

# Virtualization Awareness

*Managing Disk Resources in a Virtual Environment*

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## Executive Overview

As virtualization takes hold in most businesses and large enterprises, the proper management of a virtualized environment is becoming more important than ever. A key aspect of this management is resource availability throughout the environment, including the host and all virtual guest systems.

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This paper looks at managing disk resources in a virtualized environment, including the unique challenges presented by disk defragmentation. The importance of disk defragmentation in a virtual environment is clear, since the disk drive is the slowest resource in any computing system.

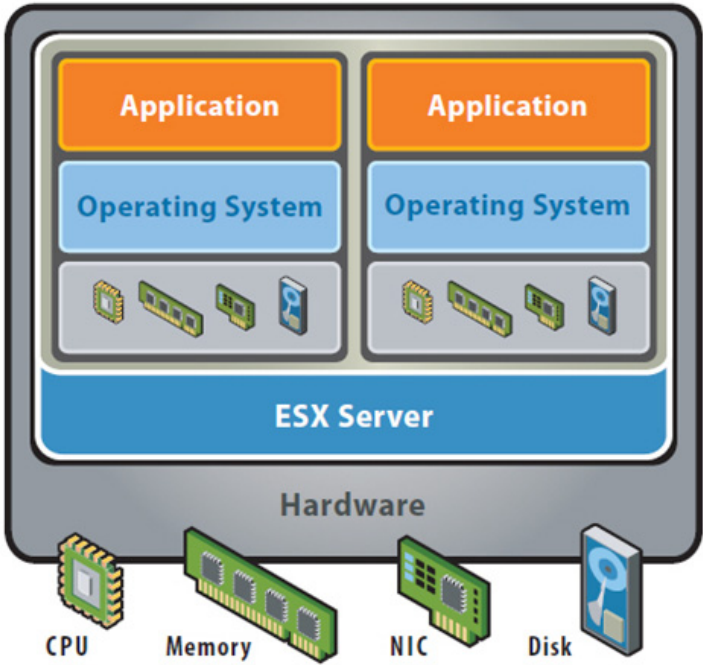
Because most defragmentation solutions were developed before the advent of virtualization, most do not properly address the unique challenges presented by virtual environments. However, the challenges and problems related to fragmentation within a virtual environment are real. Key points addressed in this paper include:

- The effects of fragmentation in a virtual machine can be even more pronounced than in a physical machine.
- Virtual machines can quickly become negatively affected by fragmentation.
- Disk defragmentation improves virtualization performance.
- If not implemented properly, automatic disk defragmentation may have negative consequences on system performance.
- Virtual Awareness eliminates wasteful resource contention.

# Virtualization Awareness: Managing Disk Resources in a Virtual Environment

A key to the successful management of a virtualized environment is making sure there are adequate resources available from the host system to support all of the virtual guest systems. The disk drive is the slowest resource in any computing system, so anything that can be done to speed up disk availability is a plus for the virtual user.

Virtualization means to create a virtual instance of a device or resource such as a server, storage device, network, or even an operating system where the framework, or virtualization abstraction layer divides the resources into one or more execution environments. Devices, applications and human users are able to interact with the virtual resource as if it were a physical resource. This means a single physical server can support multiple instances of the same or other operating systems and its physical resources, such as CPU, RAM and the disk drive, are shared among the virtual instances. (Figure 1).



VMware ESX Server virtualizes server storage and networking, allowing multiple applications to run in virtual machines on the same physical server.

Figure 1.

*In a virtual environment, the disk drives for a guest OS are stored on either the host disk drive or a SAN attached drive.*

