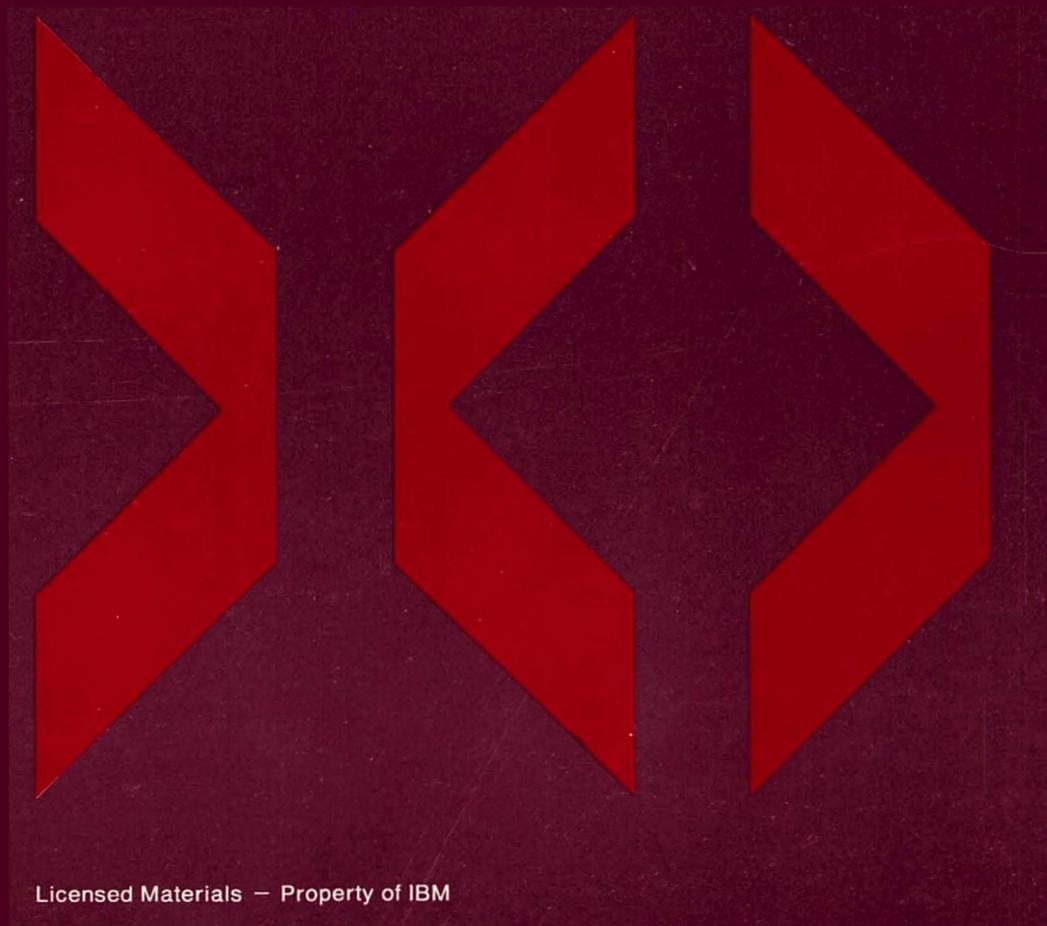




Data Facility
Hierarchical Storage Manager
Version 2 Release 5.0

LY35-0101-0

Diagnosis Reference Volume 1



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Data Facility
Hierarchical Storage Manager
Version 2 Release 5.0
Diagnosis Reference Volume 1

LY35-0101-0

Fifth Edition (December 1989)

This is a major revision of LY35-0078-1, which is now obsolete. Significant changes are summarized under "Summary of Amendments" This edition applies to Version 2, Release 5, Modification Level 0 of the Data Facility Hierarchical Storage Manager, Licensed Program 5665-329, and to all subsequent releases and modification levels until specified otherwise in new editions or technical newsletters.

Changes are made periodically to the information herein; before using this publication in connection with the operation of IBM systems, consult the latest *IBM System/370 and 4300 Processors Bibliography*, GC20-0001, for the editions that are applicable and current.

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Preface

This book is intended to help you diagnose Data Facility Hierarchical Storage Manager (DFHSM) problems. It provides overview information as to how DFHSM works and contains some internal product information that is provided as additional guidance for diagnosis. The information in this book must not be used for programming purposes.

Note: Any references to HSM in this book pertain to Version 1 Release 3 or earlier of the Hierarchical Storage Manager.

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MVS/DFP

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Major Divisions of This Book

This publication contains two sections and an index. A summary of the information in each section follows:

- Chapter 1, "Introduction" on page 1 describes how DFHSM gets control, the physical organization of DFHSM, the internal functions, the functional organization, the operating environment, error handling, and specialized algorithms.
- Chapter 2, "Functional Descriptions" on page 13 provides overview information as to how DFHSM works.

Corequisite Books

- *Data Facility Hierarchical Storage Manager Version 2 Release 5.0 Diagnosis Reference Volume 2*, LY35-0102, which describes the DFHSM design and the logic of the DFHSM routines. This book contains restricted materials of IBM.
- *Data Facility Hierarchical Storage Manager Version 2 Release 5.0 Diagnosis Reference Volume 3*, LY35-0103, which describes the DFHSM design and the logic of DFHSM routines. This book contains restricted materials of IBM.
- *Data Facility Hierarchical Storage Manager Version 2 Release 5.0 Diagnosis Reference Volume 4*, LY35-0104, which describes the DFHSM organization and data areas. This book contains restricted materials of IBM.
- *MVS/ESA Library Guide for System Product Version 3*, GC28-1563, which contains a complete listing of the MVS/SP Version 3 publications and their counterparts for the prior version.

Prerequisite Books

You should understand general programming techniques, System/370, and the Data Facility Hierarchical Storage Manager before reading this publication. If you need information about DFHSM, read:

- *Data Facility Hierarchical Storage Manager Version 2 Release 5.0 General Information*, GH35-0092, which describes DFHSM.
- *Data Facility Hierarchical Storage Manager Version 2 Release 5.0 System Programmer's Command Reference*, SH35-0083, which describes the space manager, operator, and system programmer commands. It also gives examples of how to use the commands.
- *Data Facility Hierarchical Storage Manager Version 2 Release 5.0 Installation and Customization Guide*, SH35-0084, which describes how to set up and install DFHSM. It contains information about the DFHSM data sets, procedures, and parameter library members, the user exits, the installation verification procedure, and the Version 2 Release 2.0 starter set. It also explains migration and coexistence considerations when you change from HSM Release 3 to DFHSM Version 2 Release 1.0 or when you change from DFHSM Version 2 Release 4.0 to DFHSM Version 2 Release 5.0.
- *Data Facility Hierarchical Storage Manager Version 2 Release 5.0 System Programmer's Guide*, SH35-0085, which describes the functions of DFHSM, the data compaction option, tape considerations, security and protection, using JES3 with DFHSM, and DFHSM procedures.
- *Data Facility Hierarchical Storage Manager Version 2 Release 5.0 User's Guide*, SH35-0093, which describes the DFHSM user tasks, and how to use the DFHSM user commands.

Related Books

The following publications may be helpful to you:

- *Data Facility Hierarchical Storage Manager Version 2 Release 5.0 Messages*, SH35-0094, which describes the messages issued by DFHSM.
- *Data Facility Hierarchical Storage Manager Version 2 Release 5.0 Diagnosis Guide*, LY35-0098, which describes how to diagnose failures in DFHSM.
- *Programming Systems General Information*, GC29-2228, which describes how to submit an Authorized Program Analysis Report (APAR).
- *MVS/ESA System Programming Library System Management Facilities (SMF)*, GC28-1819, which describes how to use System Management Facilities.
- *MVS/ESA Basics of Problem Determination*, GC28-1839, and *MVS/ESA Diagnosis System Reference*, LY28-1011, which provides information for use in debugging user or system programs.
- *MVS/ESA Diagnosis Data Areas Volume 1*, LY28-1043, which provides information on MVS data areas.
- *MVS/ESA Diagnosis Data Areas Volume 2*, LY28-1044, which provides information on MVS data areas.
- *MVS/ESA Diagnosis Data Areas Volume 3*, LY28-1045, which provides information on MVS data areas.

- *MVS/ESA Diagnosis Data Areas Volume 4*, LY28-1046, which provides information on MVS data areas.
- *MVS/ESA Diagnosis Data Areas Volume 5*, LY28-1047, which provides information on MVS data areas.
- *MVS/ESA Diagnosis Special Analysis Techniques*, LY28-1840, which provides additional information on debugging programs.
- *MVS/ESA Diagnosis Using Dumps and Traces*, LY28-1843, which provides additional information on debugging programs.
- *MVS/ESA JCL User's Guide*, GC28-1830, which describes how to use dynamic allocation and other job management services.
- *MVS/DFP Version 3 Release 2 Managing VSAM Data Sets*, SC26-4568, which describes the codes in messages about VSAM errors.
- *MVS/DFP Version 3 Release 2 Managing Non-VSAM Data Sets*, SC26-4557, which provides information on data set password protection.
- *MVS/DFP Version 3 Release 2 General Information*, GC26-4552, which provides an overview of MVS/DFP functions.
- *MVS/DFP Version 3 Release 2 Diagnosis Guide*, LY27-9570, which provides information on diagnosing MVS/DFP errors.
- *MVS/DFP Version 3 Release 2 Diagnosis Reference*, LY27-9571, which provides information on diagnosing MVS/DFP errors.
- *Resource Access Control Facility (RACF) General Information Manual*, GC28-0722, which describes how to use RACF.
- *TSO/E Version 2 Programming Guide*, SC28-1874, and *TSO/E Version 2 Programming Services*, SC28-1875, which describe how to write TSO command processors.
- *MVS/DFP Version 3 Release 2 System Programming Reference*, SC26-4567, provides information on return codes and reason codes.
- *MVS/DFP Version 3 Release 2 Macro Instructions for VSAM Data Sets*, SC26-4569, provides information on VSAM return codes.
- *MVS/DFP Version 3 Release 2 Macro Instructions for Non-VSAM Data Sets*, SC26-4558, provides data management macro instructions for QSAM, BSAM, BDAM, BPAM, and ISAM. This publication also provides information on return codes.
- *MVS/DFP Version 3 Release 2 Utilities*, SC26-4559, describes the utility programs available for program, device, and data management.
- *MVS/DFP Version 3 Release 2 Access Method Services for the Integrated Catalog Facility*, SC26-4562, provides information on return codes.
- *MVS/DFP Version 3 Release 2 Access Method Services for VSAM Catalogs*, SC26-4570, provides information on return codes.

SML Books

- *MVS/ESA Storage Management Library Storage Management Reader's Guide*, GC26-4654
- *MVS/ESA Storage Management Library Focus on Storage Management*, SC26-4655
- *MVS/ESA Storage Management Library Leading an Effective Storage Administration Group*, SC26-4658
- *MVS/ESA Storage Management Library Migration Planning Guide*, SC26-4659
- *MVS/ESA Storage Management Library Managing Storage Pools*, SC26-4656
- *MVS/ESA Storage Management Library Managing Data Sets and Objects*, SC26-4657
- *MVS/ESA Storage Management Library Storage Management Documentation Samples*, GV26-1022

DFDSS Books

- *Data Facility Data Set Services General Information*, GC26-4123, introduces you to DFDSS and helps in evaluating its use. It is primarily directed to data processing management.
- *Data Facility Data Set Services User's Guide*, SC26-4388, gives guidance on how to use DFDSS.
- *Data Facility Data Set Services Reference*, SC26-4389, describes DFDSS command syntax.
- *Data Facility Data Set Services Messages*, SC26-4390, lists DFDSS messages.
- *Data Facility Data Set Services Diagnosis Guide*, LY27-9538, tells how to diagnose errors you may encounter while using DFDSS.
- *Data Facility Data Set Services/Interactive Management Facility: Installation Planning Guide*, SC26-4129, tells what to consider when planning for and installing DFDSS/ISMF.

Summary of Changes

DFHSM Release 2 Version 5.0

This edition of the DFHSM Diagnosis Reference has been restructured into four volumes. This book includes information associated with the following functional characteristics:

- DFDSS data mover
 - Expanded SDSP support
 - Reblock support for partitioned data sets
 - Multi-volume data set support (SMS-managed only)
 - PDSE support
- Aggregate BACKUP and RECOVERY commands
- Improved Data Recording Capability (IDRC)
- FREEVOL enhancements
- Expanded AUDIT capabilities
- Expanded FIXCDS capabilities.

Certain modules in this book are designated as “object code only,” and are not described in detail.

Change bars are incorporated throughout the book to indicate where modifications are made.

DFHSM Version 2 Release 4.0

This edition includes technical modifications to the information. Change bars are incorporated throughout the book to indicate where the technical modifications are made.

Enhancements made within this release are:

- Recognition and Preservation of SMS Class Names
- Management of Data Sets Based on Management Class Specifications
- Conversion of Data Sets to SMS-managed Data Sets
- Expiration of Backup Versions
- Recognition and Support of System Reblockable Sequential Data Sets.

This edition also includes miscellaneous editorial modifications.

DFHSM Version 2 Release 3.0

This edition includes information associated with the following performance enhancements:

- Message table for the RECALL/RECOVERY Functions
- Message table for the MIGRATION Functions
- Message table for the BACKUP Functions
- The use of GTF (Generalized Trace Facility) with DFHSM.

This edition also includes miscellaneous editorial modifications.

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Chapter 1. Introduction

The Data Facility Hierarchical Storage Manager (DFHSM) is a collection of modules that manages data sets and space on a hierarchy of storage devices. It enables the installation to keep space available on fast-access storage devices for active data sets, and to move less active data sets to lower-cost-per-byte devices. In addition, DFHSM assists in creating and controlling backup versions of data sets that can be used for recovery.

DFHSM provides space management and availability management functions that automate space and data management.

Space management functions of DFHSM:

- Deletion of temporary data sets
- Release of over-allocated space
- Deletion of eligible, expired data sets
- Extent reduction
- Migration of data sets
- Recall of data sets.

Availability management functions of DFHSM:

- Automatic physical full-volume dump invoking Data Facility Data Set Services program
- Automatic incremental backup
- Automatic backup of DFHSM control data sets
- Command dump and backup
- Command full volume restore and data set recovery
 - Managing data sets from inventory information
 - Volume restore and system-managed recovery of individual data sets
- Expiration of backup versions
- Command aggregate BACKUP and RECOVERY.

These functions occur automatically or can be started by commands. The automatic processing is triggered by several parameters that are specified by the installation.

The primary elements of DFHSM are contained in a continuously running main control task that can be started under MVS. DFHSM performs its functions in response to determinations made automatically by DFHSM (with reference to installation-specified criteria) or in response to requests for service from outside the DFHSM work space.

Those DFHSM modules that are not part of the main DFHSM task only communicate requests to DFHSM from user tasks. These user tasks can be associated with TSO and batch environments, and the service requested can be either system-initiated or user-initiated. Most requests for DFHSM service, regardless of the source, are encoded into request blocks called management work elements

(MWEs). The MWEs are then queued and processed by the main DFHSM task and its subtasks. The automatic volume space management and backup functions do not have MWEs built, but are determined using in-storage control blocks called mounted volume tables (MVTs). DFHSM is started from a system operator's console with a START command. The main DFHSM control task, ARCCTL, is initially given control to do initialization. In addition to initializing and ending, ARCCTL functions primarily as a dispatcher. It receives requests for service from the operator and from other tasks (users or jobs), dispatches them to the appropriate subtasks, and monitors the subtasks for abnormal ends.

There are four categories of external sources of DFHSM work requests:

- Operator-initiated requests, from the system operator's console
- Requests initiated by the DFHSM startup procedure, from the SYS1.PARMLIB data set
- TSO-initiated requests, from user terminals or batch job processing
- System-initiated requests, resulting from JES3 setup or from allocation, scratch, rename, or open processing.

Figure 1 on page 3 shows control and data flow through DFHSM.

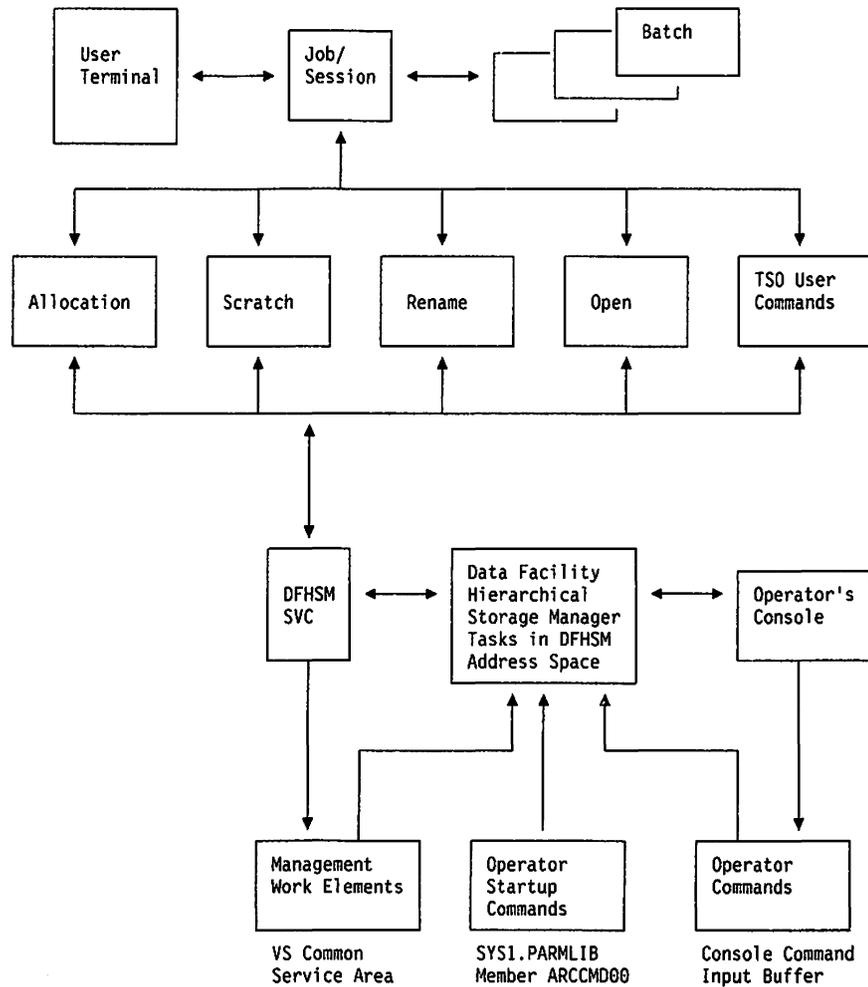


Figure 1. Control and Data Flow Through DFHSM

Operator-Initiated Requests

Operator-initiated DFHSM requests consist of commands to start, stop, and modify DFHSM. The START command can optionally include startup options that ARCCTL uses to override default options specified in the DFHSM startup procedure. The STOP command has a DUMP parameter that causes a dump of the DFHSM address space when DFHSM stops processing. The MODIFY command, however, is always specified with options, which consist of a complete DFHSM operator command. The ARCCTL task obtains operator commands directly from the system command input buffer, builds an MWE to contain the command, and dispatches the command processor subtask to process the MWE.

Requests Initiated by the Startup Procedure

Among the steps performed by ARCCTL as a result of a START command is the automatic processing of a series of DFHSM-authorized commands, which are contained in the SYS1.PARMLIB data set member ARCCMDxx. These startup commands are treated as if they had originated from the operator's console. Thus, each command from ARCCMDxx results in an MWE. However, ARCCTL calls

the appropriate command processor directly during startup rather than dispatching the command processor subtask.

TSO User-Initiated Requests

Unlike the operator commands, the TSO user commands are initiated from tasks that cannot communicate directly with the DFHSM work space. These user requests use the DFHSM supervisor call (SVC109, extended router code 24) as an intermediate step to get their DFHSM requests serviced.

TSO user commands are initially processed by TSO command processors. The command processors are DFHSM modules, but they are among the few modules that do not process in the DFHSM address space. The command processors encode their requests into MWEs that are then passed to DFHSM by the DFHSM SVC. The SVC creates a modified copy of each MWE in the system common service area (CSA), which can be accessed by any work space. (The queue of MWEs in the CSA is maintained between DFHSM startups as long as the CSA is maintained.) The SVC then posts ARCCTL to signal that work to do exists, and ARCCTL dispatches the appropriate subtask to process a copy of each MWE queued in the CSA.

System-Initiated Requests

System-initiated requests are handled in a manner similar to TSO user requests. In general, a system function determines that it requires work to be done by DFHSM before it can proceed with its processing. The system function then builds an MWE and sends it to DFHSM through the DFHSM SVC. As with TSO user commands, the MWE is copied to the CSA, where ARCCTL accesses it and dispatches the appropriate subtask to perform the requested function.

During JES3 setup processing, DFHSM checks each data set the JES3 converter/interpreter requested to determine if the referenced data set is migrated. If it is, and the data set is to be recalled as non-SMS, DFHSM modifies the volume list information to enable JES3 to know all volumes to which DFHSM might automatically recall that data set. If the data set is to be recalled as SMS, DFHSM returns the information from the Storage class, Management class, and the characteristics of the data set so that the storage group(s) can be determined for the data set. A migrated data set is not recalled at this time but is recalled later when the job begins to run. Requests for data sets that are not migrated are not changed by DFHSM.

Allocation processing checks the results of locate requests to see if the referenced data set is migrated. If the data set did migrate, an MWE is built to request that the data set be recalled.

Delete and scratch processing first determines if the data set is migrated. If the data set has been migrated, an MWE is built requesting that the data set be deleted from the migration volume without being recalled. (For delete processing, the catalog entry is also deleted.)

For rename processing, if it is determined that the data set is migrated, an MWE is built to request that the data set be recalled.

Open processing also is triggered by a DSCB-not-found condition. When it determines that this condition is a result of the data set having migrated, it builds an MWE to have the referenced data set recalled. Open processing will occur *only* for non-SMS-managed data sets.

DFHSM Physical Organization

Nearly all DFHSM modules are link-edited together as load module ARCCTL, which resides in SYS1.LINKLIB. The following modules are exceptions:

- Modules that handle TSO user commands
- DFHSM SVC (IGX00024)
- Modules that produce reports from the DFHSM log data sets
- Module ARCBVR23
- Modules that comprise the aggregate backup and recovery secondary address space
- DFHSM panels (ISMF or space maintenance)
- Modules that work with JES3 setup or with allocation, scratch, rename, and open processing.

Modules that handle TSO user commands reside in SYS1.CMDLIB. Each command processor module, together with associated service routines, is link-edited as a separate load module. These modules communicate with the main body of DFHSM through DFHSM SVC.

The DFHSM SVC (IGX00024) resides in SYS1.LPALIB. The only service routine associated with the SVC, ARCATTNW, also resides separately in SYS1.LPALIB.

The DFHSM modules ARCPRLOG and ARCPEDIT produce reports from DFHSM log data sets. Each of those modules, together with its associated service routines, is link-edited as a separate load module in SYS1.LINKLIB. Because these programs deal only with DFHSM log data sets, they have no need to communicate with the main body of DFHSM code.

DFHSM Panels are interactive storage management programs that allow you list information about your data sets through a series of panels and allow you to execute DFHSM commands against those data sets. DFHSM panels reside in:

- ISMF
 - SYS1.DFQLLIB (modules)
 - SYS1.DFQPLIB (panels)
 - SYS1.DFQMLIB (messages).
- Space Maintenance
 - SYS1.DFQPLIB (panels)
 - SYS1.DFQMLIB (messages)
 - SYS1.DFQTLIB (table).

Modules that work in conjunction with JES3 setup or with allocation, scratch, rename, and open processing reside in SYS1.LPALIB. IGG026DU is link-edited with the catalog SVC load module IGC0002F, IGG029DU is link-edited with the scratch SVC load module IGC0002I, and IGG030DU is link-edited with the rename SVC load module IGC00030. Modules IGGDASU2 and IGGDARU2 are link-edited in load module IGGDADSM. DFHSM module IFG0EX0A is link-edited as a separate load module in SYS1.LPALIB, and is called by the open/EOV module IFG0194C. If DFP 3.1.0 is not installed in the system, the VSAM OPEN exit module, IDATMSTP is link-edited into the module IDATMSTP. If DFP 3.1.0 is installed in the system, DFHSM does not replace IDATMSTP

because the DFP version of the module performs the same functions as the DFHSM version. All service routines associated with the system function modules reside in SYS1.LPALIB except ARCFAIL, which resides in SYS1.LINKLIB.

DFHSM Internal Functions

DFHSM modules that are not part of the main ARCCTL load module in DFHSM work space generally do not perform DFHSM functions. Their purpose is to build requests for functions to be performed by the main DFHSM system task and its subtasks in the DFHSM work space. (Note that, in this context, producing reports from the DFHSM log data set is not considered to be a DFHSM internal function.)

The major internal functions performed by DFHSM are:

- Migration
- Recall
- Deletion
- Backup
- Aggregate Backup and Recovery
- Recovery
- Full Volume Dump
- Full Volume Restore
- Deletion of Expired Data Sets
- Command processing.

The command processing function often leads to the performance of one of the other functions. Also, the logging and journaling activity connected with the internal functions can be thought of as one of the main DFHSM functions.

Migration: Migration is the moving of data sets

- From level 0 volumes to level 1 or level 2 volumes
- From level 1 to level 1 volumes
- From level 1 to level 2 volumes
- From level 2 volumes to other level 2 volumes.

Migration can occur automatically when triggered by conditions specified by the installation, or it can occur as a result of an operator or user command.

Recall: Recall is the process of bringing migrated data sets back to primary or non-managed volumes. Data sets are recalled from both level 1 and level 2 volumes, and recall can either be automatic or by an authorized or user command. A migrated data set is recalled automatically when a batch job or a TSO user references the data set.

Deletion: Deletion is the process of scratching data sets that have migrated under DFHSM control. The data set is deleted without being recalled to a primary or non-managed volume. The deletion function can occur automatically when a system scratch request is issued, or it can occur as a result of an authorized or user command.

Backup: Backup is the process of making copies of data sets and storing them on backup volumes. If something happens to the primary copy of a data set, a backup version can be recovered for it. Backup can occur automatically when triggered by conditions specified by the installation, or it can occur as a result of an authorized or user command.

Aggregate BACKUP and RECOVERY: Aggregate BACKUP and RECOVERY is the process of defining a group of data sets, referred to as an aggregate, and backing up the aggregate as an entity. The backup copies are written to tape. The aggregate can then be recovered as an entity at either a local or remote data processing center, by using the DFHSM aggregate recovery function.

Recovery: Recovery is the process of bringing backup versions of data sets back to a level 0 volume. The backup version can replace the original primary copy when the latter has been damaged or lost, or the recovered backup version can be renamed so it exists together with the current version when access to both versions of the data is needed. Recovery must be initiated by an operator or user command.

Full Volume Dump and Restore: DFHSM availability management has been extended to allow full, physical volume dump to tape and restore processing. DFHSM accomplishes the dump or restore by calling the Data Facility Data Set Services (DFDSS) licensed program. The dump and restore facility is an extension of the availability management functions of DFHSM. Therefore, DFHSM availability management applies to incremental backup, or dump, or both. DFHSM volume recovery is performed from either a set of DFHSM backup versions, or from a DFDSS dump copy, or from a combination of both. DFHSM data set recovery is from a DFHSM backup version, or a DFDSS dump copy.

The dump operation can be automatic or by command and can have its own independent cycle, automatic start window, and run at a multi-tasking level. The restore operation is by command only and allows for full volume or physical data set restore. Automatic dump operations can be performed on either primary or migration level 1 volumes. Command dump operations can be performed on any DASD volume.

DFHSM can make up to five concurrent dump copies, each being directed to a separate dump class. Each set of copies is known as a generation. DFHSM can maintain up to 100 generations of dumps for each volume. Optionally, DFHSM can also maintain a list of data sets that resided on each volume at the time it was dumped. The contents of this list can be displayed to allow locating a particular data set in a group of the dump volumes.

The tape volumes used to receive the dump output are a new category of DFHSM-owned volumes called dump volumes. The dump volumes can be grouped in user-defined dump classes. The individual dump classes have the following attributes defined:

- Volumes are allowed to be removed from the computer center and remain in the DFHSM inventory
- Individual physical data set restores from volumes in the classes can be allowed or disallowed
- DFDSS is allowed to specify whether to turn off the change bits for data sets that are dumped.

You can instruct DFHSM to reuse dump volumes automatically by supplying a retention period or by issuing an explicit command.

The dump and restore functions make possible a performance improvement for recovering a full volume. By performing a full-volume restore of a DFDSS-dumped DASD volume and applying incremental backup for those data sets that have been backed up since the dump was taken, you can recover faster than by using the DFHSM volume recovery function, which must search for the most recent backup version of each individual data set on the volume.

Deletion of Expired Data Sets: During space management of level 0 volumes and during cleanup activities of migration volumes, DFHSM can delete data sets that have reached their expiration dates. Such data sets are deleted even though they may not have reached the inactive age requirement for migration, deletion, or retirement. Data sets with an expiration date of zero are not deleted. The storage administrator can control whether or not DFHSM deletes the expired data sets.

Command Processing: Command processing involves the analysis of commands sent to DFHSM, and the resulting processing of the requested function. The commands fall into four categories:

- Commands that establish or modify DFHSM internal parameters controlling system operation and the processing of internal functions
- Commands that extract information from DFHSM parameter tables and control data sets in a read-only fashion for reporting purposes
- Commands that explicitly request processing of one of the primary DFHSM internal functions
- Commands that repair or rebuild DFHSM control data sets to aid in error recovery.

Log and Journal Processing: Log and journal processing involves the recording of DFHSM functions that are run. The log reflects all the service requests received, the startup and completion of internal functions, startup and shutdown of the DFHSM system task, the occurrence of major errors, DFHSM statistics, messages issued by DFHSM, and optionally, a trace of all changes made to the DFHSM control data sets. The DFHSM journal data set reflects only changes made to DFHSM control data sets.

DFHSM Functional Organization

DFHSM is a system task that runs in its own address space. For further reliability, the processing is divided into units that are assigned to subtasks. Most of the processing is done in the problem state, without assuming the capabilities of system code. The effect of this is to reduce the possibility of overall system damage due to a DFHSM malfunction, and to reduce the probability of a global DFHSM failure due to an error in processing a particular request. The separate address space with subtasking is probably the most significant design feature of DFHSM. In addition, the code was designed in modular fashion, with specific functions being assigned to specific modules, to give an overall hierarchical approach to specifying the flow of control.

The main control task, ARCCTL, is an essential part of DFHSM. When it receives control at DFHSM startup, ARCCTL sets up the initial operating environment. This includes setting up for access to data sets and communication with the

operator. The basic control blocks and tables are initialized, startup commands are processed, DFHSM SVC is started, (to indicate that DFHSM is active), and the DFHSM subtasks are attached. These subtasks control processing of the main internal functions.

After DFHSM initialization, ARCCTL dispatches work to the appropriate subtasks when service requests are sent to DFHSM. The existence of work to do is signaled by the posting of one of the event control blocks (ECBs) that ARCCTL waits on. The work requests themselves have been placed by the requestor in the CSA queue. If the request originated through DFHSM SVC, ARCCTL copies the MWE from the CSA area and puts it on the appropriate queue. Similarly, if the request has come through the operator's console, ARCCTL routes it to the proper queue.

After placing the work request in the appropriate queue, ARCCTL posts an ECB that the subtask is waiting on. After dispatching subtasks, ARCCTL monitors them in order to handle any abnormal ends that might occur. ARCCTL also controls DFHSM shutdown by requesting shutdown of its subtasks and waiting for subtask activity already in progress to complete.

Migration Subtask

The subtask that processes the migration function is ARCMCTL. ARCMCTL processes MWEs from the migration MWE queue for command-initiated migration requests, and it also determines when automatic space management should be triggered. ARCMCTL also controls the process of calculating the free space on primary and migration volumes. ARCMCTL attaches the ARCMDSN subtask to process data set migration requests, and attaches ARCMGEN to handle both automatic and command space management requests for volumes.

Recall and Deletion Subtask

The subtask that processes both the recall and deletion of migrated data sets functions is ARCRCTL. ARCRCTL processes MWEs from the recall MWE queue for recall and deletion requests. Multiple ARCRSTR subtasks can be attached by ARCRCTL to handle these requests.

Backup Subtask

The subtask that processes the backup functions is ARCBACK. ARCBACK processes MWEs from the backup MWE queue for command-initiated backup requests, and it also determines when automatic backup should be triggered. ARCBACK attaches the ARCBDSN subtask to process data set backup requests, and attaches ARCBGEN to handle both automatic and command volume backup. Multiple ARCBVOL subtasks can be attached by ARCBGEN to handle volume backup requests.

Recovery Subtask

The subtask that processes both the recovery functions is ARCGCTL. ARCGCTL processes MWEs from the backup MWE queue for data set and volume recover, and data set and volume restore. ARCGCTL attaches ARCGDSN to perform data set recover or restore requests, and attaches ARCGVOL to perform volume recover requests, and attaches ARCGRVOL to perform volume restore requests.

Dump Subtask

The subtask that processes the dump functions is ARCDCTL. ARCDCTL attaches ARCDGEN to perform both automatic and command volume dumps.

Aggregate BACKUP and RECOVERY Subtask

ARCACTL performs the aggregate backup and recovery processing function. ARCACTL selects MWEs for processing from the ABACKUP and ARECOVER queues. Up to 15 subtasks are attached, depending on the maximum number of secondary address spaces allowed.

Control Data Set Subtask

ARCCOPEN opens the control data sets during DFHSM startup, and closes the control data sets during DFHSM shutdown.

Activity Log Subtask

ARCALOG allocates, opens, closes, and writes all output to the activity log.

Problem Determination Aid Subtask

ARCPDO maintains the in-storage trace table and opens and closes the Problem Determination Aid (PDA) trace data sets.

Command Subtask

The subtask that processes DFHSM commands is ARCCP. The MWEs on the operator MWE queue contain the text of operator commands in their entirety, and ARCCP routes the MWE to the proper command processor in the DFHSM work space.

DFHSM user commands do not necessarily reach the ARCCP subtask. HMIGRATE, HRECALL, HDELETE, HBACKDS, and HRECOVER are encoded into internal function requests for migration, recall, deletion, backup, and recovery, respectively. HQUERY, HALTERDS, HBDELETE, and HSEND CMD are translated from user command format to DFHSM operator command format. They are then processed by ARCCP as operator commands.

The HLIST command also reaches ARCCP, but it is treated uniquely. An MWE from HLIST does not involve a command to process, but instead requests that a control data set record image be returned by DFHSM. ARCCP obtains the requested record and returns it in the completed MWE.

Logging and Journaling Subtask

The subtask that processes logging and journaling is ARCILOG. At DFHSM startup time, ARCILOG sets up the log and journal data sets for processing. Modules within DFHSM work space then call ARCILOG to write log and journal records. Log swapping is also performed when ARCILOG is posted to signal a request for this function.

JES3 Setup Interface

The DFHSM processing of JES3 setup takes place in module IGG026DU in the user's address space and in ARCCP. If a data set is migrated, IGG026DU builds an MWE that is sent to DFHSM by the DFHSM SVC. ARCCP returns in DFHSM's address space a volume list for a data set which is to be recalled as non-SMS, or the storage class name, management class name, and the characteristics of the data set to be used in determining the storage group to which the SMS-managed data set is to be recalled. If a data set is not migrated, for a non-SMS data set, IGG026DU builds an MWE that is sent to DFHSM by the DFHSM SVC, and ARCCP marks a DFHSM record so the data set will not be migrated until after the job is expected to run.

No processing is performed for SMS-managed data sets which have not been migrated.

DFHSM Operating Environment

DFHSM runs on the MVS operating system with JES2 or JES3. (DFHSM maintains RACF and password protection for non-SMS data sets). The publication *Data Facility Hierarchical Storage Manager Version 2 Release 5.0 General Information* has estimates for the amount of storage required by DFHSM.

DFHSM Data Sets

DFHSM uses the following data sets:

- Computing system catalog
- Migration control data set
- Backup control data set
- Offline control data set
- Journal data set
- Log data sets
- Small-data-set-packing data sets.

For information about what the data sets are and how they are used, see *Data Facility Hierarchical Storage Manager Version 2 Release 5.0 Installation and Customization Guide*. "Data Areas and Cross Reference" in *Data Facility Hierarchical Storage Manager Version 2 Release 5.0 Diagnosis Reference Volume 4* contains information about the formats of records in all but the system catalog.

Error Handling

The main DFHSM control task, by being uninvolved in the actual data movement and other processing, is isolated from the problems that might occur in the handling of the DFHSM internal functions. Thus, it is able to maintain the operation of the DFHSM as a whole even when abnormal ends occur in its subtasks. If an unrecoverable error occurs in the main DFHSM task; however, DFHSM will end.

Subtasks are attached with the ESTAI exit modules provided to intercept and process abnormal ends. The MWE that was in process at the time of the subtask

abnormal end is purged, and the subtask is reestablished to allow it to begin new work. Each subtask has a recovery control block associated with it that indicates the progress of the subtask at the time of the abnormal end. This aids the ESTAI exit module in its cleanup of task activity.

Those modules that are directly involved with data set I/O activity are also ESTAE-protected. The ESTAE exit module processes errors resulting from I/O errors, and makes retry determinations before returning control to the exit address within the module that issued the I/O request.

The aggregate backup and recovery processing is performed in a secondary address space controlled by a new DFHSM primary address space subtask. The secondary address space is protected from most abnormal endings by an ESTAE routine; unrecoverable abnormal endings will cause the secondary address space to end. The aggregate backup and recovery subtask in the primary address space is protected by an ESTAI routine.

Specialized Algorithms

As data sets of variable size are allocated, scratched, moved, and extended on a volume, the free space on the volume generally becomes scattered in small pieces.

DFHSM fragmentation index can be used as a qualitative measure of the scattering of free space on a volume. The value of the index ranges from 0 to 1; the closer to 1, the more likely it is that the free space on the volume is excessively scattered. The fragmentation index is stored in DFHSM as a binary integer from 0 to 1000 which represents the number of tenths percent. For example, if fragmentation is 50 percent, the fragmentation index is 500. The *approximate* index value is calculated as follows:

1. All Format 5 DSCBs for the volume are checked to determine the number of free tracks, F , in each extent.
2. For each extent, F is multiplied by the natural logarithm of F , and these products are added together for all extents described in all the Format 5 DSCBs, forming the sum S .
3. The natural logarithm for the total number, T , of free tracks on the volume is computed as value L .
4. The values of T , L , and S are used in the following formula to arrive at a value D that represents an *approximate* measure of the amount of extent scattering:

$$D = ((T \times L) - S)/T$$

5. Using this formula, the *approximate* value of D for the worst possible scattering (where all the free space is in separate one-track extents) is equal to L minus 1.
6. The final DFHSM fragmentation index for a volume is the ratio of the actual measure of fragmentation to the worst possible case:

$$\text{Fragmentation index} = ((T \times L) - S)/(T \times (L - 1))$$

Chapter 2. Functional Descriptions

This chapter describes the main functions of DFHSM. DFHSM performs various tasks, such as Backup, Migration and Restore, through the controlled interaction of a number of discrete, uniquely named modules. Different tasks are often performed by different groups of modules. There are however, a number of DFHSM functions (the Recover and Restore Processing areas are a good example) in which some of the same modules are involved in different systemic operations.

The descriptions that follow include the input, sequence of processing steps, and the output for each DFHSM module. Though some modules are involved in a number of functions, we have tried to group them according to the main functions in which they take part. Each functional area is preceded by a pictorial overview that specifies the flow of control among its modules. We have also described the modules separately, since each of them contains a number of subroutines, or labels, that perform small steps within the broader context of that module's operation.

DFHSM Task Control Overview

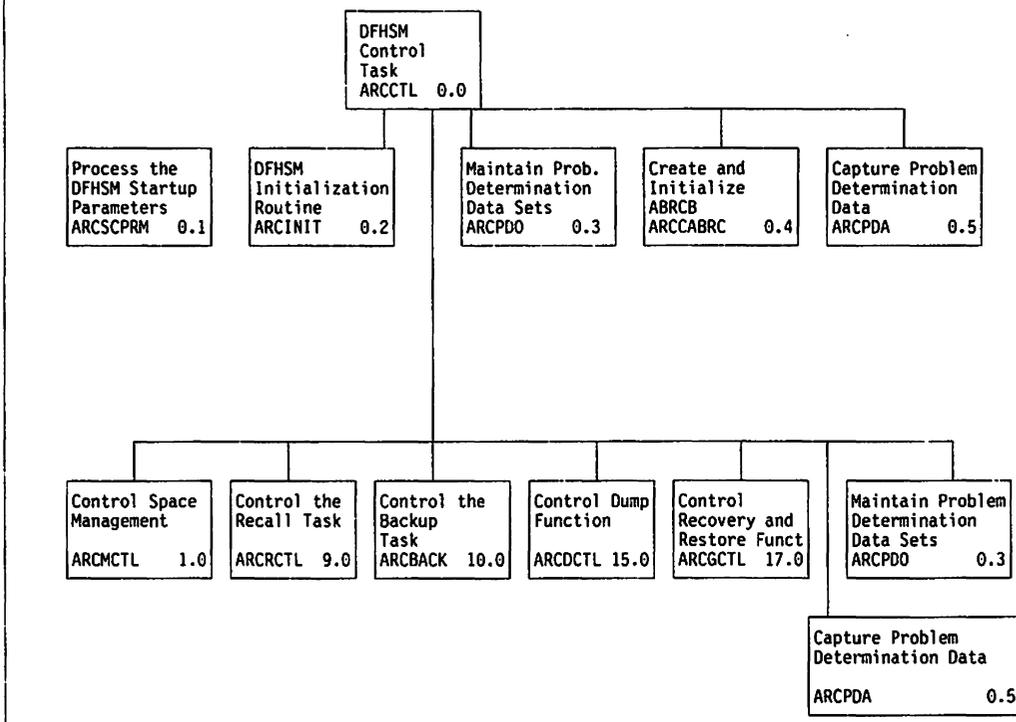


Figure 2. Visual Table of Contents for DFHSM Task Control Overview

Diagram 0.0: ARCCTL - DFHSM Control Task

Input

- Invocation Parameters
- Management Communication Vector Table (MCVT)
- VSAM Catalog
- SYS1.PARMLIB (Startup Command Stream)
- VSAM Control Blocks
- Migration Control Data Set (MCDS)
- Backup Control Data Set (BCDS)
- Space Usage Table (SUT)
- Queue Control Table (QCT)
- Management Work Elements (MWEs)
- Command Input Buffer (CIB)
- Multiple-host Processor Control Record (MHCR)
- Dummy TSO Control Blocks.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCCTL	ARCCTL
ARCPDA	ARCPDA

2. **Determine and set up the initial DFHSM processing environment:** ARCCTL checks whether DFHSM is an operator-started task. If it is not, message ARC0009I is sent to the operator and startup fails. ARCCTL sets up an ESTAE exit to handle control task abnormal ends, and then tests to determine if any other version of DFHSM is already active. If another version is active, message ARC0006I is sent to the operator and this start request is ignored. If no other version is active, the JFCBPASS bit is set on to avoid security checking of non-VSAM data sets. Storage is obtained for the TODD data area used by ARCTOPEN to keep track of open tape data sets. The storage is obtained in ARCCTL's automatic storage to prevent losing this data if ARCTOPEN abnormally ends or is detached.

ARCCTL calls ARCSCPRM to read the startup parameters from the DFHSM start procedure. If there is an error detected in the startup parameters, message ARC0010I is issued.

TSO control blocks are set up so that DFHSM can employ TSO service routines.

IDENTIFY macros are issued to create all the needed subtask entry points to be accessed by ARCCTL.

ARCINIT is called to perform most of the remaining DFHSM initialization steps. ARCCTL checks the Return Code upon return from ARCINIT to determine if an error occurred during initialization that would cause DFHSM

initialization to end. If a non-zero Return Code is detected, control passes to the DFHSM shutdown processing.

Module	Label
ARCCTL	ARCCTL
	ARCTMP
ARCINIT	ARCINIT
ARCESTAI	ARCESTAI
ARCSCPRM	ARCSCPRM
ARCWTO	ARCWTO

3. **Call ARCCABRC to GETMAIN the Aggregate Backup and Recovery Control Block:** ARCCTL will call ARCCABRC to create and initialize the Aggregate Backup and Recovery Control block. ARCCABRC will set required defaults before returning control to ARCCTL.

Module	Label
ARCCTL	ARCCTL
ARCCABRC	ARCCABRC

4. **Identify and attach the control subtasks.** The final steps before entering the normal ARCCTL activity scan include attaching each control subtask. The subtasks handle operator command, migration, recall, dump, backup, recovery/restore activity, and aggregate backup and recovery activity. After the subtasks are attached, the "DFHSM initialization complete" indicator is set, and the Problem Determination Aid task (ARCPDO) is posted to begin the internal trace function.

The following steps are performed whenever the corresponding request is found after ARCCTL has been posted, signaling work to do.

Module	Label
ARCCTL	ARCCTL
ARCALOG	ARCALOG
ARCBACK	ARCBACK
ARCCP	ARCCP
ARCMCTL	ARCMCTL
ARCRCTL	ARCRCTL
ARCDCTL	ARCDCTL
ARCGCTL	ARCGCTL
ARCACTL	ARCACTL

5. **Process DFHSM shutdown:** When a DFHSM shutdown has been requested or an unrecoverable error has occurred (including those encountered during DFHSM initialization), each control subtask is posted to shut down if it is still active. ARCSVCIF invokes the DFHSM SVC to set DFHSM inactive. Then, each subtask is detached after it has shut down. The MWEPURGE routine is given control and the queue in the common service area storage is scanned. All WAIT requests are purged except batch WAIT requests, which are left on the queue. If in a multiple processing unit environment, ARZREAD reads the MHCR from the MCDS. Accumulated control data set space usage statistics from the SUT are combined with data obtained by the SHOWCB macro and added to the MHCR. ARZUPDT then rewrites the updated MHCR. ARCLOCK enqueues the MCDS while the MHCR is being accessed. ARCWTO reports errors that occur while accessing the MCDS. Storage obtained from subpool 241(CSA) for pool definition elements and for volume

lists is freed. Before shutting down the log subtask, any accumulated daily statistics are logged and final updates are made to the DFHSM statistics and control records. ARCCOPEN is POSTed to close each control data set individually. A WAIT macro is issued on the ending ECB of ARCCOPEN for completion of the close function. Once all the control data sets have been closed, the ARCCOPEN task is DETACHED. DFHSM processing is then ended.

Module	Label
ARCCTL	ARCCTL MWEPURGE FREEUP
ARCISTAT	ARCUSTAT ARCUCTL
ARCILOG	ARCWLOG
ARCLOCK	ARCLOCK ARCUNLK
ARCSVCIF	ARCSVCIF
ARCWTO	ARCWTO ARCWTU3
ARCZREAD	ARCZREAD
ARCZUPDT	ARCZUPDT
ARCCOPEN	ARCCOPEN

6. **Process any task abnormal end:** When a control subtask abnormally ends, ARCCTL receives control from ARCESTAI. If the abnormally ending task is ARCPDO, it is neither detached nor reattached, otherwise, the abnormally ending subtask is detached and then reattached for continued processing.

Module	Label
ARCCTL	ARCCTL
ARCALOG	ARCALOG
ARCBACK	ARCBACK
ARCCP	ARCCP
ARCILOG	ARCILOG
ARCMCTL	ARCMCTL
ARCRCTL	ARCRCTL
ARCDCTL	ARCDCTL
ARCGCTL	ARCGCTL
ARCACTL	ARCACTL

7. **Load DFDSS and user exits if required:**

- If MCVTDSL D is set to 1, issue the DELETE macro to attempt to remove any existing copies of DFDSS, then issue the LOAD macro to load module ADRDSSU (DFDSS). If an error occurred loading the module, call ARCWTO to write message ARC0015I to the operator after converting the ABEND code and reason code to a printable format. A DFDSS load failure will also cause DFHSM to be selected as the primary data mover.
- Any user exits that require it will be loaded or reloaded. If the load of a user exit fails, message ARC0004I is issued to the operator with ABEND code 806 and the user exit is turned off.

Module	Label
ARCCTL	ARCCTL LOAD_DFDSS CHKEXITS
ARCWTO	ARCWTU

8. **Process work elements sent from user tasks via the DFHSM SVC:** User requests are passed from the user work tasks to ARCCTL in the system common service area queue. When work to do is found in the common service area, ARCLOCK enqueues exclusively on the MWE general queue and enqueues exclusively on the DFHSM queue control table. The queue control table contains the pointer to the head of the common service area MWE queue, which is then scanned for work elements. ARCCTL copies each valid MWE from the common service area and calls ARCENQ to chain them to the general DFHSM queue of requests, and the request is logged. ARCCTL checks whether the address space of a NOWAIT MWE has exceeded the number of MWEs allowed. If it has, ARCCTL deletes the common service area copy of the NOWAIT MWE and decreases the running total of common service area storage used, which is kept in the queue control table. ARCERP is called to request a SNAP dump if the MWE is not valid. The QCT resource is dequeued and the general DFHSM queue dequeued when processing has completed on the user requests. The daily statistics record is updated to reflect the above activity.

Module	Label
ARCCTL	ARCCTL
ARCENQ	ARCENQ
ARCERP	ARCERP
ARCLOCK	ARCLOCK ARCUNLK
ARCILOG	ARCWLOG

9. **Process work elements from the DFHSM general queue:** When work to do exists on the general DFHSM queue, ARCLOCK enqueues exclusively on the MWE general queue, and then scans the work requests. ARCDEQ is called to remove an invalid MWE from the DFHSM general queue. MWEs are tested for proper type of request and the requestor's authority to make that request. MWEs that fail the test are removed from the general queue by ARCDEQ. If the work requests are from the user, ARCSVCIF and the DFHSM SVC return control to the user. For a valid MWE, authorization to issue the command is checked if the command requires authorization. For a command that requires authorization, if the MWE does not indicate that an authorized user issued the request, the issuer's user record from the MCDS is checked for authorization. For authorization failures, the command is rejected. For MWEs to be processed, ARCDEQ dequeues each request from the general queue.

The appropriate routine is called to place the request on a functional queue and post the queue processor indicating work-to-do. ARCUNLK then dequeues the general DFHSM queue.

Module	Label
ARCCTL	ARCCTL
ARCENQ	ARCDEQ
ARCERP	ARCERP
ARCLOCK	ARCLOCK
	ARCUNLK
ARCPBQ	ARCPBQ
ARCPMQ	ARCPMQ
ARCPMWE	ARCPMWE
ARCPRQ	ARCPRQ
ARCSVCIF	ARCSVCIF

- 10. Modify QCT to reflect DFHSM Status:** Modify the QCT to reflect the current status of JES3 prevent migration MWEs, the number of non-wait MWEs to be retained in CSA, and the CSA space usage limits for non-wait MWEs.

Module	Label
ARCCTL	ARCCTL

Output

- Management Communication Vector Table (MCVT)
- TSO Control Blocks
- Queued Management Work Elements (MWEs)
- Space Usage Table (SUT)
- Migration Control Data Set (MCDS)
- Backup Control Data Set (BCDS)
- Queue Control Table (QCT)
- Pool Descriptor Element (PDE)
- Volume List of Primary Volumes in a JES3 System (VLST)
- Daily Statistics Record (DSR)
- Installation Exit Table (EXT).

Diagram 0.1: ARCSCPRM - Process the DFHSM Start Up Parameters

Input

- Start Up Parameter List Pointer (PARMPTR).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCSCPRM	ARCSCPRM
ARCPDA	ARCPDA

2. **Scan DFHSM startup parameter list for valid keywords and parameters:** ARCSCPRM scans the DFHSM startup parameters for valid keywords and parameters. Once a keyword and its associated parameter are validated, appropriate management communication vector table (MCVT) fields are updated based on that data. If ARCSCPRM detects invalid keywords or parameters, ARCWTO is called to issue message ARC0106I to the operator console to display a list of all keywords or parameters in error. Upon completion of processing, a Return Code is set based on the results of the scan and control is returned to ARCCTL. ARCCTL interrogates this Return Code and fails DFHSM startup if the Return Code is not zero.

Module	Label
ARCSCPRM	ARCSCPRM
ARCWTO	ARCWTO

Output

- Return Code:
 - 16 - DFHSM Keyword or Parameter Error.

Diagram 0.2: ARCINIT - DFHSM Initialization Routine

Input

- None.

Processing

ARCINIT performs most of the DFHSM one-time initialization functions.

Output

- Return Codes.

Diagram 0.3: ARCPDO - Maintain Problem Determination Data Sets

Input

- Job File Control Block (JFCB)
- Communications Vector Table (CVT)
- Management Communication Vector Table (MCVT)
- Recovery Control Block (RCB)
- Trace Control Table (TRCT).

Processing

1. **Initialize ARCPDO task:** Control is passed to ARCPDO at DFHSM startup. Storage for the trace control table (TRCT) is gotten and initialized. ARCPDO waits to be posted. When ARCPDO is posted ARCPDO will do one of the following actions in this order:
 - Terminate if ARCPDO task termination is requested
 - Repeat the wait if the MCVT indicates that DFHSM initialization is not yet complete
 - Repeat the wait if the MCVT indicates that 'PDA(NONE)' was specified on the SETSYS command
 - Exit the "wait forever" loop and continue ARCPDO initialization below if none of the above is true.

Storage is gotten for the trace wrap buffer. Under MVS/XA, this request is for storage above the 16 meg line.

Call ARCZEST to establish an ESTAE environment. For ABENDs involving I/O functions, retries are performed to locations within ARCPDO immediately following the I/O instruction causing the ABEND. For ABENDs not involving I/O functions, there is no retry attempted and the ARCPDO task will terminate.

ARCPDO reads the job file control blocks (JFCBs) for both the ARCPDOY and ARCPDOX problem determination data sets and saves the data set names specified on their respective DD statements. The alternate problem determination data set (ARCPDOY) is then deallocated with a call to ARCFREE. If either JFCB encountered a read failure or indicated a dummy DD was specified on the DFHSM startup JCL, call ARCWTU3 to issue message ARC0036I to the operator and permanently disable all subsequent DASD output operations.

If trace data sets are to be switched at DFHSM startup, the alternate and active problem determination data sets are renamed (see step 3), call ARCFREE to free the alternate problem determination data set. Open the active data set (ARCPDOX). If the open fails for the active data set, call ARCWTU3 to issue message ARC0036I to the operator and temporarily inhibit all subsequent DASD output operations.

Initialization is complete at this point and control transfers to the main processing loop at step 2.

Module	Label
ARCPDO	ARCPDO PSWITCH RENAME STOPIO SWITCH OPNFAIL
ARCFREE	ARCFREE
ARCWTO	ARCWTU3
ARCZEST	ARCZEST

2. **Main Process Loop:** Once ARCPDO is initialized, ARCPDO enters its main processing loop until shutdown is requested, which consists of the following steps:

- Wait for posting of the work-to-do ECB (CRTQEBC)
- Switch problem determination data sets if requested (see step 3)
- Process all of the trace buffers on the problem determination output queue (see step 4)
- When DFHSM shutdown is requested,
 - Close the problem determination output data set if it is open
 - Call ARCZEST to cancel the ESTAE environment
 - Return to the caller.

Module	Label
ARCPDO	ARCPDO MODE24 PSWITCH MODE31 WRBUF
ARCFREE	ARCFREE
ARCWTO	ARCWTU3
ARCZEST	ARCZEST

3. **Switch problem determination data sets:** Close the active problem determination data set. The RENAME macro is used to rename the active data set to the temporary name of 'uid.HSMPDO#.TEMP.HSMPDO.TEMP' where 'uid' is the high level qualifier of the data set name allocated by the ARCPDOX DD statement and '#' is the DFHSM HOSTID specified in this host. If the rename fails, the active data set keeps its original name. If the rename is successful, the alternate data set is renamed to the name of the active data set. If the alternate data set rename is successful, the old active data set is renamed from the temporary name to the name the alternate data set had. Call ARCWTU3 to issue message ARC0037I to the operator on a successful rename. If the rename is not successful, call ARCWTU3 to issue message ARC0032I to the operator. If the renaming was successful, call ARCFREE to deallocate the active problem determination data set and call ARCASHR to reallocate the active problem determination data set with disposition of SHR. Open the new active data set. If the open fails for the new active data set, call ARCWTU3 to issue message

ARC0036I to the operator and temporarily inhibit all subsequent DASD output operations.

Module	Label
ARCPDO	ARCPDO CLOSFAIL MODE24 MODE31 OPNFAIL2 PSWITCH RENAME STOPIO SWITCH
ARCALOLD	ARCALSHR
ARCFREE	ARCFREE
ARCWTO	ARCWTU3

4. **Process the problem determination trace queue:** ARCPDO processes and removes entries from the problem determination queue by the following method:

- From the queue tail, fill in the backward chain pointer in each buffer while following the forward chain all the way to the queue head.
- For each buffer on the problem determination queue, write the 4K trace data block to DASD and remove the buffer from the queue. The buffer is then returned to a pool of free buffers (or FREEMAINED if the pool already contains the maximum limit of free buffers). If an I/O error occurs, issue a SYNADAF macro and a WTO macro to indicate an I/O error that occurred. If either an I/O error or an abnormal end occurs while writing to the problem determination data set, call ARCWTU3 to issue message ARC0034I to the operator and switch the problem determination data sets (see step 3). If the switch is successful, another attempt is made to write the trace data block. If an error occurs trying to write to the switched data set, call ARCWTU3 to issue message ARC0036I to the operator and temporarily inhibit all subsequent DASD output operations.

Module	Label
ARCPDO	ARCPDO COPYBUFF COPYFREE IOABEND MODE24 MSG034 MODE31 PDOSYNAD PSWITCH STOPIO WRBUF

Output

- Trace Control Table (TRCT)
- Trace Wrap Table
- Messages
- Problem Determination Data Sets.

Diagram 0.4: ARCCABRC - Create and Initialize ABRCB

Input

- None.

Processing

ARCCABRC initializes the aggregate backup and recovery control block (ABRCB).

Output

- Initialized ABRCB.

Diagram 0.5: ARCPDA - Capture Problem Determination Data

Input

- Communications Vector Table (CVT)
- Management Communication Vector Table (MCVT)
- Trace Control Table (TRCT)
- Input Parameters.

Processing

1. **Entry and initialization** ARCPDA is called to capture problem determination data. If the in-storage trace wrap table does not exist or if the PDA function has been disabled, return to caller (go to step 5).

Get a free dynamic work area from the pool. If none is available, GETMAIN one and add it to the pool. If there are no free areas and the pool is full, return to caller (go to step 5).

Initialize the dynamic work area obtained and process the callers problem determination data for placement into the work area.

Module	Label
ARCPDA	ARCPDA CVTBITS EXITMOD PARMLOOP QUITPARM TS1

2. **Create a timestamp trace entry** After the input parameters have been processed, the trace table is checked to see if it is time to add a formatted timestamp entry in the trace table. Each trace entry contains only enough of the binary TOD clock to distinguish time differences between trace entries. This portion of the TOD clock is insufficient to pinpoint the real time the trace entry was created. Every four minutes, a TIME macro is issued to get a formatted date/time value. The additional 'TIME' trace entry is then created and appended to the front of the trace entry that was just created (before the entry is recorded in the in-storage wrap table).

Module	Label
ARCPDA	ARCPDA TIMEDONE

3. **Record the problem determination data** After the trace entry has been constructed, it is moved to the next available position of the in-storage trace wrap table. If the 'next available position' was past the end of the trace table, the pointer is reset to the beginning of the trace table before the trace entry is stored, thus overlaying previous entries. Compare and Swap instructions are used in manipulating the trace table pointers to avoid data loss due to asynchronous task updates. If the entry just created filled the last position of a block within the trace table, that block is copied and queued for output (see step 4). At this point, processing is complete. (go to step 5).

Module	Label
ARCPDA	ARCPDA CS1 POST

4. **Output data queuing:** The POST procedure copies completed blocks of trace data, puts these blocks on the output queue, and posts ARCPDO to process the queue. If the output queue is too big (over 50 blocks), DASD output is inhibited, or if the ARCPDO task has abnormally ended, the trace data block will not be queued and will eventually be lost when the in-storage trace table wraps around.

The buffers used to hold the copied data and add to the queue are kept in a pool of free buffers. If there are no buffers in the pool, a GETMAIN is issued for one. (The maximum number of buffers allowed in the free pool is controlled by a default in the MCVT). Under MVS/XA, the buffers are obtained above the 16 meg line. After the data is copied into the buffer, it is placed on the tail of the output queue. Compare and Swap instructions are used to update the queue tail pointer to avoid queuing problems due to asynchronous updates by multiple tasks.

After the buffer is queued, a POST is issued to the ARCPDO task.

Module	Label
ARCPDA	ARCPDA POST CS2 CS3 CS4

5. **Clean up and module exit** If a dynamic storage area was obtained, its lock is released and it remains in the free pool for use by a subsequent execution of ARCPDA.

The caller's registers are loaded. Control is then returned to the calling module in the same addressing mode (24 or 31 bit) that existed at entry to ARCPDA.

Module	Label
ARCPDA	ARCPDA EXITMOD

Output

- Trace Wrap Table
- Output Data Queue.

Space Management Processing

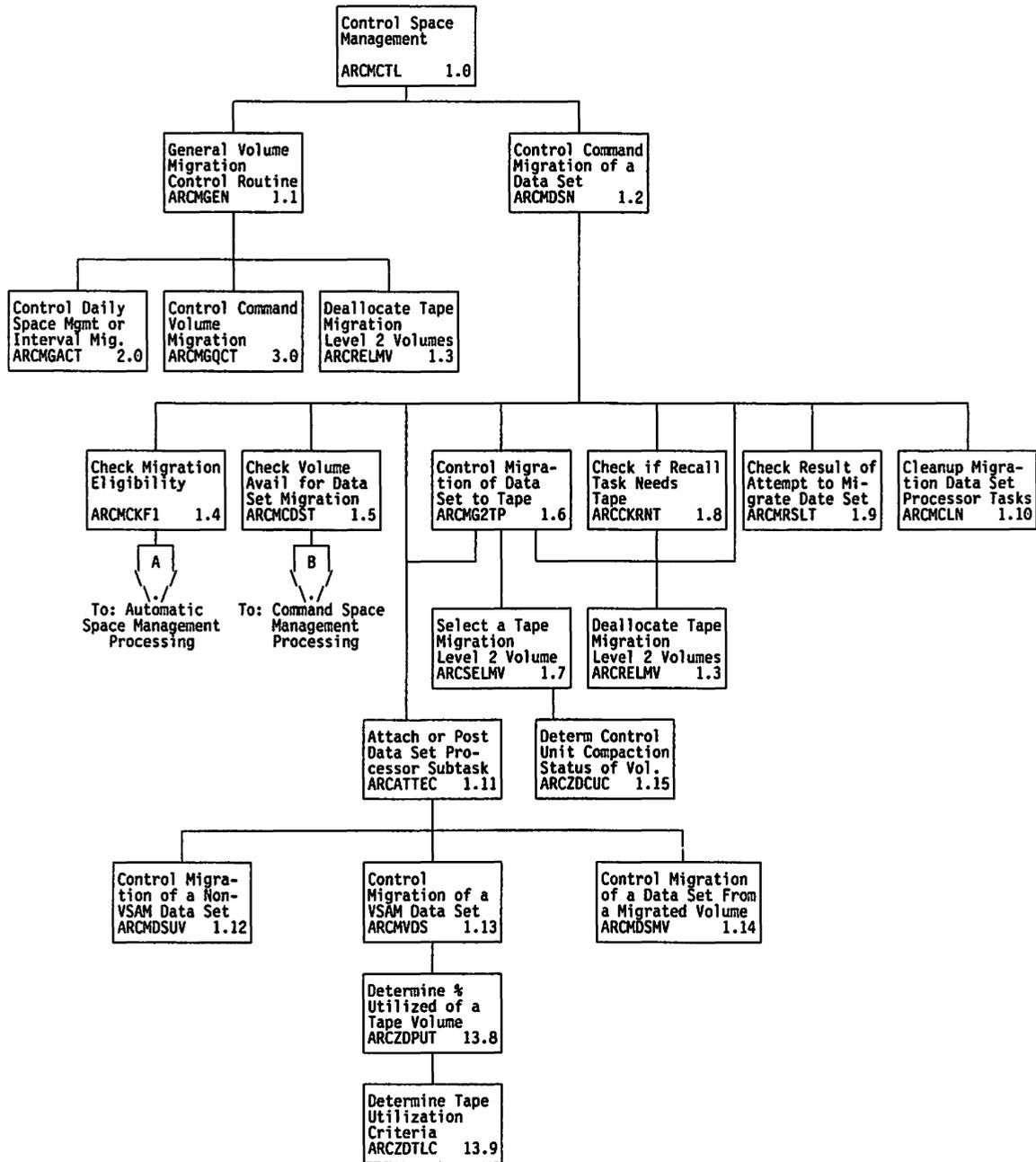


Figure 3. Visual Table of Contents for Space Management Processing

Diagram 1.0: ARCMCTL - Control Space Management

Input

- Management Communication Vector Table (MCVT)
- Mounted Volume Table (MVT)
- Management Work Elements (MWEs).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCMCTL	ARCMCTL
ARCPDA	ARCPDA

2. **Initialize to handle available work when posted. Enter wait:** ARCMCTL is attached by ARCCTL to control migration. ARCMCTL is attached with an ESTAI exit. ARCCTL will restart ARCMCTL unless DFHSM is shutting down.

The migration control recovery control block is initialized by calling ARCIRCB. Recovery control blocks for the daily space management and data set migration subtasks are created and initialized by calling ARCCRCB.

In a multiple processing unit environment on the primary processing unit, the multiple processing unit control record (MHCR) is read. The MHCR is updated at the beginning and end of space check and when daily space management is begun. ARCZREAD, ARCZWRT, and ARCZUPDT are called to do the reads and writes. For a non-primary processing unit, the MHCR is read into a work area and maintained only as a local in-core data area. For a single processing unit environment, the MHCR is maintained only as an in-core data area.

ARCMCTL calls ARCLSPAC to check the space for all migration level 1 volumes that have the space check indicator on, and all primary volumes that are subject to automatic recall or are in a user pool. ARCMSMV is called to copy the free-space information from the migration level 1 free space record (MC1) to the MVTs. In a JES3 environment, ARVCUPD is called to update the in-core VAC record. In a multiple processing unit environment, ARCMCTL calls ARCCUMC1 to update the MC1 record.

If the level 2 control record has not already been in storage, ARCZREAD reads it into a permanent location and its address is saved in the MCVT. The system timer is set to control space management.

An event control block (ECB) list, posted when there is work for ARCMCTL to do, is prepared.

The ARCMGEN and ARCMDSN TCB pointers in the migration global control block are zeroed; and ARCMCTL self-POSTs each subtask-has-ended ECB, to cause immediate dispatching from the WAIT and the attaching of each subtask (step 5 on page 31).

After ARCMCTL comes out of the wait state, it checks each ECB in the list. If ARCMCTL has been posted, it performs one of the functions described in the following steps.

Module	Label
ARCMCTL	ARCMCTL CHKVOLS MHCRINIT NOSPCK READMHCR WRITMHCR STIMER
ARCCRCB	ARCCRCB ARCIRCB
ARCCUMCI	ARCCUMCI
ARCESTAI	ARCESTAI
ARCLSPAC	ARCLSPAC
ARCMSMV	ARCMSMV
ARVCUPD	ARVCUPD
ARCZREAD	ARCZREAD
ARCZUPDT	ARCZUPDT
ARCZWRT	ARCZWRT

3. **If debug, print message:** ARCMCTL calls ARCWTL to issue message ARC0901I to command log, if debug messages are requested.

Module	Label
ARCMCTL	ARCMCTL DEBUG WRT901
ARCWTO	ARCWTL

4. **If requested, print the migration activity log:** If a print of the migration activity log has been requested, call ARCGMAIN to obtain storage for the activity log work element (ALWE). If GETMAIN is successful, call ARCPAQ to place the ALWE on the ALWE queue and post ARCALOG to open and close the activity log. If GETMAIN was not successful, call ARCWTO to issue message ARC0110I to the operator to indicate that the migration activity log could not be closed and reopened.

Module	Label
ARCMCTL	ARCMCTL CLOSELOG
ARCGMAIN	ARCGMAIN
ARCPAQ	ARCPAQ
ARCWTO	ARCWTO

5. **Handle subtask startup and end:** If a subtask (ARCMGEN, ARCMDSN) has ended (unless DFHSM shutdown is in progress), it is detached if it was attached, and then attached.

When a subtask is attached, the address of its TCB is stored in the migration global control block.

Module	Label
ARCMCTL	ARCMCTL STRTMGEN STRTMDSN
ARCMGEN	ARCMGEN
ARCMDSN	ARCMDSN

6. **If shutdown, handle end:** If a shutdown is in progress, end processing is done. If the subtasks have not completed, ARCMCTL posts the appropriate ECB to let them know it is time to quit. ARCMCTL waits for each subtask to complete. When the subtask has ended, ARCMCTL will detach the subtask.

Module	Label
ARCMCTL	ARCMCTL STOPMCTL

7. **Prepare for work request:** A particular function is requested by setting a flag in the MCVT. The individual functions are detailed in the following steps.

Module	Label
ARCMCTL	ARCMCTL MECB

8. **Process a change in the daily space management planned start time:** A change to the daily space management planned start time might require a change in the current setting of the space management timer. The timer is reset, or daily space management is started (restarted) immediately, as required. If the timer is not functioning, issue message ARC0013I to the operator. If no timer error, the next space check interrupt is determined and updated in the MHCR.

Module	Label
ARCMCTL	ARCMCTL TIMECHG MGWINDOW GMIGTEST STIMER MHCUPDI READMHCR MHCUPDT WRITMHCR BUMPDATE CHKTIME
ARCISTAT	ARCUCTL
ARCWTO	ARCWTL
ARCZREAD	ARCZREAD
ARCZWRT	ARCZWRT
ARCZUPDT	ARCZUPDT

9. **Process a check restart request:** A SETSYS NOEMERGENCY, a RELEASE MIGRATION, or a RELEASE AUTOMIGRATION command has been entered. Daily space management is restarted if all appropriate conditions are met. If restart, do the same as for step 13. If it is not restarted because the current time is not within the daily space management start window, message ARC0556I is issued to the log and the operator by calling ARCWTL.

Module	Label
ARCMCTL	ARCMCTL CHKRSTRT MGWINDOW
ARCWTO	ARCWTL

10. **Process QUERY SPACE:** ARCLSPAC is called to space check the specified volumes.

If in a multiple-host environment, ARCCUMC1 is called to update the MC1 record for each MVT entry that indicates the need.

Module	Label
ARCMCTL	ARCMCTL CHKVOLS
ARCCUMC1	ARCCUMC1
ARCLSPAC	ARCLSPAC

11. **Initiate queued migration requests:** If the data set or volume requests are on the migration queue, and DFHSM is not in emergency mode the appropriate processor (ARCMGEN, ARCMDSN) is posted.

Module	Label
ARCMCTL	ARCMCTL PROCMWES
ARCMGEN	ARCMGEN
ARCMDSN	ARCMDSN

12. **Perform hourly space check and interval migration:** The space check is requested by the expiration of the space management timer. If daily space management is currently running on this host, either the timer is reset for two hours later or if the daily space management time has changed, it is rescheduled. Otherwise, for a primary or single-host processor:

- If there is an MVT chain of non-SMS-managed volumes, call ARCLSPAC to check each such volume
- If SMS is installed:
 - If an MVT chain of SMS-managed volumes has not yet been established:
 - call ARCSMSVM to determine the SMS-managed volumes to handle
 - if ARCSMSVM returns an error, leave the chain pointer zero; and if interval migration has been requested on this host, call ARCSM570 to issue an error message
 - If the pointer to the MVT chain of SMS volumes exists (non-null), call ARCLSPAC to check each SMS-managed volume.

If needed and allowed, ARCMGEN is posted to do interval migration. ARCWTOR is called to issue message ARC0505D to the operator to request permission, if required. For a primary processing unit in a multiple processing unit environment, the MHCR is updated: ARCZREAD, ARCZUPDT and ARCZWRIT are called to do the reads and writes. ARCMSMV is called to copy the free-space information from the MCI record to the MVT records. In a JES3 environment, ARVCUPD is called to update the in-core JES3 volume activity count record (VAC).

For a non-primary processing unit in an environment with multiple processing units daily space management or space check is running on a primary host, the space check is rescheduled unless a maximum delay has been reached. ARCZREAD is called to read the MHCR, so that the primary host activity may be determined. If the space check is to be performed and if the primary host is active (determined by the existence of, and the values in, the MHCR), the space check is done by calling ARCLSPAR to copy the information from the MCDS volume records (MCVs). In this case, if interval migration is needed and allowed, ARCMGEN is posted. ARCWTOR is called to request operator permission, if required with message ARC0505D.

If the primary host is not active, the space check is performed as if this were a primary host. In this case, ARCWTL is called to write performance message ARC0405I.

At the end of space check, the system timer is set for the next space management function.

Module	Label
ARCMCTL	ARCMCTL LSPACEV BUMPDATE CHKVOLS CHECK_SMS_VOLS CHKWINDOW GMIGTEST MHCRUPDI READMHCR MHCRUPDT WRITMHCR MHCRINIT MHCRSTLS NOSPCK NPRISPCK STIMER SINTRUPT ASKOP TIMESET PERFMSG
ARCLSPAC	ARCLSPAC ARCLSPAR
ARCMGEN	ARCMGEN
ARCMSMV	ARCMSMV
ARCCUMCI	ARCCUMCI
ARCSMSVM	ARCSMSVM

ARCSM570	ARCSM570
ARVCUPD	ARVCUPD
ARCWTO	ARCWTOR
	ARCWTL
ARCZREAD	ARCZREAD
ARCZUPDT	ARCZUPDT
ARCZWRT	ARCZWRT

13. **Start daily space management:** Daily space management is requested by the following:

- Space management timer expires. A local flag is set to indicate daily space management.
- The daily space management planned start time is changed.
- A request is made that results in a restart check. If daily space management is already running, ARCMCTL sets the system timer for the next space management function, and WAITs for more work. Otherwise, if this is not a daily space management restart, all information about restarting in the management control record (MCR) is cleared.

Unless daily space management is held or the operator refuses permission (if required), ARCMGEN is posted for daily space management. ARCWTOR is called to issue message ARC0505D to obtain the operator's permission. If this is the primary processing unit in a multiple processing unit environment, ARCZREAD, ARCZUPDT, and ARCZWRT are called to read and write the MHCR.

The MCR is written by calling ARCUCTL. The system timer is set for the next space management function.

Wait for more work to do.

Module	Label
ARCMCTL	ARCMCTL
	DSM
	ASKOP
	BUMPDAT
	CHKTIME
	MHCRINIT
	READMHCR
	WRITMHCR
	STIMER
	NPRISPCK
ARCMGEN	ARCMGEN
ARCISTAT	ARCUCTL
ARCWTO	ARCWTOR
ARCZREAD	ARCZREAD
ARCZUPDT	ARCZUPDT
ARCZWRT	ARCZWRT

Output

- Recovery Control Blocks (RCBs)
- Migration Level 2 Control Record (L2CR)
- In-Storage Version of the MCR and MHCR
- Mounted Volume Table (MVT)
- Management Communication Vector Table (MCVT).

Diagram 1.1: ARCMGEN - General Volume Migration Control Routine

Input

- Management Communication Vector Table (MCVT)
- Migration Global Control Block (MGCB)
- Migration Tape Selection and Release Parameter (MTSP)
- Mounted Volume Table (MVT)
- Migration Task Control Block (MTCB).

Processing

ARCMGEN controls the automatic and command volume level space management.

Output

- None.

Diagram 1.2: ARCMDSN - Control Command Migration of a Data Set

Input

- None.

Processing

ARCMDSN controls command data set level space management.

Output

- Return Codes.

Diagram 1.3: ARCRELMV - Deallocate Tape Migration Level 2 Volumes

Input

- ARCMTSP Parameter List.

Processing

1. **Trace the entry to this module:** If the MCVT indicates tracing is active, call ARCPDA to create a trace entry for this entry to the module.
2. **Deallocate the tape volumes:** ARCRELMV calls ARCULVOL to deallocate the tape volumes currently allocated to the DFHSM task that called ARCRELMV. If an error occurs, ARCTFULL is called to mark the tape full, and ARCWTM is called to issue Message 0507I, control returns to the caller. If the tape is single-file format and PARTIALTAPE(MARKFULL) has been specified, ARCTFULL is called to mark the tape full.

