IBM Tape Manager for z/VM and TS7700:
Managing Scratch Volumes to Free Cache

NOTE: There was a TS7700 problem that causes Backup and Restore Manager to fail when writing to new tapes when tapes are managed in this way. If you are using Backup and Restore Manager, please apply the firmware fix for PMH 23899,122,000 before implementing these changes on your system. This fix is included in firmware level 8.42.2.12 and later.

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Special Notices

This document reflects the author's understanding of IBM Tape Manager for z/VM and IBM DFSMSRMS for z/VM program products as they relate to TS7700 virtual tape environment. This document is presented "As-Is" and IBM does not assume responsibility for the statements expressed herein. It reflects the opinions of the author, based on her experiences. If you have questions about the contents of this document, please contact the author at tld1@us.ibm.com.

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- Ralph Beeston
- Richard Lewis
- Benjamin Smith

Introduction

This document describes configuration and testing that were done with IBM Tape Manager for z/VM V1.3 on a z/VM V7.1 system running DFSMSRMS for z/VM. The system was connected to a TS7700 Virtual Tape Server (VTS.)

The question we are trying to address is how scratch processing is handled in the tape library (hereafter referred to as the VTS.) Specifically, since Tape Manager handles all mount requests as volume specific, when tapes are expired and scratched in Tape Manager, how can the space used in the VTS cache be freed?

Several screenshots of the VTS GUI are included in this document. These screenshots are based on the author's system. You may have an earlier or later version of the software and thus your GUI may look different. However, the functionality should be the same.

The applicability of this white paper to your environment depends on your pattern of tape usage on z/VM:

1. Many customers only use tape for backups. In this situation, the number of tapes in use at any point in time is fairly predictable – once you have the maximum number of retained backups completed. For example, if each backup requires 2 tapes, you perform a backup every day, and the retention period for your backups in 30 days, at any point in time you'll have approximately 60 tapes in use (perhaps a few more or a few less depending on the order of your expiration processing and daily backup job creation.)

   For customers that have this type of **consistent tape usage patterns**, there may be no reason to be concerned about freeing the cache in the VTS. In IBM Tape Manager for z/VM, for example, you can use the SCRSEL LASTVOL configuration option to indicate that when a scratch mount is requested, Tape Manager will chooses the last volume in the chain of eligible scratch volumes. This means the same set of tapes will be used over and over and expired data will not stay in the VTS cache for very long.

2. For customers that have **inconsistent tape usage patterns**, expired data may reside in the VTS cache for several days (or longer) before the tape is reused as a scratch tape. In this case, freeing the cache space may be a concern.

This white paper is designed to address customers in case #2 above (inconsistent tape usage patterns.)

Setup

The following are required:

- Virtual tape devices are varied online to all z/VM LPARs that will use them. At least one device is always available. If sharing with z/OS, the devices must be varied offline from z/OS when not actively being used. Contact the author if you have questions about sharing devices with z/OS.
- You have PTF UI54509 for IBM Tape Manager for z/VM V1.3 installed.
- You have access to the TS7700 GUI to see virtual volumes, fast ready categories, etc.

Removing expired z/VM tape data from (disk) cache in the VTS

Following are the full set of steps we performed to demonstrate how to automatically remove expired z/VM tape data from the cache (i.e. disk) in the TS7700 VTS:

1. You must use a unique category code for your z/VM tapes. I.e. it cannot be the same as any category codes used by z/OS.

   To determine the tape category codes used by your z/OS systems (hosts) that are connected to the VTS, issue the command `DS QLIB,CATS` on z/OS. This will display the category codes that are defined in the `DEVSUPxx PARMLIB` member.

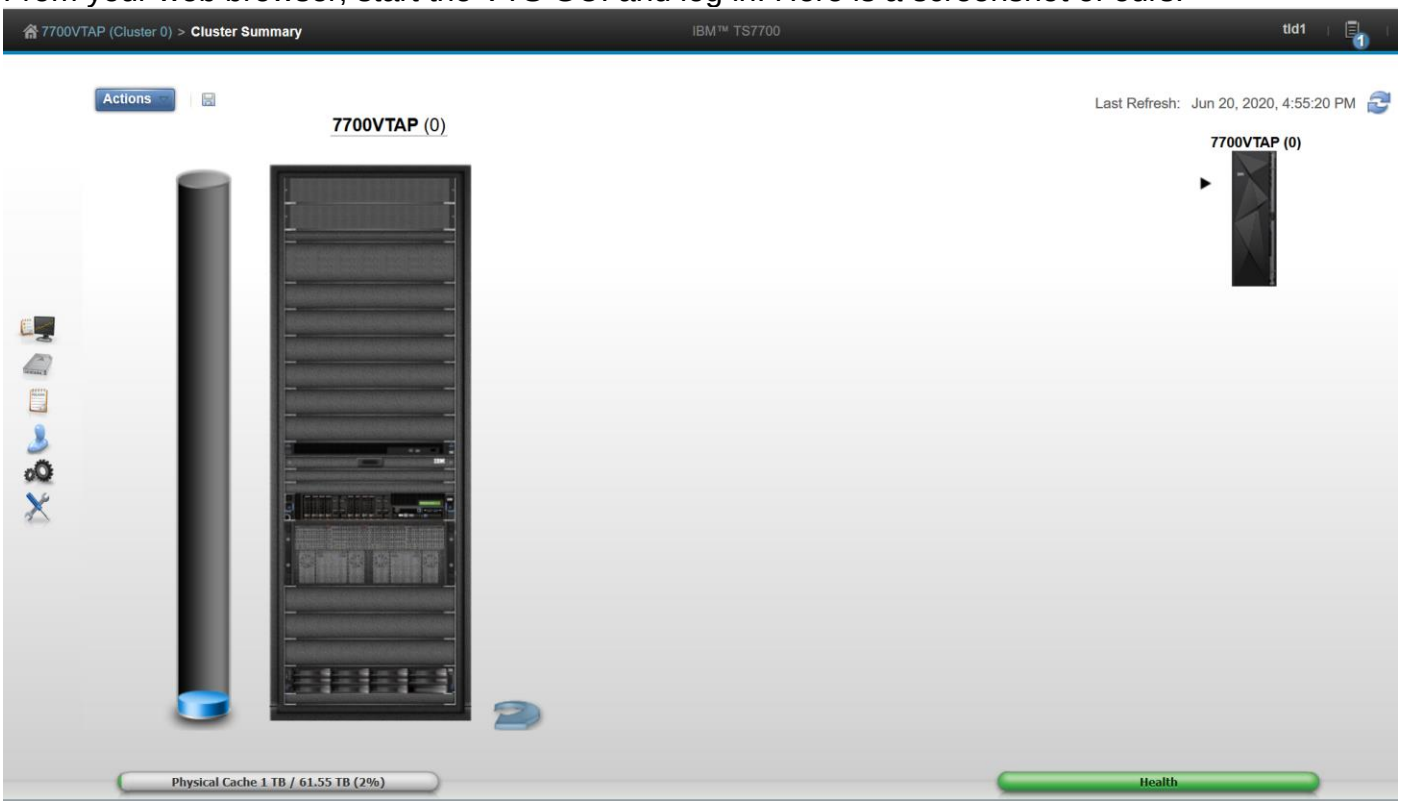
   On our system category codes **0001-000F** are already in use by **z/OS**.

