WeMark Contract Audit Report

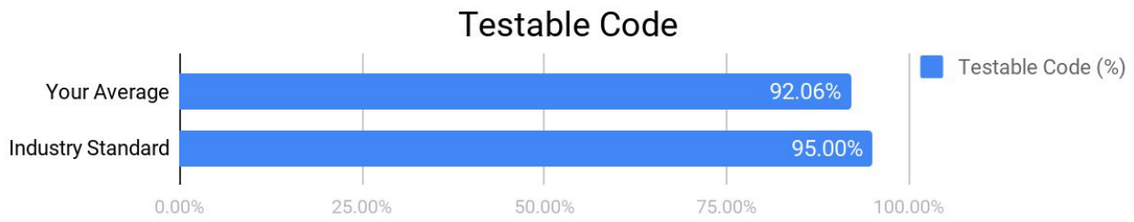
Prepared by Hosho
July 23rd, 2018

Report Version: 2.0

Executive Summary

This document outlines the overall security of WeMark's smart contract as evaluated by Hosho's Smart Contract auditing team. The scope of this audit was to analyze and document WeMark's token contract codebase for quality, security, and correctness.

All issues have been remediated or acknowledged by the WeMark Team. (See Complete Analysis)



Testable code is on par with industry standard. (See Coverage Report)

It should be noted that this audit is not an endorsement of the reliability or effectiveness of the contract, rather limited to an assessment of the logic and implementation. In order to ensure a secure contract that's able to withstand the Ethereum network's fast-paced and rapidly changing environment, we at Hosho recommend that the WeMark Team put in place a bug bounty program to encourage further and active analysis of the smart contract.

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1. Auditing Strategy and Techniques Applied

The Hosho Team has performed a thorough review of the smart contract code, the latest version as written and updated on July 20th, 2018. All main contract files were reviewed using the following tools and processes. (See All Files Covered)

Throughout the review process, care was taken to ensure that the token contract:

- Implements and adheres to existing ERC-20 Token standards appropriately and effectively;
- Documentation and code comments match logic and behavior;
- Distributes tokens in a manner that matches calculations;
- Follows best practices in efficient use of gas, without unnecessary waste; and
- Uses methods safe from reentrance attacks.
- Is not affected by the latest vulnerabilities

The Hosho Team has followed best practices and industry-standard techniques to verify the implementation of WeMark's token contract. To do so, reviewed line-by-line by our team of expert pentesters and smart contract developers, documenting any issues as they were discovered. Part of this work included writing a unit test suite using the Truffle testing framework. In summary, our strategies consist largely of manual collaboration between multiple team members at each stage of the review:

1. Due diligence in assessing the overall code quality of the codebase.
2. Cross-comparison with other, similar smart contracts by industry leaders.
3. Testing contract logic against common and uncommon attack vectors.
4. Thorough, manual review of the codebase, line-by-line.
5. Deploying the smart contract to testnet and production networks using multiple client implementations to run live tests.

