

Multiple Virtual Storage

Lesson 6: MVS Concepts
and Terminology

Lesson Objectives

- In this lesson, you will learn the following topics:
 - Various types of data used in MVS
 - Dataset organization
 - VSAM and Non-VSAM
 - MVS Datasets
 - Data Management
 - Accessing Datasets



6.1: Types of Data

MVS Data Management

- Anything that needs to be stored and accessed on user request is data for MVS.
- Various types of data used in MVS are listed below:
 - Business Data
 - Application Components
 - MVS (System Data)
 - Temporary Data



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Types of Data:

Various types of data used in MVS are listed below:

Business Data:

- Database
- Indexed Files
- Flat Files

Application Components:

- Source Programs
- Executable Programs
- Screen Definitions
- Record Layout Definitions
- Command File Scripts

MVS (System Data):

- O/S program
- User Information (ID, Password, Profile)
- Access Permissions

Temporary Data:

- O/S Built Data (for example: task queues, segment table, page table)
- Spooled Output
- Work Files for Sort

6.2: Dataset Organization

Concept

- MVS manages data by means of datasets.
- Access methods are identified primarily by the dataset organization.
- Dataset organization falls into two categories under MVS:
 - VSAM
 - Non-VSAM



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Dataset Organization:

Dataset refers to a file that contains one or more records. The record is the basic unit of information used by a program running on MVS OS.

Any named group of records is called a dataset. Datasets can hold information, such as medical records or insurance records, to be used by a program running on the system.

All types of datasets can be stored on DASD (only sequential datasets can be stored on magnetic tape).

An access method defines the technique that is used to store and retrieve data.

Access methods have their own dataset structures to organize data.

Dataset organization is categorized as VSAM and Non-VSAM:

Virtual Storage Access Method (VSAM) : It applies to both a dataset type and the access method used to manage various user datatypes.

6.2: Dataset Organization

Concept of Non-VSAM Organization

- Non-VSAM provides four basic methods of organizing data stored in datasets:
 - Physical Sequential
 - Indexed Sequential
 - Direct
 - Partitioned



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Non-VSAM:

Let us see the non-VSAM methods of organizing data:

Physical Sequential:

Records are stored one after another in consecutive sequence.

Data can reside on just any type of I/O devices.

This method of organizing data is appropriate when records from files do not have to be retrieved at random.

Indexed Sequential:

This method of organizing data includes an index, which relates key field values to the location of their corresponding data records.

Direct Organization:

This method permits random access of records.

It does not use an index.

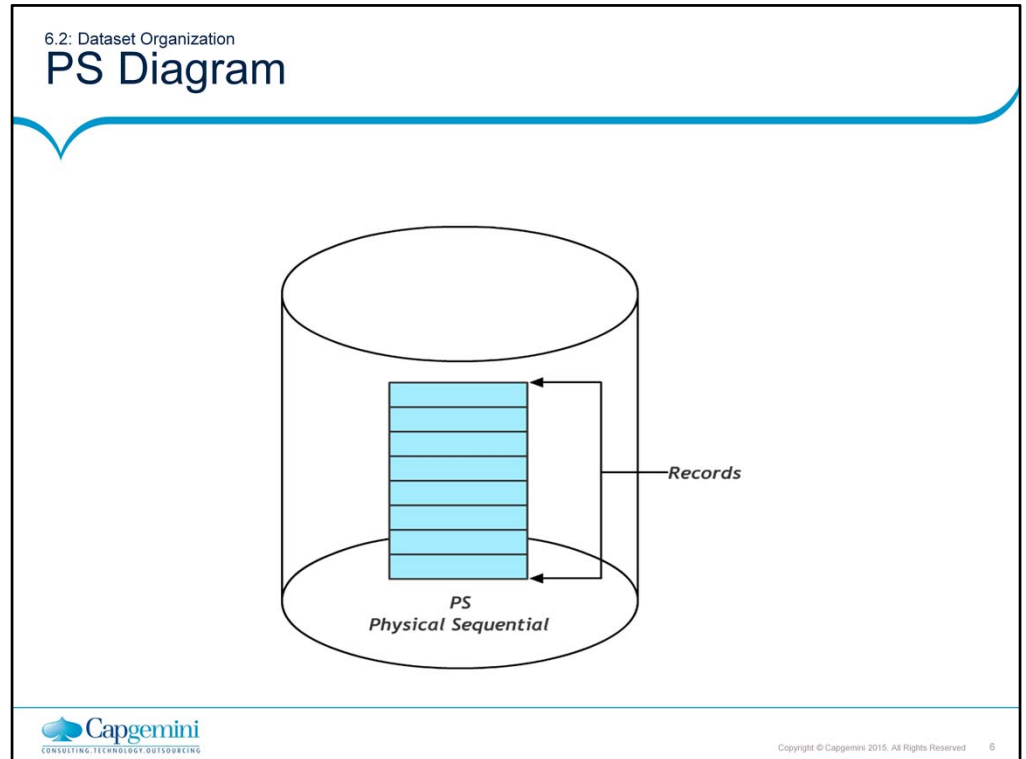
To access records, the disk location address (By hashing) of that record has to be specified.

