

# **Project Catalyst Milestone Report**

Cardano Native Token DEX Price Indexer in Kotlin

Project ID: 1200061

31 Dec 2024

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## Version History

| Document Version | Change                                       |
|------------------|----------------------------------------------|
| 1.0              | Milestone 1 (Proof of Concept) – 16 Sep 2024 |
| 2.0              | Milestone 2 (Initial Release) – 30 Nov 2024  |
| 3.0              | Milestone 3 (Final Release) – 31 Dec 2024    |

# 1. Introduction

## 1.1. Identification

This report contains progressive milestone reporting for the Cardano Native Token (CNT) Decentralised Exchange (DEX) Price Indexer, project (Project ID: 1200061).

## 1.2. Objectives

This report aims to:

- Summarise Objective Quality Evidence (OQE) pertaining to the system's ability to address requirements, organised by agreed milestones.

## 1.3. System Description

Kotlin DEX Price Indexer (<https://github.com/Edgxtech/prise>) is a database indexer which tracks the Cardano blockchain in near real-time, detects any DEX trading events, computes and persists related prices including latest price and historical candles. The system currently uses;

- Bloxbean Yaci JVM based Cardano mini-protocols library
- Cardano Foundation Token Registry for CNT metadata (modular, can be swapped)
- Trades obtained from on-chain Cardano DEX data including Minswap V1/V2, Sundaeswap V1 and Wingriders (modular can be extended)
- Bloxbean YaciStore general purpose indexer, only for txOutput resolution (modular option)
- dcSpark Carp general purpose indexer, only for txOutput resolution (modular option)
- Koios & Blockfrost general data APIs, only for txOutput resolution (modular option)
- Koin dependency injection

## 2. Project Milestones

### Milestone 1 - Proof of Concept progress release, Sep 2024

|                                         |                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Milestone Outputs</b>                | <ul style="list-style-type: none"> <li>Release of a system containing the foundational software architecture and providing the core requirement of generating and persisting price data</li> <li>At least 1x (one) UTXO resolver external interface module</li> <li>At least 1x (one) token metadata external interface module</li> <li>At least 3x (three) DEX classifier(s)</li> </ul>           |
| <b>Acceptance criteria</b>              | <ul style="list-style-type: none"> <li>1.1 Can generate and persist latest price data from at least three (3) DEX's trading activity?</li> <li>1.2 Can generate and persist historical price candles data from at least three (3) DEX's trading activity?</li> </ul>                                                                                                                               |
| <b>Evidence of milestone completion</b> | <ul style="list-style-type: none"> <li>Report section comparing a single DEX's latest prices for a sample of tokens (1.1)</li> <li>Report section comparing a single DEX's historical price candles for a sample of tokens (1.2)</li> </ul>                                                                                                                                                        |
| <b>Method of Evidence Collection</b>    | <ul style="list-style-type: none"> <li>Software Testing (JUnit tests) covering DEX trading computations, price computations, historical candle computations and database interactions. Tests are included in the project software repository on Github under <i>indexer/src/test/kotlin</i>.</li> <li>Manual Accuracy Comparisons of generated data compared to the popular Minswap DEX</li> </ul> |

### Milestone 2 - Initial release, Nov 2024

|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Milestone Outputs</b>                | <ul style="list-style-type: none"> <li>Release of a system containing the foundational software architecture and providing the core requirements of generating and persisting price data and enabling query of data</li> <li>At least 2x (two) UTXO resolver external interface modules</li> <li>At least 1x (one) token metadata external interface module</li> <li>At least 4x (four) DEX classifier(s)</li> </ul> |
| <b>Acceptance criteria</b>              | <ul style="list-style-type: none"> <li>2.1 User can query latest price data?</li> <li>2.2 User can query historical price candles data?</li> </ul>                                                                                                                                                                                                                                                                   |
| <b>Evidence of milestone completion</b> | <ul style="list-style-type: none"> <li>Report section describing test serials and results for querying latest prices (2.1)</li> <li>Report section describing test serials and results for querying historical prices (2.2)</li> </ul>                                                                                                                                                                               |
| <b>Method of Evidence Collection</b>    | <ul style="list-style-type: none"> <li>Software Testing (JUnit tests) covering API request validation and output based on an example dataset. Tests are included in the project software repository on Github under <i>webserver/src/test/kotlin</i>.</li> <li>Manual querying of an example synced dataset using an API testing tool (Postman and/or SwaggerUI)</li> </ul>                                          |

### Milestone 3 - Final Release, Dec 2024

|                            |                                                                                                                                                                                                                                                                                 |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Milestone Outputs</b>   | <ul style="list-style-type: none"> <li>Software capable of suitable performance for the intended operating environment</li> <li>Final close-out report</li> <li>Final closeout video</li> </ul>                                                                                 |
| <b>Acceptance criteria</b> | <ul style="list-style-type: none"> <li>3.1 User can install the software</li> <li>3.2 User can run the software</li> <li>3.3 User can maintain the software</li> <li>Final closeout video is publicly available</li> <li>Final closeout report is publicly available</li> </ul> |

|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Evidence of milestone completion</b> | <ul style="list-style-type: none"> <li>• Report section describing test serials and results for software installation (3.1)</li> <li>• Report section describing test serials and results for operating the software (3.2)</li> <li>• Report section describing test serials and results for maintaining the software (3.3)</li> <li>• Link to final closeout report</li> <li>• Link to final closeout video</li> </ul> |
| <b>Method of Evidence Collection</b>    | <ul style="list-style-type: none"> <li>• Manual installation, running and monitoring of the software using a fresh Linux install</li> </ul>                                                                                                                                                                                                                                                                             |

## 3. Results – Milestone 1

### 3.1. Summary

*Table 1: Summary of Milestone 1 Evidence*

|                     | Artefact                                                                                                                                                                                           | Location of Evidence                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Milestone Outputs   | <ul style="list-style-type: none"> <li>Release of a system containing the foundational software architecture and providing the core requirement of generating and persisting price data</li> </ul> | <ul style="list-style-type: none"> <li><a href="https://github.com/Edgxtech/prise">https://github.com/Edgxtech/prise</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                     | <ul style="list-style-type: none"> <li>At least 1x (one) UTXO resolver external interface module</li> </ul>                                                                                        | <ul style="list-style-type: none"> <li><a href="https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/carp/jdbc/CarpJdbcService.kt">https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/carp/jdbc/CarpJdbcService.kt</a> (implementation of a Carp based UTXO resolver)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                     | <ul style="list-style-type: none"> <li>At least 1x (one) token metadata external interface module</li> </ul>                                                                                       | <ul style="list-style-type: none"> <li><a href="https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/tokenregistry/TokenRegistryService.kt">https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/tokenregistry/TokenRegistryService.kt</a> (implementation of tokens.cardano.org metadata query)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                     | <ul style="list-style-type: none"> <li>At least 3x (three) DEX classifier(s)</li> </ul>                                                                                                            | <ul style="list-style-type: none"> <li><a href="https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/MinswapClassifier.kt">https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/MinswapClassifier.kt</a> -&gt; /* Minswap V1 */ (Minswap V1)</li> <li><a href="https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/MinswapV2Classifier.kt">https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/MinswapV2Classifier.kt</a> -&gt; /* Minswap V2 */ (Minswap V2)</li> <li><a href="https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/SundaeswapClassifier.kt">https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/SundaeswapClassifier.kt</a> (Sundaeswap V1)</li> <li><a href="https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/WingridersClassifier.kt">https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/WingridersClassifier.kt</a> (Wingriders)</li> </ul> |
| Acceptance criteria | <ul style="list-style-type: none"> <li>1.1 Can generate and persist latest price data from at least three (3) DEX's trading activity?</li> </ul>                                                   | <ul style="list-style-type: none"> <li><a href="#">Table 2: Software Verification Test Results</a> <ul style="list-style-type: none"> <li>tech.edgx.prise.indexer.service.classifier.*</li> <li>AssetServiceIT</li> <li>AssetRepositoryIT</li> </ul> </li> <li><a href="#">Table 4: Latest Price Comparison</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

|                                  |                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                               |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  | <ul style="list-style-type: none"> <li>1.2 Can generate and persist historical price candles data from at least three (3) DEX's trading activity?</li> </ul> | <ul style="list-style-type: none"> <li><a href="#">Table 2: Software Verification Test Results</a> <ul style="list-style-type: none"> <li>tech.edgx.prise.indexer.service.classifier.*</li> <li>HistoricalPriceServiceIT</li> <li>HistoricalPriceHelpers</li> </ul> </li> <li><a href="#">Table 3: Historical Price Comparison</a></li> </ul> |
| Evidence of milestone completion | <ul style="list-style-type: none"> <li>Report section comparing a single DEX's latest prices for a sample of tokens</li> </ul>                               | <ul style="list-style-type: none"> <li><a href="#">Latest Price Comparison</a></li> </ul>                                                                                                                                                                                                                                                     |
|                                  | <ul style="list-style-type: none"> <li>Report section comparing a single DEX's historical price candles for a sample of tokens</li> </ul>                    | <ul style="list-style-type: none"> <li><a href="#">Historical Price Comparison</a></li> </ul>                                                                                                                                                                                                                                                 |

## 3.2. Software Verification Testing

### Procedure

Test was conducted with the following test environment, equipment and procedures:

#### (i) Test Environment:

- Installation instructions are contained at: <https://github.com/Edgxtech/prise/blob/main/README.md>
- Test location(s): <https://github.com/Edgxtech/prise/tree/main/indexer/src/test/kotlin/tech/edgx/prise/indexer>
- Note: Tests of type Integration Test (IT) require a `src/test/kotlin/prise.properties` file with the following configs:
  - `cnode.address/cnode.port` – Cardano Node (<https://github.com/IntersectMBO/cardano-node>) pointing to a live synced node
  - either;
    - `yacistore.datasource.*` - YaciStore (<https://github.com/dcSpark/carp>) configs,
    - `carp.datasource.*` - Carp (<https://github.com/dcSpark/carp>) configs,
    - `koios.datasource.*` - Koios (<https://api.koios.rest/>) configs with API Key and URL, and
    - `blockfrost.datasource.*` - Blockfrost (<https://blockfrost.io>) configs with API Key and URL
  - `app.datasource.*` - MySQL configs point to a local database
- Software:
  - Maven is required for project building/testing
  - Java, JRE: 11, JDK: Liberica 11
  - Kotlin: 231-1.9.21-release-633-IJ8109.175

#### (ii) Test Equipment Used:

- MacBook Pro, Processor: Apple M1 Max, Memory: 64 GB Ram

### (iii) Procedures:

```
* Procedure to run a single test:
From project root (prise/indexer), run: mvn test -Dtest="<TestClassName>"
e.g. mvn test -Dtest="WingridersClassifierTest"

* Procedure to run Unit Tests:
From project root (prise/indexer), run: mvn clean test

* Procedure to run Integration Tests:
From project root (prise/indexer), run: mvn clean verify -DskipUnitTests

* Procedure to run all tests:
From project root (prise/indexer), run: mvn clean verify
```

## Results

Software testing results are contained in Table 2

*Table 2: Software Verification Test Results*

## Summary

| Tests | Errors | Failures | Skipped | Success Rate | Time    |
|-------|--------|----------|---------|--------------|---------|
| 107   | 0      | 0        | 0       | 100%         | 84.94 s |

