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Multiple Virtual Storage (MVS)

Lesson 00

Course Goals and Non Goals

Course Goals

- Basic understanding of MVS job and data management
- Basic understanding of IBM Mainframe system
- Introduction to Mainframe environment
- Work with basic ISPF commands and dataset utility

Course Non Goals

- JCL coding

Pre-requisites

Basics of Computer

Intended Audience

Developers
Programmers

Day Wise Schedule

Day 1

- Lesson 1: Introduction to OS Concepts and MVS
- Lesson 2: MVS Environment Concepts
- Lesson 3: MVS Evolution

Day 2

- Lesson 4: Typical IBM Mainframe Systems
- Lesson 5: MVS Concepts and Terminology
- Lesson 6: MVS Data Management

Day Wise Schedule

Day 3

- Lesson 7 : Tools Overview
- Lesson 8 : System Generation & Initialization
- Lesson 9 : Job Management Overview
- Appendix
  - Appendix A – Compilation process (Translators / Linkage / Loader)
  - Appendix B - Bibliography/References

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References

Books:

- The MVS JCL Primer; by Saba Zamir, Chander Ranade
- IBM Mainframe Handbook

URLs:

- http://hansen-family.com/mvs/MVS%20Commands.htm
- http://ibm.com

Next Step Courses

JCL
COBOL
VSAM
DB2
CICS

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Lesson 01: Introduction to OS Concepts and MVS

Lesson Objectives

In this lesson, you will learn the following topics:

- Basic concepts of OS
- Need and importance of OS
- Introduction to MVS

1.1: OS Concepts

Overview

OS concepts:

- What is an Operating System (O/S)
- Need and importance of O/S
- Position of O/S
- Key Functions of O/S
- About MVS

1.1: OS Concepts

What is Operating System?

Operating system is basically a system software that controls the operation of a computer.

A program that acts as an intermediary between a user of a computer and the computer hardware.

Operating system goals:

- Execute user programs and make solving user problems easier.
- Make the computer system convenient to use.

Use the computer hardware in an efficient manner.

OS – Need and Importance

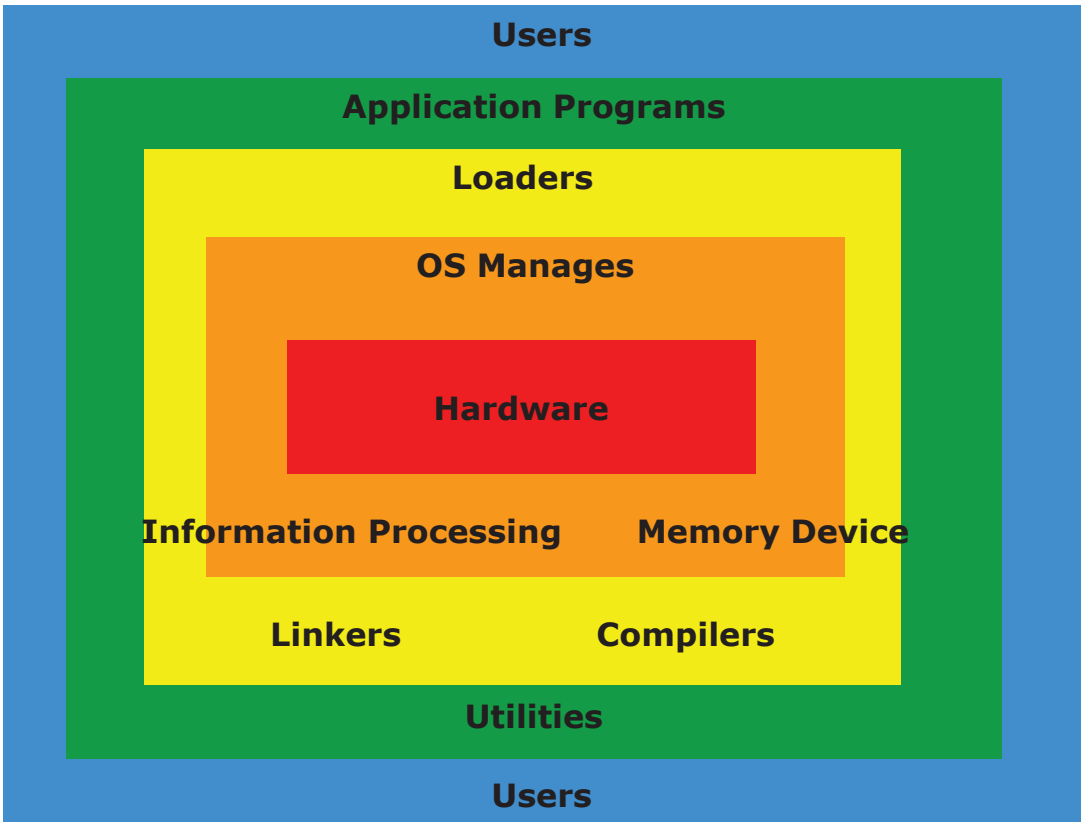
The O/S basically programs the task of scheduling and processing of job.

It is primarily used for job management, resource management.

Sophisticated O/Ses increase the efficiency of use of the computer and hence reduce the cost of using the computer.

1.2: Position of O/S in a System

Diagrammatic Representation



Key Functions

Following are the key functions of an OS:

- It keeps track of resources namely memory, I/O devices, processor, job, and information.
- It decides who gets what resource and how much.
- It allocates the resources when needed.
- It reclaims the resources back after it has been used, so that they may be allocated subsequently.

1.4: Introduction to MVS

Introduction

MVS is IBM’s most powerful operating system for mainframe computers.

Earlier it was known as IBM mainframe operating system.

Today it is called as Multiple Virtual Storage (MVS).

MVS has evolved over many years.

It is basically used for huge application and to support large databases.

About Mainframe System…

Capability to handle huge DATA
High Speed Processing
Multiple Applications
Multiple Users
Reliable
Meant for Non-Stop Operation
Modular easily expandable
Good Connectivity to Non-IBM Systems

Summary

In this lesson, you have learnt:

- MVS is an OS used in IBM Mainframe Environment.
- MVS is used for mission critical and business applications.
- It is designed to work with hundreds of users working together, located in the same locality or across continents.
- Operating System is an interface between the end user applications and the hardware.

Review Question: Crossword

1	2. I							3	
							4	O	
	5								
6									
		7							
							8		
				9					

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Lesson 02: MVS Environnent Concepts

Lesson Objectives

In this lesson, you will learn the following:

- The manner in which data and commands are processed in general
- The various MVS characteristics in detail

2.1: Data Processing

Data Processing Concepts

For executing Business applications, we can have:

- On-Line Mode / Foreground Mode:
  - It provides an interactive mode for the end user to execute the application programs.

- Batch Mode / Background Mode:
  - It provides a non-interactive mode for executing the programs.
  - Programs are normally submitted as batch job for execution.
  - Instructions to execute are maintained in a separate command file.

2.2: Command Processing

Command Processing Concepts

Command Issue Mode:

- How a user (programmer / end-user) interacts with the computer
- For example: To edit a program, to execute a program:
  - On-line Mode: Using Terminal
  - Batch Mode: Using Punched Cards, JCL

Command Execution Mode:

- Foreground: Terminal is locked while the command is being executed.
- Background: Terminal is free while the command is being executed.

2.3: Basic Characteristics of Mainframe O/S

Characteristics

The Mainframe O/S performs the following tasks:

- Batch Processing
- Multiprogramming
- Multiprocessing
- Time sharing
- Virtual Storage
- Spooling

2.3: Basic Characteristics of Mainframe O/S

Concept of Batch Processing

On a Mainframe, batch processing is the normal way of using the computer system and has been for decades.

Work is processed in units called jobs.

Job is an execution of one or more programs in pre-defined sequence.

JCL supplies specifications of a job such as programs to be executed, their sequence, where those are stored, what files are used, and where the output is to be held.

Application programs are executed in background mode

Concept of Batch Processing (Contd…)

On a Mainframe, batch processing is the normal way of using the computer system and has been for decades.

Work is processed in units called jobs.

Job is an execution of one or more programs in pre-defined sequence.

JCL supplies specifications of a job such as programs to be executed, their sequence, where those are stored, what files are used, and where the output is to be held.

Application programs are executed in background mode

Concept of Multiprogramming

Single user cannot keep CPU and I/O devices busy at all times.

The program has CPU based and Non-CPU based instructions.

CPU is kept waiting during the non-CPU based instructions execution.

- For example: I/O operations (Disk, Terminal, Printer)

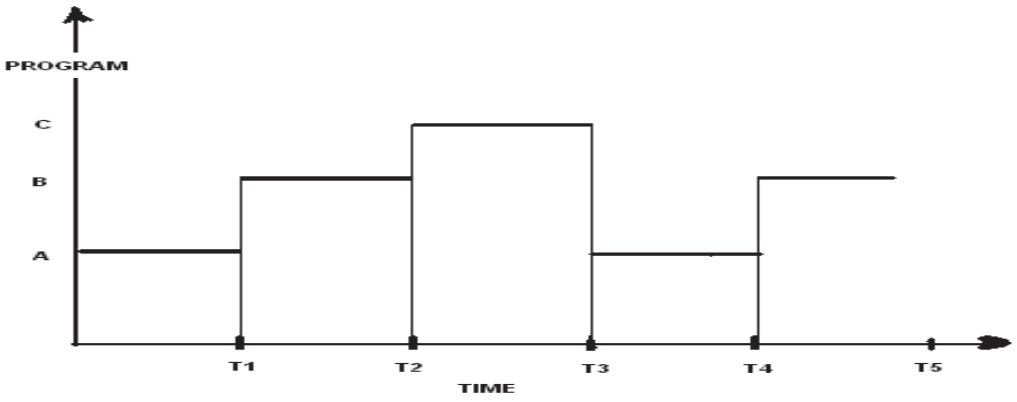
This results in wastage of CPU time - a precious resource.

How does Multiprogramming Work?

Multiple programs are kept “ready” for execution.

CPU executes only one program at any given point in time.

- If the currently executing program requires I/O, then it is put in a “wait” state. Another program is immediately taken for execution. On completion of I/O the program again becomes “ready” for execution.
- This results in an illusion that multiple programs are being executed simultaneously, hence multiprogramming.



Why Multiprogramming?

Multiprogramming organizes program execution so that CPU always has one job to execute.

Multiprogramming simply reclaims the CPU during idle periods to let other programs execute.

Multi-programming results in better and efficient CPU utilization.

2.3: Basic Characteristics of Mainframe O/S

Multiprogramming Overheads

Multiprogramming Overheads:

- Program Queue Management
- Program Status Management
- Context Switching during Changeover
- Multiple programs must be in main memory
- Management of Common Resource Sharing (e.g. Printer)
- It is critical to determine optimum level of Multiprogramming to maintain certain service level.

2.3: Basic Characteristics of Mainframe O/S

Relevance of Multiprogramming:

- Multi-programming is applicable even for single user system
- Multi-programming is a must for multi-user system

2.4: Multiprocessing

Concept of Multiprocessing

There are multiple CPUs (processors) in one machine.

During Multiprocessing, these CPUs work together under a single operating system.

Each CPU executes a separate program.

O/S assigns programs to each CPU.

Essentially CPU is treated as an allocable device!!!!!

Concept of Time Sharing

Batch processing was the only way to use mainframe in early days.

- Batch job processing is called background processing.

As terminals became more common, users needed a more direct way to use the computer system.

In Time Sharing system, each user has access to the system through a terminal. The user enters commands that are processed immediately.

- Online processing: It lets users interact directly with the computer. Time sharing is called foreground processing.

Concept of Time Sharing (Contd…)

Remember, time sharing involves the following:

- Resource Sharing
- Time Slice
- Multiple Users compete for computer resources at the same time
- At any given point in time, only one user can have control of the resources
- Think about what should be the basis of priority and sharing?

Time Sharing typically refers to sharing of resources in an interactive processing mode.

Concept of Virtual Storage

Virtual Storage is a technique that lets a large amount of main storage (memory) be simulated by a processor that actually has a smaller amount of real storage installed.

- For example: A processor that has 4 MB of real storage might use virtual storage to simulate 8 MB of main storage.
- To do this, the computer uses disk storage as an extension of real storage.
- From the user’s point of view, virtual storage appears to be real storage.

Basics of Virtual Storage

Why Virtual Storage?

- It enables execution of program larger than main memory size.

What is Virtual Storage?

- It is a technique to simulate large amount of main storage.

How is Virtual Storage implemented?

- (Refer note pages)

Advantages and Overheads

Advantages of Virtual Storage:

- Main memory can be shared by multiple programs.
- It enables effective use of the limited main storage.

Overheads of Virtual Storage:

- Address mapping
- Keeping track of what is in memory and what is not
- Data / Instructions need to be “brought in” main memory as and when required
- “Remove” from main memory what is not currently required (to make room for instructions of other program)
- Memory Management

Concept of Spooling

In Multiprogramming, common problem is of sharing access to I/O devices among programs.

- For example: Two programs writing to printer
- However, if two programs that are executing at the same time, try to write output to a printer, then the output from both programs will be intermixed in the printout and multiprogramming will not hold true.
- Another way is to share access to input and output devices among the programs that execute together in multiprogramming O/S.

How is Spooling implemented?

Output to printer is intercepted and written to a disk that is “spooled”

On completion of program “spooled”, output is queued for Printing.

This queue is processed by O/S print routine.

The O/S print routine is multi-programmed along with application programs.

Summary

In this lesson, you have learnt:

- The basics of command processing using:
  - the batch mode
  - the online processing mode
- Batch processing is the oldest form of processing data. For example: punch card.
- The mainframe characteristics like time sharing, multiprogramming, spooling, and virtual storage that form the basic for the MVS O/S

Review Question

Question 1: Virtual Storage simulates ___ memory.

- real
- virtual
- disk

Question 2: Spooling is same as buffering.

- True / False

Question 3: In multiprogramming, the ___ is reclaimed during the idle cycles.

- CPU
- memory
- output

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Multiple Virtual Storage (MVS)

Lesson 03: MVS Evolution

Lesson Objectives

In this lesson, you will learn the following topics:

- Evolution of MVS
- Concepts of PCP, MFT, and MVT

IBM Families of Operating Systems

DOS - Disk Operating System

↓ For Small System/360

DOS/VSE
(Virtual Storage Extended)

OS - Operating System

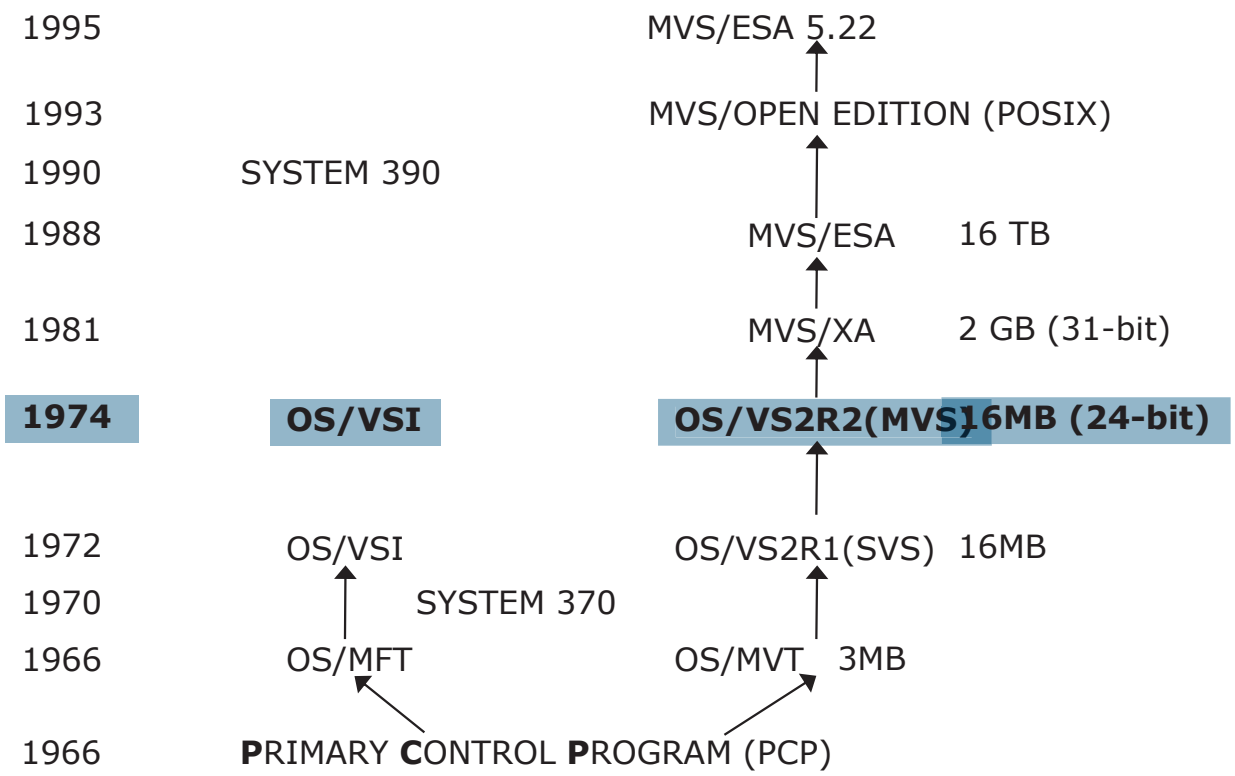
↓ For Full range System/360

MVS
(Multiple Virtual Storage)

VM/CMS - Virtual Machine Conversation Monitor System

- Simulates more than one computer system on single real machine
- Supports both DOS and OS

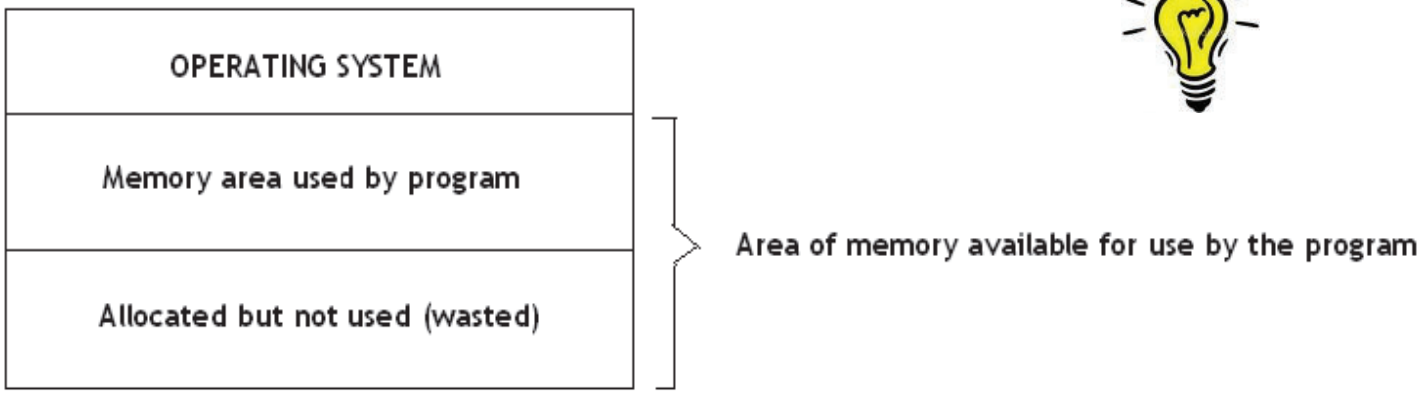
Evolution


1995
MVS/ESA 5.22
1993
MVS/OPEN EDITION (POSIX)
1990
SYSTEM 390
1988
MVS/ESA
16 TB
1981
MVS/XA
2 GB (31-bit)
1974
OS/VSI
OS/VS2R2(MVS)
16MB (24-bit)
1972
OS/VSI
OS/VS2R1(SVS)
16MB
1970
SYSTEM 370
1966
OS/MFT
OS/MVT
3MB
1966
PRIMARY CONTROL PROGRAM (PCP)

PCP

Single Contiguous Allocation of Memory

In the earlier operating systems like OS/360 PCP (Primary Control Program), which was a batch Operating System, where there is no multiprogramming, memory is allocated to a job as follows:



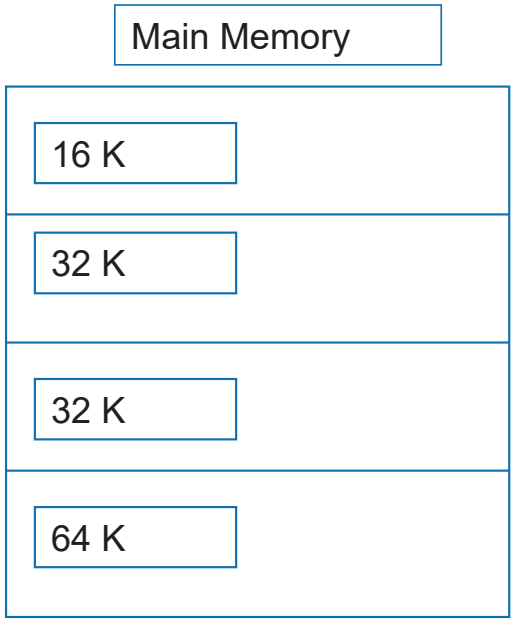
Concept of MFT

MFT stands for Multiprogramming a Fixed Number of Tasks.

It contains pre-allocated fixed number of partitions where user jobs execute.

Size of each partition is constant.

Number of jobs that can be multiprogrammed is constant.

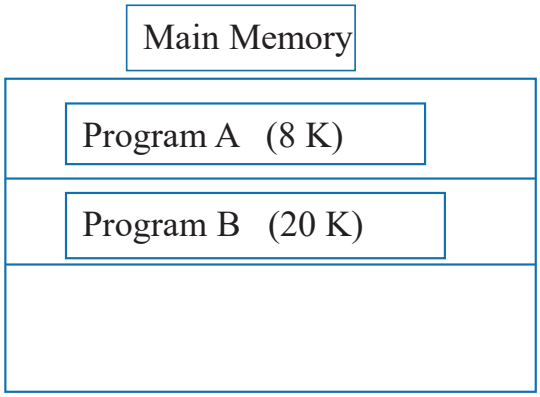


Concept of MVT

MVT stands for Multiprogramming a Variable Number Of Tasks.

It allocated storage to each program as it entered the system.

Number of programs to be multi programmed depends on the storage requirements of each program and total amount of available storage.



Operating System / Virtual Storage (OS/VS 1)

OS/VS1 was an enhancement on MFT.

This is like MFT, but the partitions are created in virtual storage than in main storage.

This virtual storage is back up auxiliary disk storage. The operating system takes care of bringing in active portions of the program from disk (virtual storage) into Central Storage as needed.

Operating System / Virtual Storage (OS/VS 2)

OS/ VS2 single virtual storage replaced MVT. This was an enhancement of MVT, with the addition of virtual storage.

This freed the operating system, as did MVT, from the problem of locating a suitable partition to run the program.

OS/VS 2 was used on System/370 machine.