   DFSMSrms on z/VM (hereafter referred to as RMS) supports any hex value between 0000 and FFFF for a category code. Consider using something in the range x'0080' through x'0089', since RMS will translate SCRATCH0 through SCRATCH9 to these hex codes.

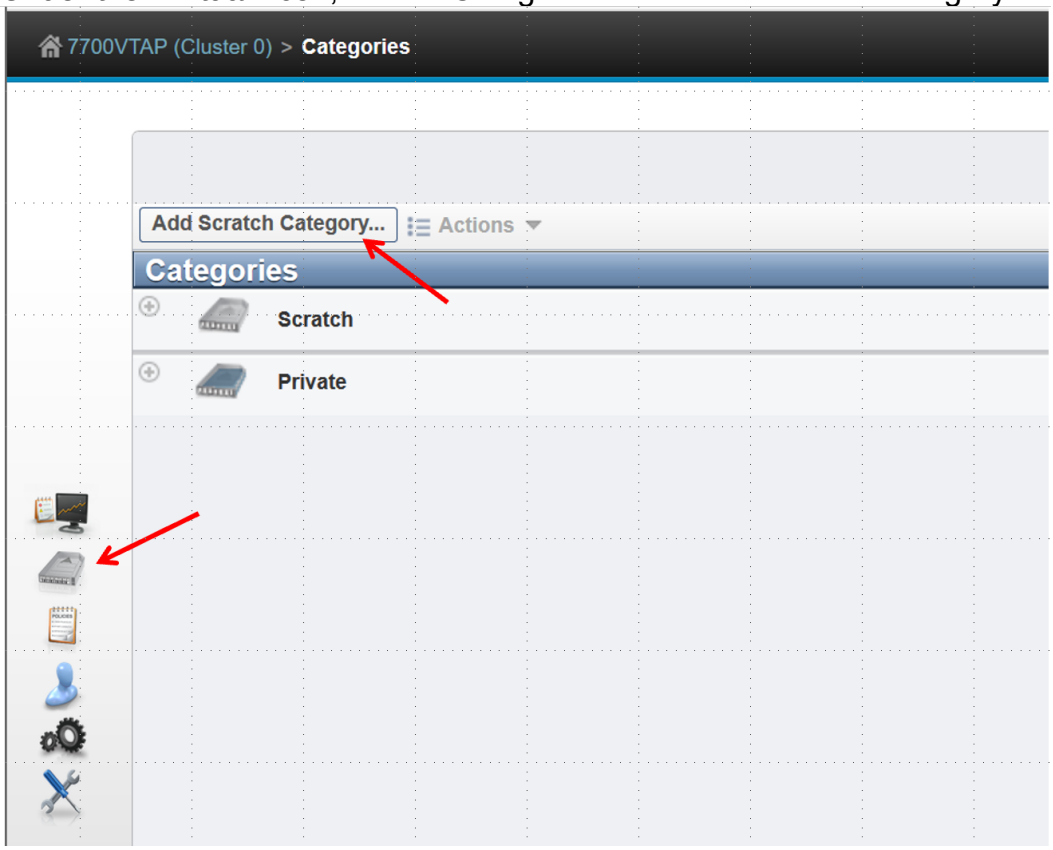
   For our test, we decided to use **0082** (aka SCRATCH2) for our **z/VM** fast ready/scratch category.

   Note: Do not use category codes 0000 or FFxx, where xx equals 0–9 or A-F. 0000 represents a null value, and FFxx is reserved for use by the hardware.

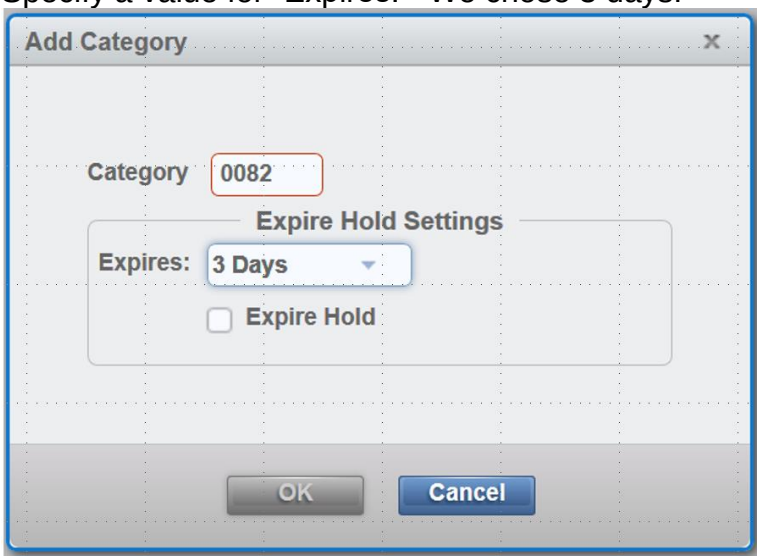
2. From your web browser, start the VTS GUI and log in. Here is a screenshot of ours:



3. In the VTS, define a fast ready (scratch) category. Recall that we chose to use 0082:
   a. Under the “Virtual” icon, select “Categories” then “Add scratch category”.



   b. Specify 0082 for “Category”
   c. Specify a value for “Expires.” We chose 3 days.

