



SHOWCASE® Image Center Study Data Management

This guide provides a set of best practices and recipes for automatically maintaining your study data using ShowCase Image Center. A primary goal of the Image Center system is to provide a reliable, low-maintenance, low-cost set of solutions to meet the clinical and legal requirements of storing your medical image data. This is a companion guide to the *Image Directory Creation and Maintenance* guide. We recommend you read both.

What is Study Data?

A 'study' is a specific clinical visit where the patient has been imaged by an imaging device, like an ultrasound or C-arm device. Study data, i.e. images, measurements and calcs, key image notes, etc. is stored as individual files in DICOM format. Internally, all files associated with a study have a unique DICOM study UID, which is the true indication that they are all part of the same study. There is no folder grouping or naming convention in DICOM that indicates which files belong to which study, or even that a file is a DICOM file. Some DICOM files have a suffix of '.dcm'. Others do not.

When you do something with a study, like viewing it, copying it, or archiving it, you are doing something to a collection of files. These files need to be treated as an inseparable collection. The Image Center manages this, and thus it is very important to *never move or delete files in an Image Directory folder*. The same should be considered generally true for Archive folders. Let the Image Center do the work of moving studies around.

The Study Data Lifecycle

The first 1-3 days

When a study is performed at an imaging device, it is sent to the Image Center. The physician then reads the study using the ShowCase Viewer and makes a clinical diagnosis based on what they see. This is typically done within 24 hours of the imaging scan.

The next 1-3 weeks

After the study has been completed, it may need to be accessed by administrators (for billing or bookkeeping), clinicians, or referring physicians as part of the patient's treatment.

The 'Prior Data' period: weeks/months/years

Depending on your practice and the patient's health issues, the physician may need to refer to the prior study for weeks, months, and even years. Comparison of priors to newer studies is not uncommon.

The Legal Retention period: 7 years or more

In the US, most states require a medical practice to retain studies for **at least 7 years**. This varies state to state, practice to practice (clinical need), and country to country. It is very important to know the clinical and legal requirements are for your practice so you can ensure you're meeting them.

The Growing Study Archive

Over the course of a medical practice's lifetime, study data can grow to many **tens of Terabytes** that the practice is required to store and access. Fortunately, local storage costs have plummeted in the last decade, making storing even 20 Terabytes of studies quite affordable.

The Image Center is designed to address the needs of the study data lifecycle, automatically, with very little manual intervention required. Read on to see how you can use the Image Center to best support your practice's needs.

Who is responsible for your data?

You are. Trillium Technology has no access to any of your study data or knowledge of how your system was configured or where or how your data is stored.

How much disk do I need?

Please see the **Disk Space Requirements** section of the *Image Directory Creation and Maintenance* guide for how to calculate this.

System Terminology

Image Directories

Image Directories are where the Image Center stores the “live” study data for immediate access by the physician through ShowCase. In DICOM terms, this is **ONLINE** storage. You can read more about Image Directories in the *Image Directory Creation and Maintenance* guide.

Storage Archives

Storage Archives are where the Image Center archives long term data. In DICOM terms, this is **NEARLINE** storage. This is study data that you may not need immediate access to, but you want to maintain for legal or reference reasons. The Image Center currently supports one type of archive: Folder Archives, which are disk archives. You can read more about Storage Archives in the *Storage Archives and Storage Tasks* guide.

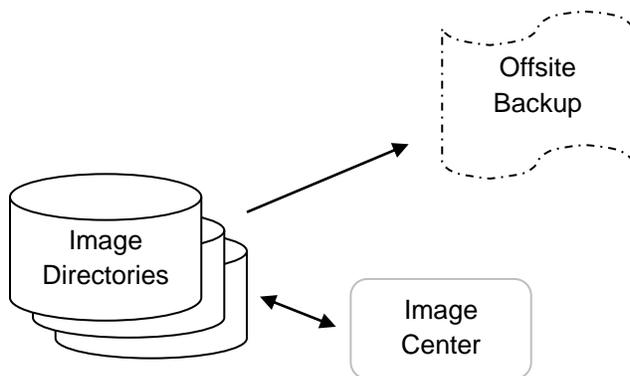
Storage Tasks

Storage Tasks are where you can set manual or automatic tasks. For example, you might want to regularly archive data that is older than 7 years out of your Image Directory and into a Folder Archive. Or move all study data that is older than 3 years from one Image Directory to another. You can read more about Storage Archives in the *Storage Archives and Storage Tasks* guide.

Storage Strategies

Here are two common storage strategies for managing your study data.

