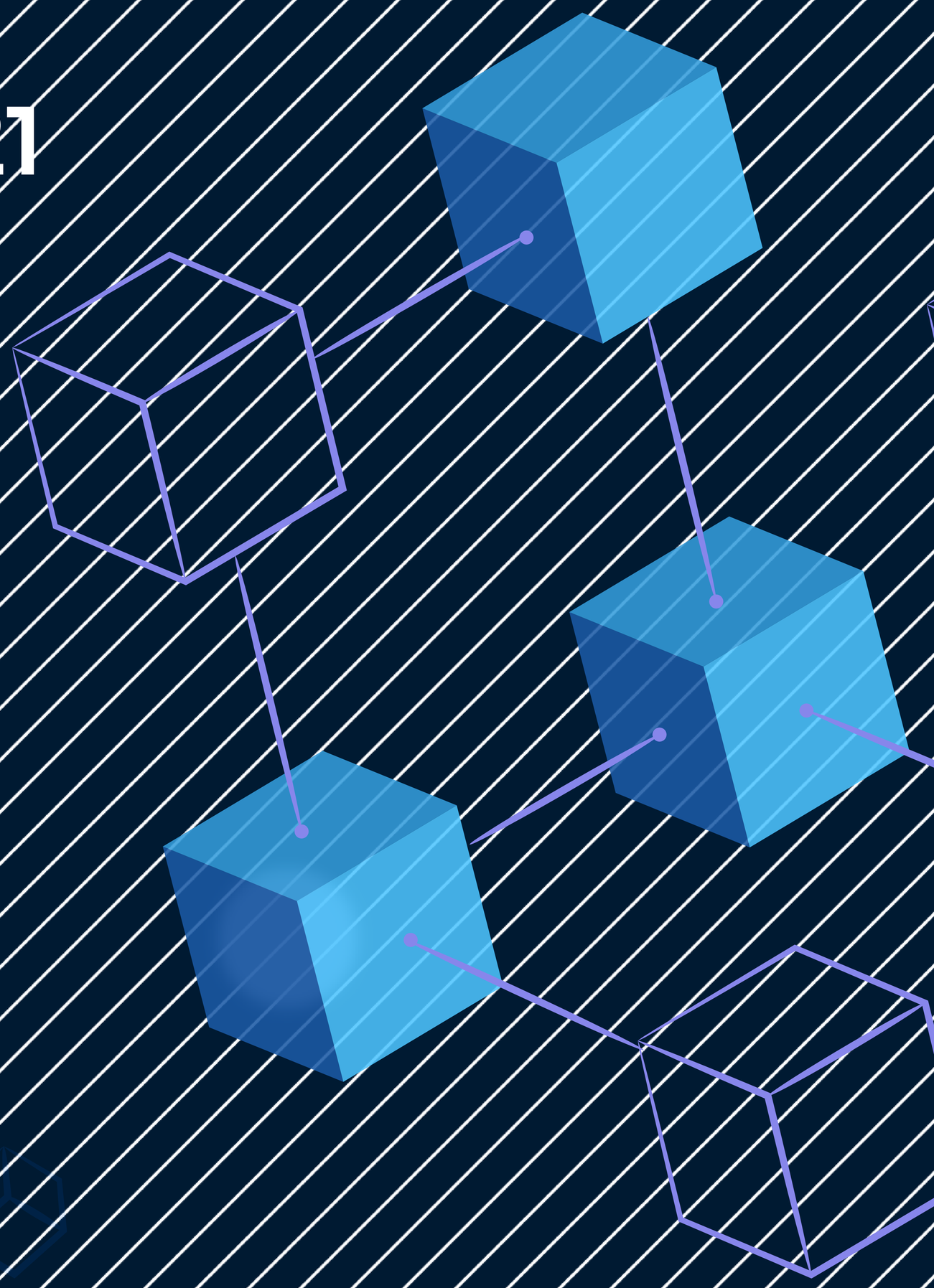
QuillAudits

Audit Report
November, 2021



For

Amplify

https://ampt.finance

Contents

Scope of the Audit

The scope of this audit was to analyze and document the Amplify Child Token smart contract codebase for quality, security, and correctness.

