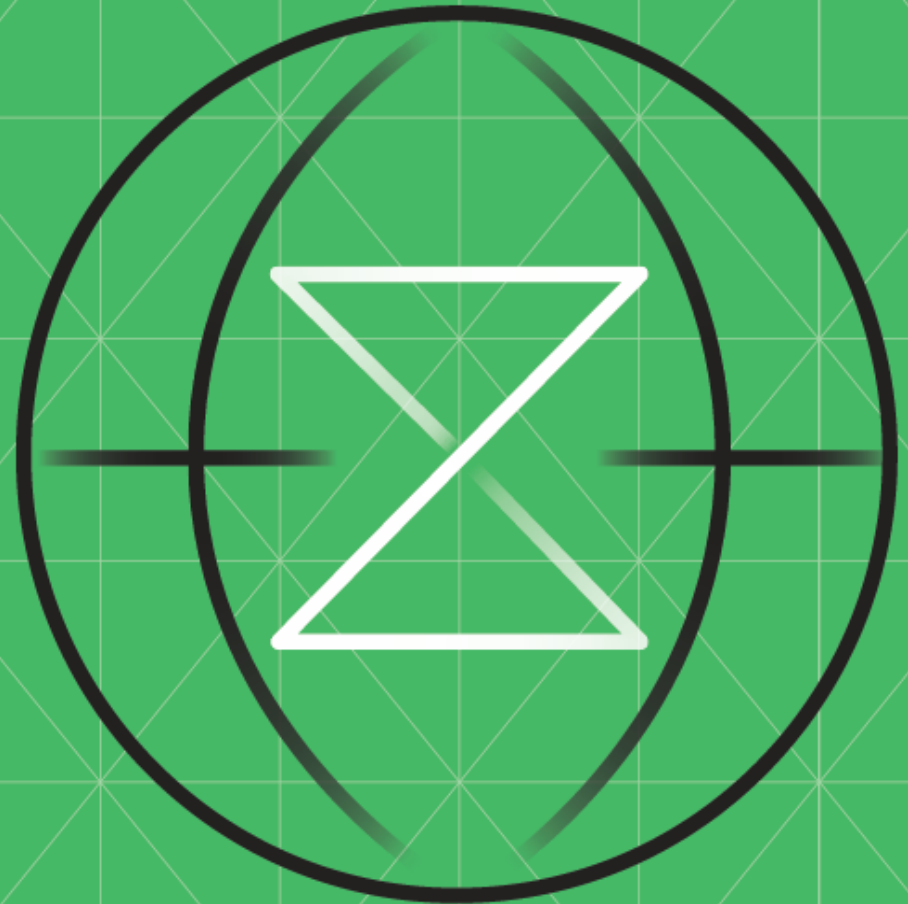


# DFSMS1

## z/OS Storage Management System

- [STORAGE MANAGEMENT ON Z/OS](#)
- [1 STORAGE TERMINOLOGY](#)
- [2 INTRODUCTION TO DFSMS](#)
- [3 INTRODUCTION TO ISMF PANEL](#)
- [4 GET HANDS-ON](#)
- [5 VOLUME](#)
- [6 WHAT'S INSIDE THE ACS ROUTINE?](#)
- [7 CONNECT THE DOTS](#)
- [8 DATA CLASS, STORAGE CLASS, STORAGE GROUPS](#)
- [9 YOUR CHALLENGE](#)



# STORAGE MANAGEMENT ON Z/OS

Getting started with the basics of storage management on z/OS using ISMF on TS0.

## THE CHALLENGE

Data and disk storage management in z/OS is important to clients when handling high amounts of data at a time. The operating system, the application programs and business data are all on disk storage. DFSMS stands for Data Facility Storage Management Subsystem. In this challenge you will learn about disk storage management discipline, including how to access DFSMS and storage attributes.

## BEFORE YOU BEGIN

You will be using a 3270 terminal for this challenge. If you have not completed the TS0 challenges, please complete those first.