Partitioned Organization:

This method consists of one or more members.

Each of these members can be processed, as if it were a separate physical sequential file.

Names of members in a Partitioned dataset (PDS) is stored in a directory.



Note: Diagram denotes the PS file in DASD.

6.2: Dataset Organization

Partitioned Dataset – Salient Features

- Here are the characteristics of Partitioned Dataset:
 - It is commonly referred as PDS and also known as Library.
 - It is used to store application components.
 - PDS is divided into one or many members.
 - Member name can be up to 8 characters long.
 - There is no extension for member.
 - Each member can be processed as an individual unit.
 - Entire PDS can be processed as one unit.
 - Each PDS contains a directory, and directory has an entry for each member in a PDS.



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Non-VSAM:

Partitioned Dataset – Salient Features:

Additional Functions for PDS are given below:

Compress

Member Management

Create, Modify, Delete, Copy, Rename

6.2: Dataset Organization

Partitioned Dataset – Salient Features

- Directory has an entry for each member in a PDS.
 - Dataset name normally consists of three qualifiers called as:
 - PROJECT
 - GROUP
 - TYPE
- Examples of Dataset Names:
 - PAYROLL.TEST.SOURCE , PAYROLL.PROD.SOURCE, INV.TEST.LOADLIB
 - Personal PDS starts with high level qualifier as User ID.
 - For example: DA00T23.NEW.SOURCE



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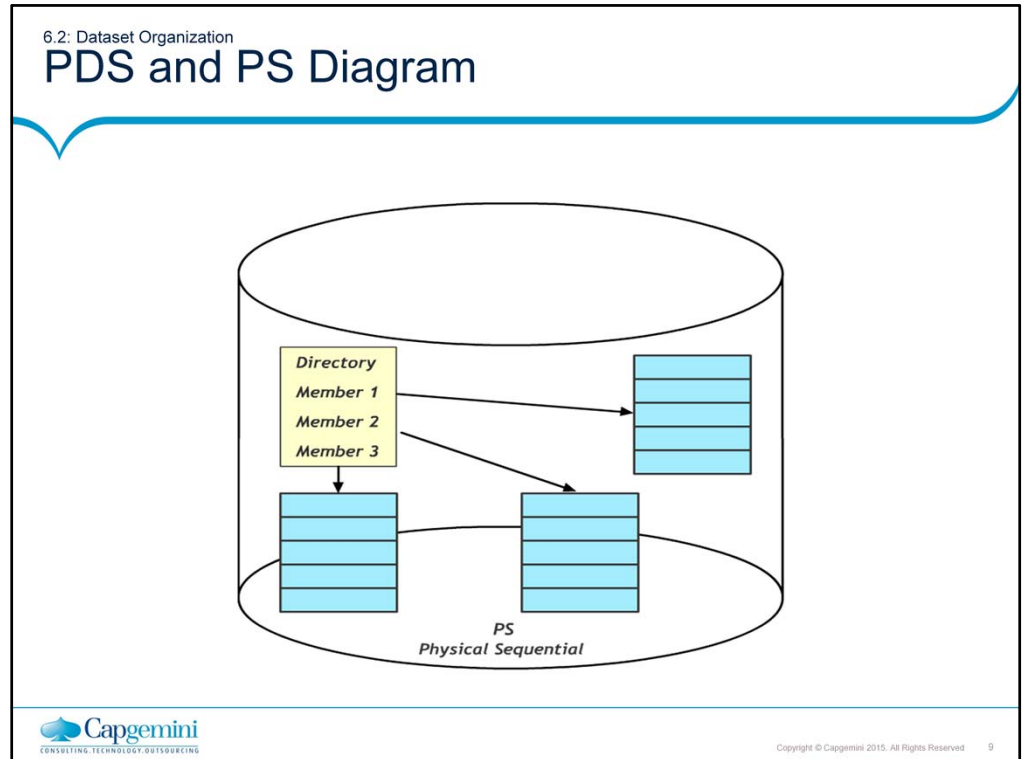
Non-VSAM:

Partitioned Dataset – Salient Features:

Some Examples of (PS) Member Name are given below:

PAB0017, PAB0105, PAC0021

Note: Usually, the application component type cannot be identified from the member name. Hence naming conventions are used for PDS.



Note: The diagram in the above slide shows the Directory (that is PDS) and PS (that is Member in a PDS).

6.2: Dataset Organization

Concept of VSAM Organization

- VSAM provides four basic methods for organizing data stored in datasets:
 - Entry Sequence Dataset - ESDS
 - Key Sequence Dataset - KSDS
 - Relative Record Dataset - RRDS
 - Linear Dataset - LDS
- All VSAM datasets must be cataloged.



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VSAM:

VSAM is used to organize records into four types of datasets: key-sequenced, entry-sequenced, linear, or relative record.

The primary difference among these types of datasets is the way in which their records are stored and accessed.

VSAM (Virtual Sequential Access Method) is used for more complex applications. VSAM arranges records by an index key, relative record number, or relative byte addressing. VSAM is used for direct or sequential processing of fixed-length and variable-length records on DASD. Data that is organized by VSAM is cataloged for easy retrieval.

The VSAM methods of organizing data are given below:

ESDS:

It can only reside on DASD.

It is functionally equivalent to Physical Sequential File.

KSDS:

It is functionally equivalent to Indexed Sequential File.

RRDS:

It lets you retrieve the record by specifying the location relative to the start of the file.

LDS:

Linear is the only form of a byte-stream dataset in traditional MVAS files.

6.2: Dataset Organization

Salient Features

- Non-VSAM was developed in mid 1960s.
- VSAM (Virtual Storage Access Method) was introduced in early 1970s.
- VSAM was expected to replace Non-VSAM Data Organization Functions.
 - Today, most sites use both VSAM and Non-VSAM Data Organization.
- VSAM is the primary data organization for user data.
- VSAM is also called as “native” file management system of IBM.

6.2: Dataset Organization

Salient Features

- Generation Data Group (GDG), used to store data in the form of generations
- GDG is used for cyclical applications
- GDG is a collection of chronologically related generations of the same file.
- Each generation or member is called as a generation data set.
- ISAM and VSAM files can not be used in a GDG.



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Generation data group (GDG) is used to store data in the form of Generations. Used for cyclical applications.

☐ It is a collection of chronologically related generations of the same file. Each generation or member is called as a generation data set.

☐ ISAM and VSAM files can not be used in a GDG.

☐ Each processing cycle creates a new generation.

☐ GDGs must be catalogued so that MVS can use the catalog entries to keep track of the relative generation numbers.

☐ When the GDG catalogue entry is made, we specify the number of generations that we wish to create.

6.2: Dataset Organization

Salient Features

- Most of the DBMS running under MVS use VSAM as underlying Data Organization (for example: DB2, IDMS).
- Physical Sequential Data Organization is used for “flat” files.
- Index Sequential and Direct Data Organization are not very popular now-a-days (these functions are handled better by VSAM).
- Partitioned Data Sets (PDS) are also used by MVS to store O/S programs.

6.2: Dataset Organization

Dataset Naming Convention

- The convention allows:
 - Alpha, Digits, National Characters @, #, \$, and “.”
 - Maximum length 44 characters for DASD, 17 for Tape
 - If length is more than 8, then it must be broken into qualifiers of maximum 8 characters each.
 - Qualifiers to be separated by “.”
 - “.” to be counted in overall length
 - First character of the qualifier to be alpha or national character
 - Last character of dataset must not be “.”
 - First qualifier to be called as high-level qualifier
 - High-level qualifier has special significance
 - For example: Following Dataset name has three qualifiers:
 - USERID.P9710.TRAN
 - High-level qualifier is USERID
 - Total length is 17