## Package List

| Package                                                      | Tests | Errors | Failures | Skipped | Success Rate | Time    |
|--------------------------------------------------------------|-------|--------|----------|---------|--------------|---------|
| <a href="#">tech.edgx.prise.indexer.util</a>                 | 7     | 0      | 0        | 0       | 100%         | 0.527 s |
| <a href="#">tech.edgx.prise.indexer.service.dataprovider</a> | 2     | 0      | 0        | 0       | 100%         | 6.452 s |
| <a href="#">tech.edgx.prise.indexer.config</a>               | 5     | 0      | 0        | 0       | 100%         | 0.015 s |
| <a href="#">tech.edgx.prise.indexer.service.price</a>        | 24    | 0      | 0        | 0       | 100%         | 9.646 s |

|                                                            |    |   |   |   |      |         |
|------------------------------------------------------------|----|---|---|---|------|---------|
| <a href="#">tech.edgx.prise.indexer.repository</a>         | 4  | 0 | 0 | 0 | 100% | 0.890 s |
| <a href="#">tech.edgx.prise.indexer.service.chaindb</a>    | 12 | 0 | 0 | 0 | 100% | 12.47 s |
| <a href="#">tech.edgx.prise.indexer.service.chain</a>      | 4  | 0 | 0 | 0 | 100% | 14.71 s |
| <a href="#">tech.edgx.prise.indexer.service</a>            | 6  | 0 | 0 | 0 | 100% | 0.240 s |
| <a href="#">tech.edgx.prise.indexer.service.classifier</a> | 43 | 0 | 0 | 0 | 100% | 40.00 s |

## tech.edgx.prise.indexer.util

|        | Class                       | Tests | Errors | Failures | Skipped | Success Rate | Time    |
|--------|-----------------------------|-------|--------|----------|---------|--------------|---------|
| passed | <a href="#">HelpersTest</a> | 7     | 0      | 0        | 0       | 100%         | 0.527 s |

## tech.edgx.prise.indexer.service.dataprovider

|        | Class                                  | Tests | Errors | Failures | Skipped | Success Rate | Time    |
|--------|----------------------------------------|-------|--------|----------|---------|--------------|---------|
| passed | <a href="#">TokenRegistryServiceIT</a> | 2     | 0      | 0        | 0       | 100%         | 6.452 s |

## tech.edgx.prise.indexer.config

|        | Class                      | Tests | Errors | Failures | Skipped | Success Rate | Time    |
|--------|----------------------------|-------|--------|----------|---------|--------------|---------|
| passed | <a href="#">ConfigTest</a> | 5     | 0      | 0        | 0       | 100%         | 0.015 s |

## tech.edgx.prise.indexer.service.price

|        | Class                                      | Tests | Errors | Failures | Skipped | Success Rate | Time    |
|--------|--------------------------------------------|-------|--------|----------|---------|--------------|---------|
| passed | <a href="#">HistoricalPriceHelpersTest</a> | 20    | 0      | 0        | 0       | 100%         | 6.595 s |
| passed | <a href="#">HistoricalPriceServiceIT</a>   | 4     | 0      | 0        | 0       | 100%         | 3.051 s |

## tech.edgx.prise.indexer.repository

|        | Class                             | Tests | Errors | Failures | Skipped | Success Rate | Time    |
|--------|-----------------------------------|-------|--------|----------|---------|--------------|---------|
| passed | <a href="#">AssetRepositoryIT</a> | 4     | 0      | 0        | 0       | 100%         | 0.890 s |

## tech.edgx.prise.indexer.service.chaindb

|        | Class                               | Tests | Errors | Failures | Skipped | Success Rate | Time    |
|--------|-------------------------------------|-------|--------|----------|---------|--------------|---------|
| passed | <a href="#">KoiosServiceIT</a>      | 4     | 0      | 0        | 0       | 100%         | 5.527 s |
| passed | <a href="#">BlockfrostServiceIT</a> | 4     | 0      | 0        | 0       | 100%         | 3.069 s |
| passed | <a href="#">YaciStoreServiceIT</a>  | 4     | 0      | 0        | 0       | 100%         | 3.871 s |

## tech.edgx.prise.indexer.service.chain

|        | Class                          | Tests | Errors | Failures | Skipped | Success Rate | Time    |
|--------|--------------------------------|-------|--------|----------|---------|--------------|---------|
| passed | <a href="#">ChainServiceIT</a> | 4     | 0      | 0        | 0       | 100%         | 14.71 s |

## tech.edgx.prise.indexer.service

|        | Class                           | Tests | Errors | Failures | Skipped | Success Rate | Time    |
|--------|---------------------------------|-------|--------|----------|---------|--------------|---------|
| passed | <a href="#">CandleServiceIT</a> | 4     | 0      | 0        | 0       | 100%         | 0.167 s |
| passed | <a href="#">AssetServiceIT</a>  | 2     | 0      | 0        | 0       | 100%         | 0.073 s |

## tech.edgx.prise.indexer.service.classifier

|        | Class                                    | Tests | Errors | Failures | Skipped | Success Rate | Time    |
|--------|------------------------------------------|-------|--------|----------|---------|--------------|---------|
| passed | <a href="#">WingridersClassifierTest</a> | 2     | 0      | 0        | 0       | 100%         | 0.184 s |
| passed | <a href="#">SundaeswapClassifierTest</a> | 2     | 0      | 0        | 0       | 100%         | 0.054 s |
| passed | <a href="#">MinswapClassifierTest</a>    | 5     | 0      | 0        | 0       | 100%         | 0.029 s |
| passed | <a href="#">MinswapV2ClassifierTest</a>  | 13    | 0      | 0        | 0       | 100%         | 0.791 s |
| passed | <a href="#">ClassifierHelpersTest</a>    | 1     | 0      | 0        | 0       | 100%         | 0.001 s |
| passed | <a href="#">MinswapV2ClassifierIT</a>    | 5     | 0      | 0        | 0       | 100%         | 17.67 s |
| passed | <a href="#">MinswapClassifierIT</a>      | 5     | 0      | 0        | 0       | 100%         | 7.458 s |
| passed | <a href="#">SundaeswapClassifierIT</a>   | 5     | 0      | 0        | 0       | 100%         | 6.779 s |
| passed | <a href="#">WingridersClassifierIT</a>   | 5     | 0      | 0        | 0       | 100%         | 7.030 s |

## Test Cases

### WingridersClassifierTest

|        |                                         |         |
|--------|-----------------------------------------|---------|
| passed | computeSwap_DuelSwapSingleTransaction   | 0.171 s |
| passed | computeSwap_SingleSwapSingleTransaction | 0.012 s |

### SundaeswapClassifierTest

|        |                                         |         |
|--------|-----------------------------------------|---------|
| passed | computeSwap_TripleSwapSingleTransaction | 0.045 s |
|--------|-----------------------------------------|---------|

|        |                                         |         |
|--------|-----------------------------------------|---------|
| passed | computeSwap_SingleSwapSingleTransaction | 0.008 s |
|--------|-----------------------------------------|---------|

## ConfigTest

|        |                      |         |
|--------|----------------------|---------|
| passed | validateProperties_1 | 0.004 s |
| passed | validateProperties_2 | 0.001 s |
| passed | validateProperties_3 | 0.002 s |
| passed | validateProperties_4 | 0.001 s |
| passed | validateProperties_5 | 0.005 s |

## MinswapClassifierTest

|        |                                            |         |
|--------|--------------------------------------------|---------|
| passed | computeSwap_NilSwap_3                      | 0.003 s |
| passed | computeSwaps_SingleSwapSingleTransaction_5 | 0.005 s |
| passed | computeSwap_SingleSwapSingleTransaction_1  | 0.003 s |
| passed | computeSwap_SingleSwapSingleTransaction_2  | 0.007 s |
| passed | computeSwap_SingleSwapSingleTransaction_4  | 0.010 s |

## HistoricalPriceHelpersTest

|        |                                                                |         |
|--------|----------------------------------------------------------------|---------|
| passed | determineTriggers_FinaliseOnly                                 | 0.012 s |
| passed | makeKnownDailyCandle                                           | 0.210 s |
| passed | makeKnownWeeklyCandle                                          | 0.011 s |
| passed | determineClosePrice_NoSlotDuplicates                           | 0.055 s |
| passed | determineOpenPrice                                             | 0.662 s |
| passed | determineTriggers_None                                         | 0.001 s |
| passed | determineTriggers_Update                                       | 0.001 s |
| passed | filterOutliers_GrubsTest                                       | 5.266 s |
| passed | filterOutliers_ExponentialMovingAverageTest_PrimitiveDT        | 0.008 s |
| passed | makeSuperCandles_HourlyFromFifteen                             | 0.001 s |
| passed | makeKnownFifteenCandle                                         | 0.005 s |
| passed | determineTriggers_FinaliseAndInitialise_NewSwapsAcrossBoundary | 0 s     |
| passed | makeKnownHourlyCandleFromSubCandles                            | 0.005 s |
| passed | determineTriggers_FinaliseAndInitialiseNext                    | 0 s     |

|        |                                             |         |
|--------|---------------------------------------------|---------|
| passed | determineClosePrice_WithSlotDuplicates      | 0.067 s |
| passed | filterOutliers_ExponentialMovingAverageTest | 0.003 s |
| passed | filterOutliersGrubbsTest                    | 0.001 s |
| passed | transformTradesToPrices                     | 0.001 s |
| passed | makeRandomCandles                           | 0.125 s |
| passed | makeKnownHourlyCandle                       | 0.003 s |

## MinswapV2ClassifierTest

|        |                                                             |         |
|--------|-------------------------------------------------------------|---------|
| passed | computeSwaps_ZapIn                                          | 0.018 s |
| passed | computeSwap_SingleTransaction_SingleSwap_1                  | 0.007 s |
| passed | computeSwap_SingleTransaction_SingleSwap_2                  | 0.006 s |
| passed | computeSwap_SingleTransaction_SingleSwap_3                  | 0.009 s |
| passed | computeSwap_SingleTransaction_SingleSwap_4                  | 0.005 s |
| passed | computeSwaps_QtyTransaction_QtySwaps_1                      | 0.094 s |
| passed | computeSwaps_QtyTransaction_QtySwaps_2                      | 0.398 s |
| passed | computeSwaps_QtyTransaction_QtySwaps_3                      | 0.222 s |
| passed | computeSwap_SingleTransaction_SingleSwap_Type3_SwapExactOut | 0.010 s |
| passed | computeSwap_ZapIn_2                                         | 0.003 s |
| passed | computeSwap_ZapIn_3                                         | 0.003 s |
| passed | computeSwap_ZapIn_4                                         | 0.003 s |
| passed | computeSwaps_SingleTransaction_QtySwaps_Type3_SwapExactOut  | 0.009 s |

## ClassifierHelpersTest

|        |               |         |
|--------|---------------|---------|
| passed | getPlutusData | 0.001 s |
|--------|---------------|---------|

## HelpersTest

|        |                            |         |
|--------|----------------------------|---------|
| passed | convertAddressToCredential | 0.507 s |
| passed | getDexName                 | 0.002 s |
| passed | calculatePriceInOtherAsset | 0 s     |
| passed | regexMatchBlockfrostApiKey | 0 s     |
| passed | findEarliestDate           | 0.001 s |

|        |                  |     |
|--------|------------------|-----|
| passed | regexMatchPolicy | 0 s |
| passed | decodeHexString  | 0 s |

