

Project Catalyst Milestone Report

Cardano Native Token DEX Price Indexer in Kotlin

Project ID: 1200061

30 Nov 2024

Table of Contents

<u>VERSION HISTORY</u>	<u>3</u>
<u>1. INTRODUCTION</u>	<u>4</u>
1.1. IDENTIFICATION	4
1.2. OBJECTIVES	4
1.3. SYSTEM DESCRIPTION.....	4
<u>2. PROJECT MILESTONES</u>	<u>5</u>
MILESTONE 1 - PROOF OF CONCEPT PROGRESS RELEASE, SEP 2024	5
MILESTONE 2 - INITIAL RELEASE, NOV 2024	5
MILESTONE 3 - FINAL RELEASE, DEC 2024.....	5
<u>3. RESULTS – MILESTONE 1.....</u>	<u>7</u>
3.1. SUMMARY	7
3.2. SOFTWARE VERIFICATION TESTING	8
PROCEDURE	8
RESULTS	9
3.3. ACCURACY VALIDATION	17
PROCEDURE	17
HISTORICAL PRICE COMPARISON.....	18
LATEST PRICE COMPARISON	22
3.4. DISCUSSION.....	24
<u>4. RESULTS – MILESTONE 2.....</u>	<u>24</u>
4.1. SUMMARY	24
4.2. API SOFTWARE VERIFICATION TESTING	26
PROCEDURE	26
RESULTS	27
4.3. API QUERY VALIDATION	28
PROCEDURE	28
QUERY LATEST PRICES	29
QUERY HISTORICAL PRICES	32
4.4. DISCUSSION.....	36

Version History

Document Version	Change
1.0	Milestone 1 (Proof of Concept) – 16 Sep 2024
2.0	Milestone 2 (Initial Release) – 30 Nov 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

Milestone Outputs	• Release of a system containing the foundational software architecture and providing the core requirement of generating and persisting price data • At least 1x (one) UTXO resolver external interface module • At least 1x (one) token metadata external interface module • At least 3x (three) DEX classifier(s)
Acceptance criteria	• 1.1 Can generate and persist latest price data from at least three (3) DEX's trading activity? • 1.2 Can generate and persist historical price candles data from at least three (3) DEX's trading activity?
Evidence of milestone completion	• Report section comparing a single DEX's latest prices for a sample of tokens (1.1) • Report section comparing a single DEX's historical price candles for a sample of tokens (1.2)
Method of Evidence Collection	• 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>. • Manual Accuracy Comparisons of generated data compared to the popular Minswap DEX

Milestone 2 - Initial release, Nov 2024

Milestone Outputs	• 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 • At least 2x (two) UTXO resolver external interface modules • At least 1x (one) token metadata external interface module • At least 4x (four) DEX classifier(s)
Acceptance criteria	• 2.1 User can query latest price data? • 2.2 User can query historical price candles data?
Evidence of milestone completion	• Report section describing test serials and results for querying latest prices (2.1) • Report section describing test serials and results for querying historical prices (2.2)
Method of Evidence Collection	• 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>. • Manual querying of an example synced dataset using an API testing tool (Postman and/or SwaggerUI)

Milestone 3 - Final Release, Dec 2024

Milestone Outputs	• Software capable of suitable performance for the intended operating environment • Final close-out report • Final closeout video
Acceptance criteria	• 3.1 User can install the software • 3.2 User can run the software • 3.3 User can maintain the software • Final closeout video is publicly available • Final closeout report is publicly available

Evidence of milestone completion	• Report section describing test serials and results for software installation (3.1) • Report section describing test serials and results for operating the software (3.2) • Report section describing test serials and results for maintaining the software (3.3) • Link to final closeout report • Link to final closeout video
---	---

3. Results – Milestone 1

3.1. Summary

Table 1: Summary of Milestone 1 Evidence

	Artefact	Location of Evidence
Milestone Outputs	Release of a system containing the foundational software architecture and providing the core requirement of generating and persisting price data	https://github.com/Edgxtech/prise
	At least 1x (one) UTXO resolver external interface module	https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/carp/jdbc/CarpJdbcService.kt (implementation of a Carp based UTXO resolver)
	At least 1x (one) token metadata external interface module	https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/tokenregistry/TokenRegistryService.kt (implementation of tokens.cardano.org metadata query)
	At least 3x (three) DEX classifier(s)	https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/MinswapClassifier.kt -> /* Minswap V1 */ (Minswap V1) https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/MinswapV2Classifier.kt -> /* Minswap V2 */ (Minswap V2) https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/SundaeswapClassifier.kt (Sundaeswap V1) https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/WingridersClassifier.kt (Wingriders)
Acceptance criteria	1.1 Can generate and persist latest price data from at least three (3) DEX's trading activity?	Table 2: Software Verification Test Results - tech.edgx.prise.indexer.service.classifier.* - AssetServiceIT - AssetRepositoryIT Table 4: Latest Price Comparison