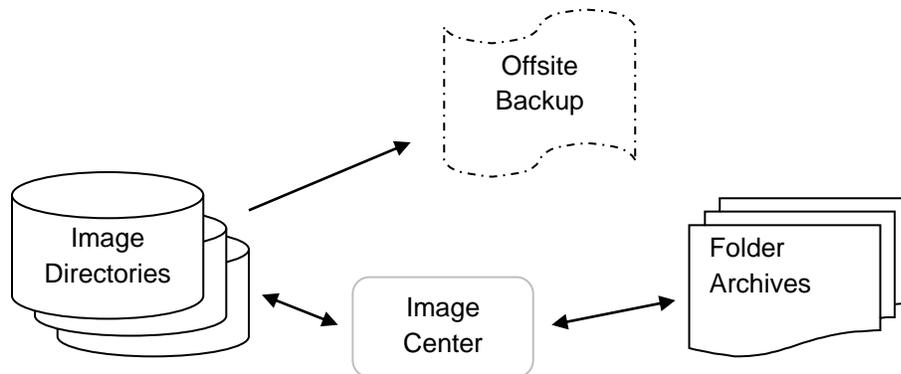
Simple Large Image Directories



This is by far the simplest way to manage your storage. When you start running out of disk space, you purchase more storage, create a new Image Directory, and direct the Image Center to store incoming studies to the new Image Directory. From the point of view of your physicians, nothing changes and they have full access to all of their prior studies.

This does mean your image storage can become quite large, but with the steadily dropping cost of hard drive storage, this is not too big of a problem. See the *Image Directory Creation and Maintenance Guide* for more information on adding storage to your system.

Image Directories with Automated Archival of Old Studies



In this strategy, you maintain the clinically or legally required minimum of studies in Image Directories and automatically archive studies older than what is required to a local Folder Archive. For example, if it makes the most clinical sense to have immediate access to 7 years of data, you keep that data in Image Directories and anything older in local Folder Archives. The Image Directories should be backed up off-site.

When using ShowCase, you will see older studies with a status of 'archived' if they have been archived. To view or otherwise do something with the study you will need to 'fetch' the study, which you can do from ShowCase. Once fetched, the study is now available and you can work with it. After some time (which you configure) the fetched study will be moved back to the Folder Archive, to keep your Image Directories from bloating with fetched studies.

This strategy is useful for massive volumes of study data, where the practicality of maintaining the core Image Directories (and backing them up) can become problematic due to size.

Note: *If you're thinking "I can use SSDs for my Image Directories and 5400 RPM drives for the Folder Archives to optimize performance", that is not a compelling reason to deploy this strategy. You would find that using an SSD or a 5400 RPM spinning platter drive for your Image Directories will provide the same performance to the end-user. The key limiting factor when viewing a study is network bandwidth between the ShowCase client and the storage medium, not raw disk I/O speed. This has been measured empirically.*

Offsite Backup

Image Directories should **always** be backed up using automated offsite backup, for several reasons:

- Protection from ransomware attacks.
- Catastrophe protection: theft, fire, or simply a hard drive that dies.
- You are legally required to maintain an archive of your studies for, in most cases, a minimum of seven years.

There are several good products out there that are affordable: iDrive and Carbonite, for example. Whatever you choose should fit in with the backup practices of your site. **Tip:** Backups should always be automated. Manually backing up or making manual copies of your studies is prone to error and will result in data loss.

You should also consider offsite backup for your Folder Archives.

How To...

How To... Add Storage to My Image Center?

Please see the section **Increasing Image Center Storage** in the *Image Directory Creation and Maintenance* guide.

How To... Move an Image Directory?

Please see the section **Moving an Image Directory** in the *Image Directory Creation and Maintenance* guide.

How To... Set Up Automatic Archival of Old Studies?

Assuming you already have an Image Directory set up, this how-to will take you through the steps for setting up your Folder Storage Archive and an Archive Storage Task.

1. Create an Archive
 - a. Open the Image Center Console
 - b. Click the **Manage Storage** button



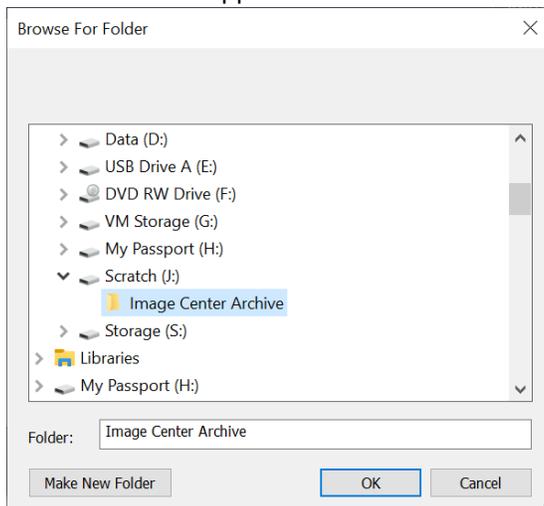
- c. Select the **Manage Storage Archives** button, a dialog will appear.



