Dell Write Filter

Dell Write Filter Performance Document

Dell Engineering
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A Dell Technical White Paper

Revisions

Date	Description	Authors
December 2018	1.0 Initial release	Ajay Yadav

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1 Introduction

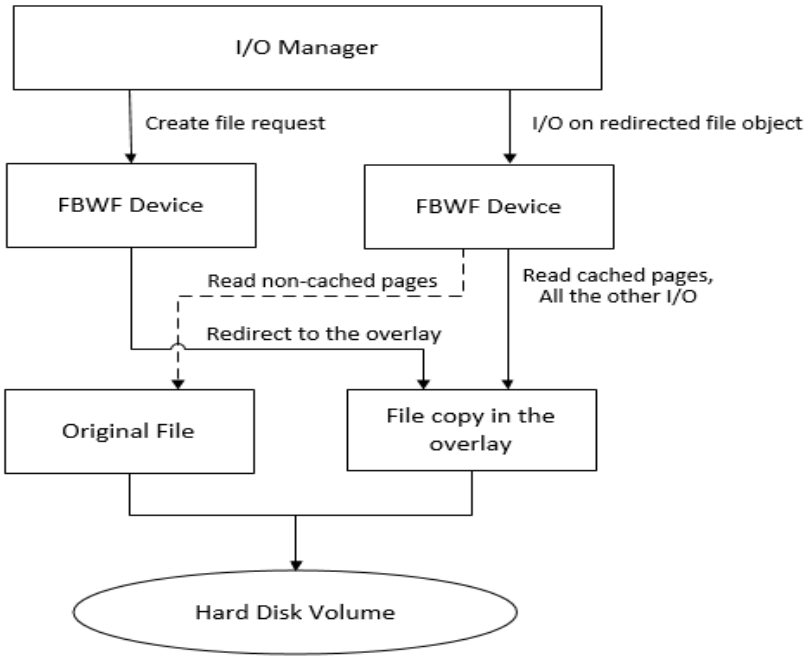
The Dell File based Write Filter (hereafter called DWF) in WyseConverterforPCs provides write protection for files & folders similar to the way it happens on MS Write Filter (Windows 7 Embedded).

Changes that users make on files & folders in the protected volumes are redirected to an overlay. Each protected volume has its own overlay, which is stored in a folder on the same volume. The size of an overlay is only limited by amount of free space available on the volume. Exclusion lists are supported for files and folders that user wants to be persistent.

The overlay is volatile & will be discarded on system reboot. The cache contents in the overlay are encrypted & secured.

1.1 Basic architecture

DWF is implemented as a legacy file-system filter driver. It attaches its device objects to a file-system device stack of each protected volume to intercept create-file requests and to redirect them into an overlay. After that it filters I\O requests, sent to redirected files and folders, to provide proper view of file system folder structure and of files' content. All newly created files and all modifications to existing files, except for those that are in the exclusion list, are stored inside an overlay.



1.2 Dell Write Filter Overlay Cache and Encryption

All the cache contents in the DWF overlay are volatile and will be cleaned-up after system restart. For security purpose, the cache contents in the overlay are encrypted. And the encryption key is not stored anywhere & it is volatile (i.e., the key is changed on every boot). This makes sure, even if the system is powered-off abruptly and the DWF overlay disk is taken out & connected to a different PC as secondary disk – the overlay contents cannot be decrypted.

1.3 Using Dell Write Filter

To configure the Wyse Software thin client to use DWF, do the following:

1.3.1 Manage Dell Write Filter State

1) Log in as WyseAdmin.
2) If automatic login to a user desktop is enabled, log off from the user desktop and log in as an administrator.
3) To disable the Dell Write Filter, double-click the DWF Disable icon on the desktop. This icon disables the filter and reboots the system.
4) Configure the Wyse Software thin client as per your requirements.
5) After you configure the Wyse Software thin client, to enable the Dell Write Filter, double-click the DWF Enable icon on the desktop.

   Note: This icon enables the filter and reboots the system. Your configurations on the Wyse Software thin client are now saved, and they persist after you reboot the thin client.

