Performance Test Report

Workspace ONE UEM 19.07.0.22

Table of Contents

Introduction 3

Audience 3

Executive Summary 4

Environment Setup 5

Tools used for load simulation 5

Risks 5

Test Architecture 6

Test Environment 7

Application Server Configurations (VMs) 7
VM Host Configuration 8
Reference Data 8

Recommendations 10

SQL Server Recommendations (same as 9.7 and 1902 recommendation) 10
Hardware Recommendations (same as 9.7 and 1902 recommendation) 10
WS1 UEM Application Servers Settings and Recommendations 10

Test Definitions 11

Scenarios 11
Scenario 1 11
Scenario 2 11
Scenario 3 12
Scenario 4 12
Background Load 12
Workload A – Device Samples 12
Workload B – Console UI Test 13
Workload C – API Usage Test 13
Workload D – Device side Force reprocess of Products 14

Out of Scope 14

Test Observations – Load Test 15

Server Performance Graphs 16

Result Set based on Scenario 3: 16
CPU Utilization 16
Available Memory 16
Requests/Sec 17
Network – Bytes Received/sec 17
Network – Bytes Sent/sec(During product/profile/application publish) 17
SQL Server Activity 18

Appendix 20

SQL Server Recommendations 20
Hardware Recommendations 24
WS1 UEM Application Servers Settings and Recommendations 24

Introduction

The objective of the test is to gauge the overall performance of the Workspace ONE (WS1) UEM system by executing variety of tests and create a reference architecture for WS1 UEM 1907 deployment.

The report has been generated after testing WS1 UEM application with the following configuration:

- 1.2 Million Devices – 1Million Android Rugged, 50K Android Smartphone and 200K iOS
- Devices distributed across 20K OGs
- Major scenarios include
    - Multiple Product publish to 533K devices along with App/Profile publish
    - Staggered assignment of Users to the published Product to simulate chainwide rollout scenarios
    - ‘Device Force Reprocess’ happening in the background for 60K devices per hour
    - Based on the simulated failure rate of 5%, 5 out of 10 Products were auto retried for 125K devices

Details of the tests are provided in the Test Definitions section

Audience

This document is intended for IT architects and administrators who want to understand the performance and scale attributes of WS1 UEM. Pre-requisites to follow this document are to have enough understanding of WS1 UEM servers and their configuration, familiarity with MS SQL Server configuration, in addition to an understanding of sizing and performance concepts.

Executive Summary

The goal of this report is,

1. To examine performance of WS1 UEM system with RSCC(Relay Server Cloud Connector)
2. To provide server sizing recommendation based on the analysis

WS1 UEM 1907 with RSCC has demonstrated similar performance and scalability with respect to multiple Product provisioning, Device Force Reprocess and Auto retry of Products, when compared to CDS(Content Delivery Service). The test load included, Product publish to Android Rugged devices, Profile and Application publish to Rugged/BYOD devices, Product Auto retry, Device Force Reprocess, Device check-in and sample simulation.

WS1 UEM Server sizing remains same as the deployment with CDS, except for 10 RSCC servers. The average CPU utilization on SQL and DS server was under 40% and 35% respectively. Console and API server CPU utilization was under 25%.

	CDS	RSCC
# of hours for Product publish to complete	~17 hours	~17 hours
CN Avg CPU utilization	5	5
DS Avg CPU utilization	30	32
SQL Avg CPU utilization	36	38

Environment Setup

- WS1 UEM 19.07.0.22 was used for this testing and all the recommendations in this document apply to this version of WS1 UEM
- MemCached version 1.4.36 on CentOS Linux release 7.4.1708 (core)
- AWCM version 6.4
- RSCC version 3.0
- All the virtual servers used for this testing use flash storage except for SQL server
- Implemented recommended changes, which are documented later in this document on the MS SQL server, at the ESX host level and on WS1 UEM application to improve performance of the overall system

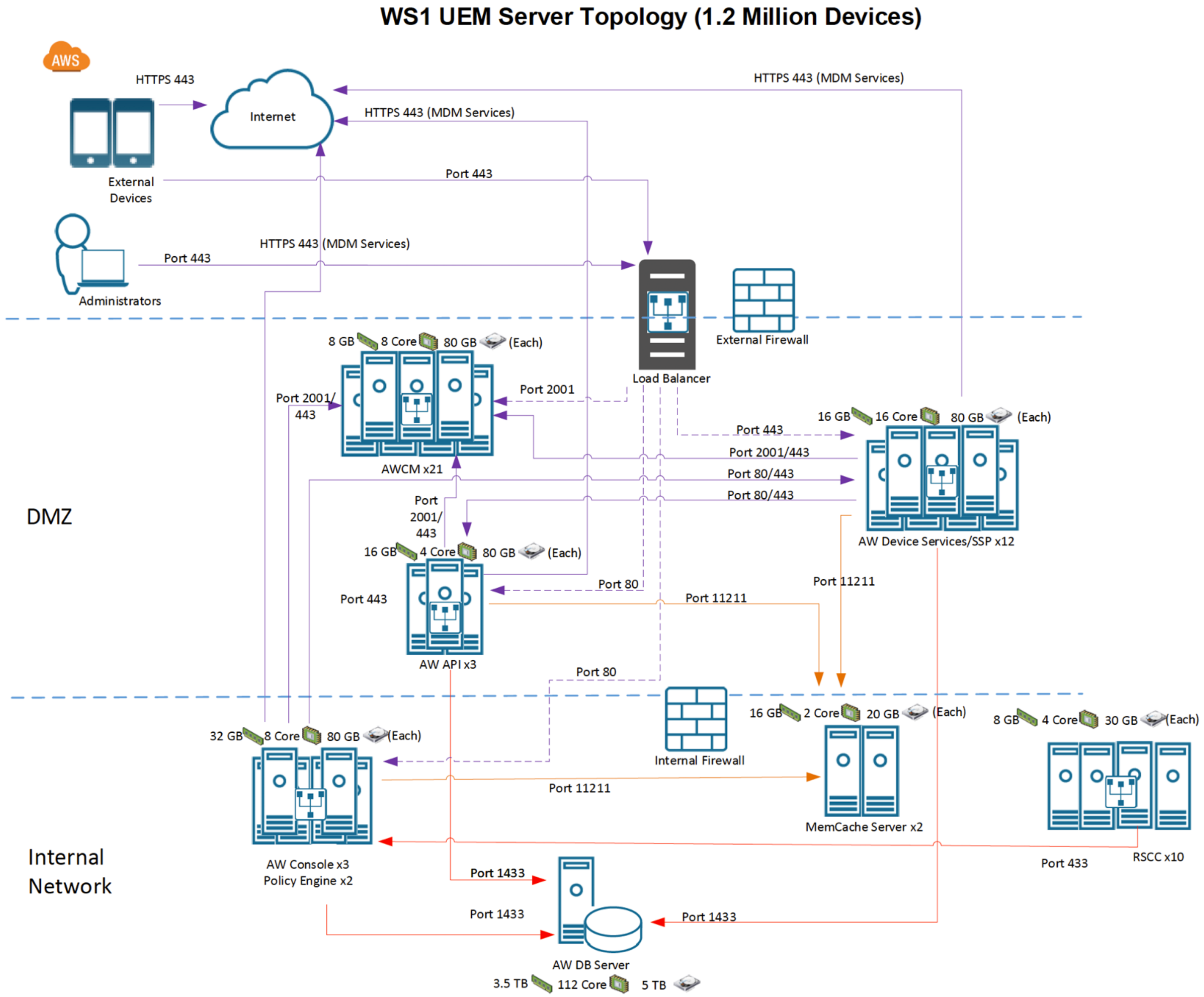
Tools used for load simulation

- Falcon - A VMWare proprietary tool used to simulate 1.2 Million virtual devices
- HP LoadRunner to generate a background load of 10 virtual users on the WS1 UEM Admin Console

Risks

1. As the testing was done on Windows Server 2016, any change to the host OS version can show different results from the scale test done. The performance impact is unknown if the application server version is not updated to Windows Server 2016
2. These tests were run using VMware’s proprietary load simulation tool which creates simulated devices. One can expect some differences in server performance between the real and simulated devices

Test Architecture



Note: RSCC interacts with Content pull endpoint on Console servers(3)

Test Environment

Recommended application server configuration of WS1 UEM key components based on the performance tests carried out.

