Hydro Snowflake ERC-1484 Marketplace Coupon Bounty
v1.0.0

06.11.19

Luiserebii

https://serebii.io
https://github.com/Luiserebii

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1. Introduction

This project aims to accomplish the creation of a smart contract marketplace which can be deployed by any one entity, from businesses to individuals. This marketplace includes item tagging, delivery method specifications, the ability to toggle items from active to inactive (and vice versa), and coupon functionality.

Items and coupons are represented as ERC-721 tokens, as non-fungible symbols which can be transferred and owned. Upon creation, items are typically registered to the EIN of the address which sent the transaction, often being the seller. On purchase of the item, the ownership over the item is transferred from the seller to the buyer. Similarly, coupons are initialized as ERC-721 tokens, but are usually registered to the user intended to use it (i.e. potential buyers). Upon redemption, coupons are burned, thus enforcing their one-off usage.

The GitHub repo for the smart contracts can be found at:
https://github.com/Luiserebii/HydroSnowflake-Marketplace-Coupons

The GitHub repo for the Snowflake Dashboard integration piece can be found at:
https://github.com/Luiserebii/HydroSnowflake-Marketplace-Dashboard

2. Brief Architecture

In order to enforce separation of concerns, efforts to separate logic and functionality between contracts and “objects” have been made. As an example, the **Marketplace** contract holds the generic logic that a contract marketplace should have, as internal functions. **SnowflakeEINMarketplace** then builds on top of the **Marketplace** contract, exposing these functions, giving the contract a way to specify restrictions on function calls to EIN owners. Finally, our **CouponMarketplaceResolver** handles the actual logic behind the Snowflake Resolver in calling the Via contract.

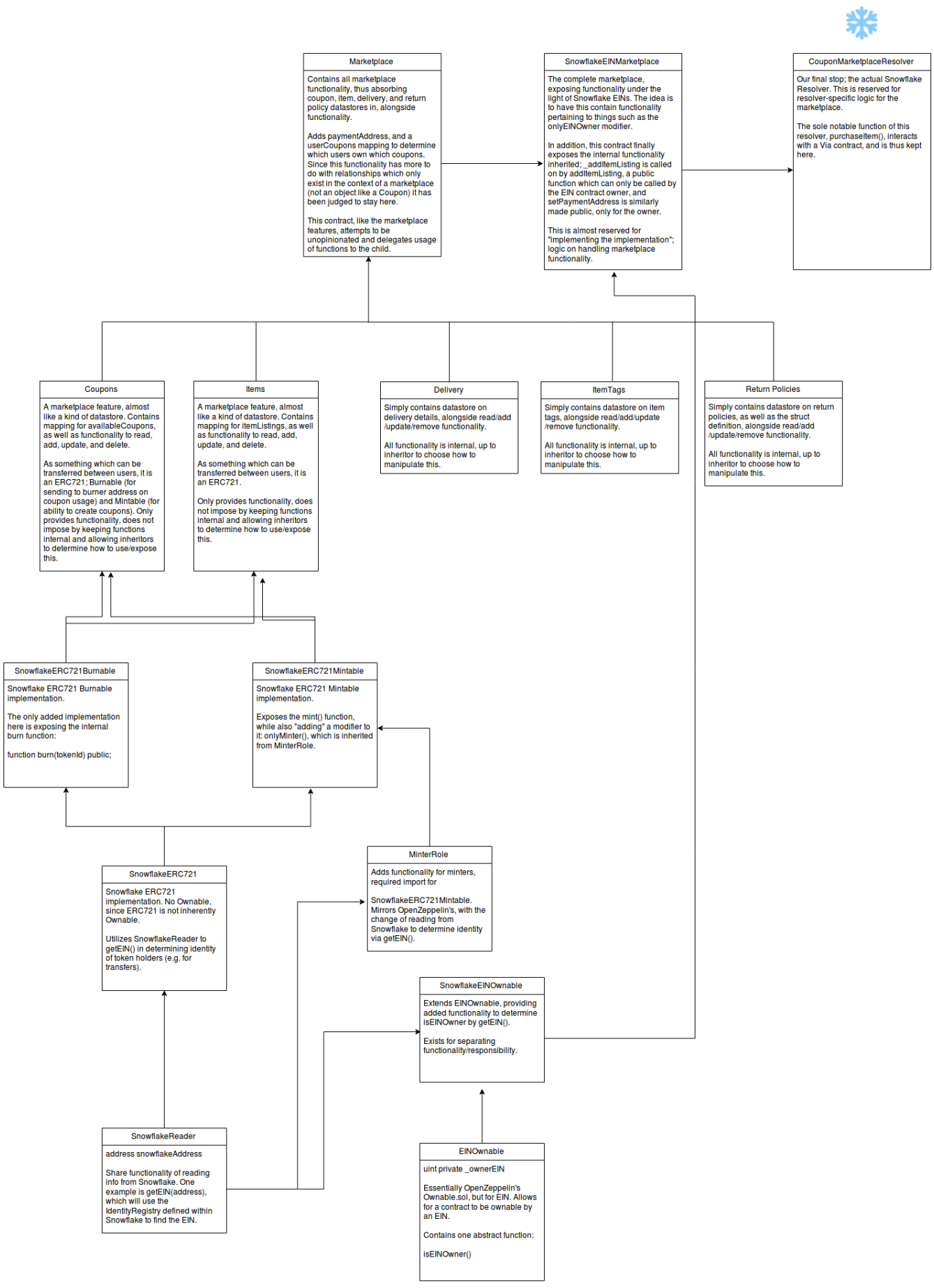
Some additional refactors have been made for the sake of object-oriented principles. **SnowflakeReader** is a contract that shares the ability to easily read the Snowflake **IdentityRegistry** through a single function. All that is needed is to set the address of the **Snowflake** contract.

