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| **HadoopCryptoLedger** |
| Refactoring Code Smells |
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# **Overview**

The purpose of this activity is to eliminate code smells in the project – “HadoopCryptoLedger”. The general process followed in this activity is as follows:

1. Use DesigniteJava (URL: [DesigniteJava](https://www.designite-tools.com/designitejava/)) to determine various types of smells present in the application. (OR) Analyze the packages for any violations of standard design principles and good practices.
2. Determine an appropriate refactoring technique to eliminate smells or resolve violations of principles.
3. Implement the technique.
4. Extract Method –

**DesigniteJava Output before Refactoring:**

Text

Description automatically generated

**DesigniteJava Output after Refactoring:**

Text

Description automatically generated

**Description of Change made:**

The tool detected the smell in this class because the following methods had 169 lines of code resulting in a long method:

1. parseBlock1346406AsEthereumBlockHeap
2. parseBlock1346406AsEthereumBlockDirect

The long methods were refactored by extracting each method into new ones. The following methods now represent the aforementioned 2 methods:

1. parseBlock1346406AsEthereumBlockHeap()
2. parseBlock1346406AsEthereumBlockHeapBlockChecks()
3. parseBlock1346406AsEthereumBlockHeapTransactionChecks0to2()
4. parseBlock1346406AsEthereumBlockHeapTransactionChecks3to5() &
5. parseBlock1346406AsEthereumBlockDirect()
6. parseBlock1346406AsEthereumBlockDirectBlockChecks()
7. parseBlock1346406AsEthereumBlockDirectTransactionChecks0to2()
8. parseBlock1346406AsEthereumBlockDirectTransactionChecks3to5()

A total of **6 methods** were labelled as “Long methods” by DesigniteJava. Only two methods were refactored and the other 4 were untouched. Therefore, the number of Long Methods, under Implementation smells is four and not zero since the following 4 methods have 105 lines of code.

1. public void parseBlock0to10AsEthereumBlockHeap()
2. public void parseBlock0to10AsEthereumBlockDirect()
3. parseBlock3510000to3510010AsEthereumBlockHeap()
4. parseBlock3510000to3510010AsEthereumBlockDirect()

However, these methods were not refactored into multiple methods, since, the blocks inside these methods are tested in **sequence** by the **EthereumBlock.readBlock()** method, and therefore cannot be split. Therefore, these 4 methods were left untouched.

Text

Description automatically generated

Text

Description automatically generated

**Relevant Files & Links:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Project | Package | File | Method | Line # |
| hadoopcryptoledger | org.zuinnote.hadoop.ethereum.format.common | EthereumFormatReaderTest | **parseBlock1346406AsEthereumBlockHeap** | **713** |
| hadoopcryptoledger | org.zuinnote.hadoop.ethereum.format.common | EthereumFormatReaderTest | **parseBlock1346406AsEthereumBlockDirect** | **904** |

**Branch:** refactoring\_implementation\_smells

**Commit#:** 8683a997bac22c51568337326664e1a52b59eeb1

1. Rename Method / Variable –

**Description of Change made:**

* The byte array - “TEST\_RLP\_LIST\_LARGELIST” was renamed to “TEST\_RLP\_LIST\_LARGE\_LIST” to remove a typographical error.

Before:

A screenshot of a computer

Description automatically generated

After:

Graphical user interface, text

Description automatically generated

* The String - “CONF\_ISSPLITABLE” was renamed to “CONF\_IS\_SPLITABLE” to remove a typographical error.
* The String - “DEFAULT\_ISSPLITABLE” was renamed to “DEFAULT\_IS\_SPLITABLE” to remove a typographical error.

Before:

A screenshot of a computer

Description automatically generated with medium confidence

After:

Text

Description automatically generated with medium confidence

**Relevant Files & Links:**

|  |  |  |  |
| --- | --- | --- | --- |
| Project | Package | File | Line# |
| hadoopcryptoledger | org.zuinnote.hadoop.ethereum.format.common | EthereumUtilDecodeTest | **53** |
| hadoopcryptoledger | org.zuinnote.hadoop.ethereum.format.common | EthereumUtilBockTest | **32** |
| hadoopcryptoledger | org.zuinnote.hadoop.bitcoin.format.mapred | AbstractBitcoinFileInputFormat | **38 & 39** |
| hadoopcryptoledger | org.zuinnote.hadoop.bitcoin.format.mapreduce | AbstractBitcoinFileInputFormat | **36 & 37** |

**Branch:** refactoring\_implementation\_smells

**Commit#:** 3e54e78c2113674325e0272ea732aff7527b3635

1. Change bidirectional association to unidirectional association

**DesigniteJava Output before Refactoring:**

Text

Description automatically generated

**DesigniteJava Output after Refactoring:**

Text

Description automatically generated

**Description of Change made:**

The tool detected the smell in this class because this class participates in a cyclic dependency.