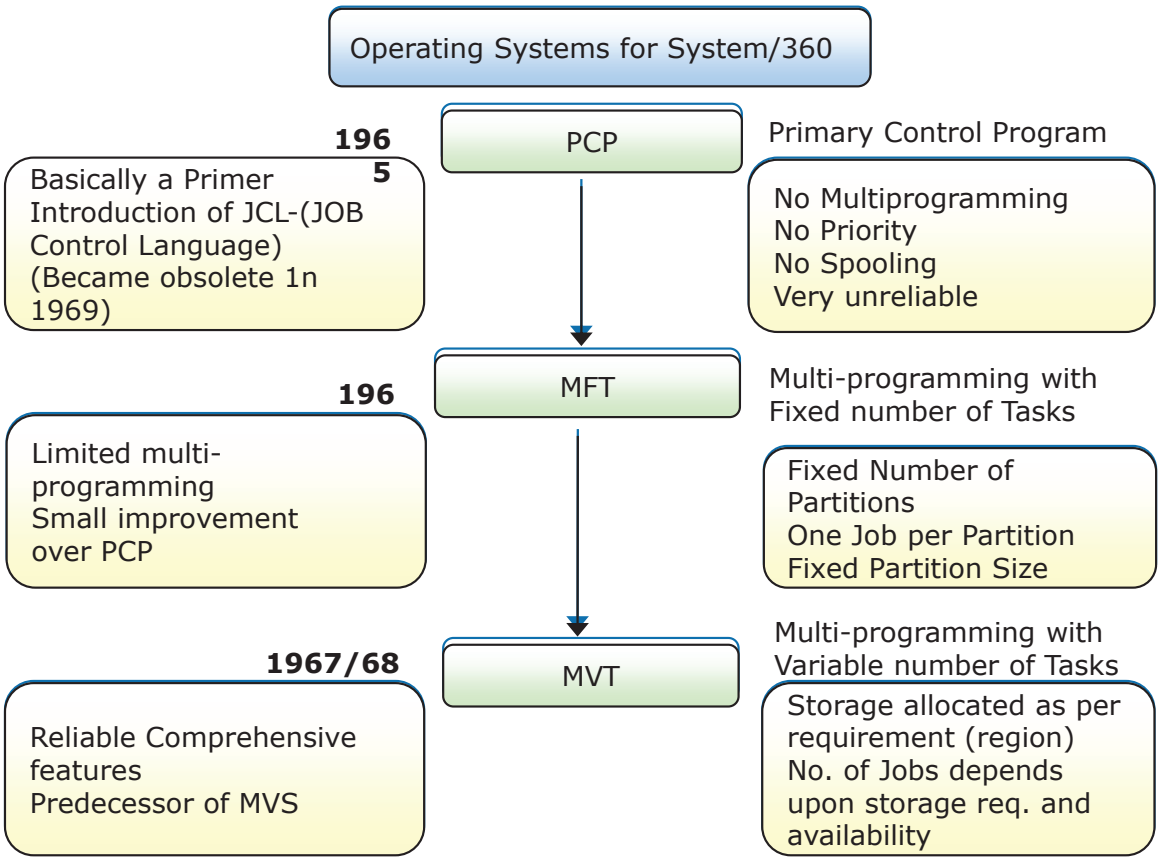
Multiple Virtual Storage (MVS)

With the growth of OS code, the available area for execution of user programs reduced using single virtual storage.

This problem was solved with the introduction of Multiple virtual storage (multiple address spaces in virtual storage) in 1974.

3.2: MVS Evolution

System/360



Utilities to overcome S/360 Limitations

Two utilities were used to overcome the limitations of S/360 :

- HSAP – Houston Automatic Spooling Priority
  - Developed unofficially (self initiative) by IBM employees
  - Distributed freely to MVT/MFT users
  - Became very popular
  - Eventually owned and supported by IBM

- ASP - Attached Support Processor
  - Developed (officially) by IBM and intended for MVT
  - Several mainframes can work together under single O/S (predecessor of multi-processing?)
  - Provided better spooling capability
  - Relatively less takers

System/370

System/370 was announced in the early 70s and supported Virtual Storage.

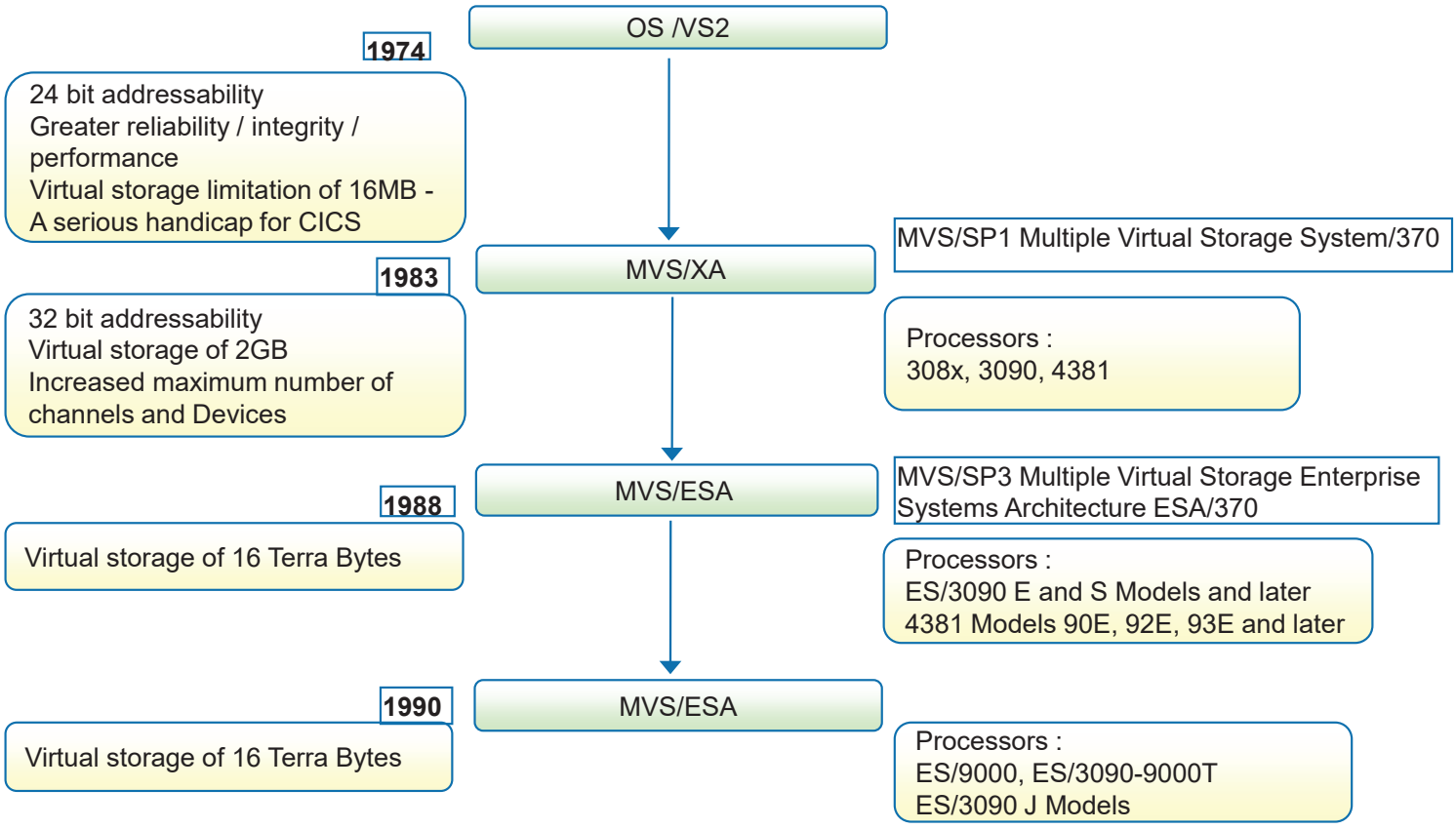
New Operating Systems OS/VS were introduced.

- OS/VS1 (Virtual System 1) - adopted from MFT
- OS/VS2 (Virtual System 2)
- Version SVS - Single Virtual Storage; adopted from MVT
- Version MVS - Multiple Virtual Storage

It was completely rewritten (in 1974).

- HASP and ASP were migrated to OS/VS2 under the names JES2 and JES3.

OS System/370 (Contd…)

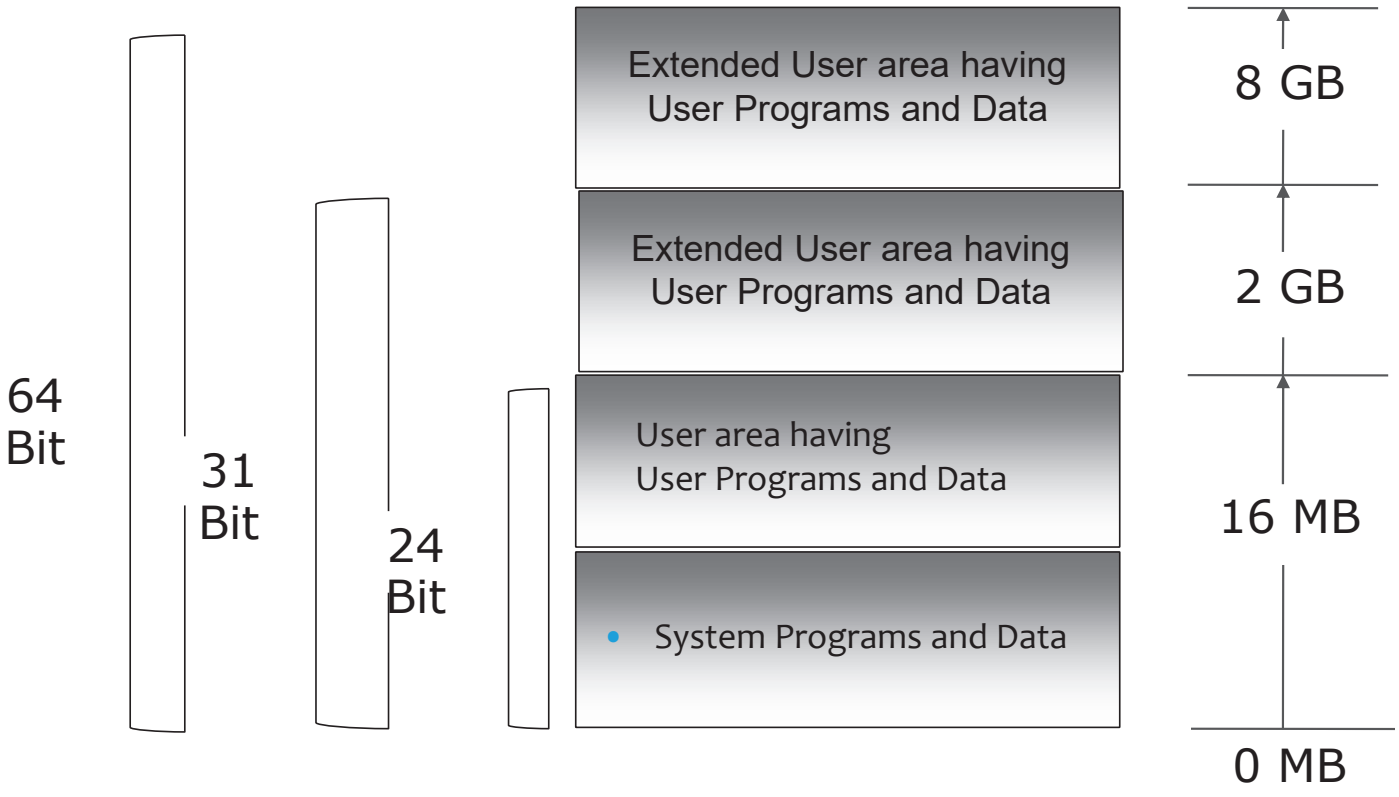


MVS/Extended Architecture (MVS/XA)

The main improvements in this OS were:

- The enhancement of address space size from 16 MB to 2 GB by the provision for 31 bit addressing.
- Old programs compiled in 24 bit mode could be marked to run in 16 MB address space (i.e.. below the 16 MB line).
- The new programs could call the old programs which run below the 16 MB line.
- The provision of a Channel subsystem to free the processor from controlling I/O devices.
- Development of Expanded storage.

MVS/Extended Architecture (MVS/XA)



MVS/Enterprise Systems Architecture (MVS/ESA)

In 1988, IBM introduced MVS/ Enterprise Systems Architecture (MVS/ESA) and System 370 / ESA, as a further enhancement to MVS/XA.

In MVS/ESA, the main additions are:

- Usage of Data space and Hyperspace.

OS / 390

The major enhancement was introduction of System 390 machine supporting OS/390 operating system.

The channel subsystem which so far used electric cables for data transmission to I/O devices now used the ESCON (Enterprise system connection) channels using fiber-optic cables which carry light pulses rather than electrical pulses. Use of light allows high speed information transfer.

ZOS

This is the latest development by IBM and it has all the features as earlier evolved

The major enhancement being its addressability of 64bit which can offer up to 256 GB of address space for each user or subsystem (but is limited to only 8 GB).

The installed central storage is 8 GB and DASD storage is around 420 GB.

Summary

In this lesson, you have learnt about:

- The evolution of the Mainframe Operating System
- The System/360, which consisted of PCP and later came up with MFT and MVT version of OS
- The System/370, which later came into existence with different version and releases
- The original name for MVS was OS/VS2.
- Overview of MVS/XAOS/390, VM, OS/Z

Review Question

Question 1: PCP is called as ____.

- Primary Control Program
- Priority Control Program
- Post Control Program

Question 2: Partition status tables are used both in MFT and MVT.

- True / False

Question 3: ____ provided better spooling capability.

- ASP
- HASP
- SVS
- MVT

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Multiple Virtual Storage (MVS)

Lesson 04: Typical IBM Mainframe Systems

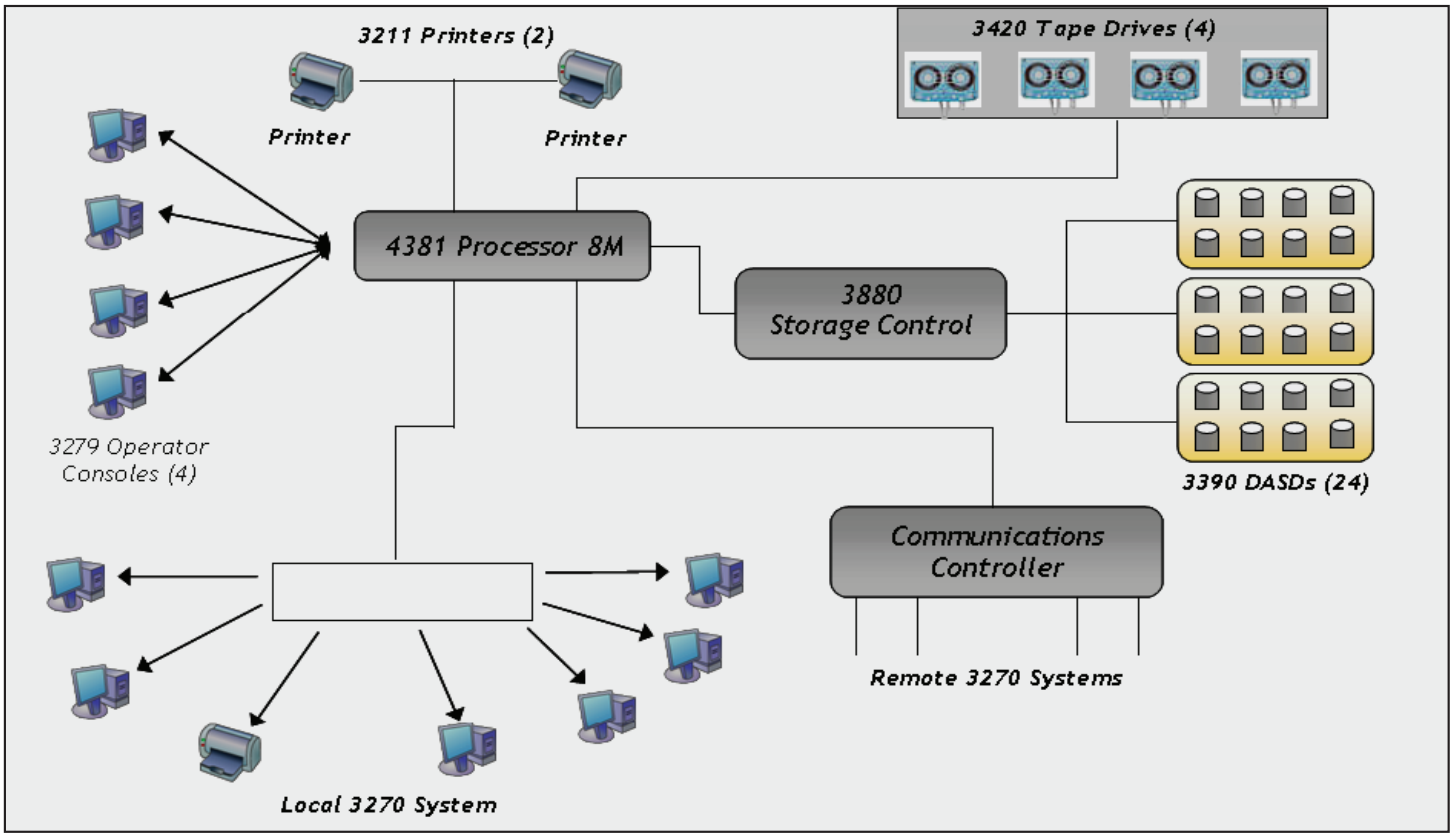
Lesson Objectives

In this lesson, you will learn the following topics:

- Typical Mainframe Configuration
- Various components of IBM Mainframe System
- Processors
- Channels Concepts
- Various I/O Devices used like DASDs and
- Communication Devices, etc

4.1: Typical IBM M/F Configuration

Small Mainframe Configuration



4.1: Typical IBM M/F Configuration

Architecture in Mainframe computer system

The mainframe computer system consists of Hardware and Software products.

The Hardware

- The Processor complex (CPU, Main storage and Channels)
- The I/O devices.

The Software

- It is running on the machine and consists of, Systems programs, subsystem programs, end-user application programs, tools and so on. The primary system program is the operating system, the MVS.

- The operating system is the interface between the software programs and the hardware.

4.2: Processors

Introduction

The central components of Mainframe are the processors.
MVS runs on processors that are members of the System/360-370 family.
This group of processors has evolved over a period spanning nearly 30 years.

4.2: Processors

Introduction

The System/360-370 family includes the following:

- System 360 models in the mid-1960s
- System 370 models in early 1970s
- 3030 models in late 1970s
- 4300, 3080 models in early 1980s
- 3090 models in late 1980s
- ES/9000 models in 1990s

4.2: Processors

PROCESSOR – CPU’s – CHANNELS - MEMORY

PROCESSOR	CPU’s	MAIN MEM	MAX CHANNEL
• 4381	1 OR 2	4 – 64MB	18
• 3084	4	32 – 128MB	48
• 3090	6	64 – 512MB	128
• ES/9000	4 – 8	2048MB	256
• S/390 G5/G6	4 – 12	1 – 32GB	256

Concept of Multiprocessing

There are multiple CPUs (processors) in one machine.

- These CPUs work together under single operating system.
- Each CPU executes a separate program.
- O/S assigns programs to each CPU.

Essentially CPU is treated as an allocable device.

4.3: Cache Memory

Concept of Cache Memory

Cache memory refers to high speed memory buffer (faster than main memory).
It operates between CPU and main memory.
It is used to store frequently accessed storage locations (instructions).
It is usually available on all processors.

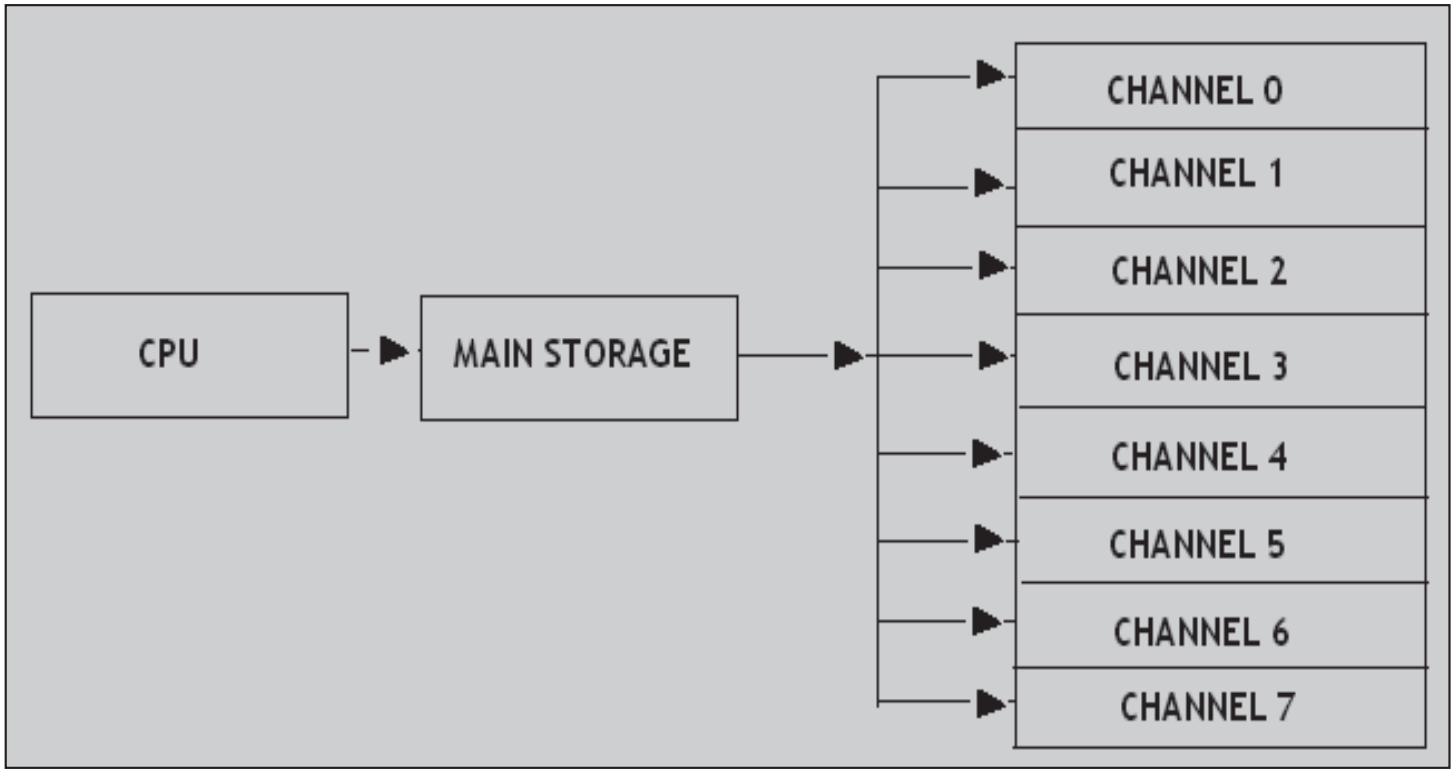
Concept of Channels

Channels provide paths between the processor and I/O devices.

- 3090 processors can have a maximum of 128 channels.
- A channel itself is a computer and executes I/O instructions called channel commands.
- I/O devices are connected to channels through an intermediate device called "Control Unit".
- Each channel can have up to eight control units.

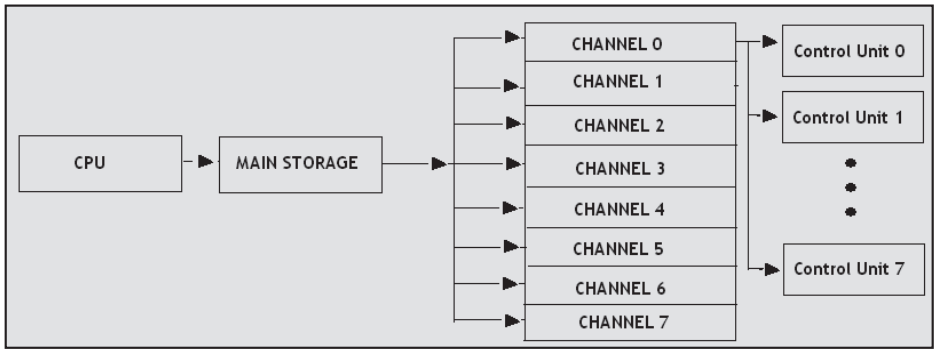
4.4: Channels

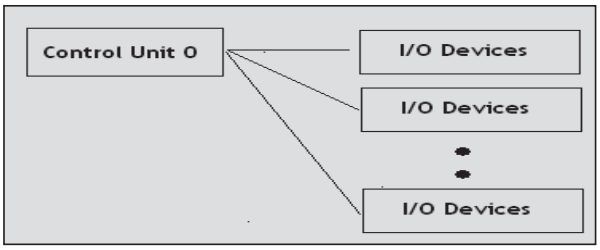
Overview of System 370 I/O Architecture



What are Control Units?

- Control units are DASD units. They can be connected to common control unit, called string, which in turn is connected to the “String Controller”.
- String Controller is connected to a channel directly or indirectly. Sometimes a control unit called “Storage Control” connects string controllers to a channel.





Channel - I/O Device Connectivity

Channels use parallel architecture, that is all bits of a byte are transmitted simultaneously.

Information transfer is in unit of two bytes.

Sixteen data wires and additional control wires are required.

It has a maximum length of 120 meters (400 feet).

