FUJITSU Software BS2000

SPACEOPT V7.0

Disk Optimization and Reorganization

User Guide

Edition April 2015

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Certified documentation
according to DIN EN ISO 9001:2008

To ensure a consistently high quality standard and user-friendliness, this documentation was created to meet the regulations of a quality management system which complies with the requirements of the standard DIN EN ISO 9001:2008.

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1 Preface

With the constant creation, deletion, enlargement and reduction of files during IT operations, the files and free storage space on the volumes of a pubset become more and more fragmented. This fragmentation increasingly impairs the performance of the file accesses and disrupts the even distribution of the I/O load over all volumes of the pubset. The extent list in the catalog entries becomes longer and longer because of the inevitable creation of several small file extents whenever the files are enlarged.

The product SPACEOPT cleans up this fragmentation through optimum reorganization of the file extents on the volumes of a pubset. The aim of SPACEOPT is to create the largest possible contiguous free storage areas on a volume so that large files with a small number of extents can be allocated space. Moreover, the number of extents is reduced where possible by combining several small extents into one large one. The result is improved performance in terms of file access. The extent list in the catalog entries becomes longer and longer because of the inevitable creation of numerous small file extents as the files increase in size, thus the upper threshold for the number of extents for each file is rapidly reached.

SPACEOPT works on a volume-by-volume basis, i.e. jobs can be specified for individual or all volumes of a pubset. SPACEOPT offers ways of assessing the allocation and fragmentation status of the volumes of a pubset and of monitoring the SPACEOPT jobs.

As well as the option of reducing the number of file extents on a volume basis (in other words, for files that have their extents on the volume being processed), the reduction of extents can also be carried out on a file basis, i.e. specifically for individual files by calling a SPACEOPT command.

The SPACEOPT product also offers the option of specifically clearing a given volume of a pubset or volume set by starting the appropriate SPACEOPT job. During this process, the extents of files located on this volume are moved to another volume of the pubset or volume set. The complete clearance of the volume is a prerequisite in order to be able to remove a volume from a pubset or volume set (for example, in order to carry out repair work).

When working with ISAM files, it may be that the continuous adding, extending, shortening and deleting of records may lead to an increasing number of free pages. These released pages are not returned to the BS2000 allocator, but instead remain under the control of the access method. This may lead to increased space requirements for ISAM files. The SPACEOPT product offers the option of determining the number of free pages of ISAM files by calling a SPACEOPT command. System support staff can then decide whether reorganizing the affected ISAM files will lead to an improvement in the storage capacity situation.

As SPACEOPT is used during ongoing operation, it does not require an (additional) service window. Nevertheless, the best time to use SPACEOPT is off-peak, as it can generate a higher I/O load, depending on how fragmented the volumes are.

Open files can also be included in the event of volume- or file-related reorganization and when emptying a volume. This enables applications which work with these files to continue running without interruption. Owing to possible affects on the performance of the applications this function should only be used at off-peak hours.

In a storage system each BS2000 disk is mapped to a logical volume. A BS2000 disk can be significantly smaller than the entire space available over the logical volume (e.g. after a disk migration). With SPACEOPT as of Version 2.0C this wasted space can be made available for the disks of a pubset without a reinitialization and the associated backup and restoration of the user data.

1.1 Objectives and target groups of this manual

This manual generally is intended for systems support staff. The REDUCE-FILE-EXTENT-NUMBER command is also relevant for non-privileged users.

1.2 Summary of contents

This manual consists of six chapters plus a reference section and index.

Chapter *1 Preface*
> contains a brief description of the SPACEOPT product, specifies the target group of the manual and explains the structure of the manual.

Chapter *2 SPACEOPT jobs and job options*
> describes how SPACEOPT manages the jobs and explains the various job statuses, job objects and how to set the task limit. This chapter contains a list of files which are normally excluded from the reorganization and describes how to exclude user-specified files from the reorganization. Finally, it explains how SPACEOPT interacts with other products.

Chapter *3 Assessing the volume status*
> describes the information function for determining the volume utilization. This chapter also contains a short list of key terms from the field of storage space management and a description of the allocation strategy in BS2000.

Chapter *4 Adapting the size of volumes*
> describes how SPACEOPT adapts the size of BS2000 disks to the size of the logical volumes in storage systems.

Chapter *5 Installing, starting, terminating, managing*
> describes how SPACEOPT is installed, started and terminated. The chapter contains additional information on the Trace diagnostic tool which is used to log extent movements and to provide accounting information for SPACEOPT.

Chapter *6 Commands*
> contains the SPACEOPT commands, i.e. syntax, function and operand descriptions, and examples.

Reference section and index
> The manual contains a list of abbreviations, a glossary of technical terms, a list of related publications and an index.

Readme file

The functional changes to the current product version and revisions to this manual are described in the product-specific Readme file.

Readme files are available to you online in addition to the product manuals under the various products at *http://manuals.ts.fujitsu.com*. You will also find the Readme files on the Softbook DVD.

Information under BS2000/

When a Readme file exists for a product version, you will find the following file on the BS2000 system:

`SYSRME.<product>.<version>.<lang>`

This file contains brief information on the Readme file in English or German (<lang>=E/D). You can view this information on screen using the `/SHOW-FILE` command or an editor. The `/SHOW-INSTALLATION-PATH INSTALLATION-UNIT=<product>` command shows the user ID under which the product's files are stored.

Additional product information

Current information, version and hardware dependencies, and instructions for installing and using a product version are contained in the associated Release Notice. These Release Notices are available online at *http://manuals.ts.fujitsu.com*.

1.3 Changes since the last edition of the manual

Messages

The "Messages" chapter is no longer included.
You can find the messages on the manual server (URL: *http://manuals.ts.fujitsu.com*) by means of an HTML application and on the "BS2000/OSD SoftBooks" DVD.

The SPACEOPT V7.0 manual contains the following changes over the previous manual SPACEOPT V3.0:

Modified commands

The following table summarizes the most important changes to the commands since SPACEOPT V3.0A.

Command	Page	Operand	Modification
MODIFY-SPACEOPT-PARAMETER	68		new command: modify SPACEOPT parameters
REDUCE-FILE-EXTENT-NUMBER	73		The command now is also permitted for non-privileged users

1.4 Notational conventions

The following notational conventions are used in this manual for the presentation of important elements in the text:

i   For comments

`Typewriter font`
Used for input into the system, system output and file names in examples.

2 SPACEOPT jobs and job options

2.1 SPACEOPT jobs

SPACEOPT is implemented as a DSSM subsystem. A server task generated via DSSM acts as the carrier task and manages all SPACEOPT jobs. SPACEOPT jobs are created asynchronously using the commands /START-SPACEOPT-JOB, /CLEAR-VOLUME and /PURGE-SPACEOPT-WORK-FILES.
SPACEOPT works on a volume-by-volume basis, i.e. SPACEOPT jobs can be specified for individual volumes of a pubset or for a whole pubset.
The individual volumes are processed under subtasks (one per volume), which are initiated and managed by the carrier task (see figure 1). The carrier task and the subtasks are system tasks. The number of active subtasks per pubset can be set (see /START-SPACEOPT-JOB, operand TASK-LIMIT on page 98).
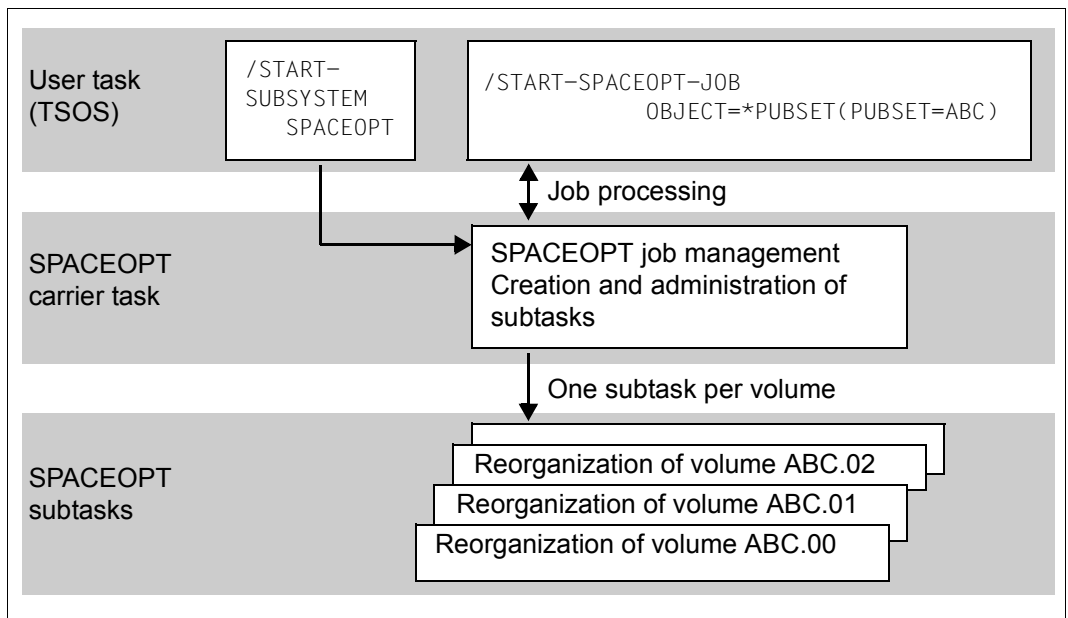
Figure 1: Structure of the SPACEOPT jobs

The `/CLEAR-VOLUME` command creates a SPACEOPT job that completely clears the contents of the volume that you specify.

The `/SHOW-SPACEOPT-JOB-STATUS` command provides information on jobs which have not yet been completed, see .

Jobs can be terminated prematurely with the `/CANCEL-SPACEOPT-JOB` command, see . The reorganization progress up to this point is retained.

You can request information to help you assess the allocation and fragmentation status of individual volumes or pubsets using the `/SHOW-SPACEOPT-SPACE-ALLOCATION` command (see). This command can also be used to check the success of a current SPACEOPT job.

As well as processing entire volumes, pubsets or volume sets you can use the `/REDUCE-FILE-EXTENT-NUMBER` command to target specific files and reduce the number of their extents. No separate SPACEOPT job is created to do this; processing is carried out synchronously under the task of user that called the command.

Information about the number of free pages in ISAM files can be obtained using the `/SHOW-FREE-ISAM-SPACE` command. If an ISAM file contains free pages, you can reorganize the file and thus reduce the amount of storage space it occupies.

Job statuses

An asynchronously created SPACEOPT may be in one of five statuses. The current statuses of these jobs can be displayed using the `/SHOW-SPACEOPT-JOB-STATUS` command. The displayed values are given in brackets after the status.

1. *Running* (RUN)
   The SPACEOPT job is in the processing phase.
   A SPACEOPT job was initiated via the `/START-SPACEOPT-JOB` command.

2. *Waiting* (WAIT)
   The SPACEOPT job is in the wait state.
   A SPACEOPT job was initiated via the `/START-SPACEOPT-JOB` command. When the `TASK-LIMIT` (see section "Setting a task limit" on page 17) is reached, the SPACEOPT job is put in the wait state. The job implicitly enters the processing phase (status *Running*) when a SPACEOPT job with the *Running* status terminates or if the `TASK-LIMIT` is increased.

3. *Purge* (PURG)
   A SPACEOPT job was initiated for purging an unsuccessful SPACEOPT job (`/PURGE-SPACEOPT-WORK-FILES` command).

4. *Purge-Wait* (PGWT)
   This status arises when a job is created for the volume with the `/START-SPACEOPT-JOB` command but a purge job is already being processed for that volume. The purge job is supplemented with the data of the second job and is given the status *Purge-Wait*. When the original purge job is complete, the job status changes to *Waiting*.

5. *Clearing* (CLEAR)
   This status occurs when a clear volume job is processed (created using the `/CLEAR-VOLUME` command).
   In comparison with the other four statuses this status represents a special case:
   – A job to clear a volume is rejected if another SPACEOPT job has already been started for that volume and has not yet been completed.
   – If a clear volume job has been started for a volume (volume is already in the `CLEARING` status), a reorganization or purge job for this volume will be rejected.
   – A clear volume job cannot change from the *Clearing* status to another status. In the same way, a reorganization or purge job is not able to change from to the *Clearing* status.

Figure 2 shows the possible status changes. Above and below the straight arrows on the left-hand side of the figure are the commands which can be used to change the status explicitly, while on the right-hand side are the events which cause an implicit change in status.

The job statuses are output using the `/SHOW-SPACEOPT-JOB-STATUS` command. Only "active" jobs with the status *Running*, *Purge, Purge-Wait* or *Clearing* already have a TSN. Jobs in the wait state are managed internally by SPACEOPT.
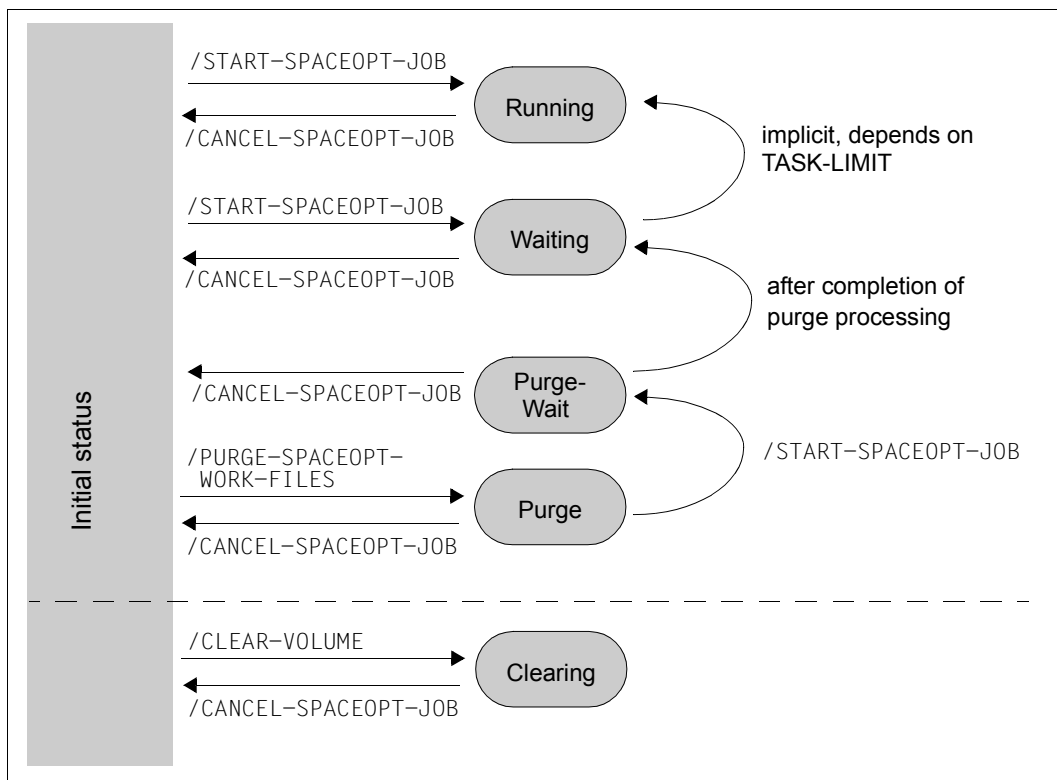
Figure 2: Job statuses and status changes

2.2 Job options

2.2.1 Objects

A SPACEOPT reorganization job (initiated using the /START-SPACEOPT-JOB command) or a job to purge the SPACEOPT work files (initiated using the /PURGE-SPACEOPT-WORK-FILES command) may apply to the following objects:

– SM pubset
– SF pubset
– Volume set
– Volume of a pubset or volume set

If a pubset or volume set is specified, a SPACEOPT job is initiated for processing each volume of this pubset or volume set. The system checks each time whether a SPACEOPT job has already been initiated for the volume in question and not yet completed. If this is the case, no new SPACEOPT job will be initiated for this volume.

With SM pubsets the volumes are determined in two stages. First, all volume sets in the *NORMAL-USE* state of the SM pubset are determined (see the /SHOW-PUBSET-CONFIGURATION command in the "Commands" manual [1]). Then the SPACEOPT jobs are initiated for each volume set thus determined. The information output by the /SHOW-SPACEOPT-JOB-STATUS command includes which volume belongs to which volume set.

A SPACEOPT job to completely clear the contents of a volume (initiated using the /CLEAR-VOLUME command) applies only to the volume that is to be cleared, not to the SM pubset, SF pubset or volume set that this volume belongs to.

2.2.2 Setting a task limit

The TASK-LIMIT operand of the /START-SPACEOPT-JOB command can be used to limit the number of SPACEOPT jobs running in parallel for an SF pubset or a volume set. This allows you to control the additional system load generated by SPACEOPT through I/O load and catalog operations.

The TASK-LIMIT operand defines a maximum number of parallel subtasks for processing the individual volumes of the SF pubset or the volume set. Execution of the individual jobs is therefore staggered. If more jobs are initiated than are specified in the TASK-LIMIT operand, these are placed in a wait state (status *Waiting*). As soon as the number of jobs with the status *Running* drops below the TASK-LIMIT, the jobs with the status *Waiting* implicitly enter the processing phase (status *Running*); see also "Job statuses" on page 14.

Special feature of SM pubsets

If the referenced object is an SM pubset, the value specified for TASK-LIMIT is assigned to each volume set of the SM pubset.

Information function for TASK-LIMIT

You can find out the current value of TASK-LIMIT using the /SHOW-SPACEOPT-JOB-STATUS command.

Modifying TASK-LIMIT value

You can modify the current TASK-LIMIT value by starting a new SPACEOPT job. If a SPACEOPT job for this pubset or volume set is still active, the existing value of TASK-LIMIT is modified by the current specification. The number of parallel jobs is successively adjusted to the new value.

The TASK-LIMIT value can be specified via the /START-SPACEOPT-JOB command.

2.2.3 Files normally excluded from the reorganization

In every system there are a number of files which are excluded from a reorganization on account of their special functions. These include system initialization files which must always be in precisely defined physical locations. The files which are normally excluded from a reorganization are listed in the following sections.

Files that are, by default, excluded from reorganization, are also excluded when attempting to reduce the number of their extents (/REDUCE-FILE-EXTENT-NUMBER command). Neither can files of this nature be moved to other volumes when clearing a volume (using the /CLEAR-VOLUME command). A volume of this nature will still contain all files that cannot be moved. The names of files which cannot be moved are logged (see page 65).

The files that are by default excluded from reorganization are listed below. In addition, users can specify their own choice of files which are to be excluded from a reorganization (see page 20).

Startup files and important system files

To guarantee smooth running of the current session or a problem-free system startup, the system files required for this are not included in a reorganization.

