

Brief Overview of the new features of Turbostore 7x24 TrueOnline

This section gives an overview of the new features of this product. Although Turbostore has been around for some time, there are several enhancements to it that comprise the 7x24 TrueOnline feature set. This section would give you enough information in a short period of time so that you will be familiar with the new feature set and could at least talk about it intelligently to customers. This section also contains a chart that outlines the new product structure and how it is different from the old one. There is also a features chart that shows which features are available in which Turbostore product.

Detailed documentation of the new Turbostore 7x24 TrueOnline features

This section gives full details on the new feature set for TrueOnline. This is the same material that appears in the new TurboStore manual with the exception that it is hyperlinked to give you instant access to further definitions of keywords and other references that are in the documentation. If you require a complete explanation of the new turbostore features, this is where you want to start.

Further information about the product

This section is a list of other sources of material about this new product. It is put here in case you want to follow up with further research. Part numbers are provided in the case of manuals and document IDs are given if they are known.

List of Turbostore Option with Explanations

This is a detailed listing of the options available with Turbostore. First, a list of each option along with the short description is given. Next, detailed text is given for each of the Turbostore TrueOnline options. The options are hyperlinked so you can directly access their detailed explanations.

Product numbers for the Turbostore products

This is a list of how the old Turbostore product number map into the new Turbostore product numbers. It also contains a matrix which shows what options are available with which product.

TurboStore 7x24 TrueOnline Overview

Turbostore 7x24 TrueOnline is HP's newest backup strategy targeted toward high end customer's or anyone who needs a non interrupting backup solution. You can start to learn about this new product by reading the 5.5 communicator article entitled "STORE and TurboSTORE/iX 7x24 True-Online Backup New Functionality".

After that, you may want to read the Product Support Plan below to get more detail but without taking up to much time. You should be able to answer most of the questions in the "Test your knowledge of TrueOnline" section once you read these two documents. If you still need more information, check out the "Detailed documentation" section on the main turbostore training page.

OFFICIAL PRODUCT NAME : 5.5 TurboStore 7x24 TrueOnline Backup
PRODUCT CODENAME : TurboStore/ix TrueOnline
KEY PRODUCT NUMBERS For 5.5 : B5152AA, B5151AA

General Description

TurboStore/iX 7x24 TrueOnline is a new feature set of TurboStore/iX II which exist for MPE/iX version 5.5 and later. This new feature set allows users to continue working uninterrupted during system and application backups. There will also be a free trial period of 90 days which can be turned on or off by the customer.

General Product Overview

The latest enhancement to Turbostore called 7x24 TrueOnline, will now enable a customer to perform application and system backups without closing files or disrupting users. This will allow Turbostore TrueOnline to compete aggressively with many other backup solutions in the marketplace. This new feature along with all the other features of TurboStore II will be available for a 90 day free trial period. The customer will be able to enable or disable this trial period by using keyword options with the store program. This enhancement to TurboStore will only be available on MPE/iX version 5.5 and later.

It is important to note that all 7x24 TrueOnline backups created with the sync point (discussed below) at the beginning of the backup can be restored on any MPE/iX system. However, backups created with the sync point at the end can ONLY be restored or verified on MPE/iX Release 5.5 or later. If you know at the time you perform the backup that a tape must be restored onto an earlier system, create the tape with the sync point at the beginning.

It should also be noted that if a Store is done using sync at end (discussed below), after image log data is stored at the end of the backup tape. During a RESTORE, files that need to have after image log data applied will be unavailable for READ or WRITE access, until the after image log data is applied. This happens at the END of the restore, so files will be unavailable for access longer than with current restore. If the backup is a sync at begin backup, files will be accessible the same as they are with the current restore.

Finally, the shadow subsystem has now been enhanced to allow up to 15 simultaneous stores of the same fileset. This should eliminate the problems with attempting to store the same files twice (or 15 times for that matter).

