Accelerating The Microsoft Windows 10 ENT x64 bit Startup and Shutdown times

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Abstract----We all know this issue that laptops /notebooks running Microsoft Windows, desktops and workstations tend to go slower and slower as we continue using them. It gets burdened with a lot of new software installations and more and more data as time elapses. This results in decreased performance of the system and hence the work output of user also decreases. Also, one major issue that most users of Microsoft Windows 10 based systems are facing is the increase in booting time and shutting down on PCs equipped with over 4GB RAM and intel i3/i5/i7 processors.

This research is done on a Dell Inspiron 3543 series laptop with 4GB of DDR3 RAM, Microsoft Windows 10 Enterprise 64-bit Edition installed on it, a Sony Vaio machine with intel core 2 duo and 4Gb RAM and Dell desktop 9200 machines. Just over a few weeks of fresh installation of Microsoft Windows 10 OS, the system started to show degraded performance and started giving increased booting up times in to windows and also started taking more time to shutdown. This was not only the case, the system has 500GB Western Digital HD and the loading of documents and power point files along with other programs started to take considerable long time. The system has gone slow and we believed too many I/O operations are taking place to read and write data from storage. (it was not a SSD disk)

To tackle this challenge, we started research and finally come up by a solution in this paper that will not only reduce I/O operations but also improves the starting and shutdown times of Windows 10 OS to more than 80%.

Keywords: *Windows 10 , Slow Boot up , Slow Shutdown .*

I. INTRODUCTION

Everybody knows the headache of a Microsoft Windows installed on notebooks/laptops, desktop or workstation becoming slow day by day. As a result of this the corporate sector lose productivity from their employees, hardware upgrades are urgently needed, and the IT staff gets bogged down with customer calls. This performance application keeps Windows PCs running better than new by reducing the amount of Input/output to disk with its special DRAM caching technology and prevention of performance degrading fragmentation to ensure defragmentation processes never have to be started.

The general system utilities that are provided with Microsoft Windows 10 ENT and related editions is not so intelligent. They start their action only when the data has already been written on the fixed drive in a fragmented state.

The system utility then starts up on user intervention or as per schedule and takes up a lot of system resources as well as hard drive storage to shuffle data, in the hope to minimize fragmentation that has happened.

This performance application works from the very start and steps write where the application is trying to write data to your hard drive, it inspects the data and allocates it the best possible place on the hard drive so that fragmentation is minimized right at the start of the disk write.

It runs seamlessly in the background occupying very little system resources. This also reduced the seek times of your hard drive resulting in more speed gains. It does it with its Intelligent Write technology.

The drivers vintmsd.sys and vintmfs.sys intelligent cache hot data and also takes care of input output operations as they are requested by the application. Both of the drives are

loaded at different stages of system boot and are found and shared for user knowledge in the below figure (4) and (5).

A user work analysis engine tracks how a user works on the system for 72 hours, it logs the specific input/output requests to cache active data within available system memory to improve the response time of applications and files, which further reduces the amount of Input/output traffic sent to disk.

II. BACKGROUND AND MOTIVATION

Since the introduction of Windows XP in early 2002, the race for a smooth and better performing Operating Systems has gained momentum. After XP, Vista was introduced by Microsoft but it failed to gain popularity due to its heavy system hardware requirements and poor memory management. This was the main issue that forced Microsoft to launch Windows 7 and it immediately got the consumer attention due to its smooth performance and better memory management. The hard requirements were also not much high. One very important thing from an end user point of view from initial installation of Operating Systems is that the "**Loading time of Windows**" and its "**Shutting down time**".

They both affect the working of an end user, if a system is taking more than two minutes in just reaching to the LOGON prompt of windows and taking more than a minute or in some cases a lot more just to get your machine Shutdown, is really frustrating and wastage of time resources. Not only this, the I/O activity with the passage of time also increases, which leads to more slowness of the machine. As time passes by the user installs more and more software in his/her system. This results in increase of the registry size and more services required to be started on windows loading time long with a fragmented hard drive.

A. Microsoft Office Applications loading times:

Within few weeks of installation of Microsoft Windows 10 Enterprise and Microsoft Office Professional 2016, We started to notice that opening time of word documents and power point files have increased. It was really frustrating when a 5MB to 8MB PowerPoint file is taking a lot of time to open. We immediately realized that there is something wrong in I/O operations that is causing this degradation. Obviously disk fragmentation is one of the issue and plays a major role in decreasing the I/O response time of any application. A properly defragmented disk volume will surely provide better response time than a disk volume cluttered with files with many empty spaces between them.

