

**Chapter
2**

**ACCESS
METHOD
SERVICES**

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Objectives

You will learn:

- Definitions: cluster, KSDS, and ESDS.
- How data resides in the CI.
- DEFINE CLUSTER parameters.
- SHAREOPTIONS.
- Loading a KSDS.
- Dynamic allocation of files.
- Loading an ESDS.
- Loading an RRDS.
- REPRO parameter.
- REPRO as backup and restore facility
- RESTORE.
- KSDS: reorganization.
- Printing a VSAM dataset.
- System-managed data.
- AMS ALLOCATE: allocating datasets.
- ALLOCATED - Defining a temporary VSAM dataset.
- Extended Format Dataset - defining.

1 Cluster - Definition

The characteristics associating with defining a cluster include:

- Volume(s) on which the dataset will be allocated.
- Type of dataset: KSDS, ESDS, or an RRDS.
- Amount of space.
- For a KSDS, the length of the prime key and its offset.
- Record size and whether it is fixed or variable.
- Control interval size.
- For a KSDS, the amount of free space.
- The name being given to the cluster.

2 KSDS Definition

The prime key of a KSDS does not have to be the first field in the record.

```

//          EXEC PGM=IDCAMS
//SYSPRINT DD SYSOUT=*
//SYSIN    DD *
  DEFINE CLUSTER          -
    (NAME (SYSED . KSDS . CLUSTER) -
    VOLUMES (VSAM02)      -
    CYLINDERS (2 , 1)    -
    CONTROLINTERVALSIZE (4096) -
    FREESPACE (10 , 20)  -
    KEYS (9 , 0)         -
    RECORDSIZE (50 , 50) -
    DATA                -
      (NAME (SYSED . KSDS . DATA) -
    INDEX                -
      (NAME (SYSED . KSDS . INDEX) -
    CONTROLINTERVALSIZE (1024) )
/*
//
    
```

Matching parentheses and usage of the continuation character (-) need to be recognized and adhered to.

2.1 Common Abbreviations

CONTROLINTERVALSIZE	CISZ
CYLINDERS	CYL
RECORDS	REC
TRACKS	TRK
FREESPACE	FSPC
RECORDSIZE	RECSZ
SHAREOPTIONS	SHR
VOLUMES	VOL

2.2 Parameters

These parameters are used for allocating a KSDS:

- NAME is a positional parameter.
 - When the dataset is successfully allocated, the cluster name will be used as the dataset name when accessing this KSDS.
- VOLUMES parameter gives the name of the volume serial number.
- CYLINDERS parameter indicates that two cylinders of primary space will now be allocated.
 - Secondary allocations will be made in increments of one cylinder each.
- CONTROLINTERVALSIZE will be 4096 bytes.
- FREESPACE (10,20) specifies that simultaneous with the initial loading of records into this cluster, each control interval will have 10 percent of its space left free and that 20 percent of the control intervals in each control area will be left unused.
- KEYS parameter indicates that the prime key is 9 bytes long and starts in position 0 of the record.
- RECORDSIZE has two values.
 - The first specifies the average record length, and the second provides the maximum record length.
- NAME parameter under DATA gives a separate name to the data component of the cluster.
- NAME parameter under INDEX gives a separate name to the index component of the cluster.
- CONTROLINTERVALSIZE value of 1024 specifies the index component control interval size.

The recommended practice is to provide separate names to the data and index components of the cluster.

If the allocation of a KSDS is completed successfully by AMS, there will be a condition code of 0.

3 ESDS Definition

Since the ESDS does not have embedded free space, the FREESPACE parameter is not used.

The KEYS parameter has no meaning in ESDS; therefore it is not used either.

```
// EXEC PGM=IDCAMS
//SYSPRINT DD SYSOUT=*
//SYSIN DD *
    DEFINE CLUSTER                -
        (NAME (SYSED.ESDS.CLUSTER) -
        VOLUMES (VSAM02)          -
        CYLINDERS (2,1)           -
        CONTROLINTERVALSIZE (4096) -
        RECORDSIZE (50,50)        -
        NONINDEXED)
/*
//
```

Since an ESDS has only a data component, a parameter related to INDEX cannot be used.

