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Getting Started with SMS

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Session B03
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What is system managed storage?

- Lets the operating system take over storage management tasks
  - Data set allocation
  - Backup management
  - Space management
  - Availability management
- Reduces number of people needed to manage storage

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What is SMS?

- SMS in an MVS subsystem
  - Manages the current storage management policy (active configuration)
  - Reduces end user data set creation & allocation complexity
  - Increases installation control of DASD, tape, and optical storage
- There is one SMS and one SMS address space per instance of MVS (z/OS)
- SMS runs in both the user's and the SMS address space

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SMS Design Considerations

- Clearly separate the domains of users, data and storage media
- Introduce the roll of storage administrator
- Preserve customer investment in JCL and other structures

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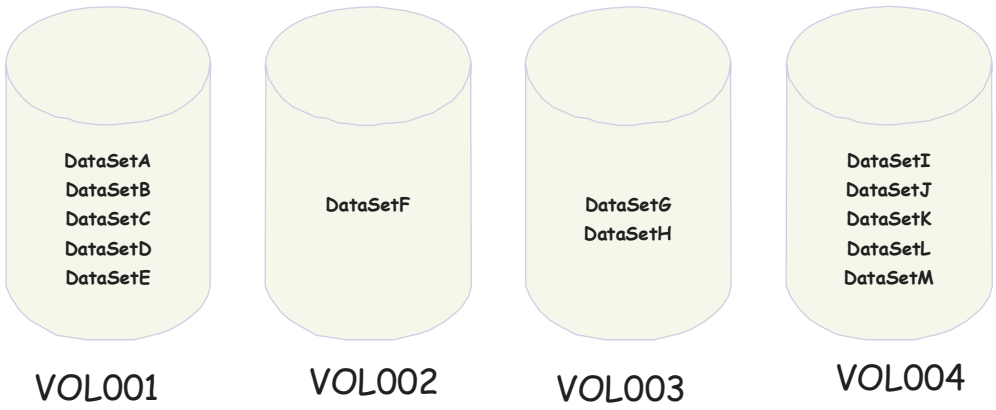
Unmanaged Environment

//DD1 DD DSN=DATASETN,DISP=NEW,VOL=SER=VOL001...



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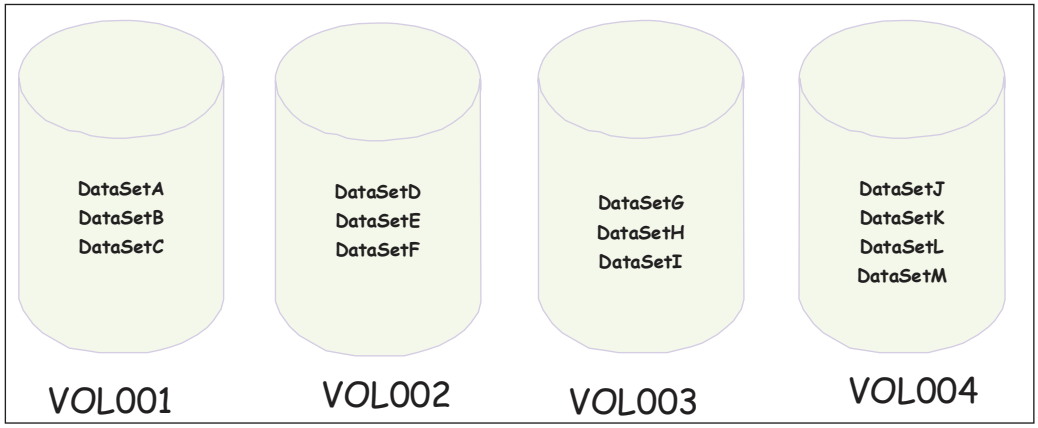
Managed Environment

//DD1 DD DSN=DATASETN,DISP=NEW,VOL=SER=VOL001...



Storage Group STORGRP1

Why should I use it?

