
      ✓ Jump to the next block: 33 (164ms)
Stage: 0, Price: 2500000000000000
      ✓ Jump to the next block: 34 (125ms)
Stage: 0, Price: 2500000000000000
      ✓ Jump to the next block: 35 (173ms)
Stage: 0, Price: 2500000000000000
      ✓ Jump to the next block: 36 (145ms)
Stage: 0, Price: 2500000000000000
      ✓ Jump to the next block: 37 (136ms)
      ✓ 0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F: Return tokens (32ms)
Stage: 0, Price: 2500000000000000
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Stage: 0, Price: 25000000000000000
      ✓ Jump to the next block: 38 (123ms)
      ✓ 0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F: Return tokens (26ms)
Stage: 1, Price: 28333333333333333
      ✓ Jump to the next block: 39 (131ms)
Stage: 1, Price: 28333333333333333
      ✓ Jump to the next block: 40 (131ms)
Stage: 1, Price: 28333333333333333
      ✓ Jump to the next block: 41 (130ms)
      ✓ 0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F: Return tokens (26ms)
Stage: 1, Price: 28333333333333333
      ✓ Jump to the next block: 42 (162ms)
---> Project withdraw:  59207 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (2
Stage: 1, Price: 28333333333333333
      ✓ Jump to the next block: 43 (166ms)
---> Contribution : 65455 GAS
      ✓ 0xeF6DCBB32a3263d35185993B608843E7A65e90f5: Buy tokens (515ms)
Stage: 1, Price: 28333333333333333
      ✓ Jump to the next block: 44 (180ms)
      ✓ 0x10a0717595A97A777F51f3ae542d4312edfD20FA: Return tokens (37ms)
---> Project withdraw:  59207 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (2
Stage: 2, Price: 31666666666666666
      ✓ Jump to the next block: 45 (198ms)
      ✓ 0xeF6DCBB32a3263d35185993B608843E7A65e90f5: Return tokens (21ms)
Stage: 2, Price: 31666666666666666
      ✓ Jump to the next block: 46 (92ms)
Stage: 2, Price: 31666666666666666
      ✓ Jump to the next block: 47 (89ms)
---> Whitelisting:  276818 GAS
---> Contribution with auto accepting : 185174 GAS
      ✓ 0xeF6DCBB32a3263d35185993B608843E7A65e90f5: Buy tokens (1166ms)
Stage: 2, Price: 31666666666666666
      ✓ Jump to the next block: 48 (114ms)
---> Project withdraw:  98129 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (1
---> Whitelisting:  210967 GAS
---> Contribution with auto accepting : 185174 GAS
      ✓ 0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c: Buy tokens (994ms)
Stage: 2, Price: 31666666666666666
      ✓ Jump to the next block: 49 (89ms)
---> Contribution with auto accepting : 200351 GAS
      ✓ 0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c: Buy tokens (490ms)
Stage: 2, Price: 31666666666666666
      ✓ Jump to the next block: 50 (87ms)
Stage: 3, Price: 34999999999999999
      ✓ Jump to the next block: 51 (86ms)
Stage: 3, Price: 34999999999999999
      ✓ Jump to the next block: 52 (91ms)
---> Project withdraw:  68129 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (8
---> Contribution with auto accepting : 200709 GAS
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      ✓ 0xeF6DCBB32a3263d35185993B608843E7A65e90f5: Buy tokens (492ms)
Stage: 3, Price: 34999999999999999
      ✓ Jump to the next block: 53 (88ms)
---> Project withdraw:  68129 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
Stage: 3, Price: 34999999999999999
      ✓ Jump to the next block: 54 (78ms)
---> Withdraw:  171420 GAS
      ✓ 0xeF6DCBB32a3263d35185993B608843E7A65e90f5: Return tokens (166ms)
Stage: 3, Price: 34999999999999999
      ✓ Jump to the next block: 55 (87ms)
Stage: 3, Price: 34999999999999999
      ✓ Jump to the next block: 56 (86ms)
      ✓ 0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F: Return tokens (16ms)