- An additional parameter, NONINDEXED, is added to the command which instructs AMS that an ESDS is to be defined.

4 How Data Resides in the CI

Characteristics which describe a RRDS definition:

- No FREESPACE parameter is used in an RRDS.
- Since an RRDS does not have a key, the KEYS parameter might not be coded.
- There is no coding for the INDEX component because it has only a data component.
- Since an RRDS does not support variable-length records, the average and maximum record length values of the RECORDSIZE parameter must be the same.
- The keyword parameter NUMBERED must be used to have AMS defined an RRDS.

```
//      EXEC PGM=IDCAMS
//SYSPRINT DD SYSOUT=*
//SYSIN    DD *
  DEFINE CLUSTER                -
      (NAME (SYSED . RRDS . CLUSTER) -
      VOLUMES (VSAM02)          -
      CYLINDERS (200)           -
      CONTROLINTERVALSIZE (4096) -
      RECORDSIZE (50 , 50)      -
      NUMBERED)
/*
//
```

5 DEFINE CLUSTER Parameters

Name

The names of the cluster, data, and index components can each be up to 44 characters long. Names longer than 8 characters must be segmented with periods. There can be a maximum of 8 characters between periods.

Cylinders, Records, and Tracks

The space allocation parameter can be coded using any of the three options.

```
CYLINDERS(25,5)
TRACKS(3,2)
RECORDS(500,250)
```

It is advisable to use cylinders.

Volumes

Multiple values may be coded in the VOLUMES parameter.

Example:

```
VOLUMES(VSAM02, VSAM03, VSAM04).
```

Indexed, Nonindexed, and Numbered

These indicate whether a KSDS, an ESDS, or an RRDS is being defined.

CONTROLINTERVALSIZE

The CI is a VSAM I/O unit of work.

ERASE and NOERASE

Files containing sensitive information should be defined with the ERASE parameter so that, when such a file is deleted, its data component is physically erased. NOERASE is the default.

FREESPACE

FREESPACE(CI percent, CA percent)

This parameter is coded only for a KSDS.

The values of freespace are coded as percentages. The first value indicates what percentage of space within each CI should remain as free space at the time of the sequential loading of the dataset. The second value indicates what percentage of free CI's within a CA will be left totally unused at the same time.

KEYS

KEYS(key length, offset)

This parameter provides the length of the KSDS key and its offset from the beginning of the record. If this parameter is not coded, the default value is (64,0). The Key length can be from 1 to 255 bytes.

RECORDSIZE

RECORDSIZE(average, maximum)

This provides AMS with average and maximum record lengths for a dataset.

SPEED and RECOVERY

RECOVERY, which is the default, preformats a VSAM dataset at the time of an initial load or a resume load.

If SPEED is specified, the load will have to be restarted from the beginning. SPEED is highly recommended.

TO and FOR

TO(date) or FOR(days)

These mutually exclusive parameters specify the retention period for the cluster being defined.

The format of the TO parameter is yyddd. The format of the FOR parameter is the number of days.

The DELETE command of AMS cannot delete a dataset whose retention period has not expired unless forced with the PURGE option of the DELETE command.

SMS

For SMS-managed VSAM datasets data class can be specified. Management class and storage class parameters can be specified which will take advantage of the attributes specific to a mainframe installation.

6 SHAREOPTIONS

SHAREOPTIONS(cross region, cross system)

The cross region parameter is a feature of VSAM which permits access to a dataset from different programs running concurrently.

SHAREOPTION 1	Means that either one or multiple programs can read the dataset.
SHAREOPTION 2	Allows multiple programs to read a dataset simultaneously with an update.
SHAREOPTION 3	Allows multiple programs to read the dataset and perform an update simultaneously.
SHAREOPTION 4	Buffers are used for direct processing; there is a refresh with each I/O on the dataset.

The cross system parameter in SHAREOPTION, specifies the amount of sharing allowed among systems. Two or more jobs in multiple operating systems can gain access to the same VSAM dataset regardless as to the disposition specified in the DD statement.

