FSLOGIX OFFICE 365 CONTAINER SCALABILITY AND SIZING

Storage Requirements

A guide for backend storage sizing FSLogix O365 VHD Containers

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Revision History

Version	Completed by	Notes	Date
1.0	Leee Jeffries	Initial Document Creation	05/03/2019
1.1	Leee Jeffries	Amends to wording	07/03/2019

Introduction

VHD Containers have been positioned as the answer to OST caching in Outlook and are the new standard for user's profile and data storage in virtual environments. This paper details storage testing that has been completed to gauge what sort of storage requirements are necessary for FSLogix VHD containers to perform optimally.

Microsoft Azure is the chosen platform for the storage testing utilising FSLogix VHD containers for both profiles and office 365 on Citrix Virtual Apps and Desktops utilising LoginVSI as the load generating tool. Office 365 email accounts are configured to cache data to the VHD containers whilst monitoring key performance indicators within the environment.

Email content has been randomly generated including different types of attachments such as music files, video and jpeg images. This data has then been imported into the Office 365 email accounts to facilitate a realistic approach for Outlook caching.

The following test scenarios have been configured and run:

- Outlook OST caching of 3 months email with search indexing enabled
- Outlook OST caching of 3 months email with search indexing disabled
- Outlook OST redirection to a network share

The remainder of this document will discuss the results of each test with a summary section at the end.

Testing Scenario

During all tests the following metrics were captured:

- Reads, writes and total operations per second for the fileserver storage
- All CPU values on session servers
- Logon times using Citrix director
- LoginVSI results

FSLogix settings will be included in each load test. 50 Users were run for each test provided a good indication of load on the server.

All Azure Automation and Templates produced for this testing can be found on Github and are publicly available.

GitHub Repository – https://github.com/FSLogix/Storage.Testing

The environment used for testing is depicted below.
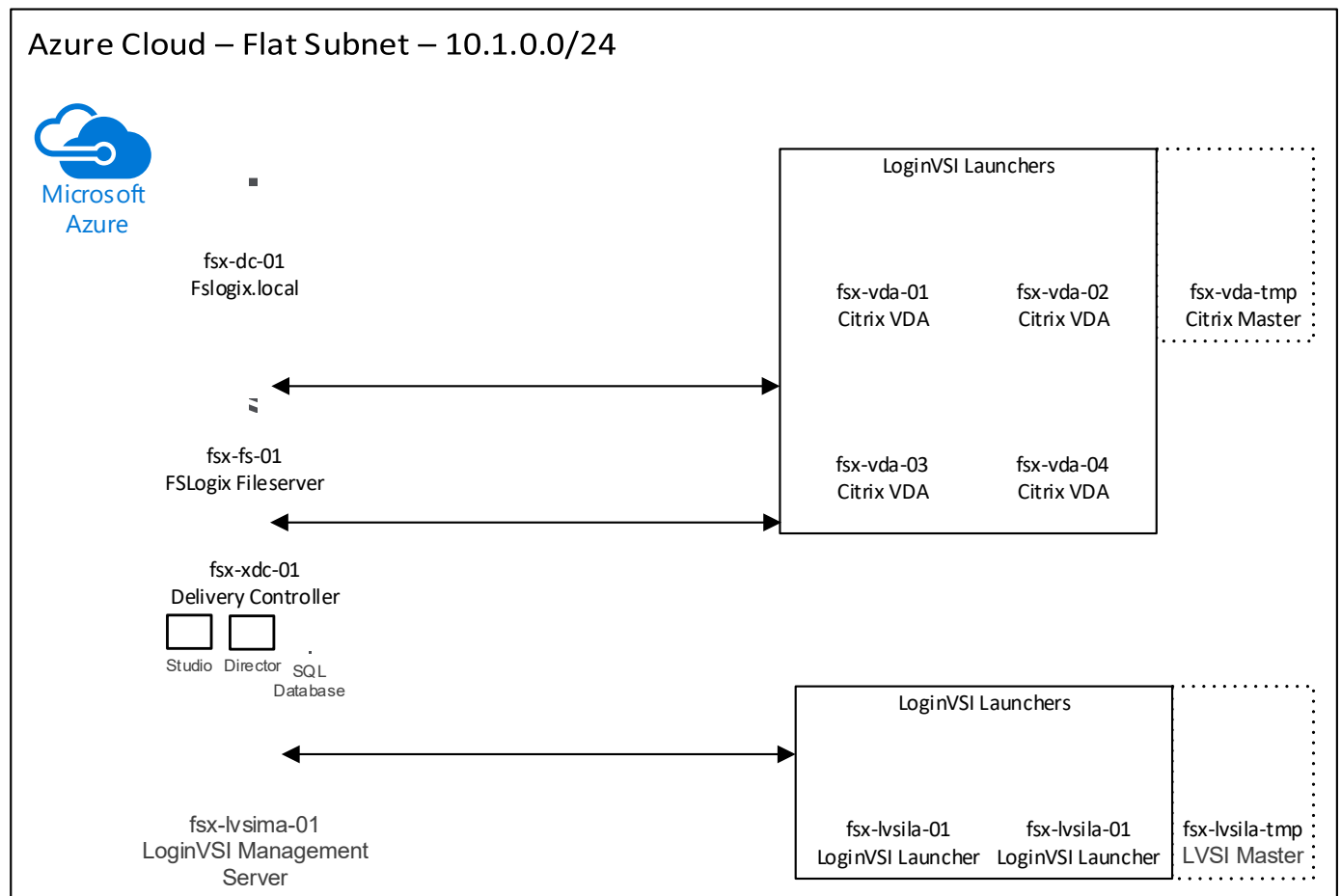
LoginVSI Launchers were provisioned utilising Citrix Machine Creation services allowing only a single master template to be created for both session servers and LoginVSI Launchers.