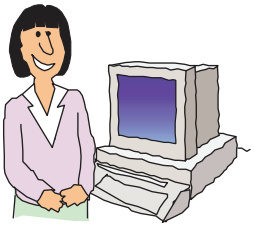
- Reduce out of space abends (X37)
- Reduce device fragmentation
- Balance allocations across a pool of devices
- Improve storage utilization
- Help achieve device independence

SMS User Interactions

System Operator

Storage Administrator

System Programmer



Application Programmer

End User

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Some basic terms

- SMS complex
- System/system group name
- Base configuration information
- Storage group
- Storage class
- Management class
- Data class
- ACS routine

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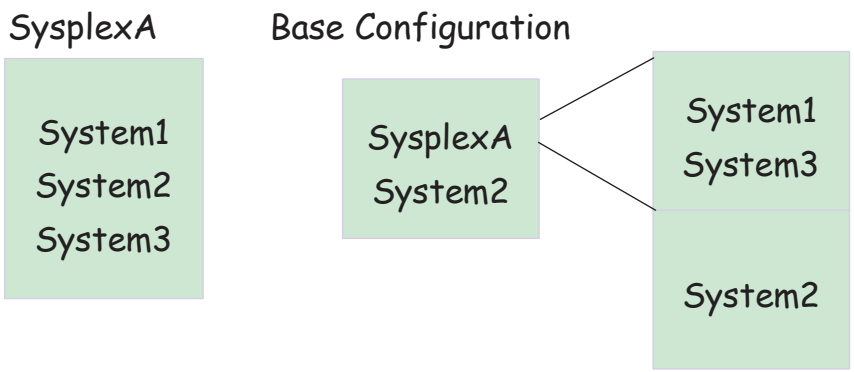
System Group



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What *is* an SMS Configuration?

- A configuration is a storage management policy
- It contains elements which define that policy:
  - Base configuration information
  - Storage groups & volumes
  - Storage classes
  - Management classes
  - Data Classes
  - Automatic Class Selection (ACS) routines
  - Optical and tape libraries and drives
  - Aggregate groups

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What is a Minimal Configuration?

- Base configuration information
- One or more storage classes
- One or more storage groups with at least one volume
- A storage group ACS routine

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What is the Base Configuration Information?

- System & system group names
- Default management class
- Default unit
- Default device geometry

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What is a Storage Group?

- Physical storage managed by SMS
  - Collection of DASD volumes
  - Volumes in tape libraries
  - Volumes in optical libraries
  - Virtual I/O storage
- Can be enabled, quiesced, quiesced new, disabled or disabled new
- Can be set to auto migrate, auto backup and/or auto dump

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What is a Storage Class?

- Performance attributes
  - Direct & sequential millisecond response
  - Direct & sequential bias
  - Initial access response time
- Availability
- Accessibility
- Guaranteed space
- Guaranteed synchronous write

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What is a Management Class?

- Space management attributes
  - Expiration & retention attributes
  - Migration attributes
  - GDG management attributes
- Backup attributes
  - Backup frequency
  - Backup versions
  - Backup retention
- Class transition attributes
- Aggregate backup attributes

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What is a Data Class?

- RECORG or RECFM
- LRECL
- Space
- DSNTYPE
- Volume count
- VSAM attributes
- RETPD or EXPDT
- Compaction

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What is an ACS Routine?

- Used to determine SMS classes and storage groups
- Used for both data sets and objects
- Can override specifications of SMS classes and groups on:
  - JCL DD statements
  - Dynamic allocation requests
  - DFSMSdss COPY, RESTORE & CONVERTV
  - DFSMShsm RECALL & RECOVER
  - IDCAMS DEFINE, ALTER & IMPORT
  - OAM STORE, CHANGE & class transition

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What Happens to an Allocation If I Create an SMS Configuration?

```
//DD1 DD DSN=DATASETN,DISP=NEW,UNIT=3380,
//          SPACE=(TRK,(5,5)),BLKSIZE=(0)....
```

Becomes roughly equivalent to:

```
//DD1 DD DSN=DATASETN,DISP=NEW,
//          SPACE=(80,(2,2)),AVGREC=K,BLKSIZE=(0)....
```