The values that can be specified are:

SHAREOPTION 1	Is reserved.
SHAREOPTION 2	Is reserved.
SHAREOPTION 3	Specifies that the dataset can be fully shared. With this option, each programmer is responsible for maintaining both read and write integrity for the data the program accesses.
SHAREOPTION 4	Specifies that the dataset can be fully shared. Buffers used for direct processing are refreshed for each request.

7 Loading a KSDS

```
//          EXEC  PGM=IDCAMS
//SYSPRINT DD  SYSOUT=*
//SOURCE   DD  DSN=BACKUP.INPUT.DATA,
//          DISP=OLD
//TARGET   DD  DSN=SYSED.KSDS.CLUSTER
//          DISP=OLD
//SYSIN    DD   *
          REPRO          -
          INFILE (SOURCE) -
          OUTFILE (TARGET)
/*
```

The input file is in ascending collating sequence on the prime key. If this does not take place, the REPRO would generate an error message whenever it found an out-of-sequence record in the input dataset. After four such error messages, the load operation is aborted.

Since applications may not always have an input file in ascending order by the prime key, an external sort must be performed on the input file before executing REPRO.

```
//SORT          EXEC  PGM=SORT
//SORTLIB      DD  DSN=SYS1.SORTLIB.DISP=SHR
//SORTIN       DD  DSN=BACKUP.INPUT.DATA,
//             DISP=OLD
//SORTOUT      DD  DSN=&&TEMP,DISP=(NEW,PASS,DELETE),
//             DCB=(RECEM=FB,LRECL=80,BLKSIZE=8000),
//             SPACE=(TRK,(5,11),UNIT=SYSDA)
//SYSIN        DD  *
          SORT FIELDS=(1,9,CH,A)
/*
//*****
//***** REPRO FROM SORTED FILE *****
//*****
//LOADSDS      EXEC  PGM=IDCAMS
//SYSPRINT     DD  SYSOUT=*
//SOURCE       DD  DSN=&&TEMP,
//             DISP=OLD
//SYSIN        DD  *
          REPRO          -
          INFILE (SOURCE) -
          ODS (SYSED.KSDS.CLUSTER)
/*
```

8 Dynamic Allocation of Files

The INDATASET and OUTDATASET parameters are being used instead of the INFILE and OUTFILE parameter.

DD statements have not been coded for allocating the datasets. In this syntax format, AMS performs a dynamic allocation of the datasets.

In order to keep JCL simple, the dynamic allocation feature of AMS should be used wherever possible.

```
//          EXEC PGM=IDCAMS
//SYSPRINT DD SYSOUT=*
//SYSIN    DD *
          REPRO                               -
          INDATASET (BACKUP . INPUT . DATA) -
          OUTDATASET (SYSED . KSDS . CLUSTER)
/*
//
```

8.1 Loading an ESDS

Loading records into an ESDS is no different than loading records into a KSDS. Since an ESDS doesn't have a prime key, sorting of the input file is not required.

However, if the application requires that the records be loaded in sequence based on a particular field, the sorting should be implemented as a separate task.

8.2 Loading an RRDS

Loading an RRDS using REPRO is the same as loading a KSDS or an ESDS. Records will be loaded from the input file into the RRDS beginning with RRN 1.

8.3 REPRO Parameters - Other

REPLACE

The REPLACE option is used for merging records into a VSAM file. It is relevant only when the target dataset already has records and is either a KSDS or an RRDS.

All the records in the source file with keys that do not match the keys of the target dataset are added to the target dataset. All the records in the source file with keys that match keys of the target dataset replace those records in the target dataset.

If the REPLACE option is not coded, records from the source dataset that have matching key records in the target dataset will not be replaced and there will be duplicate record messages.

If the target dataset is a non empty RRDS, the source dataset must be an RRDS also. The reason for this restriction is that only a source RRDS has relative record numbers which identify where the source records should be placed in the target dataset.

REUSE

The REUSE option of REPRO will logically delete the records of a target KSDS, ESDS, or RRDS and add new records.