	1.2 Can generate and persist historical price candles data from at least three (3) DEX's trading activity?	Table 2: Software Verification Test Results - tech.edgx.prise.indexer.service.classifier.* - HistoricalPriceServiceIT - HistoricalPriceHelpers Table 3: Historical Price Comparison
Evidence of milestone completion	Report section comparing a single DEX's latest prices for a sample of tokens	Latest Price Comparison
	Report section comparing a single DEX's historical price candles for a sample of tokens	Historical Price Comparison

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
tech.edgx.prise.indexer.util	7	0	0	0	100%	0.527 s
tech.edgx.prise.indexer.service.dataprovider	2	0	0	0	100%	6.452 s

tech.edgx.prise.indexer.config	5	0	0	0	100%	0.015 s
tech.edgx.prise.indexer.service.price	24	0	0	0	100%	9.646 s
tech.edgx.prise.indexer.repository	4	0	0	0	100%	0.890 s
tech.edgx.prise.indexer.service.chaindb	12	0	0	0	100%	12.47 s
tech.edgx.prise.indexer.service.chain	4	0	0	0	100%	14.71 s
tech.edgx.prise.indexer.service	6	0	0	0	100%	0.240 s
tech.edgx.prise.indexer.service.classifier	43	0	0	0	100%	40.00 s

tech.edgx.prise.indexer.util

	Class	Tests	Errors	Failures	Skipped	Success Rate	Time
passed	HelpersTest	7	0	0	0	100%	0.527 s

tech.edgx.prise.indexer.service.dataprovider

	Class	Tests	Errors	Failures	Skipped	Success Rate	Time
passed	TokenRegistryServiceIT	2	0	0	0	100%	6.452 s

tech.edgx.prise.indexer.config

	Class	Tests	Errors	Failures	Skipped	Success Rate	Time
passed	ConfigTest	5	0	0	0	100%	0.015 s

tech.edgx.prise.indexer.service.price

	Class	Tests	Errors	Failures	Skipped	Success Rate	Time
passed	HistoricalPriceHelpersTest	20	0	0	0	100%	6.595 s
passed	HistoricalPriceServiceIT	4	0	0	0	100%	3.051 s

tech.edgx.prise.indexer.repository

	Class	Tests	Errors	Failures	Skipped	Success Rate	Time
passed	AssetRepositoryIT	4	0	0	0	100%	0.890 s

tech.edgx.prise.indexer.service.chaindb

	Class	Tests	Errors	Failures	Skipped	Success Rate	Time
passed	KoiosServiceIT	4	0	0	0	100%	5.527 s
passed	BlockfrostServiceIT	4	0	0	0	100%	3.069 s

passed	YaciStoreServiceIT	4	0	0	0	100%	3.871 s
--------	------------------------------------	---	---	---	---	------	---------

tech.edgx.prise.indexer.service.chain

	Class	Tests	Errors	Failures	Skipped	Success Rate	Time
passed	ChainServiceIT	4	0	0	0	100%	14.71 s

tech.edgx.prise.indexer.service

	Class	Tests	Errors	Failures	Skipped	Success Rate	Time
passed	CandleServiceIT	4	0	0	0	100%	0.167 s
passed	AssetServiceIT	2	0	0	0	100%	0.073 s