6.3: Dataset Tracking Mechanism

Types

- The mechanisms that MVS uses to keep track of the data that is stored by it include:
 - Labels
 - Catalogs

6.3: Dataset Tracking Mechanism

Label Processing

- When a dataset is stored on disk or tape, MVS identifies it with special records called 'labels'.
- There are two types of DASD labels:
 - Volume Label or Vol1 Label or DASD Label
 - File Label or Dataset Label

6.3: Dataset Tracking Mechanism

Label Processing - Volume Label

■ Volume Label Processing:

- Each DASD is labeled. It is also called as Volume Label (VOL1 label).
- VOL1 label is stored on a disk volume at third record of track 0 in cylinder 0.
- VOL1 label (Volume label) has two important functions:
 - It identifies the volume by providing a volume serial no. : Vol-ser. Every DASD volume must have a unique six-characters vol-ser.
 - It contains the disk address of the VTOC.
 - VTOC (Volume Table of Contents) is a special file that contains the file labels for all the datasets on the volume.



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Dataset Tracking Mechanism:

Volume Serial Number:

Each DASD is identified by a unique number, Volume Serial Number, that is vol-ser. Vol Ser must be specified for accessing the Dataset (which is not cataloged). Every DASD volume must have a unique six-characters vol-ser.

VTOC:

Volume Table Of Contents that is VTOC is a special file for each DASD. The VTOC contains the file labels for all the datasets on the volume. These labels are called Data Set Control Block (DSCB) have several formats called Format-1, Format-2, and so on.

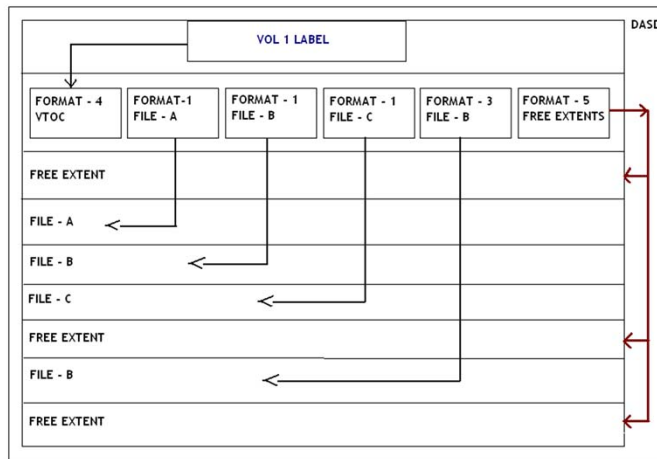
6.3: Dataset Tracking Mechanism

Label Processing - Dataset Label

- Dataset Label Processing:
 - Each dataset is a label record called File label or Data Set Control Block (DSCB).
 - DSCB describes dataset's name, it's DASD location, and other details.
 - DSCBs have several formats, called Format-1, Format-2, and so on.

6.3: Dataset Tracking Mechanism

Label Dataset



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Label Processing

When a dataset is stored on disk or tape, MVS identifies it with special records called 'labels'.

- There are 2 types of DASD labels : Volume, File Label
- All DASD volumes must contain a volume label, often called a VOL1 label. This label is always in the same place on a disk volume : the 3rd record of track zero in cylinder zero.
- Volume label has 2 important functions
 - It identifies the volume by providing a volume serial no. : Vol-ser. Every DASD volume must have a unique six-characters vol-ser.
 - It contains the disk address of the VTOC.
- The VTOC (Volume Table of Contents) is a special file that contains the file labels for the datasets on the volume.
- These labels are called Data Set Control Block (DSCB) have several formats called Format-1, Format-2 and so on.

Format-4-dscb : describes VTOC itself

Format-1-dscb : describes a dataset by supplying dataset name, DASD location & other characteristics [space is allocated to DASD file in area called extents. Each extent consists of one or more adjacent tracks]

[has room to define 3 extents for a file (1 primary, 2 secondary)]

Format-3-dscb : if file requires more than 3 extents, this dscb is created

It contains room for 13 additional secondary extents [As a result file can contain up to 16 extents]

Format-5-dscb : contain information about free extents that aren't allocated to files each can define up to 26 free extents

6.3: Dataset Tracking Mechanism

Catalog Processing

- MVS provides a comprehensive catalog facility.
 - It records the location of the files
 - Under MVS, there are two types of catalogs
 - MASTER Catalog
 - USER Catalog
- MASTER Catalog
 - In each MVS system, there is only one Master catalog
 - It contains entries that identify system datasets and an entry for each User catalog created in the Mainframe.
- USER Catalogs
 - There can be a number of User catalogs
 - User Catalogs contain entries that identify User datasets.