## INVESTMENT

Steps	Duration
9	90 minutes

# 1 STORAGE TERMINOLOGY

## GET FAMILIAR WITH STORAGE TERMINOLOGY

To more easily digest all DFSMS can do, let's familiarize yourself with the terminology.

### DASD

When a data set is allocated or a program is created, it is put on a DASD (Direct Access Storage Device). A DASD is the physical amount (volume) that it can hold.

Volume = Disk Storage = DASD

### Allocating Space

Disk space is allocated either *explicitly* or *implicitly* through DFSMS.

- Explicitly: Non-SMS-managed volumes

You are in control

Can be done through JCL, ALLOCATE (ISPF 3.4) and more

In previous challenges when you have allocated a data set, you choose the different storage attributes

- Implicitly: SMS-managed volumes

You are not in complete control

The system may assign space through Automatic Class Selection (ACS) routines. The storage administrator can create and edit ACS routines.

SMS can override you depending on what the storage administrator codes in the ACS routine.

The system may assign space or your explicit space allocation values would be changed by the ACS routine logic.

## Extents

Data sets are assigned disk space through primary or secondary extents.

- You always get 1 primary extent for volume space on a disk.
- A secondary extent is created when primary is full. The limit for secondary extents depends on the type of data set

Example: VSAM gets up to 255 secondaries vs. a PDS gets 15, and so on.

DFSM511 231014-0718

## Space Units

At this point, you have allocated multiple data sets. In non-sms managed volumes, you have control of the data set attribute values. One of these attributes is the size of the data set you want to create. With sms-managed volumes on the IBM Z Xplore system, you are constrained to the size that the storage administrator sets for you. IBM Z Xplore has set a size limit for each data set. In a DASD volume, you can use different space units to state your size volumes. Common space units for sizing are:

- Blocks
- Tracks
- Cylinders

Each of these units contains a pre-determined amount of bytes (characters). The space units used are up to you (or the clients) preference or requirements.

## 2 INTRODUCTION TO DFSMS

When a client orders a mainframe, the mainframe is an empty box. So you might be wondering, how do the operating system, customer business applications and their data all get into the mainframe?

**Answer:** They are stored on disks managed by DFSMS.

DFSMS is:

- A part of z/OS
- Used to store, retrieve, and update data on attached disk storage
- Capable of assigning various attributes to data sets

DFSMS manages both non-SMS and SMS data sets and volumes. You will be focusing on SMS-managed.

- SMS (Storage Management Subsystem) uses policies to manage storage for the operating system. With SMS-managed data sets, you use ACS routines.

How do you access DFSMS and manage ACS routines? Through the ISMF panel on TSO.

# 3 INTRODUCTION TO ISMF PANEL

ISMF stands for Interactive Storage Management Facility. Storage administrators use ISMF to automate and simplify storage data tasks.

Inside ISMF, you can do a lot of different things. You will see options that work with SMS-managed objects within the ACS routines.

The objects you will be focusing on are:

- Data Class
- Storage Class
- Storage Group

## Data Class

- Defines the way data sets are collected
- Can assign attribute values such as:

Record Format (RECFM)

EX. Fixed Block (RECFM = FB)

Record Size (LRECL)

EX. LRECL = 80

Data Set Name Type (DSORG)

EX. DSORG = PS

- You must have a data class in order to have data sets SMS-managed.
- Simply put, Data Classes are templates that standardize data set allocation for attributes.