Enabling the Demo feature

To enable the 90 day trial period for TurboStore/iX 7x24 TrueOnline, the customer must run the STORE program using the keyword DEMO as:

```
:Run store.pub.sys;info="demo"
```

Once the free trial begins, the customer will have 90 days to test the features of TurboStore/iX 7x24 TrueOnline. All other previous advanced product features will also be available during this trial period. Should the customer decided that they no longer want these advanced features enabled, they can disable them by using the keyword NODEMO as:

```
:Run store.pub.sys;info="NODEMO"
```

The extended features can be switched on and off at will, however, once the 90 day trial begins, the time will NOT be affected by turning the demo off and on. The customer will get 90 days of time, starting from the FIRST time the DEMO is enabled.

The TurboStore TrueOnline product will enable customers to perform both application and system backups without closing files or disrupting users. Unlike the previous online feature, TrueOnline will not require that the users shutdown their applications. The only noticeable effect will be that TurboImage and ALLBASE/SQL databases will have to be quiesced (that is, access to them will have to be stopped) for a short period to guarantee logical database consistency. Quiescing of the Turboimage and SQL databases is done automatically by Turbostore. No user intervention is required.

Sync at Start and Sync at End

TrueOnline now offers the ability to sync the backup either at the beginning of the Store or at the end. To sync means to establish a reference point in time. When the files on the backup are restored, they will look exactly as they did at the moment of the sync point. The current online feature only allows for the sync point to be at the beginning of the store. The format of the options that allow control of this is as follows:

```
;ONLINE[={Start|End}]  
[,start_time]  
[,ASK]
```

By default, the sync point will be at the beginning (ONLINE=START). Backups created with the START parameter will have the sync point at the beginning of the backup. Backups created with the END parameter will have the sync point at the end of the backup. In addition, you can specify a time for the sync point to occur. The time is in 24 hour format. If a time is specified with START, the sync point will occur at the time specified, or once all files are prepared for the backup, which ever event occurs last. If the time is specified with END, the sync point will occur at the time specified or once all files have been stored, which ever event occurs last.

TrueOnline will now guarantee both physical and logical consistency of database backups. This is done by setting the sync point to occur after all open transactions are complete. Database access is stopped long enough for this to occur. Although any type of database can be stored by TurboStore TrueOnline, only TurboImage and ALLBASE/SQL databases will automatically be

quiesced. You may have to manually stop access to some non-HP databases. You can make STORE wait for you to finish these operations by using the ASK parameter with the ONLINE option.

You can also now easily store databases with TrueOnline. By default, TurboStore will not allow you to specify an incomplete Turbolimage or ALLBASE/SQL database to be stored. If this is attempted, a warning will be issued telling you that the dataset(s) will not be stored. To store a database, the user only needs to specify the root file or DBCon file. TurboStore TrueOnline will figure out which files are associated with the database and store them all. This behavior may be overridden by using the PARTIALDB keyword parameter. You will then be able to store only specific datasets rather than the entire database.

For other file types such as KSAM/XL files, TrueOnline will guarantee that no partial transactions are included in the copy of the file stored on the tape. For native mode message files, TrueOnline will follow the necessary steps to successfully imitate closing the file to ensure data integrity, physical consistency, and recoverability.

Compatibility mode (CM) files, namely Circular (CIR) files, and Relative IO (RIO) files, have internal buffer structures that cannot be logged by TurboStore. If these files are open for write access during the sync point, TurboStore will capture their last known state.

User mapped files are still managed the same way as before. If a user-mapped file is left open for write access across the sync point, then TrueOnline will capture the last known state of the file, which would either be at the last FOPEN, FCLOSE, or FCONTROL 6. If TrueOnline does not capture any of these events, the file will be stored in whatever state it was in when TrueOnline opened the file, which may be inconsistent.

TrueOnline now has the ability to put a copy of a backup's STORE label and STORE directory into a disk file. This directory information allows RESTORE to more quickly determine where files are located on the backup, and to prompt users to mount the necessary media. The disc file is created by STORE and named using the following convention:

```
store_YYYYMMDD_hhmmssstt_pin##_day
```

The file is located in the HFS directory SYS/HPSTORE/store_dirs/. It is important to note that the HPSTORE group and store_dirs directory do NOT exist on the system by default. The user MUST create them, and set up the appropriate security before using the STOREDIR option. STORE will NOT print a warning if it cannot create the file because the path does not exist.