6.3: Dataset Tracking Mechanism

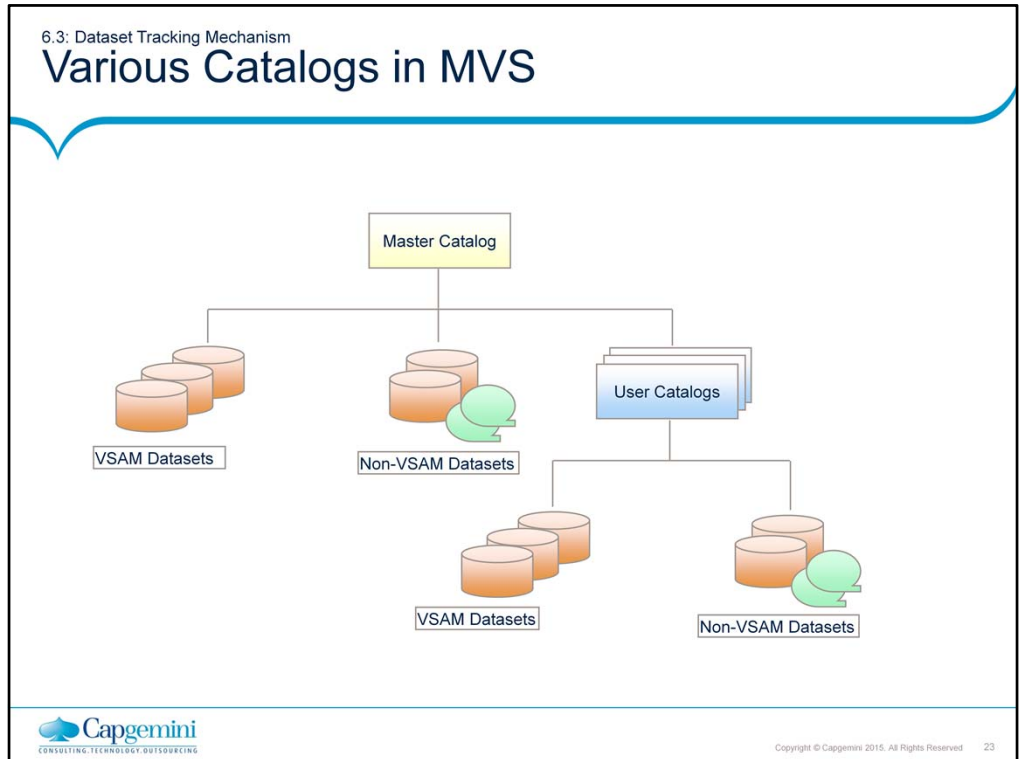
Catalog Processing

- Catalogs of the oldest format were called OS catalogs or CVOLs.
 - not used so much nowadays, as they could not differentiate between Master and User Catalog
- VSAM catalogs
- ICF (Integrated Catalog Facility)

6.3: Dataset Tracking Mechanism

Catalog Processing

- Catalog Features:
 - Each MVS has only one Master Catalog which also functions as system catalog.
 - Master Catalog is used by MVS for system datasets.
 - User Catalog is used for user datasets.
 - There can be multiple User Catalogs.



- Master Catalog contains one entry of each User Catalog:
 - VSAM datasets must be cataloged.
 - Non-VSAM datasets may or may not be cataloged.
 - An Alias can be created for a catalog.
- Usually, the high-level qualifier of a dataset is same as the catalog name or catalog alias name.
- Multiple datasets can be cataloged in single user catalog.
- Alias helps to catalog datasets with different high-level qualifiers to be cataloged in a single user catalog.

6.4: Sysplex

Sysplex

■ Sysplex

- A system complex, commonly called a Sysplex, allows multiple processors to be joined into a single unit, sharing the same Sysplex name and Couple Data Sets.
- Put another way, a Sysplex is a single logical system running on one or more physical systems.
- Sysplexes are often isolated within a single system, but Parallel Sysplex technology allows multiple mainframes to act as one.
- Used for disaster recovery, Parallel Sysplex combines data sharing and parallel computing to allow a cluster of up to 32 systems to share a workload for high performance and high availability.