1.3.2 Exclude Files and Folder using the Dell Wyse Write Control tool

1) User can add specific files or folders on a protected volume to the file exclusion list to exclude those files and folders from being filtered by DWF using the Dell Wyse Write Filter Control tool.
2) To access the tool, click the Dell Write Filter icon in the system tray. When a file or folder is in the exclusion list for a protected volume, all writes to that file or folder bypass DWF filtering, and are written directly to the protected volume and persist after the device restarts.

   Note: User must log in as an administrator to add or remove file or folder exclusions during run time, and you must restart the device for new exclusions to take effect.

1.3.3 Dell Wyse Write Filter Command Line

Administrator can use Dell Write Filter manager (dwfmgr.exe) command line utility to query & set the WF's configuration & parameters. The following are the commands supported

Dell Write Filter Commands	Task
Dwfmgr.exe /displayconfig	Displays configuration
Dwfmgr.exe /get-current-session-status	Provides information on current Write Filter status.
Dwfmgr.exe /get-next-session-status	Provides information on next session Write Filter status.
Dwfmgr.exe /enable	Enables Write Filter.
Dwfmgr.exe /disable	Disables Write Filter.
Dwfmgr.exe /addexclusion [file_path **]	Adds file exclusion For Example :

	Dwfmgr.exe /addexclusion c: \User\Admin\Desktop\Test.txt Dwfmgr.exe /addexclusion c: \User\Admin\Desktop\Test*
Dwfmgr.exe /removeexclusion [file_path **]	Removes file exclusion For Example : Dwfmgr.exe /removeexclusion c: \User\Admin\Desktop\Test.txt Dwfmgr.exe /removeexclusion c: \User\Admin\Desktop\Test*
Dwfmgr.exe /get - current - session-exclusions	Provides information on current session Write Filter exclusions.
Dwfmgr.exe /get-next-session-exclusions	Provides information on next session Write Filter exclusions.
Dwfmgr.exe /get-overlay-folder	Provides information about Write Filter disk overlay folder.
Dwfmgr.exe /get-overlay-config-size	Provides information about Write Filter overlay maximum configuration size.

Note: WyseAdmin should run the command line as administrator and navigate to path "C:\Program Files\Wyse\DellFBWF\" to access Dwfmgr.exe

1.3.4 Setting Dell Write Filter controls

To view and manage DWF control settings, use the Dell Write Filter Control dialog box. To open the dialog box, double-click the DWF icon in the notification area of the administrator taskbar. When you configure DWF control settings, some of the fields are unavailable. You can select from the list of available fields during configuration.

The Dell Write Filter Control dialog box includes the following:

Name	Option	Description
DWF status	Current Status	Shows the status of the File Based Write Filter. The status may either be Enabled or Disabled.
	Boot Command	Shows the status of the Boot Command. DWF_ENABLE means that the DWF is enabled for the next session; and DWF_DISABLE means that the DWF is disabled for the next session.
	Overlay used by DWF	Shows the amount of overlay allocated to the File Based Write Filter in Megabytes (MB) and Percentage. If Current Status is disabled, overlay allocated to DWF is always zero (0).
	Amount of overlay used for DWF Cache	Shows the amount of overlay allocated to the File Based Write Filter cache for the current session in Megabytes (MB).
	Warning #1 (%)	Shows the DWF cache percentage value at which a Low Memory warning message is displayed to the user for the current session.
	Warning #2 (%)	Shows the DWF cache percentage value at which a Critical Memory warning message is displayed to the user.