## MinswapV2ClassifierIT

|        |                                              |         |
|--------|----------------------------------------------|---------|
| passed | computeSwaps_SingleTransaction_QtySwaps      | 2.437 s |
| passed | computeSwaps_QtyTransaction_QtySwaps_2       | 10.48 s |
| passed | computeSwaps_SingleTransaction_SingleSwap_1  | 0.862 s |
| passed | computeSwaps_SingleTransaction_SingleSwap_2  | 1.043 s |
| passed | computeSwaps_SingleTransaction_Type4_Deposit | 2.819 s |

## TokenRegistryServiceIT

|        |                          |         |
|--------|--------------------------|---------|
| passed | bulkGetDecimalsAllTokens | 5.182 s |
| passed | bulkGetDecimals          | 1.238 s |

## MinswapClassifierIT

|        |                                  |         |
|--------|----------------------------------|---------|
| passed | computeSwaps_SingleTransaction_1 | 1.250 s |
| passed | computeSwaps_SingleTransaction_2 | 1.684 s |
| passed | computeSwaps_SingleTransaction_3 | 1.678 s |
| passed | computeSwaps_SingleTransaction_4 | 1.362 s |
| passed | computeSwaps_SingleTransaction_5 | 1.459 s |

## CandleServiceIT

|        |                        |         |
|--------|------------------------|---------|
| passed | crudTest               | 0.060 s |
| passed | checkAndMakeIndexes    | 0.006 s |
| passed | getCandlesBetweenTimes | 0.031 s |
| passed | clearAllCandles        | 0.036 s |

## CarpJdbcServiceIT

|        |                                |         |
|--------|--------------------------------|---------|
| passed | getInputUtxos_2                | 0.329 s |
| passed | getBlockNearestToSlot          | 1.108 s |
| passed | getBlockNearestToSlot_Specific | 1.446 s |
| passed | getInputUtxos                  | 0.639 s |

## HistoricalPriceServiceIT

|        |                                                            |         |
|--------|------------------------------------------------------------|---------|
| passed | makeCandlesFromSwaps_10tx                                  | 0.081 s |
| passed | testMakeKnownFifteenCandle                                 | 0.028 s |
| passed | batchProcessHistoricalPrices_TriggersFinaliseAndInitialise | 2.825 s |
| passed | batchProcessHistoricalPrices_TriggerUpdate                 | 0.086 s |

## AssetServiceIT

|        |                    |         |
|--------|--------------------|---------|
| passed | crudTest           | 0.042 s |
| passed | isDatabaseUptoDate | 0.006 s |

## SundaeswapClassifierIT

|        |                                           |         |
|--------|-------------------------------------------|---------|
| passed | computeSwaps_SingleTransaction_1_Reactive | 1.360 s |
| passed | computeSwaps_SingleTransaction_1          | 1.366 s |
| passed | computeSwaps_SingleTransaction_2          | 1.025 s |
| passed | computeSwaps_SingleTransaction_3          | 1.372 s |
| passed | computeSwaps_SingleTransaction_4          | 1.622 s |

## KoiosServiceIT

|        |                       |         |
|--------|-----------------------|---------|
| passed | getInputUtxos_2       | 1.217 s |
| passed | getInputUtxos_3       | 0.659 s |
| passed | getBlockNearestToSlot | 3.260 s |
| passed | getInputUtxos         | 0.361 s |

## WingridersClassifierIT

|        |                                  |         |
|--------|----------------------------------|---------|
| passed | computeSwaps_SingleTransaction_1 | 1.246 s |
| passed | computeSwaps_SingleTransaction_2 | 1.885 s |
| passed | computeSwaps_SingleTransaction_3 | 1.360 s |
| passed | computeSwaps_SingleTransaction_4 | 1.244 s |
| passed | computeSwaps_SingleTransaction_5 | 1.263 s |

## AssetRepositoryIT

|        |                            |         |
|--------|----------------------------|---------|
| passed | batchUpdateMissingOriginal | 0.350 s |
| passed | batchUpdateSomeOnly        | 0.021 s |
| passed | batchInsert                | 0.016 s |
| passed | batchUpdate                | 0.022 s |

## ChainServiceIT

|        |                                  |         |
|--------|----------------------------------|---------|
| passed | autoSelectPoint_ProvidedInConfig | 3.091 s |
| passed | autoSelectPoint_NoPriorCandles   | 6.411 s |
| passed | qualifyTransactions              | 2.000 s |
| passed | autoSelectPoint_PriorCandles_1   | 3.160 s |

## BlockfrostServiceIT

|        |                       |         |
|--------|-----------------------|---------|
| passed | getInputUtxos_2       | 0.628 s |
| passed | getInputUtxos_3       | 0.381 s |
| passed | getBlockNearestToSlot | 0.819 s |
| passed | getInputUtxos         | 1.216 s |

## YaciStoreServiceIT

|        |                       |         |
|--------|-----------------------|---------|
| passed | getInputUtxos_2       | 0.222 s |
| passed | getInputUtxos_3       | 0.117 s |
| passed | getBlockNearestToSlot | 3.389 s |
| passed | getInputUtxos         | 0.115 s |

### 3.3. Accuracy Validation

#### Procedure

Test was conducted with the following test environment, equipment and procedures:

#### (i) Test Environment:

- Software:
  - 'Prise' version: commit 5a9414809cd8f9c2d6e9f68752cb3315b9dd1379
    - Synced to local DB for ~1week of blockchain time, from 01 Aug 24 0000 UTC (start.point.time=1722470400)
    - Configured with 4x DEX Classifiers; Sundaeswap V1, Wingriders V1, Minswap V1, Minswap V2
  - Custom Flutter charting application using lightweight Trading View charts for demonstrating historical data

#### (ii) Procedures:

```
* For a sample of Cardano Native Tokens (CNT):

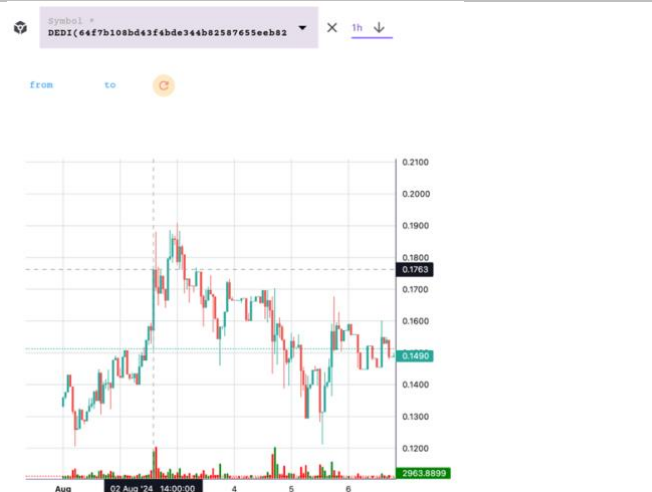
- chart historical data, screenshot the charts focussing on daily, hourly and 15min charts
- screenshot the same time range from Minswap (well-known DEX) charts
- visually compare historical charts, expecting the 'big hands' view to be correct; price/volume magnitudes and shape.
- retrieve latest prices from a backend database query of the 'asset' table for a given token, compare against Minswap V1/V2 trade at the same time
```

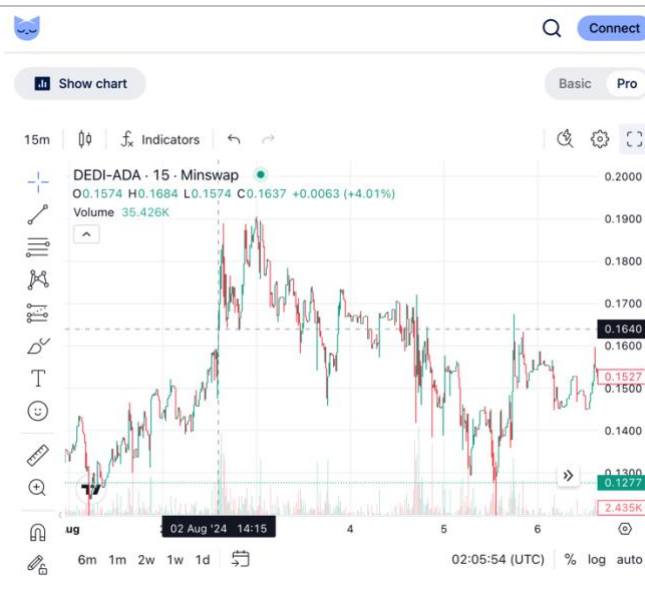
## Historical Price Comparison

### Considerations and Exceptions:

- Expect the magnitudes to be equivalent, not necessarily perfect number matching since:
  - 'Prise' is using data from multiple DEX's
  - Minswap are counting additional 'Zaps' and other non-SWAP\_EXACT\_IN type activities trade data (which only make up a small % of activity)
  - It is unknown what specific outlier filtering (if any) is being used in the comparison data
- At this milestone, only a ~1 week slice of data is compared for validation since it takes time to sync data, hence the focus of validation is on historical data for that slice of time

Table 3: Historical Price Comparison

| Prise Chart                                                                        | MinswapV2 Chart                                                                     | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TOKEN: DEDI (64f7b108bd43f4bde344b82587655eeb821256c0c8e79ad48db15d1844454449)     |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|  |  | <p><b>Candle Resolution:</b> 1 hour</p> <p><b>Pointer location:</b> 02 Aug 24 1400 UTC (1722607200)</p> <p><b>Volume (not shown at pointer):</b><br/>       Prise: 120.878k**<br/>       Minswap: 125.534k<br/>       Ok</p> <p>* Difference due to a small number of atypical swaps not yet being classified, e.g. SWAP_EXACT_OUT type.</p> <p>** Minswap V2 ZapIn (DEPOSIT) type swaps were added for Milestone 2 accounting for difference to Milestone 1 reporting</p> <p><b>Shape:</b> Ok</p> <p><b>Time alignment:</b> Ok</p> <p><b>Price Magnitude:</b> Ok (0.19 ADA)</p> |



**Candle Resolution:** 15 Minutes

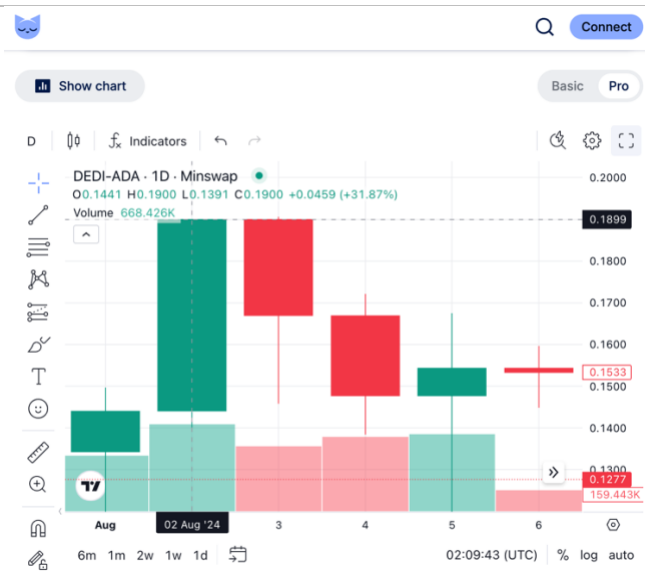
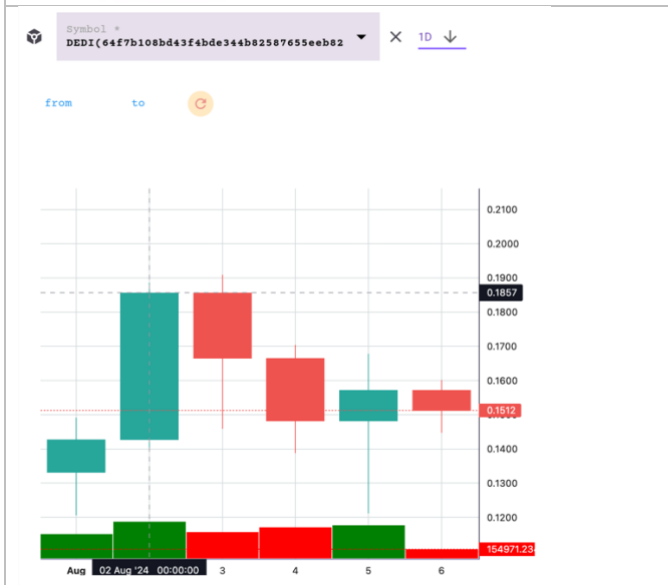
**Pointer location:** 02 Aug 24 1415 UTC  
(1722608100)