## Storage Class

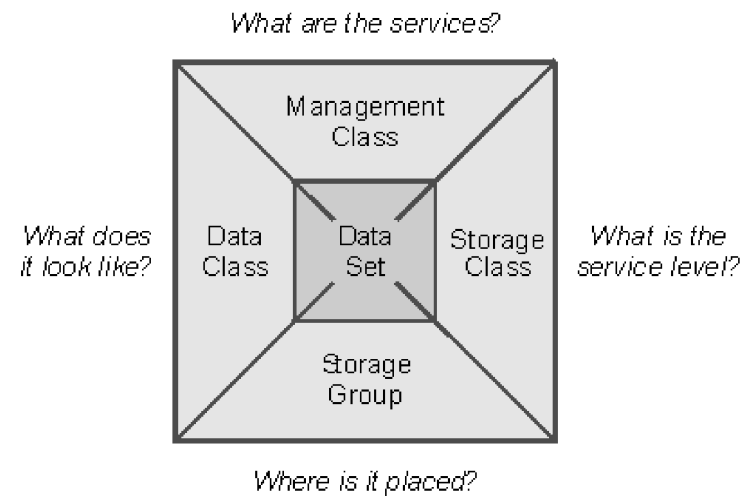
- Specify performance objectives and availability attributes that characterize a collection of data sets
- Must be assigned a storage class to be SMS-managed

## Storage Groups

- Collection of storage volumes (the disks)
- Contains the physical volume labels for each disk
- The Storage Group volumes are determined by the Storage Class name
- Helps reduce users needing to understand the storage devices that contain their data

Terminology	Description
Data Class	Sets the attributes
Storage Class	Facilitates the volume it goes on in Storage Group
Storage Group	Contains the physical volumes





Let's take a look into ISMF to view these groups more closely.

## "ACS Routine for IBM Z Xplore"

IBM Z Xplore has an ACS routine to handle all of the different data sets that are created when you allocate your different data sets.

The ACS routine determines SMS classes and storage groups when data sets are created.

This is useful for IBM Z Xplore as there are a lot of different data sets being created that fall under similar storage constraints. The ACS routine allows these data sets to automatically have the different storage constraints depending on how they are named.

For more information, visit: [ACS Routines](#).

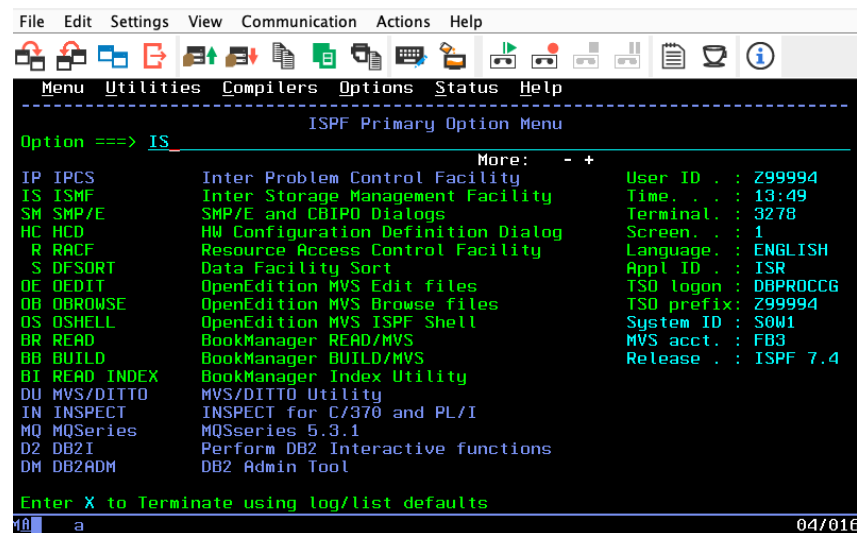
## 4 GET HANDS-ON

Let's get started on working with DFSMS.

Open up your 3270 terminal and log in using your zID and password.

You should be familiar with the ISPF menu. For this challenge, you will be working with ISPF in addition to ISMF.

Scroll down and find and open ISMF.