Eliminates the need to specify a UNIT parameter

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Starting SMS w/a configuration

1. Define an ACDS, SCDS, & a COMMDS
2. Modify SYS1.PARMLIB members
3. Establish ISMF storage administrator options
4. Define base configuration information
5. Define SMS classes & groups
6. Optionally, define optical & tape libraries
7. Define & test ACS routines
8. Validate the configuration
9. Activate the configuration

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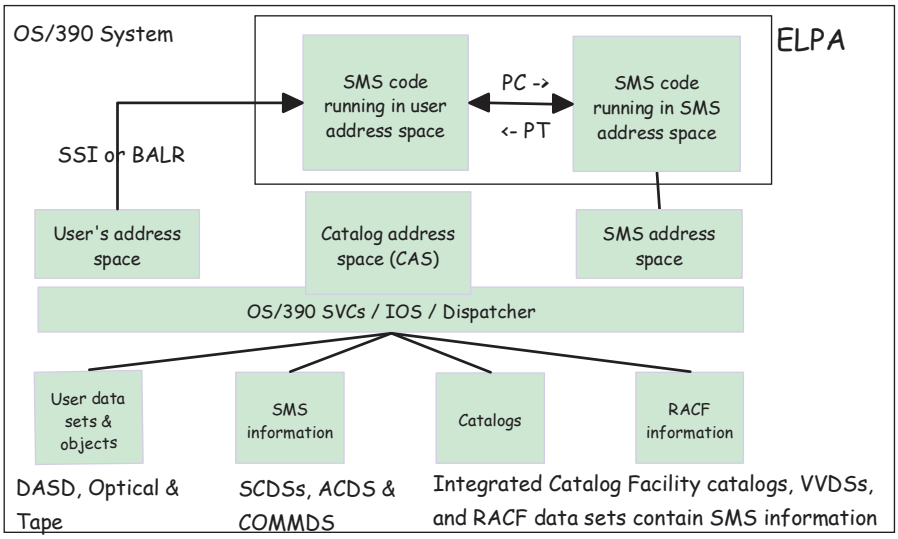
System Overview



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Defining the control data sets

```
//STEP  EXEC PGM=IDCAMS
//SYSUDUMP DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSIN    DD *
  DEFINE CLUSTER(NAME(SMS.SCDS1.SCDS) LINEAR -
     VOL(SMSV01) TRK(6 6) SHAREOPTIONS(2,3)) -
     DATA(NAME(SMS.SCDS1.SCDS.DATA))
  DEFINE CLUSTER(NAME(SMS.ACDS1.ACDS) LINEAR VOL(SMSV02) -
     TRK(6 6) SHAREOPTIONS(3,3)) -
     DATA(NAME(SMS.ACDS1.ACDS.DATA))
  DEFINE CLUSTER(NAME(SMS.COMMDS1.COMMDS) LINEAR -
      VOL(SMSVOL) TRK(1 1) SHAREOPTIONS(3,3)) -
      DATA(NAME(SMS.COMMDS1.COMMDS.DATA))
/*
```

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SYS1.PARMLIB: IGDSMSxx

```
SMS ACDS(dsname) COMMDS(dsname)
   [ACSDEFAULTS({YES|NO})]
   [AKP(nnn[,nnn[,nnn...] ])]
   [ASID({asid|*})]
   [BMFTIME({nnn|3600})]
   [CACHETIME({nnn|3600})]
   [CF_TIME({nnn|3600})]
   [COMPRESS({TAILORED|GENERIC})]
   [DB2SSID(ssid)]
   [DEADLOCK_DETECTION({iiii|15,kkkk|4})]
   [DESELECT({event[,event][,...]|ALL})]
   [DINTERVAL({nnn|150})]
   [DSNTYPE({LIBRARY|PDS})]
```


