# Best Practices for Configuring Diskeeper® Performance Software with Incremental Block-Based Backups

## Overview:

File fragmentation causes the operating system to generate unnecessary disk I/Os (more overhead on CPU and RAM), making performance suffer. 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.

Data protection and disaster recovery are paramount concerns in the enterprise – a necessity which can conflict with production demands. Servers need to be available at a constant, and maintenance windows must be exact. In many cases, snapshot or block-based incremental solutions are implemented in order to secure data integrity in high-demand production environments. Those same environments require performance software at the workstation and server levels to continue to achieve maximum service levels and maintain the highest possible data throughput.

While it is vital to address file fragmentation in order to maintain optimal data speeds and increase energy efficiency, data performance software should be configured appropriately in order to avoid any unnecessary incremental backups or snapshotting. Block-based incremental backups bypass the file system and read data directly from the Disk or Volume. Block-based backup routines which read data in different sized blocks than the file system may, though not always, be triggered by small file movements (such as those performed by file defragmentation). Data performance software should be configured appropriately when implementing block-based backup methods.

*Please see* Additional Reading *for documentation on how to improve full backup performance with defragmentation.*

## 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 block-based backup technologies.

We suggest reading this full document before executing any of the recommended configurations.

# Best Practices

## Highlights:

Implementing Diskeeper on a platform designed with block-based incremental backups 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 Defragmentation (more details below).

## Details:

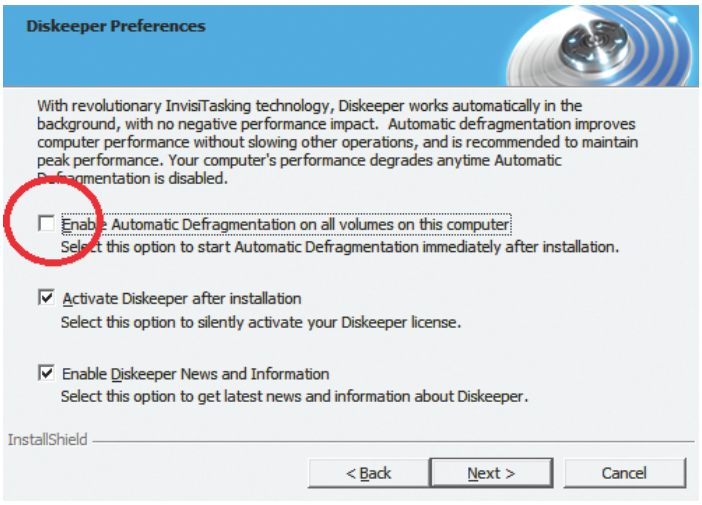
If you have established block-based incremental backups or are implementing any of the following SAN-based technologies such as Thin Provisioning, Replication, Snapshots, Continuous Data Protection (CDP) or Deduplication, it is recommended to follow these guidelines.

Defragmentation can cause unwanted side effects when any of the above-referenced technologies are employed. These side effects include:

- *With Snapshots/CDP/Block-based incremental backups*
  Likelihood of additional storage requirements for data that defragmented/moved and snapshot-related performance lag.
- *With SAN Replication*
  Likelihood of additional data replication traffic.
- *With Thin Provisioning*
  Likelihood of additional storage requirements for data that defragmented/moved.
- *With Deduplication*
  Potential for additional deduplication overhead. Also note that deduplication can be used to remove duplicate blocks incorrectly allocated due to defragmentation. This process can therefore be used to reclaim over-provisioned space.

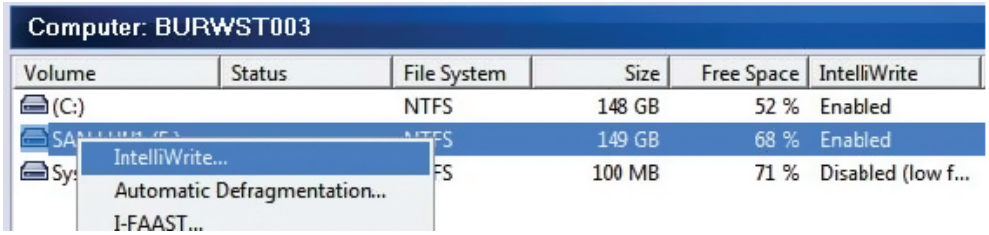
This is why it is important to enable the fragmentation prevention (IntelliWrite) and change the Automatic Defragmentation to occur during non-production periods to address the pre-existing fragmentation:

During Installation, disable Automatic Defragmentation.