Startup files

– $TSOS.SYSPRG.BOOT.*
– $TSOS.SYSREP.SLED.*
– $TSOS.SYSPRG.SLED.*
– $TSOS.SYSREP.IPL.*
– $TSOS.SYSDAT.IPL-CONF.*
– $TSOS.SYSPRG.IPL.*

These files are required for loading the BS2000 operating system and they can only be addressed at the time of startup via address references in the SVL.

System files

– $TSOS.TSOSCAT
– $TSOS.TSOSCAT.*
– $TSOS.CONVCAT
– $TSOS.SYS.PAGING.*
– $TSOS.SYSEAM
– $TSOS.SYSEAM.*
– $TSOS.SYS.PVS.SHARER.CONTROL
– $TSOS.SNAPFILE

Files of the SYSSOPT ID

Also excluded are all files under the SYSSOPT user ID.

Files in specific processing states

Files in the following processing states are not included in the reorganization:

– Open files are excluded by default, but can be explicitly included in the reorganization (see also the section "Reorganization including open files" on page 26)

– Locked files
Files with a secure lock or cache lock

– Files with the status *NOCLOSE* or *REPAIR-NEEDED*
Displayed by the /SHOW-FILE-ATTRIBUTES command,
STATUS=*PARAMETERS(CLOSED-OUTPUT=...,REPAIR-NEEDED=...) operand,
see the "Commands" manual [1]

– Files currently in the cache
Displayed by the /SHOW-FILE-ATTRIBUTES command,
STATUS=*PARAMETERS(CACHED=...,CACHE-NOT-SAVED=...) operand,
see the "Commands" manual [1]

– Files for which a CCOPY session is running

Files with specific attributes

Files with at least one of the following attributes are not included in the reorganization:

– Files with the MIGRATE=*FORBIDDEN attribute (may not be displaced)

Exception
The following files are nevertheless excluded from the reorganization by default:
– $TSOS.EQUISAMQ
– $TSOS.SYSSRPM
– $TSOS.SYSSRPM.BACKUP
– $TSOS.SYSTEM.JOBPOOL
– $TSOS.TSOSJOIN.TSNN

– Files whose catalog entry was marked by the operating system and which, as special system files, may only be processed by specific system functions
(e.g. the defect garbage file, see the "Introductory Guide to Systems Support" [5])

2.2.4 User-specified files to be excluded from the reorganization

Other files which are to be excluded from the reorganization must be listed in an "EXCEPT" file. This file must be specified in the /START-SPACEOPT-JOB EXCEPT-FILES=*FROM-FILE(...) command. It must contain no more than 4096 entries (path names) and must be a SAM file with a fixed or variable record length containing one path name (maximum length 80 characters) per entry.

The path names in the EXCEPT file are subject to the following conditions:

– [:<catid>:]$<userid>.[<filename>]
The specification of a catalog ID <catid> is optional.
A user ID <userid> must always be specified!
Wildcards are only allowed in the <filename> component. Partially qualified specifications are also allowed in <filename>. For more details, see .

SPACEOPT replaces the <catid> component with the catalog ID of the pubset or volume to be processed, and not with the default catalog ID of the specified user ID <userid>.
If an explicitly specified <catid> is different from the catalog ID of the pubset or volume to be processed, the entire path name will be ignored without further checking for correct syntax. The quota for the maximum number of path names in the EXCEPT file is not affected by this entry. In this way, specifications for several pubsets can be combined in one EXCEPT file.

– The path names must be specified in uppercase letters.

– There is no ACS replacement for the specified path names in the EXCEPT file; for information on ACS, see the "Introductory Guide to DMS" [3].

– The specification of file generations (relative or absolute) is not allowed.
The name of a file generation group, however, can be specified. This causes all associated file generations to be automatically excluded from the reorganization.

– The specification of a file name with its version is not allowed.
Versions may only be specified for names of tape files (see the "Introductory Guide to DMS" [3]). SPACEOPT does not process tape files.

If any of these rules are violated, the SPACEOPT job is terminated with a return code (`SOP0025`, `SOP0026`).

Examples of valid specifications in the EXCEPT file:

`$USER11.DATAFILE.123`	(<catid> not specified)
`:A:$USER11.DATAFILE.124`	(fully-qualified specification)
`:ABCD:$TSOS.EDT`	(fully-qualified specification)
`:X:$TSOS.SYSLNK.`	(partially-qualified specification)
`$TSOS.SYSPRG.`	(<catid> not specified and partially-qualified specification)
`$USERVIF.`	(<catid> not specified and partially-qualified specification)
`:X:$USER22.*LOG.`	(specification of wildcard and partially-qualified spec.)
`$SYSAUDIT.*LOG`	(<catid> not specified and specification of wildcard)

Handling of wildcard specifications

SPACEOPT resolves wildcard specifications and replaces them with the resulting list of path names. This means that when wildcards are specified, only files which exist at the time these specifications are resolved can be excluded. Files created later which would fall within the naming scope of the wildcard specifications are not considered (remedy: use partial qualification, see below).
The SPACEOPT job is terminated with a return code (`SOP0026`) if the resolving of the wildcards causes the maximum number of 4096 path names in the EXCEPT file to be exceeded.

Handling of partially-qualified specifications

With partially-qualified specifications, all files covered by the partial qualification are excluded from the reorganization. When a pure partial qualification is specified, the quota of the maximum number of path names in the EXCEPT file is only debited by "1", irrespective of how many files are covered by this specification.
If a partial qualification also contains wildcards, this case is treated like a wildcard specification.

Checks and error handling

The specifications in the EXCEPT file are doubly checked:

1. Under the task of the job submitter, i.e. immediately after the command has been entered, a preliminary check is made so that any major violations can be reported back immediately. The syntax of the specifications and the number of corresponding files are checked, but wildcard specifications are not yet resolved. When the program determines the total number of valid entries, it counts every entry; there is no sorting of identical or redundant entries (e.g. :ABC:$UID.A.BC, :ABC:$UID.A.). If the total number

is greater than 4096 or if violations were found during the syntax check, the SPACEOPT job is aborted. Up to ten violations are logged in the accompanying message output (`SOP0027`, `SOP0028`).

2. The "actual" resolving and replacement of the wildcard specifications does not occur until the function is executed. The syntax and the total number of file specifications are also checked. When the program determines the total number of valid entries, any repeat occurrences, redundancies and overlaps with predefined files are purged. If the EXCEPT file was modified with errors (or deleted) in the meantime, the SPACEOPT job is terminated with a corresponding message (`SOP0024`, `SOP0025` or `SOP0026`). Because the SPACEOPT job is being processed in an asynchronous system task, messages can only be output at the console. There is no detailed error logging as described under point 1.

2.2.5 Reduction of file extents

The number of file extents can be reduced within certain limits.

In the `/START-SPACEOPT-JOB` command, the `ONE-EXTENT-FILE-SIZE` operand defines the maximum file size at which the SPACEOPT tries to accommodate the whole file in only one file extent.

But SPACEOPT does not attempt to reduce the file extents for every file which meets this size requirement. It considers only those files whose extents are processed during the reorganization and whose total size does not exceed the specification in `ONE-EXTENT-FILE-SIZE`. However, if there is no area large enough, the extent is reorganized "normally".

The setting `ONE-EXTENT-FILE-SIZE=0` defines that the extents are to be reorganized normally, i.e. no attempt is made to combine all extents of a file into one.

As well as the option of reducing file extents using the `/START-SPACEOPT-JOB` command, it is also possible to carry out file-specific reduction using the `/REDUCE-FILE-EXTENT-NUMBER` command. This type of reduction can target a specified file, and is carried out synchronously under the task of the user calling the command. If you specify a list of file names, you can also process a number of files.

2.2.6 Monitoring SPACEOPT jobs using the monitor job variable

You can start SPACEOPT jobs asynchronously using the /CLEAR-VOLUME and /START-SPACEOPT-JOB commands. The calling task receives a message output to SYSOUT. This message simply states that a SPACEOPT job has been started.

Information about the status of the started system tasks can be displayed using the /SHOW-SPACEOPT-JOB command. You will need to consult the console log to find out whether a SPACEOPT job was terminated normally or abnormally.

When using the separately licensed subsystem JV, you can use the monitor job variables to monitor SPACEOPT jobs. A SPACEOPT job is defined as a number of system tasks that are created and started by specifying either the /CLEAR-VOLUME or /START-SPACEOPT-JOB command. An entire SPACEOPT job created using one of these commands can be monitored, but not the individual system tasks within this job.

Monitoring is activated by specified a job variable in the MONJV operand of either the /CLEAR-VOLUME or the /START-SPACEOPT-JOB command.

A job variable that monitors a SPACEOPT job may contain one of the following status values.

$S: The SPACEOPT job has been accepted.

$R: The first of the generated system tasks has been started.

$T: The last of the generated system tasks has been terminated normally, all other system tasks were also terminated normally.

$A: At least one of the generated system tasks was terminated abnormally.

In the system part of the monitor job variable, the TSN of the SPACEOPT server task (SOPT) is stored as the TSN (byte 5-8) and the character string "SPACEOPT" is stored as the name of the application to be monitored (byte 53-60). In addition to this, the name of the SPACEOPT command that was used to create the SPACEOPT job is also stored as application-specific information (as of byte 71).
The structure of a job-monitoring job variable is described in detail in the "JV" [8] manual.

The user part of the monitoring job variable (as of byte 128) stores information about the status of the SPACEOPT job being monitored in a printable format. Depending on the status values in the system part, the user part may contain the following status information:

Value	Status information	Meaning
$S	Empty (blanks)	No information
$R	NORMAL RUNNING	All started system tasks are running as they should.
	RUNNING WITH ERROR	At least one system task has discovered an error
$T	COMPLETED	All system tasks have been completed without errors
	COMPLETED WITH ERROR	All system tasks have been completed, but at least one of the system tasks has encountered an error
$A	ABNORMAL TASK TERMINATION	A system task was terminated abnormally
	CANCEL BY COMMAND	A system task was terminated using a /CANCEL-SPACEOPT-JOB command
	EXPORT PUBSET	A system task was terminated as a result of the pubset being exported
	STOP SUBSYSTEM	A system task was terminated as a result of a /STOP-SUBSYSTEM SUBSYSTEM-NAME=SPACEOPT command

Note

When monitoring SPACEOPT jobs within a shared pubset environment, the monitoring job variables should be accessible on both the master and the slave computer of the shared pubset environment. As a result, the monitoring job variable should be cataloged on the relevant shared pubset. If the specified job variable cannot be accessed in the shared pubset environment, the SPACEOPT job will simply be started without monitoring.

2.2.7 Reorganization including open files

Open files can be included in reorganization runs with the following functions:

- Reorganizing of files (`/REDUCE-FILE-EXTENT-NUMBER`)

- Reorganizing of volumes, volume sets or pubsets (`/START-SPACEOPT-JOB`)

- Emptying of volumes (`/CLEAR-VOLUME`)

Open files are included in reorganization runs if this is requested explicitly in the relevant command by specifying the `PROCESS-OPEN-FILES=*YES` operand. By default, open files are excluded from reorganization runs.

When open files are included in reorganization runs the following aspects must be noted in particular:

- Files cached using USER-PFA are not included in the reorganization even if this is requested explicitly (see "DAB" in the section "Compatibility with other products" on page 28).

- Reorganization of open files can have an affect on the performance of applications which access these open files. Concurrent catalog accesses by SPACEOPT and the application (e.g. OPEN, secondary allocation) can result in an open file being removed from the reorganization so as not to impair the executability of the application. Consequently it is recommended that reorganizations with SPACEOPT which include open files should preferably be performed in off-peak hours.

- If open files were included for reorganization with SPACEOPT, unloading of the SPACEOPT subsystem is rejected until all applications which access the files involved are informed of the reorganization. This may take a long time if no access takes place.

- Files which are not opened and processed using DMS resources (OPEN and DMS access methods) may not simultaneously be reorganized with SPACEOPT. These files also include files which are processed using the SPCCNTRL program (in particular including the opening of a complete volume).
  As SPACEOPT can only ensure coordination of reorganization runs with files which are opened using DMS resources, whether or not this condition is observed is the responsibility of the system administration.

2.3   Compatibility with other products

General system behavior

SPACEOPT does not impair current file processing. Open files are not included in the
SPACEOPT processing. Files locked by SPACEOPT for the duration of an extent reorgani-
zation do not normally cause the rejection of simultaneous DMS actions, because access
conflicts (parallelism of SPACEOPT and DMS actions) are intercepted by internal protocols.
The DMS action is delayed and put in a system-internal wait state until the SPACEOPT
action is completed. The DMS action is then resumed normally.

A SPACEOPT job leads to an increase in the I/O load on the volumes, depending on the
degree of fragmentation. Furthermore a higher CMS load can be expected for the pubset
on account of increased catalog accesses. It is therefore recommended that volume
reorganization be carried out when data traffic is light. On the one hand this avoids
overloading the system, while on the other it improves the result of the reorganization, as
generally fewer (open) files have to be implicitly excluded. A further advantage is that the
reorganization takes a lot less time when done off-peak.

To prevent excessive fragmentation, you should reorganize your disk space regularly. The
interval between reorganizations generally depends on the application profile with regard
to the allocation/deallocation behavior on the respective pubsets and can vary, for example,
between daily, weekly, every two weeks etc.. Regular reorganizations mean reduced
runtime for each one, and a lower average number of file extents.

In order to remove an individual volume from a pubset or volume set, the specified volume
must be completely empty. The `/CLEAR-VOLUME` command is used to start a SPACEOPT
job that completely clears the contents of a volume. During processing, the affected pubset
or volume set can remain operational, in other words, you can continue to process the other
volumes of the pubset or volume.

DAB

From DAB V8.0 on ADM-PFA caching is also permitted when reorganizing with SPACEOPT: in the event of a reorganization SPACEOPT informs DAB about the moving of files and extents so that DAB can keep the administrative data of the buffered files consistent. This means that caching of the volumes or files involved can be continued without interruption.

In the event of user PFA caching the files concerned are buffered during processing (i.e. from OPEN to CLOSE). If open files are to be explicitly included in a reorganization with SPACEOPT, the files buffered with user PFA are not processed.

For information on DAB, see the "DAB" manual [6]; for information on "USER-PFA caching", see the "Introductory Guide to Systems Support" [5]).

Shared Pubset

In a shared pubset environment (SPVS environment), it is possible to launch SPACEOPT commands on any computer, i.e. both on a master computer and on a slave computer.

The processing of the commands /SHOW-FREE-ISAM-SPACE and /SHOW-SPACEOPT-SPACE-ALLOCATION is always carried out on the computer from which they were launched.

The following applies when processing the /REDUCE-FILE-EXTENT-NUMBER, /START-SPACEOPT-JOB, /PURGE-SPACEOPT-WORK-FILES, /CANCEL-SPACEOPT-JOB, /CLEAR-VOLUME or /SHOW-SPACEOPT-JOB-STATUS command:

● When the command is entered on a slave computer of a shared pubset environment, it is forwarded to the master computer and then processed there.

● Open files which are to be included in reorganization may only be open on the master computer, otherwise execution of the command is rejected with the message SOP0051.

Export pubset

If a large degree of volume fragmentation exists, SPACEOPT jobs may need a relatively long time to carry out their volume reorganization tasks. Thus when exporting a pubset, the system terminates all SPACEOPT jobs that have been started to reorganize or delete volumes as quickly as possible; this refers to volumes that belong to the pubset that is to be exported. The level of reorganization that has been achieved by this point in time will remain.

Concurrent Copy (CCOPY)

Once a CCOPY session has been initiated, the individual extents of the extent list must not change for files which are involved in the session. All that is permitted is expansion of the extent list by adding new extents, or deletion of the entire extent list. Changes to the contents, as made by SPACEOPT, might lead to the wrong data being saved.

For this reason, all files involved in a CCOPY session are implicitly excluded from the reorganization by SPACEOPT. This eliminates the risk of the wrong data being saved.

3 Assessing the volume status

You can find out the allocation and fragmentation status of a volume using the /SHOW-
SPACEOPT-SPACE-ALLOCATION command. To help you evaluate the information output by
this command with regard to the current state of the volume, there follows a brief expla-
nation of key terms from the field of storage space management and a description of the
allocation strategy in BS2000.

3.1 General information on the allocation strategy in BS2000

This section essentially provides an overview of the allocation strategy. The terms are
explained in the glossary on page 103.
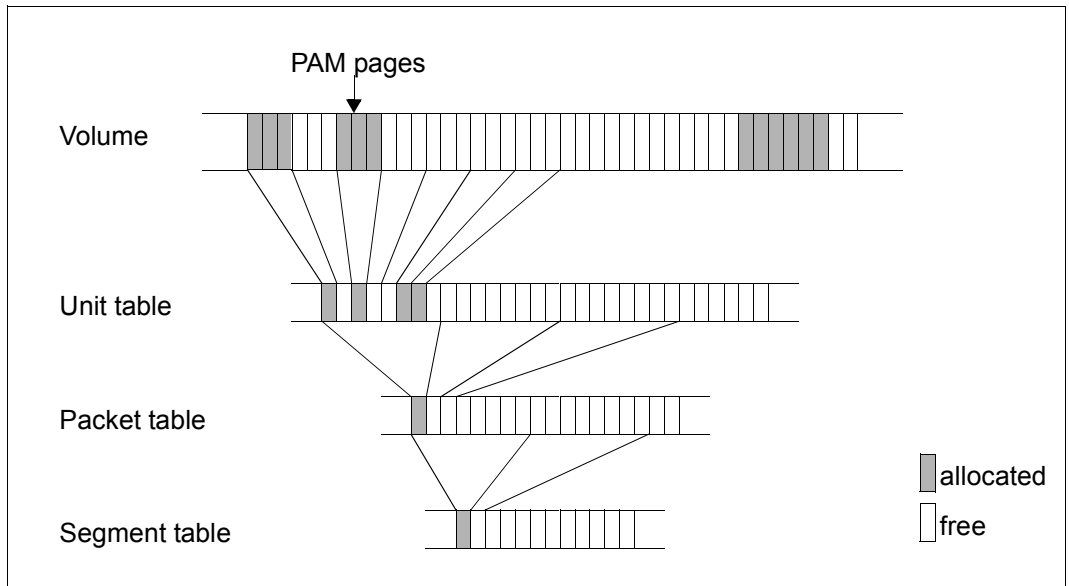
Figure 3: Administrative units of storage space management

Figure 3 shows the relationships between the individual administrative units.

A volume consists of a number of PAM pages. In figure 3, three PAM pages form an allocation unit in the unit table. Eight contiguous allocation units form a packet in the packet table. Eight contiguous packets in turn form a segment in the segment table.
A packet or segment is considered free when all allocation units it contains are free.

Storage space allocation strategy

The most important aims of storage space allocation are to keep the number of extents of a file as low as possible and to utilize the space on all volumes of a pubset or volume set as evenly as possible.