Module	Label
ARCRELMV	ARCRELMV ARCTFULL Message 0507I
ARCERP	ARCERP
ARCULVOL	ARCULVOL
ARCWTO	ARCWTM
ARCTFULL	ARCTFULL

3. **Update the MCDS volume (MCV) record and related records:** ARCRELMV calls ARCZREAD to read the MCV record for the deallocated volume, calls ARCZUPDT to update the MCV record, and the DDNAME of the tape allocation is set to blanks in the input parameter list. If the caller indicates that the last volume in the list is unavailable or not selected, and the caller is any migration task or recycle target task, the volume serial number of the old target tape volume is removed from the management control record (MCR).

ARCRELMV calls ARCFMAIN to free the storage for the MVT entry area if the caller requested it. The recovery control block (RCB) and the migration tape selection and release parameter list (MTSP) are updated. If an error occurs, processing ends, and control returns to the caller.

Module	Label
ARCRELMV	ARCRELMV RDUPDTV WRITEMCV
ARCGMAIN	ARCFMAIN
ARCISTAT	ARCUCTL
ARCWTO	ARCWTM ARCZREAD ARCZREAD
ARCZUPDT	ARCZUPDT

Output

- ARCMTSP Parameter List
- Management Control Record (MCR)
- Recovery Control Block (RCB)
- Migration Control Data Set Volume Record (MCV)
- Return Codes:
 - 0 - The migration tape is deallocated
 - 8 - The deallocation of the migration tape failed.

Diagram 1.4: ARCMCKF1 - Check Migration Eligibility

Input

- ARCKFIP Parameter List.

Processing

ARCMCKF1 determines whether a data set is supported by DFHSM and eligible for migration.

Output

- Return Codes.

Diagram 1.5: ARCMCDST - Check Volume Availability For Data Set Migration

Input

- One-character functional request key
- Index for Migration Task Control Block (MTCB)
- Pointer to Migratable Data Set Queue Element (MDQE).

Processing

ARCMCDST checks the requested target volume type that is indicated in the MDQE against the available target volume types (stored in the MGCB).

Output

- None.

Diagram 1.6: ARCMG2TP - Control the Migration of a Data Set to Tape

Input

- Migration Attach Parameter List (MATP)
- Migration Communication Vector Table (MCVT)
- Migration Task Control Block (MTCB)
- ARCMDS Parameter List
- ARCMVDS Parameter List
- Migration Tape Selection or Release Parameter List (MTSP)
- Recovery Control Block (RCB)
- Mounted Volume Table (MVT).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCMG2TP	ARCMG2TP
ARCPDA	ARCPDA

2. **Select and allocate a tape for migration:** Validate the input parameter lists. If any invalid parameter passed, call ARCERP to log the error and end the processing. Otherwise, if no tape is allocated to the calling migration task, ARCMG2TP calls ARCSELMV to select and allocate a new tape migration level 2 volume. If ARCSELMV cannot select or allocate a tape, processing ends in ARCMG2TP, and the condition is flagged in the parameter list. This also causes the calling migration controller (ARCMDSN,ARCMVOL, or ARCTLEVI) to end processing.

Module	Label
ARCMG2TP	ARCMG2TP
	VFYPARMS
	INIT
	SETUPIDX
	SELECTTP
ARCERP	ARCERP
ARCSELMV	ARCSELMV

3. **Migrate the data set to tape:** ARCMG2TP calls ARCATTEC to attach and post the proper module in the data set migration subtask to cause migration of the data set to tape.

Module	Label
ARCMG2TP	ARCMG2TP
	ATTEC
ARCATTEC	ARCATTEC

4. **Process errors in which the data set migration subtask has abnormally ended:** If the data set migration subtask abnormally ends, ARCMG2TP examines the RCB of the data set migration subtask and calls ARCRELMV to release the tapes that are allocated (if necessary). Set off the tape-needs-release indicator in the RCB of the migration controller.

Module	Label
ARCMG2TP	ARCMG2TP ABENDERR RELEASTP
ARCRELMV	ARCRELMV

5. **Process tape not mounted errors:** A tape-not-mounted error occurs in one of the following ways:

- When trying to open the migration copy on tape, the operator did not respond to the tape mount request by the installation-set time limit. DFHSM issued a message if the tape could be mounted and the operator replied 'NO.'
- While DFHSM was writing to a tape volume, an end-of-volume condition occurred. The rest of the migration copy needs to be written on a new tape volume and the operator replied 'NO' to the mount message.

For a specific data set, the migration is re-tried once after a tape-not-mounted error. ARCMG2TP does the following:

- Verifies that this is the first tape-not-mounted error for the data set.
- Calls ARCRELMV to release the tapes allocated to the task. The MCV record and RCB are updated.
- Calls ARCSELMV to select and allocate a new target tape migration level 2 volume.
- Zeroes the Return Code in the parameter list of the proper data set migration subtask, calls ARCIRCB to initialize the RCB of the data set migration subtask, and calls ARCATTEC to attach and post the proper module in the data set migration subtask to re-try the migration of the data set.

Module	Label
ARCMG2TP	ARCMG2TP TPMNTERR RELEASTP
ARCATTEC	ARCATTEC
ARCCRCB	ARCIRCB
ARCRELMV	ARCRELMV
ARCSELMV	ARCSELMV

6. **Process migration errors that did not cause the data set processor task to abnormally end and that are not tape-not-mounted errors:** There are several categories of errors. For the following errors, ARCMG2TP does not retry migration processing with the data set:

- Error opening the migration copy of the data set on tape.
- A password-protected data set could not be migrated to a tape that is not password-protected.
- Error reading the job file control block (JFCB) when trying to allocate the migration copy of the data set on tape.

For the following errors, ARCMG2TP signals to the migration control modules via flags in the parameter list:

- A GETMAIN error for the 16K buffer to write a data set to tape, or a GETMAIN error for the control blocks to allocate a data set on tape.
- An abnormal end in the tape data set user exit, ARCTDEXT. A module in the data set processor task has held migration.
- A new tape was needed and a scratch tape was selected. The open of the migration copy of the data set on the tape volume failed because the scratch tape could not be internally added to DFHSM.

For the following errors, the migration of the data set is re-tried once:

- Error reading or writing a control data set record. If 10 or more errors occur for control data set records during a migration, ARCMG2TP sets on a tape termination flag.
- Error processing a tape header or trailer label in tape end-of-volume processing.
- Error trying to update the tape table of contents (TTOC) to reflect the migration of the data set to tape and another host was busy with the TTOC.
- Error when closing the migration copy of the data set.

For the following condition, ARCMG2TP retries the migration of the data set two times:

- More than the maximum number of tape volumes (255) have been allocated with the same DDNAME.

If a module in the data set migration subtask detects that the tapes allocated to the migration task need to be released, the module adds 100 to the Return Code that would normally be passed back. When ARCMG2TP encounters one of these Return Codes greater than 100, ARCMG2TP calls ARCRELMV to release the allocated tapes, subtracts 100 from the Return Code, and sets off the indicator in the RCB of the migration controller which indicates that tapes are to be released.

Module	Label
ARCMG2TP	ARCMG2TP MIGERR RELEASTP CKRETRY
ARCATTEC	ARCATTEC
ARCCRCB	ARCIRCB
ARCRELMV	ARCRELMV
ARCSELMV	ARCSELMV

7. **Check last file block ID or volume sequence number in the MVT of tape allocation:** If any tapes are still allocated, the MVT entry for the tape allocation is checked. If the tape is a multiple-file format tape volume, check if the last file block ID is greater than 9999. If it exceeds 9999, ARCMG2TP calls ARCRELMV to release the tapes. If the tape is a 3480 single-file format tape volume, check if the volume sequence number is greater than 215. If it exceeds 215:

- Invoke ARCZCSFT to CLOSE the data set, issue error message ARC0923I if necessary, and reset the related flags in the other data-mover RCBs.
- Whether ARCZCSFT failed or not, call ARCTFULL to mark the tape volume full.
- Call ARCRELMV to deallocate the tape.

ARCSELMV selects a new tape when ARCMG2TP is called to migrate the next data set to tape.

Module	Label
ARCMG2TP	ARCMG2TP CKLFBID CLOS3480 RELEASTP
ARCRELMV	ARCRELMV
ARCSELMV	ARCSELMV
ARCTFULL	ARCTFULL
ARCZCSFT	ARCZCSFT

8. **Trace the exit of this module:** Call ARCPDA to create a trace entry for the exit of this module.

Module	Label
ARCMG2TP	ARCMG2TP
ARCPDA	ARCPDA

Output

- Migration Attach Parameter List
- Migration Tape Selection or Release Parameter List (MTSP)
- Mounted Volume Table (MVT) for tape
- RCB of data set processor
- Updated ARCMDS Parameter List
- Updated ARCMVDS Parameter List
- Return Codes:
 - 81 - No target migration tape could be selected or allocated.

Diagram 1.7: ARCSELMV - Select a Tape Migration Level 2 Volume

Input

- ARCMTSP Parameter List
- Management Control Record (MCR)
- Mounted Volume Table (MVT)
- DASD Level 2 Available Table (DL2AT) or Tape Volume Table (TVT)
- Recovery Control Block (RCB)
- Management Communication Vector Table (MCVT)
- MCDS Volume Record (MCV).

Processing

Initial Selection

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCSELMV	ARCSELMV
ARCPDA	ARCPDA

2. **Check the selected tape for the specified caller in the MCR in-core copy for selection criteria:** Depending on the specified caller, the appropriate field in the MCR is checked to see if a volume has already been selected as a target volume for the DFHSM task that is requesting initial selection. If a volume is found in the MCR record, ARCZREAD is called to read the MCDS volume record (MCV) corresponding to the volume to see if the volume can be used as a target volume. To be used as a target volume, the volume must meet the following requirements:
 - Not marked in use.
 - Not marked unavailable.
 - Be the current target.
 - Not be full.
 - The file block ID in the MCV for a 3480 single-file format tape volume is not equal to -1.
 - Incorrect format (3480 single-file format or multiple-file format) if a non-empty 3480 tape is to be used as a target volume.
 - The unit name must be compatible with the unit name specified in the SETSYS command (SETSYS RECYCLEOUTPUT(MIGRATION(unit)) | SETSYS TAPEMIGRATION(DIRECT(TAPE(unit)) | ML2TAPE(TAPE(unit)) | NONE(ROUTETOTAPE(unit)))).
 - Must meet control unit compaction criteria.

If the file block ID in the MCV for a 3480 single-file format tape volume is equal to -1, ARCTFULL is called to mark the volume full and look for another volume.

If the volume meets the above conditions, ARCTVSC is called to check whether the security options on the tape are compatible for the current types of tape security in DFHSM.

If the volume meets all requirements, ARCSELMV updates and writes the MCV. If the selected volume is an empty 3480 tape, the format flag in the MCV is set based on the currently requested format in the management communication vector table (MCVT). If an empty 3480 tape volume is selected and the currently requested format is a single-file format, the volume sequence number is set to 1 in the MCV. If a 3480 single-file format tape volume is selected, the file block ID in the MCV is set to -1.

Module	Label
ARCSELMV	ARCSELMV CHKMCRVL RDUPDTV REMLMCR WRITEMCV RLSEMCV SETUSERV CHECK_CUC_STATUS
ARCZDCUC	ARCZDCUC
ARCERP	ARCERP
ARCGMAIN	ARCGMAIN
ARCTFULL	ARCTFULL
ARCTVSC	ARCTVSC
ARCZREAD	ARCZREAD
ARCZRLSE	ARCZRLSE
ARCZUPDT	ARCZUPDT

3. **Scan the tape volume table (TVT) to select a tape:** If no tape is selected by step 2, call SCANTVT to scan the TVT. If no TVT exists, ARCSCANV is called to create the TVT. ARCLOCK is called to enqueue on this processing unit while the TVT is being scanned.

If the first pass through the TVT does not produce a target volume, ARCSELMV calls ARCSCANV to build the TVT. If a target volume is found in correct format (the checking only for a 3480 tape) and if it meets control unit compaction criteria, it is removed from the TVT.

If the selected volume is an empty 3480 tape, the format flag in the MCV is set based on the currently requested format in the MCVT. If an empty 3480 tape volume is selected and the currently requested format is a single-file format, the volume sequence number is set to 1 in the MCV. If a 3480 single-file format tape volume is selected, the file block ID in the MCV is set to -1. ARCSELMV updates and writes the MCV.

Module	Label
ARCSELMV	ARCSELMV SCANTVT CHKTVTVL CHKTVTOK RDUPDTV REMLTVT WRITEMCV RLSEMCV CHECK_CUC_STATUS

ARCZDCUC	ARCZDCUC
ARCLOCK	ARCLOCK
	ARCUNLK
ARCSCANV	ARCSCANV
ARCTFULL	ARCTFULL
ARCTVSC	ARCTVSC
ARCZREAD	ARCZREAD
ARCZRLSE	ARCZRLSE
ARCZUPDT	ARCZUPDT

4. **Allocate the selected tape:** If a target volume has been chosen, an MVT entry is created for the volume. If the volume is not successfully allocated and ARCSCANV has not been called to create the TVT, ARCSCAN is called to build the TVT. If a 3480 empty tape is allocated, the format flag in the MVT is set based on the currently requested format flag in the MCVT. If the allocated volume is an empty 3480 tape and the currently requested format is a single-file format, ARCSELMV sets the volume sequence number in MVT to 1.

Module	Label
ARCSELMV	ARCSELMV
	RDUPDTV
	WRITEMCV
	ALLOCTAP
ARCALVOL	ARCALTVL
ARCGMAIN	ARCGMAIN
ARCSCANV	ARCSCANV
ARCZREAD	ARCZREAD
ARCZUPDT	ARCZUPDT

5. **Select a scratch tape and allocate the scratch tape:** If two passes through the TVT fail to produce a target volume, a scratch tape is selected. ARCALTVL is called to allocate the scratch tape volume. If a 3480 scratch tape is allocated, ARCSELMV updates the format flag in the MVT based on the currently requested format in the MCVT. If the allocation fails, control returns to the caller.

Module	Label
ARCSELMV	ARCSELMV
	ALLOCTAP
ARCALVOL	ARCALTVL
ARCCDTUN	ARCCUNDT
ARCGMAIN	ARCGMAIN
	ARCFMAIN
ARCISTAT	ARCUCTL

6. **Clean up and return:** ARCUNLK is called to release the enqueue, and the MVT and RCB are updated. Control returns to the caller.

Subsequent Selection

1. **Scan the TVT to select a tape:** ARCLOCK is called to enqueue on this processing unit while the TVT is being scanned.

First, if the TVT exists, ARCSELMV scans it to find a target volume. If the TVT does not exist, ARCSCANV is called to build a TVT. The TVT is then scanned. The volume must meet the following conditions:

- Cannot be selected by another DFHSM task
- Cannot be in-use by another DFHSM task
- Cannot be unavailable
- Must be empty
- Density must match that of the full volume
- Must meet control unit compaction criteria.

If the file block ID in the MCV for a 3480 single-file format tape volume is equal to -1, ARCTFULL is called to mark the volume full and look for another volume.

If the first pass through the TVT does not produce a target volume and ARCSCANV has not been called to create the TVT, ARCSELMV calls ARCSCANV to rebuild the TVT. If a target volume is found, the MCV record is updated and written after ARCTVSC has been called to check the security of the volume. ARCALTVL is not called to allocate the tape volume.

If the volume is a 3480 tape, the format flag in the MCV is set to the format flag in the previous MVT, which represents the type of format that was in effect at the time of the initial volume selection. Also, the control unit compaction status flag MCVFCUCS will be set to the value in the previous MVT to match the value in effect at the time of the initial volume selection.

Module	Label
ARCSELMV	ARCSELMV CHKTVTVL CHKTVTOK RDUPDTV WRITEMCV RLSEMCV
ARCLOCK	ARCLOCK ARCUNLK
ARCSCANV	ARCSCANV CHECK_CUC_STATUS
ARCZDCUC	ARCZDCUC
ARCTVSC	ARCTVSC
ARCZREAD	ARCZREAD
ARCZRLSE	ARCZRLSE
ARCZUPDT	ARCZUPDT

2. **Select a scratch tape:** If a specific tape is not found, ARCSELMV selects a scratch tape. The scratch tape is not allocated.

Module	Label
ARCSELMV	ARCSELMV

Output

- Mounted Volume Table (MVT)
- Recovery Control Block (RCB)
- Tape Migration Level 2 Volume
- Management Control Record (MCR)
- Return Codes:
 - 0 - A tape is selected and allocated for the initial selection request, or a specific (non-scratch) tape is selected for the EOVS selection request
 - 4 - A scratch tape is selected for the EOVS selection request
 - 8 - There was a GETMAIN error either in ARCSLMV or in ARCALTVL. No tape is selected or allocated for the initial selection request
 - 12 - There were two allocation errors, or the allocation for a scratch tape failed. No tape is selected or allocated for the initial selection request
 - 16 - No unit was available for tape allocation. No tape is selected or allocated for the initial selection request.

Diagram 1.8: ARCCKRNT - Check if a Recall Task Needs Tape

Input

- Migration Tape Selection or Release Parameter List (MTSP)
- Management Control Record (MCR)
- Migration Control Data Set (MCDS)
- Migration Attach Parameter List (MATP)
- Recovery Control Block (RCB)
- Read Parameter List
- Update Parameter List
- Release Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCCKRNT	ARCCKRNT
ARCPDA	ARCPDA

2. **Validate input parameters:** If the input parameter list is syntactically invalid, issue ARCERR macro with *4nn* Return Code value, and return to caller.

Module	Label
ARCCKRNT	ARCCKRNT
ARCERP	ARCERP

3. **In a single processing unit environment, check if a recall task needs a tape that is currently allocated to a migration task:** If DFHSM is in a single processing unit environment, the in-core copy of the MCR is checked to see if a flag is set indicating that a recall needs a tape that is currently allocated to the migration task that called ARCCKRNT. If the recall task needs a tape:

- ARCCKRNT calls ARCZCSFT to scan for the RCB indicating an open single-file format 3480 data set, CLOSE it, and reset the proper RCB flags. If there was an error during CLOSE, ARCCKRNT calls ARCTFULL to mark the volume full.
- ARCCKRNT calls ARCRELMV to release the tapes and set off the indicator in the in-core MCR that says a recall task needs a tape.

Module	Label
ARCCKRNT	ARCCKRNT
	CK4OPN
	UNIPROC
	RELEASTP
ARCTFULL	ARCTFULL
ARCZCSFT	ARCZCSFT
ARCRELMV	ARCRELMV

4. **In a multiple-host processor environment, check if a recall task needs a tape that is currently allocated to a migration task:** If DFHSM is in a multiple-host processor environment, the DASD copy of the MCR must be checked to see if a recall task needs tape. ARCCKRNT calls ARCZREAD to read the DASD MCR for update.

If no error occurred during the read and a recall task needs the allocated tape:

- ARCCRNT calls ARCZCSFT to scan for the RCB indicating an open single-file-format 3480 data set, CLOSE it, and reset the proper RCB flags. If there was an error during CLOSE, ARCCRNT calls ARCTFULL to mark the volume full.
- Then the in-core MCR is updated and ARCZUPDT is called to write the in-core MCR to the DASD MCR. ARCCRNT calls ARCRELMV to release the tape. The Request Parameter List (RPL) pointer is removed from the RCB of the migration controller. If no error occurred during the read and a recall task does not need any of the allocated tapes, ARCCRNT calls ARCZRLSE to release the RPL for the read for update. The RPL pointer is removed from the RCB of the migration controller.

If an error occurred during the read or write of the MCR, the number of MCR read or write errors for the current migration pass is incremented in the migration attach parameter list.

Module	Label
ARCCRNT	ARCCRNT CK4OPN MULTPROC RELEASTP
ARCTFULL	ARCTFULL
ARCZCSFT	ARCZCSFT
ARCRELMV	ARCRELMV
ARCZREAD	ARCZREAD
ARCZRLSE	ARCZRLSE
ARCZUPDT	ARCZUPDT

5. In a multiple-host processor environment, check if the maximum number of read errors reading the MCR records has occurred: If DFHSM is in a multiple processing unit environment, check to see if the maximum number of read or write errors for MCR records has occurred during a migration pass. If so, call ARCWTM to issue message ARC0539I, and set on the proper flag in the migration attach parameter list.

Module	Label
ARCCRNT	ARCCRNT CKMAXMCR
ARCWTM	ARCWTM

Output

- Migration Tape Selection or Release Parameter List (MTSP)
- In-core Copy and DASD Copy of Migration Control Record (MCR)
- Migration Control Data Set (MCDS)
- Migration Attach Parameter List
- Recovery Control Block (RCB)
- Read Parameter List
- Update Parameter List
- Release Parameter List.

Diagram 1.9: ARCMRSLT - Check Result of Attempt to Migrate a Data Set

Input

- Index to Migration Task Control Block (MTCB) Array
- Pointer to Migratable Data Set Queue Element (MDQE).

Processing

ARCMRSLT checks the status of a data set migration attempt.

Output

- Return Codes.

Diagram 1.10: ARCMCLN - Cleanup Migration Data Set Processor Tasks

Input

- Migration Task Control Block (MTCB)
- Recovery Control Block (RCB)
- Mounted Volume Table (MVT)
- Migration Data Set Subtask Parameter List.

Processing

ARCMCLN performs migration cleanup including closing a single file tape data set, posting subtasks, detaching subtasks, and deleting control blocks.

Output

- Migration Task Control Block (MTCB).

Diagram 1.11: ARCATTEC - Attach or Post the Data Set Processor Subtask

Input

- Migration Attach Parameter List (MATTP)
- Migration Tape Selection or Release Parameter List (MTSP)
- Recovery Control Block (RCB)
- Migratable Data Set Queue Element (MDQE)
- Sphere Data Control Block (SDATA)
- System Task Control Block (TCB)
- Migration Task Control Block (MTCB)
- Management Communication Vector Table (MCVT)
- Mounted Volume Table (MVT)
- MCDS Data Set Record (MCD)
- ARCMDS Parameter List (MDSP) or
- ARCMVDS Parameter List (MVDSP).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCATTEC	ARCATTEC
ARCPDA	ARCPDA

2. **Validate input parameters:** Verify that all input parameters are valid. Call ARCERP if any parameters are invalid and return.

Module	Label
ARCATTEC	ARCATTEC
ARCERP	ARCERP

3. **Attach the data set processor subtask:** Control is passed to ARCATTEC. ARCATTEC attaches the requested data set processor subtask, if the module is not already attached, which is indicated in the Migration Attach Parameter List (MATTP) to ARCATTEC. When control is obtained following the ATTACH, save the system completion code value from the ending ECB to check for an ABEND.

Module	Label
ARCATTEC	ARCATTEC
	SETUPIDX
	INITPL
	ATTACH

4. **Post the appropriate data set processor subtask:** If the subtask was attached successfully, (the appropriate MTCBSTCB pointer is now greater than zero), issue a POST macro. The appropriate work-to-do ECB in the MTCB is posted to wake up the data set processor subtask which is indicated by the caller in the MATTP for work to do.

If the attach failed, skip to step 7 on page 53.

Module	Label
ARCATTEC	ARCATTEC POST

5. **Wait for the data set processor subtask to complete:** Issue a WAIT macro. When the posted subtask completes or ends, the ending ECB in the MTCB is posted by the data set processor subtask and ARCATTEC receives control. When control is obtained following the WAIT, the system completion code value from the ending ECB is checked to see if an ABEND is saved.

Module	Label
ARCATTEC	ARCATTEC WAIT

6. **Check if data set was a candidate for, but not able to be migrated to, a SMALLDATASETPACKING data set:** Check to see if the data set processor subtask for a data set was unsuccessful in migrating the data set to a SMALLDATASETPACKING data set; if so, update the request to go to a non-SDSP, POST the appropriate data set processor subtask and WAIT for the subtask to complete the retry.

When we receive control after the WAIT, save the system-completion-code value from the ending ECB to check for an ABEND.

Module	Label
ARCATTEC	ARCATTEC POST WAIT

7. **Check if a 3480 data set in single-file format is open:** Check if the subtask that just posted completion opened a 3480 data set in single file format. If so, indicate that there is an opened 3480 data set in single-file format in any other existing RCBs or pairs of RCBs, so that the other data set processor subtasks will know that the output data set is already opened when they are posted to process a user data set.

Module	Label
ARCATTEC	ARCATTEC CK3480DS

8. **Check for abnormal ends in the data set processor subtask and for ending errors:** Check to see if the data set processor subtask abnormally ended by examining the system-completion-code value saved earlier. A non-zero Return Code signals an abnormal end. If an abnormal end occurred, add 900 to the Return Code that the data set processor subtask passed back and detach the ABENDED data set processor subtask.

If an error occurred when setting up the ESTAE environment for data movement in the data set processor subtask, indicate to the migration controller with the flag MATFDMES.

Module	Label
ARCATTEC	ARCATTEC CKABNDER CK4OPN DETACH

9. Check for tape-not-mounted errors and tape errors that will cause the migration controllers to release the migration tapes: If the migration of the data set was to tape, do the following:

- Check the appropriate event control block (ECB) in MTCB to see if the tape was not mounted. If so, detach the data set processor subtask, and reset the fields in the MCD record of the data set if an MCD exists. For a non-VSAM data set, remove the enqueue on the data set name. For a VSAM data set, remove the enqueue on the name of the base cluster and component.
- Check if any error occurred in the migration of the data set to tape for which the migration controller needs to release the tapes. If one of these errors occurred, set on an indicator in the RCB of the migration controller.

Call ARCZCSFT to close an open single-file-format 3480 tape data set, write message ARC0923I if necessary, and reset the related flags in the pairs of RCBs for the data-mover subtasks.

If the CLOSE fails, call ARCTFULL to mark the output tape full.

- The DDNAME fields are reset in the RCB of the migration controller and in the migration tape selection parameter list from the DDNAME field in the MVT entry of tape allocation. This is done in case ARCTOPEN released the tapes allocated by the migration controller, and selected and allocated a new tape when an abnormal end occurred while opening the migration copy on the old tape.

Module	Label
ARCATTEC	ARCATTEC TAPEPROC NTMTCLUP RESETMCDV READ UPDT RESETCMD GTDSNLEN DEQDS DETACH
ARCUNLKC	ARCUNLKC
ARCTFULL	ARCTFULL
ARCZCSFT	ARCZCSFT
ARCZREAD	ARCZREAD
ARCZUPDT	ARCZUPDT

Output

- Migration Attach Parameter List (MATTP)
- ARCMDS Parameter List (MDSP)
- or*
- ARCMVDS Parameter List(MVDSP)
- Migration Tape Selection Parameter List (MTSP)
- Migratable Data Set Queue Element (MDQE)
- Recovery Control Block (RCB)
- Mounted Volume Table (MVT) Entry
- MCDS Data Set Record (MCD)
- Migration Task Control Block (MTCB).

Diagram 1.12: ARCMDSUV - Control the Migration of a Non-VSAM Data Set**Input**

- Register 1 contains the index into the MTCB which points to the ARCMDSP Parameter List.

Inout

- ARCMDSP Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
--------	-------

ARCMDSUV	ARCMDSUV
ARCPDA	ARCPDA

2. **Upon being attached, perform program initialization:** After being attached by ARCATTEC, perform program initialization, then issue a WAIT macro to wait for the work-to-do event control block (ECB).

Module	Label
--------	-------

ARCMDSUV	ARCMDSUV
	LOOP

3. **Upon being posted for work to do, check the completion code in the ECB:** Clear the work-to-do ECB and check the ECB completion code. If the completion code is XX'00', perform normal processing (starting with step 4 and ending with step 20 on page 63). If the completion code is XX'99', close the 3480 single file format data set (see step 21 on page 63). If the completion code is neither, ARCERP is called with a Return Code of 401 and processing ends.

Module	Label
--------	-------

ARCMDSUV	ARCMDSUV
	LOOP
	NORMAL
	CL3480
ARCERP	ARCERP

4. **Begin normal processing of migrating a specific non-virtual storage access method (VSAM) data set:** If ARCMDSUV is posted to perform normal processing, this indicates a request to migrate a specific non-VSAM data set from a level 0 volume to a migration level 1 or level 2 volume. Input parameters are validated. If there are any invalid parameters, proceed to step 18 on page 62 to end processing. Various local variables will be updated based on the parameter list passed to it. ARCWLOG is called to log the start of migration.

Module	Label
--------	-------

ARCMDSUV	ARCMDSUV
	NORMAL
	START
ARCILOG	ARCWLOG

5. **Check MCDS D record:** Call ARCZREAD to read the MCDS D record. If the record is found, verify the following:
- That the data set is already migrated
 - That the data set is not migratable
 - That JES3 is preventing migration of the data set
 - If in a multiple processing unit environment, that another processing unit is using the data set.

If any of these conditions are found, proceed to step 18 on page 62 to end processing; otherwise, call ARCZUPDT to update the MCDS D record with the identifier of the processing unit.

Module	Label
ARCMDSUV	ARCMDSUV
	NORMAL
	ELIGIBLE
	CHKMCD
	ZREAD
	ZUPDT
ARCZREAD	ARCZREAD
ARCZUPDT	ARCZUPDT

6. **Scratch old migration copies:** If an old migration copy of the data set exists, call ARCZMVT to find or create an mounted volume table (MVT) control block for the volume. Call ARCZSCR to scratch the old migration copy that does not reside in a small-data-set-packing (SDSP) data set. ARCZESDP is called to scratch the old migration copy that is in an SDSP data set. Call ARCZSCLN to clean up the control data set records.

Module	Label
ARCMDSUV	ARCMDSUV
	NORMAL
	ELIGIBLE
	CHKMCD
	SCROMC
ARCZESDP	ARCZESDP
ARCZMVT	ARCZMVT
ARCZSCLN	ARCZSCLN
ARCZSCR	ARCZSCR

7. **ENQ on the data set name:** ARCLOCKC is called to conditionally ENQ exclusively on the data set name resource (ARCDSN, data set name). If the enqueue fails (the data set is already in use), proceed to step 18 on page 62 to end processing.

Module	Label
ARCMDSUV	ARCMDSUV
	NORMAL
	ELIGIBLE
	ENQDSN
ARCLOCK	ARCLOCKC

8. **Determine eligibility, size, compaction, and target volume:** ARCMDSUV calls module ARCMDSDP to perform the following:
- Determine if the data set is eligible to be compacted and by what technique
 - If the data set is migrating to level 1 volume, determine if the data set is eligible to be migrated to a SDSP data set
 - Select the appropriate target migration level 1 volume
 - Allocate the SDSP on the volume selected.

The results of the calculations from the call to ARCMDSDP are stored in the MDQE. If the data set is migrating to DASD, but is ineligible for SDSP processing, ARCMDSDP will calculate the primary and secondary allocation quantities and return these in the ARCMSDPP Parameter List.

Module Label

ARCMDSUV ARCMDSUV
ARCMDSDP ARCMDSDP

9. **Allocate input data set on source volume:** If DFHSM is the data mover, or DFHSM is running under a JES3 environment, call ARCALOLD to allocate the data set being migrated. If DFDSS is the data mover, and DFHSM is running under a JES2 environment, an exclusive enqueue is performed on the system data set resource (SYSDSN, data set name), instead of the allocation. If the allocation or enqueue fails, proceed to step 18 on page 62 to end processing.

Module Label

ARCMDSUV ARCMDSUV
 NORMAL
 ALLOCIN
ARCLOCK ARCLOCKC

10. **Allocate output data set on DASD or tape target volume:** Determine the security options for the data set. If the data set is not migrating to an SDSP, call ARCZGENM to generate the migration name for the data set. If the data set is migrating to non-SDSP DASD, call ARCALNDS to get the migration copy allocated on the migration volume. The primary and secondary allocation quantities were calculated by ARCMDSDP. If the data set is migrating to a tape migration level 2 volume, call ARCALTDS to prepare the job file control block (JFCB) for the migration copy being placed on the tape volume, unless migrating to 3480 single-file format volume and the data set is already opened. If any failures occur, proceed to step 18 on page 62 to end processing.

Module Label

ARCMDSUV ARCMDSUV
 NORMAL
 ALLOCOU
 SETSECUR
 ALMIGDS
ARCALNDS ARCALNDS
ARCALTDS ARCALTDS
ARCZGENM ARCZGENM

11. **Open the output data set:** If the data set is migrating to a tape migration level 2 volume and is not being written to an already-opened 3480 single-file format data set, call ARCTOPEN to open the output data set on tape. If the data set

other than an SDSP data set is migrating to a DASD migration volume, call ARCDOPEN to open the output data set on the DASD volume.

Module	Label
ARCMDSUV	ARCMDSUV
	NORMAL
	OPENOUT
ARCDOPEN	ARCDOPEN
ARCTOPEN	ARCTOPEN

12. **Build common data set descriptor (CDD) record and reserve level 0 volume:** Build a data set descriptor record for the data set. If the DFHSM environment is not set to NOUSERVOLUMERESERVES, and the system is running in a multiple processing unit environment, and the data set is being migrated by a volume request, call ARCVLOCK to reserve the source volume. For multi-volume data sets, only the first volume containing data will be reserved. If the data set is being migrated by a volume request, call ARCZOBT to read the Format 1 data set control block (DSCB) for the data set. If the read fails or if the Format 1 DSCB has been changed, proceed to step 18 on page 62 to end processing.

Module	Label
ARCMDSUV	ARCMDSUV
	NORMAL
	MOVE
	BLDCDD
	RESRVE
ARCULOCK	ARCVLOCK
ARCZOBT	ARCZOBT

13. **Establish the erase status of data set and copy data set to migration volume:** If the erase status of the original data set is not passed as an input parameter to ARCMDSUV, ARCCKEOS is called to obtain it. If the request for erase status fails, proceed to step 18 on page 62 to end processing. If the data set is to be migrated to an SDSP, ARCPSDS is called to process the migration under DFHSM movement, and ARCMDSS is called under DFDSS movement. If the SDSP data set becomes full, ARCWTL is called to issue message ARC0542I to the migration hardcopy log. If the data set is not migrated to an SDSP, the appropriate data movement module is called. Under DFHSM movement, ARCMDS, ARCOMPDS, or ARCBODS is called based on the data set organization of the source data set. Under DFDSS movement, module ARCMDSS is called for all data set organizations eligible for migration. If data movement fails and the migration is to a tape volume, ARCTECDM is called to update the status of the tape volume before failing the migration. If data movement of the data set fails, proceed to step 18 on page 62 to end processing.

Module	Label
ARCMDSUV	ARCMDSUV
	NORMAL
	MOVE
	MOVEDATA
	SDPMOVE
ARCBODS	ARCBODS
ARCCKEOS	ARCCKEOS
ARCMDSS	ARCMDSS
ARCOMPDS	ARCOMPDS

ARCMSDS ARCMSDS
 ARCPDS ARCPDS
 ARCTECM ARCTECM
 ARCWTO ARCWTL

14. **Reset the date-last-referenced in the Format 1 DSCB of the level 0 volume and release the volume:** If the data set is reserved by DFHSM (the DFHSM environment is not set to NOUSERVOLUMERESERVES in a multiple processing unit environment while a data set is being migrated by a volume request), ARCZUF1 is called to update the Format 1 DSCB for the data set on the volume from which it was just migrated to reset the date-last-referenced to the value it contained before the migration. If a failure occurred while updating the Format 1 DSCB, proceed to step 18 on page 62 to end processing. If the volume from which the data set migrated was reserved before the data movement, either ARCUUNLK or ARCVUNLK is called to release the volume.

Module	Label
ARCMDSUV	ARCMDSUV
	NORMAL
	RESET
	RESERVE
ARCULOCK	ARCUUNLK
	ARCVUNLK
ARCZUF1	ARCZUF1

15. **Update the MCDS to reflect the migration of the data set:** ARCZREAD is called to read the D record for update. If a read failure occurs in a multiple processing unit environment, ARCWTL is called to issue message ARC0370I to the migration hard copy log. If the D record has been updated by another task during the migration of the data set, ARCZRLSE is called to release the RPL before the migration is failed. If the read fails, proceed to step 18 on page 62 to end processing. If the record does not exist for the data set, initialize a new MCDS D record. Insert into the MCDS D record information pertaining to the migration of the data set. ARCZUPDT is called to update an existing D record. If the update fails in a multiple processing unit environment, ARCWTL is called to issue message ARC0370I to the migration hard copy log. ARCZWRIT is called to create a new D record. If either the update or the write of the MCDS D record fails, proceed to step 18 on page 62 to end processing.

Module	Label
ARCMDSUV	ARCMDSUV
	NORMAL
	UPDCDS
	GETD
	ZREAD
	ISSUE370
	MCDDATES
	RCALCOMP
	WRITED
	ZUPDT
	ZWRIT
ARCWTO	ARCWTL
ARCZREAD	ARCZREAD
ARCZRLSE	ARCZRLSE
ARCZUPDT	ARCZUPDT

ARCZWRIT ARCZWRIT

16. **Check data set is in need of backup:** If a BCDS is defined, the data set migrated to a DASD migration volume, the data set resided on a primary volume under control of automatic backup, and the change flag is on for the data set, information pertaining to the backup of a migrated data set is inserted into a new backup migrated data set BCDS L record and ARCZWRIT is called to write the L record to the BCDS. If the creation of the record fails because a duplicate key is found in the BCDS, modify the key of the record and retry the creation until a unique key is found or 255 attempts have failed. If 255 attempts fail, ARCWTM is called to issue message ARC0737I to the migration hard-copy log. ARCZREAD is called to read the D record for update only if the L record has been successfully written. The D record modified to reflect the new L record. ARCZUPDT is called to update the D record. If the read or the update of the MCDS D record fails, proceed to step 18 on page 62 to end processing.

Module	Label
ARCMDSUV	ARCMDSUV
	NORMAL
	UPDCDS
	NEEDBU
	CREATMCL
	ZWRIT
	MSG737
	ZREAD
	ZUPDT
ARCWTO	ARCWTM
ARCZREAD	ARCZREAD
ARCZUPDT	ARCZUPDT
ARCZWRIT	ARCZWRIT

17. **Recatalog the data set to a volume serial number of MIGRAT and scratch the original data set from the level 0 volume:** The volume serial number and the volume device type in the system catalog for the data set are changed to a volume serial number of MIGRAT and the device type of the migration volume. If the data set was multi-volume, a list is kept of the original volume serial numbers. This is needed when scratching the data set off the source volumes. The list of volume serial numbers is returned from module ARCZSLOC. If an error occurs while scratching a multi-volume data set, message ARC545 is issued but, the migration process continues. ARCZSALT is called to alter the catalog for an SMS-managed data set. ARCZCAT is called to recatalog a non-SMS-managed data set. If the data set is reserved by DFHSM (the DFHSM environment is not set to NOUSERVOLUMERESERVES in a multiple processing unit environment while a data set is being migrated by a volume request), call ARCZOBT to read the Format 1 DSCB for the data set. If the read fails or if the Format 1 DSCB has been updated, proceed to step 18 on page 62 to end processing. Call ARCZSCR to scratch the copy of the data set that resides on the source volume. If the scratch fails, proceed to step 18 on page 62 to end processing. If the data set was multi-volume, call ARCZSCR to scratch the data on all the volumes that data set resides. If a scratch fails on any of the volumes, processing continues. Message ARC0545I is issued for each volume that a scratch failure occurred.

Module	Label
ARCMDSUV	ARCMDSUV

```

NORMAL
RECATSCR
SCRATCH_DSN
ZCAT
ARCZSLOC ARCZSLOC
ZOBT
ARCWTO ARCWTL
ARCZSALT ARCZSALT
ARCZCAT ARCZCAT
ARCZOBT ARCZOBT
ARCZSCR ARCZSCR
    
```

18. Restore Control Data Set Records and user data sets when an error occurs:

ARCERP is called to log the migration error. If the output data set is still open, ARCDCLOS is called to close it. If the output data set is tape, the following modules are called:

- ARCTCLOS is called to close the tape data set only if it is not a 3480 single file.
- ARCUTTOC is called to add the data set entry to the TTOC and immediately invalidate it so that the TTOC is kept in sync with the tape.
- If there is an error in adding the entry to the TTOC, ARCTFULL is called to mark the tape volume full. One hundred is also added to the failing Return Code to cause the caller to release the tape volume.

If the catalog has been changed to a volume serial of MIGRAT, the data set is recataloged in the system catalog back to the source volume. ARCZSALT is called to alter the catalog for an SMS-managed data set. ARCZCAT is called to recatalog a non-SMS-managed data set. If the CDS records are changed by the failing request, ARCZREAD is called to read the D record for update. Reset the previously updated D record fields and call ARCZUPDT to rewrite the updated D record. If an L record was created, call ARCZDEL to delete it. If an A record was created, call ARCZDEL to delete it. If an error occurred after the migration copy was created on a DASD volume, call ARCZSCR to scratch the migration copy from the DASD migration volume, or call ARCZESDP to delete the migration copy from the SDSP data set. If the migration copy in error was deleted from the SDSP data set because it exceeded 255 records, mark the data set eligible for a migration retry to the DASD migration volume. If an error occurred after the migration copy was created on a tape volume, call ARCTTTOC to invalidate the tape table of contents (TTOC) entry for the migration copy on the tape migration level 2 volume.

Module	Label
ARCMDSUV	ARCMDSUV
	NORMAL
	BACKOUT
	ZCAT
	CLNCDS
	ZREAD
	ZUPDT
	ZDEL
ARCERP	ARCERP
ARCDCLOS	ARCDCLOS
ARCTCLOS	ARCTCLOS
ARCUTTOC	ARCUTTOC
ARCTFULL	ARCTFULL

ARCZSALT ARCZSALT
 ARCZCAT ARCZCAT
 ARCZREAD ARCZREAD
 ARCZUPDT ARCZUPDT
 ARCZDEL ARCZDEL
 ARCZSCR ARCZSCR
 ARCZESDP ARCZESDP
 ARCITTOC ARCITTOC

19. **Free all held resources:** If the source volume is reserved, either ARCUUNLK or ARCVUNLK is called to release it. If the data set is enqueued, under the ARCDSN or SYSDSN resources, ARCUNLKC is called to dequeue it. If there is an outstanding RPL for an A record, D record, or L record, ARCZRLSE is called to release it. If an input data set is allocated, ARCFREE is called to free the allocation. If an output data set is allocated, either ARCFREE or ARCFRSDP is called to free the allocation.

Module	Label
ARCMDSUV	ARCMDSUV NORMAL CLEANUP RELEASE
ARCULOCK	ARCUUNLK ARCVUNLK
ARCLOCK	ARCUNLKC
ARCZRLSE	ARCZRLSE
ARCFREE	ARCFREE
ARCALSDP	ARCFRSDP

20. **Record the statistics and log the end of migration:** ARCMBFSR is called to update the migration statistics in the functions statistics record (FSR). If the data set migrated to a non-SDSP migration level 1 volume, ARCUMC1 is called to update the statistics in the migration level 1 free space record (MC1). If not migrating to a 3480 single-file format tape volume, check the file sequence number of the volume to ensure that the tape is still usable. If not, call ARCTFULL to mark the tape migration level 2 volume full. ARCWTLOG is called to log the end of the migration. Return to the caller.

Module	Label
ARCMDSUV	ARCMDSUV NORMAL FINISH UPDFSR
ARCMBFSR	ARCMBFSR
ARCMSMV	ARCUMC1
ARCTFULL	ARCTFULL
ARCILOG	ARCWLOG

21. **ARCMDSUV is posted to close the 3480 single-file format data set:** If ARCMDSUV is posted to close the 3480 single-file format data set, ARCTCLOS is called to close the data set. The completion code in the ECB is set based on the Return Code from ARCTCLOS.

Module	Label
ARCMDSUV	ARCMDSUV LOOP

CL3480
ARCTCLOS ARCTCLOS

22. **Post the work-complete ECB:** Post the work-complete ECB, then wait for work to do.

Module	Label
ARCMDSUV	ARCMDSUV
	LOOP
	POSTCOMP

Output

- Updated ARCMDSV Parameter List
- Mounted Volume Table (MVT)
- Migration Control Data Set (MCDS)
- Common Data Set Descriptor Record (CDD)
- Return Codes:

Note: Add 100 to the Return Code if the output volume will be changed. All Return Codes will be mapped into an ARC12xx message where xx is the Return Code.

- 3 - Error obtaining Format 1 DSCB

Reason Codes:

- Return Codes from OBTAIN macro

- 5 - No level 1 volume available

Reason Codes:

- 4 - No level 1 volumes are available

- 6 - All SDSPs were in use

- 9 - Error reading MCV record during SDAP serialization checking

- 6 - Data set already migrated

- 8 - Error allocating output data set

Reason Codes:

- Return Codes from ARCALNDS

- 9 - Unique migration name not created

- 11 - Error creating or updating MCDS record

Reason Codes:

- Return Codes from ARCZWRIT and ARCZUPDT

- 13 - Error recataloging data set to volume serial = MIGRAT

Reason Codes:

- Return Codes from the catalog macro

- 14 - Error scratching data set from source volume

Reason Codes:

- Return Codes from ARCZSCR

- 15 - More than one note list in PDS ... Target volume is DASD
- 16 - I/O error reading input data set
- 17 - I/O error reading the input directory of a PDS
- 18 - I/O error writing output data set
- 19 - Data set in use by another job or user

Reason Codes:

- 1 - Data set was in use when the input data set was allocated
- 2 - Data set was in use just prior to data movement
- 3 - Data set was in use when updating of the MCD record was attempted
- 4 - Data set was in use just prior to the scratch of a data set from the user volume
- 23 - Input volume not mounted
- 25 - Error reading CDS record

Reason Codes:

- Return Codes from ARCZREAD
- 26 - CDS control interval in use
- 33 - Data set is too large for an SDSP data set

Note: No message is issued. The migration is re-tried to a non-SDSP MLI volume.

- 35 - Error opening input data set
- 36 - Error opening output data set
- 37 - No space on migration volume
- 38 - Password-protected data set is not allowed on a non-password-protected tape
- 39 - RACF check failed to obtain ERASE status

Reason Codes:

- Return Codes from ARCCKEOS
- 42 - Error reading JFCB
- 44 - No space in the VTOC on the original volume
- 45 - Data set not eligible for migration

Reason Codes:

- 3 - The SETMIG command restricts the data set by the full data set name
- 4 - The data set was temporarily prevented from migrating because a JES3 job planned to use it
- 50 - No units available to mount migration volume
- 51 - Data set in use by another DFHSM function
- 52 - GETMAIN/FREEMAIN error

- 54 - ABEND in tape data set user exit, ARCTDEXT
- 56 - Invalid data set name when reading VTOC
- 57 - I/O error updating DSCB
- 60 - Failure to establish ESTAE environment
- 64 - Failure closing the input data set
- 70 - Error while processing an SMS-managed data set

Reason Codes:

- 6 - Error cataloging the migrated data set to MIGRAT
- 94 - Unable to open VTOC
- 96 - Error reading JFCB to update the VTOC
- 97 - DFHSM internal error during allocation of source data set
- 99 - Unsupported data set organization
- 111 - Error writing CDS record after the data was migrated to tape

Reason Codes:

- Return Codes from ARCZWRIT and ARCZUPDT
- 115 - More than one note list in the PDS and a subsequent error occurred while attempting to update the OCDS
- 116 - I/O error reading input data set and a subsequent error occurred while attempting to update the OCDS
- 117 - I/O error reading input directory of a PDS and a subsequent error occurred while attempting to update the OCDS
- 118 - I/O error writing output data set on tape volume
- 125 - Error reading CDS record after data migrated to tape

Reason Codes:

- Return Codes from ARCZREAD
- 135 - Error opening the input data set and a subsequent error occurred while attempting to update the OCDS
- 147 - Error processing header or trailer labels during end-of-volume processing
- 148 - Data set spans more than 40 tape volumes
- 152 - GETMAIN error for tape buffer
- 154 - ABEND in tape data set user exit, ARCTDEXT
- 160 - Failure to establish ESTAE environment for data movement
- 161 - Internal ADDVOL failure during end-of-volume processing
- 162 - TTOC in use by another host while attempting to add the data set entry
- 165 - Failure closing the output data set
- 167 - Failure issuing the NOTE macro
- 169 - Failure issuing the SYNCDEV macro

The following Return Codes are issued in the work-complete ECB for task processing:

- X'00' - Successful completion of function
- X'65' - Error closing 3480 single file data set.

Diagram 1.13: ARCMVDS - Control Migration of a VSAM Data Set

Input

- ARCMVDSP Parameter List.

Inout

- ARCMVDSP Parameter List.

Processing

ARCMVDS controls the migration of a VSAM data set.

Output

- Updated ARCMVDSP Parameter List
- Return Codes.

Diagram 1.14: ARCMDSMV - Control Migration of a Data Set from a Migration Volume

Input

- Register 1 contains the index into the MTCB which points to ARCMDSP Parameter List.

Inout

- ARCMDSP Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCMDSMV	ARCMDSMV
ARCPDA	ARCPDA

2. **Upon being attached, perform program initialization:** After being attached by ARCATTEC, perform program initialization. Issue a WAIT macro to wait for the work-to-do event control block (ECB).

Module	Label
ARCMDSMV	ARCMDSMV LOOP

3. **Upon being posted for work to do, check the completion code in the ECB:** Clear the work-to-do ECB and check the ECB completion code. If the completion code is X'00', perform normal processing (starting with step 4 and ending with step 18 on page 74). If the completion code is X'99', close the 3480 single file format data set (see step 19 on page 75). If the completion code is neither, ARCERP is called to log an error and processing ends.

Module	Label
ARCMDSMV	ARCMDSMV LOOP NORMAL CL3480
ARCERP	ARCERP

4. **Perform initialization and log the start of migration:** If normal processing is requested, control is passed to ARCMDSMV to migrate a specific migrated data set from a DASD migration level 1 or level 2 volume to a DASD or tape migration level 2 volume. Input parameters are validated. If there are any invalid parameters, proceed to step 16 on page 73 to end processing. If the parameter list is valid, the program variables are initialized and ARCWLOG is called to log the start of the migration.

Module	Label
ARCMDSMV	ARCMDSMV NORMAL START
ARCILOG	ARCWLOG

5. **Check MCDS D record:** ARCZREAD is called to read the MCDS D record. If the record is found and DFHSM is in a multiple processing unit environment, check to see if the data set is in use by another processing unit. If it is, proceed to step 16 on page 73 to end processing; otherwise, call ARCZUPDT to update the MCDS D record with the processing unit ID of the processing unit.

Module	Label
ARCMDSMV	ARCMDSMV NORMAL ELIGIBLE CHKMCD ZREAD ZUPDT
ARCZREAD	ARCZREAD
ARCZUPDT	ARCZUPDT

6. **Determine data set size for target volume:** If the data set is migrating to a DASD migration volume of a different device type, ARCSPCNV is called to convert the space used on the source volume to the equivalent space needed on the target volume.

Module	Label
ARCMDSMV	ARCMDSMV NORMAL ELIGIBLE OUTSIZE
ARCSPCNV	ARCSPCNV

7. **ENQ on the data set name:** ARCLOCKC is called to conditionally ENQ exclusively on the data set name resource (ARCDSN, data set name). If the enqueue fails (the data set is already in use), proceed to step 16 on page 73 to end processing.

Module	Label
ARCMDSMV	ARCMDSMV NORMAL ELIGIBLE ENQDSN
ARCLOCK	ARCLOCKC

8. **Allocate input data set on source volume:** If the data set does not reside in a small-data-set-packing (SDSP) data set, ARCALOLD is called to allocate a data set being migrated to DASD or ARCALONQ is called to allocate a data set being migrated to tape. If the data set is in an SDSP, ARCALSDP is called to allocate the SDSP data set. If the allocation fails, proceed to step 16 on page 73 to end processing.

Module	Label
ARCMDSMV	ARCMDSMV NORMAL ALLOCIN
ARCALOLD	ARCALOLD ARCALONQ
ARCALSDP	ARCALSDP

9. **Allocate output data set on target volume:** Determine the security options for the data set. If the data set was migrated to a migration level 1 volume using the original data set name or if it currently resides in an SDSP, ARCZGENM is called to generate the migration name for the data set. If the data set is migrating to a DASD migration level 2 volume, ARCALNDS is called to allocate the data set on the target volume. If the data set is migrating to a tape migration level 2 volume, ARCALTDS is called to prepare the job file control block (JFCB) for the migration copy being placed on the tape volume, unless migrating to a 3480 single-file format volume and the data set is already opened. If any failures occur, proceed to step 16 on page 73 to end processing.

Module	Label
ARCMDSMV	ARCMDSMV NORMAL ALLOCOU SETSECU ALMIGDS
ARCZGENM	ARCZGENM
ARCALNDS	ARCALNDS
ARCALTDS	ARCALTDS

10. **Open output data set:** If the data set is migrating to a tape migration level 2 volume, ARCTOPEN is called to open the output data set on tape, unless migrating to a 3480 single-file format volume and the data set is already opened. If the data set is migrating to a DASD migration volume, ARCDOPEN is called to open the output data set on the DASD volume. If the open fails, proceed to step 16 on page 73 to end processing.

Module	Label
ARCMDSMV	ARCMDSMV NORMAL OPENOU
ARCDOPEN	ARCDOPEN
ARCTOPEN	ARCTOPEN

11. **Establish the erase status of the data set and move data to migration level 2 volume:** If the erase status of the original data set is not passed as an input parameter to ARCMDSMV, ARCCKEOS is called to obtain it. If the request for erase status fails, proceed to step 16 on page 73 to end processing. ARCMMDSD is called to move the migrated data set from the source migration level 1 or level 2 volume to the target migration level 2 volume. If the movement of the data set fails and the migration was to a tape volume, ARCTECDM is called to update the status of the tape volume before failing the migration. If the movement of the data set fails, proceed to step 16 on page 73 to end processing.

Module	Label
ARCMDSMV	ARCMDSMV NORMAL MOVE
ARCCKEOS	ARCCKEOS
ARCMMDSD	ARCMMDSD
ARCTECDM	ARCTECDM

12. **Update Resource Access Control Facility (RACF) profile:** If the original data set being migrated was non-virtual storage access method (non-VSAM),

RACF-indicated, and had a discrete RACF profile that was changed to reflect the migration volume when the data set migrated to level 1, ARCRACF is called to change the profile to reflect the original level 0 volume that contained the data set. If an error occurs in RACF processing, proceed to step 16 on page 73 to end processing.

Module	Label
ARCMDSMV	ARCMDSMV NORMAL UPDCDS RACFCHG
ARCRACF	ARCRACF

13. **Update records in the migration control data set (MCDS):** ARCZREAD is called to read the MCD for update. If the read fails in a multiple processing unit environment, ARCWTL is called to issue message ARC0370I to the migration hard-copy log. If the read fails or the record has been updated during the migration of the data set, proceed to step 16 on page 73 to end processing. Insert information pertaining to the migration of the data set into the MCDS D record. ARCZUPDT is called to update the MCDS D record. If the update fails in a multiple processing unit environment, ARCWTL is called to issue message ARC0370I to the migration hard-copy log. If the update fails, proceed to step 16 on page 73 to end processing.

Module	Label
ARCMDSMV	ARCMDSMV NORMAL UPDCDS ZREAD ISSUE370 ZUPDT
ARCWTO	ARCWTL
ARCZREAD	ARCZREAD
ARCZUPDT	ARCZUPDT

14. **Update backup control data set (BCDS):** If a BCDS L record exists for the data set, ARCZREAD is called to read it for update. If the L record is not found, ARCZREAD is called to read the MCDS D record for update. The D record is modified to indicate that the L record does not exist and ARCZUPDT is called to update the MCDS D record. If the L record is found, it is modified to reflect the new migration volume, and ARCZUPDT is called to update the BCDS L record. If an error occurs while reading or updating the L record, ARCWTL is called to issue message ARC0737I to the migration hard-copy log and processing continues. If an A record exists for the data set and the data set migrated to a small-data-set-packing data set, call ARCZDEL to delete the A record.

Module	Label
ARCMDSMV	ARCMDSMV NORMAL UPDCDS UPDMCL ZREAD MSG737 ZUPDT
ARCZREAD	ARCZREAD

ARCWTO	ARCWTL
ARCZUPDT	ARCZUPDT
ARCZDEL	ARCZDEL

15. **Recatalog the migration copy and scratch the data set from the source volume:** If the data set has migrated to tape, it is recataloged in the system catalog to a device type of tape. ARCZSALT is called to alter the catalog for an SMS-managed data set. ARCZCAT is called to recatalog a non-SMS-managed data set. If the original data set was VSAM, ARCZREAD is called to read an MCDS VSAM association MCO record. If an MCO record exists for the data set, ARCZSALT is called to recatalog all of the cataloged SMS-managed VSAM objects to a device type of tape, and ARCZCAT is called to recatalog all of the cataloged non-SMS-managed VSAM objects to a device type of tape. ARCZSCR is called to scratch the old migration copy from a DASD migration volume ARCZESDP is called to delete the old migration copy from the SDSP data set.

Module	Label
ARCMDSMV	ARCMDSMV
	NORMAL
	RECATSCR
	ZCAT
	ZREAD
	RCATVSOB
ARCZSALT	ARCZSALT
ARCZCAT	ARCZCAT
ARCZREAD	ARCZREAD
ARCZSCR	ARCZSCR
ARCZESDP	ARCZESDP

16. **Restore CDS records and old migration copy when an error occurs:** ARCERP is called to log the migration error. If the cataloged data set was changed to tape device, it is recataloged in the system catalog back to the source device type. ARCZSALT is called to alter the catalog for an SMS-managed data set. ARCZCAT is called to recatalog a non-SMS-managed data set. If VSAM objects were changed to a tape device, ARCZSALT is called to recatalog all of the cataloged SMS-managed VSAM objects back to the source device type, and ARCZCAT is called to recatalog all of the cataloged non-SMS-managed VSAM objects back to the source device type. If the D record was changed by the failing request, ARCZREAD is called to read the D record for update. Reset the previously updated D record fields and call ARCZUPDT to rewrite the updated D record. If the L record was changed by the failing request, ARCZREAD is called to read the L record for update. Reset the previously updated L record fields and call ARCZUPDT to rewrite the updated L record. If an error occurs while reading or updating the L record, ARCWTL is called to issue message ARC0737I to the migration hard-copy log and processing continues. If an A record was created, call ARCZDEL to delete it. If an error occurred after the migration copy was created on a DASD volume, call ARCZSCR to scratch the migration copy from the DASD migration volume. If an error occurred after the migration copy was created on a tape volume, call ARCITTOC to invalidate the tape table of contents (TTOC) entry for the migration copy on the tape migration level 2 volume.

Module	Label
ARCMDSMV	ARCMDSMV NORMAL BACKOUT ZCAT RCATVSOB CLNCDS ZREAD ZUPDT MSG737 ZDEL
ARCERP	ARCERP
ARCZSALT	ARCZSALT
ARCZCAT	ARCZCAT
ARCWTO	ARCWTL
ARCZREAD	ARCZREAD
ARCZUPDT	ARCZUPDT
ARCZDEL	ARCZDEL
ARCZSCR	ARCZSCR
ARCITTOC	ARCITTOC

17. **Free all held resources:** If the data set is enqueued, ARCUNLKC is called to dequeue it. If there is an outstanding request parameter list (RPL) for an A record, D record, or L record, ARCZRLSE is called to release it. If an input data set is allocated, either ARCFREE or ARCFRSDP is called to free the allocation. If an output data set is allocated, ARCFREE is called to free the allocation.

Module	Label
ARCMDSMV	ARCMDSMV NORMAL CLEANUP
ARCLOCK	ARCUNLKC
ARCZRLSE	ARCZRLSE
ARCFREE	ARCFREE
ARCALSDP	ARCFRSDP

18. **Record the statistics and log the end of migration:** ARCMBFSR is called to update the migration statistics in the function statistics record (FSR). If not migrating to a 3480 single-file format tape volume, check the file sequence number of the volume to ensure that the tape is still usable. If not, call ARCTFULL to mark the tape migration level 2 volume full. ARCWTLOG is called to log the end of the migration. Return to the caller.

Module	Label
ARCMDSMV	ARCMDSMV NORMAL FINISH UPDFSR
ARCMBFSR	ARCMBFSR
ARCTFULL	ARCTFULL
ARCILOG	ARCWLOG

19. **ARCMDSMV is posted to close the 3480 single-file format data set:** If ARCMDSMV is posted to close the 3480 single-file format data set, ARCTCLOS is called to close the data set. The completion code in the ECB is set based on the Return Code from ARCTCLOS.

Module	Label
ARCMDSMV	ARCMDSMV LOOP CL3480
ARCTCLOS	ARCTCLOS

20. **Post the termination ECB:** Post the termination ECB and return to step 2 on page 69 to wait for work to do.

Module	Label
ARCMDSMV	ARCMDSMV POSTCOMP LOOP

Output

- Updated ARCMDSM Parameter List
- Return Codes:
 - 8 - Error allocating output data set
Reason Codes:
 - Return Codes from ARCALNDS
 - 9 - Unique generated name not created
 - 11 - Error writing CDS record
Reason Codes:
 - Return Codes from ARCZWRIT
 - Return Codes from ARCZUPDT
 - 13 - Error recataloging to tape device type
Reason Codes:
 - Return Codes from the catalog macro
 - 14 - Error scratching data set
Reason Codes:
 - Return Codes from ARCZESDP
 - 16 - I/O Error reading input data set ... target volume is DASD

- 18 - I/O Error writing output data set ... target volume is DASD
- 19 - Data set in use

Reason Codes:

- 1 - Data set in use when the input data set was allocated
- 3 - Data set in use when attempt was made to update the MCD record
- 23 - Input volume not mounted
- 25 - Error reading CDS record

Reason Codes:

- Return Codes from ARCZREAD
- 26 - CDS control interval in use
- 35 - Error opening data set
- 36 - Error opening output data set
- 37 - No space on migration volume
- 38 - Password-protected data set is not allowed on a non-password-protected tape
- 39 - RACF check failed

Reason Codes:

- Return Codes from ARCCKEOS
- Return Codes from ARCRACF
- 42 - Error reading JFCB
- 50 - No units available to mount source volume
- 51 - Data set in use
- 52 - GETMAIN error
- 54 - Abnormal end in tape data set user exit, ARCTDEXT
- 60 - Failure to establish ESTAE environment
- 70 - Error processing an SMS-managed data set

Reason Codes:

- 6 - Error cataloging migrated data set to MIGRAT
- 97 - Internal allocation error
- 111 - Error writing CDS record after data migrated to tape

Reason Codes:

- Return Codes from ARCZWRT
- Return Codes from ARCZUPDT
- 116 - I/O error reading input data set, and a subsequent error attempting to update the OCDS
- 117 - I/O error reading the input directory of a partitioned data set, and a subsequent error attempting to update the OCDS
- 118 - I/O error writing output data set to tape volume

- 125 - Error reading the CDS record after the data migrated to tape

Reason Codes:

- Return Codes from ARCZREAD
- 135 - Error opening the input data set, and a subsequent error attempting to update the OCDS
- 147 - Error processing the header or trailer label during end-of-volume processing
- 148 - Data set spans more than 40 tape volumes
- 152 - GETMAIN error for tape buffer
- 160 - Failure to establish ESTAE environment for data movement
- 161 - Internal ADDVOL failure during end-of-volume processing
- 162 - TTOC in use by another host during an attempt to add data set entry
- 198 - Maximum volume serials for a DDNAME was exceeded

The following Completion Codes are returned in the ending ECB for the task being processed:

- X'00' - Successful completion of the function
- X'65' - Failure in closing the 3480 tape data set.

Diagram 1.15: ARCZDCUC - Determine Control Unit Compaction Status of a Volume**Input**

- ARCTCUCP Parameter List.

Processing

ARCZDCUC determines the eligibility of a tape volume selected for output by backup, dump or migration based on control unit compaction criteria. ARCZDCUC also determines if the selected tape volume will contain control unit compacted data.

Output

- Updated ARCTCUCP Parameter List.

Automatic Space Management Processing

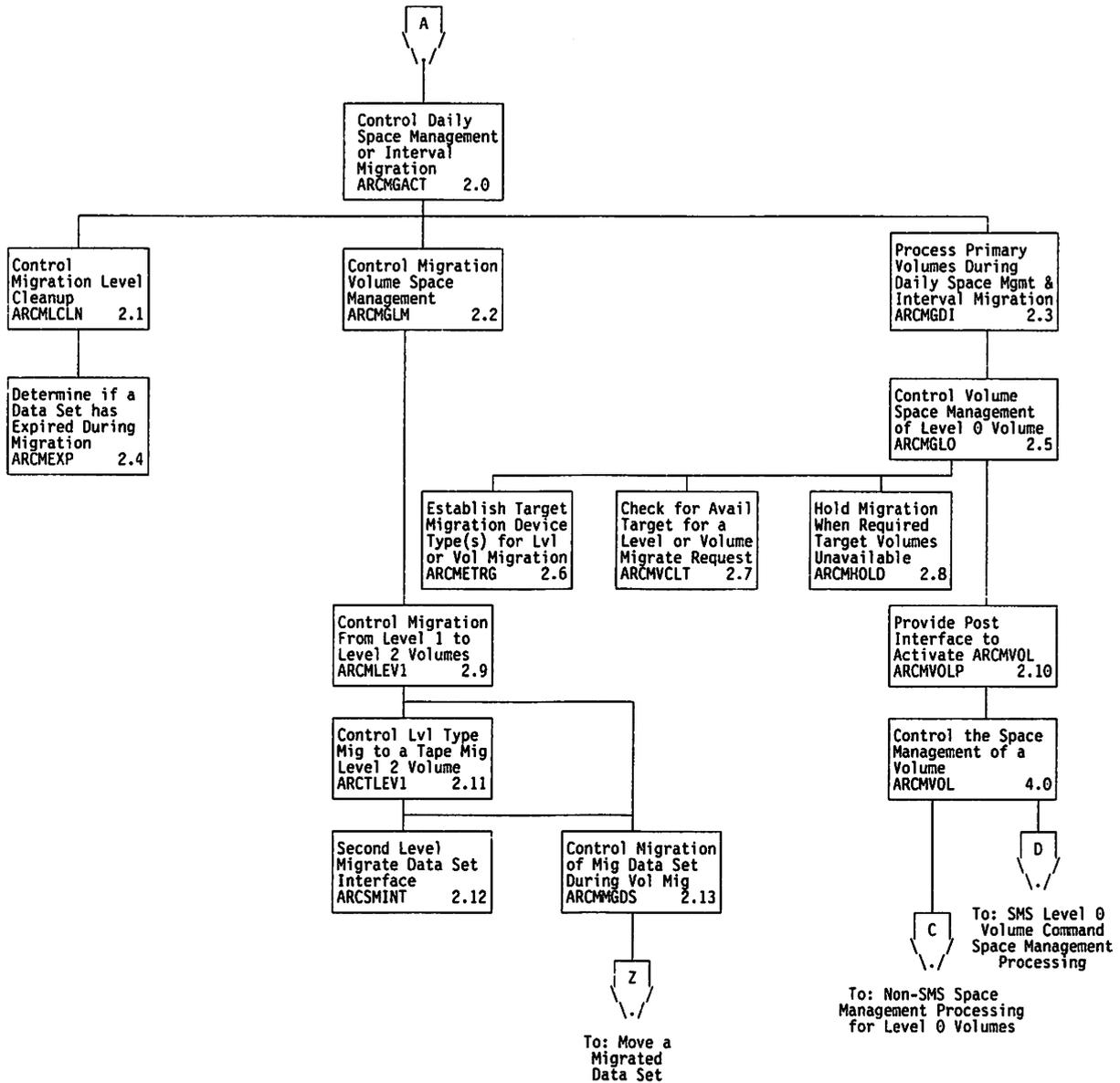


Figure 4. Visual Table of Contents for Automatic Space Management Processing

Diagram 2.0: ARCMGACT - Control Daily Space Management or Interval Migration

Input

- Management Communication Vector Table (MCVT)
- Migration Global Control Block (MGCB)
- Management Control Record (MCR)
- Mounted Volume Table (MVT)
- Migration Task Control Block (MTCB).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCMGACT	ARCMGACT
ARCPDA	ARCPDA

2. **Write ARC0520I message for starting daily space management:** If daily space management is being performed, get the time and date from the system and store them in the in-storage copy of the MCR record. Call ARCWTL to write message ARC0520I to migration log and optionally to the operator, for either starting or restarting of daily space management.

Module	Label
ARCMGACT	ARCMGACT TIMDAT MSG520
ARCWTO	ARCWTL

3. **Call ARCMLCLN to perform migration cleanup and call ARCUCTL to indicate status:** If daily space management is being performed on a primary host and migration cleanup has not been run today, call ARCGMCN to determine if this is a day on which migration cleanup is requested. If not, then update the migration cleanup flags in the MCR and call ARCUCTL to write the record. If migration cleanup is requested, do the following:

- Dequeue by calling ARCUNLK and then re-enqueue by calling ARCLOCK on the control data set update resource (ARCGPA and ARCCAT), thus allowing any exclusive waiting-for-enqueue functions of DFHSM to obtain the resource.
- Update migration cleanup flags in the MCR and call ARCUCTL to write the record.
- Call ARCMLCLN to do the cleanup of the migration control data set (MCDS) and migration volumes.
- If migration cleanup is fully completed, update the migration cleanup flags in the MCR and call ARCUCTL to write the record.

Module	Label
ARCMGACT	ARCMGACT DOMIGCLN

ARCGBCN	ARCGMCN
ARCISTAT	ARCUCTL
ARCLOCK	ARCLOCK
	ARCUNLK
ARCMLCLN	ARCMLCLN

4. **Call ARCMGLM to perform level migration and call ARCUCTL to indicate status:** If daily space management is being performed on a primary host and level migration has not been run today, scan the MVT chain for a migration level 1 volume having a valid threshold such that its allocated space is above it. If none exists, update the level migration flags in the MCR and call ARCUCTL to write the record. If at least one such volumes exist and automigration is not held, do the following:
- Dequeue by calling ARCUNLK and then re-enqueue by calling ARCLOCK on the control data set update resource (ARCGPA and ARCCAT), thus allowing any exclusive waiting-for-enqueue functions of DFHSM to obtain the resource.
 - Call ARCPRINT to put blank lines in the migration log before writing in it.
 - Update the level migration flags in the MCR and call ARCUCTL to write the record.
 - Call ARCMGLM to do the level migration.
 - If level migration is fully completed or is to DASD ML2 volumes, update the level migration flags in the MCR and call ARCUCTL to write the record.

Module	Label
ARCMGACT	ARCMGACT MIGML1S
ARCMGLM	ARCMGLM
ARCPROPN	ARCPRINT
ARCLOCK	ARCLOCK ARCUNLK
ARCISTAT	ARCUCTL
ARCZEND	ARCZEND

5. **Call ARCMGDI to perform automatic space management of primary volumes and call ARCUCTL to indicate status:** If automigration is not held and daily space management is being requested or a processing unit is requesting interval migration, then process primary volumes as follows:
- If daily space management is being processed, then update the daily space management flags in the MCR and call ARCUCTL to write the record.
 - Call ARCMGDI to process the primary volumes.
 - If daily space management is being processed and the processing of primary volumes is fully completed, then put the current time and date and updated daily space management flags in the MCR and call ARCUCTL to write the record.

Module	Label
ARCMGACT	ARCMGACT TIMDAT
ARCISTAT	ARCUCTL
ARCMGDI	ARCMGDI

ARCZEND ARCZEND

6. **Process normal ending of automatic space management of primary volumes:** Call ARCWTL to issue the ARC0521I message to the migration log and the console. Message ARC0521I indicates that daily space management has completed successfully. Get the current time and date and call ARCZREAD and ARCZUPDT to store them in the MHCR record. Call ARCLSPAC to check the space of each migration level 1 volume. Then if operating in a multiple processing unit environment, call ARCCUMC1 to propagate the free space now current in the MVTs to the migration level 1 free space record (MC1).

Module	Label
ARCMGACT	ARCMGACT NORMDALY UPDTMHCR LSPACML1
ARCCUMC1	ARCCUMC1
ARCLSPAC	ARCLSPAC
ARCWTO	ARCWTL
ARCZREAD	ARCZREAD
ARCZUPDT	ARCZUPDT

7. **Process early ending of automatic space management of primary volumes:** Call ARCZEND to generate the variable part, except for 'RESOURCES NOT AVAILABLE', for a daily space management premature end message, ARC0521I, and call ARCWTL to issue the message to the migration log and the console. If auto-start quiesce time has been reached, reset the quiesce-time-reached flag in MTCB.

Module	Label
ARCMGACT	ARCMGACT SHRTDALY
ARCWTO	ARCWTL
ARCZEND	ARCZEND

8. **Clear in-storage control flags:** Clear in-storage daily space management and interval migration flags. Return to the caller.

Module	Label
ARCMGACT	ARCMGACT

Output

- Management Communication Vector Table (MCVT)
- Management Control Record (MCR)
- Mounted Volume Table (MVT)
- Migration Task Control Block (MTCB).

Diagram 2.1: ARCMLCLN - Control Migration Level Cleanup

Input

- Migration Control Data Set (MCDS)
- Management Communication Vector Table (MCVT)
- Management Control Record (MCR)
- Mounted Volume Table (MVT)
- Recovery Control Block (RCB)
- Daily Statistics Record (DSR)
- Volume Statistics Record (VSR).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCMLCLN	ARCMLCLN
ARCPDA	ARCPDA

2. **Set up ESTAE environment:** ARCZEST is called to set up an ESTAE environment. If the ESTAE fails, ARCWTL is called to issue a failing ARC0304I message and control is returned to the caller; otherwise, RCB variables are set up and processing continues.

Module	Label
ARCMLCLN	ARCMLCLN
	SETESTAE
ARCZEST	ARCZEST
ARCWTO	ARCWTL

3. **Build and print starting message:** A TIME macro is issued to get the time and date from the system. ARCDMY is called to convert the date to YY/MM/DD. ARCWTL is called to issue the ARC0526I migration cleanup starting message.

Module	Label
ARCMLCLN	ARCMLCLN
ARCALNDR	ARCDMY
ARCWTO	ARCWTL

4. **Initialize local variables:** ARCSDATE is called to calculate the oldest date a record can exist for a data set that was compacted but did not meet the space savings requirements. Initialize local variables.

Module	Label
ARCMLCLN	ARCMLCLN
ARCSDATE	ARCSDATE

5. **Begin processing migration control data set records (MCD):** ARCZPOS is called to position to the beginning of the migration control data set. ARCSDATE is called to calculate the oldest date for keeping MCDS data set records (MCD) for recalled data sets. ARCWTL is called to issue the ARC0529I message.

Module	Label
ARCMLCLN	ARCMLCLN DOMCD BLDPOSP WRITE529
ARCSDATE	ARCSDATE
ARCWTO	ARCWTL
ARCZPOS	ARCZPOS

Repeat steps 6 through 13 on page 87 for each MCD record.

6. **Read an MCD record:** ARCZRNX is called to read the next MCD. ARCUCTL is called write an MCR to periodically record the key of the last MCD processed by migration cleanup. If migration is held or DFHSM is in shutdown or emergency mode, processing is ended beginning at step 14 on page 88.

Module	Label
ARCMLCLN	ARCMLCLN DOMCD BLDRNXTP
ARCZRNX	ARCZRNX
ARCISTAT	ARCUCTL

7. **Schedule an expired migrated non-SMS uncataloged GDG data set for deletion:** If a migrated non-SMS uncataloged GDG data set is expired, and the delete expired data set option is selected by DFHSM, the migrated non-SMS uncataloged GDG data set is scheduled for deletion.

Module	Label
ARCMLCLN	ARCMLCLN DOMCD CHKGDGDS CHKDLGDG
ARCZLOC	ARCZLOC

8. **Determine if a migrated data set is expired:** Expiration date checking is performed against the expiration date in the MCD record which was saved from the data set's Format 1 DSCB at the time the data set migrated. If a migrated SMS-managed data set does not have an expiration date indicated in the MCD record, ARCZSCMC is called to copy the SMS management class definition which contains expiration date information for an SMS-managed data set. If the copy of the SMS management class definition fails, ARCAMSG is called to issue an ARC0734I data set expiration message with the failing Return Code and processing of the MCD record is ended. If a migrated SMS-managed data set does not have a management class name indicated in the MCD record, the default SMS management class definition copy is used for expiration date checking. ARCMEXP is called to check if a migrated data set is expired using either the expiration date in the MCD record or the SMS management class definition copy.

Module	Label
ARCMLCLN	ARCMLCLN DOMCD GETEXPDS

	DELEXPDS
ARCZSCMC	ARCZSCMC
ARCAMSG	ARCAMSG
ARCMEXP	ARCMEXP

9. **Schedule an expired migrated data set for deletion:** If a migrated data set is expired, a delete request is processed as follows:

- ARCGMAIN is called to get storage for a management work element (MWE).
- An MWE for a delete request is built.
- ARCPRQ is called to put the MWE on the recall queue and post the recall task.
- ARCAMSG is called to issue an ARC0734I data set expiration message.

