



ProfileUnity™ with FlexApp™ Technology

VHDX Compacting Tool

Version 1.15
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This guide has been authored by experts at Liquidware in order to provide information and guidance concerning the .ProfileUnity™ with FlexApp™ VHD(X) compacting tool.

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Table of Contents

What's New for CompactVHD?	1
Version 1.15: Released August 3, 2021	1
Version 1.12: Released June 17, 2021	1
Version 1.10: Released May 10, 2021	1
Version 1.09: Released March 5, 2021	2
CompactVHD Overview	3
CompactVHD Software Requirements	4
Setting Up CompactVHD	5
Sample Use Case	6
CompactVHD Workflow	6
Sample Command Line Usage	7
Command Line Summary	7
Scheduling CompactVHD to Run Weekly	8
Command Line Options	10
Getting Help	13
Using Online Resources	13
Troubleshooting with the Software	13
Contacting Support	13

What's New for CompactVHD?

Version 1.15: Released August 3, 2021

What's New

In the event the CompactVHD tool fails to compact a disk because it cannot safely find VHDX child disks, you can now override this check. If you are not using ProfileUnity multi-session or FSLogix multi-session VHDXs, you can append the `"/IgnoreFailedParentChecks"` switch to the command line to override this check.

Known Issues/Limitations

In some cases, compacting 20 GB dynamic VHD files does not free up as much space as you might expect when optimized. VHDX files do not have the same issue. Therefore, to recover more free space, using VHDX files instead of VHD files is suggested.

Version 1.12: Released June 17, 2021

What's New

Additional Optimization steps were added to help reduce the overall size even more.

Issues Resolved

- Fixed an issue where a corrupted VHDX would halt the entire job.
- Fixed an issue where not finding a child disk on a corrupted VHDX would halt the entire job.

Known Issues/Limitations

In some cases, compacting 20 GB dynamic VHD files does not free up as much space as you might expect when optimized. VHDX files do not have the same issue. Therefore, to recover more free space, using VHDX files instead of VHD files is suggested.

Version 1.10: Released May 10, 2021

Issues Resolved

Fixed an issue where the newly optimized VHDX is put back into place but the original NTFS ACLs were not cloned to the new disk.

Known Issues/Limitations

In some cases, compacting 20 GB dynamic VHD files does not free up as much space as you might expect when optimized. VHDX files do not have the same issue. Therefore, to recover more free space, using VHDX files instead of VHD files is suggested.

Version 1.09: Released March 5, 2021

The first version of the VHD compacting tool is released to market. This tool enables the recovery of unused storage space inside of expandable virtual hard disks.

Known Issues/Limitations

In some cases, compacting 20 GB dynamic VHD files does not free up as much space as you might expect when optimized. VHDX files do not have the same issue. Therefore, to recover more free space, using VHDX files instead of VHD files is suggested.

CompactVHD Overview

When using a thin provisioned virtual hard disk (VHDX), the size of the virtual disk is allowed to expand as needed. Initially, the underlying VHDX file on physical storage starts out small and grows as data is added to the disk. However, while thin provisioned VHDXs automatically expand, they do not automatically shrink when data is deleted. With use over time, the used space of the VHDX on physical storage might not match the size of the corresponding VHDX file. For example, the used space inside the disk on storage might only be 1 GB while the VHDX file size is 10 GB. This discrepancy is caused by deleted data not being purged. When you delete data on an NTFS file system, the data is never really removed from the disk. NTFS will continue to write deleted data until the VHDX file is expanded to its full size.

To help mitigate this problem, directories that are no longer needed can be moved outside the VHDX. But over time, it is impossible to fully mitigate. A process that can shrink the VHDX file to as close as possible to the original state size is needed. This process also has to be scalable as there might be thousands of VHDXs in the environment that need to be compacted. The ultimate benefit of this process is the potential savings in storage where hundreds of gigabytes or even terabytes of space could be reclaimed.

To address these challenges, Liquidware has created a compacting tool called CompactVHD that can be scheduled to run and compact your disks on a regular basis. The process has been tuned to recover the most amount of space possible as compared to alternative results you might get from using PowerShell scripts. CompactVHD can either compact a single file or all VHDX files in a given directory.

CompactVHD Software Requirements

VHDX file formats are supported for compaction. CompactVHD requires the following components for installation:

Component	Requirements
OS Platforms Supported	Windows 10 or Windows Server 2016/2019. Only 64-bit versions where applicable are supported. Both physical and virtual instances are also supported.
Additional Software	Microsoft® .NET Framework 4.6.2 or higher. The specific version should match the same version used for the ProfileUnity Client.
CPU	2 CPU
Memory	1 GB
Storage (EXE)	10 MB
Free Disk Space	Free disk space is needed locally to compact VHDs. The free disk space requirement is equal to the largest VHD to compact. For example, if the largest disk in your user population is 20 GB, then you will need 20 GB free locally.
Backup File Storage	Varies with your environment. Backup files can be kept in the same directory as the working VHDXs or moved to an alternate storage location.

