illion Decisioning Performance Improvements

Program Overview

Version 1.0. February 2019

Contents

Introduction

In Q2 of 2018, illion Software Solutions engaged in a project to focus on improving the overall performance and stability of the illion Decisioning system. The project included the following tasks:

- Enhance the performance of dash board widgets

- Rectify issues around memory leaks

- Rectify issues around TCP connectivity between Inteport and the illion Decisioning engine

- Upgrade the .net framework

- Improve logging

- Speed up and optimise the datastore component

- Update the SFTP component used in illion Decisioning

The outcome of this project has seen the response times of engine process requests improved by a substantial 47%.

Improvements

Following is a summary of the improvements implemented as part of the illion Decisioning performance improvement project. Where possible a measurement of gain after implementation is also provided. The illion Decisioning performance improvements outlined in this document take effect from version 5.1.0.11.

Performance Improvements

PDR-4963 | PIP10-44 Dashboard application search optimisation

Change description: Performance improvements have been made to the dashboard, ensuring application searches are returned in a reasonable timeframe.

Measure: Statistics from t_log_entry table.

Metrics

Query	Before (avg, ms)	After (avg, ms)	Percentage Gain
Client A			
• Default search	43.33	17	61%
• Without date range limit	123	16.6	87%
• Filter by First Process Date	1125	42	96%
Client B	(~2.5M records)	(~5.8M records)	
• Without date range limit	2262700	20	100%
• Filter by application status	21399	8357	61%
• Filter by merchant	1069	28.67	97%
• Filter by credit product	86	76	12%
• Filter by first process date	Time-out (30+ secs)	523	100%
• Filter by entered queue	1048	49	95%
• Filter by follow-up	20934	6433	69%

PDR-4947 | PIP10-85 Dashboard search - runs twice on login

Change description: An issue has been resolved, which caused the dashboard application search to run twice in certain scenarios, ensuring it only runs once and saves on load time.

Metrics

Before	After	Percentage gain
2 x No. of seconds taken for application search	1 x No. of seconds taken for application search	50%

PDR-4946 | PIP10-84 Widgets - custom query

Change description: Various dashboard widgets have been enhanced for performance improvements.

The affected widgets are:

- Auto Decision
- Alert Activity
- Merchant Approvals
- Applications for Merchant

Measure: Statistics from t_log_entry table.

Metrics

Query	Before (avg, ms)	After (avg, ms)	Gain
Auto Decision	495.24	470.15	1.05 x faster
Alert Activity	10,087.41	8,967.82	1.12 x faster
Merchant Approvals	178.08	34.33	5.19 x faster
Applications for Merchant	61.27	27.16	2.25 x faster

PDR-4945 | PIP10-83 Widgets - search query

Change description: Various dashboard widgets were enhanced with performance improvements in the way that they retrieve the data, resulting in quicker widget load times.

Widgets affected:

- Queue Summary
- Status Summary
- Product Summary
- Applications by Product
- Underwriter Summary

Measure: Statistics from t_log_entry table

Metrics

Query	Before (avg, ms)	After (avg, ms)	Gain
Queue Summary	303.7	43.23	7.03 x faster
Status Summary	388.01	48.26	8.04 x faster

Query	Before (avg, ms)	After (avg, ms)	Gain
Product Summary	53.4	6.64	8.04 x faster
Applications for Product	549.24	155.62	3.53 x faster
Underwriter Summary	41.57	4.48	9.28 x faster

PDR-5142 | PIP10-64 Optimise datastore. Reduce number of DB hits.

Change description: The datastore mechanism in illion Decisioning would historically insert one record at a time to the database, thus resulting in opening and closing database connection per commit causing a performance hit. This has now been rectified for SQL by using table-valued parameters. This new mechanism uses batch insert to store application details to the database.

Measure: Statistics from t_log_entry table is used to record the time taken to store application data to the database.

Metrics

Component	Improvement
Average duration of time to store data	83%
Average duration of time taken to store events to T_LOG_PROCESSING table	98%

Overall Database Improvement Metrics

Since the implementation of the performance improvements there has been no unplanned outages (crashes) of the illion Decisioning engine.

The table below provides measurements taken on the database before and after the performance improvements.