How the allocation turns out depends on many different factors, including the number of PAM pages requested by the user, the volume configuration and the allocation status of the volumes. The requested size (number of PAM pages) is converted into allocation units and compared with the packet size and segment size. In the majority of cases the storage space is selected according to the procedure described below. But in borderline situations other strategies are also employed.

When an existing file is being extended, SPACEOPT first tries to allocate the space directly after the last extent of the file to the file, i.e. to create a seamless connection on the most recently allocated disk.

Procedure for storage space allocation on a volume:
(R below is the requested size in allocation units)

- *Request greater than 64 allocation units:*
  Searches for a series of contiguous segments to match the requested size

- *Request between 8 and 64 allocation units:*
  Searches for a segment with exactly $\frac{R}{8}$ (rounded up, integer) contiguous packets

- *Request = 8 allocation units:*
  Searches for the first free packet in the packet table

- *Request smaller than 8 allocation units:*
  Searches for exactly R contiguous allocation units which do not belong to a free packet (i.e. one in which no allocation units are occupied)

If the request cannot be fully met according to the above rules, it will be divided up.

3.2 Determining the volume status

Systems support staff can get an overview of the allocation and fragmentation status of individual volumes using the /SHOW-SPACEOPT-SPACE-ALLOCATION command. This information, which can be provided in various levels of detail, helps systems support to determine whether a reorganization is necessary.

A distinction is made between evaluated output and non-evaluated output:

Evaluated output

```
/SHOW-SPACEOPT-SPACE-ALLOCATION INFORMATION=*SUMMARY    or
/SHOW-SPACEOPT-SPACE-ALLOCATION INFORMATION=*FREE-ALLOC-UNITS
```

In the evaluated output, the information on the free storage areas is output from the perspective of the BS2000 Allocator component (see page 31). Free areas which extend beyond segment and packet limits are split up such that the parts either form whole packets/segments or are smaller than one packet/segment and then each lie completely within these units. This basically corresponds to how free storage space is considered in allocation processes.

Non-evaluated output

```
/SHOW-SPACEOPT-SPACE-ALLOCATION INFORMATION=*FREE-PAGES
```

The free areas are output as they are exist on the volume, i.e. without regard for the Allocator administrative units packet or segment.

Detailed output

In the detailed output, the position and size of the individual free areas on a volume are sorted according to size. Evaluated and non-evaluated output can be distinguished.
The different output formats can be seen in the following section from a volume allocation, in which as of PHP 2275 the next 39 PAM pages are not allocated:
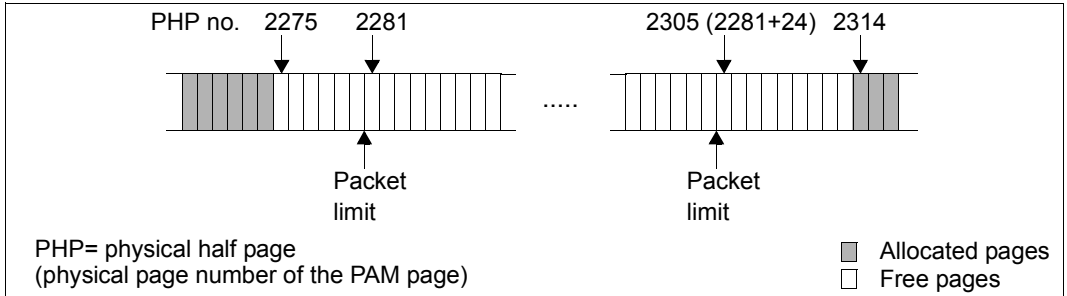
Figure 4: Section from a volume allocation

Non-evaluated detailed output

```
/SHOW−SPACEOPT−SPACE−ALLOCATION ...,INFORMATION=*FREE−PAGES
```

```
%VOLUME ! PAM−PAGES !  PHP−FROM !    PHP−TO
%−−−−−−−+−−−−−−−−−−−+−−−−−−−−−−−+−−−−−−−−−−−
%ABCD.1        39       2275        2313
```

As of PHP 2275 there is a contiguous area of 39 PAM pages which is currently not occupied by any file.

Evaluated detailed output

```
/SHOW−SPACEOPT−SPACE−ALLOCATION ...,INFORMATION=*FREE−ALLOC−UNITS
```

```
%VOLUME ! PAM−PAGES !  PHP−FROM !    PHP−TO ! ALLOC−SIZE ! ALLOC−UNIT
%−−−−−−−+−−−−−−−−−−−+−−−−−−−−−−−+−−−−−−−−−−−+−−−−−−−−−−−+−−−−−−−−−−−
%ABCD.1        24       2281        2304           1    PACKET
%ABCD.1         9       2305        2313           3    UNIT
%ABCD.1         6       2275        2280           2    UNIT
```

The free areas are output according to size. The largest area begins at PHP 2281 - with a contiguous free space of one packet (24 PAM pages). There is a small area as of PHP 2305 with 3 allocation units (9 PAM pages), and finally the smallest area comprises 2 allocation units (6 PAM pages) and begins at PHP 2275.

Advantage of evaluated output

If in the above example you only consider the non-evaluated output, you might reasonably conclude that there is room for an allocation of, say, 32 pages as of PHP 2275. But the evaluated output, by taking into account the cited procedure during space allocation, makes it clear that the desired allocation will not be completely accommodated in this location, as an area of 2 packets will be sought for it.
(32 : 3 = 10.66 ≈ 11 allocation units; 11 : 8 = 1.375 ≈ 2 packets)

SUMMARY output

A summary of the allocation status of a volume can be output via `/SHOW-SPACEOPT-SPACE-ALLOCATION ...,INFORMATION=*SUMMARY`. In this summary the free areas are assigned to certain categories according to their size. The information output shows how many free areas there currently are within a category. With regard to the view of the free areas, the evaluated output is always used here. The following categories are displayed:

1. UNIT 1..7
   Summary of the free areas with a size of 1 to 7 allocation units. If you take, say, an allocation unit size of 3 PAM pages as the basis, the number of free areas with a size of up to 21 PAM pages is displayed.

2. PACK 1..7
   Summary of the free areas with a size of 1 to 7 packets; i.e. with an allocation unit size of 3 PAM pages, the number of free areas with a size of 24 to 168 PAM pages is displayed.

3. SEGM 1..63
   Summary of free areas with a size of 1 to 63 segments. With an allocation unit size of 3 PAM pages, the number of free areas with a size of 192 to 12,096 PAM pages is displayed.

4. SEGM 64..4095
   Summary of free areas with a size of 64 to 4095 segments; i.e. with an allocation unit size of 3 PAM pages, the number of free areas with a size of 12,288 to 786,240 PAM pages is displayed.

5. SEGM 4096..
   Summary of free areas with a size of 4096 segments or more. With an allocation unit size of 3 PAM pages, the number of free areas with a size of 786,432 PAM pages or more is displayed.

The table below shows the sizes of the individual categories in PAM pages, depending on the allocation unit.

Category	AU = 3	AU = 4	AU = 32
UNIT 1..7	3 - 21	4 - 28	32 - 224
PACK 1..7	24 - 168	32 - 224	256 - 1,792
SEGM 1..63	192 - 12,096	256 - 16,128	2,048 - 129,024
SEGM 64..4096	12,288 - 786,240	16,384 - 1,048,320	131,072 - 8,386,560
SEGM 4096..	> 786,432	> 1,048,576	> 8,388,608

In addition, three specific reference values are output for each volume, which provide further information on the allocation situation.

– `LARGEST-AREA`
  Outputs the size in PAM pages of the largest contiguous free segment area on the volume.

– `FREE PAGES`
  Outputs the total of all free areas on the volume in PAM pages.

– `TOTAL-PAGES`
  Outputs the total capacity of the volume in PAM pages

Example

```
/SHOW-SPACEOPT-SPACE-ALLOCATION OBJECT=*PUBSET(PVSX),INFORMATION=*SUMMARY
```

```
%VOLUME! NUMBER-OF-CONTIGUOUS-FREE-SPACE-AREAS!  LARGEST !    FREE !   TOTAL
%       !  UNIT !  PACK !  SEGM !  SEGM!  SEGM!     AREA !  PAGES !   PAGES
%       ! 1..7 ! 1..7 ! 1..63 !..4095!4096..!          !        !
%-------+-------+-------+-------+------+------+----------+--------+----------
%PVSX.0    491     427     46      1      0     108480    161661    225657
%PVSX.1    509     473     20      1      0     114048    155043    225660
```

3.3   **Usage scenarios**

You can check the success of a SPACEOPT job for storage space optimization by analyzing the output from the /SHOW−SPACEOPT−SPACE−ALLOCATION command. The following example illustrates how the output can be evaluated:

1. /SHOW−SPACEOPT−SPACE−ALLOCATION OBJECT=*PUBSET(PUBSET=PVSX)

```
%VOLUME! NUMBER-OF-CONTIGUOUS-FREE-SPACE-AREAS!  LARGEST !    FREE !   TOTAL
%       !  UNIT ! PACK ! SEGM ! SEGM! SEGM!       AREA !   PAGES !   PAGES
%       !  1..7 ! 1..7 ! 1..63 !..4095!4096..!         !         !
%-------+-------+-------+-------+------+------+----------+---------+----------
%PVSX.0     491     427     46      1      0    108480    161661    225657
%PVSX.1     509     473     20      1      0    114048    155043    225660
```

The current allocation status of the pubset PVSX is determined via the summary display. From the output you can see that the pubset consists of 2 volumes PVSX.0 and PVSX.1. Both volumes show a large number of free small areas, which indicates a high degree of fragmentation.

2. /START−SPACEOPT−JOB OBJECT=*PUBSET(PUBSET=PVSX)

```
%  SOP0001 Task for Command START-SPACEOPT-JOB initiated and started
...
...
```

Space optimization is initiated for the pubset PVSX.

3. /SHOW−SPACEOPT−SPACE−ALLOCATION OBJECT=*PUBSET(PUBSET=PVSX)

```
%VOLUME! NUMBER-OF-CONTIGUOUS-FREE-SPACE-AREAS!  LARGEST !    FREE !   TOTAL
%       !  UNIT ! PACK ! SEGM ! SEGM! SEGM!       AREA !   PAGES !   PAGES
%       !  1..7 ! 1..7 ! 1..63 !..4095!4096..!         !         !
%-------+-------+-------+-------+------+------+----------+---------+----------
%PVSX.0       3       4      1      1      0    151296    161661    225657
%PVSX.1       3       4      0      1      0    154752    155043    225660
```

Once the SPACEOPT job is complete, the current allocation status of the pubset is determined again. Notice that the total number of free areas is now minimal, which indicates optimum reorganization of the volumes.

4. /SHOW-SPACEOPT-SPACE-ALLOCATION OBJECT=*PUBSET(PUBSET=PVSX),
INFORMATION=*FREE-ALLOC-UNITS

```
%VOLUME ! PAM-PAGES !  PHP-FROM !   PHP-TO ! ALLOC-SIZE ! ALLOC-UNIT
%-------+-----------+-----------+----------+------------+-----------
%PVSX.0     151296       74305     225600          788   SEGMENT
%PVSX.0       9984       45505      55488           52   SEGMENT
%PVSX.0        120       55489      55608            5   PACKET
%PVSX.0         96       74209      74304            4   PACKET
%PVSX.0         72       45433      45504            3   PACKET
%PVSX.0         72      225601     225672            3   PACKET
%PVSX.0          9       45424      45432            3   UNIT
%PVSX.0          9       55609      55617            3   UNIT
%PVSX.0          3      225673     225675            1   UNIT
%PVSX.1     154752       70849     225600          806   SEGMENT
%PVSX.1         96       51745      51840            4   PACKET
%PVSX.1         72       51841      51912            3   PACKET
%PVSX.1         72      225601     225672            3   PACKET
%PVSX.1         24       70825      70848            1   PACKET
%PVSX.1         21       51724      51744            7   UNIT
%PVSX.1          3       51913      51915            1   UNIT
%PVSX.1          3      225673     225675            1   UNIT
```

The current allocation status is determined via the evaluated detailed view. Both volumes reveal one very large area of 788 and 806 contiguous free segments respectively.

5. /SHOW-SPACEOPT-SPACE-ALLOCATION OBJECT=*PUBSET(PUBSET=PVSX),
INFORMATION=*FREE-PAGES

```
%VOLUME ! PAM-PAGES !  PHP-FROM !   PHP-TO
%-------+-----------+-----------+-----------
%PVSX.0     151467       74209     225675
%PVSX.0      10194       45424      55617
%PVSX.1     154851       70825     225675
%PVSX.1        192       51724      51915
```

Another variant is to determine the current allocation status via the non-evaluated detailed view. In this case, the total free space is concentrated in two large contiguous areas for each volume.

Process example

The pubset SBZ2 is to be reorganized with SPACEOPT.

```
(IN)  /SHOW-SPACEOPT-SPACE-ALLOCATION OBJECT=*PUBSET(PUBSET=SBZ2) ——— (1)
(OUT)
```

```
%VOLUME! NUMBER-OF-CONTIGUOUS-FREE-SPACE-AREAS! LARGEST !    FREE !    TOTAL
%      !  UNIT !  PACK ! SEGM !  SEGM! SEGM!    AREA !   PAGES !    PAGES
%      !  1..7 !  1..7 ! 1..63 !..4095!4096..!        !         !
%------+-------+-------+------+-----+-----+---------+---------+---------
%SBZ2.0         42      54      9      1     0    230400   239394   1025988
%SBZ2.1         34      56      8      2     0    165504   223761   1025991
```

```
(IN)  /START-SPACEOPT-JOB OBJECT=*PUBSET(PUBSET=SBZ2) ——————————————— (2)
(OUT)
```

```
%  SOP0035 Subsystem User-Id SYSSOPT does not exist on Pubset SBZ2
```

```
(IN)  /ADD-USER USER-IDENTIFICATION=SYSSOPT,- ——————————————————————— (3)
( )    PROTECTION-ATTRIBUTE=*PARAMETERS,PUBSET=SBZ2,-
( )    DEFAULT-PUBSET=SBZ2,PHYSICAL-ALLOCATION=*ALLOWED,-
( )    ACCOUNT-ATTRIBUTES=*PARAMETERS(ACCOUNT=1)
```

```
(IN)  /START-SPACEOPT-JOB OBJECT=*PUBSET(PUBSET=SBZ2,TASK-LIMIT=1) ——— (4)
(OUT)
```

```
%  SOP0001 Task for Command START-SPACEOPT-JOB initiated and started
```

```
(IN)  /SHOW-SPACEOPT-JOB-STATUS OBJECT=*ALL-JOBS ———————————————————— (5)
(OUT)
```

```
%VOLUME !PUB-/ !  TSN  ! STA  ! CPU-USED  ! TASK- !   START-TIME    ! MOVED
%       !VOLSET!       !      !           ! LIMIT !                 ! EXTENTS
%-------+------+-------+------+-----------+-------+-----------------+--------
%SBZ2.0   SBZ2   XAAX   RUN       1.9802     1   2003-03-12.094043      56
%SBZ2.1   SBZ2   *NONE  WAIT      0.0000     1        *NONE            0
```

```
(IN)  /SHOW-SPACEOPT-JOB-STATUS OBJECT=*ALL-JOBS ———————————————————— (6)
(OUT)
```

```
%  SOP0037 For specified object there is no existing task
```

```
(IN)  /SHOW-SPACEOPT-SPACE-ALLOCATION OBJECT=*PUBSET(PUBSET=SBZ2) ————  (7)
(OUT)
%VOLUME! NUMBER-OF-CONTIGUOUS-FREE-SPACE-AREAS! LARGEST !   FREE  !  TOTAL
%      !  UNIT ! PACK !  SEGM !  SEGM!  SEGM!    AREA !  PAGES  !  PAGES
%      !  1..7 ! 1..7 ! 1..63 !..4095!4096..!        !        !
%------+-------+-------+-------+------+------+----------+----------+----------
%SBZ2.0     10     11      4      1      0     228672   239394   1025988
%SBZ2.1     15     16      6      1      0     215616   223761   1025991
```

(1)   Output of the current allocation status of the pubset SBZ2. The pubset comprises the volumes SBZ2.0 and SBZ2.1. Both volumes show a large number of free small areas, which indicates a high degree of fragmentation.

(2)   A SPACEOPT job is started for the pubset SBZ2. Because the SYSSOPT ID is not initialized on this pubset, the message SOP0035 is output.

(3)   The SYSSOPT ID is initialized on the pubset SBZ2 by means of the /ADD-USER command.

(4)   A SPACEOPT job is started for the pubset SBZ2 with specification of a task limit.

(5)   A status request via the command /SHOW-SPACEOPT-JOB-STATUS OBJECT=*ALL-JOBS shows all currently active SPACEOPT jobs. The number of extents relocated by the reorganization so far is shown for each volume.

(6)   Another status request some time later shows that there are no more SPACEOPT jobs.

(7)   A new output of the allocation status for the pubset SBZ2 shows the space optimization executed in comparison with the output under point (1). The number of free small areas has been greatly reduced, which indicates optimum reorganization of the volumes.
        This information and other job-specific outputs are also sent to the console and the CONSLOG file.

3.4 Console output

To allow you to check the asynchronous SPACEOPT jobs, the allocation status of the
processed volumes is displayed via the message SOP0004 at the start and successful
completion of each job. The information displayed confirms the summary output of the
/SHOW-SPACEOPT-SPACE-ALLOCATION command.

In addition, the total number of free areas from a non-evaluated perspective is output. By
comparing this figure before and after the reorganization, you can make an initial
assessment of how the volume status has improved.

Example

Input from system administrator terminal:

/START-SPACEOPT-JOB OBJECT=*PUBLIC-DISK(PVSX.1)

Console output:

```
...
%XAA6-000.145657  %  SOP0002 'START-SPACEOPT-JOB' for volume PVSX.1 started
%XAA6-000.145657  %  SOP0004 Space summary for PVSX.1: free areas of t1=509,
t2=473, t3=20, t4=1, t5=0, largest area = 114048HPs, free space = 155043 HPs,
total space = 225660 HPs, free areas = 463
...
%XAA6-000.145701  %  SOP0004 Space summary for PVSX.1: free areas of t1=3, t2=4,
t3=0, t4=1, t5=0, largest area = 154752 HPs, free space = 155043 HPs, total
space = 225660 HPs, free areas = 2
%XAA6-000.145701  %  SOP0003 Job for volume PVSX.1 terminated
```

The inserts for the keywords t1,.. t5, largest area, free space and total space of
the message SOP0004 correspond to the values of the summary output of the /SHOW-
SPACEOPT-SPACE-ALLOCATION command. The value for free areas specifies from a
non-evaluated perspective how many contiguous areas make up the total free space of a
volume. In this example the SPACEOPT job causes a major reduction in the fragmentation
from 463 to 2 areas.