In order to use the REUSE option of REPRO, the target dataset must have been defined with the REUSE option in the DEFINE CLUSTER command.

SKIP and COUNT

SKIP skip the specific number of records and output the number of records in count.

```
//REPRO      EXEC  PGM=IDCAMS
//SYSPRINT   DD  SYSOUT=*
//SYSIN      DD  *
              REPRO              -
              INDATASET (BACKUP . INPUT . DATA)      -
              OUTDATASET (SYSED . KSDS . CLUSTER)     -
              SKIP (2)
/*
//
```

FROMKEY and TOKEY

Copy records beginning with a particular key value and ending with another key value.

```
// REPRO EXEC PGM=IDCAMS
// SYSPRINT DD SYSOUT=*
// OUTPS DD DSN=SAMPLE.SOME.RECORDS.DATA,
//          DISP=NEW,UNIT=SYSDA,VOL=SER=VSAM02,
//          DCB=(RECFM=FB,LRECL=80,BLKSIZE=0)
//          SPACE=(TRK,(5,11))
// SYSIN DD *
//          REPRO -
//          INDATASET(SYSED.KSDS.CLUSTER) -
//          OUTFILE(OUTPS) -
//          FROMKEY(333333333) -
//          TOKEY(777777777)
/*
//
```

9 REPRO as Backup and Restore Facility

```
//BACKUP      EXEC  PGM=IDCAMS
//SYSPRINT    DD  SYSOUT=*
//TARGET      DD  DSN=SAMPLE.BACKUP.FILE(+1) ,
//              DISP=(NEW,CATLG,DELETE) ,UNIT=TAPE ,
//              LABEL=(1,SL) ,
//              DCB=(MOD.DSCB,RECFM=FB,LRECL=50,BLKSIZE=0)
//SYSIN       DD  *
              REPRO                                -
              INDATASET(EMPLOYEE.KSDS.CLUSTER)    -
              OUTFILE(TARGET)
/*
//
```

9.1 RESTORE

Restoring the VSAM file from its backup is typically a three-step procedure:

1. Delete the VSAM file with the DELETE command.
2. Reallocate the file with the DEFINE CLUSTER command.
3. Load records from the backup file into the VSAM file using the REPRO command.

```
//RESTORE EXEC PGM=IDCAMS
//SYSPRINT DD SYSOUT=*
//SOURCE DD DSN=SAMPLE.BACKUP.FILE(0),
// DISP=OLD,UNIT=TAPE,LABEL=(1,SL)
//SYSIN DD *
/*****/
/**** FOLLOWING COMMAND DELETES VSAM DATASET ****/
/****/
DELETE SYSED.KSDS.CLUSTER
/****/
/**** FOLLOWING COMMAND ALLOCATES VSAM DATASET **/
/****/
DEFINE CLUSTER -
      (NAME (SYSED.KSDS.CLUSTER) -
      VOLUMES (VSAM02) -
      CYLINDERS (2,1) -
      KEYS (9,0) -
      RECORDSIZE (50,50) -
      CONTROLINTERVALSIZE (4096) -
      DATA (NAME (SYSED.KSDS.DATA) -
      INDEX (NAME (SYSED.KSDS.INDEX) -
      CATALOG (VSAM.CATALOG.TWO)
/****/
/**** FOLLOWING COMMAND RESTORES VSAM DATASET ****/
/****/
REPRO -
      INFILE (SOURCE) -
      OUTDATASET (SYSED.KSDS.CLUSTER)
/*
//
```

10 KSDS: Reorganization

Reorganization is a four step procedure:

1. Make a backup of the KSDS into a physical sequential dataset using the REPRO command.
2. Delete the KSDS with the DELETE command.
3. Define the KSDS using the DEFINE CLUSTER command.
4. Reload the KSDS from the backup file using the REPRO command.

