

ItemBlocks

The digital passport for your physical items

Fabian Zeiher
Iosif Koen

18/Dec/2023

Agenda

- What is ItemBlocks
- Motivation
- Tech Stack
- Implementation
- Testing
- Demo
- Reflection

What is ItemBlocks

- Connect physical items to the blockchain
- QR Code based identification
- Store and Access Information
- Track Ownership
- Track Changes

ItemBlocks 0xba08d5 ✓


**Your digital passport for
your physical items**

CREATE

Create a new Item Passport now!

You created these items:

Loka Fädar Päron
Vatten



Frisk vatten med smak av Fläder päron.
Fantastiskt.

Item Website

Motivation

- Data Transparency
- Data Access
- Data Integrity
- Verifiable Information



➔ Full access to potentially security relevant information.

Possible Use Cases

- Cross-company supply chains
- Food safety information
- Labelling of Construction Materials
- Origin Tracing

Deployment

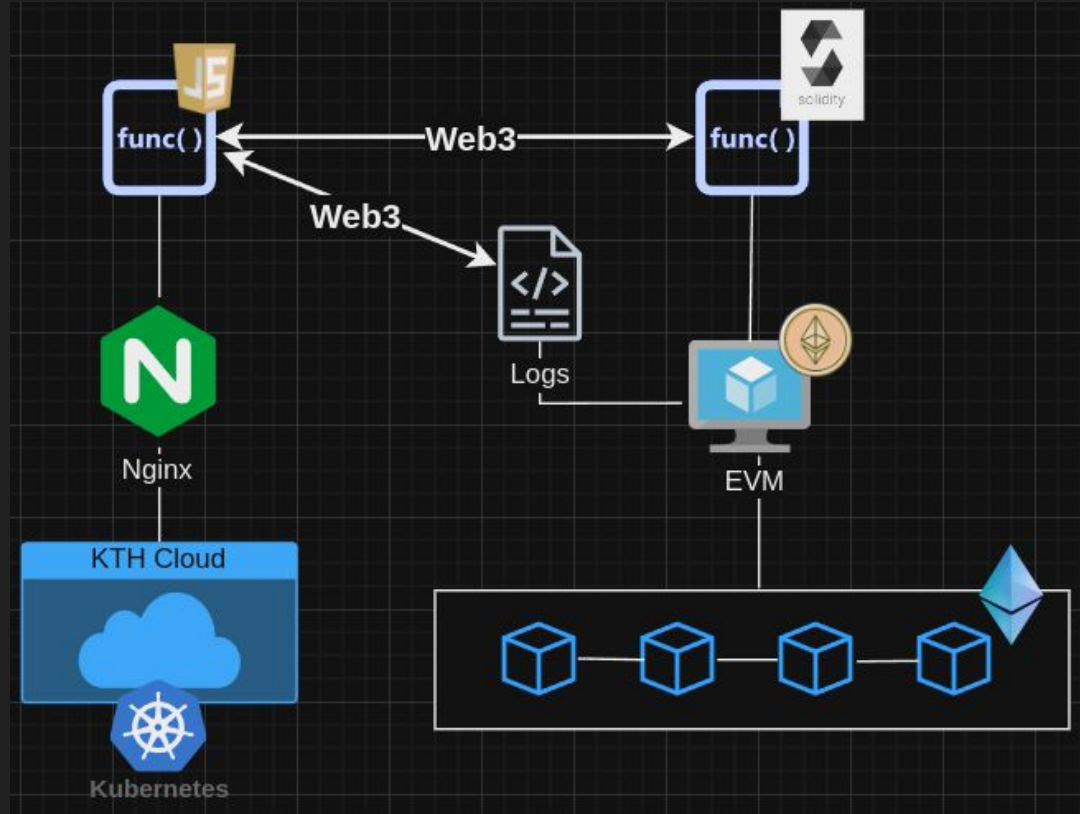
Smart Contract

- Manual Deployment w/ Remix

Web Application

- Continuous Deployment
 - GitHub Actions
 - KTH Cloud (Thank you to Pierre!)

Deployed Stack



On the shoulders of giants

App



Pico.CSS

UI / UX



Framework

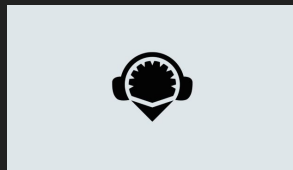


Bundler

Contract



Static Analysis



Deploy



Testing

Implementation

Extension of ERC721

TokenID	➡	Owner
TokenID	➡	Passport
TokenID	➡	[All owners]
Creator	➡	[Token IDs]

```
import "openzeppelin-contracts/contracts/token/ERC721/ERC721.sol";
import "openzeppelin-contracts/contracts/access/Ownable.sol";

contract ItemBlocks is ERC721, Ownable {
    struct Passport {
        string name;
        string desc;
        string family;
        string url;
        string img;
    }

    mapping (uint256 ⇒ Passport) public itemPassports;
    mapping (uint256 ⇒ address[]) public allItemOwners;
    mapping (address ⇒ uint256[]) public createdItems;


    enum Role {Owner, Creator}
```

Blockchain Scanning

Utilising the power of ethereum logs we can track:

- Item Passport Creation (Who, When)
- Ownership Changes
- Data Changes
 - Who made the change?
 - What changed?
 - When did it change?
 - In which role was the change made?

