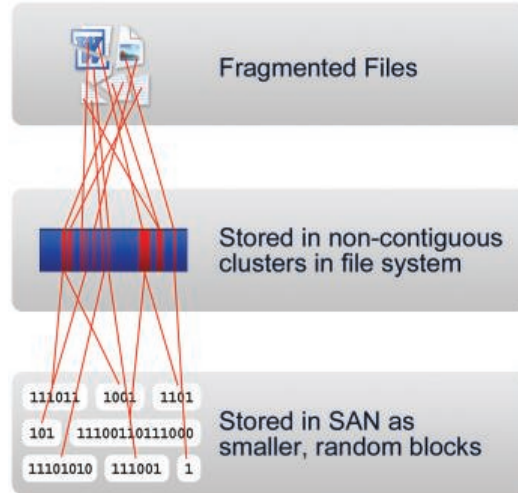


# Best Practices for Using V-locity® on Storage Area Networks (SANs)

## Overview:

As a high-performing storage solution based on block protocols (e.g., iSCSI, FC), SANs excel at optimizing block access. SANs work at a storage layer underneath the operating system's file system; usually NTFS when discussing Microsoft Windows®. That dictates that a SAN is unaware of "file" fragmentation and unable to solve this issue.



With file fragmentation causing the host operating system to generate additional unnecessary disk I/Os (more overhead on CPU and RAM), performance suffers. In most cases the randomness of I/O requests, due to fragmentation and concurrent data requests, results in the blocks that make up the file being physically scattered in uneven stripes across a SAN LUN/aggregate. This causes even *greater* degradation in performance.

**Warning**

**Severity:** ⚠ **Warning**

**Warning:** High rate of 1634 split I/O per second was detected. This represents 93 percent of total I/O processes. Consider size of I/O processes compared to disk format size and **defragment** or reformat any disks with a high split I/O rate.

**Related:** [Disk Diagnosis](#)

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**Performance**

**Resource Overview**

Component	Status	Utilization	Details
CPU	<span style="color: green;">●</span> Idle	5 %	Low CPU load.
Network	<span style="color: green;">●</span> Idle	0 %	Busiest network adapter is less than 15%. <span style="float: right;">🔍</span>
Disk	<span style="color: red;">●</span> Busy	1756 /sec	<b>Disk I/O is more than 500 (read/write) per second on disk 0.</b> <span style="float: right;">🔍</span>
Memory	<span style="color: green;">●</span> Normal	38 %	1271 MB Available.

Fortunately, there are simple solutions to NTFS file system fragmentation: fragmentation prevention and defragmentation. Both approaches solve file fragmentation at the source – the local disk file system within the virtual machine.

## IntelliWrite

### ***“The only way to prevent fragmentation before it happens™”***

IntelliWrite® fragmentation prevention technology is an advanced file system driver that leverages and improves upon modern Windows' file system “Best Fit” file-write design, in order to write a file in a non-fragmented state on the initial write. Intelligently writing contiguous files to the disk provides four principal benefits above and beyond defragmentation, including:

- Prevents most fragmentation before it happens.
- Better file-write performance.
- An energy-friendly approach to improving performance, as defragmentation is not required for files handled by IntelliWrite.
- 100% compatibility with copy-on-write technologies used in advanced storage management solutions (e.g., snapshots).

While eliminating fragmentation improves performance, it is important to properly configure and account for advanced SAN features. We suggest reading this full document before executing any of the recommended configurations.

## Best Practices:

### Highlights:

Implementing V-locity virtual platform optimizer in your virtual environment over SAN is simple and straightforward. There are two principal concepts to ensuring proper configuration and optimal results:

- Ensure IntelliWrite is enabled for all volumes.
- Find a time to schedule Automatic Optimization (more details below).