4 Adapting the size of volumes

In a storage system (e.g. ETERNUS DX) the BS2000 disks are emulated. Here each BS2000 volume is mapped onto a logical volume. The service engineer determines both the size and the allocation of these logical volumes to physical volumes when the hardware of the disk subsystem is configured.
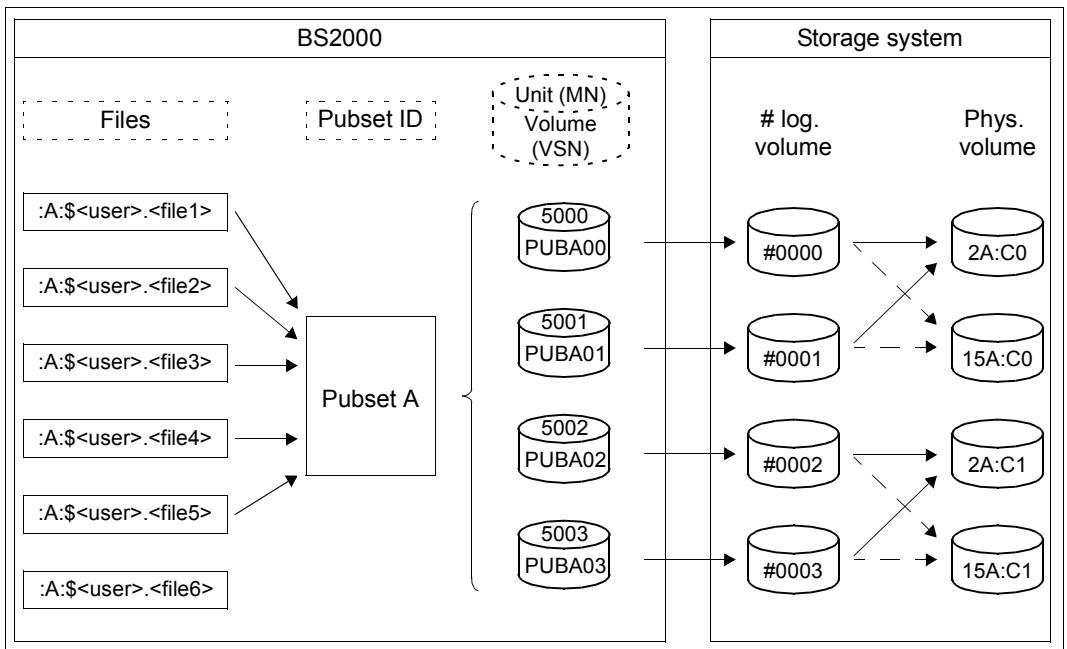

Figure 5: Allocation of BS2000 volumes to logical and physical volumes of a disk subsystem

Ideally the size of a BS2000 volume is at most the same as that of the allocated logical volume. However, owing to the emulated disk type (CKD or FBA disk architecture) and the disk formatting, "normal" disk wastage can occur, i.e. the capacity of the BS2000 volume is a little less than that of the logical volume. The table below shows how the normal disk wastage influences the size of the BS2000 volume:

Device type of the emulated disk	Formatting	Net capacity of the BS2000 volume (in % of the size of the logical volume)
D3490-x (CKD)	2K	68
	NK2	76
	NK4	86
D3435 (FBA)	2K	81
	NK2	100
	NK4	Currently not supported

The net capacities shown in the table relate to an 18-Gbyte disk. Depending on the disk size slight deviations are possible. However, the general rule is:
– The normal disk wastage is lower on FBA disks than on CKD disks.
– During formatting the NK format generates less wastage.

In addition to this normal disk wastage, the size of a BS2000 volume can be further reduced by additional disk wastage which can, for example, occur after a volume with a lower capacity has been restored with FDDRL or after disk migration.

Size adaption with ADAPT-PUBSET-SIZE

As of Version 2.0C this additional disk wastage without reinitialization and the associated backup and restoration of the user data can be utilized for volumes of a pubset by means of the SPACEOPT command /ADAPT-PUBSET-SIZE.

This function is available for all supported disk types supported. The command performs no action for a disk of a disk type which is not supported but displays this with the relevant message and, if required, continues processing with the next disk.

With regard to the number of volumes to be processed, the command has the following call options:

● With a single-feature pubset (SF pubset) the size of all disks (volumes) of the pubset or of individual disks can be adapted.

● With a system-managed pubset (SM pubset) the size of all disks (volumes), the disks of specific volume sets or individual disks can be adapted.

Prerequisites

Size adaption of volumes is possible under the following conditions:

● The pubset involved is not imported.

● All disks to be adapted are attached (i.e. they are in the ATTACHED status).

● Depending on the pubset type the following volumes may be needed:
    – for SF pubsets the pubres,
    – for SM pubsets all disks of the control volume set and the volres of those volume sets to which the volumes to be adapted belong.

Termination of size adaption

After the /ADAPT-PUBSET-SIZE command has been called the F5 labels of the processed volumes are moved. Final termination of size adaption is implemented with F5 label restoration when the next import takes place. Restoration takes place automatically after a positive response has been received for the message DMS038C.

Disk capacity > 32 GB

When the size is adapted a disk capacity of 32 GB can only be exceeded if the associated pubset has the attribute LARGE-VOLUMES=*ALLOWED. Otherwise the size adaption is limited to 32 GB (with rounding in line with the allocation unit).

Applications

Size adaption should be used if it is possible that additional disk wastage exists. This need not be known when you execute the /ADAPT-PUBSET-SIZE command as the command first determines the used capacity and the maximum capacity of the associated logical volume when it processes a volume and only initiates size adaption if this is required.

In storage systems the BS2000 host component supplies, among other things, information on the used and maximum capacity of the logical volume and can thus provide information on the additional disk wastage (see the /SHOW-STORAGE-DEVICE-CONFIG command in the "SHC-OSD" manual [9]).

Size adaption can be required after the following actions:

● Restoration of public volumes with FDDRL
When a volume is restored with FDDRL the capacity of the volume is always taken over, even if the disk to which the restoration takes place permits a greater capacity. Wastage that occurs in this way can be removed after restoration through size adaption.

●   Disk migration with DRV
     The DRV migration function copies the data inventory from disks of various types (e.g.
     CKD disks of the type D3490-xx or FBA disks of the type D34211-xx) to FBA disks of
     the type D3435 emulated in a storage system. As the source disk is copied 1:1, the
     target disk (BS2000 volume) evinces the same capacity data in the storage system. If
     the maximum capacity of the logical volume is greater, unused space may result. Size
     adaption means that the higher capacity can also be made available for the BS2000
     volumes.

5 Installing, starting, terminating, managing

This chapter describes the installation of the SPACEOPT V7.0 subsystem, and provides additional notes on the operation and management of SPACEOPT.

– Components and installation
– Starting SPACEOPT
– Terminating SPACEOPT
– Trace diagnostic tool
– Logging of extent movements
– SPACEOPT accounting record

5.1 Supplied components and installation

SPACEOPT is supplied as a subsystem. The subsystem SPACEOPT V7.0 runs only under BS2000 OSD/BC V10.0.

Supplied components

SPACEOPT is normally installed via IMON. The relevant file and volume attributes are listed in the SOLIS2 delivery note.
The following supplied components are included in the installation of the SPACEOPT V7.0 subsystem:

File name	Explanation
SYSFGM.SPACEOPT.070.D	German release notice
SYSFGM.SPACEOPT.070.E	English release notice
SKMLNK.SPACEOPT.070	Load library for SQ systems
SYSLNK.SPACEOPT.070	Load library for S systems
SYSMES.SPACEOPT.070	Message file
SYSREP.SPACEOPT.070	REP file
SYSSDF.SPACEOPT.070	SDF syntax file
SYSSSC.SPACEOPT.070	Subsystem catalog
SYSSII.SPACEOPT.070	Information file for the installation with IMON

System administrator tasks

SYSSOPT user ID

The SYSSOPT user ID is necessary for the operation of SPACEOPT. Under this user ID, SPACEOPT creates pubset-specific auxiliary and work files.

The SYSSOPT user ID must be entered in the user catalogs of all pubsets that are to be processed using SPACEOPT. The entry in the user catalog of a pubset can be made using the following command (see the "Commands" manual [1]):

```
/ADD-USERUSER-ID=SYSSOPT,PUBSET=...,PROT-ATTR=*PAR(LOGON-PASS=...),
ACCOUNT-ATTR=*PAR(ACCOUNT=...)
```

It is not necessary to specify further operands (the default values can be used).

If the SYSSOPT user ID does not exist in the user catalog of the pubset, the SPACEOPT jobs will be terminated with the return code SOP0035.

Installing the subsystem

SPACEOPT is a subsystem of BS2000 and is managed by DSSM. To be loaded by DSSM it must be declared in the subsystem catalog. The subsystem declarations required for this can be found in the SYSSSC.SPACEOPT.070 file.

The subsystem declarations must be entered in the subsystem catalog with the SSCM program. The /START-SUBSYSTEM command activates the SPACEOPT subsystem and thus also the associated message file, syntax file and REP file.

For information on the subsystem catalog and SSCM, see the "Subsystem Management (DSSM/SSCM)" manual [2].

The messages and help texts can be found in the SYSMES.SPACEOPT.070 file.

5.2 Starting SPACEOPT

Following installation the SPACEOPT subsystem can be loaded and started using the following command:

```
/START-SUBSYSTEM SUBSYSTEM-NAME=SPACEOPT
```

The following applies to the other operands of the command:

–   VERSION = *STD / <version>
    an explicitly specified version (<version>) must match the version defined in the subsystem catalog

–   Specifications for SUBSYSTEM-PARAMETER are ignored

–   The specification RESET=*YES causes the command to be rejected

–   SYNCHRONOUS = *NO / *YES
    Both specifications are allowed

–   For VERSION-PARALLELISM only *NONE is allowed; other specifications cause the command to be rejected

The command is described in the "Subsystem Management" manual [2].

5.3 Terminating SPACEOPT

The SPACEOPT subsystem is terminated and unloaded[1] with the following command:

```
/STOP-SUBSYSTEM SUBSYSTEM-NAME=SPACEOPT
```

The following applies to the other operands of the command:

–   VERSION = *STD / <version>
    an explicitly specified version (<version>) must match the version defined in the subsystem catalog

–   Specifications for SUBSYSTEM-PARAMETER are ignored

–   FORCED = *NO / *YES
    Both specifications are allowed

–   SYNCHRONOUS = *NO / *YES
    Both specifications are allowed

The command is described in the "Subsystem Management" manual [2].

---

[1] If open files were included in a reorganization using SPACEOPT, unloading of the SPACEOPT subsystem is rejected until all applications which access the files concerned have been informed of the reorganization.

`/STOP-SUBSYSTEM` implicitly terminates all SPACEOPT jobs. DSSM does not complete the unloading until all SPACEOPT subtasks have finished working. You can find out which jobs are still active using the command

```
/SHOW-SUBSYSTEM-STATUS SUBSYSTEM-NAME=SPACEOPT
```

or

```
/SHOW-SPACEOPT-JOB-STATUS OBJECT=*ALL-JOBS
```

Once the subsystem has been unloaded, the SPACEOPT commands are no longer available.

5.4 Diagnostics with trace

If problems occur when you are using the SPACEOPT product, you can activate a trace for diagnostic purposes, which will log the most important steps of the data reorganization. The trace files should be made available to BS2000 diagnostics.

Activating and deactivating the trace

The trace is activated and deactivated using the commands of the Trace Manager (see the "Diagnostics Handbook" [4])

```
/START-TRACE TRACE-ID=*ALL(SUBSYSTEM-NAME=SPACEOPT)
```
or
```
/STOP-TRACE TRACE-ID=*ALL(SUBSYSTEM-NAME=SPACEOPT)
```

Trace files

For each volume for which a SPACEOPT job is executed, once the trace has been activated a file is created on the home pubset under the TSOS user ID with the following name:

```
:<catid>:$TSOS.SYSTRC.SPACEOPT.<vsn>.yyyy-mm-dd.hhmmss
```

5.5 Logging of extent movements

When processing the SPACEOPT commands /START-SPACEOPT-JOB, /CLEAR-VOLUME and /REDUCE-FILE-EXTENT-NUMBER, SPACEOPT usually moves file extents.

In order to ensure that these movements can be traced accurately, the security officer can specify that when extents are moved, the affected files or volumes are logged.

Prerequisite for the creation of the log is the use of the software product SECOS as of version V4.0A (see the "SECOS" manual [7]). The recording of loggable events is carried out using the subsystem SATCP (SAT = **S**ecurity **A**udit **T**rail). SATLOG files created using SATCP are then evaluated using the SATUP utility (under the SYSAUDIT user ID).

File accesses by SPACEOPT can be logged for the object "FILE" with the events "FSO" or "FME" (default setting: no logging);

– **FSO:** Select object for reorganization (**f**ile - **s**elect **o**bject)
   This event logs user requests, for example, the jobs issued to SPACEOPT. Depending on the object that has been selected, the following items of information may be logged.
   catid   Catalog ID of the selected pubset
   filename   File name of the selected file
   vsn1   The VSN of the selected volume

– **FME:** Move file extents (**f**ile-**m**ove **e**xtents)
   This event is used to log the results of job processing. The following items of information are logged:
   filename   File name of the processed file
   sopact   Short form of a SPACEOPT command (CLEAR-VOL, REDUCE-EXT or
               START-JOB)
   vsn1   Optional, the VSN of the processed volume

Whether there is a single record or several associated records with the event FME for a record with the event FSO will depend on whether, during processing, files have been moved or extents have moved. A record with the event FME is only written if a file or at least one extent of a file has been moved. By contrast, for each record with an FME event, a record will always exist with an FSO event .

An exact description of the loggable events FSO and FME can be found in the "SECOS" manual [8].

The following section contains a range of typical application examples. Since these are only designed to show the type of information that is logged, only extracts from the logs are given. (The information is not shown in the format output by the SATUT evaluation program.)

Example 1: Reducing the file extents of a file

```
/REDUCE-FILE-EXTENT-NUMBER FILE-NAME=FILE
```

For the specified file (default catalog ID is PVSX) a selection record FSO is logged and when reduction of file extents is carried out a results log FME is logged:

```
FSO: filename=:PVSX:$USER.FILE
FME: filename=:PVSX:$USER.FILE, sopact=REDUCE-EXT
```

Example 2: Reducing the file extents of several files

```
/REDUCE-FILE-EXTENT-NUMBER FILE-NAME=*FROM-FILE(LIST-FILE-NAME=FLIST)
```

The file name list FLIST contains the path names of 5 files. For each processed file a selection record FSO is logged. If the number of file extents of a file is reduced, an additional FME results record is created (in this case, for $FILE_1$, $FILE_2$ and $FILE_5$ only):

```
FSO: filename=:PVSX:$USER.FILE₁
FME: filename=:PVSX:$USER.FILE₁, sopact=REDUCE-EXT
FSO: filename=:PVSX:$USER.FILE₂
FME: filename=:PVSX:$USER.FILE₂, sopact=REDUCE-EXT
FSO: filename=:PVSX:$USER.FILE₃
FSO: filename=:PVSX:$USER.FILE₄
FSO: filename=:PVSX:$USER.FILE₅
FME: filename=:PVSX:$USER.FILE₅, sopact=REDUCE-EXT
```

Example 3: Reorganizing a volume

```
/START-SPACEOPT-JOB OBJECT=*PUBLIC-DISK(VOL=PVSX.0)
```

For the specified volume, an FSO selection record is logged and for each file of the volume for which extents are moved, an FME results record is also logged (in this case, extent movements for n files):

```
FSO: vsn1=PVSX.0
FME: filename=:PVSX:$USER.FILE₁, vsn1=PVSX.0, sopact=START-JOB
FME: filename=:PVSX:$USER.FILE₂, vsn1=PVSX.0, sopact=START-JOB
 .
 .
 .
FME: filename=:PVSX:$USER.FILEₙ, vsn1=PVSX.0, sopact=START-JOB
```

Example 4: Reorganizing a pubset

```
/START-SPACEOPT-JOB OBJECT=*PUBSET(PUBSET=PVSX)
```

For the specified pubset, an FSO selection record is logged and for each file of the pubset for which extents are moved, an FME results record is also logged (in this case, n files with extent movements and pubset PVSX with 2 volumes):

```
FSO: catid=PVSX
FME: filename=:PVSX:$USER.FILE₁, vsn1=PVSX.0, sopact=START-JOB
FME: filename=:PVSX:$USER.FILE₂, vsn1=PVSX.0, sopact=START-JOB
.
.
.
FME: filename=:PVSX:$USER.FILEₙ, vsn1=PVSX.1, sopact=START-JOB
```

Example 5: Clearing a volume

```
/CLEAR-VOLUME VOLUME=PVSX.0
```

For the specified volume, an FSO selection record is logged and for each file of the volume that is moved, an FME results record is also logged (in this case, n movements):

```
FSO: vsn1=PVSX.0
FME: filename=:PVSX:$USER.FILE₁, vsn1=PVSX.0, sopact=CLEAR-VOL
FME: filename=:PVSX:$USER.FILE₂, vsn1=PVSX.0, sopact=CLEAR-VOL
.
.
.
FME: filename=:PVSX:$USER.FILEₙ, vsn1=PVSX.0, sopact=CLEAR-VOL
```

5.6   SPACEOPT accounting record

SPACEOPT creates accounting records when reorganizing files using /START-SPACEOPT-JOB and when clearing a volume using /CLEAR-VOLUME. When these commands arecalled, a system task is created asynchronously for each volume that is to be processed.

At the beginning and end of an asynchronously started system task a SPACEOPT accounting record is written. This contains primarily the "amount of CPU time used" and the "number of inputs/outputs".

By comparing these pairs of accounting records, it is possible to determine the amount of resources used per system task. The pairs of records differ in terms of the basic information contained in the record index ("A" for the start of the record and "B" for the end of the record). A record with the index "B" cannot exist without the corresponding index "A".
A record with the index "A" can exist without the corresponding index "B"; however this record must then be ignored.
The accounting is carried out for the user ID and the accounting number of the task issuing the command. If no accounting number is specified at the beginning of the task in the /SET-LOGON-PARAMETERS command, "ADMINSTR" is used as the accounting number.

