Cyberscope

Audit Report

Harmony Nodes

March 2022

Type	ERC20
SHA256	b6e543b5b8c4465a4aefcca6fa40382d76c33f114789132a5152ca8ca36c781c
Audited by	© cyberscope

Table of Contents

Contract Review

SHA256	b6e543b5b8c4465a4aefcca6fa40382d76c33f114789132a5152ca8ca36c781c
Source	HarmonyNodes.sol
Domain	harmonynodes.com

Audit Updates

Initial Audit	14th March 2022
Corrected	

Harmony Nodes Workflow

Harmony nodes tokens implement a reward mechanism. Users have the ability to create nodes. The user pays in HONE tokens in order to get a node. The nodes have a variation of cost and interest multipliers. The interest multiplier is increased logarithmically to the node's cost. The nodes cost / interest multiplier ratio is the following:

No	Type	Node Cost	Multiplier
0	Nano	100	1
1	Mini	250	3
2	Pico	500	7
3	Mega	1000	16
4	Giga	5000	100

Each address can update the owned node without limit. For instance, an address could have one Nano and two Mega nodes.

Contract Analysis

Critical Medium Minor Pass

Severity	Code	Description
●	ST	Contract Owner is not able to stop or pause transactions
●	OCTD	Contract Owner is not able to transfer tokens from specific address
●	OTUT	Owner Transfer User's Tokens
●	ELFM	Contract Owner is not able to increase fees more than a reasonable percent (25%)
●	ULTW	Contract Owner is not able to increase the amount of liquidity taken by dev wallet more than a reasonable percent
●	MT	Contract Owner is not able to mint new tokens
●	BT	Contract Owner is not able to burn tokens from specific wallet
●	BC	Contract Owner is not able to blacklist wallets from selling

ST - Stop Transactions

Criticality	minor
Location	contract.sol#L493

Description

The contract owner has the authority to stop transactions for all users. The owner may take advantage of it by setting the `limit` to zero.

```
require(amount <= limit, 'This transfer exceeds the allowed limit!');
```

Recommendation

The contract could embody a check for not allowing setting the limit less than a reasonable amount. A suggested implementation could check that the maximum amount should be more than a fixed percentage of the total supply.

The team should carefully manage the private keys of the owner’s account. We strongly recommend a powerful security mechanism that will prevent a single user from accessing the contract admin functions. That risk can be prevented by temporarily locking the contract or renouncing ownership.

MT - Mint Tokens

Criticality	critical
Location	contract.sol#508

Description

The contract owner or the HONEManager role has the authority to mint tokens. The owner may take advantage of it by calling the `mint` function. As a result the contract tokens will be highly inflated.

```
function mint(uint256 _amount) public {
  require(msg.sender == HONEManager || msg.sender == owner, 'Can only be used by HONEManager or owner.');
  _mint(msg.sender, _amount);
}
```

Recommendation

The owner should carefully manage the credentials of the owner's account. We advised considering an extra-strong security mechanism that the actions may be quarantined by many users instead of one. The owner could also renounce the contract ownership for a period of time or pass the access to the zero address.

Contract Diagnostics

Critical Medium Minor

Severity	Code	Description
Medium	AP	Admin Privileges
Medium	RSC	Reward System Concern
Medium	MNO	Mint Node Overcharge
Medium	FNM	Function Naming Misused
Minor	CO	Code Optimization
Minor	CR	Code Repetition
Minor	MC	Missing Check
Minor	L01	Public Function could be Declared External
Minor	L04	Conformance to Solidity Naming Conventions
Minor	L07	Missing Events Arithmetic
Minor	L08	Tautology or Contradiction

AP - Admin Privileges

Criticality	medium
Location	contract.sol#L550,665

Description

- The dev addresses will initially get an interest multiplier for 10 Giga nodes without paying.
- The contract owner has the ability to reserve nodes for any address without paying the corresponding fees.

```
for(i=0; i < _devs.length; i++){
  HONENodesAddresses.push(_devs[i]);
  Account memory account = Account(true, 0, 0, 0, 0, 10, 0);
  accounts[_devs[i]] = account;
  totalNodes += 5;
}
```

Recommendation

The owner should carefully manage the credentials of the owner's account. We advised considering an extra-strong security mechanism that the actions may be quarantined by many users instead of one. The owner could also renounce the contract ownership for a period of time or pass the access to the zero address.

RSC - Reward System Concern

Criticality	medium
Location	contract.sol#L558

Description

The reward system contains a mint/burn mechanism that may inflate or deflate the token balance and the node holders. For instance:

Example 1

HONEManager balance: 10,000 HONE

1. A user buy a Giga node by paying 500,000 HONE.
2. The HONEManager will be 510,000.
3. The owner triggers the *manageRewards()* function.