In order to take advantage of the unique methods in which we are determining identity (via EINs, instead of addresses), much of OpenZeppelin’s contracts pertaining to contract ownership and ERC-721s have been rewritten within the context of Snowflake.

A diagram on the next page elaborates on the smart contract architecture. Note that this is an older version, yet still preserves the same organizational idea.

This diagram can also be found at:
https://camo.githubusercontent.com/8ce82d8a0317b15410a4d801a6514276555bc1cb/68747470733a2f2f736572656269692e696f2f687964726f2f696d672f536e6f77666c616b65253230436f75706f6e2532304d61726b6574706c6163652532302d25323048796472f253230426f756e74792e706e67

Notes on differences from this diagram can be found here:
https://github.com/Luiserebii/HydroSnowflake-Marketplace-Coupons/blob/master/docs/diagram_change_notes


Marketplace
Contains all marketplace functionality, thus absorbing coupon, item, delivery, and return policy datastores in, alongside functionality.
Adds paymentAddress, and a userCoupons mapping to determine which users own which coupons. Since this functionality has more to do with relationships which only exist in the context of a marketplace (not an object like a Coupon) it has been judged to stay here.
This contract, like the marketplace features, attempts to be unopinionated and delegates usage of functions to the child.
SnowflakeEINMarketplace
The complete marketplace, exposing functionality under the light of Snowflake EINs. The idea is to have this contain functionality pertaining to things such as the onlyEINOwner modifier.
In addition, this contract finally exposes the internal functionality inherited; _addItemListing is called on by addItemListing, a public function which can only be called by the EIN contract owner, and setPaymentAddress is similarly made public, only for the owner.
This is almost reserved for "implementing the implementation"; logic on handling marketplace functionality.
CouponMarketplaceResolver
Our final stop; the actual Snowflake Resolver. This is reserved for resolver-specific logic for the marketplace.
The sole notable function of this resolver, purchaseItem(), interacts with a Via contract, and is thus kept here.
Coupons
A marketplace feature, almost like a kind of datastore. Contains mapping for availableCoupons, as well as functionality to read, add, update, and delete.
As something which can be transferred between users, it is an ERC721; Burnable (for sending to burner address on coupon usage) and Mintable (for ability to create coupons). Only provides functionality, does not impose by keeping functions internal and allowing inheritors to determine how to use/expose this.
Items
A marketplace feature, almost like a kind of datastore. Contains mapping for itemListings, as well as functionality to read, add, update, and delete.
As something which can be transferred between users, it is an ERC721.
Only provides functionality, does not impose by keeping functions internal and allowing inheritors to determine how to use/expose this.
Delivery
Simply contains datastore on delivery details, alongside read/add /update/remove functionality.
All functionality is internal, up to inheritor to choose how to manipulate this.
ItemTags
Simply contains datastore on item tags, alongside read/add/update /remove functionality.
All functionality is internal, up to inheritor to choose how to manipulate this.
Return Policies
Simply contains datastore on return policies, as well as the struct definition, alongside read/add /update/remove functionality.
All functionality is internal, up to inheritor to choose how to manipulate this.
SnowflakeERC721Burnable
Snowflake ERC721 Burnable implementation.
The only added implementation here is exposing the internal burn function:
function burn(tokenId) public;
SnowflakeERC721Mintable
Snowflake ERC721 Mintable implementation.
Exposes the mint() function, while also "adding" a modifier to it: onlyMinter(), which is inherited from MinterRole.
SnowflakeERC721
Snowflake ERC721 implementation. No Ownable, since ERC721 is not inherently Ownable.
Utilizes SnowflakeReader to getEIN() in determining identity of token holders (e.g. for transfers).
MinterRole
Adds functionality for minters, required import for
SnowflakeERC721Mintable. Mirrors OpenZeppelin's, with the change of reading from Snowflake to determine identity via getEIN().
SnowflakeEINOwnable
Extends EINOwnable, providing added functionality to determine isEINOwner by getEIN().
Exists for separating functionality/responsibility.
SnowflakeReader
address snowflakeAddress
Share functionality of reading info from Snowflake. One example is getEIN(address), which will use the IdentityRegistry defined within Snowflake to find the EIN.
EINOwnable
uint private _ownerEIN
Essentially OpenZeppelin's Ownable.sol, but for EIN. Allows for a contract to be ownable by an EIN.
Contains one abstract function:
isEINOwner()