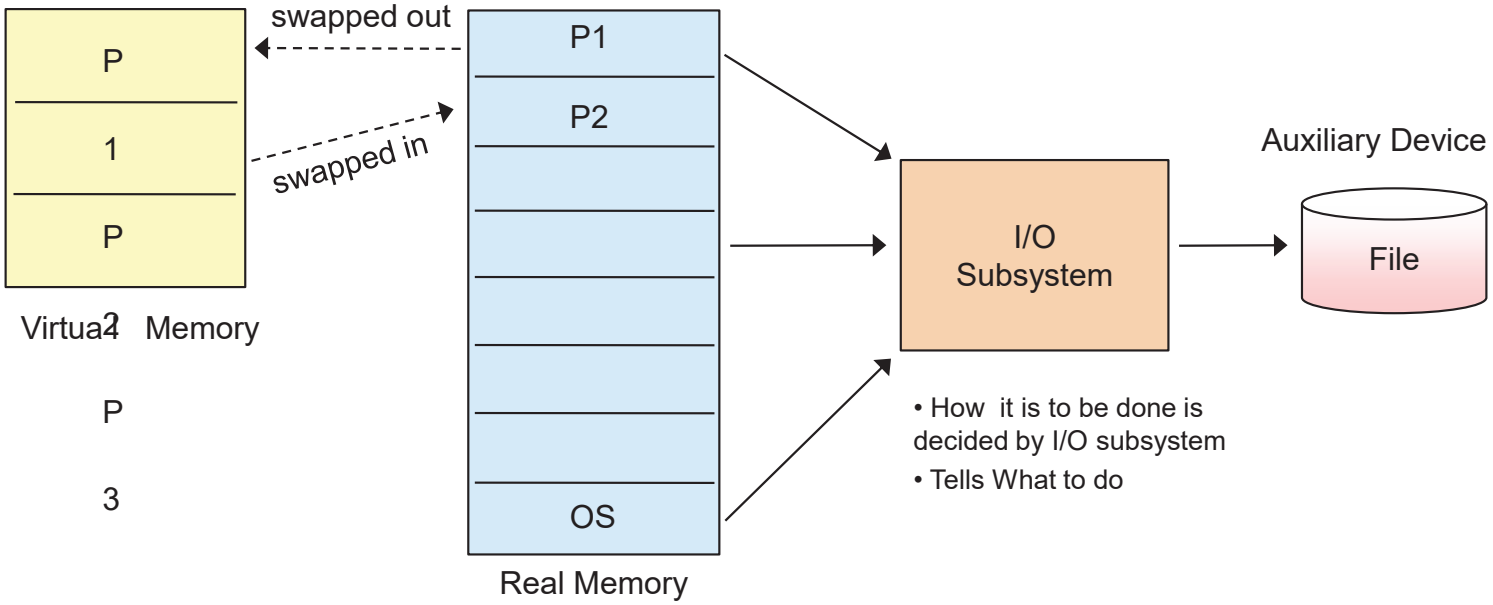
The data speed is of 4.5mbps.

Use of copper results in heavy, expensive cabling.

Concept of Input-Output Management

Input-Output Management:

- **Problem:** Application should not worry about device characteristics. I/O device speed is 100 times slower than CPU.
- **Solution:** Let all I/O be handled by a specialized system-I/O Subsystem.



Types

We have the following types of I/O devices:

- Unit record devices
- Magnetic tape devices
- Direct Access Storage Devices (disks)
- Telecommunication devices

4.5: I/O Devices

Concept of Unit Record Devices

Unit record devices consist of:

- Card Devices (now obsolete): Readers/ Punches/ Reader &Punches
- Printer
  - Impact Printers - 600 to 2000 LPM
  - Non-Impact Printers - 3800 sub-system, 20,000 LPM

Each record processed is a single physical unit.

- For example: card device ~ punch card; printer ~ printed line

The devices have built-in control units for themselves.

They are directly attached to the channel.

4.5: I/O Devices

Concept of Magnetic Tapes

Magnetic Tapes have high volume storage.

- They have sequential processing.
- They are normally used as back-up devices.
- They are also used for physical transfer of data.
- Normally four to eight tape drives are connected to one control unit.

Concept of DASDs

DASD stands for Direct Access Storage Device. DASD is IBM’s official name for Disk.

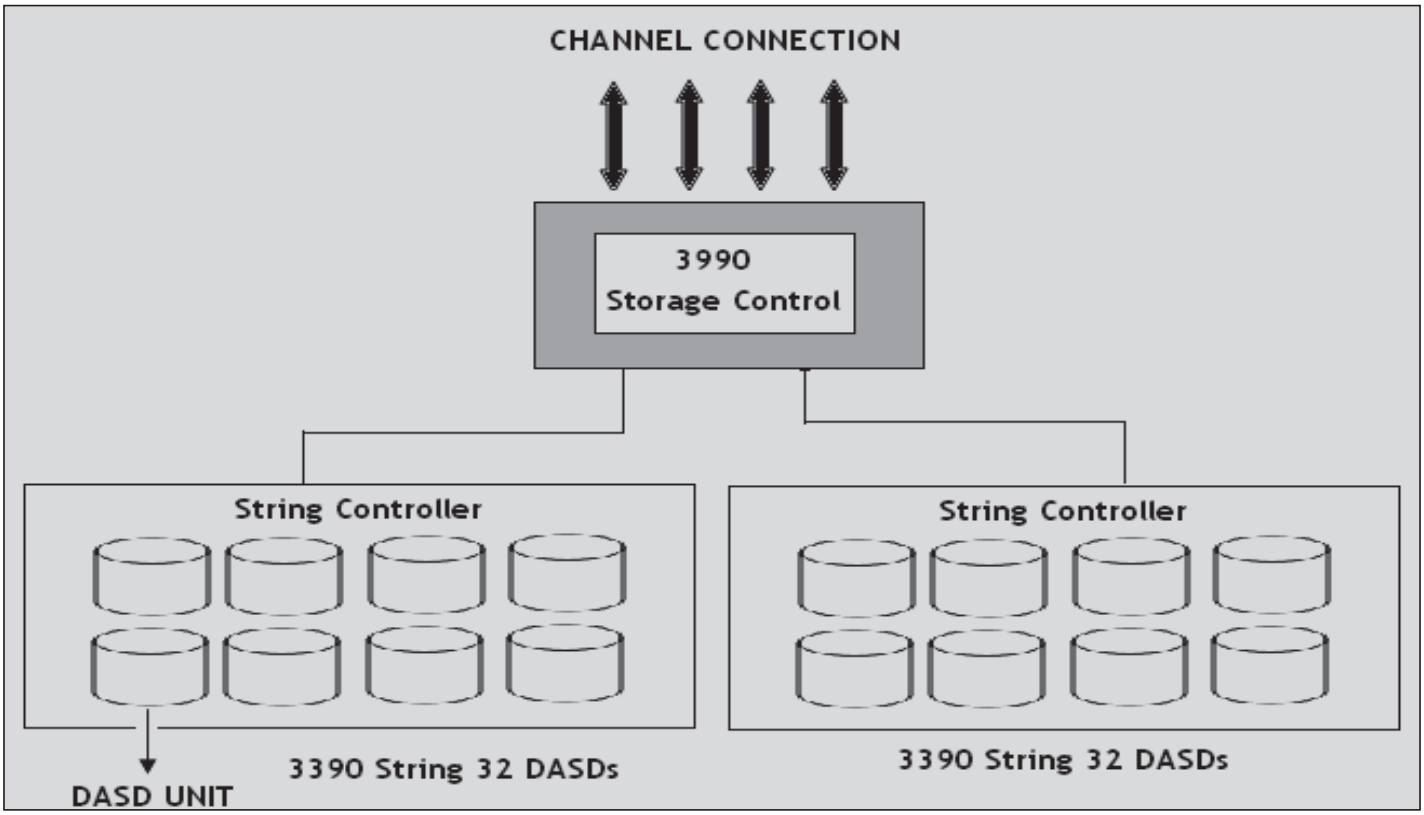
- It is non-removable; it offers better reliability and is faster.
- Each unit is called as disk pack or Volume.
  - A group of DASDs of same type are connected together to form a string and are connected to a string controller.
  - Multiple string controllers are connected to a storage controller, which are in turn attached to channels.
  - Each type of DASD device requires two kinds of control units to attach it to a channel.

DASD Control Units

There are two types of DASD control units:

- String Controller:
  - It attaches a group of DASDs of same type, resulting into a string.
- Storage Control:
  - It connects up to 8 strings of DASD to a channel.

Diagram showing DASD Control Units



Concept of Data Communication Network

Data Communication Network allows local and remote terminals to access the computer systems.

Components of data communication are as follows:

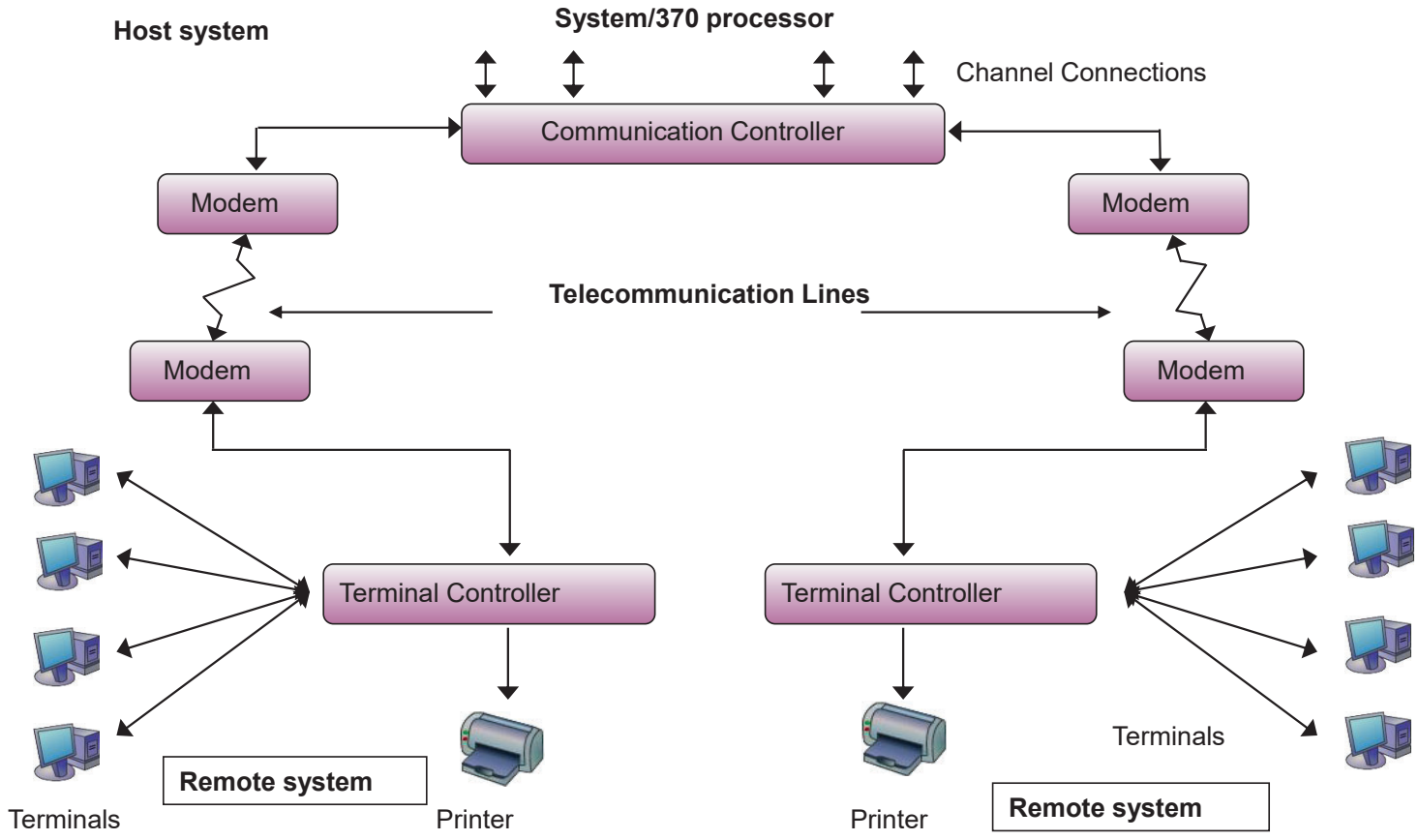
- Host Computer
- Communications Controller
- Terminal controller
- Modems and telecommunication lines (telephone line, Satellite Link)

Data Communication equipment lets an installation create a data communication network (or telecommunication network)

It lets users at local terminals (terminals at the computer site) and remote terminals (terminals that are not at the computer site) access a computer system.

4.6: Data Communication Network

A Diagrammatic Representation



Summary

In this lesson, you have learnt about:

- The typical mainframe system and its main components.
  - Processors is the main component
  - System/370 is a multiprocessing system.
  - Various I/O devices can be used like cards /punches, tapes and disk storage.
  - DASD is the disk storage that is used.
  - Remote communication can be achieved using the Communication device.

Review Question

Question 1: ___ is a specific unit of storage used in DASDs.

- Option 1: Volume
- Option 2: Memory
- Option 3: Cache

Question 2: DASD does not require any control unit to connect to processor.

- True / False

Question 3: The terminal controllers are attached to the ___ via modems.

- Option 1: Control Unit
- Option 2: Communication Controller
- Option 3: Terminals

Capgemini

Multiple Virtual Storage (MVS)

Lesson 05: MVS Concepts and Terminology

Lesson Objectives

In this lesson, you will learn:

- MVS concepts
- The concepts of
  - Address Space
  - Paging
  - Swapping

5.1: MVS Concepts

Overview

Two main component of MVS are:

- Virtual Storage
- Multiprogramming

In MVS, the concepts of Virtual storage and Multiprogramming are closely related.

In a way, they refer to the same functionality in MVS.

Let us see each of these components and understand what is MVS.

Concept of Virtual Storage

Virtual storage is a facility that simulates a large amount of main storage by treating DASDs storage as an extension of real storage.

In other words, when virtual storage is used, the processor appears to have more storage than it actually does.

Concept of Address Space

To search information in a location, an address is required that indicates storage location.

- An address space is a complete range of addresses that can be accessed by the computer.
- The number of digits allowed to represent an address limits the maximum size of a computer's address space.
- For example: Suppose a computer records its addresses using six decimal digits. Then such a computer can access storage with addresses from 0 to 999,999.

Main storage consists of millions of individual storage locations, each of which can store one character or byte of information.

- To refer to a particular location, we can use an address, which indicates the storage location's offset from the beginning of memory.
- The first byte of storage is at address 0, the second byte of storage is at address 1, and so on.
- Each successive byte of main storage has an address that is one greater than the previous byte of storage.

Concept of Address Space (contd.)

The original System/370 processors used 24-bit binary numbers to represent an address.

- Since the largest number that can be represented in 24 bits is about 16 million, an address space on a System/370 cannot contain more than 16M bytes of storage.

370-XA processors, in XA mode, operate using 31-bit addresses.

- So the largest address space that can be used is 2 GB.

Concept of Address Space(contd.)

One way to think of Virtual Storage is that it lets the computer push its address space to the maximum capacity allowed by the address format, even if the amount of real storage installed on the processor is less than the maximum capacity of the address format.

So, in 370-mode, virtual storage can simulate a 16 MB address space, even if only 4 MB or 8 MB of real storage is actually installed.

MVS Address Space

In MVS, the concept of virtual storage is taken one step further.

- MVS not only simulates more storage, but it also uses real storage to simulate several address spaces, each of which is independent of the other.
- Hence the name Multiple Virtual Storage (MVS).
- MVS uses real storage and areas of DASD storage, called page data sets, in combination to simulate several virtual storage address spaces.
- When multiple virtual storages are used, the total amount of virtual storage that can be simulated is almost limitless. This is because MVS can create an almost unlimited number of address spaces.
- However, the size of an address (24 bits or 31 bits) still limits the size of each individual address space to 16 MB or 2 GB.

MVS Address Space

Furthermore, various factors limit the number of address spaces that can be simulated. Some of them are:

- The speed of the processor
- The amount of real storage installed effectively

Although an MVS system can support more than one address space at a time, the CPU can access only one address space at a time.

5.4: MVS

MVS Address Space

When CPU is accessing instructions and data from a particular address space, that address space is said to be in control of the CPU. So the program in that address space will continue to execute until MVS intervenes and places the CPU in control of another address space.

Multiple virtual storage is how MVS implements multiprogramming.

Each background job or time sharing user is given its own address space.

MVS Address Space

So each job or user can access up to 16MB or 2GB of virtual storage independently of any other job or user on the system at the same time.

To pass control from one job or user to another, MVS transfers control of the CPU to the other job’s or user’s address space.

Then the CPU can access instructions and data in that address space until MVS is ready to pass control to a job or user in yet another address space.

Concept of Paging

The total amount of Virtual Storage that can be used under MVS is almost unlimited. As a result, the amount of real storage present on a particular machine is nearly always less than the amount of Virtual Storage being used.

To provide for a larger virtual storage, MVS treats DASD as an extension of real storage.

MVS divides virtual storage into 4K sections called pages.

Concept of Paging

Data is transferred between real and DASD storage one page at a time.

- Real storage is divided into 4K sections called page frames, each of which can hold one page of virtual storage.
- The DASD area used for virtual storage, called a page data set, is divided into 4K page slots, each of which can hold one page of virtual storage.

When a program refers to a storage location that is not in real storage, a page fault occurs.

Concept of Paging

When a page fault occurs:

- MVS locates the page that contains the needed data on DASD and transfers it into real storage. This operation is called a “page-in”.
  - In some cases, the new page can overlay data in a real storage page frame.
- Sometimes, data in a page frame has to be moved to a page data set to make room for the new page. That is called a “page-out”.

Concept of Paging

The real storage frames that contain those tables cannot be paged out. They must always remain in real storage as long as their associated address spaces are active.

Either way, “the process of bringing a new page into real storage is called paging”.

At any given moment, page frames in real storage contain pages from more than one address space.

MVS keeps track of the pages that are in particular page frames by maintaining tables that reflects the current status of real storage and of each address space.

5.5: Paging

Concept of Paging

The paging process is managed by several components of MVS. The three major components are:

- Real Storage Manager (RSM)
- Auxiliary Storage Manager (ASM)
- Virtual Storage Manager (VSM)

5.5: Paging

Concept of Paging

RSM:

- It manages real storage.
- It directs movements of pages among real and auxiliary.
- It builds segment and page table.

ASM:

- It keeps track of the contents of the page dataset and swap dataset.
- Page dataset contains virtual pages that are currently occupying a real storage frame.

Concept of Paging

VSM:

- It controls allocation / de-allocation of virtual storage.
- It maintains storage use information for Storage Management Facility (SMF).

5.6: Swapping

Concept of Swapping

Depending on the amount of real storage that a system has, and the types of jobs it is processing, MVS can efficiently multiprogram only a certain number of jobs at once.

So, using a process called swapping, MVS periodically transfers entire address spaces in and out of virtual storage. These address spaces are temporarily unavailable for processing.

Concept of Swapping (contd.)

When an address space is swapped out, its critical pages – the ones that contain the tables that keep track of the location of each virtual page for the address space – are written to a special data set called a swap data set.

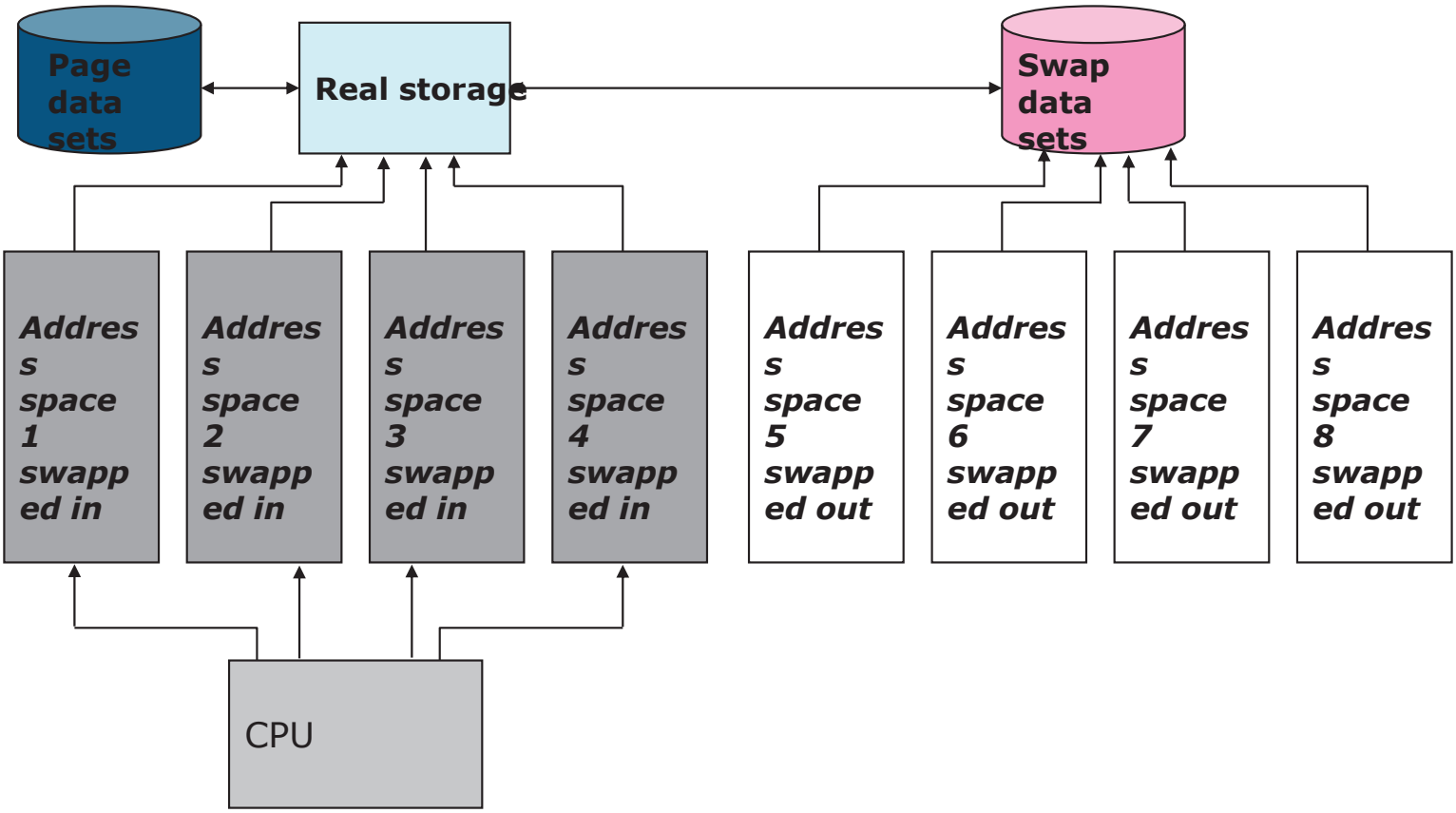
Later, when the system can accommodate the job again, the address space is swapped in so that it can be processed again.

Concept of Swapping(contd.)

The figure on the following slide depicts the following:

- Four address spaces are currently swapped in. The gray color indicates the address space that is currently in control.
- Four additional address spaces are swapped out. They cannot compete for virtual storage or the CPU until they are swapped in.

Concept of Swapping(contd.)



Concept of Swapping (contd.)