Checked Vulnerabilities

We have scanned the smart contract for commonly known and more specific vulnerabilities. Here are some of the commonly known vulnerabilities that we considered:

- Re-entrancy
- Timestamp Dependence
- Gas Limit and Loops
- DoS with Block Gas Limit
- Transaction-Ordering Dependence
- Use of tx.origin
- Exception disorder
- Gasless send
- Balance equality
- Byte array
- Transfer forwards all gas
- ERC20 API violation
- Malicious libraries
- Compiler version not fixed
- Redundant fallback function
- Send instead of transfer
- Style guide violation
- Unchecked external call
- Unchecked math
- Unsafe type inference
- Implicit visibility level

Techniques and Methods

Throughout the audit of smart contract, care was taken to ensure:

- The overall quality of code.
- Use of best practices.
- Code documentation and comments match logic and expected behaviour.
- Token distribution and calculations are as per the intended behaviour mentioned in the whitepaper.
- Implementation of ERC-20 token standards.
- Efficient use of gas.
- Code is safe from re-entrancy and other vulnerabilities.

The following techniques, methods and tools were used to review all the smart contracts.

Structural Analysis
In this step, we have analysed the design patterns and structure of smart contracts. A thorough check was done to ensure the smart contract is structured in a way that will not result in future problems.

Static Analysis
Static analysis of smart contracts was done to identify contract vulnerabilities. In this step, a series of automated tools are used to test the security of smart contracts.

Code Review / Manual Analysis
Manual analysis or review of code was done to identify new vulnerabilities or verify the vulnerabilities found during the static analysis. Contracts were completely manually analysed, their logic was checked and compared with the one described in the whitepaper. Besides, the results of the automated analysis were manually verified.

Gas Consumption
In this step, we have checked the behaviour of smart contracts in production. Checks were done to know how much gas gets consumed and the possibilities of optimization of code to reduce gas consumption.

Tools and Platforms used for Audit
Remix IDE, Truffle, Truffle Team, Solhint, Mythril, Slither, Solidity statistic analysis, Theo.

Issue Categories

Every issue in this report has been assigned to a severity level. There are four levels of severity, and each of them has been explained below.

Risk-level	Description
High	A high severity issue or vulnerability means that your smart contract can be exploited. Issues on this level are critical to the smart contract's performance or functionality, and we recommend these issues be fixed before moving to a live environment.
Medium	The issues marked as medium severity usually arise because of errors and deficiencies in the smart contract code. Issues on this level could potentially bring problems, and they should still be fixed.
Low	Low-level severity issues can cause minor impact and or are just warnings that can remain unfixed for now. It would be better to fix these issues at some point in the future.
Informational	These are severity issues that indicate an improvement request, a general question, a cosmetic or documentation error, or a request for information. There is low-to-no impact.

Number of issues per severity

Type	High	Medium	Low	Informational
Open	0	0	0	0
Acknowledged	0	0	0	0
Closed	2	0	1	4

Introduction

During the period of **November 02, 2021 to November 09, 2021** - QuillAudits Team performed a security audit for **Amplify Child Token** smart contracts.

The code for the audit was taken from following the official link: https://github.com/amplifylabs/contracts/blob/main/protocol/contracts/Governance/AMPTChild.sol

Ver. No.	Date	Commit hash
1	November 02	31526ea5e5c5a1c308d0065aab1f57ec8d765fc6
2	November 09	52262ff372119a73ae10970a7980d91510c00a43

Issues Found

A. Contract – ERC20

High severity issues

1. Balance of senders is updated incorrectly

Description
The balance of the sender is updated incorrectly due to the operation at line 331 in the function **_transferTokens()**.

L331: **balances[src] -= safeSub(balances[src], amount, "AMPT::_transferTokens: transfer amount exceeds balance");**

As we can see that the **balances[src] = balances[src] - safeSub(balances[src], amount)**, instead of **balances[src] = safeSub(balances[src], amount)**.

Remediation
We recommend changing the operation above to

balances[src] = safeSub(balances[src], amount, "AMPT::_transferTokens: transfer amount exceeds balance");

Status: Fixed in version 02

2. Deposit and Withdraw do not update vote balance

Line	Code

94-105	function deposit(address user, bytes calldata depositData) external {
	require(msg.sender == childChainManagerProxy, "You're not allowed to deposit");
	require(user != address(0), "AMPT::deposit: cannot transfer from the zero address");
	
	uint256 amount = abi.decode(depositData, (uint256));
	
	// `amount` token getting minted here & equal amount got locked in RootChainManager
	totalSupply += amount;
	balances[user] += amount;
	
	emit Transfer(address(0), user, amount);
	}

117-124	function withdraw(uint256 amount) external {
	require(amount > 0, "Amount must be greater than 0");
	
	balances[msg.sender] = safeSub(balances[msg.sender], amount, "ERC20: burn amount exceeds balance");
	totalSupply = safeSub(totalSupply, amount, "AMPT::withdraw: update total suply failed");
	
	emit Transfer(msg.sender, address(0), amount);
	}

Description
The **deposit and withdrawal** functions work like mint and burn for ERC20 tokens. But in this token's implementation every transfer needs to call the **_moveDelegates** function to update the vote balance of the delegate.