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SYS1.PARMLIB: IGDSMSxx

```
   [DSSTIMEOUT({nnn|0}]
   [GDSRECLAIM({YES|NO}]
   [HSP_SIZE(nnn)]
   [INTERVAL({nnn|15})]
   [JOBNAME({jobname|*})]
   [LOG_OF_LOGS(logstreamname)]
   [LRUCYCLES({nnn|240})]
   [LRUTIME([nnn|15})]
   [MAXLOCKS({max|0,incr|0})]
   [OAMPROC(procname)]
   [OAMTASK(taskid)]
   [OVRD_EXPDT({YES|NO})]
```

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SYS1.PARMLIB: IGDSMSxx

```
[PDSESHARING({NORMAL|EXTENDED})]
[PDSE_MONITOR({YES|NO,interval,duration})]
[QTIMEOUT({nnn|300}]
[REVERIFY({YES|NO})]
[RLSINIT({NO|YES})]
[RLSMAXCFFeatureLevel({A|Z})
[RLSDYNAMICCFCACHEREASSIGN({YES|NO}]
[RLS_MAX_POOL_SIZE({nnnn|100})]
[RLSTMOUT({nnn|0})
[SELECT({event[,event][...]|ALL})]
[SIZE(nnn{K|M})]
```


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SYS1.PARMLIB: IGDSMSxx

```
[SMF_TIME({YES|NO})]
[SYSNAME(sysname1[,sysname2[....,sysname32] ])]
[SYSTEMS({32|8})]
[TRACE({OFF|ON})]
[TRACEEXIT(user_trace_exit)]
[TVSNAME(tvsname1[,tvsname2[....,tvsname32] ])]
[TV_START_TYPE({WARM|COLD[,WARM|COLD...]})]
[TYPE({ALL|ERROR})]
[USE_RESOWNER({YES|NO})]
```

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SYS1.PARMLIB: IEFSSNyy

```
SUBSYS SUBNAME(SMS)
          [INITRN(IGDSSIIN)]
          [INITPARM('ID=xx,PROMPT=NO|YES|DISPLAY')]

OR:

SMS[,IGDSSIIN[,options] ]
      Valid options:
      [ID={xx|00}]
      [PROMPT=NO|YES|DISPLAY]
```


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SYS1.PARMLIB: IEASYSzz

```
....
SCH=(65,01),
SMF=65,
SMS=xx,
SQA=(6,8),
SSN=(00,Y7,05,TC,L),
SVC=AA,
SYSNAME=SYSTEM1,
VAL=53,
VIODSN=SYS1.STGINDEX,
VRREGN=260,
PAGE=(SYS1.PAGE1,SYS1.PAGE2,SYS1.PAGE3,L)
```

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Setting Storage Administrator Options

- Under ISPF, enter ISMF
- Select option 0 (ISMF Profile)
- Select option 0 (User Mode Selection)
- Set user mode to 2 (Storage Administrator)
- Type PF3 three times to exit ISMF

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Defining the Base Configuration

- Under ISPF, enter ISMF
- Select option 8 (Control Data Set)
- Select option 2 (Define)
- Enter description, default unit, default management class & default device geometry
- Hit F8 to scroll down & enter system and system group names
- Hit F3 to save & exit

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CDS Application Selection

```
                          CDS APPLICATION SELECTION
Command ===>

To Perform Control Data Set Operations, Specify:
  CDS Name . . 'F051878.TEST.SCDS'
                             (1 to 44 Character Data Set Name or 'Active')

Select one of the following Options:

     1. Display       - Display the Base Configuration
     2. Define        - Define the Base Configuration
     3. Alter         - Alter the Base Configuration
     4. Validate      - Validate the SCDS
     5. Activate      - Activate the CDS
     6. Cache Display - Display CF Cache Structure Names for all CF Cache Sets
     7. Cache Update  - Define/Alter/Delete CF Cache Sets

If CACHE Display is chosen, Enter CF Cache Set Name . . *
                              (1 to 8 character CF cache set name or * for all)

Use ENTER to Perform Selection;
Use HELP Command for Help; Use END Command to Exit.
```