**Volume (not shown at pointer):**  
Prise: 35.4257k  
Minswap: 35.426k  
Ok

**Shape:** Ok

**Time alignment:** Ok

**Price Magnitude:** Ok (0.19 ADA)



**Candle Resolution:** 1 Day

**Pointer location:** 02 Aug 24 0000 UTC  
(1722556800)

**Volume (not shown at pointer):**  
Prise: 649.386k  
Minswap: 668.426k  
Ok  
*\*\* Difference due to a small number of atypical swaps not yet being classified, e.g. SWAP\_EXACT\_OUT type. Since Milestone 1, MinswapV2 ZapIn (DEPOSIT) type swaps have been added*

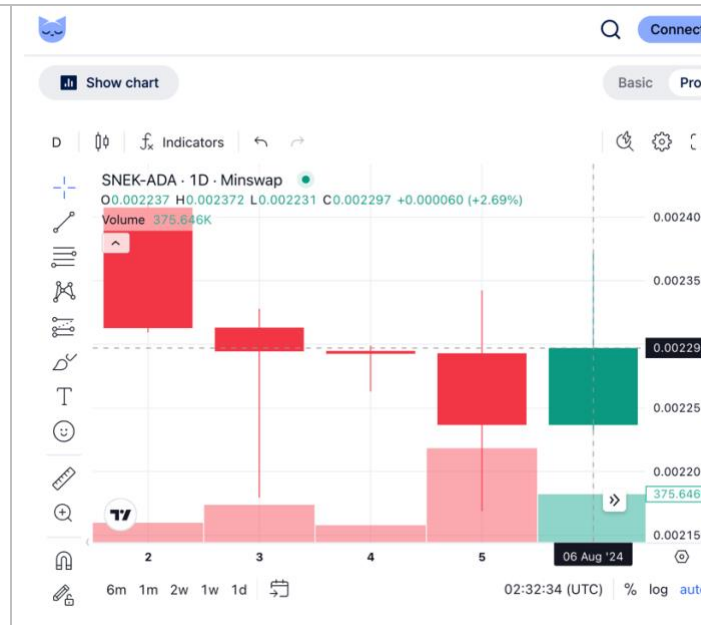
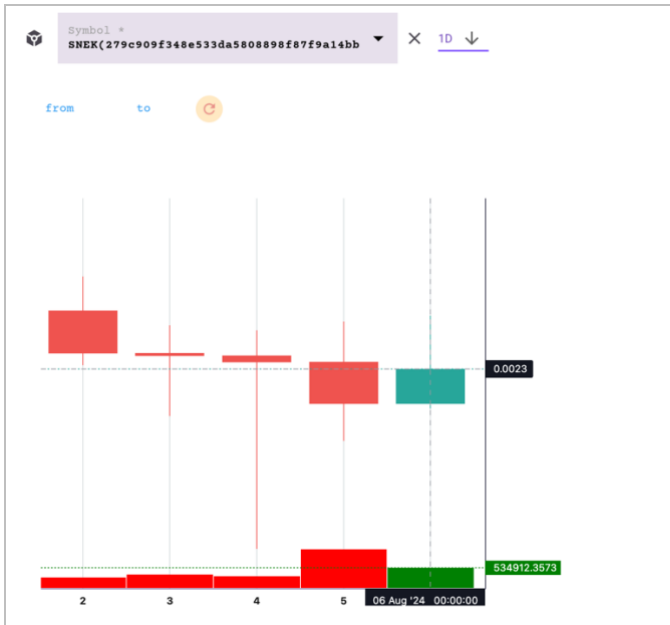
**Shape:** Ok

**Time alignment:** Ok

**Price Magnitude:** Ok (~0.19 ADA)

TOKEN: SNEK (279c909f348e533da5808898f87f9a14bb2c3dfbbacccd631d927a3f534e454b)

|                                                                                    |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   |   | <p><b>Candle Resolution:</b> 1 hour</p> <p><b>Pointer location:</b> 05 Aug 24 0600 UTC (1722837600)</p> <p><b>Volume (not shown at pointer):</b><br/>         Prise: 283.329k<br/>         Minswap: 201.962k<br/>         Ok<br/>         ** Difference due to SNEK trading on multiple DEXs and significant volume on other DEXs for this candle period.</p> <p><b>Shape:</b> Ok</p> <p><b>Time alignment:</b> Ok</p> <p><b>Price Magnitude:</b> Ok (~0.002 ADA)</p> <p><b>Comment:</b> Prise data appears choppy since SNEK is traded on more DEXs and there is more discrepancy between DEXs, as opposed to previous example (DEDI) which is mostly traded on MinswapV2 during this period</p>    |
|  |  | <p><b>Candle Resolution:</b> 15 minutes</p> <p><b>Pointer location:</b> 06 Aug 24 0345 UTC (1722915900)</p> <p><b>Volume (not shown at pointer):</b><br/>         Prise: 103.905k<br/>         Minswap: 80.704k<br/>         Ok<br/>         ** Difference due to SNEK trading on multiple DEXs and significant volume on other DEXs for this candle period.</p> <p><b>Shape:</b> Ok</p> <p><b>Time alignment:</b> Ok</p> <p><b>Price Magnitude:</b> Ok (~0.002 ADA)</p> <p><b>Comment:</b> Prise data appears choppy since SNEK is traded on more DEXs and there is more discrepancy between DEXs, as opposed to previous example (DEDI) which is mostly traded on MinswapV2 during this period</p> |



**Candle Resolution:** 1 Day

**Pointer location:** 06 Aug 24 0000 UTC  
 (1722902400)

**Volume (not shown at pointer):**  
 Prise: 537.769k  
 Minswap: 375.646k  
 Ok  
 \*\* Difference due to SNEK trading on multiple DEXs  
 and significant volume on other DEXs for this candle  
 period.

**Shape:** Ok

**Time alignment:** Ok

**Price Magnitude:** Ok (~0.002 ADA)

## Latest Price Comparison

### Considerations and Exceptions:

- The indexer was stopped at an arbitrary point ~1 week in blockchain time from 01 Aug 24, which is reflected in the date this comparison is made
- Comparing at an arbitrary point in time is merely to avoid needing to synch the entire blockchain history for this testing
- The primary comparison DEX is Minswap v1/v2 since the data is available publicly using date/time filters
- The comparison price was taken from the DEX web application trading history page, e.g.  
<https://minswap.org/swap?cA=da8c30857834c6ae7203935b89278c532b3995245295456f993e1d24&tA=4c51&cB=&tB=>

### Overview of Results:

- For the indexer processing during the timeframe 01 Aug - ~07 Aug 24:
  - Total entries persisted in database: 661
  - Unique DEX's: 4x DEX smart contracts
- A comparison of prices at the point the indexer was stopped, for a sample of tokens is provide in Table 4.

Table 4: Latest Price Comparison

| Token   | Policy                | Price [ADA] | DEX        | Last Update [UTC+8] | Comparison                          | Result          |
|---------|-----------------------|-------------|------------|---------------------|-------------------------------------|-----------------|
| CHARLI3 | 8e5139890...b9490e15a | 0.22241981  | minswap    | 7/8/2024 4:11       | 0.222 @ 0411<br><a href="#">Tx</a>  | Ok (exact)      |
| CHARLI3 | 8e5139890...b9490e15a | 0.22179735  | sundaeswap | 6/8/2024 15:10      | -                                   | Ok (equivalent) |
| CHARLI3 | 8e5139890...b9490e15a | 0.22753845  | wingriders | 7/8/2024 5:38       | -                                   | Ok (equivalent) |
| DEDI    | 64f7b108b...48db15d18 | 0.15565952  | minswapv2  | 7/8/2024 7:42       | 0.155 @ 0742<br><a href="#">Tx</a>  | Ok (exact)      |
| HOSKY   | a0028f350...7d481c235 | 2.57E-08    | minswap    | 7/8/2024 7:00       | 0.07257 @ 0700                      | Ok (exact)      |
| HOSKY   | a0028f350...7d481c235 | 2.56E-08    | minswapv2  | 7/8/2024 7:23       | 0.07256 @ 0723                      | Ok (exact)      |
| HOSKY   | a0028f350...7d481c235 | 2.57E-08    | sundaeswap | 5/8/2024 23:10      | -                                   | Ok (equivalent) |
| HOSKY   | a0028f350...7d481c235 | 2.6834E-08  | wingriders | 7/8/2024 4:56       | -                                   | Ok (equivalent) |
| LQ      | da8c30857...f993e1d24 | 2.1393E-06  | minswap    | 6/8/2024 23:08      | 2.139 @ 06Aug 2308                  | Ok (exact)      |
| LQ      | da8c30857...f993e1d24 | 2.10727201  | minswapv2  | 7/8/2024 6:18       | 2.107 @ 0618                        | Ok (exact)      |
| LQ      | da8c30857...f993e1d24 | 2.09253137  | sundaeswap | 7/8/2024 0:58       | -                                   | Ok (equivalent) |
| LQ      | da8c30857...f993e1d24 | 2.13325889  | wingriders | 7/8/2024 6:44       | -                                   | Ok (equivalent) |
| MIN     | 29d222ce7...d267170c6 | 0.04265584  | minswap    | 7/8/2024 6:15       | 0.0426 @ 0615<br><a href="#">Tx</a> | Ok (exact)      |