Stage: 4, Price: 38333333333333332
      ✓ Jump to the next block: 57 (78ms)
      ✓ 0x10a0717595A97A777F51f3ae542d4312edfD20FA: Return tokens (13ms)
Stage: 4, Price: 38333333333333332
      ✓ Jump to the next block: 58 (154ms)
      ✓ 0x10a0717595A97A777F51f3ae542d4312edfD20FA: Return tokens (18ms)
Stage: 4, Price: 38333333333333332
      ✓ Jump to the next block: 59 (100ms)
Stage: 4, Price: 38333333333333332
      ✓ Jump to the next block: 60 (82ms)
---> Project withdraw:  68129 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
---> Contribution with auto accepting : 186126 GAS
      ✓ 0xeF6DCBB32a3263d35185993B608843E7A65e90f5: Buy tokens (455ms)
---> Contribution with auto accepting : 186126 GAS
      ✓ 0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c: Buy tokens (474ms)
Stage: 4, Price: 38333333333333332
      ✓ Jump to the next block: 61 (83ms)
---> Withdraw:  156420 GAS
      ✓ 0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c: Return tokens (149ms)
Stage: 4, Price: 38333333333333332
      ✓ Jump to the next block: 62 (75ms)
      ✓ 0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F: Return tokens (20ms)
      ✓ 0x10a0717595A97A777F51f3ae542d4312edfD20FA: Return tokens (27ms)
Stage: 5, Price: 41666666666666665
      ✓ Jump to the next block: 63 (81ms)
      ✓ 0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F: Return tokens (13ms)
---> Project withdraw:  68129 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
---> Project withdraw:  60858 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
Stage: 5, Price: 41666666666666665
      ✓ Jump to the next block: 64 (87ms)
---> Project withdraw:  68129 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
Stage: 5, Price: 41666666666666665
      ✓ Jump to the next block: 65 (103ms)
---> Project withdraw:  68129 GAS
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      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
Stage: 5, Price: 41666666666666665
      ✓ Jump to the next block: 66 (92ms)
---> Contribution with auto accepting : 186602 GAS
      ✓ 0xeF6DCBB32a3263d35185993B608843E7A65e90f5: Buy tokens (503ms)
Stage: 5, Price: 41666666666666665
      ✓ Jump to the next block: 67 (88ms)
      ✓ 0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F: Return tokens (14ms)
---> Contribution with auto accepting : 186602 GAS
      ✓ 0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c: Buy tokens (512ms)
Stage: 5, Price: 41666666666666665
      ✓ Jump to the next block: 68 (89ms)
---> Withdraw:  156420 GAS
      ✓ 0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c: Return tokens (228ms)
Stage: 6, Price: 44999999999999998
      ✓ Jump to the next block: 69 (85ms)
---> Project withdraw:  68129 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
---> Project withdraw:  60858 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
Stage: 6, Price: 44999999999999998
      ✓ Jump to the next block: 70 (84ms)
---> Whitelisting:  52939 GAS
---> Contribution with auto accepting : 283023 GAS
      ✓ 0x10a0717595A97A777F51f3ae542d4312edfD20FA: Buy tokens (543ms)
Stage: 6, Price: 44999999999999998
      ✓ Jump to the next block: 71 (82ms)
Stage: 6, Price: 44999999999999998
      ✓ Jump to the next block: 72 (83ms)
---> Contribution with auto accepting : 187019 GAS
      ✓ 0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c: Buy tokens (515ms)
Stage: 6, Price: 44999999999999998
      ✓ Jump to the next block: 73 (92ms)
---> Withdraw:  171420 GAS
      ✓ 0x10a0717595A97A777F51f3ae542d4312edfD20FA: Return tokens (175ms)
---> Project withdraw:  68070 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