Application Server Configurations (VMs)

Recommended configuration		
Database Server	OS	Windows Server 2016
	SQL Server	Microsoft SQL Server Enterprise 2016: Core-based Licensing (64-bit)
	SQL Server version	13.0.5149.0
	vCPU	28 cores x 4 sockets (112 CPU)
	vRAM	3.5 TB
	Total DB storage	5 TB
	Transaction Log storage	500 GB
	Temp DB storage	1 TB
3 X Admin Console 2 X Policy Engine	OS	Windows Server 2016
	vCPU	2 cores x 4 sockets (8 CPU)
	vRAM	32 GB
	Storage	95 GB
12 X Device Services	OS	Windows Server 2016
	vCPU	8 cores x 2 sockets (16 CPU)
	vRAM	16 GB
	Storage	95 GB
3 X API Server	OS	Windows Server 2016
	vCPU	2 cores x 2 sockets (4 CPU)
	vRAM	16 GB
	Storage	95 GB
2X MemCached Server	OS	CentOS Linux release 7.4.1708
	MemCached Version	1.4.36
	vCPU	2 cores x 1 socket (2 CPU)
	vRAM	16 GB
	Storage	25 GB
	OS	Windows Server 2016

21X AWCM Server	vCPU	4 cores x 2 socket (8 CPU)
	vRAM	8 GB
	Storage	25 GB
10X RSCC Server	OS	Windows Server 2016
	vCPU	2 cores x 2 socket (4 CPU)
	vRAM	8 GB
	Storage	100 GB

Note: Load balancer is configured to offload DS requests on the application server

VM Host Configuration

Recommended configuration		
Database Server	Host Model	Dell Inc. PowerEdge R940
	Processor Type	Intel(R) Xeon(R) Platinum 8176M CPU @ 2.10GHz
	vCPU	4 sockets x 28 cores
	Logical Processors	224
	Hyper threading	Active
	vRAM	4 TB
	Storage hardware	PURE Fiber Channel Disk (Flash Drive)
AirWatch Servers	Host Model	Dell Inc. PowerEdge R640
	Processor Type	Intel(R) Xeon(R) Gold 6152 CPU @ 2.10GHz
	vCPU	2 sockets x 22 cores
	Logical Processors	88
	Hyper threading	Active
	vRAM	382 GB
	Storage hardware	PURE Fiber Channel Disk (Flash Drive)

Reference Data

Devices	Android	1Million(Rugged) + 50K(Smart phone)
	iOS	200K
Organization Groups	Customer OGs	2
	Container OG	26864
	Device Distribution	Random
	Largest OG	198K
	Smallest OG	1
Administrators	Total Accounts	14

	Logged In	10
Users	Total Accounts	357K
Smart Groups	Various sizes (1-775K devices)	44K
Applications (For BYO devices)	Internal	25
	Public	15
	Unmanaged	0
Products	Products with Apps/Files & Actions/Profiles	Applications: 80
		Files and Actions: 256
		Profiles: 358
Profiles	All Types	60

Recommendations

The following settings and recommendations are provided after Performance tests were successfully completed for 1Million devices:

SQL Server Recommendations (same as 9.7 and 1902 recommendation)

1. Add 1 tempdb file per core (112 tempdb files for 112 core)
2. Add Trace flags in Startup Parameters for "mssqlserver" service as per Microsoft
3. Set "Lock Pages in Memory" privilege for the service account
4. Disable "Named Pipes" and Enable "TCP/IP" network protocol
5. Increase Maximum Worker threads in server properties to "7500"
6. Set "Max Degree Of Parallelism" to 2 and "Cost threshold for Parallelism" to 50
7. Enable "Received Side scale" setting for Network Adapter on SQL server
8. Set "Delayed Durability" under database properties = "Forced" to reduce WriteLog waits

Hardware Recommendations (same as 9.7 and 1902 recommendation)

1. Enable Network Interface Card "Received Side Scaling" for efficient distributions of network receive processing across multiple CPUs on all servers, including SQL server.
2. Change ESX Host power management to "High Performance" (updated windows power policies)

WS1 UEM Application Servers Settings and Recommendations

1. Update WS1 UEM application server to 1907 revision 12
2. Set Product Provisioning AWCM Throttle Rate: 20
3. Set Product Provisioning Command Release Batch Size: 2000 per 2 mins
4. Set Certificate Profile Publish Frequency: 100
5. Set Apple Profile Installation Batch Size: 450 (*changed from 300 in 9.7*)
6. Set iOS Device Invites Per Second:30
7. Set FastLaneMessageRateMultiple:1.5
8. Enable event log consolidation (config file)
   a. Though these changes were done in 1902, "AW.ChangeEvent.QueueService.exe.config" file has to be updated again after upgrading to 1907
9. Enable Auto retry setting
10. Use smart group patch API to add bulk of users to existing Smart Group
11. RSCC specific recommendations:
    a. Enable below feature flags:
       i. RelayServerCloudConnectorFeatureFlag
       ii. PullServiceInstallerFeatureFlag
    b. System code(DB) changes:

  i. RelayServerCloudConnectorApplicableCommandRetrievalBatchSize: 2000
  ii. RelayServerCloudConnectorMaxCommandQueueIteration: 1
  iii. RelayServerCloudConnectorBatchSize: 50

c. RSCC configuration on the console:
  i. Pull Frequency: 5
  ii. Max pull connection: 1
  iii. Max Push Connections: 50
  iv. Report Status Batch Size: 25

Note:

Steps to implement or enable recommendations related to SQL server, Hardware and WS1 UEM Application Server settings, along with comprehensive explanations, are given in the appendix.

Test Definitions

A test is to simulate device load using Falcon and administrator activity using Load Runner in the WS1 UEM system. We ran through different tests to determine the architecture that can sustain realistic activity from 1.2 Million devices. The test composed of scenarios with workloads defined below.

The tests below were created to define a typical workflow for large customers using Android rugged devices and BYOD use-cases on the same instance. The tests encompass areas like Product provisioning, Application / Profile push (including certificates), API load and multi-admin usage of the application.

Scenarios

Below scenarios define full load generated for the test.

Scenario 1

Single Product Publish with App while publishing one internal Application and 2 Profiles

- Add a Managed Internal Application and assign it to 1Million devices through Product provisioning via console
- Add a Managed Internal Application and assign it to 200K iOS devices after 1 hour of the above Product publish
- Add 2 Profiles (iOS and Android) with certificate (ADCS CA) and publish it to 10K iOS and 10K Android Rugged devices after 2 hours of the above Product publish
- Background load mentioned below was running throughout the test

Scenario 2

Publishing multiple Products at once to 533K devices along with VPP and Profile publish

- Publish 10 Products (Apps 4, Files and Actions 5 and Profile 1) at the same time to 533K devices

  - Enable Auto retry for 5 Products
- After 1 hour add a VPP SToken with 3 Apps and 200 licenses and assign it to 200K iOS devices
- Add 2 profiles (iOS and Android) with certificate (ADCS CA) and publish it to 10K iOS and 10K Android devices after 2 hours of above-mentioned Product publish

Scenario 3

Staggered publishing of multiple Products to 533K devices along with VPP and Profile publish

- Publish of 10 Products (Apps 4, Files and Actions 5 and Profile 1) to 533K devices
  - Activate a Product every 30 minutes
  - Enable Auto retry for 5 Products
- After 1 hour add Internal application and assign it to 200K iOS devices
- Add 2 Profiles (iOS and Android) with Cert(ADCS CA) and publish it to 10K iOS and 10K Android Smartphone devices after 2 hours of Product publish

Scenario 4

Switch from RSCC to CDS during Product Publish

- Publish a product to 533K devices
- Stop RSCC windows service on all RSCC servers
- De-activate all the RSCC relay servers on the console
- Set RelayServerCloudConnectorFeatureFlag to false
- Start CDS

Background Load

Workload A – Device Samples

- Interrogator Samples every 8 hours
  - Application
  - Files/action
  - Profiles
  - Events action
  - Network sample
- Beacon Samples and command check-in every 1 hour
- Job Samples
- Above values are directly proportional to number of devices that are part of the test
- Run custom index job every 24 hours
- Run purge job every 24 hours

Workload B – Console UI Test

Overview: Test simulates 10 Administrators navigating around the console UI

Details:

- Number of users – 10
- Administrator will navigate to different OGs (OGs: Global, BYOD, Name_571, Name_573, Name_578)
- Administrator will navigate to different list views in an OG
  - Application (Products), Profiles (Products), Smart Group, Device and Product list view
- Administrators will navigate to Device Details page for different devices at different OG and navigate to the below tabs.
  - Products/Network/Troubleshooting/Certificates tabs
- Load Runner Config:
  - Ramp up – 1 user every 10 seconds
  - Steady state duration – 60 minutes
  - Ramp down – 5 users every 30 seconds

Workload C – API Usage Test

Considerations:

- Run API calls based on high API usage estimates from Walmart

Below table defines API that will be tested as part of this workload, with the expected rate

API	Expected number of transactions per hour (during Business hours: *Peak)
Create Organization Group	5 Per/Hour
Create Smart Group	5 Per/Hour
Create User Group	10 Per/Hour
Add users to user group	This API will be run as part of the scenario 4
Deactivate Products	5 Per/Hour
Application Search	10 Per/Hour
Device Search	10 Per/ Hour
Tunnel API to fetch Whitelist of devices	10 Per/Hour
Tunnel API to check if a device is Whitelisted or not	240 Per/Hour
Tunnel API to get config	1 Per/Hour
Application add API and then publish it with Product	6 Apps/Hour

Workload D – Device side Force reprocess of Products

Overview: This step will simulate triggering of force reprocess of Products from device

- Trigger 60K Device Force reprocess per hour throughout the test
- Simulate failures to 10% relay servers

Out of Scope

- WS1 app + vIDM scenarios were not considered
- Transfer time/latency between CDS and Relay Servers
- Device sample load that is simulated doesn't consider 8.3 or lesser Android Agent version
- COPE enrollment flow
- SEG and Tunnel Server (UAG) load i.e. Devices hitting SEG/Tunnel Server
- Power BI that pulls data directly from DB
- WS1 UEM Analytics was not enabled

Test Observations – Load Test

- WS1 UEM Application Servers handled the load generated through Product/Application/Profile publish, Devices Check in, Console Users and API
- Average CPU utilization on Device Services servers was around 32% during the test and spikes around 80% each time there is high inflow of device samples
- SQL server was stable and average CPU utilization was 40% with periodic spikes up to 90% during full load which includes Product/App/Profile/Samples and API load
- 8 GB of memory was used on DS and 6 GB on Console server during this full load
- Average 12 MBps of network bandwidth was used on each DS severs during the test duration
- During full load we observed an average of 105 HTTPS requests being processed per second across all 12 DS servers and were able handle the load efficiently
- There were no commands found in the message queues on all application servers after the test. This signifies the system could process all the commands queued during the test
- We saw slight increase in response time of console page loads as we have added more devices, applications and products