Figure (1);

The above screenshot in figure (1) shows processes running in a Windows 10 Enterprise 64bit system equipped with intel i7 processor and 8 Gb of RAM with 500Gb Hdd. It shows that number of services and system programs are increasing with every new release of Windows and most of them are to be loaded at Windows startup and cause degraded boot performance.

III. EXPERIMIENT AND RESULTS

Multiple experiments were performed in University of Management and Technology, Information Processing

Laboratory to evaluate the performance application, the results (both booting times and shutdown times of machines) from five Dell Machines are produced below.

Accelerating the Booting and Shutting down times of Microsoft Windows 10 systems:

Dell, i7 (fifth generation) Systems,
8 Gb DDR3 RAM and 500 Gb SATA Hdd ,
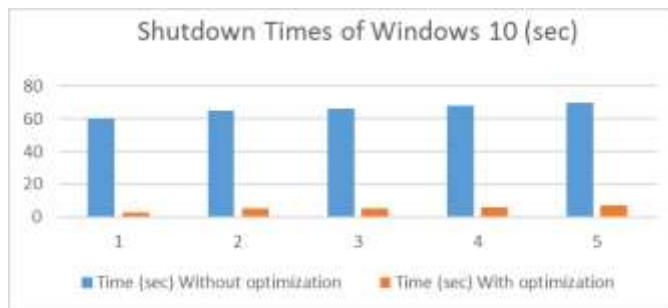**Microsoft Windows 10 Enterprise 64 bit.**
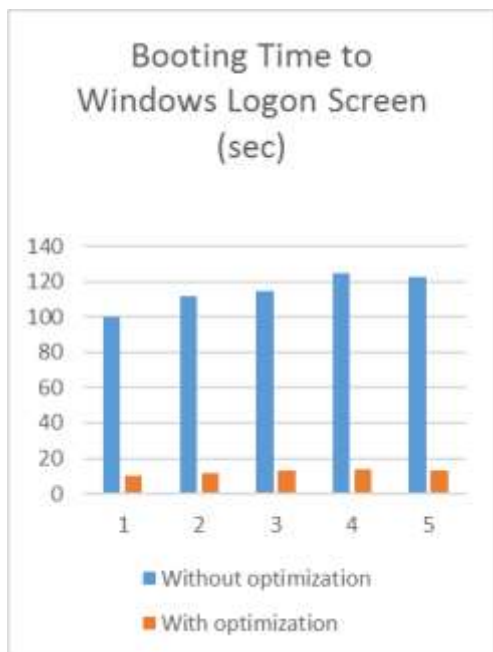
Figure(2);

On AC Power with optimization services disabled:

Avg Booting to Windows logon time: ~115 seconds
Avg Shutting Down time: (Fig 3)   ~ 66 seconds

On AC Power with optimization services enabled:

Avg Booting to Windows logon time: ~12 seconds
Avg Shutting Down time: (Fig 3)   ~ 5 seconds

Figure(3);

Results:

The timings obtained for booting into windows logon screen and shutdown from Figure(2)&(3) clearly shows the benefits of performance application.

The resulting speed gains in Booting as well shutting down times are 9 times faster for Boot up and 12 times faster for Shutdowns, which is superb.

The above speed gains are achieved by strategically moving files into sequential order on hard drives to minimize the number of I/O requests and random I/Os during the boot process. Involving cache and filter drivers to cache I/O.

Not only this the below factors also contributed for this rapid response.

1. The unnecessary boot time file logging is disabled.
2. The crucial boot time files to be loaded are placed in the initial sectors of hard disk, so they can be loaded much more quickly.
3. Intelligent cache is used to track the loading of files and then load all driver files collectively in one go, instead of multiple I/O operations.

Trade-offs:

As far as trade-offs are concerned there is no major trade-off with respect to resource utilization on the computer. It uses minimum resources and that too when CPU is idle.

1. 4 GB RAM is needed for Intelligent Memory caching to work optimally.
2. 30$ fee for single computer license is to be paid.
3. The caching/speed gains are not there on Soft restarts of the Operating System.

IV.   I/O BOTTLENECK

The issue of input/output operations slowing down an operating system performance is quite common one. Whatever operating system it may be whenever the input/output operations will exceed the system performance is bound to go down, same is the case here which we experienced in Windows 10 Enterprise x64 bit edition.

A. The general disk defragmenter that comes with Windows 10 is not as smart as it should be. Instead of running defragmenting tool later on, how is this that the files are initially stored in a better way so that there is minimum fragmentation of HD space as the OS stores them.