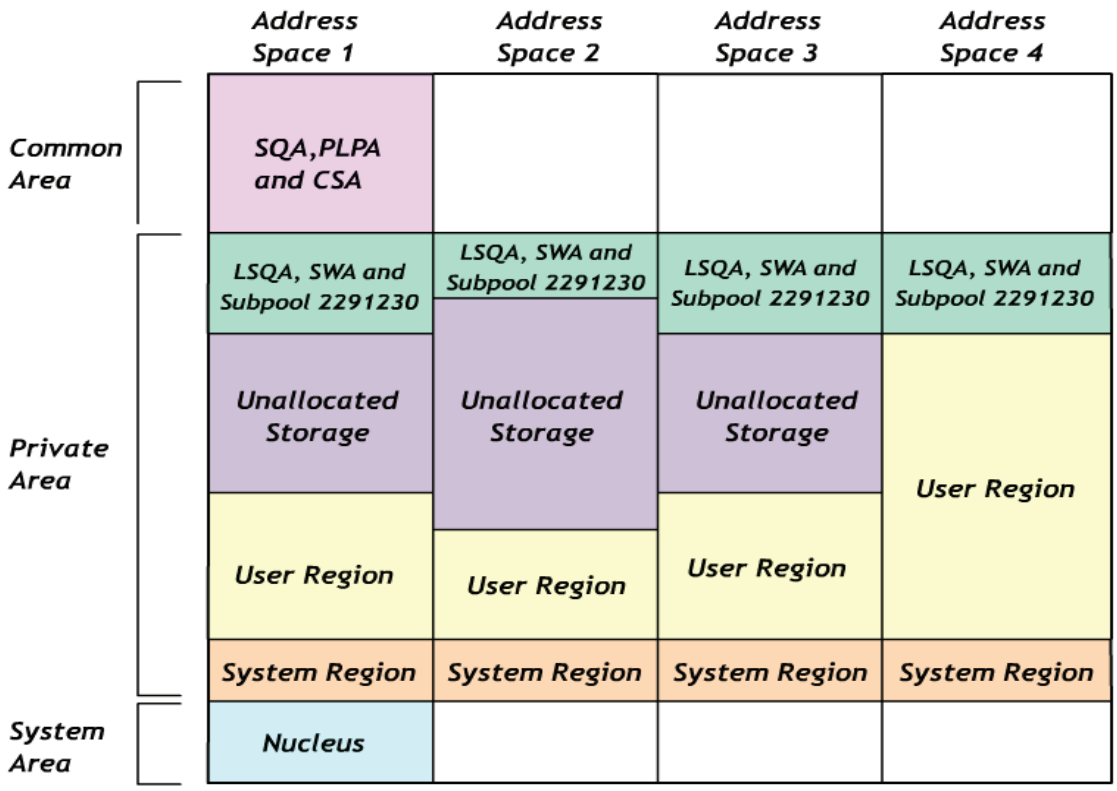
Swapping is same thing as paging, only at a higher level.

Rather than moving small 4K pieces of virtual storage in and out of real storage, swapping effectively moves entire address spaces in and out of virtual storage.

Since paging occurs only for address spaces that are currently in virtual storage, paging does not occur for address spaces that are swapped out.

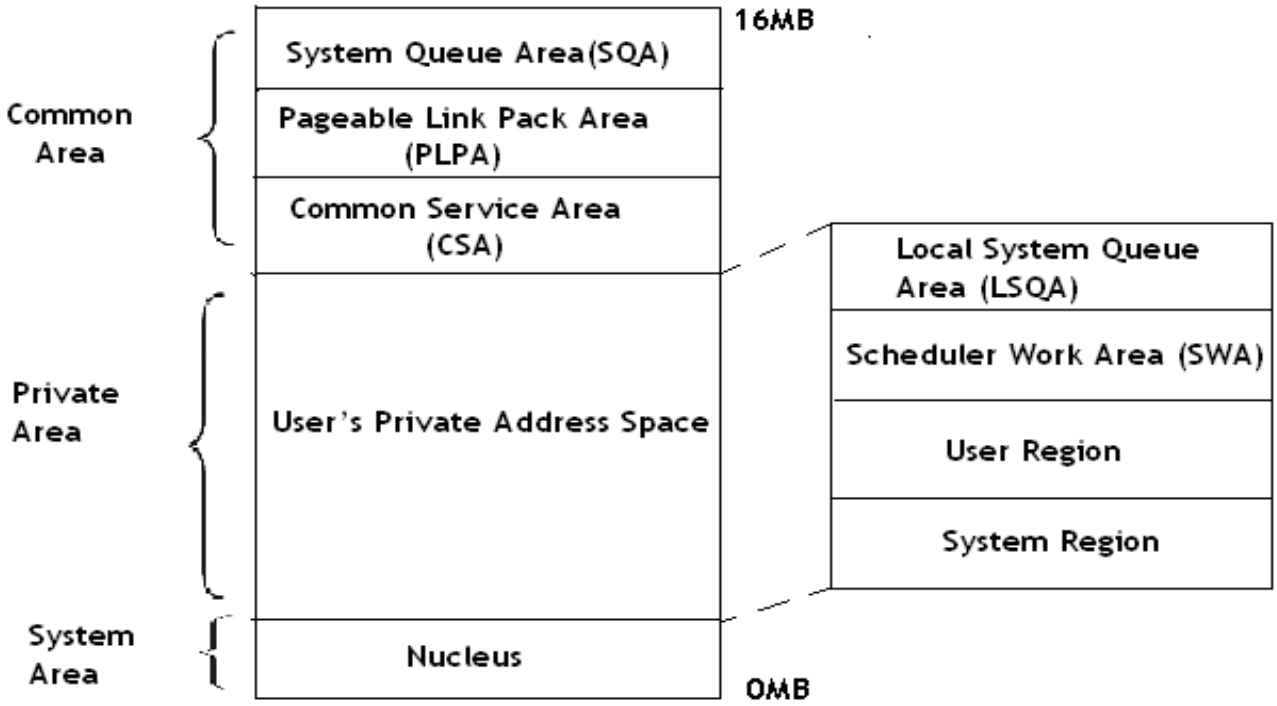
5.7: Virtual Storage Layout

Diagrammatic Representation



5.7: Virtual Storage Layout

Virtual Storage Address Space Areas



5.7: Virtual Storage Layout

Virtual Storage Address Space Areas

System Area:

- It contains the nucleus load module, page frame table entries, data blocks for system libraries, and so many other things
- It is always resident in the memory.
- Contains operating system programs and data
- These areas are shared by all address space on the system
- Resides at the low end of the address space
- Contains the MVS nucleus which among other things controls the operations of virtual storage paging and swapping

System Area

The entire system area must be resident at all times so it operates in real mode

It can’t be paged or swapped

Common Area

Common Area:

- It contains parts of the system control program, control blocks, tables, and data areas.
- System queue area(SQA) contains important system tables and data areas that are used by nucleus
- Sqa is fixed in real storage
- The common service area contains information that’s similar to information in sqa but that doesn’t have to be fixed in real storage

Common Area –Pageable Link Pack Area

Contains operating system programs that don’t have to be fixed in real storage in the nucleus.

Not fixed in real storage.

5.7: Virtual Storage Layout

Virtual Storage Address Space Areas

Private Area:

- The Private Area is made up of :
  - System Region
  - User Region
  - Scheduler Work Area (SWA)
  - Local System Queue Area (LSQA)

Private Area

Is the portion of address space that contains data that’s unique for each address space

Within each job’s or user’s private area there are 3 basic areas

At the bottom of the private area is system region an area of storage used by operating systems program that provide services for users program running in private area

LSQA

Local system area contains tables used to control private area including tables needed to manage the private area’s virtual storage

It’s LSQA that’s written to the swap dataset when an address space is swapped out.

Subpool 229/230 contains additional system Information.

Virtual Storage Address Space Areas

User Region:

- It is the space within Private Area that is available for running the user’s program.

Scheduler Work Area (SWA):

- SWA contains control blocks that exist from task initiation to task termination.
- The information in SWA is created when a job is interpreted and used during job initiation and execution.
- It is pageable and swappable.
- Contains tables used to manage the execution of jobs and program within private area

Demo

Demo on:

- The TSO Mainframe Environment
- ISPF menu

Summary

In this lesson, you have learnt about:

- Various MVS concepts:
  - Multiprogramming and Virtual Storage are two main feature in MVS.
  - Paging and Swapping are necessary to ensure that pages needed for execution are there in the main memory.
  - Address space in which the pages are stored in datasets.

Review Question: Match the Following

1. Address Space	a. Page frames
2. Multiprogramming	b. Address space
3. Virtual Storage	c. Jobs
4. Paging	d. Pages
5. Swapping	e. page datasets

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Multiple Virtual Storage (MVS)

Lesson 06: Data Management in MVS

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

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

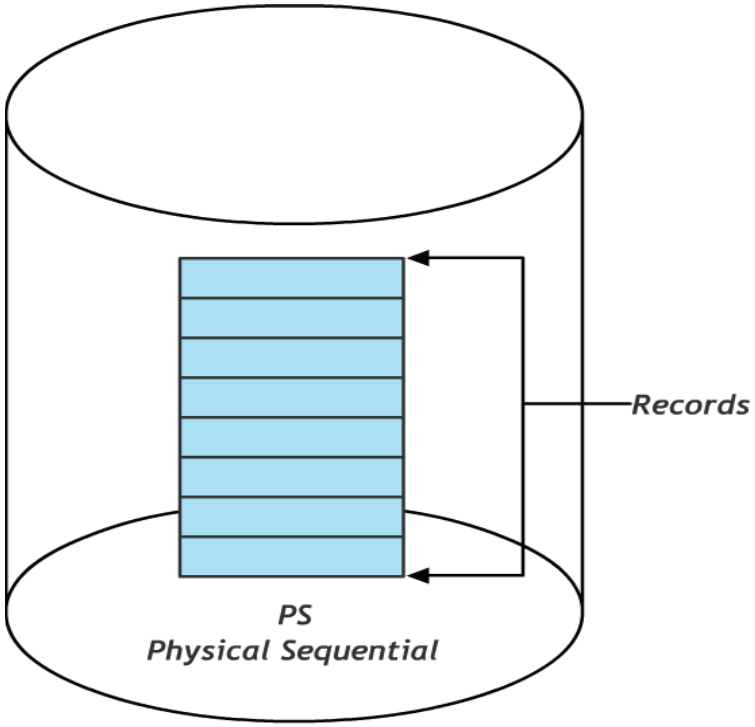
6.2: Dataset Organization

Concept of Non-VSAM Organization

Non-VSAM provides four basic methods of organizing data stored in datasets:

- Physical Sequential
- Indexed Sequential
- Direct
- Partitioned

PS Diagram



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.

Partitioned Dataset – Salient Features

Directory has an entry for each member in a PDS.

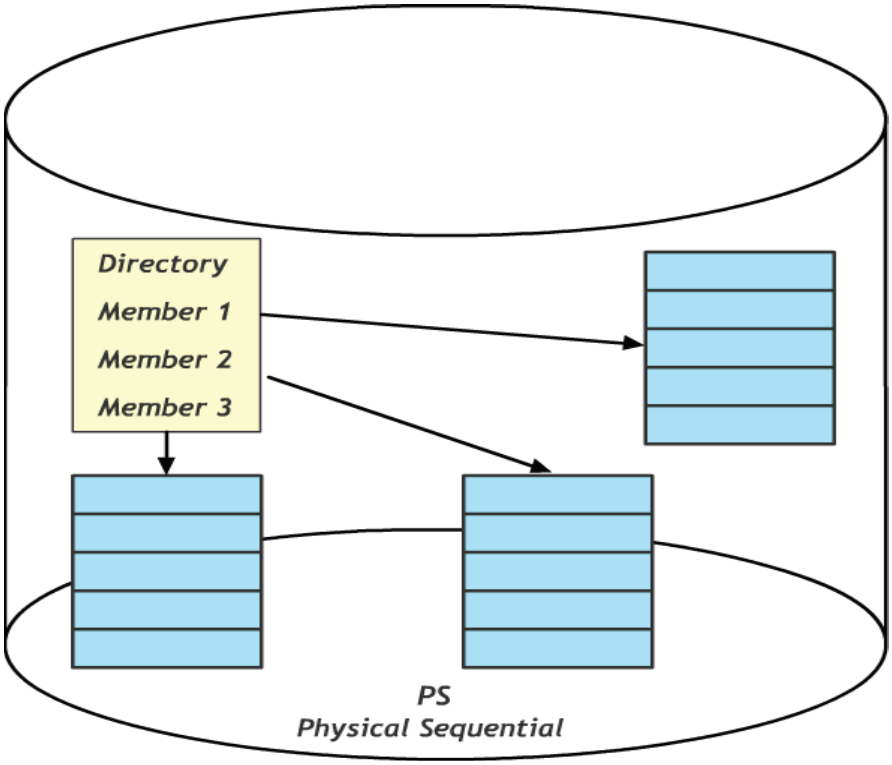
- Dataset name normally consists of three qualifiers called as:
  - PROJECT
  - GROUP
  - TYPE

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

6.2: Dataset Organization

PDS and PS Diagram



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.

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.

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

Types

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

- Labels
- Catalogs

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

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.

6.3: Dataset Tracking Mechanism

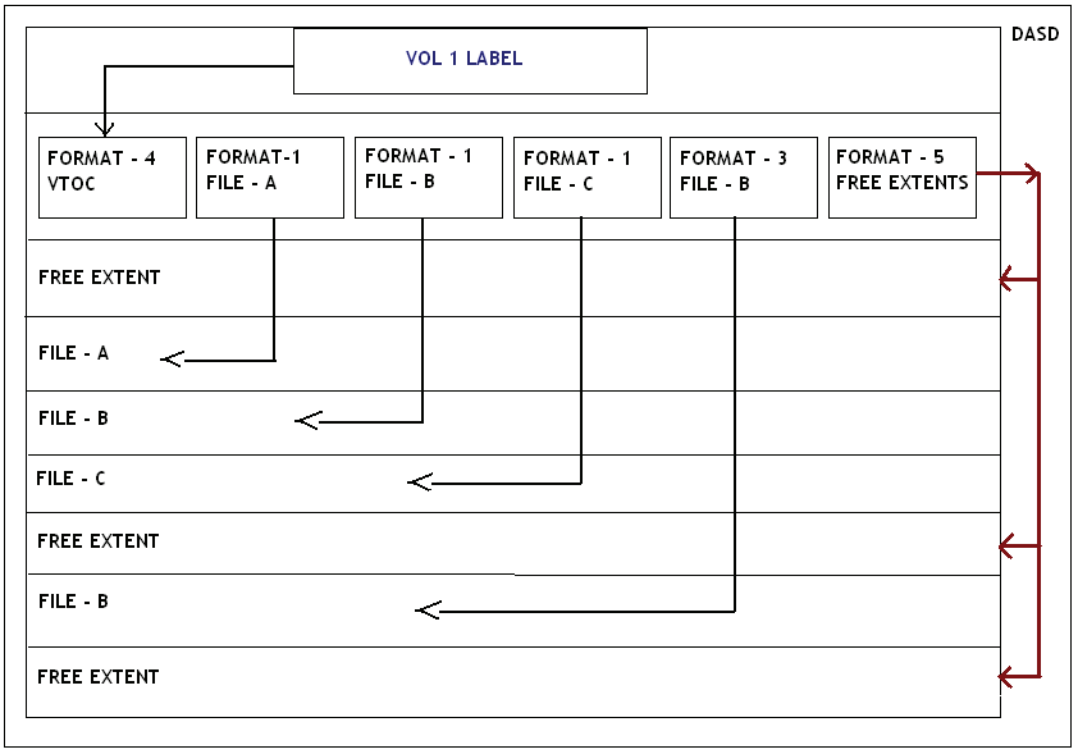
Label Processing - Dataset Label

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



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.

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)

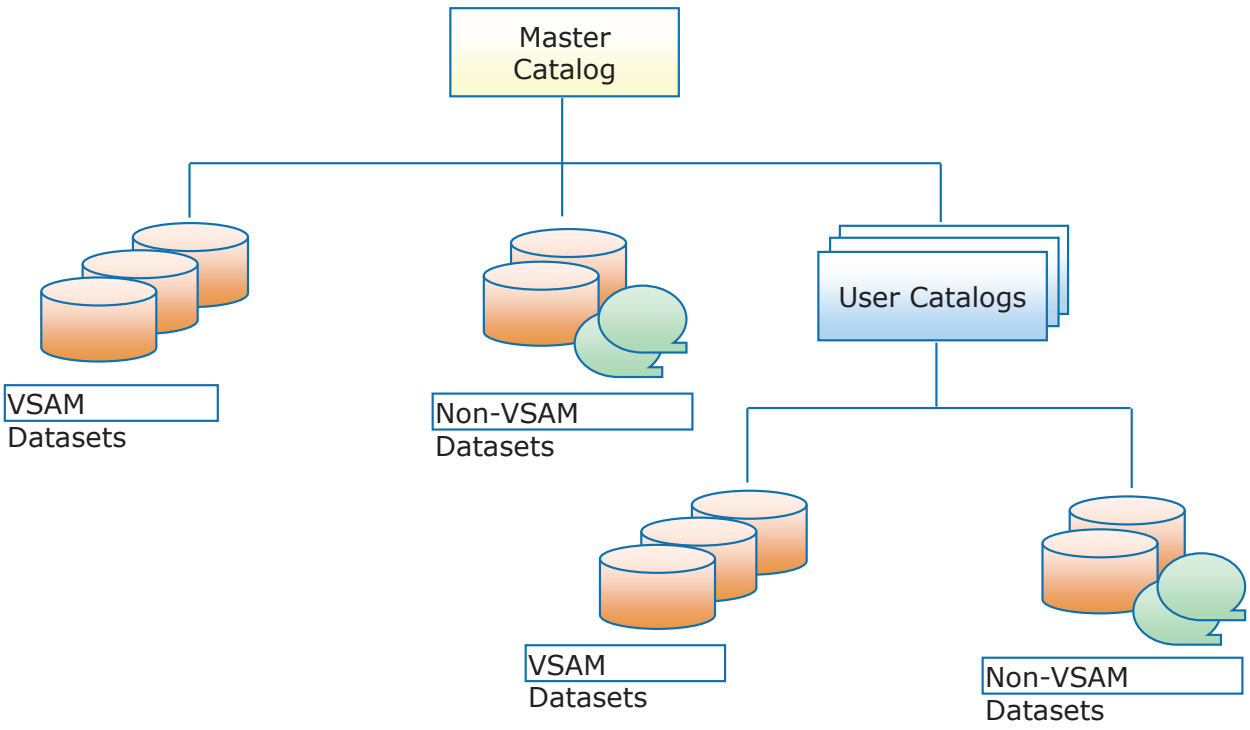
6.3: Dataset Tracking Mechanism

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.

Various Catalogs in MVS



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.

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

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

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

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.

Accessing Datasets in MVS - Processing

Processing:

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

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

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

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

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.

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Multiple Virtual Storage (MVS)

Lesson 07: MVS Tools Overview

Lesson Objectives

In this lesson, you will learn the following topics:

- Subsystems
  - JES
  - Channels
  - TSO/ISPF
  - CICS
  - DB2
  - IMS
  - RACF
- Working with TSO/ISPF

Subsystems & other facilities

- Some of the facilities available under MVS are also considered to be subsystems.

- SUBSYSTEM
  - A software product that operates in its own address space under the control of MVS.
  - May provide services that duplicate services provided by the operating system.

Subsystems

- JES
  - Job Entry System, controls the processing of the JOB.
- Channel
  - controls the path between the CPU and the I/O device.
- TSO & ISPF
  - TSO (Time-Sharing Option), lets terminal users invoke MVS facilities interactively.
  - Each TSO user is given a unique address space and can allocate data sets and invoke programs just as a batch job can.
  - ISPF (Interactive System Productivity Facility), runs as a part of TSO.
  - Takes the advantage of full screen capabilities of 3270 terminals.

Subsystems (Contd.)

- CICS
  - Customer Information Control System
  - Supports large network of terminals to run interactive application programs
- IMS
  - Information Management System.
  - Consists of two components: DB (DL/I) and DC
- DB2
  - DataBase 2.
  - Relational database management system

- RACF
  - Resource Allocation Control Facility
  - Provides the security feature on the mainframe

Use of TSO

- Time Sharing Option (TSO) is an interactive processing tool.
- It is used by the terminal user to interactively invoke MVS facilities.
- TSO internally treats each terminal user as a Job.
- Various TSO commands are available, thus providing a variety of functions.

7.1: TSO

Time Saring Option (TSO)

TSO User-id

- Not longer than 7 characters
- Can contain A-Z and 0-9
- First character must be alphabet

Password

- Maximum 8 characters
- Combination of letters and numerical
- First character must be alphabet

Time Sharing Option (TSO) Contd…

TSO FUNCTIONS

- Commands that provides a variety of functions can be used.
- Allow Dataset Management functions
- Program Development functions.
- Batch job functions.
- Other functions like Help, Broadcast, CLIST and REXX.
- You can issue these at the READY prompt or TSO command.

Demo

Logon to Mainframe

Usage of demo READY prompt on TSO region

Logoff from Mainframe

7.2: ISPF

Use of ISPF

ISPF stands for Interactive System Productivity Facility.

ISPF runs as part of TSO.

Following key functions are implemented using ISPF:

- **Editor:** Program Sources, Job Commands
- **Data Management:** PDS and Physical Sequential Data Set Management
- **Job Processing:** Initiate Job, Check job log
- Miscellaneous
- **PDF:** Program Development Facility is part of ISPF.