Note:

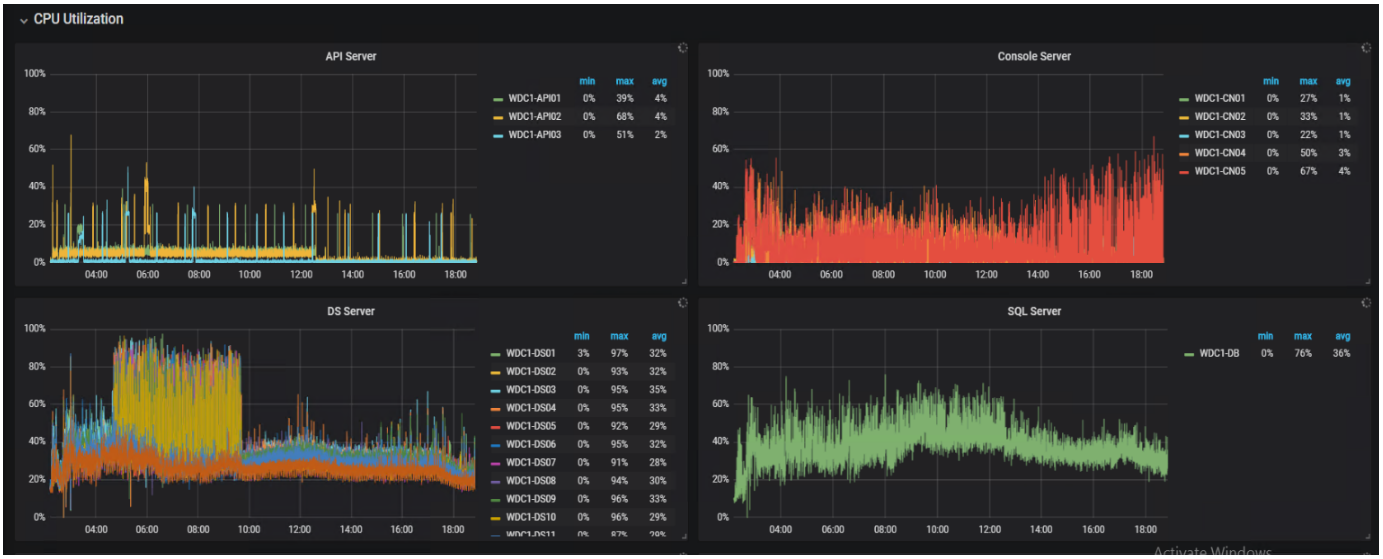
Under unexpected constant load, the DS servers may utilize 100% CPU and struggle to recover unless traffic is terminated as part of the standard health checks implemented at the Load Balancer. If the server continues to receive requests past capacity, it may be required to perform IIS reset to clear queued requests and return to normal operation.

Server Performance Graphs

Result Set based on Scenario 2:

Publishing multiple products at once along with Profile publish. Graph shows the system health during 10 products publish to 533K Android Rugged devices, ADCS certificate profile to iOS and Android devices (5K each).

CPU Utilization



API Server

	min	max	avg
WDC1-API01	0%	39%	4%
WDC1-API02	0%	68%	4%
WDC1-API03	0%	51%	2%

Console Server

	min	max	avg
WDC1-CN01	0%	27%	1%
WDC1-CN02	0%	33%	1%
WDC1-CN03	0%	22%	1%
WDC1-CN04	0%	50%	3%
WDC1-CN05	0%	67%	4%

DS Server

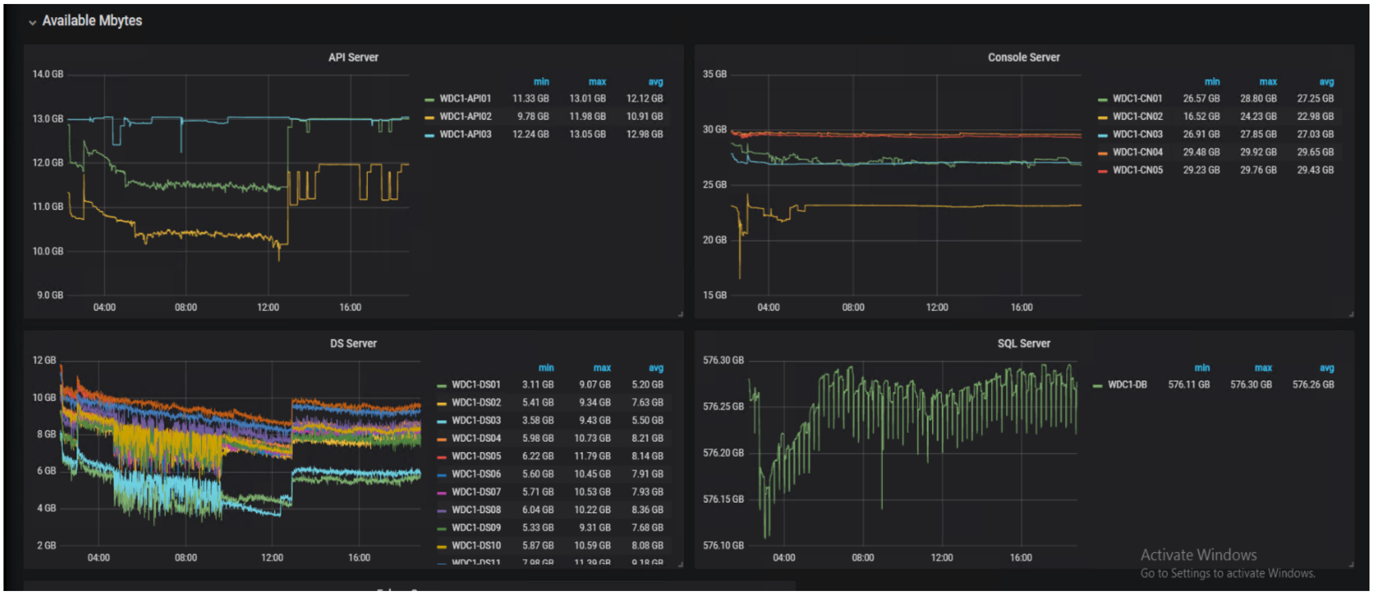
	min	max	avg
WDC1-DS01	3%	97%	32%
WDC1-DS02	0%	93%	32%
WDC1-DS03	0%	95%	35%
WDC1-DS04	0%	95%	33%
WDC1-DS05	0%	92%	29%
WDC1-DS06	0%	95%	32%
WDC1-DS07	0%	91%	28%
WDC1-DS08	0%	94%	30%
WDC1-DS09	0%	96%	33%
WDC1-DS10	0%	96%	29%
WDC1-DS11	0%	87%	29%

SQL Server

	min	max	avg
WDC1-DB	0%	76%	36%

Observation: Average CPU utilization on SQL server was around 36% and for DS servers it was below 35%. Console and API server CPU usage was below 20% with spikes up to 60%

Available Memory



API Server

	min	max	avg
WDC1-API01	11.33 GB	13.01 GB	12.12 GB
WDC1-API02	9.78 GB	11.98 GB	10.91 GB
WDC1-API03	12.24 GB	13.05 GB	12.98 GB

Console Server

	min	max	avg
WDC1-CN01	26.57 GB	28.80 GB	27.25 GB
WDC1-CN02	16.52 GB	24.23 GB	22.98 GB
WDC1-CN03	26.91 GB	27.85 GB	27.03 GB
WDC1-CN04	29.48 GB	29.92 GB	29.65 GB
WDC1-CN05	29.23 GB	29.76 GB	29.43 GB

DS Server

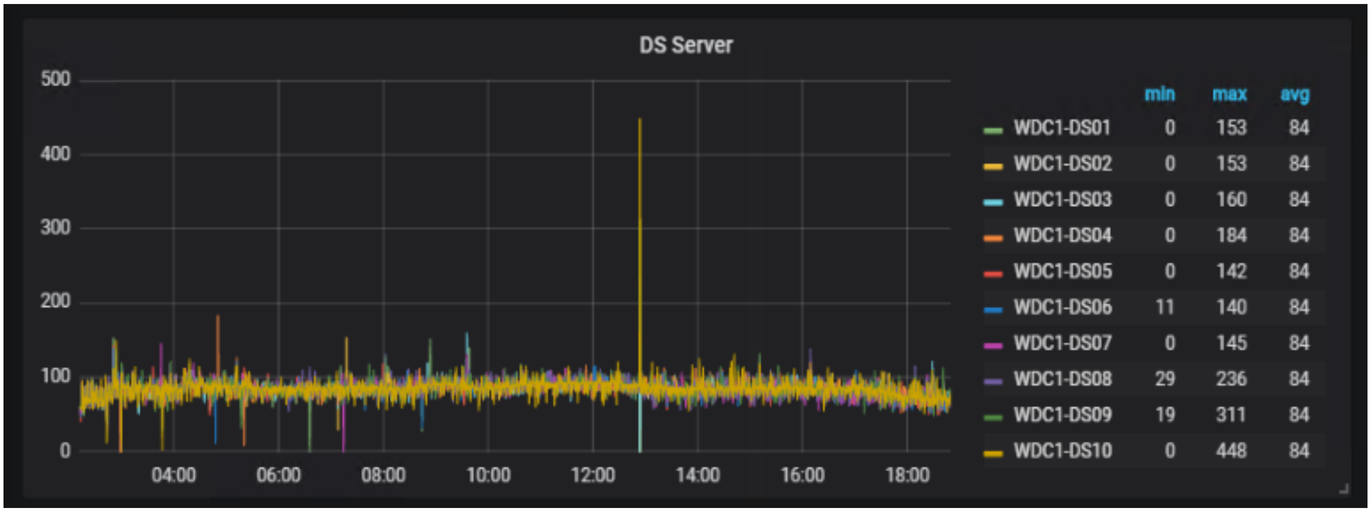
	min	max	avg
WDC1-DS01	3.11 GB	9.07 GB	5.20 GB
WDC1-DS02	5.41 GB	9.34 GB	7.63 GB
WDC1-DS03	3.58 GB	9.43 GB	5.50 GB
WDC1-DS04	5.98 GB	10.73 GB	8.21 GB
WDC1-DS05	6.22 GB	11.79 GB	8.14 GB
WDC1-DS06	5.60 GB	10.45 GB	7.91 GB
WDC1-DS07	5.71 GB	10.53 GB	7.93 GB
WDC1-DS08	6.04 GB	10.22 GB	8.36 GB
WDC1-DS09	5.33 GB	9.31 GB	7.68 GB
WDC1-DS10	5.87 GB	10.59 GB	8.08 GB
WDC1-DS11	7.98 GB	11.39 GB	9.18 GB

SQL Server

	min	max	avg
WDC1-DB	576.11 GB	576.30 GB	576.26 GB

Observation: Average 8 GB memory was used on DS servers during the test. 3 to 9 GB of memory was used on Console and API servers.