Loka
Vatten




Frisk vatten med smak av Fläder päron

Item Website

Edited By: [Owner]
[0xba08d9AaA2b5cbB67a97abB6Cb918B37E4d5](#)

Block Number: 10223905

Loka
Vatten



Core Functions

createPassport()

updatePassport()

updateOwnership()

```
function updatePassport(uint tokenId, string memory name, string memory desc, s
    require( isEligible(tokenId, msg.sender), "Must be the owner of the item or

    itemPassports[tokenId] = Passport ({
        name: name,
        desc: desc,
        family: family,
        url: url,
        img: img
    });

    emit PassportUpdate(
        tokenId,
        msg.sender,
        msg.sender == ownerOf(tokenId) ? Role.Owner: Role.Creator,
        name,
        desc,
        family,
        url,
        img);

    return (tokenId);
}
```

Unit Testing

Fully tested implementation.

```
> forge coverage
[::] Compiling...
[::] Compiling 37 files with 0.8.23
[::] Solc 0.8.23 finished in 3.49s
Compiler run successful!
Analysing contracts...
Running tests...
```

File	% Lines	% Statements	% Branches	% Funcs
src/ItemBlocks.sol	100.00% (21/21)	100.00% (22/22)	100.00% (12/12)	100.00% (9/9)
test/ItemBlocksTest.t.sol	100.00% (1/1)	100.00% (2/2)	100.00% (0/0)	100.00% (1/1)
Total	100.00% (22/22)	100.00% (24/24)	100.00% (12/12)	100.00% (10/10)

Static Analysis

No significant findings.

THIS CHECKLIST IS NOT COMPLETE. Use `--show-ignored-findings` to show all the results. Summary

- [incorrect-exp](#) (1 results) (High)
- [divide-before-multiply](#) (8 results) (Medium)
- [shadowing-local](#) (2 results) (Low)
- [reentrancy-benign](#) (2 results) (Low)
- [reentrancy-events](#) (1 results) (Low)
- [assembly](#) (3 results) (Informational)
- [pragma](#) (1 results) (Informational)
- [dead-code](#) (35 results) (Informational)
- [solc-version](#) (13 results) (Informational)



incorrect-exp

Impact: High Confidence: Medium

- ID-0 [Math.mulDiv\(uint256,uint256,uint256\)](#) has bitwise-xor operator ^ instead of the exponentiation operator **:
 - [inverse = \(3 * denominator\) ^ 2](#)

lib/openzeppelin-contracts/contracts/utils/math/Math.sol#L123-L202

Property Testing (Fuzzing)

```
echidna ./echidna/PropertyTest.sol --contract ItemBlocksPropertyTest

[ Echidna 2.2.1 ]

Time elapsed: 19s
Workers: 0/1
Seed: 8068625653721161801
Calls/s: 2500
Total calls: 50009/50000

Unique instructions: 4084
Unique codehashes: 1
Corpus size: 28 seqs
New coverage: 2s ago

Chain ID: -
Fetched contracts: 0/3
Fetched slots: 0/0

Tests (5)

echidna_create_more: passing
echidna_need_to_create_history_and_passport: passing
echidna_set_creator: passing
echidna_owner_is_last_entry_allItemOwners: passing
echidna_owner_not_zero: passing

Log (29)

[2023-12-17 18:38:47.30] [Worker 0] Test limit reached. Stopping.
[2023-12-17 18:38:45.08] [Worker 0] New coverage: 4084 instr, 1 contracts, 28 seqs in corpus
[2023-12-17 18:38:43.71] [Worker 0] New coverage: 3692 instr, 1 contracts, 27 seqs in corpus
[2023-12-17 18:38:43.17] [Worker 0] New coverage: 3605 instr, 1 contracts, 26 seqs in corpus
[2023-12-17 18:38:42.16] [Worker 0] New coverage: 3577 instr, 1 contracts, 25 seqs in corpus
[2023-12-17 18:38:42.11] [Worker 0] New coverage: 3535 instr, 1 contracts, 24 seqs in corpus
[2023-12-17 18:38:36.86] [Worker 0] New coverage: 3514 instr, 1 contracts, 23 seqs in corpus

Campaign complete, C-c or esc to exit
```

Demo Time

Join the fun!



Future Work

- DAO to manage “Editors”
- Certifications:
 - A verifiable claim attesting to the correctness of information
- Native Mobile Application:
 - access to camera



Reflection

- Good coding experience
- We learned a lot
- Powerful tech stack (for Solidity)
- Blockchain has a lot of potential to be useful for the community

Take Home Message

Build a dApp for your community.

THANK YOU!