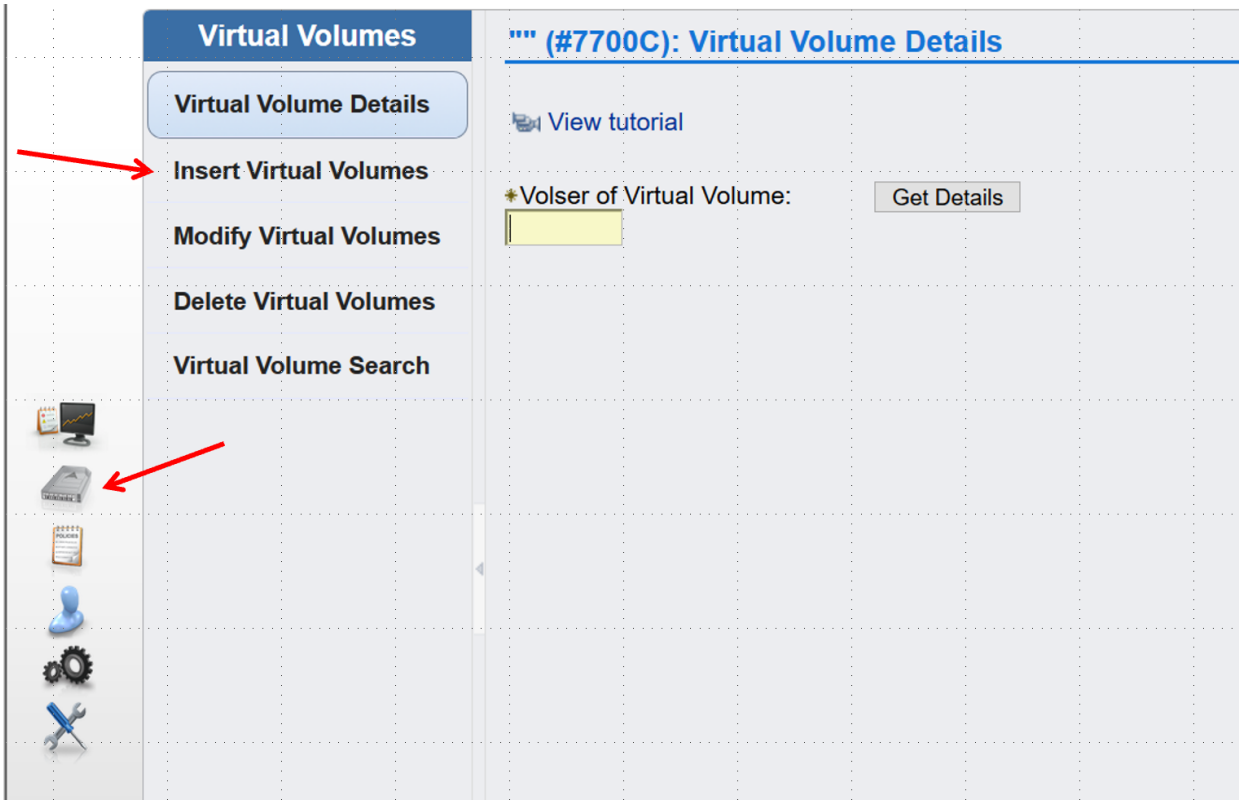


The expire time is the number of hours or days after a virtual volume is returned to the Fast Ready category (scratch) before its data content is automatically delete-expired. The volume becomes a candidate for delete-expire once all the following conditions are met:

i. The amount of time since the volume entered the Fast Ready category is equal to or greater than the expire time (3 days in our case.)
ii. The amount of time since the volume's record data was created or last modified is greater than 12 hours.
iii. At least 12 hours has passed since the volume was migrated out of or recalled back into disk cache.

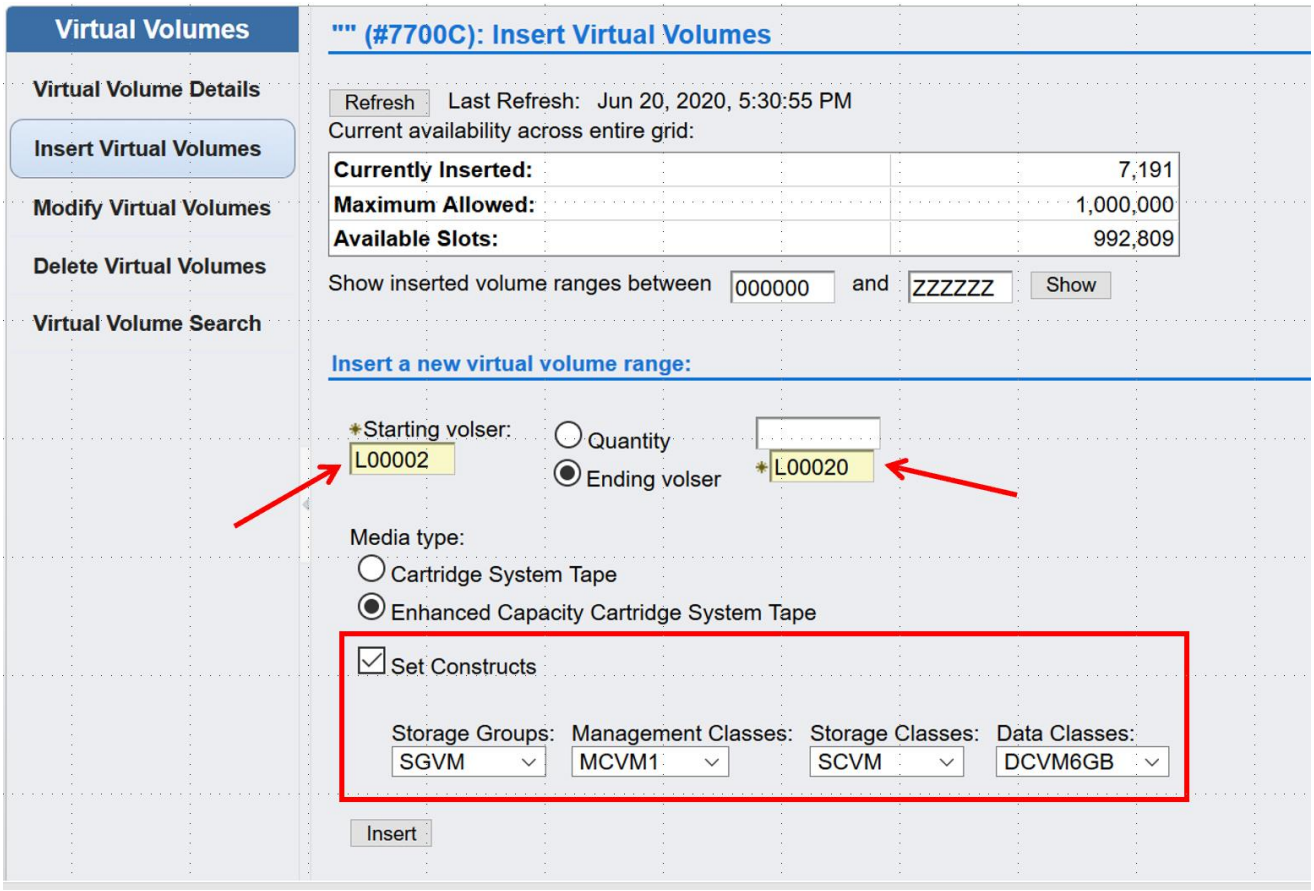
d. The "**Expires**" value specified in the library should match the "**ExpHold**" value we will specify for these tapes in Tape Manager. We'll define "ExpHold" in Tape Manager later in this white paper.
e. Do **not** select the "Expire Hold" option. By not selecting it, the virtual volume **can** be mounted or have its category and attributes changed within the expired time duration.
f. Click OK.