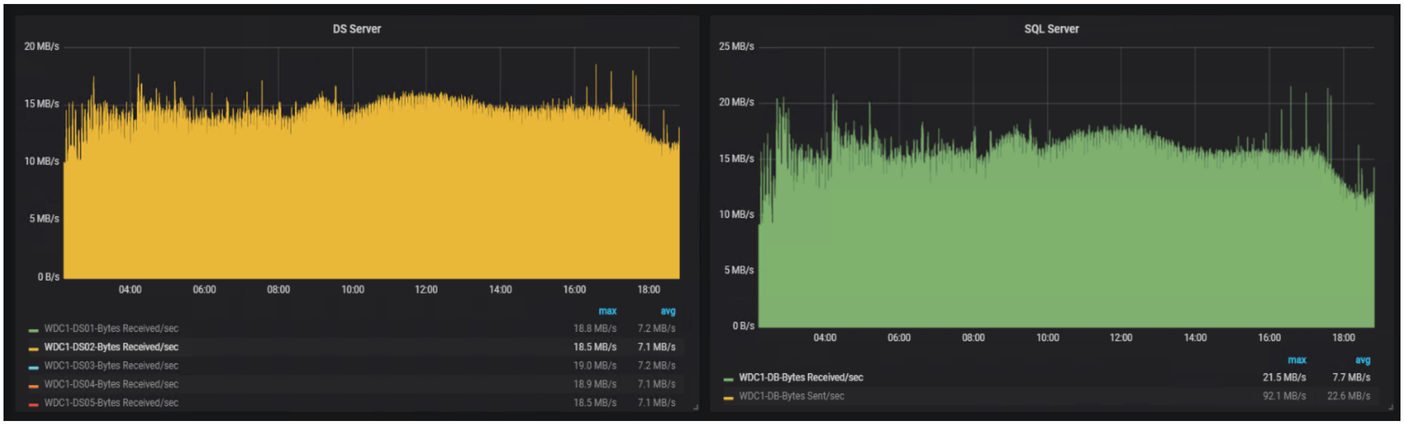
Requests/Sec



	min	max	avg
🟩 WDC1-DS01	0	153	84
🟨 WDC1-DS02	0	153	84
🟦 WDC1-DS03	0	160	84
🟧 WDC1-DS04	0	184	84
🟥 WDC1-DS05	0	142	84
🟦 WDC1-DS06	11	140	84
🟪 WDC1-DS07	0	145	84
🟪 WDC1-DS08	29	236	84
🟩 WDC1-DS09	19	311	84
🟨 WDC1-DS10	0	448	84

Observation: Each DS server processed 84 requests/sec on average with max request up to 448 request/sec. These requests are HTTPS requests with SSL pass through settings on F5 load balancer.

Network – Bytes Received/sec

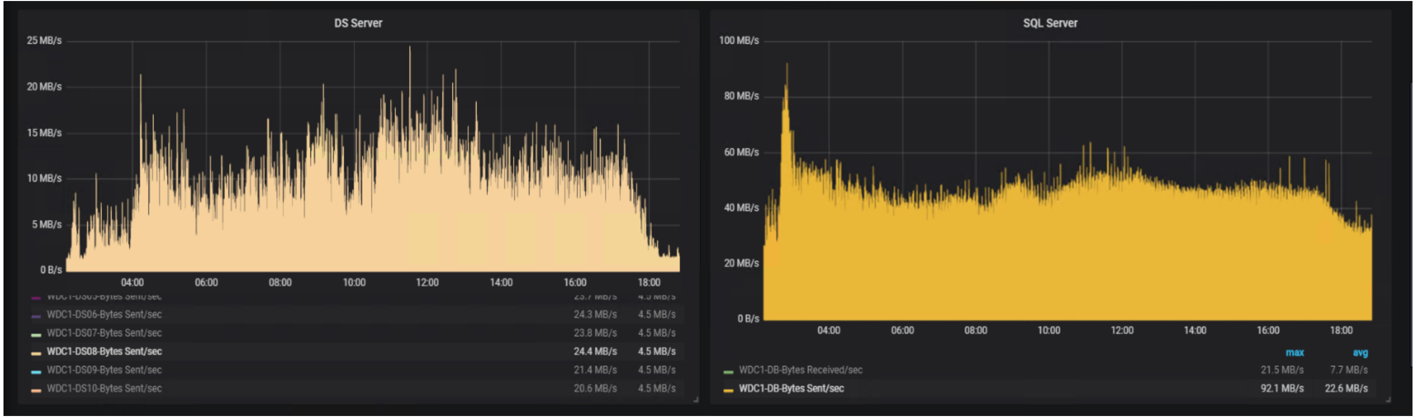


	max	avg
🟩 WDC1-DS01-Bytes Received/sec	18.8 MB/s	7.2 MB/s
🟨 WDC1-DS02-Bytes Received/sec	18.5 MB/s	7.1 MB/s
🟦 WDC1-DS03-Bytes Received/sec	19.0 MB/s	7.2 MB/s
🟧 WDC1-DS04-Bytes Received/sec	18.9 MB/s	7.1 MB/s
🟥 WDC1-DS05-Bytes Received/sec	18.5 MB/s	7.1 MB/s

	max	avg
🟩 WDC1-DB-Bytes Received/sec	21.5 MB/s	7.7 MB/s
🟨 WDC1-DB-Bytes Sent/sec	92.1 MB/s	22.6 MB/s

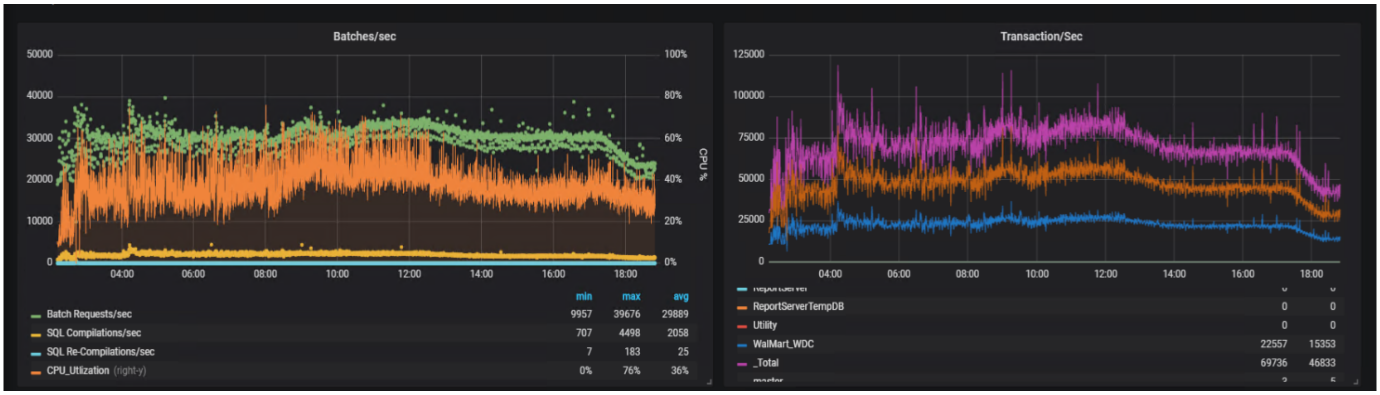
Observation: DS was receiving up to 19.00 MB of data during the active product/profile/application publish. Average Bytes Received/Sec for DS was 7.2 MB/s and for SQL server 7.7 MB/s

Network – Bytes Sent/sec(During product/profile/application publish)