Module	Label
ARCMLCLN	ARCMLCLN DOMCD GETEXPDS DELEXPDS
ARCAMSG	ARCAMSG
ARCGMAIN	ARCGMAIN
ARCPRQ	ARCPRQ

10. **Delete a migrated data set that is in small data set packing (SDSP):** If a delete of a migrated data set in an SDSP is needed, ARCDDS is called to delete it and ARCAMSG is called to issue an ARC0734I delete message.

Module	Label
ARCMLCLN	ARCMLCLN DOMCD SCRATCH
ARCAMSG	ARCAMSG
ARCDMDS	ARCDDS

11. **Delete a migrated data set that is not in an SDSP:** If a delete is needed of a migrated data set that is not in an SDSP, the delete is processed as follows:

- ARCKVOL is called to check that the migration volume is already mounted. If the volume is not mounted, the delete is not processed.
- If the volume is an ML2 volume, the MVT chain is searched for the volume's MVT. If it is not found, a GETMAIN macro is issued for storage to build an MVT for the volume. If the GETMAIN fails, the delete is not processed. After the MVT is built, ARCALVOL is called to allocate the volume. If the allocate fails, ARCWTN is called to issue the ARC0500I message and the delete is not processed. If the allocate is successful, ARCENQ is called to add the MVT to the MVT chain.
- If the volume is an ML1 volume, the MVT chain is searched for the volume's MVT. When it is found, ARCALVOL is called to allocate the volume. If the allocate fails, ARCWTN is called to issue the ARC0500I message and the delete is not processed. If the allocate is successful, a GETMAIN macro is issued for storage to build an array of MVT pointers if the array does not exist. If the GETMAIN fails, the delete is not processed. If the MVT pointer array exists, the MVT is added to it.

- ARCZSCR is called to scratch the data set, have it erased if necessary, and update the ML1 free space if the migrated data set was on an ML1 volume.
- ARCAMSG is called to issue an ARC0734I delete message.

Module	Label
ARCMLCLN	ARCMLCLN DOMCD SCRATCH VIRTL2 NUMVTENT ERR500 VIRTL1
ARCALVOL	ARCALVOL
ARCAMSG	ARCAMSG
ARCCKVOL	ARCCKVOL
ARCENQ	ARCENQ
ARCWTO	ARCWTL
ARCZSCR	ARCZSCR

12. **Delete MCO, MCA and MCD records:** The MCD is examined to see if MCDS records should be retained. The records are needed when the following conditions exist:

- The record describes a data set that is currently migrated.
- The record is used to prevent a data set from migrating.
- The record describes a JES3 setup (directed recall or prevent migration) that has not expired.
- The record indicates migration processing is occurring.
- The record has an identifier indicating DFHSM multiple processing unit serialization and the record has been accessed in the last 24 hours.
- The record describes a data set that was recalled within a number of days as specified by the space manager. The related type MCDS alias entry records (MCAs) and MCDS VSAM association records (MCOs) are deleted when the MCDS data set record (MCD) is deleted.
- The record describes a data set that has been recalled for less than 90 days, was compacted when it migrated, and did not save enough space in the compaction process to make it eligible for compaction during subsequent migrations.

If the MCDS records are not needed, they are deleted as follows:

- If a dummy MCD is indicated and the record has been in use too long, ARCZDEL is called to delete the MCD record because there is not an MCA associated with it, and ARCAMSG is called to issue an ARC0734I delete control data set entry message.
- If the MCD processing unit identifier indicates multiple processing unit environment processing and the record has been in use too long, it is processed as follows:
 - If the migrated data set was VSAM, ARCZREAD is called to read an MCO if it is indicated in the MCD. If the read fails, none of the MCDS records are deleted. If the read is successful, ARCZDEL is called to delete each existing MCA and ARCAMSG is called to issue an ARC0734I delete control data set entry message for each deleted MCA.

After all MCAs are deleted, ARCZDEL is called to delete the MCO and ARCAMSG is called to issue an ARC0734I delete control data set entry message.

- If the migrated data set was non-VSAM, ARCZDEL is called to delete the MCA and ARCAMSG is called to issue an ARC0734I delete control data set entry message.
- If there are no errors in deleting MCAs and MCOs for VSAM or the MCA record for non-VSAM, ARCZDEL is called to delete the MCD and ARCAMSG is called to issue an ARC0734I delete control data set entry message.
- If the MCD processing unit identifier indicates single processing unit environment processing, it is processed as follows:
 - If the migrated data set was VSAM, ARCZREAD is called to read an MCO if it is indicated in the MCD. If the read fails, none of the MCDS records are deleted. If the read is successful, ARCZDEL is called to delete each existing MCA and ARCAMSG is called to issue an ARC0734I delete control data set entry message for each deleted MCA record. After all MCAs are deleted, ARCZDEL is called to delete the MCO and ARCAMSG is called to issue an ARC0734I delete control data set entry message.
 - If the migrated data set was non-VSAM and the oldest date for keeping the record is past, ARCZDEL is called to delete the MCA and ARCAMSG is called to issue an ARC0734I delete control data set entry message.
 - If there are no errors in deleting MCAs and MCOs for VSAM or the MCAs for non-VSAM and the oldest date for keeping the record is past, ARCZDEL is called to delete the MCD and ARCAMSG is called to issue an ARC0734I delete control data set entry message.

Module	Label
ARCMLCLN	ARCMLCLN DOMCD DELCHK DELETE BLDDELP VSEXTRA BLDREADP
ARCAMSG	ARCAMSG
ARCZDEL	ARCZDEL
ARCZREAD	ARCZREAD

13. **Update the need scratch flag in the MCD:** If the migration copy was successfully deleted but the MCD was retained, ARCZREAD is called to read the MCO for update. If the read is successful, the need scratch flag in the MCD is reset and ARCZUPDT is called to update the MCD.

Module	Label
ARCMLCLN	ARCMLCLN DOMCD MCDUPDAT BLDREADP
ARCZREAD	ARCZREAD

ARCZUPDT ARCZUPDT

14. **End MCD processing:** ARCZRLSE is called to release any outstanding RPLs. If any ML2 MVTs were built, each one is processed as follows:

- ARCULVOL is called to deallocate the volume
- ARCULVRT is called to unload the volume
- A FREEMAIN macro is issued to free the MVT storage. If a FREEMAIN error occurs, ARCERP is called to log the error.

ARCULVOL is called to deallocate each ML1 volume that was allocated. After all ML1 volumes are deallocated, a FREEMAIN macro is issued to free the array of MVT pointers. If a FREEMAIN error occurs, ARCERP is called to log the error.

Module	Label
ARCMLCLN	ARCMLCLN DOMCD BLDRLSEP FREL2MVT FL1ARMVT
ARCERP	ARCERP
ARCULVOL	ARCULVOL
ARCULVRT	ARCULVRT
ARCZRLSE	ARCZRLSE

15. **Begin processing daily statistics records (DSR):** ARCSDATE is called to calculate the oldest date for keeping DSRs. ARCWTLS is called to issue the ARC0529I message. ARCZPOS is called to position to the beginning of the DSRs.

Module	Label
ARCMLCLN	ARCMLCLN DODSR BLDPOSP WRITE529
ARCSDATE	ARCSDATE
ARCWTO	ARCWTLS
ARCZPOS	ARCZPOS

Repeat step 16 through step 17 for each DSR record.

16. **Read a DSR:** ARCZRNXT is called to read the next DSR. ARCUCTL is called write an MCR to periodically record the key of the last DSR processed by migration cleanup. If migration is held or DFHSM is in shutdown or emergency mode, processing is ended beginning at step 18.

Module	Label
ARCMLCLN	ARCMLCLN DODSR BLDRNXT
ARCISTAT	ARCUCTL
ARCZRNXT	ARCZRNXT

17. **Delete DSRs:** If a DSR is old enough to delete, ARCZDEL is called to delete the record and ARCMSG is called to issue an ARC0734I delete control data set entry message.

Module	Label
ARCMLCLN	ARCMLCLN DODSR DELETE
ARCMSG	ARCMSG
ARCZDEL	ARCZDEL

18. **End DSR processing:** ARCZRLSE is called to release any outstanding request parameter lists (RPLs).

Module	Label
ARCMLCLN	ARCMLCLN DODSR QUITDSR BLDRLSEP
ARCZRLSE	ARCZRLSE

19. **Begin volume daily statistics records (VSR):** ARCZPOS is called to position to the first VSR.

Module	Label
ARCMLCLN	ARCMLCLN DOVSR BLDPOSP
ARCZPOS	ARCZPOS

Repeat step 20 through step 21 for each VSR record.

20. **Read a VSR:** ARCZRNXT is called to read the next VSR. ARCUCTL is called write an MCR to periodically record the key of the last VSR processed by migration cleanup. If migration is held or DFHSM is in shutdown or emergency mode, processing is ended beginning at step 22.

Module	Label
ARCMLCLN	ARCMLCLN DOVSR BLDRNXT
ARCISTAT	ARCUCTL
ARCZRNXT	ARCZRNXT

21. **Delete VSRs:** If a VSR is old enough to delete, ARCZDEL is called to delete the record and ARCMSG is called to issue an ARC0734I delete control data set entry message. If a VSR is not old enough to delete, ARCZRLSE is called to release any outstanding RPLs and ARCZPOS is called to position to the next VSR.

Module	Label
ARCMLCLN	ARCMLCLN DOVSR DELETE BLDRLSEP BLDPOSP
ARCMSG	ARCMSG
ARCZDEL	ARCZDEL

ARCZPOS	ARCZPOS
ARCZRLSE	ARCZRLSE

22. **End VSR processing:** ARCZRLSE is called to release any outstanding RPLs.

Module	Label
ARCMLCLN	ARCMLCLN
	DOVSR
	QUITVSR
	BLDRLSEP
ARCZRLSE	ARCZRLSE

23. **Build and print ending message:** A TIME macro is issued to get the time and date from the system. ARCDMY is called to convert the date to YY/MM/DD. ARCWTN is called to issue the ARC0527I migration cleanup ending message.

Module	Label
ARCMLCLN	ARCMLCLN
ARCALNDR	ARCDMY
ARCWTO	ARCWTN

24. **Cancel ESTAE environment:** ARCZEST is called to cancel the ESTAE environment. ARCZRLSE is called to release any outstanding RPLs. Control is returned to the caller.

Module	Label
ARCMLCLN	ARCMLCLN
	ESTAECLN
	BLDRLSEP
ARCZEST	ARCZEST
ARCZRLSE	ARCZRLSE

Output

- Modified Migration Control Data Set (MCDS)
- Daily Statistics Record (DSR)
- Volume Statistics Record (VSR).

Diagram 2.2: ARCMGLM - Control Migration Volume Space Management

Input

- Migration Level 2 Control Record (L2CR)
- Management Communication Vector Table (MCVT)
- Migration Global Control Block (MGCB)
- Migration Task Control Block (MTCB)
- Migration Control Data Set (MCDS)
- Mounted Volume Table (MVT)
- Management Work Element (MWE).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCMGLM	ARCMGLM
ARCPDA	ARCPDA

2. **Update MTCB for the TERMINAL and DAYS parameters:** Update the flag in the MTCB to indicate whether the TERMINAL parameter is specified. The value of DAYS is put in a field in the MTCB if DAYS is specified in the command. Otherwise, the DFHSM default age for migration level 1 volumes is put in MTCB.

Module	Label
ARCMGLM	ARCMGLM
	DAYSTERM

3. **Issue message ARC0571I if Storage Management Subsystem (SMS) is not active:** If none of Management Class Lists was retrieved by ARCMGEN (SMS is not active in the system), call ARCWTL to issue message ARC0571I to the migration activity log and to the operator.

Module	Label
ARCMGLM	ARCMGLM
	CHK_SMS_MC
ARCWTO	ARCWTL

4. **Set flag in MCR to indicate level 1 to level 2 migration:** If migration is to a Level 2 DASD, a flag in the management control record (MCR) is turned on to indicate that the migration from level 1 to level 2 is in process. ARCUCTL is called to update the MCR before the flag is reset after the migration is done.

Module	Label
ARCMGLM	ARCMGLM
	L2DASD
UPDTMCR	UPDTMCR
ARCLOCK	ARCLOCK
	ARCUNLK

5. **Enqueue and dequeue from the control data sets:** ARCUNLK is called to dequeue the control data set, and ARCLOCK is called to enqueue the control data set, thus allowing any exclusive waiting-for-enqueue functions of DFHSM to obtain the resource. (qname='ARCGPA ' rname='ARCCAT '.)

Module	Label
ARCMGLM	ARCMGLM
ARCLOCK	ARCLOCK
	ARCUNLK

6. **Process all level 1 volume migrations:** Call ARCMETRГ to establish the possible target migration volume(s). Call ARCMCVLT to check if the possible target migration volume(s) are available for level 1 volume migration. If the possible target volume(s) are not available, bypass the level 1 volume migration. Otherwise, call ARCMLEV1 to process all level 1 volume migrations as a response to command migration or automatic level migration. ARCPRINT is called to space between volumes in the migration activity log. After the all level 1 volume migrations was processed, call ARCMHOLD to check if the migration should be held because of the required target migration volume(s) are not available for migration to continue to run. If it is an all level 1 volume migration command, ARCLSPAC is called to list space on all level 1 migration volumes after the command is processed. If in multi-host, then propagate free space to MCI record by calling ARCCUMCI.

Module	Label
ARCMGLM	ARCMGLM
	ALLML1
ARCMETRГ	ARCMETRГ
ARCMCVLT	ARCMCVLT
ARCMLEV1	ARCMLEV1
ARCMHOLD	ARCMHOLD
ARCLSPAC	ARCLSPAC
ARCCUMCI	ARCCUMCI
ARCPROPN	ARCPRINT

7. **Process the data set deletion or data set retirement on the migration volumes:** If the request is to do data set deletion or data set retirement on a migration level 1 or level 2 volume, the MVT recall composite flags are set to specify data set deletion or data set retirement. If the volume to be deleted is a tape migration level 2 volume, ARCDBAUT is called to perform data set deletion or data set retirement on the volume. Otherwise, ARCMVOLP is called to post ARCMVOL to handle data set deletion or data set retirement on the migration volume.

Module	Label
ARCMGLM	ARCMGLM
	DBADBU
ARCDBAUT	ARCDBAUT
ARCMVOLP	ARCMVOLP

8. **Process a specific migration level 1 or level 2 volume:** Call ARCMETRГ to establish the possible target migration volume(s). Call ARCMCVLT to check if the possible target migration volume(s) are available. If they are not available, bypass the migration. If there are more than one migration level 2 DASD key ranges, and the target volumes are level 2 DASD volumes, call ARCMLEV2. Otherwise, call ARCMVOLP. After the volume has been processed, call

ARCMHOLD to check if the migration should be held because of the required target migration volume(s) are not available for migration to continue to run.

Module	Label
ARCMGLM	ARCMGLM ML1ORML2
ARCMLEV2	ARCMLEV2
ARCMETRG	ARCMETRG
ARCMCVLT	ARCMCVLT
ARCMVOLP	ARCMVOLP
ARCMHOLD	ARCMHOLD

Output

- Migration Task Control Block (MTCB)
- Mounted Volume Table (MVT)
- Management Work Element (MWE)
- Management Control Record (MCR)
- Recovery Control Block (RCB).

Diagram 2.3: ARCMGDI - Process Primary Volumes During Daily Space Management and Interval Migration

Input

- Management Communication Vector Table (MCVT)
- Migration Global Control Block (MGCB)
- Management Control Record (MCR)
- Migration Task Control Block (MTCB)
- Mounted Volume Table (MVT).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCMGDI	ARCMGDI
ARCPDA	ARCPDA

2. **Build or refresh SMS MVT chain:** If SMS lock token was not obtained, none of SMS management class definition list was retrieved, or Fast VTOC/VVDS load module, IGDCSP00, was not successfully loaded into DFHSM address space at DFHSM startup, call ARCSM570 to issue message ARC0570I, and bypass the space management for all SMS-managed volumes.

If space management for SMS volumes is not bypassed and daily space management is being performed, call ARCSMSVM to build or refresh the SMS MVT chain. If ARCSMSVM failed to build or refresh the SMS MVT chain, call ARCSM570 to issue message ARC0570I to the migration activity log and to the operator, and bypass the space management on all SMS-managed volumes.

Module	Label
ARCMGDI	ARCMGDI INIT CHK_SMS
ARCSMSVM	ARCSMSVM
ARCSM570	ARCSM570

3. **Position on the MVT chain to volume where daily space management restart should occur:** If daily space management is being performed and had been interrupted during processing of volumes, then position on the SMS or non-SMS MVT chain to the volume that was in process at the time of the interruption.

Module	Label
ARCMGDI	ARCMGDI DSM_RESTART POSITION_MVT

4. **Loop through the SMS MVT chain and non-SMS MVT chain for the volumes eligible for daily space management or interval migration and call ARCMGL0 for each one:** Examine each MVT entry for eligibility for automatic processing.

For a volume to be eligible, it must have a valid MVT entry. The MVT entry must indicate the following:

- It is a primary volume with the volume attribute of automatic space management.
- The volume has not caused a volume task to abnormally end.
- The volume is not currently suspended from automatic processing (migration is not held at end of data set and at end of volume).

If a volume is eligible and the request is for daily space management, the auto-start quiesce time for migration is checked to determine if daily space management should be performed. When the auto-start quiesce time is reached, daily space management is ended.

Before DFHSM can do interval migration on a volume, the following two conditions must be met:

- The needs-migration flag must be on for the volume.
- The space management technique must be migration.

If daily space management is currently being performed, save the volser in the MCR record for restart. Call ARCUCTL to write out the MCR record.

Call ARCMGL0 to perform space management on the volume.

Module	Label
ARCMGDI	ARCMGDI PROCESS_DI MIGPHAS1 VOLELIG CK_QTIME
ARCISTAT	ARCUCTL
ARCMGL0	ARCMGL0

5. **For daily space management, re-attempt the space management for volumes marked as skipped because they were in use at the first attempt:** If daily space management is being performed, loop through the SMS MVT chain and non-SMS MVT chain and retry each volume marked as in-use during phase 1. For each such volume, verify eligibility and check the auto-start quiesce time as described in step 4 and call ARCMGL0. When all volumes flagged as not available have been re-attempted and all were processed, control returns to the caller. If none was processed during this pass through the loop, then wait five minutes before going back through the loop to attempt reprocessing the volume. ARCMGDI will go through the loop a maximum of nine times.

Module	Label
ARCMGDI	ARCMGDI DSM_MISS MIGPHAS2 VOLELIG CK_QTIME
ARCMGL0	ARCMGL0

6. For each volume that was in-use ten times, write ARC0301I message: For each volume that was in-use for all ten attempts during daily space management, call ARCWTL to issue message ARC0301I to the operator and the migration activity log.

Module	Label
ARCMGDI	ARCMGDI SKIPMSG_CNTL SKIPMSG MSG301
ARCWTO	ARCWTL

Output

- Management Control Record (MCR)
- Migration Task Control Block (MTCB)
- Mounted Volume Table (MVT).

Diagram 2.4: ARCMEXP - Determine if a Data Set Has Expired During Migration

Input

- ARCMEXPP Parameter List.

Processing

ARCMEXP is a functional process invoked during migration processing to determine if a data set has expired. If an expiration date was not specified and the data set is SMS-managed, ARCMEXP checks the management class expiration attributes.

Output

- None.

Diagram 2.5: ARCMGL0 - Control Volume Space Management of Level 0 Volume

Input

- Management Communication Vector Table (MCVT)
- Migration Global Control Block (MGCB)
- Migration Task Control Block (MTCB)
- Management Work Element (MWE)
- Mounted Volume Table (MVT)
- Migration Control Data Set Volume Record (MCV)
- Management Control Record (MCR)
- Recovery Control Block (RCB).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCMGL0	ARCMGL0
ARCPDA	ARCPDA

2. **Initialization:** Perform initialization of internal flags and addressability of the mounted volume table (MVT), migration task control block (MTCB), management work element (MWE), and record control block (RCB). Set the flag in the MTCB to indicate whether the TERMINAL parameter is specified.

Module	Label
ARCMGL0	ARCMGL0 INIT

3. **Enqueue volume being processed:** Call ARCLOCKC to enqueue the volume being processed. If the volume enqueue fails for a command request, ARCWTM is called to issue Message ARC0301I and the processing ends. If the volume is enqueued and the volume has an MCDS volume record (MCV) (in a multiple processing unit environment), call ARCCMHRD to serialize the MCV. If another processing unit is using the MCV, update the MVT fields to indicate that the volume is to be skipped and that another host processing unit is using the MCV. Call ARCUNLKC to dequeue the volume. The migration will fail if the MCV is not found; it will also fail if, while reading the MCV, an I/O error occurs. Failure will cause Message ARC0510I to be issued. Call ARCUNLKC to dequeue the volume.

Module	Label
ARCMGL0	ARCMGL0 ENQVOL ENQMCV MSG301 MSG510
ARCCMHRD	ARCCMHRD
ARCLOCK	ARCLOCKC ARCUNLKC

ARCWTO ARCWTL
 ARCWTU

4. **Build MVT recall composite flags and synchronize volume attributes in MVT with MCV if necessary:** If necessary, serialization is not done, return to the caller. Otherwise, if the volume is a non-SMS-managed volume, call ARCZVLAT to build the MVT recall composite flags. If DFHSM is in a multiple processing unit environment, call ARCZVLAT to synchronize the volume attributes in the MVT entry with the information in the corresponding MCV and to build the MVT recall composite flags.

Module	Label
ARCMGL0	ARCMGL0 MVTRCL
ARCZVLAT	ARCZVLAT

5. **Update MCR and RCB. Set minimum migration age in MTCB:** If the user specifies a space management technique in the command, and the volume is a non-SMS-managed volume, reset the MVT recall composite flags to the user's value. If the command is a data set deletion or data set retirement request for a non-SMS-managed volume, put the inactive age (*days*) of data set deletion or data set retirement in the MTCB. If the volume is to be migrated, call ARCMETRG to establish the possible target migration device type(s) for the migration. Call ARCMCVLT to check if the target migration device type(s) are available. If the target volume(s) are not available, bypass the migration of the volume. Otherwise, set the minimum migration age in the MTCB if the command specified the MIGRATE parameter for a non-SMS-managed volume and *days* was specified. If *days* is not specified for a non-SMS-managed volume, obtain the minimum migration age (specified on the ADDVOL command and stored in the MCV record) by calling ARCZREAD to read the MCV record if it has not been read. If the age is not specified on the ADDVOL command, use the DFHSM default age for migration. If the volume is a DFHSM-managed non-SMS volume and *days* was specified for the MIGRATE, DELETEBYAGE, or DELETEIFBACKEDUP parameter, turn off the valid threshold flag in the MVT. If the volume is managed by DFHSM and the migration activity log is used, ARCMGL0 calls ARCPRINT to print the output at the top of the page. Save MVT pointer in RCB.

Module	Label
ARCMGL0	ARCMGL0 USRSPSM MIGRATE DBADBU TARGET_DEVTYPE THRESHLD
ARCPROPN	ARCPRINT
ARCISTAT	ARCUCTL
ARCMETRG	ARCMETRG
ARCMCVLT	ARCMCVLT
ARCZREAD	ARCZREAD

6. **Call ARCMVOLP to post ARCMVOL to perform command space management on the volume:** Call ARCMVOLP to set up the interface parameter list and post ARCMVOL to perform the space management command, or daily space management or interval migration on the volume.

After the volume has been processed, call ARCMHOLD to check if the migration should be held. The required target migration device type(s) may not be available for migration to continue to run.

Module	Label
ARCMGL0	ARCMGL0
ARCMVOLP	ARCMVOLP
ARCMHOLD	ARCMHOLD

7. **Release MCV. Dequeue the volume processed. Reset the flags in MVT:** Before returning to the caller, restore the valid threshold flag in MVT if it is turned off, release the serialization on the MCV, dequeue the processed volume, zero the MVT pointer in the RCB, and reset the flag in the MVT to indicate that the migration is not needed on the volume.

Module	Label
ARCMGL0	ARCMGL0 THRESHLD DEQMCV
ARCCMHRD	ARCCMHWR
ARCLOCK	ARCUNLKC

Output

- Migration Task Control Block (MTCB)
- Mounted Volume Table (MVT)
- Management Work Element (MWE)
- Management Control Record (MCR)
- Recovery Control Block (RCB)
- Return Codes:
 - 66 - Volume enqueue failed for a specified Level 0 volume.

Diagram 2.6: ARCMETRG - Establish the Possible Target Migration Device Type(s) for Level or Volume Migration

Input

- Index for Migration Task Control Block (MTCB).

Processing

ARCMETRG determines the possible target device type(s) for a level or volume migration request (through automatic or command requests) and indicates the possible target device type(s) in the MTCB.

Output

- None.

Diagram 2.7: ARCMCVLT - Check for an Available Target for a Level or Volume Migration Request

Input

- One-character functional request key
- Index for Migration Task Control Block (MTCB)
- Migration Global Control Block (MGCB).

Processing

ARCMCVLT checks the availability of target volumes for a level or volume migration request by comparing the possible target types (stored in the MTCB) against the available target types.

Output

- None.

Diagram 2.8: ARCMHOLD - Hold Migration When the Required Target Volume(s) are Unavailable

Input

- None.

Processing

ARCMHOLD verifies that the target migration volume(s) are available for the migration function to continue. ARCMHOLD holds migration if the target migration volume(s) are unavailable.

Output

- None.

Diagram 2.9: ARCMLEV1 - Control Migration from Level 1 to Level 2 Volumes

Input

- Migration Control Data Set (MCD) records
- DAYS - The number of days a data set must be unreferenced before being moved from Level 1 to Level 2
- TERM - Output to operator option
- MTSPTR - Pointer to the migration tape selection list or zero.

Processing

ARCMLEV1 controls the subsequent migration of a data set from Level 1 to Level 2 volumes by determining destination and building MDQEs.

Output

- None.

Diagram 2.10: ARCMVOLP - Provide the Post Interface to Activate ARCMVOL

Input

- Mounted Volume Table (MVT)
- Migration Task Control Block (MTCB)
- Management Work Element (MWE)
- Recovery Control Block (RCB)
- Management Communication Vector Table (MCVT).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCMVOLP	ARCMVOLP
ARCPDA	ARCPDA

2. **For data set deletion or data set retirement on a DASD migration volume, migration of a single migration volume, or when processing a FREEVOL command, post ARCMVOL to perform the function. Return to the caller after getting the termination event control block (ECB) posted:** If data set deletion or data set retirement is being done on a DASD migration volume (level 1 or 2), obtain the address of the work-to-do ECB and post ARCMVOL. Obtain the address of the termination ECB. Return to the caller when data set deletion or data set retirement of the volume is complete. If ARCMVOL ABENDs, DETACH and ATTACH ARCMVOL using ARCESTAI on the ATTACH.

Module	Label
ARCMVOLP	ARCMVOLP
	POSTMVOL
ARCMVOL	ARCMVOL
ARCESTAI	ARCESTAI

3. **Update MVT flags needed by ARCMVOL:** Update the MVT entry for the volume to be migrated by resetting the missed flag, setting the host ID, and marking the entry in use. If the CONVERT parameter of the MIGRATE command is specified and a primary volume is being processed, propagate from the MWE to the MVT the MWE fields that ARCMVOL uses.

Module	Label
ARCMVOLP	ARCMVOLP
	INIT
	CNVTFUNC

4. **Enqueue and dequeue DFHSM control data sets:** Call ARCUNLK to dequeue and ARCLOCK to enqueue shared on the control data sets ('ARCGPA' 'ARCCAT'), thus allowing any exclusive waiting-for-enqueue functions of DFHSM to obtain the resource.

Module	Label
ARCMVOLP	ARCMVOLP MVOLP
ARCLOCK	ARCLOCK ARCUNLK

- 5. Post ARCMVOL with work to do, and wait for termination ECB to be posted:**
Obtain the address of the waiting-for-work ECB, and post ARCMVOL with work to do. Obtain the address of the termination ECB, and wait for ARCMVOL to post the termination ECB back when migration is complete. If ARCMVOL ABENDS, DETACH and ATTACH ARCMVOL using ARCESTAI on the ATTACH.

Module	Label
ARCMVOLP	ARCMVOLP MVOLP POSTMVOL
ARCMVOL	ARCMVOL
ARCESTAI	ARCESTAI

- 6. Reset MVT flags before returning to the caller:** Before returning to the caller, reset the host field in the MVT and clear the MVT fields used for the CONVERT function.

Module	Label
ARCMVOLP	ARCMVOLP

Output

- Mounted Volume Table (MVT)
- Management Communication Vector Table (MCVT).

Diagram 2.11: ARCTLEV1 - Control Level Type Migration to a Tape Migration Level 2 Volume

Input

- None.

Processing

ARCTLEV1 determines which data set to migrate to Level 2 and verifies an ADDVOL has been performed on the migration Level 1 volume on which the migration copy resides. ARCTLEV1 deallocates any tape volume still allocated to volume migration.

Output

- None.

Diagram 2.12: ARCSMINT - Second Level Migrate Data Set Interface

Input

- Pointer to ARCSMINT Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCSMINT	ARCSMINT
ARCPDA	ARCPDA

2. **Validate the ARCSMXP parameter list:** If called with an invalid parameter list, ARCERP is called to issue a Return Code to the caller.

Module	Label
ARCSMINT	ARCSMINT
ARCERP	ARCERP

3. **Copy the MCD record:** Copy the MCDS data set record (MCD) and provide the address to ARCMMEXT.

Module	Label
ARCSMINT	ARCSMINT

4. **Calculate the days since last referenced:** Calculate the days since last referenced and store in SMXAGE.

Module	Label
ARCSMINT	ARCSMINT CALCDAYS

5. **Establish an ESTAE:** ARCCRCB is called to build a recovery control block (RCB) and ARCZEST is called to establish an ESTAE around the call to ARCMMEXT. If the ESTAE fails to be established, control returns to the caller.

Module	Label
ARCSMINT	ARCSMINT
ARCCRCB	ARCCRCB
ARCZEST	ARCZEST

6. **Call the installation Second Level Migrate Data Set exit:** Call ARCMMEXT and pass the addresses of the copied MCD, SMXAGE, SMXFLAGS, and SMXRETC, as parameters. If the installation exit abnormally ends, message ARC0004I is issued as the user exit insert and the abnormal end code from the RCB as the abnormal code insert.

Module	Label
ARCSMINT	ARCSMINT EXITRTRY CALLWTO
ARCMMEXT	ARCMMEXT
ARCWTO	ARCWTL

7. **Cancel ESTAE:** ARCZEST is called to cancel the ESTAE. ARCDRCB is called to delete the RCB.

Module	Label
ARCSMINT	ARCSMINT
ARCZEST	ARCZEST
ARCCRCB	ARCDRCB

Output

- **Return Codes:**
 - 000 - Proceed with migration (set by ARCMEXT)
 - 004 - Do not migrate (set by ARCMEXT)
 - 016 - Installation exit abnormally ended
 - 060 - Error establishing ESTAE environment.

Diagram 2.13: ARCMMGDS - Control Migration of a Migrated Data Set During Volume Migration

Input

- ARCMGDSP Parameter List.

Inout

- ARCMGDSP Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCMMGDS	ARCMMGDS
ARCPDA	ARCPDA

2. **Establish addressability:** Addressability is established for MTCB, MDQE, MATP, MDS, FSR, MTSP, and RCB. The parameter list is checked for validity. If an error is found, ARCERP is called in debug mode with an error code of 4NN, and ARCMMGDS returns control to the caller.

Module	Label
ARCMMGDS	ARCMMGDS
	VALIDATE
ARCERP	ARCERP

3. **Prepare for the migration:** ARCCFSR is called to create a functional statistics record. The functional statistics record is initialized to type 2, and the data set name is stored in it.

ARCIRCB is called to initialize the RCB for the data set processor subtask.

Determine the type of the migration (level migration or a specific volume migration).

Module	Label
ARCMMGDS	ARCMMGDS
	PREPARE_MIG
ARCCFSR	ARCCFSR
ARCCRCB	ARCIRCB

4. **Migrate the data set:** Call ARCMCVLT to check the availability of the target volumes for the volume or level migration and call ARCMCDST to check the availability of the target volume for this data set migration.

If the target volumes are not available for the volume or level migration, terminate the function.

If the target volume is not available for this data set migration, skip the migration of this data set.

Otherwise, proceed to migrate the data set either to a tape migration volume or to a DASD migration volume.

If the migration of the data set to level 2 DASD failed because there was not enough free space on the level 2 target volume, or because the level 2 target volume is virtual and could not be mounted, or the VTOC is full, terminate the

use of the level 2 DASD target volume and attempt to associate another level 2 DASD volume.

If the migration was unsuccessful, call ARCMRSLT to report the result of the migration.

If the migration failed because the VTOC was full, because a lack of level 1 space and an LSPACE was done, or because the level 2 DASD could not be mounted or did not have enough free space and another level 2 DASD was associated, retry the migration of the same data set.

Module	Label
ARCMMGDS	ARCMMGDS CHK_TARGET_DEVTYPE MIG_TO_TAPE_PROC MIG_TO_DASD_PROC L2RLSE UPDTMCV MSG535 CHK_RETRY_MIG
ARCMCVLT	ARCMCVLT
ARCMCDST	ARCMCDST
ARCZREAD	ARCZREAD
ARCZRPLS	ARCZRPLS
ARCZUPDT	ARCZUPDT
ARCMSREL	ARCMSREL
ARCULVOL	ARCULVOL
ARCULVRT	ARCULVRT
ARCMRSLT	ARCMRSLT
ARCWTO	ARCWTL

5. **Migration to tape:** ARCMG2TP is called to migrate the data set to tape. If there is a tape or tapes allocated to volume migration, ARCCRNT is called to check if a RECALL task needs an allocated tape. ARCMMSG is called to issue message ARC0734I. If migrate was successful statistics are updated. If an FSR exists, call ARCDFSR to process and delete it. Copy the Return Code and Reason Code from data set processor subtask into ARCMMGDS' Return Code and Reason Code.

Module	Label
ARCMMGDS	ARCMMGDS MIG_TO_TAPE_PROC UPDTSTATC
ARCAMSG	ARCAMSG
ARCCRNT	ARCCRNT
ARCCFSR	ARCCFSR
ARCMG2TP	ARCMG2TP

6. **Migration to DASD:** ARCMSMV is called to select a level 1 migration volume as a target volume. If migration is to level 2, ARCMSL2V is called to select a level 2 migration volume as a target volume. ARCATTEC is called to migrate the data set to DASD. ARCMMSG is called to issue message ARC0734I. If migrate was successful, statistics are updated. If an FSR exists, ARCDFSR is called to process and delete it. Copy the Return Code and Reason Code from data set processor subtask into ARCMMGDS' Return Code and Reason Code.

Module	Label
ARCMMSGDS	ARCMMSGDS MIG_TO_DASD_PROC GET_TARGET_VOLUME UPDTSTATC
ARCAMSG	ARCAMSG
ARCATTEC	ARCATTEC
ARCCFSR	ARCCFSR
ARCMSL2V	ARCMSL2V
ARCMSMV	ARCMSMV

Output

- Updated ARCMGDSP Parameter List
- Return Codes:
 - 95 - The operator could not mount any scratch tape.

Command Volume/Level Space Management Processing

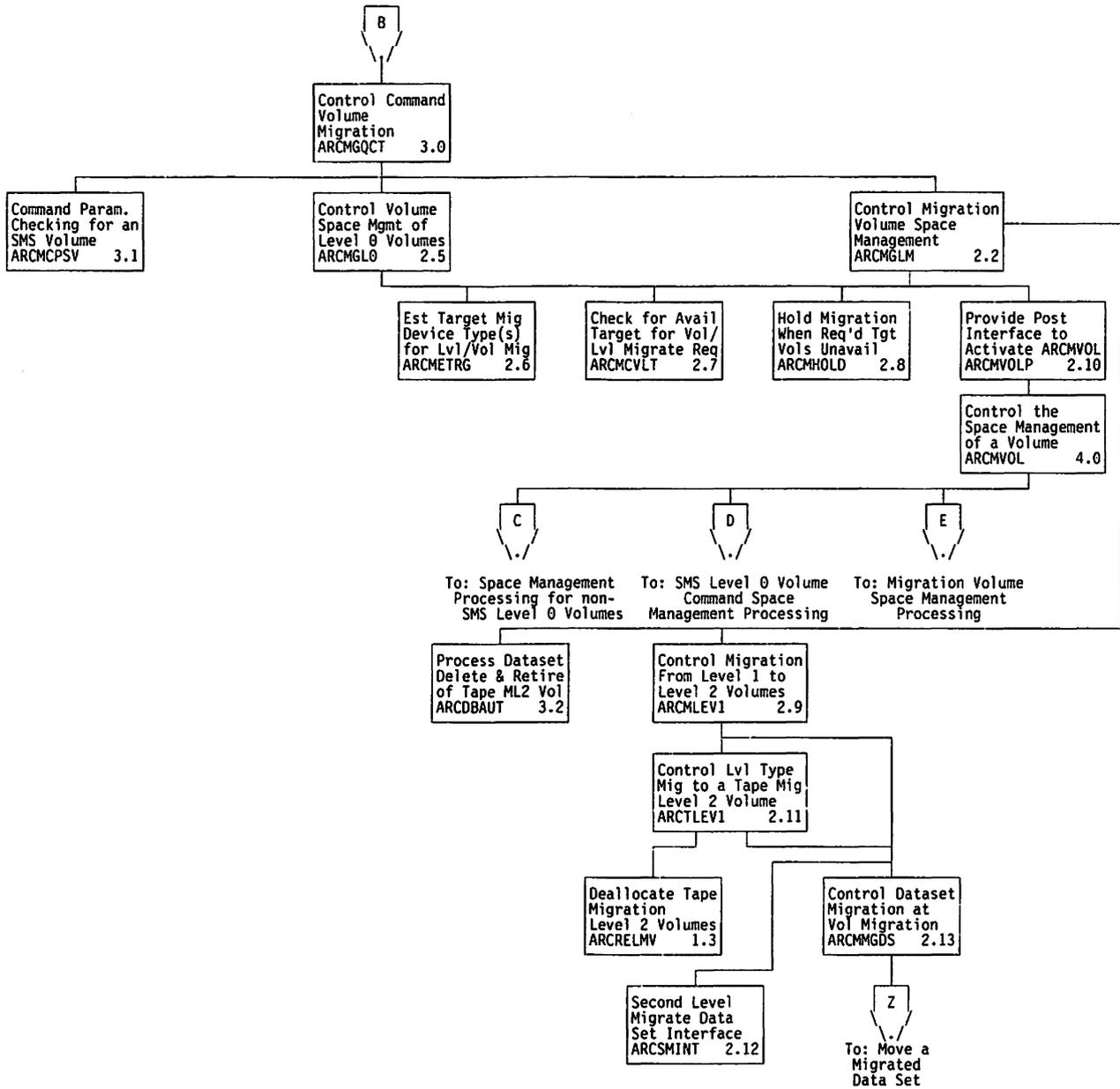


Figure 5. Visual Table of Contents for Command Space Management Processing

Diagram 3.0: ARCMGQCT - Control Command Volume Migration

Input

- None.

Processing

ARCMGQCT controls command volume migration by processing the migration MWE queue.

Output

- Return Codes.

Diagram 3.1: ARCMCPSV - Command Parameter Checking for an SMS Volume

Input

- Pointer to migration Management Work Element (MWE).

Processing

ARCMCPSV checks the other command parameters for compatibility when an SMS volume is processed.

Output

- Return Codes.

Diagram 3.2: ARCDBAUT - Processing Data Set Deletion and Retirement of Tape Migration Level 2 Volumes

Input

- Input Parameters
- MCDS Volume Record (MCV)
- Tape Table of Contents (TTOC)
- Migration Control Data Set (MCDS).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCDBAUT	ARCDBAUT
ARCPDA	ARCPDA

2. **Set up startup environment:** Message ARC0522I is issued to indicate the start of data set deletion or data set retirement for the tape migration level 2 volume. If a user exit exists, ARCZEST is called to establish an ESTAE environment. If the setup of the ESTAE environment fails, message ARC0304I is issued and control is returned to the caller.

Module	Label
ARCDBAUT	ARCDBAUT
	STDBADBU
	BLDESTAE
ARCCRCB	ARCCRCB
ARCILOG	ARCWLOG
ARCWTO	ARCWTL
ARCZEST	ARCZEST

3. **Determine if volume is in use:** ARCDBAUT calls ARCZREAD to read the MCV for the volume to see if another function is using the volume. If the volume is in-use, message ARC0535I is issued, ARCZRLSE is called to release the read request parameter list (RPL), and control returns to the caller. If the volume is not in-use, the in-use flag is set, the deletion flag is set and, if this is a multiple-host processor environment, the host ID is stored in the MCV.

Module	Label
ARCDBAUT	ARCDBAUT
	MCVINUSE
	MCVREAD
	MCVUPDT
	MCVNOUSE
	MSG0535I
ARCAMSG	ARCAMSG
ARCZREAD	ARCZREAD
ARCZRLSE	ARCZRLSE
ARCZUPDT	ARCZUPDT

4. **Determine data set eligibility for data set deletion or data set retirement:** ARCDBAUT enqueues on the TTOC and, if this is a multiple processing unit

environment, calls ARCCMHRD to put the host ID in the base TTOC. If the read of the TTOC fails, message ARC0535I is issued and control returns to the caller. If the read is successful, ARCDBAUT checks if DFHSM is being shut down, migration is held, or DFHSM is in emergency mode. Then, ARCDBAUT calls ARCZREAD to read MCD record for each valid entry in TTOC record. If the MCD record indicates that the data set is an SMS-managed, migrated data set, skip the DBA or DBU process for the data set. Otherwise, ARCDBAUT scans for an eligible data set to delete with the following criteria for data set deletion or data set retirement. For data set deletion, the following conditions must exist before any attempt is made to delete the data set:

The TTOC is checked first for age eligibility by comparing the difference between today's date and the date-last-referenced against the number of days before the data set is eligible for deletion.

If the data set meets the age criterion, the TTOC is checked for an expiration date. If the date has not expired, the data set is not deleted.

If the expiration date in the TTOC was not specified or if the expiration date has passed, the user exit is called (if it exists) to give the user a chance to confirm the deletion. If the user exit abnormally ends, message ARC0004I is issued, migration is held, and control returns to the caller. For data set retirement, the same age criteria is done as described for data set deletion. If the data set passes this initial validity check, ARCDBAUT determines whether a current backup version for the data set exists. This is done by first determining whether this data set has a DFHSM-generated name. If it has, the second qualifier is HMIG and the MCDS alias entry record (MCA) must be read to get the original data set name. The MCDS data set record (MCD) must be read to obtain data set date information so the existence of a backup version can be verified. Then, ARCDBAUT calls ARCVERBU to verify that the data set has a current backup version. If it does not have a current backup version, the data set is skipped. If it does have a current backup version, the MCB record must be updated to indicate that the data set is retired. If the record cannot be updated, the data set is skipped. If the record is updated, the deletion process continues as in data set deletion processing by asking the user to confirm the deletion.

Module	Label
ARCDBAUT	ARCDBAUT ENQUTTOC GETTOCRD READMCD VALIDDS DBAVALID DBUVALID DBUEXIT MCBUPDTE
ARCADEXT	ARCADEXT
ARCAMSG	ARCAMSG
ARCCMHRD	ARCCMHRD
ARCLOCK	ARCLOCK
ARCVERBU	ARCVERBU
ARCWTO	ARCWTL
ARCZREAD	ARCZREAD
ARCZUPDT	ARCZUPDT

5. **Delete the data set records:** ARCCFSR is called to create an FSR for each data set. ARCWLOG is called to log a code of 21. For all data sets validated through the above process, ARCITTOC is called to invalidate the TTOC.

For an eligible data set, ARCZSCLN is called to delete the MCA, MCDS VSAM associations record (MCO), and MCD records for the data set. On successful return, ARCRACF (for a non-VSAM data set) or ARCVSCHK (for a VSAM data set) is called to delete the Resource Access Control Facility (RACF) profile. After the profile has been deleted, a call is made to ARCZCAT to uncatalog the data set. When the first or last data set on the volume being processed is valid and is part of a multiple-volume data set, ARCITTOC is called to invalidate the data set on the additional volumes. The additional volumes are specified in the MCD record.

If the data set has been deleted, ARCAMSG is called to issue message ARC0734I for each data set. ARCDFSR is called to process and delete the FSR for the data set.

After all the base TTOC data sets have been processed, the extension records must go through the same validation and deletion process.

Module	Label
ARCDBAUT	ARCDBAUT LOGFUNCT MODTTOC READMCO UNCATDS DELRAFC
ARCAMSG	ARCAMSG
ARCCFSR	ARCCFSR ARCDFSR
ARCITTOC	ARCITTOC
ARCILOG	ARCWLOG
ARCRACF	ARCRACF
ARCVSCHK	ARCVSCHK
ARCZCAT	ARCZCAT
ARCZSCLN	ARCZSCLN

6. **Restore original operating environment:** After the TTOC has been processed, the MCV record is read, the in-use flag is turned off and, if this was a multiple processing unit environment, the host ID is removed. The MCV record is then written back to the MCDS. ARCDBAUT also removes the enqueue from the TTOC.

ARCDBAUT removes the ESTAE environment and message ARC0523I is issued to indicate the end of the function. Control returns to the caller.

Module	Label
ARCDBAUT	ARCDBAUT MCVNOUSE ENQUTTOC BLDESTAE
ARCCMHRD	ARCCMHWR
ARCLOCK	ARCUNLK
ARCWTO	ARCWTL
ARCZREAD	ARCZREAD
ARCZRLSE	ARCZRLSE

ARCZUPDT	ARCZUPDT
ARCZEST	ARCZEST
ARCCRCB	ARCDRCB

Output

- Messages
- Migration Control Data Set Volume Record (MCV)
- Function Statistics Record (FSR).

Non-SMS Level 0 Volume Space Management Processing

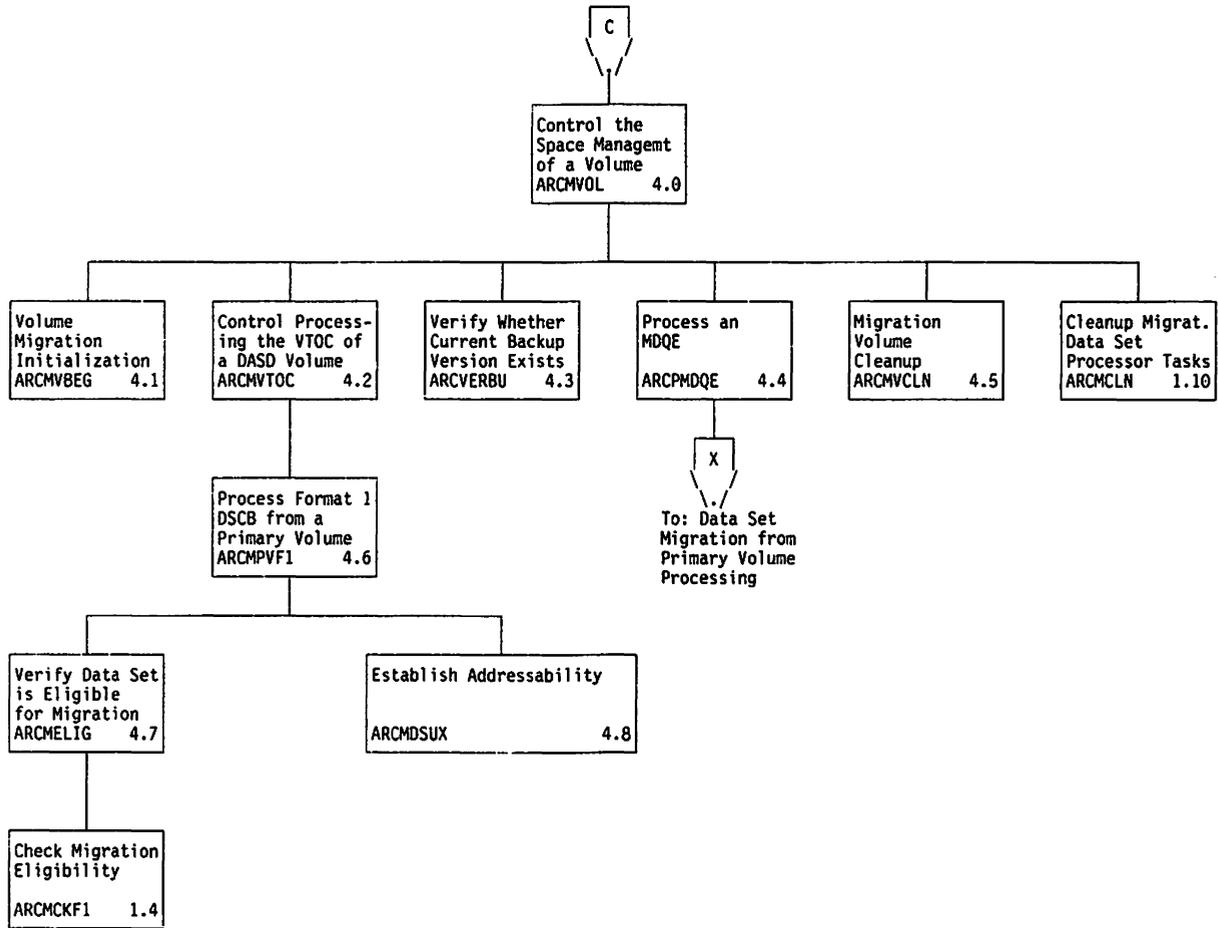


Figure 6. Visual Table of Contents for Non-SMS Level 0 Volume Space Management Processing

Diagram 4.0: ARCMVOL - Control the Space Management of a Volume

Input

- Migration Task Control Block (MTCB).

Processing

ARCMVOL is invoked to space manage a user volume (non-DFHSM managed or DFHSM managed primary volume) or a DFHSM migration volume.

Output

- None.

Diagram 4.1: ARCMVBEG - Volume Migration Initialization

Input

- ARCMVBCP Parameter List.

Inout

- ARCMVBCP Parameter List.

Processing

ARCMVBEG initializes the ARCMVOL task recover control block (RCB) and creates subtask RCBs. ARCMVBEG closes a single-file format data 3480 tape when the tape format is changed to multi-file.

Output

- Updated ARCMVBCP Parameter List
- Return Codes.

Diagram 4.2: ARCMVTOC - Control Processing of the VTOC of a DASD Volume

Input

- ARCMVLIP Parameter List.

Inout

- ARCMVLIP Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCMVTOC	ARCMVTOC
ARCPDA	ARCPDA

2. **Establish addressability and validate the parameter list:** Establish addressability for the migration task control block (MTCB), and for the mounted volume table (MVT). Check the parameter list for validity, if an error is detected, call ARCERP to log the error.

Module	Label
ARCMVTOC	ARCMVTOC
ARCERP	ARCERP

3. **Calculate the free space on the volume:** If the source volume is a primary volume, ARCLSPAC is called to calculate the number of free tracks on the volume. If ARCLSPAC is successful, the process is not delete by age (DBA)/delete if backed up (DBU), and the volume has valid thresholds, calculate the percent of free space on the volume. If the percent of free space on the volume indicates that the volume is under threshold, no migration is necessary at this time.

Module	Label
ARCMVTOC	ARCMVTOC
ARCLSPAC	ARCLSPAC

4. **Read the volume table of contents (VTOC) and process the Format 1 data set control blocks (DSCBs):** If ARCMVTOC's Return Code is still zero, set up the parameter list for ARCZVTOC. In a loop do the following while the Return Code from ARCZVTOC is zero. Call ARCZVTOC to read the VTOC and return a DSCB. If the volume is a primary volume, call ARCMPVF1 and pass it the Format 1 DSCB. If the volume is a migration volume, call ARCMVF1 and pass it the Format 1 DSCB. If an error occurs in ARCMVF1 or ARCMPVF1, set the flag that tells ARCZVTOC to close the VTOC.

Module	Label
ARCMVTOC	ARCMVTOC
ARCMMVF1	ARCMMVF1
ARCMPVF1	ARCMPVF1
ARCZVTOC	ARCZVTOC

Output

- Updated ARCMVL1P Parameter List
- Return Codes:
 - 999 - Halt volume processing - No error message necessary.

Diagram 4.3: ARCOVERBU - Verify Whether a Current Backup Version Exists

Input

- Mounted Volume Table (MVT)
- Format 2 DSCB
- MCDS MCD record if the data set is migrated.

Processing

1. **Issue a locate request if necessary:** If the data set being checked:
 - Is non-VSAM
 - Has been changed since its last backup
 - The retirement function is in process and is on a Level 0 volume

indicate that the data set requires backup and return. Otherwise, for a non-VSAM data set, set up a catalog parameter list and issue a LOCATE macro to get catalog information and save it for the caller.

Module	Label
ARCOVERBU	ARCOVERBU LOCATEDS MULTIVOL
ARCLOCK	ARCLOCK ARCUNLK

2. **For data set retirement requests, read the data set's BCDS data set record (MCB) and search for a current backup version:** If the request is not for data set retirement, control returns to the caller. ARCZREAD is called to read the BCDS data set record (MCB) for the data set. If the record is not found or an error occurred on the read of the record, the Return Code and Reason Code are set to the proper values and control is returned to the calling program. If the total number of backup versions is 0, the Return Codes and Reason Codes are set. The MCB record is scanned for a backup version for the data set being checked. If a backup version is found, the date of creation of the backup version is checked against the date-last-referenced field in the data set's Format 1 data set control block (DSCB) or MCDS D record, if it is migrated, to ensure that the backup version is current. If no backup version is found or the backup version is not current, set the Return Codes and Reason Codes to failing values. If a current backup version is found, the version name is returned to the caller and control returns to the caller.

Module	Label
ARCOVERBU	ARCOVERBU CATLG UNCTSCAN CURRENT
ARCZREAD	ARCZREAD

Output

- Return Code
 - Reason Code
- Version Name.

Diagram 4.4: ARCPMDQE - Process a Migratable Data Set Queue Element (MDQE)

Input

- Index for the Migration Task Control Block (MTCB)
- Address of the Migratable Data Set Queue Element (MDQE).

Processing

ARCPMDQE controls the processing of a Migratable Data Set Queue Element (MDQE) during Level 0 volume migration.

Output

- None.

Diagram 4.5: ARCMVCLN - Migration Volume Cleanup

Input

- ARCMVBCP Parameter List.

Inout

- ARCMVBCP Parameter List.

Processing

ARCMVCLN performs cleanup functions for space management of a volume.

Output

- Updated ARCMVBCP Parameter List.

Diagram 4.6: ARCMPVF1 - Process a Format 1 DSCB from a Primary Volume

Input

- ARCMVLIP Parameter List.

Inout

- ARCMVLIP Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCMVF1	ARCMVF1
ARCPDA	ARCPDA

2. **Validate the parameter list:** Check the validity of the parameter list. If validity checking fails, ARCERP is called to log the error and control is returned to the caller.

Module	Label
ARCMVF1	ARCMVF1 VALIDATE
ARCERP	ARCERP

3. **Determine the data set eligibility:** Calculate the age of the data set (the number of days since the data set was last referred to). If the date last referred to in the Format 1 DSCB is older than the creation date, calculate the age of the data set using the creation date.

ARCMELIG is called to determine the migration eligibility of the data set and to return catalog information about the data set (VSAM sphere backup control record (SDATA) control block for virtual storage access method (VSAM) data sets, volume list for non-VSAM data sets).

Module	Label
ARCMVF1	ARCMVF1 ELIGIBLE
ARCMELIG	ARCMELIG

4. **Delete expired VSAM data set:** If the Format 1 DSCB is for a base data object, ARCFVBC is called to get the base cluster name. ARCCLUSZ is called to calculate the size of the base cluster. If the cluster is empty, the data set is not processed. ARCALOLD is called to allocate the data set for deletion. If the allocation fails, the data set is not processed. If the allocation is successful, ARCDLVIS is called to delete the data set and ARCFREE is called to deallocate the DDNAME. ARCAMSG is called to issue an ARC0734I message indicating the deletion of the data set.

Module	Label
ARCMVF1	ARCMVF1 DEL_VSAM
ARCFVBC	ARCFVBC
ARCCLUSZ	ARCCLUSZ
ARCALOLD	ARCALOLD

ARCDELVS	ARCDELVS
ARCFREE	ARCFREE
ARCAMSG	ARCAMSG

5. **Delete expired non-VSAM data set:** ARCDSSZ is called to calculate the size of the data set to be scratched. ARCZSCR is called to scratch the data set. If the data set was scratched successfully and it is cataloged on the source volume that the task is processing, ARCZCAT is called to uncatalog the data set. ARCAMSG is called to issue an ARC0734I message indicating the deletion of the data set.

Module	Label
ARCMVPF1	ARCMVPF1 DEL_NONVSAM
ARCDSSZ	ARCDSSZ
ARCZSCR	ARCZSCR
ARCZCAT	ARCZCAT
ARCAMSG	ARCAMSG

6. **Data set is eligible and the date last referenced is zero:** When the data set is eligible for space management, or the data set is a list or utility data set, and the date last referenced in its Format 1 DSCB is 0, ARCZUF1 is called to initialize the date last referenced in the Format 1 DSCB to today's date and the data set is not processed. If the call to ARCZUF1 fails, ARCWTL is called to issue the ARC0554I message for an open VTOC error and the ARC0501I message for any other I/O error while reading the VTOC.

Module	Label
ARCMVPF1	ARCMVPF1 DATE_LAST_REF_PROC
ARCZUF1	ARCZUF1
ARCWTO	ARCWTL

7. **Build migratable data set queue element (MDQE) for eligible data set:** When a data set is eligible for space management, an MDQE is built for processing the data set. ARCCLUSZ is called to calculate the size in tracks of a VSAM data set for the queue element. If the cluster is empty, the data set is not processed. ARCDSSZ is called to calculate the size in tracks of a non-VSAM data set for the queue element. If an error occurs in getting the size, the data set is not processed.

If the user exit, ARCMDEXT, is active, and the volume is being space managed with the migration technique, or for data set delete by age (DBA) processing, or for data set delete if backed up (DBU) processing, ARCMDSUX is called to determine if the user wants space management on the data set.

If the data set is migrating to tape, and the volume is not being space managed for DBA/DBU processing or extent reduction, and need of backup is indicated, ARCKBUP is called to check if the data set is truly in need of backup.

If the data set has not been eliminated for processing, its migration priority is calculated and ARCZQBLD is called to chain the queue element to the end of the chain of queue elements.

Module	Label
ARCMVPF1	ARCMVPF1
ARCCLUSZ	ARCCLUSZ

	ARCDSSZ
ARCMDSUX	ARCMDSUX
ARCCKBUP	ARCCKBUP
ARCZQLD	ARCZQLD

8. **Process list or utility data sets:** If a list or utility data set is old enough to be deleted, and there was no error in the locate of the data set, VSAM data sets are deleted as described in step 4 on page 124 and non-VSAM data sets are deleted as described in step 5 on page 125. If a list or utility data set is not old enough to be deleted, and the task is processing a MIGRATE VOLUME CONVERT DAYS(0) command, and the data set has extents, the data set is processed as described in step 7 on page 125.

Module	Label
ARCMVPF1	ARCMVPF1 UTIL_OR_LIST_DS_PROC DEL_VSAM DEL_NONVSAM MDQLD

9. **Issue message for certain ineligible data sets:** ARCAMSG is called to issue ARC0734I messages for the data sets that are ineligible for migration for any reason other than age.

Module	Label
ARCMVPF1	ARCMVPF1
ARCAMSG	ARCAMSG

Output

- Updated ARCMVLIP Parameter List
- Return Codes:
 - 000 - Function completed successfully
 - 501 - Any error in ARCZUF1 except an OPEN or CLOSE error
 - 554 - Open error in ARCZUF1
 - 555 - Close error in ARCZUF1
 - 999 - Error building MDQE chain
 - Halt volume processing
 - No error message necessary.

Diagram 4.7: ARCMELIG - Verify That a Data Set is Eligible for Migration

Input

- Retained Data Set Level Element (RLE)
- VSAM Sphere Backup Control Record (SDATA)
- Data Set Control Block (DSCB)
- ARCMELGP Parameter List
- Mounted Volume Table (MVT).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCMELIG	ARCMELIG
ARCPDA	ARCPDA

2. **Validate the input parameter list:** Verify that the input parameters are valid. Call ARCERP if any parameter is invalid.

Module	Label
ARCMELIG	ARCMELIG
ARCERP	ARCERP

3. **Invoke the ARCSAEXT user exit:** If input parameter list is valid; and if the data set is not a VTOC Index, VVDS, ICF catalog, VSAM catalog, or OS CVOL; and if the ARCSAEXT user exit is in effect, call ARCSAINT to let the user exit determine whether the data set should be processed by DFHSM. If the user exit ABENDs, migration will be held.

Module	Label
ARCMELIG	ARCMELIG
	SEEALLEX
ARCSAINT	ARCSAINT

4. **Validate the dsname format:** Call ARCMCKF1 to verify (only) that the dsname has a valid format. If invalid, control is returned to the caller; otherwise, continue with the next step.

Module	Label
ARCMELIG	ARCMELIG
ARCMCKF1	ARCMCKF1

5. **Check if the data set is a utility data set:** Call ARCCHKUT to determine whether it is a utility data set too young to scratch. If so, set an internal flag, and Return Code (ELGRC) to 12; continue with the next step.

Module	Label
ARCMELIG	ARCMELIG
	CKUTIL
ARCCHKUT	ARCCHKUT

6. **Check if the data set is a list data set:** Call ARCCHKEL to determine whether it is a listing data set. If so, and if the data set age is < MCVTELAG, set an internal flag, and Return Code to 16; continue with the next step.

Module	Label
ARCMELIG	ARCMELIG CKLIST
ARCCHKUT	ARCCHKEL

7. **Check the age of a data set:** Check whether the data set meets the age criteria for migration or delete by age (DBA)/delete if backed up (DBU).

Module	Label
ARCMELIG	ARCMELIG AGECHKS

8. **Check the expiration date of a non-VSAM data set:** If the SETSYS EXPIREDDATASETS(SCRATCH) command is in effect, check if the expiration data of a non-VSAM data set (which could be a utility or listing data set earlier found too young to scratch) is met.

Module	Label
ARCMELIG	ARCMELIG EXPCHKNV

9. **Verify VSAM data set is a base data object:** When the data set is VSAM, call ARCFVBC to check whether the Format-1 DSCB passed represents a base data object.

If it does, ARCFVBC creates an SDATA control block and puts it on the chain of SDATA control blocks that the caller passed to ARCMELIG.

If it does not, ARCFVBC passes back a Return Code, which is returned to the caller.

Module	Label
ARCMELIG	ARCMELIG FVBC
ARCFVBC	ARCFVBC

10. **Check the expiration date of a VSAM data set:** If the SETSYS EXPIREDDATASETS(SCRATCH) command is in effect, check for a VSAM data set is met.

Module	Label
ARCMELIG	ARCMELIG EXPCHKVS

11. **Check DSCB-related attributes:** Call ARCMCKF1 to check for the following:

- A "system data set"
- An OS CVOL
- An ICF catalog
- A VSAM catalog
- A VSAM data set not cataloged in an ICF catalog
- A non-supported DSORG

Perform the following checks:

- Check that the data set is cataloged in an ICF catalog when DFDSS is the data mover
- Check if the data set is uncataloged or if an error occurred in the ARCZLOC module for a LOCATE error
- Check if the catalog entry corresponding to the name of the data set lists the same volume and device type as the volume that is migrating.

If any of the above conditions are detected, indicate the errors to the caller.

Module	Label
ARCMELIG	ARCMELIG VOLCHKS LOC CKCTLGEN
ARCZLOC	ARCZLOC

Output

- VSAM Sphere Backup Control Record (SDATA)
- Catalog Information
- Format 1 Data Set Control Block (DSCB)
- Updated ARCMELGP Parameter List
- ARCZLOC Parameter List
- Return Codes:
 - 0 - Data set is eligible for migration
 - 2 - Error in LOCATE other than “Catalog Entry Not Found”
 - Reason Codes:
 - Return Codes from LOCATE
 - 4 - Error detected in call to ARCFVBC
 - Reason Codes:
 - 4 - The Format 1 DSCB passed to ARCMELIG does not represent a base data object
 - 8 - No more attempts to migrate VSAM data sets from the current volume should be tried
 - 8 - Data set failed age checks. Do no further checking (possibly an unexpired Expiration-Date-Protected GDG data set, or the data set is a Password-protected GDG)
 - 12 - Data set is a Utility data set
 - Reason Codes:
 - 0 - Data set is two days old or older
 - 2 - Data set is less than two days old

- 16 - Data set is a List data set

Reason Codes:

- 0 - Data set is old enough to scratch
- 2 - Data set is too young to scratch

Flags set for Return Code 12 or Return Code 16:

- ELGLUUCT - Set ON if Utility or List data set is uncataloged
 - ELGLUERR - Set ON if error in LOCATE of Utility or List data set
 - ELGLUWRG - Set ON if Utility or List data set is cataloged on a different device or volume than the volume being space-managed
- 20 - Discrepancies in catalog entry
 - Catalog entry for the data set lists a different VOLSER than the VOLSER of the volume being space-managed
 - Catalog entry for the data set lists a different device type than the device type of the volume being space-managed
 - Virtual bit in the catalog entry (in UCB device type) is different than the virtual bit (in UCB device type) of the volume that is migrating
 - Data set is multi-volume

- 24 - ARCSAEXT user exit returned a non-zero Return Code

Reason Codes:

- (Non-zero Return Codes from ARCSAINT)
 - 4 - Do not process this data set
 - 8 - The exit deleted the data set
 - 16 - ABEND in the exit
- 27 - Data set has no extents
 - 30 - Data set is uncataloged
 - 45 - Data set is a system data set, an OS CVOL or part of a Retain-level entry with restricted migration

Reason Codes:

- 1 - Data set is a System data set, an OS CVOL, an ICF catalog, or VSAM catalog
 - 2 - Data set is part of a Retain level entry with restricted migration
- 99 - The data set is of a type that DFHSM cannot migrate

Reason Codes:

- 2 - Data set is VSAM and not cataloged with ICF
- 4 - Data set organization is other than Physical Sequential, Partitioned, Direct Access, or VSAM
- 6 - Data set has a block size greater than the track size, or the data set is not allocated with the TRACKOVERFLOW option
- 8 - Data set is unmovable
- 10 - Data set has an extent for user labels

- 12 - Data set is allocated with the split-cylinder option
- 14 - Data set name is in the APF list of authorized program libraries
- 16 - GDG is password protected
- 20 - ICF VSAM data set has the erase option
- 36 - The data set name is invalid.

Diagram 4.8: ARCMDSUX - Establish Addressability

Input

- ARCMDSXP Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCMDSUX	ARCMDSUX
ARCPDA	ARCPDA

2. **Upon being attached, establish addressability:** Addressability is established for MTCB, MDQE, MVT, and RCB. The parameter list is checked for validity. If an error is found, ARCERP is called to log an error, and control is returned to the caller.

Module	Label
ARCMDSUX	ARCMDSUX VALIDATE
ARCERP	ARCERP

3. **Establish ESTAE environment:** ARCZEST is called to establish an ESTAE environment. If there is failure establishing the ESTAE, ARCWTL is called to issue message ARC0535I, ARCMDSUX's Return Code is set to 60, migration is held, and control is returned to the caller.

Module	Label
ARCMDSUX	ARCMDSUX ERRMSG
ARCWTO	ARCWTL
ARCZEST	ARCZEST

4. **Call ARCADEXT or ARCMDEXT:** ARCMVOL's task RCB is set up to handle an abnormal end in the user exit. If DBA or DBU is in progress, ARCADEXT is called, otherwise ARCMDEXT is called.

Module	Label
ARCMDSUX	ARCMDSUX ADEXT MDEXT
ARCADEXT	ARCADEXT
ARCMDEXT	ARCMDEXT

5. **Process the exit Return Code:** ARCADEXT's Return Code: If a non-zero Return Code was set by the user exit, update the ARCMDSXP parameter list to indicate DFHSM should not scratch the data set (MDSXRC = 8).

ARCMDEXT's Return Code: If an invalid Return Code was set by the exit (not 0, 4, 8, 12, 16, 20, 24, 28, or 32), update the ARCMDSXP parameter list to indicate DFHSM should not migrate the data set (MDSXRC = 8).

If the user exit indicated the data set should not be migrated (Return Code 8), update the ARCMDSXP parameter list to indicate DFHSM should not migrate the data set (MDSXRC = 8).

If a valid non-zero Return Code other than 8 was returned by the user exit, perform the following:

- If the Return Code was 4, 16, 24, or 32, the exit indicated the data set should not be compacted. Update the MDQE to reflect this.
- If the Return Code was 20, 24, 28, or 32, the exit indicated the data set should be directed to tape, independent of the environment established by the SETSYS TAPEMIGRATION command. Update the MDQE to reflect this. Note that these Return Codes are ignored if the data set is being processed for just extent reduction or if it is being processed as a result of a volume conversion.
- If the Return Code was 12, 16, 28, or 32, the exit indicated the check to determine if a data set needs backup does not need to be performed. Update the ARCMDSXP parameter list to reflect this.
- Indicate in the ARCMDSXP parameter list that further processing can be performed for the data set (MDSXRC=0).

Module	Label
ARCMDSUX	ARCMDSUX ADEXT MDEXT

6. **Cancel ESTAE environment:** ARCZEST is called to cancel the ESTAE environment.

Module	Label
ARCMDSUX	ARCMDSUX
ARCZEST	ARCZEST

7. **ABEND in user exit:** If an abnormal end occurred in a user exit, ARCWTL is called to issue message ARC0004I, ARCAMSG is called to issue message ARC0734I with Return Code 54, ARCWTL is called to issue message ARC0535I, ARCMDSUX's Return Code is set to 16, and migration is held.

Module	Label
ARCMDSUX	ARCMDSUX ERRMSG HEXCNT
ARCWTO	ARCWTL
ARCAMSG	ARCAMSG

Output

- The Return Code in MDSXP is updated to indicate whether or not the data set should be space managed
- Return Codes:
 - 0 - No error occurred

If ARCMDEXT was called and the exit indicated the data set should not be compacted, the MDQE is updated to reflect this

If ARCMDEXT was called and the exit indicated the data set should be migrated to tape, the MDQE is updated to reflect this

If the exit indicated DFHSM does not need to check if a data set that is going to tape is in need of backup, MDSXNCKB is set on

- 8 - Do not space manage the data set
- 16 - User exit abnormal end of task
- 60 - Error establishing ESTAE environment.

SMS Level 0 Volume Space Management Processing

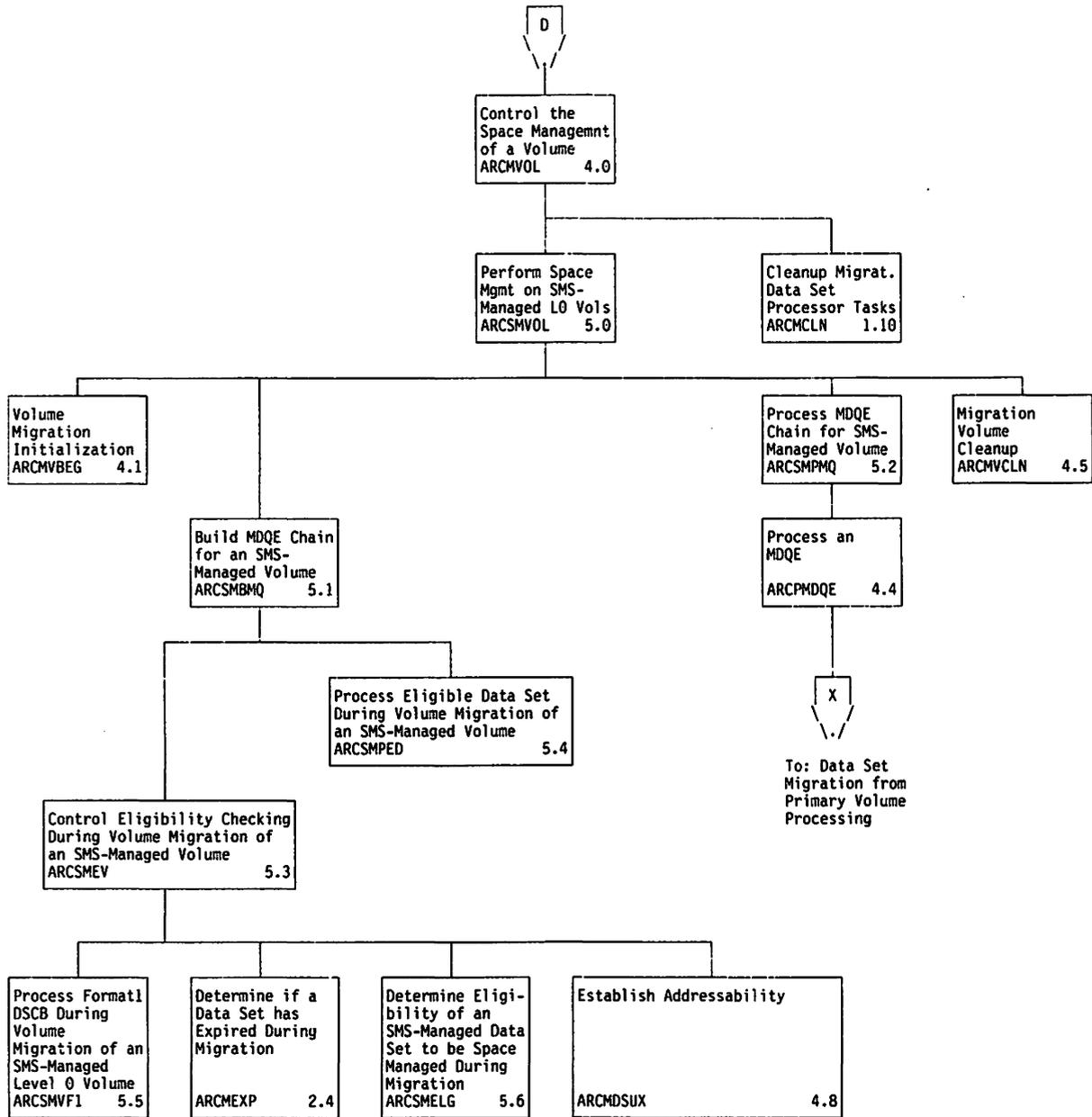


Figure 7. Visual Table of Contents for SMS Level 0 Volume Space Management Processing

Diagram 5.0: ARCSMVOL - Perform Space Management on SMS-Managed Level 0 Volumes

Input

- Index for Migration Task Control Block (MTCB).

Processing

ARCSMVOL controls the processing of the space management functions for SMS-managed Level 0 volumes.

Output

- None.

Diagram 5.1: ARCSMBMQ - Build MDQE Chain for SMS-Managed Volume

Input

- Index for Migration Task Control Block (MTCB).

Processing

ARCSMBMQ controls the scanning of the extract list for an SMS-managed volume to create MDQEs.

Output

- None.

Diagram 5.2: ARCSMPMQ - Process MDQE Chain for an SMS-Managed Volume

Input

- Index for Migration Task Control Block (MTCB).

Processing

ARCSMPMQ controls the processing of the MDQE chain during volume migration of an SMS-managed volume.

Output

- None.

Diagram 5.3: ARCSMEV - Control Eligibility Checking During Volume Migration of an SMS-Managed Volume

Input

- ARCSMEVP Parameter List.

Inout

- ARCSMEVP Parameter List.

Processing

ARCSMEV controls the eligibility checking that is performed for each data set during the volume migration of an SMS-managed volume.

Output

- Updated ARCSMEVP Parameter List
- Return Codes.

Diagram 5.4: ARCSMPED - Process an Eligible Data Set During Volume Migration of an SMS-Managed Volume

Input

- ARCSMEVP Parameter List.

Inout

- ARCSMEVP Parameter List.

Processing

ARCSMPED is invoked during the volume migration of an SMS-managed volume. ARCSMPED controls the processing of a data set that has been indicated as being eligible for DFHSM to space manage.

Output

- Updated ARCSMEVP Parameter List.

Diagram 5.5: ARCSMVF1 - Process Format 1 DSCB during Volume Migration of an SMS-Managed Level 0 Volume

Input	<ul style="list-style-type: none">• ARCSMEVP Parameter List.
Inout	<ul style="list-style-type: none">• ARCSMEVP Parameter List.
Processing	ARCSMVF1 is invoked during volume migration of an SMS-managed volume. ARCSMVF1 controls the processing related to the checking of the Format 1 DSCB information to determine if a data set is supported by DFHSM.
Output	<ul style="list-style-type: none">• Return Codes.

Diagram 5.6: ARCSMELG - Determine Eligibility of an SMS-Managed Data Set to Be Space Managed During Migration

Input	<ul style="list-style-type: none">• ARCSMEVP Parameter List.
Inout	<ul style="list-style-type: none">• ARCSMEVP Parameter List.
Processing	ARCSMELG determines if a data set is eligible to be processed during the volume migration of an SMS-managed volume.
Output	<ul style="list-style-type: none">• Updated ARCSMEVP Parameter List• Return Codes.