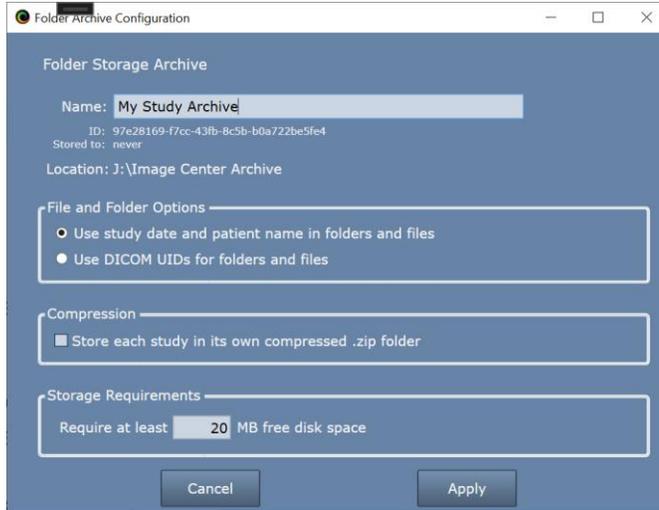
- d. Click the **New...** button and select **Folder Archive**



A folder browser appears:



- e. Select an empty folder (or click **Make New Folder**) on a disk that has plenty of disk space. If you want to use a network share, enter the full UNC path name of the share in the Folder: text box, e.g. “\\25.66.165.65\Image Center Archive” or “\\NAS34\Image Center Archive”. Please be sure to read the section *Setting up Folder Archives on Network Shares* (later in this document) for more details on using network shares.
- f. Click OK, a configuration dialog appears:



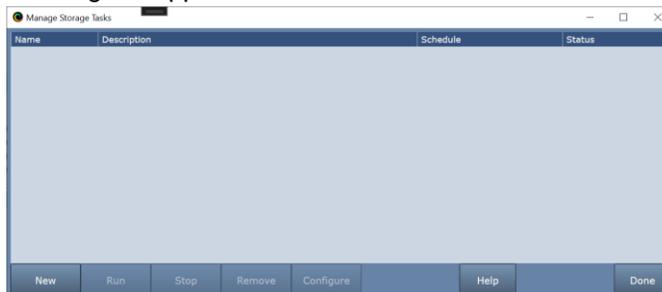
- i. In the **Name** field, enter a name for your archive.
- ii. **File and Folder Options:** We generally recommend using the default “Use study date and patient name...” option. This allows you to find studies in the archive just by looking at the folders in the archive. The study containing the folder will be a stand-alone DICOM folder with a DICOMDIR in it.
- iii. **Compression:** If you turn this on, each study will be stored in a zip file, which you will have to uncompress to access.
- iv. Click the **Apply** button. The archive will appear in the list of archives in the Manage Storage Archives dialog.

2. Create a Storage Task

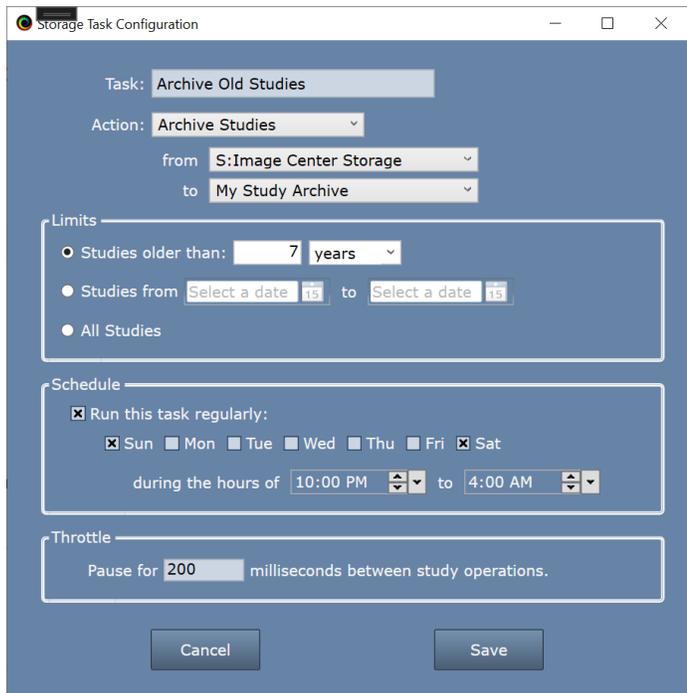
- a. At the Image Center Console, click **Manage Storage** and select **Manage Storage Tasks**



A dialog will appear:

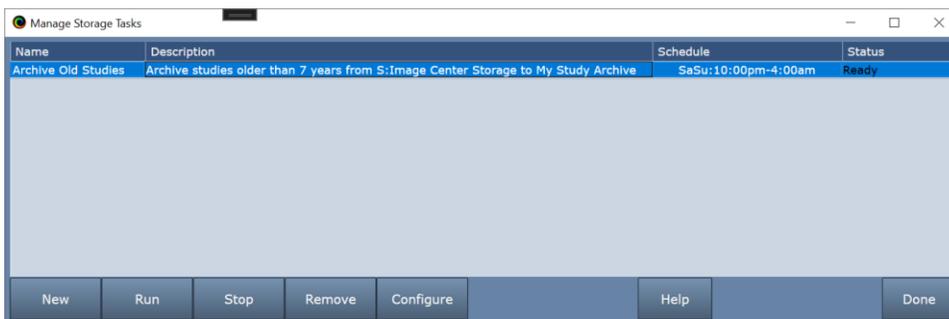


- b. Click the **New** Button. The Storage Task Configuration dialog will appear:



- i. In **Task**, enter name for your task, e.g. “Archive Old Studies”
- ii. Click the **Action** drop-down and select “Archive Studies”.
- iii. In the **from** drop-down, select the Image Directory you wish to archive
- iv. In the **to** drop-down, select the Archive you wish to archive to.
- v. Under **Limits**, select the parameters for what studies to archive, in this example, all studies older than 7 years.
- vi. Under **Schedule**, choose when you want the storage task to run. In this example, the task will run at night on the weekends.
- vii. Under **Throttle**, we recommend leaving in the default of 200 milliseconds.
- viii. Click **Save**. The task will now appear in the **Manage Storage Tasks** dialog.

You have now set up your Image Directory to automatically archive to your Folder Archive. As long as your Image Center is running during the scheduled hours, it will check to see if there are studies old enough to archive, and if there are, it will archive them into your archive folder.



You can also manually run the archive task by selecting the task and clicking the **Run** button.

How To... Move Data from one Image Directory to Another

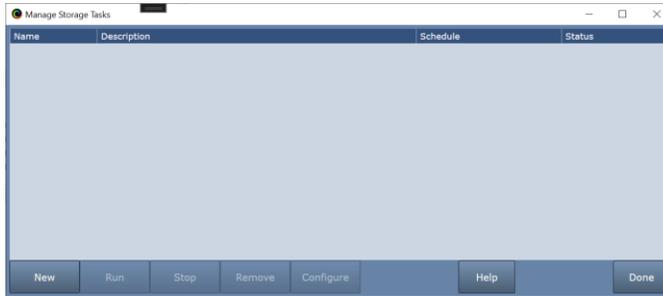
Let’s say you had an Image Directory on a drive, and the drive was running out of space, so you went and bought a new drive and started storing studies to that new drive. After a while, you decide you’d like to move all the data from the old studies Image Directory into the new one, so that all of your data is one place. This recipe is for you!

In this example, the original Image Directory is named “S: Image Center Storage” and the new, larger Image Directory is named “J: Mass Storage”

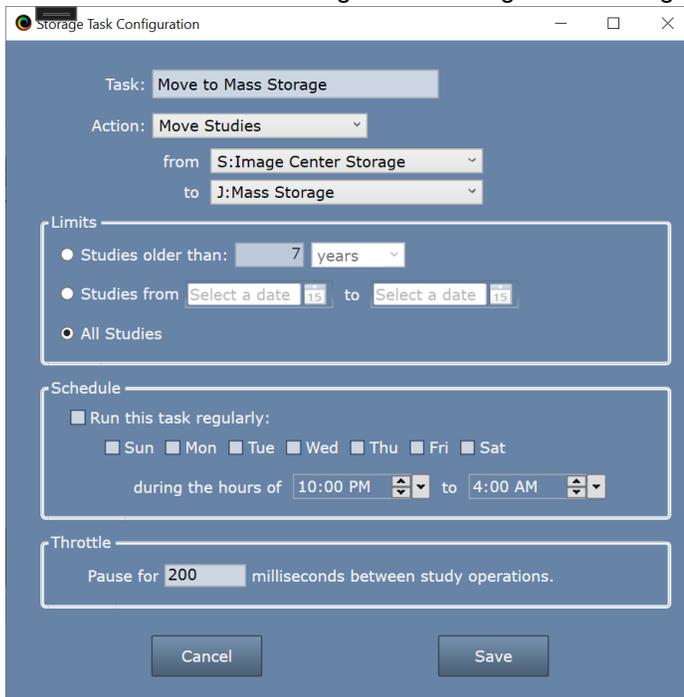
1. At the Image Center Console, click **Manage Storage** and select **Manage Storage Tasks**



A dialog will appear:



2. Click the **New** Button. The Storage Task Configuration dialog will appear:



- c. In **Task**, enter name for your task, e.g. “Move to Mass Storage”
- d. Click the **Action** drop-down and select “Move Studies”.
- e. In the **from** drop-down, select the Image Directory you wish to move studies out of, e.g. “S:Image Center Storage”
- f. In the **to** drop-down, select the Image Directory you wish to move the studies into, e.g. “J:Mass Storage”
- g. Under **Limits**, select “All Studies”.
- h. Under **Schedule**, don’t set anything. You will run this storage task manually.
- i. Under **Throttle**, we recommend leaving in the default of 200 milliseconds.