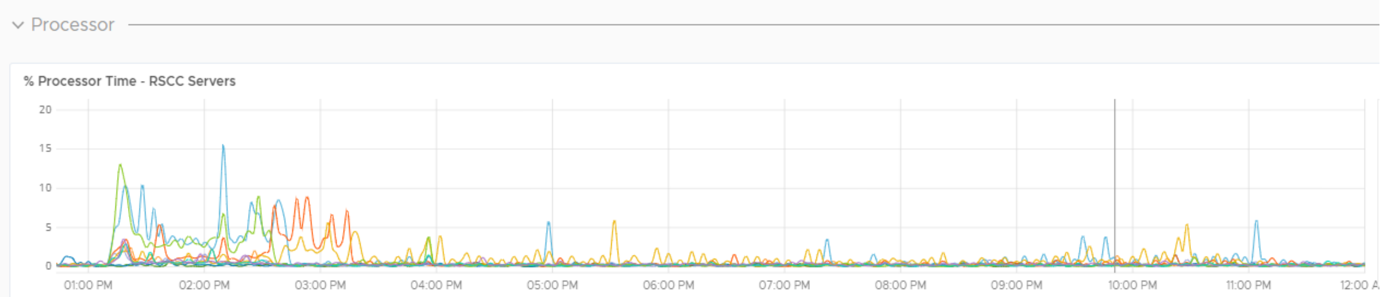
Observation: DS was sending up to 24.4 MB of data during the active product/profile/application publish and SQL server average Bytes Sent/Sec was 24 MB. Average Bytes Sent/Sec on DS was 4.5 MB/s during the test

SQL Server Activity



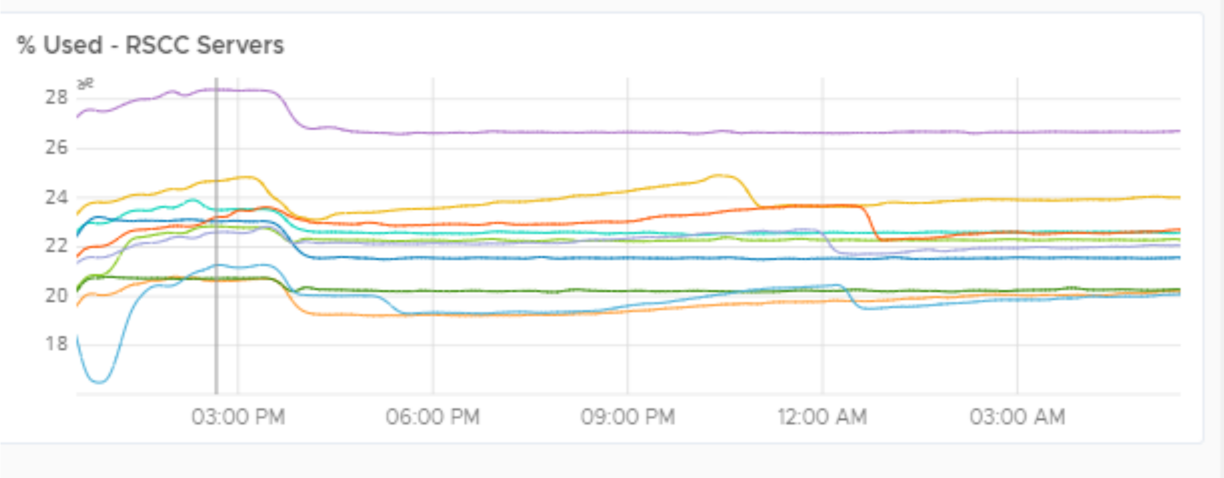
Observation: An average of 29889 Batch Request/sec was observed on the database. An average of 22557transactions/sec was observed on the application database and the overall average transactions/sec was 69736. Periodic spikes were observed on Database servers. This was due to devices check-in every 2 minutes

CPU Utilization - RSCC Servers



Observation: Max CPU utilization on RSCC servers was below 20%.

Memory Utilization - RSCC Servers



Observation: Memory utilization on RSCC servers was below 30%.

Appendix

SQL Server Recommendations

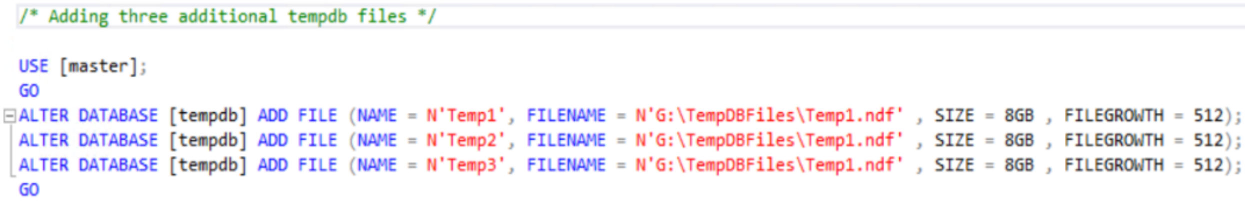
a) Add 1 tempdb file per core (112 tempdb files for 112 core)

i) Each tempdb data file was added with below parameters:

(1) Initial Size: 16000 MB

(2) Autogrowth: 512 MB

(3) Sample script for adding new tempdb files



```
/* Adding three additional tempdb files */

USE [master];
GO
ALTER DATABASE [tempdb] ADD FILE (NAME = N'Temp1', FILENAME = N'G:\TempDBFiles\Temp1.ndf' , SIZE = 8GB , FILEGROWTH = 512);
ALTER DATABASE [tempdb] ADD FILE (NAME = N'Temp2', FILENAME = N'G:\TempDBFiles\Temp1.ndf' , SIZE = 8GB , FILEGROWTH = 512);
ALTER DATABASE [tempdb] ADD FILE (NAME = N'Temp3', FILENAME = N'G:\TempDBFiles\Temp1.ndf' , SIZE = 8GB , FILEGROWTH = 512);
GO
```

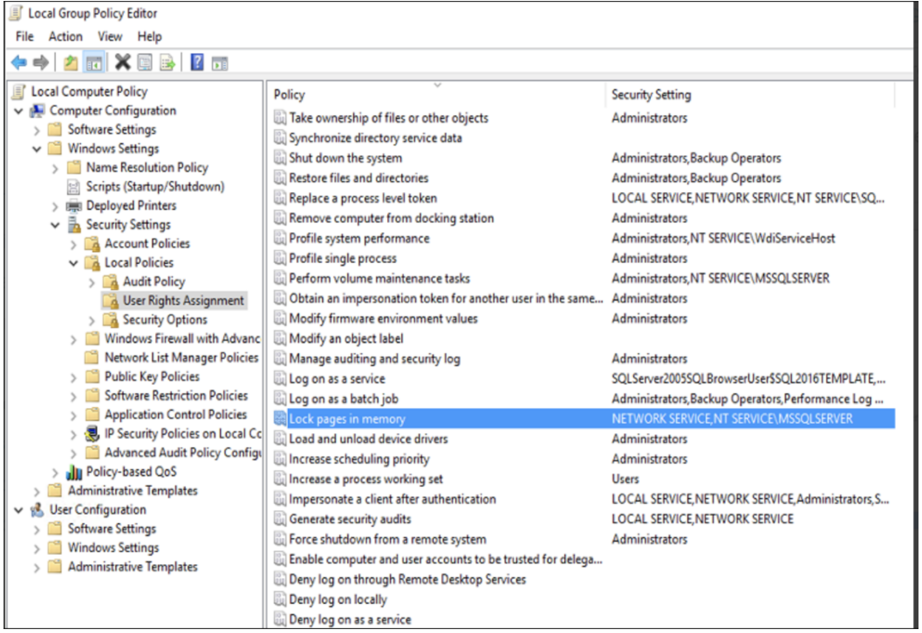
b) Add below Trace flags in Startup Parameters for "mssqlserver" service as per Microsoft recommendations

Trace Flag	Knowledge Base
i) **T174**	https://support.microsoft.com/en-us/help/3026083/fix-sos-cachestore-spinlock-contention-on-ad-hoc-sql-server-plan-cache
ii) **T834**	https://support.microsoft.com/en-us/help/920093/tuning-options-for-sql-server-when-running-in-high-performance-workloads
iii) **T3247**	https://support.microsoft.com/en-us/help/3216543/workloads-that-utilize-many-frequent-short-transactions-in-sql-server

c) Set “Lock Pages in Memory” privilege for the service account

i) Open *Local Group Policy Editor*

ii) Navigate to *Computer Configuration* > *Windows Settings* > *Local Policies* > *User Rights Assignment*

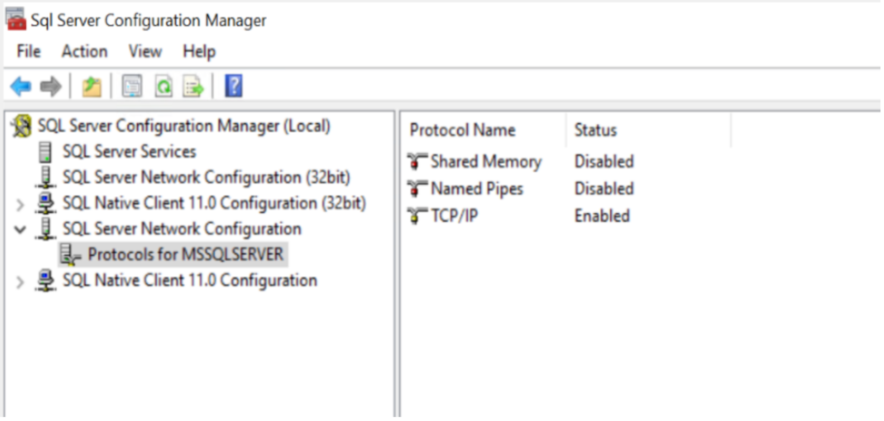


Policy	Security Setting
Take ownership of files or other objects	Administrators
Synchronize directory service data	
Shut down the system	Administrators,Backup Operators
Restore files and directories	Administrators,Backup Operators
Replace a process level token	LOCAL SERVICE,NETWORK SERVICE,NT SERVICE\SQ...
Remove computer from docking station	Administrators
Profile system performance	Administrators,NT SERVICE\WdiServiceHost
Profile single process	Administrators
Perform volume maintenance tasks	Administrators,NT SERVICE\MSSQLSERVER
Obtain an impersonation token for another user in the same...	Administrators
Modify firmware environment values	Administrators
Modify an object label	
Manage auditing and security log	Administrators
Log on as a service	SQLServer2005SQLBrowserUser$SQL2016TEMPLATE,...
Log on as a batch job	Administrators,Backup Operators,Performance Log ...
Lock pages in memory	NETWORK SERVICE,NT SERVICE\MSSQLSERVER
Load and unload device drivers	Administrators
Increase scheduling priority	Administrators
Increase a process working set	Users
Impersonate a client after authentication	LOCAL SERVICE,NETWORK SERVICE,Administrators,S...
Generate security audits	LOCAL SERVICE,NETWORK SERVICE
Force shutdown from a remote system	Administrators
Enable computer and user accounts to be trusted for delega...	
Deny log on through Remote Desktop Services	
Deny log on locally	
Deny log on as a service	