Migration Volume Space Management Processing

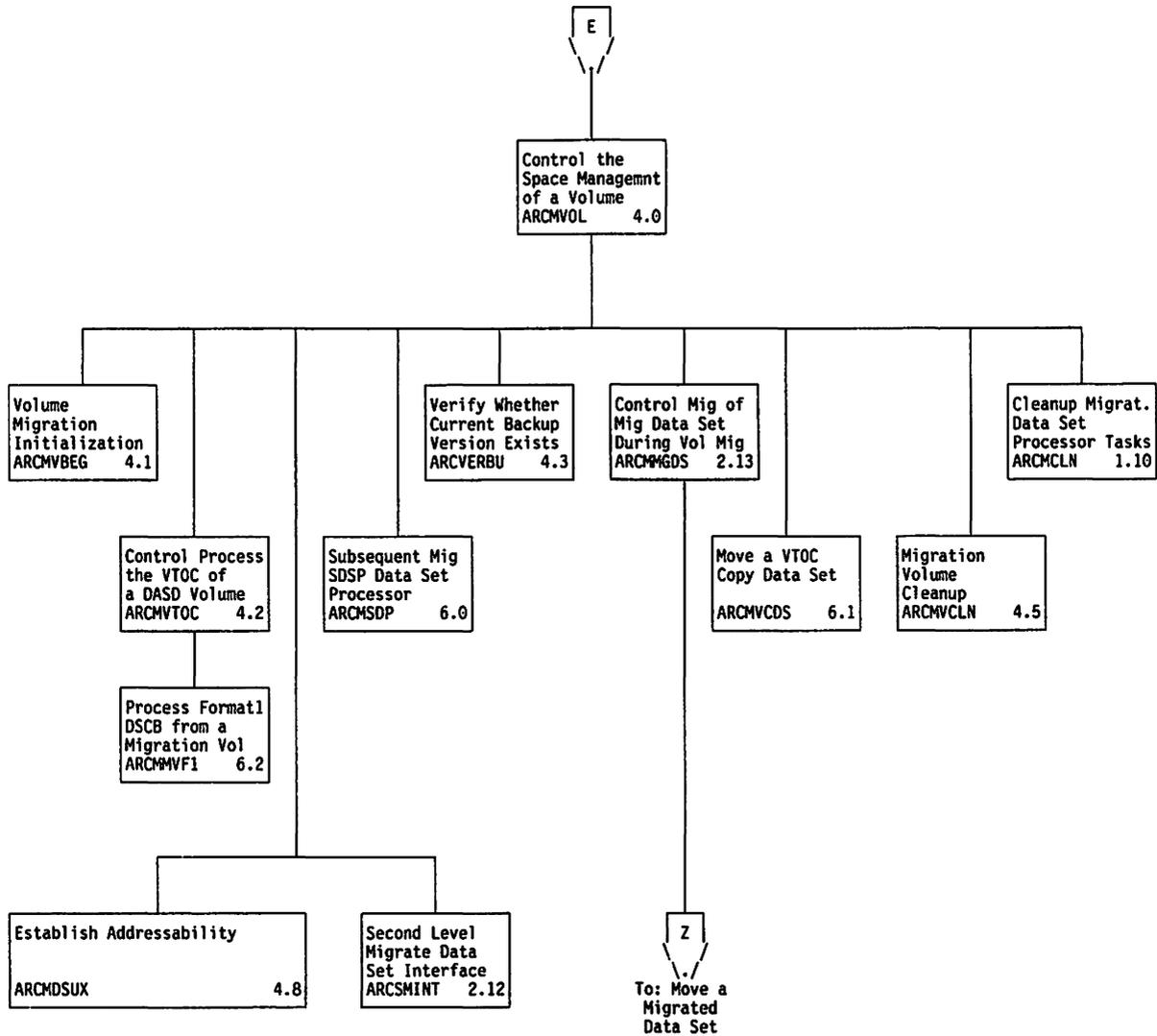


Figure 8. Visual Table of Contents for Migration Volume Space Management Processing

Diagram 6.0: ARCMVSDP - Subsequent Migration SDSP Data Set Processor

Input

- ARCMVL1P Parameter List.

Inout

- ARCMVL1P Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCMVSDP	ARCMVSDP
ARCPDA	ARCPDA

2. **Initialize local variables, verify input parameters, establish addressability:** Control is passed to ARCMVSDP to read the small data set packing (SDSP) data set on a volume, build migration data set queue elements (MDQEs) for the user data sets stored in the SDSP, and chain these MDQEs to the end of the MDQE chain. Verify input parameters, call ARCERP for invalid parameters. Initialize local variables. Establish addressability to control blocks.

Module	Label
ARCMVSDP	ARCMVSDP PARM_CHK
ARCERP	ARCERP

3. **Allocate the SDSP:** Call ARCALSDP to allocate the small data set packing data set. When control returns to ARCMVSDP, check Return Code from ARCALSDP. If Return Code is 24, an error message was already issued by ARCALSDP, skip to step 6. If Return Code is non-zero and not 24, call ARCWTM to issue message ARC0541I to migration log, skip to step 6.

Module	Label
ARCMVSDP	ARCMVSDP ALLOCSDP MSG541
ARCALSDP	ARCALSDP
ARCWTM	ARCWTM

4. **Open SDSP and prepare for read:** Call ARCOSDP to open the SDSP. If open fails, skip to step 6. Utilize virtual storage access method (VSAM) macros to build a request parameter list (RPL) for reading the SDSP. If VSAM macro fails to get RPL, call ARCERP for VSAM macro error, call ARCWTM to issue message ARC0541I to migration log, and skip to step 6.

Module	Label
ARCMVSDP	ARCMVSDP OPENSdp BLD_RPL MSG541 READSDSP

ARCERP	ARCERP
ARCOSDP	ARCOSDP
ARCWTO	ARCWTL

5. **Build MDQEs for the user data sets stored in the SDSP:** For each user data set in the SDSP, do the following until end-of-file is reached or an error occurs:

- Read the key for the data set in the SDSP
 If the VSAM macro fails during read:
 - Call ARCERP for VSAM macro error,
 - Call ARCWTL to issue message ARC0541I to migration log
 - Skip to step 6.
- Build an MDQE for each SMS-managed data set without verifying the age criterion or for each non-SMS-managed data set that meets the age requirements and call ARCZQBLD to add the MDQE to the MDQE chain.
 If ARCZQBLD returns a non-zero Return Code:
 - Skip to step 6.
 - Increment total data set counter.
 - Build key for next data set in the SDSP.

Module	Label
ARCMSDP	ARCMSDP MDQBLD RCD_CHK CALCDAYS MSG541 READSDSP
ARCERP	ARCERP
ARCWTO	ARCWTL
ARCZQBLD	ARCZQBLD

6. **Finish processing SDSP, return to caller:** Call ARCZRLSE to release the request parameter list (RPL) if one is held. Call ARCCSDP to close the SDSP data set if opened. Call ARCFRSDP to deallocate the SDSP if allocated. Return to the caller.

Module	Label
ARCMSDP	ARCMSDP QUITSDSP ZRLSE
ARCERP	ARCERP
ARCOSDP	ARCCSDP
ARCFRSDP	ARCFRSDP
ARCZRLSE	ARCZRLSE

Output

- MDQEs are added to the MDQE chain for the user data sets located in the SDSP
- The data set count field in ARCMVL1P will be incremented.

Diagram 6.1: ARCMVCDS - Move a VTOC Copy Data Set

Input

- ARCMVCDP Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCMVCDS	ARCMVCDS
ARCPDA	ARCPDA

2. **Validate input parameters:** If the parameters or the passed data set name (DSN) are invalid, call ARCERP to log the error and return to the caller.

Module	Label
ARCMVCDS	ARCMVCDS CHKINPUT PARSE_DSN
ARCERP	ARCERP

3. **Allocate and open the data set to be moved:** Call ARCZVCUT to allocate and open the volume table of contents (VTOC) copy data set to be moved, requesting that ARC0704I not be issued. If no error occurs, call ARCZCAT to uncatalog the data set to be moved. (the data set is now uncataloged, ARCZVCUT can now allocate the new data set on another ML1 volume.) If an error occurs, return to the caller. Otherwise, call ARCZCAT to catalog the VTOC copy data set.

Module	Label
ARCMVCDS	ARCMVCDS OPENOLD
ARCZCAT	ARCZCAT
ARCZVCUT	ARCZVCUT

4. **Allocate and open a new data set on another ML1 volume:** Call ARCZVCUT to allocate and open the new VTOC copy data set. If an error occurs, proceed to the cleanup steps. If no errors occurred, then put the new volume table of contents (VTOC) copy data set name in the recovery control block (RCB).

Module	Label
ARCMVCDS	ARCMVCDS OPENNEW
ARCZVCUT	ARCZVCUT

5. **Copy the old data set into the new one:** Call ARCZVCRW to read entries from the old VTOC copy data set. Call ARCZVCRW to write the entry for the new data set. If an I/O error occurred reading from the input data set or writing to the output data set, proceed to the cleanup steps and end processing.

Module	Label
ARCMVCDS	ARCMVCDS COPYDS
ARCZVCRWE	ARCZVCRWE

6. **Close and deallocate the new data set:** If the new data set was opened, call ARCZVCUT to deallocate and close the new VTOC copy data set. If an error occurs, call ARCERP to identify this error.

Module	Label
ARCMVCDS	ARCMVCDS CLOSENEW
ARCERP	ARCERP
ARCZVCUT	ARCZVCUT

7. **Close and deallocate the old data set:** If the old data set was opened, call ARCZVCUT to deallocate and close the old VTOC copy data set. If an error occurs, call ARCERP to identify this error.

Module	Label
ARCMVCDS	ARCMVCDS CLOSEOLD
ARCERP	ARCERP
ARCZVCUT	ARCZVCUT

8. **Update the associated dump generation record (DGN) or eligible volume record (MCP):** If moving a dump VTOC copy data set, call ARCZREAD to read the associated DGN record for update. If moving a backup VTOC copy data set, call ARCZREAD to read the associated MCP record for update. If the read fails, set a non-zero Return Code. Otherwise, call ARCZUPDT to update the record with the new volume serial number and device type fields corresponding to the new volume the data set is on. If the update fails, call ARCZSCR to scratch the new VTOC copy data set from the target volume. When the new VTOC copy data set is scratched from the target volume, ARCZCAT is called to recatalog the old VTOC copy data set.

Module	Label
ARCMVCDS	ARCMVCDS UPDATREC UPDATE_DUMP UPDATE_BACKUP SCRATCH_OLD RELEASE_RPL
ARCZCAT	ARCZCAT
ARCZREAD	ARCZREAD
ARCZSCR	ARCZSCR
ARCZRLSE	ARCZRLSE
ARCZUPDT	ARCZUPDT

9. **Scratch the old data set:** Call ARCZSCR to scratch the old VTOC copy data set from the source volume.

Module	Label
ARCMVCDS	ARCMVCDS SCRATCH_OLD
ARCZSCR	ARCZSCR

10. **Clean up the data set:** If an ending error occurred after the new data set was allocated, call ARCZSCR to scratch the new VTOC copy data set from the target volume. After scratching the new VTOC copy data set, ARCZCAT is called to uncatalog it. Remove the VTOC copy data set name from the RCB. Update the free space on the target volume by calling ARCUMCI. Return to the caller.

Module	Label
ARCMVCDS	ARCMVCDS SCRATCH_NEW UPDATE_NEW_SPACE RELEASE_RPL
ARCMSMV	ARCUMCI
ARCZCAT	ARCZCAT
ARCZSCR	ARCZSCR

Output

- Return Codes:
 - 00 - Move of VTOC copy data set was successful
 - 04 - Error allocating or opening the VTOC copy data set
 - 08 - Error allocating or opening the new VTOC copy
 - 12 - I/O error reading the old VTOC copy data set
 - 16 - I/O error writing to the new VTOC copy data set
 - 20 - Error closing or deallocating the new VTOC copy data set
 - 22 - Error closing or deallocating the old VTOC copy data set
 - 24 - DGN or MCP record not found
 - 28 - Error reading the associated DGN or MCP record for update
 - 32 - Error updating the associated DGN or MCP record for update.

Diagram 6.2: ARCMVF1 - Process a Format 1 DSCB from a Migration Volume

Input

- ARCMVLIP Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCMVF1	ARCMVF1
ARCPDA	ARCPDA

2. **Establish addressability and validate the parameter list:** Addressability is established for Format 1 DSCB, migration task control block (MTCB), and management work element (MWE). The parameter list is checked for validity. If an error is found, ARCERP is called to log the error, and ARCMVF1 returns control to the caller.

Module	Label
ARCMVF1	ARCMVF1 VALIDATE
ARCERP	ARCERP

3. **Process the Format 1 DSCB:** Determine the starting position of the second level qualifier (if it has one) of the data set name.

If the second qualifier of the data set name is HMIG, increment the total data set count and build an MDQE for it, it is a migrated data set.

If the second qualifier of the data set name is DUMPVTOC, increment the total data set count and if a FREEVOL age zero is in progress, build an MDQE for it. It is a DUMP VTOC backup copy and must be moved to another level 1 volume.

If the second qualifier of the data set name is VTOC, increment the total data set count and if a FREEVOL age zero is in progress, build an MDQE for it. It is a BACKUP VTOC backup copy and must be moved to another level 1 volume.

If the data set is SYS1.VVDS or the VTOC index data set, ignore it, and return to the caller.

If none of the above conditions are true, increment the total data set count and call ARCZLOC to do a locate on the data set. If the locate indicates that the data set is cataloged on volume MIGRAT, it is an HSM pre-release 3 migrated data set, build an MDQE for it.

Ignore any other kind of data set, it is a user data set, return to caller.

Module	Label
ARCMVF1	ARCMVF1 LOC MDQBLD
ARCZLOC	ARCZLOC

4. **Build MDQE for eligible data set:** Addressability is established for the local copy of the MDQE, and it is initialized to binary zero.

Store the Format 1 DSCB in the local copy of the MDQE and turn on the flag to indicate that the data set is being processed as the result of a volume process.

Call ARCDSSZ to get the size, in tracks, of the data set for the MDQE. This information will be put in the local copy of the MDQE.

If there is no error in the size calculation of the data set, call ARCZQBLD to chain the queue element to the end of the chain of queue elements.

Module	Label
ARCMMVF1	ARCMMVF1
	MDQBLD
ARCCLUSZ	ARCDSSZ
ARCZQBLD	ARCZQBLD

Output

- None.

Data Set Migration from Primary Volume Processing

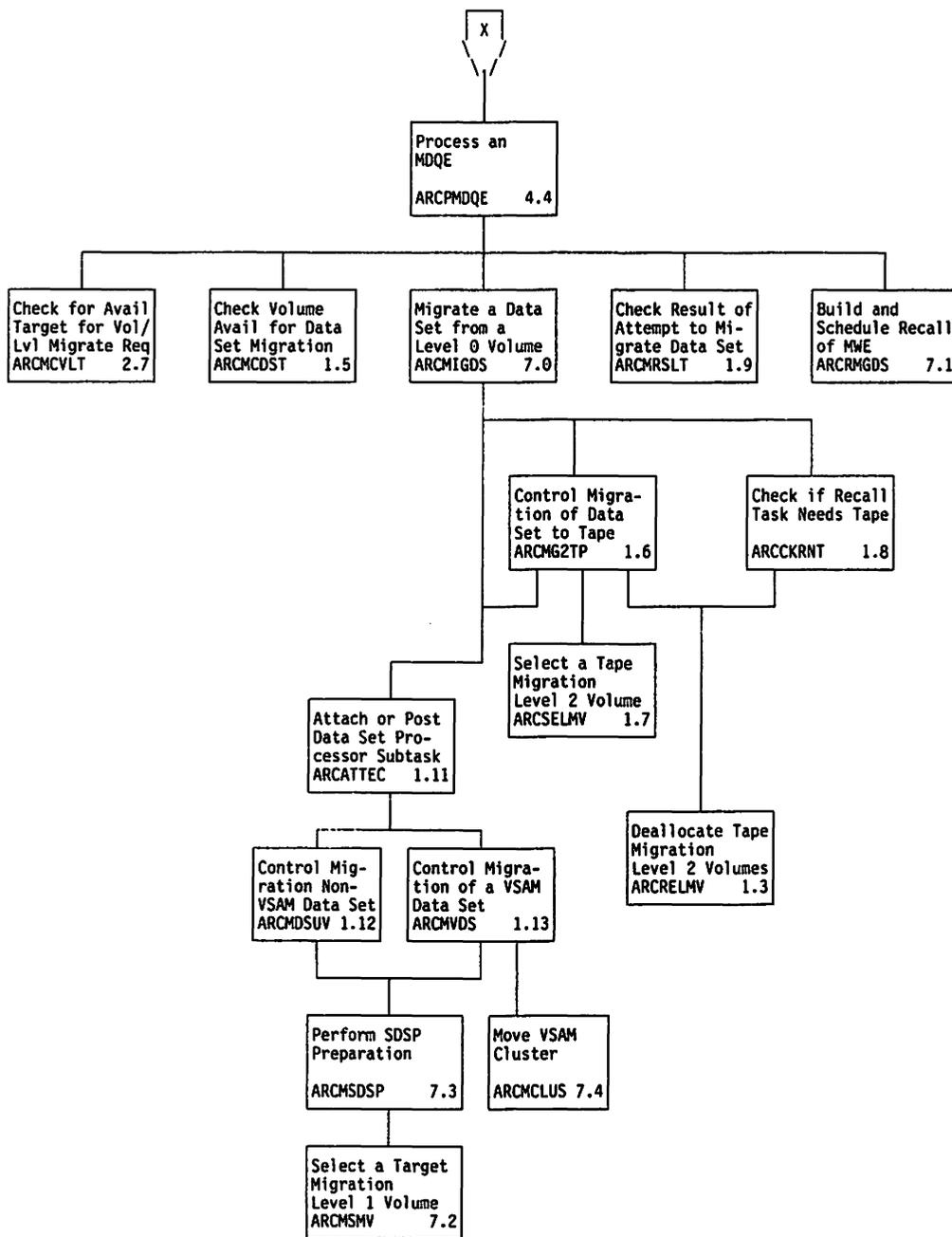


Figure 9. Visual Table of Contents for Data Set Migration from Primary Volume Processing

Diagram 7.0: ARCMIGDS - Migrate a Data Set from a Level 0 Volume

Input

- ARCMIGDP Parameter List.

Inout

- ARCMIGDP Parameter List.

Processing

ARCMIGDS controls the command migration of a data set from a Level 0 volume.

Output

- Updated ARCMIGDP Parameter List.

Diagram 7.1: ARCRMGDS - Build and Schedule Recall of MWE

Input

- Pointer to the Migratable Data Set Queue Element (MDQE)
- Pointer to the Mounted Volume Table (MVT) Entry for the Migration Source Volume.

Processing

ARCRMGDS builds and schedules a Management Work Element (MWE) to have an SMS data set recalled.

Note: The MDQE must have indicated extent reduction or conversion.

Output

- Return Codes.

Diagram 7.2: ARCMSMV - Select a Target Migration Level 1 Volume

Input

- Input Parameters
- Migration Level 1 Free Space Record (MCI)
- Mounted Volume Table (MVT).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance to this module.

Module	Label
ARCMSMV	ARCMSMV
ARCPDA	ARCPDA

2. **Validate parameter list:** Validate parameter list and set pointer to hardcopy log. Call ARCERP if invalid parameter encountered.

Module	Label
ARCMSMV	ARCMSMV
ARCERP	ARCERP

3. **Update MVT free space information from the MCI:** If in a multiple-host processor environment and the caller wants to update all the MVT free space information, call ARCZREAD to read all MCI records. All corresponding MVTs are updated with free space information. If the RPL used to update the MCI record cannot be saved in the RCB, call ARCWTl to issue message ARC0901I to the command activity log.

Module	Label
ARCMSMV	ARCMSMV
	BLDREADP
	ENDUMVT
ARCWTO	ARCWTl
ARCZREAD	ARCZREAD

4. **Select the target migration level 1 volume:** If the caller requests a target volume containing a small-data-set-packing (SDSP) data set, the first assigned migration level 1 volume that contains an SDSP is selected. If the caller does not want an SDSP, the assigned migration level 1 volume with the most free space is selected from the MVT chain and is returned to the caller. If a volume with an SDSP is requested but not found, the ML1 volume with the most free space is selected. If a volume with an SDSP is requested, but none of the volumes containing an SDSP could be selected, fail the request (SDSP serialization checking is only done when the method of SDSP serialization allowing multiple recall tasks to concurrently access the same SDSP is in effect). With that method of SDSP serialization checking, the VSA control block is used to determine if this host is using the SDSP. If this host is not using the SDSP, ARCZREAD is called to read the MCV to check if any other hosts are using the SDSP.

Module	Label
ARCMSMV	ARCMSMV CHKINUSE BLDREADP
ARCZREAD	ARCZREAD

5. **Entry point ARCUMC1:** Call ARCPDA to create a trace entry for this entry to the module.

Module	Label
ARCMSMV	ARCUMC1
ARCPDA	ARCPDA

6. **Update the MVT free space information and the MC1 entry for the volume:** Initialize local variables and set pointer to hardcopy log. Translate the number of 2K blocks into the number of tracks. If in a multiple-host processor environment, ARCZREAD is called to read the MC1 and ARCZUPDT is called to update the free space information in the volume entry for the volume. If the MC1 is not found, ARCMSMV calls ARCCUMC1 to create the record and then update the free space for the volume. If unable to save pointer to request parameter list (RPL) in the caller's RCB, call ARCWTl to write message ARC0901I to the migration activity log to warn of too many outstanding RPLs. Call ARCRLSE to release the request parameter list (RPL).

Module	Label
ARCMSMV	ARCUMC1 SETLOG CONVERT FNDFRP BLDREADP MSG901 ENDUMC1
ARCCUMC1	ARCCUMC1
ARCWTO	ARCWTl
ARCZREAD	ARCZREAD
ARCZRLSE	ARCZRLSE
ARCZUPDT	ARCZUPDT

Output

- Read Parameter List
- Mounted Volume Table (MVT)
- Write Parameter List.

Diagram 7.3: ARCMSDSP - Perform SDSP Preparation

Input

- ARCMSDPP Parameter List.

Processing

ARCMSDSP determines if a data set is eligible for compaction and migration to SDSP and prepares the target volume for this function to take place.

Output

- Return Codes.

Diagram 7.4: ARCMCLUS - Move VSAM Cluster

Input

- MCLUP Parameter List
- MDSSP Parameter List.

Processing

ARCMCLUS is a service module for migration and backup of VSAM clusters.

Output

- MDSSP Parameter List
- Return Codes.

Move a Migrated Data Set Processing

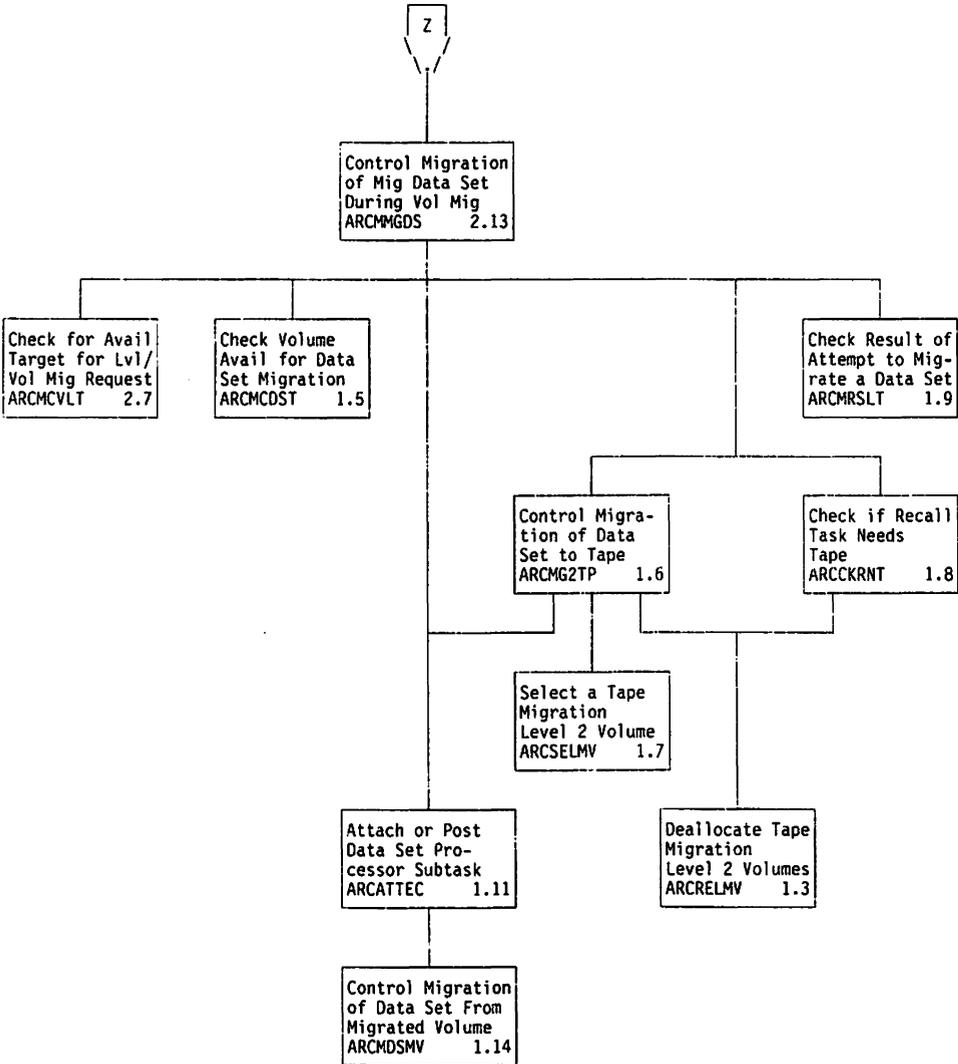


Figure 10. Visual Table of Contents for Move a Migrated Data Set Processing

Recall and Delete Processing

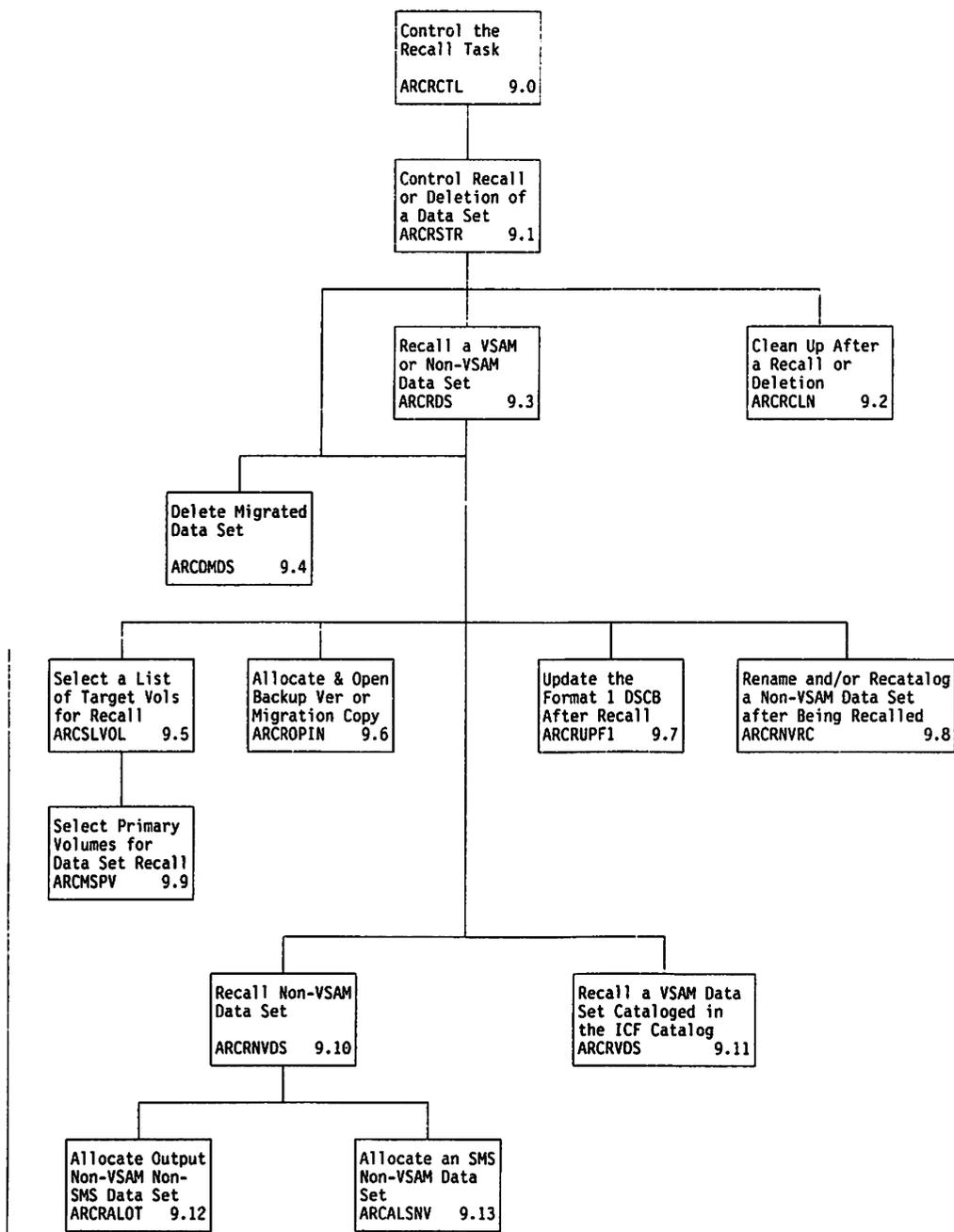


Figure 11. Visual Table of Contents for Recall and Delete Processing

Diagram 9.0: ARCRCTL - Control the Recall Task

Input

- Management Communication Vector Table (MCVT)
- Recall Task Control Blocks (RTCBs)
- Management Work Elements (MWEs).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCRCTL	ARCRCTL
ARCPDA	ARCPDA

2. **Build recall task control blocks:** The ARCRCTL main task attaches ARCRCTL to process recall requests. Any abnormal end conditions are handled with an ESTAI exit to ARCESTAI. ARCGMAIN is called to get storage for RTCB and event control blocks (ECBs) and if running in a JES3 environment, storage for volume lists to keep JES3 statistics. If the GETMAIN fails, ARCERP is called to shut DFHSM down. If the GETMAIN succeeds, ARCRCTL initializes RTCBs and ECB addresses and if running in a JES3 environment, the pointers to volume arrays are set and the volume arrays are cleared. ARCRCTL then waits to be posted, indicating a request for work to do of one of the types described in the following steps. It waits for three types of ECBs. These are:

- Work-to-do ECB that ARCRCTL or ARCPRQ is to post.
- Two minute timer ECB that the STIMER exit routine of ARCRCTL posts to recheck recall MWEs waiting for resources.
- Fifteen recall ECBs that ARCRSTR sets to indicate that a recall is complete.

Module	Label
ARCRCTL	ARCRCTL
ARCERP	ARCERP
ARCGMAIN	ARCGMAIN

3. **Process shutdown request:** When any ECB is posted to end the waiting of ARCRCTL and shutdown has been requested, processing is allowed to complete for each busy recall subtask. After completion, clean up activity occurs as described in the step 5. ARCRCTL then returns to ARCRCTL after all of its subtasks have ended.

Module	Label
ARCRCTL	ARCRCTL SHUTDOWN TASKTERM

4. **Shutdown not requested:** When the work-to-do ECB is posted to ARCRCTL and shutdown has not been requested, ARCRCTL scans all of its subtasks to see if any of them are waiting. If any subtask is waiting, it has just completed a tape recall and is waiting a short period of time to see if any more tape recalls are posted on the recall queue for the same tape. If ARCRCTL finds a waiting subtask and finds a tape recall from the volume that is still allocated to the

subtask, ARCRCTL posts the subtask to wake up and process the new MWE without deallocating the tape. This action is performed even if tape recall or TSO tape recall is held, but not performed when recall is held.

Module	Label
ARCRCTL	ARCRCTL TAPESCAN

5. **End completed recall subtasks:** When a recall subtask has finished processing a request, the DETACH macro is issued to end the subtask. MWEs that are waiting for resources are eligible for retry based on their circumstances.

- Data set in use by this processing unit – 30 retries are allowed
- Data set in use by another processing unit – 3 retries are allowed
- Tape volume in use by another task – 15 retries are allowed
- Another recall active from an small-data-set-packing (SDSP) data set – unlimited retries.

A tape recall subtask checks the MCDS volume record (MCV) to see if the needed tape volume is in use. If it is, the subtask returns, the MWE is time-stamped, and becomes eligible for retry for up to 15 times. If 15 retries have been made, a write to operator with reply message ARC0380A is sent to the operator by calling ARCWTOR asking whether or not the tape volume is really not available. The operator can decide to tell DFHSM to issue the mount request, continue waiting, or cancel the recall.

If a deallocation error occurred in the subtask (Return Code 67), the MWE Return Codes and Reason Codes are cleared, the subtask is disabled, message ARC0367I is issued, and the MWE is retried in another task. For completed MWEs that are not eligible to be retried, the MWE is purged in following way. The recall queue is serialized by calling ARCLOCK (qname='ARCPGA' rname='RMDSQ') and the MWE is dequeued by ARCDEQ and ARCUNLK is called to release the queue. Function statistics record (FSR) data is updated and processed by calling ARCDFSR. The completed MWE is purged by calling ARCPMWE. If running in a JES3 environment, the JES3 volume activity count record (VAC) is updated from the volume list by calling ARVCUPD.

Module	Label
ARCRCTL	ARCRCTL TASKTERM DEALLOC MWEPURGE
ARCCFSR	ARCDFSR
ARCENQ	ARCDEQ
ARCESTAI	ARCESTAI
ARCLOCK	ARCLOCK ARCUNLK
ARCPMWE	ARCPMWE
ARVCUPD	ARVCUPD
ARCWTO	ARCWTL ARCWTOR

6. **Scan the MWE queue until an eligible MWE is found:** ARCRCTL checks an MWE which is not waiting for an active recall from an SDSP to complete and it is not being processed; then ARCRCTL considers it to have found an eligible

MWE. Even if an MWE is waiting for an active recall from an SDSP to complete, but there is no SDSP recall now and the MWE has been waiting for 1.8 minutes or longer, ARCRCTL considers it found an eligible MWE. If ARCRCTL has found an eligible MWE during the recall queue scan, it starts new recall tasks.

Module	Label
ARCRCTL	ARCRCTL STARTRCL

7. **Start new recall subtasks to process queued requests:** If any subtasks are not busy and any work requests are on the recall queue, the recall queue is examined to select a recall request to be processed.

Module	Label
ARCRCTL	ARCRCTL

8. **If TSO tape recall is held, TSO WAIT type recall requests are changed to NOWAIT type requests:** When scanning MWEs, ARCRCTL checks if TSO tape recall is held and if the MWE is TSO WAIT type recall request. If so, ARCGMAIN is called to obtain storage to create a new MWE that is a copy of the one just selected, and change it to a NOWAIT request. The new MWE is added to the recall queue by calling ARCPRQ for later processing and old WAIT type MWE is failed. If this happens, message ARC0389I is issued to the system operator. If the MWE is a non-TSO WAIT type request and the appropriate recall category is held (all recall or tape recall), the MWE is failed.

Module	Label
ARCRCTL	ARCRCTL MWEPURGE
ARCGMAIN	ARCGMAIN
ARCPRQ	ARCPRQ
ARCWTO	ARCWTO

9. **User exit abnormal ends check:** During the MWE scan for possible start of a new recall task, ARCRCTL checks for recall which the user exit is to be taken. If the target volume serial number is not specified and there was a prior error in the recall user exit routine, then the MWE is failed. If the FSR is not built, ARCCFSR is called to build an FSR. The recall queue is serialized by calling ARCLOCK (qname='ARCPGA ' rname='RMDSQ ') and the MWE is dequeued by ARCDEQ and ARCUNLK is called to release the queue. The MWE Return Code is set and ARCDFSR is called to process the FSR and the MWE is purged by calling ARCPMWE.

Module	Label
ARCRCTL	ARCRCTL
ARCCFSR	ARCCFSR ARCDFSR
ARCENQ	ARCDEQ
ARCLOCK	ARCLOCK ARCUNLK
ARCPMWE	ARCPMWE

10. **Found a candidate MWE and start new recall task:** When ARCRCTL finds an MWE which is a candidate for a new recall task, check the MWE if the recall request is from tape. If the MWE is for a tape recall, then try to start a tape

subtask; otherwise, it starts one of DASD recall, DASD delete, or tape delete subtask.

Module	Label
ARCRCTL	ARCRCTL TAPEMWE START

11. **Start tape recall subtask:** ARCRCTL checks the volume serial number of tape recall MWE against any active tape subtasks. If a subtask is waiting and the MWE being examined is a single volume tape recall from the subtask's last volume, ARCRCTL posts the subtask's WAIT ECB. If the task is not waiting and the first or last volume serial number of any currently active tape recall is the same as the first or last volume serial number of the MWE on the queue, skip the MWE because its resources are already being used. If the skipped MWE is a single volume tape recall from the last volume serial number of a currently active tape recall, ARCRSTR will find the MWE on the queue after it completes the MWE it is processing.

Module	Label
ARCRCTL	ARCRCTL START

12. **Start recall or delete subtask:** When an eligible MWE is found and the recall is not from currently active tape subtasks, prepare to start another subtask. Check to see if the recall is from an SDSP and the old method of SDSP serialization is being used. The detail of the SDSP serialization is explained in the next step. ARCCFSR creates an FSR for the MWE and the RTCB is assigned to the MWE. A recovery control block (RCB) is also built for the request (or reinitialized if one already exists) by calling ARCCRCB or ARCIRCB. A recall subtask (ARCRSTR) is then attached to process the request. The process is repeated as long as recall requests are on the queue and the maximum number of recall tasks have not been started. The maximum number of tape recall tasks that can be started is determined by a separate value established with the SETSYS command.

Module	Label
ARCRCTL	ARCRCTL
ARCCFSR	ARCCFSR
ARCCRCB	ARCCRCB
	ARCIRCB
ARCRSTR	ARCRSTR

13. **Serialization of SDSP:** Small-data-set-packing (SDSP) recalls are retried in one of two ways, depending upon what SDSP serialization method is used.
- SDSP serialization method of allowing multiple recall tasks to concurrently access the same SDSP. An SDSP recall that failed because the SDSP was being used for output is eligible for retry after waiting 30 seconds or more. This is done by setting the time stamp in the MWE for the SDSP recall that failed so it appears that the MWE has already been waiting 1.3 minutes.
 - SDSP serialization method of allowing only one SDSP recall per host to be active. If an MWE recall is waiting because a task is already processing a recall from an SDSP data set, no time stamp comparison is made. The waiting request becomes eligible for processing immediately after the active recall from an SDSP is complete.

Module	Label
ARCRCTL	ARCRCTL

Output

- Recall Task Control Blocks (RTCBs)
 - Management Communication Vector Table (MCVT)
 - Management Work Elements (MWEs)
 - Function Statistics Record (FSR)
 - Recovery Control Block (RCB)
 - Return Codes:
 - 26 - Recall failed due to an error in the user exit
 - 52 - GETMAIN error
 - 74 - Wait recall failed due to recall being held
- Reason Codes:
- 16 - Recall was held
 - Recall(TAPE) was held and the migrated copy is on tape
 - 75 - TSO WAIT recall changed to NOWAIT recall
 - 86 - DFHSM was shutdown while a mount message was pending
 - 95 - Operator refused to mount tape.

Diagram 9.1: ARCRSTR - Control Recall or Deletion of a Data Set

Input

- Recall Tasks Control Block (RTCB) for this recall.

Processing

ARCRSTR controls the recall or deletion of a data set. ARCRSTR searches for other recalls from the same tape and processes them without deallocating the tape.

Output

- Return Codes.

Diagram 9.2: ARCRCLN - Clean Up After a Recall or Deletion

Input

- Recall Task Control Block Pointer (RTCBP)
- Bits Requesting Deallocation or No Deallocation (FUNBITS).

Inout

- Modified RTCB, RCB, and RDMP data areas.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCRCLN	ARCRCLN
ARCPDA	ARCPDA

2. **Dequeue the migration control data set (MCDS):** ARCUNLK is called to free the enqueue on the control data set.

Module	Label
ARCRCLN	ARCRCLN
ARCLOCK	ARCUNLK

3. **Dequeue the data set name:** The DEQ macro is issued to free the enqueue of the migrated data set.

Module	Label
ARCRCLN	ARCRCLN

4. **Release the control data set request parameter list (RPL):** If the RPL pointer of the RCB is not zero, ARCZRLSE is called to free the RPL.

Module	Label
ARCRCLN	ARCRCLN
ARCZRLSE	ARCZRLSE

5. **Release the MCDS data set record (MCD) host ID serialization:** ARCCMHWR is called to clear the host ID in the MCD of the migrated data set.

Module	Label
ARCRCLN	ARCRCLN
ARCCMHRD	ARCCMHWR

6. **Free the 16K tape input buffer:** ARCFMAIN is called to free the 16K tape input buffer.

Module	Label
ARCRCLN	ARCRCLN
ARCGMAIN	ARCFMAIN

7. **Close, deallocate and remove the serialization of the tape volumes:** If a 3480 single-file format tape data set is open, ARCTCLOS is called to close it. If the close fails, message ARC0923I is written to the command activity log. If the

caller requests deallocation, ARCRELMV is called to deallocate the tape volumes and to clear the host ID in the MCDS volume records (MCVs).

Module	Label
ARCRCLN	ARCRCLN
ARCTCLOS	ARCTCLOS
ARCWTO	ARCWTL
ARCRELMV	ARCRELMV

8. **Recatalog VSAM component names if necessary:** If the non-VSAM catalog entries for the component names of a VSAM data set need to be recataloged with a volume serial of "MIGRAT" then call ARCZSVCC to perform this function. If ARCZSVCC is successful, ARCWTL will be called to issue message ARC0372I to the command log to indicate completion.

Module	Label
ARCRCLN	ARCRCLN SMS_CLEANUP MSG372
ARCWTO	ARCWTL
ARCZSVCC	ARCZSVCC

9. **Remove the data set name from the SMS allocation queue if necessary:** If the non-VSAM data set name is still on the SMS allocation queue, then call ARCZSAQM to remove it.

Module	Label
ARCRCLN	ARCRCLN SMS_CLEANUP
ARCZSAQM	ARCZSAQM

10. **Free the ACERO storage:** If an ACERO address is still in the RDMP data area, then call ARCFMAIN to free the ACERO storage.

Module	Label
ARCRCLN	ARCRCLN SMS_CLEANUP
ARCGMAIN	ARCFMAIN

Output

- Modified Recall Task Control Block (RTCB)
- Modified Recovery Control Block (RCB)
- Return Codes (RCLRC):
 - 0 - No errors occurred
 - 16 - Call to ARCRELMV failed
- Reason Codes (RCLREAS)
 - Return Codes from ARCRELMV

Return Codes in MWERC (Independent of RCLRC)

- 41 - Alien record catalog error

Reason Code in MWEREAS

- The previous Return Code in MWERC which indicates the original failure.

Diagram 9.3: ARCRDS - Recall a VSAM or Non-VSAM Data Set

Input	<ul style="list-style-type: none">• ARCRDMP Parameter List.
Inout	<ul style="list-style-type: none">• ARCRDMP Parameter List.
Processing	ARCRDS controls the recall of a single data set. There may be more than one data set recall executing at the same time.
Output	<ul style="list-style-type: none">• Updated ARCRDMP Parameter List• Return Codes.

Diagram 9.4: ARCDMDS - Delete a Migrated Data Set**Input**

- ARCRDMP Recall and Deletion Parameter List.

Inout

- ARCRDMP Recall and Deletion Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCDMDS	ARCDMDS
ARCPDA	ARCPDA

2. **Read the MCDS VSAM associations record (MCO) for virtual storage access method (VSAM) data sets:** If an MCO exists for this data set, ARCZREAD reads the record. If the read fails, the management work element (MWE) is failed.

Module	Label
ARCDMDS	ARCDMDS
ARCZREAD	ARCZREAD

3. **Mount the volume:** If the deletion is for a migrated data set on DASD, ARCKVOL is called to find out if the volume the data set resides on is mounted. If it is mounted or is a virtual mass storage system (MSS) volume, ARCALOLD is called to allocate the data set.

Module	Label
ARCDMDS	ARCDMDS
	CHKMOUNT
ARCALOLD	ARCALOLD
ARCKVOL	ARCKVOL

4. **Obtain the erase status of the data set:** If the erase status of the original data set is not passed as an input parameter to ARCDMDS, ARCCKEOS is called to obtain the erase status. If the request for erase status fails, the delete is failed.

Module	Label
ARCDMDS	ARCDMDS
ARCCKEOS	ARCCKEOS

5. **Call ARCDMS to scratch or invalidate the data set:** If the volume is mounted, ARCDMS is called to scratch the migrated data set and process the relevant migration control data set (MCDS) records (see steps 8 through 10). If the data set cannot be scratched but a BCDS backup migrated data set record (MCL) exists, ARCZDEL is called to delete the MCL so that automatic backup will not try to backup this data set.

Module	Label
ARCDMDS	ARCDMDS
	ARCDMS
ARCZDEL	ARCZDEL

6. **Uncatalog the data set and delete the MCDS data set record (MCD):** If all processing has been successful and the request is not from a SCRATCH intercept module, then the data set's catalog entry(s) is deleted. For non-SMS data sets, (including each component of a VSAM data set currently cataloged) processing is as follows:

- ARCLOCK is called to enqueue the data set shared on qname='ARCGPA ' rname='VSAMLOCK '.
- The component name is uncataloged.
- ARCUNLK is called to dequeue the data set.

ARCZDEL is called to delete the catalog entry(s) for SMS-managed data sets (including a separate call for each component of a VSAM data set currently cataloged).

If an uncatalog request fails, ARCWTU is called to issue message ARC0513I to the user or to the migration activity log when RECYCLE is the caller.

If the MCA, MCL, and MCO records are successfully deleted, ARCZDEL is called to delete the MCD.

Module	Label
ARCDMDS	ARCDMDS UNCATLG UNCATDS
ARCLOCK	ARCLOCK ARCUNLK
ARCWTO	ARCWTU
ARCZDEL	ARCZDEL
ARCZSDEL	ARCZSDEL

7. **Delete the Resource Access Control Facility (RACF) profile for the data set and the virtual storage access method (VSAM) related parts, deallocate the data set and return:** RACF profiles can exist for the following:

- Non-VSAM data sets
- VSAM spheres that have RACF protection on the base cluster only.
- VSAM spheres that are eligible for volume level migration can contain up to eight specific components in the sphere: base cluster, base data object, base index object, one base path, one alternate index (AIX), AIX data object, AIX index object, and one AIX path.

ARCVSCHK is called to delete the base cluster RACF profile for VSAM data sets. ARCRACF is called to delete the RACF profile for non-VSAM data sets. Either ARCRACF or ARCVSCHK is called to delete RACF profiles for VSAM components in the sphere. If the RACF profile delete request fails, ARCERP is called to log the error. If the volume is allocated, ARCFREE is called to deallocate it. If a virtual migration level 2 volume was allocated and the SETSYS command parameter is UNLOAD, ARCULVRT is called to unload the virtual volume. Return to the caller.

Module	Label
ARCDMDS	ARCDMDS DELRPROF
ARCERP	ARCERP
ARCFREE	ARCFREE

ARCRACF	ARCRACF
ARCULVRT	ARCULVRT
ARCVSCHK	ARCVSCHK

8. **Scratch the data set in a small-data-set-packing (SDSP) data set:** Control is passed to entry point ARCDMS. If the migrated data set resides in an SDSP data set, ARZESDP is called to erase the data set from the SDSP.

Module	Label
ARCDMS	ARCDMS DELSDP
ARZESDP	ARZESDP

9. **Scratch the data set not in an SDSP:** ARCITTOC is called to invalidate the tape table of contents (TTOC) entry for the migration copy in the offline control data set (OCDS). If the migrated data set on DASD does not reside in an SDSP, ARZSCR is called to scratch it.

Module	Label
ARCDMS	ARCDMS
ARCITTOC	ARCITTOC
ARZSCR	ARZSCR

10. **Delete the MCDS records:** If the scratch of the migration copy succeeded, ARZSCLN is called to delete the MCDS VSAM associations record (MCO), BCDS backup migrated data set record (MCL), and all MCDS alias entry records (MCAs) associated with this migrated data set. If the scratch failed and an MCL exists, ARZDEL is called to delete the MCL record. Return to the caller of ARCDMS.

Module	Label
ARCDMS	ARCDMS ZDEL
ARZDEL	ARZDEL
ARZSCLN	ARZSCLN

Output

- Updated ARCRDMP Recall and Deletion Parameter List
 - System Catalog
 - Modified MCDS Data Set (MCD) Record
 - Function Statistics Record (FSR)
 - Management Work Element (MWE)
 - Recovery Control Block (RCB)
 - Recovery Tasks Control Block (RTCB)
 - Return Codes:
 - 01 - CDS read error for zero record
 - 39 - RACF check failed to obtain erase status
- Reason Codes:
- Return Codes from ARCCKEOS.

Diagram 9.5: ARCSLVOL - Select a List of Target Volumes for Recall

Input

- Data Set MCD Record Pointer (MCDP)
- Dummy MVT Pointer (VTPP)
- Pointer to Space for Volume List
- RCB Pointer (RCBPTR)
- Candidate Volume List Area (SPVLISTP)
- Recall MWE Pointer (MWEF).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCSLVOL	ARCSLVOL
ARCPDA	ARCPDA

2. **If the user supplied a target volume, check the validity of the volume:** If the user specified a target volume to recall the data set and the system is running in a JES3 environment and preselected volumes exist for the recall, check the expiration date for the preselected volumes. If the expiration date has not passed, check to determine if the specified volume is contained in the list of preselected volumes. If the user-selected volume is not in the list of preselected volumes, fail the recall.

If there are no JES3 preselected volumes, then search the MVT chain for the user-selected volume. If the volume cannot be found in the MVT chain, create an MVT for the volume, and call ARCFDVTE to update the MVT. If the volume device type is not supported or its track size is incompatible, fail the recall. Indicate in the volume list to be passed back to ARCRDS that one volume was selected for the recall, and set the MVT pointer in the volume list.

Module	Label
ARCSLVOL	ARCSLVOL
	RSVJ3CMP
ARCFDVTE	ARCFDVTE

3. **If volumes are preselected for JES3, check to determine if the volumes are still valid:** If the system is running in a JES3 environment and volumes have been preselected, check the volumes again as follows:
 - If the volume is a DBU or DBA type, it is rejected.
 - If the migrated data set's space management flags are valid and volumes with 'LIKE' space management attributes are required but the attributes of this volume are 'UNLIKE', the volume is rejected.

For each volume in the preselected list that was not rejected by either of the previous checks, increase the count of volumes acceptable to use, and put the MVT pointer of the volume into the volume list to be passed back to ARCRDS. If after all preselected volumes have been checked and none are acceptable to use, fail the recall.

Module	Label
ARCSLVOL	ARCSLVOL CERTIFYV CHKCOMPF

4. **If data set pools are defined, select a volume from the correct data set pool:** If data set pools are defined, set the pointer to the first data set pool. Search the pool definition elements, comparing the qualifier of the pool with the high-level qualifier of the data set being recalled. If no pool entry is found for the data set or if a pool entry is found but no volumes exist in the pool, then proceed to step 5 for further volume selection determination. If a pool entry is found for the data set and a volume exists in the pool, then select a volume from the data set pool for the recall of the data set. (ARCSPPV is called to select a list of eligible target volumes from the specified pool.) If no volumes are available, fail the recall of the data set. If the user exit is to be taken, then set up the parameter list and call the user exit (see step 8).

Module	Label
ARCSLVOL	ARCSLVOL USERPOOL USEREXIT
ARCGMAIN	ARCGMAIN ARCFMAIN
ARCMSPV	ARCSPPV ARCMSPV

5. **If the recall is to the volume containing the catalog in which the data set is cataloged, find the catalog volume:** If the recall is to the volume on which the catalog containing the data set resides, get the high-level qualifier of the data set name. If the data set has a single qualifier name, then proceed to step 6 for further volume selection determination. If a high-level qualifier exists for the data set, then find the volume on which the catalog resides by setting up a catalog parameter list, and issuing a LOCATE on the high-level qualifier of the data set name in order to get the volume serial number of the volume containing the catalog. ARCLOCK and ARCUNLK are called to provide a shared enqueue on qname='ARCGPA ' rname='VSAMLOCK ' spanning the VSAM LOCATE request. If the LOCATE fails with an error other than a not-found condition, fail the recall. If the LOCATE fails with a not-found condition, then go to step 6. If the volume that contains the catalog was found, search the MVT chain to determine if the volume is managed by DFHSM. If the volume is not managed by DFHSM, set up an MVT and call ARCFDVTE to update the MVT. If the volume is on an unsupported device type, fail the recall.

Set to 1 the number of entries in the volume list being passed back to ARCRDS, and insert the pointer to the MVT into the volume list.

Module	Label
ARCSLVOL	ARCSLVOL CATVOL
ARCFDVTE	ARCFDVTE
ARCMSPV	ARCMSPV
ARCLOCK	ARCLOCK ARCUNLK

6. **If volume pools are defined, select a volume from the correct volume pool:** If volume pools are defined, set the pointer to the first volume pool. Search the pool definition elements, comparing the volume serial ID from the pool with the original volume serial ID of the data set being recalled. If no pool entry is found for the data set original source volume, select any volume managed by DFHSM for the recall (see step 7). If a pool entry is found for the data set, select a volume from the volume pool for the recall of the data set. ARCSPPV is called to select a list of eligible target volumes from the specified pool. If no volumes are available, fail the recall of the data set. If the user exit is to be taken, set up the parameter list and call the user exit (see step 8).

Module	Label
ARCSLVOL	ARCSLVOL USERPOOL ANYVLIST USEREXIT
ARCGMAIN	ARCGMAIN ARCFMAIN
ARCMSPV	ARCSPPV ARCMSPV

7. **If the conditions in steps 1 through 5 do not apply, select any DFHSM-managed volume:** ARCMSPV is called to select a list of eligible target volumes. If no volumes are available, fail the recall of the data set. If the user exit is to be taken, set up the parameter list and call the user exit (see step 8).

Module	Label
ARCSLVOL	ARCSLVOL ANYVLIST USEREXIT
ARCGMAIN	ARCGMAIN ARCFMAIN
ARCMSPV	ARCMSPV

8. **User Exit Processing (called from steps 4, 6, or 7):** ARCSLVOL calls the user exit, ARCRDXT. ARCRDXT can select up to five volumes to which to recall the data set. ARCRDXT returns up to five numbers that are indexes to the volumes in the list of the eligible target volumes. If the first number the user exit returns is zero, ARCSLVOL returns the best five volumes from the list of eligible target volumes to ARCRDS. If the exit is taken and the first number returned is not zero, return to ARCRDS the pointer to the MVT entry of the valid volumes the exit selected. Issue error message ARC0316I if there is any invalid selection number (a negative number or number out of the range of the list of eligible volumes) returned with the valid ones. If the exit does not select any valid volumes, fail the recall. If the user exit abnormally ends, message ARC0004I is issued and all non-directed recalls are not held.

Module	Label
ARCSLVOL	ARCSLVOL VARIABLE USEREXIT USEXIT1
ARCRDXT	ARCRDXT
ARCWTL	ARCWTL

Output

- Completed Volume List
- Modified MCD Record
- Pool Descriptor Element (PDE)
- Device Table (DVT).

Diagram 9.6: ARCROPIN - Allocate and Open a Backup Version or Migration Copy

Input

- ARCROPIP Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCROPIN	ARCROPIN
ARCPDA	ARCPDA

2. **Verify that the input parameters are correct:** Control is passed to ARCROPIN to open a backup version or migration. Verify that the input parameters are valid including all pointers, request, and indication flags. If any error is found in the input parameters, call ARCERP to record the error, set the Return Code, and return to the caller.

Module	Label
ARCROPIN	ARCROPIN
	PARMVRFY
ARCERP	ARCERP

3. **Check if the required DASD volume is mounted:** If the required volume is a DASD volume, call ARCCCKVOL to determine if the volume is mounted. If the volume is not mounted and it is a virtual mass storage system (MSS) volume, check if the MSS is active. If the MSS is not active, set the Return Code and return. If the volume needs to be mounted and a TSO user ID has been provided, issue message ARC0612I to the user.

Module	Label
ARCROPIN	ARCROPIN
	DASDCHK
ARCCCKVOL	ARCCCKVOL
ARCWTO	ARCWTU

4. **Allocate the input data set if it is on DASD:** If the data set must be allocated without an ENQ, call ARCALONQ to do so. If the data set is in a small-data-set-packing (SDSP) data set, call ARCALSDP to allocate the SDSP data set. Otherwise, call ARCALOLD to allocate the data set. If the allocation fails, set the appropriate Return Code and return to the caller. If the allocation is successful, put the DDNAME into the caller's recovery control block (RCB) and indicate in the parameter list that the data set has been successfully allocated.

Module	Label
ARCROPIN	ARCROPIN
	DASDALLO
ARCALOLD	ARCALOLD
	ARCALONQ
ARCALSDP	ARCALSDP

5. **Read the Job File Control Block (JFCB) if requested to do so:** If the caller requests that the JFCB be read, set up the data control block (DCB) properly, and issue the RDJFCB macro. If the RDJFCB fails, call ARCERP to take a SNAP dump of the task. If the RDJFCB is successful, the JFCB and DCB addresses are stored in the mounted volume table (MVT), and the JFCB is modified with the input data set name and file sequence number. A bit is set on to indicate the JFCB has been read for this volume.

Module	Label
ARCERP	ARCERP
ARCROPIN	ARCROPIN
	TAPEJFCB

6. **Open the input data set:** If the input volume is a tape volume, call ARCTOPEN to open or position to the data set. If the input data set is in an SDSP data set, call ARCOSDP to open the SDSP. Otherwise, call ARCDOPEN to open the DASD data set. If the open fails, set the Return Code and return to the caller. If the open succeeds, store the data control block (DCB) address in the RCB, indicate in the RCB if it is a 3480 single-file format tape, and indicate in the parameter list that the data set was opened.

Module	Label
ARCROPIN	ARCROPIN
	DASDOPEN
	TAPEOPEN
ARCDOPEN	ARCDOPEN
ARCOSDP	ARCOSDP
ARCTOPEN	ARCTOPEN

7. **Read the first block of data:** If the input volume is a tape volume, use the READ and CHECK macros to read the first 16K block from the tape. If end-of-volume is encountered, increment the block count in the Tape Data Set Volume List. If the input data set is in an SDSP, call ARCRSDP to read the first record from the SDSP. For other data sets on DASD, use the queued sequential access method (QSAM) GET macro to read the first 2K block. If any errors occur trying to read the first block of data, call ARCERP to log the error and set the Return Code. Return to the caller.

Module	Label
ARCERP	ARCERP
ARCROPIN	ARCROPIN
	TAPERead
	DASDREAD
ARCOSDP	ARCRSDP

Output

- Return Codes (imbedded in ARC11.xxI messages, where the Return Codes are represented by xx):
 - 11 - Premature end-of-file occurred while reading data set
 - 12 - An I/O error occurred while reading the data set
 - 16 - The allocation resource is in use
 - 17 - An error occurred while reading the JFCB
 - 31 - The operator cancelled the volume mount

- 35 - An error occurred while opening the input data set
- 50 - No units are available to mount the input volume
- 53 - The MSS is inactive
- 68 - An error occurred while positioning to the input data set
- 97 - DFHSM internal error allocation.

Diagram 9.7: ARCRUPF1 - Update the Format 1 DSCB After Recall

Input

- ARCRDMP Parameter List.

Inout

- ARCRDMP Parameter List.

Processing

ARCRUPF1 updates for Format 1 DSCB after recalling a data set.

Output

- Updated ARCRDMP Parameter List
- Return Codes.

Diagram 9.8: ARCRNVRC - Rename and/or Recatalog a Non-VSAM Data Set After Being Recalled

Input

- ARCRDMP Parameter List.

Inout

- ARCRDMP Parameter List.

Processing

ARCRNVRC renames and/or recatalogs a non-VSAM data set after being recalled.

Output

- Updated Parameter List for ARCRDMP
- Return Codes.

Diagram 9.9: ARCMSPV - Select Primary Volumes for Data Set Recall

Input

- Pool Descriptor Element (PDE)
- Data Set to MCD Record Pointer (CATE)
- Volume List Area Pointer (PVN)
- User Exit Volume Attribute Array Pointer (PVU)
- User Pool Definition Entry Pointer (PDEPTR).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance to this module.

Module	Label
ARCMSPV	ARCMSPV
ARCPDA	ARCPDA

2. **Search mounted volume table for primary volumes eligible for recall of the data set:** ARCMSPV is called to request an ordered list of the primary volumes having the most space available to recall a data set. The mounted volume table chain is searched to find and build a list of eligible volumes. Eligible volumes are primary volumes that allow automatic recall, and meet device-type restrictions and DFHSM attribute requirements for the data set to be recalled. In a JES3 system, the volume must be in the DFHSM general pool. ARCKVOL is called to find the unit control block (UCB) for the volume being processed. If no eligible volumes are found, an error Return Code is returned to the caller.

Module	Label
ARCMSPV	ARCMSPV
	CHKCOMP
ARCKVOL	ARCKVOL

3. **Order the list by the most available free space:** ARCQSORT is called to sort the list of eligible volumes ordered by descending free space within attribute categories. This ordered list is then returned to the caller. If the user exit is to be taken and the list of eligible volumes includes volumes whose attributes are different than the volume from which the data set migrated, then the User Exit Volume Attribute Array (USEXVAA) is also built and returned to the caller.

Module	Label
ARCMSPV	ARCMSPV
	SORTLIST
	BLDATTR
ARCQSORT	ARCQSORT

4. **Entry Point ARCSPPV:** Call ARCPDA to create a trace entry for this entry to the module.

Module	Label
ARCMSPV	ARCSPPV
ARCPDA	ARCPDA

5. **Search the mounted volume table for the primary volumes that are part of the specified recall pool passed and that are eligible for recall of this particular data set:** Entry point ARCSPPV is called to build a list of primary volumes that are members of the specified pool passed. The DFHSM MVT chain is searched to find eligible volumes, which must be primary volumes and must meet the device-type restrictions for the data set to be recalled. If no eligible volumes are found, an error Return Code is returned to the caller.

Module	Label
--------	-------

ARCMSPV	ARCSPPV
---------	---------

6. **Order the list by the most available free space:** ARCQSORT is called to sort the list of eligible volumes ordered by descending free space within attribute categories. This ordered list is then returned to the caller.

Module	Label
--------	-------

ARCMSPV	ARCSPPV
	SORTLIST
ARCQSORT	ARCQSORT

Output

- Ordered List of MVT Pointers to Eligible Volumes
- Volume List Area Pointer (PVN)
- User Exit Volume Attribute Array Pointer (PVU)
- Number of Total Eligible Volumes in List (NFND)
- Number of Unlike Eligible Volumes in List (NUFND)
- Return Codes:
 - 0 - A list of eligible volumes has been created
 - 8 - No eligible volumes were found.

Diagram 9.10: ARCRNVDS - Recall a Non-VSAM Data Set

Input

- ARCRDMP Parameter List.

Inout

- ARCRDMP Parameter List.

Processing

ARCRNVDS recalls non-VSAM data sets and performs output volume and data set allocations for non-DFDSS migrated data sets.

Output

- Updated ARCRDMP Parameter List
- Return Codes.

Diagram 9.11: ARCRVDS - Recall a VSAM Data Set Cataloged in the Integrated Catalog Facility Catalog

Input

- ARCRDMP Recall Parameter List.

Inout

- ARCRDMP Recall Parameter List.

Processing

ARCRVDS controls the recall of a VSAM data set.

Output

- Recalled VSAM data set or flags set in RDMP
- Return Codes.

Diagram 9.12: ARCRALOT - Allocate an Output Non-VSAM, Non-SMS Data Set

Input

- ARCRALOP Parameter List.

Inout

- ARCRALOP Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCRALOT	ARCRALOT
ARCPDA	ARCPDA

2. **Verify that the input parameters are correct:** Control is passed to ARCRALOT to allocate the target data set for the recovery of a non-virtual storage access method (VSAM) data set. Verify that the input parameters are valid including all pointers and request and indication flags. If any error is found in the input parameters, call ARCERP to record the error, set the Return Code, and return to the caller.

Module	Label
ARCRALOT	ARCRALOT
ARCERP	ARCERP

3. **Determine the space allocation units and quantities for direct, unmovable, undefined and zero-secondary-allocation data sets:** If the data set is being put back on the same device type as what it came from, it was allocated in cylinders, and it is not an unmovable data set, calculate the number of cylinders required from the number of tracks recorded in the common data set descriptor record (CDD).

If the data set organization is unmovable or was allocated without a secondary allocation quantity, and the target device type is different than the source, ARCSPCNV is called to determine the space requirements on the target volume.

If the data set organization is direct or undefined, and the original allocation was in tracks, the same number of tracks will be allocated on the target device regardless of the device type.

If the data set organization is direct or undefined and the target device type is different than the source, the original allocation units and quantities must be adjusted accordingly. The TRKCALC macro is used if the original allocation was in blocks. ARCFDVTE is called to locate the device table entry if the original allocation was in cylinders; then the cylinder allocation is converted to tracks. If the TRKCALC macro or call to ARCFDVTE fails, set the Return Code and return to the caller. The data set control block (DSCB) copy in the CDD will be modified to indicate track allocation and the converted quantities.

Module	Label
ARCRALOT	ARCRALOT
ARCFDVTE	ARCFDVTE
ARCSPCNV	ARCSPCNV

4. **Determine the space allocation units and quantities for sequential and partitioned data sets:** The original units of allocation are always maintained. If the CDD has the actual space used, pass this to ARCSPCNV; if not, the original allocation quantity is passed. Call ARCSPCNV to determine space requirements on the target volume. If the data set is being put back on a different device type than what it came from, ARCSPCNV does the necessary conversions to derive an equivalent amount of space. If the data set is partitioned, make certain the primary allocation is large enough to hold the directory blocks. Use the TRKCALC macro to determine space requirements for directory blocks. Increase the primary quantity if necessary. If the TRKCALC macro fails, set the Return Code and return.

Module	Label
ARCRALOT	ARCRALOT
ARCSPCNV	ARCSPCNV

5. **Allocate the output data set:** Set up the allocation request parameters and the allocation request flags for ARCALNDS. Blank the data set name field passed by the caller so a temporary name is generated for the data set. For all unmovable data sets, the absolute relative record address (TTR) is calculated for the data set. Call ARCALNDS to allocate the output data set. If the allocation fails, set the Return Code. If the failure is because the volume is now SMS-managed, update the MVT to indicate it is no longer valid for a non-SMS volume. If the allocation is successful, put the DDNAME in the caller's recovery control block (RCB). Issue the TIME macro to get the allocation completion time; put the date and time in the parameter list to return to the caller. Return to the caller.

Module	Label
ARCRALOT	ALLOCATE
ARCALNDS	ARCALNDS

Output

- Updated ARCRALOP Parameter List
- Return Codes:
 - 06 - Error allocating data set
 - Reason Codes:
 - 16 - DYNALLOC error
 - 20 - Request cancelled by user exit
 - 24 - Invalid parameter list to DYNALLOC
 - 39 - Error attempting to set the RACF indicator
 - 40 - The volume is SMS-managed
 - 20 - Unsupported device type
 - 21 - Requested volume not available
 - Reason Codes:
 - 02 - Return Code of 8 issued by ARCALNDS
 - 24 - Not enough space on volume
 - 37 - Specified unit incompatible with volume.

Diagram 9.13: ARCALSNV - Allocate an SMS Non-VSAM Data Set

Input

- ARCALSNP Parameter List.

Inout

- ARCALSNP Parameter List.

Processing

ARCALSNV allocates SMS non-VSAM data sets through service modules.

Output

- Return Codes.

Volume and Level Backup Processing

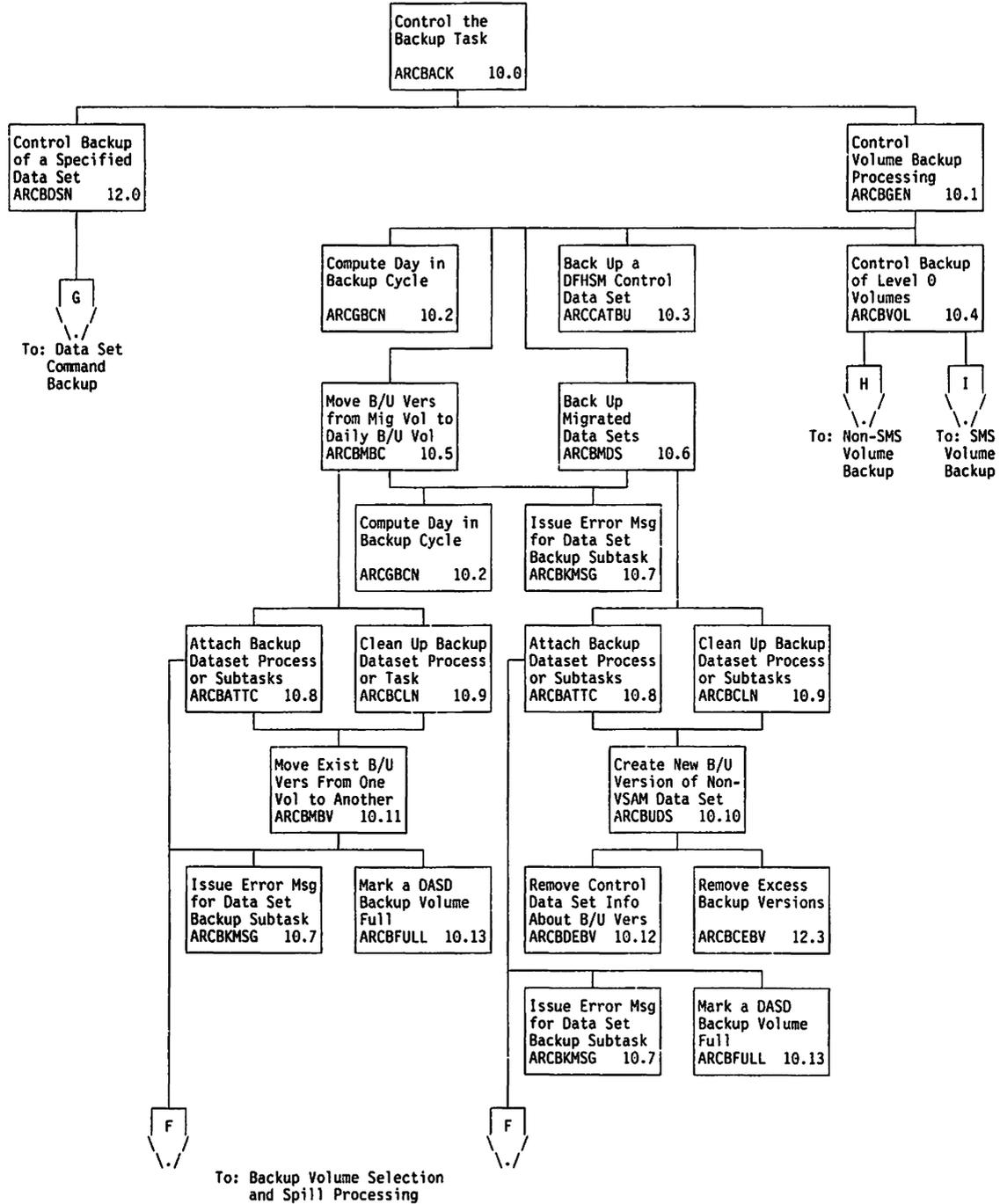


Figure 12. Visual Table of Contents for Volume and Level Backup Processing

Diagram 10.0: ARCBACK - Control the Backup Task

Input

- Management Communication Vector Table (MCVT)
- Management Work Elements (MWEs)
- Backup Control Record (BCR)
- Activity Log Work Element (ALWE).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for this module.

Module	Label
ARCBACK	ARCBACK
ARCPDA	ARCPDA

2. **Initialize the backup control task. Build backup task control blocks (BTCBs). Wait for backup work to do:** ARCCTL attaches ARCBACK to control automatic and command-driven backup requests. In case of abnormal end conditions in the ARCBACK task, an ESTAI exit is set up, which allows ARCCTL to restart ARCBACK if necessary. When initially attached, ARCBACK calls ARCCRCB to initialize its RCB and creates RCBs for two subtasks that will be attached (ARCBGEN, ARCBDSN). ARCBACK then calls ARCGMAIN to create a BTCB for each of the maximum number of backup subtasks that ARCBGEN can attach, and two BTCBs for ARCBMDS and ARCBMBC. It also creates another BTCB for ARCBDSN. If ARCGMAIN fails, ARCBACK calls ARCWTL to issue message ARC0738, then holds backup. ARCBACK sets on the completion bit of the work event control block (ECB) of ARCBGEN so ARCBGEN gets attached immediately. The timer that controls the start of automatic backup is set. ARCBACK waits to be posted indicating work to do before attempting any of the functions in the following steps.

Module	Label
ARCBACK	ARCBACK
	STIMER
ARCCRCB	ARCCRCB
	ARCIRCB
ARCESTAI	ARCESTAI
ARCGMAIN	ARCGMAIN
ARCWTO	ARCWTL

3. **Clean up old work and process shutdown request if requested:** ARCBACK goes into a WAIT state and when it wakes up it checks to see if the backup hardcopy log needs to be closed and a new one needs to be opened. If the close of backup hardcopy log is needed, ARCGMAIN is called to get storage for the activity log work element (ALWE) and if the storage was successfully GETMAINed, ARCBACK builds the ALWE with a function code of 2 to request a close/deallocate and an allocate/open the activity log. Then ARCPAQ is called to queue the ALWE to the ALWE queue and post ARCALOG to process the request. If the GETMAIN for the ALWE was not successful, ARCWTO is called to issue message ARC110I to indicate that the activity log could not be closed and reopened. When the subtasks have ended processing, an old copy of each subtask is detached.

For ARCBDSN which is driven from specific work elements (MWEs), ARCPMWE is called to purge any existing MWE that has been completed. If a shutdown has been requested, ARCBACK waits for the subtasks to complete any work. After the work is done, the subtasks are detached and control is returned to ARCCTL.

Module	Label
ARCBACK	ARCBACK
ARCALOG	ARCALOG
ARCGMAIN	ARCGMAIN
ARCPAQ	ARCPAQ
ARCPMWE	ARCPMWE
ARCWTO	ARCWTO

4. **Initiate general backup processing:** If a shutdown has not been requested, ARCBGEN is attached and a check is made to see if a timer interruption has occurred, signaling either a change in the start time for automatic backup or that the automatic backup process should be started. If backup is not being held and is enabled, and DFHSM is not in emergency mode, ARCUCTL is called to update the current autobackup start time field in the backup control record (BCR) with the current time and ARCBGEN is posted to start automatic backup processing. The timer is then reset.

Module	Label
ARCBACK	ARCBACK STIMER
ARCBGEN	ARCBGEN
ARCISTAT	ARCUCTL

5. **Process individual backup requests that are queued:** After calling ARCLOCK (qname='ARCGPA ', rname='BAKQ ') to lock the backup queue of requests, ARCBACK scans the queue for requests not currently being handled. If backup is not enabled, each MWE is ended, dequeued with ARCENQ, and purged by ARCPMWE. If backup is held and the backup request is a WAIT type request, the MWE is purged by ARCPMWE. If backup is active, the data set requests are marked busy dequeued by ARCDEQ, and channeled to the ARCBDSN subtask for a data set backup request. The ARCBDSN subtask is then attached and posted to process the management work element. If a volume backup request is found in the backup queue, ARCBGEN is posted indicating work to do. When all queued requests have been started, ARCUNLK unlocks the backup queue and ARCBACK returns to its wait loop.

Module	Label
ARCBACK	ARCBACK BDSN
ARCBDSN	ARCBDSN
ARCBGEN	ARCBGEN
ARCENQ	ARCDEQ
ARCLOCK	ARCLOCK ARCUNLK
ARCPMWE	ARCPMWE

Output

- Backup Task Control Blocks (BTCBs)
- Management Communication Vector Table (MCVT)
- Management Work Elements (MWEs)
- Backup Control Record (BCR)
- Activity Log Work Element (ALWE)
- Return Codes:
 - 40 - Backup is disabled
 - 52 - GETMAIN for BTCB storage
 - 74 - Backup function is held and the MWE is a wait-type request.

Diagram 10.1: ARCBGEN - Control Volume Backup Processing

Input

- Backup Management Work Elements (MWEs) on the backup queue.