Here the **withdraw** function does not update the vote balance of the delegates when the user burns its tokens. Similarly, the **deposit** function does not update the vote balance and delegates can lose their votes.

This can be exploited by executing the following loop several times : **deposit** → **delegate** → **withdraw**. This way any user can **gain access to unlimited votes**.

Remediation
We recommend,
Using the following in deposit function after updating the balance and total supply:

```
_moveDelegates(delegates[address(0)], delegates[user], amount);
```

Using the following in withdraw function after updating the balance and total supply:

```
_moveDelegates(delegates[msg.sender], delegates[address(0)], amount);
```

Status: Fixed **in version 02**

Medium severity issues

No issues were found.

Low level severity issues

3. Lack of Input Validation

The newChildChainManagerProxy is not checked and compared with the current **childChainManagerProxy**.

We recommend adding a check if the **newChildChainManagerProxy == childChainManagerProxy**, which should revert the transaction, this helps to avoid the potential for erroneous values to result in unexpected behaviors or wasted gas.

Status: Fixed in version 02

Informational issues

4. Typos

Please consider fixing the following typos:

L121: **suply** should be **supply**

Status: Fixed in version 02

5. State Variable Default Visibility

L35: **address deployer;**

Description
The Visibility of the aforementioned variable is not defined. Labeling the visibility explicitly makes it easier to catch incorrect assumptions about who can access the variable.

Status: Fixed in version 02

6. State variables that could be declared immutable

Line	Code
35	address deployer;

Description
The above state variables should be declared immutable to save gas.

Remediation
Add the **immutable** attributes to state variables that never change after deployment.

Status: Fixed in version 02

7. Missing Events for Significant Transactions

Description
The missing event makes it difficult to track off-chain decimal changes. An event should be emitted for significant transactions calling the functions :
- updateChildChainManager

Remediation
We recommend emitting the appropriate events.

Status: Fixed in version 02

Functional Tests

Functions	Inputs	Output	Expected Output	Transaction Hash	Result	Fix Status
updateChildChainManager	0x60b6D91cB698F41E1eD928f9631cEC6b8Ff8F6cC	0x60b6D91cB698F41E1eD928f9631cEC6b8Ff8F6cC	0x60b6D91cB698F41E1eD928f9631cEC6b8Ff8F6cC	0x587c418c4eabfcac3ee5adbecc1a3e5a778ef870429fdf0805e087b1c9071c77	Passed	N/A
deposit	"0x153b057d5d7262dC92099B59c975255ecE66784F","0x0000000000000000000000000000000000000000000000000000000000000045"	True	True	0xc96301c48ec3b8766b736805fe2343481913493c209f58ee163457ef85c3c18a	Passed	N/A
transfer	"0x1dd64394E29c5988f04A8E074D0DBACd4D614729","69"	True	True	0xd8172016e04caabff05608949c59a8f6762dc4256432bd47aad850f0f26af3d3	**FAILED**	**Fixed**
balanceOf	0x153b057d5d7262dC92099B59c975255ecE66784F	69	0	call0x153b057d5d7262dC92099B59c975255ecE66784F0xA4eceE6f0fD8f39991D20B0B2c0b10c08a072c6A0x70a08231000000000000000000000000153b057d5d7262dc92099b59c975255ece66784f	Passed	N/A
balanceOf	0x1dd64394E29c5988f04A8E074D0	69	69		Passed	N/A

	DBACd4D614729					
approve	"0x1dd64394E29c5988f04A8E074D0DBACd4D614729","20"	True	True	0x2d043932204c847109062d9688c0d2142f6dd3c5ab6d275b617d9e087485a176	Passed	N/A
transferFrom	"0x153b057d5d7262dC92099B59c975255ecE66784F","0x1dd64394E29c5988f04A8E074D0DBACd4D614729","20"	True	True	0xf246125df92ed5e2ecd351628bdd268f551bdf131f931df0bcab2658ffaa1ca6	Passed	N/A
approve	"0x1dd64394E29c5988f04A8E074D0DBACd4D614729","20"	True	True	0x695850a9b0456f727530380dbc34c850a5d3d99f51eb6ca4bad5558cb67203a7	Passed	N/A
decreaseAllowance	"0x1dd64394E29c5988f04A8E074D0DBACd4D614729”,”15”	True	True	0x94b367d2c6389477201ba9246736123743852e30c9e36592b784bc7003ea2a94	Passed	N/A
allowance	0x153b057d5d7262dC92099B59c975255ecE66784F, 0x1dd64394E29c5988f04A8E074D0DBACd4D614729 = 5	5	5	call0x153b057d5d7262dC92099B59c975255ecE66784F0xA4eceE6f0fD8f39991D20B0B2c0b10c08a072c6A0xdd62ed3e0000000000000000000000000153b057d5d7262dc92099b59c975255ece66784f0000000000000000000000001dd64394e29c5988f04a8e074d0dbacd4d614729	Passed	N/A

