

Continuous Number Sequence

- Performance Improvements

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Agenda

The Problem

Business Scenarios

Solution & Design Approach

Demo

Current Status & What's Next

Q&A

Number Sequence in F&O

Identification

Number sequence code:

Name:

Scope parameters

Scope:

- Shared
- Company
- Legal entity
- Operating unit
- Company and Fiscal calendar period
- Legal entity and Fiscal calendar period
- Operating unit type

Segments

+ Add Remove Move up Move down

Segment	Value	Length
Company	▼	0
Fiscal calendar period	▼	0
Constant	▼	1
Alphanumeric	▼	9

Format:

References

General

SETUP

In use: No Yes

Manual: No Yes

Stopped: No Yes

Continuous: No Yes

ALLOW USER CHANGES

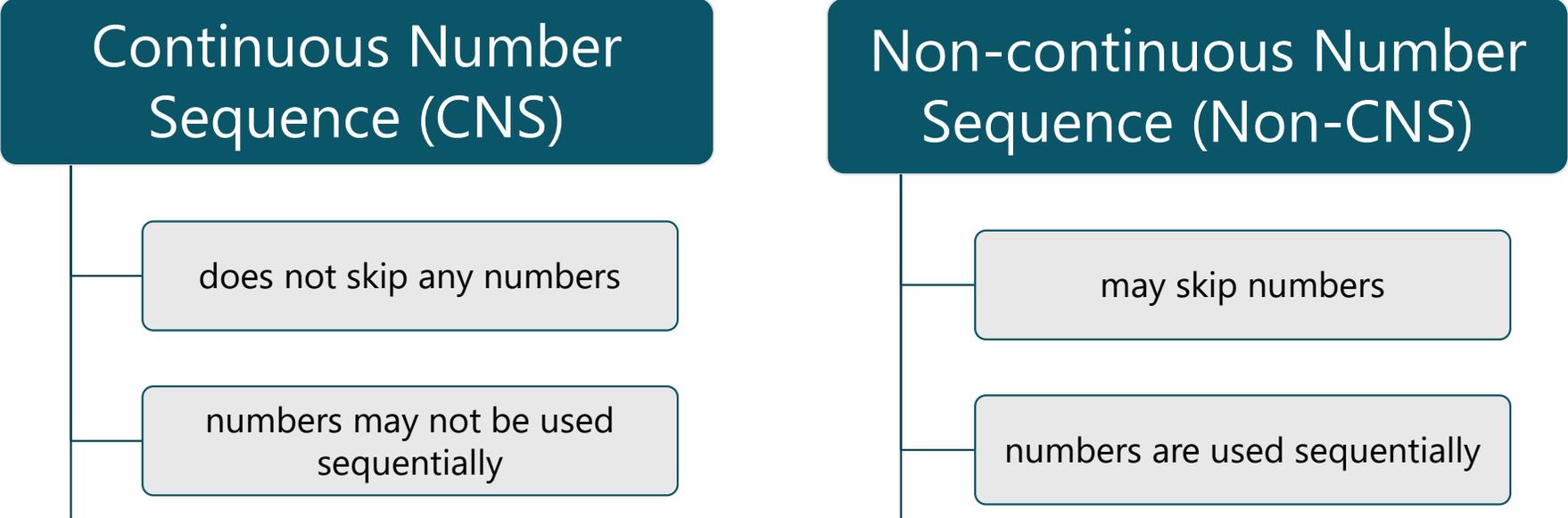
To a lower number: No Yes

To a higher number: No Yes

NUMBER ALLOCATION

Smallest: Largest: Next:

Continuous Flag?



Performance



Preallocation - You should increase the preallocation quantity according to your regulatory requirement for better performance.

The functionality preallocate numbers in NumberSequenceList for continuous number sequences and in memory of the computer for non-continuous number sequences. This applies to all the number sequences that are used as system keys, merely to link data in the database and sequences used for entities which cannot have gap in the numbers.

You can use the Preallocation functionality for continuous and non-continuous number sequences. You must specify how many numbers to preallocate, e.g., 10 numbers. The system will select 10 numbers at a time to store in the memory of the computer. Thus, the system will select a new set of numbers from the database every tenth time a number is required.