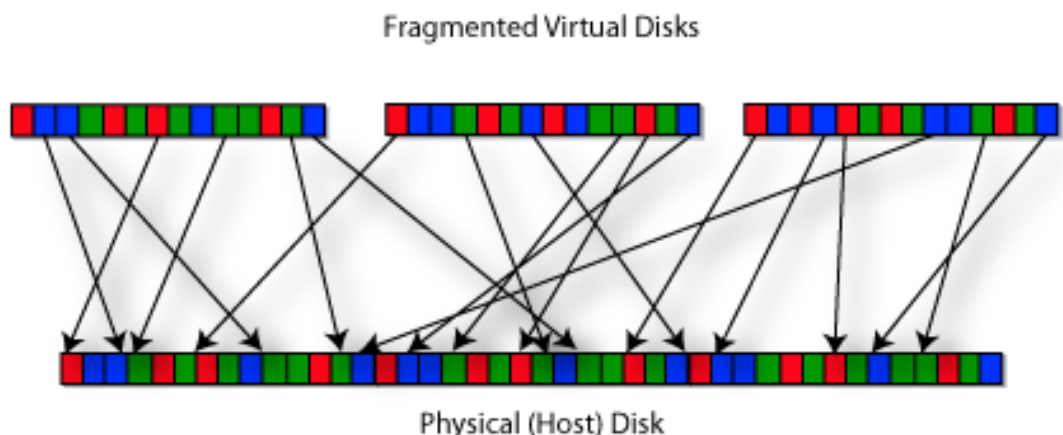
## Virtualization and Disk Storage

In a virtual environment, the disk drives for a guest OS are stored on either the host disk drive or a SAN attached drive. As the number of virtual machines increase, the disk I/O load on the host drive increases proportionally. System administrators must continually monitor and balance the disk I/O loads for the virtual machines against the capacity of the host to ensure that optimal disk performance can be maintained.

## File and Free Space Fragmentation and Virtual System Performance

The negative effect of file fragmentation in a Windows® operating system is well documented. Poor I/O performance, slow boot times, slow application launches, extended backup times and increased help desk incidents are all symptoms of file fragmentation. Fragmentation occurs when the file system can't create a file in a contiguous string of logical clusters. File creation, deletion and extension all exacerbate file fragmentation as the disk fills up and the remaining free space is scattered around the disk. Many users don't realize that even on new systems, the process of application installation, and the post-installation cleanup, can leave hundreds of files fragmented across the disk. With continued use, files and free space fragmentation degrade overall system performance.

In a virtual environment, the effects of fragmentation can be even more pronounced. Each virtual machine is running an instance of the Windows file system and incurring its own fragmentation. As fragmentation increases, the demand for additional CPU and I/O resources increases proportionally. This increasing demand can have a negative impact on the performance of other virtual machines on the same host, since they are competing for the same resources. Several competing virtual machines will have an adverse effect on the host platform performance, which may not be able to provide adequate CPU and I/O resources to its guests.



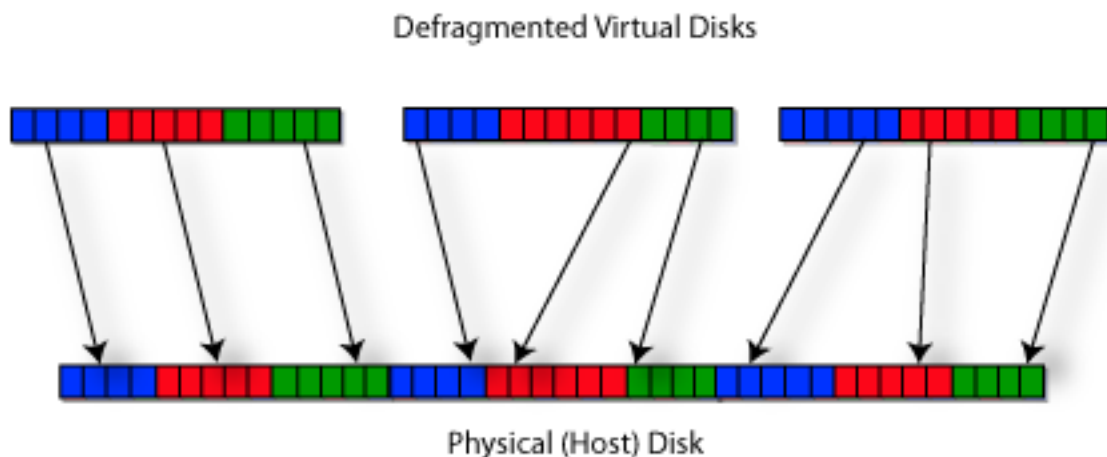
## Disk Defragmentation Improves Virtualization Performance

Disk defragmentation improves virtualization performance. Defragmentation can take place on the virtual disk (Windows guest OS) or on the physical disk (Windows host OS). Defragmentation on the virtual disk optimizes the disk I/O and minimizes the resource demand for that virtual machine. Defragmentation on the physical disk (Windows host OS) optimizes the core disk resources available to all the guests and compounds the benefit of defragmenting solely on the guest virtual disks.