The participating classes in the cycle are: EthereumUtil & EthereumTransaction

The cyclic dependency was resolved by introducing an interface into the equation. **EthereumUtil** now implements the interface – **EthereumTransactionInterface,** and **EthereumTransaction** is dependent on the interface instead of EthereumUtil.

**Relevant Files & Links:**

|  |  |  |  |
| --- | --- | --- | --- |
| Project | Package | File | Line# |
| hadoopcryptoledger | org.zuinnote.hadoop.ethereum.format.common | EthereumUtil | **48** |
| hadoopcryptoledger | org.zuinnote.hadoop.ethereum.format.common | EthereumTransaction | **59, 79 & 90** |
| hadoopcryptoledger | org.zuinnote.hadoop.ethereum.format.common | EthereumTransactionInterface | **New Interface** |

**Branch:** refactoring\_design\_smells

**OLD Commit#:** 3162dbfb08ca1a80c1079df7f7982e8ef4be2882

**Commit#:** bd7fe898b4d1130eed6f02a58ff720196d2d846a

1. Extract Class

**DesigniteJava Output before Refactoring:**

Text

Description automatically generated

**DesigniteJava Output after Refactoring:**

Text

Description automatically generated

**Description of Change made:**

The tool detected a “Multifaceted abstraction” smell in this class because the cohesion among the methods of this class is low. The Lack of Cohesion among methods (LCOM) of this class is: 0.857. The participating class is EthereumUtilTest.

The smell was resolved by refactoring the class into 3 cohesive classes, namely – EthereumUtilBlockTest, EthereumUtilEncodeTest and EthereumUtilDecodeTest.

EthereumUtilBlockTest contained test methods - checkTestDataBlock1346406Available, calculateChainIdBlock1346406(), getTransActionHashBlock1346406() and getTransActionSendAddressBlock1346406().

EthereumUtilEncodeTest and EthereumUtilDecodeTest now contain Test methods for Encode and Decode methods, respectively.

**Relevant Files & Links:**

|  |  |  |  |
| --- | --- | --- | --- |
| Project | Package | File | Line# |
| hadoopcryptoledger | org.zuinnote.hadoop.ethereum.format.common | EthereumUtilTest | **Class Extracted** |
| hadoopcryptoledger | org.zuinnote.hadoop.ethereum.format.common | EthereumUtilBlockTest | **New Class** |
| hadoopcryptoledger | org.zuinnote.hadoop.ethereum.format.common | EthereumUtilEncodeTest | **New Class** |
| hadoopcryptoledger | org.zuinnote.hadoop.ethereum.format.common | EthereumUtilEncodeTest | **New Class** |

**Branch:** refactoring\_design\_smells

**OLD Commit #:** 0d26ba2626945a50317c6a1d4efdf777605e38e0

**Commit #:** f682830b65bd34f438d48d00dd4a7c507ac4f570

1. Pull-Up Method

**Description of Change made:**

This refactoring technique was employed to remove code duplication in sub-classes.

The participating classes are: **BitcoinBlockFlinkInputFormat**, **BitcoinRawBlockFlinkInputFormat** & **BitcoinTransactionFlinkInputFormat**.

The method which’s duplicated across all these classes is: **reachedEnd()**

The duplication in code was resolved by pulling the method up to the Abstract class – **AbstractBitcoinFlinkInputFormat** which is extended by all 3 of the aforementioned sub-classes.

**Relevant Files & Links:**

|  |  |  |  |
| --- | --- | --- | --- |
| Project | Package | File | Line# |
| hadoopcryptoledger | org.zuinnote.flink.bitcoin | AbstractBitcoinFlinkInputFormat | **102** |
| hadoopcryptoledger | org.zuinnote.flink.bitcoin | BitcoinBlockFlinkInputFormat | **56** |
| hadoopcryptoledger | org.zuinnote.flink.bitcoin | BitcoinRawBlockFlinkInputFormat | **57** |
| hadoopcryptoledger | org.zuinnote.flink.bitcoin | BitcoinTransactionFlinkInputFormat | **61** |

**Branch:** refactoring\_implementation\_smells

**Commit#:** 2da51bffaa6e3b19993f23cf62d26c0f877ff008

URL to GitHub Issue: <https://github.com/ZuInnoTe/hadoopcryptoledger/issues/87>

Pull Request URL: <https://github.com/ZuInnoTe/hadoopcryptoledger/pull/88>

# **Citations**

1. "A Taxonomy of Software Smells", *Tusharma.in*, 2022. [Online]. Available: https://tusharma.in/smells/. [Accessed: 21- Mar- 2022].
2. “Refactoring and Design Patterns,” *refactoring.guru*. [Online]. Available: https://refactoring.guru/. [Accessed: 22-Mar-2022]