In the above case **Intelligent Write operations** are needed to be deployed to prevent split I/Os (which are the redundant I/Os) from being generated when a file is broken into pieces before being written to disk.

B. As more and more applications are being installed on the system and the registry is also getting bloated, the Read operations from the HD needs to be optimized as well. So that more and more that is read from HD with minimum CPU cycles involved.

In the above case **Intelligent Read operations** are needed so that Hot Data (the most likely to be accessed data) is cached properly in much faster DRAM. This will enhance the application and files response time. In this case a special

driver sits in the background and do the trick. It also maintains the list of recent I/Os and intelligently predicts the upcoming I/O requests as well.

V. Solution

Vlocity is a software solution that reduces I/O by optimizing data placement at the Windows OS level in both physical and virtual environments. Significant storage performance improvements are achieved without the need to purchase additional hardware. The software is installed directly on the Windows OS running on a guest machine as a thin file system driver to feed the OS intelligence on file sizes and help choose the best write allocations. Because the software resides at the point of I/O creation (the application), unnecessary I/O can be reduced and, in most cases, completely eliminated.

Below you can see the two special driver files that are loaded at boot time for Vlocity.

One is the caching storage filter driver "vintmsd.sys" and the other is "vintmfs.sys" the file system filter driver.

Load order for drivers and services:

Start value	Group name	Tag	Service/Device	Display Name	Image path
Boot	System Reserved	n/a*	pcw	Performance Counters for Windows Driver	System32\drivers\pcw.sys
Boot	WdfLoadGroup	n/a*	Wdf01000	@%SystemRoot%\system32\drivers\Wdf010...	system32\drivers\Wdf01000.sys
Boot	Boot Bus Extender	759	kl1	kl1	system32\DRIVERS\kl1.sys
Boot	Boot Bus Extender	7	acpiex	Microsoft ACPIEx Driver	System32\Drivers\acpiex.sys
Boot	Boot Bus Extender	2	msisadrv		System32\drivers\msisadrv.sys
Boot	Boot Bus Extender	3	pci	@pci.inf,%pci_svcdesc%;PCI Bus Driver	System32\drivers\pci.sys
Boot	Boot Bus Extender	4	isapnp		System32\drivers\isapnp.sys
Boot	Boot Bus Extender	5	vdrvroot	@vdrvroot.inf,%vdrvroot_svcdesc%;Microso...	System32\drivers\vdrvroot.sys
Boot	Boot Bus Extender	6	cm_km	Kaspersky Lab ZAO Cryptographic Module x...	system32\DRIVERS\cm_km.sys
Boot	Boot Bus Extender	n/a*	partmgr	@%SystemRoot%\system32\drivers\partmgr...	System32\drivers\partmgr.sys
Boot	Boot Bus Extender	n/a*	pdc	@%SystemRoot%\system32\drivers\pdc.sys,...	system32\drivers\pdc.sys
Boot	Boot Bus Extender	n/a*	vintmsd	V-locity Caching Storage Filter Driver	system32\drivers\vintmsd.sys
Boot	System Bus Extender	7	pciide		System32\drivers\pciide.sys
Boot	System Bus Extender	3	pcmcia		System32\drivers\pcmcia.sys
Boot	System Bus Extender	1	vmbus	@wvmbus.inf,%vmbus.SVCDESC%;Virtual M...	System32\drivers\vmbus.sys
Boot	System Bus Extender	8	intelide		System32\drivers\intelide.sys
Boot	System Bus Extender	8	spaceport	@spaceport.inf,%Spaceport_ServiceDesc%;St...	System32\drivers\spaceport.sys
Boot	System Bus Extender	9	nvraid		System32\drivers\nvraid.sys
Boot	System Bus Extender	9	volmgr	@volmgr.inf,%volmgr_svcdesc%;Volume M...	System32\drivers\volmgr.sys
Boot	System Bus Extender	10	volmgrx	@%SystemRoot%\system32\drivers\volmgrx...	System32\drivers\volmgrx.sys

Figure(4);

The third important service is the velocity service itself, which runs as a background "performance software service" in Windows 10 (VService.exe) providing the GUI interface to interact with the optimization software and to extract system statistical reports as well as to get the Benefit analysis report.