4. If you do not already have a range of virtual volumes, create new ones in the VTS, specifying a range you have confirmed you can use:
   a. Under the "Virtual" icon, select "Virtual Volumes", then "Insert Virtual Volumes".



   b. Specify the starting volser and either an ending volser or the quantity of volsers in the range. The author specified L00002 through L00020.

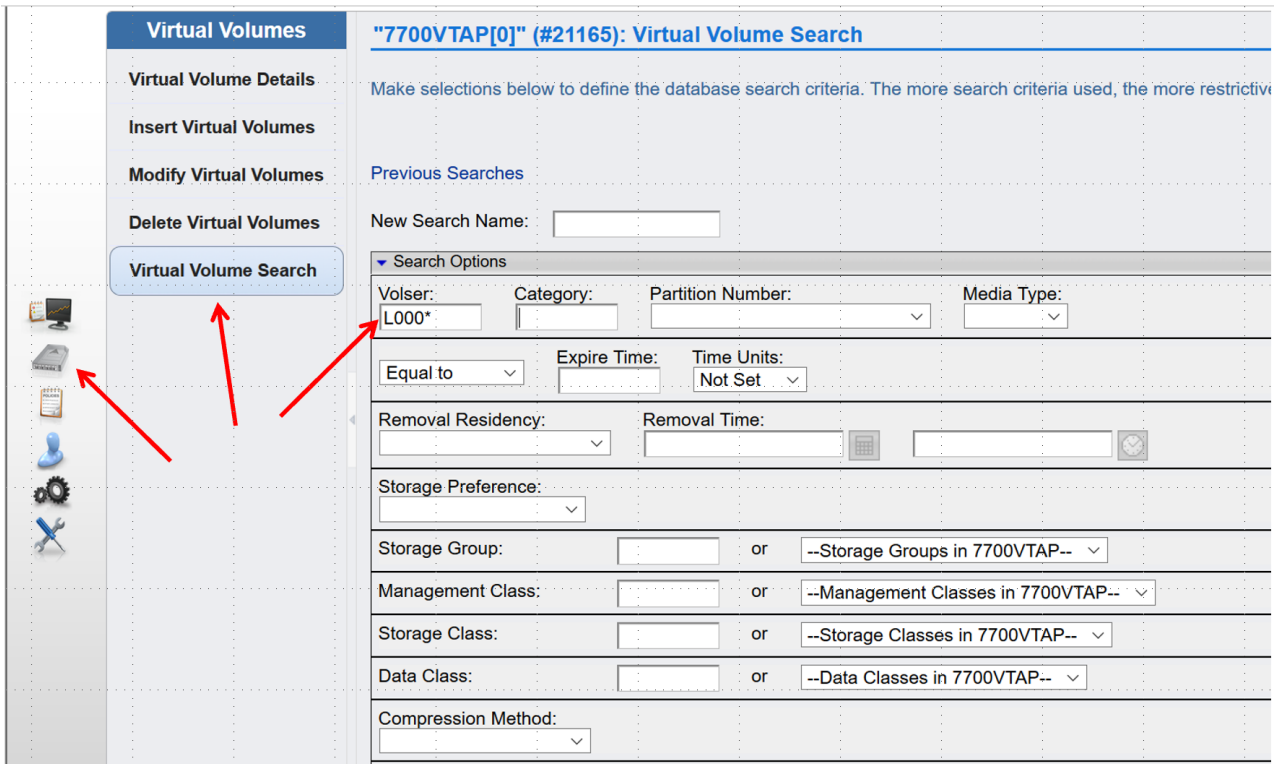
c. Choose the default constructs for storage group, management class, storage class and data class, or those requested by your storage administrator. Remember, these will apply to the volsers regardless of category code. For most z/VM installations, only the management class construct is interesting, since it determines copy policy for volume redundancy. Again, review with your storage administrator.



d. Click “Insert”.

e. Depending on how many volsers you inserted, this may take a few minutes. Follow the instructions on the screen for checking the status of your insert request.

f. You can confirm the virtual volumes are inserted using the “Virtual Volume Search” function in the GUI under “Virtual, “Virtual Volumes”. You can use an asterisk (*) for a wildcard in your search. For example, in the search options, we specified Volser L000*.



5. Update the Define_Media statement in the Tape Manager SYS CONFIG file (TxTMM 198 disk) to specify the scratch category. Items in red are site specific values, so use yours.

```
Define_Media VTAPEL,
  DevPool 3590L,
  Mode RW,
  ScrSel RANDOM,
  VolCat VOL,
  ScrCat SCRATCH2,
  ExpHold 3
```

   Notes:
   - The DevPool value should match the DevPool statement also in the Tape Manager SYS CONFIG file:
     ```
     Devpool,
        3590L,
        ATL,
        VMSYSATL,
        770-77F
     ```
   - The value of ExpHold should be 3. This is the number of days Tape Manager will treat the tape as expired, but not available for scratch mounts. This value should match the value you specified in step 3d above. This allows both Tape Manager and the library to give you a grace period after the tape is expired and before data is potentially erased or unavailable.
   - The value of ScrCat must correspond to the scratch category you defined in steps 1 and 3 above. Remember z/VM maps scratch category SCRATCH2 to 0082.