Processing

ARCBGEN initializes and restarts volume backup processing and monitors the activity during this process.

Output

- Completed MWEs to the requestor
- Return Codes.

Diagram 10.2: ARCGBCN - Compute Day in Backup Cycle

Input

- None.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGBCN	ARCGBCN
ARCPDA	ARCPDA

2. **Compute the day number in the backup cycle:** Get the current date, and the date on which the backup cycle was defined. Convert these dates into Gregorian dates by calling ARCALNDR. The Gregorian dates are converted into serial dates by calling ARCKDAY. If the backup cycle is not defined, a default value of 1 is returned as the day number in backup cycle. If it is defined, the day number is calculated from the difference of the two serial dates mentioned above. When the current time is less than the AUTOBACKUPSTART planned start time, and the current date is greater than the cycle start date, the day number is one less than the one calculated above. If this number turns out to be zero, the day number is set to the last day in the defined cycle.

Module	Label
ARCGBCN	ARCGBCN CURDATE DTECONV
ARCALNDR	ARCALNDR ARCKDAY

3. **ARCGMCN is called to compute the day number in migration cleanup cycle:** Get current date. If the cycle is not defined, create a 1 day cycle and update the MCR record by calling ARCUCTL. Call ARCALNDR to convert the current date, and the date the migration cleanup was defined, into Gregorian dates. The Gregorian dates are converted into serial dates by calling ARCKDAY. The day number is calculated from the difference of two serial dates mentioned above.

Module	Label
ARCGBCN	ARCGMCN CURDATE DTECONV
ARCALNDR	ARCALNDR ARCDAY
ARCISTAT	ARCVCTL

Output

- The day number in the migration cleanup cycle.

Diagram 10.3: ARCCATBU - Back Up a DFHSM Control Data Set

Input

- Recovery Control Block (RCB)
- Management Communication Vector Table (MCVT)
- Multiple Processing Unit Control Record (MHCR)
- Management Control Record (MCR)
- Backup Control Record (BCR)
- Migration Control Data Set (MCDS)
- Backup Control Data Set (BCDS)
- Offline Control Data Set (OCDS)
- Backup Volume
- User Exit.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCCATBU	ARCCATBU
ARCPDA	ARCPDA

2. **Set up an ESTAE environment. Issue message that the control data set backup function is starting:** ARCBGEN passes control to ARCCATBU. ARCCATBU calls ARCCRCB to get the RCB. An ESTAE macro is issued to set up the ESTAE environment. After an ESTAE environment is set up, ARCCATBU calls ARCWTL to issue a message indicating that the backup of the control data sets is starting.

Module	Label
ARCCATBU	ARCCATBU
	ESTAE
	WRITEMSG
ARCCRCB	ARCCRCB
ARCWTO	ARCWTL

3. **Exclusively enqueue the control data sets. Compute the last final qualifier of the backup data set name. Reserve the volumes:** Before ARCCATBU backs up the control data sets and (optionally) the journal data set, ARCCATBU calls ARCLOCK to exclusively enqueue the control data sets. If in a multiple processing unit environment, ARCCATBU also calls ARCULOCK to reserve each volume that contains a control data set. The backup control record (BCR) is updated to indicate which control data set is being backed up. If the MCDS is being backed up, the management control record (MCR) is updated. The MCVT is set to indicate whether backup is in process or has completed. If the control data sets are backed up as a part of automatic backup, ARCCATBU calls ARCUCTL to update the MCR and BCR.

If the SETSYS CDSVERSIONBACKUP command was specified, ARCCATBU calls ARCZREAD to read the MHCR so it can compute the next final qualifier for the backup data set name. If the backup device category is DASD,

ARCCATBU invokes the ARCSLOCE macro to set up the parameter list ARCSLOCP and calls ARCZSLOC to locate the backup data set and to retrieve the list of volumes associated with the data set.

If ARCZSLOC cannot locate the data set, ARCCATBU issues a message indicating that the data set could not be backed up. If it can locate the DASD data set or the data set is on tape, ARCCATBU calculates the next final qualifier.

Module	Label
ARCCATBU	ARCCATBU
ARCISTAT	ARCUCTL
ARCLOCK	ARCLOCK
ARCULOCK	ARCULOCK
ARCZREAD	ARCZREAD
ARCZSLOC	ARCZSLOC

4. **Back up the control data sets and journal data set (if requested):** ARCCATBU loops through the backup process until all defined control data sets (and optionally the journal data set) are backed up. ARCCATBU updates the BCR and the MCVT and issues a message indicating that backup of a specific control data set or journal data set is starting. First, an RDJFCB macro is issued to find the input data set name.

After the job file control block (JFCB) is read, ARCCATBU locates the output data set. If the SETSYS CDSVERSIONBACKUP command was specified and the backup device category is DASD, ARCCATBU tries to locate the DASD data set. If the backup device category is tape, ARCCATBU calls ARCALTVL to allocate the scratch tape. After the scratch tape is allocated, ARCCATBU finds the address of the real JFCB of the tape data set whose DDNAME was passed to ARCCATBU. ARCCATBU then updates the real JFCB to contain the backup data set name, the specified expiration date or retention date, and set off the flag indicating this is a temporary data set.

If the SETSYS NOCDSVERSIONBACKUP command was specified, ARCCATBU tries to locate the real JFCB address for the backup data set name whose DDNAME is specified in the startup procedure.

After ARCCATBU locates the output data set, it calls ARCALSHR to allocate the input data set.

After ARCALSHR allocates the input data set, ARCCATBU checks whether the SETSYS CDSVERSIONBACKUP command was specified. If it was specified, ARCCATBU calls ARCALOLD to allocate the output backup data set. ARCCATBU then backs up the input data set. Next, ARCCATBU backs up the control data sets. The Access Method Services EXPORT command is set up using the name of the control data set returned by the RDJFCB macro and the DDNAME returned by allocation. The Access Method Services parameter list is set up to link to Access Method Services to run the EXPORT command. ARCCATBU links to Access Method Services to run the EXPORT command.

During I/O processing, Access Method Services returns to ARCCATBU to respond to the export request. If a DDNAME of SYSIN is found, the EXPORT command is returned to Access Method Services. If a DDNAME of SYSPRINT is found, a message that Access Method Services returns is written in the command activity log. If automatic backup invoked ARCCATBU, a message is also written in the backup activity log.

Module	Label
ARCCATBU	ARCCATBU SETSTATS WRITEMSG READJFCB FINDDASD ADDRJFCB MODJFCB GETOUTDS ALLOCIN BACKJRNL BACKCDS GETVOLS
ARCALVOL	ARCALTVL
ARCZSLOC	ARCZSLOC
ARCALOLD	ARCALOLD ARCALSHR
ARCFREE	ARCFREE
ARCWTO	ARCWTL

5. **Update the MHCR with the new final qualifier. Rename the backup data set if necessary:** After the control data sets are backed up and if SETSYS CDSVERSIONBACKUP was specified, ARCCATBU calls ARCZREAD to read the MHCR record for update and calls ARCZUPDT to update the MHCR record with the new final qualifier.

ARCCATBU calls ARCALVOL to allocate the volume the backup data set is on if all the following conditions are true:

- Backup device category is DASD
- Backup data set must be renamed
- Volume the data set is on is not mounted.

If the backup data set is to be renamed, and the data set is SMS-managed, the ARCSALTE macro is used to set up the ARCSALTP parameter list and to invoke ARCZSALT to rename the VTOC, VVDS, and BCS entries associated with the data set. For non-SMS-managed data sets, CAMLST, RENAME, CATALOG, and UNCATLG functions are used.

After the backup data set is renamed, ARCCATBU calls ARCFREE to release the allocated volume.

If the backup device category is tape or a non-SMS backup data set is renamed, the new backup data set is cataloged and the old backup data set is uncataloged.

Module	Label
ARCCATBU	ARCCATBX UPDTMHCR WRITEMSG RENAME CATUNCAT
ARCALVOL	ARCALVOL
ARCZSALT	ARCZSALT
ARCFREE	ARCFREE
ARCWTO	ARCWTL
ARCZREAD	ARCZREAD

ARCZUPDT ARCZUPDT

6. **Do any necessary cleanup processing. Dequeue and release volumes. Process the user exit if requested. Issue message that the control data set backup function is complete:** If any errors occurred during the backup processing or after the control data sets are backed up, ARCCATBU does cleanup processing.

ARCCATBU calls ARCUUNLK to release the volumes, then calls ARCUNLK to dequeue the control data set resource. Finally, ARCCATBU calls ARCFREE to release any allocated data sets.

If the process of backing up the control data sets is successful and the control data set backup user exit is requested, ARCCATBU calls ARCCBEXT to process the user exit. If the user exit abnormally ends, ARCCATBU disables the user exit and issues a message.

After all processing completes, a message is written indicating that the backup of the control data sets has ended. ARCCATBU then calls ARCDRCB to release the RCB.

Module	Label
ARCCATBU	ARCCATBX CLEANUP USEREXIT
ARCCBEXT	ARCCBEXT
ARCCRCB	ARCDRCB
ARCFREE	ARCFREE
ARCLOCK	ARCUNLK
ARCULOCK	ARCUUNLK
ARCWTO	ARCWTL

Output

- Messages
- Management Control Record (MCR)
- Backup Control Record (BCR)
- Management Communication Vector Table (MCVT)
- Multiple Processing Unit Control Record (MHCR)
- Renamed Backup Data Set.

Diagram 10.4: ARCBVOL - Control Backup of Level 0 Volume

Input

- Upon entry, Register 1 contains the task ID number which is used to index the appropriate Backup Task Control Block (BTCB) which contains all the information necessary to perform the volume backup.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCBVOL	ARCBVOL
ARCPDA	ARCPDA

2. **Upon being attached, perform program initialization:** After being attached by ARCBGEN, perform program initialization, and issue a WAIT macro to wait for the work-to-do event control block (ECB).

Module	Label
ARCBVOL	ARCBVOL

3. **Upon being posted for work to do, check the completion code:** When posted with work to do, ARCBVOL will check the completion code (BTCBWECD) in the work-to-do ECB. For completion code X'99', ARCBVOL will call ARCBCLN to clean up the data set processor tasks, post ARCBGEN that the volume task is complete, and then go back into the WAIT state. For any completion code other than 0 or X'99', ARCBVOL will call ARCERP and then go back into the wait state.

For a completion code 0, ARCBVOL will proceed with normal volume backup. If the volume is SMS-managed and a FREEVOL of a backup volume is being requested, a call to ARCBFVOL is made. For other SMS-managed volumes, ARCSBVOL is called to control the backup. For non-SMS-managed volumes, ARCBVOL controls the backup. For both SMS and non-SMS-managed volumes, ARCBVOL calls ARCBCLN to clean up the data set processor task when completed with the volume.

Module	Label
ARCBVOL	ARCBVOL NORMAL
ARCBCLN	ARCBCLN
ARCBCLN	ARCERP
ARCSBVOL	ARCSBVOL
ARCBFVOL	ARCBFVOL

4. **Perform initialization for normal volume backup processing:** Call ARCBVBEG to perform initialization for the ARCBVOL task. If an error occurred in ARCBVBEG, processing ends. Local variables are initialized. ARCZVCNM is called to generate the backup VTOC and VCAT copy data set names.

Module	Label
ARCBVOL	ARCBVOL NORMAL
ARCBVBEG	ARCBVBEG

ARCLOCK ARCLOCK
 ARCZVCNM ARCZVCNM

5. **Allocate and open VTOC copy data set:** ARCZVCUT is called to allocate and open the VTOC copy data set on an MLI volume. If an error occurs, allow ARCZVCUT to issue the ARC0704I message, and end the processing.

Module	Label
ARCBVOL	ARCBVOL NORMAL QUIT
ARCZVCUT	ARCZVCUT

6. **Read VTOC of Level 0 volume, and process data set control blocks:** ARCZVTOC is called to return each DSCB on the Level 0 volume being processed.

Before processing each DSCB, ARCZEND is called to check for DFHSM ending conditions. If DFHSM is ending early, ARCWTN is called to issue message ARC0714I to the operator and the backup activity log, and processing ends.

For each DSCB ARCZVTOC returns successfully, check the type and perform the following (skip the DSCB if it is not a Format 1 or Format 4):

- **Process Format 4 DSCB:** ARCBVOL uses the Format 4 data set control block to determine if the volume is owned by a VSAM catalog. If it is, ARCFVCL is called to determine which catalog, if any, owns the volume. If the MCP record identified the owning catalog, ARCFVCL checks that catalog to see if it owns the volume. When the owning VSAM catalog is not found, ARCWTN is called to issue message ARC0732I to the operator's console and the backup activity log. When the owning VSAM catalog is found, ARCWTN is called to issue message ARC0727I to the operator's console and the backup activity log identifying the owning catalog, and ARCFVSC is called to locate on the volume all VSAM data sets not cataloged in the Integrated Catalog Facility catalog.

A dummy Format 1 DSCB is written to the VTOC copy data set for each VSAM data set not cataloged in the Integrated Catalog Facility catalog that ARCFVSC locates. ARCZVCRW is called to write the required fields from the dummy Format 1 DSCB to the VTOC copy data set. If an error occurs, allow ARCZVCRW to issue the ARC0704I message, and end the processing. If ARCFVSC misses some or all VSAM data sets, message ARC0758I is written to the backup activity log.

- **Process Format 1 DSCB:** Skip the Format 1 DSCB if it is one of the following:
 - Non-ICF VSAM catalog
 - VTOC index data set
 - VSAM volume data set (VVDS).

If the "See All" exit is active (EXTSAUSE = "Y" and EXTSAPTR < > 0) and the data set is not an ICF catalog or OS CVOL, then call ARCSAINT.

The following action should be taken, based on ARCSAINT's Return Codes:

- 0 - Proceed with backup
- 4 - Write the Format 1 DSCB to the VTOC copy data set, if it is eligible. But do not allow it to be queued for backup
- 8 - The exit deleted the data set Skip all further processing of this data set (do not write the Format 1 to the VTOC copy data set and do not allow it to be queued for backup)
- 16 - The installation exit ABENDED
 - Hold backup
 - Skip all further processing of this data set
 - End processing.

The following Format 1 DSCBs can now be skipped (they were required to be passed to the "See All" exit, but are not eligible to be backed up).

- List data set (ARCCHKEL performs check)
- Utility data set (ARCCHKUT performs check).

For the Format 1 of a data or index component of a VSAM cluster, perform the following:

- Check for either of the following two conditions: 1) The data set is cataloged in an Integrated Catalog Facility catalog, the SETSYS INCREMENTALBACKUP(CHANGEDONLY) option is in effect and the changed bit is off in the Format 1 DSCB. 2) The Return Code from ARCSAINT indicated the VTOC copy should be updated if necessary, but the data set should not be queued for backup. If either condition is true, then perform the following:
 - Call ARCFVBC to check if the Format 1 DSCB is for the base data component of the data set, but do not have ARCFVBC build an SDATA control block and queue for backup. If the Format 1 DSCB is for the base data component, then it is written to the VTOC copy data set. ARCZVCRW is called to write the required fields from the Format 1 DSCB to the VTOC copy data set. If an error occurs, allow ARCZVCRW to issue the ARC0704I message, and end the processing.
- Otherwise (neither of the above two conditions were true), ARCFVBC is called to determine if the Format 1 DSCB is for the base data component of the data set. For a base data component, ARCFVBC builds an SDATA control block on a queue of SDATA control blocks. If there is a GETMAIN failure in ARCFVBC, message ARC0758I is written to the backup activity log. ARCFVBC will return the base cluster name which ARCBVOL will store in the Format 1 DSCB. ARCZVCRW is called to write the required fields from the Format 1 DSCB to the VTOC copy data set. If an error occurs, allow ARCZVCRW to issue the ARC0704I message, and end the processing.
- ARCBVOL ignores any VSAM data set cataloged in the Integrated Catalog Facility catalog that ARCFVBC indicates is not a base data component.

For a non-VSAM data set perform the following:

- Write the Format 1 DSCB to the VTOC copy data set. ARCZVCRW is called to write the required fields from the Format 1 DSCB to the VTOC copy data set. If an error occurs, allow ARCZVCRW to issue the ARC0704I message, and end the processing.
- Check for either of the following two conditions: 1) Incremental backup, SETSYS INCREMENTALBACKUP(CHANGEDONLY) specified, the change bit not on in the Format 1 DSCB, and data set not an OS CVOL. 2) The Return Code from ARCSAINT indicated the data set should not be backed up. If either condition is true, then skip further processing of this DSCB. Otherwise, ARCENQ is called to place the Format 1 DSCB on the queue of non-VSAM data sets to be backed up. For an error getting space for the Format 1 DSCB queue, message ARC0708I is written to the backup activity log, and processing ends.

For each VSAM or non-VSAM Format 1 DSCB successfully written to the VTOC copy data set, increment a count of how many have been written. This information is later transferred into the MCP record when it is updated.

Module	Label
ARCBVOL	ARCBVOL FINDSCB FMTIDSCB FMT4DSCB MSG758 NORMAL NXTDSCB PUSH SEEALL QUIT
ARCCHKEL	ARCCHKEL
ARCCHKUT	ARCCHKUT
ARCENQ	ARCENQ
ARCERP	ARCERP
ARCGMAIN	ARCGMAIN ARCFMAIN
ARCFVBC	ARCFVBC
ARCFVCVL	ARCFVCVL
ARCFVSC	ARCFVSC ARCFVSFM
ARCWTO	ARCWTL
ARCZVTOC	ARCZVTOC
ARCZVCRW	ARCZVCRW
ARCSAINT	ARCSAINT
ARCZEND	ARCZEND

7. **Close and deallocate VTOC copy data set:** After successfully processing the VTOC, close the VTOC copy data set. ARCZVCUT is called to close and deallocate the backup VTOC copy data set. If an error occurs, allow ARCZVCUT to issue the ARC0704I message, and end the processing. If ARCZVCUT successfully closed the VTOC copy data set, issue message ARC0728I to the backup activity log to report the successful creation of the VTOC copy data set. Note that ARCZVTOC has already closed the VTOC.

Module	Label
ARCBVOL	ARCBVOL NORMAL MSG728 QUIT
ARCZVCUT	ARCZVCUT

8. **Back up any generation data group entries in VSAM catalog:** If the volume is owned by a VSAM catalog and the catalog resides on the primary volume, backup the generation data group entries in the VSAM catalog.

If the target backup volume is a single-file format 3480 tape, then allocate and open the tape data set as follows:

- Call ARCALTDS to allocate the tape data set. If the JFCB read fails, message ARC0739I is written to the backup activity log, ARCERP is called to log an internal error, ARCTFULL is called to mark the tape full so it will not be selected again, and processing ends after the MCP record has been updated. If a GETMAIN error occurs in ARCALTDS, message ARC0708I is written to the backup activity log. ARCTFULL is called to mark the tape full so it will not be selected again, and processing ends after the MCP record has been updated.
- Call ARCTOPEN to open the tape data set. If the open fails, issue message ARC0707I. ARCTFULL is called to mark the backup volume full so it will not be selected again, and processing ends after the MCP record has been updated.

ARCBVCAT is called to backup any generation data group base entries in the VSAM catalog.

If the backup volume is a tape volume, and ARCBVCAT fails with a retryable error condition, then ARCBVOL will retry the backup using a different tape volume. The following steps are performed:

- Call ARCTFULL to mark the current tape volume full
- Call ARCSELBV to release current tape volume
- Call ARCSELBV to select another tape daily backup volume
- If single-file format 3480 tape is being used then allocate and open the tape data set as documented above
- Call ARCBVCAT to retry backup of generation data group base entries
- If ARCBVCAT returns a code 12 on either attempt, the VCAT copy is good, but backup cannot continue on the same tape. In this case, ARCBVOL swaps tapes and continues backing up the primary volume
- If ARCBVCAT fails on the second attempt and message ARC0707I has not been issued by ARCBVCAT, then it is written to the backup activity log
- During tape swapping, if an error occurs in ARCSELBV either releasing the old tape or selecting the new tape, one of the following messages is written to the backup activity log: ARC0702I, ARC0703I, ARC0706I, ARC0708I, ARC0712I, ARC0730I, or ARC0733I, and processing ends after the MCP record has been updated.

If backup is to a single file 3480 tape, call ARCTCLOS to close the tape data set. If the close fails, message ARC0923I is written to the backup activity log, and processing ends after the MCP record has been updated.

If the backup volume is a DASD volume, and there was a non-retryable error, then call ARCUBVR to mark the volume unavailable. Processing ends after the MCP record has been updated.

If the backup volume is a DASD volume, and ARCBVCAT fails with a retryable error condition, then ARCBVOL swaps target volumes as follows:

- Call ARCBFULL to mark the current DASD volume full if there was not enough space on the target volume.
- Call ARCUBVR to mark the target volume unavailable for an open error.
- Call ARCSELBV to release current DASD volume
- Call ARCBGDBV to select another daily backup volume
- Call ARCBVCAT to retry backup of generation data group base entries
- If ARCBVCAT fails on its second attempt with a not enough space error, then call ARCBFULL to mark the DASD volume full. Processing ends after the MCP record has been updated.

If ARCBVCAT fails on its second attempt with an error other than not enough space, then call ARCUBVR to mark the DASD volume unavailable. Processing ends after the MCP record has been updated.

Module	Label
ARCBVOL	ARCBVOL ALOCOPEN_3480SF ALTDS BVCAT_DASD_ERR BVCAT_TAPE_ERR CLSTDS MSG707 MSG708 MSG739 NORMAL QUIT SELBVERR SWAPVOL TOPEN VTOCFULL
ARCALTDS	ARCALTDS
ARCBVCAT	ARCBVCAT
ARCTCLOS	ARCTCLOS
ARCTOPEN	ARCTOPEN
ARCTFULL	ARCTFULL
ARCSELBV	ARCSELBV
ARCWTO	ARCWTL
ARCERP	ARCERP
ARCBFULL	ARCBFULL
ARCBGDBV	ARCBGDBV
ARCUBVR	ARCUBVR

9. **Roll off old VTOC copy data set:** ARCUMC1 is called to update the MLI volume's free space for the newly created VTOC copy data set. ARCBROLV is called to roll off the oldest VTOC copy data set. Also, ARCBROLV will update the MCP record with the new VTOC copy data set information. If an error occurs, end the processing.

Module	Label
ARCBVOL	ARCBVOL ARCQUIT
ARCBROLV	ARCBROLV
ARCUMC1	ARCUMC1

10. **Back up eligible VSAM and non-VSAM data sets:** ARCBVOL calls ARCBVOL2 to create backup copies of all eligible VSAM and non-VSAM data sets on the primary volume.

Module	Label
ARCBVOL	ARCBVOL NORMAL
ARCBVOL2	ARCBVOL2

11. **Clean up and release all resources:** When all data sets have been backed up or an error has occurred preventing the volume backup operation from completing, various cleanup steps are performed. ARCFVSFM frees any storage obtained for the SDATA control blocks or the non-VSAM Format 1 DSCB queue.

If the VTOC copy is still open, an error has occurred. ARCZVCUT is called to close and deallocate the backup VTOC copy data set (suppress issuance of ARC0704I if an error is encountered).

If the VTOC copy data set is to be scratched, then ARCZSCR is called. Indicate that no erase is required if no writes have been done to the VTOC copy data set. If writes have been done, indicate the Erase-On-Scratch status is unknown.

If the VTOC data set is open (error condition occurred external to ARCZVTOC which caused processing to end early), call ARCZVTOC to close the VTOC data set.

ARCBVEND is called to perform cleanup processing for the ARCBVOL task. ARCBVOL posts ARCBGEN that it has finished backing up the volume. If the CDS resource is held (qname='ARCGPA ', rname='ARCCAT '), remove the ENQ by calling ARCUNLK. ARCBVOL will then wait for more work to do.

Module	Label
ARCBVOL	ARCBVOL NORMAL QUIT
ARCBVEND	ARCBVEND
ARCFVSC	ARCFVSFM
ARCLOCK	ARCUNLK
ARCWTO	ARCWTL

ARCZVCUT ARCZVCUT
ARCZVTOC ARCZVTOC
ARCZSCR ARCZSCR

Output

- Backup version created for each eligible data set.

Diagram 10.5: ARCBMBC - Move Backup Versions from Migration Volumes to Daily Backup Volumes

Input

- None.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCBMBC	ARCBMBC
ARCPDA	ARCPDA

2. **Initialize variables, create recovery control block (RCB) for subtask, issue starting message, and position to the first BCDS move backup version record (MCM) in the BCDS:** ARCBMBC is called to move the backup versions off the level 1 migration volumes. ARCDMY is called to obtain the current date for use in the starting message ARC0718I that ARCWTL issues. ARCGBCN is called to obtain the day in the backup cycle. ARCIRCB is called to initialize the RCB for ARCBMBC. ARCCRCB is called to create an RCB for the backup subtask ARCBMBV. ARCZPOS is called to position to the first BCDS move backup version record (MCM) record in the backup control data set (BCDS). If positioning fails, control is passed to step 6 on page 203 ARCBMBC calls ARCZRNXT to read each MCM record. If the reading of the MCM records fails in ARCZRNXT, control is passed to step 6 on page 203 ARCBMBC copies the data set name and volume serial number from the MCM record. If DFHSM is shut down, placed in emergency mode, backup processing is held, or message ARC0715I is issued, control is passed to step 6 on page 203 The processing continues with next record in MCM until all records are processed in MCM.

Module	Label
ARCBMBC	ARCBMBC TIMEMSG INIT POSMCM READNEXT
ARCALNDR	ARCDMY
ARCCRCB	ARCCRCB ARCIRCB
ARCGBCN	ARCGBCN
ARCWTO	ARCWTL
ARCZPOS	ARCZPOS
ARCZRNXT	ARCZRNXT
ARCZRPLS	ARCZRPLS

3. **Locate the mounted volume entry table for the migration volume and backup volume. Obtain the Format 1 data set control block (DSCB) for the data set:** ARCBMBC locates the mounted volume table (MVT) for the level 1 volume in the MVT chain. If the volume has no entry in the MVT chain, ARCBMBC calls ARCZREAD to read the MCDS volume record (MCV) for the volume. If an MCV record exists, ARCBMBC calls ARCGMAIN to obtain storage for a temporary MVT entry and initializes the MVT entry. If the GETMAIN macro fails for the MVT entry, ARCBKMSG is called to issue message ARC0716I and

control is passed to step {ALLOC}. ARCFDVTE is called to update the MVT unit name, the number of tracks, and the amount of FREESPACE. ARCENQ is called to put the MVT on the MVT chain. If this is a primary volume, a flag is set to indicate a migration volume in the local copy of the MVT. ARCALVOL is called to allocate the migration volume. ARCBMBC then issues an OBTAIN macro to read the Format 1 DSCB. If the OBTAIN fails for a not-found condition for the Format 1 DSCB, ARCZDEL is called to delete the MCM record. If the Format 1 DSCB indicates the data set is empty, and a volume has been allocated, ARCULVOL is called to deallocate the volume. If the FSR has been created, then ARCDFSR is called to process and delete the FSR. Cleanup then continues as in step 7 on page 203. If the data set is not empty, ARCCLUSZ is called to calculate the size of the data set. ARCZREAD is called to read the BCDS backup version record (MCC). If the MCC is not found, call ARCZSCR to scratch the backup version and ARCZDEL deletes the MCM. If the MCC BCDS backup version record is found and it is marked for deletion with erase, then the backup version is erased by calling ARCZSCR. If the scratching was successful, both the MCC and the MCM are deleted, but if the scratching fails, leave the MCC and MCM records alone so that the backup version will be scratched later, and go on to step 5.

Module	Label
ARCBMBC	ARCBMBC MOVEVERS SETUP LOOKMVT READMCV PRIMARY ALLOCVOL ISSUEDBT CALCSIZE READMCC
ARCALVOL	ARCALVOL
ARCBKMSG	ARCBKMSG
ARCCFSR	ARCDFSR
ARCCLUSZ	ARCCLUSZ
ARCENQ	ARCENQ
ARCFDVTE	ARCFDVTE
ARCGMAIN	ARCGMAIN
ARCULVOL	ARCULVOL
ARCWTO	ARCWTL
ARCZDEL	ARCZDEL
ARCZSCR	ARCZSCR
ARCZREAD	ARCZREAD

4. **Move the backup version to a daily backup volume:** Call ARCCFSR to create the function statistics record (FSR). ARCIRCB is then called to initialize the recovery control block (RCB) for the subtask. Initialize the parameter list for the attach of ARCBMBV. Initialize the parameter list for the call to ARCBATTC. Call ARCBATTC. The results of the data set movement are logged by calling ARCMSG to issue message ARC0734I. If ARCBMBC allocated the migration volume, ARCULVOL is called to deallocate the volume. If data movement was successful, ARCZDEL is called to delete the MCM record.

Module	Label
ARCBMBC	ARCBMBC MOVEBACK BATTCALL LOGRESLT
ARCAMSG	ARCAMSG
ARCBATTC	ARCBATTC
ARCBKMSG	ARCBKMSG
ARCCFSR	ARCCFSR
ARCCRCB	ARCCRCB ARCIRCB
ARCULVOL	ARCULVOL
ARCZDEL	ARCZDEL

5. **Process the special Return Codes from the movement of the data set:** If the Return Code from the backup operation indicates an open error and tape, processing is ended and all backup activity is held. If the tape data set exit abnormally ended, processing is ended. Cleanup continues as in step 7.

Module	Label
ARCBMBC	ARCBMBC SPEERROR

6. **Detach data set processor:** When all of the data set records have been processed or an ending error has occurred, call ARCBCLN to post ARCBMBV to close the 3480 single-file format tape data set, if required, detach the data set processor subtask ARCBMBV, and delete the RCB for ARCBMBV. Continue normal cleanup as in step 7.

Module	Label
ARCBMBC	ARCBMBC CLEANUP
ARCBCLN	ARCBCLN

7. **Clean up and release all resources and issue the completion message:** ARCZPLS is called to release any control data set positioning, when necessary. ARCDFSR processes and deletes any outstanding FSR. ARCDEQ is called to remove the temporary MVT from the MVT chain. ARCFMAIN is called to free the temporary MVT. If an error occurs in FREEMAIN, ARCBKMSG is called to issue message ARC0716I. ARCBMBC calls ARCSELBV to release a DASD backup volume if one is allocated. If tape, ARCBMBC returns to ARCBGEN without deallocating the tape daily backup volume that is allocated. ARCWTI issues completion message ARC0719I.

Module	Label
ARCBMBC	ARCBMBC RLSERPL SCANMVT RELDASD ISSUEEND
ARCBKMSG	ARCBKMSG
ARCCFSR	ARCDFSR
ARCENQ	ARCDEQ
ARCGMAIN	ARCFMAIN
ARCSELBV	ARCSELBV

ARCWTO
ARCZPLS

ARCWTL
ARCZPLS

Output

- None.

Diagram 10.6: ARCBMDS - Back Up Migrated Data Sets

Input

- Backup Control Data Set (BCDS)
- Mounted Volume Tables (MVTs)
- VTOC of Migration Volume
- Format 1 DSCB
- Recovery Control Block (RCB)
- Functions Statistics Record (FSR)
- Request Parameter List (RPL)
- Backup Task Control Block (BTCB)
- Management Communication Vector Table (MCVT).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCBMDS	ARCBMDS
ARCPDA	ARCPDA

2. **Initialize variables, create RCB for subtask, issue starting message, and position to the first BCDS backup migrated data set record (MCL) in the BCDS:**
 ARCBMDS is called to back up any updated data sets that have migrated. The date and time are obtained, and ARCDMY converts the date to calendar form. ARCWTL is called to issue a starting message ARC0735I. Local variables are initialized. ARCGBCN is called to get the day in the backup cycle. ARCIRCB is called to initialize the RCB for ARCBMDS. ARCCRCB is called to create an RCB for the backup subtask ARCBUDS. ARCZPOS is called to position to the first MCL record in the BCDS and ARCZRPLS is called to store the RPL pointer in the RCB. ARCBMDS loops through the MCL records by calling ARCZRNXT to read the next sequential record and calling ARCZRPLS to remove the RPL pointer in the RCB. If DFHSM is shut down, placed in emergency mode, or backup processing is held, message ARC0715I is issued and control passes to step 6 on page 208. If there is an error positioning to or reading the next record, control passes to step 6.

Module	Label
ARCBMDS	ARCBMDS TIMEMSG INIT POSMCL MSG715 READNEXT
ARCALNDR	ARCDMY
ARCCRCB	ARCIRCB ARCCRCB

ARCGBCN	ARCGBCN
ARCWTO	ARCWTL
ARCZPOS	ARCZPOS
ARCZRNXT	ARCZRNXT
ARCZRPLS	ARCZRPLS

3. **Determine data set backup eligibility:** To be eligible for backup, a data set must never have been backed up before or a specified number of days must have elapsed since the last backup version of the data set was created. When a data set is SMS-managed and a backup version exists, ARCZSCMC is called to obtain the backup frequency in the management class definition and ARCZTODC is called to convert the time of day clock value of the last backup date in the MCL record to a packed decimal date for the frequency check. ARCZREAD is called to read the BCDS for eligibility checking from information in the MCB record. If the read fails, ARCAMSG is called to issue data set movement message ARC0734I. If the maximum backup versions allowed for non-SMS-managed data sets is zero, ARCZREAD is called to read the MCD record for update, ARCZRPLS is called to store the RPL pointer in the RCB, ARCZUPDT is called to update the MCD record to reset the MCL field, ARCZRPLS is called to remove the RPL pointer in the RCB, and ARCZDEL is called to delete the MCL record.

Module	Label
ARCBMDS	ARCBMDS
	BAKSETUP
	LRECSTUP
	READMCB
	DSERROR
	LOGRESLT
	CHKDBU
	UPDMCD
	DELLREC
	DELMCL
	SPEERROR
	SKIPDS
ARCAMSG	ARCAMSG
ARCZDEL	ARCZDEL
ARCZSCMC	ARCZSCMC
ARCZTODC	ARCZTODC
ARCZREAD	ARCZREAD
ARCZRPLS	ARCZRPLS
ARCZUPDT	ARCZUPDT

4. **Locate or build the mounted volume table for the migration volume and allocate the migration volume. Obtain Format 1 DSCB for the data set:** If the data set resides on a migration level 1 volume, ARCBMDS locates the level 1 volume in the MVT chain. If an entry is not found in the MVT chain, ARCZREAD is called to read the MCDS volume record (MCV) for the migration volume. If no MCV exists, ARCAMSG is called to issue message ARC0734I to indicate that the data set is not backed up. If the MCV exists, ARCGMAIN is called to get storage for the MVT. If the GETMAIN fails, ARCBKMSG is called to issue message ARC0716I. ARCFDVTE is called to update the device type, the number of tracks, and the amount of free space in the MVT. The base MVT entry is built. ARCENQ is called to put the entry on the MVT chain. If the data set resides on a migration level 2 volume, ARCZREAD is called to read the MCV record and a local MVT is built. When the MVT has been located or

created, ARCALVOL is called to allocate the migration volume. If the data set is not in a small-data-set-packing (SDSP) data set, an OBTAIN is issued to read the Format 1 data set control block (DSCB). If the data set is in an SDSP data set, a dummy Format 1 DSCB is built. If the Format 1 DSCB indicates that the data set is empty, it is skipped. ARCCLUSZ is called to calculate the size of the data set when it is not empty. If either the data set is empty as indicated by the Format 1 DSCB or ARCCLUSZ calculates that no space is presently being used by the data set, ARCZREAD is called to read the MCD record for update, ARCZRPLS is called to store the RPL pointer in the RCB, ARCZUPDT is called to update the MCD record to reset the MCL field, ARCZRPLS is called to remove the RPL pointer in the RCB, and ARCZDEL is called to delete the MCL record. ARCZUPDT is called to update MCD record to reset the MCL field and ARCZDEL is called to delete the MCL.

Module	Label
ARCBMDS	ARCBMDS
	BAKSETUP
	LOOKMVT
	READMCV
	DSERROR
	LOGRESLT
	PRIMARY
	READML2
	ALLOCVOL
	ISSUEOBT
	BUILDDUM
	CALCSIZE
	UPDMCD
	DELLREC
	DELMCL
	SPEERROR
ARCALVOL	ARCALVOL
ARCAMSG	ARCAMSG
ARCBKMSG	ARCBKMSG
ARCCLUSZ	ARCCLUSZ
ARCENQ	ARCENQ
ARCFDVTE	ARCFDVTE
ARCGMAIN	ARCGMAIN
ARCZDEL	ARCZDEL
ARCZREAD	ARCZREAD
ARCZRPLS	ARCZRPLS
ARCZUPDT	ARCZUPDT

5. **Back up migrated data set:** ARCCFSR is called to create a Functional Statistics Record (FSR), which is updated with current values. ARCIRCB is called to initialize the RCB for ARCBUDS. The parameter list for ARCBUDS is initialized. The parameter list for ARCBATTC is initialized and then ARCBATTC is called. Upon return from ARCBATTC, ARCAMSG is called to write message ARC0734I to the log, indicating the results of the backup operation. If the backup of the migrated data set was successful, ARCZDEL is called to delete the MCL record. ARCULVOL is called to deallocate the migration volume, if ARCBMDS has allocated the volume. ARCDFSR then processes and deletes the FSR, if ARCBATTC has not already freed it.

Module	Label
ARCBMDS	ARCBMDS MIGBCKUP CREATFSR BUDSCALL DSERROR LOGRESLT DELLREC DELMCL SPEERROR
ARCAMSG	ARCAMSG
ARCBATTC	ARCBATTC
ARCBKMSG	ARCBKMSG
ARCCFSR	ARCCFSR ARCDFSR
ARCCRCB	ARCIRCB
ARCULVOL	ARCULVOL
ARCZDEL	ARCZDEL

6. **Clean up and release all resources and issue the completion message:** When all of the data sets have been processed or an ending error has occurred, ARCBCLN is called to detach the ARCBUDS task. ARCZRLSE is called, when necessary, to release any control data set positioning. ARCDFSR is called to process and delete any remaining FSRs. ARCDEQ is called to remove any temporary MVTs from the queue. ARCFMAIN is called to free the temporary MVT storage. If an error occurs during FREEMAIN processing, ARCBKMSG is called to issue the appropriate error message. If a DASD daily backup volume is currently allocated, ARCSELBV is called to release the volume. Call ARCBKMSG if release is not successful. Tape volumes are not deallocated before the return to ARCBGEN. ARCWTL issues completion message ARC0736I. ARCBMDS returns to ARCBGEN.

Module	Label
ARCBMDS	ARCBMDS CLEANUP SCANMVT DASDREL ISSUEEND
ARCBCLN	ARCBCLN
ARCBKMSG	ARCBKMSG
ARCCFSR	ARCDFSR
ARCENQ	ARCDEQ
ARCGMAIN	ARCFMAIN
ARCSELBV	ARCSELBV
ARCWTO	ARCWTL
ARCZRLSE	ARCZRLSE

Output

- Recovery Control Block (RCB)
- Mounted Volume Table (MVT)
- Daily Backup Volume
- Format 1 Data Set Control Block (DSCB)
- Function Statistics Record (FSR)

- DASD Daily Backup Volume
- Backup Task Control Block (BTCB)
- Return Codes:

Note: All Return Codes map into an ARC13xxI message where xx is the Return Code.

- 0 - Backup version successfully created for every migrated data set meeting the eligibility requirements
- 3 - Obtain error reading the Format 1 DSCB

Reason Code:

--- Return Codes from OBTAIN macro

- 4 - Required migration volume not available
- 25 - Error reading MCG record during backup

Reason Codes:

--- Return Codes from ARCZREAD

- 66 - Retired version for data set exists
- 70 - Error while processing SMS-managed data set
 - 4 - SMS is not installed
 - 5 - Error obtaining management class definition.

Diagram 10.7: ARCBKMSG - Issue Error Messages for the Data Set Backup Processor Subtask

Input

- Input Parameters
- PROFLAGS - Caller of ARCBKMSG
- Error Code Relating to Message to be Issued (ERRCODE)
- Address of the Mounted Volume Table (MVTP).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCBKMSG	ARCBKMSG
ARCPDA	ARCPDA

2. **Verify that the parameters passed are valid:** Verify that both ARCBATTC and ARCBATTC's caller are specified, when ARCBATTC is the caller. If ARCBATTC is not the caller, ARCBSPIL, ARCBMBC or ARCBMDS must be specified. Verify that the error code passed is not less than or equal to zero, and that the address of the mounted volume table (MVT) is not equal to zero. If any of these conditions are not true, fail the request by invoking ARCERP in DEBUG mode with the invalid Return Code.

Module	Label
ARCBKMSG	ARCBKMSG INVALID
ARCERP	ARCERP

3. **Select message routine to be processed:** If the caller of ARCBATTC is ARCBVOL2 or ARCBSPIL, select the backup, cleanup, or spill messages. If the caller of ARCBATTC is ARCBMBC or ARCBMDS, select the movement of backup versions and backup migrated data set messages.

Module	Label
ARCBKMSG	ARCBKMSG SPILBVOL BMBCBMDS

4. **Issue the appropriate message:**
 - a. Based on the error code and flags passed on input for backup, cleanup, or spill, build the appropriate message inserts and call ARCWTL to issue one of the following messages: ARC0702I, ARC0703I, ARC0706I, ARC0708I, ARC0712I, ARC0730I, or ARC0733I.
 - b. Based on the error code and the flags passed on input for movement of backup versions or backup of migrated data sets, build the appropriate message inserts and call ARCWTL to issue one of the following messages: ARC0709I, ARC0710I, ARC0711I, ARC0713I, ARC0716I, or ARC0731I.

Module	Label
ARCBKMSG	ARCBKMSG
ARCWTO	ARCWTL

Output

- None.

Diagram 10.8: ARCBATTC - Attach the Backup Data Set Process or Subtasks

Input

- Input Parameters
- Backup Task Control Block (BTCB)
- Recovery Control Block (RCB)
- ARCBMBV Parameter List
- ARCBUDS Parameter List
- ARCBVDS Parameter List
- Mounted Volume Table (MVT)
- Backup Control Record (BCR)
- Function Statistics Record (FSR).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCBATTC	ARCBATTC
ARCPDA	ARCPDA

2. **Validate parameter list ARCBATTP:** Upon entry, ARCBATTC validates that the parameter list for its processing has been initialized properly. If not initialized properly, ARCERP is invoked in DEBUG mode, and a Return Code is set in ARCBATTP indicating which information is missing or incorrect.

Module	Label
ARCBATTC	ARCBATTC
	INVALID
ARCERP	ARCERP

3. **Determine if the subtask requested is already attached:** Check the BTCB to determine if the requested subtask is already attached. If it is, do not reattach it. If it is not attached, put the task ID in Register 1 and attach the subtask.

Module	Label
ARCBATTC	ARCBATTC
	SETSUBTK
	ATTACH
ARCBMBV	ARCBMBV
ARCBUDS	ARCBUDS
ARCBVDS	ARCBVDS
ARCESTAI	ARCESTAI

4. **Determine whether single-file tape mode:** If the field in the RCB of any one of the attached backup subtasks indicates that 3480 single-file format is specified, set the field on in all the record control blocks (RCB).

Module	Label
ARCBATTC	ARCBATTC
	SNGFFT

5. **Get a daily backup volume:** ARCBATTC ensures the availability of a backup or spill volume as follows:

When the caller of ARCBATTC is ARCBVOL2 and there is a need to get a new daily backup volume, perform the following:

- a. ARCBGDBV is called to get the daily backup volume.
- b. If a backup volume is not obtained, indicate that no backup volumes are available. Call ARCBKMSG to issue the appropriate message and end processing.
- c. If processing a multiple file format tape volume, determine if the maximum file sequence number has been reached. If it has, call ARCTFULL to mark the volume full.
- d. If processing a 3480 single file format tape, determine if the maximum volume sequence number (215) has been reached. If it has, POST the subtask that opened the tape data set to close it. If the close fails, call ARCWTL to issue message ARC0923I, issue a DETACH of the task with STAE= YES to force the close of the tape data set, REATTACH the task, and call ARCTFULL to mark the tape full.
- e. If the volume is marked full, call ARCSELBV to release the backup tape. If the release fails, call ARCBKMSG to issue the appropriate message, and end processing.

When the caller of ARCBATTC is ARCBVOL2 and there is no need to get a new daily backup volume, perform the following:

- a. If the daily backup volume is a tape volume, steps c and d above are executed.
- b. If the daily backup volume is full, perform the same processing as in step e, above.

When the caller is not ARCBVOL2 and the caller wishes to use any device type already allocated, perform the following:

- a. If a backup volume is not currently allocated, call ARCSELBV to select a backup volume for the subtask. If there is a failure selecting a volume, ARCBKMSG is called to issue the appropriate error message, and processing is ended.
- b. If a tape volume is selected, verify that it is not full by performing steps c through e in the first section above.

When the caller specifically requests a tape volume, perform the following:

- a. If tape volumes are available but none are currently allocated, call ARCSELBV to select a backup volume for the subtask.
- b. If there is a failure selecting a volume other than a volume not available, ARCBKMSG is called to issue the appropriate error message, and processing is ended.
- c. If neither a tape volume nor a DASD volume is available, ARCBKMSG is called to issue the appropriate error message, and processing is ended.
- d. If a tape volume is not available but a DASD volume is available, skip the data set, and end processing.
- e. If a tape volume is selected, verify that it is not full by performing steps c through e in the first section above.

When the caller specifically requests a DASD volume, perform the following:

- a. If DASD volumes are available but none are currently allocated, call ARCBSELBV to select a backup volume for the subtask.
- b. If there is a failure selecting a volume other than a volume not available, ARCBKMSG is called to issue the appropriate error message, and processing is ended.
- c. If the Return Code from ARCBSELBV indicates neither a DASD nor a tape volume is available, call ARCBKMSG to issue the appropriate error message, and processing is ended.
- d. If a DASD volume is not available but a tape volume is available, and end processing.

Module	Label
ARCBATTC	ARCBATTC GETBV CHKFULVL BLDTFULL CLOSTPDS ATTACH RELBVOL SELBVOL ISSUEMSG
ARCBGDBV	ARCBGDBV
ARCBKMSG	ARCBKMSG
ARCBSELBV	ARCBSELBV
ARCTFULL	ARCTFULL
ARCWTO	ARCWTL

6. **If the backup data set exit is requested, take exit:** Set up ESTAE environment for invocation of user exit. If the ESTAE setup fails, call ARCBKMSG to issue an ARC0734I message.

Call the backup data set user exit ARCBDEXT and check the Return Code when exit has completed processing. If the exit sets a Return Code of 8, the BCDS backup migrated data set record (MCL) is deleted.

Module	Label
ARCBATTC	ARCBATTC TAKEEXIT SETESTAE USEREXIT
ARCBKMSG	ARCBKMSG
ARCBDEXT	ARCBDEXT
ARCZDEL	ARCZDEL
ARCZREAD	ARCZREAD
ARCZUPDT	ARCZUPDT

7. **Finish setup for post of data set processor subtasks:** If DFHSM in emergency mode or backup disabled do not allow data set to be processed or retried. If BACKUP or AUTOBACKUP is held, do not allow a data set to be processed or retried. If a data set is being retried, free the old FSR and create a new FSR and update it with the data set age, data set name, and the function type for the new FSR. If there is an error FREEMAINing the FSR, call ARCBKMSG to issue ARC0708I message.

ARCBATTC updates the BTCB, and then posts the data set processor subtask with work to do. ARCBATTC waits for processing to complete.

Module	Label
ARCBATTC	ARCBATTC SETUPOST ISSUEMSG
ARCBKMSG	ARCBKMSG
ARCCFSR	ARCCFSR
ARCGMAIN	ARCFMAIN

8. **Determine type of error that occurred in the data set processing subtask:** If there was an error detected against the input data set, end the data set processing and do not retry the data set.

If output to tape and unable to mount the initial volume for the first time, then detach the subtask (STAE = YES), call ARCUBVR to update the backup cycle volume record (BVR) to mark the volume unavailable, call ARCSELBV to release the tape volume. If the caller is ARCBVOL2, call ARCBGDBV to get a new backup volume; otherwise, ARCBATTC selects a new backup volume. If there is a failure getting another backup volume, the data set will not be retried. Call ARCWTL to issue message ARC0746I to the backup log and return to the caller. Reattach the data set processor subtask.

If output is to tape and an I/O error is detected, call ARCAMSG to issue message ARC0734I, close the tape data set, release the volume, and get another volume and retry the data set once. If the data set fails a second time, skip the data set.

When a data movement error has occurred and it is the first error, close the tape data set if output is to tape, release the volume, get another volume, and retry the data set once. If a second data movement error occurs on the same data set, skip the data set.

The data set should be skipped if the whole data set would not fit on the volume or this is the second failure on this data set. If either of these cases is true, do not retry the data set, call ARCAMSG to issue message ARC0734I, and return to the caller. Otherwise, call ARCBFULL to mark the DASD backup volume full. Call ARCSELBV to release the volume. If the caller is ARCBVOL2, call ARCBGDBV to get a new backup volume. Otherwise, ARCBATTC selects a new backup volume. If the DASD backup volume is not mounted (dynamic allocation error and MSS volume), call ARCUBVR to mark the volume unavailable and call ARCSELBV to release the backup volume. If the caller is ARCBVOL2, call ARCBGDBV to get a new backup volume. Otherwise, ARCBATTC selects a new backup volume. If a new volume could not be obtained, do not retry the data set.

If abnormal end occurred in the subtask, add 900 to the Return Code. If a tape is allocated to the data set processor subtask, call ARCSELBV to release the tape. If the release fails do not retry the data set. Detach the subtask with STAE = NO, re-attach the failing subtask and get another backup volume. Return to the caller.

If shutdown is requested during wait for a tape to be mounted, detach the failing subtask, and return to the caller.

Module	Label
ARCBATTC	ARCBATTC

	IOERRORS
	DATAMOVE
	BVFULL
	SWAPDASD
	PROABEND
	FSTFAIL
	ISSUEMSG
	UBVRERR
	RELBVOL
	ATTACH
	GETBV
	CLOSETPDS
ARCAMSG	ARCAMSG
ARCBFULL	ARCBFULL
ARCBGDBV	ARCBGDBV
ARCBKMSG	ARCBKMSG
ARCCBVR	ARCUBVR
ARCCFSR	ARCCFSR
ARCGMAIN	ARCFMAIN
ARCSELBV	ARCSELBV
ARCTFULL	ARCTFULL
ARCWTO	ARCWTL

Output

- Backup Task Control Block (BTCB)
- Function Statistics Record (FSR)
- ARCBUDS Parameter List
- ARCBVDS Parameter List
- ARCBMBV Parameter List
- Return Codes:
 - 2 - Skip the data set
 - 4 - Halt processing, release of volume failed
 - 6 - Skip the data set, requested backup device type not available
- Reason Codes:
 - 4 - DASD is available, caller requested tape
 - 8 - Tape is available, caller requested DASD
 - 8 - Halt processing, no backup volumes available
 - 10 - Halt processing, BVR update failed
 - 12 - ESTAE setup for user exit failed, halt processing
 - 86 - Shut down requested while waiting for tape mount
 - 95 - Tape could not be mounted
- Reason Codes:
 - 4 - Initial tape mount request
 - 8 - End of volume mount request.

Diagram 10.9: ARCBCLN - Clean Up the Backup Data Set Processor Tasks

Input

- Backup Task Control Block (BTCB)
- Recovery Control Block (RCB)
- Spill or Backup Processing Indicating Flags
- Address of Target MVT for the Tape Data Set to be Closed.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCBCLN	ARCBCLN
ARCPDA	ARCPDA

2. **Validate parameter task ID passed to ARCBCLN:** Upon entry, ARCBCLN validates that the parameter is within the valid range of task IDs for backup. If task ID is not valid, ARCERP is invoked in DEBUG mode, a Return Code is set indicating the parameter is incorrect. Return to the caller.

Module	Label
ARCBCLN	ARCBCLN
ARCERP	ARCERP

3. **Determine if open 3480 single-file format data set for task ID:** For each data set subtask, determine whether there is an open 3480 single-file format data set. If the RCB indicates an open 3480 single-file format data set, go to step 4; otherwise, go to step 5.

Module	Label
ARCBCLN	ARCBCLN FINDRCB

4. **Close 3480 single-file format data set:** Post the work-to-do event control block (ECB) of the data set processor subtask that opened the data set with completion code (X'99') to close the data set. Wait for the ending ECB. If the close fails (completion code X'65'), obtain the Return Code from the close from the appropriate subtask parameter list and then call ARCWTL to issue message ARC0923I. Call ARCTFULL to mark the volume full.

Module	Label
ARCBCLN	ARCBCLN CLOSTPDS
ARCTFULL	ARCTFULL
ARCWTO	ARCWTL

5. **Detach data set processor subtasks:** If the close of the 3480 single-file format data set failed, issue a DETACH macro for the data set processor subtasks with STAE = YES to force release of the volume. If a 3480 single-file format data set was not open or the close was successful, detach the data set processor subtasks.

Module	Label
ARCBCLN	ARCBCLN

6. **Delete RCBs for data set processor subtasks:** Call ARCDRCB to delete the data set processor subtasks' recovery control blocks.

Module	Label
ARCBCLN	ARCBCLN
ARCCRCB	ARCDRCB

Output

- None.

Diagram 10.10: ARCBUDS - Create a New Backup Version of a Non-VSAM Data Set

Input

- ARCBUDSP Parameter List
- Format 1 DSCB
- Primary or Migration Volume
- Data Control Block (DCB)
- MCDS Data Set Record (MCD)
- Source Volume Mounted Volume Table (MVT)
- Target Volume Mounted Volume Table (MVT)
- Backup Task Control Block (BTCB).

Inout

- ARCBUDSP Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCBUDS	ARCBUDS
ARCPDA	ARCPDA

2. **Upon being attached, perform program initialization:** Perform program initialization. Issue a WAIT macro to wait for the work-to-do event control block (ECB).

Module	Label
ARCBUDS	ARCBUDS LOOP

3. **Upon being POSTed for work to do, check the completion code in the ECB.:** Check the completion code in the ECB. If the completion code is XX'00', perform normal processing (see steps 4 through 15). If the completion code is XX'99', close the 3480 single file format data set (see step 17). If the completion code is neither, call ARCERP with a Return Code of 408 and ends processing.

Module	Label
ARCBUDS	ARCBUDS LOOP NORMAL CL3480
ARCERP	ARCERP

4. **If ARCBUDS is posted to perform normal processing:** Input parameters are validated. If there are any invalid parameters, ARCERP is called with a Return Code of 4*mm*, where *mm* is a value from 0 to 10 indicating the parameter in error, and processing ends. Local variables are initialized. ARCWLOG is called to log the start of backing up the data set.

Module	Label
ARCBUDS	ARCBUDS NORMAL START
ARCERP	ARCERP
ARCILOG	ARCWLOG

5. **Determine if another DFHSM function is processing the data set:** ARCLOCKC is called to perform a test enqueue on the data set name to verify that another DFHSM function is not currently processing the data set. If another DFHSM function is currently processing the data set, the data set is not backed up.

Module	Label
ARCBUDS	ARCBUDS NORMAL ELIGIBLE
ARCLOCK	ARCLOCKC

6. **Create placeholder BCDS backup version record (MCC). Read MCD record if backing up a migrated data set:** If a migrated data set is being backed up, ARCZREAD is called to read the MCD record from the migration control data set (MCDS) to get information from the Format 1 data set control block (DSCB) of the original data set. ARCZGENM is called to generate a name for the backup version and to create the placeholder backup MCC in the backup control data set (BCDS).

Module	Label
ARCBUDS	ARCBUDS NORMAL CHKCDS
ARCZGENM	ARCZGENM
ARCZREAD	ARCZREAD

7. **Allocate source data set:** If the data set being backed up is migrated and resides in a small-data-set-packing (SDSP) data set, ARCALSDP is called to allocate the SDSP data set. If DFDSS is the data movement method in a JES2 environment, ARCLOCKC is called to conditionally enqueue on SYSDSN; otherwise, ARCALSHR is called to allocate the source data set or ARCALSUL is called to allocate the user label data set. For any allocation failure, proceed to step 14 on page 223 to end processing.

Module	Label
ARCBUDS	ARCBUDS NORMAL ALLOCIN
ARCALOLD	ARCALSHR ARCALSUL
ARCALSDP	ARCALSDP
ARCLOCK	ARCLOCKC

8. **Allocate target backup version:** If the size of the input data set was not passed by the caller, ARCCLUSZ is called to calculate the data set size. If the data set is too large to reside on a DFHSM-owned volume, then fail data set backup. If the data set is from an SDSP data set, calculate the size from MCDCSZ in the MCD record. If the target backup volume is a DASD volume, ARCSPCNV is

called to convert the input data set size to the target output size. If the data set should be compacted, ARCZCOMP is called to determine the compaction table to use during backup of the data set. ARCALNDS is called to allocate the backup version on a DASD backup volume. If the target volume is a tape daily backup volume, ARCALTDS is called to allocate the backup version if the data set is not already opened. Allocation of the backup version on a tape daily backup volume means reading the job file control block (JFCB), and updating it by inserting the data set name, file sequence number, and volume serial number. If any failures occur, proceed to step 14 on page 223 to end processing.

Module	Label
ARCBUDS	ARCBUDS NORMAL ALLOCOUT COMPCTDS
ARCALNDS	ARCALNDS
ARCALTDS	ARCALTDS
ARCCLUSZ	ARCCLUSZ
ARCSPCNV	ARCSPCNV
ARCZCOMP	ARCZCOMP

9. **Open target backup version:** If the target volume is a DASD backup volume, ARCDOPEN is called to open the backup version. If the target volume is a tape daily backup volume, ARCTOPEN is called to open the backup version. ARCTOPEN is not called if writing to an already-opened 3480 tape with single file format. If the open of the backup version is successful, the pointer to the DCB is stored in the recovery control block (RCB). If the data set being backed up is not a migrated data set, the Common Data Set Descriptor Record (CDD) is built. Each backup version and migration copy has a CDD in the first record. If the open fails, proceed to step 14 on page 223 to end processing.

Module	Label
ARCBUDS	ARCBUDS NORMAL OPENOUT
ARCDOPEN	ARCDOPEN
ARCTOPEN	ARCTOPEN

10. **Copy data using DFHSM or DFDSS:** If the data set is being backed up from a level 0 volume and DFHSM is running in a multiple-host processor environment and global data-set-level serialization of system resources is not provided by system facilities, ARCCKVOL is called to get unit control block (UCB) information and ARCULOCK is called to reserve the source volume. If the erase status is not already determined, ARCKEOS is called to obtain it. The data set is then copied to the target volume.

- a. **COPY DATA USING DFHSM:** If the data set is an OS CVOL or basic direct access method (BDAM) data set, ARCBODS is called to back it up. If the data set is a physical sequential data set, ARCMSDS is called to back it up. If the data set is a partitioned data set, ARCOMPDS is called to back it up. If the data set being backed up is a migrated data set, ARCMMDSS is called to back it up. If an error occurs obtaining the erase status or during data movement, proceed to step 14 on page 223 to end processing.
- b. **COPY DATA USING DFDSS:** If DFDSS is the data movement method chosen then an eligible data set residing on a level 0 volume will be backed up using DFDSS as the data mover. If the data set is eligible, ARCMDSS is called

to back up the data set. If an error occurs obtaining the erase status or during data movement, proceed to step 14 on page 223 to end processing.

Module	Label
ARCBUDS	ARCBUDS NORMAL COPY
ARCBODS	ARCBODS
ARCCKEOS	ARCCKEOS
ARCKVOL	ARCKVOL
ARCMDSS	ARCMDSS
ARCMMS	ARCMMS
ARCMPS	ARCMPS
ARCMSDS	ARCMSDS
ARCULOCK	ARCULOCK

11. **Reset data set updated bit:** The date-last-referenced needs to be reset to the value it had before DFHSM backed up the data set because DFHSM opened and closed the data set during backup causing the date-last-referenced in the Format 1 DSCB to be set to the current date.

If the data set being backed up resides on a level 0 volume, ARCZUF1 is called to turn off the data-set-updated bit in the Format 1 DSCB and to reset the date-last-referenced in the Format 1 DSCB. The date-last-referenced needs to be reset to the value it had before DFHSM backed up the data set because DFHSM opened and closed the data set during backup. This caused the date-last-referenced in the Format 1 DSCB to be set to the current date. If the data set being backed up is a migrated data set, ARCZREAD is called to set the data-set-updated bit to zero in the MCD and ARCZUPDT is called to write the updated record back to the MCDS. If the source volume has been reserved, ARCUUNLK is called to release the volume. If an error occurs, proceed to step 14 on page 223 to end processing.

Module	Label
ARCBUDS	ARCBUDS NORMAL COPY RESET
ARCULOCK	ARCUUNLK
ARCZREAD	ARCZREAD
ARCZUF1	ARCZUF1
ARCZUPDT	ARCZUPDT

12. **Back up the discrete Resource Access Control Facility (RACF) profile:** If RACF profile backup versions are desired and the data set is discretely RACF protected, ARCRACF is called for cataloged data sets that are RACF-indicated, and ARCVSCHK is called for migrated virtual storage access method (VSAM) data sets to back up the discrete RACF profile. If an error occurs, ARCWTI is called to write message ARC0382I to the backup log and processing continues.

Module	Label
ARCBUDS	ARCBUDS NORMAL BKUPRACF MSG382
ARCRACF	ARCRACF

ARCVSCHK ARCVSCHK
 ARCWTO ARCWTL

13. **Update the BCDS records:** If the caller did not pass the generation number of the last backup version created for this data set, ARCZREAD is called to read the BCDS data set record (MCB) to get the generation number. ARCZREAD is called to read the BCDS backup version record (MCC) for update. Information pertaining to the backup of the data set is inserted into the MCC and ARCZUPDT is called to update the MCC. ARCZREAD is called to read the MCB for update. If it is found and the generation number passed by the caller is not the same as the generation number in the MCB, ARCZREAD is called to read the MCC record for update, the generation number in the MCC is corrected, and ARCZUPDT is called to update the MCC. If the MCB is not found, initialize a new MCB record. Insert into the existing or new MCB information pertaining to the backup of the data set. If an MCB is found, ARCBCEBV is called to collect the entries from the MCB that describe excess backup versions. If the data set is on a volume with Guaranteed Backup Frequency (MVTGBF) and the process is incremental backup (BTCBFTOT), and the data set has not changed since the last backup, turn on the CEBV_SELECT_LATEST flag before calling ARCBCEBV. ARCZWRIT is called to write a new MCB. ARCZUPDT is called to update the existing MCB. If any excess backup versions exist, and an error occurred while writing or updating the MCB, and a new backup version of the discrete RACF profile was created, ARCRACF is called to delete the newly created profile. If a new backup version of the discrete RACF profile was created, ARCRACF is called to delete the old RACF profile backup versions. If an error occurs while deleting a discrete RACF backup profile, ARCWTL is called to write message ARC0382I to the backup activity log and processing continues. If an SMS-managed data set was backed up from a primary volume, ARCZSALT is called to alter the last back up date in the catalog. ARCBDEBV is called to delete all excess backup versions. If an error updating the BCDS records occurs, proceed to step 14 to end processing.

Module	Label
ARCBUDS	ARCBUDS NORMAL UPDCDS READB UPDATEC FILLC UPDATEB CORRECTC FILLB DELRACF MSG382
ARCBCEBV	ARCBCEBV
ARCBDEBV	ARCBDEBV
ARCRACF	ARCRACF
ARCWTO	ARCWTL
ARCZREAD	ARCZREAD
ARCZSALT	ARCZSALT
ARCZUPDT	ARCZUPDT
ARCZWRIT	ARCZWRIT

14. **Restore Control Data Set records when an error occurs:** ARCZRLSE is called two times to release any outstanding request parameter lists (RPLs). If the

output backup version is allocated on a DASD volume, ARCFREE is called to deallocate it and ARCZSCR is called to scratch it. If the output backup version is on a tape volume, ARCTECDM is called to process the tape error. If an MCC was created, ARCZDEL is called to delete it. If an MCB was created, ARCZDEL is called to delete it. If the MCB was updated, ARCZREAD is called to read it for update. the previous MCB copy is restored, ARCZUPDT is called to update it. If a new backup version of the discrete RACF profile was created, ARCRACF is called to delete the newly created profile. If an error occurs while deleting a discrete RACF backup profile, ARCWTL is called to write message ARC0382I to the backup activity log and processing continues. If the data set being backed up resides on a primary volume, ARCZUF1 is called to turn on the data-set-updated bit in the Format 1 DSCB if it was on before the backup attempt. If the data set being backed up resides on a migration volume, ARCZREAD is called to read the MCD for update, the data-set-updated bit in the MCD is turned on, and ARCZUPDT is called to update the MCD.

Module	Label
ARCBUDS	ARCBUDS NORMAL QUIT BACKOUT TAPERROR DELRACF
ARCFREE	ARCFREE
ARCILOG	ARCWLOG
ARCRACF	ARCRACF
ARCTECDM	ARCTECDM
ARCZDEL	ARCZDEL
ARCZREAD	ARCZREAD
ARCZRLSE	ARCZRLSE
ARCZSCR	ARCZSCR
ARCZUF1	ARCZUF1
ARCZUPDT	ARCZUPDT

15. **Free any obtained resources:** If the backup was targeted to a migration level 1 volume, ARCUMC1 is called to update the free space for the volume. If the source volume is reserved, ARCUUNLK is called to release it. If the input data set is allocated, either ARCFRSDP or ARCFREE is called to free the allocation. If the input data set is enqueued, ARCUNLKC is called to dequeue it. If the output backup version is allocated, ARCFREE is called to free the allocation. ARCZRLSE is called two times to release any outstanding RPLs. If the data set is enqueued, ARCUNLKC is called to dequeue it.

Module	Label
ARCBUDS	ARCBUDS NORMAL CLEANUP
ARCALSDP	ARCFRSDP
ARCFREE	ARCFREE
ARCLOCK	ARCUNLKC
ARCMSMV	ARCUMC1
ARCULOCK	ARCUUNLK
ARCZRLSE	ARCZRLSE

16. **Record statistics and log the end of Backup:** ARCMBFSR is called to update the backup statistics in the functional statistics record (FSR). ARCWLOG is called to write a type 18 log record that indicates that the data set backup is complete. Return to the caller.

Module	Label
ARCBUDS	ARCBUDS NORMAL CLEANUP
ARCILOG	ARCWLOG
ARCMBFSR	ARCMBFSR

17. **If ARCBUDS is posted to do so, close the 3480 single file format data set:** When ARCBUDS is posted to close the 3480 single file format data set, ARCTCLOS is called to close the 3480 data set. The completion code in the ECB is set based on the Return Code from ARCTCLOS: XX'00' means a successful close. XX'65' means a failure occurred while closing the 3480 data set.

Module	Label
ARCBUDS	ARCBUDS LOOP CL3480
ARCTCLOS	ARCTCLOS

18. **Post the work-complete ECB:** Post the work-complete ECB. Wait for work to do.

Module	Label
ARCBUDS	ARCBUDS LOOP POSTCOMP

Output

- Updated ARCBUDSP Parameter List
- Recovery Control Block (RCB)
- Type 17 Log Record
- BCDS Backup Version Record (MCC)
- MCDS Data Set Record (MCD)
- DDNAME in RCB
- Daily Backup or Migration Level 1 Volume
- Job File Control Block (JFCB)
- Data Control Block (DCB) Pointer in the RCB
- Format 1 DSCB
- BCDS Data Set Record (MCB)
- Function Statistics Record (FSR)
- Type 18 Log Record
- Backup Task Control Block (BTCB)
- Common Data Set Descriptor Record (CDD)

- **Return Codes:**
 - 100 is added to the Return Code if the output volume is to be changed. Most Return Codes will be mapped into an ARC13.xxI message where xx is the Return Code
 - 0 - Backup successful
 - 7 - Obtain error reading Format 3 DSCB
 - Reason Codes:
 - Return Codes from ARCDSSZ
 - 8 - Error allocating backup copy
 - Reason Codes:
 - Return Codes from ARCALNDS
 - 9 - Cannot generate a unique backup version name
 - Reason Codes:
 - Return Codes from ARCZGENM
 - 11 - Error creating or updating record in BCDS
 - Reason Codes:
 - Return Codes from ARCZUPDT, ARCZGENM, and ARCZWRT
 - 15 - Cannot backup partitioned data set with more than one notelist member
 - 16 - I/O error reading source data set
 - 17 - I/O error reading PDS directory
 - 19 - Data set in use by another job or user
 - 23 - Cannot mount volume required for backup
 - 24 - Error reading or updating record in MCDS
 - Reason Codes:
 - Return Codes from ARCZUPDT and ARCZREAD
 - 25 - Error reading BCDS record during backup
 - Reason Codes:
 - Return Codes from ARCZREAD
 - 35 - Error opening input data set
 - 36 - Error opening output data set
 - Reason Codes:
 - Return Codes from ARCDOPEN and ARCTOPEN
 - 37 - Out of space on target DASD volume
 - 38 - Attempt to backup a password-protected data set to a non-password-protected tape volume in a tape security environment that is neither RACFINCLUDE nor EXPIRATIONINCLUDE
 - 39 - Attempt to create a backup profile for a RACF-indicated data set failed or a RACF check failed to obtain the erase status of the data set

Reason Codes:

--- Return Codes from ARCRACF or ARCCKEOS

- 41 - Wrong DSCB found when module attempted to turn off the data-set-update bit and reset the date-last-referenced
- 42 - Error reading the job file control block
- 43 - Error updating the Format 1 DSCB

Reason Codes:

--- Return Codes from ARCZUF1

- 50 - No units available to mount tape volume
- 51 - Another DFHSM function is using the data set
- 52 - GETMAIN/FREEMAIN error
- 54 - Tape data set user exit (ARCTDEXT) ABEND
- 60 - Error establishing an ESTAE environment
- 61 - Internal ADDVOL failed
- 65 - Error closing output data set

Reason Codes:

--- Return Codes from ARCTECDM

- 68 - Backup failed because of an error in DFDSS
- 77 - Error allocating dummy DD during backup
- 97 - Internal allocation error

Reason Codes:

-- Return Codes from ARCALSHR

- 99 - Unsupported data set organization

The following Completion Codes are returned in the work-complete ECB for the task being processed:

- 00 - Successful completion of the function
- 65 - Failure closing 3480 tape data set.

Diagram 10.11: ARCBMBV - Move an Existing Backup Version from One Volume to Another

Input

- ARCBMBVP Parameter List
- Daily Backup or Migration Level 1 Volume
- Backup Task Control Block (BTCB).

Inout

- ARCBMBVP Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCBMBV	ARCBMBV
ARCPDA	ARCPDA

2. **Upon being attached, perform program initialization:** Perform program initialization. Issue a WAIT macro to wait for the work-to-do event control block (ECB).

Module	Label
ARCBMBV	ARCBMBV LOOP

3. **Upon being posted for work to do, check the completion code in the ECB:** Check the completion code in the ECB. If the completion code is X'00', perform normal processing (see steps 4 through 13). If the completion code is X'99', close the 3480 single-file format data set (see step 4). If the completion code is neither, ARCERP is called to log the error, and processing ends.

Module	Label
ARCBMBV	ARCBMBV LOOP NORMAL CL3480
ARCERP	ARCERP

4. **If ARCBMBV is posted to perform normal processing:** Input parameters are validated. If there are any invalid parameters, ARCERP is called to log the error. Processing ends. Local variables are initialized. ARCWLOG is called to write a type 17 log record to the DFHSM log, indicating the start of moving this backup version.

Module	Label
ARCBMBV	ARCBMBV NORMAL START
ARCERP	ARCERP
ARCILOG	ARCWLOG

5. **Allocate source backup version:** If the backup version is being moved to DASD, ARCALSHR is called to allocate the source backup version. If the backup version is being moved to tape, ARCALONQ is called to allocate the source backup version. If the allocation is successful, the DDNAME returned from the allocation is stored in the recovery control block (RCB). For any allocation failure, proceed to step 11 on page 230 to end processing.

Module	Label
ARCBMBV	ARCBMBV NORMAL ALLOCIN
ARCALOLD	ARCALSHR ARCALONQ

6. **Allocate target backup version:** ARCCLUSZ is called to calculate the size of the source backup version. If the target volume is a DASD volume, ARCSPCNV is called to convert the input backup version size to the target output backup version size. ARCALNDS is called to allocate the target backup version on the DASD backup volume. If the target volume is a tape volume, ARCALTDS is called to allocate the tape backup version if the data set is not already opened. If allocation fails or if the type of security required for the data set is not the current security process in use for tape processing, proceed to step 11 on page 230 to end processing.

Module	Label
ARCBMBV	ARCBMBV NORMAL ALLOCOU
ARCALNDS	ARCALNDS
ARCALTDS	ARCALTDS
ARCCLUSZ	ARCCLUSZ
ARCSPCNV	ARCSPCNV

7. **Open target backup version:** If the target volume is a DASD backup volume, ARCDOPEN is called to open the target backup version. If the target volume is a tape backup volume, ARCTOPEN is called to open the target backup version. ARCTOPEN is not called if writing to an already opened 3480 tape with single-file format. If the open of the target backup version is successful, the pointer to the data control block (DCB) is stored in the RCB. If the open of the target backup version fails, proceed to step 10 to end processing.

Module	Label
ARCBMBV	ARCBMBV NORMAL OPENOUT
ARCDOPEN	ARCDOPEN
ARCTOPEN	ARCTOPEN

8. **Get erase status and move backup version:** ARCCKEOS is called to obtain the erase status. ARCMMDS is called to move the backup version. If an error occurs obtaining erase status or during data movement, proceed to step 11 on page 230 to end processing.

Module	Label
ARCBMBV	ARCBMBV

	NORMAL
	COPY
ARCKEOS	ARCKEOS
ARCMDS	ARCMDS

9. **Update backup control data set (BCDS) records:** ARCZREAD is called to read the BCDS backup version record (MCC) for update. Information pertaining to the movement of the backup volume to another volume is inserted into the MCC and ARCZUPDT is called to update the MCC. ARCZREAD is called to read the BCDS data set record (MCB) for update. Information pertaining to the movement of the backup volume to another volume is inserted into the MCB and ARCZUPDT is called to update the MCB. If an error updating the BCDS records occurs, proceed to step 11 to end processing.

Module	Label
ARCBMBV	ARCBMBV NORMAL UPDCDS UPDATEC UPDATEB
ARCZREAD	ARCZREAD
ARCZUPDT	ARCZUPDT

10. **Scratch source backup version:** ARCZSCR is called to scratch the source backup version after successful data movement of the backup version to the target volume.

Module	Label
ARCBMBV	ARCBMBV NORMAL SCRATCH
ARCZSCR	ARCZSCR

11. **Backout the attempted movement of the backup version when an error occurs:** If the output backup version is allocated on a DASD volume, ARCFREE is called to deallocate it and ARCZSCR is called to scratch it. If the output backup version is on a tape volume, ARCTECDM is called to process the tape error. If the MCC or the MCB was not found and ARCBMBV was called by ARCBMBC, ARCZDEL is called to delete the MCM. If the MCC or the MCB was not found, ARCZSCR is called to scratch the input backup version. If the MCB was not found, ARCZDEL is called to delete the MCC. If the MCC was updated, ARCZREAD is called to read the record for update, the previous MCC copy is restored, ARCZUPDT is called to update it.

Module	Label
ARCBMBV	ARCBMBV NORMAL QUIT BACKOUT SCRATCH TAPERROR
ARCFREE	ARCFREE
ARCTECDM	ARCTECDM
ARCZDEL	ARCZDEL
ARCZREAD	ARCZREAD
ARCZSCR	ARCZSCR

ARCZUPDT ARCZUPDT

12. **Free any obtained resources:** If the input data set is allocated, ARCFREE is called to deallocate it. If the output backup version is allocated on a DASD volume, ARCFREE is called to deallocate it. ARCZRLSE is called to release any outstanding RPLs.

Module	Label
ARCBMBV	ARCBMBV NORMAL CLEANUP
ARCFREE	ARCFREE
ARCZRLSE	ARCZRLSE

13. **Record statistics and log the completion of moving the backup version:** ARCBMFSR is called to update the backup statistics in the functional statistics record (FSR). ARCWLOG is called to write a type 18 log record that indicates that the movement of this backup version is complete. Return to the caller.

Module	Label
ARCBMBV	ARCBMBV NORMAL FINISH
ARCILOG	ARCWLOG
ARCMBFSR	ARCMBFSR

14. **If ARCBMBV is posted to do so, close the 3480 single file format data set:** When ARCBMBV is posted to close the 3480 single file format data set, ARCTCLOS is called to close the 3480 data set. The completion code in the ECB is based on the Return Code from ARCTCLOS. X'00' means a successful close and X'65' means a failure occurred while closing the 3480 data set.

Module	Label
ARCBMBV	ARCBMBV LOOP CL3480
ARCTCLOS	ARCTCLOS

15. **Post the work-complete ECB:** Post the work-complete ECB. Wait for work to do.