DWF Cache settings	Amount of overlay to be used for DWF Cache	Shows the amount of overlay that is to be used as the File Based Write Filter cache for the next session in MB. This value should be in the range of 256 MB to 32 GB. There is an extra check to ensure that this value does not exceed 50% of Total Available overlay.
DWF Warning settings	Warning #1 (%)	Shows the DWF cache percentage value at which a Low Memory warning message is displayed to the user (Default value = 80, Minimum value = 50, Maximum value = 80).
	Warning #2 (%)	Shows the DWF cache percentage value at which a Critical Memory warning message is displayed to the user. Once the memory level crosses the warning level 2, system automatically restarts. (Default value = 90, Minimum value = 55,Maximum value = 90)
DWF State	Enable DWF	Allows you to enable the file based Write Filter and prompts you to restart the Wyse Software thin client device. To save the changes, restart the Wyse Software thin client. After the system restarts to enable the File Based Write Filter, the File Based Write Filter status icon in the desktop notification area turns green.
	Disable DWF	Allows you to disable the File Based Write Filter and prompts you to restart the Wyse Software thin client device. To save the changes, restart the Wyse Software thin client. After disabling the File Based Write Filter, the File Based Write Filter status icon in the desktop notification area turns red and the File Based Write Filter remains disabled after the system restarts.
	Defaults	Allows you to reset the DWF Cache Settings area, and the DWF Warning Settings area to their default values.
Exclusion List	Current Session	Allows you to add and remove a file or directory, to or from the exclusion list for the next session. This retrieves the list of files or directories that are written through in the current session and the title of the pane is shown as Current Session Exclusion List.
	Next Session	The Next Session retrieves the list of files or directories that are written through for the next session and the title of the pane is shown as Next Session Exclusion List. The system will not restart the Wyse Software thin client, and the changes are not committed until an administrator restarts the Wyse Software thin client device manually.

2 Abbreviation

Symbol	Definition
DWF	Dell Write Filter
MS	Microsoft
UWF	(Microsoft's) Unified Write Filter

3 DWF Parameter v/s UWF Parameter

Parameter	MS UWF	DWF
displayconfig	Yes	Yes
overlaydetail	Yes	Yes
enable	Yes	Yes
disable	Yes	Yes
addvolume	Yes	No
removevolume	Yes	No
addexclusion	Yes	Yes
removeexclusion	Yes	Yes
setthreshold	Yes	No
setcompression	Yes	No
setpreallocation	Yes	No
commitfile	Yes	No
restorefile	Yes	No

4 Test Environment and Hardware Details

To conduct the Dell Write filter performance test we have created a Test bed setup with identical hardware configuration and details as mention in below:

Hardware Details	Dell Write Filter	Microsoft Unified Write filter
Windows OS	WC4PC - Windows 7 x64 Ent sp1	WC4PC - Windows 10 x64 Ent
Ram Size	4 GB	4 GB
Disk Size	120 GB	120 GB
Processor	i5 2.50 GHz	i5 2.50 GHz
Device	E7270	E7270