This functionality is very important for the general speed of the system. This is because selecting numbers from the database is considerably slower than selecting from the preallocated entity.

ACTIVATE PREALLOCATION

Preallocation

No

ALLOCATED NUMBERS

Quantity of numbers	Next	Largest
<input type="text"/>	<input type="text"/>	<input type="text"/>

Problem



Legal Requirements

Legal compliance to not have any gaps in their number series

F&O only provides numbers without gaps, no guarantee of being in Sequence

Performance

Enterprise Readiness

Bulk operation is more time consuming and less performant

Challenge exist since beginning of F&O/AX/Axapta

System Issues

SQL Blockings (table lock) during CNS

Un-used numbers in case of AOS crashes or unexpected termination

TIMESTAMP	BLOCKING_TREE
2023-01-19 13:56:36.3232940	HEAD - 1455 CREATE PROCEDURE [dbo].[getNumInternal] @numberid bigint, @globalTransId bigint, @UserId nvarchar(20), @sessionId
2023-01-19 13:56:36.3232940	----- 3891 (@P1 bigint)SELECT TOP 1 T1.ALLOWCHANGEDOWN,T1.ALLOWCHANGEUP,T1.ANNOTATEDFORMAT,T1.BLOCKED,T1.CLEANATACCESS,T1.CLEANINT
2023-01-19 13:56:36.3232940	----- 9003 (@P1 bigint)SELECT TOP 1 T1.ALLOWCHANGEDOWN,T1.ALLOWCHANGEUP,T1.ANNOTATEDFORMAT,T1.BLOCKED,T1.CLEANATACCESS,T1.CLEANINT
2023-01-19 13:56:36.3232940	----- 9004 (@P1 bigint)SELECT TOP 1 T1.ALLOWCHANGEDOWN,T1.ALLOWCHANGEUP,T1.ANNOTATEDFORMAT,T1.BLOCKED,T1.CLEANATACCESS,T1.CLEANINT
2023-01-19 13:56:36.3232940	----- 9006 (@P1 bigint)SELECT TOP 1 T1.ALLOWCHANGEDOWN,T1.ALLOWCHANGEUP,T1.ANNOTATEDFORMAT,T1.BLOCKED,T1.CLEANATACCESS,T1.CLEANINT
2023-01-19 13:56:36.3232940	----- 9014 (@P1 bigint)SELECT TOP 1 T1.ALLOWCHANGEDOWN,T1.ALLOWCHANGEUP,T1.ANNOTATEDFORMAT,T1.BLOCKED,T1.CLEANATACCESS,T1.CLEANINT
2023-01-19 13:56:36.3232940	----- 9015 (@P1 bigint)SELECT TOP 1 T1.ALLOWCHANGEDOWN,T1.ALLOWCHANGEUP,T1.ANNOTATEDFORMAT,T1.BLOCKED,T1.CLEANATACCESS,T1.CLEANINT
2023-01-19 13:56:36.3232940	----- 9016 (@P1 bigint)SELECT TOP 1 T1.ALLOWCHANGEDOWN,T1.ALLOWCHANGEUP,T1.ANNOTATEDFORMAT,T1.BLOCKED,T1.CLEANATACCESS,T1.CLEANINT
2023-01-19 13:56:36.3232940	----- 9017 (@P1 bigint)SELECT TOP 1 T1.ALLOWCHANGEDOWN,T1.ALLOWCHANGEUP,T1.ANNOTATEDFORMAT,T1.BLOCKED,T1.CLEANATACCESS,T1.CLEANINT
2023-01-19 13:56:36.3232940	----- 9018 (@P1 bigint)SELECT TOP 1 T1.ALLOWCHANGEDOWN,T1.ALLOWCHANGEUP,T1.ANNOTATEDFORMAT,T1.BLOCKED,T1.CLEANATACCESS,T1.CLEANINT
2023-01-19 13:56:36.3232940	----- 9021 (@P1 bigint)SELECT TOP 1 T1.ALLOWCHANGEDOWN,T1.ALLOWCHANGEUP,T1.ANNOTATEDFORMAT,T1.BLOCKED,T1.CLEANATACCESS,T1.CLEANINT
2023-01-19 13:56:36.3232940	----- 9024 (@P1 bigint)SELECT TOP 1 T1.ALLOWCHANGEDOWN,T1.ALLOWCHANGEUP,T1.ANNOTATEDFORMAT,T1.BLOCKED,T1.CLEANATACCESS,T1.CLEANINT