The screenshot shows a terminal window titled 'ISPF Primary Option Menu'. The window has a menu bar with 'File', 'Edit', 'Settings', 'View', 'Communication', 'Actions', and 'Help'. Below the menu bar is a toolbar with various icons. The main area displays a list of options with their descriptions and user information. The 'Option ==>' field is set to 'IS'. The user information on the right includes User ID: Z99994, Time: 13:49, Terminal: 3278, Screen: 1, Language: ENGLISH, Appl ID: ISR, TSO logon: DBPROCCG, TSO prefix: Z99994, System ID: S0M1, MVS acct.: FB3, and Release: ISPF 7.4. The bottom of the screen shows 'Enter X to Terminate using log/list defaults' and a status bar with '04/016'.

```
File Edit Settings View Communication Actions Help
-----
Menu Utilities Compilers Options Status Help
-----
ISPF Primary Option Menu
Option ==> IS
More: - +
IP IPCS      Inter Problem Control Facility
IS ISMF      Inter Storage Management Facility
SM SMP/E     SMP/E and CBIPO Dialogs
HC HCD       HW Configuration Definition Dialog
R RACF       Resource Access Control Facility
S DFSORT     Data Facility Sort
OE OEDIT     OpenEdition MVS Edit files
OB OBROWSE   OpenEdition MVS Browse files
OS OSHELL    OpenEdition MVS ISPF Shell
BR READ      BookManager READ/MVS
BB BUILD     BookManager BUILD/MVS
BI READ INDEX BookManager Index Utility
DU MVS/DITTO MVS/DITTO Utility
IN INSPECT   INSPECT for C/370 and PL/I
MQ MQSeries  MQSeries 5.3.1
D2 DB2I      Perform DB2 Interactive functions
DM DB2ADM    DB2 Admin Tool
Enter X to Terminate using log/list defaults
04/016
```

In the ISMF Menu, you will see a lot of different areas to explore. Let's set up your profile first to make sure you can view everything.

Find ISMF Profile, User Mode Selection, and make sure you are the storage administrator.

Once you have done this, head back to the ISMF panel and you should see a screen DIFFERENT than the image below. You will have more options available.

```
Panel  Help
      ISMF PRIMARY OPTION MENU - z/OS DFSMS V2 R4
Enter Selection or Command ==>
Select one of the following options and press Enter:

0 ISMF Profile           - Change 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
9 Aggregate Group       - Specify Data Set Recovery Parameters
L List                  - Perform Functions Against Saved ISMF Lists
R Removable Media Manager - Perform Functions Against Removable Media
X Exit                  - Terminate ISMF

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

Now you can begin exploring ISMF. You will be focusing on Volume, Data Class, Storage Class and Storage Group.

## 5 VOLUME

You learned earlier that volumes are the same as disk storage which are the same as DASDs.

When clients purchase a mainframe, they also purchase disk storage. You will find all of the disk storage listed in the volumes panel in ISMF.

Volumes are either non-SMS-managed or SMS-managed. You can use your DASD volumes more efficiently by allowing SMS to manage data placement.

- Example: SMS can help you avoid running out of space and wasting system resources by repeatedly migrating and recalling relatively active data, while another user group has excess space that is either unused or used for data that is rarely needed.

1. Find the Volume section in ISMF
2. Go into DASD and view the panel screen that appears.
3. Change the panel so that you are viewing volumes that are:

SMS-managed

Start with ZXP

Acquiring Physical and Space data

Viewing all storage groups

Active

```

Panel Defaults Utilities Scroll Help
                                VOLUME SELECTION ENTRY PANEL                Page 1 of 3
Command ==>

Select Source to Generate Volume List . . 2 (1 - Saved list, 2 - New list)
 1 Generate from a Saved List              Query Name To
   List Name . . . . .                     Save or Retrieve
 2 Generate a New List from Criteria Below
   Specify Source of the New List . . 2 (1 - Physical, 2 - SMS)
   Optionally Specify One or More:
   Enter "/" to select option              Generate Exclusive list
   Type of Volume List . . . 1             (1-Online,2-Not Online,3-Either)
   Volume Serial Number . . ZXP*           (fully or partially specified)
   Device Type . . . . .                   (fully or partially specified)
   Device Number . . . . .                 (fully specified)
   To Device Number . . . . .              (for range of devices)
   Acquire Physical Data . . Y             (Y or N)
   Acquire Space Data . . . Y             (Y or N)
   Storage Group Name . . . *             (fully or partially specified)
   CDS Name . . . . . 'ACTIVE'            (fully specified or 'Active')