7.2: ISPF

Data Management Functions

Dataset Management functions

- Allocate Datasets dynamically
- List Datasets
- Print Datasets
- Copy Datasets
- Delete Datasets
- Rename Datasets
- List Catalog Entries
- List VTOC Entries
- Use AMS Services

7.2: ISPF

PDF & Batch Functions

Program Development functions

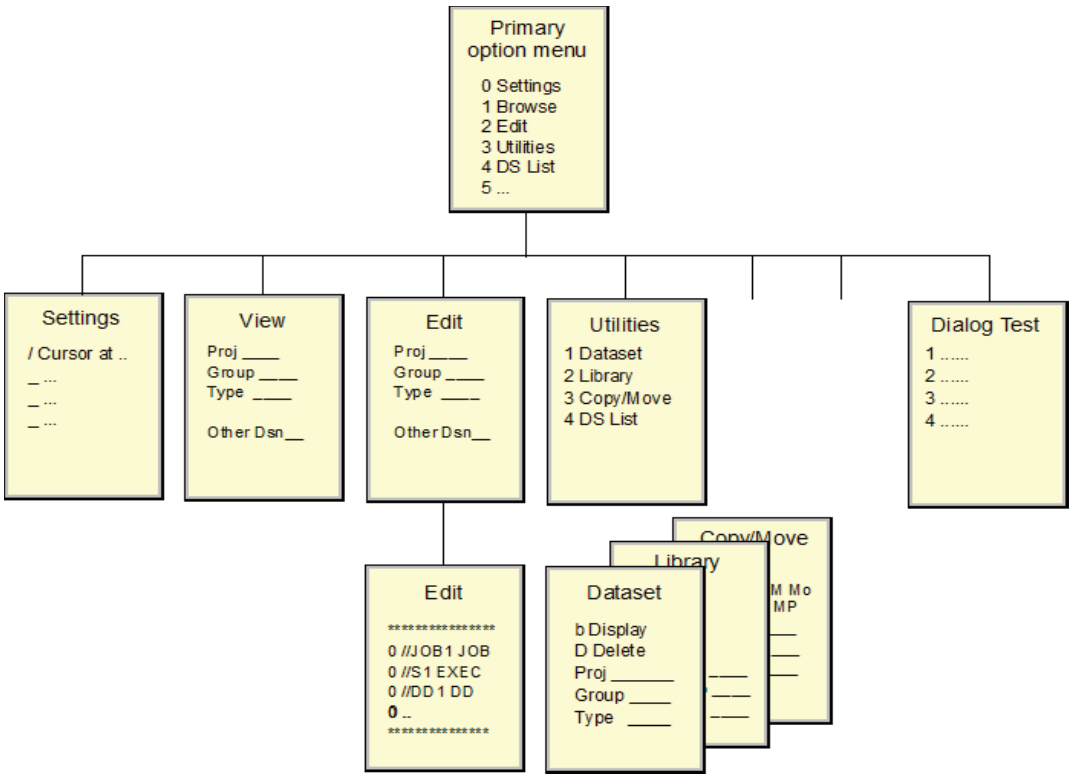
- Create program
- Edit program
- Compile program
- Linkedit a program
- View output
- Route output to a printer

Batch job functions

- Submit Jobs for background processing
- Monitor the progress of a background job
- View output
- Route output

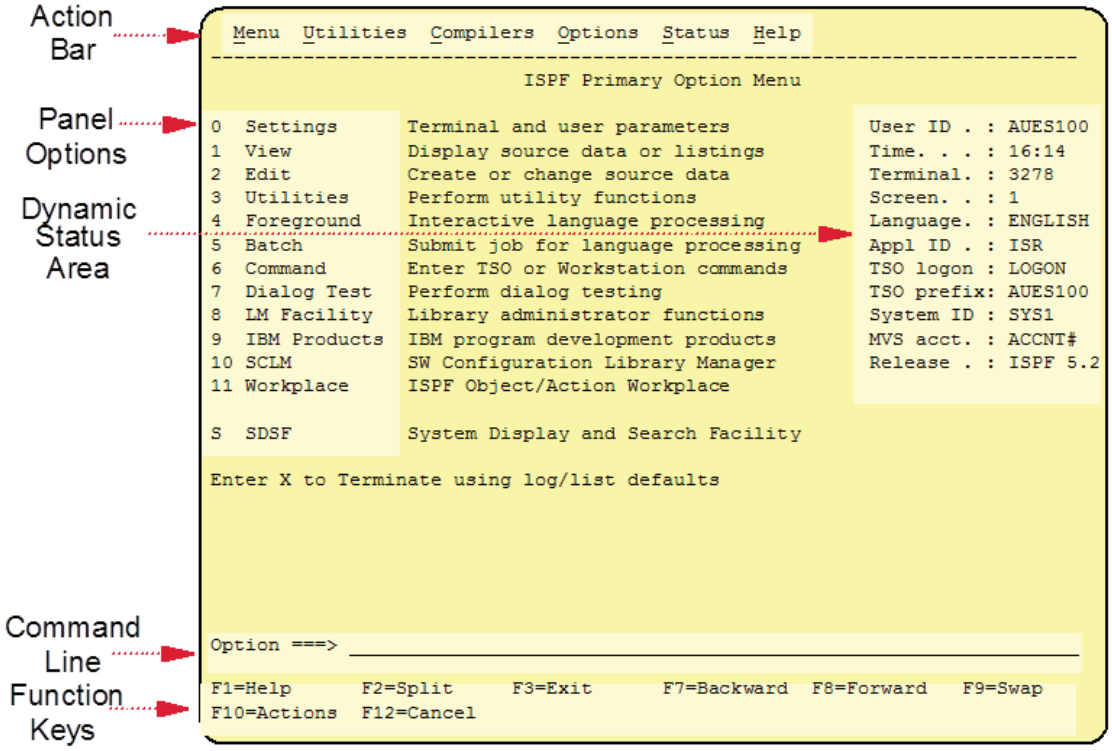
7.2: ISPF

ISPF Menu Structure



7.2: ISPF

General Structure of ISPF Panels



7.2: ISPF

List of Function Keys & Identifier Keys

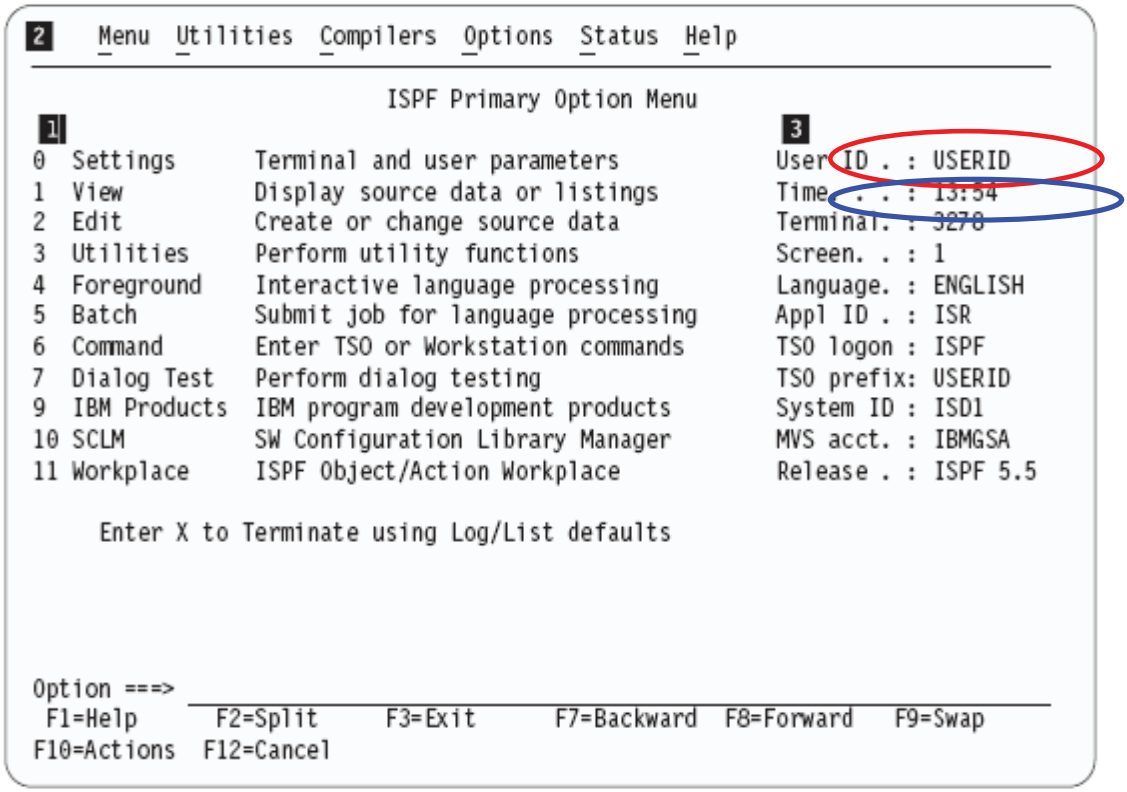
PA/PF Key Map

PF1 ===> HELP	Enter the Tutorial
PF2 ===> SPLIT	Enter Split Screen Mode
PF3 ===> END	Terminate the current operation
PF4 ===> RETURN	Return to primary options menu
PF5 ===> RFIND	Repeat find
PF6 ===> RCHANGE	Repeat Change
PF7 ===> UP	Move screen window up
PF8 ===> DOWN	Move screen window down
PF9 ===> SWAP	Activate the other logical screen in split screen mode
PF10 ===> LEFT	Scroll screen left
PF11 ===> RIGHT	Scroll screen right
PF12 ===> RETRIEVE	Retrieve last command
PA1 ===> ATTENTION	Interrupt Current operation
PA2 ==> RESHOW	Redisplay the current screen

PF1 - PF12 Keys may be duplicated from PF13 to PF24 in 24 key mode.

7.2: ISPF

Interactive System Productivity Facility (ISPF)



Interactive System Productivity Facility (ISPF) Contd…

Exiting from ISPF

- To terminate ISPF you can
- type =x at the command line
- or use the PF3 key to exit
- If you haven’t specified default dispositions for your List and log datasets then the termination panel is displayed

Interactive System Productivity Facility (ISPF) Contd…

Editing Datasets (Option 2)

- The Primary Editor entry is similar to that for Browse as regards concatenating datasets and dataset selection.
- Labels can be defined as in browse but may be entered as line commands.
- Error messages may be removed by typing RESET on the command line.

Scroll Amounts

- HALF Move the screen windows half a page (11 lines or 40 columns)
- PAGE Move the screen windows one page (22 lines or 80 columns)
- N Move the screen windows n lines or columns
- CSR Move the screen windows at the cursor position to top, bottom, left, right
- DATA Move the screen windows one line or one column less than a full page

7.2: ISPF

Line Commands

Standard Line editing commands

- C copy this line
- Cn Copy n lines starting with this line
- CC Copy a block of lines
- A Place the copied lines after this line
- An Repeat the copied lines n times after this line
- B Place the copied lines before this line
- Bn Repeat the copied lines n times before this line

- D Delete line
- Dn Deletes n lines starting with this line
- DD Deletes the block of lines beginning with the first DD commands and ending with the second DD command

7.2: ISPF

Line Commands

- X Exclude this line
- Xn Exclude n lines starting with this line
- XX Exclude a block of lines

- S Show one line of the excluded text
- Sn Show n lines

- F Show the first line of the excluded text
- Fn Show the first n lines

- L Show the last line of the excluded text
- Ln Show the last n lines

7.2: Tools

Line Commands

- I Insert a single line following this line
- In Insert n lines following this line

- M Move this line
- Mn Move n lines starting with this line
- MM Move a block of lines
- A Place the moved lines after this line
- An Repeat the moved lines n times after this line

- B Place the moved lines before this line
- Bn Repeat the moved lines n times before this line.

7.2: ISPF

Line Commands

- R Repeat this line
- Rn Repeat this line n times
- RR Repeat a block of lines
- RRn Repeat a block of lines n times

Shifting text source

Data shift	Column shift	Meaning
• <	(	Shift this line left 2 position
• <n	(n	Shift this line n position left
• <<	((	Shift a block of lines left
• < <n	((n	Shift a block of lines left
• >	)	Shift this line right 2 position
• >n	)n	Shift this line n position right
• >>	))	Shift a block of lines right
• >>n	))n	Shift a block of lines right

7.2: ISPF

Line Commands

- TE Text Edit
- TF Text Flow
- TS Text Split
- LC Lower Case
- UC Upper Case

Other Line Commands

- COLS Display column line
- TABS Setting up a tab positions
- MASKS Display a mask line. Used for repetitive insertion of information
- BOUNDS Display boundary line

7.2: ISPF

Primary Commands

Primary Commands/Command line commands

- CANCEL
- CAPS ON / OFF
- LOCATE To locate a dataset
- TSO SUBMIT To execute
- SORT Sorts the dataset list based on the fields shown on the next transparency
- FIND Finds occurrence of a string with the list of datasets
- SAVE DSN Saves the current dataset
- COPY COPY member [AFTER / BEFORE]
- CREATE CREATE [member]
- DELETE DELETE ALL
- EDIT EDIT [member Name]
- CHANGE CHANGE str1 str2 [range] ALL

7.2: ISPF

Primary Commands

Primary Commands

- FIND FIND str1
- HEX HEX ON / OFF
- LOCATE LOCATE [NUMBER]
- SAVE
- UNDO
- UNNUM
- RENUM
- RESET
- REPLACE REPLACE [memebr Name]

7.2: ISPF

DSLIST Commands

DSLIST Commands

- M Member list
- C Catalog a dataset
- D Delete a dataset
- E Edit a dataset
- F Free unused space in a dataset
- I Display information for a dataset
- M Display a member list
- P Print a dataset
- R Rename a dataset
- S Display a shortened version of dataset information

7.2: ISPF

DLIST Commands

DSLIST Commands

- U Uncatalog a dataset
- X Print a dataset indexed listing
- Z Compress a dataset
- = Repeat the last command

MEMBER SELECTION LIST Commands

- S Select Member
- D Delete Member
- B Browse Member
- E Edit Member

7.2: ISPF

ISPF Main Menu

TSO / ISPF MAIN Menu

```
          ---------------------- ISPF/PDF PRIMARY OPTION MENU ---------------
---------

OPTION  ===> pfshow
                                                                        USERID
- iGTRN01
   0  ISPF PARMS      - Specify terminal and user parameters     TIME    - 06:58
   1  BROWSE          - Display source data or output listings
            TERMINAL - 3278
   2  EDIT            - Create or change source data             PF KEYS  - 12
   3  UTILITIES       - Perform utility functions
   4  FOREGROUND      - Invoke language processors in foreground
   5  BATCH           - Submit job for language processing
   6  COMMAND         - Enter TSO Command, CLIST, or REXX exec
   7  DIALOG TEST     - Perform dialog testing
   8  LM UTILITIES    - Perform library administrator utility functions
   9  IBM PRODUCTS    - Additional IBM program development products
  10  SCLM            - Software Configuration and Library Manager
   C  CHANGES         - Display summary of changes for this release
   T  TUTORIAL        - Display information about ISPF/PDF
   X  EXIT            - Terminate ISPF using log and list defaults
   D  DATACENTER      - Perform Datacenter Defined Functions
   S  SDSF            - Spool Display and Search Facility
   U  USER            - Perform User Defined Functions
 F1=HELP    F2=SPLIT    F3=END     F4=RETURN   F5=RFIND    F6=RCHANGE
 F7=UP      F8=DOWN     F9=SWAP    F10=LEFT    F11=RIGHT   F12=RETRIEVE
```

7.2: ISPF

ISPF Utilities Menu

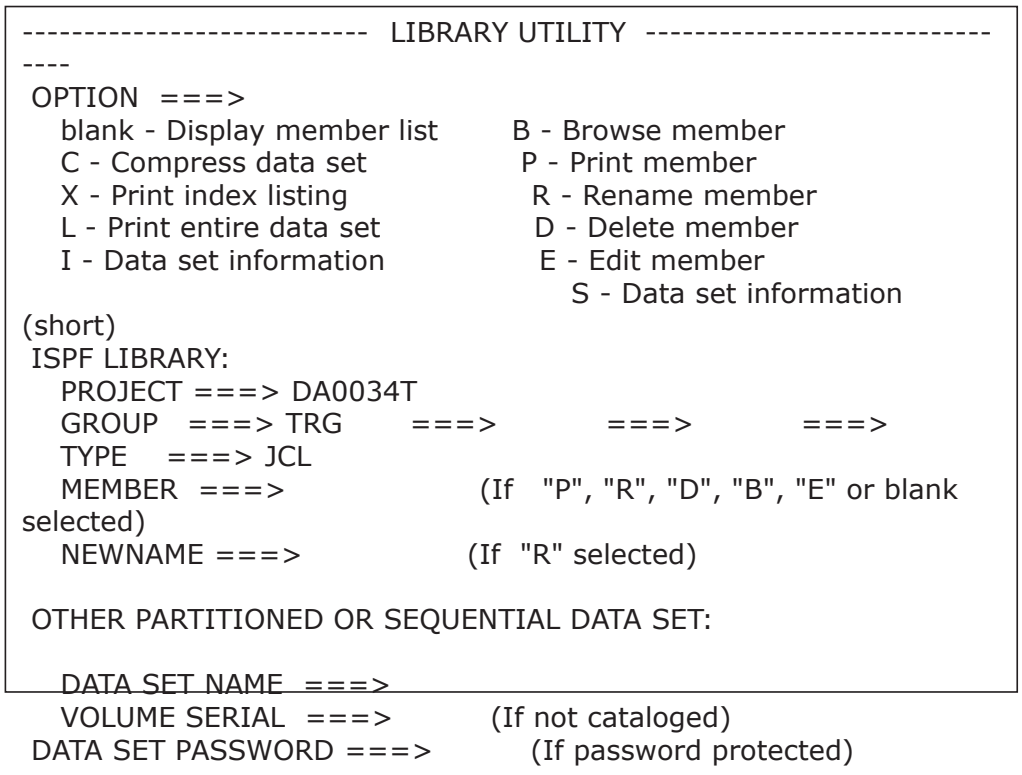
ISPF Option 3

```
------------------------  UTILITY SELECTION MENU  ----------------------------
 OPTION  ===>
    1  LIBRARY          -  Compress or print data set.  Print index listing.
                          Print, rename, delete, browse, or edit members
    2  DATASET          - Allocate, rename, delete, catalog, uncatalog, or
                          display information of an entire data set
    3  MOVE/COPY   - Move, copy, or promote members or data sets
    4  DSLIST           - Print or display (to process) list of data set names
                         Print or display VTOC information
    5  RESET            - Reset statistics for members of ISPF library
    6  HARDCOPY    - Initiate hardcopy output
    8  OUTLIST          -     Display, delete, or print held job output
    9  COMMANDS         - Create/change an application command table
   10  CONVERT          - Convert old format menus/messages to new format
   11  FORMAT           - Format definition for formatted data Edit/Browse
   12  SUPERC           - Compare data sets  (Standard Dialog)
   13  SUPERCE          - Compare data sets and Search-for strings (Extended
Dialog)
   14  SEARCH-FOR - Search data sets for strings of data (Standard Dialog)
```

7.2: ISPF

ISPF Utilities Menu

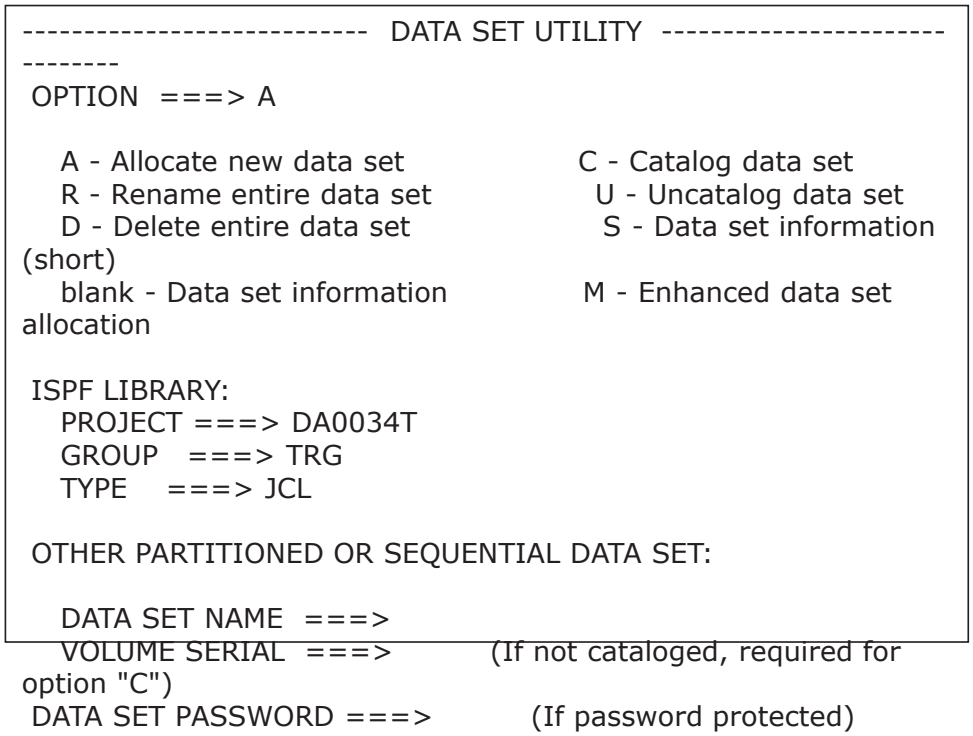
ISPF Library Utility (Option 3.1)



7.2: ISPF

ISPF Utilities Menu

ISPF Dataset Utility (Option 3.2)



7.2: ISPF

ISPF Utilities Menu

New dataset allocation (option 3.2.A)

```
----------------------  ALLOCATE NEW DATA SET  -----------------------------
 COMMAND ===>
 DATA SET NAME: DA0034T.TRG.JCLS
    VOLUME SERIAL              ===> BS3008     (Blank for authorized default
volume)
    GENERIC UNIT               ===>              (Generic group name or unit
address)
    SPACE UNITS                ===> BLOCK     (BLKS, TRKS, or CYLS)
    PRIMARY QUANTITY          ===> 26          (In above units)
    SECONDARY QUANTITY     ===> 12          (In above units)
    DIRECTORY BLOCKS          ===> 0           (Zero for sequential data set)
    RECORD FORMAT              ===> FB
    RECORD LENGTH              ===> 150
    BLOCK SIZE                   ===> 1500
    EXPIRATION DATE            ===>          (YY/MM/DD, YYYY/MM/DD
                  YY.DDD, YYYY.DDD in Julian form  DDDD for retention period in
days or blank)
                              ( * Only one of these fields may be specified)
```

7.2: ISPF

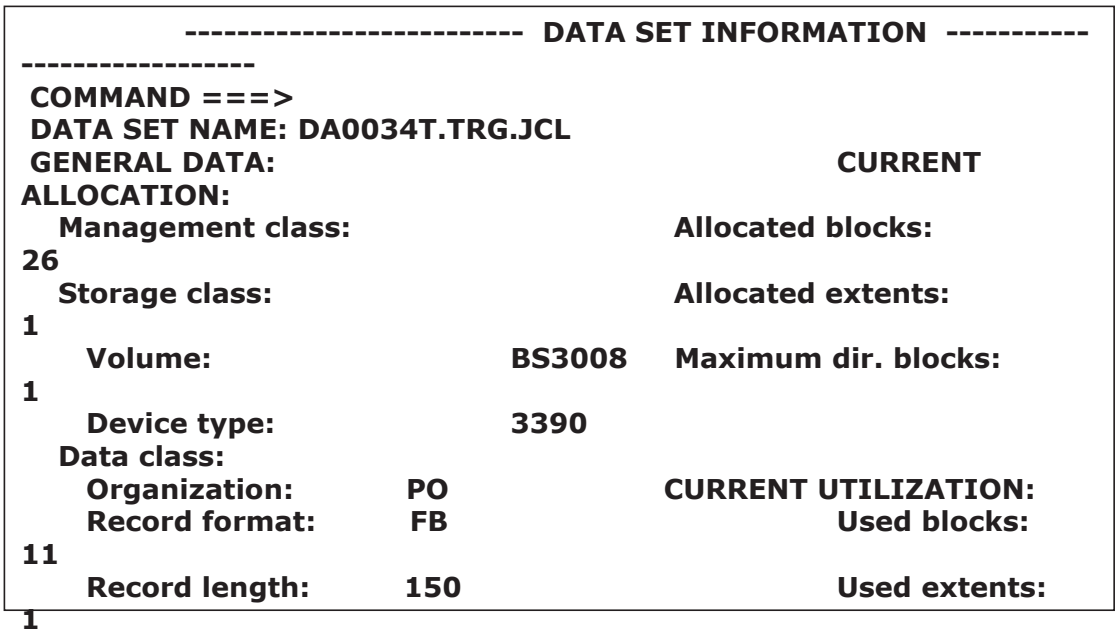
ISPF Utilities Menu

Renaming Dataset (Option 3.2.R)

```
---------------------------  RENAME DATA SET  ----------------
----------------
 COMMAND ===>

 DATA SET NAME: DA0034T.TRG.JCL
 VOLUME:        BS3008
 ENTER NEW NAME BELOW:     (The data set will be
recataloged.)

 ISPF LIBRARY:
    PROJECT ===> DA0034T
    GROUP   ===> TRG
    TYPE    ===> JCL

 OTHER PARTITIONED OR SEQUENTIAL DATA SET:
    DATA SET NAME  ===>
```

ISPF Utilities Menu

Dataset information (Option 3.2.s)



```
          ------------------------- DATA SET INFORMATION -----------
------------------
 COMMAND ===>
 DATA SET NAME: DA0034T.TRG.JCL
 GENERAL DATA:                                        CURRENT
ALLOCATION:
   Management class:                    Allocated blocks:
26
   Storage class:                       Allocated extents:
1
      Volume:                  BS3008    Maximum dir. blocks:
1
      Device type:             3390
   Data class:
      Organization:          PO          CURRENT UTILIZATION:
      Record format:         FB                Used blocks:
11
      Record length:         150               Used extents:
1
      Block size:           1500                Used dir.
blocks:              1
      1st extent blocks:      26               Number of
members:           5
      Secondary blocks:       12
      Data set name type:   PDS
      Creation date:        1996/08/08
```

7.2: ISPF

ISPF Utilities Menu

Allocate datasets managed by SMS

```
          ------------------------  ALLOCATE NEW DATA SET  -----------------------------
 COMMAND ===>
 DATA SET NAME: DA0034T.TRG.JCL
   MANAGEMENT CLASS       ===> MCSTANDS          (Blank for default management
class)
   STORAGE CLASS          ===> SCNORM            (Blank for default storage
class)
   VOLUME SERIAL           ===>                  (Blank for authorized default
volume)
   DATA CLASS              ===>                  (Blank for default data class)
   SPACE UNITS            ===> BLOCK             (BLKS, TRKS, CYLS, KB, MB or
BYTES)
   PRIMARY QUANTITY        ===> 26                          (In above units)
   SECONDARY QUANTITY     ===> 12                          (In above units)
   DIRECTORY BLOCKS       ===> 1                 (Zero for sequential data set) *
   RECORD FORMAT          ===> FB
   RECORD LENGTH           ===> 150
   BLOCK SIZE              ===> 1500
   DATA SET NAME TYPE     ===> PDS                         (LIBRARY, PDS, or
blank)      *
   EXPIRATION DATE         ===>                  (YY/MM/DD, YYYY/MM/DD
                                                 YY.DDD, YYYY.DDD in Julian
form

                                                 DDDD for retention period in
days

                                                 or blank)
```