The following will happen:

poolAmount = 500000

runwayInDays = 5000

newTotalTokens = 36500

amountToBurn = 463500

poolAmount = 36500

That means that the corresponding user's tokens will be burned.

Example 2

On the other hand, the contract owner may trigger the *manageRewards()* in an early state, mint new tokens and use the *burnHONE()* function in order to transfer these tokens to an address.

```
function manageRewards() public {
  require(msg.sender == owner, 'You must be the owner to run this.');

  uint poolAmount = HONEAddress.balanceOf(address(this)) / 10 ** 18;
  uint runwayInDays = poolAmount/((totalNodes * HONEInterestRatePercent *
nodeMultiplers[4]) / 100);
  if(runwayInDays > 900){
    uint newTotalTokens = (365 * HONEInterestRatePercent * totalNodes *
nodeMultiplers[4]) / 100; // 365 is the desired runway
    uint amountToBurn = poolAmount - newTotalTokens;
    HONEAddress.burn(amountToBurn * 10 ** 18);
  }
  else if(runwayInDays < 360){
    uint newTotalTokens = (365 * HONEInterestRatePercent * totalNodes *
nodeMultiplers[4]) / 100; // 365 is the desired runway
    uint amountToMint = newTotalTokens - poolAmount;
    HONEAddress.mint(amountToMint * 10 ** 18);
  }
}
```

Recommendation

A more clear approach for minting/burning tokens could be introduced. Additionally, the namings could be changed to smething more related to the business logic. For instance the runwayInDays does not contain any data that is related to the days.

MNO - Mint Node Overcharge

Criticality	medium
Location	contract.sol#L558

Description

The `mintHarmonyNode()` provides a node according to a charge. If the issuer provides more tokens than the specification, they are all transferred to the contract. The `mintHarmonyNode()` does not provide a way to track these amounts. Thus, the user will essentially pay more than the required without any reward.

```
if(_nodeType == 0){
  require(_HONEAmount >= 100 * 10 ** 18, 'You must provide at least 100 HONE for the LP token');

  account.nanoCount++;
}
...
HONEAddress.transferFrom(_address, address(this), _HONEAmount);
```

Recommendation

The mintHarmonyNode() should transfer only the amount of tokens that is requirement for the specific node type.

FNM - Function Naming Misused

Criticality	critical
Location	contract.sol#L659

Description

The `burnHONE()` naming provides the perception that the provided amount of HOME will be burned. In contrast, the function sent from the contract to the target address the provided amount of HONE.

```
function burnHONE(address _dead, uint amount) public {
  require(msg.sender == owner, 'You must be the owner to run this.');
  HONEAddress.transfer(_dead, amount);
}
```

Recommendation

The naming of the function should be changed to something more related to the function’s business logic.

CO - Code Optimization

Criticality	minor
Location	contract.sol#L558,603

Description

There are code segments that could be optimized. A segment may be optimized so that it becomes a smaller size, consumes less memory, executes more rapidly, or performs fewer operations.

The contract checks if the target address is the sender.

```
function mintHarmonyNode(address _address, uint _HONEAmount, uint _nodeType)
public {
  require(msg.sender == _address, 'Only user can create a node.');

function claimYield(address _to) public {
  require(msg.sender == _to, 'Only user can widthraw its own funds.');
```

Recommendation

Since the only allowed address is the sender, then the argument could be eliminated and use the `msg.sender` directly.

CR - Code Repetition

Criticality	minor
Location	contract.sol#L668

Description

There are code segments that are repetitive in the contract. Those segments increase the code size of the contract unnecessarily.

For instance, the following code segment is used in `mintHarmonyNode()` and `awardNode()` as well.

```
Account memory account;

if(accounts[_address].exists){
  account = accounts[_address];
}
else{
  account = Account(true, 0, 0, 0, 0, 0, 0);
  HONENodesAddresses.push(_address);
}
```

Recommendation

Create an internal function that contains the code segment and remove it from all the sections.

MC - Missing Check

Criticality	critical
Location	contract.sol#L654,665

Description

The contract is processing variables that have not properly sanitized and checked that they form the proper shape. These variables may produce vulnerability issues.