- j. Click the Save button.
- 3. The task will now appear in the Manage Storage Tasks dialog:



- a. Select the task you just created.
- b. Click the **Run** button. You will see the Status of the task change to something like this:

Schedule	Status
SaSu:10:00pm-4:00am	Ready
<unscheduled>	34/1001 studies (2%) [0 errors]

The task is running in the background. This task runs at a lower priority than other study processing tasks in the Image Center, so it won't interfere with studies being sent to the Image Center from your imaging devices. That said, it's usually a good idea to do these large data migration activities after hours. If for some reason your Image Center computer is shut down during this operation, just **Run** the move task again. It will pick up where it left off.

Cleaning Up

Once you've finished moving all of the studies, check to see if all of the studies have been moved out of the old Image Directory by going to the Image Center Console, selecting **Manage Storage** and then **Manage Image Directories**.

A list of your Image Directories will appear:



Make sure that the Image Directory you just moved shows **0** in the number of studies. If it does, it is safe to remove that Image Directory, which you can do by clicking the **Remove** button and following the dialogs that appear.

How To... Move Studies Out of My Image Center Into An Archive?

Let's say you've got a lot of *really* old studies, and you just don't want them in the Image Center anymore – not even in the study list, but you don't want to completely delete them. This how-to is for you.

Assuming you already have an Image Directory set up, follow these steps for setting up your Folder Storage Archive and a Move Studies Storage Task.

1. Create an Archive
 - a. Open the Image Center Console
 - b. Click the **Manage Storage** button



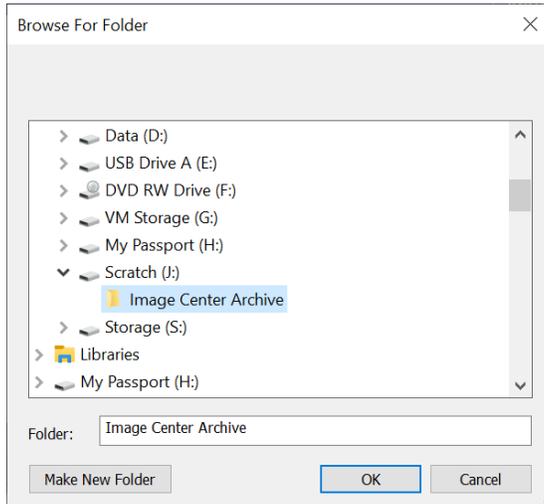
- c. Select the **Manage Storage Archives** button, a dialog will appear.



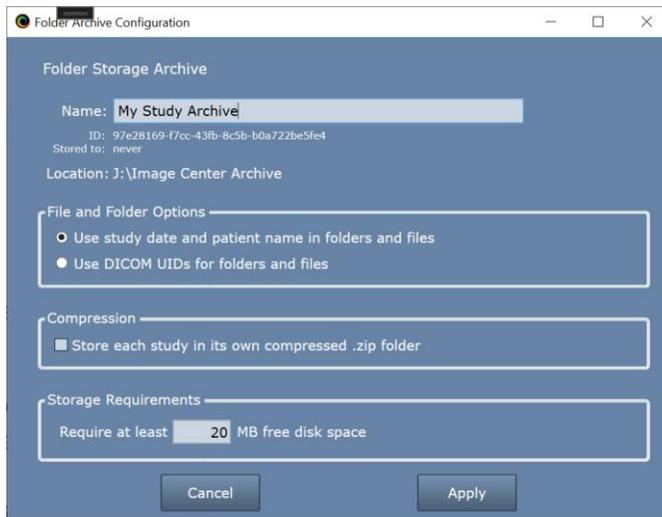
- d. Click the **New...** button and select **Folder Archive**



A folder browser appears:



- e. Select an empty folder (or click **Make New Folder**) on a disk that has plenty of disk space. If you want to use a network share, enter the full UNC path name of the share in the Folder: text box, e.g. “\\25.66.165.65\Image Center Archive” or “\\NAS34\Image Center Archive”. Please be sure to read the section *Setting up Folder Archives on Network Shares* (later in this document) for more details on using network shares.
- f. Click OK, a configuration dialog appears:



- i. In the **Name** field, enter a name for your archive.
- ii. **File and Folder Options:** We generally recommend using the default “Use study date and patient name...” option. This allows you to find studies in the archive just by looking at the folders in the archive. The study containing the folder will be a stand-alone DICOM folder with a DICOMDIR in it.
- iii. **Compression:** If you turn this on, each study will be stored in a zip file, which you will have to uncompress to access.
- iv. Click the **Apply** button. The archive will appear in the list of archives in the Manage Storage Archives dialog.