Module	Label
ARCBMBV	ARCBMBV LOOP POSTCOMP

Output

- Updated ARCBMBVP Parameter List
- Recovery Control Block (RCB)
- Type 17 Log Record
- DDNAME in RCB
- Daily or Spill Backup Volume
- Modified Job File Control Block (JFCB)

- Data Control Block (DCB) Pointer in RCB
- BCDS Backup Version Record (MCC)
- BCDS Data Set Record (MCB)
- Function Statistics Record (FSR)
- Type 18 Log Record
- Return Codes:
 - 100 is added to the Return Code if the output volume is to be changed. Most Return Codes will be mapped into an ARC13.xxI message where xx is the Return Code
 - 0 - Backup version successfully moved
 - 7 - OBTAIN error reading Format 3 DSCB
 - Reason Codes:
 - Return Code from ARCCLUSZ
 - 8 - Error allocating target backup version of DASD backup volume
 - Reason Codes:
 - Return Code from ARCALNDS
 - 11 - Error updating backup control data set record
 - Reason Codes:
 - Return Code from ARCZUPDT
 - 19 - Error allocating backup version on source volume because backup version in use
 - 23 - Error allocating backup version on source volume because volume cannot be mounted
 - 25 - Error reading backup control data set record
 - Reason Codes:
 - Return Code from ARCZREAD
 - 36 - Error opening backup version on target volume
 - Reason Codes:
 - Return Code from ARCDOPEN
 - 37 - Out of space on target DASD daily backup volume
 - 38 - Attempt to place backup version of password protected data set on non-password protected tape backup volume in a tape security environment that is not EXPIRATIONINCLUDE or RACFINCLUDE
 - 39 - A RACF check failed to obtain the erase status of the backup version
 - Reason Codes:
 - Return Code from ARCCKEOS
 - 42 - Error reading the job file control block
 - 50 - Error allocating backup version on source volume because no unit available on which to mount the volume
 - 52 - GETMAIN/FREEMAIN error

- 54 - Error moving backup version to tape backup volume because an abnormal end in the tape data set exit occurred

- Error closing output data set during backup

Reason Codes:

- Return Code from ARCTECDM

- 80 - Backup control data set record not found

Reason Codes:

- Return Code from ARCZREAD

- 97 - DFHSM internal allocation error

Reason Codes:

- Return Code from ARCALSHR

The following Completion Codes are returned in the work-complete ECB for the task being processed:

- 00 - Successful completion of function
- 65 - Failure closing the 3480 tape data set.

Diagram 10.12: ARCBDEBV - Remove Control Data Set Information About Backup Versions

Input

- Description of Each Backup Version to be Disposed of (XBUI)
- BCDS Backup Version Record (MCC)
- BCDS Backup Volume Record (MCT)
- Number of Elements in the Array (COUNT)
- Backup Version Description Array (EXCBUI)
- Recovery Control Block Pointer (RCBPTR).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance to this module.

Module	Label
ARCBDEBV	ARCBDEBV
ARCPDA	ARCPDA

Perform steps 2 through 6 for each backup version (XBUI entry) which is actually excess and can be deleted, that is, has a zero Return Code value.

2. **Read MCC record:** ARCZREAD is called to read the MCC from the backup control data set (BCDS).

Module	Label
ARCBDEBV	ARCBDEBV
ARCZREAD	ARCZREAD

3. **Invalidate data set entry in the tape table of contents (TTOC) record for a backup version on tape:** If the backup version is on a tape backup volume, ARCZREAD reads the MCT to determine the type of backup volume (daily, spill, or unassigned). The list of tape backup volumes where the backup versions reside is created and ARCITTOC is called to invalidate the data set entry in the TTOC records.

Module	Label
ARCBDEBV	ARCBDEBV
ARCITTOC	ARCITTOC
ARCZREAD	ARCZREAD

4. **Scratch backup version if on a migration level 1 volume:** If the backup version resides on a migration level 1 volume, ARCZSCR is called to scratch the backup version and update the migration level 1 free space record (MC1). ARCZDEL then deletes the BCDS move backup version record (MCM).

Module	Label
ARCBDEBV	ARCBDEBV
ARCZSCR	ARCZSCR
ARCZDEL	ARCZDEL

5. **Delete backup profiles associated with the excess backup versions:** If the BCDS data set record (MCB) indicates that a backup profile exists, ARCRACF is called to delete the discrete profile. If the deletion of the discrete profile fails, ARCWTM is called to issue message ARC0382I to the backup log.

Module	Label
ARCBDEBV	ARCBDEBV
ARCRACF	ARCRACF
ARCWTO	ARCWTM

6. **Delete the MCC from the BCDS:** If the original data set has the erase attribute and erase-on-scratch support is allowed for DFHSM backup versions, and the volume where the backup version resides is NOT an MLI or tape or non-removable-DASD volume, the MCC record is updated with scratch and erase indications;

If the original data set does NOT have the erase attribute, or the backup version is on a non-removable-DASD volume:

- ARCBDEBV calls ARCZSCR, with the erase-on-scratch indicator to scratch the backup version
- ARCBDEBV calls ARCZDEL to delete the MCC record in the BCDS.

Module	Label
ARCBDEBV	ARCBDEBV
	UPDATEC
ARCZDEL	ARCZDEL
ARCZREAD	ARCZREAD
ARCZRPLS	ARCZRPLS
ARCZSCR	ARCZSCR
ARCZUPDT	ARCZUPDT

Output

- Tape Table of Contents (TTOCs)
- Migration Level 1 Volume
- Backup Control Data Set (BCDS).

Diagram 10.13: ARCBFULL - Mark a DASD Backup Volume Full

Input

- MVT DASD Backup Volume Pointer (MVTPTR).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCBFULL	ARCBFULL
ARCPDA	ARCPDA

2. **Check the validity of the mounted volume table (MVT) pointer:** If the MVT pointer is zero, call ARCERP.

Module	Label
ARCBFULL	ARCBFULL
ARCERP	ARCERP

3. **Set on full flag in BCDS backup volume record (MCT) for backup volume:** Call ARCZREAD to read for update the MCT record for the DASD backup volume. Set on the full flag and call ARCZUPDT to write the updated record back to the backup control data set (BCDS).

Module	Label
ARCBFULL	ARCBFULL
ARCZREAD	ARCZREAD
ARCZUPDT	ARCZUPDT

4. **Set on full flag in backup cycle volume record (BVR) entry for backup volume:** Call ARCUBVR to set on the full flag in the BVR volume entry for the DASD backup volume.

Module	Label
ARCBFULL	ARCBFULL
ARCCBVR	ARCUBVR

Output

- BCDS Backup Volume Record (MCT)
- ARCUBVR Parameter List
- Return Codes:
 - 0 - DASD backup volume marked full successfully
 - 4 - Error reading BCDS Backup Volume Record (MCT) for update
Reason Codes:
 - Return Codes from ARCZREAD
 - 8 - Error writing BCDS Backup Volume Record (MCT)
Reason Codes:
 - Return Codes from ARCZUPDT
 - 12 - Error while updating the BVR volume entry

Reason Codes:

- **Return Codes from ARCUBVR.**

Backup Volume Selection and Spill Processing

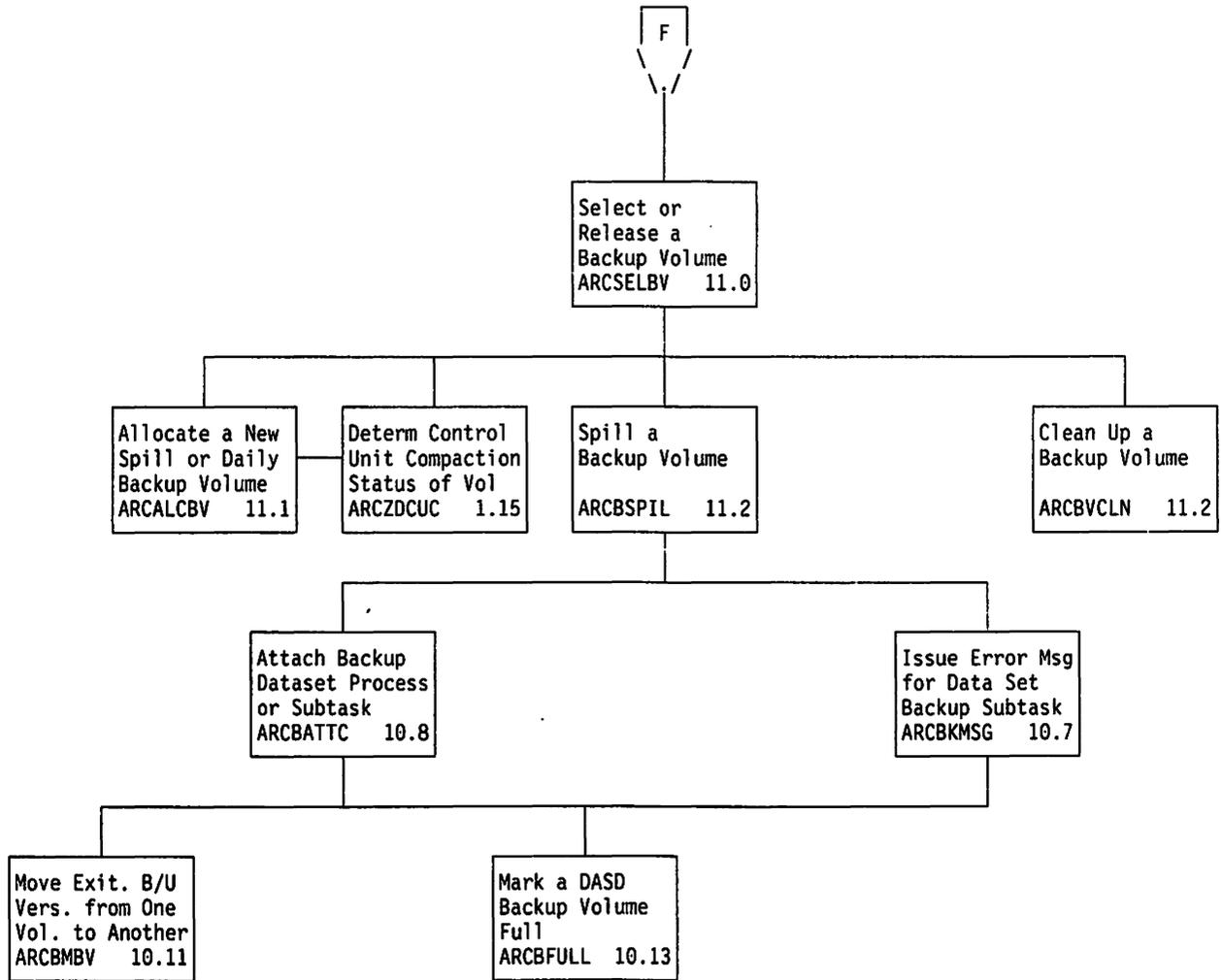


Figure 13. Visual Table of Contents for Backup Volume Selection and Spill Processing

Diagram 11.0: ARCSELBV - Select or Release a Backup Volume

Input

- Backup Cycle Volume Record (BVR)
- Mounted Volume Table (MVT)
- Day in Backup Cycle (DAY)
- Volume Backup Task ID (TASKID)
- Processing Options (OPTS)
- Daily Backup Volume (DDNAME)
- MVT Pointer (MVTP).

Processing

1. **Trace the entry to this module:** If the MCVT indicates tracing is active, call ARCPDA to create a trace entry for this module.

Module	Label
ARCSELBV	ARCSELBV
ARCPDA	ARCPDA

2. **Mainline procedure. Initialize variables, serialize resources, and control processing:** ARCSELBV is called to release the backup volume the calling task is using or to select a backup volume for the calling task to use. Local variables are initialized and the date and time are obtained. If a tape backup volume is being released, call ARCULVOL to deallocate the volume so the tape unit is released. If the tape volume is single-file format and PARTIALTAPE(MARKFULL) has been specified, call ARCTFULL to mark the volume full. ARCLOCK is called to enqueue exclusively on the BVR ('ARCGPA' 'ARCBVRxx'). If running in a multiple processing unit environment, ARCCMHRD is called to read the BVR, insert the host identifier, and write the BVR back to the backup control data set (BCDS).

ARCSELBV then processes the input options.

- If a backup volume is being released, internal procedure RBV is called.
- If any type of daily backup volume is to be selected, internal procedure SADBv is called.
- If a DASD daily backup volume is to be selected, internal procedure SDDBV is called.
- If a tape daily backup volume is to be selected, internal procedure STDBV is called.
- If any type of spill backup volume is to be selected, internal procedure SASBV is called. If a DASD spill backup volume is to be selected, SDSBV is called.
- If a tape spill backup volume is to be selected, internal procedure STSBV is called.

Upon return from the release or select procedure, if running in a multiple processing unit environment, ARCCMHWR is called to read the BVR, remove the host identifier, and write it back to the BCDS.

ARCUNLK is called to dequeue from the BVR resource.

Module	Label
ARCSELBV	ARCSELBV DEALLOC ENQBVR DEQBVR RBV SADBV SDDBV STDBV SASBV SDSBV STSBV
ARCCMHRD	ARCCMHRD ARCCMHR
ARCLOCK	ARCLOCK ARCUNLK
ARCULVOL	ARCULVOL
ARCTFULL	ARCTFULL

3. **Internal procedure RBV. Release backup volume:** Internal procedure RBV is called to release a daily or spill backup volume.

- If a DASD backup volume is being released, ARCLSPAC calculates the amount of free space. ARCZREAD reads the backup volume record for update. ARCZUPDT updates the record with the free-space information and the current date and time, and writes it to the BCDS. ARCULVOL deallocates the backup volume being released. If the backup volume is an mass storage system (MSS) volume, ARCMSREL relinquishes the space acquired on the volume.
- If the user has requested the unloading of a virtual DASD backup volume, ARCULVRT is called to unload the volume, thus freeing the unit control block (UCB). ARCZREAD is called to read the BVR for update and the volume is marked as not in use. ARCZUPDT is called to update the BVR.
- If the volume just released is not full and available, ARCSELBV checks to see if there are any tasks waiting for an available backup volume of the same type (tape or DASD, daily or spill). ARCSELBV posts the first task it finds waiting for the same type of backup volume. If the MVT is not being saved, ARCFMAIN is called to free the storage.

Module	Label
ARCSELBV	ARCSELBV RBV POSTER DEALLOC FREEMVT
ARCACREL	ARCMSREL
ARCFMAIN	ARCFMAIN
ARCLSPAC	ARCLSPAC
ARCULVOL	ARCULVOL
ARCULVRT	ARCULVRT
ARCZREAD	ARCZREAD
ARCZUPDT	ARCZUPDT

4. **Internal procedure SADBV. Select any daily backup volume:** Internal procedure SADBV is called to select any type of daily backup volume. The BVR for this

day in the backup cycle is scanned for an available volume of any device type. If an available volume is found, and it passed control unit compaction selection criteria, an MVT is built and the volume is allocated.

When the MVT is built, ARCFDVTE fills in all device dependent fields.

DASD volumes are allocated by ARCALVOL, and tape volumes are allocated by ARCALTVL. If a DASD backup volume has not been cleaned up on this day, ARCBSPIL is called.

For an empty 3480 being selected for use in 3480 single-file format, the single-file format flag is set on and the volume sequence number is set to 1 on the initial volume selection. ARCZUPDT is called to update the MCT. If the update fails, ARCUBVR is called to mark the volume unavailable and a Return Code of 2 is set to ensure the volume is not used. If the security of the tape volume fails with a Return Code greater than 1, then call ARCZREAD to read the MCT to reset the file block ID to the original value saved on input. ARCZUPDT is called to update the MCT. If no daily backup volume is available in the BVR, one of the following two alternatives is performed.

Module	Label
ARCSELBV	ARCSELBV SADBV SCANBVR GETNEXT SECURITY MARKVOL GETMVT BUILDMVT ALLOCBV RSETFBID
ARCFDVTE	ARCFDVTE
ARCALVOL	ARCALVOL ARCALTVL
ARCBSPIL	ARCBSPIL
ARCZREAD	ARCZREAD
ARCUBVR	ARCUBVR
ARCZUPDT	ARCZUPDT

- a. If the number of volumes in the BVR for this day in the backup cycle is less than the daily limit, ARCALCBV is called to find an unassigned backup volume and assign it as a daily backup volume to this day in the backup cycle. The type of unassigned backup volume requested depends on the type of volumes in the BVR for this day. If only DASD volumes are in the BVR, only a DASD volume is requested. If only tape volumes are in the BVR, only a tape volume is requested. If DASD and tape volumes are in the BVR, either a DASD or tape volume is requested. If an unassigned volume is found, an MVT is built, ARCFDVTE fills in all device dependent fields, and the volume is allocated. DASD volumes are allocated by ARCALVOL, and tape volumes are allocated by ARCALTVL. If a DASD backup volume has not been cleaned up on this day, ARCBSPIL is called. If an unassigned backup volume is not found, one of the following two alternatives is performed.

Module	Label
ARCSELBV	ARCSELBV SADBV

	GETUBV
	BUILDMVT
	ALLOCBV
ARCALCBV	ARCALCBV
ARCFDVTE	ARCFDVTE
ARCALVOL	ARCALVOL
	ARCALTVL
ARCBSPIL	ARCBSPIL

- 1) If there are only DASD volumes in the BVR, ARCSELBV calls ARCBSPIL to spill the full DASD daily backup volumes. If a volume is below its threshold after spilling, an MVT is built and the volume is allocated by ARCALVOL. If no volume is below its threshold after spilling and a DASD daily backup volume is already in use, ARCSELBV waits for a DASD daily backup to become available.

Module	Label
ARCSELBV	ARCSELBV SADBV SPILL GETMVT BUILDMVT ALLOCBV WAIT
ARCBSPIL	ARCBSPIL
ARCALVOL	ARCALVOL

- 2) If there are both tape and DASD volumes in the BVR, ARCSELBV calls ARCBSPIL to spill the full DASD daily backup volumes. If a volume is below its threshold after spilling, an MVT is built and the volume is allocated by ARCALVOL. If no volume is below its threshold after spilling, ARCSELBV calls ARCALTVL to allocate a scratch tape. If no scratch tape is available and a daily backup volume is already in use, ARCSELBV waits for any daily backup volume to become available. Message ARC0700I is issued by ARCWTL when ARCSELBV waits for a backup volume.

Module	Label
ARCSELBV	ARCSELBV SADBV SPILL GETMVT BUILDMVT ALLOCBV SCRATCH WAIT
ARCBSPIL	ARCBSPIL
ARCWTO	ARCWTL
ARCALVOL	ARCALVOL ARCALTVL

- 3) If only tape volumes are in the BVR, ARCSELBV calls ARCALTVL to allocate a scratch tape. If no scratch tape is available and a tape daily backup volume is already in use, ARCSELBV waits for a tape daily backup volume to become available. Message ARC0700I is issued by ARCWTL when ARCSELBV waits for a backup volume.

Module	Label
ARCSELBV	ARCSELBV SADBV SCRATCH GETMVT BUILDMVT ALLOCBV WAIT
ARCALVOL	ARCALTVL
ARCWTO	ARCWTL

- b. If the number of volumes in the BVR is equal to or greater than the daily limit, one of the following three alternatives is performed.

Module	Label
ARCSELBV	ARCSELBV SADBV

- 1) If only DASD volumes are in the BVR, ARCSELBV calls ARCBSPIL to spill the full DASD daily backup volumes. If a volume is below the threshold, an MVT is built and the volume is allocated by ARCALVOL. If no volume is below the threshold after spilling, ARCALCBV is called to find a DASD unassigned backup volume. If a DASD unassigned backup volume is found, an MVT is built and the volume is allocated. If no DASD unassigned backup volume is found and a DASD daily backup volume is already being used, ARCSELBV waits for a DASD daily backup volume to become available. Message ARC0700I is issued by ARCWTL when ARCSELBV waits for a backup volume.

Module	Label
ARCSELBV	ARCSELBV SADBV SPILL GETMVT BUILDMVT ALLOCBV GETUBV WAIT
ARCALCBV	ARCALCBV
ARCALVOL	ARCALVOL
ARCBSPIL	ARCBSPIL
ARCWTO	ARCWTL

- 2) If DASD and tape volumes are in the BVR, ARCSELBV calls ARCBSPIL to spill the full DASD daily backup volumes. If a volume is below its threshold after spilling, an MVT is built and the volume is allocated. If no volume is below its threshold after spilling, ARCALCBV is called to find an unassigned backup volume. If an unassigned backup volume is found, an MVT is built and the volume is allocated. If no unassigned backup volume is found, ARCSELBV calls ARCALTVL to allocate a scratch tape. If no scratch tape is available and a daily backup volume is already in use, ARCSELBV waits for any daily backup volume to become available. Message ARC0700I is issued when ARCSELBV waits for a backup volume.

Module	Label
ARCSELBV	ARCSELBV SADBV SPILL GETMVT BUILDMVT ALLOCBV GETUBV SCRATCH WAIT
ARCALCBV	ARCALCBV
ARCBSPII	ARCBSPII
ARCWTO	ARCWTL
ARCALVOL	ARCALTVL

- 3) If only tape volumes are in the BVR, ARCALCBV is called to find an unassigned tape daily backup volume. If an unassigned tape backup volume is found, an MVT is built and the volume is allocated by ARCALTVL. If no unassigned backup volume is found, a scratch tape is allocated. If no scratch tape is available and a tape daily backup volume is already being used, ARCSELBV waits for a tape daily backup volume to become available. Message ARC0700I is issued when ARCSELBV waits for a backup volume.

Module	Label
ARCSELBV	ARCSELBV SADBV GETUBV GETMVT BUILDMVT ALLOCBV WAIT
ARCALCBV	ARCALCBV
ARCALVOL	ARCALTVL
ARCWTO	ARCWTL

5. **Internal procedure SDDBV. Select a DASD daily backup volume:** Internal procedure SDDBV is called to select a DASD daily backup volume. The BVR for this day in the backup cycle is scanned for an available DASD daily backup volume. If an available DASD daily backup volume is found, an MVT is built and the volume is allocated by ARCALVOL.
- If an available DASD daily backup volume is not found and the number of volumes assigned to this day in the backup cycle is less than the daily limit, ARCALCBV is called to find an unassigned DASD backup volume.
 - If an unassigned DASD backup volume is found, an MVT is built and the volume is allocated by ARCALVOL.
 - If no unassigned DASD backup volume is found, ARCSELBV calls ARCBSPII to spill the full DASD daily backup volumes assigned to this day in the backup cycle.
 - If a DASD daily backup volume is below its threshold after spilling, an MVT is built and the volume is allocated by ARCALVOL. If no DASD daily backup volume is below its threshold after spilling and a DASD daily

backup volume is already being used, ARCSELBV waits for a DASD daily backup volume to become available.

- If an available DASD daily backup volume is not found and the number of volumes assigned to this day in the backup cycle is greater than or equal to the daily limit, ARCSELBV calls ARCBSPIL to spill the full DASD daily backup volumes assigned to this day in the backup cycle.
- If a DASD daily backup volume is below its threshold after spilling, an MVT is built and the volume is allocated by ARCALVOL.
- If no DASD daily backup volume is below its threshold after spilling, ARCALCBV is called to find an unassigned DASD backup volume an unassigned DASD backup volume.
- If an unassigned DASD backup volume is found, an MVT is built and the volume is allocated by ARCALVOL.
- If no unassigned DASD backup volume is found and a DASD daily backup volume is already in use, ARCSELBV waits for a DASD daily backup volume to become available.

Message ARC0700I is issued by ARCWTL when ARCSELBV waits for a backup volume.

Module	Label
ARCSELBV	ARCSELBV SDDBV SCANBVR GETMVT BUILDMVT ALLOCBV GETUBV SPILL
ARCALCBV	ARCALCBV
ARCBSPIL	ARCBSPIL
ARCWTO	ARCWTL
ARCALVOL	ARCALVOL

6. **Internal procedure STDBV. Select a tape daily backup volume:** Internal procedure STDBV is called to select a tape daily backup volume. The BVR is scanned for an available tape daily backup volume. If an available tape daily backup volume is found, and it passes control unit compaction selection criteria, an MVT is built and the volume is allocated. If a tape daily backup volume is not found, ARCALCBV is called to find an unassigned tape backup volume. If an unassigned tape backup volume is found, an MVT is built and the volume is allocated. If an unassigned tape backup volume is not found, ARCSELBV allocates a scratch tape. If a scratch tape is not available and a tape daily backup volume is already being used, ARCSELBV waits for a tape daily backup volume to become available.

Module	Label
ARCSELBV	ARCSELBV STDBV SCANBVR GETMVT BUILDMVT ALLOCBV

	GETUBV
	SCRATCH
	WAIT
ARCALCBV	ARCALCBV
ARCALVOL	ARCALTVL

7. **Internal procedure SASBV. Select any spill backup volume:** Internal procedure SASBV is called to select any type of spill backup volume. The spill BVR is scanned for an available volume of any device type. If an available volume is found, and it passes control unit selection criteria, an MVT is built and the volume is allocated. If no spill backup volume is available, ARCALCBV is called to find an unassigned backup volume and assign it as a spill backup volume. The type of unassigned backup volume requested depends on the type of volumes in the spill BVR. If only DASD volumes are in the BVR, only a DASD volume is requested. If only tape volumes are in the BVR, only a tape volume is requested. If both DASD and tape volumes are in the BVR, either a DASD or tape volume is requested. If an unassigned volume is found, an MVT is built and the volume is allocated by ARCALVOL. If an unassigned backup volume is not found, one of the following three alternatives is performed.

Module	Label
ARCSELBV	ARCSELBV
	SASBV
	SCANBVR
	GETMVT
	BUILDMVT
	ALLOCBV
	GETUBV
ARCALCBV	ARCALCBV
ARCALVOL	ARCALVOL

- a. If only DASD volumes are in the BVR, ARCSELBV calls ARCBSPIL to clean up the full DASD spill backup volumes. If a volume is below its threshold after cleanup, an MVT is built and the volume is allocated. If no volume is below its threshold after cleanup and a spill backup volume is already being used, ARCSELBV waits for any spill backup volume to become available.

Module	Label
ARCSELBV	ARCSELBV
	SADBV
	CLEANUP
	GETMVT
	BUILDMVT
	ALLOCBV
	WAIT
ARCBSPIL	ARCBSPIL
ARCALVOL	ARCALVOL

- b. If tape and DASD volumes are in the BVR, ARCSELBV calls ARCBSPIL to clean up the full DASD spill backup volumes. If a volume is below its threshold after cleanup, an MVT is built and the volume is allocated by ARCALVOL. If no volume is below its threshold after cleanup, ARCSELBV calls ARCALTVL to allocate a scratch tape. If no scratch tape is available and a spill backup volume is already being used, ARCSELBV waits for any spill backup volume to become available.

Module	Label
ARCSELBV	ARCSELBV SADBV CLEANUP GETMVT BUILDMVT ALLOCBV SCRATCH WAIT
ARCBSPIL	ARCBSPIL
ARCALVOL	ARCALVOL ARCALTVL

- c. If only tape volumes are in the BVR, ARCSSELBV calls ARCALTVL to allocate a scratch tape. If no scratch tape is available and a spill backup volume is already being used, ARCSSELBV waits for any spill backup volume to become available.

Module	Label
ARCSELBV	ARCSELBV SADBVR GETMVT BUILDMVT ALLOCBV SCRATCH WAIT
ARCALVOL	ARCALTVL

8. **Internal procedure SDSBV. Select a DASD spill backup volume:** Internal procedure SDSBV is called to select a DASD spill backup volume. The spill BVR is scanned for an available DASD spill backup volume. If an available DASD spill backup volume is found, an MVT is built and the volume is allocated by ARCALVOL. If an available DASD spill backup volume is not found, ARCALCBV is called to get an unassigned DASD backup volume to assign it as a spill backup volume. If an unassigned DASD backup volume is found, an MVT is built and the volume is allocated by ARCALVOL. If an unassigned DASD backup volume is not found, ARCSSELBV calls ARCBSPIL to clean up the full DASD spill backup volumes. If a volume is below its threshold after cleanup, an MVT is built and the volume is allocated. If no volume is below its threshold after cleanup and a DASD spill backup volume is already being used, ARCSSELBV waits for a DASD spill backup volume to become available.

Module	Label
ARCSELBV	ARCSELBV SDSBV SCANBVR GETMVT BUILDMVT ALLOCBV GETUBV CLEANUP WAIT
ARCALCBV	ARCALCBV
ARCBSPII	ARCBSPII
ARCALVOL	ARCALVOL

9. **Internal procedure STSBV: Select a tape spill backup volume:** Internal procedure STSBV is called to select a tape spill backup volume. The spill BVR is scanned for an available tape spill backup volume. If an available tape spill backup volume is found, and it passed control unit selection criteria, an MVT is built and the volume is allocated. If an available tape backup volume is not found, ARCALCBV is called to find an unassigned tape backup volume and assign it as a spill backup volume. If an unassigned tape backup volume is found, an MVT is built and the volume is allocated by ARCALTVL. If an unassigned tape backup volume is not found, a scratch tape is allocated. If a scratch tape is not available and a tape spill backup volume is already being used, ARCSELBV waits for a tape spill backup volume to become available.

Module	Label
ARCSELBV	ARCSELBV STSBV SCANBVR GETMVT BUILDMVT ALLOCBV SCRATCH WAIT
ARCALCBV	ARCALCBV
ARCALVOL	ARCALTVL

Output

- Backup Cycle Volume Record (BVR)
- Mounted Volume Table (MVT)
- BCDS Backup Volume Record (MCT)
- Daily Backup Volume DDNAME
- MVT Pointer (MVTP)
- Return Codes:
 - 4 - Error reading/writing BVR
 - 8 - Error reading/writing other BCDS record
 - 12 - Error allocating/deallocating backup volume
 - 16 - GETMAIN/FREEMAIN error
 - 20 - BVR in use by another host

- 24 - No backup volume of type requested available
- 28 - DFHSM shutdown or in emergency mode.

Diagram 11.1: ARCALCBV - Allocate a New Spill or Daily Backup Volume

Input

- Backup Control Data Set (BCDS)
- Offline Control Data Set (OCDS)
- Daily/Spill Function Indicator (FUNC)
- BVR Work Area Address (BVWKAP)
- Input Flags (FLAGS)
- Day of Backup Cycle (DAY)
- Activity Log Indicator (CALLTYP)
- Volume Serial Number (VSN)
- MVT End of Volume Pointer (MVYP).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCALCBV	ARCALCBV
ARCPDA	ARCPDA

2. **Read the first unassigned backup cycle volume record (BVR):** ARCLOCK is called to enqueue the BVR. If in a multiple processing unit environment, ARCCMHRD is called to read the base BVR record and set the host ID field. ARCZREAD is called to read the first unassigned BVR.

Module	Label
ARCALCBV	ARCALCBV
	SHOST
	MHOST
ARCCMHRD	ARCCMHRD
ARCLOCK	ARCLOCK
ARCZREAD	ARCZREAD

3. **Scan the volume entries to find an available volume for use:** ARCALCBV scans the volume entries and test flags to determine volume availability. If the caller has specified that an empty tape volume is to be selected, choose only an empty tape volume. If the tape volume is a 3480, a call is made to module ARCZDCUC to determine the control unit compaction status of the volume. If the volume passes the control unit selection criteria, copy the management communication vector table (MCVT) 3480 tape option to the BVR. If the caller has specified that a tape volume of a given density is to be selected, choose only a tape volume with that density. If the caller indicates the tape does not have to be empty and it is a 3480 tape, verify that the BVR and the MCVT 3480 tape options match. If not, skip the volume. After ARCZREAD has read the BCDS backup volume record (MCT) record, call ARCTVSC to do security checking. If no backup or spill volumes are available and extension records exist, ARCZREAD reads and tests them to determine if they are usable backup volumes. If none are available after all records have been scanned, ARCALCBV returns to the caller with an indication that no volumes are available.

Module	Label
ARCALCBV	ARCALCBV SRCHUNAS CHECK_CUC_STATUS
ARCALCBV	ARCZDCUC
ARCTVSC	ARCTVSC
ARCZREAD	ARCZREAD

4. **Update the volume record, backup cycle volume record, and for a tape volume, the tape table of contents record:** If an available volume is found, ARCZREAD is called to read the MCT for update. Flags are set in the MCT to indicate the volume is now a daily or spill backup volume. If the volume is a 3480 and single-file format, this is also indicated in the MCT record. ARCZUPDT is called to rewrite the record in the BCDS. Before deleting the BVR, a test is made to determine if the volume is a 3480 tape and if it is, the information is saved. ARCDDBVR is called to delete the volume entry from the unassigned backup cycle volume record. ARCCBVR is called to add it to the correct backup cycle volume record. If a tape volume is selected, ARCCTTOC is called to delete and add the tape table of contents (TTOC).

Module	Label
ARCALCBV	ARCALCBV UPDMCT
ARCCBVR	ARCDDBVR ARCCBVR
ARCCTTOC	ARCDTTOC ARCCTTOC ARCMTTOC
ARCZREAD	ARCZREAD
ARCZUPDT	ARCZUPDT

Output

- Backup Control Data Set (BCDS)
- Offline Control Data Set (OCDS)
- Backup Volume Record (BVR)
- Tape Table of Contents (TTOC)
- Return Codes:
 - 4 - No volume available
 - 8 - Error in access of an unassigned BVR
 - 16 - Error in access of TTOC
 - 20 - BVR in use by another host.

Diagram 11.2: ARCBSPIL and ARCBVCLN - Spill or Clean Up a Backup Volume

Input

- ARCSPIIP Parameter List.

Processing

ARCBSPIL spills old backup versions from DASD daily backup volume to the spill backup volume.

Output

- Updated ARCSPIIP Parameter List
- Return Codes.

Data Set Command Backup Processing

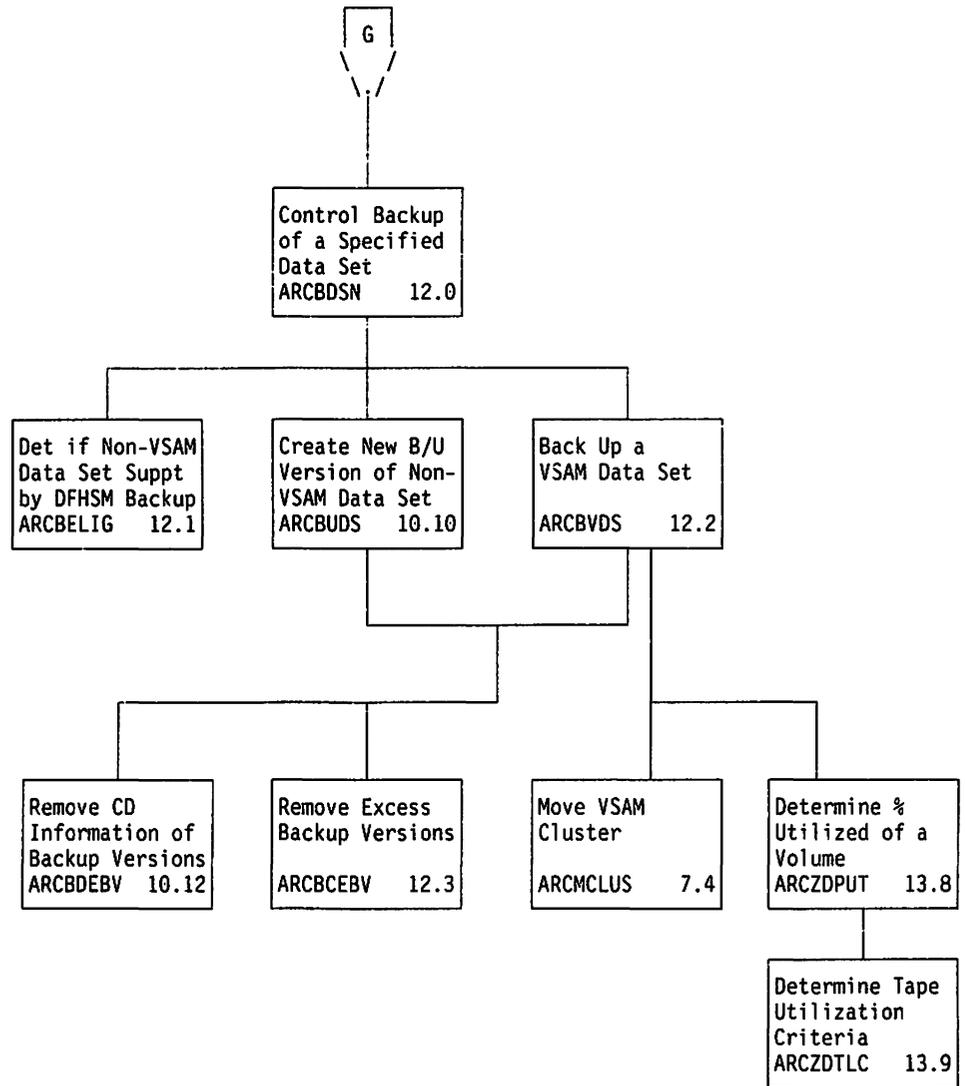


Figure 14. Visual Table of Contents for Data Set Command Backup Processing

Diagram 12.0: ARCBDSN - Control Backup of a Specified Data Set

Input

- Pointer to backup request Management Work Element (MWE).

Processing

ARCBDSN controls the command backup of a specified data set and creates a BCDS 'M' record for it and deletes any existing 'L' record.

Output

- Return Codes.

Diagram 12.1: ARCBELIG - Determine if a Non-VSAM Data Set is Supported by DFHSM Backup

Input

- Format 1 DSCB
- Mounted Volume Table (MVT).

Processing

1. **Check Format 1 data set control block (DSCB) to determine if non-virtual storage access method (VSAM) data set is supported by backup:** ARCBELIG checks whether the input MVT and DSCB pointers are valid. It also checks information in the Format 1 DSCB for a non-VSAM data set to determine if the data set is supported by DFHSM backup. ARCZLOC is called to obtain multi-volume data set information. The following list of non-VSAM data sets are not supported by DFHSM backup:

- Non-VSAM data sets with a data set organization other than physical sequential (PS), partitioned (PO), or direct access (DA).
- Unsupported user label data sets.
- Non-SMS-managed multi-volume data sets.
- Split cylinder (shared extent) data sets.
- Unmovable data sets with more than one extent on the volume.
- Physical sequential (PS), partitioned (PO), or direct access (DA) where the block size plus the key length of the data set is greater than maximum block size supported by the device. The data set is on and the track overflow bit is off in either the Format 1 DSCB for the data set or the device type field in the MVT that contains 4 bytes of unit control block (UCB) device type characteristics.
- PO data sets with zero block size.

Module	Label
ARCBELIG	ARCBELIG
ARCZLOC	ARCZLOC

2. **Check for size of the data set:** ARCCLUSZ is called to obtain the data set size. If an invalid parameter list was passed, ARCERP is called.

Module	Label
ARCBELIG	ARCBELIG
ARCCLUSZ	ARCCLUSZ
ARCERP	ARCERP

Output

- Return Codes:
 - 0 - Data set is supported by backup
 - 4 - Unsupported data set organization
 - 7 - OBTAIN error

- 8 - The block size plus the key length of the data set is greater than the maximum block size of the device where the data set resides, and the track overflow bit is OFF in the Format 1 DSCB for the data set or in the UCB for that device
- 12 - The data set contains a user label and is not supported by backup
- 16 - The data set is a shared-cylinder data set and not supported by backup
- 20 - The data set is unmovable with one or more extents on the volume and not supported by backup
- 24 - The data set is multi-volume and not supported by backup
- 36 - The data set name is invalid.

Diagram 12.2: ARCBVDS - Back Up a VSAM Data Set

Input

- ARCBVDSP Parameter List
- Backup Task Control Block (BTCB)
- BCDS Data Set Record (MCB).

Inout

- ARCBVDSP Parameter List.

Processing

ARCBVDS controls the backup of a VSAM user data set to tape or DASD.

Output

- Updated ARCBVDSP Parameter List
- Return Codes.

Diagram 12.3: ARCCEBV - Remove Excess Backup Versions

Input

- ARCCEBVP Parameter List.

Inout

- ARCCEBVP Parameter List.

Processing

ARCCEBV removes backup index array (BUI) entries, which describe the excess backup versions from the BCDS data set record (MCB) and adjusts the MCB record to reflect the removed backup versions.

Output

- Updated ARCCEBVP Parameter List
- Return Codes.

Non-SMS Volume Backup Processing

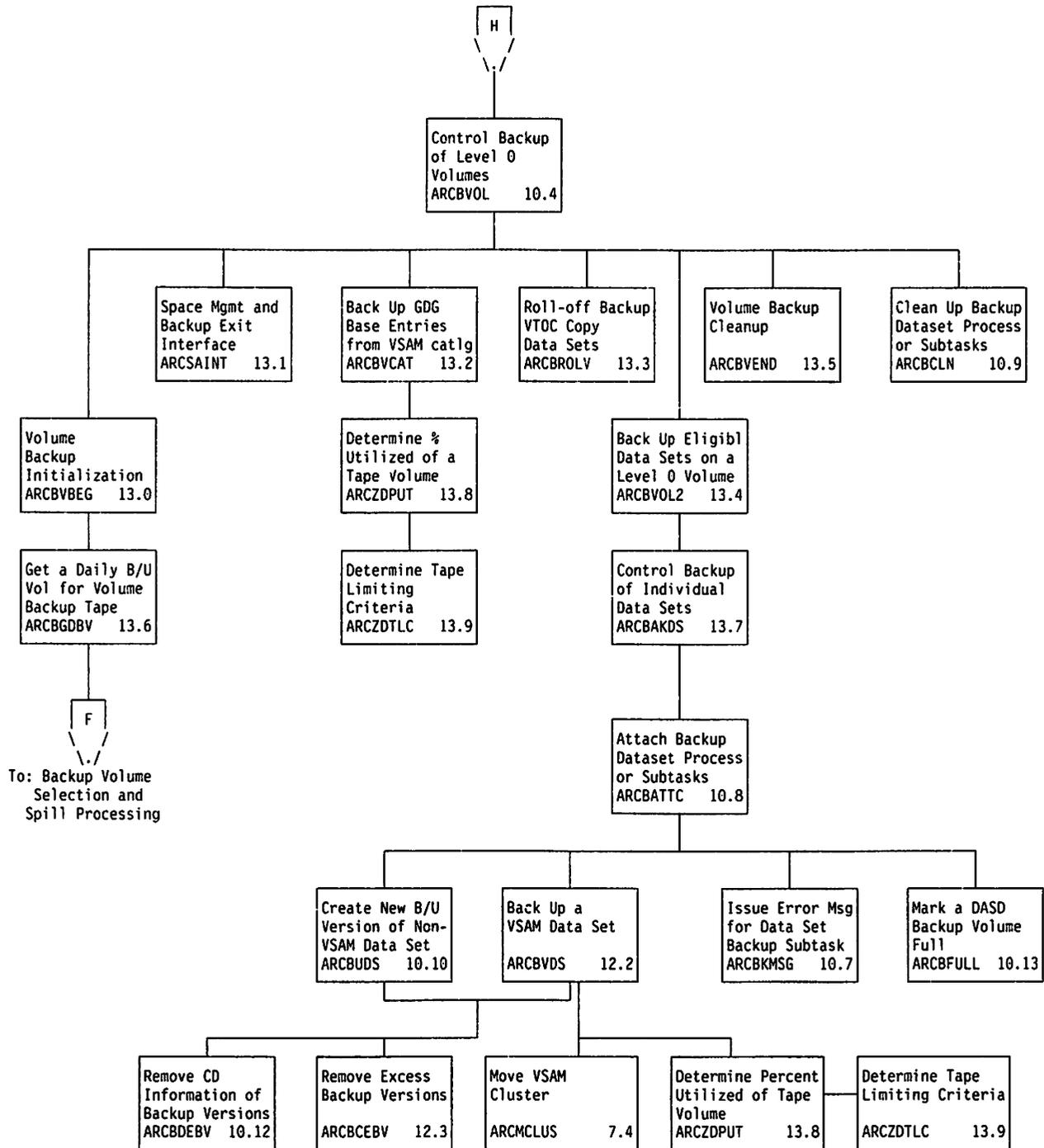


Figure 15. Visual Table of Contents for Non-SMS Volume Backup Processing

Diagram 13.0: ARCBVBEG - Volume Backup Initialization

Input

- ARCBVBEP Parameter List.

Inout

- ARCBVBEP Parameter List.

Processing

ARCBVBEG performs the initialization functions for volume backup.

Output

- Updated ARCBVBEP Parameter List
- Return Codes.

Diagram 13.1: ARCSAINT - Space Management and Backup Exit Interface

Input

- ARCSAINT Parameter List.

Processing

ARCSAINT acts as an interface with the space management and backup exit.

Output

- Return Codes.

Diagram 13.2: ARCBVCAT - Back Up Generation Data Group Base Entries from the VSAM Catalog

Input

- Mounted Volume Table (MVT)
- Recovery Control Block (RCB)
- VSAM Catalog
- Primary Volume BCDS Eligible Volume Record Pointer (MCPD)
- MVT for Target Backup Volume Pointer (BVTP)
- VCAT Copy Data Set DDNAME (VCATDSN)
- Tape Output Data Set DDNAME (TAPEDDN)
- Backup Task ID (TASKID)
- Mother Task Event Control Block Pointer (ECBPTR)
- Recovery Control Block Pointer (RCBPTR).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCBVCAT	ARCBVCAT
ARCPDA	ARCPDA

2. **Allocate the volume catalog (VCAT) backup copy data set:** If the backup data set is to be written to a multiple-file tape, ARCALTDS is called to read the job file control block (JFCB) of the tape. If the read fails, ARCWTL is called to write message ARC0707I to the backup activity log, and processing ends. If the backup data set is on DASD, ARCALNDS is called to allocate the data set. If the allocation of the data set fails, and ARCWTL is called to write message ARC0707I to the backup activity log to inform the user that the generation data group base entries were not backed up. If not enough space existed on the backup volume, processing is stopped, but ARCWTL is not called. Control returns to ARCBVOL. The backup of the generation data group entries is retried once after the volume has been cleaned up.

Module	Label
ARCBVCAT	ARCBVCAT
	QUIT
ARCALTDS	ARCALTDS
ARCALNDS	ARCALNDS
ARCWTO	ARCWTL

3. **Open the VCAT backup copy data set:** If the data set is on a 3480 single-file format tape, it is already open (left open by the caller ARCBVOL). If the data set is on a multiple-file backup volume, ARCTOPEN is called to open it. If the data set is on DASD, ARCDOPEN is called to open it. If ARCDOPEN had an ESTAE setup error, ARCWTL is called to write message ARC0707I to the backup activity log. If the data set open fails, control is passed back to ARCBVOL.

Module	Label
ARCBVCAT	ARCBVCAT QUIT
ARCDOPEN	ARCDOPEN
ARCFREE	ARCFREE
ARCTOPEN	ARCTOPEN
ARCWTO	ARCWTL

4. **Copy generation data group base entries from virtual storage access method (VSAM) catalog to copy data set and de-allocate the data set:** The VSAM catalog parameter list is initialized so entries from the VSAM catalog can be read using the LOCATE macro. If an error occurs during the LOCATE, unless the backup is to 3480 single-file format tape, the data sets are closed. If the backup is to 3480 single file format tape, ARCTCLOS is called to issue a SYNCDEV macro. The eligible volume record (MCP) of the source volume is updated, and ARCWTL is called to write message ARC0729I to inform the user that entries from the VSAM catalog have been backed up. The generation data group base entries that are successfully located are written to the backup copy data set. If the backup copy data set resides on DASD, the PUT macro is used to write the entries. If the backup copy data set is on tape, ARCBVCAT buffers the generation data group base entries into a 16K buffer and then issues a WRITE macro to write the buffer out to tape. After the write, the module ARCZDPUT will be called to determine if the output tape volume has reached the target level capacity as specified by the user via the SETSYS TAPEUTILIZATION command.

Module	Label
ARCBVCAT	ARCBVCAT ABENDEXT EOF EOV EOVABEND FILLBUF FREEBUF MCPUPDAT NXTGDG WRITEREC WRERR WVCAT
ARCZDPUT	ARCZDPUT
ARDCLOS	ARDCLOS
ARCFMAIN	ARCFMAIN
ARCFREE	ARCFREE
ARCGMAIN	ARCGMAIN
ARCITTOC	ARCITTOC
ARCLOCK	ARCLOCK
ARCTCLOS	ARCTCLOS
ARCTEOV	ARCTEOV
ARCTFULL	ARCTFULL
ARCTVERR	ARCTVERR
ARCUNLK	ARCUNLK
ARCUTTOC	ARCUTTOC
ARCWTO	ARCWTL
ARCZREAD	ARCZREAD

5. **Error conditions on DASD:** If the generation data group base entries are being backed up to DASD and an out-of-space condition occurs before all entries have been copied, the current volume is freed, and the program returns to ARCBVOL. For any other type of error, the abnormal end is allowed to complete.

Module	Label
ARCBVCAT	ARCBVCAT ABENDEXT EOVABEND QUIT
ARCDCLOS	ARCDCLOS
ARCFREE	ARCFREE

6. **Error conditions on tape:** If the generation data group base entries are being backed up to tape and an error occurs during the processing of the tape labels, abnormal end processing is bypassed. ARCTVERR is called to process the error, and control is returned to ARCBVOL. If a write error occurs on the tape, ARCTFULL is called to mark the volume full so it will not be used again, and control is passed back to ARCBVOL. For all other errors, ARCTFULL is called and abnormal end processing is allowed to continue.

Module	Label
ARCBVCAT	ARCBVCAT ABENDEXT EOV EOVABEND QUIT WRTERR
ARCFREE	ARCFREE
ARCGMAIN	ARCFMAIN
ARCTCLOS	ARCTCLOS
ARCTEOV	ARCTEOV
ARCTFULL	ARCTFULL
ARCTVERR	ARCTVERR
ARCWTO	ARCWTL

7. **Close VCAT copy data set and update MCP record:** When all generation data group base entries have been located and written to the copy data set, and the copy data set is on DASD or multiple-file tape, the copy data set is closed. If the copy data set is on 3480 single-file format tape, ARCTCLOS is called to do a SYNCDEV instead of a CLOSE. If the copy is on tape, the tape table of contents (TTOC) is updated. The MCP of the source volume is updated and ARCWTL writes a completion message (ARC0729I) to the backup activity log and the operator. If the copy is on DASD, ARCFREE frees the output allocation. ARCBVCAT now returns to ARCBVOL.

If there was a SYNCDEV failure in ARCTCLOS, the VCAT copy is not valid. The 16K buffer is freed, the 3480 single-file tape format data set is closed, the 3480 tape volume format is marked full, and ARCBVCAT returns to ARCBVOL. If there was an ARCZNOTE failure in ARCTCLOS, the table of contents (VTOC) copy is valid but the 3480 tape cannot be used any further. The 16K buffer is freed, the 3480 single-file format tape data set is closed, the MCP and TTOC are updated, and ARCBVCAT returns to ARCBVOL with a Return Code of 12. If the close fails on tape, ARCWTL is called to issue message ARC0923I to the backup activity log.

Module	Label
ARCBVCAT	ARCBVCAT EOF MCPUPDAT QUIT
ARDCLOS	ARDCLOS
ARCFREE	ARCFREE
ARCITTOC	ARCITTOC
ARCTCLOS	ARCTCLOS
ARCUTTOC	ARCUTTOC
ARCWTO	ARCWTL
ARCZREAD	ARCZREAD

Output

- Copy Data Set
- Return Codes:
 - 4 - Error with tape volume - processing halted
 - 8 - Allocation error
 - 12 - Error with tape volume - a valid VTOC copy exists, but the 3480 tape cannot be used further
 - 18 - Error with tape volume - retry condition exists
 - 35 - Open error
 - 52 - GETMAIN error
 - 54 - Tape data set exit ABEND
 - 98 - Maximum tape volumes per DDNAME reached.

Diagram 13.3: ARCBROLV - Roll-off Backup VTOC Copy Data Sets

Input

- ARCBROLP Parameter List.

Inout

- ARCBROLP Parameter List.

Processing

ARCBRV controls the roll-off of the oldest backup VTOC copy of a data set.

Output

- Updated ARCBROLP Parameter List
- Return Codes.

Diagram 13.4: ARCBVOL2 - Back Up Eligible Data Sets on a Level 0 Volume

Input

- Backup Task Control Block (BTCB)
- Management Communication Vector Table (MCVT)
- Mounted Volume Table (MVT)
- Data Control Block (DCB)
- VTOC of primary volume
- I/O buffers
- Generation Data Group base entries in VSAM catalog
- Backup Control Data Set (BCDS)
- VSAM Sphere Backup Control Record (SDATA)
- Recovery Control Block (RCB).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCBVOL2	ARCBVOL2
ARCPDA	ARCPDA

2. **Back up eligible VSAM data sets:** Before processing each SDATA control block, ARCZEND is called to check if any ending conditions have been encountered (the end volume backup processing indicator in the BTCB is updated with ARCZEND's results). If an ending condition was encountered, ARCWTL is called to issue message ARC0714I to the operator and the Backup Activity Log.

If it is detected that the VSAM component is open for output, then the data set is not processed and the ARC0734I message is issued.

ARCZREAD is called to read the BCDS data set record (MCB). If the MCB record indicates the data set has a retired backup version, the backup is failed and ARCMMSG is called to issue ARC0734I.

If incremental backup is being performed, every data set is examined to determine if it meets eligibility criteria. For a data set to be eligible for backup, it must never have been backed up, or must have changed since its last backup version was created and a specified number of days must have elapsed since its last backup version was created. If total backup is being performed, every data set is eligible for backup.

If compaction is requested for the target device type, check the MCB record to determine if the data set is eligible for compaction. ARCCLUSZ calculates the size of the VSAM data set. If the data set is empty, the data set is not processed, and ARCMMSG is called to issue ARC0734I.

If the data set is eligible for backup, ARCBKDS is called to perform the backup.

Module	Label
ARCBVOL2	ARCBVOL2 ELIGIBLE

	QUIT
	READMCB
	SKIPVDS
	VDSERROR
ARCAMSG	ARCAMSG
ARCBKDS	ARCBKDS
ARCCLUSZ	ARCCLUSZ
ARCWTO	ARCWTL
ARCZEND	ARCZEND
ARCZREAD	ARCZREAD

3. **Back up eligible non-VSAM data sets:** Before processing each BQE, ARCZEND is called to check if any ending conditions have been encountered (the end volume backup processing indicator in the BTCB is updated with ARCZEND's results). If an ending condition was encountered, ARCWTL is called to issue message ARC0714I to the operator and the Backup Activity Log.

ARCBELIG is called to determine if the data set is supported by DFHSM's backup function. ARCZLOC is called to issue a locate for the data set to see if it is cataloged. If the data set is catalogued, the volume list returned by ARCZLOC is examined to make sure this is a single volume data set. If the data set is not catalogued, it is not processed and an ARC0734I message is issued. If the data set is an OS CVOL, the name is changed to agree with the BCDS B record entry, that is, 'SYSCTLG.VVOLSER'.

ARCZREAD is called to read the BCDS data set record (MCB). If the MCB record indicates the data set has a retired backup version, the backup is failed and ARCAMSG is called to issue ARC0734I.

If incremental backup is being performed, each data set is examined to determine if it meets eligibility criteria. For a data set to be eligible for backup, the data set must never have been backed up, or must have changed since its last backup version was created and a specified number of days must have elapsed since its last backup version was created. If total backup is being performed, every data set is eligible for backup.

If compaction is requested for the target device type, check the MCB record to determine if the data set is eligible for compaction.

If the data set is eligible for backup, ARCBKDS is called to perform the backup.

Module	Label
ARCBVOL2	ARCBVOL2
	CHKDBU
	DSERROR
	ELIGIBLE
	QUIT
	READMCB
	SKIPDS
ARCAMSG	ARCAMSG
ARCBKDS	ARCBKDS
ARCBELIG	ARCBELIG
ARCWTO	ARCWTL
ARCZLOC	ARCZLOC
ARCZEND	ARCZEND
ARCZREAD	ARCZREAD

Output

- Input Parameters
- Mounted Volume Table (MVT)
- DDNAME
- Backup Cycle Volume Record (BVR)
- Return Codes:
 - 02 - Locate error
 - Reason Codes:
 - Return Codes from ARZLOC
 - 20 - Multi-volume data set
 - 25 - Error reading MCB record
 - Reason Codes:
 - Return Codes from ARZREAD
 - 66 - Data set has a retired backup version
 - 78 - DFDSS is the data mover, data set uncataloged
 - Reason Codes:
 - 4 - Data set not cataloged in the ICF catalog
 - 99 - Unsupported data set
 - Reason Codes:
 - Return Codes from ARCBELIG.

Diagram 13.5: ARCBVEND - Volume Backup Cleanup

Input

- ARCBVBEP Parameter List.

Inout

- ARCBVBEP Parameter List.

Processing

ARCBVEND performs the cleanup function after the backup of a volume.

Output

- Updated ARCBVBEP Parameter List.

Diagram 13.6: ARCBGDBV - Get a Daily Backup Volume for a Volume Backup Tape

Input

- Input Parameters
- Volume Backup Task.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCBGDBV	ARCBGDBV
ARCPDA	ARCPDA

2. **Get a tape daily backup volume:** If the caller wants a tape daily backup volume, ARCBGDBV checks the backup task control block (BTCB) to see if a tape daily backup volume is currently allocated. If one is, the DDNAME and mounted volume table (MVT) pointer in the BTCB are returned to the caller. If no tape daily backup volume is currently allocated, ARCSELBV is called to select and allocate a tape daily backup volume. The DDNAME and MVT pointer that ARCSELBV returns are returned to the caller of ARCBGDBV.

If a DASD daily backup volume is currently allocated, ARCSELBV is called to free the allocation of the DASD daily backup volume.

Module	Label
ARCBGDBV	ARCBGDBV
ARCSELBV	ARCSELBV

3. **Get a DASD daily backup volume:** If the caller wants a DASD daily backup volume, ARCBGDBV checks the BTCB to see if a DASD daily backup volume is currently allocated. If one is, the DDNAME and MVT pointer in the BTCB are returned to the caller. If no DASD daily backup volume is currently allocated, ARCSELBV is called to select and allocate a DASD daily backup volume. The DDNAME and MVT pointer that ARCSELBV returns are returned to the caller of ARCBGDBV.

If a tape daily backup volume is currently allocated, ARCSELBV is called to free the allocation of the tape daily backup volume.

Module	Label
ARCBGDBV	ARCBGDBV
ARCSELBV	ARCSELBV

4. **Get any type of daily backup volume:** If the caller wants any type of daily backup volume, ARCBGDBV checks the BTCB to see if a tape or DASD daily backup volume is currently allocated. If no daily backup volume (tape or DASD) is currently allocated, ARCSELBV is called to allocate any type of daily backup volume. The DDNAME and MVT pointer that ARCSELBV returns are returned to the caller of ARCBGDBV.

If a DASD daily backup volume is currently allocated, the DDNAME and MVT pointer in the BTCB are returned to the caller. If a tape daily backup volume is currently allocated, the DDNAME and MVT pointer in the BTCB are returned to the caller.

Module	Label
ARCBGDBV	ARCBGDBV
ARCSELBV	ARCSELBV

Output

- Pointer to the Mounted Volume Table (MVT)
- DDNAME.

Diagram 13.7: ARCBKDS - Control Backup of Individual Data Sets

Input

- ARCBKDP Parameter List.

Inout

- ARCBKDP Parameter List.

Processing

ARCBKDS controls the back up of SMS or non-SMS individual data sets.

Output

- Updated ARCBKDP Parameter List
- Return Codes.

Diagram 13.8: ARCZDPUT - Determine Percent Utilized of a Tape Volume**Input**

- ARCTPUTP Parameter List.

Inout

- Updated 'Data Written' Counters for Data Set (TPUTP)
- Updated 'Data Written' Counters for Mount (TTLI).

Processing

ARCZDPUT determines the percent utilized of a single file tape volume and forces an end-of-volume (EOV) when the target capacity of that volume is reached. The target capacity is defined by the user via the SETSYS TAPEUTILIZATION or SETSYS MAXSINGLEFILEBLOCKS command.

Output

- Return Code indicating if the tape volume should be forced to end-of-volume (EOV) or if the tape volume should continue to be used for writing data.

Diagram 13.9: ARCZDTLC - Determine Tape Limiting Criteria**Input**

- Pointer to ARCTPUTP Parameter List.

Processing

ARCZDTLC scans the user unit table or pseudo user unit table to obtain information related to tape limiting.

Output

- Return Codes.

SMS Volume Backup Processing

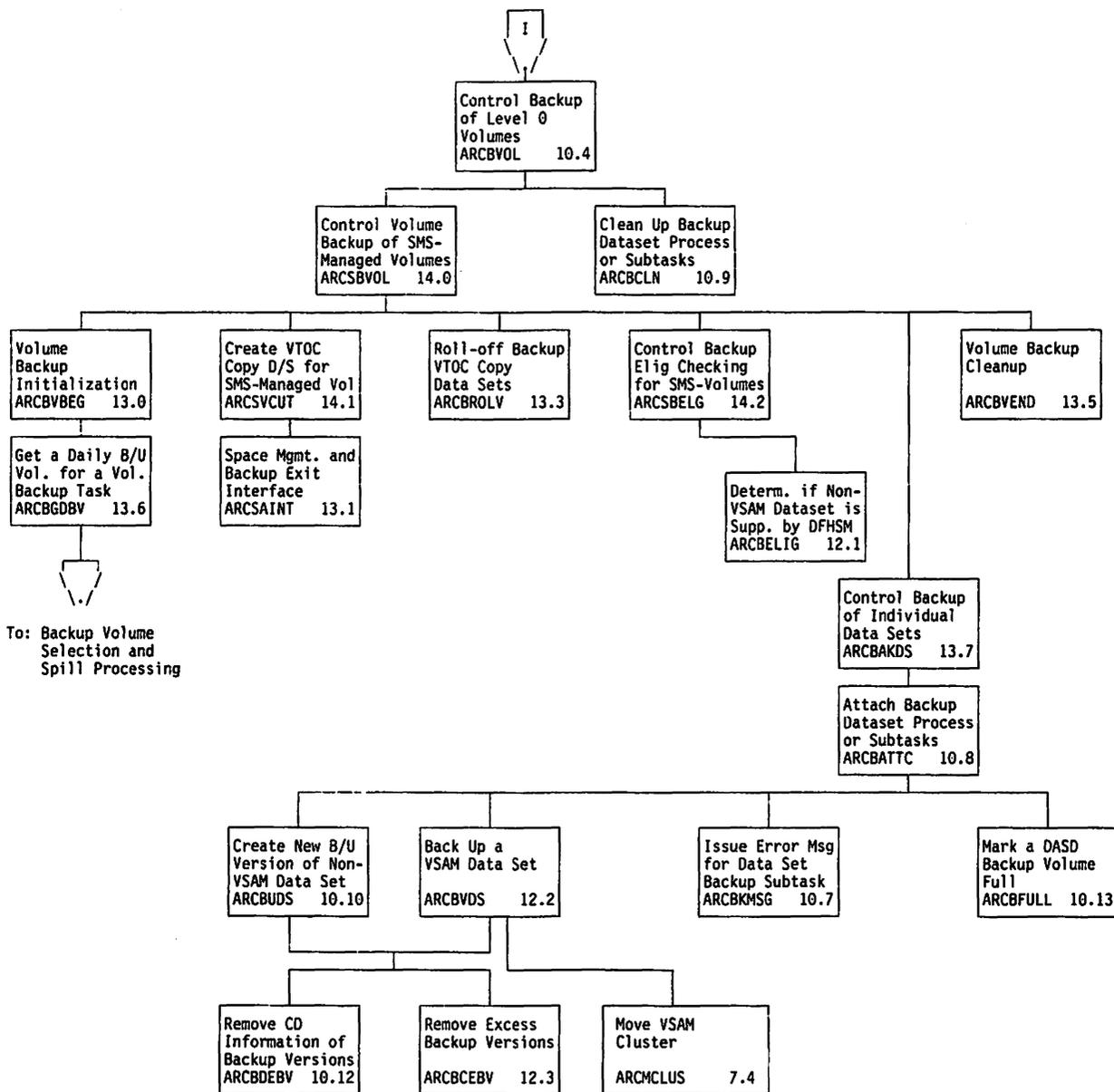


Figure 16. Visual Table of Contents for SMS Volume Backup Processing

Diagram 14.0: ARCSBVOL - Control Volume Backup of SMS-Managed Volumes

Input

- Index for Backup Task Control Block (BTCB).

Processing

ARCSBVOL controls the backup of SMS-managed volumes.

Output

- None.

Diagram 14.1: ARCSVCUT - Create VTOC Copy Data Set for an SMS-Managed Volume

Input

- ARCSVCUP Parameter List.

Processing

ARCSVCUT controls the creation of a VTOC copy data set for an SMS-managed volume using the extract list created by VTOC/VVDS services.

Output

- Updated ARCSVCUP Parameter List
- Return Codes.

Diagram 14.2: ARCSBELG - Control Backup Eligibility Checking for SMS Volumes

Input

- ARCSBELP Parameter List.

Inout

- ARCSBELP Parameter List.

Processing

ARCSBELG controls the eligibility checking for data sets being processed during the volume backup of an SMS-managed volume.

Output

- Updated ARCSBELP Parameter List
- Return Codes.

Dump Processing

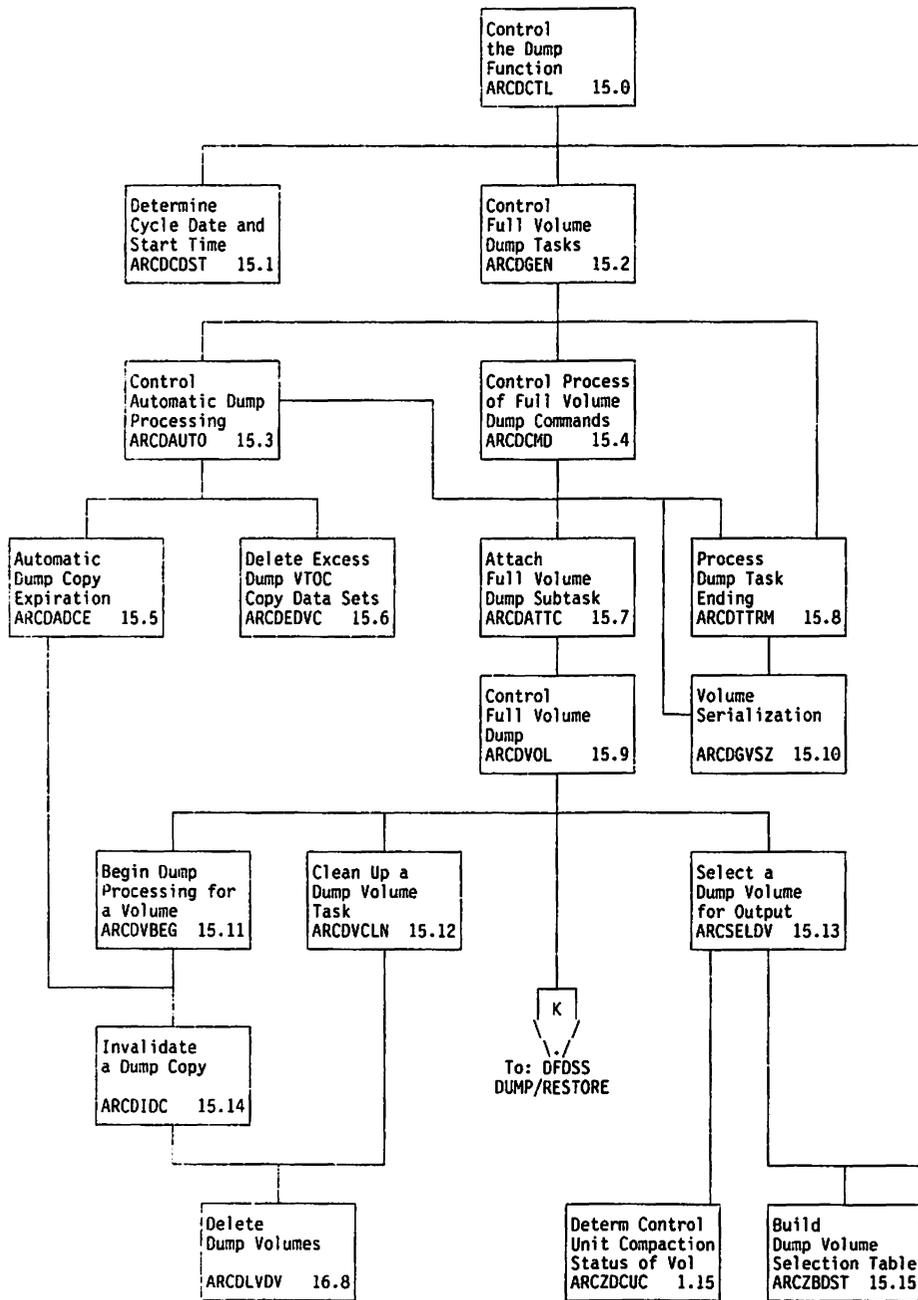


Figure 17. Visual Table of Contents for Dump Processing

Diagram 15.0: ARCDCTL - Control Dump Function

Input

- None.

Processing

ARCDCTL controls building of the dump volume selection table and processing of explicit dump-related commands.

Output

- Return Codes.

Diagram 15.1: ARCDCDST - Determine Cycle Date and Start Time

Input

- Function Request Code.

Processing

ARCDCDST determines the cycle day and date, checks the automatic dump start time, and optionally updates the Dump Control Record (DCR).

Output

- Return Codes.

Diagram 15.2: ARCDGEN - Control Full Volume Dump Tasks

Input

- Event Control Block (ECB) List.

Processing

ARCDGEN controls automatic and command-initiated full volume dump processing.

Output

- None.

Diagram 15.3: ARCDAUTO - Control Automatic Dump Processing

Input

- ARCDAUTO Request Flags
- Pointer to an Event Control Block (ECB) List.

Processing

ARCDAUTO controls automatic and level functions dump processing.

Output

- None.

Diagram 15.4: ARDCMD - Control Processing of Full Volume Dump Commands

Input

- Address of an Event Control Block (ECB) List.

Processing

ARDCMD controls the processing of full volume dump commands. For each BACKVOL DUMP-type MWE on the backup queue, a volume dump subtask is attached.

Output

- Return Codes.

Diagram 15.5: ARCDADCE - Automatic Dump Copy Expiration

Input

- None.

Processing

ARCDADCE expires any dump copy that is found to have reached its expiration date or the end of its retention period.

Output

- None.

Diagram 15.6: ARCDDEDVC - Delete Excess Dump VTOC Copy Data Sets

Input

- None.

Processing

ARCDDEDVC deletes any dump volume table of contents (VTOC) copy data sets that are in excess of the VTOCCOPIES parameter value established with the DEFINE command.

Output

- None.

Diagram 15.7: ARCDATTC - Attach Full Volume Dump Subtask

Input

- The Dump Task Control Block (DTCB) index that corresponds to the ARCDVOL subtask to be attached.

Processing

ARCDATTC either initializes the existing recovery control block (RCB) for the ARCDVOL subtask, or creates an RCB if one does not exist, and attaches the full volume dump subtask.

Output

- Return Codes.

Diagram 15.8: ARCDTTRM - Process Dump Task Ending

Input

- Index for Dump Task Control Block (DTCB).

Processing

ARCDTTRM processes the ending of a volume dump task.

Output

- Return Codes.

Diagram 15.9: ARCDVOL - Control Full Volume Dump

Input

- Index for Dump Task Control Block (DTCB).

Processing

ARCDVOL controls the full volume dump of a single volume. There may be more than one volume dump attached and executing at the same time.

Output

- Return Codes.

Diagram 15.10: ARCDGVSZ - Volume Serialization

Input

- ARCVSZP Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCDGVSZ	ARCDGVSZ
ARCPDA	ARCPDA

2. **Validate input parameters:** For all calls, the parameter list must be validated. If any parameters are in error, call ARCERP to process the error and return to the caller.

Module	Label
ARCDGVSZ	ARCDGVSZ VAL_PARMS
ARCERP	ARCERP

3. **Establish mounted volume table (MVT):** If the MVT was not passed by the caller, then:
 - a. Call ARCGMAIN to get storage for a temporary MVT. If this fails, set a Return Code, call ARCWTU3 to issue message ARC0708I, and call ARCWTL to issue the same message to the user if the caller requested, and if user ID is provided. Then return to the caller.
 - b. Call ARCZMVT to find or build an MVT for the volume. If a failure occurs, free the MVT storage by calling ARCFMAIN and return to the caller. If the MVT is for an SMS volume, but SMS is not installed or the level of DFDSS installed does not support SMS-managed volumes, call ARCSM570 to issue message ARC0570I. Depending on the Return Code from ARCZMVT, call ARCWTU3 to issue message ARC0510I to the dump activity log and call ARCWTL to issue message ARC0510I to the requestor, or call ARCSM570 to issue message ARC0570I to the requestor and dump activity log if a failure occurred getting an MVT for an SMS volume.

If the MVT was found, and the request is for recovery or restore, call ARCZOBT to read the Format 4 DSCB for the volume. If an error occurs, or if the volume is in SMS Initial status, call ARCSM570 to issue message ARC0570I.

Module	Label
ARCDGVSZ	ARCDGVSZ SERIALIZATION MESSAGE_ARC0510 MESSAGE_ARC0570 MESSAGE_ARC0708 MVT_BUILD ZMVT_RETURN_CODE_HANDLER ZMVT_POINTER_TEST OBTAIN
ARCGMAIN	ARCGMAIN

ARCSM570	ARCSM570
ARCZMVT	ARCZMVT
ARCZOBT	ARCZOBT
ARCWTO	ARCWTL
	ARCWTU3
ARCGMAIN	ARCFMAIN

4. **Serialize volume:** If an MVT is available, do the following:

- a. Call ARCLOCKC to enqueue exclusively on the DFHSM primary volume resource (qname='ARCPVOL ', rname=volser, type=exclusive, scope=local). If this enqueue is unsuccessful and a command is being processed, call ARCWTL to issue message ARC0301I to the dump activity log and call ARCWTU3 to issue the same message to the requestor.

If the caller requested the MVT be marked "in-use", and the volume is in use, then indicate in the MVT whether it is in use in this host or another host.

- b. In a multi-host environment, call ARCCMHRD to update the MCV record with the host ID, and perform multi-host interval checking if an automatic process has requested the serialization. If the multi-host serialization is successful, update the MVT with the DUMPCLASS from the MCV record. If there is an SDSP on the volume, call ARCALSDP to allocate the SDSP. If the allocation fails, call ARCCMHWR to remove the host-id from the MCV record and call ARCUNLKC to release the enqueue on the primary volume; then call ARCWTL to issue message ARC0331I to the requested activity log and call ARCWTU3 to issue ARC0331I to the requestor.
- c. If a CDS I/O error occurs, call ARCWTL to issue message ARC0510I to the dump activity log. Also call ARCWTU3 to issue the same message to the requestor. Call ARCUNLKC to dequeue the ARCPVOL-volser resource if held. If volume is already in use call ARCWTL to issue message ARC0301I to the dump activity log and call ARCWTU3 to issue message ARC0301I to the requestor. Call ARCFMAIN to free the MVT if necessary.

If an MVT is found or built successfully, and serialization is successful, then return the MVT address to the caller.

Module	Label
ARCDGVSZ	ARCDGVSZ MULTI_HOST_SERIALIZATION SERIALIZATION LOCK_SDSP MESSAGE_ARC0301 MESSAGE_ARC0331 MESSAGE_ARC0510
ARCALSDP	ARCALSDP
ARCLOCK	ARCLOCKC ARCUNLKC
ARCWTO	ARCWTL ARCWTU3

5. **Removal of serialization:** The steps required to perform removal of serialization are:

- a. If an SDSP was allocated on the volume, call ARCFRSDP to deallocate it.
- b. If the volume is a DFHSM managed volume, then call ARCCMHWR to reset the processing unit ID in the MCV record if this is a multiple processing unit environment.
- c. If the volume is a level 0 volume, then call ARCUNLKC to dequeue the ARCPVOL volser resource.
- d. If the MVT is temporary, call ARCFMAIN to free the storage.

Module	Label
ARCDGVSZ	ARCDGVSZ DESERIALIZATION
ARCALSDP	ARCFRSDP
ARCCMHRD	ARCCMHWR
ARCLOCK	ARCUNLKC
ARCGMAIN	ARCFMAIN

Output

- DVSZFMVT - (Bit one) On = mounted volume table (MVT) address returned
- DVSZMVTP - pointer to MVT entry
- DVSZRC - Return Code
- Return Codes:
 - 0 - Normal completion
 - 2 - Non-zero Return Code from ARCZMVT returned in Reason Code
Reason Codes:
 - Non-zero Return Codes from ARCZMVT
 - 4 - ARCLOCKC could not enqueue the DFHSM primary volume resource
Reason Codes:
 - Non-zero Return Codes from ARCLOCKC
 - 6 - ARCCMHRD could not update the MCV record with the host ID
Reason Codes:
 - Return Codes from ARCCMHRD
 - 8 - SDSP serialization failed
Reason Codes:
 - Return Codes from ARCALSDP
 - 14 - Environmental error for SMS
 - 52 - Failure to get storage for temporary MVT.