Together these drivers and system files work hand in hand to provide better I/O operations and speedy Boot up in

Load order for drivers and services:

Start value	Group name	Tag	Service/Device	Display Name	Image path
Boot	Early-Launch*	1*	klelam	klelam	system32\DRIVERS\klelam.sys
Boot	Network*	n/a*	Mup	@%systemroot%\system32\drivers\mup.sys,-101	System32\Drivers\mup.sys
Boot	PnP Filter*	4*	nv_agp	@machine.inf, %agpnvidia_svcdesc%;NVIDIA nForce AGP Bus Filter	System32\drivers\nv_agp.sys
Boot	n/a*	n/a*	pwdrvio	pwdrvio	system32\drivers\pwdrvio.sys
Boot	PnP Filter*	n/a*	rdyboost	ReadyBoost	System32\drivers\rdyboost.sys
Boot	*	n/a*	sbp2port	@sbp2.inf,%sbp2_ServiceDesc%;SBP-2 Transport/Protocol Bus Driver	System32\drivers\sbp2port.sys
Boot	*	n/a*	storufs	@storufs.inf, %UfsServiceDesc%;Microsoft Universal Flash Storage (UFS) Driver	System32\drivers\storufs.sys
Boot	PnP Filter*	2*	uagp35	@machine.inf,%uagp35_svcdesc%;Microsoft AGPv3.5 Filter	System32\drivers\uagp35.sys
Boot	PnP Filter*	5^	uliagpkx	@machine.inf, %uliagpkx_svcdesc%;Uli AGP Bus Filter	System32\drivers\uliagpkx.sys
Boot	*	n/a*	volmgr	@volume.inf, %VolumeClassName%;Storage volumes	System32\drivers\volmgr.sys
Boot	Core Security Extensions*	1*	WindowsTrust...	Windows Trusted Execution Environment Class Extension	system32\drivers\WindowsTrustedRT.sys
Boot	Core Security Extensions*	2*	WindowsTrust...	@WindowsTrustedRTProxy.inf,%WindowsTrustedRTProxy_SVCDESC%;Microsoft Windows Truste...	System32\drivers\WindowsTrustedRTProxy.sys
System	Port	1	klhk	Kaspersky Lab service driver	\SystemRoot\system32\DRIVERS\klhk.sys
System	SCSI CDROM Class	1	cdrom	@cdrom.inf,%cdrom_ServiceDesc%;CD-ROM Driver	\SystemRoot\System32\drivers\cdrom.sys
System	FSFilter Open File	2	klbackupflt	Kaspersky Lab klbackupflt	system32\DRIVERS\klbackupflt.sys
System	FSFilter Encryption	n/a*	FileCrypt	@%systemroot%\system32\drivers\filecrypt.sys,-100	system32\drivers\filecrypt.sys
System	FSFilter Activity Monitor	3	KLIF	Kaspersky Lab Driver	system32\DRIVERS\klif.sys
System	FSFilter Activity Monitor	4	klpd	Kaspersky Lab format recognizer driver	system32\DRIVERS\klpd.sys
System	FSFilter Activity Monitor	n/a*	vintmfs	V-locity File System Filter Driver	\??\C:\Windows\system32\drivers\vintmfs.sys
System	Base	1	Null		
System	Base	2	Beep	Beep	
System	Video	2	BasicDisplay		\SystemRoot\System32\drivers\BasicDisplay.sys
System	Video	3*	BasicRender		\SystemRoot\System32\drivers\BasicRender.sys
System	File system	n/a*	Mdfs		
System	File system	n/a*	Npfs		

Figure(5)

Windows 10 as well as swift shutdown. The beauty is that we may install as many application programs and services but the speed gains provided by Vlocity are never lost.

VI. Related Works

Labs in reference (2) and various experimentation done on different windows machines shows a major boost in the input/output operations intelligent handling by the operating system and the drivers as mentioned above.

Condusiv is doing the main research in this area, it is a more than thirty years old software company housed in California.

The DRAM technology helps in treating the dynamic RAM available in the systems as an intelligent cache. Those systems which have SSD disk can take more advantage of such tweaking resulting in a super performance, as the not used RAM is being used intelligently to cache hot data. Later on when RAM is needed for other processes, it is always available for them.

VII. Conclusion and Future Work

In order to constantly maintain a fast and responsive machine, it is absolutely necessary that I/O operations needs to be streamlined along with optimized loading of drivers and services at Boot time to ensure minimum time is wasted during the system boot. Same goes with the shutdown of Windows whose time also should be minimum. In this context We can say without a shadow of the doubt that this performance software application program from Condusiv Technologies known as "**Vlocity End point** "is indeed very helpful and can give an end user as well as an IT professional a much better solution for speeding up their machines without spending extra money on the hardware.

Although this performance application gives good results, but still there is need for improvement as the size of Operating Systems is increasing with an increased list of services and drivers being loaded at boot up. Thus, it is necessary to implement a caching technology that works with both soft and cold booting of the systems.

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