Use ENTER to Perform Selection; Use DOWN Command to View next Selection Panel;
Use HELP Command for Help; Use END Command to Exit.

```

4. Press enter to view the volume list.

5. Look at the volume series and the other data listed about each DASD volume.

*Remember to move right and left to view more information.*

Below are a few descriptions of what you are seeing:

Terminology	Description
Volume Serial	The different disks named by storage administrator
Alloc Space	Facilitates the volume it goes on
Free Extents	How many secondary extents are available
Physical Status	Volume is SMS-managed (CONVERT) or not
Storage Group Name	Storage group it is assigned to

Remember, these are all of the volumes that are SMS-managed. ISMF can display all of the physical volumes controlled by the specific z/OS (both SMS and non-SMS). To view all volumes, you would change the source to be Physical in the volume selection panel.

Next, you are going to dive into the SMS-managed ACS routine.

## What are sms control data sets (CDS) and how do I find what they are called?

An ACS routine has two control data sets. 1. Active control data set (ACDS) 2. Source control data set (SCDS)

The SCDS is where you make changes that are used to create the ACDS. You can change the CDS name depending on which data set you are viewing.

To find the name of the ACS routine you will be using SDSF. Go to SDSF through ISPF, type `u log` and hit enter, then type `/d sms`.

You will see your source control data set (SCDS) and your active control data set (ACDS). When working with your active data set, you can either use the full name of ACDS or you can type "Active".

```
ACS APPLICATION SELECTION
Display Filter View Print Options Search Help
-----
SDSF ULOG  CONSOLE Z99994          LINE  COMMAND ISSUED
COMMAND INPUT ==> _                SCROLL ==> PAGE
RESPONSE=SOW1
IGD0002I 13:41:16 DISPLAY SMS 134
SCDS = SMS.SCDS1.SCDS
ACDS = SMS.ACDS1.ACDS
COMMDS = SMS.COMMDS1.COMMDS
ACDS LEVEL = z/OS V2.4
DINTERVAL = 150
REVERIFY = NO
ACSDEFAULTS = NO
  SYSTEM      CONFIGURATION LEVEL  INTERVAL SECONDS
  SVSCPLEX    -----            N/A
  SOW1        2023/06/22 13:41:06    15
```



## 6 WHAT'S INSIDE THE ACS ROUTINE?

Find the ACS option in the ISMF Panel.

In the ACS panel under CDS name, when you see 'ACTIVE', it is referring to the ACDS.

```
Panel Utilities Help
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      . . 'ACTIVE'
                (1 to 44 Character Data Set Name or 'Active')

Use ENTER to Perform Selection;
Use HELP Command for Help; Use END Command to Exit.
M0 a 07/002
```

1. Display the ACS routine created for IBM Z Xplore.
2. Browse the types of ACS objects that are in the control data set. These are the values that are used for IBM Z Xplore.
3. Look at `vendor.parmlib`. This is where the source code for the CDS is stored. A storage administrator can edit and change the ACS objects through `vendor.parmlib`.

Feel free to scroll around to view other information, like the members that hold each object and who last updated the CDS.

DFSMS11231014-0718

1. Head to ISPF display panel and observe the three members within the source data set. *Hint: They contain a \$*

- Key words to note/focus on:

## WHEN

4. Do the same thing with storage class and storage group. Notice the naming conventions between the three routines and see how they all connect.