Format of the SPACEOPT accounting record

Record description (20 bytes)

Field no.	Displacement		Length (bytes)	Format	Meaning
	hex.	dec.			
1	00	0	4	A	ID of the accounting record: "SOPA"
2	04	4	8	B2	Time stamp of the TOD system clock
3	0C	12	2	B	Length of the identification part X'1C' (see below)
4	0E	14	2	B	Length of the basic informaiton: X'24' (see below)
5	10	16	4	B	--- reserved ---

Identification part (28 bytes)

Field no.	Displacement		Length (bytes)	Format	Meaning
	hex.	dec.			
1	14	20	8	A	User ID
2	1C	28	8	A	Account number ("ADMINSTR")
3	24	36	4	A	Task sequence number (TSN) of the system task
4	28	40	8	A	Group name

Basic information (36 bytes)

Field no.	Displacement		Length (bytes)	Format	Meaning
	hex.	dec.			
1	30	48	8	B2	Task CPU time (TU and TPR)
2	38	56	4	B	Number of inputs/outputs
3	3C	60	19	A	Printable time stamp in the format yyyy-mm-dd hh-mm-ss
4	4F	79	1	A	Record index; possible values: – "A" at the beginning of the system task – "B" at the end of the system task
5	50	80	4	B	--- reserved ---

A SPACEOPT accounting record thus has a total length of 84 bytes; variable extension information is not available.

Explanation of the format

– A   alphanumeric value

– B   binary number

– B2   binary representation of the CPU time:
    – The first four bytes contain the seconds
    – The second four bytes contain the nanoseconds

Note regarding accounting for other SPACEOPT commands

For the SPACEOPT commands `/CANCEL-SPACEOPT-JOB`, `/PURGE-SPACEOPT-WORK-FILES`, `/REDUCE-FILE-EXTENT-NUMBER`, `/SHOW-FREE-ISAM-SPACE`, `/SHOW-SPACEOPT-JOB-STATUS`, and `/SHOW-SPACEOPT-SPACE-ALLOCATION` no specific accounting is carried out. The amount of resources used can, if required, be determined using the accounting record that is created at the end of a task. This accounting record (ID: "TASK") contains, as part of its basic information, specifications regarding the amount of CPU time used and the number of inputs/outputs carried out.
You should also bear in mind that these SPACEOPT commands, with the exception of `/PURGE-SPACEOPT-WORK-FILES`, are carried out synchronously in the task that issues the command. This means that the resources that are recorded by a task accounting record, are not necessarily just resources used by SPACEOPT but also resources used by other processes.

Recording the amount of resources used may be useful when, for example, reducing the number of file extents using the command `/REDUCE-FILE-EXTENT-NUMBER`, when a large number of file extents may need to be moved (as this may take some time).

6 Commands

The metasyntax and general command return codes are described in "Commands, Volume 1" [1].

Overview of commands

Command	Function
ADAPT-PUBSET-SIZE	Adapt volume size
CANCEL-SPACEOPT-JOB	Cancel SPACEOPT job
CLEAR-VOLUME	Completely clear a Volume
MODIFY-SPACEOPT-PARAMETER	Modify SPACEOPT parameter
PURGE-SPACEOPT-WORK-FILES	Purge SPACEOPT work files
REDUCE-FILE-EXTENT-NUMBER	Reduce the number of file extents
SHOW-FREE-ISAM-SPACE	Show the number of free pages of an ISAM file
SHOW-SPACEOPT-JOB-STATUS	Show information on SPACEOPT jobs
SHOW-SPACEOPT-SPACE-ALLOCATION	Show space allocation on volumes
START-SPACEOPT-JOB	Start SPACEOPT job

ADAPT-PUBSET-SIZE
Adapt volume size

Domain: STORAGE-MANAGEMENT

Privileges: TSOS, HSMS-ADMINISTRATION

Function

The `/ADAPT-PUBSET-SIZE` command is used in a storage system (e.g. Eternus DX) to adapt the size of the BS2000 disks of an SF or SM pubset to the size of the logical volume by which they are implemented. Such an adaption can, for example, be required after disk migration using DRV. See also the chapter "Adapting the size of volumes" on page 43.

The set of the volumes to be adapted can be defined using the following specifications:

– With a single-feature pubset (SF pubset) the size of all disks (volumes) of the pubset or individual disks can be adapted.
– With a system-managed pubset (SM pubset) the size of all disks (volumes), the disks of particular volume sets or individual disks can be adapted.

Size adaption of volumes is possible under the following conditions:

– The pubset concerned is not imported.
– All disks to be adapted are attached (`ATTACHED` status).
– In the case of an SM pubset the disks of the control volume set and the volres of the volume set to which the disks which are to be adapted belong must on all accounts be attached.
– In the case of an SF the pubres must on all accounts be attached.

The size adaption is terminated by the next import of the pubset with an F5 label restoration for the volumes concerned. The restoration is performed automatically after a positive acknowledgment of the message `DMS038C`.

During size adaption a disk capacity of 32 GB can be exceeeded only if the accociated pubset has the attribute `LARGE-VOLUMES=*ALLOWED`. Otherwise the size adaption is restricted to 32 GB (rounded according to the allocation unit).

This command processes all disk types supported. The command does nothing for a disk of a type which is not supported but indicates this with a corresponding message and, if required, continues processing with the next disk.

Format

ADAPT-PUBSET**-SIZE**

PUBSET = <cat-id 1..4>
,**PUB**SET**-TYPE** = <u>***SINGLE-FEATURE**</u> (...) / ***SYS**TEM-**MANAG**ED(...)
*SINGLE-FEATURE(...)
│ **VOL**UME = <u>***ALL**</u> / list-poss(255): <vsn>
*SYSTEM-**MANAG**ED(...)
│ **VOL**UME-**SET** = <u>***ALL**</u> / list-poss(255): <cat-id>(...)
│   <cat-id>(...)
│   │ **VOL**UME = <u>***ALL**</u> / list-poss(255): <vsn>

Operands

PUBSET = <cat-id>
ID of the pubset for which the size adaption is to take place.

PUBSET-TYPE = <u>*SINGLE-FEATURE</u>(...) / *SYSTEM-MANAGED(...)
Specifies whether the pubset is an SF or SM pubset.

PUBSET-TYPE = <u>*SINGLE-FEATURE</u>(...)
The pubset is an SF pubset. The pubres must be online.

   VOLUME = <u>*ALL</u> / list-poss(255): <vsn>
   Specifies the volumes for which a size adaption is to take place.

   VOLUME = <u>*ALL</u>
   The size adaption is to take place for all volumes of the pubset.

   VOLUME = list-poss(255): <vsn>
   The size adaption is to take place for the volumes of the pubset which are explicitly
   specified. All volumes specified must belong to the SF pubset.

PUBSET-TYPE = *SYSTEM-MANAGED(...)
The pubset is an SM pubset. To permit size adaption within an SM pubset the control
volume set and, for each volume set that is to be adapted, the volres must be online.

   VOLUME-SET = <u>*ALL</u> / list-poss(255): <cat-id>(...)
   Specifies the volume sets for which a size adaption is to take place.

   VOLUME-SET = <u>*ALL</u>
   The size adaption is to take place for all volume sets of the SM pubset.

VOLUME-SET = list-poss(255): <cat-id>(...)
The size adaption is to take place for the explicitly specified volume set of the SM pubset. Multiple volume sets can be specified in a list.

VOLUME = *ALL / list-poss(255): <vsn>
Specifies the volumes for which a size adaption is to take place.

VOLUME = *ALL
The size adaption is to take place for all volumes of the volume set.

VOLUME = list-poss(255): <vsn>
The size adaption is to take place for the explicitly specified volume of the volume set. All the volumes specified must belong to the volume set.

Command return codes

(SC2)	SC1	Maincode	Meaning
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
	1	CMD2201	Internal parameter error
	2	CMD0200	Command currently unavailable
	2	CMD2202	Subsystem not defined
	3	CMD2203	Error during installation
	32	CMD0221	Internal SDF error
	32	CMD2009	Error in S variable
	32	SOP0022	Internal error
	64	CMD0216	Required privilege missing
	65	CMD2241	Subsystem not loaded
	66	CMD2242	No connection to subsystem
	128	CMD2280	Subsystem is not available (short-term)
	129	CMD2281	Subsystem is not available (long-term)
	130	CMD2282	Subsystem not available for undefined period of time

CANCEL-SPACEOPT-JOB
Cancel SPACEOPT job

Domain: STORAGE-MANAGEMENT

Privileges: TSOS, HSMS-ADMINISTRATION

Function

The `/CANCEL-SPACEOPT-JOB` command cancels an active or waiting SPACEOPT job. The reorganization progress up to this point is retained.

You can find out about all active and waiting SPACEOPT jobs using the `/SHOW-SPACEOPT-JOB-STATUS` command.

Format

```
CANCEL-SPACEOPT-JOB

 OBJECT = *PUBSET(...) / *PUBLIC-DISK(...) / *BY-TSN(...) / *ALL-JOBS

    *PUBSET(...)
       │    PUBSET = <cat-id>
       │    ,EXCEPT-VOLUMES = *NONE / list-poss(255): <vsn>

    *PUBLIC-DISK(...)
       │    VOLUME = list-poss(255): <vsn>

    *BY-TSN(...)
       │    TSN = list-poss(255): <alphanum-name 1..4>
```

Operands

OBJECT = *PUBSET(...) / *PUBLIC-DISK(...) / *BY-TSN(...) / *ALL-JOBS
Specifies which SPACEOPT jobs are to be canceled.
When the operand value *PUBSET(...) or *PUBLIC-DISKS(...) is specified for a shared
pubset, the command is always executed on the master computer. When the command is
entered at the slave computer, it is sent to the master computer before being executed there
(for more information about the execution of commands in a shared pubset environment
see the notes on).
When the operand value *BY-TSN(...) or *ALL-JOBS is specified, the command is executed
on the computer that issued the command.

OBJECT = *PUBSET(...)
All SPACEOPT jobs for the volumes of a pubset or volume set are to be canceled.

   PUBSET = <cat-id>
   Catalog ID of the pubset or volume set.

   EXCEPT-VOLUMES = *NONE / list-poss(255): <vsn>
   EXCEPT-VOLUMES=... allows you to specify whether there are any volumes of the
   pubset or volume set for which SPACEOPT jobs are not to be canceled.

   EXCEPT-VOLUMES = *NONE
   All SPACEOPT jobs are to be canceled.

   EXCEPT-VOLUMES = list-poss(255): <vsn>
   List of volumes whose SPACEOPT jobs are not to be canceled.
   Volumes which are not part of the pubset or volume set are ignored.

OBJECT = *PUBLIC-DISK(...)
The SPACEOPT jobs for specific volumes of an SF pubset or volume set are to be canceled.

   VOLUME = list-poss(255): <vsn 6..6>
   Volume serial numbers (VSNs) of the volumes whose SPACEOPT jobs are to be
   canceled. All volumes must belong to the same SF pubset or volume set, which must
   have been imported.

OBJECT = *BY-TSN(...)
The SPACEOPT job is identified by its task sequence number (TSN). To find out the TSN,
see also the /SHOW-SPACEOPT-JOB-STATUS command.

   TSN = list-poss(255): <alphanum-name 1..4>
   TSN of the SPACEOPT job to be canceled.

OBJECT = *ALL-JOBS
All currently active and waiting SPACEOPT jobs are to be canceled. To find out which
SPACEOPT jobs are active, see also the /SHOW-SPACEOPT-JOB-STATUS command.

Command return codes

(SC2)	SC1	Maincode	Meaning
	0	CMD0001	Command executed successfully
1	0	CMD0001	No volumes to process / SPACEOPT job already active
	1	CMD0202	Syntax error
	1	CMD2201	Internal parameter error
	1	SOP0034	Incorrect VOLUME operand
	2	CMD0200	Command currently unavailable
	2	CMD2202	Subsystem not defined
	3	CMD2203	Error during installation
	32	CMD0221	Internal SDF error
	32	SOP0022	Internal error
	64	CMD0216	Required privilege missing
	64	SOP0030	VSN not in volume catalog
	64	SOP0031	Pubset not found or not accessible
	64	SOP0033	TSN not found
	64	SOP0037	Object not found
	64	SOP0039	Command not available on slave computer
	65	CMD2241	Subsystem not loaded
	66	CMD2242	No connection to subsystem
	128	CMD2280	Subsystem is not available (short-term)
	129	CMD2281	Subsystem is not available (long-term)
	130	CMD2282	Subsystem not available for undefined period of time
	130	SOP002C	Insufficient storage space

CLEAR-VOLUME
Completely clear a volume

Domain: STORAGE-MANAGEMENT

Privileges: TSOS, HSMS-ADMINISTRATION

Function

The `/CLEAR-VOLUME` command can be used to remove all files (for restrictions, see page 65) from the specified volume and move them to other volumes in the same pubset or volume set. A SPACEOPT job is started in order to execute the command `/CLEAR-VOLUME`.

Completely clearing a volume can only be carried out if it is not possible to allocate storage space on the affected volume. The following utilization restrictions can be set explicitly by the system support team for the affected volume using the `/MODIFY-PUBSET-RESTRICTIONS` command:

–   Utilization restrictions for the volume of a SF pubset:
    ```
    /MODIFY-PUBSET-RESTRICTIONS PUBSET=<pvsid>,PUBSET-TYPE=*SINGLE-FEATURE
        (ALLOCATION-ON-VOLUME=*NOT-ALLOWED(VOLUME=<vsn>))
    ```

–   Utilization restrictions for the volume of a volume set:
    ```
    /MODIFY-PUBSET-RESTRICTIONS PUBSET=<pvsid>,PUBSET-TYPE=*SYSTEM-MANAGED
        (VOLUME-SET=<volset>,RESTRICTION=*ALLOCATION-ON-VOLUME=
        (MODE=*NOT-ALLOWED(VOLUME=<vsn>)))
    ```

If, on successful completion of clearing of the specified volume, allocation of the storage space on this volume is to be permitted again, the utilization restriction can be lifted using an appropriate `/MODIFY-PUBSET-RESTRICTIONS` command.

The clearing of a volume is, for example, necessary when reconfiguring volumes during normal operation: a volume can only be taken out of the configuration of a pubset or volume set if this volume is completely empty.

If the job for the specified volume has been initiated successfully, the `/CLEAR-VOLUME` command is terminated and the caller regains control. Processing is then carried out asynchronously. The processing statuses can be queried using the `/SHOW-SPACEOPT-JOB-STATUS` command.

A job to clear a volume is rejected if a SPACEOPT job to move file extents has already been started for this volume (`/START-SPACEOPT-JOB`) or a job to purge SPACEOPT work files (`/PURGE-SPACEOPT-WORK-FILES`) has been initiated.

A SPACEOPT job to clear a volume can be monitored by a monitor job variable if you are using the software product JV.

Restrictions

The clearing of a volume is carried out as far as it is possible. Important system files, locked files and files with certain attributes cannot be moved. These are the same files as are described under section "Files normally excluded from the reorganization" on page 18. Files that cannot be moved to other volumes are logged in the output file `:<catid>:$SYSSOPT.SPACEOPT.<vsn>.yyyy-mm-dd.hhmmss`. It is also not possible to move the current log file.

Open files are moved only if this is explicitly requested using the `PROCESS-OPEN-FILES=*YES` operand (see also the section "Reorganization including open files" on page 26).

If the allocation lock is lifted for the volume while the clearing job is running, it is possible to create files on the volume again. These files are **not** taken into consideration by the current SPACEOPT job. Thus, to ensure that the volume is cleared completely, you will need to start the complete clearance process again.

Format

CLEAR-VOLUME
VOLUME = <vsn>   ,**MONJV** = ***NONE** / <filename 1..54 without-gen-vers>   ,**JV-PASS**WORD = ***NONE** / <c-string 1..4> / <x-string 1..8> / <integer -2147483648..2147483647> / ***SECRET**   ,**PROCESS-OPEN-FILES** = ***NO** / ***Y**ES

Operands

VOLUME = <vsn>
Determines the volume sequence number (VSN) of the volume that is to be cleared completely.
If the command is launched from a slave computer and the specified volume belongs to a shared pubset, this command is sent to the master computer and executed there (for information on the execution of commands in a shared pubset environment, see the notes on page 28).

MONJV = <u>*NONE</u> / <filename 1..54 without-gen-vers>
Specifies whether the SPACEOPT job to clear a volume is to be monitored by a job variable.

MONJV = <u>*NONE</u>
The SPACEOPT job created in order to clear a volume is not to be monitored by a job variable.

MONJV = <filename 1..54 without-gen-vers>
Name of the job variable that is to monitor the SPACEOPT job created to clear a volume. It is only possible to specify a monitoring job variable if the software product JV has been purchased and installed.
If the specified job variable has not been cataloged it will be set up by SPACEOPT.
The status values that a monitoring job variable may assume are described in the section "Monitoring SPACEOPT jobs using the monitor job variable" on page 24.

JV-PASSWORD = <u>*NONE</u> / <c-string 1..4> / <x-string 1..8> /
<integer -2147483648..2147483647> / *SECRET
Serves to specify the password for the monitoring job variable. The JV-PASSWORD operand has the following special characteristics:
– The password entered is not logged.
– The input field is automatically blanked out in an interactive dialog.
– In unguided dialog and foreground procedures, the entry *SECRET or ^ permits concealed input of the password.

PROCESS-OPEN-FILES = <u>*NO</u> / *YES
Specifies whether the SPACEOPT job for emptying a volume should also process open files.

PROCESS-OPEN-FILES = <u>*NO</u>
The SPACEOPT job for emptying a volume does not process open files, i.e. open files remain on the volume.

PROCESS-OPEN-FILES = *YES
The SPACEOPT job for emptying a volume should also move open files.

Command return codes

(SC2)	SC1	Maincode	Meaning
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
	1	CMD2201	Internal parameter error
	1	SOP0034	Incorrect VOLUME operand
	2	CMD0200	Command currently unavailable
	2	CMD2202	Subsystem not defined
	3	CMD2203	Error during installation
	32	CMD0221	Internal SDF error
	32	SOP0022	Internal error
	64	CMD0216	Required privilege missing
	64	SOP0009	No MSCF connection to master
	64	SOP002F	Allocator lock not set for specified volume
	64	SOP0030	VSN not in volume catalog
	64	SOP0031	Pubset not found or not accessible
	64	SOP0035	The SYSSOPT ID has not been created
	64	SOP003E	Job to clear a volume of the pubset or a volume of the volume set is already active
	64	SOP003F	SPACEOPT job is already activated for the affected pubset or volume set
	64	SOP005A	Processing error for an open file
	64	SOP0058	Extent movement for an open file aborted by access method
	64	SOP0059	Input/output cannot be stopped for an open file
	64	SOP0068	Open files cannot be processed
	64	SOP0069	Open files cannot be processed on the master
	65	CMD2241	Subsystem not loaded
	66	CMD2242	No connection to subsystem
	128	CMD2280	Subsystem is not available (short-term)
	128	SOP0008	MSCF connection to master computer is overloaded/has timed out
	129	CMD2281	Subsystem is not available (long-term)
	130	CMD2282	Subsystem not available for undefined period of time
	130	SOP002C	Insufficient storage space

MODIFY-SPACEOPT-PARAMETER
Modify SPACEOPT parameters

Domain: STORAGE-MANAGEMENT

Privileges: TSOS, HSMS-ADMINISTRATION

Function

With the `/MODIFY-SPACEOPT-PARAMETER` command you can modify SPACEOPT parameters during the pragram run.