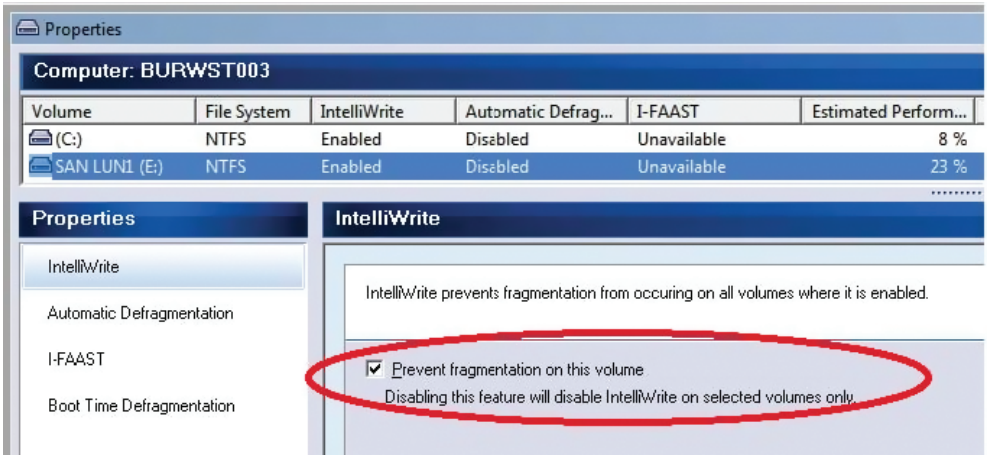



◀ *Uncheck the "Enable Automatic Defragmentation" option during installation.*

Upon installation, ensure IntelliWrite is enabled on all volumes (default). IntelliWrite was specifically designed to be 100% compatible with all incremental backups or advanced SAN features, and should be enabled on all systems. IntelliWrite configuration is enabled or disabled per volume, and can be used in conjunction with Automatic Defragmentation, or exclusively. Note: IntelliWrite is a critical component in Diskeeper 2011. The use of Diskeeper 2011 assures complete disk optimization while avoiding the negative impact on incremental backups or on the data redundancy technologies associated with SAN infrastructures.

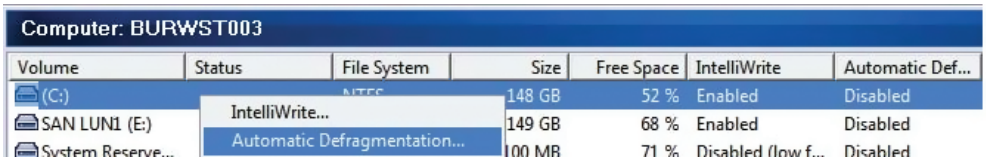



▲ *To ensure IntelliWrite is enabled, right-click a volume(s) and select the feature.*

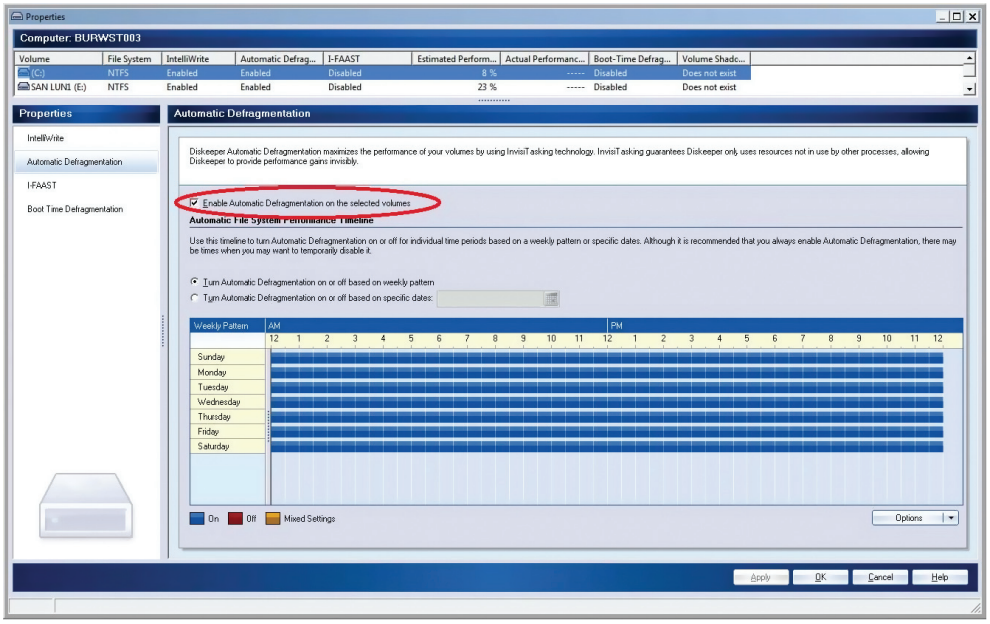



▲ *Then confirm "Prevent Fragmentation on this volume" is selected, and click "OK" to complete.*

Once installed, enable Automatic Defragmentation for any volumes that are not performing block-based incremental backups or mapped to a SAN LUN. This may include the System Partition (e.g., C:\). Note that Automatic Defragmentation is enabled by default.