7.2: ISPF

ISPF Utilities Menu

Move / Copy (Option 3.3)

```
---------------------------  MOVE/COPY UTILITY  ---------------------
----------
 OPTION  ===>
    C - Copy data set or member(s)                 CP - Copy and
print
    M - Move data set or member(s)                 MP - Move and
print
    L - Copy and LMF lock member(s)               LP - Copy, LMF
lock, and print
    P - LMF Promote data set or member(s)      PP - LMF Promote
and print

 SPECIFY "FROM" DATA SET BELOW, THEN PRESS ENTER KEY

 FROM ISPF LIBRARY:        ------ Options C, CP, L, and LP only -----
--
    PROJECT   ===> DA0034T
    GROUP      ===> TRG       ===>          ===>          ===>
    TYPE        ===> JCL
    MEMBER   ===>                (Blank or pattern for member
selection list,
                              '*' for all members)
 FROM OTHER PARTITIONED OR SEQUENTIAL DATA SET:
    DATA SET NAME       ===>
    VOLUME SERIAL       ===>          (If not cataloged)
 DATA SET PASSWORD ===>          (If password protected)
```

7.2: ISPF

ISPF Utilities Menu

Move / Copy (Option 3.3)

```
COPY --- FROM DA0034T.TRG.JCL ----------------------------------------------
-
 COMMAND ===>

 SPECIFY "TO" DATA SET BELOW.

 TO ISPF LIBRARY:
    PROJECT ===> DA0034T
    GROUP     ===> TRG
    TYPE        ===> JCL

 TO OTHER PARTITIONED OR SEQUENTIAL DATA SET:
    DATA SET NAME  ===>
    VOLUME SERIAL  ===>         (If not cataloged)
 DATA SET PASSWORD ===>          (If password protected)

 "TO" DATA SET OPTIONS:
    IF PARTITIONED, REPLACE LIKE-NAMED MEMBERS ===> YES    (YES or
NO)
    IF SEQUENTIAL, "TO" DATA SET DISPOSITION           ===> OLD    (OLD
or MOD)
    SPECIFY PACK OPTION FOR "TO" DATA SET              ===>   (YES, NO or
blank)
```

7.2: ISPF

ISPF Utilities Menu

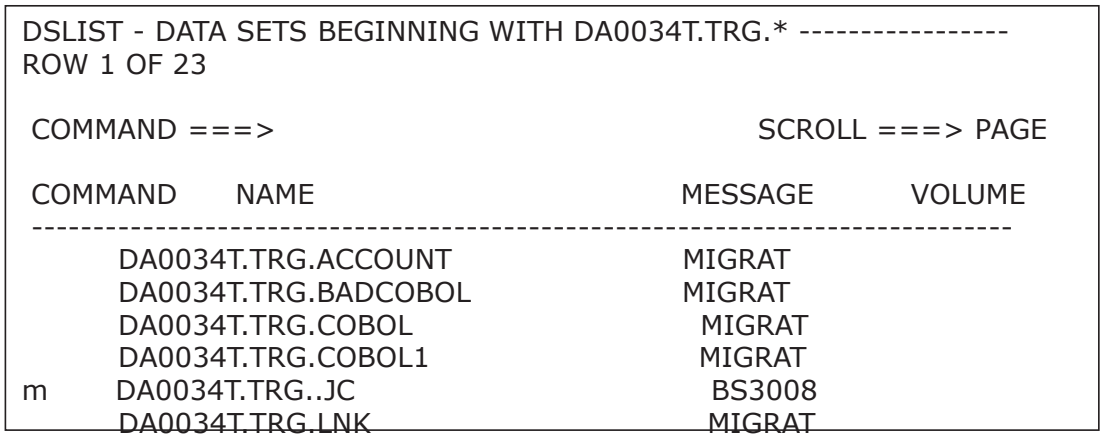
DSLIST Utility (Option 3.4)

```
          --------------------------- DATA SET LIST UTILITY ---------------
--------------

 OPTION  ===>

   blank - Display data set list *                P   - Print data set list
   V     - Display VTOC information only    PV - Print VTOC information
only

 Enter one or both of the parameters below:
   DSNAME LEVEL  ===> DA0034T.TRG.*
   VOLUME        ===>

   INITIAL DISPLAY VIEW     ===> VOLUME
(VOLUME,SPACE,ATTRIB,TOTAL)
   CONFIRM DELETE REQUEST   ===> YES      (YES or NO)
 * The following line commands will be available when the list is
displayed:

 B - Browse data set       C - Catalog data set       F - Free unused
space
 E - Edit data set         U - Uncatalog data set     = - Repeat last
command
 D - Delete data set       P - Print data set
 R - Rename data set       X - Print index listing
 I - Data set information  M - Display member list
```

7.2: ISPF

ISPF Utilities Menu

DSLIST Dataset Selection



Demo

Working with TSO and ISPF

Summary

In this lesson, you have learnt:

- TSO is a MVS component that lets terminal users access MVS facilities.
- ISPF runs under the control of TSO, provides program facility to manage background job-processing.
- RACF is used for security, VTAM is used for telecommunication, and CICS is used for interactive application development.

Review Question: Match the Following

1. VTAM	a. TSO
2. CICS	b. Security Package
3. RACF	c. Utility program
4. ISPF	d. TC Access Method
5. SORT	e. Interactive Applications

Capgemini

Multiple Virtual Storage (MVS)

Lesson 08: System Generation & Initialization

Lesson Objectives

In this lesson, you will learn the following topics:

- System Generation & Initialization
- System Datasets
- ISRDDN diagnostic utility

System Generation

System generation is the process of creating a Mainframe system

Distribution libraries -

- OS on a series of tapes

Sysgen

- In terms of macro instructions
- hardware configuration
- OS options to be installed
- creates a series of system libraries that hold OS code

System Initialization

- System initialization is the process of starting a previously generated system
- Initial Program Load (IPL) from sys control after sysgen
- Initialization can be automated without operator intervention by specifying options in SYS1.PARMLIB

System Datasets

- SYS1.NUCLEUS
  - PDS containing nucleus program
  - One of the members contains a pointer to the Master Catalog

- SYS1.PARMLIB
  - Options for initialization
  - Contains about 30 members that specify various options which is used during System initialization.

- SYS1.LINKLIB
  - Contains mostly OS executables
  - Contains executable programs that are written by users in COBOL.
  - These are not read into storage until they are required

System Datasets (Contd..)

- SYS1.LPALIB
  - Contains executable programs that are part of the operating system.
  - These are always available in storage for any program that needs them.

- SYS1.PROCLIB :
  - PDS containing JCL procedures
  - These can be used by any valid JCL user.

- SYS1.CMDLIB
  - Commands for TSO mode

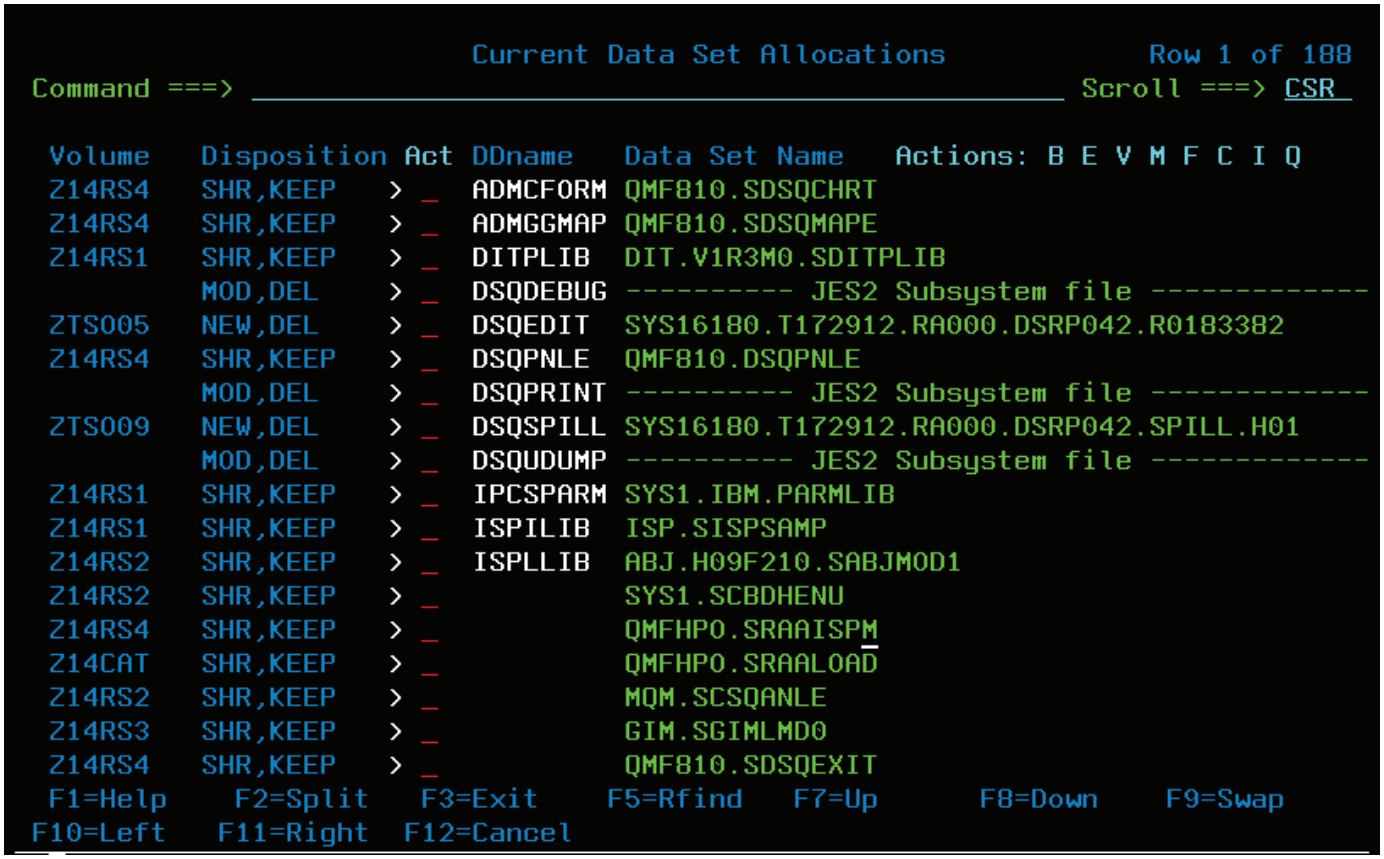
ISRDDN diagnostic utility

- ISRDDN is a utility, that provides a list of allocated DD names, a list of system ENQs, a list of data set causing ENQ contention, and a means of viewing storage within a TSO user's address space.

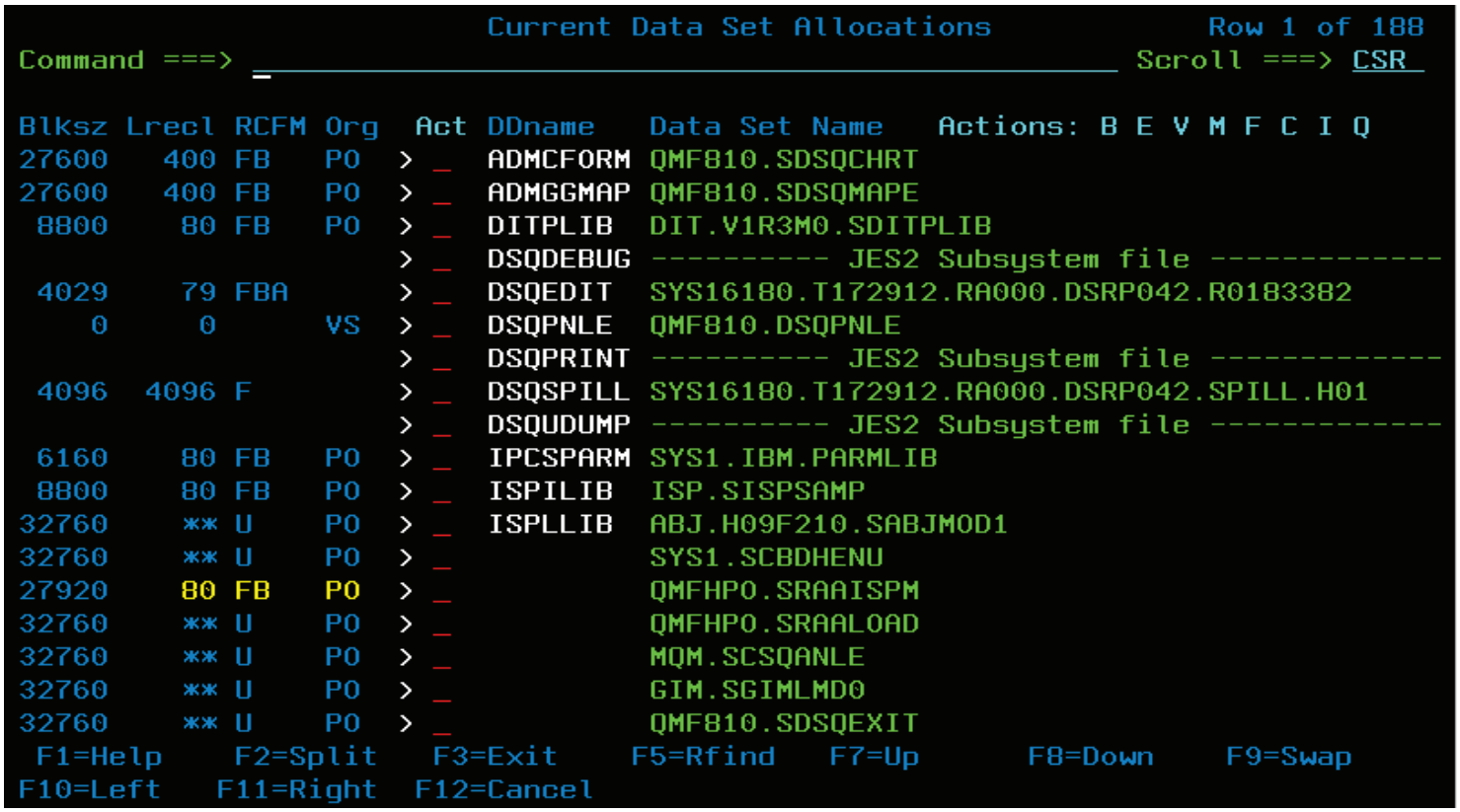
- ISRDDN is also used to provide some facilities to gather information about the environment, that we work on.

- To invoke the ISRDDN program, type TSO ISRDDN on any of the ISPF command line.

Current dataset allocation list



Data set attributes in ISRRDN



Summary

In this lesson, you have learnt:

- System generation & initialization
- System datasets

Review Question: Match the Following

1._____ is the process of creating a Mainframe system

2.Initialization can be automated by specifying options in _____

Capgemini

Multiple Virtual Storage (MVS)

Lesson 09: Job Management Overview

Lesson Objectives

In this lesson, you will learn the following topics:

- The basic concept and functions of Job
- Various stages of a Job
- Job Management
- Job Scheduling

Concept

- JOB:
  - A single unit of work in Batch Processing.
  - It is used to execute one or more programs / procedures as a series of steps.

- JOB STEP:
  - Each program to be executed by a Job is called a job step.

- JCL:
  - Job Control Language
  - The language used to code the job.

- JES:
  - An important Subsystem of MVS. It keeps track of jobs that enter the system, Presents them to MVS for processing. Sends spooled output to the correct destination.

Concept of Job Entry Subsystem (JES)

- Job Entry Subsystem (JES):
  - JES shares the load on the operating system.
  - It takes care of all inputs and outputs.
  - It does a simple basic syntax checking.
  - It performs resource Initialization.
  - It creates address space.
  - JES is also known as Job Scheduler.
  - It is classified into JES2 and JES3
  - Jobs are sent to MVS depending on the class priority schemes.

Job Management Functions

- Job Management Functions are listed below:
  - Receive the job into operating system
  - Schedule the job for processing by O/S
  - Execute the Job
  - Process the output

Stages of Job

- Various stages of a Job are as follows:
  - Job Preparation
  - Job Scheduling
  - Job Execution
  - End of execution (normal, erroneous)

Erroneous Termination of a Job

- Type of execution errors include the following:
  - Incorrect commands (command syntax errors)
  - Required resources (Data Sets, Program Library, Program Load Module) not available
  - Violation of access permissions for data sets, program load module, and so on.
  - Mismatch in data set status, as required by job and as it actually exists, for example: a create is issued for a data set which already exists.
  - Program errors
  - Mismatch for Dataset - between program definition and actual characteristics
  - Infinite loop
  - Data Type mismatch - numeric variable contains non-numeric data

- Any abnormal termination of program is called as “Abend”.

How does a Job enter into the System?

- To enter, or submit, the job into the system, the terminal user issues a SUBMIT command.

- When you submit the job, JES reads the job stream (sequence of JCL commands) from a DASD file and copies it to a job queue, which is a part of a special DASD file called JES SPOOL.

How is a Job Scheduled for Execution

- MVS does not necessarily process jobs in the order in which they are submitted.
  - Instead, JES examines the jobs in the job queue and selects the most important jobs for execution. That way JES can prioritize its work, giving preference to more important jobs.

- JES uses two characteristics to classify a job's importance, both of which can be specified in the job's JCL:
  - Job Class
  - Job Priority

How is a Job Scheduled for Execution?

- If two or more jobs are waiting to be executed, then the JES scheduler selects the one with higher priority.

- Each job class is represented by a single character, either a letter (A-Z) or a digit (0-9).
  - Job classes are assigned based on the processing characteristics of the job.

How is a Job Scheduled for Execution?...contd

- INITIATOR: An initiator is a program that runs in the system region of an address space.
  - Each initiator can handle one job at a time.
    - It examines the JES spool, selects an appropriate job for execution, executes the job in its address space, and returns to the JES spool for another job.
  - The number of active initiators on a system and as a result the number of address spaces eligible for batch job processing determine the number of batch jobs that can be multiprogrammed at once.

How is a Job Scheduled for Execution?...contd

Each initiator has one or more job classes associated with it. It executes jobs only from those classes.

Initiator	Eligible Job Classes
1	A
2	B,C,D,H,L,T
3	B,C,D,H,L,T
4	B,C
5	B,C
6	C

How is a Job Scheduled for Execution?...contd

- Within a job class, initiator selects jobs for execution based on their priorities, which can range from 0 to 15.
- If two or more jobs have same class and priority, then they are executed in the order in which they are submitted.

How is a Job Scheduled for Execution?...contd

- Once an initiator has selected a job for execution, it invokes a program called the interpreter.
- The interpreter's job is to examine the job information passed to it by JES and create a series of control blocks in the SWA, a part of the address space's private area.
- Control blocks describe all the datasets the job needs.

How is a Job Executed?

- Initiator goes through three phases for each step of job:
  1. Allocation (required resources are allocated)
  2. Processing (region is created and program is loaded and executed)
  3. De-allocation (resources are released)

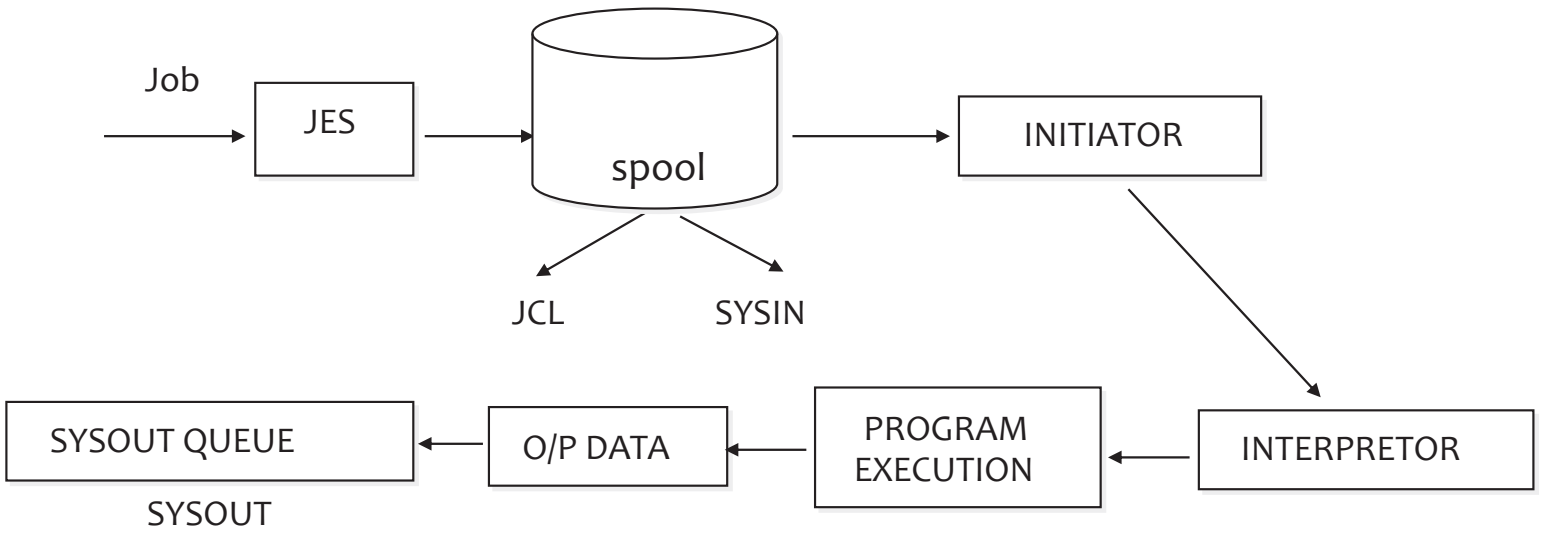
- This continues until there are no more job steps to process.

How is a Job Executed?

- Then, the initiator releases the job and searches the spool again for another job from the proper class to execute.

- As a user's program to execute, it can retrieve data that was included as part of job stream and stores in the JES spool.

How is a Job Executed?...contd



How is the Job’s Output Processed?

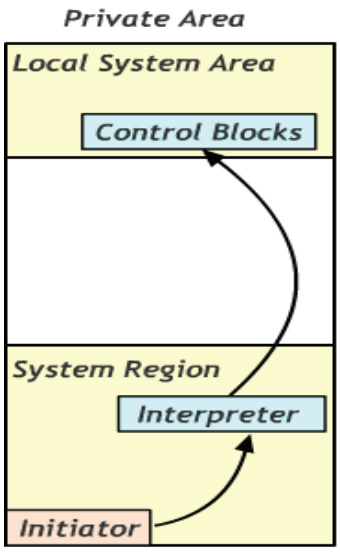
- Like Jobs, SYSOUT data is assigned an output class that determines how the output will be handled.

- Common O/P classes are as follows:
  - A : Printer
  - B : Card Punch O/P
  - X : Held O/P

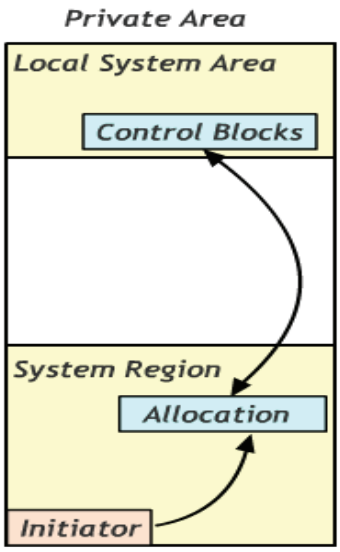
How is a Job Purged?

- After the job's output has been processed, the job is purged from the system.
  - That is to say, JES spool space, the job used, is freed so it can be used by other jobs, and any JES control blocks associated with the job are deleted.
- Once a job has been purged, JES no longer knows of its existence.

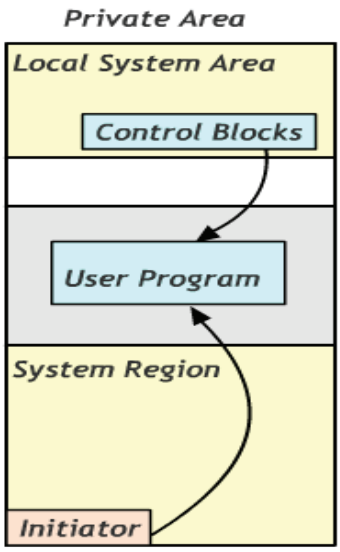
Overview of Allocation and Job Execution



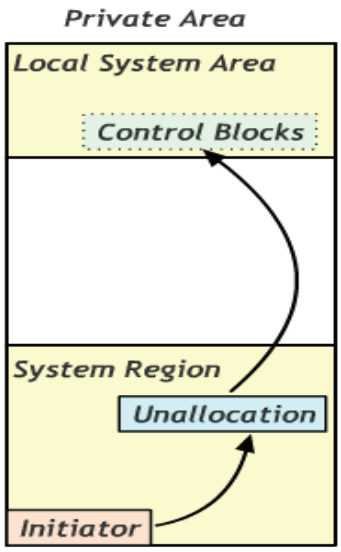
After the initiator selects a job for execution, it invokes the interpreter, which builds the required control blocks in the address space's SWA.