d) Disable "Named Pipes" and Enable "TCP/IP" network protocol

i) Open *Sql Server Configuration Manager*

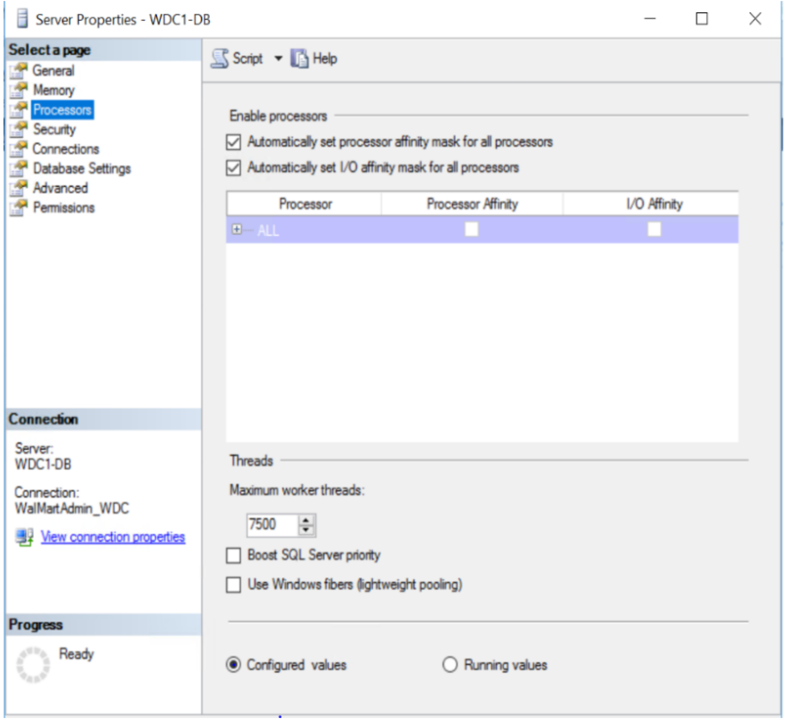
ii) Navigate to *SQL Server Network Configuration > Protocols for MSSQLSERVER*


Sql Server Configuration Manager
File Action View Help
SQL Server Configuration Manager (Local)
SQL Server Services
SQL Server Network Configuration (32bit)
SQL Native Client 11.0 Configuration (32bit)
SQL Server Network Configuration
Protocols for MSSQLSERVER
SQL Native Client 11.0 Configuration

Protocol Name	Status
Shared Memory	Disabled
Named Pipes	Disabled
TCP/IP	Enabled

e) Increase Maximum Worker threads in server properties to "**7500**"

i) Open *Server Properties* from SSMS and go to *Processors* tab



Server Properties - WDC1-DB

Select a page: General, Memory, **Processors**, Security, Connections, Database Settings, Advanced, Permissions

Enable processors

☑ Automatically set processor affinity mask for all processors

☑ Automatically set I/O affinity mask for all processors

Processor	Processor Affinity	I/O Affinity
ALL	□	□

Threads

Maximum worker threads: 7500

□ Boost SQL Server priority

□ Use Windows fibers (lightweight pooling)

Connection

Server:
WDC1-DB

Connection:
WalMartAdmin_WDC

View connection properties

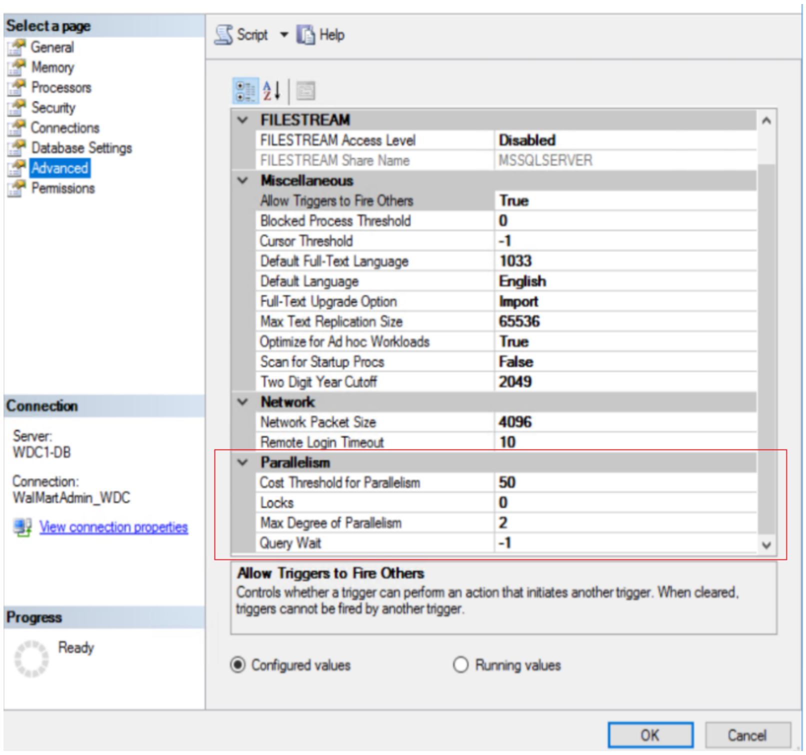
Progress

Ready

● Configured values ○ Running values

f) Set “Max Degree of Parallelism” to 2 and “Cost threshold for Parallelism” to 50

i) Open *Server Properties* from SSMS and go to *Advanced* tab



Select a page: General, Memory, Processors, Security, Connections, Database Settings, **Advanced**, Permissions

FILESTREAM	
FILESTREAM Access Level	Disabled
FILESTREAM Share Name	MSSQLSERVER
Miscellaneous	
Allow Triggers to Fire Others	True
Blocked Process Threshold	0
Cursor Threshold	-1
Default Full-Text Language	1033
Default Language	English
Full-Text Upgrade Option	Import
Max Text Replication Size	65536
Optimize for Ad hoc Workloads	True
Scan for Startup Procs	False
Two Digit Year Cutoff	2049
Network	
Network Packet Size	4096
Remote Login Timeout	10
Parallelism	
Cost Threshold for Parallelism	50
Locks	0
Max Degree of Parallelism	2
Query Wait	-1

Allow Triggers to Fire Others
Controls whether a trigger can perform an action that initiates another trigger. When cleared, triggers cannot be fired by another trigger.

Connection

Server:
WDC1-DB

Connection:
WalMartAdmin_WDC

View connection properties

Progress

Ready

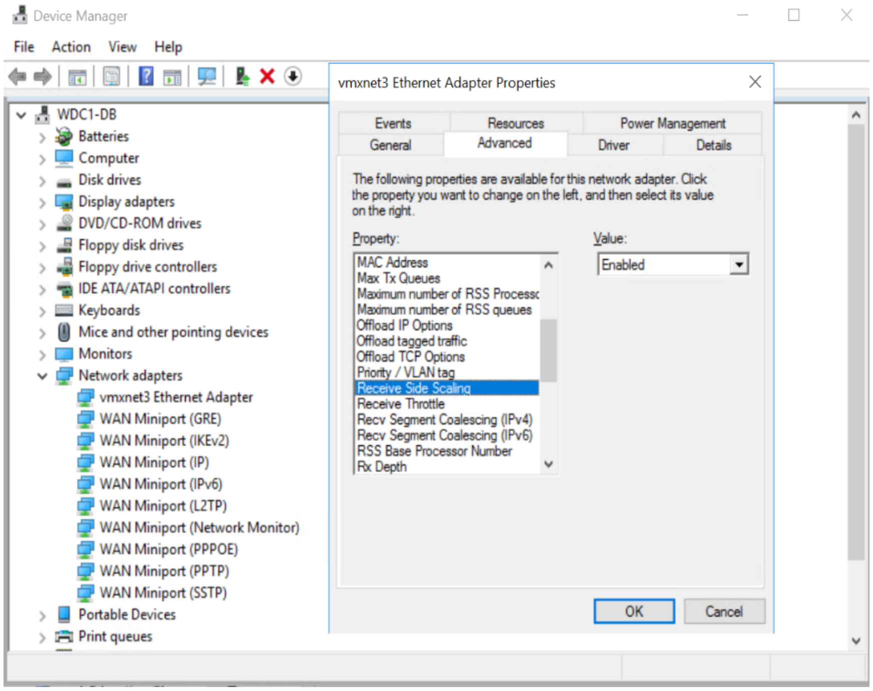
● Configured values ○ Running values

g) Enable “Received Side scale” setting for Network Adapter on SQL server

i) Open *Device Manager* in SQL server and run DEVMGMT.msc from Command Prompt

ii) Expand **Network adapters**, right click on your adapter and select **Properties**

iii) Select the **Advanced** tab and find **Receive Side Scaling.** Set this to **Enabled** if it isn't already.