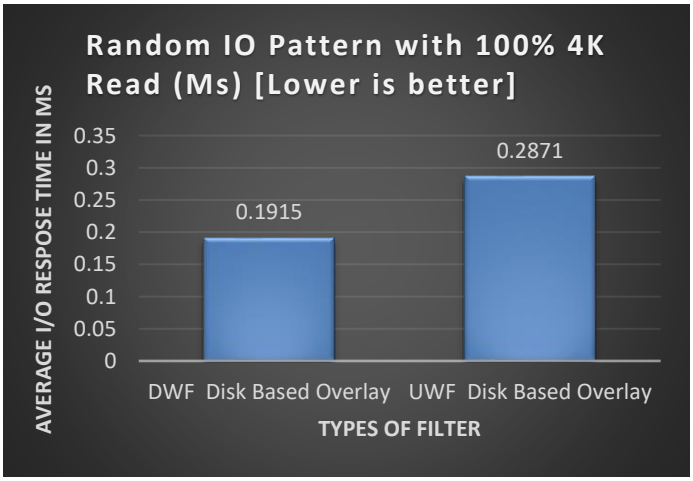
5 I/Ometer test result for DWF and UWF

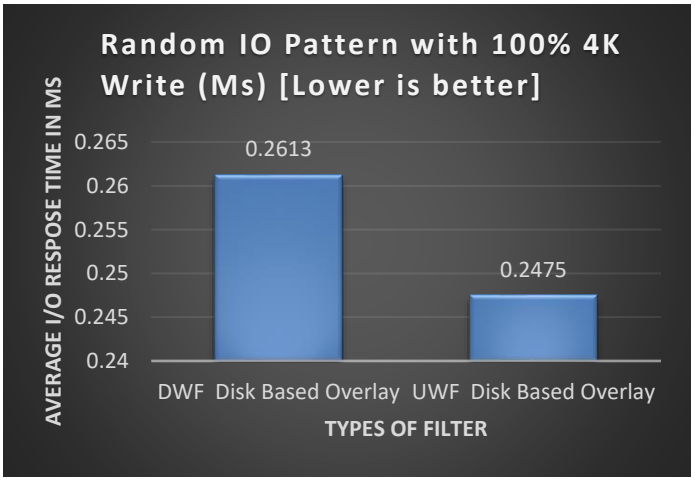
IO meter is used to capture the I/O response time on a machine. We have leveraged the Random IO pattern test of IO meter to capture 100% 4k (i.e. the page size) Read and Write. The test calculates the IO average response time and *lower the response time better is the performance*

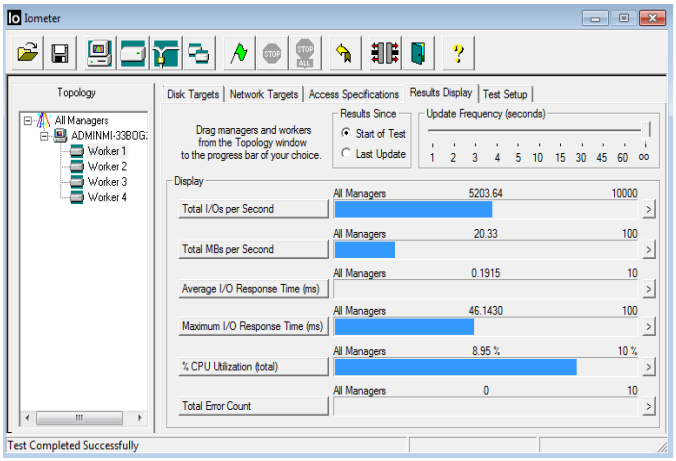
The below test is conducted to understand the Dell write filter performance in handling the IO and average response time taken when compared to MS UWF.

So from the below test we conclude that Dell Write filter is better in handling the Random 100% 4k read IO as the average response time is lesser than the MS UWF and Dell Write Filter has very slight delay in handling the Random 100% 4k write IO as the average response time is slightly greater than the MS UWF.But during the test we have not observed any interruption due the lag in response time when compare to MS UWF.