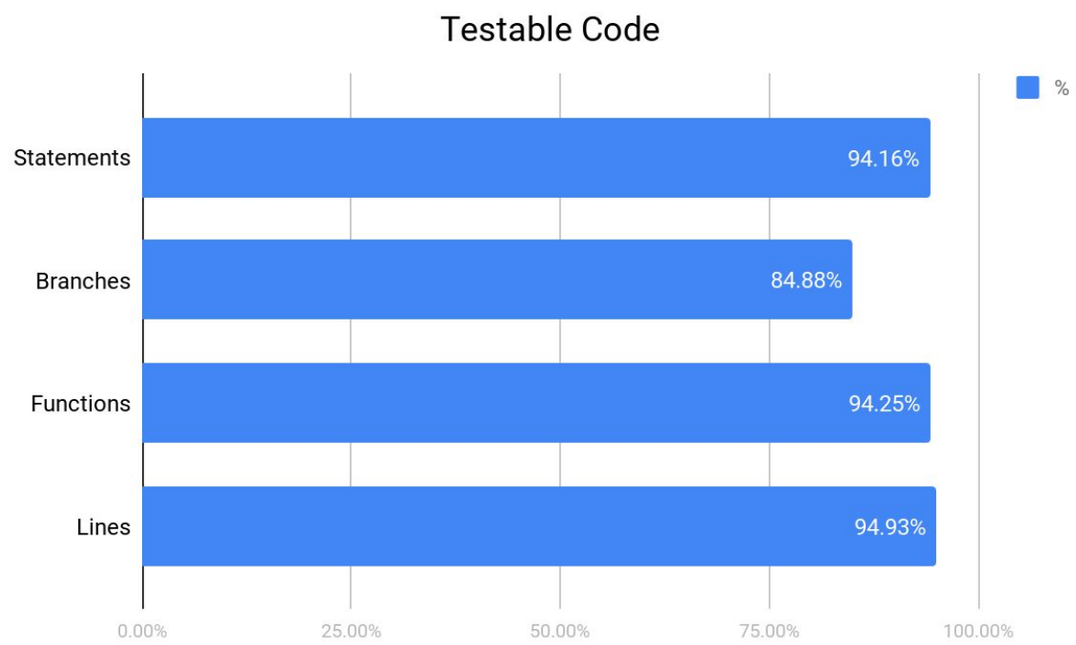
2. Structure Analysis and Test Results

2.1. Summary

The WeMark contracts consist of an upgradable, burnable, ERC-20 token, with a well implemented vesting system that is loaded from the Crowdsale. The Crowdsale contains a simple flat pricing structure, with bonus tokens provided based on the amount of ETH submitted to the contract.

2.2 Coverage Report

As part of our work assisting WeMark in verifying the correctness of their contract code, our team was responsible for writing a unit test suite using the Truffle testing framework.



For individual files see Additional Coverage Report

2.3 Failing Tests

No failing tests.

See Test Suite Results for all tests.

3. Complete Analysis

For ease of navigation, sections are arranged from most critical to least critical. Issues are tagged "Resolved" or "Unresolved" depending on whether they have been fixed or addressed. Furthermore, the severity of each issue is written as assessed by the risk of exploitation or other unexpected or otherwise unsafe behavior:

- **Informational** - The issue has no impact on the contract's ability to operate.
- **Low** - The issue has minimal impact on the contract's ability to operate.
- **Medium** - The issue affects the ability of the contract to operate in a way that doesn't significantly hinder its behavior.
- **High** - The issue affects the ability of the contract to compile or operate in a significant way.
- **Critical** - The issue affects the contract in such a way that funds may be lost, allocated incorrectly, or otherwise result in a significant loss.

3.1. Resolved, Low: ERC-20 Compliance

Contract: WemarkToken

Explanation

The ERC-20 standards state that the declaration for `decimals` should be a *uint8* as opposed to *uint256* as it currently is in this contract.

Resolution

This issue has been resolved by the WeMark team by declaring *unit8* `decimals` in their token contract deployment.

3.2. Resolved, Low: Unnecessary Inheritance

Contract: WemarkToken

Explanation

WemarkToken extends FractionalERC20, but the variable `decimals` is already declared in both WemarkToken and CrowdsaleToken. Additionally, the ERC-20 interface is enforced in CrowdsaleToken so nothing is gained by inheriting from FractionalERC20.

Resolution

The WeMark Team has removed the FractionalERC20 contract, eliminating the unnecessary inheritance.

3.3. Resolved, Low: Unusable Function

Contract: CrowdsaleToken

Explanation

During the initialization process, the function `setTokenInformation` is called to establish the token name and symbol. The WemarkToken child contract then explicitly sets both of these strings, overwriting anything established previously and rendering this function unusable.

Resolution

This has been acknowledged by the WeMark Team.

3.4. Resolved, Low: Invalid Check

Contract: WemarkCrowdsalePricingStrategy

Explanation

There is a check in this contract, at the beginning of the `calculatePrice` function, verifying that `milestoneCount` is greater than zero, in other words there is at least one milestone. However, as the initializer utilizes a `uint[10]` array then halves that length, `milestoneCount` cannot be smaller than five, making this check invalid.

Resolution

The invalid check has been removed from the `calculatePrice` function by the WeMark Team.

3.5. Resolved, Informational: Unnecessary Code

Contract: CrowdsaleToken

Explanation

The variables `name`, `symbol`, and `decimals` are overwritten through inheritance and thus are unused.

Resolution

As these variables are no longer defined within the WemarkToken contract, being passed in as parameters instead, the inheritance issue no longer exist.

3.6. Resolved, Informational: Wasted Gas

Contract: WemarkTokenCrowdsale

Explanation

Altering `wemarkToken` to be a global variable would avoid gas costs from repeatedly setting it in the function.

Resolution

The `wemarkToken` variable has been declared as global which will avoid unnecessary gas costs.

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4. Closing Statement

We are grateful to have been given the opportunity to work with the WeMark Team.

The team of experts at Hosho, having backgrounds in all aspects of blockchain, cryptography, and cybersecurity, can say with confidence that the WeMark contract is free of any critical issues.