tech.edgx.prise.indexer.service.classifier

	Class	Tests	Errors	Failures	Skipped	Success Rate	Time
passed	WingridersClassifierTest	2	0	0	0	100%	0.184 s
passed	SundaeswapClassifierTest	2	0	0	0	100%	0.054 s
passed	MinswapClassifierTest	5	0	0	0	100%	0.029 s
passed	MinswapV2ClassifierTest	13	0	0	0	100%	0.791 s
passed	ClassifierHelpersTest	1	0	0	0	100%	0.001 s
passed	MinswapV2ClassifierIT	5	0	0	0	100%	17.67 s
passed	MinswapClassifierIT	5	0	0	0	100%	7.458 s
passed	SundaeswapClassifierIT	5	0	0	0	100%	6.779 s
passed	WingridersClassifierIT	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
```

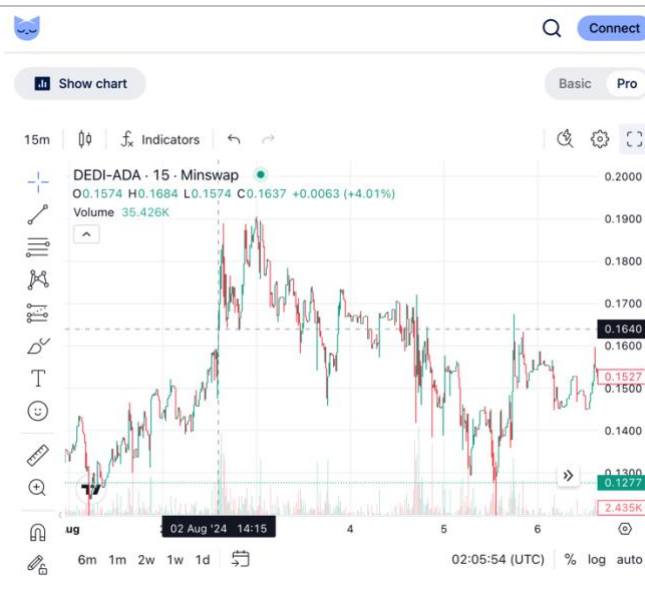
Historical Price Comparison

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



Candle Resolution: 15 Minutes

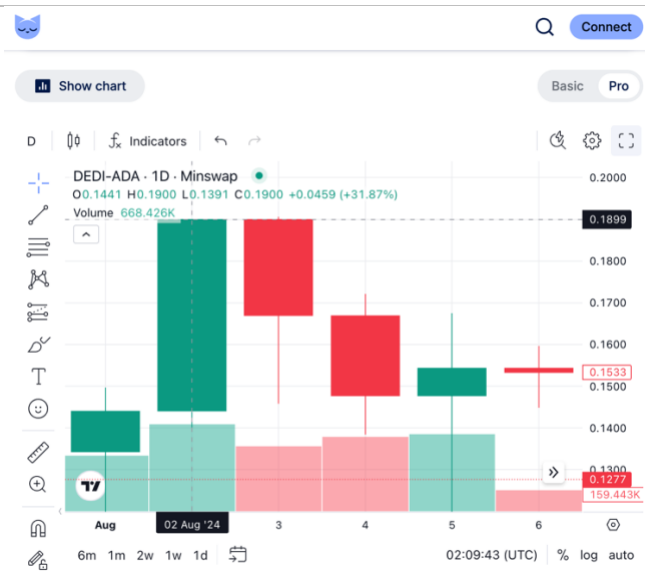
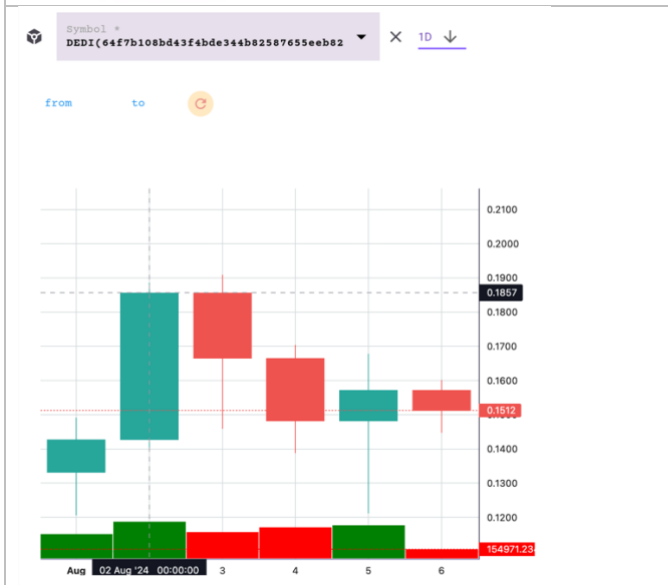
Pointer location: 02 Aug 24 1415 UTC
(1722608100)

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)

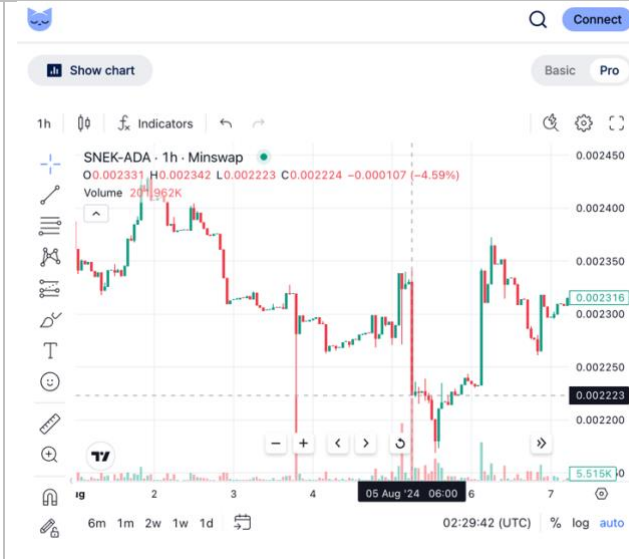
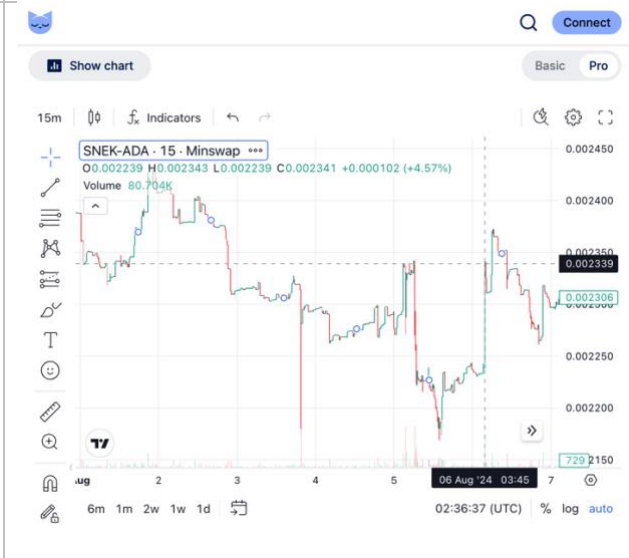
Volume (not shown at pointer):
Prise: 649.386k
Minswap: 668.426k
Ok
*** Difference due to a small number of atypical swaps not yet being classified, e.g. SWAP_EXACT_OUT type. Since Milestone 1, MinswapV2 ZapIn (DEPOSIT) type swaps have been added*

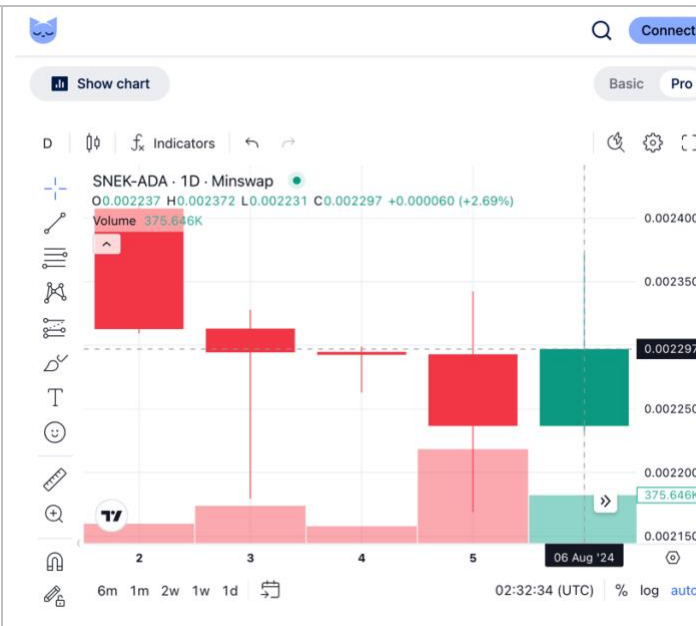
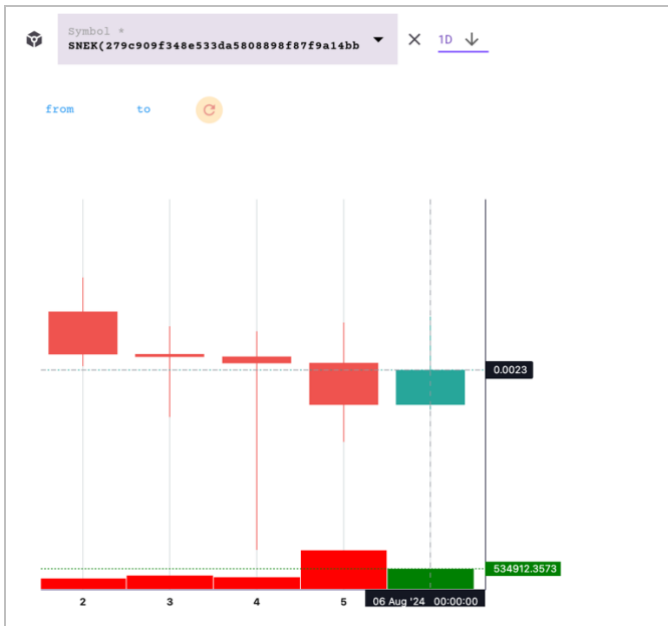
Shape: Ok

Time alignment: Ok

Price Magnitude: Ok (~0.19 ADA)

TOKEN: SNEK (279c909f348e533da5808898f87f9a14bb2c3dfbbacccd631d927a3f534e454b)

		Candle Resolution: 1 hour Pointer location: 05 Aug 24 0600 UTC (1722837600) Volume (not shown at pointer): Prise: 283.329k Minswap: 201.962k 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) Comment: 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
		Candle Resolution: 15 minutes Pointer location: 06 Aug 24 0345 UTC (1722915900) Volume (not shown at pointer): Prise: 103.905k Minswap: 80.704k 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) Comment: 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



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 Tx	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 Tx	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 Tx	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 Tx	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 Tx	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 Tx	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 Tx	Ok (equivalent)