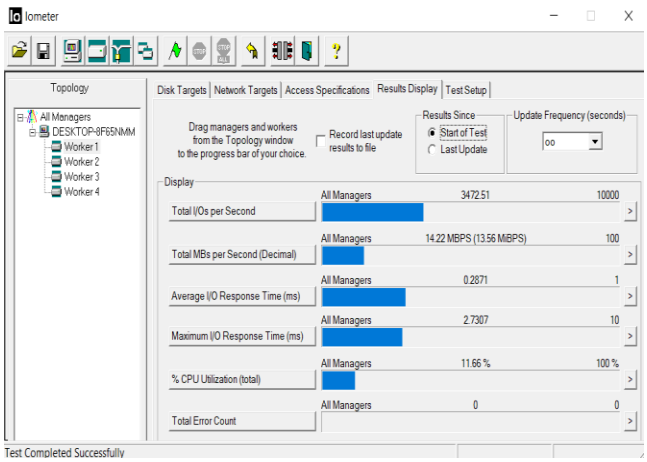
I/O Meter Report: 11th Oct 2018



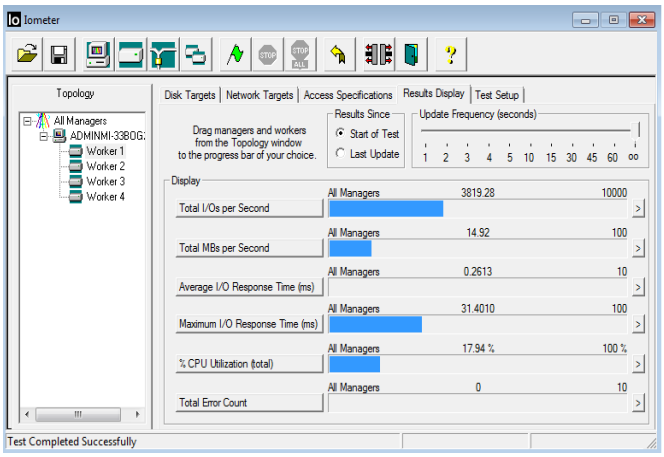




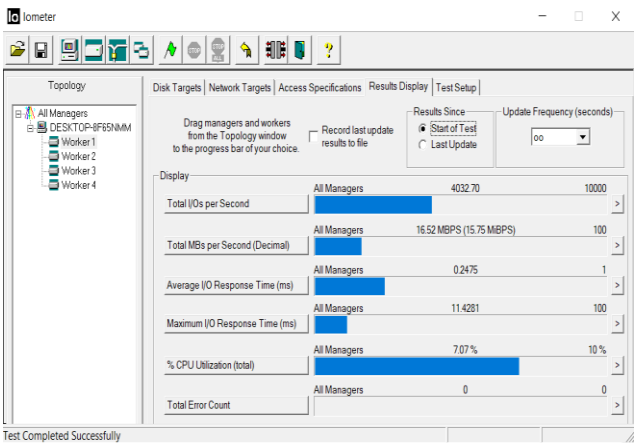
DWF Random I/O Pattern for 100% 4k Read



UWF Random I/O Pattern for 100% 4k Read



DWF Random I/O Pattern for 100% 4k Write



UWF Random I/O Pattern for 100% 4k Write

6 Users Types & definitions

An organization will have different user and each user will have different accessibility and usage over the system. To define the usage of the system and the amount of overlay used by every user we have bifurcated user asper usage as heavy and the medium user.

So Dell Write filter performance testing will be conducted in accordance to the usage of the below user by replicating there day to day activity as defined below and understand how the Dell write filter is performing by capturing the I/O responses and DWF overlay consumption during the test execution time.

Heavy user – spends entire day on below software:

- Chrome
- Google docs/ MS Office Live
- Skype for business
- YouTube
- Jira/SharePoint/Wiki
- Local PDF with Acrobat reader
- Email Usage

Medium user – combination of VDI and few browser apps

- Citrix/VMware/RDP – for accessing the corporate desktop
- Skype for business
- YouTube
- Local PDF with Acrobat reader (e.g.: for printing purpose)
- Local Media

7 High data consumption model

As defined in Section 6 Heavy user, we have taken a day to day usage scenario of working on Web Outlook accessing Email, Downloading Documents , Reading the document , Writing the document , modifying the save document, Sharing the document over email etc.

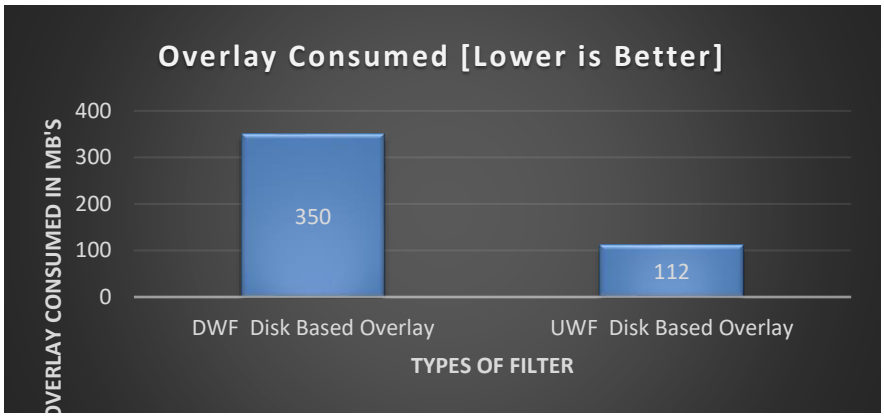
The below test was conducted to compare the overlay consumption, accessibility/restriction problem while handling the documents and email when compared to MS UWF