The statements made in this document should not be interpreted as investment or legal advice, nor should its authors be held accountable for decisions made based on them.

We at Hosho recommend that the WeMark Team put in place a bug bounty program to encourage further analysis of the smart contract by other third parties.

5. Test Suite Results

Coverage Report: Contract: WemarkCrowdsale

✓ Should deploy crowdsale with the proper configuration (1958ms)

✓ Should handle whitelisting (1049ms)

✓ Should only accept eth from whitelisted addresses (308ms)

✓ Should handle `preallocateVested` (2477ms)

✓ Should not `finalize` crowdsale early (147ms)

✓ Should preallocate tokens for crowdsale (829ms)

✓ Should verify base contract (1545ms)

✓ Should only accept ETH from whitelisted addresses during presale (19793ms)

✓ Should require that the finalize agent is deployed properly (1196ms)

✓ Should handle time shifting for the end time (849ms)

Contract: Pricing Strategy

✓ Should return the milestone data (189ms)

✓ Should return back the token count based on milestones (1523ms)

Contract: WemarkToken

✓ Should deploy a token with the proper configuration (298ms)

✓ Should not `transfer` non-released token (379ms)

✓ Should allocate tokens per the minting function, and validate balances (1150ms)

✓ Should release tokens and enable `transfer` (832ms)

✓ Should `transfer` tokens from *0xd86543882b609b1791d39e77f0efc748dfff7dff* to *0x42adbad92ed3e86db13e4f6380223f36df9980ef* (450ms)

✓ Should not `transfer` negative token amounts (280ms)

✓ Should not `transfer` more tokens than you have (307ms)

✓ Should allow *0xa3883a50d7d537cec8f9bad8e8404aa8ff3078f3* to authorize *0x341106cb00828c87cd3ac0de55eda7255e04933f* to `transfer` 1000 tokens (147ms)

✓ Should allow *0xa3883a50d7d537cec8f9bad8e8404aa8ff3078f3* to zero out the *0x341106cb00828c87cd3ac0de55eda7255e04933f* authorization (147ms)

✓ Should allow *0x667632a620d245b062c0c83c9749c9bfadf84e3b* to authorize *0x53353ef6da4bbb18d242b53a17f7a976265878d5* for 1000 token spend, and *0x53353ef6da4bbb18d242b53a17f7a976265878d5* should be able to send these tokens to *0x341106cb00828c87cd3ac0de55eda7255e04933f* (743ms)

✓ Should not allow *0x53353ef6da4bbb18d242b53a17f7a976265878d5* to `transfer` negative tokens from *0x667632a620d245b062c0c83c9749c9bfadf84e3b* (245ms)

✓ Should not allow *0x53353ef6da4bbb18d242b53a17f7a976265878d5* to `transfer` tokens from *0x667632a620d245b062c0c83c9749c9bfadf84e3b* to *0x0* (89ms)

✓ Should not transfer tokens to *0x0* (103ms)

✓ Should not allow *0x53353ef6da4bbb18d242b53a17f7a976265878d5* to `transfer` more tokens than authorized from *0x667632a620d245b062c0c83c9749c9bfadf84e3b* (303ms)

✓ Should allow an approval to be set, then increased, and decreased (495ms)

✓ Should not allow ETH to be sent to the contract (61ms)

✓ Should return the upgrade state (80ms)

✓ Should allow token information to be set (237ms)

ERC20 Token Standard Interface

✓ Should have the correct `'name'` definition

✓ Should have the correct `'approve'` definition

✓ Should have the correct `'totalSupply'` definition

✓ Should have the correct `'transferFrom'` definition

✓ Should have the correct `'decimals'` definition

✓ Should have the correct `'balanceOf'` definition

✓ Should have the correct `'symbol'` definition

✓ Should have the correct `'transfer'` definition

✓ Should have the correct `'allowance'` definition

✓ Should have the correct `'Transfer'` definition

✓ Should have the correct `'Approval'` definition

Contract: Additional token management

Vesting

✓ Should require proper configuration for a vesting setup (11719ms)

✓ Should allow revocation of a revoking enabled grant (3428ms)

✓ Should allow calculation of the amount of tokens released during the vesting period (1258ms)

✓ Should return the date when the last token can be transferred (1775ms)

Upgradeable Token

✓ Should allow the upgrade master to be set (295ms)

✓ Should allow the upgrade state to be checked (3219ms)

✓ Should require that the agent not be set to *0x0* (193ms)