### Details:

If you are implementing any of the following SAN-based technologies such as Thin Provisioning, Replication, Snapshots, Continuous Data Protection (CDP) or De-duplication, it is recommended to follow these guidelines. Defragmentation/Space Reclamation can cause unwanted side effects when any of the above-referenced technologies are employed. These side effects include:

- *With SAN Replication* — Likelihood of additional data replication traffic.
  - *With Snapshots/CDP* — Likelihood of additional storage requirements for data that defragmented/moved and snapshot-related performance lag.
  - *With Thin Provisioning* — Likelihood of additional storage requirements for data that defragmented/moved.
  - *With De-duplication* — Potential for additional de-duplication overhead. De-duplication can remove duplicate blocks incorrectly allocated due to defragmentation.
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Note: The more that you utilize VMotion/Live Migration services in your virtual environment, the less that the Space Reclamation Engine in V-locity will prompt any of the issues listed. If you employ these special virtual services frequently, you may continue to fully utilize Automatic Space Reclamation while employing the rest of this Best Practices document with specific regard to Automatic Defragmentation.

This is why it is important to enable IntelliWrite fragmentation prevention technology and schedule Automatic Optimization to occur during non-production periods to address any pre-existing fragmentation:

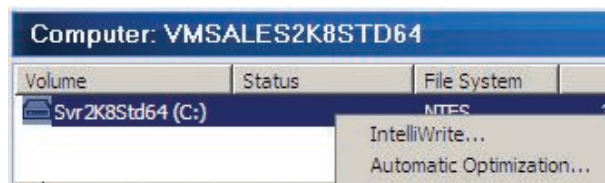
During V-locity Guest Installation, disable Automatic Defragmentation and Automatic Space Reclamation.

► *Uncheck the "Enable Automatic Defragmentation" and "Enable Space Reclamation" options during installation.*

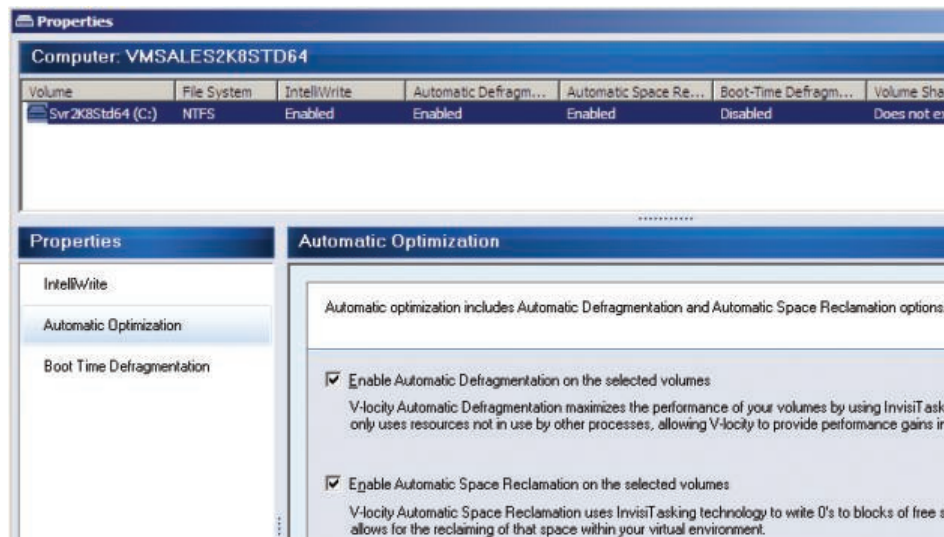


Upon installation, IntelliWrite fragmentation prevention technology is enabled on all volumes by default. IntelliWrite was specifically designed to be 100% compatible with all advanced SAN features, and should be enabled on all SAN LUNs. IntelliWrite configuration is enabled or disabled per volume, and can be used in conjunction with Automatic Optimization, or exclusively. Note: IntelliWrite is a critical component in V-locity. The use of V-locity assures complete disk optimization while avoiding negative impact on SAN infrastructures.