|                  |                       |            |            |                |                                           |                 |
|------------------|-----------------------|------------|------------|----------------|-------------------------------------------|-----------------|
| MIN              | 29d222ce7...d267170c6 | 0.04240157 | minswapv2  | 7/8/2024 7:04  | 0.0424 @ 0704                             | Ok (exact)      |
| MIN              | 29d222ce7...d267170c6 | 0.05022207 | sundaeswap | 7/8/2024 4:07  | -                                         | Ok (equivalent) |
| MIN              | 29d222ce7...d267170c6 | 0.04505389 | wingriders | 7/8/2024 1:38  | -                                         | Ok (equivalent) |
| orcfxtoken       | a3931691f...32a6c1e51 | 0.02571787 | minswap    | 4/8/2024 8:37  | 0.0257 @ 04Aug 0837<br><a href="#">Tx</a> | Ok (exact)      |
| orcfxtoken       | a3931691f...32a6c1e51 | 0.02567866 | minswapv2  | 7/8/2024 3:58  | 0.0256 @ 07Aug 0358                       | Ok (exact)      |
| orcfxtoken       | a3931691f...32a6c1e51 | 0.0261956  | sundaeswap | 5/8/2024 9:34  | -                                         | Ok (equivalent) |
| orcfxtoken       | a3931691f...32a6c1e51 | 0.02574555 | wingriders | 6/8/2024 23:08 | -                                         | Ok (equivalent) |
| PAVIA            | 884892bcd...0e7a903ae | 0.00289664 | minswap    | 7/8/2024 7:42  | 0.00289 @ 0742                            | Ok (exact)      |
| PAVIA            | 884892bcd...0e7a903ae | 0.0029369  | minswapv2  | 7/8/2024 7:02  | 0.00293 @ 0702<br><a href="#">Tx</a>      | Ok (exact)      |
| PAVIA            | 884892bcd...0e7a903ae | 0.00295873 | sundaeswap | 7/8/2024 6:31  | -                                         | Ok (equivalent) |
| PAVIA            | 884892bcd...0e7a903ae | 0.00292703 | wingriders | 7/8/2024 7:37  | -                                         | Ok (equivalent) |
| REVV             | 94cbb4fcb...c4c135864 | 0.03326211 | minswap    | 6/8/2024 2:08  | 0.0332 @ 0208<br><a href="#">Tx</a>       | Ok (exact)      |
| REVV             | 94cbb4fcb...c4c135864 | 0.03679635 | sundaeswap | 6/8/2024 9:32  | -                                         | Ok (equivalent) |
| REVV             | 94cbb4fcb...c4c135864 | 0.03736526 | wingriders | 6/8/2024 5:09  | 0.03671652 @ 0509<br><a href="#">Tx</a>   | Ok (equivalent) |
| ShenMicroUSD     | 8db269c3e...879a1cd61 | 1.02518536 | minswap    | 7/8/2024 3:16  | 1.0251 @ 0316<br><a href="#">Tx</a>       | Ok (exact)      |
| ShenMicroUSD     | 8db269c3e...879a1cd61 | 1.02483286 | minswapv2  | 7/8/2024 6:44  | 1.0248 @ 0644                             | Ok (exact)      |
| ShenMicroUSD     | 8db269c3e...879a1cd61 | 1.11243162 | sundaeswap | 1/8/2024 22:40 | -                                         | Ok (equivalent) |
| ShenMicroUSD     | 8db269c3e...879a1cd61 | 1.02686275 | wingriders | 7/8/2024 3:16  | -                                         | Ok (equivalent) |
| SUNDAE           | 9a9693a9a...4aa144d77 | 0.01584183 | minswap    | 6/8/2024 22:42 | 0.0158 @ 2242<br><a href="#">Tx</a>       | Ok (exact)      |
| SUNDAE           | 9a9693a9a...4aa144d77 | 0.01644704 | sundaeswap | 7/8/2024 0:06  | -                                         | Ok (equivalent) |
| SUNDAE           | 9a9693a9a...4aa144d77 | 0.01669488 | wingriders | 6/8/2024 13:34 | 0.01647 @ 1204<br><a href="#">Tx</a>      | Ok (equivalent) |
| worldmobiletoken | 1d7f33bd2...2a0f34e1e | 0.54209603 | minswap    | 7/8/2024 6:07  | 0.542 @ 0607<br><a href="#">Tx</a>        | Ok (exact)      |
| worldmobiletoken | 1d7f33bd2...2a0f34e1e | 0.5413276  | minswapv2  | 7/8/2024 7:13  | 0.541 @ 0713<br><a href="#">Tx</a>        | Ok (exact)      |

|                  |                       |            |            |               |   |                 |
|------------------|-----------------------|------------|------------|---------------|---|-----------------|
| worldmobiletoken | 1d7f33bd2...2a0f34e1e | 0.54099246 | sundaeswap | 7/8/2024 7:24 | - | Ok (equivalent) |
| worldmobiletoken | 1d7f33bd2...2a0f34e1e | 0.54199875 | wingriders | 7/8/2024 6:41 | - | Ok (equivalent) |

### 3.4. Discussion

The software meets the requirements for Milestone 1 – Proof of Concept progress release. The software can effectively generate and persist latest price and historical candle data for a range of Decentralised Exchanges (DEX). The accuracy of generated data matches other publicly available trading data.

## 4. Results – Milestone 2

Milestone 2 is primarily about adding and validating the API / query interface; however, various enhancements and expansions were also made, namely:

- Additional 'spent' UTXO resolver module(s) based on Blockfrost & YaciStore were added
- Classification of MinswapV2 ZapIn transactions was added, to account for missing volume witnessed at milestone 1 (results have been updated in Table 3)

### 4.1. Summary

*Table 5: Summary of Milestone 2 Evidence*

|                   | Artefact                                                                                                                                                                                                                         | Location of Evidence                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Milestone Outputs | <ul style="list-style-type: none"> <li>• Release of a system containing the foundational software architecture and providing the core requirements of generating and persisting price data and enabling query of data</li> </ul> | <ul style="list-style-type: none"> <li>• <a href="https://github.com/Edgxtech/prise">https://github.com/Edgxtech/prise</a> <ul style="list-style-type: none"> <li>• Indexer: <a href="https://github.com/Edgxtech/prise/tree/main/indexer">https://github.com/Edgxtech/prise/tree/main/indexer</a></li> <li>• API Webserver: <a href="https://github.com/Edgxtech/prise/tree/main/webserver">https://github.com/Edgxtech/prise/tree/main/webserver</a></li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                   | <ul style="list-style-type: none"> <li>• At least 2x (two) UTXO resolver external interface module</li> </ul>                                                                                                                    | <ul style="list-style-type: none"> <li>• <a href="https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/yacistor/YaciStoreService.kt">https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/yacistor/YaciStoreService.kt</a> (implementation based on Yaci Store general purpose indexer)</li> <li>• <a href="https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/carp/jdbc/CarpJdbcService.kt">https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/carp/jdbc/CarpJdbcService.kt</a> (implementation based on Carp general purpose indexer)</li> <li>• <a href="https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/blockfrost/BlockfrostService.kt">https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/blockfrost/BlockfrostService.kt</a> (implementation based on Blockfrost API)</li> <li>• <a href="https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/koios/KoiosService.kt">https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/koios/KoiosService.kt</a> (implementation based on Koios API)</li> </ul> |
|                   | <ul style="list-style-type: none"> <li>• At least 1x (one) token metadata external interface module</li> </ul>                                                                                                                   | <ul style="list-style-type: none"> <li>• <a href="https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/tokenregistry/TokenRegistryService.kt">https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/tokenregistry/TokenRegistryService.kt</a> (implementation of tokens.cardano.org metadata query)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

|                                  |                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  | <ul style="list-style-type: none"> <li>At least 4x (four) DEX classifier(s)</li> </ul>                                                    | <ul style="list-style-type: none"> <li><a href="https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/MinswapClassifier.kt">https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/MinswapClassifier.kt</a> -&gt; (Minswap V1)</li> <li><a href="https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/MinswapV2Classifier.kt">https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/MinswapV2Classifier.kt</a> -&gt; (Minswap V2)</li> <li><a href="https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/SundaeswapClassifier.kt">https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/SundaeswapClassifier.kt</a> (Sundaeswap V1)</li> <li><a href="https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/WingridersClassifier.kt">https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/WingridersClassifier.kt</a> (Wingriders)</li> </ul> |
| Acceptance criteria              | <ul style="list-style-type: none"> <li>2.1 User can query latest price data?</li> </ul>                                                   | <ul style="list-style-type: none"> <li><a href="#">Table 6: API Software Verification Tests</a> <ul style="list-style-type: none"> <li>ApiControllerIT</li> </ul> </li> <li><a href="#">Section 4.3 API Query Validation</a> <ul style="list-style-type: none"> <li>Query Latest Prices</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                  | <ul style="list-style-type: none"> <li>2.2 User can query historical price candles data?</li> </ul>                                       | <ul style="list-style-type: none"> <li><a href="#">Table 6: API Software Verification Tests</a> <ul style="list-style-type: none"> <li>ApiControllerIT</li> </ul> </li> <li><a href="#">Section 4.3 API Query Validation</a> <ul style="list-style-type: none"> <li>Query Historical Prices</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Evidence of milestone completion | <ul style="list-style-type: none"> <li>Report section describing test serials and results for querying latest prices (2.1)</li> </ul>     | <ul style="list-style-type: none"> <li><a href="#">Section 4.2 API Software Verification Testing</a></li> <li><a href="#">Section 4.3 API Query Validation</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                  | <ul style="list-style-type: none"> <li>Report section describing test serials and results for querying historical prices (2.2)</li> </ul> | <ul style="list-style-type: none"> <li><a href="#">Section 4.2 API Software Verification Testing</a></li> <li><a href="#">Section 4.3 API Query Validation</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

## 4.2. API Software Verification Testing

### Procedure

Test was conducted with the following test environment, equipment and procedures:

#### (i) Test Environment and Equipment:

*\*\* No change from Section 3.2 \*\**

## (ii) Procedures:

Enter /webserver working directory

\* Procedure to run Unit Tests:

From project root (prise/webserver), run: mvn clean test

\* Procedure to run Integration Tests:

From project root (prise/webserver), run: mvn clean verify -DskipUnitTests

\* Procedure to run all tests:

From project root (prise/webserver), run: mvn clean verify

## Results

Software testing results are contained in Table 6.

Table 6: API Verification Test Results

## Summary

| Tests | Errors | Failures | Skipped | Success Rate | Time    |
|-------|--------|----------|---------|--------------|---------|
| 34    | 0      | 0        | 0       | 100%         | 0.776 s |

## Package List

| Package                                              | Tests | Errors | Failures | Skipped | Success Rate | Time    |
|------------------------------------------------------|-------|--------|----------|---------|--------------|---------|
| <a href="#">tech.edgx.prise.webserver.validator</a>  | 15    | 0      | 0        | 0       | 100%         | 0.101 s |
| <a href="#">tech.edgx.prise.webserver.controller</a> | 18    | 0      | 0        | 0       | 100%         | 0.675 s |
| <a href="#">tech.edgx.prise.webserver</a>            | 1     | 0      | 0        | 0       | 100%         | 0 s     |

## tech.edgx.prise.webserver.validator

|         | Class                                        | Tests | Errors | Failures | Skipped | Success Rate | Time    |
|---------|----------------------------------------------|-------|--------|----------|---------|--------------|---------|
| success | <a href="#">GetLatestPricesValidatorTest</a> | 5     | 0      | 0        | 0       | 100%         | 0.080 s |

|         |                                                  |    |   |   |   |      |         |
|---------|--------------------------------------------------|----|---|---|---|------|---------|
| success | <a href="#">GetHistoricalPricesValidatorTest</a> | 10 | 0 | 0 | 0 | 100% | 0.021 s |
|---------|--------------------------------------------------|----|---|---|---|------|---------|

## tech.edgx.prise.webserver.controller

|         | Class                           | Tests | Errors | Failures | Skipped | Success Rate | Time    |
|---------|---------------------------------|-------|--------|----------|---------|--------------|---------|
| success | <a href="#">ApiControllerIT</a> | 18    | 0      | 0        | 0       | 100%         | 0.675 s |

## tech.edgx.prise.webserver.controller

|         | Class                           | Tests | Errors | Failures | Skipped | Success Rate | Time    |
|---------|---------------------------------|-------|--------|----------|---------|--------------|---------|
| success | <a href="#">ApiControllerIT</a> | 18    | 0      | 0        | 0       | 100%         | 0.675 s |