Done (00:02.796): 8950 records

SELECTED: 1



Business Scenarios

Business Scenarios

- Any business process where system should use "Continuous" number sequence
- Need to avoid gaps for regulatory requirements
- Need Performance gains

Customers using “Continuous” number sequence in

- Journals (General, Payment, Vendor etc.)
- Vouchers
- Customer Invoices
- Vendor Invoices
- Free Text Invoices
- ...



Solution & Design Approach

Solution?

Performance Optimization

Bring back un-used Numbers
(crash scenarios)

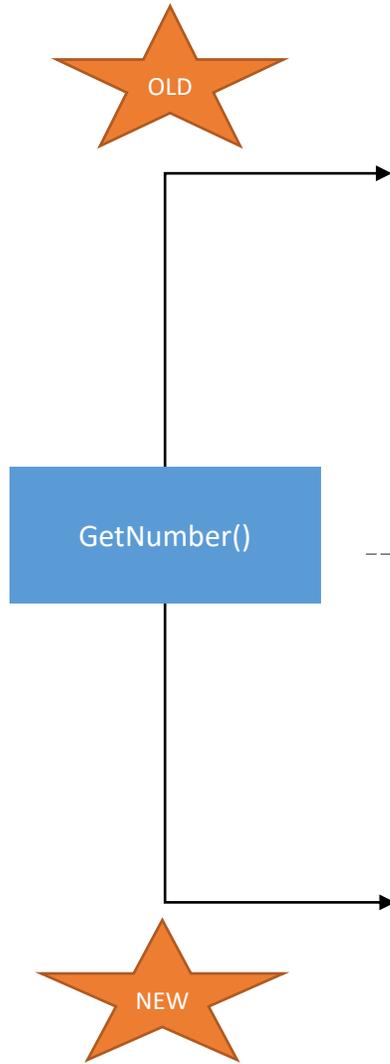
Configurable Pre-Allocation for
Continuous Number Sequence

Design thoughts

- Reduce the unnecessary call to database
- Effective usage of SQL locks (like Read past, rowlock, nolock)
- To fasten the number allocation, pre-populate the Number Sequence list with set of record
 - It help reduce contention on Number Sequence Table records
- Introduced the performance improvement, such that is easy to measure the improvement, triage and rollout the feature
 - Introduced new state for the Number Sequence Status
 - Updated the telemetry
 - Create a parallel and performant flow without impacting existing one

CONTINUOUS NUMBER SEQUENCE

FNO NUMBER SEQUENCE



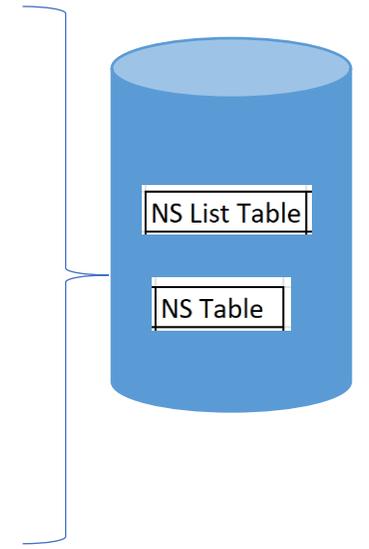
NumberSequenceTable/NumberSequenceList

- Fetch NS from NSList for the incoming NS id
- Take lock on NS Table, insert one record into NSList
- Make an additional call to update the status of NSList to active
- Concurrent request gets serialize and leads to blocking session

Clean-up

- Clean-up to handled used/abort

Multiple SQL calls for getNumber
Failed to scale due to blocking session



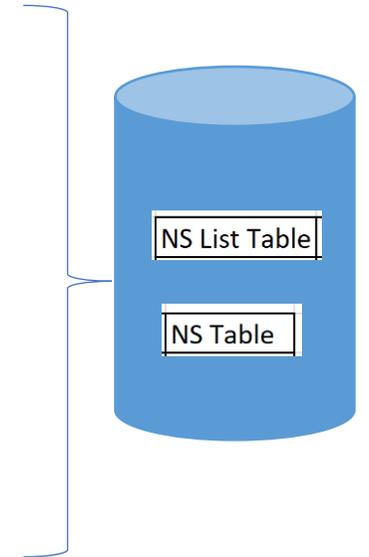
NumberSequenceTable/NumberSequenceList

- Fetch NS from NSList for the incoming NS id
- Prepopulate NSList with a set of records based on prefetch size
- Reduce the contention on the NSTable