There is still a benefit to be realized from defragmenting virtual disks with Windows guests when the host is running a non-Windows OS, as with VMware's ESX Server. The Windows guests still compete for the host resources, so keeping the guest in optimal I/O condition minimizes the demand on the host regardless of the OS. A secondary benefit of keeping the Windows guests defragmented and lowering the resource demand is that it may allow you to support additional guests on the same host, thereby reducing the need for continuous load balancing.

According to VMware®, "Like physical drives, virtual disks can become fragmented. Defragmenting disks rearranges files, programs and unused space on the disk so that programs run faster, and files open more quickly." [VMware – Defragmenting Virtual Disks](#)

In addition, VMware has noted that "Performance is weakened on the physical disk holding the virtual machine's working directory or virtual disk files. If you are experiencing slow disk performance in the virtual machine, or if you want to improve the speed of suspend and resume operations, check to be sure that the host disk that holds the virtual machine's working

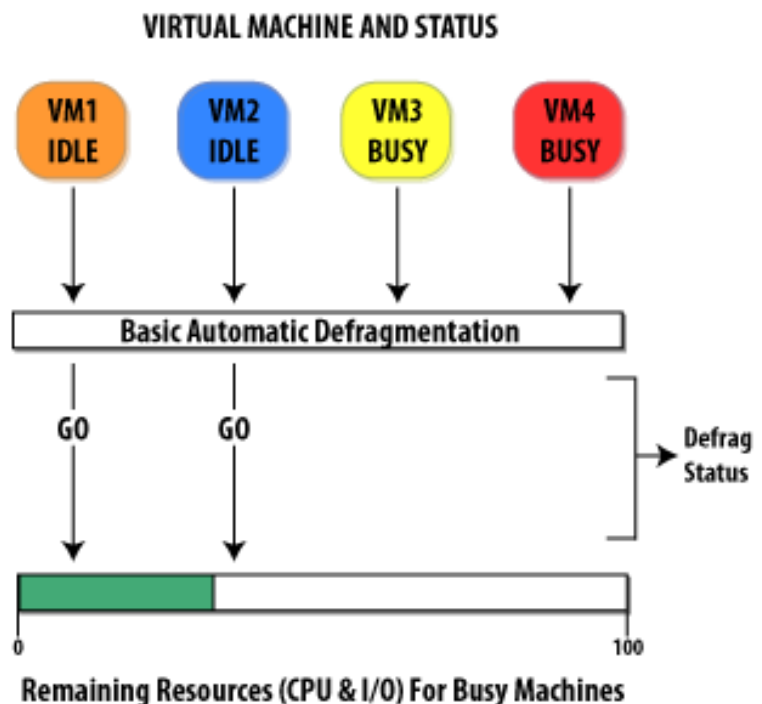


directory and virtual disk files is not badly fragmented. If it is fragmented, you can improve performance by running a defragmentation utility to reduce fragmentation on that host disk.” VMware Defragmentation of Disk Drives.

### **Automatic Disk Defragmentation - Not Always a Good Idea**

Automatic disk defragmentation is a feature available with third party enterprise-capable disk defragmentation products. The premise behind automatic disk defragmentation is that instead of scheduling disk defragmentation to run on a fixed interval, the automatic defragmentation mode detects when the system is idle and initiates a defrag pass only when the system is idle. While this saves the system administrator the time needed to set fixed interval schedules for the virtual systems, it does come with a serious downside.