The full user load of 50 users was spread across the 4 fsx-vda-xx servers utilising Citrix technology.

An introduction on using the azure templates can be found here:

[FSLogix Storage and Scalability Testing Introduction and Usage 1.0.pdf](#)

The following LoginVSI workloads were used for the testing phase with a single exception of removing the outlook configuration and allowing the standard user profile for the user to load.

- Outlook OST caching of 3 months email with search indexing enabled – Task Worker
- Outlook OST caching of 3 months email with search indexing enabled – Knowledge Worker
- Outlook OST caching of 3 months email with search indexing disabled – Task Worker
- Outlook OST caching of 3 months email with search indexing disabled – Knowledge Worker

Each set of tests were run 3 times to ensure an average value was obtained for consistent reporting.

Every test ran for a period of 30 minutes during which Outlook being open would have been actively caching. The users Outlook cache was deleted upon every login to ensure Outlook would cache mail during each period of testing.

Mailboxes were filled with random content which was generated via a PowerShell script which is available here:

https://github.com/leeej84/Random-Email-Content-Generator

The script will randomly select content from a repository of publicly available images, videos and sound clips for attachments and random text from a publicly sourced eBook for the body.

This information was then exported as a PST and imported into each Office 365 mail account for the testing. The total size of the mailbox PST was 3GB.

Outlook OST caching of 3 months email with search indexing enabled

This test is designed to gather scalability information for caching of email with search indexing enabled.

Search Roading has been enabled within the FSLogix configuration entries as well as Outlook Cached mode with Outlook caching the full amount of data stored within the Office 365 mailbox.

Results

The following table shows the results of the testing phases, each result is calculated using the following formula:

Recommended IOPS = Average IOPS + (IOPS Standard Deviation x 2)

Task Worker

Test Name	WriteIOPS Avg	WriteIOPS StdDev	Recommended Write IOPS Sizing	ReadIOPS Avg	ReadIOPS StdDev	Recommended Read IOPS Sizing
FSLogix_Caching_Indexing_On_TaskWorker	2.44	1.05	4.54	3.59	2.08	7.74
FSLogix_Caching_Indexing_On_TaskWorker	2.23	1.07	4.36	3.30	2.44	8.18
FSLogix_Caching_Indexing_On_TaskWorker	2.41	1.16	4.73	3.37	2.07	7.52