Clean-up

- Enhanced clean-up to handle crashes or unexpected terminations
- Update NSList table with recycle numbers

Read Past & Row lock for NSListTable
No-lock for NSTable
UX for Pre-Allocation CNS Configuration
Prepopulate NSList based on the pre-allocation quantity (default is 5)
Enhanced auto clean-up to be non-blocking



NS List Status

- Free (0)
 - If no free records, then Prepopulate based on the pre-allocation quantity
- Active (1)
 - This status is used today without the new feature
- Block (2)
- Reserved (3)
- Active Non-Blocking (4)
 - Clean-up job update records to Free Status
 - This status will be used in new feature

UI Changes

- Number Sequence
 - Automatic cleanup ensures to clean unused numbers via system job periodically, helpful in case of AOS crashes, or unexpected termination
 - Performance Tab can now work for Continuous Number Sequence (CNS) as well. User can set Pre-Allocation quantity of numbers like Non-Continuous Number Sequence (Non-CNS)

Number sequences | Standard view ▾

<Tes_100 : <Tes_100

SETUP

In use
 No

Manual
 No

Stopped
 No

Continuous
 Yes

ALLOW USER CHANGES

To a lower number
 No

To a higher number
 No

NUMBER ALLOCATION

Smallest	Largest	Next
<input type="text" value="1"/>	<input type="text" value="99999"/>	<input type="text" value="1"/>

Automatic cleanup

Complete cleanup - periodic update

When you select the Continuous check box of a number sequence, the system automatically ensures that no numbers from the current sequence are lost. The system furthermore ensures that selected numbers are returned to the list if an update is unexpectedly terminated or fails.

In cases of power failure, crashes, or other kinds of unexpected termination, the system cannot return the numbers automatically. This is because the client process stops, leaving no time for the required cleanup of the selected numbers. The complete cleanup will find such temporary lost numbers and return them to the list with the status Free.

To execute the complete cleanup manually, click Clean up. You can also have the complete cleanup executed automatically with a specified time interval. To do this, select the Cleanup check box and specify an interval (in hours) for how often the cleanup should be performed.