Part of the balancing act that comes with virtualization is making sure the host can provide adequate resources for the virtual systems to do their work. In the case of automatic defragmentation of virtual systems, it is possible to consume host resources to the detriment of working virtual machines. For example, a physical system is set up with five (5) virtual Windows guests. Automatic disk defragmentation is invoked to run on the virtual systems whenever they are idle. At some point, two of the virtual systems become idle and the remaining three are busy. As defined, the automatic disk defragmentation would start on the two idle virtual systems without regard to the demand for resources from the three busy virtual systems. This

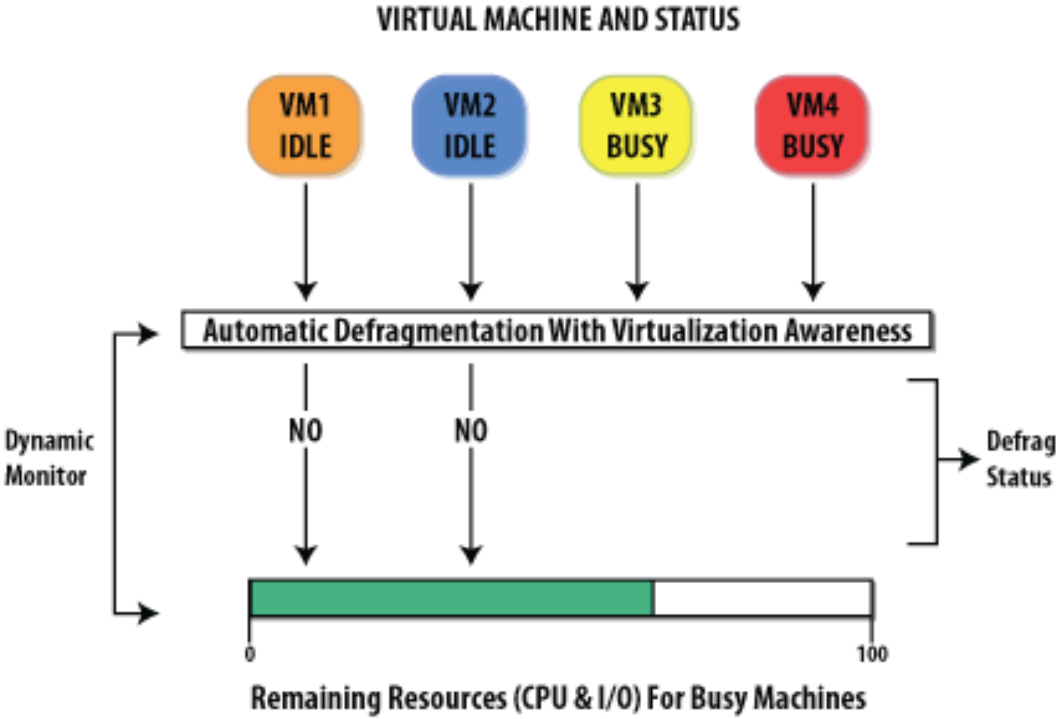


lack of virtual awareness can cause a resource bottleneck on the working virtual systems, since the host system cannot satisfy the resource demand of all the Windows guests simultaneously. In this case, the system administrator would have to make some decisions about moving the virtual machines to another server or stopping the defragmentation which keeps the disks in optimal running order. Virtualization Awareness addresses this issue.

**Virtualization Awareness - A New Way to Maintain System Performance**

System administrators should not have to decide between getting the work done and good system performance. As we showed in the case above, the downside of automatic disk defragmentation is that it can strangle the host resources to the performance detriment of the all the virtual systems.

PerfectDisk® 10 vSphere ESX and PerfectDisk 10 Hyper-V with Virtual Awareness are the answers to this dilemma. Virtualization Awareness monitors the availability of the physical host resources and precludes automatic disk defragmentation from running if adequate resources are not available. In the example above, virtualization awareness would prevent the automatic defragmentation of the two idle systems if the host did not have sufficient resources to support the working virtual machines and the defragmentation.



The benefit of Virtualization Awareness to the organization and the system administrator is that virtual disks can be optimized for top performance, which eases the total resource burden on both the virtual and the host systems. Further, this can be accomplished in a fully automated manner without administrator intervention and without concern about the impact on host resources.

The same applies to any Virtual Desktop Infrastructure (VDI) implementations. Virtualization Awareness will keep multiple instances of virtual desktops set for automatic defragmentation from consuming all the available resources on the host. Virtualization Awareness will permit automatic defragmentation up to a dynamic threshold level based on the available host resources.

[Watch the PerfectDisk 10 vSphere ESX webinar recording.](#)

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