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Defining the Base

```
                          SCDS BASE DEFINE                Page 1 of 2
Command ===>

SCDS Name . : F051878.TEST.SCDS
SCDS Status : INVALID

To DEFINE SCDS Base, Specify:

 Description ===>
             ===>

 Default Management Class  . .          (1 to 8 characters)
 Default Unit  . . . . . . . .          (esoteric or generic device name)
 Default Device Geometry
   Bytes/Track . . . . . . . . 47476    (1-999999)
   Tracks/Cylinder . . . . . . 15       (1-999999)



Use ENTER to Perform Verification; Use DOWN Command to View next Panel;
Use HELP Command for Help; Use END Command to Save and Exit; CANCEL To Exit.
```

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Defining the Base

```
                              SCDS BASE DEFINE         ADD SYSTEM OR SYS GROUP
Command ===>

SCDS Name . : F051878.TEST.SCDS
SCDS Status : INVALID

Specify one of the following options . . 1         (1 Add, 2 Delete, 3 Rename)

  Specify System Name . . . . . SYSTEM1   or Sys Group Name . .

  New System/Sys Group Name . .           (For option 3, Rename)

System:


Sysgrp:


Use ENTER to Perform Option; Use UP Command to View previous Panel;
Use HELP Command for Help; Use END Command to Save and Exit; CANCEL To Exit.
```


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Defining SMS Classes & Groups

```
                    ISMF PRIMARY OPTION MENU - z/OS DFSMS V1 R5
Enter Selection or Command ===>

Select one of the following options and press Enter:

0  ISMF Profile              - Specify ISMF User Profile
1  Data Set                  - Perform Functions Against Data Sets
2  Volume                    - Perform Functions Against Volumes
3  Management Class          - Specify Data Set Backup and Migration Criteria
4  Data Class                - Specify Data Set Allocation Parameters
5  Storage Class             - Specify Data Set Performance and Availability
6  Storage Group             - Specify Volume Names and Free Space Thresholds
7  Automatic Class Selection - Specify ACS Routines and Test Criteria
8  Control Data Set          - Specify System Names and Default Criteria
9  Aggregate Group           - Specify Data Set Recovery Parameters
10 Library Management        - Specify Library and Drive Configurations
11 Enhanced ACS Management   - Perform Enhanced Test/Configuration Management
C  Data Collection           - Process Data Collection Function
L  List                      - Perform Functions Against Saved ISMF Lists
P  Copy Pool                 - Specify Pool Storage Groups for Copies
R  Removable Media Manager   - Perform Functions Against Removable Media
X  Exit                      - Terminate ISMF

Use HELP Command for Help; Use END Command or X to Exit.
```

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Defining ACS Routines

```
                          ACS APPLICATION SELECTION
Command ===>

Select one of the following options:
   1. Edit            - Edit ACS Routine source code
   2. Translate       - Translate ACS Routines to ACS Object Form
   3. Validate        - Validate ACS Routines Against Storage Constructs
   4. Test            - Define/Alter Test Cases and Test ACS Routines
   5. Display         - Display ACS Object Information
   6. Delete          - Delete an ACS Object from a Source Control Data Set


If Display Option is Chosen, Specify:

  CDS Name  . . 'F051878.TEST.SCDS'
                              (1 to 44 Character Data Set Name or 'Active')


Use ENTER to Perform Selection;
Use HELP Command for Help; Use END Command to Exit.
```


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Defining ACS Routines

```
PROC 0 STORCLAS
/*********************************************************************/
/*     ONLY PROCESS VALID DASD UNITS                                 */
/*********************************************************************/
FILTLIST VALID_UNITS INCLUDE('3380','3350','3330-1','3330','3390',
                  '3590-1','9345','SYSDA','SYSSQ','SYSALLDA','VIO', '')

IF &UNIT ª= &VALID_UNITS THEN DO
    SET &STORCLAS = ''
    EXIT
    END
/*********************************************************************/
/*     TAKE CARE OF ATL REQUEST                                      */
/*********************************************************************/
FILTLIST ATL_VOLS INCLUDE(1B*, 1M*, 1D*, 1S*)

IF &UNIT = '3590-1' THEN DO
    SET &STORCLAS = ''
    IF &ALLVOL = &ATL_VOLS THEN SET &STORCLAS = 'NORMAL'
    IF &JOB = 'HSM' AND &HLQ = 'HSM' THEN SET &STORCLAS = 'NORMAL'
    EXIT
    END
```