6. From a z/VM user ID that is authorized as an Admin in Tape Manager, stop and restart Tape Manager (TxTMM). Replace TxTMM with the name of your Tape Manager server (typically TCTMM in a shared catalog environment or TMTMM in a Dedicated Catalog environment.)
   ```
   TAPCMD STOP
   XAUTOLOG TxTMM
   ```

7. On z/VM, add tapes to Tape Manager:
   a. Logon to a z/VM user ID that is authorized as an Admin in Tape Manager.

   b. Define a tape pool in Tape Manager that your user ID can use:
      ```
      TAPCMD POOLDEF userid TAPEPOOL MEDIA VTAPEL FREEPOOL SYS RETNMAX 99999
      ```

      For *userid*, specify the user ID you are logged onto. This is useful for this test. For production environments, specify the tape pools you are using. For MEDIA specify the media name defined in Tape Manager's SYS CONFIG file on the TxTMM 198 disk. We've specified VTAPEL above.

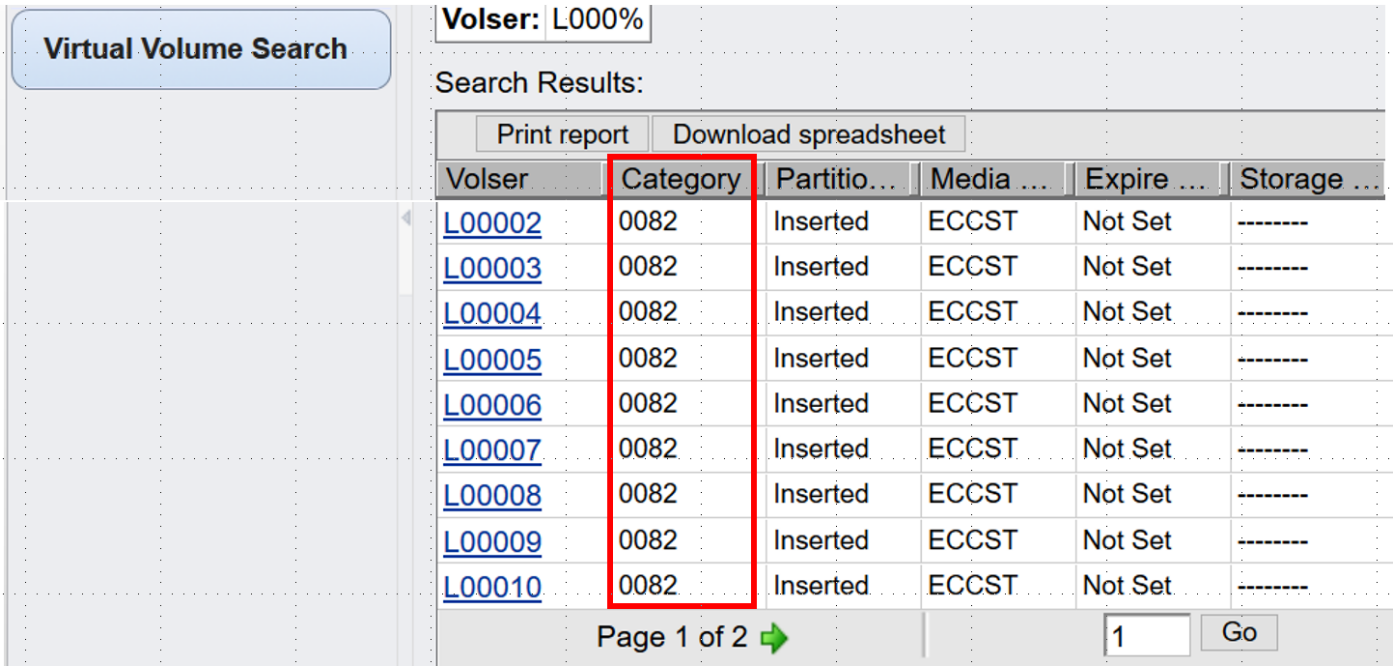
c. Add tapes to Tape Manager as scratch tapes.

   Typical installations will add them to the system free pool. For ATL, specify the Library_Name defined in Tape Manager's SYS CONFIG file. We've specified VMSYSATL. For MEDIA specify the media name defined in Tape Manager's SYS CONFIG file. We've specified VTAPEL.

   Note that specifying SCRCAT SCRATCH2 will tell Tape Manager to also issue commands to RMS to move the tapes into the Scratch Category we defined. In our case, the Scratch Category is 0082 (aka SCRATCH2.)

```
TAPCMD TAPEADD VOL L00002-L00020 POOL SYS MEDIA VTAPEL SCRCAT SCRATCH2 ATL VMSYSATL
```

8. In the VTS GUI, use the "Virtual Volume Search" function to check the category codes for the range of volsers. They should now all be 0082 (SCRATCH2 category.)



9. On z/VM, mount one of these tapes in Tape Manager and write data to it. The author dumped the MAINT 193 disk to the tape. That disk was 500 cylinders in size and 51% full.