Currently only the interruptability of the copying process can be switched on or off. Thus disc-IO-intensive programs running parallelly to SPACEOPT can be handled with priority.

Format

MODIFY-SPACEOPT-PARAMETER
IO-SPEED = <u>*UNCHANGED</u> / *STD / *LOW

Operands

IO-SPEED = <u>*UNCHANGED</u> / *STD / *LOW
Switches the interruptability of the copying process on or off.

IO-SPEED = <u>*UNCHANGED</u>
The selected parameter is unchanged.

IO-SPEED = *STD
The copying of the extends will not be interrupted.

IO-SPEED = *LOW

The copying of the extends will be interrupted. Disc-IO-intensive programs running parallelly to SPACEOPT are handled with priority .

> **i** After the termination of the concurring progam the parameter should be set to its default value.

Command return codes

(SC2)	SC1	Maincode	Meaning
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error or missing privileges

PURGE-SPACEOPT-WORK-FILES
Purge SPACEOPT work files

Domain: STORAGE-MANAGEMENT

Privileges: STD-PROCESSING, TSOS, HSMS-ADMINISTRATION

Function

The `/PURGE-SPACEOPT-WORK-FILES` command initiates a necessary purge for a SPACEOPT job which was not completed successfully (e.g. in the last session). The main task here is the controlled release of internal SPACEOPT work files and thus of allocated disk space under the SYSSOPT ID. User files can also be processed unrestricted in the usual way without activation of the purge function.

With every SPACEOPT job started with the `/START-SPACEOPT-JOB` command, the system checks at the beginning whether a purge job is necessary for the corresponding volume. If so, a purge job is implicitly initiated. As a rule, explicit purge jobs are only necessary if a purge is to be performed without a new SPACEOPT job.

Purge jobs are executed asynchronously. You can find out their status using the `/SHOW-SPACEOPT-JOB-STATUS` command. Explicit purge jobs do not affect the task limit (see section "Setting a task limit" on page 17).

Format

PURGE-SPACEOPT-WORK-FILES
OBJECT = *PUBSET(...) / ***PUBLIC-DISK**(...)
*PUBSET(...)
│   **PUB**SET = <cat-id>
│   **EXCEPT-VOL**UMES = ***NONE** / list-poss(255): <vsn>
*PUBLIC-DISK(...)
│   **VOL**UME = list-poss(255): <vsn>

Operands

OBJECT = *PUBSET(...) / *PUBLIC-DISK(...)
Specifies the objects for which the purge function is to be started. In any case the relevant pubset must have been imported, i.e. it must have the MRSCAT status "local accessible". If this is a shared pubset, the command is executed on the master computer. When the command is entered at the slave computer, it is sent to the master computer before being executed there (for more information about the execution of commands in a shared pubset environment see the notes on).

OBJECT = *PUBSET(...)
The purge function is started for a whole pubset or volume set, i.e. the system checks for each volume of the pubset or volume set whether a purge job is necessary, and the necessary purge jobs are initiated.

> **PUBSET = <cat-id>**
> Catalog ID of the pubset or volume set.

> **EXCEPT-VOLUMES = *NONE / list-poss(255): <vsn>**
> `EXCEPT-VOLUMES=...` allows you to specify whether there are any volumes of the pubset or volume set for which no purge job is to be initiated.

> **EXCEPT-VOLUMES = *NONE**
> No volumes are to be ignored, i.e. for every volume of the pubset or volume set the system checks whether a purge job can be initiated and, if applicable, starts it.

> **EXCEPT-VOLUMES = list-poss(255): <vsn>**
> Specifies volumes for which no purge job is to be initiated.
> Volumes which do not belong to the pubset or volume set are ignored.

OBJECT = *PUBLIC-DISK(...)
The purge function is started for specific volumes.

> **VOLUME = list-poss(255): <vsn>**
> VSNs of the volumes. All specified volumes must belong to the same SF pubset or volume set.

Command return codes

(SC2)	SC1	Maincode	Meaning
	0	CMD0001	Command executed successfully
1	0	CMD0001	No volumes to process / job already active
	1	CMD0202	Syntax error
	1	CMD2201	Internal parameter error
	1	SOP0034	Incorrect VOLUME operand
	2	CMD0200	Command currently unavailable
	2	CMD2202	Subsystem not defined
	3	CMD2203	Error during installation
	32	CMD0221	Internal SDF error
	32	SOP0022	Internal error
	64	CMD0216	Required privilege missing
	64	SOP0030	VSN not in volume catalog
	64	SOP0031	Pubset not found or not accessible
	64	SOP0039	Command not available on slave computer
	65	CMD2241	Subsystem not loaded
	66	CMD2242	No connection to subsystem
	128	CMD2280	Subsystem is not available (short-term)
	129	CMD2281	Subsystem is not available (long-term)
	130	CMD2282	Subsystem not available for undefined period of time
	130	SOP002C	Insufficient storage space

REDUCE-FILE-EXTENT-NUMBER
Reduce the number of file extents

Domain: STORAGE-MANAGEMENT

Privileges: STD-PROCESSING, TSOS, HSMS-ADMINISTRATION

Function

A nonprivileged user can process the command only for his own files or for files for which he is defined as co-owner.

You can use the command `/REDUCE-FILE-EXTENT-NUMBER` to reduce the number of extents for one or more specified file(s). The specifications for FILE-NAME are used to determine those files for which a reduction of the number of extents is to be carried out.

The following is achieved by reducing the number of extents of a file:

– The continuous creation, extension, reduction and deletion of files does not lead to increased fragmentation of the volumes of the affected pubset.

– You can still process the affected files without restriction, as the system ensures that you never reach the maximum number extents.

In order to reduce the number of file extents, the volumes of the affected pubset require large areas of contiguous storage space. To ensure that the sufficient space is available, it is recommended that the pubsets to which the affected files have been allocated are reorganized first. The reorganization of affected pubsets can be initiated using the `/START-SPACEOPT-JOB` command

When executing the command `/REDUCE-FILE-EXTENT-NUMBER`, no separate asynchronous SPACEOPT job is created; processing is carried out synchronously under the task of user that called the command.

Restrictions

Files that are excluded from extent reduction include important system files, locked files and files with certain attributes. These are the files that are described in section "Files normally excluded from the reorganization" on page 18.
Also excluded from extent reduction are files on private disks, tape files, migrated files, files with a single extent and files that do not occupy physical space.

Open files are processed only if this is explicitly requested using the `PROCESS-OPEN-FILES=*YES` operand (see also the section "Reorganization including open files" on page 26).

Format

REDUCE-FILE-EXTENT-NUMBER

FILE-NAME = <filename 1..54 without-vers> / *FROM-FILE(...)
 	
   *FROM-FILE(...)
      │   LIST-FILE-NAME = <filename 1..54 without-gen-vers>
 	
,PROCESS-OPEN-FILES = *NO / *YES

Operands

FILE-NAME = <filename 1..54 without-vers> / *FROM-FILE(...)
Determines a file or a number of files for which reduction of the number of file extents is to
be carried out. For files located on a shared pubset, the command can be launched from
both the master computer and from a slave computer. The affected pubset must have been
imported, or in other words, it must be in the MRSCAT status "local accessible" (for more
information about executing commands in a shared pubset environment, see the notes on
page 28).

FILE-NAME = <filename 1..54 without-vers>
Path name of the file for which a reduction of the number of extents is to be carried out. The
specification of a file generation is permitted, but not the specification of a file generation
group (the group entry does not have any extents).

FILE-NAME = *FROM-FILE(...)
The path names of the files whose number of extents are to be reduced are taken from a
file name list. The file name list must be a SAM file with fixed or variable record lengths
which contains a fully-qualified path name (maximum of 54 characters) in each record.
Partially-qualified specifications or specifications with wildcard characters are not
permitted. The use of leading blanks in a record is permitted, blank lines are ignored.
Multiple occurrences of the path name of a file are permitted, however the affected file will
only be processed once. SPACEOPT attempts to process all files. A separate message will
be output to SYSOUT for all files for which the number of extents cannot be reduced.
A file name list can, for example, be created using an editor. However, it is very quick and
easy to use the /SHOW-FILE-ATTRIBUTES command to create a file name list. This
provides you with the complete range of file selection options (partial-qualification,
wildcards and selection criteria).

    LIST-FILE-NAME = <filename 1..54 without-gen-vers>
    Path name of the file name list

Example of creation of file name list

The following example shows how to determine all files or file generations on pubset PVSX, for which the number of extents lies between a lower threshold 'x' and an upper threshold 'y':

```
/SHOW-FILE-ATTRIBUTES FILE-NAME=:pvsx:$*.,
    SELECT=*BY-ATTRIBUTES(NUMBER-OF-EXTENTS=*INTERVAL(FROM=x,TO=y),
    GENERATIONS=*YES),OUTPUT=<filelist>(FORM-NAME=FILE-NAME)
```

The <filelist> file as specified in the OUTPUT operand contains the fully-qualified path names of the affected files and file generations. This file can be used as an input file for the SPACEOPT command `/REDUCE-FILE-EXTENT-NUMBER`.

PROCESS-OPEN-FILES = <u>*NO</u> / *YES
Specifies whether the reduction in the number of extents should also be performed for open files.

PROCESS-OPEN-FILES = <u>*NO</u>
The reduction in the number of extents is not performed for open files.

PROCESS-OPEN-FILES = *YES
The reduction in the number of extents is to be performed for open files.

Command return codes

(SC2)	SC1	Maincode	Meaning/Guaranteed messages
	0	CMD0001	Command executed successfully
2	0	SOP0056	Error during reduction of the number of extents for some files. At least one of the following guaranteed messages was issued: SOP0022, SOP002C, SOP0031, SOP0035, SOP0050, SOP0051, SOP0052, SOP0053, SOP0054, SOP0055, SOP0060, SOP0064, SOP0065
	1	CMD0202	Syntax error
	1	CMD2201	Internal parameter error
	2	CMD0200	Command currently unavailable
	2	CMD2202	Subsystem not defined
	3	CMD2203	Error during installation
	32	CMD0221	Internal SDF error
	32	SOP0022	Internal error
	64	CMD0102	Command interrupted using the K2 button
	64	CMD0216	Required privilege missing
	64	SOP0031	Pubset could not be found/could not be accessed
	64	SOP0035	The SYSSOPT ID has not been created
	64	SOP005A	Processing error for an open file

(SC2)	SC1	Maincode	Meaning/Guaranteed messages
	64	SOP0050	File does not exist
	64	SOP0051	File is locked
	64	SOP0052	Error creating a SPACEOPT auxilliary file
	64	SOP0053	Number of file extents cannot be reduced
	64	SOP0054	File attributes do not permit extent reduction
	64	SOP0055	DAB activated for file
	64	SOP0057	Command interrupted by a /CANCEL-JOB
	64	SOP0058	Extent movement for an open file aborted by access method
	64	SOP0059	Input/output cannot be stopped for an open file
	64	SOP0060	File is by default excluded from reorganization
	64	SOP0061	DMS error on opening or processing the file list file
	64	SOP0062	Invalid format of file list file
	64	SOP0063	File list file contains no valid records
	64	SOP0067	Name of the specified file is syntactically invalid
	64	SOP0068	Open files cannot be processed
	64	SOP0069	Open files cannot be processed on the master
	65	CMD2241	Subsystem not loaded
	66	CMD2242	No connection to subsystem
	128	CMD2280	Subsystem is not available (short-term)
	129	CMD2281	Subsystem is not available (long-term)
	130	CMD2282	Subsystem not available for undefined period of time
	130	SOP002C	Insufficient storage space

SHOW-FREE-ISAM-SPACE
Show the number of free pages of an ISAM file

Domain: STORAGE-MANAGEMENT

Privileges: TSOS, HSMS-ADMINISTRATION

Function

You can use the /SHOW-FREE-ISAM-SPACE command to determine the number of free
pages of an ISAM file.

Processing an ISAM file (adding, extending, shortening or deleting records) can result in an
increasing number of free pages in front of the logical end of the file. Since these free pages
remain allocated, the size of the ISAM file may continue to increase despite the fact that
this additional space is not occupied by real data.

Reorganization is recommended if an ISAM file contains a large number of free pages (this
can be done using the PERCON utility).

Format

```
SHOW-FREE-ISAM-SPACE

 FILE-NAME = <filename 1..54 without-vers> / *FROM-FILE (...)

    *FROM-FILE (...)
       │  LIST-FILE-NAME = <filename 1..54 without-gen-vers>

,OUTPUT = *SYSOUT / *SYSLST(...)

    *SYSLST(...)
       │  SYSLST-NUMBER = *STD / <integer 1..99>
```

Operands

FILE-NAME = <filename 1..54 without-vers> / *FROM-FILE(...)

Name of a file or file name list. Only ISAM files can be processed in this way, for all other files the command is rejected with the message SOP0066.

For files located on a shared pubset, the command can be launched from both the master computer and from a slave computer. The affected pubset must have been imported, or in other words, it must be in the MRSCAT status "local accessible" (for more information about executing commands in a shared pubset environment, see the notes on).

FILE-NAME = <filename 1..54 without-vers>

Path name of the file for which the number of free pages is to be determined. The specification of a file generation is permitted, but not the specification of a file generation group index.

FILE-NAME = *FROM-FILE(...)

The path names of the files whose number of extents are to be reduced are taken from a file name list. The file name list must be a SAM file with fixed or variable record lengths which contains a fully-qualified path name (maximum of 54 characters) for each record. Partially-qualified specifications or specifications with wildcard characters are not permitted. The use of leading blanks in a record is permitted, blank lines are ignored. Multiple occurrences of the path name of a file are permitted, however the affected file will only be listed once. If output is not possible for a file (e.g. file is not an ISAM file), a message is output to SYSOUT and the system continues processing the file name list.

A file name list can, for example, be created using an editor. However, it is very quick and easy to use the /SHOW-FILE-ATTRIBUTES command to create a file name list. This provides you with the complete range of file selection options (partial-qualification, wildcards and selection criteria).

LIST-FILE-NAME = <filename 1..54 without-gen-vers>

Path name of the file name list.

Example of creation of file name list

The following example shows how to determine all ISAM files and/or file generations on pubset PVSX, for which the number of extents lies between a lower threshold 'x' and an upper threshold 'y':

```
/SHOW-FILE-ATTRIBUTES FILE-NAME=:PVSX:$*.,SELECT=*BY-ATTRIBUTES(
FILE-STRUCTURE=*ISAM,GENERATIONS=*YES,SIZE=*INTERVAL(FROM=x,TO=y)),
OUTPUT=<filelist>(FORM-NAME=FILE-NAME)
```

The <filelist> file as specified in the OUTPUT operand contains the fully-qualified path names of the affected files and file generations. This file can be used as an input file for the SPACEOPT command SHOW-FREE-ISAM-SPACE.

OUTPUT = *SYSOUT / *SYSLST(...)
This specifies where the information is to be output. Information can be output to SYSOUT (default) or to the system file SYSLST.

OUTPUT = *SYSOUT
Information is output to SYSOUT.

OUTPUT = *SYSLST(...)
Information output in printable format to the system file SYSLST. The first byte of each output record is X'40'.

    SYSLST-NUMBER = *STD / <integer 1..99>
    Determines whether the information is to be output to the system file SYSLST or to a SYSLST file from the range SYSLST01 through SYSLST99.
    The default is *STD, which means that the output is sent to the SYSLST system file.

Command return codes

(SC2)	SC1	Maincode	Meaning/Guaranteed messages
	0	CMD0001	Command executed successfully
2	0	SOP0056	Error when displaying free pages for some files. At least one of the following guaranteed messages was issued: SOP0022, SOP002C, SOP0050, SOP0064, SOP0065, SOP0066
	1	CMD0202	Syntax error
	1	CMD2201	Internal parameter error
	2	CMD0200	Command currently unavailable
	2	CMD2202	Subsystem not defined
	3	CMD2203	Error during installation
	32	CMD0221	Internal SDF error
	32	CMD2009	Error in S variable
	32	SOP0022	Internal error
	64	CMD0216	Required privilege missing
	64	SOP0050	File does not exist
	64	SOP0061	DMS error on opening or processing a file
	64	SOP0062	Invalid format of file list file
	64	SOP0063	File list file contains no valid records
	64	SOP0066	Specified file is not an ISAM file
	64	SOP0067	Name of the specified file is syntactically invalid
	65	CMD2241	Subsystem not loaded
	66	CMD2242	No connection to subsystem
	128	CMD2280	Subsystem is not available (short-term)
	129	CMD2281	Subsystem is not available (long-term)
	130	CMD2282	Subsystem not available for undefined period of time
	130	SOP002C	Insufficient storage space

Output format

The output of the command `/SHOW-FREE-ISAM-SPACE` contains a block of information with four value lines for each of the specified files. The value lines provide the following information, the path name of the file, the number of reserved pages, the number of free pages and the proportion of free pages to reserved pages.

Output example

```
%======================================================================
% FILE_NAME   : :2OS6:$TSOS.ISAMFILE
% TOTAL_PAGES :        102
% FREE_PAGES  :         10
% PERCENT     :          9%
%======================================================================
```

The following table describes the output lines, possible values and their meanings:

Output line	Value	Meaning
FILE_NAME	<filename 1..54>	Path name of the processed file
TOTAL_PAGES	0..2,147,483,647	Total number of pages in the processed ISAM file, up to and including the logical last page (in units of 2 KB).
FREE_PAGES	0..2,147,483,647	Total number of free pages in the processed ISAM file before the logical end of the file (in units of 2 KB).
PERCENT	0..100 %	Percentage of free pages in relation to the total number of pages in the ISAM file (including the last logical page)

S variables

Output information	Name of S variable	T	Contents
Path name of the ISAM file	var(*LIST).F-NAME	S	<filename 1..54>
Number of free pages	var(*LIST).FREE-PAGE	I	0..2,147,483,647
Total number of all pages up to and including LHP	var(*LIST).TOTAL-PAGE	I	0..2,147,483,647

SHOW-SPACEOPT-JOB-STATUS
Show information on SPACEOPT jobs

Domain: STORAGE-MANAGEMENT

Privileges: TSOS, HSMS-ADMINISTRATION

Function

The `/SHOW-SPACEOPT-JOB-STATUS` command is used to request information on active and waiting SPACEOPT jobs.

This command supports structured output in S variables (see the "Commands" manual, under "Output in S variables" [2]).