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Defining ACS Routines

```
/*********************************************************************/
/*     ALLOW SMS INITIALIZATION JOB TO RUN OUTSIDE OF SMS            */
/*********************************************************************/
IF &JOB = DASDSYS% AND (&GROUP = '#FFCA' OR &GROUP = 'SPECIAL') THEN DO
    SET &STORCLAS = ''
    EXIT
    END
/*********************************************************************/
/*     FAIL USER ALLOCATION ON SYSTEM VOLUME                         */
/*********************************************************************/
FILTLIST SYS_VOLS INCLUDE(RES*, LV1*, D94*, TMP*, IPCS*, MVSPP%)
FILTLIST SYS_GROUPS INCLUDE('D94', '#FFCA', 'SPECIAL', 'SYSSTC')

IF &ANYVOL = &SYS_VOLS AND &GROUP ^= &SYS_GROUPS
      AND &ACSENVIR ª= 'RECALL' THEN DO
    WRITE 'UNAUTHORIZED ALLOCATION TO SYSTEM VOLUME'
    SET &STORCLAS = ''
    EXIT CODE(4)
    END
```


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Defining ACS Routines

```
/*********************************************************************/
/*     FAIL USER ALLOCATION TO VOLUME NOGOOD - USUALLY FROM DB2      */
/*********************************************************************/
IF &ANYVOL = 'NOGOOD' THEN DO
    WRITE 'INVALID VOLUME SERIAL - NOGOOD'
    SET &STORCLAS = ''
    EXIT CODE(4)
    END
/*********************************************************************/
/*     ALLOW ALLOCATION TO PRIVATE VOLUMES                           */
/*********************************************************************/
FILTLIST STOR_VOLS INCLUDE(SYS1*, SYS2*, SYS3*, SYS4*, SCR*, '*', '')
/* NOTE: FOR HSM RECALL AND RECOVER THE VOLID PASSED TO ACS IS THE
   VOLUME ON WHICH THE DATA SET RESIDED AT TIME OF MIGRATION/BACKUP.  */
IF &ANYVOL ª= &STOR_VOLS AND &ACSENVIR ª= 'RECALL'
    AND &ACSENVIR ª= 'CONVERT' THEN DO
    SET &STORCLAS = ''
    EXIT
    END
```

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Defining ACS Routines

```
/*********************************************************************/
/*     ALLOW NON-SMS RECALL TO SHRXXX VOLUMES                        */
/*********************************************************************/
IF &ACSENVIR = 'RECALL' AND &ANYVOL = SHR* THEN DO
    SET &STORCLAS = ''
    EXIT
    END
/*********************************************************************/
/*     SYS1 DATA SETS ARE ALWAYS GUARANTEED SPACE                    */
/*********************************************************************/
IF &HLQ = 'SYS1' THEN DO
    SET &STORCLAS = 'NORMALG'
    EXIT
    END
/*********************************************************************/
/*     SET SYSTEM STORAGE CLASS                                      */
/*********************************************************************/
FILTLIST NORMAL_ACSENVIR INCLUDE('RECALL', 'RECOVER', 'CONVERT')
IF &ALLVOL = '' OR &ALLVOL = '*' OR &ACSENVIR = &NORMAL_ACSENVIR
    THEN SET &STORCLAS = 'NORMAL'
ELSE SET &STORCLAS = 'NORMALG'

END
```