```

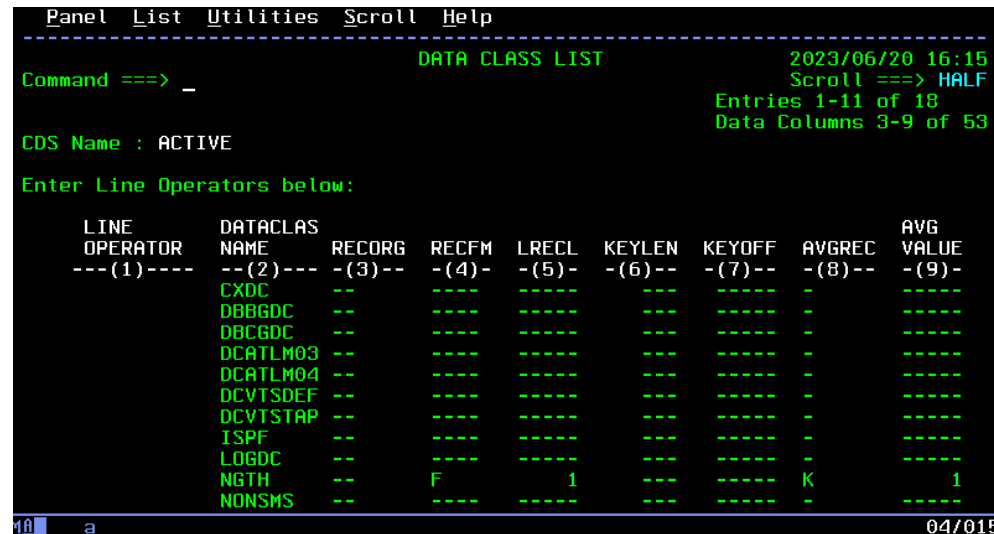
Command ==> _____ Scroll ==> CSR
***** Top of Data *****
==MSG> -Warning- The UNDO command is not available until you change
==MSG> your edit profile using the command RECOVERY ON.
000001 PROC 1 DATACLAS
000002 /*=====*/
000003 /*20221022 RDC SPECIFY HANDLING FOR JCL3OUT AND VSAMPRNT */
000004 /*=====*/
000005 /* */
000006 FILTLIST ZID INCLUDE(Z0*,Z1*,Z2*,Z3*,Z9*)
000007 /* EXCLUDE('ZXP','ZCX','ZOS','ZWE100') */
000008
000009 FILTLIST SPF INCLUDE(Z*.SPF*,**,Z*.SOW1.**)
000010
000011 FILTLIST CINPUT INCLUDE(Z*.INPUT)
000012 FILTLIST CSOURCE INCLUDE(Z*.SOURCE)
000013 FILTLIST CJCL INCLUDE(Z*.JCL)
b
08/015

```

## 8 DATA CLASS, STORAGE CLASS, STORAGE GROUPS

You have seen what makes up each member for the active data set, but what are the volume constraints for each name within each type? For example, what are the data set attributes for a data set that is Z\*.JCL?

1. Make your way back to ISMF and find the data class panel.
2. Make sure you are using the 'ACTIVE' data set, type an \* for data class name and list all data classes.
3. Review all of the data class names that are active. Try and find the names that are used in the ACS routine for IBM Z Xplore.
4. Look at the attributes assigned to some of the data classes. You can scroll to the right to view more.
5. Do the same thing for Storage Classes and Storage Groups. Are you understanding the pattern on how data class, storage class and storage group all connect?



LINE	OPERATOR	DATACLASS NAME	RECOG	RECFM	LRECL	KEYLEN	KEYOFF	AVGREC	VALUE
---	(1)---	(2)---	(3)---	(4)---	(5)---	(6)---	(7)---	(8)---	(9)---
		CXDC	--	----	----	----	----	----	----
		DBBGDC	--	----	----	----	----	----	----
		DBCGDC	--	----	----	----	----	----	----
		DCATLM03	--	----	----	----	----	----	----
		DCATLM04	--	----	----	----	----	----	----
		DCVTISDEF	--	----	----	----	----	----	----
		DCVTSTAP	--	----	----	----	----	----	----
		ISPF	--	----	----	----	----	----	----
		LOGDC	--	----	----	----	----	----	----
		NGTH	--	F	1	----	----	K	1
		NONSMS	--	----	----	----	----	----	----

## How do I know which volume my storage groups are on?

You have seen how the data class, storage class and storage groups work together to make up the ACS routine. How do you know which volume serial each data set will go to?

In the storage group list, type `listvol` in the line operator column and you can view which storage groups are on each volume.