Component	Before	After	Percentage Gain
Database			
SQL Queries Response time	1.56 ms	0.84 ms	46.15%
SQL Queries Throughput	4.16k/min	12.9k/min	210%
SQL Modifications Response time	2.09 ms	2.2 ms	- 5.26%*
SQL Modifications Throughput	1.98k/min	4.21k/min	112%
SQL Transaction Response time	3.21 ms	2.19 ms	31%
SQL Transactions Throughput	77.3/min	156/min	101%

* This is an expected outcome of the new batch insert process that provides an overall performance benefit.

Component	Before	After	Percentage Gain
illion Decisioning Engine			
Stability - Memory Usage			
Min-Max	80MB - 9.5GB	171MB - 5.3GB	
Average	4.5GB	2.2GB	~50%
Performance			
Response time	25.4 ms	19.5 ms	23%
Throughput	452/min	1.45k/min	220%

Stability/Memory Improvements

The illion Decisioning engine had issues related to not freeing up objects and releasing memory after it was used. This resulted in the engine running out of memory and crashing under high load situations.

We resolved this by identifying offending objects and disposing them. This allowed the server to re-allocated that memory to other requests.

Stability / Memory Improvement Summary

Before	After
illion Decisioning engine used on average 11 - 12GB of memory in our managed environment. The engine crashed on a high load	The engine only uses an average of 4-5GB of memory, and this usage does not increase over time or when the engine is under high load

The following change descriptions collectively make up the improvement described above.

PDR-4944 | PIP10-28 High memory consumption - garbage collection & memory leaks

Change description: Changes were made to the garbage collection process to ensure the process is run at an optimal time, which has resulted in increased uptime of the illion Decisioning engine. Performance improvements were also made to clean-up memory.

Measure: Memory dump obtained from the production environment

Dev benchmarking

Before	After
32 instances of the XMLSchemaValidator were found holding memory	Post November release no instances of XMLSchemaValidator holding memory

PDR-5026 | PIP10-94 Dynamic loading of flow objects

Change description: Performance improvements were made to prevent redundant memory usage.

Measure: Memory dump obtained from the production environment

Dev benchmarking

Before	After
Multiple instances of the same object were found holding memory (total 47 objects)	Post November release this object list is now capped to only one instance.

PDR-5032 | PIP10-98 Dispose of SSLStream in TCPSocketListener

Change description: Performance improvements to resource management to increase stability and overall up-time.

Measure: Memory dump obtained from the production environment

Dev benchmarking

Before	After
41 instances of the SSLStream were found holding memory	Post November release no instances of SSLStream holding memory

PDR-4946 | PIP10-41 TCP – Improved data transport connection

Change description: Connectivity was improved between illion Decisioning components to ensure that in specific scenarios, communication is completely closed on the illion Decisioning engine side prior to Integate or Inteport closing communications. The changes made will prevent ECP socket errors in the logs. .

Measure: Dynatrace report

Metrics

Before	After
Two process crashes were reported in Dynatrace	Post November release no process crashes were reported on Dynatrace related to this issue

PDR-5129 | PIP10-114 Engine socket unresponsiveness

Change description: The TCP socket logic has been updated to handle all exceptions thus preventing the engine from becoming unresponsive.

Measure: In the event of a SSL stream exception the engine remains responsive. Changes are indicative by the stability of the system and increased uptime of the engine.

PDR-5138 | PIP10-116 Engine open/close DB connection on every request

Change description: illion Decisioning engine code was updated to remove redundant backup database logic.

Measure: Changes are indicative by the stability of the system and increased uptime of the engine.

PDR-5139 Handle uncaught exceptions

Change description: illion Decisioning engine code has been reviewed and updated to ensure all exceptions are handled gracefully.

Measure: Changes are indicative by the stability of the system and increased uptime of the engine.

PDR-5140 | PIP10-112 Memory Leaks in IF_Tools.clsTransform.cs

Change description: To reduce memory consumption while storing schemas/xslt files, an expiring cache mechanism has been introduced that clears the cache periodically, and a capacity limit to stop the cached list from growing above a certain threshold.

Measure: Memory dump obtained from the production environment

Metrics

Before	After
High memory consumption related to schemas/xslt files	Low memory usage for schemas/xslt files

PDR-5141 | PIP10-113 Engine SFTP connections

Change description: Upgrade of the Renci.SshNet.dll v2016.0.0 to Renci.SshNet.dll v2016.1.0, to prevent the failure to close the connection properly between the illion Decisioning Engine to the SFTP server.

Measure: No percentage gain, changes are indicative by the stability of the system, increased uptime of the engine and decreased memory usage