ShenMicroUSD	8db269c3e...879a1cd61	1.02518536	minswap	7/8/2024 3:16	1.0251 @ 0316 Tx	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 Tx	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 Tx	Ok (equivalent)
worldmobiletoken	1d7f33bd2...2a0f34e1e	0.54209603	minswap	7/8/2024 6:07	0.542 @ 0607 Tx	Ok (exact)
worldmobiletoken	1d7f33bd2...2a0f34e1e	0.5413276	minswapv2	7/8/2024 7:13	0.541 @ 0713 Tx	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	• 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	• https://github.com/Edgxtech/prise • Indexer: https://github.com/Edgxtech/prise/tree/main/indexer • API Webserver: https://github.com/Edgxtech/prise/tree/main/webserver
	• At least 2x (two) UTXO resolver external interface module	• https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/yacistore/YaciStoreService.kt (implementation based on Yaci Store general purpose indexer) • https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/carp/jdb

		c/CarpJdbcService.kt (implementation based on Carp general purpose indexer) https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/blockfrost/BlockfrostService.kt (implementation based on Blockfrost API) https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/koios/KoiosService.kt (implementation based on Koios API)
	At least 1x (one) token metadata external interface module	https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/dataprovider/module/tokenregistry/TokenRegistryService.kt (implementation of tokens.cardano.org metadata query)
	At least 4x (four) DEX classifier(s)	https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/MinswapClassifier.kt -> (Minswap V1) https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/MinswapV2Classifier.kt -> (Minswap V2) https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/SundaeswapClassifier.kt (Sundaeswap V1) https://github.com/Edgxtech/prise/blob/main/indexer/src/main/kotlin/tech/edgx/prise/indexer/service/classifier/module/WingridersClassifier.kt (Wingriders)
Acceptance criteria	2.1 User can query latest price data?	Table 6: API Software Verification Tests - ApiControllerIT Section 4.3 API Query Validation - Query Latest Prices
	2.2 User can query historical price candles data?	Table 6: API Software Verification Tests - ApiControllerIT Section 4.3 API Query Validation - Query Historical Prices
Evidence of milestone completion	Report section describing test serials and results for querying latest prices (2.1)	Section 4.2 API Software Verification Testing Section 4.3 API Query Validation