Diagram 15.11: ARCDVBEG - Begin Dump Processing for a Volume

Input

- Index for Dump Task Control Block (DTCB).

Processing

ARCDVBEG begins the volume dump process. It reads the eligible volume record (MCP), creates one if one does not exist, and determines which dump classes will be dumped into. ARCDVBEG also determines whether dump frequency requirements have been met.

Output

- Return Codes.

Diagram 15.12: ARCDVCLN - Clean Up a Dump Volume Task

Input

- Index for Data Task Control Block (DTCB).

Processing

ARCDVCLN performs all ending cleanup functions after a full volume dump has been performed, whether the dump was successful or unsuccessful.

Output

- None.

Diagram 15.13: ARCSELDV - Select a Dump Volume for Output

Input

- ARCSLDVP Parameter List.

Processing

ARCSELDV selects a dump tape volume from the Dump Volume Selection Table (DVST) for a given volume dump task.

Output

- Return Codes.

Diagram 15.14: ARCDIDC - Invalidate a Dump Copy

Input

- ARCDIDC Parameter List
- Dump Generation Record (DGN).

Processing

ARCDIDC invalidates a single dump copy, multiple dump copies, or the entire dump generation. The invalidated dump copies are removed from the dump generation record and the dump volumes are deleted from the list of volumes owned or managed by DFHSM. ARCDIDC also scratches the dump volume table of contents (VTOC) copy data set that is no longer needed.

Output

- Return Codes.

Diagram 15.15: ARCZBDST - Build Dump Volume Selection Table

Input

- ARCBDSTP Parameter List.

Processing

ARCZBDST builds the dump volume selection table (DVST) of the available dump volumes. ARCZBDST resets the processing unit IDs in the DVL records and either rebuilds the DVST when it is empty, if no volume meeting its requirements can be found, or if the table does not exist.

Output

- Return Codes.

DFDSS Dump and Restore Processing

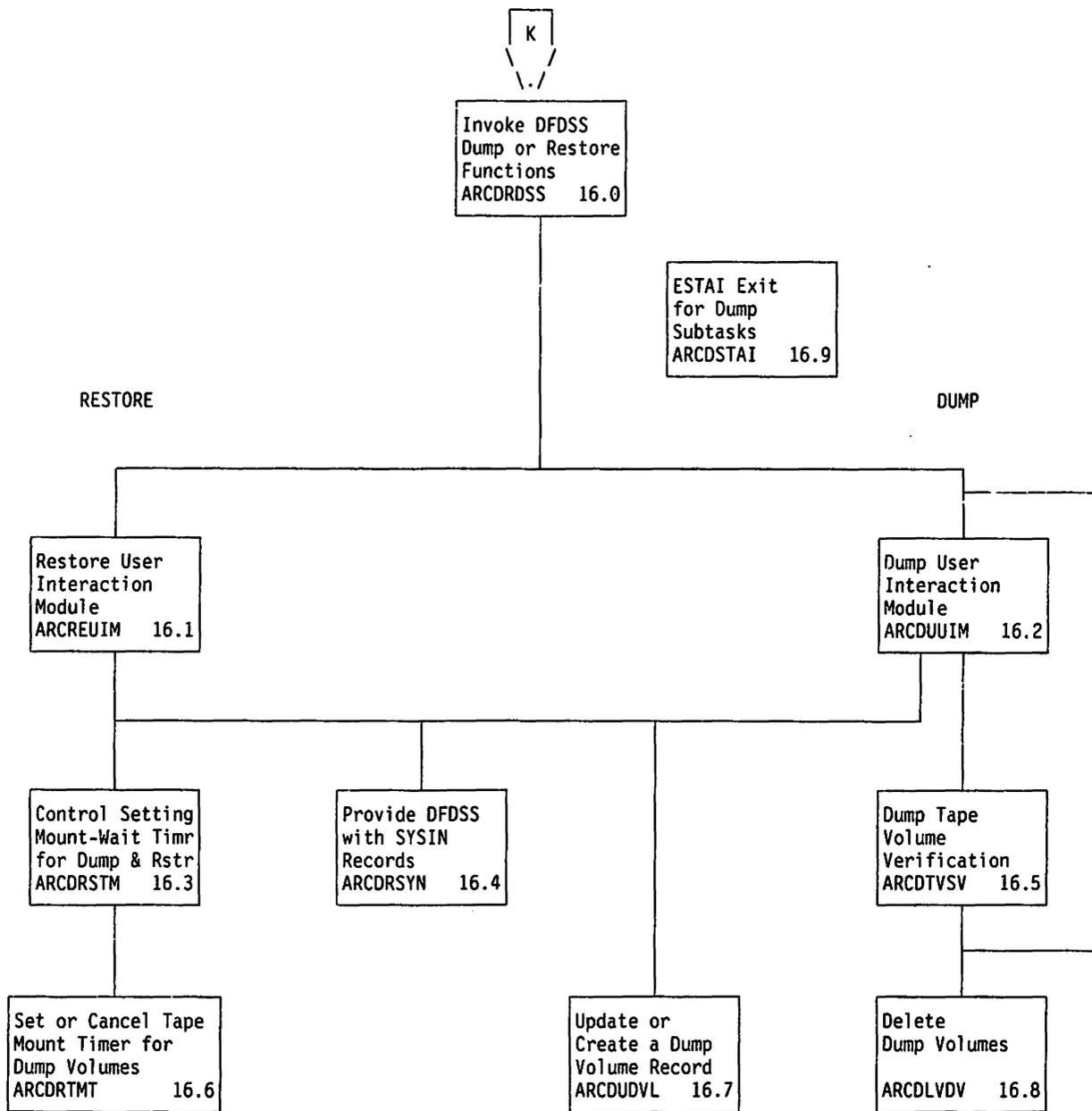


Figure 18. Visual Table of Contents for DFDSS Dump/Restore Processing

Diagram 16.0: ARCDRDSS - Invoke DFDSS Dump or Restore functions**Input**

- ARCDDSSP Parameter List.

Processing

ARCDRDSS builds DFDSS commands in storage in a SYSIN record format to invoke DFDSS dump or restore functions for SMS and non-SMS-managed data sets.

Output

- Updated ARCDDSSP Parameter List
- Return Codes.

Diagram 16.1: ARCREUIM - Restore User Interaction Module**Input**

- Data Facility Data Set Services (DFDSS) ADREID0 Parameter List.

Processing

ARCREUIM serves as the User Interaction Module (UIM) for invocation of the DFDSS restore function, and is an exit taken by DFDSS at various points during DFDSS restore processing. ARCREUIM monitors DFDSS while requests for volume or data set restore are being processed.

Output

- Return Codes.

Diagram 16.2: ARCDUUIIM - Dump User Interaction Module**Input**

- Data Facility Data Set Services (DFDSS) ADREID0 Parameter List.

Processing

ARCDUUIIM serves as the User Interaction Module (UIM) for invoking the DFDSS dump function, and is an exit taken by DFDSS at various points during DFDSS dump processing. ARCDUUIIM monitors DFDSS while volume dumps are being processed.

Output

- Return Codes.

Diagram 16.3: ARCDRSTM - Control Setting of Mount-Wait Timer for Dump and Restore

Input

- Pointer to the ARCDDSSP Parameter List
- FUNCTION CHAR(1):
- Attach ARCDRTMT
 - Attach ARCDRTMT and post it to set the mount wait timer
 - Post ARCDRTMT to set the mount wait timer
 - Detach ARCDRTMT
 - Post ARCDRTMT to cancel mount wait time and detach subtask
 - Post ARCDRTMT to cancel mount wait timer.

Processing

ARCDRSTM controls the setting of the mount wait timer for dump and restore.

Output

- Return Codes
 - 08 - Failure in the ATTACH macro (ARCERP called with debug option)
 - 16 - ABEND in the ARCDRTMT subtask (ARCERP called with debug option).

Diagram 16.4: ARCDRSYN - Provide DFDSS With SYSIN Records

Input

- Pointer to DFDSS's exit identification block
- Pointer to the DFHSM ARCDDSSP Parameter List.

Processing

ARCDRSYN is invoked when Data Facility Data Set Services (DFDSS) is reading a SYSIN record. It provides DFDSS with the next line of the dump or restore command that is being processed.

Output

- None.

Diagram 16.5: ARCDTVSV - Dump Tape Volume Verification**Input**

- Pointer to the DFP IOCOEVSE Parameter List
- Pointer to the Mounted Volume Table (MVT).

Processing

ARCDTVSV performs the necessary security and verification checking on tape volumes requested for mounting. ARCDTVSV is invoked in response to mount scratch requests.

Output

- Return Codes.

Diagram 16.6: ARCDRTMT - Set or Cancel Tape Mount Timer for Dump Volumes**Input**

- Sets pointer to the ARCDDSSP Parameter List
- Work-to-do Event Control Block (ECB).

Processing

ARCDRTMT is attached by ARCDRSTM and posted to set up or cancel STIMERS for the mount wait time protection of dump tape volumes. It also requires three asynchronous STIMER exists which gain control if the timer expires.

Output

- ECB completion codes.

Diagram 16.7: ARCDUDVL - Update or Create a Dump Volume Record**Input**

- Index to the DDSSP Parameter List
- Index to the MVT pointer (MVTIDX) in the DDSSP.

Processing

ARCDUDVL is invoked after the first write has been performed to a dump tape to create or update a backup control data set (BCDS) dump volume record (DVL), and to add the tape volume to the in-storage copy of the BCDS dump generation record (DGN).

Output

- Return Codes.

Diagram 16.8: ARCDLVDV - Delete Dump Volumes

Input

- The input to this module differs according to the number of dump volumes to be deleted
 - If only one dump volume is to be deleted, the address of a 6-byte volume serial number is required
 - If all the dump volumes containing a dump copy in the DGN record are to be deleted, the address of a DGN record is required.

Processing

ARCDLVDV performs the DELVOL function for a dump volume, or for all volumes associated with a dump copy.

Output

- Updated ARCDLDVP Parameter List
- Return Codes.

Diagram 16.9: ARCDSTAI - ESTAI Exit for Dump Subtasks

Input

- Pointer to the System Diagnostic Work Area (SDWA) control block.

Processing

ARCDSTAI is the ESTAI exit module for the dump subtasks in the dump function. This module also processes abnormal end situations for the ARCDCTL, ARCDGEN, ARCDVOL, and ARCDSSU (DFDSS) dump subtasks.

Output

- None.

Volume Recovery Processing

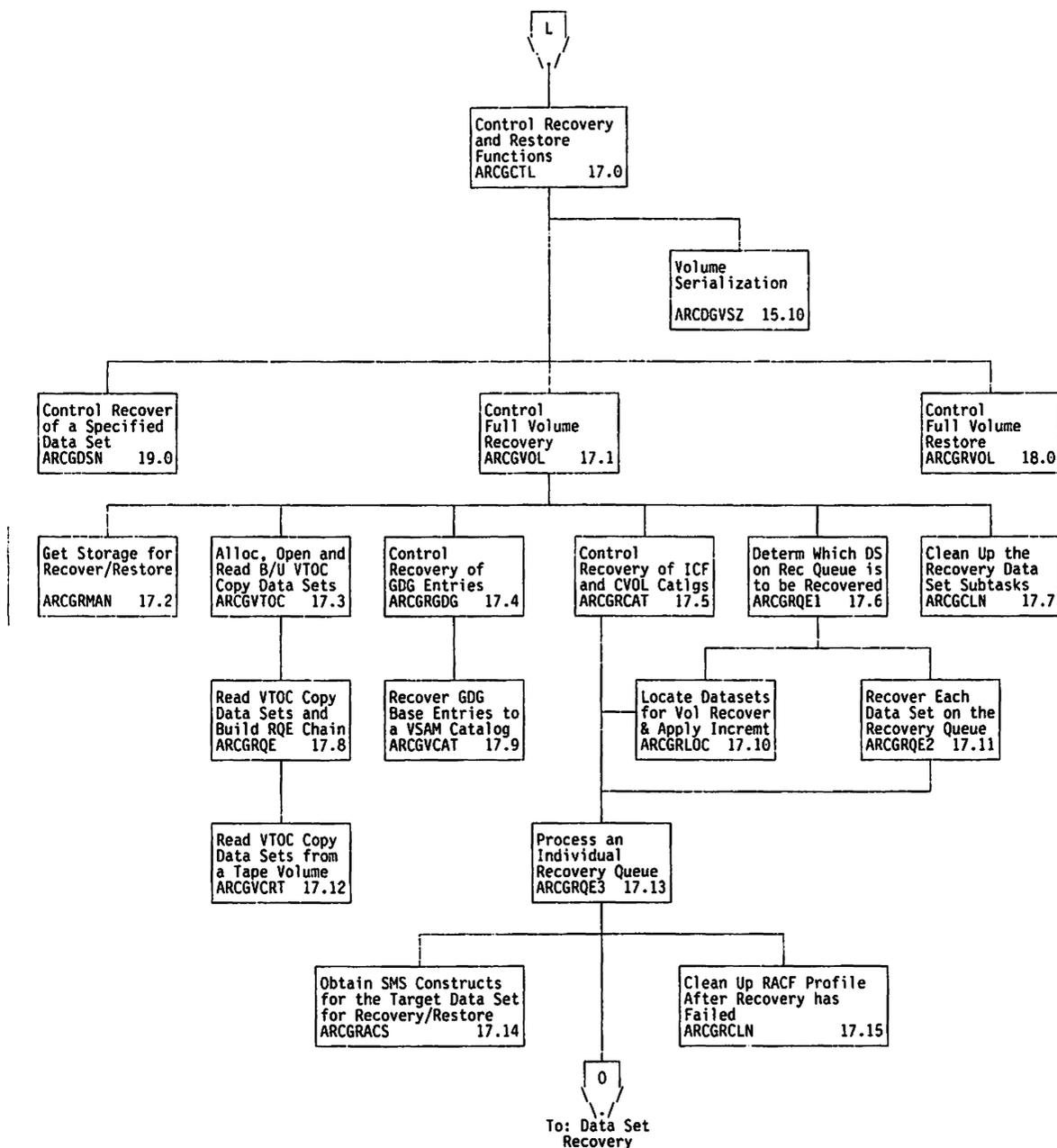


Figure 19. Visual Table of Contents for Volume Recovery Processing

Diagram 17.0: ARCGCTL - Control Recovery and Restore Functions

Input

- Management Work Element (MWE)
- Management Communication Vector Table (MCVT)
- Recovery Control Block (RCB).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGCTL	ARCGCTL
ARCPDA	ARCPDA

2. **Set up for the recovery and restore functions:** ARCGCTL is attached by ARCCTL once and remains attached to control the recovery and restore functions as long as DFHSM is active.

It does the following setups for the recovery and restore functions:

- Call ARCGMAIN to get storage for the recovery/restore task control block (GTCB) array. If this fails, call ARCCTL to issue message ARC0738I, disable backup function, and return to ARCCTL. Otherwise, save the address of the GTCB array in the management communication vector (MCVT) table and initialize the GTCBs.
- Set up an event control block (ECB) list including three ending ECBs (one for each subtask) and one work-to-do ECB for itself.
- Execute steps 3 to 5 as long as DFHSM is not shut down.

Module	Label
ARCGCTL	ARCGCTL SETUP MSG738
ARCGMAIN	ARCGMAIN
ARCWTO	ARCCTL

3. **Manage the dump and backup activity logs:** If no volume restore task is attached and dump activity log is open and has been written to, POST ARCDCTL to close and reopen the volume dump log.

If none of volume and data set recovery tasks is attached and backup activity log is open and has been written to, POST ARCBACK to close and reopen the backup log.

Issue the WAIT macro to wait for one of the ECBs which are in the ECB list to be posted.

Clear ARCGCTL's work-to-do ECB.

Module	Label
ARCGCTL	ARCGCTL WAIT MANAGLOG

4. **DETACH the subtask if it ended:** When one of the ending ECBs is posted, do the following:
- If IMPORT fails the data set recovery because there is not enough space in the primary allocation to include the requested free space and no secondary allocation is allowed, call ARCWTU to issue Message ARC0769I, and retry recovery of the data set.
 - Detach the subtask with STAE = YES. Reset the subtask task control block (TCB) pointer and ending ECB in the GTCB.
 - For ARCGVOL and ARCGRVOL subtasks, call ARCDGVSZ to remove the volume serialization done for the target volume.
 - Call ARCPMWE to purge the management work element (MWE) that the subtask was processing.
 - Call ARCDRCB to delete the subtask's recovery control block (RCB).

If DFHSM is being shutdown and any subtask is still active, then WAIT for any active subtask to end.

Module	Label
ARCGCTL	ARCGCTL DETSUBT VOLPROC MSG769
ARCCRCB	ARCDRCB
ARCDGVSZ	ARCDGVSZ
ARCLOCK	ARCLOCK
ARCENQ	ARCENQF
ARCUNLK	ARCUNLK
ARCPMWE	ARCPMWE
ARCWTO	ARCWTU

5. **Attach recovery and restore subtasks to process the recovery and restore MWEs:** If DFHSM is not being shutdown, not in emergency mode, and recovery is not held, do the following:
- Call ARCLOCK with a qname = 'ARCGPA ' and rname = 'BAKQ ' to enqueue exclusively on the backup MWE queue.
 - Search through the backup MWE queue to process the recovery and restore MWEs.
 - If backup is disabled, call ARCDEQ to remove the MWE from the backup queue, fail the MWE, and call ARCPMWE to purge MWE.
 - If the recovery function is held and the MWE is a WAIT-type MWE, call ARCDEQ to remove the MWE from the backup queue, fail the MWE, and call ARCPMWE to purge the MWE.
 - If this is a volume recovery MWE, the recovery is not held, and ARCGVOL is not already attached, proceed to step 7 to begin the volume recovery subtask.
 - If this is a data set restore MWE (the FROMDUMP was specified in the data set recover command), the TAPEDATASET recovery is held, and this is a wait-type MWE, call ARCDEQ to remove the MWE from backup queue, fail the MWE, and call ARCPMWE to purge the MWE.

- If this is a data set restore or recovery from tape MWE, the TAPEDATASET recovery is held, and this is a non-wait-type MWE, skip the MWE.
- If this is a data set restore or recovery MWE, the recovery function and TAPEDATASET recovery are not held and ARCGDSN is not already attached, proceed to step 7 to begin the data set recovery subtask.
- If this is a volume restore MWE (FROMDUMP is specified on the volume recover command) but Data Facility Data Set Services (DFDSS) is not installed or is not of a sufficient release level to support invocation from DFHSM, call ARCDEQ to remove the MWE from backup queue, fail the MWE, and call ARCPMWE to purge the MWE.
- If this is a volume restore MWE and ARCGRVOL is not already attached, proceed to step 7 to begin the volume restore subtask.
- Call ARCUNLK with a qname of 'ARCGPA ' and rname of 'BAKQ to dequeue the backup MWE queue after the search.

Module	Label
ARCGCTL	ARCGCTL MWEPROC PURGEMWE ATTSUBT
ARCDEQ	ARCDEQ
ARCLOCK	ARCLOCK ARCUNLK
ARCPMWE	ARCPMWE
ARCUNLK	ARCUNLK

6. **Return to ARCCTL:** When DFHSM is shut down, call ARCFMAIN to free the storage for GTCBs and return to ARCCTL.

Module	Label
ARCGCTL	ARCGCTL
ARCGMAIN	ARCFMAIN

7. **Begin a subtask:** Call ARCDEQ to remove the MWE from the backup MWE queue and mark the MWE is being processed.

Call ARCCRCB to create an RCB with three data set array entries.

Store the RCB address in GTCB and MWE address in RCB.

For the ARCGVOL and ARCGRVOL subtasks, call ARCDGVSZ to find or build an MVT for the target volume, and to serialize the volume. If ARCDGVSZ encounters a failure, call ARCPMWE to purge the MWE. Otherwise, save the address of the MVT entry returned by ARCDGVSZ in RCB. Issue the ATTACH macro to attach the subtask.

Save the subtask's TCB address in the appropriate GTCB.

Module	Label
ARCGCTL	ARCGCTL VOLPROC ATTSUBT
ARCCRCB	ARCCRCB
ARCDEQ	ARCDEQ
ARCPMWE	ARCPMWE
ARCDGVSZ	ARCDGVSZ

Output

- Return Codes:
 - 0 - The recover command was successful
 - 40 - Recovery function disabled
 - 62 - Restore from dump volume failed; DFDSS not at a sufficient level
 - Reason Codes:
 - 4 - Physical DFDSS RESTORE from a dump volume failed
 - 74 - Data set/volume recovery failed; the function held
 - Reason Codes:
 - 4 - Recovery was held
 - 8 - Recover (TAPEDATASET) was held and backup version or dump copy is on tape
 - 86 - Recover failed; DFHSM shutdown occurred while waiting for tape mount
 - 95 - Recover failed; tape volume could not be mounted.

Diagram 17.1: ARCGVOL - Control Full Volume Recovery

Input

- Management Work Element (MWE)
- Recovery Control Block (RCB)
- Recovery Task Control Block (GTCB).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGVOL	ARCGVOL
ARCPDA	ARCPDA

2. **Validate the Recovery/Restore Task Control Block ARCGTCB:** ARCGVOL is attached by ARCGCTL to control full volume recovery. ARCGVOL validates the ARCGTCB control block. If there are any errors, call ARCERP to inform the user of the error, and return to the caller.

Module	Label
ARCGVOL	ARCGVOL CHECK_INPUT
ARCERP	ARCERP

3. **Start full volume recovery:** Call ARCTDATE to get the current time and date for message ARC0772I and call ARCWTL and/or ARCWTU3 to issue message ARC0772I to indicate the start of volume recovery. Call ARCGRMAN to initialize areas for GDSP, BCDS data set record (MCB), BCDS backup version record (MCC), and eligible volume record (MCP), and save the addresses in ARCGTCB and ARCGDSP.

Module	Label
ARCGVOL	ARCGVOL SETUP_RECOVERY
ARCGRMAN	ARCGRMAN
ARCTDATE	ARCTDATE
ARCWTO	ARCWTL ARCWTU3

4. **Allocate and retrieve information for the volume being recovered:** Call ARCALVOL to allocate the volume being recovered. If any allocation error, proceed to step 7. Call ARCZREAD to read the MCP for the volume. If any read error occurs, call ARCWTL to issue message ARC0752I and proceed to step 7. If the MCP is in the old format, call ARCCMCP to convert the MCP to the new expanded format. If any conversion error occurs, proceed to step 7.

Module	Label
ARCGVOL	ARCGVOL TARGET_VOLUME
ARCALVOL	ARCALVOL
ARCCMCP	ARCCMCP
ARCWTO	ARCWTL ARCWTU3

ARCZREAD ARCZREAD

5. **Build a queue for all data sets to be recovered:** Call ARCZEND to check that DFHSM is not shutdown or in emergency mode, backup is not disabled, or recovery is held at end of data set. If so, end the recovery process. Call ARCGVTOC to allocate, open, and read the volume table of contents (VTOC) copy data set, if there is a backup VTOC copy data set. ARCGVTOC calls ARCGRQE to build the recovery queue of all the data sets to be recovered for the volume. If any errors occur, proceed to step 7. If there is not a VTOC copy data set, call ARCWTL and/or ARCWTU3 to issue message ARC0752I.

Module	Label
ARCGVOL	ARCGVOL
ARCGVTOC	ARCGVTOC
ARCWTO	ARCTWL
	ARCWTU3
ARCZEND	ARCZEND

6. **Recover the data sets for the volume:** Call ARCCRCB twice to create and initialize the recovery control blocks (RCBs) for ARCGDS and ARCGVDS. If there are Integrated Catalog Facility or OS CVOL catalog(s) on the volume being recovered, then call ARCGRCAT to recover the catalog data set(s) on the recovery queue built by ARCGRQE. If there is an error recovering any catalog data set(s), call ARCWTL to issue message ARC0754I, and proceed to step 7. If there is a virtual storage access method (VSAM) catalog on the volume, call ARCGRGDG to recover GDG entries from the VSAM catalog. If the Return Code from ARCGRGDG indicates that the user exit in ARCGVCAT abnormally ended, proceed to step 7. Call ARCGRQE1 to recover the rest of the data sets on the recovery queue built by ARCGRQE.

Module	Label
ARCGVOL	ARCGVOL
	RECOVER_DATASET
ARCCRCB	ARCCRCB
ARCGRCAT	ARCGRCAT
ARCGRGDG	ARCGRGDG
ARCGRQE1	ARCGRQE1
ARCWTO	ARCWTL

7. **Cleanup procedure:** Call ARCGCLN to clean up the data set recovery subtasks. Call ARCULVOL to deallocate the backup volume(s), and if the backup volume is an virtual volume and the installation requested to unload the virtual volume, call ARCULVRT to unload the virtual volume. If the target volume is a mass storage system (MSS) volume, call ARCMSREL to relinquish MSS space, and call ARCULVOL to deallocate the volume. Call ARCFMAIN to free the storage for the tape volume list of all the tape volumes used for recovery. Call ARCFMAIN to free the storage for the recovery queue elements (RQEs). Call ARCFMAIN to free the storage for the GDSP areas. If any data set was recovered to the target volume, call ARCLSPAC to update the space on the recovered volume. Get the current time and date for message ARC0773I and call ARCWTL and/or ARCWTU3 to issue message ARC0773I to indicate that the full volume recovery is finish. Return to the caller.

Module	Label
ARCGVOL	ARCGVOL
	CLEANUP
	FREESTORAGE
ARCACREL	ARCMSREL
ARCGCLN	ARCGCLN
ARCGMAIN	ARCFMAIN
ARCLSPAC	ARCLSPAC
ARCTDATE	ARCTDATE
ARCULVOL	ARCULVOL
ARCULVRT	ARCULVRT
ARCWTO	ARCWTL
	ARCWTU3

Output

- Recovered backup version of data sets in the volume.

Diagram 17.2: ARCGRMAN - Get Storage for Recovery/Restore

Input

- ARCGRMANP Parameter List
- Recovery Task Control Block (GTCB).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGRMAN	ARCGRMAN
ARCPDA	ARCPDA

2. **Check input parameter list:** ARCGRMAN validates the input parameter list. If any error are found, then ARCERP is called to log the error, a non-zero Return Code is set, and control is returned to the caller immediately.

Module	Label
ARCGRMAN	ARCGRMAN
	CHKINPUTS
ARCERP	ARCERP

3. **Get a block of storage for the requesting function** ARCGRMAN calls ARCGMAIN to get a block of storage from subpool 2 for the volume recovery, volume restore without APPLYINCREMENTAL/ volume restore with APPLYINCREMENTAL, or data set recovery/restore task.

Module	Label
ARCGRMAN	ARCGRMAN
	GET_STORAGE
ARCGMAIN	ARCGMAIN

4. **Assign addresses:** ARCGRMAN divides the block storage gotten into pieces of the storages, gets the addresses of the storages, and saves the addresses in Recovery/Restore Task Control Block (GTCB) and in Recovery/Restore Data Set Parameter List (GDSP).

Module	Label
ARCGRMAN	ARCGRMAN
	ASSIGN_ADDR
	ASSIGN_SECOND_ADDR
	ASSIGN_QUANCHOR_ADDR
	ASSIGN_THIRD_ADDR

Output

- Return Codes
 - 0 - Storage obtained successfully
 - 52 - GETMAIN failure.

Diagram 17.3: ARCGVTOC - Allocate, Open and Read Backup VTOC Copy Data Sets

Input

- ARCGTOCP Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGVTOC	ARCGVTOC
ARCPDA	ARCPDA

2. **Validity checking of input parameter list:** ARCGVTOC is called to allocate, open, and read the backup volume table of contents (VTOC) copy data set.
 - ARCGVTOC validates the input parameter list ARCGTOCP. If any are in error, it calls ARCERP and returns to the caller.
 - If the input parameters are all valid, ARCGVTOC attempts the following steps for the latest copy of the VTOC data set. If any error occurred on allocating, opening, or reading of the latest copy of VTOC data set and the next latest copy of VTOC is eligible for use, ARCGVTOC will call ARCWTL to issue message ARC076II, process the following steps for the next latest copy of the VTOC data set.

Module	Label
ARCGVTOC	ARCGVTOC CHKINPUTS INITIAL MSG761
ARCERP	ARCERP
ARCWTO	ARCWTL

3. **Construct the VTOC copy data set name:** If the VTOC copy data set is on a single-file 3480 tape backup volume, construct the single-file tape data set name for VTOC copy data set. If the VTOC copy data set is not on a single-file format 3480 tape backup volume, call ARCZVCNM to construct the name.

Module	Label
ARCGVTOC	ARCGVTOC VTOCPROC VTOCNAME
ARCZVCNM	ARCZVCNM

4. **Allocate and open the backup VTOC copy data set on ML1 (Migration Level 1) or backup DASD volume:** If the backup VTOC copy data set is on an ML1 or DASD volume:
 - Call ARCZMVT to find or build a mounted volume table (MVT) entry for allocation
 - If the MVT entry was obtained, call ARCALVOL to allocate the volume
 - Call ARCZVCUT to allocate and open the VTOC copy data set.

Module	Label
ARCGVTOC	ARCGVTOC VTOCDASD VTOCDASD_ALLOC_OPEN
ARCALVOL	ARCALVOL
ARCZMVT	ARCZMVT
ARCZVCUT	ARCZVCUT

5. **Allocate and open the backup VTOC copy data set on tape volume(s):** If the backup VTOC copy data set is on tape volume(s):

- Call ARCZQBLD to build a tape volume queue for all tapes needed by this recovery
- Call ARCWTO to issue message ARC0760I for each tape added to the tape queue to notify the operator that the tape is needed for recovery
- Call ARCZTMVT to build an MVT entry, verify if the tape volume(s) are available, and allocate the tape volume(s)
- Call ARCZEST to set up an ESTAE environment before reading JFCB
- If the tape volume(s) are allocated, read the job file control block (JFCB)
- If the read of JFCB failed, call ARCULVOL to deallocate the volume and call ARCERP to log the error and take a SNAP dump
- If the read of JFCB was successful, call ARCTOPEN to open the VTOC copy data set.

Module	Label
ARCGVTOC	ARCGVTOC VTOCTAPE BLD_TAPEQ VTOCTAPE_OPEN ZQBLD_PROG
ARCERP	ARCERP
ARCTOPEN	ARCTOPEN
ARCULVOL	ARCULVOL
ARCWTO	ARCWTO
ARCZEST	ARCZEST
ARCZQBLD	ARCZQBLD
ARCZTMVT	ARCZTMVT

6. **Read VTOC copy data set:** Call ARCGRQE to read VTOC copy data set, build Recovery Queue Element (RQE) for each data set on the VTOC copy data set, and chain the RQEs on an RQE queue for recovery.

Module	Label
ARCGVTOC	ARCGVTOC READVTOC
ARCGRQE	ARCGRQE

7. **Clean up:** If any error occurred during the processing of the VTOC copy data set, call ARCWTL to issue message ARC0749I if it was requested. Otherwise, issue ARC0704I, ARC0708I, ARC0739I, ARC0752I, and ARC0759I depending on what error occurred.

If any VTOC copy data set was opened, call ARCTCLOS to close it if it is on a multiple file tape or call ARCZCSFT to close it if it is on a single-file tape or call ARCZVCUT to close it if it is on a DASD volume.

Call ARCULVOL to deallocate any allocated volume.

Module	Label
ARCGVTOC	ARCGVTOC CLEANUP ERRPROC MSG704 MSG708 MSG739 MSG749 MSG752 MSG759
ARCTCLOS	ARCTCLOS
ARCULVOL	ARCULVOL
ARCWTO	ARCWTL
ARCZCSFT	ARCZCSFT
ARCZVCUT	ARCZVCUT

Output

- Return Codes
 - 0 - The VTOC copy data set was successfully read
 - 2 - Early termination
 - 4 - MCT record not found for the backup volume
 - 6 - Error reading JFCB for VTOC copy data set on a tape volume
 - 8 - Volume allocation error
 - 12 - Error allocating the VTOC copy data set
 - 14 - Error occurred reading the VTOC copy data set
 - 16 - Error opening the VTOC copy data set
 - 20 - Tape backup volume not available
 - 24 - Unsupported device type found for backup volume or ML1 volume
 - 52 - GETMAIN error
 - 60 - Error establishing ESTAE environment.

Diagram 17.4: ARCGRGDG - Control Recovery of Generation Data Group Entries

Input

- Management Work Element (MWE)
- ARCGDGP Parameter List
- Recovery Task Control Block (GTCB)
- Recovery Data Set Parameter List (GDSP)
- Eligible Volume Record (MCP).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGRGDG	ARCGRGDG
ARCPDA	ARCPDA

2. **Build volume catalog (VCAT) copy data set name:** ARCGRGDG is called to allocate the backup volume which the VCAT (old virtual storage access method (VSAM) catalog) copy data set is on and invoke ARCGVCAT to recover generation data group (GDG) entries for an old VSAM catalog.

It validates the input parameter list ARCGDGP. If any are in error, it calls ARCERP and returns to the caller.

Module	Label
ARCGRGDG	ARCGRGDG
	VALIDATE_PARMS
ARCERP	ARCERP

3. **Validate the volume on which the VCAT copy resides:** If there is no volume entry in the eligible volume record (MCP) for this VCAT copy, call ARCWTL to write message ARC0756I to the backup activity log and return to the caller. Otherwise, call ARCZREAD to read the BCDS backup volume record (MCT) for the volume on which the VCAT copy data set resides. If the read fails, call ARCWTL to write message ARC0756I to the backup activity log and return to the caller.

Module	Label
ARCGRGDG	ARCGRGDG
	VERIFY_VCAT_VOL
ARCWTO	ARCWTL
ARCZREAD	ARCZREAD

4. **Check the currently allocated and mounted volume:** If the VCAT copy data set is on a volume other than the volume currently mounted and allocated, call ARCZCSFT to close the volume if it is a single file format tape volume. Call ARCULVOL to deallocate the volume.

If the volume is a virtual volume, call ARCULVRT to unload the volume. If the deallocation was unsuccessful, call ARCWTL to write message ARC0762I to the backup activity log, and return to the caller.

If the currently mounted and allocated volume is the same volume on which the VCAT copy data set resides, validate the volume records to assure they match the required volume. If there is a mismatch, return to the caller.

Module	Label
ARCGRGDG	ARCGRGDG ALLOCATE_VOLUME CLEAR_VOLUME VERIFY_CURRENT_VOLUME
ARCULVOL	ARCULVOL
ARCULVRT	ARCULVRT
ARCWTO	ARCWTL
ARCZCFST	ARCZCFST

5. **Allocate the volume on which the VCAT copy resides:** If the VCAT copy data set is on a backup DASD volume, call ARCZMVT to create a mounted volume table (MVT) entry for the volume. Call ARCALVOL to allocate the backup volume. If the allocation fails, call ARCWTL to write message ARC0756I to the backup activity log, and return to the caller.

If the VCAT copy data set is on a backup tape volume, call ARCZTMVT to determine if the tapes are available and allocate them. For any failure from ARCZTMVT, call ARCWTL to write message ARC0756I to the backup activity log, and return to the caller.

Module	Label
ARCGRGDG	ARCGRGDG ALLOCATE_VOLUME ALLOCATE_TAPE ALLOCATE_DASD
ARCALVOL	ARCALVOL
ARCWTO	ARCWTL
ARCZMVT	ARCZMVT
ARCZTMVT	ARCZTMVT

6. **Recover GDG base entry copies:** ARCZVCNM is called to build the VCAT copy data set name. If there were no errors, call ARCGVCAT to recover the GDG base entry copies. If a point failure occurred during the recovery, call ARCZCSFT to close the tape if the recovery was from a single-file format tape. Cause recovery to end if the user exit abnormally ended during the GDG base entry recovery. Return to the caller.

Module	Label
ARCGRGDG	ARCGRGDG GET_GDG_COPIES
ARCGVCAT	ARCGVCAT
ARCZCFST	ARCZCFST
ARCZVCNM	ARCZVCNM

Output

- Return Codes
 - 0 - The GDG entries were successfully recovered
- Reason Codes:
- 4 - Allocation of the backup volume failed
 - 6 - No VCAT copy data set exists

- 10 - The required backup volumes are not available
- 20 - An MCT read failure occurred or the MCT record was not found
- 24 - A volume is indicated as being allocated, but the MVT for the allocated volume is absent
- 25 - A volume is indicated as being allocated, but device type indicated in the MVT is different from the device type indicated in the MCT record
- 26 - Device type indicated in the MCT record is not recognized as a supported device type
- 28 - Deallocation of the input volume failed The volume and device will remain allocated until this task ends
- 30 - Failure during the actual recovery of the base GDG entries process is neither 2 nor 4
- 54 - A user exit abnormally ended
- 68 - A POINT macro failed.

Diagram 17.5: ARCGRCAT - Control Recovery of Integrated Catalog Facility and CVOL Catalogs

Input

- Recovery Task Control Block (GTCB)
- ARCGRQEP Parameter List
- Recovery Data Set Parameter List (GDSP).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGRCAT	ARCGRCAT
ARCPDA	ARCPDA

2. **Validate input parameter list:** Validate the input parameter list, ARCGRQEP. If there are any errors, call ARCERP to inform the user of the error, and return to the caller.

Module	Label
ARCGRCAT	ARCGRCAT
	INIT
	CHKINPUTS
ARCERP	ARCERP

3. **Do catalog LOCATEs for the catalog data sets:** Call ARCGRLOC to do catalog LOCATEs for the catalog data sets on the volume being recovered.

Module	Label
ARCGRCAT	ARCGRCAT
ARCGRLOC	ARCGRLOC

4. **Determine if the catalog is to be recovered:** Loop through Recovery Queue Element (RQE) queue. For each RQE, verify if the data set is eligible for recovery:

- If the RQE is for an ICF catalog, call ARCALVOL to make sure the volume being processed was mounted and call ARCZOBT to do an OBTAIN for the catalog. If the catalog exists on the volume, fail the recovery of this catalog and call ARCDEQ to delete the data set from the queue. If the ICF catalog is currently cataloged on a volume other than the volume being recovered or the catalog spans to other volumes, fail the recovery of this catalog and call ARCDEQ to delete the data set from the queue.
- If the data set is not deleted, call ARCZREAD to read the MCB record. If the read fails, then call ARCDEQ to dequeue the RQE.
- For volume recovery, check if the latest backup version is older than the date specified by the user, and if it was, call ARCDEQ to remove the RQE.
- If the data set is still on the queue, call ARCZREAD to read the MCC record. If a read error occurs, then call ARCDEQ to dequeue the RQE.
- For volume restore, check if the backup copy was made before the full volume dump, and if so, call ARCDEQ to remove the RQE. Also for volume restore, check the current level of DFP installed and the level of

DFP used when the catalog was backed up to make sure that the level is sufficient to allow apply incremental processing to continue. If the level of DFP is sufficient, call ARCDEQ to remove the RQE.

- If the data set was not deleted from the queue, update the RQE from MCC record.

Module	Label
ARCGRCAT	ARCGRCAT CATALOGDS VALIDITY_ICFCAT READCDS GET_BACKCOPY COMPARE_DATE COMPARE_TIME_STAMPS UPDATE_RREQ
ARCALVOL	ARCALVOL
ARCCDTUN	ARCCDTUN
ARCZOBT	ARCZOBT
ARCDEQ	ARCDEQ
ARCZREAD	ARCZREAD

5. **Recover the Integrated Catalog Facility or OS CVOL data set:** Call ARCZLSRT to sort the RQE queue with the volume serial number and file sequence number as an ascending order. Loop through the sorted queue, for each catalog data set on the queue, do the following:

- Call ARCDEQ to dequeue the RQE from the queue.
- Call ARCGRQE3 to attempt to recover the RQE (recover the data set).

Module	Label
ARCGRCAT	ARCGRCAT SORT_RREQ RECOVER_CATDS
ARCDEQ	ARCDEQ
ARCGRQE3	ARCGRQE3
ARCZLSRT	ARCZLSRT

6. **Issue message for Integrated Catalog Facility or OS/CVOL catalog:** Call ARCAMSG to issue message ARC0734I for each Integrated Catalog Facility or OS/CVOL catalog that was failed by this module. If recovery of any catalog fails, then after returning to the caller, the volume recovery will be failed.

Module	Label
ARCGRCAT	ARCGRCAT MSG734
ARCAMSG	ARCAMSG

Output

- Return Codes
 - 04 - At least one catalog data set recovery failed
 - 25 - Cannot restore value with an ICF catalog without DFP 2.3.0, or at least one catalog was backed up by DFP prior to Release 2.3.0
 - 27 - APPLYINCREMENTAL process cannot continue because the value contains an owning VSAM catalog
 - 52 - GETMAIN error from ARCGRLOC.

Diagram 17.6: ARCGRQE1 - Determine Which Data Sets on the Recovery Queue Should be Recovered

Input

- ARCGRQEP Parameter List.

Inout

- Recovery queue pointed to by ARCGDSP.

Processing

ARCGRQE1 validates the ARCGRQEP input parameter list and determines which data sets on the recovery queue should be recovered.

Output

- Processed data sets on the recovery queue
- Return Codes.

Diagram 17.7: ARCGCLN - Clean Up the Recovery Data Set Processor Subtasks

Input

- Management Communication Vector Table (MCVT)
- Recovery Task Control Block (GTCB)
- Recovery Control Block (RCB)
- GTCB Index (TASKID)
- GDSP Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGCLN	ARCGCLN
ARCPDA	ARCPDA

2. **Validate input parameters:** ARCGCLN validates the input parameters. If any invalid parameter is passed, ARCERP is called to issue the error message and ARCGCLN processing ends.

Module	Label
ARCGCLN	ARCGCLN
ARCERP	ARCERP

3. **RACF discrete profile recovery cleanup:** Determine if the virtual storage access method (VSAM) or non-VSAM subtask was active for this data set recovery. If a valid recovery parameter list has been passed to ARCGCLN, profile recovery cleanup is necessary if the data set recovery subtask abnormally ended or finished with a Return Code other than 0, 1, or 9 (0 - successful completion, 1 and 9 - errors reading or updating BCDS records). Call ARCGRCLN to do the profile recovery cleanup.

Module	Label
ARCGCLN	ARCGCLN
	CKPRFRCV
ARCGRCLN	ARCGRCLN

4. **Close the 3480 single-file format tape data set:** Call ARCZCSFT to check if any single-file 3480 tape data set was opened and, if so, close the opened data set.

Module	Label
ARCGCLN	ARCGCLN
ARCZCSFT	ARCZCSFT

5. **Detach the attached data set recovery subtasks:** For each attached data set recovery subtask, issue a DETACH macro to detach the subtask.

Module	Label
ARCGCLN	ARCGCLN
	DETACH

6. **Delete the RCBs:** For each RCB created for the data set recovery subtask, call ARCDRCB to delete it.

Module	Label
ARCGCLN	ARCGCLN DELERCB
ARCCRCB	ARCDRCB

Output

- Recovery Task Control Block (GTCB)
- Recovery Control Block (RCB)
- Recovery Data Set Parameter List (GDSP).

Diagram 17.8: ARCGRQE - Read VTOC Copy Data Sets and Build RQE Chain

Input

- ARCGRQEP Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGRQE	ARCGRQE
ARCPDA	ARCPDA

2. **Validate input parameter list:** Validate the input parameter list, ARCGRQEP. If there are any errors, call ARCERP to inform the user of the error, and return to the caller.

Module	Label
ARCGRQE	ARCGRQE
	CHECK_INPUT
ARCERP	ARCERP

3. **Read one record of the volume table of contents (VTOC) copy data set:** Read one record of the VTOC copy data set, for each data set to be processed. Invoke ARCZEND to check if DFHSM is shutdown, is in emergency mode, if backup functions are disabled, or if recovery functions are held, and if so, call ARCWTU3 to issue message ARC0624I. Also call ARCWTU3, if log messages are to be displayed on the terminal, to display the message to the user on the terminal. If the VTOC copy data set is on a DASD volume, call ARCZVCRW to read a VTOC copy data set record from the DASD volume. If the VTOC copy data set is on a tape volume, call ARCGVCRT to read a VTOC copy data set record from the tape volume.

Module	Label
ARCGRQE	ARCGRQE
	READ_VTOC_RECORD
ARCGVCRT	ARCGVCRT
ARCWTO	ARCWTU3
ARCWTO	ARCWTU3
ARCZEND	ARCZEND
ARCZVCRW	ARCZVCRW

4. **Build recovery queue element (RQE) chain:** For each data set (one record) listed in the VTOC copy data set that is to be recovered, build an RQE. Fill in the data set name, the data set organization, and set the indication of an Integrated Catalog Facility catalog, OS CVOL catalog, or unmovable data set into the skeleton RQE. and set the indicator whether the data set came from a dump or backup VTOC copy data set. Then call ARCZQBLD to build an RQE. If this is a cataloged data set, it will be added to the catalog RQE queue, otherwise it will be added to the non-catalog RQE queue.

Module	Label
ARCGRQE	ARCGRQE
	BUILD_RQE_ENTRY
ARCZQBLD	ARCZQBLD

5. **Clean up at END-OF-FILE:** When END-OF-DATA is reached, any I/O error during the read, or if an error occurs from a called module, then close the data set. If a DASD volume, call ARCZVCUT. If a single-file format 3480 tape, call ARCZCSFT to close the tape unless the condition is END-OF-DATA then leave the tape open. If for a non-single-file format tape, then call ARCTCLOS to close the tape volume.

Module	Label
ARCGRQE	ARCGRQE CLEANUP
ARCTCLOS	ARCTCLOS
ARCZCSFT	ARCZCSFT
ARCZVCUT	ARCZVCUT

Output

- **Return Codes**
 - 02 - Early ending due to: DFHSM shutdown, DFHSM emergency mode, backup disable, or recovery held at end-of-data or at end-of-volume
 - 14 - An error occurred while reading the VTOC copy data set.

Diagram 17.9: ARCGVCAT - Recover Generation Data Group Base Entries to a VSAM Catalog

Input

- Mounted Volume Table (MVT)
- VSAM Catalog
- Recovery Control Block (RCB)
- Job File Control Block (JFCB)
- Data Set's Backup Version Record Pointer (MCCP)
- Backup Volume Table Entry Pointer (BVTP)
- VCAT Copy Data Set DDNAME (VCATDDN)
- VCAT Copy Data Set Name (VCATDSN)
- Terminal Output Indicator (TERM)
- Tape Input Data Set DDNAME (TAPEDDN)
- Mother Task Event Control Block Pointer (ECBPTR)
- Management Communication Vector Table (MCVT)
- ARCGVOL address areas (DCBJFCBP).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGVCAT	ARCGVCAT
ARCPDA	ARCPDA

2. **Allocate and open the copy data set:** ARCGVCAT gets control to recover generation data group base entries for a volume. If the volume catalog (VCAT) copy data set is on tape, check if the job file control block (JFCB) has been read by the caller for the VCAT copy data set. If so, skip the reading of the JFCB. If JFCB has not been read, read the JFCB for the VCAT copy data set. If the read fails, ARCERP is called to issue a SNAP dump. Otherwise, the VCAT data set name is placed in the JFCB. If the VCAT copy data set is on a 3480 single-file format tape volume, put 1 in the JFCB for the file sequence number; otherwise, the file sequence number in the JFCB is set from the eligible volume record (MCP).

If the VCAT copy data set is on DASD, ARCALOLD is called to allocate the data set. If the allocation fails, ARCWTL is called to issue error message ARC0756I and control returns to the caller. If the VCAT copy data set is on a tape volume, ARCTOPEN is called to open or position the VCAT copy data set. If the data set is on DASD, ARCDOPEN is called to open the data set. If the open fails, ARCWTL is called to issue error message ARC0756I and control returns to the caller. If the open on DASD is successful, the end of data and SYNAD exits are established.

Module	Label
ARCGVCAT	ARCGVCAT
	READJFCB

	QUIT
	MSG756
ARCALOLD	ARCALOLD
ARCDOPEN	ARCDOPEN
ARCERP	ARCERP
ARCTOPEN	ARCTOPEN
ARCWTO	ARCWTL

3. **Recover the backed up generation data group base entries from the copy data set to the virtual storage access method (VSAM) catalog:** The backed up generation data group base entries are recovered to the VSAM catalog on the volume being recovered. If the backup versions are on tape, a GETMAIN for a 16K buffer is done. If the GETMAIN fails, ARC0756I is issued and control is returned to the caller. A 16K block is read from the tape and logical records are extracted. If the backup versions are on DASD, the GET macro is used to read the backup versions. If a read error occurs and the backup versions are on tape, the 16K buffer is freed. If the FREEMAIN fails, ARCERP is called. ARCWTL is called to inform the user of a read error by issuing message ARC0756I, the data sets are closed, and control returns to the caller. A VSAM parameter list is built to issue a VSAM catalog request for the generation data group base entry being recovered. Surrounding the request is a call to serialize and deserialize the ARCGPA/VSAMLOCK resource. If the VSAM catalog request fails, message ARC0764I is issued for the data set. Otherwise, message ARC0763I is issued indicating that the data set was successfully cataloged.

Module	Label
ARCGVCAT	ARCVCAT
	NXTGDG
	RVCAT
	RDBLOCK
	FREEBUF
	RDERR
	MSG756
	DASDERR
ARCLOCK	ARCLOCK
	ARCUNLK
ARCWTO	ARCWTL
ARCERP	ARCERP

4. **Close the VCAT copy data set and return:** When no more generation data group entries remain to be recovered, close the input data set and indicate in the recovery control block (RCB) that the data control block (DCB) is closed if the VCAT copy data set is not on a single-file 3480 tape volume. If the VCAT copy data set is on a 3480 single-file format tape volume, do not close the data set. Return to ARCGVOL.

Module	Label
ARCGVCAT	ARCGVCAT
	EOF
	QUIT

Output

- Recovery Control Block (RCB)
- Job File Control Block (JFCB)
- Return Codes:
 - 0 - GDG base entries were recovered successfully
 - 54 - User exit ABEND.

Diagram 17.10: ARCGRLOC - Locate Data Sets for Volume Recovery and Apply Incremental

Input

- Index to Recovery Task Control Block (GTCB).

Inout

- Data set recovery queue pointed to by ARCGDSP
- Catalog recovery queue pointed to by ARCGDSP.

Processing

ARCGRLOC obtains catalog information for data sets on the RQE chain and adds non-ICF VSAM data sets to the RQE chain.

Output

- Return Codes.

Diagram 17.11: ARCGRQE2 - Recover Each Data Set On the Recovery Queue

Input

- ARCGRQEP Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGRQE2	ARCGRQE2
ARCPDA	ARCPDA

2. **Validate input parameter list:** Validate the input parameter list, ARCGRQEP. If there are any errors, call ARCERP to inform the user of the error, and return to the caller.

Module	Label
ARCGRQE2	ARCGRQE2
	CHECK_INPUT
ARCERP	ARCERP

3. **Process the unmovable data sets:** For each data set on the recovery queue chain, invoke ARCZEND to check if DFHSM is shutdown, is in emergency mode, if backup is disabled, or if recovery is held. If so, then call ARCWTN to issue message ARC0624I and end recovery. For each unmovable data set on the recovery queue chain, call ARCDEQ to dequeue the recovery queue (RQE) from the chain, and call ARCGRQE3 to process the RQE to recover the data set.

Module	Label
ARCGRQE2	ARCGRQE2
	RECOVER_DATASETS
ARCENQ	ARCDEQ
ARCGRQE3	ARCGRQE3
ARCWTO	ARCWTN
ARCZEND	ARCZEND

4. **Process all the remaining data sets on the recovery queue:** For each data set on the recovery queue chain, invoke ARCZEND to check if DFHSM is shutdown, is in emergency mode, if backup is disabled, or if recovery is held. If so, then call ARCWTN to issue message ARC0624I and end recovery. Otherwise, call ARCDEQ to dequeue the RQE from the chain, and call ARCGRQE3 to process the RQE to recover the data set.

Module	Label
ARCGRQE2	ARCGRQE2
	RECOVER_DATASETS
ARCENQ	ARCDEQ
ARCGRQE3	ARCGRQE3
ARCWTO	ARCWTN
ARCZEND	ARCZEND

5. **Clean up after recovery:** When the recovery is finished, call ARCZCSFT to close the 3480 single file data set.

Module	Label
ARCGRQE2	ARCGRQE2
	CLOSE_SINGLEFILE_TAPE
ARCZCSFT	ARCZCSFT

Output

- The recovery of each data set on the recovery queue
- Return Codes:
 - 2 - Processing halted early
(DFHSM shutdown, in emergency mode, BACKUP disabled, or recovery held at end-of-data set or at end-of-volume.)

Diagram 17.12: ARCGVCRT - Read the VTOC Copy Data Sets From a Tape Volume

Input

- Recovery Task Control Block (GTCTB)
- Recovery Data Set Parameter List (GDSP)
- ARCVCRTP Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGVCRT	ARCGVCRT
ARCPDA	ARCPDA

2. **Validate input parameter list:** Validate the input parameter list, ARCVCRTP. If there are any errors, call ARCERP to inform the user of the error, and return to the caller.

Module	Label
ARCGVCRT	ARCGVCRT
	CHECK_INPUT
ARCERP	ARCERP

3. **Initial read of volume table of contents (VTOC) copy data set from tape:** Setup error exit addresses. If this is the first call, then get a 16K buffer from subpool 2 and set up the read data entry control block (DECB). If this is the first call or if less than four bytes left in 16K input buffer, then issue the READ macro to read in a 16K block from tape and issue the CHECK macro to check the results of the read.

Module	Label
ARCGVCRT	ARCGVCRT
	GET_STORAGE_BLOCK
	READ_BLOCK_OF_DATA
ARCGMAIN	ARCGMAIN

4. **Move a record into the caller's buffer:** If the remaining 16K buffer is not one full record, move the partial record into a work area, read another 16K block from tape, and then move in the rest of the record. Otherwise, move one record into the work area. Update the position pointers in the 16K input block. Move the record into the buffer provided by the caller. Return to the caller.

Module	Label
ARCGVCRT	ARCGVCRT
	MOVE_RECORD
	READ_BLOCK_OF_DATA

5. **END-OF-DATA exit routine:** Call ARCFMAIN to free storage for 16K buffer.

Module	Label
ARCGVCRT	ARCGVCRT END_OF_DATA_ROUTINE
ARCGMAIN	ARCFMAIN

6. **Error exit routines:** The SYNAD error routine uses the SYNADAF macro to analyze the I/O error and SYNADRLS macro to release the message buffer obtained by the SYNADAF macro. Then ARCWTL is called to issue the error message ARC0645I with the SYNAD information from the analysis. Call ARCFMAIN to free storage for 16K buffer. EOF error routine (EOF should not happen) just returns to the caller to end the recovery.

Module	Label
ARCGVCRT	ARCGVCRT EOFEXIT SYNADEXT
ARCGMAIN	ARCFMAIN

Output

- **Return Codes**
 - 00 - Processing successfully completed, end of data not reached
 - 04 - Processing successfully completed, end of data reached
 - 08 - Read failed
 - 52 - GETMAIN error occurred.

Diagram 17.13: ARCGRQE3 - Process an Individual Recovery Queue

Input

- Recovery Task Control Block (GTCB)
- Recovery Data Set Parameter List (GDSP)
- ARCGRQEP Parameter List.

Processing

ARCGRQE3 allocates the backup volume and attaches the recovery subtask to recover a data set.

Output

- Recovered Data Set
- Return Codes.

Diagram 17.14: ARCGRACS - Obtaining SMS Constructs for the Target Data Set for Recovery/Restore

Input

- Recovery Task Control Block (GTCB)
- Recovery Data Set Parameter List (GDSP)
- ARCGACSP Parameter List.

Processing

ARCGRACS determines if the target data set is SMS-managed and gets the SMS constructs for the data set if it is SMS-managed.

Output

- Return Codes.

Diagram 17.15: ARCGRCLN - Clean Up the RACF Profile When Restore or Recovery Has Failed

Input

- The index to the Recovery Task Control Block (GTCB)
- Recovery Task Control Block (GTCB)
- Recovery Data Set Parameter List (GDSP).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGRCLN	ARCGRCLN
ARCPDA	ARCPDA

2. **Validate the input parameters:** Validate the input parameter list to this module. If any are in error, call ARCERP and return to the caller.

Module	Label
ARCGRCLN	ARCGRCLN
ARCERP	ARCERP

3. **Get the data set name:** If the data set is a virtual storage access method (VSAM) data set and the NEWNAME is specified, get the NEWNAME cluster name from GDSNCDSN. Otherwise, get the original cluster name from GDSBCDSN. If the data set is not an VSAM data set, get the data set name from GSDSDSN.

Module	Label
ARCGRCLN	ARCGRCLN
	GET_DATASET_NAME

4. **Delete the created RACF discrete profile:** If a RACF discrete profile was created, do the following:
 - If the data set is a non-VSAM data set or an Integrated Catalog Facility catalog, call ARCRACF to delete the profile. If the data set is an VSAM data set, call ARCVSCHK to delete the profile. Reset the fields in GDSP relating to the RACF discrete profile creation.

Module	Label
ARCGRCLN	ARCGRCLN
	DELETE_PROFILE
ARCRACF	ARCRACF
ARCVSCHK	ARCVSCHK

5. **Reset updated RACF discrete profile:** If the RACF discrete profile has been updated for a non-VSAM data set, do the following:
 - If the data set's profile has been updated to a new volume, call ARCRACF to reset the volume in the discrete profile to its original volume.
 - If the reset failed, call ARCWTU to issue message ARC0382 to inform the user that the update of a discrete RACF profile failed for a RACF indicated

data set. Reset the fields in GDSP relating to the RACF discrete profile updating.

Module	Label
ARCGRCLN	ARCGRCLN FIX_PROFILE MSG382
ARCACRF	ARCACRF
ARCWTO	ARCWTU

Output

- The RACF discrete profile is updated or deleted.

Volume Restore and APPLYINCREMENTAL

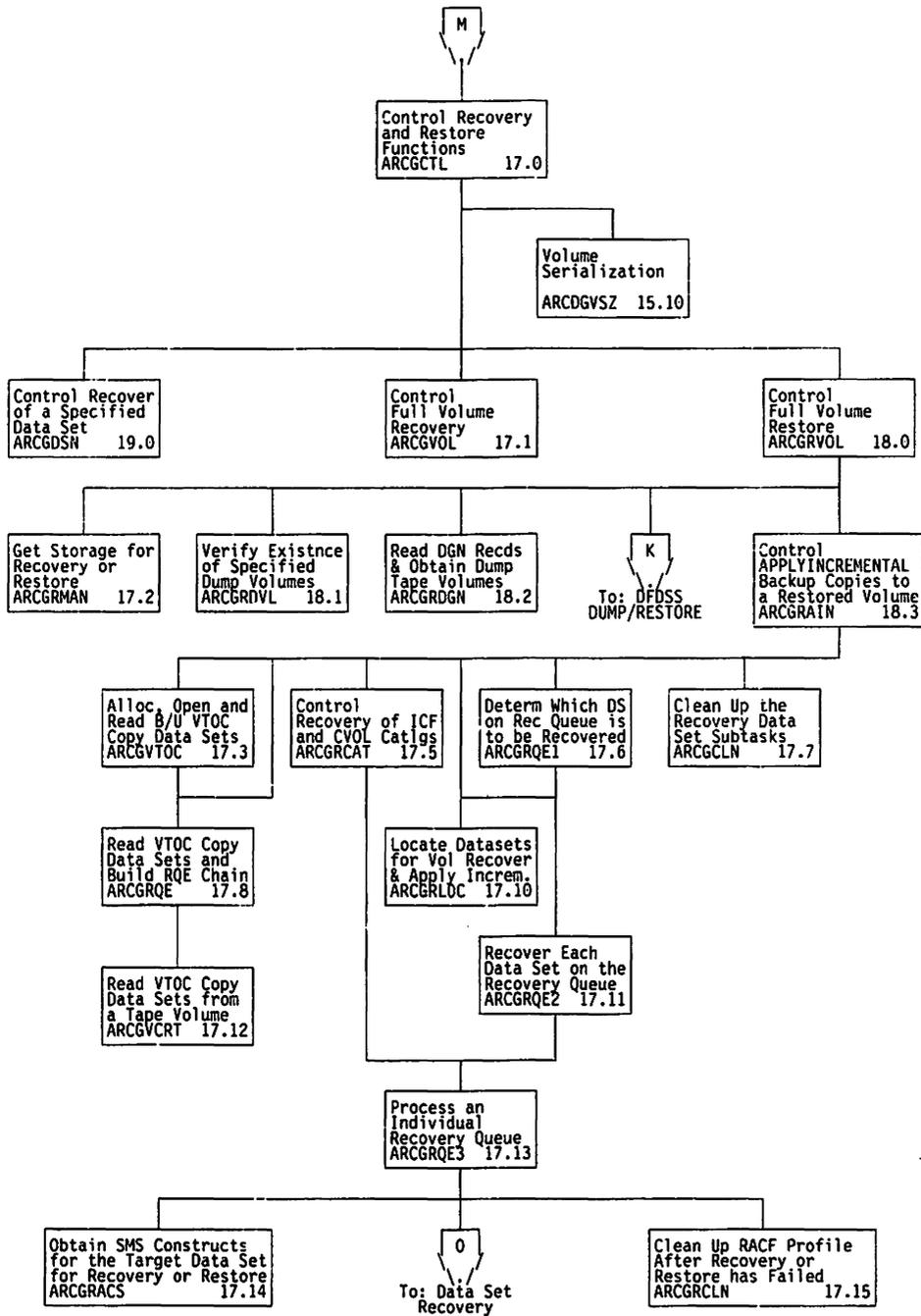


Figure 20. Visual Table of Contents for Volume Restore and APPLYINCREMENTAL Processing

Diagram 18.0: ARCGRVOL - Control Full Volume Restore from a Volume

Input

- Recovery Task Control Block (GTCB)
- Management Work Element (MWE).

Processing

ARCGRVOL centralizes and controls full volume restore functions and invokes DFSS to restore the volume.

Output

- None.

Diagram 18.1: ARCGRDVL - Verify the Existence of the Specified Dump Volumes

Input

- ARCGDVLP Parameter List
- Recovery Task Control Block (GTCB)
- Recovery Data Set Parameter List (GDSP).

Processing

ARCGRDVL verifies whether the specified dump volumes exist, and gets the other dump tape volumes that contain the desired dump copy.

Output

- Return Codes.

Diagram 18.2: ARCGRDGN - Read DGN Records and Obtain Dump Tape Volumes

Input

- ARCGDGNP Parameter List
- Recovery Task Control Block (GTCB)
- Recovery Data Set Parameter List (GDSP).

Processing

ARCGRDGN reads the dump generation record (DGN) and obtains the desired volume dump copy(s) and dump tape volumes in accordance with parameters specified in the RECOVER command.

Output

- Return Codes.

Diagram 18.3: ARCGRAIN - Control APPLYINCREMENTAL Backup Copies to a Restored Volume

Input

- None.

Processing

ARCGRAIN is invoked after successful completion of a full volume restore, and the incremental backup copies are to be applied to the restored volume.

If Integrated Catalog Facility/OS CVOL catalogs exist on the restored volume, ARCGRAIN recovers these catalogs before applying any incremental backup copies. It then determines which backup version should be applied to the restored volume.

Output

- Return Codes.

Data Set Recovery and Restore Control Processing

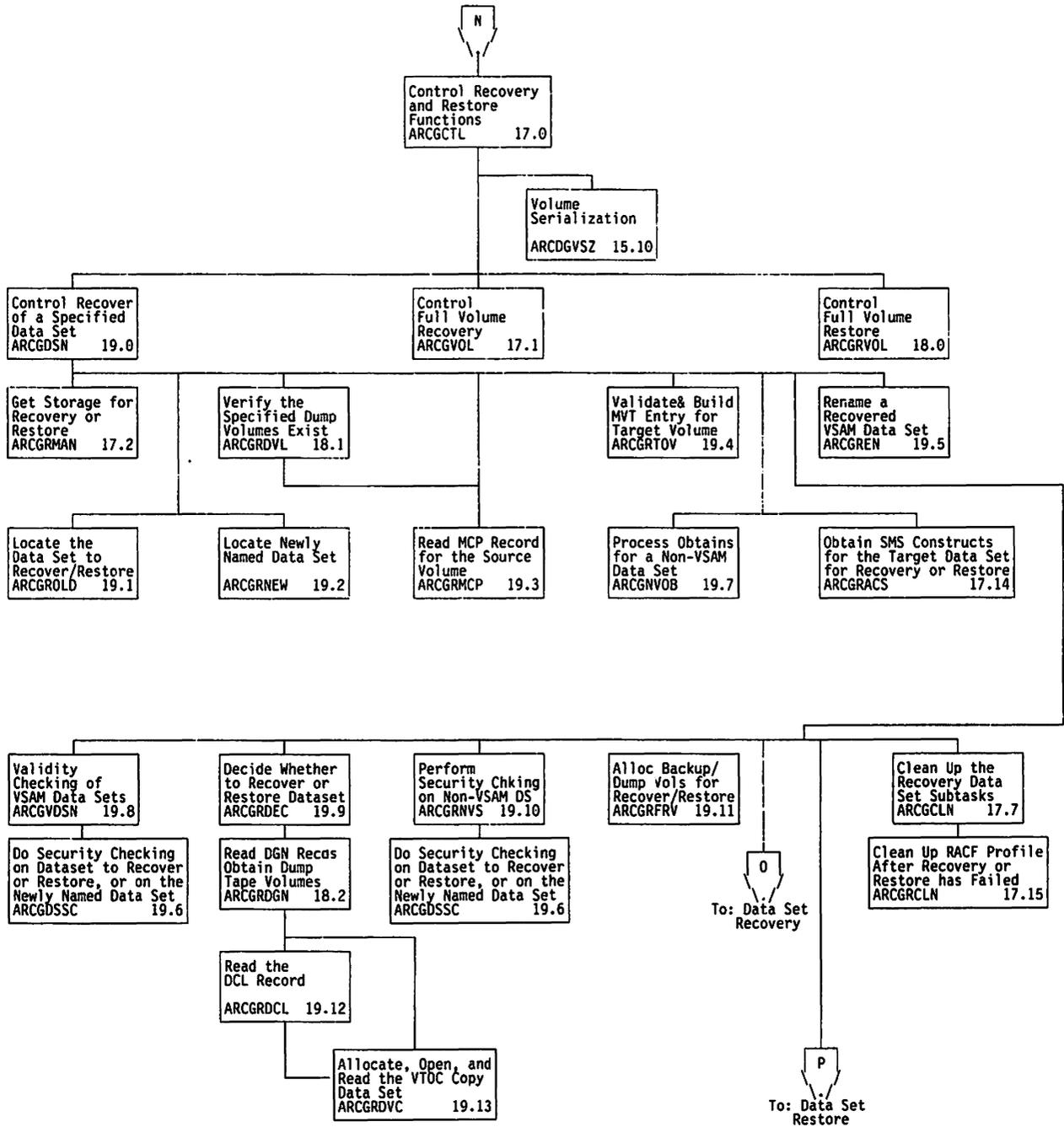


Figure 21. Visual Table of Contents for Data Set Recovery and Restore Control Processing

Diagram 19.0: ARCGDSN - Control Recovery of a Specified Data Set

Input

- Recovery Task Control Block (GTCB)
- Recovery Data Set Parameter List (GDSP)
- Management Work Element (MWE).

Processing

ARCGDSN controls the recovery or restore of a specified data set.

Note: Special consideration is given for the restore of a VSAM cluster that is not currently cataloged or for the restore of a VSAM non-SMS cluster which is currently cataloged on a volume other than the TOVOLUME as specified in the RECOVER command. If there is a backup version for this data set, ARCGDSN will first recover this backup version to construct the catalog information which was defined originally by the user. If this recovery fails, or if there is no backup version, ARCGDSN issues a warning message to the user that the recovery has completed, but the catalog information may be inaccurate.

Output

- Function Statistics Record (FSR)
- Return Codes.

Diagram 19.1: ARCGROLD - Locate the Data Set to be Recovered or Restored

Input

- Management Work Element (MWE)
- Recovery Task Control Block (GTCB)
- Recovery Data Set Parameter List (GDSP).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGROLD	ARCGROLD
ARCPDA	ARCPDA

2. **Generate the name for an OS/CVOL (Operating System Control Volume) data set:** If recover/restore an OS CVOL catalog is specified and the user is unauthorized to recover an OS/CVOL catalog data set, fail the RECOVER command and return to the caller.

Otherwise, construct the name for the catalog.

Module	Label
ARCGROLD	ARCGROLD OSCVOL

3. **Do a LOCATE on the data set to be recovered/restored:** ARCGROLD is called by ARCGDSN when an individual data set is to be recovered/restored. As soon as ARCGROLD gets control, it calls ARCVVSC to do a LOCATE on the data set to be recovered/restored.

If the Return Code from ARCVVSC indicates a GETMAIN error or LOCATE error, fail the RECOVER command and return to the caller.

If the data set is currently cataloged but is cataloged to 'MIGRAT', fail the RECOVER command and return to the caller.

If the data set is currently cataloged, FROMVOLUME parameter was not specified in the RECOVER command, and REPLACE parameter and NEWNAME parameter were not specified in the RECOVER command, fail the RECOVER command and return to the caller.

If the data set is not currently cataloged and the FROMVOLUME parameter was not specified in the RECOVER command or if the data set is currently cataloged, then the data set is to be cataloged after the recovery/restore.

Module	Label
ARCGROLD	ARCGROLD SETUP CATALOGED_DS
ARCVVSC	ARCVVSC

4. **Read MCB (Backup Control data set data set record) record for the data set to be recovered/restored:**

Call ARCZREAD to read MCB record for the data set to be recovered/restored.

If a read error (not including record not found) occurred, fail the RECOVER command and return to the caller.

If MCB record found, get the most recent backup copy if the GENERATION parameter or the DATE parameter was not specified in the RECOVER command or get the backup copy according to the GENERATION parameter or the DATE parameter specified, and/or according to the request of cataloged/uncataloged data set.

Module	Label
ARCGROLD	ARCGROLD READMCB
ARCZREAD	ARCZREAD

5. Read Backup control data set backup version record (MCC) for the data set to be recovered/restored: Call ARCZREAD to read MCC record for the data set to be recovered/restored.

If read error (not including record not found), fail the recover command and return to the caller.

If MCC record found, check if mismatch of MCC record and catalog entry of cataloged data set (MCC record says the data set is a virtual storage access method (VSAM) and catalog says it is a non-VSAM or vice versa). If so, call ARCFMAIN to free SDATA if it was gotten, fail the RECOVER command and return to the caller.

If MCC record found and if the data set was backed up with DFDSS data movement, check if DFDSS (minimum level of Version 2.5.0) and DFP (minimum level of Version 2.3.0) level are appropriate. Also check the DFP (minimum level of Version 3.2.0)/MVS (minimum level of Version 3.2.0) level for PDSE data sets.

Module	Label
ARCGROLD	ARCGROLD READMCC
ARCZREAD	ARCZREAD
ARCGMAIN	ARCFMAIN

6. Validity checking when an incremental backup version does not exist for the data set: If neither MCB nor MCC record was found, and one of the following is true, fail the recover command and return to the caller:

- If FROMDUMP(DUMPVOLUME) was not specified for a multi-volume VSAM data set.
- The data set is a KEYRANGE VSAM data set.
- The GENERATION keyword was specified.
- The data set is an ICF catalog data set.
- FROMDUMP and NEWNAME were specified on the recover command for a currently existing VSAM data set.
- The data set to be recovered/restored is an old VSAM data set (not cataloged in an ICF catalog).

Module	Label
ARCGROLD	ARCGROLD NO_BACKUP_VALIDITY

7. Validity checking when FROMDUMP was specified:

If one of the following is true, fail the recover command and return to the caller:

- FROMDUMP was specified without DUMPVOLUME for a multi-volume VSAM data set.
- FROMDUMP was specified for a VSAM KEYRANGE data set.
- FROMDUMP was specified for an ICF catalog data set.
- FROMDUMP and NEWNAME were specified for a VSAM data set currently cataloged.
- FROMDUMP was specified for a VSAM data set cataloged in a non-ICF catalog.

Module	Label
ARCGROLD	ARCGROLD RESTORE_VALIDITY

8. Validity checking for an ICF catalog data set:

If one of the following is true, fail the RECOVER command and return to the caller:

- If the data set is an ICF catalog and the NEWNAME was specified on the RECOVER command.
- If the data set is an ICF catalog and the user is unauthorized to recover/restore an ICF catalog.

Module	Label
ARCGROLD	ARCGROLD ICF_CAT_VALIDITY

9. Validity checking for an SMS data set :

If one of the following is true, fail the recover command and return to the caller:

- If the data set is currently cataloged as an SMS data set, NEWNAME and FORCENONSMS were not specified, and SMS is not installed in the system.
- If the data set is currently cataloged as an SMS data set, NEWNAME and FORCENONSMS were not specified, FROMDUMP was specified, and the level of DFDSS is not sufficient to support SMS-managed data set.

Module	Label
ARCGROLD	ARCGROLD TARGET_DS

10. Set up for the recovery/restore: Update fields and flags relating to the catalog information, backup version information, and the target data set information.

Module	Label
ARCGROLD	ARCGROLD TARGET_DS VSAM_DS

Output

- Return Codes:
 - 0 - Processing completed successfully
 - 1 - An error occurred during the recovery process, while reading the DFHSM control data set
 - Reason Codes:
 - Return Codes from ARCZREAD
 - 14 - A catalog locate error occurred
 - Reason Codes:
 - Return Codes from the VSAM catalog
 - 28 - Backup/Dump copy does not exist
 - Reason Codes:
 - 0 - The data set was not backed up
 - 4 - The requested backup version was not found
 - 12 - A recovery request was issued without specifying FROMDUMP(DUMPVOLUME) for a multi-volume VSAM data set and there was no backup version for the data set
 - 16 - A recovery request was issued for a KEYRANGE VSAM data set and there is no backup version for the data set
 - 33 - Old copy of data set exists, but REPLACE not specified
 - 43 - Other errors other than LOCATE error
 - Reason Codes:
 - 6 - Non-VSAM catalog error
 - 15 - VSAM component has a logical record length too large
 - 16 - OPEN component failure
 - 18 - LOCATE error on base data or index component
 - 19 - LOCATE error on base path component
 - 28 - LOCATE error on AIX
 - 38 - LOCATE error on AIX data or index component
 - 39 - LOCATE error on AIX path component
 - 45 - The data set has been migrated
 - 52 - GETMAIN error
 - 57 - Recovery process cannot be performed with the NEWNAME

Reason Codes:

- 20 - NEWNAME requested for an Integrated Catalog Facility catalog version differs from the data set
- 58 - Recover data set failed

Reason Codes:

- 12 - The data set organization of the backup version selected differs from the data set for which there is a current catalog entry
- 14 - Non-SMS key range data set
- 26 - The recovery of an Integrated Catalog Facility catalog was requested by an unauthorized user
- 36 - The data set spans more than one value
- 61 - Licensed program is not at a sufficient level

Reason Codes:

- 04 - The data set is an PDSE data set, but an insufficient level of DFP or MVS is installed to support PDSE data sets
- 08 - The data set was backed up using DFDSS data movement, but an insufficient level of DFP is installed to recover (restore) the data set
- 62 - DFDSS is not at a sufficient level

Reason Codes:

- 08 - The data set was backed up using DFDSS data movement, but an insufficient level of DFDSS is installed to recover (restore) the data set
- 70 - DFHSM encountered an SMS-related error

Reason Codes:

- 5 - SMS is not installed on the system and FORCENONSMS was not specified
- 6 - The version of DFDSS is not at sufficient level to support SMS-managed data sets and FORCENONSMS was not specified
- 71 - The user is not authorized to recover an OS/CVOL
- 73 - Recovery of a VSAM component failed
- 88 - Recover or restore of a data set or volume failed

Reason Codes:

- 62 - NEWNAME and FROMDUMP were specified on the recover command for an existing VSAM data set and DFDSS does not support the NEWNAME option for VSAM data sets
- 72 - A recovery request was issued with FROMDUMP for a KEYRANGE VSAM data set
- 74 - FROMDUMP was specified without DUMPVOLUME for a multi-volume VSAM data set
- 76 - FROMDUMP was specified to restore a VSAM data set which is currently cataloged in a non-ICF catalog.