### 4.3. API Query Validation

#### Procedure

##### (i) Test Environment

- Software:
  - 'Prise' version: commit a7737ab30ffd54063b76b79f9546a71cac94a52d
    - Synced to local DB for ~1week of blockchain time, from 01 Aug 24 0000 UTC (start.point.time=1722470400)
    - Configured with 4x DEX Classifiers; Sundaeswap V1, Wingriders V1, Minswap V1, Minswap V2
  - Swagger-UI V3 API Documentation and query tool

##### (ii) Procedures:

Navigate to Documentation: `https://<url>/swagger-ui/index.html`

##### \* Query Latest Prices:

- Select endpoint [prices/latest]
- Query all tokens
- Query a sample of specific tokens

##### \* Query Historical Prices:

- Select endpoint [prices/historical/candles]
- Query a sample of Cardano Tokens and candle resolutions [1W, 1D, 1h, 15m]

Summarise results obtained from the SwaggerUI tool

## Query Latest Prices

(/api/prices/latest getLatestPrices)

### 1. Query all latest prices

GET

/api/prices/latest

getLatestPrices

Parameters

| Name          | Description                                                       |
|---------------|-------------------------------------------------------------------|
| symbol        | Cardano Native Token Id (hexpolicy+hexname) or (lovelace) for ADA |
| array[string] | (query)                                                           |

Add Item

Execute

```
Curl
curl -X GET "http://localhost:8092/api/prices/latest" -H "accept: application/json"

Request URL
http://localhost:8092/api/prices/latest

Server response
Code    Details
200

Response body
{
  "date": "2024-11-28T14:21:00+0000",
  "assets": [
    {
      "symbol": "29d222ce763455e3d7a09a665ce554f0ac89d2e99a1a83d267170c64d494e",
      "name": "MIN",
      "last_price_ada": 0.042401081317543096,
      "last_update": "2024-08-07T00:27:07+0000",
      "pricing_provider": "minswapv2"
    },
    {
      "symbol": "64f7b188bd43f4bde344b02507655eeb821256c0c8e79ad48db15d1844454449",
      "name": "DEDI",
      "last_price_ada": 0.1544956005354389,
      "last_update": "2024-08-07T00:53:43+0000",
      "pricing_provider": "minswapv2"
    },
    {
      "symbol": "533bb54a8850ee3cbe463106409399112b74c905342cb1792a797a0494e4459",
      "name": "INDY",
      "last_price_ada": 1.5773350451778232,
      "last_update": "2024-08-07T00:46:01+0000",
      "pricing_provider": "minswap"
    },
    {
      "symbol": "b6a7467ea1deb012008ef4e87b5ff371e5f7142d7b356a40d9b42a0436f726e75636f706996173205b766996120436861696e506f72742e696f5d",
      "name": "ADA",
      "last_price_ada": 1.0,
      "last_update": "2024-08-07T00:00:00+0000",
      "pricing_provider": "minswap"
    }
  ]
}

Response headers
cache-control: no-cache-no-store-max-age=0-must-revalidate
connection: keep-alive
content-type: application/json
date: Thu 28 Nov 2024 14:21:00 GMT
expires: 0
keep-alive: timeout=60
pragma: no-cache
transfer-encoding: chunked
vary: OriginAccess-Control-Request-MethodAccess-Control-Request-Headers
x-content-type-options: nosniff
x-frame-options: DENY
x-xss-protection: 1; mode=block
```

Successful response (200) with no expected irregularity.

## 2. Query selected latest prices

GET /api/prices/latest getLatestPrices

Parameters

| Name                  | Description                                                       |
|-----------------------|-------------------------------------------------------------------|
| symbol                | Cardano Native Token Id (hexpolicy+hexname) or (lovelace) for ADA |
| array(string) (query) |                                                                   |

f00ac89d2e99a1a83d267170c64d494e -

Add Item

Execute

Query specific token: MIN  
(29d222ce763455e3d7a09a665ce554f00ac8  
9d2e99a1a83d267170c64d494e)

Curl

```
curl -X GET "http://localhost:8092/api/prices/latest?symbol=29d222ce763455e3d7a09a665ce554f00ac89d2e99a1a83d267170c64d494e" -H "accept: application/json"
```

Request URL

```
http://localhost:8092/api/prices/latest?symbol=29d222ce763455e3d7a09a665ce554f00ac89d2e99a1a83d267170c64d494e
```

Server response

Code Details

200

Response body

```
{
  "date": "2024-11-28T15:14:24+0000",
  "assets": [
    {
      "symbol": "29d222ce763455e3d7a09a665ce554f00ac89d2e99a1a83d267170c64d494e",
      "name": "MIN",
      "last_price_ada": 0.042401081317543096,
      "last_update": "2024-08-07T00:27:07+0000",
      "pricing_provider": "minswapv2"
    },
    {
      "symbol": "29d222ce763455e3d7a09a665ce554f00ac89d2e99a1a83d267170c64d494e",
      "name": "MIN",
      "last_price_ada": 0.05022207432589103,
      "last_update": "2024-08-06T20:07:32+0000",
      "pricing_provider": "sundaeswap"
    },
    {
      "symbol": "29d222ce763455e3d7a09a665ce554f00ac89d2e99a1a83d267170c64d494e",
      "name": "MIN",
      "last_price_ada": 0.04266604620949878,
      "last_update": "2024-08-07T00:50:27+0000",
      "pricing_provider": "minswap"
    }
  ],
  {
    "symbol": "29d222ce763455e3d7a09a665ce554f00ac89d2e99a1a83d267170c64d494e",

```

Download

Response headers

```
cache-control: no-cache, no-store, max-age=0, must-revalidate
connection: keep-alive
content-type: application/json
date: Thu28 Nov 2024 15:14:24 GMT
expires: 0
keep-alive: timeout=60
pragma: no-cache
transfer-encoding: chunked
vary: OriginAccess-Control-Request-MethodAccess-Control-Request-Headers
x-content-type-options: nosniff
x-frame-options: DENY
x-xss-protection: 1; mode=block
```

Successful response (200) with no expected irregularity.

### 3. Query multiple selected latest prices

GET /api/prices/latest getLatestPrices

Parameters

| Name                                                            | Description                                                                             |
|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| symbol                                                          | array(string) Cardano Native Token Id (hexpolicy+hexname) or (lovelace) for ADA (query) |
| 5d16cc1a177b5d9ba9cfa9793b07e60f1fb70f                          | -                                                                                       |
| 279c909f348e533da5808898f87f9a14bb2c3c                          | -                                                                                       |
| 51a5e236c4de3af2b8020442e2a26f454fda3b04cb621c1294a0ef34424f4fb | -                                                                                       |
| <a href="#">Add item</a>                                        |                                                                                         |

[Execute](#)

Multiple tokens selected:

#### 1 Token: IAG

(5d16cc1a177b5d9ba9cfa9793b07e60f1fb70f  
ea1f8aef064415d114494147)

#### 2. SNEK

(279c909f348e533da5808898f87f9a14bb2c3  
dfbbaccdd631d927a3f534e454b)

#### 3. BOOK

(51a5e236c4de3af2b8020442e2a26f454fda3  
b04cb621c1294a0ef34424f4fb)

Curl

```
curl -X GET "http://localhost:8092/api/prices/latest?symbol=5d16cc1a177b5d9ba9cfa9793b07e60f1fb70fea1f8aef064415d114494147&symbol=279c909f348e533da5808898f87f9a14bb2c3dfbbaccdd631d927a3f534e454b&symbol=51a5e236c4de3af2b8020442e2a26f454fda3b04cb621c1294a0ef34424f4fb" -H "accept: application/json"
```

Request URL

```
http://localhost:8092/api/prices/latest?symbol=5d16cc1a177b5d9ba9cfa9793b07e60f1fb70fea1f8aef064415d114494147&symbol=279c909f348e533da5808898f87f9a14bb2c3dfbbaccdd631d927a3f534e454b&symbol=51a5e236c4de3af2b8020442e2a26f454fda3b04cb621c1294a0ef34424f4fb
```

Server response

| Code | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 200  | <p>Response body</p> <pre>{   "date": "2024-11-30T01:30:45+0000",   "assets": [     {       "symbol": "279c909f348e533da5808898f87f9a14bb2c3dfbbaccdd631d927a3f534e454b",       "name": "SNEK",       "last_price_ada": 0.0022971155855701205,       "last_update": "2024-08-07T00:37:45+0000",       "pricing_provider": "minswap"     },     {       "symbol": "279c909f348e533da5808898f87f9a14bb2c3dfbbaccdd631d927a3f534e454b",       "name": "SNEK",       "last_price_ada": 0.0022824224815309402,       "last_update": "2024-08-06T18:07:17+0000",       "pricing_provider": "sundswap"     },     {       "symbol": "279c909f348e533da5808898f87f9a14bb2c3dfbbaccdd631d927a3f534e454b",       "name": "SNEK",       "last_price_ada": 0.002276563914791377,       "last_update": "2024-08-06T23:54:57+0000",       "pricing_provider": "minswapv2"     },     {       "symbol": "51a5e236c4de3af2b8020442e2a26f454fda3b04cb621c1294a0ef34424f4fb",       "name": "BOOK", </pre> <p><a href="#">Download</a></p> <p>Response headers</p> <pre>cache-control: no-cache-no-store-max-age=0must-revalidate connection: keep-alive content-type: application/json date: Sat 30 Nov 2024 01:30:45 GMT expires: 0 keep-alive: timeout=60 pragma: no-cache transfer-encoding: chunked vary: OriginAccess-Control-Request-MethodAccess-Control-Request-Headers x-content-type-options: nosniff x-frame-options: DENY x-xss-protection: 1; mode=block</pre> |

Successful response (200) with no expected irregularity.

## Query Historical Prices

(/api/prices/historical/candles getHistoricalPrices)

### 1. Query historical weekly candles

Token: IAG

(5d16cc1a177b5d9ba9cfa9793b07e60f1fb70  
fea1f8aef064415d114494147)

Resolution: 1W

GET /api/prices/historical/candles getHistoricalPrices

Parameters

| Name                                       | Description                                                                                                                                                 |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| from<br>integer(int64)<br>(query)          | Time from [Seconds since epoch]<br><input type="text" value="from - Time from [Seconds since epoch]"/>                                                      |
| resolution * required<br>string<br>(query) | Resolution width<br><input type="text" value="1W"/>                                                                                                         |
| symbol * required<br>string<br>(query)     | Cardano Native Token Id (hexpolicy+hexname); e.g. 279c909f34<br><input type="text" value="5d16cc1a177b5d9ba9cfa9793b07e60f1fb70fea1f8aef064415d114494147"/> |
| to<br>integer(int64)<br>(query)            | Time from [Seconds since epoch]<br><input type="text" value="to - Time from [Seconds since epoch]"/>                                                        |

Execute

#### Responses

##### Curl

```
curl -X GET "http://localhost:8092/api/prices/historical/candles?resolution=1W&symbol=5d16cc1a177b5d9ba9cfa9793b07e60f1fb70fea1f8aef064415d114494147" -H "accept: application/json"
```

##### Request URL

```
http://localhost:8092/api/prices/historical/candles?resolution=1W&symbol=5d16cc1a177b5d9ba9cfa9793b07e60f1fb70fea1f8aef064415d114494147
```

##### Server response

##### Code Details

200

##### Response body

```
{  
  "time": 1722211200,  
  "open": 0.20200151058296262,  
  "high": 0.20583196244586274,  
  "low": 0.1787507556123732,  
  "close": 0.18361054522953105,  
  "volume": 820969.944867  
}
```

Download

##### Response headers

```
cache-control: no-cache-no-store-max-age=0must-revalidate  
connection: keep-alive  
content-type: application/json  
date: Thu20 Nov 2024 16:02:26 GMT  
expires: 0  
keep-alive: timeout=60  
pragma: no-cache  
transfer-encoding: chunked  
vary: OriginAccess-Control-Request-MethodAccess-Control-Request-Headers  
x-content-type-options: nosniff  
x-frame-options: DENY  
x-xss-protection: 1; mode=block
```

Successful response (200) with no expected irregularity.