Another new feature of TrueOnline is the ability to specify where the shadow log files that log changes to files that are being backed up reside. The LOGVOLSET option allows you to specify which volume set to use for the log files. This option can be used either with the current ONLINE feature, or the newer 7x24 TrueOnline feature.

You now have the ability to have the output device for a Store be a disc file. This gives the user the ability to store the data to disk for those unique situations where this is desired. Since the disk backup file created is a flat, binary disk file, it can be moved to different systems and then RESTORE can be used to extract the archived files.

File equations are used to tell TurboStore TrueOnline to store to a disc file as:

FILE BACKUP1;DEV=DISC

When specifying the file equation, ;DEV=DISC MUST be specified in order to STORE to a disk file. The target of the file equation can point to any MPE or HFS filename. Any other information specified in the file equation will be ignored by TurboStore TrueOnline.

It is STRONGLY recommended that you do NOT build the target disk file before invoking STORE. TurboStore will create the target disk file as a binary file, with a default record size of 256 bytes. The file will also be created with the file code of 2501, which is a file system mnemonic for STORE.

Finally, TrueOnline has now added an additional feature called STATISTICS. This enables customers to get extra data about the backup that was previously not available. This extra information includes:

Amount of data written to each piece of media for each parallel set

Amount of time required to write each piece of media

Throughput for each piece of media

Number of retries incurred for each piece of media.

If an online or 7x24 online backup is performed, then information on the amount of log data written is displayed.

New Product Number Structure

Current Product Structure

New Product Structure

HP30319A -----> Now, part of FOS
HP36387A -----> TurboStore/iX II B5152AA
HP36397A -----/
HP36388A -----> TurboStore/iX II B5151AA
HP36398A -----/
7x24 TrueOnline -----/

TurboSTORE Feature Comparison:

Feature	STORE/iX FOS	TSTORE/iX II B5151AA	True Online Backup B5152AA
Multiple Store devices (STORESET)	Y	Y	Y
File Interleaving (INTER)	Y	Y	Y
Data compression (COMPRESS)	N	Y	Y
Online Backup (ONLINE)	N	N	Y
Parallel Restore (RESTORESET)	N	Y	Y
Optical Devices (MOSET)	N	Y	Y
Labeled tapes (support)	Y	Y	Y

TurboSTORE/iX 7x24 True-Online Backup

This chapter describes how to use TurboSTORE/iX 7x24 True-Online Backup. It includes a description of all the options provided for performing 7x24 true-online backups, as well as discussions about TurboSTORE's interactions with the system during these backups.

The sections in this chapter include:

Using TurboSTORE/iX 7x24 True-Online Backup
Consistent Backups
How Shadow Logging Works
Logging File Attribute Modifications
TurboSTORE/iX 7x24 True-Online Backup Options
Restoring TurboSTORE/iX 7x24 True-Online Backups

Using TurboSTORE/iX 7x24 True-Online Backup

When using TurboSTORE/iX 7x24 True-Online Backup, you can perform file, application, and system backups without closing files or disrupting users. Some guidelines for performing these backups are discussed below.

TurboSTORE 7x24 True-Online Backup can perform two types of online backups:

The first type is referred to as an online backup, which requires that all files being stored be closed for write access when the backup first starts. This is the type of online backup formally available with the TurboSTORE/iX II with Online Backup product. The online backup refers to a backup created with only the ONLINE option of TurboSTORE/iX 7x24 True-Online Backup.

The second type is referred to as a 7x24 true-online backup, which lets you backup applications without requiring any files to be closed for write access at any time during the backup. The 7x24 true-online backup refers to a backup created with the ONLINE=START or the ONLINE=END option of TurboSTORE/iX 7x24 True-Online Backup.