Stage: 6, Price: 44999999999999998
      ✓ Jump to the next block: 74 (80ms)
---> Contribution with auto accepting : 187019 GAS
      ✓ 0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c: Buy tokens (590ms)
Stage: 7, Price: 48333333333333331
      ✓ Jump to the next block: 75 (97ms)
Stage: 7, Price: 48333333333333331
      ✓ Jump to the next block: 76 (99ms)
Stage: 7, Price: 48333333333333331
      ✓ Jump to the next block: 77 (95ms)
---> Project withdraw:  68129 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
---> Contribution with auto accepting : 187377 GAS
      ✓ 0x10a0717595A97A777F51f3ae542d4312edfD20FA: Buy tokens (463ms)
---> Withdraw:  156297 GAS
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      ✓ 0xeF6DCBB32a3263d35185993B608843E7A65e90f5: Return tokens (159ms)
Stage: 7, Price: 48333333333333331
      ✓ Jump to the next block: 78 (85ms)
---> Whitelisting:  235613 GAS
---> Contribution with auto accepting : 187259 GAS
      ✓ 0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F: Buy tokens (1859ms)
---> Withdraw:  156361 GAS
      ✓ 0x10a0717595A97A777F51f3ae542d4312edfD20FA: Return tokens (257ms)
---> Contribution with auto accepting : 187377 GAS
      ✓ 0xeF6DCBB32a3263d35185993B608843E7A65e90f5: Buy tokens (730ms)
---> Contribution with auto accepting : 187377 GAS
      ✓ 0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c: Buy tokens (799ms)
Stage: 7, Price: 48333333333333331
      ✓ Jump to the next block: 79 (107ms)
---> Project withdraw:  68129 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
---> Contribution with auto accepting : 187377 GAS
      ✓ 0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c: Buy tokens (894ms)
Stage: 7, Price: 48333333333333331
      ✓ Jump to the next block: 80 (101ms)
Stage: 8, Price: 51666666666666664
      ✓ Jump to the next block: 81 (98ms)
---> Withdraw:  156356 GAS
      ✓ 0xeF6DCBB32a3263d35185993B608843E7A65e90f5: Return tokens (288ms)
Stage: 8, Price: 51666666666666664
      ✓ Jump to the next block: 82 (97ms)
Stage: 8, Price: 51666666666666664
      ✓ Jump to the next block: 83 (156ms)
---> Contribution with auto accepting : 187853 GAS
      ✓ 0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c: Buy tokens (594ms)
Stage: 8, Price: 51666666666666664
      ✓ Jump to the next block: 84 (89ms)
---> Project withdraw:  68129 GAS
      ✓ 0xFE6B56FdCF920382Af1493828E79C017EE090F2a Project: Withdraws ETH (
Stage: 8, Price: 51666666666666664
      ✓ Jump to the next block: 85 (76ms)
---> Withdraw:  156356 GAS
      ✓ 0x10a0717595A97A777F51f3ae542d4312edfD20FA: Return tokens (173ms)
Stage: 8, Price: 51666666666666664
      ✓ Jump to the next block: 86 (144ms)
---> Contribution with auto accepting : 187853 GAS
      ✓ 0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c: Buy tokens (706ms)
Stage: 9, Price: 54999999999999997
      ✓ Jump to the next block: 87 (101ms)
      ✓ rICO should be finished (37ms)
      ✓ rICO balance - getAvailableProjectETH should be 0 (25ms)
      ✓ rICO rest balance should be no more or less than 0% off to what was
      ✓ rICO balance should have all getAvailableProjectETH still (25ms)
      ✓ Project balance + getAvailableProjectETH should be committedETH (46
      ✓ Project should have all projectWithdrawnETH (14ms)
      ✓ 0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F: compare full token bala
      ✓ 0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F: reserved token balance s
      ✓ 0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F: unlocked token balance s
      ✓ 0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F: unlocked token balance s