For each job step, the indicator invokes allocation routines to allocate the units, volumes, and data sets required by the job step.



After the job step's resources have been allocated, the initiator creates a user region, loads the user program into it, and transfers control to the user program.

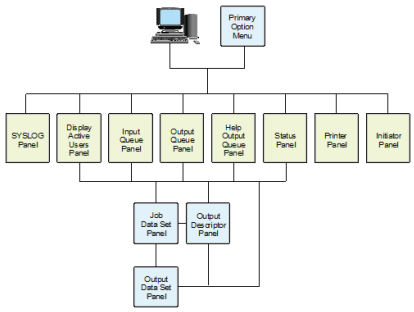


When the user program completes the initiator invokes unallocated routines to deallocate the resources used by the job step. Then if the job has more steps, the initiator repeats the allocation execution-unallocation process

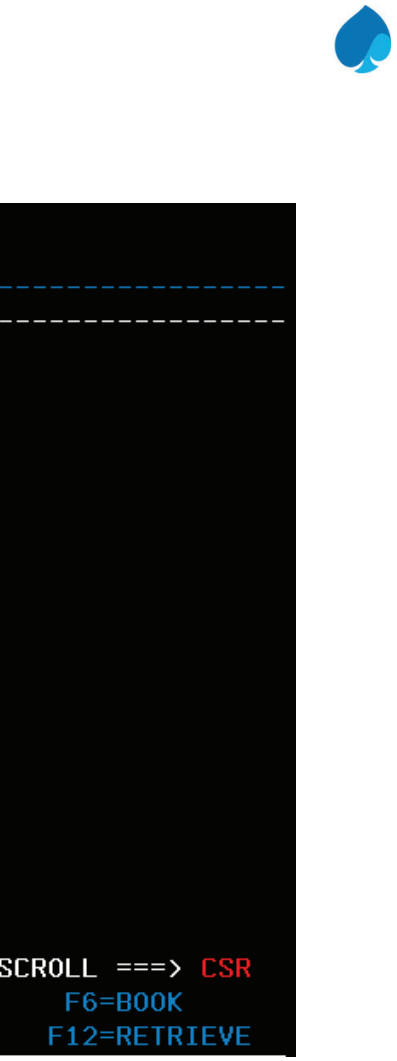
Using SDSF

- After submitting a job, Z/OS users use System Display and Search Facility (SDSF) to review the job output for successful completion or JCL errors.
- SDSF lets the users to:
  - View and search the system log
  - Enter system commands
  - Hold, release, cancel, and purge jobs
  - Monitor jobs while they are processed
  - Display job output before deciding to print it
  - Control the order in which jobs are processed
  - Control the order in which output is printed
  - Control printers and initiators

SDSF panel hierarchy



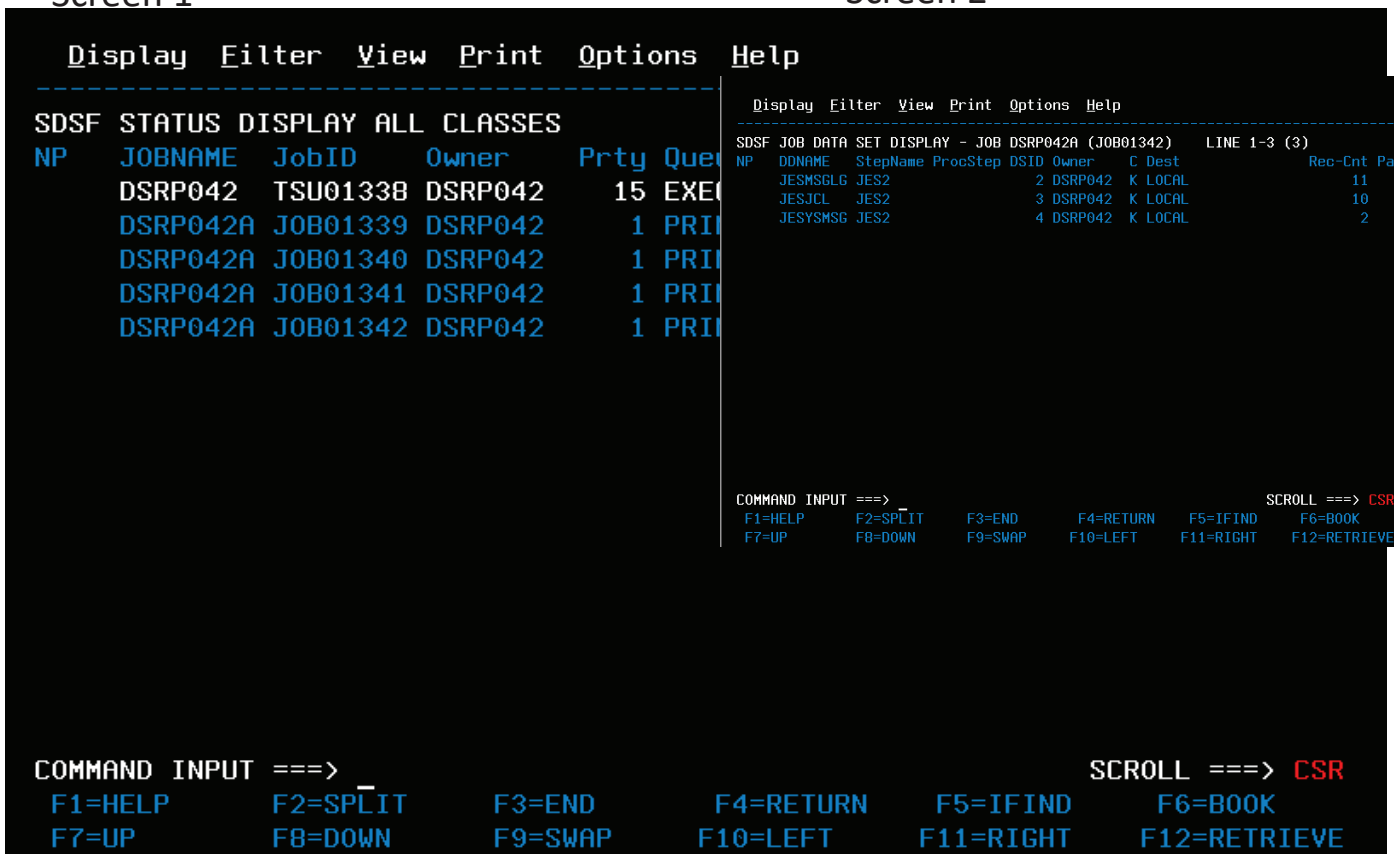
SDSF: Primary Option Menu



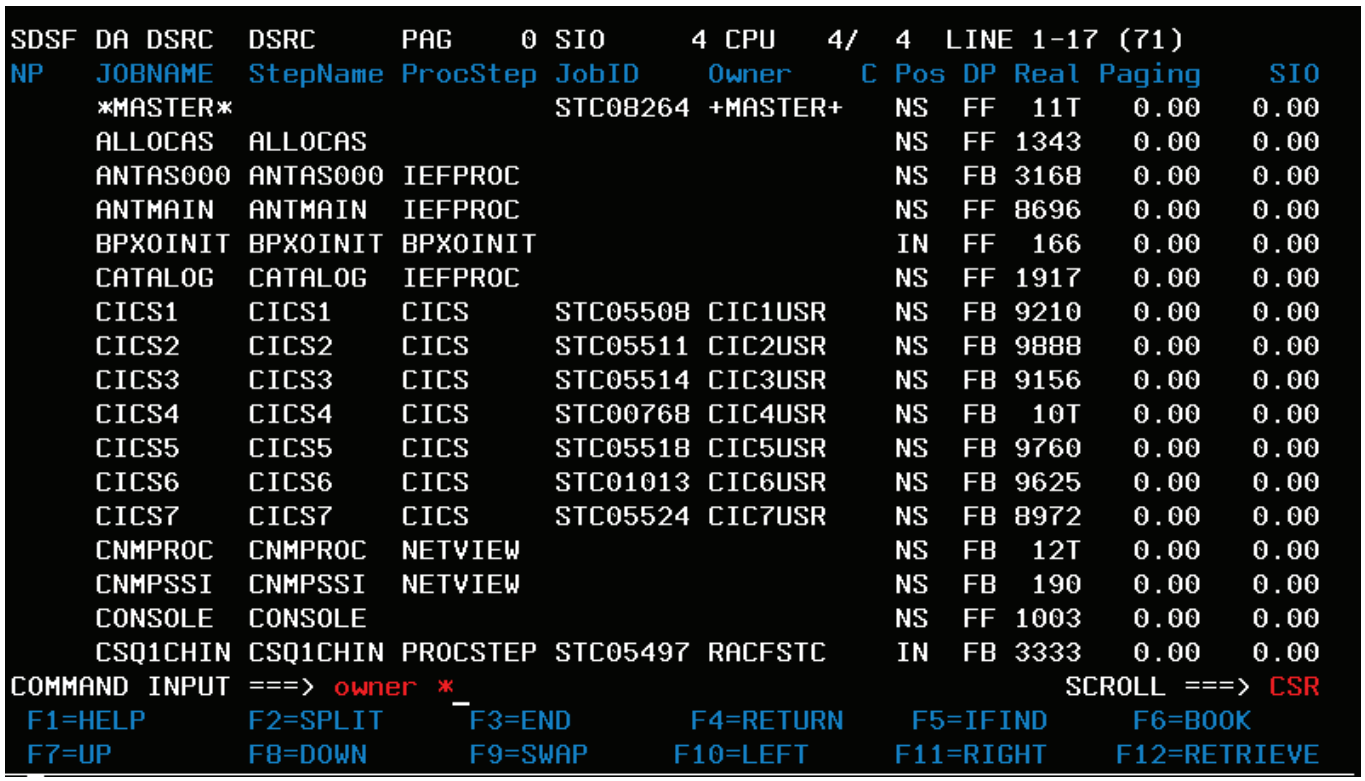
Viewing of JES2 output files

Screen 1

Screen 2



SDSF: Display active users (DA)



Demo

Demo on:

- COBOL program execution and JCL program
- Output of COBOL program

Summary

In this lesson, you have learnt:

- Job is an execution of one or more related programs in sequence.
- JCL is a file containing control statements that provide the specifications necessary to process a job.
- Job goes through various stages, such as:
  - Preparation
  - Scheduling
  - Execution
  - Termination

Review Question

Question 1: ____ selects job for execution.

- Option 1: Initiator
- Option 2: JES
- Option 3: Scheduler

Question 2: Job Output are always held.

- True/ False

Question 3: Job Priority ranges from ____ to ____.

Multiple Virtual Storage (MVS)

Lab Book

Document Revision History

Date	Revision No.	Author	Summary of Changes
22-Jun-05	Version: 1.01		Added screen shots for options 3.12, 3.13, 3.14 and 3.15
26-Oct-09	Version 2.0D	Padmaja Purandare	Added extra Lab assignment
03-Dec-09	Version 2.0	CLS Team	Review
18-Oct-10	Version 3.0	Vaishali Kasture	Review and Extra Assignments in Appendix
30-June-11	Version 4.0	Rajita Dhumal	Added some lab exercises after Integration
8th-Aug-12	Version 4.1	Rajita Dhumal	Revamped after Assignment Review

Table of Contents

Getting Started

Overview

This lab book is a guided tour for learning Mainframe Environment and setup. It comprises solved examples and 'To Do' assignments. Follow the steps provided in the solved examples and work out the 'To Do' assignments given.

Setup Checklist for MVS

Here is what is expected on your machine in order for the lab to work.

Minimum System Requirements

- Intel Pentium 90 or higher (P166 recommended)
- Microsoft Windows 95, 98, or NT 4.0, 2k, XP.
- Memory: 32MB of RAM (64MB or more recommended)
- Mainframe Connectivity using the Passport Client (Pc-to-Host software)

Please ensure that the following is done:

- CA-Relia software is already installed
- Passport PC-to-Host Terminal Software is installed to connect to MF Server

Instructions

- Note the Mainframe userid (for example: DSRP002 or DSRB002) and password for connecting to mainframe environment which would be given by the faculty. Remember the Mainframe ID to be used from now onward through all the MF courses henceforth.

- Create any PDS or PS with the following naming convention
  <<Userid>>.<<yourname>>.<<pdsname>>
- For Creating PS
  <<Userid>>.<<yourname>>.<<psname>>

- All lab exercise will be kept in a proper PDS.

- Debug all the COBOL programs offline without using MF connectivity (Dry run using Notepad and/or word documents for Pseudo Code and/or Code generation) prior to uploading in mainframe environment and check all programs are error and warning free.

Learning More (Bibliography if applicable)

- MVS JCL by Doug Lowe

- OS/VS2 MVS OVERVIEW by IBM
- THE MVS PRIMER by David Shelby Kirk
- EXPERT MVS/XA JCL by Caranthsis Mani
- MVS JCL, 2/ED. By Doug Lowe

Lab 1. Mainframe Environment

Goals	• Logging in the mainframe environment. • Understand the TSO and the different ISPF menus
Time	15 Minutes

1.1: Logging in the mainframe environment.

Login to Mainframe Environment using Passport Client Software.

Solution:

Step 1: From the Start menu navigate to Programs → Passport Client → Passport PC-to-Host.

Step 2: Key in the **IP host name** (Get it from the faculty). Once IP is entered, the IBM mainframe will be connected.

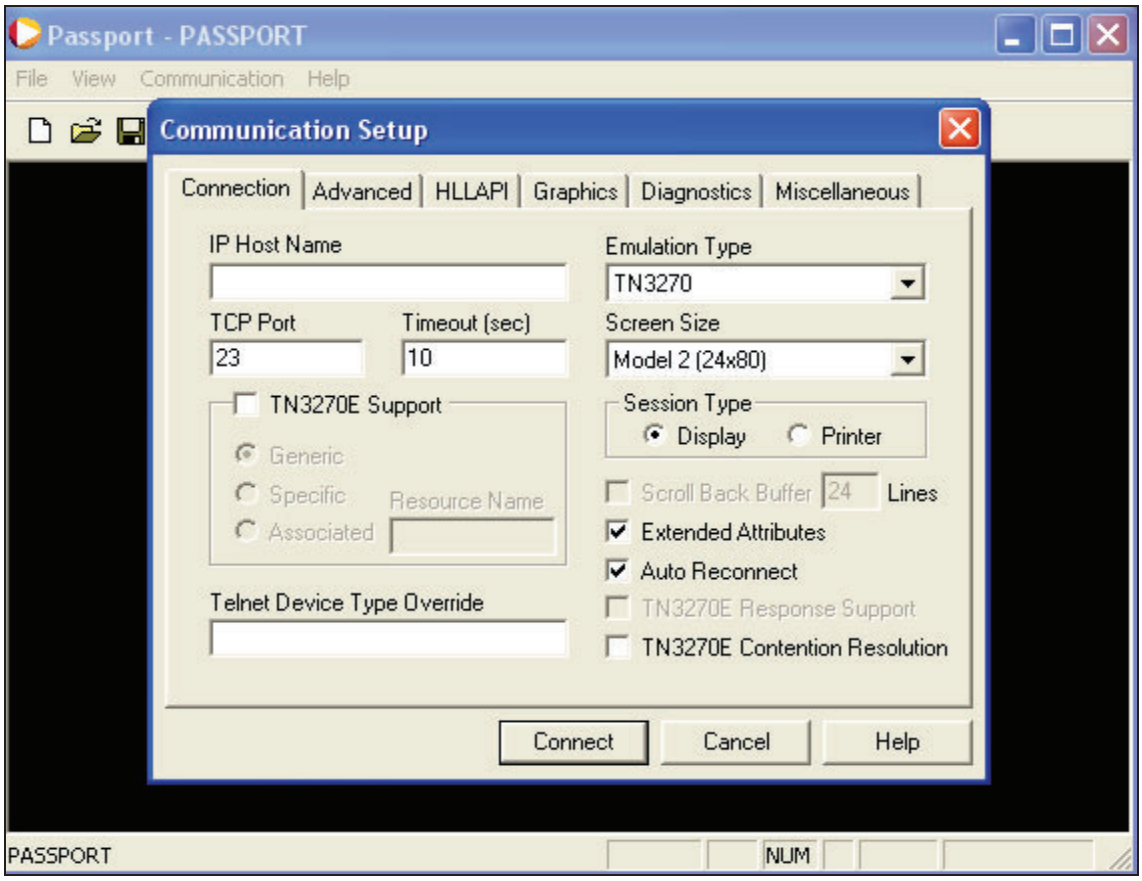


Figure 1: PC-to Host software

Step 3: Key in the TSO option. Key in the "**TSO"** command**.**

Step 4: Key in the Mainframe user id and password to logon to mainframe environment.

Note: Change the password at the very first logon and inform the faculty about the newly changed password.

Step 5: Key in the command "**P**" to enter the **ISPF menu**, which allows you to key in various commands.

1.2 Understand the TSO and the different ISPF menus

To Do: Go through the Primary Options Menu under ISPF

To Do: Use option 1 for Display source data or output listings (Refer to Appendix for various options under BROWSE)

To Do: Use Option 3 for understanding various utility functions

To Do: Exiting ISPF

Step: To terminate ISPF you can type =x at the command line or use the PF3 key to exit

Lab 2. Creation of PDS (Partitioned Dataset)

Goals	• PDS Creation
Time	15 Minutes

2.1: Creation of COBOL PDS

Problem: Need to create PDS to save all COBOL programs.

Solution:

Step 1: Key in the command **3.2 (ISPF/PDF PRIMARY OPTION MENU Screen)**, which will take you to utilities for allocation (**UTILITY SELECTION MENU Screen)**

Step 2: Key in the option as **A (allocate) on DATA SET UTILITY Screen**, type your name as "group", and give an appropriate name for the PDS.

Example for the Name of PDS: DSRP001.SCOTT.COBOL

Step 3: Key in the option for dataset allocations on **ALLOCATE NEW DATA SET Screen**. The important ones are space units, primary quantity of units, secondary quantity of units, directory blocks (for storing member information in PDS), record format, record length, block size, and mainly the dataset name type (PDS).

Step 4: Press **ENTER** key **on DATA SET UTILITY Screen** to view the details of the dataset that is newly allocated.

2.2: Creation of JCL PDS

TO DO

Problem: Need to create PDS to save all JCL programs.

Hint: PDS is created is same as COBOL PDS

2.3: Creation of LOADLIB PDS

TO DO

Problem: Create a PDS for storing Load Module of the COBOL programs.

Hint: PDS is created is same as COBOL PDS. Change the parameter Record Format to 'U' as RECFM = U while creating LOADLIB PDS

To Do

Problem: Create a VSAM PDS same as JCL PDS.

Problem: Create a CICS PDS and DB2 PDS

Problem: Delete PDS
Step: The **D (delete)** option can be used to delete the PDS.

Lab 3. Creation of PSDS (Physical Sequential Data Set)

Goals	Create a flat file EMPLOYEE with the following structure
Time	15 minutes

3.1: Creation of PSDS

Problem: Create one flat file called EMPLOYEE with the following structure:

EMPNO	**C**	**3**
EMPNAME	**C**	**10**
EMPDEPT	**C**	**3**
EMPDESIG	**C**	**4**
EMPSAL	**N**	**5**

Solution:

Step 1: Key in the command **3.2** which will take you to utilities for allocation (**Primary Option Menu screen)**

Step 2: In the **Data Set Utility screen**, key in the option as **A (allocate)**, type your file in single quotes at **Data Set Name ….** (Here the name of the Data Set is **employee** under your own COBOL PDS)

Step 3: Key in the appropriate parameters **on Allocate New Data Set screen.** The difference in PDS and PSDS parameters is that for PSDS, **Directory Blocks** is Zero and **Data Set name type** should be blank for a PSDS.

Step 4: To see information about your Data Set allocation, the option should be kept blank. Press **ENTER** key **on DATA SET UTILITY Screen** to view the details of the dataset that is newly allocated

Step 5: Once the dataset is allocated, the records can be entered. Select option **2** from **ISPF (Edit)**. Type the dataset name in the **Edit Entry Panel**.

Step 6: Enter 10 records using the editor. Leave appropriate spaces for fields with less data.

Step 7: Type **Save** for saving the file or **Cancel** to discard changes. Press **F3** (function key) to save and exit.

3.2: Creation of Employee PSDS

Create a PSDS for storing Employee record using some other alternative method.

Hint: Check Option 2 in ISPF menu

Lab 4. View the Newly created PDS/PSDS, Browse, Edit

Goals	To view your PDS and file in the dataset list.
Time	10 minutes

Solution:

Step 1: Type option **3** in ISPF.

Step 2: Select **4** option for data set listing.

Step 3: Type the **login id** followed by ***** to see all the datasets or login id along with specific dataset.

Step 4: For any operation to be done on the Dataset, type **/ (slash)**.

Step 5: The following screen appears after the **/** option is selected. You can operate further on the file with the various options available. Select option **1** for editing the file. This will take you to the **Edit Entry Panel**.

Lab 5. Move, Copy, Rename members of PDS

Goals	Move / Copy, rename the members from one PDS to another.
Time	15 minutes

5.1: Move / Copy, rename the members from one PDS to another

TO DO

Problem: Move newly created member EMPLOYEE from an existing PDS to some other PDS

Step 1: Key in option **M** for moving on MOVE/COPY Utility Screen. Give the source data set name with details (Group, Type, and Member).

TO DO

Problem: Copy newly created member EMPLOYEE from an existing PDS to some other PDS

Step 1: We can copy by selecting the option **C (Copy)**.

Lab 6. Using Data Shift Commands

Goals	Upload the COBOL program using the utility available in ISPF in mainframe environment and indent as required.
Time	15 minutes

6.1: Using Shift Commands, indenting the programs.

Solution:

Step 1: Upload the COBOL Program using the **ISPF menu 6**.

Step 2: Store the Cobol Program in COBOL PDS by specifying appropriate path.

Step 3: Use **Edit** option to change the COBOL program.

Step 4: Use data shift commands to indent the COBOL program. (As a part of lab practices, do code alignment offline itself in notepad/text editor)

Hint: Refer **Appendix** to use the Data Shift commands

Lab 7. Editor Commands

Goals	Study the various editor commands.
Time	20 minutes

7.1: Studying the various Editor commands

Solution:

Step 1: Select option **2** from **ISPF** to go to the **Edit Entry Panel**.

Step 2: Select the file name to be edited, and give the right project, group.

Step 3: Type **COLS** in the command area to see the column numbers. This will be helpful while typing COBOL program.

Step 4: Use **d** to delete a line.

Step 5: To delete a set of lines, mark a block of lines with **DD** at the start and end.

Step 6: Select a line for copying by giving a **C** command at the source. At the destination, the command **B** or **A** can be used to copy before / after the current line.

Step 7: Similarly blocks for **copy** and **move** can be marked with **CC** and **MM**, respectively, and for copying before and after the command **B** or **A** can be used.

Step 8: You can use the **I10** command to insert 10 lines, **d10** to delete 10 lines. (Refer Appendix B).

Step 9: Finally, after all the changes are done, you can give the command to save.

Step 10: For changing a string, use the **C** Source-String Destination-String **ALL** command.

Step 11: Use the command **copy <filename>** to copy contents of a file to the current file.

Lab 8. Split Session

Goals	Split up the sessions and work in second session.
Time	10 minutes

8.1: Splitting a Session and working in the second session

Solution:

Step 1: Use **F2** key to split the session. Use **F9** key to switch between the sessions.

The following figure shows the look and feel of a split screen.