The Sync Point

When performing a backup, you want to know at what point in time the backup occurred. This is helpful when performing a recovery so you know that all files were restored to a state at the same time. This is the point called the sync point, where all files are synchronized. It can occur at different times, depending on the type of backup performed.

You can schedule when the sync point occurs (either at the start or the end) by scheduling when the backup job is launched. Be aware, however, that a certain set up time is required for TurboSTORE to create the list of files to be stored. Depending on the number of files being stored, the sync point may happen soon after the backup is launched, or may occur 5-15 minutes later. To better control when the sync point occurs, a fixed time can be specified on the STORE command line. See "Creating a 7x24 True-Online Backup (ONLINE)" later on for more details.

The NOTIFY option can also be used to launch a job stream once the sync point has occurred.

WARNING: All 7x24 true-online backups created with the sync point at the beginning can be restored on any MPE/iX system. However, backups created with the sync point at the end can only be restored or verified on MPE/iX Release 5.5 or later. If you know at the time you perform the backup that a tape must be restored onto an earlier system, create the tape with the sync point at the beginning.

Sync Point at the Beginning of Backup

The sync point is always at the beginning of an online backup when only the ONLINE option is used. A 7x24 true-online backup can also have the sync point at the beginning by using the ONLINE=START option.

The main difference between these two types of backups is that an online backup (ONLINE) requires all files to be closed at the sync point, while a 7x24 true-online backup (ONLINE=START) allows users to access and modify their files, uninterrupted, throughout the sync point and backup.

Why Use the Sync Point at the Beginning of a Backup?

Using the sync point at the beginning of a backup has the following advantages over using it at the end:

1. Synchronizing at the start of a backup gives you better control of when the sync will occur.
2. It spreads the log data throughout the tape and therefore one is less vulnerable to media errors.
3. It allows for faster recovery of partial restores, since sync at end requires RESTORE to read the log files from the end of the last piece of media.
4. It allows for migration of files to earlier releases of TurboSTORE/iX, whereas sync at end does not.

For example, scheduling the sync point at the beginning of the backup is useful when your system is heavily used during the day, making performing backups then impractical. The backup can be started at the end of the busy day shift, and run during the night. Since no application shutdown is required, users, perhaps from other time zones, can continue to access their files and applications uninterrupted.

Sync Point at the End of Backup

TurboSTORE/iX 7x24 True-Online Backup can also schedule the sync point at the end of the backup using the ONLINE=END option. Using the options described in "Creating a 7x24 True-Online Backup (ONLINE)", you can schedule the sync point to occur at a fixed time, or at the end of the backup. However, if you specify the sync point to occur at a certain time, it does not occur until all files have been stored.

Why Use the Sync Point at the End of a Backup?

Using the sync point at the end of a backup has the following advantages over using it at the beginning:

1. Synchronizing at the end of the backup creates a logically consistent copy of your data at the time of the end of the backup.
2. It gives you the most recent copy of your data.

3. The backup media can be off the system and stored in a data safe before running a "risky" application. If the "risky" application fails, you can recover your data at the point just prior to starting the application.

4. All file changes occurring during the backup are logged and stored at the end of the backup media.

For example, scheduling the sync point at the end of the backup can be useful if you start your backup in the middle of the day (at lunch time, for example). The backup can then run throughout the afternoon shift, and be finished before your disk-intensive batch jobs are run at night.

Synchronizing at the end would then allow you to save the state of your system at the end of the working day.

If your batch jobs do not run successfully, you can restore from that backup without losing a day's work. If this is important to business operations, you may want to consider backup with the sync point at the end.

Consistent Backups

Even though database files generally constitute the largest part of any backup, TurboSTORE/iX 7x24 True-Online Backup also backs up system and non-database files. Since TurboSTORE allows changes to files during a backup, it establishes a close tie to the file system to ensure physical and logical consistency.

Physical Consistency

Physical consistency is ensured by providing a snapshot of the fileset at a specific point in time, specifically, at the sync point. This is adequate for files that are not "related" to other files, and have no dependencies on changes to other files. This includes system files, some flat files and any other files not associated with a database.