11 Printing a VSAM Dataset

```
//KSDSPRNT EXEC PGM=IDCAMS
//SYSPRINT DD SYSOUT=*
//SYSIN DD *
PRINT -
    INDATASET (SYSED . KSDS . CLUSTER) -
    DUMP
/*
//
```

KSDS prints in character format.

```
PRINT -
    INDATASET (SYSED . KSDS . CLUSTER) -
    CHAR
```

11.1 Selective Printing

SKIP can be used to skip a specific number of records before starting the printing. The default is to skip no records. COUNT can be used to print a specific number of records.

Both of these parameters can be used for KSDS's, ESDS's, RRDS's, and non-VSAM datasets. The FROMKEY and TOKEY parameters can be used to print records of a KSDS beginning with a particular key field and ending with another.

FROMADDRESS and TONUMBER can be used to print records of an RRDS between two relative record numbers.

```
PRINT -
    INDATASET (SAMPLE . INPUT . DATA) -
    SKIP (3) COUNT (4) -
    CHAR
```

```
PRINT -
    INDATASET (SYSED . KSDS . CLUSTER) -
    FROMKEY (4444444444) -
    COUNT (3) -
    CHAR
```

```
PRINT -
    INDATASET (SYSED . RRDS . CLUSTER) -
    FROMNUMBER (5) -
    TONUMBER (8) -
    CHAR
```

12 System- managed Data

SMS: Storage Management Subsystem automates the management of storage.

SMS uses the values provided at allocation time to optimize the placement of data, simplify backup/recover, volume placement, default attributes, and perform archiving.

Programmers can allocate datasets more easily using the facilities of SMS.

SMS can be used for specifying dataset requirements by:

data class	storage class	management class
------------	---------------	------------------

If the user does not specify these classes, the system uses ACS: Automatic Class Selection routines to determine classes. The ACS is determined by the system administrator.

Data class	A named list of dataset allocation and space attributes that SMS assigns to a dataset. Data class can be used with non-system-managed dataset.
Storage class	A named list of dataset service or performance objectives. This class is used to control the placement of objects in an object storage hierarchy.
Management class	A named list of management attributes controlling action for retention, migration, backup, and release of allocated but unused space in datasets.

13 AMS ALLOCATE: Allocating Datasets

There are two ways to cause a new dataset to be system-managed:

- Specify the SMS parameter STORCLAS explicitly. MGMTCLAS and DATACLAS can also be specified.
- Have ACS routines assign the SMS classes to the dataset.

In order to allocate non-system-managed datasets, the DATACLAS parameter can be specified. Do not specify the MGMTCLAS and STORCLAS parameters.

The ALLOCATE command is used to allocate a new VSAM dataset. Data class is not assigned, and attributes assigned through the default data class will be overridden by explicitly specified parameters:

```
//SYSSED      JOB      ...
//STEP1      EXEC    PGM=IDCAMS , DYNAMNBR=1
//SYSPRINT   DD      SYSOUT=*
//SYSIN      DD      *
      ALLOC                                -
          DSNAME (MY . EMPLOYEE . QTR)    -
          NEW CATALOG                      -
          SPACE (20 , 2)                   -
          AVBLOCK (100)                   -
          AVGREC (K)                       -
          LRECL (80)                      -
          RECORG (ES)                     -
          STORCLAS (FAST)                 -
          MGMTCLAS (VSAM)
/*
```

13.1 ALLOCATED - Defining a Temporary VSAM Dataset

```
//ALLOC    JOB    ...  
//STEP1    EXEC  PGM=IDCAMS  
//SYSPRINT DD   SYSOUT=*  
//SYSIN    DD    *  
           ALLOC          -  
             DSNAME (&CLUSTER) -  
             NEW PASS          -  
             REORG (ES)        -  
             SPACE (1,10)      -  
             AVGREC (M)        -  
             LRECL (256)       -  
             STORCLAS (TEMP)  
  
/*
```

14 Extended Format Dataset - Defining

An extended format dataset for VSAM can be allocated for a:

KSDS	ESDS	RRDS	VRRDS	LDS
------	------	------	-------	-----

There are some datasets that cannot be extended including:

- Catalogs
- Other system datasets
- Temporary datasets

When a dataset is allocated as an extended format dataset, the data and index are extended format.

Any alternate indexes related to an extended format cluster also are extended format.