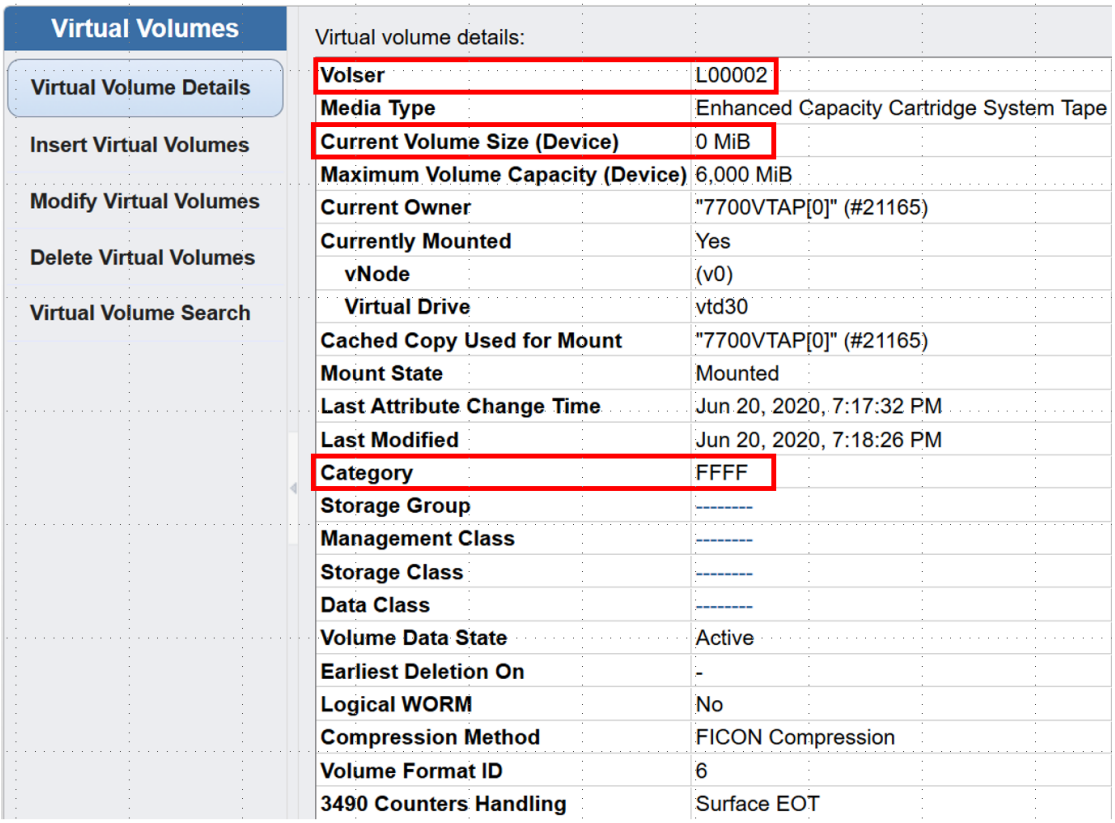
    a. Issue the following command to mount a scratch tape:
    ```
    TAPCMD TAPEMNT SCR userid TAPEPOOL TEXT 'MAINT 193 disk'
    ```

    "*userid* TAPEPOOL" is the tape pool we created in step 7b.

    On the author's system, Tape Manager mounted volser L00002 on device 770.

    b. Issue the following commands to write data to the tape followed by 2 tape marks signifying end of tape:
    ```
    VMFPLC2 DUMP * * V
    VMFPLC2 WTM 2
    ```

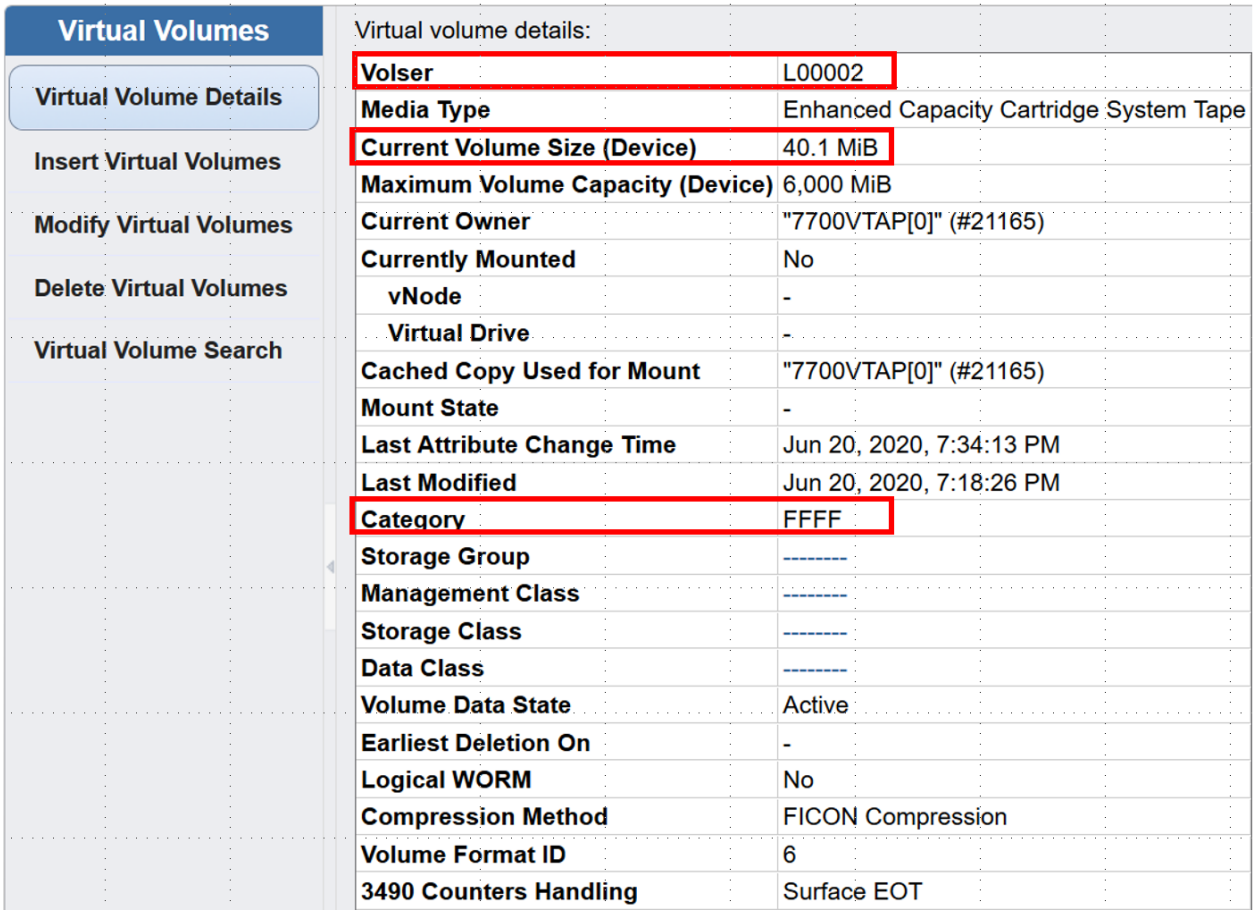
10. Check the status of the volume in the VTS:
    a. While the tape is still mounted (and after data has been written) use the "Virtual Volume Details" function in the VTS to see volume details such as space used, category code, etc. Notice it says the compressed data is 0MiB since the tape is still mounted and wasn't previously written before this mount. The category code has been changed from 0082 (the scratch category) to FFFF (a private category.)



b. From z/VM, detach the tape:
```
DET 181
```

c. Wait a few seconds to make sure the tape is actually detached from the system. (Tape Manager does some checking before it tells RMS to detach it.)

d. From the VTS, check the Virtual Volume Details again. Notice it says the compressed data is 40.0MiB, and the category code is still the private category FFFF.