For KSAM XL files and files enabled for transaction management, TurboSTORE will guarantee that no partial transactions are included in the copy of the file stored on the tape. This ensures that a consistent copy of the file is stored.

If Native Mode Message files are open during the sync point, TurboSTORE will follow the necessary steps to successfully imitate closing the file to ensure data integrity, physical consistency, and recoverability.

User-mapped files are managed the same way they were with as TurboSTORE/iX II with Online Backup. Whenever changes are made to a user-mapped file being stored by a 7x24 true-online backup, the entire file is copied to TurboSTORE's log files. However, if a user-mapped file is left open for write access across the sync point, then TurboSTORE will capture the last known state of the file, which would either be at the last FOPEN, FCLOSE, or FCONTROL 6. If TurboSTORE does not capture any of these events, the file will be stored in whatever state it was in when TurboSTORE opened the file, which may be inconsistent. A warning message is printed for all user-mapped files open across the sync point.

NOTE: Compatibility mode (CM) files, namely Circular (CIR) files, Relative I/O (RIO) files, have internal buffer structures that cannot be logged by TurboSTORE. If these files are open for write access during the sync point, TurboSTORE will capture their last known state, which is either since the last FCLOSE or the last FCONTROL 6. A warning will be issued for all CM files that were open across the sync point.

Logical Consistency

In addition to physical consistency, TurboSTORE/iX 7x24 True-Online Backup also guarantees logical consistency for databases. This is done by setting the sync point to occur when all open transactions against the databases have completed. No new transactions can start until the open transactions are complete, which is called quiescing the database.

Although any type of database can be stored by TurboSTORE, only TurboIMAGE and ALLBASE/SQL databases will be automatically quiesced using special database intrinsics.

You can make TurboSTORE wait at the sync point while you quiesce other types of databases by hand. This is done by specifying the ASK parameter with the ONLINE option, as described later in "Quiescing Files and Databases (ASK)."

Once all databases are quiesced, TurboSTORE establishes the logically consistent synchronization point. It then unquiesces all TurboIMAGE and ALLBASE/SQL databases.

NOTE: Only databases being stored by a TurboSTORE/iX 7x24 True-Online Backup are quiesced. If a database is being stored, but is not enabled for write access, it is not quiesced.

How Shadow Logging Works

TurboSTORE/iX 7x24 True-Online Backup uses shadow logging to intercept any changes made to files while they are being stored.

When the Sync Point is at the Beginning

When the sync point occurs at the beginning of the backup, shadow logging guarantees that TurboSTORE will capture the state of the fileset as it is right before the files begin to be written out. When a file is opened for write access, any changes made to the file are monitored by shadow logging. When a modification occurs, the part of the file being changed is copied. This "before image" is added to internal shadow log files. Once the data has been copied, the modification can proceed. The before image logs for all files are maintained until the information is requested by TurboSTORE. TurboSTORE requests a file's log data once it has finished storing the file. The log data is written immediately following the file data. The before image log data is maintained until the media that the file resides on has been completed. At reel switch time, or at the end of the backup (whichever comes first), the before image log data for all files on that media is released.

By default, the before image log files are created on the same volume set as the files being stored. You can create the log files on a specific volume set by specifying the volume set name using the LOGVOLSET option, as explained in "Performing Online Backup" in the "List of TurboStore Options" section of this training.

RESTORE restores a file by first reading the file data that had been written to the media. The log data is then read in and replaces any sections of the file that were already restored. Once a file's before image logs are applied, the file is restored to its state at the time of the sync point.

When the Sync Point is at the End

When the sync point occurs at the end of the backup, shadow logging captures the state of the files as they are at the end of the backup. In this case, instead of copying the before images of modifications to log files, shadow logging uses a bitmap to keep track of the modified pages. Once the backup is completed, the bitmap is used to collect the modified "after image" pages from the system. This data is then written out to the end of the media. For parallel backups, after image log data is written at the end of each parallel set. For more information on parallel backups, see Chapter 3, "Preparing Storage Devices".

During the backup, logging is turned on for a file when TurboSTORE begins to write it out. The logging stays on for a file until the sync point occurs at the end of the backup.