The transfer is triggered without checking if it has completed successfully. In case of failure, the issuer will lose the accumulated interests without receiving them.

```
function claimYield(address _to) public {
    require(msg.sender == _to, 'Only user can widthraw its own funds.');
    require(accounts[_to].interestAccumulated > 0, 'Interest accumulated must be
greater than zero.');

    uint amount = accounts[_to].interestAccumulated;
    accounts[_to].interestAccumulated = 0;

    HONEAddress.transfer(_to, amount);
}
```

The *_nodeType* should be a number less or equal to 4, otherwise the totalNodes will be increased without the corresponding counter update.

```
function awardNode(address _address, uint _nodeType) public {
  require(msg.sender == owner, 'You must be the owner to run this.');
```

The *HONEInterestRatePercent* should not be allowed to be zero because it is used as a divider in the calculations.

```
function changeDailyYield(uint _newRate) public {
  require(msg.sender == owner, 'You must be the owner to run this.');
  HONEInterestRatePercent = _newRate;
}
///
uint runwayInDays = poolAmount/((totalNodes * HONEInterestRatePercent *
```

```
nodeMultiplers[4]) / 100);
```

Recommendation

The contract should properly check the variables according to the required specifications

L01 - Public Function could be Declared External

Criticality	minor
Location	contract.sol#L181,189,206,213,220,240,251,297,316,488 and 10 more

Description

Public functions that are never called by the contract should be declared external to save gas.

```
awardNode
burnHONE
changeDailyYield
manageRewards
payYield
claimYield
mintHarmonyNode
burn
mint
...
```

Recommendation

Use the external attribute for functions never called from the contract

L04 - Conformance to Solidity Naming Conventions

Criticality	minor
Location	contract.sol#L488,493,508,513,479,558,603,654,659,665 and 6 more

Description

Solidity defines a naming convention that should be followed. Rule exceptions:

- Allow constant variable name/symbol/decimals to be lowercase.
- Allow _ at the beginning of the mixed_case match for private variables and unused parameters.

```
HONEInterestRatePercent
HONEAddress
HONENodesAddresses
_nodeType
_address
_dead
_newRate
_to
_HONEAmount
...
```

Recommendation

Follow the Solidity naming convention.
https://docs.soliditylang.org/en/v0.4.25/style-guide.html#naming-conventions

L07 - Missing Events Arithmetic

Criticality	minor
Location	contract.sol#L493

Description

Detected missing events for critical arithmetic parameters. There are functions that have no event emitted, so it is difficult to track off-chain changes.

```
limit = _limit
```

Recommendation

Emit an event for critical parameter changes.

L08 - Tautology or Contradiction

Criticality	minor
Location	contract.sol#L558

Description

Detects expressions that are tautologies or contradictions. For instance, an uint variable will always be greater than or equal to zero.

```
require(bool,string)(_nodeType >= 0 && _nodeType <= 4,Invalid node type)
```

Recommendation

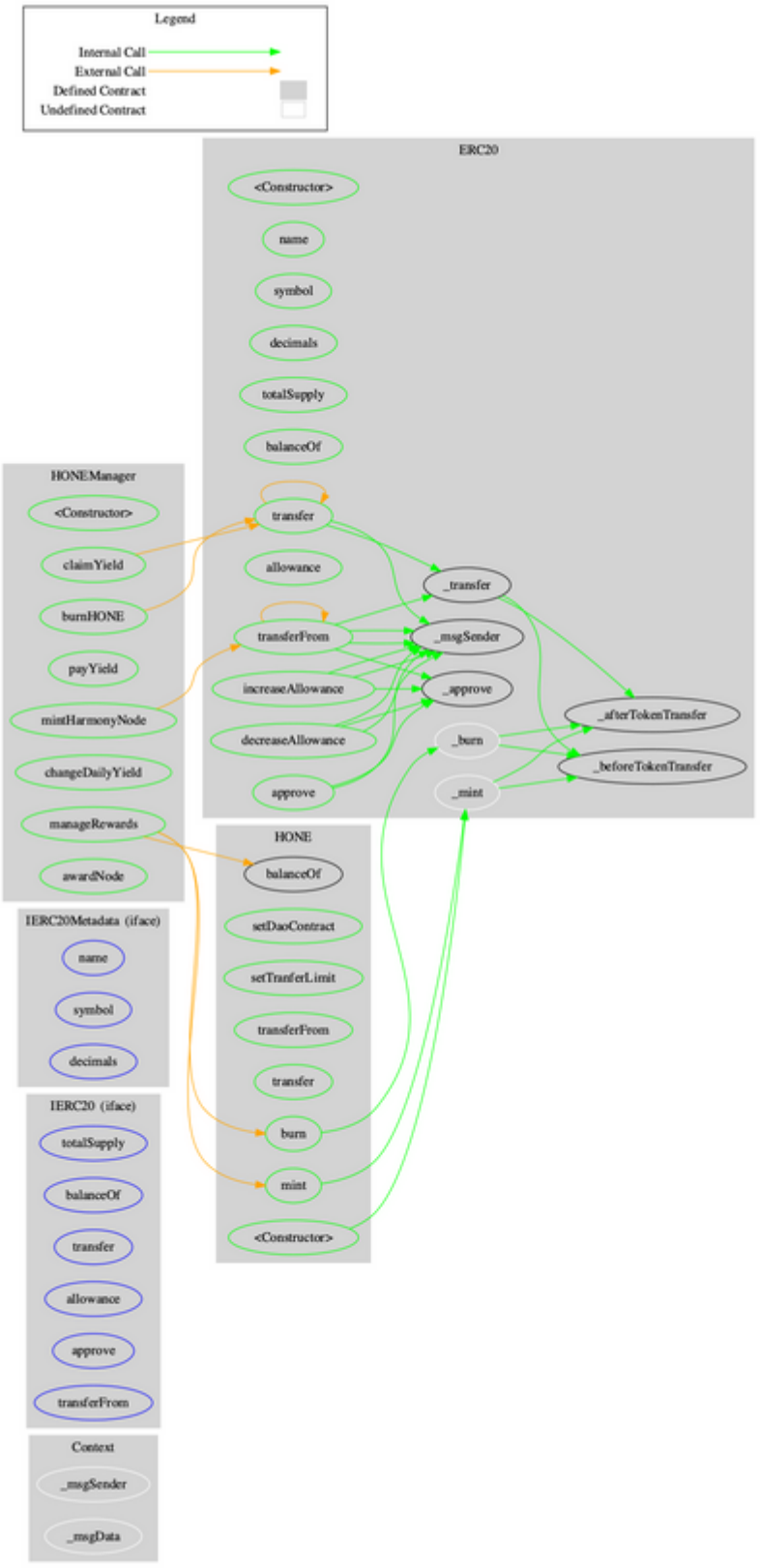
Fix the incorrect comparison by changing the value type or the comparison.