ACTIVATE COMPLETE CLEANUP

LATEST COMPLETE CLEANUP

Clean up
 Yes

Interval

DateTime

Performance

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ACTIVATE PREALLOCATION

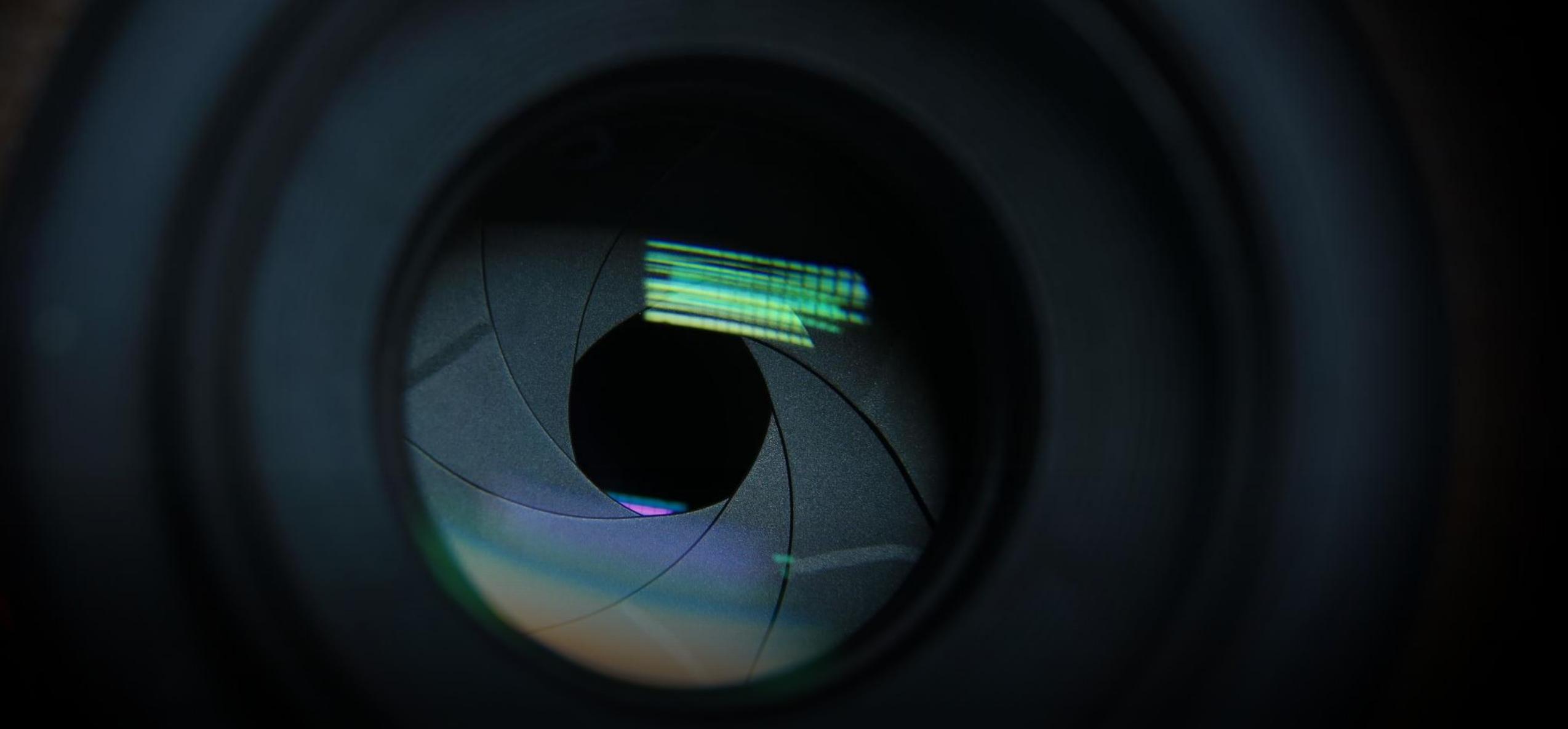
ALLOCATED NUMBERS

Preallocation
 No

Quantity of numbers

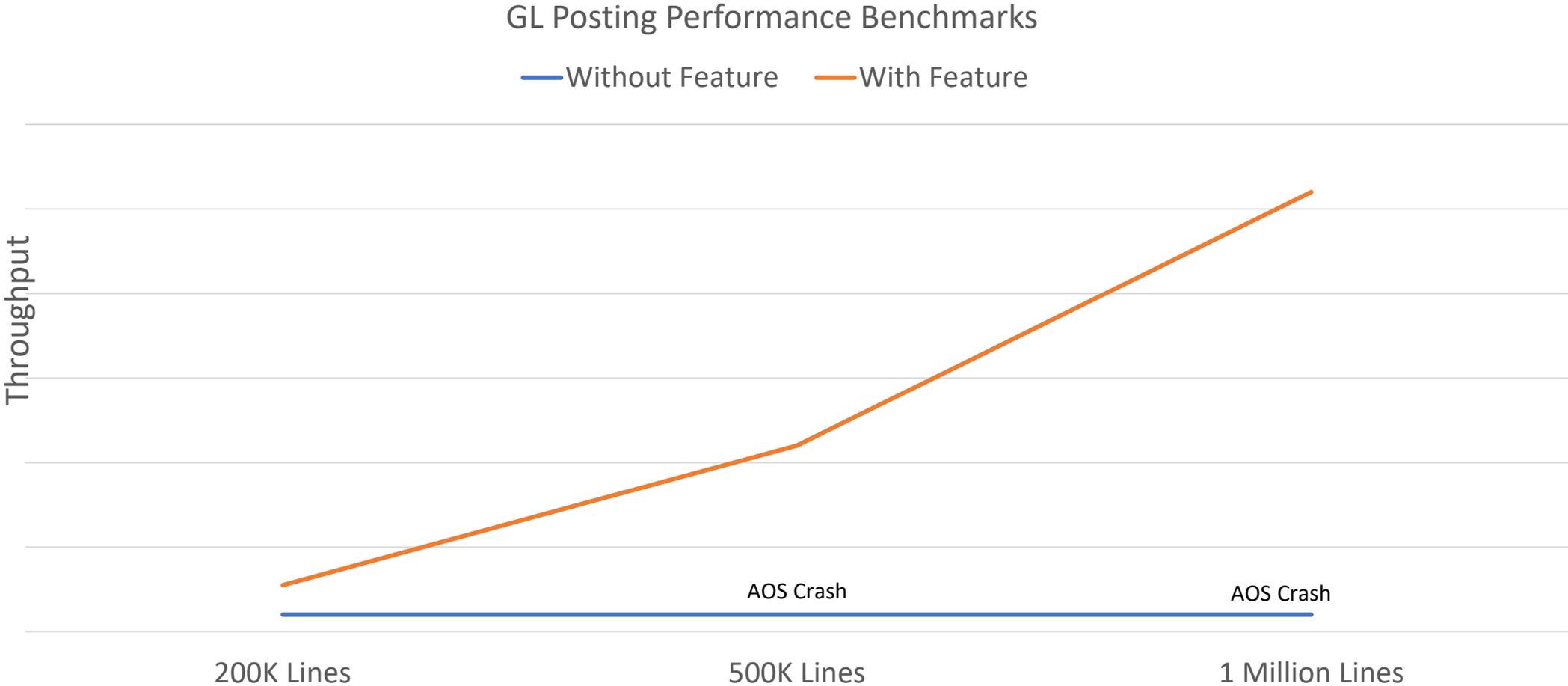
Next

Largest



Demo

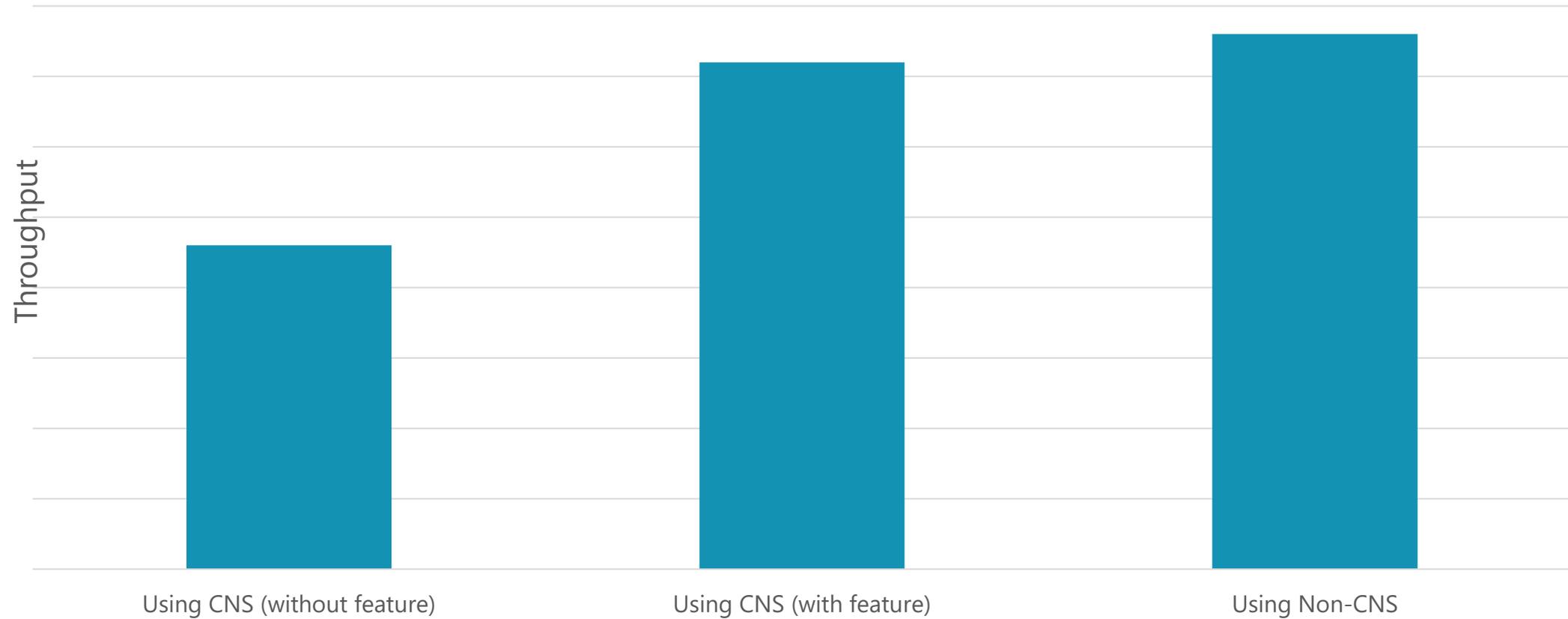
Performance – GL Posting