## 2. Query historical daily candles

Token: DjedMicroUSD  
(8db269c3ec630e06ae29f74bc39edd1f87c819f1056206e879a1cd61446a65644d6963726f555344)  
Resolution: 1D

GET /api/prices/historical/candles getHistoricalPrices

**Parameters**

| Name                                       | Description                                                                                                                    |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| from<br>integer(int64)<br>(query)          | Time from [Seconds since epoch]<br><input type="text" value="from - Time from [Seconds since epoch]"/>                         |
| resolution * required<br>string<br>(query) | Resolution width<br><input type="text" value="1D"/>                                                                            |
| symbol * required<br>string<br>(query)     | Cardano Native Token Id (hexpolicy+hexname); e.g. 279c909f348<br><input type="text" value="79a1cd61446a65644d6963726f555344"/> |
| to<br>integer(int64)<br>(query)            | Time from [Seconds since epoch]<br><input type="text" value="to - Time from [Seconds since epoch]"/>                           |

**Execute**

**Curl**

```
curl -X GET "http://localhost:8092/api/prices/historical/candles?resolution=1D&symbol=8db269c3ec630e06ae29f74bc39edd1f87c819f1056206e879a1cd61446a65644d6963726f555344" -H "accept: application/json"
```

**Request URL**

```
http://localhost:8092/api/prices/historical/candles?resolution=1D&symbol=8db269c3ec630e06ae29f74bc39edd1f87c819f1056206e879a1cd61446a65644d6963726f555344
```

**Server response**

**Code**      **Details**

200

**Response body**

```
[
  {
    "time": 1722470400,
    "open": 2.5419325066284193,
    "high": 2.6698068580484173,
    "low": 2.3891987875640926,
    "close": 2.5792202716026518,
    "volume": 224749.872929
  },
  {
    "time": 1722556800,
    "open": 2.5792202716026518,
    "high": 2.736677059739712,
    "low": 2.562525383496526,
    "close": 2.714677255533338,
    "volume": 79438.83521399999
  },
  {
    "time": 1722643200,
    "open": 2.714677255533338,
    "high": 2.846764221011661,
    "low": 2.6442151309085323,
    "close": 2.7136550893300777,
    "volume": 331334.51858699999
  }
]
```

**Response headers**

```
cache-control: no-cache
connection: keep-alive
content-type: application/json
date: Thu28 Nov 2024 16:07:43 GMT
expires: 0
keep-alive: timeout=60
pragma: no-cache
transfer-encoding: chunked
vary: OriginAccess-Control-Request-MethodAccess-Control-Request-Headers
x-content-type-options: nosniff
x-frame-options: DENY
x-xss-protection: 1; mode=block
```

**Download**

Successful response (200) with no expected irregularity.

### 3. Query historical hourly candles

Token: BOOK  
(51a5e236c4de3af2b8020442e2a26f454fda3  
b04cb621c1294a0ef34424f4f4b)  
Resolution: 1h

GET

/api/prices/historical/candles

getHistoricalPrices

Parameters

| Name                                                                             | Description                                                                                                          |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| <div>from</div> <div>integer(int64)</div> <div>(query)</div>                     | <div>Time from [Seconds since epoch]</div> <div>from - Time from [Seconds since epoch]</div>                         |
| <div>resolution <span>required</span></div> <div>string</div> <div>(query)</div> | <div>Resolution width</div> <div>1h</div>                                                                            |
| <div>symbol <span>required</span></div> <div>string</div> <div>(query)</div>     | <div>Cardano Native Token Id (hexpolicy+hexname); e.g. 279c909f34</div> <div>I54fda3b04cb621c1294a0ef34424f4fb</div> |
| <div>to</div> <div>integer(int64)</div> <div>(query)</div>                       | <div>Time from [Seconds since epoch]</div> <div>to - Time from [Seconds since epoch]</div>                           |

Execute

Curl

```
curl -X GET "http://localhost:8092/api/prices/historical/candles?resolution=1h&symbol=51a5e236c4de3af2b8020442e2a26f454fda3b04cb621c1294a0ef34424f4f4b" -H "accept: application/json"
```

Request URL

<http://localhost:8092/api/prices/historical/candles?resolution=1h&symbol=51a5e236c4de3af2b8020442e2a26f454fda3b04cb621c1294a0ef34424f4f4b>

Server response

| Code | Details |
|------|---------|
|------|---------|

200

Response body

```
{
  "time": 1722470400,
  "open": 0.039130088974700654,
  "high": 0.039130088974700654,
  "low": 0.039130088974700654,
  "close": 0.039130088974700654,
  "volume": 100
},
{
  "time": 1722474000,
  "open": 0.039130088974700654,
  "high": 0.039130088974700654,
  "low": 0.039130088974700654,
  "close": 0.039130088974700654,
  "volume": 1192.589219
},
{
  "time": 1722477600,
  "open": 0.039130088974700654,
  "high": 0.039130088974700654,
  "low": 0.039130088974700654,
  "close": 0.039130088974700654,
  "volume": 1318.943788
},
{
```

### Response headers

```
cache-control: no-cache no-store max-age=0 must-revalidate
connection: keep-alive
content-type: application/json
date: Thu 28 Nov 2024 16:11:19 GMT
expires: 0
keep-alive: timeout=60
pragma: no-cache
transfer-encoding: chunked
vary: Origin Access-Control-Request-Method Access-Control-Request-Headers
x-content-type-options: nosniff
x-frame-options: DENY
x-xss-protection: 1; mode=block
```

Successful response (200) with no expected irregularity.

#### 4. Query historical fifteen-minute candles

Token: SNEK  
(279c909f348e533da5808898f87f9a14bb2c3dfbbacccd631d927a3f534e454b)  
Resolution: 15m

GET /api/prices/historical/candles getHistoricalPrices

| Name                                       | Description                                                                                                                                                                          |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| from<br>integer(int64)<br>(query)          | Time from [Seconds since epoch]<br><input type="text" value="from - Time from [Seconds since epoch]"/>                                                                               |
| resolution * required<br>string<br>(query) | Resolution width<br><input type="text" value="15m"/>                                                                                                                                 |
| symbol * required<br>string<br>(query)     | Cardano Native Token Id (hexpolicy+hexname); e.g. 279c909f348e533da5808898f87f9a14bb2c3dfbbacccd631d927a3f534e454b<br><input type="text" value="4bb2c3dfbbacccd631d927a3f534e454b"/> |
| to<br>integer(int64)<br>(query)            | Time from [Seconds since epoch]<br><input type="text" value="to - Time from [Seconds since epoch]"/>                                                                                 |

Execute

```
curl -X GET "http://localhost:8092/api/prices/historical/candles?resolution=15m&symbol=279c909f348e533da5808898f87f9a14bb2c3dfbbacccd631d927a3f534e454b" -H "accept: application/json"
```

Request URL

```
http://localhost:8092/api/prices/historical/candles?resolution=15m&symbol=279c909f348e533da5808898f87f9a14bb2c3dfbbacccd631d927a3f534e454b
```

Server response

| Code | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 200  | <div>Response body</div> <pre>[   {     "time": 1722470400,     "open": 0.002383950293611721,     "high": 0.002383950293611721,     "low": 0.002383950293611721,     "close": 0.002383950293611721,     "volume": 2331.079044   },   {     "time": 1722471300,     "open": 0.002383950293611721,     "high": 0.002412168681536977,     "low": 0.002350814899625,     "close": 0.0023614393493255853,     "volume": 24520.911444   },   {     "time": 1722472200,     "open": 0.0023614393493255853,     "high": 0.0023614393493255853,     "low": 0.0023614393493255853,     "close": 0.0023614393493255853,     "volume": 1517.826037   } ]</pre> <div>Download</div> <div>Response headers</div> <pre>cache-control: no-cache, no-store, max-age=0, must-revalidate connection: keep-alive content-type: application/json date: Thu28 Nov 2024 16:14:27 GMT expires: 0 keep-alive: timeout=60 pragma: no-cache transfer-encoding: chunked vary: OriginAccess-Control-Request-Method, Access-Control-Request-Headers x-content-type-options: nosniff x-frame-options: DENY x-xss-protection: 1; mode=block</pre> |

Successful response (200) with no expected irregularity.

#### 4.4. Discussion

The software meets the requirements for Milestone 2 – Initial release. The software enables a user to query data generated by the indexer. Some features related to Milestone 1 have also been expanded, including adding of two chain database modules and classification of MinSwap V2 ‘ZapIn’ swaps. There is a need for continual improvement to account for e.g. upgraded DEXs and to cover all atypical types of swaps.