```
Panel  List  Utilities  Scroll  Help
-----
STORAGE GROUP LIST                2023/06/22 15:32
Command ==>                        Scroll ==> HALF
                                   Entries 1-11 of 14
                                   Data Columns 3-6 of 52

CDS Name : ACTIVE

Enter Line Operators below:

  LINE   STORGRP  SG      VIO   VIO   AUTO
  OPERATOR NAME   TYPE   MAXSIZE UNIT  MIGRATE
  --- (1) --- -- (2) --- ----- (3) ----- -- (4) -- (5) - -- (6) ---
                                CXXR00TSG POOL      ----- NO
                                DBBGS   POOL      ----- NO
                                DBCGSG   POOL      ----- NO
                                DB2ARCG POOL      ----- NO
                                *LISTVOL ISPF   POOL      ----- YES
                                LOGSG     POOL      ----- NO
                                SGATLDS  TAPE      -----
                                SGNOP     POOL      ----- YES
                                SGSLOAD  POOL      ----- YES
                                SGSPDS   POOL      ----- YES
                                SGSSEQ    POOL      ----- YES

MP  a                                     18/006
```

## 9 YOUR CHALLENGE

You have explored a lot of different parts of DFSMS, both non-SMS and SMS-managed. You now possess critical information to be a z/OS storage administrator.

Your challenge is to allocate two different data sets: Non-SMS-managed and SMS-managed.

Allocate your non-SMS-managed data set:

1. Find the `ZXP*` volume serial name that is non-SMS-managed.

*Hint: Remove storage group name and CDS from volume selection entry panel*

2. In one of the objects of the ACS routine, find the correct naming convention for your data set that will make it non-SMS.

*Hint: a blank storage class (' ') results in non-SMS-managed data set allocation. Remember, the data class references the storage class.*

3. Allocate a new data set with the information you found in step 1 and 2.

4. Attributes for your data set:

The volume serial you found in step 1

Space Unit: TRKS

Primary Quantity: 5

Secondary Quantity: 1

Record Format: Fixed Block

Record Length: 20

Data Set Name Type: Sequential Data Set

*Hint: It is not PDS, what are your other options?*

*Note: The IBM Z Xplore ACS routine is set up to include any data set that starts with your zID. You will need to create a zID data set that will NOT be SMS-managed. That is why you are using the ACS routine to find the data set naming convention for a non-SMS-managed data set.*

Allocate your SMS-managed data set:

1. Create a data set with `yourzid.toobig`.

2. Keep all of the attributes the same except:

Remove volume serial

Primary Quantity: 100 tracks

Data set name type: Library (PDS/E)

3. What happens? Note the last three words that are said in message line.

Some of your data set attributes were overridden by the ACS routine. You can view all of the attributes by typing `i` next to your new data set in 3.4.

4. Create a member in your new data set called `MESSAGE`.

5. Inside your member:

Put the *last* three words found in step 3.

Once you have created your two data sets, check your work over to make sure you have everything correct. After you have successfully done this, find `ZXP.PUBLIC.JCL` and submit the member **CHKSMS1**

DFSMS1 | 231014-0718

Nice job - let's recap	Next up ...
<p>You have been introduced to DFSMS and the different ways volume storage is managed. You have gotten familiar with sms-managed volumes and ACS routines. You created two data sets that get you familiar with how the IBM Z Xplore ACS routine works and have tested the limits for storage space.</p>	<p>Keep completing challenges that use TSO or go back to challenges using VS Code. Stay tuned for more challenges on DFSMS and other z/OS topics.</p>