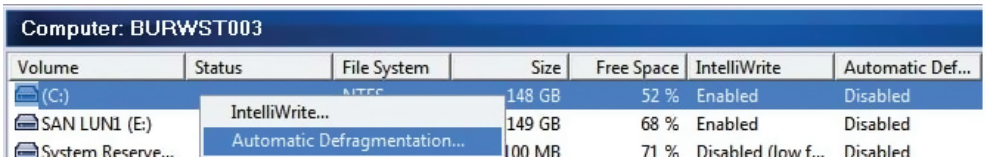

▲ *Then confirm "Prevent Fragmentation on this volume" is selected, and click "OK" to complete.*



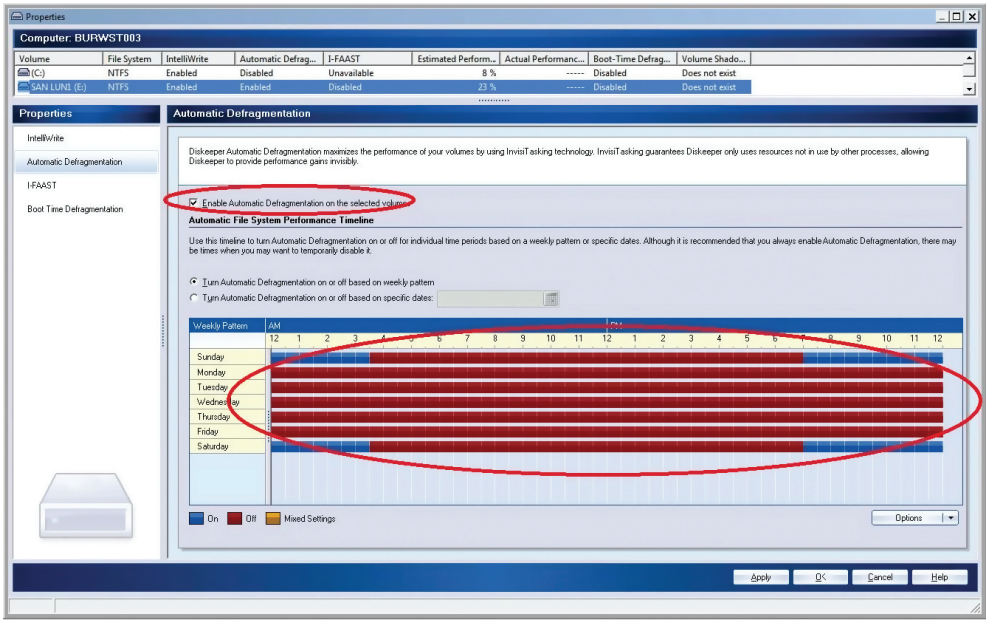

▲ *To enable Automatic Defragmentation, right-click a volume(s) and select the feature.*

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

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



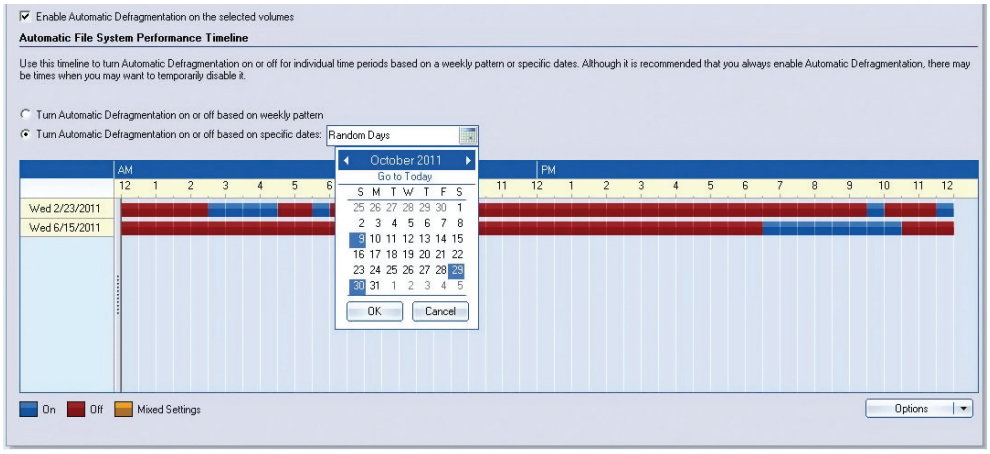

▲ *To enable Automatic Defragmentation during non-production periods, right click a volume(s) and select the feature.*