	Report section describing test serials and results for querying historical prices (2.2)	Section 4.2 API Software Verification Testing Section 4.3 API Query Validation

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
tech.edgx.prise.webserver.validator	15	0	0	0	100%	0.101 s
tech.edgx.prise.webserver.controller	18	0	0	0	100%	0.675 s
tech.edgx.prise.webserver	1	0	0	0	100%	0 s

tech.edgx.prise.webserver.validator

	Class	Tests	Errors	Failures	Skipped	Success Rate	Time
success	GetLatestPricesValidatorTest	5	0	0	0	100%	0.080 s
success	GetHistoricalPricesValidatorTest	10	0	0	0	100%	0.021 s

tech.edgx.prise.webserver.controller

	Class	Tests	Errors	Failures	Skipped	Success Rate	Time
success	ApiControllerIT	18	0	0	0	100%	0.675 s

tech.edgx.prise.webserver.controller

	Class	Tests	Errors	Failures	Skipped	Success Rate	Time
success	ApiControllerIT	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)

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 <pre>{ "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": "64f7b108bd43f4bde344b02507655eeb021256c0c8e79ad48db15d1844454449", "name": "DEDI", "last_price_ada": 0.1544956005354389, "last_update": "2024-08-07T00:53:43+0000", "pricing_provider": "minswapv2" }, { "symbol": "533bb94a850ee3cbe463106409399112b74c905342cb1792a797a0494e4459", "name": "INDY", "last_price_ada": 1.5773350451778232, "last_update": "2024-08-07T00:46:01+0000", "pricing_provider": "minswap" }, { "symbol": "b6a7467ea1deb012008ef4eb7b5ff371e5f7142d7b356a40d9b42a0436f726e75636f706996173205b76696120436861696e506f72742e696f5d", "name": "ADA", "last_price_ada": 1.0, "last_update": "2024-08-07T00:00:00+0000", "pricing_provider": "minswap" }] }</pre> Response headers <pre>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</pre>

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": 0.842401081317543096,
      "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	-
Add item	

[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	Response body <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> Download Response headers <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 integer(int64) (query)	Time from [Seconds since epoch] from - Time from [Seconds since epoch]
resolution * required string (query)	Resolution width 1W
symbol * required string (query)	Cardano Native Token Id (hexpolicy+hexname); e.g. 279c909f34 5d16cc1a177b5d9ba9cfa9793b07e60f1fb70fea1f8aef064415d114494147