The following properties are available for this network adapter. Click the property you want to change on the left, and then select its value on the right.

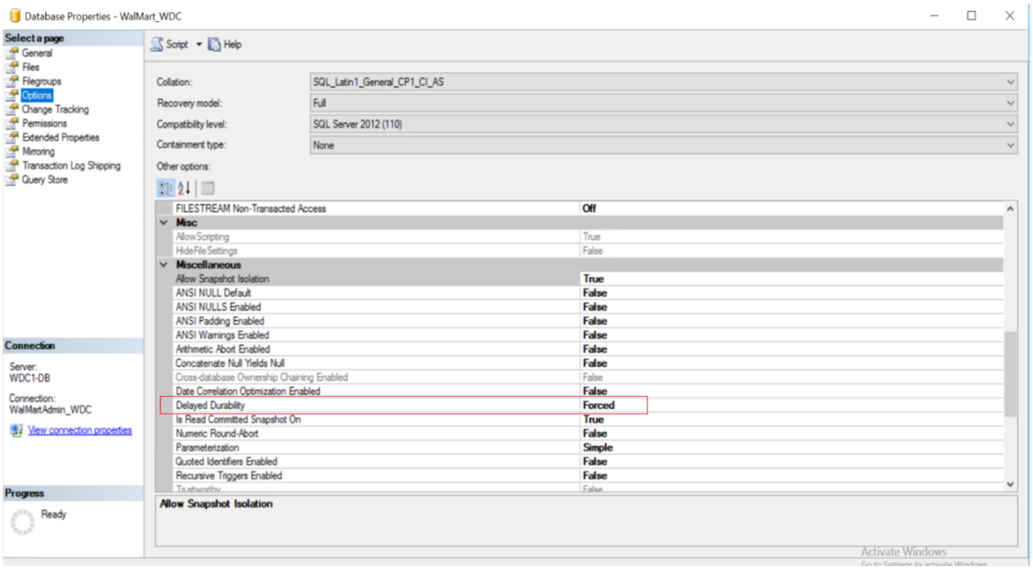
Property:

- MAC Address
- Max Tx Queues
- Maximum number of RSS Processc
- Maximum number of RSS queues
- Offload IP Options
- Offload tagged traffic
- Offload TCP Options
- Priority / VLAN tag
- Receive Side Scaling
- Receive Throttle
- Recv Segment Coalescing (IPv4)
- Recv Segment Coalescing (IPv6)
- RSS Base Processor Number
- Rx Depth

Value: Enabled

h) Set "Delayed Durability" under database properties = "Forced" to reduce WriteLog waits

i) Open *Database Properties* from SSMS and go to *Options*



Server:
WDC1-DB

Connection:
WalMartAdmin_WDC

Ready

Collation: SQL_Latin1_General_CP1_CI_AS

Recovery model: Full

Compatibility level: SQL Server 2012 (110)

Containment type: None

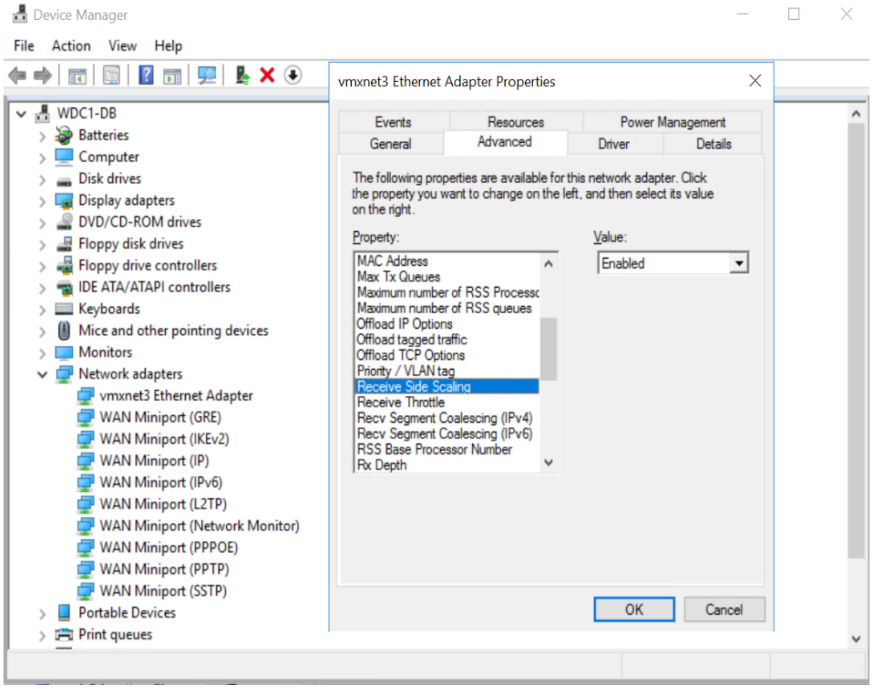
Other options:

FILESTREAM Non-Transacted Access	Off
Misc	
AllowScripting	True
HideFileSettings	False
Miscellaneous	
Allow Snapshot Isolation	True
ANSI NULL Default	False
ANSI NULLS Enabled	False
ANSI Padding Enabled	False
ANSI Warnings Enabled	False
Arithmetic Abort Enabled	False
Concatenate Null Yields Null	False
Cross-database Ownership Chaining Enabled	False
Date Correlation Optimization Enabled	False
Delayed Durability	Forced
Is Read Committed Snapshot On	True
Numeric Round-Abort	False
Parameterization	Simple
Quoted Identifiers Enabled	False
Recursive Triggers Enabled	False
Trustworthy	False

Allow Snapshot Isolation

Hardware Recommendations

1. Enable Network Interface Card “Received Side Scaling” for efficient distributions of network receive processing across multiple CPUs on all application servers.
   a) Open *Device Manager* in SQL server and run DEVMGMT.msc from Command Prompt
   b) Expand ***Network adapters***, right click on your adapter and select ***Properties***
   c) Select the ***Advanced*** tab and find ***Receive Side Scaling***. Set this to ***Enabled*** if it isn’t already.



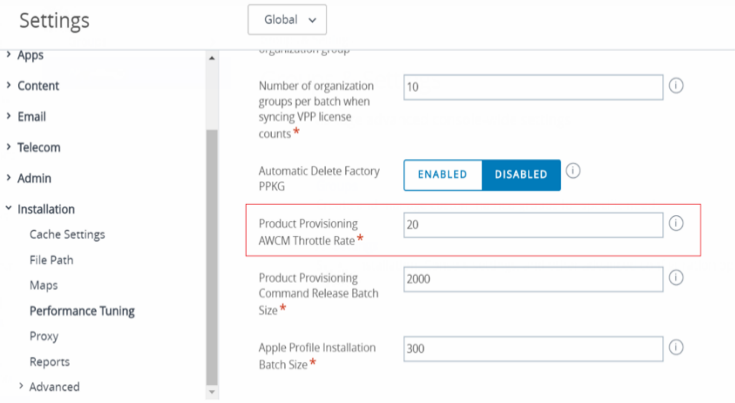
The following properties are available for this network adapter. Click the property you want to change on the left, and then select its value on the right.

Property: Receive Side Scaling

Value: Enabled

WS1 UEM Application Servers Settings and Recommendations

1. Set Product Provisioning AWCM Throttle Rate: 20
   I. Navigate to *Settings* > *Installation* > *Performance Tuning*



Number of organization groups per batch when syncing VPP license counts* 10

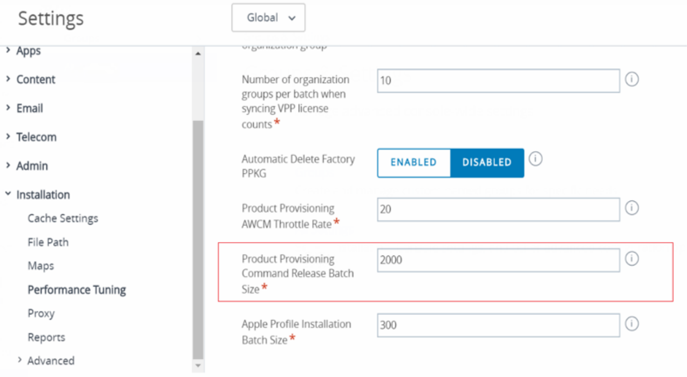
Automatic Delete Factory PPKG: DISABLED

Product Provisioning AWCM Throttle Rate* 20

Product Provisioning Command Release Batch Size* 2000

Apple Profile Installation Batch Size* 300

2. Set Product Provisioning Command Release Batch Size: 2000 per 2 mins
   I. Navigate to *Settings* > *Installation* > *Performance Tuning*



Number of organization groups per batch when syncing VPP license counts*: 10

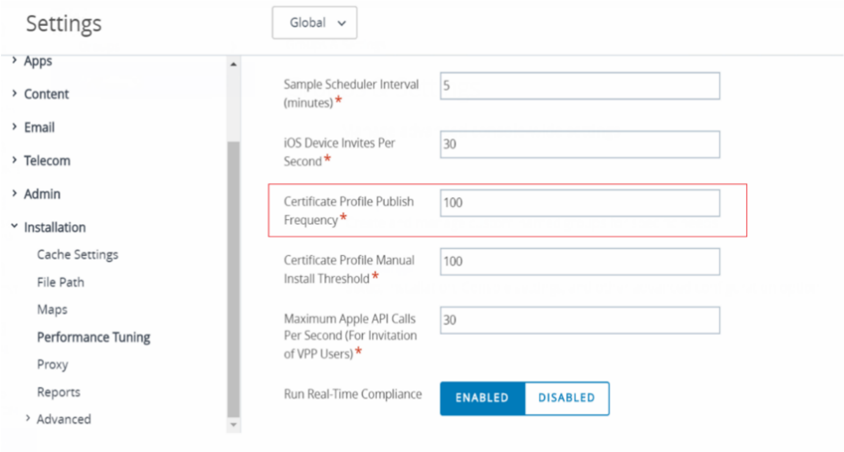
Automatic Delete Factory PPKG: ENABLED [✓ DISABLED]