## 5. Results – Milestone 3

### 5.1. Summary

Table 7: Summary of Milestone 3 Evidence

|                                         | Artefact                                                                                                                                | Location of Evidence                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Milestone Outputs</b>                | <ul style="list-style-type: none"> <li>Software capable of suitable performance for the intended operating environment</li> </ul>       | <ul style="list-style-type: none"> <li><a href="https://github.com/Edgxtech/prise">https://github.com/Edgxtech/prise</a> <ul style="list-style-type: none"> <li>Indexer: <a href="https://github.com/Edgxtech/prise/tree/main/indexer">https://github.com/Edgxtech/prise/tree/main/indexer</a></li> <li>API Webserver: <a href="https://github.com/Edgxtech/prise/tree/main/webserver">https://github.com/Edgxtech/prise/tree/main/webserver</a></li> </ul> </li> </ul> |
|                                         | <ul style="list-style-type: none"> <li>Final close-out report</li> </ul>                                                                | <ul style="list-style-type: none"> <li><a href="https://edgxtech.github.io/docs/Catalyst_Project_1200061_Kotlin_PriceIndexer_Report_Close-Out_signed.pdf">https://edgxtech.github.io/docs/Catalyst_Project_1200061_Kotlin_PriceIndexer_Report_Close-Out_signed.pdf</a></li> </ul>                                                                                                                                                                                       |
|                                         | <ul style="list-style-type: none"> <li>Final closeout video</li> </ul>                                                                  | <ul style="list-style-type: none"> <li>YouTube: “Project Catalyst   Fund 12   Close-Out Video   Kotlin Price Indexer”, <a href="https://youtu.be/l61mwZat6lo">https://youtu.be/l61mwZat6lo</a></li> </ul>                                                                                                                                                                                                                                                               |
| <b>Acceptance criteria</b>              | <ul style="list-style-type: none"> <li>3.1 User can install the software</li> </ul>                                                     | <ul style="list-style-type: none"> <li><a href="#">5.2 Software Installation &amp; Operation Testing</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                     |
|                                         | <ul style="list-style-type: none"> <li>3.2 User can run the software</li> </ul>                                                         | <ul style="list-style-type: none"> <li><a href="#">5.2 Software Installation &amp; Operation Testing</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                     |
|                                         | <ul style="list-style-type: none"> <li>3.3 User can maintain the software</li> </ul>                                                    | <ul style="list-style-type: none"> <li><a href="#">5.2 Software Installation &amp; Operation Testing</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                     |
| <b>Evidence of milestone completion</b> | <ul style="list-style-type: none"> <li>Report section describing test serials and results for software installation (3.1)</li> </ul>    | <ul style="list-style-type: none"> <li><a href="#">5.2 Software Installation &amp; Operation Testing</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                     |
|                                         | <ul style="list-style-type: none"> <li>Report section describing test serials and results for operating the software (3.2)</li> </ul>   | <ul style="list-style-type: none"> <li><a href="#">5.2 Software Installation &amp; Operation Testing</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                     |
|                                         | <ul style="list-style-type: none"> <li>Report section describing test serials and results for maintaining the software (3.3)</li> </ul> | <ul style="list-style-type: none"> <li><a href="#">5.2 Software Installation &amp; Operation Testing</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                     |
|                                         | <ul style="list-style-type: none"> <li>Link to final closeout report</li> </ul>                                                         | <ul style="list-style-type: none"> <li><a href="https://edgxtech.github.io/docs/Catalyst_Project_1200061_Kotlin_PriceIndexer_Report_Close-Out_signed.pdf">https://edgxtech.github.io/docs/Catalyst_Project_1200061_Kotlin_PriceIndexer_Report_Close-Out_signed.pdf</a></li> </ul>                                                                                                                                                                                       |
|                                         | <ul style="list-style-type: none"> <li>Link to final closeout video</li> </ul>                                                          | <ul style="list-style-type: none"> <li>YouTube: “Project Catalyst   Fund 12   Close-Out Video   Kotlin Price Indexer”, <a href="https://youtu.be/l61mwZat6lo">https://youtu.be/l61mwZat6lo</a></li> </ul>                                                                                                                                                                                                                                                               |

### 5.2. Software Installation & Operation Testing

#### Procedure

Start with a fresh Linux (Ubuntu) System:

- Linux Ubuntu 22.x with software including; git, java11, maven, mysql

#### Install Prise:

- `git clone https://github.com/Edgxtech/prise.git`
- follow instructions in: <https://github.com/Edgxtech/prise/blob/main/README.md>

#### Signup for a Blockfrost account:

- <https://blockfrost.io/auth/signin>
- Generate a mainnet project and note down the API Key (e.g. mainnet...)

#### Edit prise.properties:

```
chain.database.service.module=blockfrost
blockfrost.datasource.url=https://cardano-mainnet.blockfrost.io/api/v0
blockfrost.datasource.apikey=<Insert your key>
cnode.address=backbone.cardano.iog.io
cnode.port=3001
start.point.time=1722470400
```

#### Run:

- `cd indexer`
- `mvn clean install -DskipTests`
- `mvn exec:exec -Dconfig=prise.properties`

#### Monitor:

- look for chain sync time increasing:  
`watch curl localhost:9108/metrics (e.g. gauge_chain_sync_slot 1.30905528E8)`
- check mysql db is populating:  
`mysql> select count(*) from prise.asset;`  
`mysql> select count(*) from prise.candle_fifteen;`

## Results

### Steps Performed

#### 1. System Setup

- Installed Operating System:
  - Ubuntu 22.04.5 LTS

- Installed Software:
  - git version 2.34.1
  - openjdk version "11.0.25" 2024-10-15
  - Apache Maven 3.6.3
  - mysql Ver 8.0.40-0ubuntu0.22.04.1 for Linux on x86\_64 ((Ubuntu))

## 2. Clone Prise Repository

- The repository was cloned successfully using the command:  
`git clone https://github.com/Edgxtech/prise.git`

## 3. Blockfrost API Key Registration

- Created an account at Blockfrost.
- Successfully generated a mainnet project API key to use for testing.

## 4. Configured MySQL

- Logged into MySQL as root and ran as specified:  
`CREATE USER 'prise'@'localhost' IDENTIFIED BY 'prise';`  
`GRANT ALL PRIVILEGES ON prise.* TO 'prise'@'localhost' WITH GRANT OPTION;`  
`FLUSH PRIVILEGES;`

## 5. Build & Run Prise Software

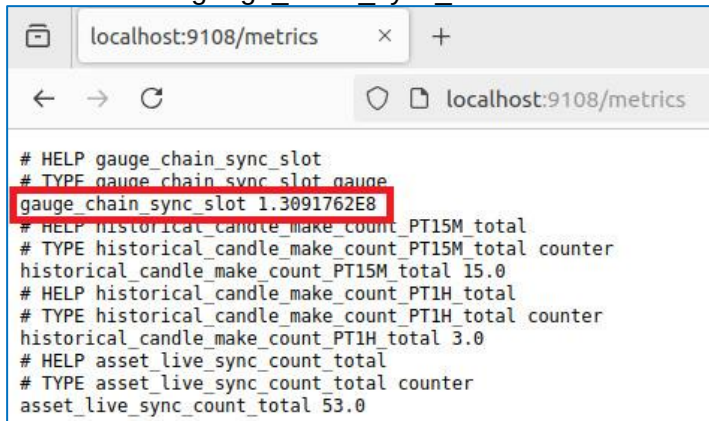
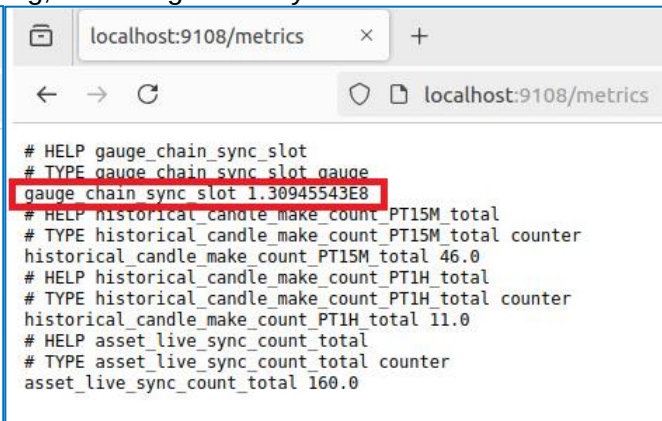
- Ran the webserver:  
`mvn clean install -DskipTests`  
`mvn spring-boot:run`
- Configured `src/main/resources/application.properties` :  
`spring.datasource.username` & `password` updated to 'prise' as in step above

- Copied & Configured prise.properties from prise.example.properties with the necessary settings:  
`chain.database.service.module=blockfrost`  
`blockfrost.datasource.url=https://cardano-mainnet.blockfrost.io/api/v0`  
`blockfrost.datasource.apikey= mainnet.....`  
`cnode.address=backbone.cardano.iog.io`  
`cnode.port=3001`  
`start.point.time=1722470400`
- Ran the Prise indexer using the specified configuration:  
`mvn exec:exec -Dconfig=prise.properties`

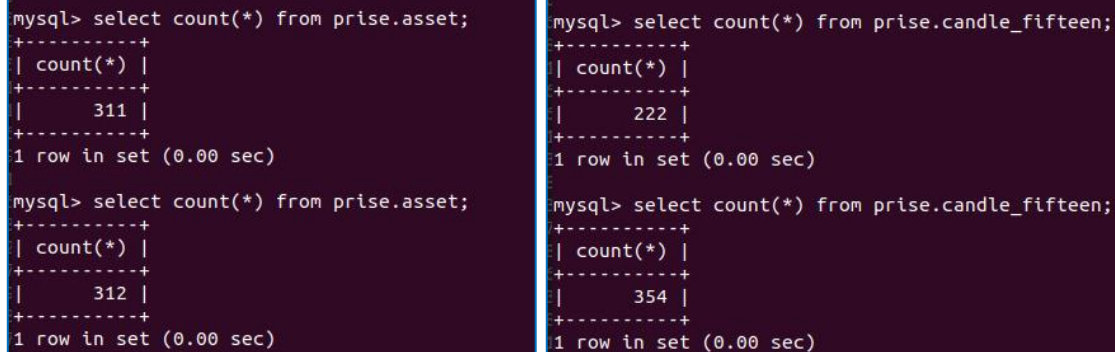
## 6. Monitoring and Validation

- Chain Sync:  
Verified chain sync progress by visiting on browser:  
<http://localhost:9108/metrics>

Observed the `gauge_chain_sync_slot` value incrementing, indicating active synchronization.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <pre># HELP gauge_chain_sync_slot # TYPE gauge_chain_sync_slot gauge gauge_chain_sync_slot 1.3091762E8 # HELP historical_candle_make_count_PT15M_total # TYPE historical_candle_make_count_PT15M_total counter historical_candle_make_count_PT15M_total 15.0 # HELP historical_candle_make_count_PT1H_total # TYPE historical_candle_make_count_PT1H_total counter historical_candle_make_count_PT1H_total 3.0 # HELP asset_live_sync_count_total # TYPE asset_live_sync_count_total counter asset_live_sync_count_total 53.0</pre> |  <pre># HELP gauge_chain_sync_slot # TYPE gauge_chain_sync_slot gauge gauge_chain_sync_slot 1.30945543E8 # HELP historical_candle_make_count_PT15M_total # TYPE historical_candle_make_count_PT15M_total counter historical_candle_make_count_PT15M_total 46.0 # HELP historical_candle_make_count_PT1H_total # TYPE historical_candle_make_count_PT1H_total counter historical_candle_make_count_PT1H_total 11.0 # HELP asset_live_sync_count_total # TYPE asset_live_sync_count_total counter asset_live_sync_count_total 160.0</pre> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

- Database Population:  
Logged into MySQL and executed queries to confirm database updates:  
`select count(*) from prise.asset;`  
`select count(*) from prise.candle_fifteen;`
- Verified that data is being inserted into the tables:
  - Prise.asset
  - prise.candle\_fifteen



```
mysql> select count(*) from prise.asset;
+-----+
| count(*) |
+-----+
|      311 |
+-----+
1 row in set (0.00 sec)

mysql> select count(*) from prise.asset;
+-----+
| count(*) |
+-----+
|      312 |
+-----+
1 row in set (0.00 sec)

mysql> select count(*) from prise.candle_fifteen;
+-----+
| count(*) |
+-----+
|      222 |
+-----+
1 row in set (0.00 sec)

mysql> select count(*) from prise.candle_fifteen;
+-----+
| count(*) |
+-----+
|      354 |
+-----+
1 row in set (0.00 sec)
```

### 5.3. Discussion

The software meets the requirements for Milestone 3 – Final release. Installation, operation and basic maintenance can be performed by a typical user in a typical environment. Key functionalities including indexation, back-end data retrieval and monitoring of sync status metrics were validated without errors.

## 6. Conclusion

This report covered progressive milestone reporting for the Cardano Native Token (CNT) Decentralised Exchange (DEX) Price Indexer, project (Project ID: 1200061). All three (3) milestones were delivered on-time as projected and provide the capability to index price data within a database and to query that data through a standard API. The primary artefact produced was a software repository hosted on Github, which provides a solution others can use, extend, modify or reference for their purposes, saving developer time & effort. The software will require adaptation to new or upgraded DEX smart contracts if price data therein is required, however these may be developed as modules within the same software architecture.