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Translating ACS Routines

```
ACS TRANSLATOR ***** TIME 17:47:07 DATE 07/19/2001 PAGE 0001 *****

SCDS NAME:              F051878.TEST.SCDS
ACS SOURCE DATA SET:    F051878.ACS.ROUTINES
ACS SOURCE MEMBER:      SC

0001      PROC STORCLAS
0002      FILTLIST MYDSN INCLUDE(F051878.**) EXCLUDE(F051878.JCL.**)
0003      IF &DSN = &MYDSN THEN
0004        SET &STORCLAS = 'SC1'
0005      ELSE
0006        SET &STORCLAS = ''
0007      END

TRANSLATION RETURN CODE:  0000

SIZE OF OBJECT TABLE: 0000000344
```

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Translating ACS Routines

```
ACS TRANSLATOR ***** TIME 17:50:17 DATE 07/19/2001 PAGE 0001 *****


SCDS NAME:               F051878.TEST.SCDS
ACS SOURCE DATA SET:     F051878.ACS.ROUTINES
ACS SOURCE MEMBER:       SC1


0001      PROC STORCLAS
0002      FILTLIST MYDSN INCLUDE(F051878.**) EXCLUDE(F051878.JCL.**)
0003      IF &DSN = &MYDSN THEN
0004        SET &STORCLAS = 'SC2'
0005      ELSE
0006        SET &STORCLAS = ''
0007      EXIT

*******   IGD03212I MISSING END KEYWORD FOR THE ACS ROUTINE
```

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Testing ACS Routines

```
                        ACS APPLICATION SELECTION
Command ===>

Select one of the following options:
   1. Edit             - Edit ACS Routine source code
   2. Translate        - Translate ACS Routines to ACS Object Form
   3. Validate         - Validate ACS Routines Against Storage Constructs
   4. Test             - Define/Alter Test Cases and Test ACS Routines
   5. Display          - Display ACS Object Information
   6. Delete           - Delete an ACS Object from a Source Control Data Set


If Display Option is Chosen, Specify:

  CDS Name  . . 'F051878.TEST.SCDS'
                              (1 to 44 Character Data Set Name or 'Active')


Use ENTER to Perform Selection;
Use HELP Command for Help; Use END Command to Exit.
```

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Testing ACS Routines

```
                                ACS TEST SELECTION
Command ===>

Select one of the following Options:

     1. DEFINE      - Define an ACS Test Case
     2. ALTER       - Alter an ACS Test Case
     3. TEST        - Test ACS Routines


If DEFINE or ALTER Option is Chosen, Specify:

  ACS Test Library . . ACS.ROUTINES
  ACS Test Member  . . TC1




Use ENTER to Perform Selection;
Use HELP Command for Help; Use END Command to Exit.
```


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Testing ACS Routines

```
                          ACS TEST CASE DEFINE                Page 1 of 4
Command ===>

ACS Test Library  : F051878.ACS.ROUTINES
ACS Test Member . : TC1

To DEFINE ACS Test Case, Specify:
  Description ==>
  Expected Result
  DSN (DSN/Collection Name) . .
  MEMN (Object Name)  . . . . .
  Sysname . . .           Xmode . . . .            Def_dataclas  . .
  Sysplex . . .           ACSenvir  . .            Def_mgmtclas  . .
  DD  . . . . .           Dataclas  . .            Def_storclas  . .
  Dsorg . . . .           Mgmtclas  . .            Dsntype . . . . .
  Recorg  . . .           Storclas  . .              If Ext  . . . .
  Dstype  . . .           Storgrp . . .
  Dsowner . . .           Size  . . . .
  Expdt . . . .           Maxsize . . .
  Retpd . . . .           Blksize . . .
Use ENTER to Perform Verification; Use DOWN Command to View next Panel;
Use HELP Command for Help; Use END Command to Save and Exit; CANCEL to Exit.
```

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Validating the Configuration

- From Automatic Class Selection (option 7)
  - Select option 3 (Validate)
  - Enter the SCDS name, an * for ACS routine type, and the name of the output listing data set
  - Press Enter
- From Control Data Set (option 8)
  - Select option 4 (Validate)
  - Enter the SCDS name, an * for ACS routine type, and the name of the output listing data set
  - Press Enter