2. Create a Storage Task

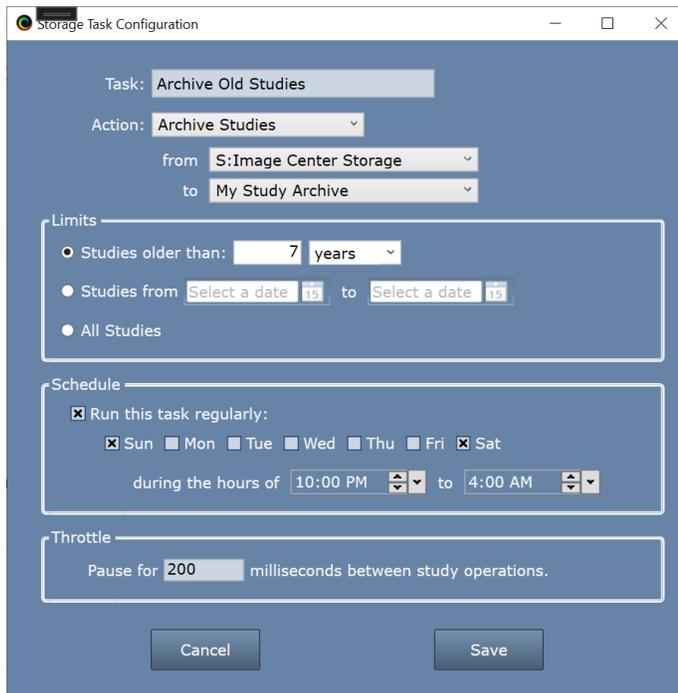
- a. At the Image Center Console, click **Manage Storage** and select **Manage Storage Tasks**



A dialog will appear:

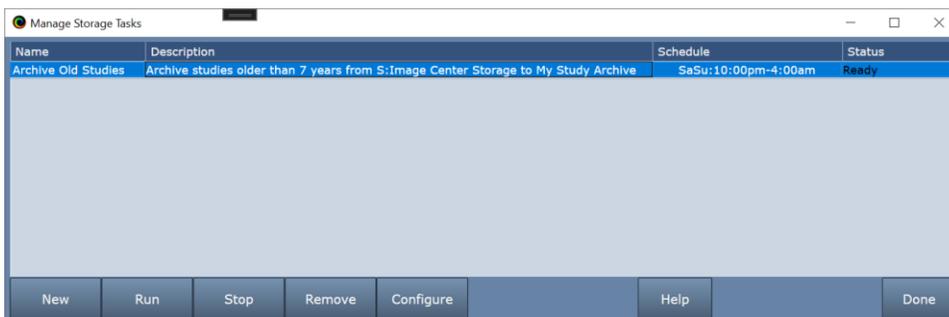


- b. Click the **New** Button. The Storage Task Configuration dialog will appear:



- i. In **Task**, enter name for your task, e.g. “Archive Old Studies”
- ii. Click the **Action** drop-down and select “Archive Studies”.
- iii. In the **from** drop-down, select the Image Directory you wish to archive
- iv. In the **to** drop-down, select the Archive you wish to archive to.
- v. Under **Limits**, select the parameters for what studies to archive, in this example, all studies older than 7 years.
- vi. Under **Schedule**, choose when you want the storage task to run. In this example, the task will run at night on the weekends.
- vii. Under **Throttle**, we recommend leaving in the default of 200 milliseconds.
- viii. Click **Save**. The task will now appear in the **Manage Storage Tasks** dialog.

You have now set up your Image Directory to automatically archive to your archive folder. As long as your Image Center is running during the scheduled hours, it will check to see if there are studies old enough to archive, and if there are, it will archive them into your archive folder.



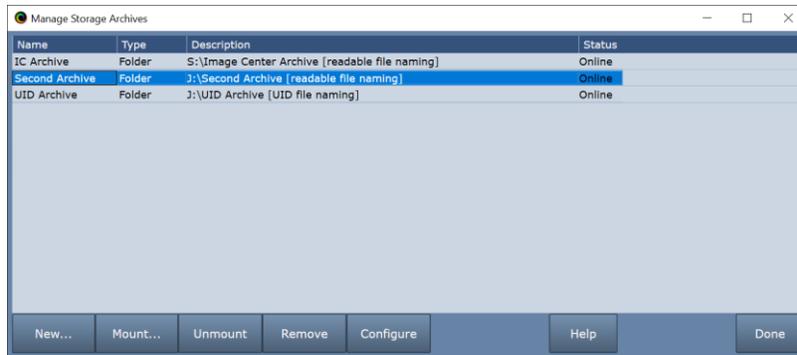
You can also manually run the archive task by selecting the task and clicking the **Run** button.