Contract Functions

Contract	Type	Bases		
	Function Name	**Visibility**	**Mutability**	**Modifiers**
Context	Implementation			
	_msgSender	Internal		
	_msgData	Internal		
IERC20	Interface			
	totalSupply	External		-
	balanceOf	External		-
	transfer	External	✓	-
	allowance	External		-
	approve	External	✓	-
	transferFrom	External	✓	-
IERC20Metadata	Interface	IERC20		
	name	External		-
	symbol	External		-
	decimals	External		-
ERC20	Implementation	Context, IERC20, IERC20Metadata		
	<Constructor>	Public	✓	-
	name	Public		-
	symbol	Public		-
	decimals	Public		-
	totalSupply	Public		-
	balanceOf	Public		-
	transfer	Public	✓	-
	allowance	Public		-

	approve	Public	✓	-
	transferFrom	Public	✓	-
	increaseAllowance	Public	✓	-
	decreaseAllowance	Public	✓	-
	_transfer	Internal	✓	
	_mint	Internal	✓	
	_burn	Internal	✓	
	_approve	Internal	✓	
	_beforeTokenTransfer	Internal	✓	
	_afterTokenTransfer	Internal	✓	
HONE	Implementation	ERC20		
	<Constructor>	Public	✓	ERC20
	setDaoContract	Public	✓	-
	setTranferLimit	Public	✓	-
	transferFrom	Public	✓	-
	transfer	Public	✓	-
	mint	Public	✓	-
	burn	Public	✓	-
HONEManager	Implementation			
	<Constructor>	Public	✓	-
	mintHarmonyNode	Public	✓	-
	claimYield	Public	✓	-
	payYield	Public	✓	-
	manageRewards	Public	✓	-
	changeDailyYield	Public	✓	-
	burnHONE	Public	✓	-
	awardNode	Public	✓	-

Contract Flow



Domain Info

Domain Name	harmonynodes.com
Registry Domain ID	2678732538_DOMAIN_COM-VRSN
Creation Date	2022-03-02T07:29:09Z
Updated Date	2022-03-04T03:12:34Z
Registry Expiry Date	2023-03-02T07:29:09Z
Registrar WHOIS Server	whois.godaddy.com
Registrar URL	http://www.godaddy.com
Registrar	GoDaddy.com, LLC
Registrar IANA ID	146

The domain has been created 12 days before the creation of the audit. It will expire in 12 months.

There is no public billing information, the creator is protected by the privacy settings.

Summary

The Harmony Nodes is a contract that contains a standard token functionality enriched with a reward mechanism based on nodes acquisition. The token contains some functions that can be abused by the owner, like minting tokens. A multi-wallet signing pattern will provide security against potential hacks. Temporarily locking the contract or renouncing ownership will eliminate all the contract threats.

The Nodes acquisition mechanism contains some flows that may affect the expected behaviour. We mention some concerns regarding the contract owner privileges.

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The Cyberscope team

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