General Ledger Posting - Generating Voucher during Posting

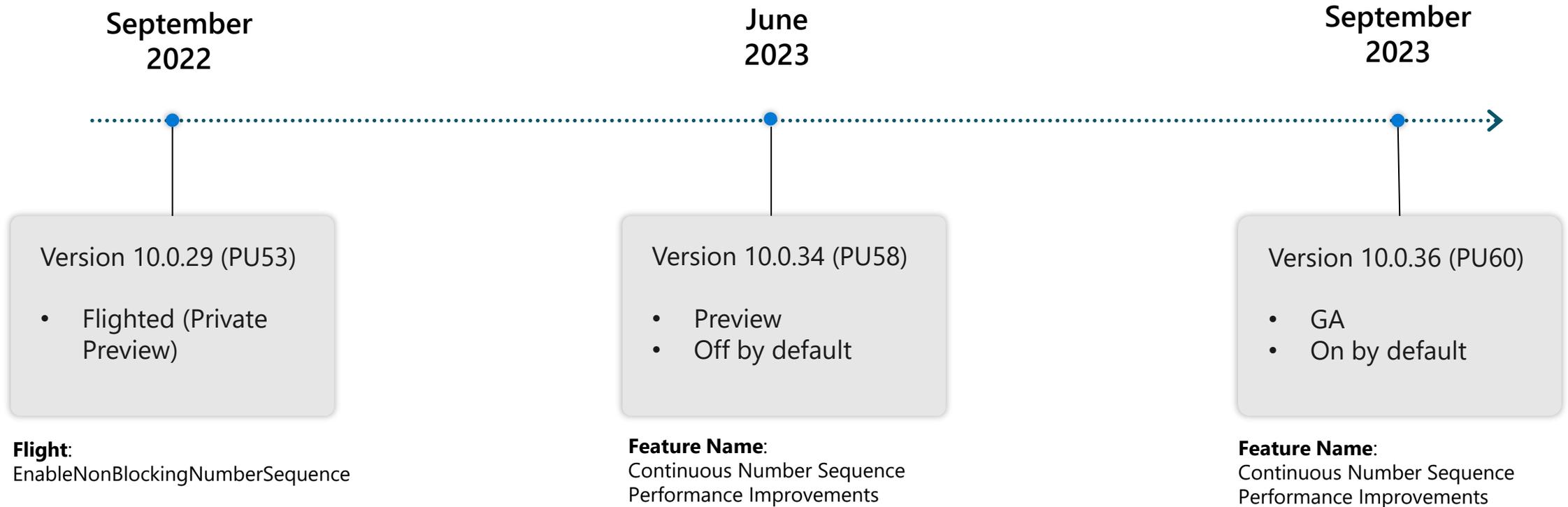
Performance – FTI Posting

FTI Posting Performance Benchmarks



Phased Rollout*

Feature Management availability



*tentative based on feedback

Key Takeaways

- Sometimes, auto-generated Ids (numbers) shouldn't have gaps due to Legal compliance
- Finance & Operations (F&O) apps provide continuous in the no-gap (no unused numbers) manner
- CNS Performance can also be improved now using Pre-Allocation, similar to non-CNS
- With Pre-Allocation in CNS: system keep track of generated, used, and un-used numbers
- Clean-up job (system job) logic is improved with new feature and should run periodically to use numbers update the generated number's status appropriately
- Multiple customers using the feature in Production successfully



Thank You