How To... Move a Folder Archive?

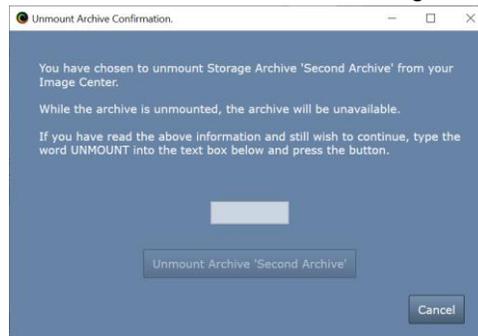
Here is how to move a Folder Archive from its existing location to a new one:

1. Open the Image Center console.

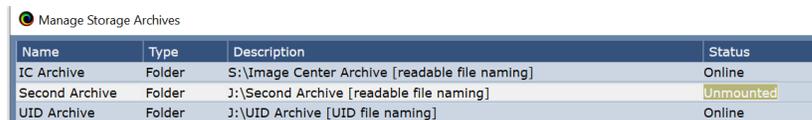
- Click the **Manage Storage** button and select **Manage Storage Archives**.



- Select an archive and click the **Unmount** button. A confirmation dialog will appear:

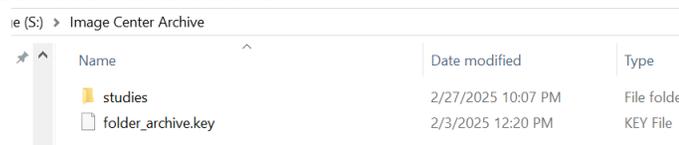


Read the dialog, enter the word UNMOUNT, and click the “Unmount Archive” button. The archive is now in an Unmounted state:



While the archive is in this state, you cannot store or fetch anything into or out of the archive.

- Using Windows File Explorer or any other file system tools, copy/move the entire archive to its new location. An archive’s root folder looks like this:



The root, in this example, is the folder **S:\Image Center Archive**. You want to move that folder, which contains the studies folder and the folder_archive.key file. *Do not just move the studies folder.* You’ve got to have that .key file next to it to keep the system happy.

- Once the archive has been moved, go back to the Manage Storage Archived dialog and click the **Mount...** button and select **Folder Archive**.



The Windows *Browse for Folder* dialog appears. Navigate to the new root folder for the archive. If this is a network share, enter the full UNC path name into the Folder: part of the dialog (see the section on *Setting up Folder Archives on Network Shares* below). Click OK.

The Folder Archive Status should change from *Unmounted* to *Online*.

How To... Delete Old Studies from My Image Directory?

Warning: We do not recommend doing this. We recommend using the “How To... Move Studies Out of My Image Center Into An Archive” instead.

It is best practice to purchase more disk storage. We provide this example because we have had customers request this feature. If you do implement this how-to, make sure you have completely researched the clinical and legal requirements for study retention for your practice and that you are conforming to them. Trillium Technology, Inc. is not responsible for any data loss should you use this feature.

In this example, the Image Directory you want to delete studies from is named “S: Image Center Data Storage”

1. At the Image Center Console, click **Manage Storage**
2. Select **Manage Storage Tasks**. A dialog will appear.
3. Click the **New** Button. The Storage Task Configuration dialog will appear
 - a. In **Task**, enter name for your task, e.g. “Delete Old Studies”
 - b. Click the **Action** drop-down and select “Delete Studies”.
 - c. In the **from** drop-down, select the Image Directory you wish to move studies out of, e.g. “S: Image Center Data Storage”
 - d. Under **Limits**, select “Studies Older Than XXX Years”. Enter in the age of the studies you wish to delete.
 - e. Under **Schedule**, don’t set anything. You will run this storage task manually.
 - f. Under **Throttle**, we recommend leaving in the default of 200 milliseconds.
 - g. Click the Save button.
4. The task will now appear in the Manage Storage Tasks dialog
 - a. Select the task you just created.
 - b. Click the **Run** button.
 - c. You will prompted to confirm that you wish to run this task. Follow the instructions in the prompt.
5. You will see the Status of the task change, indicating its progress. The task is running in the background. This task runs at a lower priority than other study processing tasks in the Image Center, so it shouldn’t interfere with studies being sent to the Image Center from your imaging devices. If for some reason your Image Center computer is shut down during this operation, just **Run** the task again. It will pick up where it left off.