✓ Should require that only the `upgradeMaster` can set the agent (159ms)

✓ Should require a positive true return from `isUpgradeAgent` (450ms)

✓ Should require that the `originalSupply` variable is the same as the current `totalSupply` (397ms)

6. All Contract Files Tested

Commit Hash: f6b13cb1c1da65d9dc4b4362949679bcbe05a443

File	Fingerprint (SHA256)
WemarkCrowdsalePricingStrategy.sol	AE5AB4286D9446E9A8317B51D32F56C7814F5857E0774370AB04884F9CC739D5
WemarkToken.sol	A77D26BCCC08409B43112C803B320101821B52ECED61F95EF979F6E37473FFA0
WemarkTokenCrowdsale.sol	BD4B5854DEFE5491D7517217A8D07AB8E4B078E596E010BB3EA75F1F024478C4
WemarkTokenCrowdsaleFinalizeAgent.sol	2D2D76363CB73F50F51263190C573645FA8244569B6422A93A7E1552996FE2F3
lib/Haltable.sol	CB527F970CF61BAE9C82E5E96166FF7B4D616E5D2A15BB1ECA6464E984A3F10F
lib/crowdsale/Crowdsale.sol	A4D5D489D2EC6EAC68F8D3C0A4176A8485AE13822CB8CD69BA31024C02835E2A
lib/crowdsale/CrowdsaleBase.sol	5C98752269B1AEB1D63D8B0AC9C219BBE27F0F555547DB451F4859E197946BBC
lib/crowdsale/FinalizeAgent.sol	5A6C2928E222DD8D8A1A2891330A837D55F50B8EF251582AD712C6B600A8C30D
lib/crowdsale/PricingStrategy.sol	336353613F823BDFF38731F54CD550C73239C4A96FFD9D12FECBAEC27F950554
lib/token/BurnableToken.sol	C251989596ABBB86DBD9898DD02BA9846F14A08B47B5E32590208841C53EAAD3
lib/token/CrowdsaleToken.sol	263D1A9797D76EDACEA7279A201CCF3BBD28F182567FC8022CA5B0D8EABA7AFD
lib/token/LimitedTransferToken.sol	3A9CD0885EE52EA255F67F04C63607C1885EA6921B278479A001ACBF624F17AE
lib/token/ReleasableToken.sol	B208E0637AC04B62F3C6BB244787A9BF01E894DAA72D5CBB007C661D462D13F9
lib/token/UpgradeAgent.sol	DF57182FA70918013398B2CCC13438BEB4B8DBCD09262E8740F129DB9318B399
lib/token/UpgradeableToken.sol	D8C040D13C955A578BF0223DF39137B06C67133907B03E4968DA5761DED1740E
lib/token/VestedToken.sol	65440B0E7501BCA6A3EC5153834FEA4D9E78FBDFB3ECBA5625D12639948B306F

7. Individual File Coverage Report

File	% Statements	% Branches	% Functions	% Lines
WemarkCrowdsalePricingStrategy.sol	100.00%	83.93%	100.00%	100.00%
WemarkToken.sol	100.00%	100.00%	100.00%	100.00%
WemarkTokenCrowdsale.sol	100.00%	85.00%	100.00%	100.00%
WemarkTokenCrowdsaleFinalizeAgent.sol	100.00%	80.77%	100.00%	100.00%
lib/Haltable.sol	75.00%	66.67%	80.00%	75.00%
lib/crowdsale/Crowdsale.sol	100.00%	100.00%	100.00%	100.00%
lib/crowdsale/CrowdsaleBase.sol	85.14%	77.59%	86.67%	87.10%
lib/crowdsale/FinalizeAgent.sol	100.00%	100.00%	100.00%	100.00%
lib/crowdsale/PricingStrategy.sol	50.00%	100.00%	50.00%	50.00%
lib/token/BurnableToken.sol	100.00%	100.00%	100.00%	100.00%
lib/token/CrowdsaleToken.sol	100.00%	100.00%	100.00%	100.00%
lib/token/LimitedTransferToken.sol	100.00%	100.00%	100.00%	100.00%
lib/token/ReleasableToken.sol	80.00%	75.00%	100.00%	84.62%
lib/token/UpgradeAgent.sol	0.00%	100.00%	0.00%	0.00%
lib/token/UpgradeableToken.sol	100.00%	100.00%	100.00%	100.00%
lib/token/VestedToken.sol	100.00%	100.00%	100.00%	100.00%
All files	**94.16%**	**84.88%**	**94.25%**	**94.36%**