11. Verify the status of the tape in Tape Manager for z/VM. Logon to an authorized userID on z/VM and issue:
```
TAPCMD TAPEQRY VOL volser SHORT
```

Notice the tape is Used (not Free) – see the second column in the Flags field.
Notice the expiration date is sometime in the future (depending on your defaults.)

```
TAPCMD TAPEQRY VOL L00002 SHORT
Ready; T=0.01/0.01 22:14:22
 EUMTAP0010I TAPEQRY message 000034 received from TRACY.
 Volume Owner    Name     Flags  Media  Exp Date R/W ID   R/W Date Dev  DevT
 L00002 TRACY    TAPEPOOL AUNNIN VTAPEL 20200928 TRACY    20200620 0770 3490
 EUMTAP0083I TAPEQRY request 000034 complete - RC 0.
```

12. Expire the tape in Tape Manager
    a. From z/VM, change the expiration date of the tape to a date earlier than today:
       `TAPCMD TAPEMOD VOL volser EXPDAYS -1`

    b. Query the tape again to confirm the expiration date
       `TAPCMD TAPEQRY VOL volser SHORT`

```
TAPCMD TAPEQRY VOL L00002 SHORT
Ready; T=0.01/0.01 22:16:46
 EUMTAP0010I TAPEQRY message 000037 received from TRACY.
 Volume Owner    Name     Flags  Media  Exp Date R/W ID   R/W Date Dev  DevT
 L00002 TRACY    TAPEPOOL AUNNIN VTAPEL 20200619 TRACY    20200620 0770 3490
 EUMTAP0083I TAPEQRY request 000037 complete - RC 0.
```

    c. Run Expiration processing in Tape Manager:
       `TAPCMD EXPSTART`

       Notice the message indicating the volume is expired.

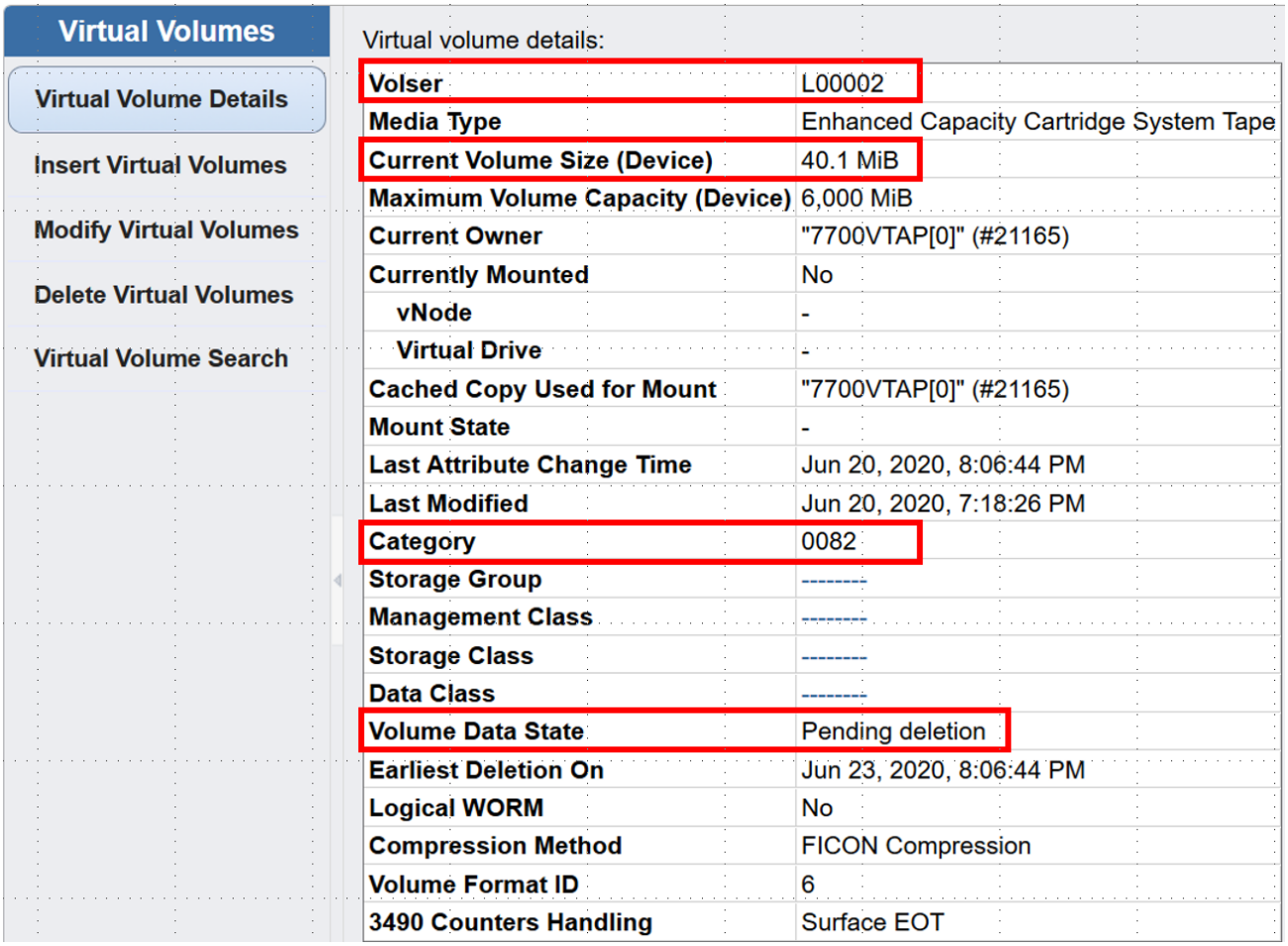
```
TAPCMD EXPSTART
Ready; T=0.01/0.01 22:17:30
 EUMTAP0010I EXPSTART message 000038 received from TRACY.
 EUMTAP0398I Expiration/Daily processing started on 20200620 at 22:17:30.
 EUMTAP0208I Volume L00002 expired as of 20200619 selected for expiration processing.
 EUMTAP0202I Expiration process bypassed for SYSTEM HOLD volume L00007.
 EUMTAP0202I Expiration process bypassed for SYSTEM HOLD volume L00008.
 EUMTAP0501I Volume L00002 moving to free pool SYS from TRACY TAPEPOOL.
 EUMTAP0399I Expiration/Daily processing ended on 20200620 at 22:17:30.
RDR FILE 0010 SENT FROM TMTMM    PRT WAS 0218 RECS 0009 CPY  001 A NOHOLD NOKEEP
 EUMTAP0083I EXPSTART request 000038 complete - RC 0.
```

d. Do another query to confirm it's now Free instead of Used (second column in the Flags field).