Participant Stats: 0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F Result {
  '0': true,
  '1': '3',
  '2': '0',
  '3': '62000000000000000000',
  '4': '2063333333333333282',
  '5': '0',
  '6': '62000000000000000000',
  '7': '0',
  '8': '67',
  whitelisted: true,
  contributions: '3',
  withdraws: '0',
  reservedTokens: '62000000000000000000',
  committedEth: '2063333333333333282',
  pendingEth: '0',
  _currentReservedTokens: '62000000000000000000',
  _unlockedTokens: '0',
  _lastBlock: '67' }
-------
Compare prices paid  33888888888888888
      ✓ 0x668d51FD53ee7d1dA66d8Cc9eB0274E0D9634C2F: compare price average, s
      ✓ 0x10a0717595A97A777F51f3ae542d4312edfD20FA: compare full token balan
      ✓ 0x10a0717595A97A777F51f3ae542d4312edfD20FA: reserved token balance s
      ✓ 0x10a0717595A97A777F51f3ae542d4312edfD20FA: unlocked token balance s
Participant Stats: 0x10a0717595A97A777F51f3ae542d4312edfD20FA Result {
  '0': true,
  '1': '2',
  '2': '3',
  '3': '69935689161348817000',
  '4': '3276953567763392027',
  '5': '0',
  '6': '4700750087631469563',
  '7': '65234939073717347437',
  '8': '74',
  whitelisted: true,
  contributions: '2',
  withdraws: '3',
  reservedTokens: '69935689161348817000',
  committedEth: '3276953567763392027',
  pendingEth: '0',
  _currentReservedTokens: '4700750087631469563',
  _unlockedTokens: '65234939073717347437',
  _lastBlock: '74' }
-------
Compare prices paid  46666666666666664
Compare prices withdraw  46237780567259190
      ✓ 0x10a0717595A97A777F51f3ae542d4312edfD20FA: compare price average, s
      ✓ 0xeF6DCBB32a3263d35185993B608843E7A65e90f5: compare full token balan
      ✓ 0xeF6DCBB32a3263d35185993B608843E7A65e90f5: reserved token balance s
      ✓ 0xeF6DCBB32a3263d35185993B608843E7A65e90f5: unlocked token balance s
Participant Stats: 0xeF6DCBB32a3263d35185993B608843E7A65e90f5 Result {
  '0': true,
  '1': '7',
  '2': '3',
  '3': '1093294312754142480000',
  '4': '3813784881602372481',
  '5': '0',
  '6': '15455486025207072261',
  '7': '93873945250207175739',
  '8': '70',
  whitelisted: true,
  contributions: '7',
  withdraws: '3',
  reservedTokens: '1093294312754142480000',
  committedEth: '3813784881602372481',
  pendingEth: '0',
  _currentReservedTokens: '15455486025207072261',
  _unlockedTokens: '93873945250207175739',
  _lastBlock: '70' }
-------
Compare prices paid  35476190476190475
Compare prices withdraw  31705770993565596
      ✓ 0xeF6DCBB32a3263d35185993B608843E7A65e90f5: compare price average, s
      ✓ 0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c: compare full token balan
      ✓ 0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c: reserved token balance s
      ✓ 0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c: unlocked token balance s
Participant Stats: 0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c Result {
  '0': true,
  '1': '11',
  '2': '2',
  '3': '542031893923099250000',
  '4': '23555201231560275220',
  '5': '0',
  '6': '105489722069174269196',
  '7': '436542171853924980804',
  '8': '75',
  whitelisted: true,
  contributions: '11',
  withdraws: '2',
  reservedTokens: '542031893923099250000',
  committedEth: '23555201231560275220',
  pendingEth: '0',
  _currentReservedTokens: '105489722069174269196',
  _unlockedTokens: '436542171853924980804',
  _lastBlock: '75' }
-------
Compare prices paid  41666666666666665
Compare prices withdraw  33769882384568211
      ✓ 0x920aF392141B3aaEc72f93D829F00aB47cFdbd2c: compare price average, s


  200 passing (33s)
```

```
Done
--------------------------------------------------------------------

Killing existing ganache-cli instance at pid 44604.
```

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