When a file with after image log data is restored, the initial file data is read in first. Once the after image log data is read in, it is applied to the file data, reapplying all changes made to the files during the backup. This restores all files to their state at the end of the backup.

However, since the log data is at the end of the backup, files with after image (AI) data are not available until the end of the backup is reached, and the after image log data is applied.

Logging File Attribute Modifications

In addition to keeping track of changes to a file's data during a 7x24 true-online backup, changes to a file's attributes, such as filename, file limit, and file code, are also captured to ensure a consistent backup.

File Creations and Purges

When the sync point is at the end of the backup, file creations and file purges that occur during the backup are captured by shadow logging. TurboSTORE/iX 7x24 True-Online Backup also handles equivalent POSIX commands for purging files, such as UNLINK(), FUNLINK(), and other MPE/iX commands that purge files, like PURGEACCT and PURGEGROUP.

Other File Attributes

If RENAMEing a file causes it to qualify for a 7x24 true-online backup, the file will be included in the backup. Conversely, if a file is renamed to not qualify for a 7x24 true-online backup's fileset list, it will be removed from the backup. These actions will only happen if the sync point is at the end of the backup.

TurboSTORE/iX 7x24 True-Online Backup Options

This section discusses the new options available for creating TurboSTORE/iX 7x24 True-Online Backups.

Creating a TurboSTORE/iX 7x24 True-Online Backup (ONLINE)

A TurboSTORE/iX 7x24 True-Online Backup is performed only when either the START or END parameter is included with the ONLINE option.

If no parameters are specified for ONLINE, the sync point automatically occurs at the beginning of the backup, and an online backup is performed where all files must be closed for write access at that time.

Up to 15 TurboSTORE/iX 7x24 True-Online Backups can be running at once. Also, a file can be stored by up to 15 7x24 true-online backups.

Initiating a TurboSTORE/iX 7x24 True-Online Backup (START and END)

The initiation of a 7x24 true-online backup with a logically consistent sync point is controlled by the START or END parameter with the ONLINE option. Backups created with the START parameter have the sync point at the beginning of the backup. Backups created with the END parameter have the sync point at the end of the backup.

In addition to the START or END parameter, you can specify a time for the sync point to occur. The time is specified in 24-hour format (hh:mm[:ss]). If a time is specified with END, the sync point occurs at the time specified or once all files have been stored, whichever event occurs last. If a time is specified with START, the sync point occurs at the time specified, or once all files are prepared for the backup, whichever event occurs last.

For example, you can initiate a backup with the following command:

```
:STORE /;*tape;ONLINE=END,17:30
```

If the backup completed at 17:00, TurboSTORE would continue to log changes until 17:30. It would then synchronize the databases and write the log data to the backup media. If, on the other hand, the backup did not complete until 18:00, TurboSTORE would delay the sync point until 18:00.

Quiescing Files and Databases (ASK)

If you need to synchronize any other file types (e.g., CM file types such as CIR files and RIO files) and/or any third-party databases that are not automatically synchronized, you can use the ASK option. ASK makes STORE wait for you to finish these operations. If the following backup is initiated:

```
:STORE /;*tape;ONLINE=END,17:30,ASK
```

TurboSTORE asks:

```
17:30/#S21/59/ARE ALL FILES AND DATABASES QUIESCED FOR ONLINE BACKUP (Y/N)?
```

When all of your applications are quiesced, you should reply:

:REPLY 59,Y

If you reply with the following:

:REPLY 59,N

TurboSTORE asks:

17:34/#S21/59/DO YOU WANT TO ABORT THE BACKUP(YES/NO)?

A reply of YES aborts STORE and the backup will be incomplete and invalid. A reply of NO causes TurboSTORE to ask the original question:

17:34/#S21/59/ARE ALL FILES AND DATABASES QUIESCED FOR ONLINE BACKUP (Y/N)?