Setting Up CompactVHD

Download the CompactVHD tool from the following location on the Liquidware Support Portal and copy the executable to your environment:

https://cdn.liquidware.com/FlexApp/CompactVHD_v1.15.zip

It is expected that the program will typically be run from the ProfileUnity server, whereas the ProfileDisk VHDx will typically be stored on a file share on a file server/NAS or perhaps elsewhere in the network. In any case, the key is that this program is extremely I/O intensive. Because network file access tends to be slow, the program copies the files from the network share to a working directory via the /WorkDir option, which should refer to a local directory, ideally SSD. The program then does the most I/O-intensive operations in the working directory, and then copies the results back out to the network storage where ProfileDisk files are normally located.

Sample Use Case

For this sample use case, you have an organization with 1000 users. Typically, the staff logs off around 5 PM on Friday night and starts logging back in to the system at 8 AM on Monday morning. This gives you 63 hours of downtime to optimize user disks. However, using all of the downtime is not recommended. The best practice is to place a buffer of time on the front and backend of the compaction process. If you start the compaction process at 10 PM on Friday and stop it at 3 AM Sunday, you have 53 hours to complete compacting as many VHDs as possible.

In general, compacting a VHD averages 3-5 minutes per disk, or 12-20 VHDs per hour. The first run takes the longest, but each session should get faster as more compactions are done. With our use case of ~20 VHDs per hour * 53 hours, you should be able to compact ~1060 VHDs. Based on the amount of VHDs to complete in the given time period, it is highly likely that not all will finish. Some will have to be done in the next compaction session.

CompactVHD Workflow

Here is the main workflow for the compacting tool.

1. CompactVHD looks for existing ProfileUnity or Microsoft FSLogix multi-session child disks.

If a child disk exists, then the parent disk is NOT current and this disk will be skipped. The child disk needs to be committed or deleted before compacting the parent disk.

2. The tool will check to make sure the VHDX to be compacted is not locked.

If the disk is locked, it is likely that a user is logged in, a disconnected session has the disk open, or the file server is holding an open handle on the disk. CompactVHD will skip performing optimization on these disks.

3. The parent disk is copied to the local temp path.

It is best to perform the optimization locally. The free disk space needed locally in %temp% is equal to your largest disk. If the largest disk in your user population is 20 GB, then you will need 20 GB free locally.

4. Optimization steps are performed.
5. The newly optimized disk is copied back to the source disk path with a temporary name.
6. CompactVHD verifies the original disk has not been modified.

For example: If a user were to log in while the tool was performing its optimization steps, then the work would be discarded at the end of the compacting process. The version of the disk that was optimized is no longer the most current version.

7. The original virtual disk filename is appended with `.BK` and the newly optimized disk is put into place.
 - a. This process takes milliseconds and is the best chance that a user will not log in during the swap of the two disks making the new disk the primary disk.
 - b. The original disk is never mounted, just renamed, if all the steps are 100% successful. This avoids locked production disks at the start of the next shift. Worse case, the copied disk could be locked if something happens in the middle of the process (for example, if Windows Updates reboots the host we are running on).

Sample Command Line Usage

The following is a sample command with options that can be used to compact the VHDs.

```
LwL.ProfileUnity.Client.CompactVHD.exe /VHDDir \\server.local\home  
/MinDaysSinceLastCompaction 30 /BackupPath \\bk.local\bkUserProfileDisks /MinDiskMB  
1024 /MaxHours 53 /SMTPServer smtp.server.local /MailTo IT@local.com /MailFrom  
ProU_Compact@local.com /AcceptEULA
```

Command Line Summary

Looking at the command line usage options selected above, the following is a summary of intended actions to perform.

The tool will compact ALL VHDX files it finds in all sub directories in `\\server.local\home`. Any VHDs that were already compacted in the last 30 days will be skipped. Note any VHDX that is the same size after compaction as it was before compaction will be aborted. The backup location of the original disks will be stored in another network path (`\\bk.local\bkUserProfileDisks`) and not in the production share for the user's disks. Any VHDX that is not at least 1024 MB in size will be skipped. The maximum hours the job will be allowed to run is 53 hours, and it will gracefully finish its last job if it was started right before the 53-hour mark. An email report of Nominal, OrigSize, NewSie, Savings, MM:SS and File Name (all sizes in MB) will be sent to `IT@local.com` from `ProU_Compact@local.com` using mail server `smtp.server.local`. The final step is the acceptance the End User License Agreement to authorize the use of the tool. The parameter of `/AcceptEULA` is required in all options for the tool to perform its function.

