

# PoINT Jukebox Manager V4.0

## Volume Sets

### White Paper

#### 1 General Functionality

PoINT Jukebox Manager version 4.0 provides two ways to represent physical media in the jukebox file system. These two ways can also be used in combination.

##### 1.1 Default Representation

Per default each individual medium (or medium side in case of double sided media) inside the jukebox is represented as one subdirectory. The following figure gives an example of the relation between file system representation and physical medium:

<u>file system representation</u>	<u>related medium inside the jukebox</u>
Z:\disc1	medium 1
\disc2	medium 2
\disc3	medium 3
\disc4	medium 4
...	

In the example "Z" represents the drive letter of the jukebox file system. Under this drive letter each individual imported medium is represented as a subdirectory; e.g. access to data stored on medium 2 is by using the path name "Z:\disc2".

##### 1.2 Volume Sets

In addition to the default representation version 4.0 of PoINT Jukebox Manager introduces the concept of Volume Sets.

This functionality allows the administrator to group multiple media to one logical medium, which is called a "Volume Set". By this new concept the direct relation between file system representation and an individual physical medium does no longer exist. Files and directories are written to the Volume Set as a logical medium, which is represented as a single subdirectory of the jukebox file system.

The following figure gives an example of the relation between file system representation and physical media if the concept of Volume Sets is applied:

<u>file system representation</u>	<u>related medium inside the jukebox</u>
Z:\volume_set_1	medium 1, medium 2, medium 5
\volume_set_2	medium 3, medium 6
\volume_set_3	medium 4
\volume_set_4	medium 7, medium 8
...	

If a user or an application writes data using the path name „Z:\volume\_set\_1“ the jukebox management software decides how the data is stored on the different media of the Volume Set (i.e. medium 1, 2, and 5). This process is completely transparent to the user, which means that he does not see any relation to a specific physical medium nor that he has to deal with media boundaries.

## 2 Implementation Features

Main features of the Volume Set implementation of PoINT Jukebox Manager are as follows.

- A Volume Set may consist of one or more media. The maximum number of media in a Volume Set is limited only by the number of the available jukebox slots.
- Multiple Volume Sets built of different or same media types, can be created in one system. They may be located in one or in more than one jukeboxes.
- Media belonging to a Volume Set can be located in different jukeboxes.
- All writable media types supported by PoINT Jukebox Manager (CD-R, DVD-R, DVD-RAM, DVD-RAM WO, WORM and MO) can be combined to Volume Sets if the following requirements are fulfilled:

All media of a single Volume Set must have the same type and in case of MO, MO/WORM also have the same sector size.

Write-once media must be empty before they can be added to a Volume Set.

Rewritable media may contain data, however, they are formatted before they can be added to a Volume Set. Please note, that in this case all data residing on a rewritable medium is destroyed.

- A Volume Set can still be accessed if one or more media of that Volume Set are off-line, i.e. exported from jukebox. Operations requiring online availability of one of these media will fail and result in a log entry with the number/name of the required medium.
- Media can be exported from the jukebox while the Volume Set is on-line if there are no references open to either side of the disc.
- Files may span multiple media. As a consequence files can be larger than a single medium.
- Directories may span multiple media. This means if a medium containing a specific directory is full and subsequently more files are added to this directory the directory is continued on another medium and the new file is written to that medium.

## 3 File and Directory Spanning

Files and directories may span multiple media. Therefore the file size is not limited by the size of a single media. Instead, a file is automatically extended to another medium, if the medium containing this file is full. Also, if a medium containing a specific directory is full and more files are added to this directory, it is continued on another medium and new files are written to this medium.

Optionally file spanning can be disabled. In this case the behavior varies depending on the write cache settings:

- If intermediate caching on hard disk is disabled ("Write through" or "No caching on hard disk"), new files are created on a medium with sufficient free space. If there is no sufficient space available an appropriate error code is returned.
- If intermediate caching on hard disk is enabled new files are first written to hard disk. At this time PoINT Jukebox Manager ensures only that new files will fit on one of the media. If this is not the case an error code is returned. Since these files will be moved to the optical media at a later time it may happen that there is no sufficient contiguous free space available to migrate one of these files without spanning it over multiple media. In this situation PoINT Jukebox Manager stops flushing the cache and generates an administrative alert. The administrator may either add new media to the Volume Set or enable file spanning.

#### **4 Finalization for CD-R and DVD-R Media**

Because incrementally written CD-R or DVD-R media cannot be read in CD/DVD-ROM drives unless they have been finalized, PoINT Jukebox Manager automatically finalizes CD/DVD-R media as soon as they are full. This function can be disabled.

It is also possible to manually trigger the finalization of CD-R and DVD-R media as long as there are no files open.

#### **5 Multiple Drive Usage**

If there are multiple read requests for different media in a Volume Set all available drives are used. If necessary media swaps are scheduled as for 'single volume' media.

In case of multiple parallel write requests for a single Volume Set these write requests are dispatched to different media if a sufficient number of free drives is available. This 'write optimization' can optionally be disabled. This optimization technique for parallel write requests is not used if intermediate caching on hard disk is enabled.

#### **6 File System Format and Operations**

Each medium of a Volume Set contains a standard UDF file system readable by any operating system supporting this format.

Please note the following restrictions for access to Volume Set media outside PoINT Jukebox Manager:

- In case of a write-once medium it is not possible to determine whether the data on that medium represents the most recent data for this file.
- It is not possible to determine what part (offset, length) of the file is visible if the file has been split by the file spanning mechanism.

Volume Sets, containing re-writable media can be accessed like a single re-writable volume, with the following limitation:

- File move operations within a Volume Set are not allowed.

Access to write-once Volume Sets is limited to write-once functionality, i.e. files on a write-once Volume Set cannot be logically modified nor logically deleted.

## **7 Adding media to an existing Volume Set**

Volume Sets can be dynamically expanded if necessary. PoINT Jukebox Manager supports adding new media to a Volume Set while it is on-line. The media will automatically be formatted after adding them to the Volume Set.

## **8 Removing Media from a Volume Set**

PoINT Jukebox Manager supports temporary removal of a medium from the jukebox while the Volume Set is on-line. Files on that medium are not be accessible as long as the medium is off-line, however, the directory structure remains fully visible. If a user accesses a file on a medium which is currently off-line he gets an appropriate error message and a log file entry is generated.

To make a temporarily removed medium available again it must be imported, rescanned and activated.

A medium can also be permanently removed from a Volume Set. This may be necessary if it is defect. In this case the Volume Set must be taken off-line. The directory structure of the removed medium is removed from the Volume Set and all files and directories are no longer accessible.

Once a medium has been permanently removed from a Volume Set, it is not possible to add it again to a Volume Set unless it has been re-formatted before.

## **9 Volume Set Recovery**

Volume Sets can be recovered automatically in case of a system crash or if it is necessary to import it in a different computer. In this case all media belonging to a Volume Set have to be imported and rescanned to re-build the directory structure.

If only a subset of all media belonging to a Volume Set are imported only the directories and files on these media are visible and the complete Volume Set is marked **read only**.