Format

```
SHOW-SPACEOPT-JOB-STATUS

 OBJECT = *ALL-JOBS / *PUBSET(...) / *PUBLIC-DISK(...) / *BY-TSN(...)

    *PUBSET(...)
      │  PUBSET = <cat-id>

    *PUBLIC-DISK(...)
      │  VOLUME = list-poss(255): <vsn>

    *BY-TSN(...)
      │  TSN = list-poss(255): <alphanum-name 1..4>
,SELECT = *ALL / *BY-ATTRIBUTES(...)

    *BY-ATTRIBUTES(...)
      │  VOLUME = *ANY / list-poss(255): <vsn>
      │  STATUS = *ANY / *RUNNING / *WAITING / *PURGE / *PURGE-WAIT / *CLEARING
,OUTPUT = *SYSOUT / *SYSLST(...)

    *SYSLST(...)
      │  SYSLST-NUMBER = *STD / <integer 1..99>
```

Operands

OBJECT = <u>*ALL-JOBS</u> / *PUBSET(...) / *PUBLIC-DISK(...) / *BY-TSN(...)
Specifies the objects for which information on the SPACEOPT jobs is to be output.
When the operand value *PUBSET(...) or *PUBLIC-DISKS(...) is specified for a shared
pubset, the command is always executed on the master computer. When the command is
entered at the slave computer, it is sent to the master computer before being executed there
(for more information about the execution of commands in a shared pubset environment
see the notes on).
When the operand value *BY-TSN(...) or *ALL-JOBS is specified, the command is executed
on the computer that issued the command.
If no SPACEOPT job is found for the specified object, the command is terminated with a
return code (SOP0033, SOP0037).

OBJECT = <u>*ALL-JOBS</u>
Information is displayed on all SPACEOPT jobs.

OBJECT = *PUBSET(...)
Information is displayed on the SPACEOPT jobs of a pubset or volume set.

   PUBSET = <cat-id>
   Catalog ID of the pubset or volume set.

OBJECT = *PUBLIC-DISK(...)
Information is displayed on the SPACEOPT jobs of specific volumes.

   VOLUME = list-poss(255): <vsn>
   VSNs of the volumes. All specified volumes must belong to the same SF pubset or
   volume set.

OBJECT = *BY-TSN(...)
Information is displayed on the SPACEOPT jobs of specific TSNs.

   TSN = list-poss(255): <alphanum-name 1..4>
   TSNs of the SPACEOPT jobs.

SELECT = <u>*ALL</u> / *BY-ATTRIBUTES(...)
Specifies whether the number of SPACEOPT jobs implicitly specified in the OBJECT
operand is to be limited.

SELECT = <u>*ALL</u>
Information is displayed on all SPACEOPT jobs specified in the OBJECT operand.

SELECT = *BY-ATTRIBUTES(...)
The number of SPACEOPT jobs specified in the OBJECT operand is to be limited by means
of selection criteria.
The default *ANY means that the SPACEOPT jobs are not limited by these selection criteria.

VOLUME = *ANY / list-poss(255): <vsn>
Information is displayed only on the SPACEOPT jobs of the specified volumes.

STATUS = *ANY / *RUNNING / *WAITING / *PURGE / *PURGE-WAIT / *CLEARING
Information is displayed only on SPACEOPT jobs with the specified status (see also
"Job statuses" on page 14).

STATUS = *RUNNING
Information is displayed only on SPACEOPT jobs with the status *Running*.

STATUS = *WAITING
Information is displayed only on SPACEOPT jobs with the status *Waiting*.

STATUS = *PURGE
In formation is displayed only on SPACEOPT jobs with the status *Purge*.

STATUS = *PURGE-WAIT
Information is displayed only on SPACEOPT jobs with the status *Purge-Wait*.

STATUS = *CLEARING
The information is only to be output for SPACEOPT jobs that are created by calling the
/CLEAR-VOLUME command and are in the status *Clearing*.

OUTPUT = *SYSOUT / *SYSLST(...)
Defines where the information is to be output. You can choose either SYSOUT (default) or
the system file SYSLST.

OUTPUT = *SYSOUT
The information is output to SYSOUT.

OUTPUT = *SYSLST(...)
The information is output to the system file SYSLST in edited form. The first byte of each
output record is X'40'.

SYSLST-NUMBER = *STD / <integer 1..99>
Specifies whether the output is to the system file SYSLST or to a SYSLST file from the
set SYSLST01 through SYSLST99.
The default is *STD, i.e. output to the system file SYSLST.

Command return codes

(SC2)	SC1	Maincode	Meaning
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
	1	CMD2201	Internal parameter error
	1	SOP0034	Incorrect VOLUME operand
	2	CMD0200	Command currently unavailable
	2	CMD2202	Subsystem not defined
	3	CMD2203	Error during installation
	32	CMD0221	Internal SDF error
	32	CMD2009	Error in S variable
	32	SOP0022	Internal error
	64	CMD0216	Required privilege missing
	64	OPS0002	K2 interrupt for output in S variables
	64	SOP0030	VSN not in volume catalog
	64	SOP0031	Pubset not found or not accessible
	64	SOP0033	TSN not found
	64	SOP0037	Object not found
	64	SOP0039	Command not available on slave computer
	65	CMD2241	Subsystem not loaded
	66	CMD2242	No connection to subsystem
	128	CMD2280	Subsystem is not available (short-term)
	129	CMD2281	Subsystem is not available (long-term)
	130	CMD2282	Subsystem not available for undefined period of time
	130	SOP002C	Insufficient storage space

Output format

The output contains a header and one or more value lines, depending on the number of objects that have been selected. A different header will be output depending on the type of job.

Header for reorganization or purge jobs:

```
VOLUME !PUB-/ !  TSN  ! STA  !  CPU-USED  ! TASK- !   START-TIME    ! MOVED
       !VOLSET!      !      !             ! LIMIT !                 ! EXTENTS
```

Header for a clear volume job:

```
VOLUME !PUB-/ !  TSN  ! STA  !  CPU-USED  ! TOTAL !   START-TIME    ! MOVED
       !VOLSET!      !      !             ! FILES !                 ! FILES
```

When outputting reorganization or purge jobs and clear volume jobs at the same time, both headers are output and the jobs listed under the appropriate header.

The following table describes the output columns with the possible values and their meanings.

Output column	Value	Meaning
VOLUME	<vsn>	VSN of the volume
PUB-/VOLSET	<catid 1..4>	Catalog ID of the SF pubset or volume set
TSN	<alphanum-name 1..4> *NONE	TSN or *NONE for SPACEOPT jobs with the status *Waiting*
STA		Processing status of the SPACEOPT job, where a * at the beginning of a column indicates that a cancel command has already been issued for this job (using /CANCEL-SPACEOPT-JOB):
	RUN	SPACEOPT job has the status *Running*
	WAIT	SPACEOPT job has the status *Waiting*
	PURG	Purge job initiated, is in processing phase
	PGWT	Purge job initiated, is in processing phase; after successful completion, processing is resumed with SPACEOPT job
	CLEAR	SPACEOPT job to clear a volume is currently in *Clearing* status
CPU-USED	<nnnnnn.nnnn>	CPU time used in seconds
TASK-LIMIT	NONE <integer 1..255>	*only for reorganization and purge jobs* Setting for the maximum number of subtasks per pubset or volume set

Output column	Value	Meaning
TOTAL-FILES	<integer 0..2147483647>	*only for a clear volume job* Total number of files with extents on the volume that is to be cleared
START-TIME	<yyyy-mm-dd.hhmmss>	Start time of the processing phase of the SPACEOPT job
MOVED EXTENTS	<integer 0..2147483647>	*only for reorganization and purge jobs* Number of extents moved
MOVED FILES	<integer 0..2147483647>	*only for a clear volume job* Number of file extents that have already been carried out

Example

```
/START-SPACEOPT-JOB OBJECT=*PUBSET(PUBSET=SBZC)
/SHOW-SPACEOPT-JOB-STATUS SELECT=*PUBSET(PUBSET=SBZC) ————————————— (1)
```

```
VOLUME !PUB-/ ! TSN ! STA ! CPU-USED ! TASK- !  START-TIME    ! MOVED
       !VOLSET!     !     !          ! LIMIT !               ! EXTENTS
-------+------+-------+------+------------+-------+----------------+--------
SBZC.0  SBZC   XADC   RUN       5.0138       1 2004-03-23.082337      124
SBZC.1  SBZC  *NONE   WAIT      0.0000       1     *NONE              0
SBZC.2  SBZC  *NONE   WAIT      0.0000       1     *NONE              0
```

```
/CLEAR-VOLUME VOLUME=SBZD.2
/SHOW-SPACEOPT-JOB-STATUS SELECT=*PUBSET(PUBSET=SBZD) ————————————— (2)
```

```
VOLUME !PUB-/ ! TSN ! STA ! CPU-USED ! TOTAL !  START-TIME    ! MOVED
       !VOLSET!     !     !          ! FILES !               ! FILES
-------+------+-------+------+------------+-------+----------------+--------
SBZD.2  SBZD   XAE1   CLEAR     2.1713     140 2004-03-23.082423       45
```

(1)   Reorganization has been started for pubset SBZC. The /SHOW-SPACEOPT-JOB-STATUS command indicates that volume SBZC.0 is currently being processed (status *RUN*) and 124 extent movements (MOVED EXTENTS) have already been carried out. The subtasks for the other volumes of the pubset are waiting (*WAIT* status).

(2)   The volume SBZD.2 of pubset SBZD is to be cleared. The `/SHOW-SPACEOPT-JOB-STATUS` command indicates that the process to clear volume SBZD.2 has been started (*CLEARING* status). Of the 149 files in total (`TOTAL FILES`) 45 files or their file extents (`MOVED FILES`) have already been moved to other volumes of the pubset.

The output in the second example (clearing a volume) differs to the output for the first example (reorganization of files) because it contains the output columns `TOTAL FILES` (instead of `TASK-LIMIT`) and `MOVED FILES` (instead of `MOVED EXTENTS`).

S variables

Output information	Name of S variable	T	Contents
CPU used in seconds	var(*LIST).CPU-USED	S	<nnnnnn.nnnn>
Number of extent movements	var(*LIST).MOV-EXT	I	1..2,147,483,647
Catalog ID of the SF pubset or volume set	var(*LIST).PUBSET	S	<catid 1..4>
Processing status of SPACEOPT job *RUN= SPACEOPT job has status *Running* *WAIT= SPACEOPT job has status *Waiting* *PURGE= purge job initiated, is in processing phase *PURGE-WAIT= purge job initiated, is in processing phase; after successful completion, processing is resumed with `/START-SPACEOPT-JOB` *CLEAR= SPACEOPT job is in the status *Clearing*	var(*LIST).STA	S	*RUN *WAIT *PURGE *PURGE-WAIT *CLEAR
Start time of processing phase of SPACEOPT job	var(*LIST).START	S	<yyyy-mm-dd.hhmmss>
Setting for the maximum number of subtasks per pubset or volume set	var(*LIST).TASK-LIM	S	1..255 *NONE
Total number of files with extents on the volume that is to be cleared	var(*LIST).NUM-OF-F	I	1..2,147,483,647
Number of files on volume to be cleared with extents that have already been moved	var(*LIST).NUM-OF-F-MOVE	I	1..2,147,483,647
TSN or *NONE for SPACEOPT jobs with the status *Waiting*	var(*LIST).TSN	S	<alphanum-name 1..4> *NONE
VSN of the volume	var(*LIST).VOL	S	<vsn>

SHOW-SPACEOPT-SPACE-ALLOCATION
Show space allocation on volumes

Domain: STORAGE-MANAGEMENT

Privileges: TSOS, HSMS-ADMINISTRATION

Function

The /SHOW-SPACEOPT-SPACE-ALLOCATION command gives systems support an overview of the space allocation on individual volumes or the whole pubset or volume set. The information can be provided in varying levels of detail. It allows systems support to determine whether a reorganization is necessary (see also section "Determining the volume status" on page 33).

This command supports structured output in S variables (see the "Commands" manual, under "Output in S variables" [2]).

Format

SHOW-SPACEOPT-SPACE-ALLOCATION

OBJECT = ***PUB**SET(...) / ***PUBLIC-DISK**(...)
 	
    *PUBSET(...)
     │ **PUB**SET = \<cat-id>
 	
    *PUBLIC-DISK(...)
     │ **VOL**UME = list-poss(255): \<vsn>
 	
 ,**INF**ORMATION = ***SUMMARY** / ***FREE-ALLOC-UNITS** / ***FREE-PAGES**
 	
 ,**OUTPUT** = ***SYSOUT** / ***SYSLST**(...)
 	
    *SYSLST(...)
     │ **SYSLST-NUM**BER = ***STD** / \<integer 1..99>

Operands

OBJECT = *PUBSET(...) / *PUBLIC-DISK(...)
Specifies the objects for which information is to be output. If you are dealing with a shared pubset, the command can be issued on both the master computer and a slave computer. The relevant pubset must have been imported, i.e. it must have the MRSCAT status "local accessible".

OBJECT = *PUBSET(...)
Information on a pubset or volume set is displayed.

   PUBSET = <cat-id>
   Catalog ID of the pubset or volume set.

OBJECT = *PUBLIC-DISK(...)
Information on specific volumes is displayed.

   VOLUME = list-poss(255): <vsn>
   VSNs of the volumes. All specified volumes must belong to the same SF pubset or volume set. If some of the specified volumes do not exist, the return code S0P0037 will be output once the command has been executed.

INFORMATION = *SUMMARY / *FREE-ALLOC-UNITS / *FREE-PAGES
Defines the scope of the information to be output.

INFORMATION = *SUMMARY
A summary is output, containing the information for each selected volume in one line. The free areas are based on an evaluated output.

Output information: VSN, number of contiguous free areas in specific size categories, largest free area, number of free PAM pages, total capacity of the volume.

INFORMATION = *FREE-ALLOC-UNITS
Evaluated output of the number of free areas of a volume, sorted according to size (see also page 33 and page 91).

Output information: VSN, size, physical page numbers (PHP), allocation size and allocation unit.

INFORMATION = *FREE-PAGES
Non-evaluated output of the number of free areas of a volume, sorted according to size (see also page 33 and page 91).

Output information: VSN, size and physical page numbers (PHP).

OUTPUT = <u>*SYSOUT</u> / *SYSLST(...)
Defines where the information is to be output. You can choose either SYSOUT (default) or the system file SYSLST.

OUTPUT = <u>*SYSOUT</u>
The information is output to SYSOUT.

OUTPUT = *SYSLST(...)
The information is output to the system file SYSLST in edited form. The first byte of each output record is X'40'.

SYSLST-NUMBER = <u>*STD</u> / <integer 1..99>
Specifies whether the output is to the system file SYSLST or to a SYSLST file from the set SYSLST01 through SYSLST99.
The default is *STD, i.e. output to the system file SYSLST.

Command return codes

(SC2)	SC1	Maincode	Meaning
	0	CMD0001	Command executed successfully
	1	CMD0202	Syntax error
	1	CMD2201	Error in parameter
	1	SOP0034	Incorrect VOLUME operand
	2	CMD0200	Command currently unavailable
	2	CMD2202	Subsystem not defined
	3	CMD2203	Error during installation
	32	CMD2009	Error in S variable
	32	CMD0221	Internal SDF error
	32	SOP0022	Internal error
	64	CMD0216	Required privilege missing
	64	OPS0002	K2 interrupt for output in S variables
	64	SOP0030	VSN not in volume catalog
	64	SOP0031	Pubset not found or not accessible
	64	SOP003B	Error during catalog access
	64	SOP003C	Error during F5 label access
	65	CMD2241	Subsystem not loaded
	66	CMD2242	No connection to subsystem
	128	CMD2280	Subsystem is not available (short-term)
	129	CMD2281	Subsystem is not available (long-term)
	130	CMD2282	Subsystem not available for undefined period of time
	130	SOP002C	Insufficient storage space

Output formats

A distinction is made between evaluated and non-evaluated output (see also page 33):

– With evaluated output, the information is provided from the perspective of the BS2000 Allocator component (see page 31). Free areas which extend beyond segment and packet boundaries are divided up such that the parts either form whole packets/segments or are smaller than one packet/segment and then each lie completely within these units. A contiguous free area on the volume can be described in evaluated output by a series of areas of the size unit, packet and/or segment.
– In non-evaluated output, the free areas are shown as they are to be found on the volume, without regard for the Allocator's administrative units packet or segment.

Levels of detail

The output information can be requested in three levels of detail:

1. SUMMARY(evaluated)
2. FREE-ALLOC-UNITS(evaluated)
3. FREE-PAGES(non-evaluated)

Output format when INFORMATION=*SUMMARY

`INFORMATION=*SUMMARY` produces a summary output in which the information for each selected volume is displayed in one line. The free areas are based on an evaluated output (see also page 35).

Example

```
/SHOW-SPACEOPT-SPACE-ALLOCATION OBJECT=*PUBSET(PVSX),INFORMATION=*SUMMARY
```

```
%VOLUME! NUMBER-OF-CONTIGUOUS-FREE-SPACE-AREAS! LARGEST !    FREE !   TOTAL
%       !  UNIT ! PACK ! SEGM ! SEGM! SEGM!      AREA !   PAGES !   PAGES
%       !  1..7 ! 1..7 ! 1..63 !..4095!4096..!          !         !
%-------+-------+-------+-------+------+------+----------+---------+----------
%PVSX.0     491     427     46      1      0     108480    161661    225657
%PVSX.1     509     473     20      1      0     114048    155043    225660
```

The current allocation status of the pubset PVSX is determined from the summary display. The output shows that the pubset consists of 2 volumes PVSX.0 and PVSX.1. Both volumes reveal a large number of free small areas, which indicates a high degree of fragmentation.

Explanation of the output columns:

Output column	Value	Meaning
VOLUME	<vsn>	VSN of the volume
UNIT 1..7	1..5,592,405	Number of contiguous free areas with a size of 1 to 7 allocation units; i.e. with an allocation unit size of 3 PAM pages, the number of free areas with a size of up to 21 PAM pages is displayed.
PACK 1..7	1..699,051	Number of contiguous free areas with a size of 1 to 7 packets; i.e. with an allocation unit size of 3 PAM pages, the number of free areas with a size of 24 to 168 PAM pages is displayed.
SEGM 1..63	1..87,382	Number of contiguous free areas with a size of 1 to 63 segments; i.e. with an allocation unit size of 3 PAM pages, the number of free areas with a size of 192 to 12096 PAM pages is displayed.
SEGM ..4095	1..1,366	Number of contiguous free areas with a size of 64 to 4095 segments; i.e. with an allocation unit size of 3 PAM pages, the number of free areas with a size of 12288 to 786240 PAM pages is displayed.
SEGM 4096..	1..22	Number of contiguous free areas with a size of over 4096 segments; i.e. with an allocation unit size of 3 PAM pages, the number of free areas with a size of 786432 PAM pages or more is displayed.
LARGEST AREA	1..2,147,483,647	Largest contiguous free segment area on the volume. Size is specified in PAM pages.
FREE PAGES	1..2,147,483,647	Sum of all free areas on the volume in PAM pages.
TOTAL PAGES	1..2,147,483,647	Total capacity of the volume in PAM pages.