Diagram 19.2: ARCGRNEW - Locate the Newly Named Data Set

Input

- Management Work Element (MWE)
- Recovery Task Control Block (GTCTB)
- Recovery Data Set Parameter List (GDSP).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGRNEW	ARCGRNEW
ARCPDA	ARCPDA

2. **Do a LOCATE on the NEWNAME data set which was specified on the RECOVER command:** ARCGRNEW is called when a NEWNAME data set was specified on the RECOVER command. When ARCGRNEW gets control, it calls ARCVVSC to do a LOCATE on the NEWNAME data set.

If one of the following is true, fail the RECOVER command, and end the process.

- The Return Code from ARCVVSC indicates that a GETMAIN error or LOCATE error
- The NEWNAME data set is not a cluster name for a VSAM data set
- The data set is currently cataloged but is cataloged to 'MIGRAT'
- The NEWNAME data set is currently cataloged and REPLACE was not specified on the RECOVER command
- The NEWNAME data set is currently cataloged as an SMS data set, FORCENONSMS was not specified, and SMS is not installed in the system
- The NEWNAME data set is currently cataloged as an SMS data set, FORCENONSMS was not specified, FROMDUMP was specified, and the version of DFDSS is not a sufficient level to support SMS-managed data set.

Module	Label
ARCGRNEW	ARCGRNEW INIT LOCATE CATALOGED_DS
ARCVVSC	ARCVVSC

3. **Validate check between the NEWNAME and original data sets:** If one of the following is true, fail the RECOVER command, and end the process.
 - The data set organization (VSAM or non-VSAM) between NEWNAME and the data set to be recovered/restored is different or the data set organization between NEWNAME and backup version is different.
 - The original data set and NEWNAME data set are different VSAM type (KSDS, ESDS, or RRDS).

- Call ARCVSCAT to get the catalog name. Check if the original data set and NEWNAME data set are from the different catalog.

Module	Label
ARCGRNEW	ARCGRNEW VSAMDS
ARCVSCAT	ARCVSCAT

4. **Generate the data and index component names for the NEWNAME data set:** If the data set is not currently cataloged and the FROMVOLUME parameter was not specified on the RECOVER command or the data set is currently cataloged, then the data set is to be cataloged after recovery/restore.

If the NEWNAME data set specified on the RECOVER command does not exist and a VSAM data set is to be recovered/restored, generate the data and index component names.

Module	Label
ARCGRNEW	ARCGRNEW CREATEDATA
ARCTDATE	ARCTDATE

Output

- Return Codes:
 - 14 - A catalog locate error occurred
Reason Codes:
 - Return Codes from the VSAM catalog
 - 33 - An old copy of the data set exists, but the REPLACE option was not specified
 - 43 - Error retrieving catalog information during Recover/Restore
Reason Codes:
 - 6 - Non-VSAM catalog error
 - 15 - VSAM component logical record length too large
 - 16 - OPEN component failure
 - 18 - LOCATE error on base data or index component
 - 19 - LOCATE error on base path component
 - 28 - LOCATE error on AIX
 - 38 - LOCATE error on AIX data or index component
 - 39 - LOCATE error on AIX path component.
 - 45 - Data set is migrated
 - 52 - GETMAIN error
 - 56 - Catalog locate error
 - 57 - Data set cannot be recovered with NEWNAME

Reason Codes:

- 8 - Specify a new data set name that is not cataloged in the same catalog as the old data set name
- 14 - Key range non-SMS data set
- 36 - The data set spans more than one volume
- 58 - Recover data set failed

Reason Codes:

- 10 - The data set name specified in the NEWNAME parameter is currently cataloged, but it is not the name of a VSAM base or non-VSAM data set, or it is not the same VSAM and the VSAM data set being recovered
- 12 - The data set organization of the backup version selected differs from the data set for which there is a current catalog entry
- 70 - DFHSM encountered an SMS-related error while processing a data set

Reason Codes:

- 5 - SMS is not installed on the system and FORCENONSMS was not specified
- 6 - The version of DFDSS is not at sufficient level to support SMS-managed data sets and FORCENONSMS was not specified.

Diagram 19.3: ARCGRMCP - Read MCP Record for the Source Volume

Input

- Recovery Task Control Block (GTCTB)
- Recovery Data Set Parameter List (GDSP).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGRMCP	ARCGRMCP
ARCPDA	ARCPDA

2. **Determine the source volume:** If the user specified the DUMPVOLUME parameter, use the dump copy source volume in the dump generation record (DGN) as the source volume. If the DUMPVOLUME parameter was not specified by the user, but the user specified the FROMVOLUME parameter, use the FROMVOLUME parameter specified as the source volume. If the DUMPVOLUME parameter and FROMVOLUME parameter were not specified by the user, use the volume the data set is backup from as the source volume, and if the data set is currently cataloged, set the catalog volume to the volume the data set is cataloged on. If a source volume and catalog volume has not yet been determined, set the Return Code and return to the caller.

Module	Label
ARCGRMCP	ARCGRMCP
	SET_VOL

3. **Read the eligible volume record (MCP) for the source volume:** If a source volume was determined, then call ARCZREAD to read the MCP record for the source volume and call ARCCMCP to convert MCP record to extended format, if the MCP is in old format. For a read error or a record not found, return to the caller.

Module	Label
ARCGRMCP	ARCGRMCP
	READ_MCP
ARCZREAD	ARCZREAD
ARCCMCP	ARCCMCP

4. **Read the MCP for the catalog volume of the data set:** If a catalog volume was determined, call ARCZREAD to read the MCP for the catalog volume that the data set is currently cataloged on and call ARCCMCP to convert MCP record to extended format, if the MCP is in old format. For a read error or a record not found, return to the caller.

Module	Label
ARCGRMCP	ARCGRMCP
	READ_MCP
ARCCMCP	ARCCMCP
ARCZREAD	ARCZREAD

Output

- Return Codes:
 - 1 - An error occurred while reading the MCP record
 - 4 - Source volume was not determined
 - 28- Backup or dump copy does not exist

Reason Codes:

- 4 - MCP record not found.

Diagram 19.4: ARCGRTOV - Validate and Build an MVT Entry for the Target Volume

Input

- Recovery Task Control Block (GTCB)
- Recovery Data Set Parameter List (GDSP)
- Management Work Element (MWE).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGRTOV	ARCGRTOV
ARCPDA	ARCPDA

2. **Determine the target volume serial number:** If FROMVOLUME was not specified and the target data set is currently cataloged as an SMS (Storage Management Subsystem) managed data set, set the target volume to the volume the target data set is currently cataloged on. If the user specified TOVOLUME, and the data set is a non-Integrated Catalog Facility virtual storage access method (VSAM) data set, call ARCVSCAT to find the name of the catalog that the data set is cataloged in, and call ARCZGCAT to verify the target volume is owned by the catalog. If an error occurs, call ARCWTU to issue message ARC0765I and end processing. If the user specified TOVOLUME, set the target volume to TOVOLUME.

If TOVOLUME is not specified, but the user specified FROMVOLUME, set the target volume to the FROMVOLUME.

If TOVOLUME and FROMVOLUME are not specified, but the target data set is currently cataloged, set the target volume to the volume the target data set is currently cataloged on.

If TOVOLUME and FROMVOLUME are not specified, and the target data set is not cataloged, but the user-specified DUMPVOLUME, set the target volume to the source volume of the dump copy.

If TOVOLUME, FROMVOLUME, and DUMPVOLUME are not specified and the target data set is not cataloged, set the target volume to the source volume of the backup version.

Module	Label
ARCGRTOV	ARCGRTOV SET_TARGET_VOL TOVOLUME CHKTOVOL
ARCVSCPW	ARCVSCAT
ARCZGCAT	ARCZGCAT
ARCWTO	ARCWTU

3. **Retrieve or build the MVT entry for the target volume:** Call ARCZMVT to find a mounted volume table (MVT) entry or to build an MVT entry. If an error occurs, end the processing for the target volume.

Module	Label
ARCGRTOV	ARCGRTOV GET_MVT_ENTRY
ARCZMVT	ARCZMVT

4. **Verify target volume:** Verify that the volume is not a migration volume. If the volume is a migration volume, end the processing. Check if the user-specified device type is inconsistent with the device type of the target volume for the data set which is to be recovered/restored to a non-SMS-managed volume. If so, end the processing. Check for block size and track overflow incompatibility (not for system reblockable data set and not for non-preallocated SMS data set). If incompatible, end the processing.

Module	Label
ARCGRTOV	ARCGRTOV VERIFY_TARGET_VOL

Output

- Return Codes:
 - 1 - CDS read error
 - Reason Codes:
 - Return Codes from ARCZREAD
 - 2 - Data set not backed up
 - 14 - A catalog locate error occurred
 - Reason Codes:
 - 40 - Catalog does not own the target volume
 - 20 - Unsupported device type
 - 37 - Incompatible device type
 - 45 - The TOVOLUME is a migration volume
 - 49 - The device and data set are incompatible
 - 72 - DFHSM encountered an SMS-related error while selecting a target volume
 - Reason Codes:
 - 1 - SMS is not installed on the system
 - 4 - The Format 4 DSCB indicates that the volume is SMS-managed, but SMS is not installed on the system
 - 5 - Error reading the Format 4 DSCB for the volume
 - 6 - Error retrieving an SMS volume definition
 - 7 - Error retrieving an SMS storage group definition for the volume
 - 9 - The volume is in SMS initial status
 - 11 - The indications of an SMS-managed volume in the Format 4 DSCB and the SMS storage group volume definition do not agree
 - 13 - The device type retrieved from the SMS storage group definition is not supported by DFHSM

- 15 - Error reading or writing an MCV record for an SMS-managed volume
- 19 - Volume is not mounted
- 52 - GETMAIN error.

Diagram 19.5: ARCGREN - Rename a Recovered VSAM Data Set

Input

- ARCGDSP Parameter List.

Processing

ARCGREN invokes the module to do the rename of a recovered VSAM data set and if a data set already exists with the new name, ARCGREN deletes it prior to invoking the rename module.

Output

- Updated ARCGDSP Parameter List
- Return Codes.

Diagram 19.6: ARCGDSSC - Do Security Checking on Data Set to Recover or Restore, or on the Newly Named Data Set

Input

- ARCGSSCP Parameter List.

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGDSSC	ARCGDSSC
ARCPDA	ARCPDA

2. **Do security check on the data set passed by the caller:** ARCGDSSC is called to do the security check on the data set to be recovered/restored and on the NEWNAME data set specified on the RECOVER command. It validates the input parameter list. If any are in error, it calls ARCERP and returns to the caller.

For virtual storage access method (VSAM) data set that is not an Integrated Catalog Facility catalog, ARCVSCHK is called to get the volume the data set is currently cataloged to and to do the authorization checking.

For non-VSAM data set or Integrated Catalog Facility catalog data set, ARCRACF is called to do the authorization checking.

Module	Label
ARCGDSSC	ARCGDSSC
	CHKINPUTS
	AUTHCHK
ARCERP	ARCERP
ARCRACF	ARCRACF
ARCVSCHK	ARCVSCHK

3. **Validate the Return Code from ARCVSCHK or ARCRACF:** If the Return Code from ARCVSCHK or ARCRACF indicates that the user is authorized to access the data set, save the ERASE status from ARCRACF if the ERASE status was returned from RACF.

If the Return Code from ARCVSCHK or ARCRACF indicates that the password checking should be done and the data set is currently cataloged and non-SMS, or is not currently cataloged and was non-SMS at the time of backup, perform password checking. Save the ERASE status from ARCRACF if the ERASE status was returned from RACF and call ARCCHKPW for a non-VSAM data set password checking or check the user specified password against the password from the catalog or BCDS B record for a VSAM data set. Return if in error.

If the Return Code from ARCVSCHK or ARCRACF indicates that the user is not authorized to access the data set and the data set being security checked is the NEWNAME data set, fail the RECOVER command and return to the caller.

If the Return Code from ARCVSCHK or ARCRACF indicates that the user is not authorized to access the data set, the data set is currently cataloged or was cataloged at the time of backup or dump, is discretely RACF protected, and a

backup profile exists for the data set, call ARCRACF to do the authorization check against the backup profile.

If the data set is not discretely RACF protected, no backup profile exists, or Return Code from the second call to ARCRACF indicates that the user is unauthorized, fail the RECOVER command and return to the caller.

Module	Label
ARCGDSSC	ARCGDSSC EOSPROC PSWDCHK BACKUPCHK SETERC
ARCCHKPW	ARCCHKPW
ARCRACF	ARCRACF

Output

- Return Codes:
 - 0 - User is authorized to access the data set
 - 22 - An error occurred while processing a password-protected data set
 - 39 - An error occurred while processing a RACF-protected data set
- Reason Codes:
 - Return Codes from ARCRACF
- 56 - Catalog locate error - VSAM recovery failed
- Reason Codes:
 - Return Codes from ARCVSLOC.

Diagram 19.7: ARCGNVOB - Process Obtains for a Non-VSAM Data Set

Input

- Recovery Task Control Block (GTCB)
- Recovery Data Set Parameter List (GDSP).

Processing

ARCGNVOB performs the obtains for a non-VSAM data set to be recovered or restored and/or for the NEWNAME data set specified on the RECOVER command.

Output

- Return Codes.

Diagram 19.8: ARCGVDSN - Validity Checking of VSAM Data Sets

Input

- Index to the Recovery Task Control Block (GTCB)
- Indicator of ACS service routine invocation.

Processing

ARCGVDSN performs the validity checking of VSAM data sets for SMS and non-SMS-managed data sets.

Output

- GVDSN_FLAGS
- Return Codes.

Diagram 19.9: ARCGRDEC - Decide Whether to Recover or Restore a Data Set

Input

- Recovery Task Control Block (GTCB)
- Recovery Data Set Parameter List (GDSP)
- Management Work Element (MWE)
- Eligible Volume Record (MCP).

Processing

ARCGRDEC determines whether to do a recovery of an incremental backup version, or a restore from a full volume dump, for a data set.

Output

- Return Codes.

Diagram 19.10: ARCGRNVS - Perform Security Checking of Non-VSAM Data Sets

Input

- Recovery Task Control Block (GTCB)
- Recovery Data Set Parameter List (GDSP)
- Management Work Element (MWE)
- Dump Generation Record (DGN)
- BCDS Backup Version Record (MCC).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGRNVS	ARCGRNVS
ARCPDA	ARCPDA

2. **Do security check(s) on the data set to be recovered or restored if the NEWNAME was not specified on the recover command:** ARCGRNVS calls ARCGDSSC to do the security check for the original data set on the following volumes:

- a. The target volume.
- b. The volume the original data set is currently cataloged on (catalog-volume) if the catalog-volume is different from the target volume.
- c. The volume the data set was backed up from or was dumped from if the original data set is not currently cataloged and the FROMVOLUME was not specified.
- d. The FROMVOLUME if the specified FROMVOLUME is different from the target volume.

If any security check failed, the recovery is terminated.

Module	Label
ARCGRNVS	ARCGRNVS ORIGINALDS ORIGDS_CURCAT ORIGCATDS_NOTCURCAT ORIGDS_UNCAT GDSSCPROC
ARCGDSSC	ARCGDSSC

3. **Do security check(s) on the data set to be recovered or restored and the NEWNAME data set if the NEWNAME was specified on the recover command:**

If the NEWNAME was specified on the recover command, ARCGRNVS calls ARCGDSSC to do the security check for the following data sets and volumes:

- a. For the original data set on its catalog-volume.
- b. For the original data set on the volume it was backed up from or dumped from if it is not currently cataloged.
- c. For the original data set on the specified FROMVOLUME.

- d. For the NEWNAME data set on the target volume.
- e. For the NEWNAME data set on its catalog-volume if its catalog volume is different from the target volume.

If any security check failed, the recovery is terminated.

Module	Label
ARCGRNVS	ARCGRNVS NEWNAME CATNEW_ORIGDS NEWDS_CURCAT NEWDS_NOTCURCAT NEWDS_UNCAT_ORIGDS NEWDS_UNCAT GDSSCPROC
ARCGDSSC	ARCGDSSC

Output

- Return Codes:
 - 0 - User is authorized to access the data
 - 22 - Error processing password-protected data set
Reason Codes:
 - Return Codes from ARCCHKPW
 - 39 - Error processing a RACF-protected data set
Reason Codes:
 - Return Codes from ARCVSCPW
 - 56 - VSAM recovery failed
Reason Codes:
 - Return Codes from ARCVSCPW.

Diagram 19.11: ARCGRFRV - Allocate Backup/Dump Volumes for Recover or Restore Processing

Input

- Recovery Data Set Parameter List (GDSP)
- Recovery Task Control Block (GTCB)
- A one-byte field that indicates whether backup or dump volumes need to be allocated
- Management Work Element (MWE).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGRFRV	ARCGRFRV
ARCPDA	ARCPDA

2. **Validate input parameter:** Validate the input parameter. If there is an error, call ARCERP to inform the user of the error, and return to the caller.

Module	Label
ARCGRFRV	ARCGRFRV
ARCERP	ARCERP

3. **Build mounted volume table (MVT) entry and allocate volume:** For direct access storage device (DASD), call ARCZMVT to build an MVT entry and to validate the device type. For tape, call ARCWTU to issue message ARC0612I, call ARCZTMVT to read the backup control data set (BCDS) record, build the MVT entry, issue message ARC0313A and ARC0366A to the operator and allocate the backup or dump volume. Save the address to the MVT entry in the GDSP. For tape, set the indicators to indicate that recovery or restore is from tape. When an error occurs, set the appropriate Return Code in the management work element and return to the caller.

Module	Label
ARCGRFRV	ARCGRFRV
	BACKUP_ALLOC_DASD
	BACKUP_ALLOC_TAPE
	DUMP_ALLOC
ARCZMVT	ARCZMVT
ARCZTMVT	ARCZTMVT
ARCWTO	ARCWTU

Output

- Backup or dump volume allocated and an MVT entry built
 - Return Codes:
 - 1 - An error occurred while reading the control data set record
- Reason Codes:
- Return Codes from ARCZREAD

- 20 - Unsupported device type for DASD
- 28 - Backup or dump copy does not exist

Reason Codes:

- 4 - Backup control data set record (BCDS) not found
- 64 - Allocation error
- 95 - Tape volume(s) could not be mounted.

Diagram 19.12: ARCGRDCL - Read the DCL Record**Input**

- Recovery Task Control Block (GTCB)
- Recovery Data Set Parameter List (GDSP)
- Dump Generation Record (DGN)
- ARCGDCLP Parameter List.

Processing

ARCGRDCL reads the dump class record (DCL), to see whether the dump class has a data set restore attribute, and to see if the data set to be restored is in the dump volume table of contents (VTOC) copy data set.

Output

- Return Codes.

Diagram 19.13: ARCGRDVC - Allocate, Open, and Read the Dump VTOC Copy Data Set**Input**

- Recovery Task Control Block (GTCB)
- Recovery Data Set Parameter List (GDSP)
- Dump Generation Record (DGN).

Processing

ARCGRDVC reads the dump volume table of contents (VTOC) copy data set to see if the data set to be recovered/restored is in the dump VTOC copy data set, and to save the security flags from VTOC entry.

Output

- Return Codes.

Data Set Recovery Processing

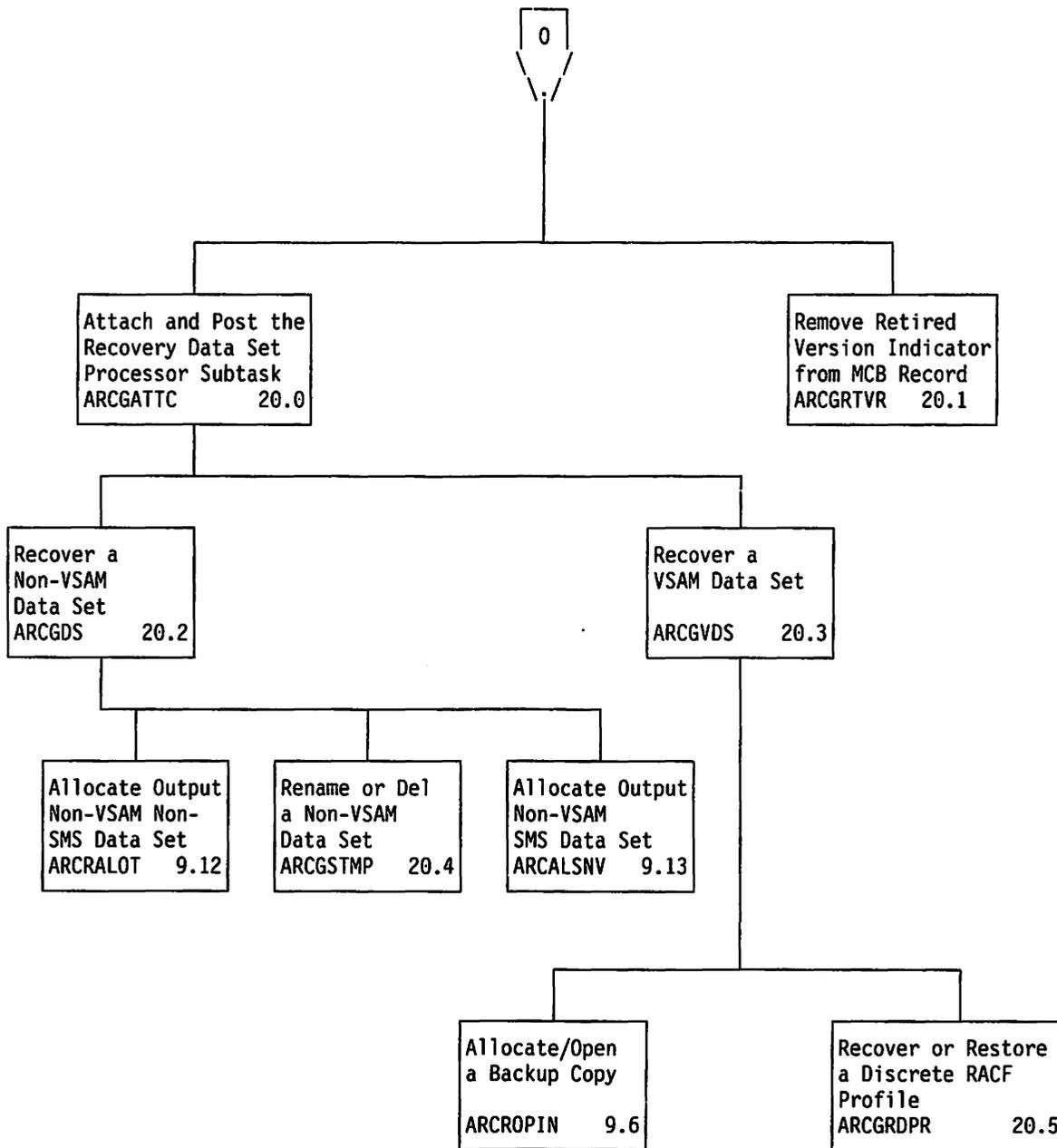


Figure 22. Visual Table of Contents for Data Set Recovery Processing

Diagram 20.0: ARCGATTC - Attach and Post the Recovery Data Set Processor Subtasks

Input

- Recovery ATTACH Parameter List (GATP)
- Recovery Data Set Parameter List (GDSP)
- Recovery Task Control Block (GTCB)
- Recovery Control Block (RCB)
- Mounted Volume Table (MVT).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGATTC	ARCGATTC
ARCPDA	ARCPDA

2. **Attach the requested data set recovery subtask:** Control is passed to ARCGATTC. ARCGATTC validates the input parameters. If any invalid parameters are passed, ARCERP is called to issue an error message and processing ends. Otherwise, ARCGATTC attaches the requested data set recovery subtask if the subtask has not been attached.

Module	Label
ARCGATTC	ARCGATTC INIT ATTACH
ARCERP	ARCERP
ARGDS	ARGDS
ARGVDS	ARGVDS

3. **Post the requested data set recovery subtask:** Issue a POST macro. The work-to-do event control block (ECB) in the recovery task control block (GTCB) for the requested data set recovery subtask is posted to wake up the subtask to recover the data set.

Module	Label
ARCGATTC	ARCGATTC POST

4. **Wait for the data set recovery subtask to complete:** Issue a WAIT macro. When the posted data set recovery subtask completes or ends, the ending ECB in the GTCB for the subtask is posted by the subtask and ARCGATTC receives control.

Module	Label
ARCGATTC	ARCGATTC WAIT

5. **Check if a 3480 single-file format data set is open:** Upon waking up from the WAIT, check whether the subtask that just posted completion opened a 3480 single-file format data set. If so, indicate there is an open 3480 single-file format

data set in any other existing RCB so that the other data set recovery subtask will know that the input data set is already open when it is posted to recover a user data set.

Module	Label
ARCGATTC	ARCGATTC UPDTRCB

6. **Check for abnormal ends or tape-not-mounted errors in the data set recovery subtask:** Check to see if the data set recovery subtask abnormally ended by examining the task control block (TCB) of the data set recovery subtask. A non-zero Return Code indicates an abnormal end. If an abnormal end occurred, add 900 to the Return Code that the data set recovery subtask passed back, set the job file control block (JFCB) read flag in the MVT to off, and detach the abnormally ended subtask.

If the data set recovery subtask ended normally, check the ending ECB in the GTCB for the subtask to see if the tape was not mounted when the data set was recovered from tape. If DFHSM shutdown was requested when the data set recovery subtask was waiting for a tape mount, or the operator could not mount the tape, detach the subtask with STAE = YES.

Module	Label
ARCGATTC	ARCGATTC CKERROR DETACH

Output

- Recovery Data Set Parameter List (GDSP)
- Recovery Task Control Block (GTCB)
- Recovery Control Block (RCB)
- Mounted Volume Table (MVT)
- Return Codes:
 - 0 - The ATTACH and/or POST of the data set recovery subtask was successful and the subtask ended normally
 - 9nn - ABEND in the recovery subtask (ARCGATTC add 900 to the Return Code from the data set recovery subtask)
- Return Codes relating to tape processing
 - 86 - DFHSM shutdown was requested while waiting for a tape mount
 - 95 - The tape from which the data is being moved could not be mounted.

Diagram 20.1: ARCGRTVR - Remove Retired Version Indicator from the MCB Record

Input

- Recovery Task Control Block (GTCB) Index (INDXGTCB)
- Recovery Data Set Parameter List (GDSP)
- BCDS Data Set Record (MCB).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGRTVR	ARCGRTVR
ARCPDA	ARCPDA

2. **Verify the input parameters:** ARCGRTVR is called to remove the retired version indication from the BCDS data set record (MCB). Verify that the input recovery task control block (GTCB) index is valid. If the input parameter is in error, call ARCERP to log the error, and return.

Module	Label
ARCGRTVR	ARCGRTVR
ARCERP	ARCERP

3. **Check if a retired version is being recovered or a deletion discover date exists in the MCB record:**

- Check the BUI entries in the MCB to determine if a retired version is being recovered.
- Check if the deletion discover date exists in the MCB record for the data set being recovered.

If none of the above is true, return to the caller.

If any one of the above is true, proceed to the next step.

Module	Label
ARCGRTVR	ARCGRTVR

4. **Read the MCB record:** Call ARCZREAD to read the MCB for update. If an error occurs, set the Return Code and return. If no error occurs, save the address of the VSAM request parameter list (RPL) in the recovery control block (RCB).

Module	Label
ARCGRTVR	ARCGRTVR
	READBREC
ARCZREAD	ARCZREAD

5. **Set the retired version flag off or remove the deletion discover date:**

- Search all the BUI entries in the MCB to find the retired version flag(s). When found, set them OFF.
- Remove the deletion discover date from the MCB record.

Module	Label
ARCGRTVR	ARCGRTVR

6. **Update the MCB record:** Call ARCGRTVR to write the updated copy of the MCB back to the backup control data set (BCDS). Zero the RPL pointer in the RCB. If an error occurs, set the Return Code. Return to the caller.

Module	Label
ARCGRTVR	ARCGRTVR UPDTBREC
ARCZUPDT	ARCZUPDT

Output

- Return Codes:
 - 00 - The data set is not a retired data set, or the retired version indication was successfully removed from the MCB record
 - 01 - An error occurred while trying to read the MCB record
 - 09 - An error occurred while trying to update the MCB record.

Diagram 20.2: ARCGDS - Recover a Non-VSAM Data Set

Input

- ARCGDSP Parameter List
- Recovery Task Control Block (GTCB) index of the attaching task.

Processing

ARCGDS processes the recovery of a non-VSAM data set.

Output

- Updated ARCGDSP Parameter List
- Return Codes.

Diagram 20.3: ARCGVDS - Recover a VSAM Data Set

Input

- Recovery Task Control Block Index (GTCB)
- Recovery Data Set Parameter List (GDSP).

Processing

ARCGVDS recovers a VSAM data set for a data set recovery request or a volume recovery request.

Output

- Return Codes.

Diagram 20.4: ARCGSTMP - Rename or Delete a Non-VSAM Data Set

Input

- ARCGRTWA Data Area.

Inout

- ARCGRTWA Data Area.

Processing

ARCGSTMP renames and/or deletes non-VSAM data sets.

Output

- ARCGRTWA Data Area Filled In
- Return Codes.

Diagram 20.5: ARCGRDPR - Recover or Restore a Discrete RACF Profile

Input

- Index to appropriate GTCB of Caller (INDXGTCB).

Processing

1. **Trace the entry to this module:** Call ARCPDA to create a trace entry for the entrance of this module.

Module	Label
ARCGRDPR	ARCGRDPR
ARCPDA	ARCPDA

2. **Verify the input parameters:** Verify that the input recovery task control block (GTCB) index is valid (must be 1, 2, or 3). If the input parameter is in error, call ARCERP to log the error, and return.

Module	Label
ARCGRDPR	ARCGRDPR
ARCERP	ARCERP

3. **Check if called to turn on RACF-indication in the catalog record:** If the ARCGDSP parameter list shows that the data set is virtual storage access method (VSAM), ARCGRDPR may be called to turn on the RACF indicator in the catalog record. The RACF indicator is turned on in the catalog by issuing SVC 26 (LOCATE) with a catalog request that calls for altering the catalog entry. Before issuing the LOCATE, call ARCLOCK to enqueue on major queue name ARCGPA, minor queue name VSAMLOCK to serialize catalog access within the DFHSM address space. Then enter supervisor state, key zero, so catalog management will honor DFHSM's request to bypass security checking. After issuing SVC 26, return to problem state, key 8, and call ARCUNLK to dequeue from major queue name ARCGPA, minor name VSAMLOCK. If the catalog alter request fails, call ARCWTU to issue message ARC0385I. Exit from ARCGRDPR.

Module	Label
ARCGRDPR	ARCGRDPR CATRIND MSG38X
ARCLOCK	ARCLOCK ARCUNLK
ARCWTO	ARCWTU

4. **Create a profile for the recovered data set name that is not the same as the original data set name, modeling it after the original data set name:** If the original data set name is different than the recovered data set name, an attempt is made to create a new discrete profile for the recovered data set using the original data set name as a model. If the requestor is not DFHSM-authorized, set up the ARCRACFP parameter list with the requestor's user ID and RACF group and use the user's ACEE in the call to tell ARCRACF to do authorization checking when creating the RACF discrete profile. If the data set is non-VSAM, then call ARCRACF to create the profile. If the original data set is currently cataloged, the current volume serial number from the catalog is provided to ARCRACF; otherwise, the volume serial number from which it was backed up is provided. If the data set is VSAM, then call ARCVSCHK to create the profile.

If the profile creation is successful, call ARCWTU to issue message ARC0386I and return to the caller. If the profile creation fails because the desired profile already exists and the data set is non-VSAM, return to the caller. If the profile creation fails because the desired profile already exists and the data set is VSAM, a bit is turned on in the ARCGDSP parameter list so that the caller will check if the original data set was RACF indicated when it was backed up. If it was not, ARCGRDPR is called again after the recovery to issue SVC 26 to request catalog management to set on the RACF indicator in the catalog record for the base cluster. Then control returns to the caller. If the profile creation fails for any other reason than 'already exists' or 'authorization failure', call ARCWTU to issue message ARC0382I and continue processing with step 6. If the profile creation fails for lack of authorization by a DFHSM non-authorized user, the recovery will be failed.

Module	Label
ARCGRDPR	ARCGRDPR NEWMODEL MSG382 MSG38X
ARCRCACF	ARCRCACF
ARCVSCHK	ARCVSCHK
ARCWTO	ARCWTU

5. **Create a profile for the recovered data set name that is the same as the original data set name, modeling it after itself:** If the original data set name is the same as the recovered data set name, and the caller did not indicate an attempt was already made to update the profile, an attempt is made to create a new discrete profile for the recovered data set, using itself as the model. This invocation of RACF does not use the requestor's user ID and group because it is an attempt to get information from RACF. No profile will be created. If the data set is non-VSAM, or if the data set is an Integrated Catalog Facility catalog, then call ARCRACF to create the profile. If the data set was cataloged before the recovery began and is non-VSAM, the current volume serial number is passed to ARCRACF; otherwise, the volume from which it was backed up is provided. If the data set is VSAM and not an Integrated Catalog Facility catalog, then call ARCVSCHK to create the profile. If the profile creation fails because the desired profile already exists and the data set is non-VSAM, return to the caller. If the profile creation fails because the desired profile already exists and the data set is VSAM, a bit is turned on in the ARCGDSP parameter list so that the caller will check if the original data was RACF indicated when it was backed up. If it was not backed up, ARCGRDPR is called again after the recovery to issue SVC 26 to request catalog management to set on the RACF indicator in the catalog record for the base cluster. Then control returns to the caller. If the profile creation fails for any other reason than 'already exists', continue processing with step 7.

Module	Label
ARCGRDPR	ARCGRDPR OLDMODEL
ARCRCACF	ARCRCACF
ARCVSCHK	ARCVSCHK
ARCWTO	ARCWTU

6. **Create a new profile modeled after a backup profile:** The BUI entries in the BCDS data set record (MCB) are searched to find out if a backup version has a backup profile associated with it. If a backup profile exists, an attempt is made

to create a new discrete profile for the recovered data set using the backup profile as a model. If the requestor is not DFHSM-authorized, set up the ARCRACFP parameter list with the requestor's user ID and RACF group and use the user's access control environment element (ACEE) in the call to tell ARCRACF to do authorization checking when creating the RACF discrete profile. If the data set is non-VSAM, use the recovered data set name from the ARCGDSP parameter list. If it is VSAM, use the original name from the ARCGDSP parameter list if no new name is asked for, or use the new name from the parameter list if asked for. If the data set is non-VSAM, or if the data set is an Integrated Catalog Facility catalog, then call ARCRACF to create the profile. If the data set is VSAM and not an Integrated Catalog Facility catalog then call ARCVSCHK to create the profile.

If the profile creation is successful, call ARCWTU to issue message ARC0386I, and return to the caller. If the profile creation fails because the desired profile already exists and the data set is non-VSAM, return to the caller. If the profile creation fails because the desired profile already exists and the data set is VSAM, a bit is turned on in the ARCGDSP parameter list so that the caller will check if the original data was RACF indicated when it was backed up. If it was not backed up, ARCGRDPR will be called again after the recovery to issue SVC 26 to request catalog management to set on the RACF indicator in the catalog record for the base cluster. Then control returns to the caller. If the profile creation fails for any other reason than 'already exists', or 'authorization failure', call ARCWTU to issue message ARC0382I and continue. If the profile creation fails for lack of authorization by a DFHSM non-authorized user, the recovery will be failed.

Module	Label
ARCGRDPR	ARCGRDPR MODEL BUP MSG382 MSG38X
ARCRACF	ARCRACF
ARCVSCHK	ARCVSCHK
ARCWTO	ARCWTU

7. **Create a minimal profile for the recovered data set:** If a backup profile does not exist, or if the creation attempt modeled after the backup profile failed, an attempt will be made to create a minimal discrete profile for the recovered data set. If the requestor is not DFHSM-authorized, set up the ARCRACFP parameter list with the requestor's user ID and RACF group and use the user's ACEE in the call to tell ARCRACF to perform authorization checking when creating the RACF discrete profile. If the data set is non-VSAM, use the recovered data set name from the ARCGDSP parameter list. If it is VSAM, use the original name from the ARCGDSP parameter list if no new name is asked for, or use the new name from the parameter list if asked for. If the data set is non-VSAM or if the data set is an Integrated Catalog Facility catalog, then call ARCRACF to create the profile. If the data set is VSAM and not an Integrated Catalog Facility catalog, then call ARCVSCHK to create the profile.

If the profile creation is successful, call ARCWTU to issue message ARC0384I. If the profile creation fails because the desired profile already exists and the data set is non-VSAM, return to the caller. If the profile creation fails because the desired profile already exists and the data set is VSAM, a bit is turned on in the ARCGDSP parameter list so that the caller will check if the original data was RACF indicated when it was backed up. If it was not backed up, ARCGRDPR will be called again after the recovery to issue SVC 26 to request catalog

management to set on the RACF indicator in the catalog record for the base cluster. Then control returns to the caller. If the profile creation fails for any other reason than 'already exists', or 'authorization failure', call ARCWTU to issue messages ARC0382I and ARC0383I and turn on a bit so the caller will check if the original data set was RACF indicated when backed up. If the profile creation fails because of lack of authorization by a DFHSM non-authorized user, the recovery will be failed.

Module	Label
ARCGRDPR	ARCGRDPR CREATMIN MSG382 MSG38X
ARCRACF	ARCRACF
ARCVSCHK	ARCVSCHK
ARCWTO	ARCWTU

Output

- A discrete RACF profile for the data set recovered, depending on whether processing is successful. If it is, GDSIPRFC is turned on
- If processing is unsuccessful, a Return Code of 39 and a Reason Code of 8 may be generated. Processing will have failed due to an unauthorized user, and recovery is ended
 - Return Codes:
 - 39 - Authorization failure
 - Reason Codes:
 - 8 - Profile creation failed due to an unauthorized user ... Recovery ended.

Data Set Restore Processing

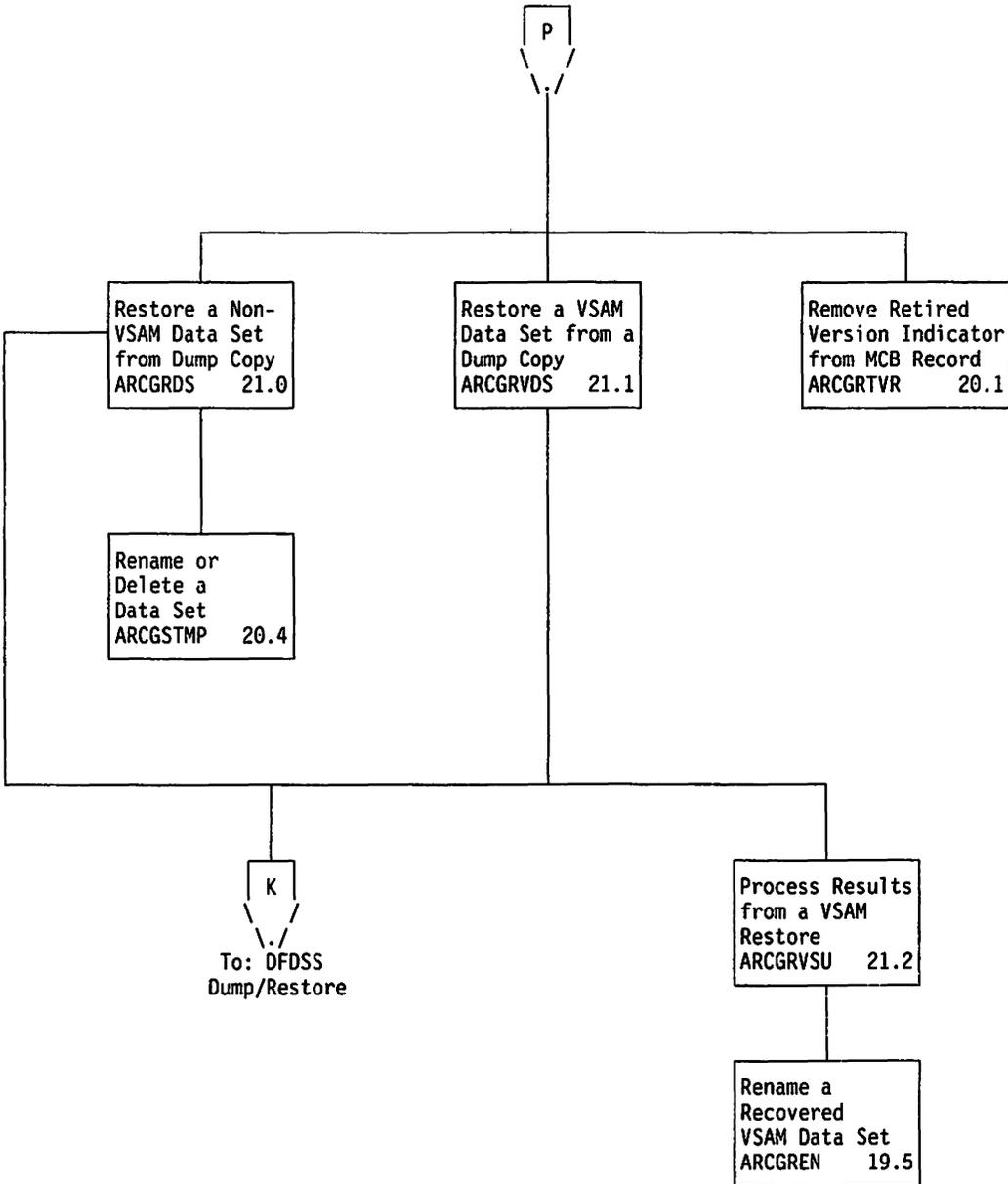


Figure 23. Visual Table of Contents for Data Set Restore Processing

Diagram 21.0: ARCGRDS - Restore a Non-VSAM Data Set from a Dump Copy

Input

- ARC GDSP Parameter List.

Processing

ARCGRDS restores an individual non-VSAM data set from a dump copy, to catalog or recatalog the data set, and to update the Format 1 DSCB for the restored data set.

Output

- Return Codes.

Diagram 21.1: ARCGRVDS - Restore a VSAM Data Set from a Dump Copy

Input

- ARC GDSP Parameter List.

Processing

ARCGRVDS restores an individual VSAM data set from a dump copy and catalogs the restored data set if necessary.

Output

- Return Codes.

Diagram 21.2: ARCGRVSU - Process Results from a VSAM Restore

Input

- Index to current Recovery Task Control Block (GTCB)
- Pointer to ARCDDSSP Parameter List.

Processing

ARCGRVSU processes the results from a VSAM restore.

Output

- Return Codes.

List of Abbreviations

ACB	access control block	EOV	end of volume
ACEE	access control environment element	EXT	user exit table
AIX	alternate index	FSR	function statistics record
ASXB	address synchronization record	GATP	recovery attach parameter list
BCDS	backup control data set	GDG	generation data group
BCR	backup control record	GDSP	recovery data set parameter list
BDAM	basic direct access method	GTCB	recovery task control block
BDS	basic device support	ISPF/PDF	Interactive System Productivity Facility/Program Development Facility
BSAM	basic sequential access method	JES3	job entry subsystem 3
BTCB	backup task control block	JFCB	job file control block
BVR	backup cycle volume record	L2CR	level 2 control record
CCW	channel control word	MATP	migration attach parameter list
CDD	common data set descriptor record	MCA	MCDS alias entry record
CDSV	CDSVERSIONBACKUP table	MCB	BCDS data set record
CIB	command input buffer	MCC	BCDS backup version record
COMNM	compaction names table	MCD	MCDS data set record
CSA	common service area	MCDS	migration control data set
DASD	direct storage access device	MCK	control data set key and record header
DBA	delete by age	MCL	BCDS backup migrated data set record
DBU	delete if backed up	MCM	BCDS move backup version record
DCB	data control block	MCO	MCDS VSAM associations record
DCL	dump class record	MCP	eligible volume record
DCR	dump control record	MCR	management control record
DEB	data extent block	MCT	BCDS backup volume record
DECB	data entry control block	MCU	MCDS user record
DFDSS	Data Facility Data Set Services	MCV	MCDS volume record
DFHSM	Data Facility Hierarchical Storage Manager	MCVT	management communication vector table
DFP	data facility product	MC1	migration level 1 free space record
DGN	dump generation record	MDQE	migratable data set queue element
DL2AT	DASD level 2 available table	MGCB	migration global control block
DSCB	data set control block	MHCR	multiple-host processor control record
DSR	daily statistics record	ML1	migration level 1 volume
DTCB	Dump task control block	ML2	migration level 2 volume
DVL	BCDS dump volume record	MLOG	DFHSM log or journal record header
DVST	Dump volume selection table	MSS	mass storage system
DVT	device table	MTCB	migration task control block
ECB	event control block	MTS	migration tape selection
EOF	end of file		

MTSP	migration tape selection and release parameter	SR	synchronization record
MVT	mounted volume table	SUT	space usage table
MWE	management work element	SVC	supervisor call
OCDS	offline control data set	TAL	tape allocation list
PCL	parameter control list	TCB	task control block
PDE	pool descriptor element	TIOT	task input/output table
PDL	parameter descriptor list	TT	trap table
PDSE	partitioned data set extended	TCC	tape table of contents record
PTF	program temporary fix	TTOC	tape table of contents
QCT	queue control table	TTR	relative record address
QSAM	queued sequential access method	TTX	tape timer exit
RACF	Resource Access Control Facility	TVT	tape volume table
RCB	recovery control block	UCB	unit control block
RLE	retained data set level element	UUT	user unit table
RPL	request parameter list	VAC	JES3 volume activity count record
RTCB	recall tasks control block	VCAT	volume catalog
RTM	recovery termination manager	VLST	volume list of primary volumes in JES3
SAF	System Authorization Facility	VSAM	virtual storage access method
SDATA	VSAM sphere backup control block	VSR	volume statistics record
SDSP	small data set packing	VTOC	volume table of contents
SDWA	system diagnostic work area	WTOR	write to operator with reply
SMS	storage management subsystem	YTCB	recycle task control block

Glossary of Terms and Abbreviations

This glossary includes definitions of some terms found in this document. Some of the terms defined below are from:

- The *American National Dictionary for Information Processing Systems*, copyright 1982 by the Computer and Business Equipment Manufacturers Association. Copies may be purchased from the American National Standards Institute at 1430 Broadway, New York, New York 10018. These definitions are identified by an asterisk.
- The *ISO Vocabulary - Information Processing*, and the *ISO Vocabulary - Office Machines*, developed by the International Standards Organization, Technical Committee 97, Subcommittee 1. Definitions from published sections of this vocabulary are identified by the symbol "(ISO)" preceding the definition. Definitions from draft proposals and working papers under development by the ISO/TC97 vocabulary subcommittee are identified by the symbol "(TC97)," indicating that final agreement has not yet been reached among its participating members.

A

ABARS. Aggregate backup and recovery support.

accompany data set. In aggregate backup and recovery processing, a data set that is physically transported from the backup site to the recovery site instead of being copied to the aggregate data tape. It is cataloged during recovery.

ACCOMPANY keyword. The keyword used in the selection data set to create an accompany list.

accompany list. An optional list in the selection data set that identifies the accompany data sets.

ACEE. Access control environment element.

ACS. Automatic class selection.

active data. Data that is frequently accessed by users and that resides on level 0 volumes.

activity log. In DFHSM, a SYSOUT or DASD-type data set used to record activity and errors that occurred during DFHSM processing.

AG. Aggregate group.

aggregate backup. The process of copying the data sets and control information of a user-defined group of data

sets so that they may be recovered later as an entity by an aggregate recovery process.

aggregate group. A Storage Management Subsystem class that defines control information and identifies the data sets to be backed up by a specific aggregate backup.

aggregate recovery. The process of recovering a user-defined group of data sets that were backed up by aggregate backup.

aggregated data sets. In aggregate backup and recovery processing, data sets that have been defined in an aggregate group as being related.

AIX. See alternate index.

allocate data set. In aggregate backup and recovery processing, a data set name that is listed in the selection data set. The space for this data set is allocated and the data set is cataloged at the recovery location, but the actual data is not restored.

ALLOCATE keyword. The keyword used in the selection data set to create an allocate list.

allocate list. An optional list in the selection data set that identifies the allocate data sets.

alternate index. In systems with VSAM, a collection of index entries related to a given base cluster and organized by an alternate key, that is, a key other than the prime key of the associated base cluster data records. Its function is to provide an alternate directory for locating records in the data component of a base cluster. See also path.

alternate index cluster. In VSAM, the data and index components of an alternate index.

alternate tape volumes. In DFHSM, copies of original tape volumes created during tape copy processing. The volumes can either be stored on-site or off-site for use later in the event of a disaster. During the tape replace processing, these volumes can replace the original volumes that may be lost.

alternate tape volume reference. In DFHSM, additional fields in the TTOC record that record information about the alternate tape volume. These fields provide DFHSM with the necessary information to refer to the alternate tape volume.

audit. A DFHSM process that detects discrepancies between data set information in the VTOCs, the computing system catalog, the MCDS, BCDS, and OCDS.

AUTH. The DFHSM command used to identify an authorized user who can issue DFHSM system programmer and storage administrator commands.

authorized user. In DFHSM, the person or persons who are authorized through the DFHSM AUTH command to issue DFHSM system programmer, storage administrator, and operator commands.

automatic backup. In DFHSM, the process of automatically copying eligible data sets from DFHSM-managed volumes or migration volumes to backup volumes during a specified backup cycle.

automatic cartridge loader feature. A feature of the 3480 Magnetic Tape Subsystem providing the operator with the capability of preloading multiple tapes to be used as migration, backup, or dump tapes.

automatic class selection (ACS). A mechanism for assigning SMS classes and storage groups.

automatic dump. In DFHSM, the process of using DFDSS to automatically do a full volume dump of all allocated space on DFHSM-managed volumes to designated tape dump volumes.

automatic migration. In DFHSM, the process of automatically moving eligible data sets from user volumes to migration level 1 or level 2 volumes, or from migration level 1 volumes to migration level 2 volumes, without a specific request for each data set moved. See interval migration.

availability management. In DFHSM, the process of ensuring that a current version (backup copy) of the installation's data sets resides on tape or DASD.

B

backup. In DFHSM, the process of copying a data set residing on a level 0 volume, level 1 volume, or a volume not managed by DFHSM to a backup volume. See automatic backup, incremental backup.

backup control data set (BCDS). A VSAM, key-sequenced data set that contains information about backup versions of data sets, backup volumes, dump volumes, and volumes under control of the backup and dump functions of DFHSM.

backup copy. In DFHSM, a copy of a data set that is kept for reference in case the original data set is destroyed.

backup cycle. In DFHSM, a period of days for which a pattern is used to specify the days in the cycle on which automatic backup is scheduled to take place.

backup frequency. In DFHSM, the number of days that must elapse since the last backup version of a data set

was made until a changed data set is again eligible for backup.

backup profile. In DFHSM, a RACF discrete data set profile associated with the backup version of a cataloged data set that is protected by a RACF discrete data set profile.

backup version. See backup copy.

backup volume. A volume managed by DFHSM to which backup versions of data sets are written.

backup volume cleanup process. A DFHSM process that scratches data set backup versions on DASD that are no longer needed.

backup VTOC copy data set. In DFHSM, a copy of the VTOC of a volume that was backed up by DFHSM. This VTOC data set contains only part of the Format 1 DSCB for each data set from the original data set. This data set is written on a migration level 1 volume.

base cluster. In systems with VSAM, a key-sequenced or entry-sequenced file over which one or more alternate indexes are built. See also cluster.

BCDS. See backup control data set.

base data component. In VSAM, a component of the base cluster containing data of a data set.

BDAM. Basic direct access method.

BVR. Backup cycle volume record.

C

catalog. (1) * (ISO) A directory of files and libraries, with reference to their locations. A catalog may contain other information such as the types of devices in which the files are stored, passwords, blocking factors. (2) * (ISO) To enter information about a file or a library into a catalog. (3) The collection of all data set indexes that are used by the control program to locate a volume containing a specific data set. (4) To include the volume identification of a data set in the catalog. (5) See VSAM master catalog, VSAM user catalog.

CDD. See common data set descriptor record.

CDT. Class descriptor table.

changed data set. In DFHSM, a data set that has been opened for other than read-only access.

CLIST. See command list.

cluster. In systems with VSAM, a named structure consisting of a group of related components, for

example, a data component with its index component. See also base cluster.

command list. A command procedure containing executable sequences of TSO commands, subcommands, and command procedure statements.

command procedure. In TSO, a data set or a member of a partitioned data set containing TSO commands to be performed sequentially by the EXEC command. See also CLIST.

common data set descriptor record. A record which precedes a user's data set on a DFHSM-owned volume and that is used to return the data set to the user's format.

common filter services. A subcomponent of DFP common services. Common filter services compares data items with filter keys and indicates which data items match the keys and how many matches have been found.

common service area (CSA). In OS/VS2, a part of the common area that contains data areas addressable by all address spaces, but protected during its use by the key of the requester.

compaction. In DFHSM, a method of compressing and encoding data that is migrated or backed up.

compress. In DFHSM, to release unused space in a partitioned data set during the migrate/recall and backup/recovery processes.

computing system catalog. In DFHSM, the master catalog and any associated user catalogs used as sources during the audit process.

contiguous space. An unbroken consecutive series of storage locations.

control data set. In DFHSM, one of three data sets (BCDS, MCDS, and OCDS) that contain records used in DFHSM processing.

control file. In aggregate backup and recovery processing, one of three aggregate files generated by the aggregate backup process. It contains the catalog, allocation, volume, and related information necessary to perform aggregate recovery.

converter/interpreter processing. The job segment that converts and interprets JCL for MVS.

CSA. See common service area.

current backup version. In DFHSM, a backup copy of the data set that was created on a date after the data set was last updated.

cycle start date. In DFHSM, the date a backup cycle, dump cycle, or migration cleanup cycle is started.

D

daily backup volume. In DFHSM, a volume associated with a given day in the backup cycle and assigned to contain backup versions created on that cycle day.

daily space management. In DFHSM, the automatic space management of data sets that occurs once every 24 hours.

DASD. See direct access storage device.

DASD calculation services (DCS). A subcomponent of DFP common services. DCS retrieves and calculates data set information for both VSAM and non-VSAM data sets based on the user's input request.

data class. A list of allocation attributes that the system uses for the creation of data sets.

data control block (DCB). A control block used by access method routines in storing and retrieving data.

Data Facility Data Set Services (DFDSS). An IBM licensed program used to copy, move, dump, and restore data sets and volumes.

Data Facility Hierarchical Storage Manager (DFHSM). An IBM licensed program used to manage volumes and data sets. data in an MVS operating environment.

data file. In aggregate backup and recovery processing, one of three aggregate files generated by the aggregate backup process. It contains the backup copies of the data sets to be recovered.

data migration. See migration.

data set change indicator. A bit in the DSCB that indicates whether the data set was opened for output. This is bit 6 of the DS1DSIND field in the Format 1 DSCB. This indicator is supported on MVS systems that have data-set-changed flag support installed.

data set deletion. In DFHSM, the space management technique of deleting non-SMS-managed data sets that have not been used for a specified number of days and that do not have expiration date protection.

data set group. Data sets that have the same set of initial characters in their names.

data set organization. The type of arrangement of data in a data set. Examples are sequential organization or partitioned organization.

data set pool. One or more volumes managed by DFHSM to which data sets that have migrated can be

recalled, depending on the set of initial characters of the data set name.

data set retirement. In DFHSM, the space management technique of deleting non-SMS-managed data sets that have not been referred to for a specified number of days, and that have a backup version.

date last referred to. In DFHSM, the last date when a data set was opened.

DBA. See delete-by-age.

DBU. See delete-if-backed-up.

DCB. See data control block.

DCS. See DASD calculation services.

debug mode. In DFHSM, the method of operation that projects the changes that would occur in normal operation but in which no user data moves.

decompaction. In DFHSM, the process of decoding and expanding data that was compacted during daily space management or backup.

delete-by-age (DBA). In DFHSM, the space management technique of deleting non-SMS-managed data sets that have not been opened for a specified number of days.

delete-if-backed-up (DBU). In DFHSM, the space management technique of deleting non-SMS-managed data sets that have not been opened for a specified number of days, and that have a current backup version.

DFDSS. See Data Facility Data Set Services.

DFHSM. See Data Facility Hierarchical Storage Manager.

DFHSM-authorized user. In DFHSM, the person or persons who are authorized through the DFHSM AUTH command to issue system programmer and storage administrator commands.

DFHSM log. In DFHSM, a pair of sequential data sets, X and Y, containing a chronological list of transactions and statistics occurring in DFHSM.

DFHSM-managed volume. A volume managed by DFHSM containing data sets that are directly accessible to the user.

DFHSM secondary address space. A separate address space started and controlled by DFHSM to perform aggregate backup or aggregate recovery processing.

DFP common services. A component of DFP that contains three subcomponents: common filter services

(CFS), DASD calculation services (DCS), and device information services (DIS).

direct access storage device (DASD). A device in which the access time is effectively independent of the location of data.

directed recall. Moving a migrated data set from a level 1 or a level 2 volume to a level 0 volume and specifying the target volume and unit name where the data set can be allocated.

disaster. An unplanned occurrence that keeps a company or organization from conducting its normal business for some time period.

disaster backup. A means to protect a computing system complex against data loss in the event of a disaster. In DFHSM, the copying of all data on 3480 single-file tape volumes, or the equivalent, for storage at another location. The copied tape volumes can be used at another location to replace tape volumes that may be lost in a disaster.

disaster recovery. A means to replace lost data at another location with sufficient resources in order to resume operation. In DFHSM, the replacement of lost data that was contained on 3480 single-file tape volumes, or the equivalent, in the event of a disaster.

discrete backup profile. A RACF profile created when DFHSM backs up a cataloged, RACF-indicated data set.

discrete profile. A RACF profile that contains security information about a specific data set on a particular volume.

disposition processing. In OS/VS, a function performed by the initiator at the end of a job step to keep, delete, catalog, or uncatalog data sets, or pass them to a subsequent job step, depending on the data set status of the disposition specified in the DISP parameter of the DD statement.

DSCB. Data set control block. See also Format 1 DSCB.

DSLO. Distributed Systems License Option.

dump. See full volume dump.

dump class. A DFHSM-named set of characteristics that describe how volume dumps are managed.

dump copy. In DFHSM, a copy of the volume image produced by the DFDSS full volume dump function.

dump cycle. In DFHSM, a period of days for which a pattern is used to specify the days in the cycle on which automatic full volume dump is scheduled to take place.

dump generation. A successful full volume dump of a volume that may contain one to five identical dump copies.

dump VTOC copy data set. In DFHSM, a copy of the VTOC of a volume dumped by DFHSM. This VTOC data set contains only part of the Format 1 DSCB for each data set from the original data set. This data set is written on a migration level 1 volume.

E

eligibility age. The number of days since a data set met its criteria to be migrated.

emergency mode. In DFHSM, the method of operation that prevents data set movement and deletion in space management, backup, and recovery processes.

encode. (TC97) To convert data by the use of a code in such a manner that reconversion to the original form is possible.

erase-on-scratch. A RACF and DFP/XA function that overwrites the space occupied by a data set when the data set is scratched from a DASD device supported by MVS/XA.

ESDS. Entry-sequenced data set.

esoteric unit names. The names a user assigns to I/O devices that have the same device type. When the user specifies the assigned unit name to DFHSM, DFHSM associates the unit name to its device type.

exclude data set. In aggregate backup and recovery processing, a data set in the selection data set exclude list. This data set is to be excluded from being processed by aggregate backup.

EXCLUDE keyword. The keyword used in the selection data set to create an exclude list.

exclude list. An optional list in the selection data set that identifies those data sets that are to be excluded from being processed by aggregate backup.

expiration. The removal of a user data set from either a user (non-DFHSM-owned) volume, or from a DFHSM-owned volume when the user data set has been migrated. If there is an explicit expiration date, it is found in the Format 1 DSCB for a non-migrated data set, or in the MCD record for a migrated data set. If there is no explicit expiration date, the management class attributes are checked to determine an implicit expiration date.

extents. A continuous space on a direct access storage volume, occupied by or reserved for a particular data set, data space, or file.

extent reduction. In DFHSM, the releasing of unused space, reducing the number of extents, and compressing partitioned data sets.

F

FBA. See fixed-block architecture.

fixed-block architecture. Data stored in blocks of fixed size; these blocks are addressed by block number relative to the beginning of the particular file.

FMID. Function modification identifier.

Format 1 DSCB. An identifier DSCB that describes a data set or VSAM data space and its first three extents. Refer to the appropriate system data areas manual.

fragmentation index. The qualitative measure of the scattered free space on a volume.

FSR. Functional statistics record

full volume dump. In DFHSM, the process of using a DFDSS function that backs up the entire allocated space on a volume.

full volume restore. In DFHSM, the process of using a DFDSS function that restores the entire volume image.

functional statistics record. A record that is created each time a DFHSM function is processed. It contains a log of system activity and is written to SYS1.LOGREC.

functional verification procedure. A procedure distributed with DFHSM that tests to verify that all basic DFHSM functions are working properly.

G

general pool. In a DFHSM environment with JES3, the collection of all DFHSM primary volumes added to that processor that have a mount status of permanently-resident or reserved, that have the automatic recall attribute, specified, and that have a mount attribute of storage or private.

generic profile. A RACF profile that contains security information about multiple data sets, users, or resources that may have similar characteristics and require a similar level of protection.

H

high threshold of occupancy. In DFHSM, the upper limit of space to be occupied on a volume managed by DFHSM. Contrast with low threshold of occupancy.

I

IDCAMS data set. In aggregate backup and recovery processing, a file created during the aggregate recovery verification process. It can be used to resolve data set conflicts that were detected.

inactive age. In DFHSM, the number of days since the data set was last referred to.

inactive data. Copies of active or low-activity data that reside on DFHSM-owned dump and incremental backup volumes. See also low-activity data.

include data set. In aggregate backup and recovery processing, a data set in the selection data set include list. This data set is processed by aggregate backup.

INCLUDE keyword. The keyword used in the selection data set to create an include list.

include list. A required list in the selection data set that identifies the include data sets that are to be processed by aggregate backup.

incremental backup. In DFHSM, the process of copying a data set that has been opened for other than read-only access since the last backup version was created, and that has met the backup frequency criteria.

incremental recovery. Recovery of the latest backup copy of a data set or data sets made by incremental backup.

inline backup. The process of copying a specific data set to a migration level 1 volume from a batch environment. This process allows you to back up data sets in the middle of a job.

installation verification procedure (IVP). A procedure distributed with DFHSM that tests to verify that the basic facilities of DFHSM are functioning correctly.

instruction data set. In aggregate backup and recovery processing, a data set that contains instructions, commands, or any data the aggregate backup site defines as needed for aggregate recovery at the recovery site.

instruction file. In aggregate backup and recovery processing, one of three aggregate files generated by the aggregate backup process. It contains the instruction data set.

interactive storage management facility (ISMF). The interactive panels of MVS/DFP that allows users and storage administrators access to the storage management functions of DFDSS and DFHSM.

Interactive System Productivity Facility (ISPF). An IBM licensed program used to develop, test, and run

application programs interactively. ISPF is the interactive access method for all storage management functions.

interval migration. In DFHSM, automatic migration that occurs when the high threshold of occupancy is reached or exceeded on a DFHSM-managed volume during a specified time interval. Data sets are moved from the volume, largest eligible data set first, until the low threshold of occupancy is reached.

ISMF. See interactive storage management facility.

ISPF. See Interactive System Productivity Facility.

ISPF/PDF. Interactive System Productivity Facility/Program Development Facility.

IVP. See installation verification procedure.

J

JCL. Job control language.

JES2. Job entry subsystem 2.

JES3. Job entry subsystem 3.

JFCB. Job file control block.

journal data set. In DFHSM, a sequential data set used by DFHSM for recovery of the MCDS, BCDS, and OCDS. The journal contains a duplicate of each record in the control data sets that has changed since the MCDS, BCDS, and OCDS were last backed up.

K

KSDS. Key-sequenced data set.

L

level 0 volume. A volume that contains data sets directly accessible by the user. The volume may be either DFHSM managed or not DFHSM managed.

level 1 volume. A volume owned by DFHSM containing data sets that migrated from a level 0 volume.

level 2 volume. A volume under control of DFHSM containing data sets that migrated from a level 0 volume, from a level 1 volume, or from a volume not managed by DFHSM.

like device. Pertaining to (DASD) devices with identical geometry: that is, the same number of bytes per track, the same number of tracks per cylinder, and the same number of cylinders per actuator.

linear data set. In VSAM, a named linear string of data, stored in such a way that it can be retrieved or updated in 4096-byte units.

low-activity data. Data that is infrequently accessed by users and is eligible to be moved or has been moved to DFHSM-owned migration volumes.

low threshold of occupancy. The lower limit of space to be occupied on a volume managed by DFHSM. Contrast with high threshold of occupancy.

M

management class. A list of data set migration, backup, and retention attributes that DFHSM uses to manage storage at the data set level.

management work element (MWE). A control block containing the necessary information to direct DFHSM functions.

managed volume. See DFHSM-managed volume and primary volume.

MCB. BCDS data set record.

MCC. Backup version record.

MCD. MCDS data set record.

MCDS. See migration control data set.

MCP. Eligible volume record.

MCT. Backup volume record.

MCV. Primary and migration volume record.

MCVT. Management communication vector table.

migration. In DFHSM, the process of moving a cataloged data set from a DFHSM-managed volume to a migration level 1 or migration level 2 volume, from a migration level 1 volume to a migration level 2 volume, or from a volume not managed by DFHSM to a migration level 1 or migration level 2 volume.

migration cleanup. In DFHSM, the first phase of daily space management. This process deletes unnecessary records or migration copies.

migration control data set (MCDS). A VSAM, key-sequenced data set that contains statistics records, control records, user records, records for data sets that have migrated, and records for volumes under migration control of DFHSM.

migration level 1 volume. See level 1 volume.

migration level 2 volume. See level 2 volume.

migration volume. A volume under control of DFHSM that contains migrated data sets.

minimal discrete profile. A profile with no access list or model profile. The minimal discrete profile is used when recovering a RACF-indicated data set whose original profile or backup profile no longer exists.

minimum migration age. In DFHSM, the number of days a data set must remain unopened before DFHSM can select it to migrate from a volume.

ML1. Migration level 1. See level 1 volume.

ML2. Migration level 2. See level 2 volume.

model entity. A model data set name that defines a discrete data set profile for RACF protection.

multiple-file format. In DFHSM, a 3480 tape format, or the equivalent, that requires a unique standard label data set for each user data set written. When DFHSM writes in multiple-file format it writes one tape data set for every user data set to all 3480 migration and backup volumes.

mutually exclusive parameters. A set of parameters of which only one can be used. If more than one parameter is specified, only the last parameter specified is used.

MVS/DFP. An IBM licensed program used to manage programs, devices, and data in an MVS operating environment.

MVS/Enterprise Systems Architecture (MVS/ESA). An MVS operating system environment that supports accessing of virtual storage in multiple address spaces and data spaces.

MVS/Extended Architecture (MVS/XA). An MVS operating system environment that supports 31-bit real and virtual storage addressing, increasing the size of addressable real and virtual storage from 16 megabytes to 2 gigabytes.

MVS/SP. An IBM licensed program used to control the MVS operating system and establish a base for a MVS/XA or MVS/370 environment.

MVT. Mounted volume table.

MWE. See management work element.

N

non-DFHSM-managed volume. A volume not defined to DFHSM containing data sets that are directly accessible to users.

O

OCDS. See offline control data set.

offline control data set (OCDS). In DFHSM, a VSAM, key-sequenced data set that contains information about tape backup volumes and tape migration level 2 volumes.

online. (1) * (ISO) Pertaining to the operation of a functional unit when under the direct control of a computer. (2) * Pertaining to a user's ability to interact with a computer. (3) * Pertaining to a user's access to a computer via a terminal. (4) Controlled by, or communicating with, a computer.

original tape volume. In DFHSM, a 3480 single-file tape volume, or the equivalent, used to store data during migration or backup processing, and from which a copy (called the alternate volume) is made for disaster recovery.

OS/VS2. A virtual storage operating system that is an extension of OS/MVT.

owned space. The storage space on a set of volumes to which DFHSM allocates migrated data sets and backup versions, but to which user jobs should not allocate. Included in this set are migration level 1, migration level 2, and backup volumes.

owned volume. A volume on which DFHSM writes dump, migration, or backup data sets.

P

partitioned data set (PDS). A data set in DASD that is divided into partitions, called members, each of which can contain a program, part of a program, or data.

partitioned data set extended (PDSE). A DFP library structure that is an enhanced replacement for a partitioned data set.

path. (1) (TC97) In a network, any route between any two nodes. (2) In a data base, a sequence of segment occurrences from the root segment to an individual segment. (3) In VSAM, a named, logical entity providing access to the records of a base cluster either directly or through an alternate index. (4) In an online IMS/VS system, the route a message takes from the time it is originated through processing; in a multisystem environment, the route can include more than one IMS/VS system.

PCDD. Pseudo common data set descriptor (CDD) record

PDF. Program Development Facility.

PDS. Partitioned data set.

PDSE. Partitioned data set extended.

physical data set restore. In DFHSM, the process of using a DFDSS function to restore one data set from a dump copy created by using the DFHSM full volume dump function.

pool of volumes. See data set pool, general pool, and volume pool.

primary processing unit. In a multiple processing-unit-environment, the processing unit assigned to do level functions (such as backing up migrated data sets).

primary volume. A non-SMS volume managed by DFHSM containing data sets that are directly accessible to the user.

PSCB. Protected step control block.

PSP. Preventive services planning.

PTF. Program temporary fix.

Q

quiesce time. A time of day after which an automatic function does not start processing any more volumes.

R

RACF. See Resource Access Control Facility.

recall. The process of moving a migrated data set from a level 1 or level 2 volume to a DFHSM-managed volume or to a volume not managed by DFHSM.

recovery. In DFHSM, the process of copying a backup version of a data set from a backup volume to a specified volume or to the volume from which the backup version was created.

recycle process. A DFHSM process that, based on the percentage of valid data on a tape backup or migration level 2 volume, copies all valid data on the tape to a tape spill backup or migration level 2 volume.

Resource Access Control Facility (RACF). An IBM-licensed program that provides access control by identifying and verifying users to the system. RACF authorizes access to resources, logs unauthorized access attempts, and logs accesses to protected data sets.

restart data set. A data set created by DFHSM if aggregate recovery fails. It contains a list of all the data sets successfully restored during the aggregate recovery

and allows the user to restart the aggregate recovery once the cause of the failure has been resolved.

restore. In DFHSM, the process of invoking DFDSS to perform the program's recover function. In general, it is to return to an original value or image, for example, to restore data in main storage from auxiliary storage.

retired version. In DFHSM, a specially marked backup version that DFHSM created before it deleted the non-SMS-managed original data set during data set retirement.

retirement. See data set retirement.

RRDS. Relative record data set.

S

SAF. System authorization facility.

SCP. System control programming.

SDSP. See small data set packing.

secondary address space. See DFHSM secondary address space.

selection data set. In aggregate backup and recovery processing, a sequential data set or a member of a partitioned data set, used to define the data sets that comprise the input to the aggregate backup function. It contains any include, exclude, accompany, or allocate lists.

sequential data set. A data set whose records are organized on the basis of their successive physical positions, such as on magnetic tape.

similar device. A (DASD) device with the same number of bytes per track and tracks per cylinder.

single-file format. In DFHSM, a 3480 format, or the equivalent, consisting of one standard-label data set that spans up to 255 tape volumes.

small data set packing (SDSP). In DFHSM, the process used to migrate data sets that contain equal to or less than a specified amount of actual data. The data sets are written as one or more records into a VSAM data set on a migration level 1 volume.

small-data-set-packing data set. In DFHSM, a VSAM key-sequenced data set allocated on a migration level 1 volume and containing small data sets that have migrated.

SMF. System Management Facilities

SMP. System Modification Program.

SMP/E. System Modification Program Extended.

SMS. See Storage Management Subsystem.

SMS class. A list of attributes that SMS applies to data sets having similar allocation (data class), performance (storage class), or availability (management class) needs.

SMS-managed data set. A data set that has been assigned a storage class.

space manager. See storage administrator.

space management. In DFHSM, the process of managing aged data sets on DFHSM-managed and migration volumes. The three types of space management are: migration, deletion, and retirement.

spill backup volume. A volume owned by DFHSM to which all but the latest backup version of a data set are moved when more space is needed on a DASD daily backup volume or all valid versions are moved when a tape backup volume is recycled.

spill process. A DFHSM process that moves all but the latest backup version of a data set from a DASD daily backup volume to a spill backup volume.

SSI. See subsystem interface.

SSSA. Subsystem option block extension for SMS.

storage administrator. In DFHSM, the person or persons who are authorized through the DFHSM AUTH command to issue DFHSM system programmer and storage administrator commands, who can affect the authority of other DFHSM users, and who control the ways DFHSM manages DASD space.

storage class. A list of storage performance and availability service requests.

storage group. A list of real DASD volumes, or a list of serial numbers of volumes that no longer reside on a system but that end users continue to refer to in their JCL.

storage hierarchy. An arrangement in which data may be stored in several types of storage devices that have different characteristics such as capacity and speed of access.

Storage Management Subsystem (SMS). An operating environment that helps automate and centralize the management of storage. To manage storage, SMS provides the storage administrator with control over data class, storage class, management class, storage group, and ACS routine definitions.

suballocated file. A VSAM file that occupies a portion of an already defined data space. The data space may contain other files. Contrast with unique file.

subsystem interface (SSI). The means by which system routines request services of the master subsystem, a job entry subsystem, or other subsystems defined to the subsystem interface.

system-managed storage. An approach to storage management in which the system determines data placement and an automatic data manager handles data backup, movement, space, and security.

T

threshold of occupancy. A limit of occupied space on a volume managed by DFHSM.

time sharing option (TSO). An option on the operating system for a System/370 that provides interactive time sharing from remote terminals.

TIOT. Task input/output table.

trace. (1) A record of the execution of a computer program that exhibits the sequence in which the instructions were executed. (2) To record a series of events as they occur. (3) In MSS, a monitor in the mass storage control that records data about the system's activity, staging, and destaging. The data describes completed 3850 Mass Storage System functions from the activity schedule queues plus time stamps.

TSO. See time sharing option.

TSO/E. Time sharing option/extended.

TTOC. Tape table of contents record.

U

undirected recall. In DFHSM, moving a migrated data set from a level 1 or level 2 volume to a level 0 volume without specifying the target volume or unit where the volume can be allocated. Undirected recall can be automatic or by command.

unique file. A VSAM file that occupies a data space of its own. The data space is defined at the same time as the file and cannot contain any other file. Contrast with suballocated file.

unlike device. A DASD device with a different number of bytes per track and tracks per cylinder, or both.

V

virtual DASD. In DFHSM, this refers to the 3850 Mass Storage System (MSS).

virtual storage access method (VSAM). An access method for indexed or sequential processing of fixed and variable-length records on direct access devices. The records in a VSAM data set or file can be organized in logical sequence by a key field (key sequence), in the physical sequence in which they are written on the data set or file (entry-sequence), or by relative-record number.

virtual storage constraint relief (VSCR). A function that increases the amount of storage available for the user's application program.

volume. (1) (ISO) A certain portion of data, together with its data carrier, that can be handled conveniently as a unit. (2) (ISO) A data carrier that is mounted and demounted as a unit, for example, a reel of magnetic tape, a disk pack. (3) That portion of a single unit of storage that is accessible to a single read/write mechanism, for example, a drum, a disk pack, or part of a disk storage module. (4) A storage medium that is mounted and demounted as a unit; for example, magnetic tape or diskette.

volume pool. In DFHSM, a set of related primary volumes. When a data set is recalled, if the original volume that it was on is in a defined volume pool, the data set can be recalled to one of the volumes in the pool.

volume serial number. An identification number in a volume label that is assigned when a volume is prepared for use in the system.

volume table of contents (VTOC). (1) A table on a direct access volume that describes each data set on the volume. (2) An area on a disk or diskette that describes the location, size, and other characteristics of each file and library on the disk or diskette.

VSAM. See virtual storage access method.

VSAM master catalog. A key-sequenced data set or file with an index containing extensive data set and volume information that VSAM requires to locate data sets or files, to allocate and deallocate storage space, to verify the authorization of a program or operator to gain access to a data set or file, and to accumulate usage statistics for data sets or files.

VSAM sphere. A VSAM sphere contains the following eight components: base cluster, base data object, base index object, base path, alternate index, alternate index data object, alternate index index object, and alternate index path.

VSAM user catalog. An optional VSAM catalog used in the same way as the master catalog and pointed to by the master catalog. Use of user catalogs lessens the contention for the master catalog and facilitates volume portability.

VSCR. See virtual storage constraint relief.

VTOC. See volume table of contents.

VVDS. VSAM volume data set.

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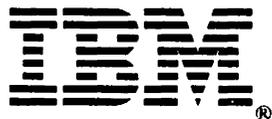
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