Knowledge Worker

Test Name	WriteIOPS Avg	WriteIOPS StdDev	Recommended Write IOPS Sizing	ReadIOPS Avg	ReadIOPS StdDev	Recommended Read IOPS Sizing
FSLogix_Caching_Indexing_On_KnowledgeWorker	3.22	1.29	5.80	3.99	2.07	8.14
FSLogix_Caching_Indexing_On_KnowledgeWorker	3.12	1.29	5.70	3.73	2.22	8.17
FSLogix_Caching_Indexing_On_KnowledgeWorker	3.09	1.25	5.59	3.75	2.18	8.10

Outlook OST caching of 3 months email with search indexing disabled

This test is designed to gather scalability information for caching of email with search indexing disabled.

Search Roaming has been disabled within the FSLogix configuration entries, Outlook Cached mode is enabled with Outlook caching the full amount of data stored within the Office 365 mailbox.

Results

The following table shows the results of the testing phases, each result is calculated using the following formula:

Recommended IOPS = Average IOPS + (IOPS Standard Deviation x 2)

Task Worker

Test Name	WriteIOPS Avg	WriteIOPS StdDev	Recommended Write IOPS Sizing	ReadIOPS Avg	ReadIOPS StdDev	Recommended Read IOPS Sizing
FSLogix_Caching_Indexing_Off _TaskWorker1	2.53	1.20	4.94	3.82	2.30	8.42
FSLogix_Caching_Indexing_Off _TaskWorker2	2.47	1.17	4.82	3.75	2.23	8.22
FSLogix_Caching_Indexing_Off _TaskWorker3	2.42	1.18	4.77	3.63	2.26	8.15

Knowledge Worker

Test Name	WriteIOPS Avg	WriteIOPS StdDev	Recommended Write IOPS Sizing	ReadIOPS Avg	ReadIOPS StdDev	Recommended Read IOPS Sizing
FSLogix_Caching_Indexing_Off_Kn owledgeWorker1	2.22	1.00	4.23	2.82	1.44	5.70
FSLogix_Caching_Indexing_Off_Kn owledgeWorker2	3.19	1.19	5.56	3.96	2.08	8.12
FSLogix_Caching_Indexing_Off_Kn owledgeWorker3	3.02	1.22	5.47	4.11	2.69	9.49
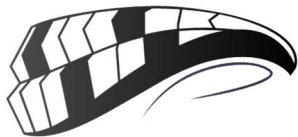
Results Summary

Taking the results from all tests and providing a final average yields the following results:

Row Labels	Mean Write IOPS	Mean Read IOPS
FSLogix_Caching_Indexing_Off_KnowledgeWorker	5.1	7.8
FSLogix_Caching_Indexing_Off_TaskWorker	4.8	8.3
FSLogix_Caching_Indexing_On_KnowledgeWorker	5.7	8.1
FSLogix_Caching_Indexing_On_TaskWorker	4.5	7.8

If you are planning an FSLogix deployment, it is recommended that you provision the backend storage supporting your O365 Containers to support the necessary number of users based on the below formula:

Required IOPS = Total Users x Recommended IOPS

Taking an average of all tests we are left with 8 Read IOPS and 5 Write IOPS Per user overall.

The below table shows some examples of sizing:

Total Users	Recommended Read IOPS Per User	Recommended Write IOPS Per User	Total Required Read IOPS	Total Required Write IOPS
100	8	5	800	500
200	8	5	1600	1000
300	8	5	2400	1500
400	8	5	3200	2000
500	8	5	4000	2500
600	8	5	4800	3000
700	8	5	5600	3500
800	8	5	6400	4000
900	8	5	7200	4500
1000	8	5	8000	5000
2000	8	5	16000	10000

One caveat to these results, there is no substitution for real world testing in your own working environment, all users work differently, and all apps also behave differently. These results are based on a controlled set of tests and should be used as an indication for sizing.

Credits

The following people were also involved in generating the results and analysing data for this testing information to make its way into the light.

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Jim Moyle