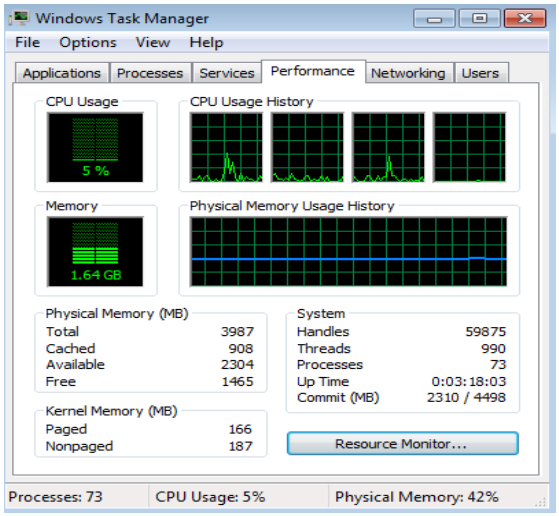
From below test it is observed that DWF consumes ~3x time overlay when compare to MS UWF, but if we calculate it as per the day usage time i.e. 8 hrs. We are way below the 32 GB overlay mark. If the user uses the machine with the same usage without a reboot it will continue to work for ~4 days until it fills up the overlay to 90%.

Overlay consumed in 4 hrs. = 350 MB
Overlay Consumed in 8 hrs. (One Working Day) = 350 * 2 = 700 MB

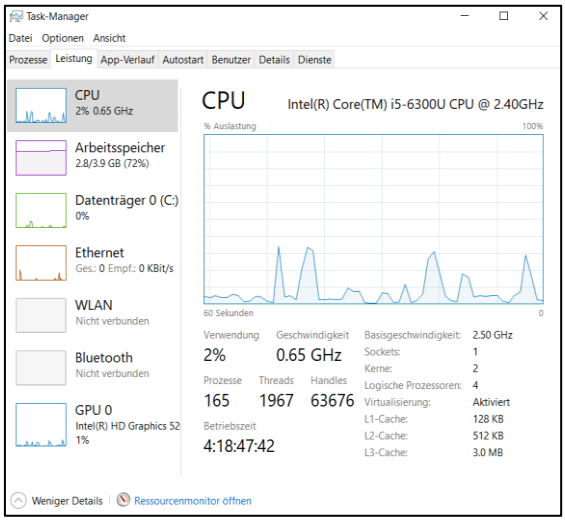
So to conclude the test result the DWF overlay consumption is high but under the defined overlay mark and we have not observed any accessibility/restriction problem while handling the documents and email when compared to MS UWF

Heavy User (DD-MM): 29th OCT 2018 (Web Outlook Access)





DWF System Performance Graph



UWF System Performance Graph

Parameters	Value	DWF Disk Based Overlay	UWF Disk Based Overlay
Overlay Consumption	Disk Used Overlay in MB	350	112

Parameters	Value	DWF	UWF
System Performance	CPU	5%	2%
	Physical Memory Consumed	1.64GB	2.8 GB
	System > Handle	59875	63676
	System > Commit	73	165
	System > Test Conducted Time	3hrs	4hrs
	System > Threads	990	1967

8 Medium data consumption model

As defined in Section 6 Medium user, we have taken a day to day usage scenario of working on Citrix connection and playing some local application like windows media player running an HD video locally and running MS office, Accessing Web mail, Citrix pro cases inside Citrix Session.

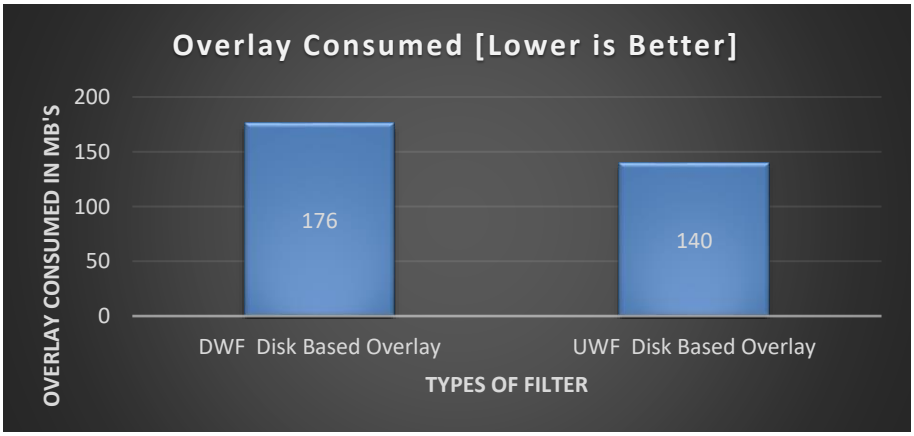
The below test was conducted to compare the overlay consumption, accessibility/restriction problem while Connecting to Citrix Connection and playing local media file when compared to MS UWF