Scheduling CompactVHD to Run Weekly

To schedule CompactVHD to run weekly, complete the following tasks:

1. Open the **Task Scheduler** in Windows. and create a New Basic Task.
2. In the Actions column, click the **Create Basic Task** option.
3. Enter a name for the task.
4. Click the **Next** button.
5. Select the **Weekly** radio button.
6. Click the **Next** button.
7. Set your task to start when your window of downtime begins.
8. Click the **Next** button.
9. Select the **Start a program** radio button.
10. Click the **Next** button.
11. In the **Program/script** field, enter the location of the CompactVHD executable.
12. In the **Add arguments (optional)** field, enter the command line arguments.
13. In the **Start in (optional)** field, enter the path where the executable is stored.
14. Click the **Next** button.
15. On the Summary screen, select the **Open the Properties dialog for this task when I click Finish** checkbox.
16. Click the **Finish** button.
17. On the Properties screen that opens, select the **Run whether user is logged on or not** radio button.
18. Click the **Change User or Group** button and pick your "Domain account" that the tool will run under. Its very import this service account already have read and write permissions to where the user's VHDs are stored. If the account does not have read and write permissions, the job will fail on those where access is denied.
19. Select the **Run with highest privileges** checkbox.
20. In the **Configure for** field, select **Windows Server 2016**.
21. Click the **Settings** tab.

22. Change the setting for **Stop the task if it runs longer than** to 54 hours. The example of 54 hours comes from the use case above where we created a buffer for when things start and end. The job itself stops after 53 hours. We do not want the job to be running any time users might login. If the job is still running after 54 hours it will be terminated.
23. Click **OK** and then on the Task Scheduler login screen, enter your account password to run the scheduled task.

Command Line Options

The following table lists the available command line options for CompactVHD.

Option	Description
<code>/AcceptEULA</code>	Required parameter (if not supplied, the program will tell you where the EULA is and suggest you read it)
<code>/LogName <dir></code>	Overrides the default logfile (not generally needed). The default path is <code>%temp%</code> for the account running the tool.
<code>/LogLevel info</code>	Overrides the default logging level. For this program, "info" is recommended.
<code>/VHDFile <path></code>	Fully-qualified path to a single VHDX file. Only this one file will be compacted. Note that you must specify either <code>/VHDFile</code> or <code>/VHDDir</code> but not both.
<code>/VHDDir <dir></code>	Specifies the directory that contains all VHDX files, typically something like <code>\\server\share</code> . All VHDs in that directory (except parent/child disks) will be compacted. Note that you must specify either <code>/VHDFile</code> or <code>/VHDDir</code> but not both.
<code>/StartsWith A-L</code>	Gives one or more ranges that the file must start with, such as <code>/StartsWith A-C</code> . Note that it is actually looking at the part of the path beyond the <code>/VHDDir</code> , so whatever letters come next (typically the username) are what it is looking at.
<code>/WorkDir <dir></code>	Provides a work directory, ideally on local SSD storage. All files for each VHD being compacted will be put in subdirectories of this directory. If a compaction completes successfully, the subdirectory will be deleted. If a compaction fails for some reason, the subdirectory (which also contains VHD log files that might be useful for problem diagnosis) will remain. The default is <code>%temp%\CompactVHD</code> .
<code>/EraseBK <dir></code>	The program renames the old VHDX files as <code>.vhd.BK</code> or <code>.vhdx.BK</code> , but that leads to large amounts of space being taken up by the backup files. Running the compactor with <code>/EraseBK</code> will delete those backup (BK) files.
<code>/ConvertTo <VHD VHDX></code>	Converts VHD files to VHDX files (or vice versa). Must be used with <code>/VHDDir</code> or <code>/VHDFile</code> .
<code>/SMTPServer <SMTP Server></code>	The program can send an email with a summary of what it did. This specifies the SMTP server to use for sending that email.
<code>/SMTPPort <num></code>	Specifies the SMTPPort to use for sending the summary email. This is generally not needed unless the SMTP server is running on a non-