Output format when INFORMATION=*FREE-ALLOC-UNITS and INFORMATION=*FREE-PAGES

INFORMATION=*FREE-ALLOC-UNITS and INFORMATION=*FREE-PAGES both produce a detailed list of free contiguous areas per volume. If INFORMATION=*FREE-ALLOC-UNITS is specified, the free areas are displayed in evaluated form, but if INFORMATION=*FREE-PAGES is specified, they are displayed in non-evaluated form. The free areas are shown sorted by volume and in descending order of the size of the free areas (see also page 34).

Examples

/SHOW-SPACEOPT-SPACE-ALLOCATION OBJECT=*PUBSET(PVSX),
INFORMATION=*FREE-ALLOC-UNITS

```
%VOLUME ! PAM-PAGES !  PHP-FROM !    PHP-TO ! ALLOC-SIZE ! ALLOC-UNIT
%-------+-----------+-----------+-----------+------------+-----------
%PVSX.0    151296       74305      225600          788    SEGMENT
%PVSX.0      9984       45505       55488           52    SEGMENT
%PVSX.0       120       55489       55608            5    PACKET
%PVSX.0        96       74209       74304            4    PACKET
%PVSX.0        72       45433       45504            3    PACKET
%PVSX.0        72      225601      225672            3    PACKET
%PVSX.0         9       45424       45432            3    UNIT
%PVSX.0         9       55609       55617            3    UNIT
%PVSX.0         3      225673      225675            1    UNIT
%PVSX.1    154752       70849      225600          806    SEGMENT
%PVSX.1        96       51745       51840            4    PACKET
%PVSX.1        72       51841       51912            3    PACKET
%PVSX.1        72      225601      225672            3    PACKET
%PVSX.1        24       70825       70848            1    PACKET
%PVSX.1        21       51724       51744            7    UNIT
%PVSX.1         3       51913       51915            1    UNIT
%PVSX.1         3      225673      225675            1    UNIT
```

The current allocation status is determined from the evaluated output. Both volumes reveal one very large area of 788 and 806 contiguous free segments respectively.

/SHOW-SPACEOPT-SPACE-ALLOCATION OBJECT=*PUBSET(PVSX),INFORMATION=*FREE-PAGES

```
%VOLUME ! PAM-PAGES !  PHP-FROM !    PHP-TO
%-------+-----------+-----------+-----------
%PVSX.0    151467       74209      225675
%PVSX.0     10194       45424       55617
%PVSX.1    154851       70825      225675
%PVSX.1       192       51724       51915
```

Another variant is to determine the current allocation status via the non-evaluated output. In this case, the total free space is concentrated in two large contiguous areas for each volume.

Explanation of the output columns:

Output column	Value	Meaning
VOLUME	<vsn>	VSN of the volume
SIZE	1..2,147,483,647	Size of the contiguous free area in PAM pages
PHP-FROM	1..2,147,483,647	Start of the area on the volume
PHP-TO	1..2,147,483,647	End of the area on the volume
ALLOC-SIZE	1..87,382	Size of the area in Allocator administrative units
ALLOC-UNIT	UNIT PACKET SEGMENT	Allocator administrative unit to which the ALLOC–SIZE column refers

S variables

The INFORMATION operand of the command is used to define which S variables are supplied with values. The following specifications can be made for INFORMATION:

Notation in command	Abbreviated notation in table
INFORMATION=*SUMMARY INFORMATION=*FREE-ALLOC-UNITS INFORMATION=*FREE-PAGES	1 2 3

Output information	Name of S variable	T	Contents	Cond.
Size of the area in Allocator administrative units	var(*LIST).ALLOC-SIZE	I	1..87.382	2
Allocator administrative unit to which the ALLOC–SIZE column refers	var(*LIST).ALLOC-UNIT	S	*UNIT *PACKET *SEGMENT	2
Total free PAM pages	var(*LIST).FREE-PAGE	I	1..2.147.483.647	1
Largest contiguous free segment area. Size specified in PAM pages	var(*LIST).LARG-AREA	I	1..2.147.483.647	1
Number of contiguous free areas with a size of 4096 segments or more	var(*LIST).LARG-SEGM	I	1..22	1
Number of contiguous free areas with a size of 64 to 4095 segments	var(*LIST).MID-SEGM	I	1..1.366	1
Number of contiguous free areas with a size of 1 to 7 packets	var(*LIST).PACK	I	1..699.051	1
Start of the area on the volume	var(*LIST).PHP-FROM	I	1..2.147.483.647	2,3
End of the area on the volume	var(*LIST).PHP-TO	I	1..2.147.483.647	2,3

Output information	Name of S variable	T	Contents	Cond.
Size of the contiguous free area in PAM pages	var(*LIST).SIZE	I	1..2.147.483.647	2,3
Number of contiguous free areas with a size of 1 to 63 segments	var(*LIST).SMALL-SEGM	I	1..87.382	1
Total free and allocated PAM pages	var(*LIST).TOTAL-PAGE	I	1..2.147.483.647	1
Number of contiguous free areas with a size of 1 to 7 allocation units	var(*LIST).UNIT	I	1..5.592.405	1
VSN of the volume	var(*LIST).VOL	S	<vsn>	1,2,3

START-SPACEOPT-JOB
Start SPACEOPT job

Domain: STORAGE-MANAGEMENT

Privileges: TSOS, HSMS-ADMINISTRATION

Function

The /START-SPACEOPT-JOB command starts a SPACEOPT job. The specifications for the
OBJECT operand determine the volumes for which a reorganization is to be performed. For
each of these volumes a separate subtask is generated, under which the relevant volume
is processed. At the start of processing, the system checks for each volume whether a
purge job is necessary (see the /PURGE-SPACEOPT-WORK-FILES command). If so, the
purge job is started implicitly before the actual processing.

Once the jobs for the determined volumes have been successfully initiated, the /START-
SPACEOPT-JOB command is terminated and the user regains control. Processing is then
asynchronous. The respective processing statuses can be requested using the /SHOW-
SPACEOPT-JOB-STATUS command. The SPACEOPT job is complete when all subtasks
have terminated.

A SPACEOPT reorganization job can be monitored using a monitor job variable.

Open files are included in the reorganization only if this is explicitly requested using the
PROCESS-OPEN-FILES=*YES operand (see also the section "Reorganization including
open files" on page 26).

Format

```
START-SPACEOPT-JOB

 OBJECT = *PUBSET(...) / *PUBLIC-DISK(...)

    *PUBSET(...)
    │    PUBSET = <cat-id>
    │    ,TASK-LIMIT = *STD / *NONE / <integer 1..255>
    │    ,EXCEPT-VOLUMES = *NONE / list-poss(255): <vsn>

    *PUBLIC-DISK(...)
    │    VOLUME = list-poss(255): <integer>
,EXCEPT-FILES = *NONE / *FROM-FILE(...)

    *FROM-FILE(...)
    │    LIST-FILE-NAME = <filename 1..54 without-gen-vers>
,ONE-EXTENT-FILE-SIZE = 1920 / <integer 0.. 2147483647 2Kbyte>

,KEEP-CONTIGUOUS-AREA = 5760 / <integer 1920..2147483647 2Kbyte>

,MONJV = *NONE / <filename 1..54 without-gen-vers>

,JV-PASSWORD = *NONE / < c-string 1..4> / <x-string 1..8> / <integer -2147483648..2147483647> / *SECRET

,PROCESS-OPEN-FILES = *NO / *YES
```

Operands

OBJECT = *PUBSET(...) / *PUBLIC-DISK(...)
Specifies the object for which a SPACEOPT job is to be initiated. In any case, the relevant pubset must have been imported, i.e. it must have the MRSCAT status "local accessible". If this is a shared pubset environment, a command launched by the slave computer is sent to the master computer and executed there (for or more information about the execution of commands in a shared pubset environment see the notes on).

OBJECT = *PUBSET(...)
A SPACEOPT job is initiated for all volumes of a pubset or volume set for which no SPACEOPT job is active.

> **PUBSET = <cat-id>**
> Catalog ID of the pubset or volume set.

TASK-LIMIT = *STD / *NONE / <integer 1..255>
Specifies the maximum number of parallel subtasks for the processing of the pubsets
or volume sets. With a SPACEOPT job for a pubset or volume set all volumes are
processed, with a separate subtask being generated for each one. The number of
parallel subtasks can be limited, for example so as not to impede parallel jobs on
account of too great a load on the system resources. Execution of the individual
SPACEOPT jobs is therefore staggered.
If an SM pubset is specified in the OBJECT=*PUBSET(PUBSET=...) operand, the value
specified for TASK-LIMIT is assigned to every volume set of the SM pubset.
If a SPACEOPT job is still active for this pubset or volume set, the existing value of
TASK-LIMIT is modified by the current specification. The number of parallel
SPACEOPT jobs is successively adjusted to the new value.

TASK-LIMIT = *STD
How this operand works depends on whether a SPACEOPT job is active for this pubset
or volume set:
– If there is no active SPACEOPT job for this pubset or volume set,
  TASK-LIMIT=*NONE is assumed.
– If a SPACEOPT job is active for this pubset or volume set, the existing value of
  TASK-LIMIT is not changed.

TASK-LIMIT = *NONE
The number of parallel SPACEOPT jobs is not limited.

TASK-LIMIT = <integer 1..255>
Defines the maximum number of parallel SPACEOPT jobs.

EXCEPT-VOLUMES = *NONE / list-poss(255): <vsn>
EXCEPT-VOLUMES=... allows you to specify whether any volumes of the pubset or
volume set are to be excluded from the reorganization.

EXCEPT-VOLUMES = *NONE
No volumes are to be excluded, i.e. a SPACEOPT job is to be initiated for every volume
of the pubset or volume set.

EXCEPT-VOLUMES = list-poss(255): <vsn>
Specifies volumes of the pubset or volume set for which no SPACEOPT job is to be
initiated.
Volumes which do not belong to the pubset or volume set are ignored.

OBJECT = *PUBLIC-DISK(...)
Lists specific volumes of an SF pubset or volume set for which a SPACEOPT job is to be initiated.
No new SPACEOPT job is initiated for volumes for which a SPACEOPT job already exists. You can find out about the existing SPACEOPT jobs with the /SHOW-SPACEOPT-JOB-STATUS command.

> **VOLUME = list-poss(255): <vsn>**
> VSNs of the volumes. All specified volumes must belong to the same SF pubset or volume set.

EXCEPT-FILES = *NONE / *FROM-FILE(...)
EXCEPT-FILES=... allows you to specify whether any files are to be excluded from the reorganization.
Important system files, open files and files with certain attributes are excluded from a reorganization by default (for more details, see section "Files normally excluded from the reorganization" on page 18).

EXCEPT-FILES = *NONE
No further files are excluded from the reorganization.

EXCEPT-FILES = *FROM-FILE(...)
The path names of the files to be excluded from a reorganization are taken from the so-called EXCEPT file. This file must be a SAM file with fixed or variable record length, which contains one path name (max. 80 characters) per record. No more than 4096 files may be excluded. For details of the syntax for the path names, see section "User-specified files to be excluded from the reorganization" on page 20).

> **LIST-FILE-NAME = <filename 1..54 without-gen-vers>**
> Path name of the EXCEPT file.

ONE-EXTENT-FILE-SIZE = 1920 / <integer 0..2147483647 *2Kbyte*>
Defines the maximum size of files in PAM pages (2K pages), at which SPACEOPT tries to accommodate the whole file in just one file extent.
If, however, there is no area large enough, the extent is reorganized "normally".
The default setting is that with files of up to 10 segments (with an allocation unit of 6K), SPACEOPT tries to consolidate extents. If you specify a value of less than 6 PAM pages, the extents will not be consolidated.

KEEP-CONTIGUOUS-AREA = <u>5760</u> / <integer 1920..2147483647 *2Kbyte*>
Specifies a size in PAM pages (2K pages) as of which the contiguously allocated areas cannot be reorganized.
To avoid unnecessary file movements, SPACEOPT does not reorganize contiguously allocated areas as of the specified size. The default setting for the area size is 5760 PAM pages (30 segments if the allocation unit is 6K). The lowest possible setting is 1920 PAM pages (10 segments if the allocation unit is 6K).

MONJV = <u>*NONE</u> / <filename 1..54 without-gen-vers>
Specifies whether a SPACEOPT job is to be monitored by a job variable.

MONJV = <u>*NONE</u>
Specifies that a SPACEOPT job is not to be monitored by a job variable.

MONJV = <filename 1..54 without-gen-vers>
Name of the job variable that is to monitor the SPACEOPT job created to clear a volume. It is only possible to specify a monitoring job variable if the software product JV has been purchased and installed.
If the specified job variable has not been cataloged it will be set up by SPACEOPT.
The status values that a monitoring job variable may assume are described in the section "Monitoring SPACEOPT jobs using the monitor job variable" on page 24.

**JV-PASSWORD = <u>*NONE</u> / <c-string 1..4> / <x-string 1..8> /
<integer -2147483648..2147483647> / *SECRET**
Serves to specify the password for the monitoring job variable. The operand is only evaluated if job monitoring has been specified (see the MONJV operand). The JV-PASSWORD operand has the following special characteristics:
– The password entered is not logged.
– The input field is automatically blanked out in an interactive dialog.
– In unguided dialog and foreground procedures, the entry *SECRET or ^ permits concealed input of the password.

PROCESS-OPEN-FILES = <u>*NO</u> / *YES
Specifies whether the SPACEOPT job should also include open files in the reorganization.

PROCESS-OPEN-FILES = <u>*NO</u>
Open files are not included in the reorganization, i.e. they are not processed in the SPACEOPT job.

PROCESS-OPEN-FILES = *YES
The SPACEOPT job should also include open files in the reorganization.

Command return codes

(SC2)	SC1	Maincode	Meaning/Guaranteed messages
	0	CMD0001	Command executed successfully
1	0	CMD0001	No volumes to process / SPACEOPT job already active
			Guaranteed messages: SOP0032, SOP0036
	1	CMD0202	Syntax error
	1	CMD2201	Internal parameter error
	1	SOP0034	Incorrect VOLUME operand
	2	CMD0200	Command currently unavailable
	2	CMD2202	Subsystem not defined
	3	CMD2203	Error during installation
	32	CMD0221	Internal SDF error
	32	SOP0022	Internal error
	64	CMD0216	Required privilege missing
	64	SOP0024	DMS error in the EXCEPT file
	64	SOP0025	EXCEPT file has invalid format
	64	SOP0026	Too many entries in the EXCEPT file
	64	SOP0030	VSN not in volume catalog
	64	SOP0031	Pubset not found or not accessible
	64	SOP0035	SYSSOPT ID not initialized
	64	SOP0039	Command not available on slave computer
	64	SOP005A	Processing error for an open file
	64	SOP0058	Extent movement for an open file aborted by access method
	64	SOP0059	Input/output cannot be stopped for an open file
	64	SOP0068	Open files cannot be processed
	64	SOP0069	Open files cannot be processed on the master
	65	CMD2241	Subsystem not loaded
	66	CMD2242	No connection to subsystem
	128	CMD2280	Subsystem is not available (short-term)
	129	CMD2281	Subsystem is not available (long-term)
	130	CMD2282	Subsystem not available for undefined period of time
	130	SOP002C	Insufficient storage space

Glossary

allocation unit, unit
Storage unit for the management of volumes and files. The size of an allocation unit is determined by the number of PAM pages. Allocation units of 3, 4 or 32 PAM pages are currently possible.
The allocation unit is specified by the user when formatting the volume.

extent
Storage area in which the user data of a file is partially or fully stored. Extents are always multiples of the allocation unit. The set of all extents of a file can be found in the catalog entry of the file in the form of the extent list. This list contains the names of the volumes as well as the number and position of the extents.

fragmentation
Disordered division of storage space into areas which hold or do not hold data.

fragments
Parts of a file or small isolated storage areas.

optimization
Reorganizing the allocated disk space by moving files or file extents so as to produce large, contiguous, free storage areas.

packet
The allocation units are grouped into larger units, called packets, for easier management. Each packet represents eight contiguous allocation units. A packet is considered free when all the allocation units within it are free.

PAM page
A contiguous storage space of 2048 bytes. In BS2000, the PAM page is the unit of formatting for volumes.

PHP (physical half page)
Physical page number of a PAM page on the volume.

reorganization

Rearrangement of the extents to recreate large, contiguous, free storage areas on the volume. During a reorganization, several small extents of a file can also be combined to form one larger extent. The extent list is updated each time.

segment

Packets are grouped into larger units, called segments, for easier management. Each segment is an amalgamation of eight contiguous packets.

unit table

Allocation table for storage space management. This table is a bitmap in which each allocation unit is represented by one bit, which indicates whether the allocation unit is occupied or free.

Abbreviations

ACS	**A**lias **C**atalog **S**ervice
AU	**A**llocation **U**nit
CCOPY	**C**oncurrent **Copy**
CMS	**C**atalog **M**anagement **S**ystem
DAB	**D**isk **A**ccess **B**uffer
DSSM	**D**ynamic **S**ub**s**ystem **M**anagement
DMS	**D**ata **M**anagement **S**ystem
HSMS	**H**ierarchical **S**torage **M**anagement **S**ystem
IMON	**I**nstallation **Mon**itor
PHP	**P**hysical **H**alf **P**age
SF pubset	**S**ingle-**F**eature Pubset
SM pubset	**S**ystem-**M**anaged Pubset
SOLIS	**So**ftware **Li**eferungs- und **I**nformations**s**ystem (German acronym for "software delivery and information system")
SPVS	**S**hared **P**ublic **V**olume **S**et
SSCM	**S**tatic **S**ubsystem **C**atalog **M**anagement
VSN	**V**olume **S**erial **N**umber

Related publications

You will find the manuals on the internet at *http://manuals.ts.fujitsu.com*. You can order printed copies of those manuals which are displayed with an order number.

[1] **BS2000 OSD/BC**
Commands
User Guide

[2] **DSSM / SSCM**
Subsystem Management
User Guide

[3] **BS2000 OSD/BC**
Introductory Guide to DMS
User Guide

[4] **BS2000 OSD/BC**
Diagnostics Handbook
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[5] **BS2000 OSD/BC**
Introduction to System Administration
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[6] **DAB** (BS2000)
Disk Access Buffer
User Guide

[7] **SECOS** (BS2000)
     Security Control System
     User Guide

[8] **JV** (BS2000)
     Job Variables
     User Guide

[9] **SHC-OSD** (BS2000)
     Storage Management
     User Guide

[10] **DRV** (BS2000)
     Dual Recording by Volume
     User Guide

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