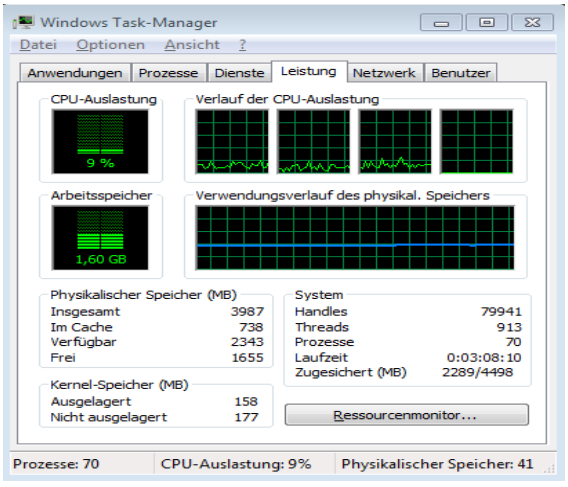
From below test it is observed that DWF consumes ~3x time overlay when compare to MS UWF, but if we calculate it as per the day usage time i.e. 8 hrs. We are way below the 32 GB overlay mark. If the user uses the machine with the same usage without a reboot it will continue to work for ~6 days until it fills up the overlay up to 90%.

Overlay consumed in 3 hrs. = 176 MB
Overlay Consumed in 8 hrs. (One Working Day) = 176 * 2.6 = 457 MB

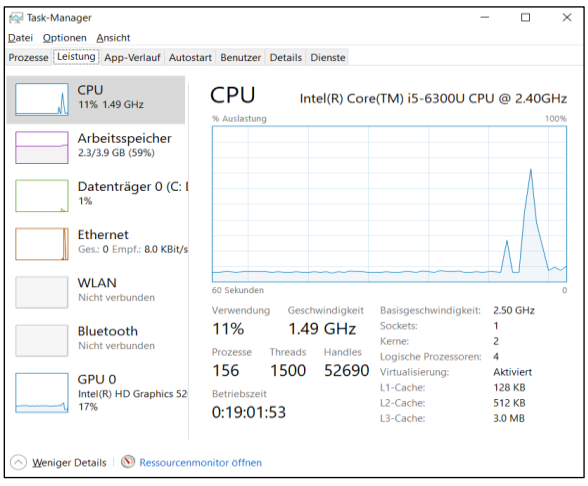
So to conclude the test result the DWF overlay consumption is high but under the defined overlay mark and we have not observed any accessibility/restriction problem while connecting to Citrix Connection and playing local media file when compared to MS UWF

Medium User (DD-MM): 11th OCT 2018 (Playing Media + Citrix Connection)





DWF System Performance Graph



UWF System Performance Graph

Parameters	Value	DWF Disk Based Overlay	UWF Disk Based Overlay
Overlay Consumption	Disk Used Overlay in MB	176	140

Parameters	Value	DWF	UWF
System Performance	CPU	9%	11%
	Physical Memory Consumed	1.60 GB	2.3 GB
	System > Handle	79941	52690
	System > Commit	70	156
	System > Test Conducted Time	3hrs	3hrs
	System > Threads	913	1500

9 Conclusion

As per the above test conducted in section 6,7 and 8 we concluded that DWF provides protection to file/folder writes with nominal usage in CPU, memory & disk (bandwidth & size) when compared to MS UWF.