Setting up Folder Archives on Network Shares

Make sure you entered the full UNC pathname to the NAS share when you set up the archive.

The Image Center has one Windows Service that accesses Folder Archives: the **ShowCase Image Center Service**. For the Image Center to use network shares, this service must have full read/write/create permission for the network share. One way to accomplish this is to configure the services to use login credentials that have full access permissions to those shares.

1. Open the Windows Services dialog
2. Right click on the ShowCase Image Center Service and select Properties
3. Click on the Log On tab
4. Select the “This account:” option and enter an account name and password. You may need to Browse to get the exact name for the account you want to use. Make sure this account has full access to the folder share.
5. Stop and Start the ShowCase Image Center Service

These steps may vary, depending on the Windows operating system you are using. This is only one way to approach providing proper access to the network shares for the Image Center's Windows Services. Your IT policies may dictate another.

Appendix A: Storage Costs, an Example

Estimating Storage Needs

The following is a rough estimate based on common study sizes and usage patterns of imaging devices.

1 Ultrasound Machine, 50 weeks of operation, 5 days a week, 10 studies per day, average study size of 150MB:

$$50 \times 5 \times 10 \times 150\text{MB} = 375\text{GB}$$

1 US Machine => 375GB / year

A 7 year archive will require 2.6TB of storage for 1 ultrasound machine. Let's round this up to 3TB for simplicity's sake:

1 US Machine => 7 year archive => 3TB of storage.

A Real World Example of Storage Costs

There are two primary costs associated with storing studies:

1. The cost of local disk (and the IT cost to set up and maintain the hardware)
2. The cost of off-site backup

It is **essential** that you have offsite backup of your data, through something like iDrive or Carbonite. It is your only defense against ransomware, physical catastrophe (theft, fire, etc.), and hardware failure. Hardware failure is the most likely problem you will encounter.

In the following examples, we consider **7 years storage** for a practice with **2 ultrasound machines** being used **250 days a year, 10 studies/day**. That's 375GB/year x 2 US machines x 7 years => **6TB of storage**.

Cost of Local Disk

The cost of local disk can vary widely, from simple local hard drive solutions, to mirrored RAID NAS solutions. Which you pick depends on your budget and how fast you want to recover from hard drive failure or other catastrophe.

Simple Local Hard Drive

This can be as simple as a hard drive installed in the same computer that hosts your Image Center. Always use a high quality drive, like a Western Digital Black drive with a 5 year warranty. Simple 5400 RPM platters are fine – there is no user-noticeable performance improvement using 7200 RPM drives or SSD drives.

WD Black: **\$130** for 6 TB. Assuming you replace that drive after 5 years, that's **\$260** over a 7 year period.

Pros: Low cost, simple deployment.

Cons: In the event of a hardware failure, you need to buy a replacement drive and restore from off-site backup.

Robust Local Storage

Your best bet for robust local storage is to use a *mirrored* RAID 1 NAS, with 2 6TB hard drives, so that if one drive fails the system continues to operate, with little to no impact on your daily practice.

Synology NAS (\$500) + 2 WD Red Pro drives (\$440): **\$940**. Assuming you replace NAS and drives after 5 years, that's **\$1880** over a 7 year period.

(All prices are \$US, as of August, 2024)

Cost of Off-site Backup

We'll just jump right in and assume you're backing up 6TB for 7 years. An iDrive 10TB Personal (1 machine, 1 user) subscription is \$225 for 2 years, total cost over 7 years is **\$900**.

What about storing my data in the Cloud?

The lowest cost cloud storage for 6TB that we've seen quoted for medical data is \$30 per TB per month, so that's $6 \times 30 \times 12 \Rightarrow$ **\$2160** per year, and **\$15,120** over a period of 7 years. True costs can vary widely. Beware of prices that appear too good to be true. There is usually a catch.

If you do investigate cloud storage solutions, make sure they have robust network connection and are certified to store PIH data. It is common for cloud storage of medical data to require a BAA agreement between customer and vendor.

Generally, we do not recommend cloud storage for our customers. The few who have attempted it (despite our warnings) have had issues with reliability, speed, and most importantly, cost.

About these Estimates

These are very rough estimates, and can vary widely depending on the needs of your organization, existing backup strategies and IT overhead for hardware costs. The examples given here are meant to give you an idea of the scope and magnitude of the costs. In summary, simple vs robust local storage can increase your costs by a factor of 10x. Local storage vs. cloud storage can again increase these costs by a factor of 10x.

These estimates were made in the month of August 2024 and should not be used for any kind of budgeting. Proper budgeting should be done by your IT group.

It is worth noting that while prices on local storage continue to drop rapidly, cloud storage pricing has not.

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