6.5: Dataset Management

Functions of Dataset

■ Data Management Functions for Non-PDS:

- Allocate
- Process
 - Add Records
 - Modify Records
- Delete Records
- De-allocate (delete)
- Copy
- Rename
- Catalog/Uncatalog

6.5: Dataset Management

Functions of Dataset

- Functions for PDS:
 - Compress
 - Member Management
 - Create, Modify, Delete, Copy, Rename

6.5: Dataset Management

Functions of Dataset

- How Data Management is achieved?
 - Interactively using MVS Commands
 - Executing MVS Utility Programs (batch mode)
 - Through Application Programs
 - On-line Processing
 - Batch Processing

6.6: Dataset Processing

Accessing Datasets in MVS

- How are datasets processed in MVS?
- An application program that is part of a user job goes through three phases as it processes a dataset:
 1. Allocation
 2. Processing
 3. De-allocation

6.6: Dataset Processing

Accessing Datasets in MVS - Allocation


- Allocation:

- The process of locating an existing dataset or space for a new dataset and preparing the system control block needed to use the dataset is called "Allocation".
- Allocation occurs at three levels:
 - Unit is selected and allocated, for example: SYSALLDA-DASD, TAPE.
 - Volume is allocated.
 - Dataset on that volume is allocated.

6.6: Dataset Processing

Accessing Datasets in MVS - Processing

- Processing:
 - Processing involves three steps:
 - Opening datasets
 - Processing I/O
 - Closing datasets

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Dataset Processing:

Accessing Datasets in MVS – Processing:

An access method is an interface between an application program and the physical operations of storage devices.

Physical Sequential - BSAM, QSAM :-like sequential file disadvantage is that records have to be processed one at a time from the beginning as if the file reside on tape

Indexed Sequential - BISAM, QISAM (obsolete) records can be accessed sequentially and randomly depending on processing requirements

Direct - BDAM

Partitioned - BPAM

ESDS, KSDS, RRDS - VSAM

Entry sequenced data set –reside on dasd. Key sequenced dataset same as indexed sequential file.

Relative record dataset:-it lets you retrieve the record by specifying the location of relative to the start of file.

LdS linear is only form of a byte-stream dataset in traditional MVS files.

6.6: Dataset Processing

Accessing Datasets in MVS - Processing

- When you code an i/o instruction in an application program and you actually invoke an access method which in turn issues proper I/o instructions to access the I/o device
- Basic sequential access method provides low level support for sequential datasets
- Basic indexed sequential file for indexed
- Basic direct access method for direct files
- Queued access methods provide a higher level of support for sequential and indexed sequential files

6.6: Dataset Processing

Accessing Datasets in MVS – De-allocation

- De-allocation:

- Each file is automatically de-allocated when job is finished with it.
- While de-allocating, disposition of dataset can be decided, whether you want to retain the file or should it be deleted.
- Disposition indicates what MVS does with a non-Vsam file when its deallocated.
- Disposition of temporary files indicates whether the file should be retained until the end of the job or deleted immediately

6.6: Dataset Processing


Accessing Datasets in MVS – De-allocation


- For permanent file, disposition indicates whether a file should be kept or deleted
- In addition permanent file disposition's indicates whether an entry for the file should be maintained in master catalog or user catalog.

6.6: Dataset Processing

Demo

- Demo on:
 - Creation of PDS and PS



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Summary

- In this lesson, you have learnt:

- Any named group of records is called a dataset. The records in a dataset can be organized in various ways.
- There are many different types of datasets in MVS and there are different methods for accessing them, namely VSAM and Non-VSAM.
- An access method defines the technique that is used to store and retrieve data.
 - DASD volumes are used for storing data and executable programs and for temporary working storage.
- DASD labels identify DASD volumes and the datasets that they contain.
- Datasets are first allocated, processed, and then de-allocated.
- Catalogs can be either of the following:
 - User or Master



Review Question

- Question 1: VSAM datasets are always ____.
 - Option 1: Cataloged
 - Option 2: Un-Cataloged
 - Option 3: Master Catalog
- Question 2: MVS has many different types of datasets.
 - True / False
- Question 3: ____ applies to both a dataset type and the access method used to manage various user data types.