► *To ensure IntelliWrite is enabled, right-click a volume(s) and select the feature.*

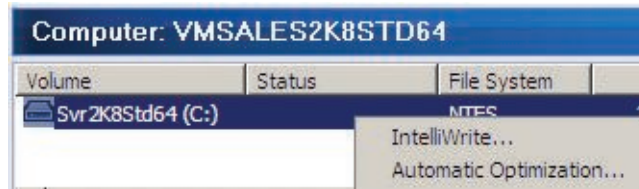


► *Then confirm both Automatic Optimization boxes are checked and click "OK" to complete.*

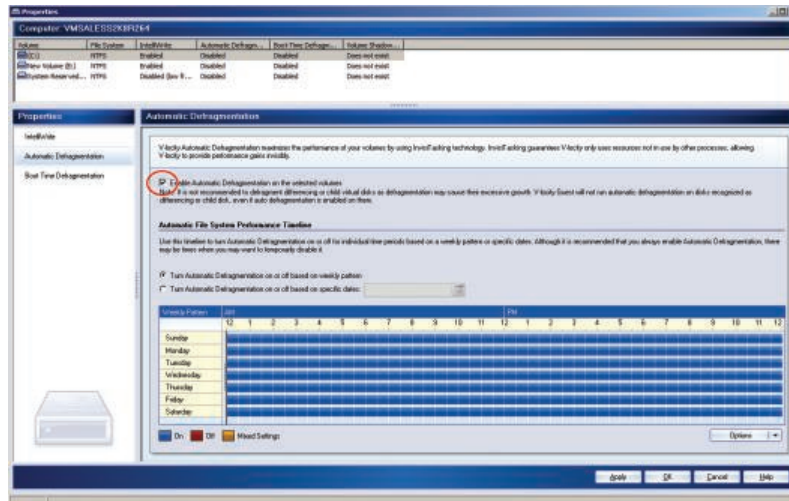


If you are not using any advanced SAN features, it is recommended to enable Automatic Optimization for all days/times. However, note that pre-existing fragmentation will require significant effort from V-locity to clean up. This effort will generate disk I/O activity within the SAN.

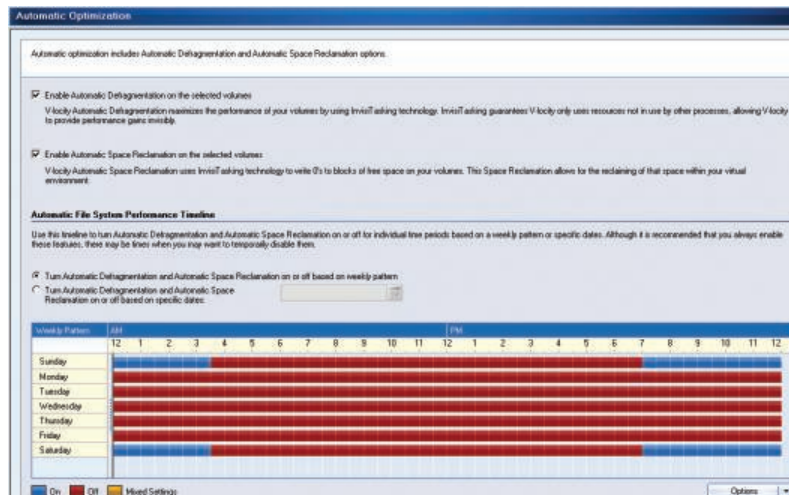
Therefore, if existing fragmentation is significant, initially schedule V-locity to run during off-peak hours. As V-locity has robust scheduling capability, this is easily configured.



▲ To enable Automatic Optimization during non-production periods, right-click a volume(s) and select the feature.