increaseAllowance	"0x1dd64394E29c5988f04A8E074D0DBACd4D614729","15"	True	True	0x003328bc7cb9250b46047ec694c1237ae9a5125eb3392f0122db9208a0ed69b8	Passed	N/A
allowance	0x153b057d5d7262dC92099B59c975255ecE66784F, 0x1dd64394E29c5988f04A8E074D0DBACd4D614729	True	True		Passed	N/A
withdraw	from: 0x1dd64394E29c5988f04A8E074D0DBACd4D614729 withdraw: 30	True	True	0x4dfb757778a6fa3292cccafab5de12496dc36f07b1051aa5293ce223929b973c	Passed	N/A

Automated Tests

Slither

```
INFO:Detectors:
AMPTChild._writeCheckpoint(address,uint256,uint256,uint256) (AMPTChild.sol#356-367) uses a dangerous strict equality:
        - nCheckpoints > 0 && checkpoints[delegatee][nCheckpoints - 1].fromBlock == currentBlockNumber (AMPTChild.sol#359)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#dangerous-strict-equalities
INFO:Detectors:
AMPTChild.delegateBySig(address,uint256,uint256,uint8,bytes32,bytes32) (AMPTChild.sol#253-263) uses timestamp for comparisons
        Dangerous comparisons:
        - require(bool,string)(getBlockTimestamp() <= expiry,AMPT::delegateBySig: signature expired) (AMPTChild.sol#261)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#block-timestamp
INFO:Detectors:
AMPTChild.getChainId() (AMPTChild.sol#384-388) uses assembly
        - INLINE ASM (AMPTChild.sol#386)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#assembly-usage
INFO:Detectors:
Pragma version0.8.4 (AMPTChild.sol#2) necessitates a version too recent to be trusted. Consider deploying with 0.6.12/0.7.6
solc-0.8.4 is not recommended for deployment
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#incorrect-versions-of-solidity
INFO:Detectors:
approve(address,uint256) should be declared external:
        - AMPTChild.approve(address,uint256) (AMPTChild.sol#142-145)
increaseAllowance(address,uint256) should be declared external:
        - AMPTChild.increaseAllowance(address,uint256) (AMPTChild.sol#159-162)
decreaseAllowance(address,uint256) should be declared external:
        - AMPTChild.decreaseAllowance(address,uint256) (AMPTChild.sol#177-183)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#public-function-that-could-be-declared-external
INFO:Slither:AMPTChild.sol analyzed (1 contracts with 75 detectors), 8 result(s) found
INFO:Slither:Use https://crytic.io/ to get access to additional detectors and Github integration
```