to integer(int64) (query)	Time from [Seconds since epoch] 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 integer(\$int64) (query)	Time from [Seconds since epoch] from - Time from [Seconds since epoch]
resolution * required string (query)	Resolution width 1D
symbol * required string (query)	Cardano Native Token Id (hexpolicy+hexname); e.g. 279c909f348 79a1cd61446a65644d6963726f555344
to integer(\$int64) (query)	Time from [Seconds since epoch] 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 <pre>[{ "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": 331334.51858699997 }]</pre> Response headers <pre>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</pre>

Successful response (200) with no expected irregularity.

3. Query historical hourly candles

Token: BOOK
(51a5e236c4de3af2b8020442e2a26f454fda3b04cb621c1294a0ef34424f4f4b)
Resolution: 1h

GET /api/prices/historical/candles getHistoricalPrices

Name	Description
from integer(int64) (query)	Time from [Seconds since epoch] from - Time from [Seconds since epoch]
resolution * required string (query)	Resolution width 1h
symbol * required string (query)	Cardano Native Token Id (hexpolicy+hexname); e.g. 279c909f34154fda3b04cb621c1294a0ef34424f4f4b 154fda3b04cb621c1294a0ef34424f4f4b
to integer(int64) (query)	Time from [Seconds since epoch] to - Time from [Seconds since epoch]

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 <pre>[{"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}]</pre> Response headers <pre>cache-control: no-cache, no-store, max-age=0, must-revalidate connection: keep-alive content-type: application/json date: Thu26 Nov 2024 16:11:19 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>

Download

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 integer(int64) (query)	Time from [Seconds since epoch] from - Time from [Seconds since epoch]
resolution * required string (query)	Resolution width 15m
symbol * required string (query)	Cardano Native Token Id (hexpolicy+hexname); e.g. 279c909f348e533da5808898f87f9a14bb2c3dfbbacccd631d927a3f534e454b 4bb2c3dfbbacccd631d927a3f534e454b
to integer(int64) (query)	Time from [Seconds since epoch] 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	Response body <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> Download Response headers <pre>cache-control: no-cache-no-store-max-age=0must-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-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.

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.