Option	Description
	standard port. The default port is 25.
<code>/SMTPSSL</code>	Use this option to establish an SSL connection with the SMTP server for sending emails. Some SMTP servers require SSL while others prohibit it.
<code>/SMTPUser <domain\user></code>	UserID for SMTP server. Note that some servers require this to match the <code>/MailFrom</code> address.
<code>/SMTPPass <password></code>	Password for the <code>/SMTPUser</code> . This is assumed to be cleartext, but if you want to provide an encrypted password, prefix the password with "ENCRYPTED: "
<code>/SetSMTPPass <password></code>	Takes the given cleartext password, encrypts it, adds an "ENCRYPTED: " prefix, and writes it into the <code>app.config</code> .
<code>/MailTo <email1[, email2, ...] ></code>	One or more (comma-separated) email addresses that the summary should be sent to.
<code>/MailFrom <from email></code>	The email address that the summary email will appear to have come from.
<code>/MaxThreads <num></code>	The maximum number of simultaneous compactions. This number might be reduced, based on available space on the <code>/WorkDir</code> drive. Note that the process is heavily I/O-bound, and testing seems to show that running 2 or more simultaneous compactions actually slows it down overall rather than speeding it up. As a result, the default is "1", and use of this option is discouraged.
<code>/MinDiskMB <num></code>	Specifies a minimum disk size in MB before processing. Any VHDX files below this size will be skipped. The default is 500 MB. A less aggressive suggestion is 1024.
<code>/MinSaveMB <num></code>	Specifies the minimum savings in MB required to be worth performing a compaction. The default is zero, but that can result in the creation of a <code>.BK</code> file of many gigabytes just to save a few megabytes. By setting this parameter, you can tell it to skip the compaction and the creation of the <code>.BK</code> file if the savings are minimal.
<code>/MaxHours <num></code>	Stops the process shortly after X hours. It is recommended that if you want to schedule a job to run for 8 hours, set this parameter to 7 hours so that the program will stop cleanly instead of getting interrupted. You can use fractional hours (e.g. <code>/MaxHours 0.25</code> = 15 mins). The default is 0, which means "no limit".
<code>/BackupPath <dir></code>	By default, the program will save the user's original files as <code>".vhd.BK"</code> or <code>".vhdx.BK"</code> files in the same directory. In case the process is interrupted, and you need to restore them, rename them

Option	Description
	<p>without the BK extension. The backup location will only keep the most recent backup each time the job is run. However, keeping backup files in the same directory means that disk space consumed on the disk containing the VHDX will go UP, not down, because the disk contains both the current VHD and the backup VHD. Disk space can be reclaimed when files are erased with the <code>"/EraseBK"</code> option (which you should not do until you are comfortable that there are no issues).</p> <p>With the <code>/BackupPath</code> option, you can specify an alternate location to store the backup files (perhaps on less expensive disks), so that the disk space consumed on the main drive goes down. Of course, this means that restoring the data will involve copying the files back, rather than just renaming them. The <code>"/EraseBK"</code> option will use the <code>/BackupPath</code>, if specified, as the location in which backup files should be erased.</p>
<code>/MinDaysSinceLastCompaction</code> <code><num></code>	<p>By default, all VHDX files will be compacted (subject to <code>/MinDiskMB</code> and <code>/MaxHours</code>). Compacting all files might be overkill if the disk was just compacted a few days ago. With this option, you can tell it to skip any VHDX files that were last compacted less than X days ago. The default is 0, which means "no limit".</p> <p>When set to 30 and running the job weekly, disks that were compacted in the last 30 days will be skipped while focusing on disks that might have not been compacted on the last run if time for the job ran out. This ensures all disks are getting compacted on a regular basis.</p>
<code>/IgnoreFailedParentChecks</code>	<p>Overrides the process that checks to see if a child disk exists. Normally, the existence of a child disk would stop the disk compaction process. In the event the CompactVHD tool fails to compact a disk because it cannot safely find VHDX child disks, you can now override this check. Note that any connection between a child and parent disk will be broken after the parent disk has been compacted. Do NOT use this option with ProfileUnity multi-session or FSLogix multi-session VHDXs.</p>

Getting Help

If you have questions or run into issues while using our software, Liquidware is here to help. Our goal is to provide you with the knowledge, tools, and support you need.

Using Online Resources

Liquidware maintains various kinds of helpful resources on our [Customer Support Portal](#). If you have questions about your product, use these online resources. The Support Portal includes product forums and a searchable knowledge base, as well as the ability to submit a case to the Liquidware Support system on the [Liquidware Customer Support Portal](#). For product documentation, refer to our [Liquidware Document Repository](#).

Troubleshooting with the Software

ProfileUnity and FlexApp provide full logging capabilities to track activities. In addition, Liquidware provides several avenues for self-service, which includes the [Liquidware Customer Support Portal](#), [Knowledgebase](#), and [Online Training](#) site. You may find answers to many of your questions, along with Liquidware Self Service options.

Contacting Support

If you need to contact our Support staff for technical assistance, log a request on the [Liquidware Customer Support Portal](#). Prior to logging a case you should review these helpful tips:

- Check the [Product Documentation](#) included with your Liquidware Product.
- Try to see if the problem is reproducible.
- Check to see if the problem is isolated to one machine or more.
- Note any recent changes to your system and environment.
- Note the version of your Liquidware product and environment details such as operating system, virtualization platform version, etc.