3. Deployment

The Hydro Snowflake Coupon Marketplace currently relies on an npm module called **solidity-deploy**. Although Truffle deployment scripts are available, much difficulty has been found in trying to validate the contracts on Etherscan. After weeks of frustration, I started to think that the Truffle migrate tool was creating some sort of bytecode corresponding to flattened code I could not determine. The contracts compiled by Truffle were often hundreds of bytes larger than contracts compiled by use of a flattening tool.

Since the Hydro Snowflake Dashboard requires verification of the Resolver contract, this quickly becomes an issue given the complexity of the deployment process. Manual flattening and compiling/deploying on Remix is possible, but does not scale. To overcome this issue, I spent the time writing a module to simplify the flattening and deployment process, which are used by the deployment scripts.

To deploy the Snowflake Coupon Marketplace, **cd** into the **/deployments** directory and run the following commands, replacing the empty values (signified by **[VAL]**) with their respective addresses. You will need to locate the address of the respective deployed contracts as needed.

Due to what is likely a web3 bug, larger contract deployments will run, but will not return to signal success. It is recommended to check the deployment address on Etherscan for new deployments, and to stop the script once the deployment is confirmed. These commands have been marked by asterisks (*****).

./deployment.sh
(INIT and ITEMFEATURE)

node main-deploy.js --stage 3
(COUPON_FEATURE)*

node main-deploy.js --stage 4
(COUPON_MARKETPLACE_VIA)*

node main-deploy.js --stage 5 --CouponMarketplaceViaAddress [VAL] --CouponFeatureAddress [VAL] --ItemFeatureAddress [VAL]
(COUPON_MARKETPLACE_RESOLVER)*

node main-deploy.js --stage 6 --CouponMarketplaceViaAddress [VAL] --CouponMarketplaceResolverAddress [VAL]

(SET_1)

node main-deploy.js --stage 7 --CouponMarketplaceResolverAddress [VAL]
(COUPON_DISTRIBUTION)

node main-deploy.js --stage 8 --CouponMarketplaceResolverAddress [VAL]
--CouponDistributionAddress [VAL]
(FINISH)

Successful example logs can be found in the **/docs** directory. Here is the most recent one:
https://github.com/Luiserebii/HydroSnowflake-Marketplace-Coupons/blob/master/docs/HydroSnowflake%20Manual%20Deployment%20Log%2006-07-19

4. Usage

Using the Hydro Snowflake Coupon Marketplace contracts are fairly simple. The resolver inherits two variables from the **Marketplace** contract: **ItemFeatureAddress**, and **CouponFeatureAddress**. In order to add, update, or remove items or coupons, you will need to interact with the respective contract to do so. There is no UI for this at the moment, so the most user-friendly option would have to be through Etherscan.

The best descriptions on how to use the contract is through the contract tests, which has documentation explaining each step. Please see:
https://github.com/Luiserebii/HydroSnowflake-Marketplace-Coupons/blob/master/test/marketplace/coupon-marketplace.js

The React front-end is self-explanatory. Simply select an item, type in a coupon code if available, and click “Purchase” to purchase the item!

5. Final Thoughts

I hope this documentation has been useful, and above all, clear.

If you would like to contact me, please email me at: luis@serebii.io

Thank you!
~Luiserebii~