Product Provisioning AWCM Throttle Rate*: 20

Product Provisioning Command Release Batch Size*: 2000

Apple Profile Installation Batch Size*: 300

3. Set Certificate Profile Publish Frequency: 100
    I. Navigate to *Settings* > *Installation* > *Performance Tuning*



Sample Scheduler Interval (minutes)*: 5

iOS Device Invites Per Second*: 30

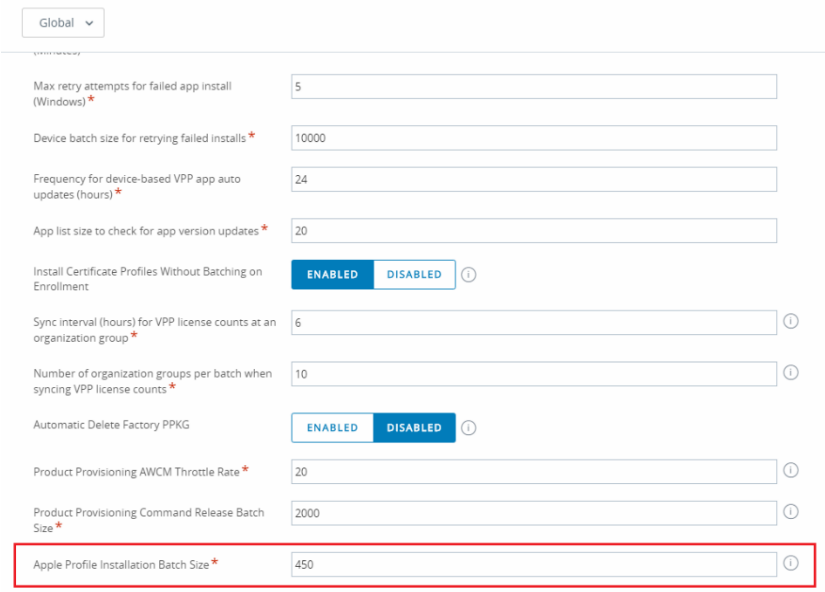
Certificate Profile Publish Frequency*: 100

Certificate Profile Manual Install Threshold*: 100

Maximum Apple API Calls Per Second (For Invitation of VPP Users)*: 30

Run Real-Time Compliance: [✓ ENABLED] DISABLED

4. Set Apple Profile Installation Batch Size: 450
    I. Navigate to Settings > Installation > Performance Tuning



Max retry attempts for failed app install (Windows)*: 5

Device batch size for retrying failed installs*: 10000

Frequency for device-based VPP app auto updates (hours)*: 24

App list size to check for app version updates*: 20

Install Certificate Profiles Without Batching on Enrollment: [✓ ENABLED] DISABLED

Sync interval (hours) for VPP license counts at an organization group*: 6

Number of organization groups per batch when syncing VPP license counts*: 10

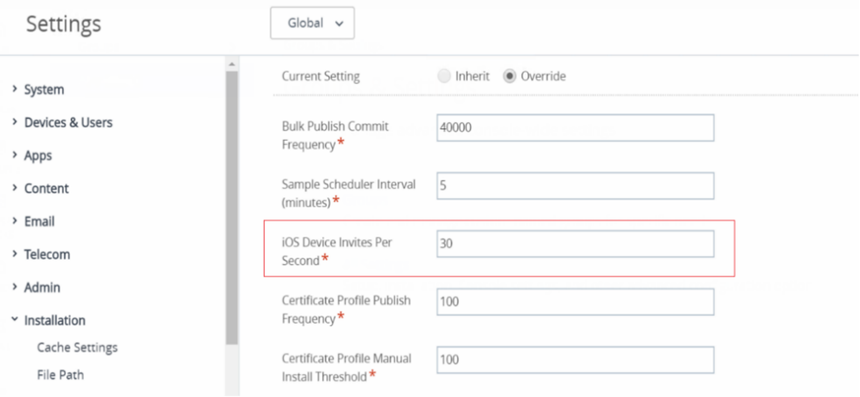
Automatic Delete Factory PPKG: ENABLED [✓ DISABLED]

Product Provisioning AWCM Throttle Rate*: 20

Product Provisioning Command Release Batch Size*: 2000

Apple Profile Installation Batch Size*: 450

5. Set iOS Device Invites Per Second:30
   I. Navigate to *Settings > Installation > Performance Tuning*



Current Setting ○ Inherit ● Override

Bulk Publish Commit Frequency* 40000

Sample Scheduler Interval (minutes)* 5

iOS Device Invites Per Second* 30

Certificate Profile Publish Frequency* 100

Certificate Profile Manual Install Threshold* 100

6. Override the default value in Systemcode table for FastLaneMessageRateMultiple to 1.5 by updating Systemcodeoverride table in DB.
7. Event log consolidation : This file "AW.ChangeEvent.QueueService.exe.config” has to be modified with below changes(on Console, DS, PE and CDS servers)
   i. Need to add these two attributes(highlighted in bold)under AWEventLog section:

```
<add
name="AWEventLog" serverAddress=".\Private$\" bulkReadLimit="500" batchInterval="10000"/>
```

8. Turn on Auto retry setting: ProductProvisioningFailedJobRetryFeatureFlag

   URL: `https://{envUrl}/api/system/FeatureFlag/{ffName}/{ogUuid}/{true|false}`

   Method: POST

   API Body:

```
        {
             "name": "",
          "isEnabled": true,
               "state": "Production"
        }
```

   Headers:
   authorization: Basic [Base64 Encoded Credentials]
   content-type: application/json
   aw-tenant-code: [API Key]
   Accept: application/json

To get Global OG UUID:

select LocationGroupUUID from LocationGroup (nolock) where locationgroupid = 7

To validate if Feature Flag is enabled:

Expected response is 200. Use the Get API to validate if the Feature flag is enabled.
https://{host}/api/system/featureflag/{FeatureFlagName}/{LocationGroupUUID}

9. Smart Group patch API to add users to existing Smart Group

API URL: Api/mdm/smartgroups/<SmartGroupUUID>
Method: PATCH

Replace <SmartGroupUUID> with the UUID of the Smart Group that needs to be updated

API Body:

```
[
   {
     "op": "add",
      "path": "/smartGroupsOperationsV2/users",
      "value": " <EnrollmentUserUUID1>, <EnrollmentUserUUID2>"
   }
 ]
```

Replace < EnrollmentUserUUID > with the UUID of the users that needs to be added

Headers:
authorization: Basic [Base64 Encoded Credentials]
content-type: application/json
aw-tenant-code: [API Key]
accept: application/json;version=2

10. Turn on RSCC feature flag: PullServiceInstallerFeatureFlag and RelayServerCloudConnectorFeatureFlag

*URL***:** https://{envUrl}/api/system/FeatureFlag/{ffName}/{ogUuid}/{true|false}
Method: POST
API Body:

```
{
   "name": "",
 "isEnabled": true,
"state": "Production"
}
```

Headers:
authorization: Basic [Base64 Encoded Credentials]
content-type: application/json
aw-tenant-code: [API Key]
Accept: application/json

To get Global OG UUID:

select LocationGroupUUID from LocationGroup (nolock) where locationgroupid = 7

To validate if Feature Flag is enabled:
Expected response is 200. Use the Get API to validate if the Feature flag is enabled.

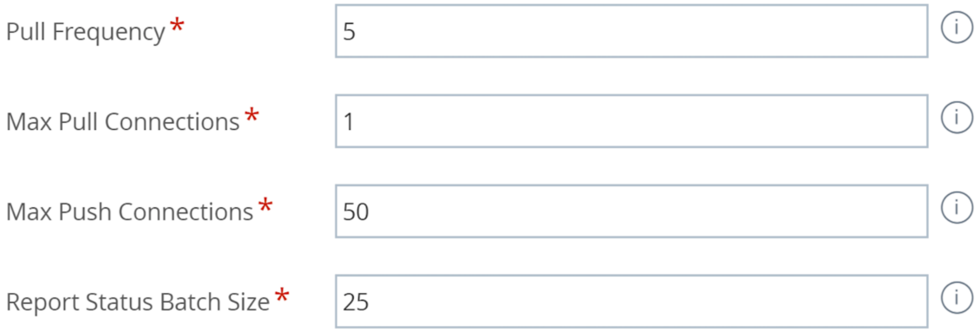
https://{host}/api/system/featureflag/{FeatureFlagName}/{LocationGroupUUID}

11. Update systemcodes using below SQL script:

```
BEGIN TRANSACTION
-- act
update dbo.systemcode set defaultvalue =50 where systemcodeid = 5725
update dbo.systemcode set defaultvalue=2000 where systemcodeid = 5818
update dbo.systemcode set defaultvalue=1 where systemcodeid = 5819

-- verify
select * from dbo.systemcode where systemcodeid in (5818, 5819, 5725)

-- once this is confirmed, commit
COMMIT TRANSACTION

-- or else revert
-- ROLLBACK TRANSACTION
```

12. RSCC Console configuration:

- Navigate to Device > Provisioning > Relayservers > List View
- Edit RSCC Server
- Update below values



Pull Frequency *	5
Max Pull Connections *	1
Max Push Connections *	50
Report Status Batch Size *	25

-