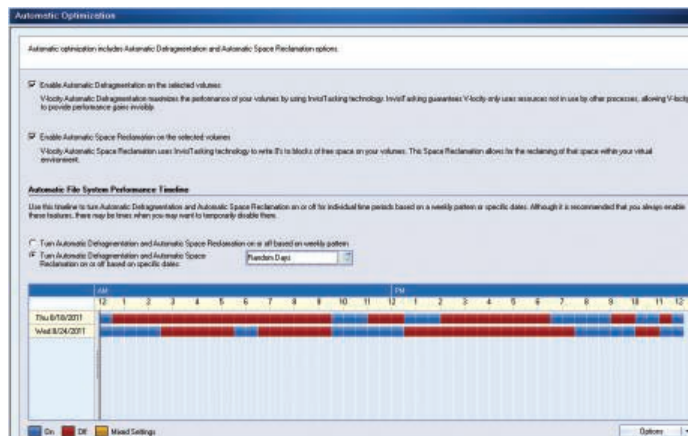
▲ Then check the options to Enable Automatic Defragmentation & Enable Automatic Space Reclamation on the selected volumes.



▲ To enable Automatic Defragmentation during non-production periods, V-locity is scheduled by using your mouse to highlight over the 30-minute blocks in the interactive weekly calendar.

The above example disables defragmentation Monday through Friday. It also disables defragmentation Saturdays and Sundays except between 7 p.m. until 3:30 a.m. the following morning. This would afford 17 hours of defragmentation availability per week. Immediately following these scheduled defragmentation periods is when SAN maintenance for advanced features should be addressed (e.g., thin reclamation, de-duplication).

Should accommodating SAN maintenance be difficult (e.g., limited maintenance windows) using a weekly optimization process, very granular scheduling is also available with V-locity. Note: maintenance windows are not required in order to implement and benefit from IntelliWrite.



▲ To schedule for specific non-recurring dates and times in the future, select the “Turn Automatic Defragmentation and Automatic Space Reclamation on or off based on specific dates” option. Click any multitude of dates and times using Shift-Select or Ctrl-Select. Once done, click OK to complete.

Once pre-existing fragmentation has been removed, increase the periods in which the Windows file systems are actively optimized by V-locity. With real-time defragmentation and InvisiTasking® technology, V-locity immediately cleans up fragmentation that is not prevented by IntelliWrite. This minimal ongoing optimization generates only invisible, negligible I/O activity.

## Best Practices Summary:

- Ensure IntelliWrite is enabled for all volumes (enabled by default).
- Automatic Optimization should be enabled at all times for all direct-attached storage volumes.
- Schedule Automatic Optimization on SAN LUNs, based on use of advanced SAN features.
- If you are making significant use of virtual migration services, keep Automatic Space Reclamation fully enabled to fully benefit from increased VM Density.
- Run SAN processes such as space reclamation and/or de-duplication on recently optimized LUNs using advanced SAN features.

## **Additional Reading:**

*Inside IntelliWrite Technology:*

[http://downloads.diskeeper.com/pdf/IntelliWrite\\_Technology\\_brief.pdf](http://downloads.diskeeper.com/pdf/IntelliWrite_Technology_brief.pdf)

*Comprehensive Best Practices Configuration Document:*

[http://downloads.diskeeper.com/pdf/Best\\_Practices\\_Eliminating\\_Fragmentation.pdf](http://downloads.diskeeper.com/pdf/Best_Practices_Eliminating_Fragmentation.pdf)

*Best Practices for Thin Provisioned Virtual Disks and SAN LUNs:*

<http://www.diskeeper.com/blog/post/2010/11/30/Thin-Provisioning-and-Defrag.aspx>

*Maximize the Performance of Your Windows SAN Infrastructure (Windows IT Pro paper):*

<http://downloads.diskeeper.com/pdf/Performance-Windows-SAN.pdf>

*Diskeeper Corporation Virtual Optimization:*

<http://downloads.diskeeper.com/pdf/FeatureComparisonChart.pdf>