TAPCMD TAPEQRY VOL *volser* SHORT

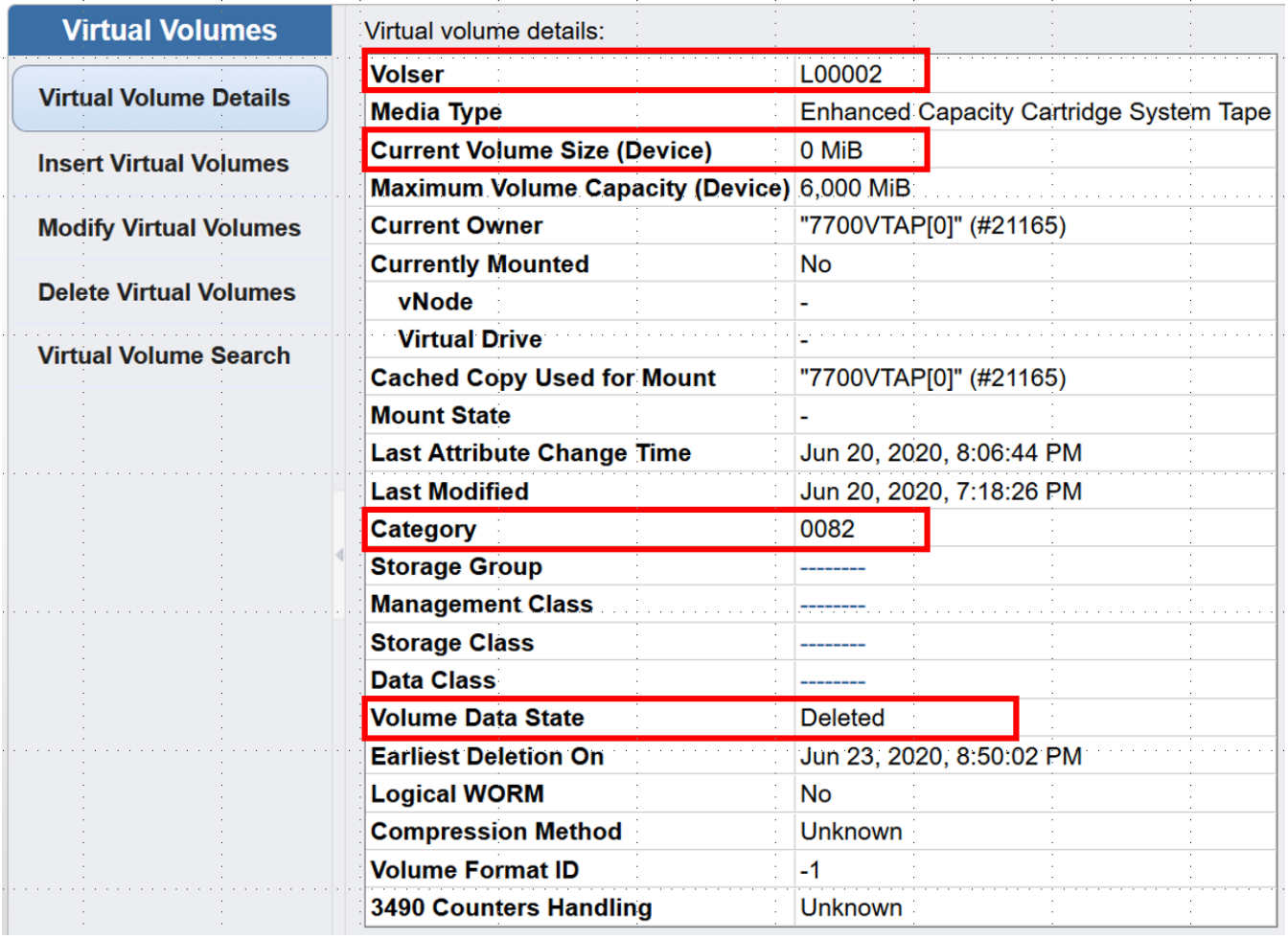
```
TAPCMD TAPEQRY VOL L00002 SHORT
Ready; T=0.01/0.01 22:18:20
 EUMTAP0010I TAPEQRY message 000039 received from TRACY.
 Volume Owner    Name     Flags  Media  Exp Date R/W ID   R/W Date Dev  DevT
 L00002 SYS               AFNNIN VTAPEL 00000000 TRACY    20200620 0770 3490
 EUMTAP0083I TAPEQRY request 000039 complete - RC 0.
```

e. Confirm the tape has been moved back to the scratch category (0082, aka SCRATCH2) in the VTS. From the VTS GUI, check virtual volume details. Notice it says the compressed data is still 40.1MiB but the category code is changed to 0082 and the Volume Data State is "Pending deletion" with an Earliest Deletion On value of tomorrow's date.



13. Wait 3 days for the library to delete the contents (or whatever time period you specified for the fast ready category or the time period specified .)

14. After 3 days, verify the status of the tape via the Virtual Volume Details function in the VTS GUI. Notice the data size is now 0 MiB, and the volume is still in the fast ready scratch category 0082.



Summary

IBM Tape Manager for z/VM V1.3 (with PTF UI54509) supports scratch and expiration processing in the IBM TS7700 Virtual Tape Server, allowing you to more efficiently manage cache (disk) space in the VTS. With the procedures outlined in this white paper, expired tape contents are removed from the cache, allowing more space for active tape content.

Once the initial configuration is complete, Tape Manager and the VTS will automatically free the space as tapes are expired. The only ongoing tasks for the z/VM system programmer or administrator are to:

- Create new virtual volumes (volsers) for z/VM as needed, using the TS7700 GUI (step 4 above)
- Add the newly created z/VM volsers to Tape Manager (step 7 above.)