▲ *Then check "Enable Automatic Defragmentation on the selected volumes." Diskeeper is then scheduled by using your mouse to highlight over the 30-minute blocks in the interactive weekly calendar.*

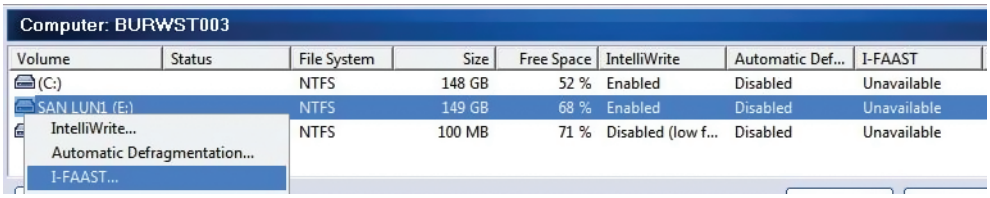
The above example disables defragmentation Monday through Friday. It also disables defragmentation Saturdays and Sundays except between 7 p.m. until 3:30 a.m. the following morning. This would afford 17 hours of defragmentation availability per week. Immediately following these scheduled defragmentation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

Should accommodating incremental block-based backups or SAN maintenance be difficult (e.g., limited maintenance windows) using a weekly optimization process, very granular scheduling is also available with Diskeeper. 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 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.*

If you are implementing the above-mentioned incremental block-based backups it is also recommended to disable I-FAAST® (Intelligent File Access Acceleration Sequencing Technology). I-FAAST sequences hot "files" (not blocks) in a Windows volume, after determining hardware performance characteristics. The sequencing process creates additional movement of data and is therefore generally recommended to disable when incremental block-based backups are in place.




▲ *To disable I-FAAST, right-click a volume(s) and select the feature.*

Note: I-FAAST requires Automatic Defragmentation be enabled. Also note that I-FAAST is disabled by default in Diskeeper 2011 in certain cases. Also note that I-FAAST generates additional disk I/Os and will therefore cause an increase in the aforementioned Automatic Defragmentation side effects.

Once pre-existing fragmentation has been removed, increase the periods in which Diskeeper 2011 actively optimizes the Windows file systems. With real-time defragmentation and InvisiTasking® technology, Diskeeper immediately cleans up fragmentation (that is not prevented by IntelliWrite). This minimal ongoing optimization generates only invisible, negligible I/O activity.

## New features in Diskeeper 2011 to improve disk performance:

The new Instant Defrag™ technology in Diskeeper 2011 dramatically minimizes I/O activity, and exponentially speeds up defragmentation. The Instant Defrag engine is provided fragmentation information, in real time, by the IntelliWrite file system filter driver (those fragments that it does not prevent). Without the traditional need to run a time- and resource-intensive whole-volume fragmentation analysis, Instant Defrag can address the recently fragmented files as they occur. This dynamic approach prevents a buildup of fragmentation, which could incur additional I/O overhead to solve at a later date/time.

Diskeeper 2011 also introduces new Efficiency Mode (default) which maximizes performance while minimizing disk I/O activity. By focusing on efficiency and performance and not on presenting a "pretty disk" visual display, Diskeeper 2011 minimizes negative side effects (e.g., reduced snapshot storage requirements or thin LUN growth on SANs, etc.) while maximizing performance benefits.

By default, Efficiency Mode also disables proprietary file placement features such as I-FAAST.

## Best Practices Summary:

- Ensure IntelliWrite is enabled for all volumes.
- Automatic Defragmentation should be enabled at all times for all direct-attached storage volumes with no incremental block-based backup occurring.
- Use Efficiency Mode of Diskeeper 2011.
- Schedule Automatic Defragmentation on storage volumes where incremental block-based backup is established.

## Additional Reading:

*Inside IntelliWrite technology:*
http://downloads.diskeeper.com/pdf/IntelliWrite_Technology_brief.pdf

*Improving Backup Performance with Defragmentation:*
http://downloads.diskeeper.com/pdf/Improving-Backup-Performance-with-Defragmentation.pdf

*SAN Best Practices configuration document:*
http://www.diskeeper.com/blog/file.axd?file=2011%2f3%2fBest+Practices+for+using+Diskeeper+on+Storage+Area+Networks.pdf

*Comprehensive Best Practices configuration document:*
http://downloads.diskeeper.com/pdf/Best_Practices_Eliminating_Fragmentation.pdf