When TurboSTORE receives a reply of YES to this question, it quiesces all TurboIMAGE and ALLBASE/SQL databases, turns on before image logging, unquiesces the databases, tells you to unquiesce all your applications, and completes the backup. You are notified on the console:

17:35/#S21/59/ALL OF YOUR APPLICATIONS CAN BE UNQUIESCED NOW.

You can then perform any actions needed to unquiesce your applications.

Storing Part of a Database (PARTIALDB)

By default, TurboSTORE will not allow you to specify an incomplete TurboIMAGE or ALLBASE/SQL database to be stored. If you want to override this behavior, specify the PARTIALDB option. Any databases that are partially stored will NOT be quiesced at the sync point.

NOTE: Database corruption may result if not all database files are stored during a backup. Be sure that you only want to store certain database files before overriding the default behavior with PARTIALDB.

Creating a Disk Directory File (STOREDIRECTORY and NOSTOREDIRECTORY)

When creating a 7x24 true-online backup with the sync point at the end of the backup, the STOREDIRECTORY option will be enabled by default. To override this behavior, specify the NOSTOREDIRECTORY option. It is strongly recommended that you use the STOREDIRECTORY option when creating true-online backups with the sync point at the end of the backup. Doing so will greatly increase recovery time when the backup needs to be restored.

Restoring TurboSTORE/iX 7x24 True-Online Backups

When restoring a backup that was created with the sync point at the beginning of the backup, RESTORE performs the following tasks for each file restored:

1. Restores the initial file data.
2. Applies any before image log data that exists on the backup.

When a 7x24 true-online backup with the sync point at the end of the backup is restored, RESTORE performs the following tasks:

1. Restores the initially stored files.
2. Restores all new files that were added to the fileset during the backup due to renames or builds.
3. Applies any changes made to files after they were written to the media (the after image logs).
4. Does not restore all files that were deleted from the fileset during the backup.

If RESTORE is unable to read the media directory information from a media directory disk file, it will ask the user to mount the last piece of media from the backup. Once it has read the media directory, it will prompt the user to mount the necessary piece(s) of media for the recovery process.

NOTE: Since the after image log data is stored at the end of the backup, files that need to have after image log data applied will be unavailable for read OR write access, until the after image log data is applied at the end of the backup. Once RESTORE reads and applies the after image log data for a file, the file can be accessed again.

Restoring with a Disk Directory File (STOREDIRECTORY)

When restoring files, RESTORE first reads in the Store labels from the devices specified either in the restorefile parameter, or in the RESTORESET option. It then opens the appropriate media directory disk file, if one exists. This allows RESTORE to more efficiently restore files. The greatest advantage occurs when selectively restoring files from many tapes, or if the backup was created with the sync point at the end.

Selective restores can be optimized further by specifying the disk directory file name with the STOREDIR[ECTORY] option. If you specified a name for the backup at Store time with the STOREDIRECTORY option, that name can also be specified here. Alternately, you can specify the full HFS directory disk file created by STORE.

Using the STOREDIR option causes RESTORE to read the directory on disk and prompts you to mount the correct media for the restore, shown as follows:

```
17:30/#S20/40/MOUNT MEDIA 2 OF SET 1 FOR RESTORE ON LDEV 7
```

For example, to restore the backup created on June 22, 1994 at 1:30pm by Pin 30, issue the following command:

```
:RESTORE *tape;JONNYS.BIG.FILE;&
```

```
:STOREDIR=/SYS/HPSTORE/store_dirs/store_19940622_1330_pin30_wed
```

To restore the full backup from Friday named FRIFULL, issue the command:

```
:RESTORE *tape;/:STOREDIRECTORY=FRIFULL.HPSTORE.SYS
```

Further Turbostore Reference Material found at docs.hp.com:

STORE and TurboSTORE/iX Products Manual: HP 3000 MPE/iX Computer Systems

<http://docs.hp.com/en/B5151-90003/index.html>

MPE/iX 5.5 Technical Communicator Article:

STORE and TurboSTORE/iX 7x24 True-Online Backup New Functionality

<http://docs.hp.com/mpeix/onlinedocs/communicator/ix55/ct5152aa.html>