Mythril

```
==== Dependence on predictable environment variable ====
SWC ID: 120
Severity: Low
Contract: 0x4FB7d2f0c2e673B063258b8550d260bAB020d2c2
Function name: getPriorVotes(address,uint256)
PC address: 3301
Estimated Gas Usage: 1479 - 2045
A control flow decision is made based on a predictable variable.
The block.number environment variable is used in to determine a control flow decision. Note that the values of variables like coinbase, gaslimit, block num
ber and timestamp are predictable and can be manipulated by a malicious miner. Also keep in mind that attackers know hashes of earlier blocks. Don't use an
y of those environment variables for random number generation or to make critical control flow decisions.
--------------------
Initial State:

Account: [ATTACKER], balance: 0x0, nonce:0, storage:{}
Account: [SOMEGUY], balance: 0x0, nonce:0, storage:{}

Transaction Sequence:

Caller: [SOMEGUY], function: getPriorVotes(address,uint256), txdata: 0x782d6fe1000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000, value: 0x0
```

```
==== Potential denial-of-service if block gas limit is reached ====
SWC ID: 128
Severity: Low
Contract: 0x4FB7d2f0c2e673B063258b8550d260bAB020d2c2
Function name: increaseAllowance(address,uint256)
PC address: 11406
Estimated Gas Usage: 1772 - 2627
Potential denial-of-service if block gas limit is reached.
A storage modification is executed in a loop. Be aware that the transaction may fail to execute if the loop is unbounded and the necessary gas exceeds the
block gas limit.
--------------------
Initial State:

Account: [ATTACKER], balance: 0x1, nonce:0, storage:{}
Account: [SOMEGUY], balance: 0x1000000000041, nonce:0, storage:{}

Transaction Sequence:

Caller: [SOMEGUY], function: approve(address,uint256), txdata: 0x095ea7b3000000000000000000000000010101010101010101010101010101010101010101010101
0101010101010101010101010101010101010101010101, value: 0x0
Caller: [ATTACKER], function: increaseAllowance(address,uint256), txdata: 0x39509351000000000000000000000000010101010101010101010101010101010101010101010101
1010101010101010101010101010101010101010101010101010101010101, value: 0x0
```

```
==== Potential denial-of-service if block gas limit is reached ====
SWC ID: 128
Severity: Low
Contract: 0x4FB7d2f0c2e673B063258b8550d260bAB020d2c2
Function name: gasprice_bit_ether(int128)
PC address: 11541
Estimated Gas Usage: 2061 - 2916
Potential denial-of-service if block gas limit is reached.
A storage modification is executed in a loop. Be aware that the transaction may fail to execute if the loop is unbounded and the necessary gas exceeds the
block gas limit.
--------------------
Initial State:

Account: [ATTACKER], balance: 0x1000000000001, nonce:0, storage:{}
Account: [SOMEGUY], balance: 0x40000040000, nonce:0, storage:{}

Transaction Sequence:

Caller: [ATTACKER], function: approve(address,uint256), txdata: 0x095ea7b3000000000000000000000000010101010101010101010101010101010101010101010101
1010101010101010101010101010101010101010101010101010101010101, value: 0x0
Caller: [CREATOR], function: gasprice_bit_ether(int128), txdata: 0x23b872dd000000000000000000000000010101010101010101010101010101010101010100000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000, value: 0x0
```

SOLHINT LINTER

```
AMPTChild.sol
   2:1   error    Compiler version 0.8.4 does not satisfy the ^0.5.8 semver requirement                                compiler-version
   7:5   warning  Constant name must be in capitalized SNAKE_CASE                                                     const-name-snakecase
  10:5   warning  Constant name must be in capitalized SNAKE_CASE                                                     const-name-snakecase
  13:5   warning  Constant name must be in capitalized SNAKE_CASE                                                     const-name-snakecase
  35:5   warning  Explicitly mark visibility of state                                                                 state-visibility
  71:5   warning  Explicitly mark visibility in function (Set ignoreConstructors to true if using solidity >=0.7.0)  func-visibility
  72:9   warning  Error message for require is too long                                                               reason-string
  80:9   warning  Error message for require is too long                                                               reason-string
  96:9   warning  Error message for require is too long                                                               reason-string
 179:9   warning  Error message for require is too long                                                               reason-string
 186:9   warning  Error message for require is too long                                                               reason-string
 187:9   warning  Error message for require is too long                                                               reason-string
 225:13  warning  Error message for require is too long                                                               reason-string
 258:9   warning  Error message for require is too long                                                               reason-string
 259:9   warning  Error message for require is too long                                                               reason-string
 261:9   warning  Error message for require is too long                                                               reason-string
 284:9   warning  Error message for require is too long                                                               reason-string
 328:9   warning  Error message for require is too long                                                               reason-string
 329:9   warning  Error message for require is too long                                                               reason-string
 374:16  warning  Avoid to make time-based decisions in your business logic                                          not-rely-on-time
 386:9   warning  Avoid to use inline assembly. It is acceptable only in rare cases                                  no-inline-assembly

✖ 21 problems (1 error, 20 warnings)
```

Results

No major issues were found. Some false positive errors were reported by the tools. All the other issues have been categorized above according to their level of severity.

Closing Summary

In this report, we have considered the security of the **Amplify Child Token** platform. We performed our audit according to the procedure described above.

The audit showed several high, low, and informational severity issues. In the end, all of the issues were fixed by the Auditee.

Disclaimer

Quillhash audit is not a security warranty, investment advice, or an endorsement of the **Amplify Child Token** platform. This audit does not provide a security or correctness guarantee of the audited smart contracts. 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. Securing smart contracts is a multistep process. One audit cannot be considered enough. We recommend that the **Amplify Child Token** Team put in place a bug bounty program to encourage further analysis of the smart contract by other third parties.

Audit Report

November, 2021

For

Amplify

https://ampt.finance

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