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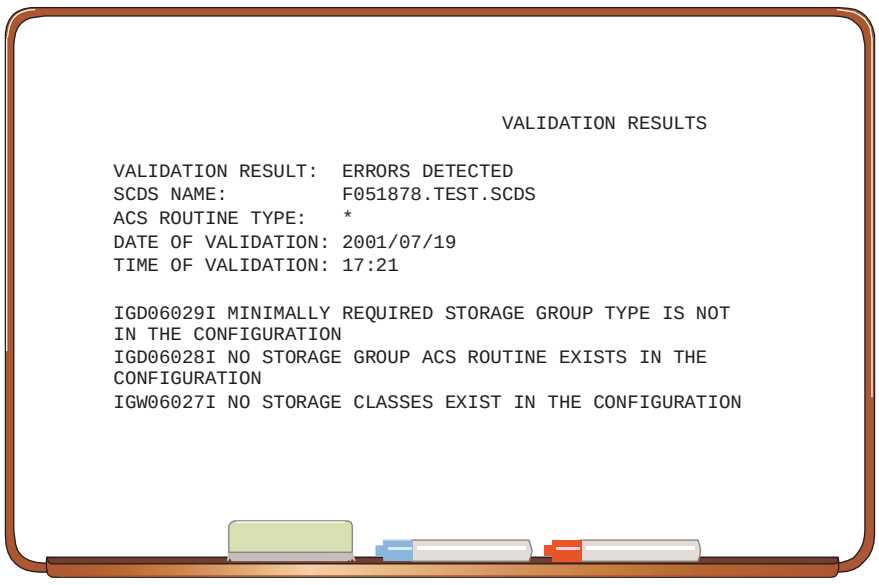
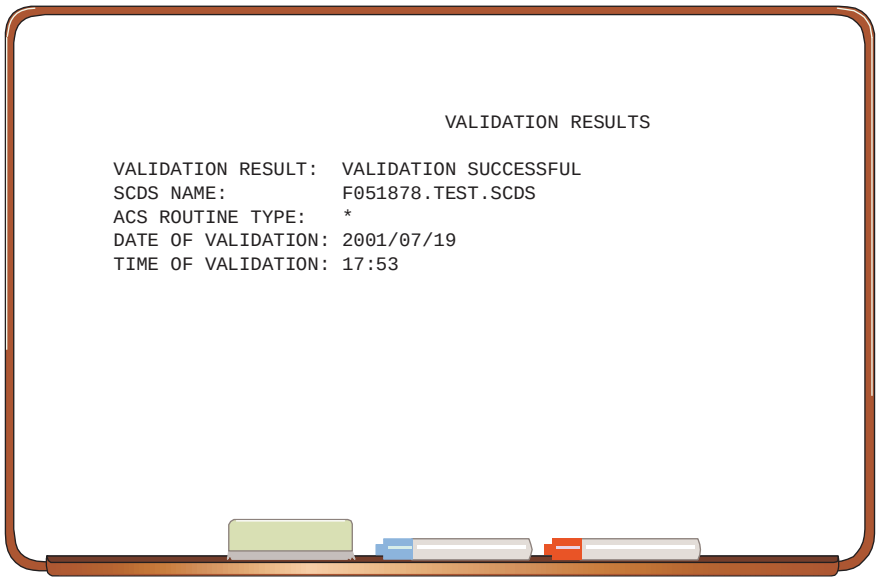
Unsuccessful Validation



Successful Validation



Activating the Configuration

- SETSMS SCDS(scdsname) ACDS(acdsname) operator command
- ISMF option 8 (Control Data Set Application) then select option 5 (Activate)
- Type ACTIVATE on the ISMF command line

In Summary

- SMS:
  - selects constructs for data sets
  - selects volumes for new allocations, recalls, recovers, copies & restores
  - stores information that is used to automate space management, back up management & availability management at the data set level
  - makes features such as striping & VSAM record level sharing (RLS) available for use