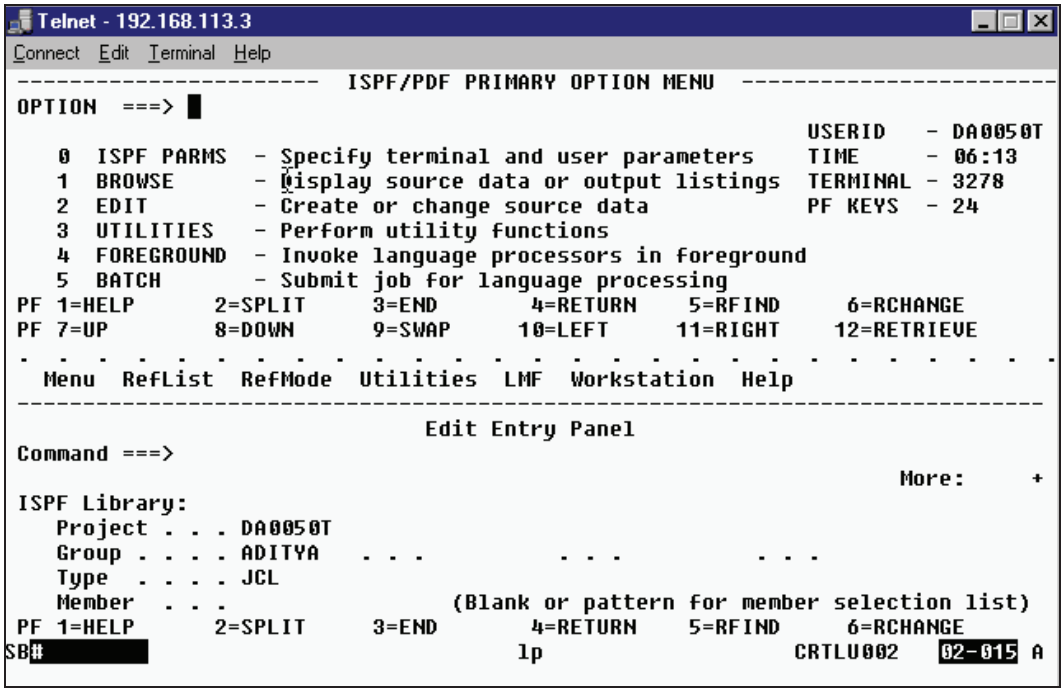


Figure 1: A split session

Lab 9. XMIT Command

Goals	Transfer (XMIT) the given member JCL to another user.
Time	15 minutes

9.1: Using the XMIT Command

Solution:

Step 1: Select Option **6** (command) in ISPF.

Step 2: Type the command as shown in the following figure. The **da0053t** is the destination user who will be transmitted the **aditya.jcl** PDS.

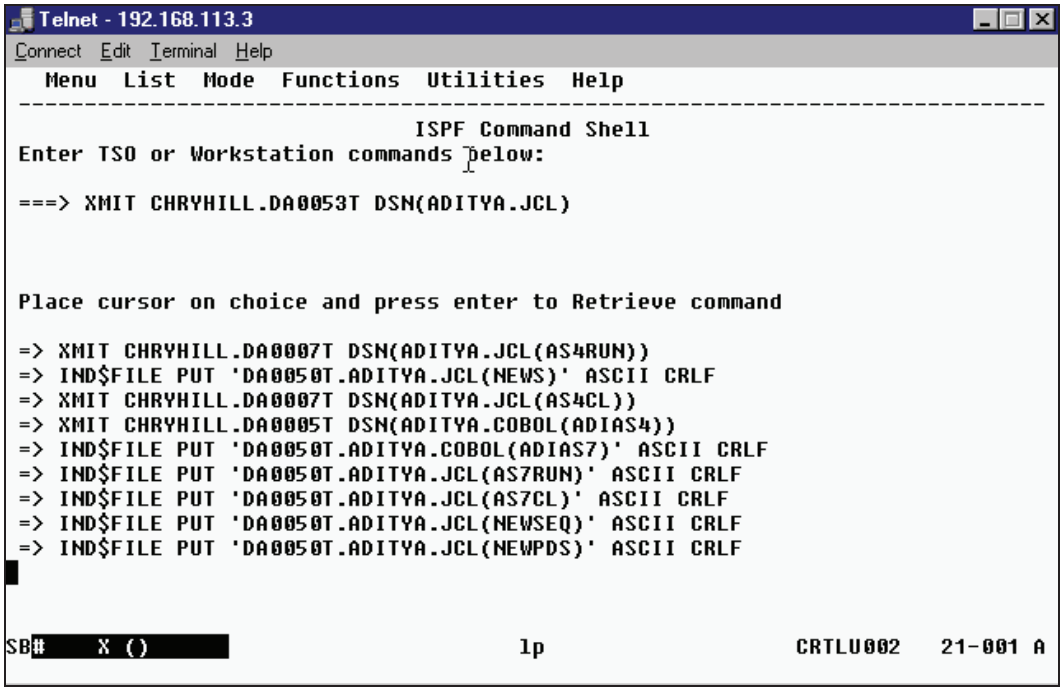


Figure 2: Transmitting aditya.jcl PDS

Step 3: The **da0053t** will have to receive the PDS with the **RECEIVE** command.

Lab 10. Comparison of two datasets (Standard)

Goals	To compare two datasets
Time	15 minutes

10.1: Comparing two standard datasets

Solution:

Step 1: From the **ISPF/PDF Primary Option Menu**, select option **3** to go to the **Utility selection Panel**.
Step 2: In the **Utility Selection Panel**, select option **12** to invoke the **SuperC** compare utility.
Step 3: Specify the name of the 'new' dataset that you want to compare. An '*****' mark against a **Member** option indicates that you want to compare all the datasets. Press **Enter** key to continue.

Step 4: Specify the name of the 'old' dataset, which you want to compare with previously selected 'new' datasets. Press **Enter** key to continue.

Step 5: As the comparison process begins, a message " ***** SuperC LINE Compare invoked ***** " is displayed on the screen.

Step 6: The matches and the differences are displayed under the **SUPERC.LIST** view. Here, in the statistics, the letter '**I**' indicates **Insert**, that is added to the new data set, and does not appear in old data set. The letter '**D**' indicates **Delete**, that is it is visible in the old data set but is absent (deleted) from the new data set.

Step 7: Press **F11** key to see the matches / differences details. These details list the total number of matches and also suggest the deletions and insertions to be made to make the datasets identical.

Step 8: Press **F8** key to go forward to see the statistics.

Step 9: Press **F9** key to move down the screen to see the non-paired files, which cannot be compared since there are no matching files in the new data set.

Step 10: This screen provides the options that are used by this utility for listing type, columns to be compared, the longest line, and processing.

10.2: Comparison of two datasets (Extended)

Step 1: In the **Utility Selection Panel**, select option **13** to invoke the **SuperCE Utility** for dataset comparison utility.

Step 2: Key in the old and new dataset names that have to be compared, and mention the types of comparison to be made. There are four ways to compare the datasets, namely file, line, word, and byte.

Step 3: Press **Enter** key to continue. A message saying " ***** SuperC FILE compare invoked. ***** " will be flashed on the screen.

Step 4: And then you get the statistics.

Step 5: Press **F9** key to continue.

Step 6: For line-by-line comparisons, select the compare type as **2** while setting the parameters for the **SuperCE utility**.

Step 7: Invoking the **3.13** utility with compare option **2** is similar to using the **3.12** utility. **3.12** option.

Step 8: Get the statistics, and press **F9** key to continue.

Step 9: The following screen gives the overall statistics for Line based comparison of data sets.

Step 10: Press **F11** key to see the hidden statistics on the right.

Step 11: To perform the word based comparison, select option **3** as the compare type.

Step 12: Press **F9** key to get the word-wise details.

Step 13: Select option **4** as the **Compare Type** to perform byte–wise comparison of datasets.

Step 14: The byte-wise statistics will be displayed.

Lab 11. Search-For Utility (Standard)

Goals	To understand the use of Search-For Utility
Time	20 minutes

11.1: Using the Search-For Utility

Solution:

Step 1: Select option **14** to invoke the **Search-For utility**.

Step 2: Key in the Search String, for example: EMPFILE, and the names of the datasets in which the string needs to be searched.

Step 3: Press **Enter** key to search. A message saying " ***** Search in progress ***** " is flashed on the screen.

Step 4: Press **F8** key to continue and to see the statistics.

11.2: Search-for utility (Extended)

To Do

Step 1: In the **Utility Selection Panel**, select option **15** (**Search-ForE**) to invoke the **Extended Search-For** utility.

Step 2: Key in the strings to be searched. Here, you can search for multiple strings.

Lab 12. Working with File Manager

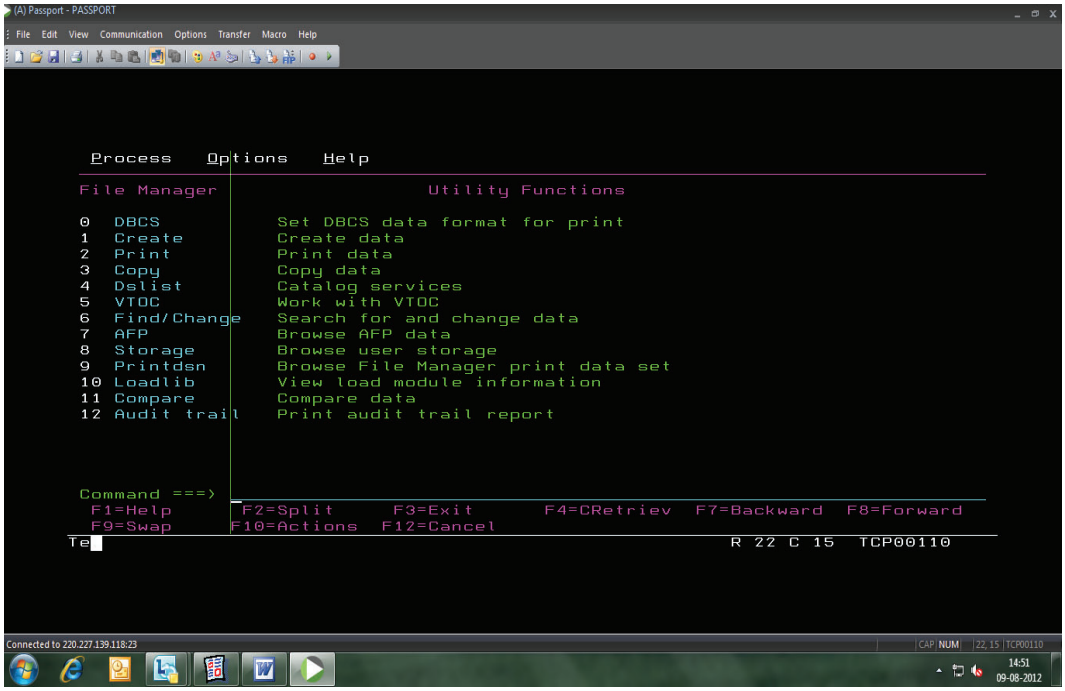
Goals	To understand the use of File Manager Utility
Time	60 minutes

11.1: Using the File Manager Utility

To Do:

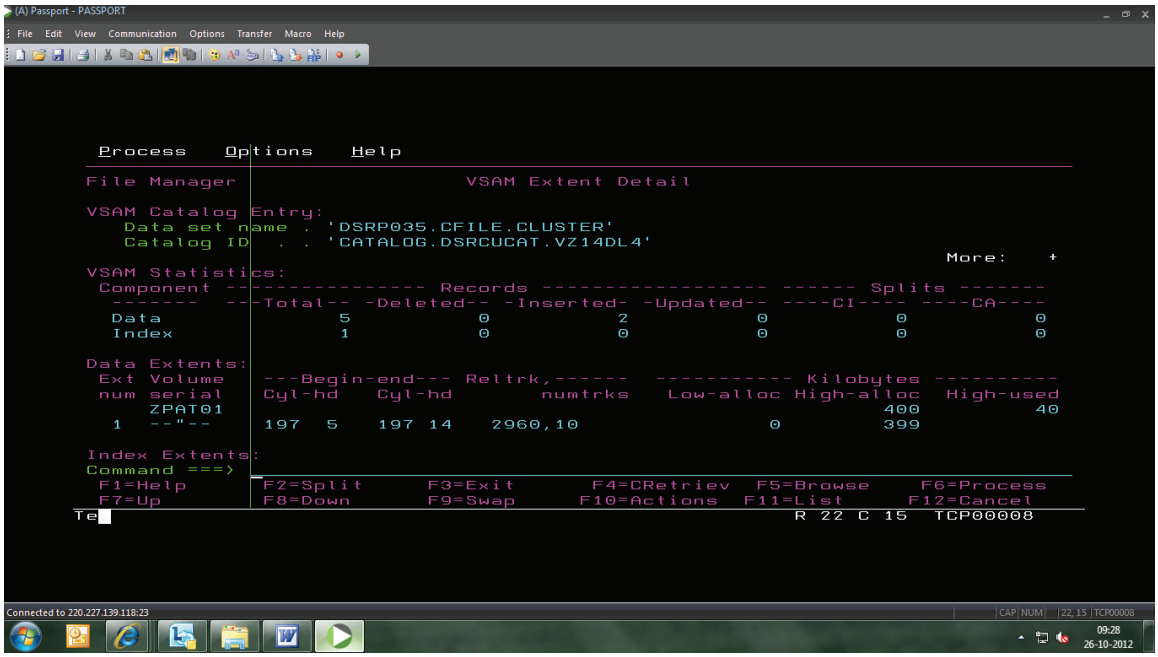
Do perform various editing operations across existing datasets such as find, copy, edit, print, compare and display data using File Manager utility.

(HINT: Use option 16 in ISPF Primary Options)



To Do:

Get the record count in VSAM file using file manager as shown in below screenshot.



(Hint: From the "UTILITY FUNCTIONS" screen choose option 4 (Dslist). On the "DATA SET LIST" screen put an "I" against the vsam file and enter. On the "VSAM ENTRY DETAIL" screen, press F11)

Appendix

Appendix – A: Compiling, linking, and executing a COBOL program

Solution:

Step 1: Key in the COBOL program using the **Edit Entry Panel**.

Step 2: We need to compile, link, and execute the COBOL program. Use the **Edit Entry Panel** to edit the **complink** JCL.

Step 3: Give the **source file name** and the **loadlib name** along with details.

Step 4: If there are no errors, then we can submit the JCL. Use the **SUBMIT** command.

Step 5: After submitting the JCL, a unique job id will be returned to us. This can be further used for identifying this job.

Step 6: If compilation is successful, then the return code will be Zero.

Step 7: Open the **Run JCL**, provide the **loadlib name** with details of the PDS, and submit the job.

Step 8: After submitting the JCL job, a unique job id will be given for the Job. The return code should be zero for successful execution of the program. View the spooler to view the output.

Step 9: Use the command Start ST;SD **on the command prompt to view the details.**

Step 10: Select the right job in the spooler area.

Step 11: Further details will be displayed. Select the SYSOUT RUN to view output.

Appendix - B: Compilation and Run JCL

```
EDIT       DA0001T.PRASANNA.JCL(COMPLINK) - 01.99        Columns 00001 00072
 Command ===>                                              Scroll ===> CSR
 ****** ***************************** Top of Data ******************************
 000100 //DA0001TC  JOB  LA2719,'PRASANNA',NOTIFY=DA0001T,
 000110 //              MSGCLASS=X,TIME=(0,1)
 000112 //*************************************************************
 000120 //* STEP TO COMPILE A PROGRAM
 000130 //* COMPILER PROGRAM NAME - IKFCBL00
 000140 //* LIBRARY NAME - SYS1.COBCOMP
 000150 //* SYSLIN - OUTPUT FILE NAME
```



```
000160 //* SYSIN  - INPUT FILE NAME (I.E. COBOL PROGRAM NAME)
000170 //* SYSUT1,2,3, -  TEMPORARY FILES REQUIRED BY COBOL COMPILER
000180 //*************************************************************
000200 //COB          EXEC PGM=IKFCBL00,REGION=1024K,
000210 //
PARM='NOTRUNC,NODYNAM,LIB,SIZE=4096K,BUF=116K,APOST,NORES'
000400 //SYSLIB     DD  DSN=SYS1.COBCOMP,DISP=SHR
000500 //SYSPRINT DD SYSOUT=*
000600 //SYSLIN     DD DSN=&&TEMP,DISP=(NEW,PASS),
000700 //                UNIT=SYSALLDA,SPACE=(TRK,(40,40))
000710 //SYSUT1    DD  UNIT=SYSALLDA,SPACE=(TRK,(6,1))
000800 //SYSUT2    DD  UNIT=SYSALLDA,SPACE=(CYL,(6,1))
000900 //SYSUT3    DD  UNIT=SYSALLDA,SPACE=(CYL,(6,1))
000910 //SYSUT4    DD  UNIT=SYSALLDA,SPACE=(CYL,(6,1))
001000 //SYSIN      DD  DSN=DA0001T.PRASANNA.COBOL(PRG1),DISP=SHR
001100 //*****************************************************
001110 //* STEP TO LINK THE COBOL PROGRAM
001120 //* LINKER PROGRAM NAME - IEWL
001130 //* LIBRARY NAME - SYS1.COBLIB
001140 //* SYSLMOD - OUTPUT DATASET NAME
001150 //* SYSLIN - INPUT DATASET NAME
001160 //*****************************************************
001200 //LKED          EXEC  PGM=IEWL,PARM='LIST,XREF,LET,MAP',
001300 //                    REGION=4096K,COND=(0,LT,COB)
001400 //SYSLIN       DD  DSN=&&TEMP,DISP=(OLD,DELETE)
001500 //SYSLIB       DD  DSN=SYS1.COBLIB,DISP=SHR
001600 //SYSLMOD    DD  DSN=DA0001T.PRASANNA.LOADLIB(PRG1),
001610 //                      DISP=SHR,UNIT=SYSALLDA
001800 //SYSUT1      DD  UNIT=SYSALLDA,SPACE=(1024,(50,20))
001900 //SYSPRINT   DD SYSOUT=*
002000 //
****** **************************** Bottom of Data **************************
```



```
EDIT       DA0001T.PRASANNA.JCL(RUN) - 01.23            Columns 00001 00072
 Command ===>                                                 Scroll ===>
CSR
 ****** ***************************** Top of Data ******************************
 000100 //DA0001TR JOB LA2719,'PRASANNA',NOTIFY=DA0001T,
 000200 //       MSGCLASS=X,TIME=(0,1)
 000300 //*************************************
 000400 //*STEP TO RUN COMPILED COBOL PROGRAM
 000500 //COBRUN      EXEC PGM=PRG1
 000600 //STEPLIB     DD DSN=DA0001T.PRASANNA.LOADLIB,DISP=SHR
 000700 //SYSPRINT    DD SYSOUT=*
 000810 //INF1        DD DSN=DA0001T.EMPDATA,DISP=SHR
 000900 //OTF1        DD DSN=DA0001T.L3,DISP=(NEW,CATLG,DELETE),
 001000 //                UNIT=SYSDA,SPACE=(TRK,(1,1)),
 001100 //                DCB=(LRECL=80,RECFM=FB,BLKSIZE=800,DSORG=PS)
 001200 //SYSOUT      DD SYSOUT=*
 ****** **************************** Bottom of Data ***************************
```


Appendix - C: ISPF (Interactive System Productivity Facility)

Primary Options Menu:

Access to ISPF is gained by keying in ISPF at the READY prompt. This is done as default in the auto executed CLIST at startup. When this command is keyed in, you get the Primary Options Menu.

```
---------------------- ISPF/PDF PRIMARY OPTION MENU ------------------------
 OPTION  ===> pfshow                                        USERID   - DA0034T

   0  ISPF PARMS       - Specify terminal and user parameters          TIME     - 06:58
   1  BROWSE           - Display source data or output listings        TERMINAL -
3278
   2  EDIT             - Create or change source data                  PF KEYS  - 12
   3  UTILITIES        - Perform utility functions
   4  FOREGROUND       - Invoke language processors in foreground
   5  BATCH                    - Submit job for language processing
   6  COMMAND          - Enter TSO Command, CLIST, or REXX exec
   7  DIALOG TEST      - Perform dialog testing
   8  LM UTILITIES     - Perform library administrator utility functions
   9  IBM PRODUCTS     - Additional IBM program development products
  10  SCLM                     - Software Configuration and Library Manager
   C  CHANGES          - Display summary of changes for this release
   T  TUTORIAL         - Display information about ISPF/PDF
   X  EXIT             - Terminate ISPF using log and list defaults
   D  DATACENTER       - Perform Datacenter Defined Functions
   S  SDSF                  - Spool Display and Search Facility
   U  USER                  - Perform User Defined Functions

 F1=HELP     F2=SPLIT    F3=END      F4=RETURN   F5=RFIND    F6=RCHANGE
   •   F7=UP          F8=DOWN       F9=SWAP       F10=LEFT      F11=RIGHT
       F12=RETRIEVE
```


Browsing Datasets (Option 1)

```
------------------------ BROWSE - ENTRY PANEL  -----------------------------
COMMAND ===>

ISPF LIBRARY:
  PROJECT ===> DA0034T
  GROUP    ===> TRG      ===>         ===>         ===>
  TYPE       ===> JCL
  MEMBER ===>              (Blank or pattern for member selection list)

OTHER PARTITIONED OR SEQUENTIAL DATA SET:
  DATA SET NAME  ===>
  VOLUME SERIAL  ===>        (If not cataloged)

DATA SET PASSWORD ===>         (If password protected)
MIXED MODE       ===> NO      (Specify YES or NO)
FORMAT NAME      ===>
```

Browse Commands

- Type “COLS” command for displaying columns.
- Scroll up, down, left right with PF7, PF8, PF10, and PF11 respectively.
- Set Scroll amount to CRSR, HALF, PAGE, n lines, max, DATA
- Scroll by n lines, to top, or bottom
- Define / LOCATE {line number}/label.
- FIND string {NEXT/PREV/FIRST/LAST/ALL}.
- PF5 for repeat find and use of “&”.
- Use of PF12 to recall last command.
- Terminate Browse with PF3 Key.
- FIND string {NEXT/PREV/FIRST/LAST/ALL} {CHAR/PREFIX/SUFFIX/WORD} col-1 col-2
- Column limitation search
- T ‘text’ - for case insensitive search
- X ‘hex-string’ for a hex search

Editing Datasets (Option 2)

- The Primary Editor entry is similar to that for Browse as regards concatenating datasets and dataset selection.
- Labels can be defined as in browse but may be entered as line commands.
- Error messages may be removed by typing RESET on the command line.

Standard editing commands

I/In	Insert 1 or n lines.
D(n)	Delete line or n lines.
DD	Delete the block marked by the 2 DD line commands.
R(n)	Repeat 1 or n lines.
RR	Repeat the block marked by the 2 RR line commands.
C(n)	Copy 1 or n lines.
CC	Copy the block marked between the 2 CC line commands.
M(n)	Move 1 or n lines.
MM	Move the block marked between the 2 CC line commands.
A(n)	Copy or Move lines 1 or n times after this line.
B(n)	Copy or Move lines 1 or n times before this line.

Creating datasets and exiting editor

- To create a new member, specify non-existent member name in the current PDS.
- You can quit the editor without saving changes by the CANCEL command.
- You can update the dataset with the SAVE command.
- You can exit with implicit save using the END command or PF3 key.

Edit Profiles

- Edit profiles control editing options.
- Normal editing of a new dataset uses the default profile - the dataset type.
- To display the edit profile, type PROFILE on the command line in the editor.
- To remove it from the screen, type RESET.
- This gives you a display as shown below:

```
EDIT ---- DA0034T.TRG.JCL(JCL1) - 01.27 ---------------------- COLUMNS 001 072
 COMMAND ===>                                                  SCROLL ===> CSR
 ****** ***************************** TOP OF DATA ******************************
 =PROF> ....STD (FIXED - 150)....RECOVERY OFF....NUMBER ON STD.....................
 =PROF> ....CAPS ON....HEX OFF....NULLS ON STD....TABS ON STD....SETUNDO
OFF....
 =PROF> ....AUTOSAVE ON....AUTONUM OFF....AUTOLIST OFF....STATS ON.....
 =PROF> ....PROFILE UNLOCK....IMACRO NONE....PACK OFF....NOTE ON.....
 =BNDS> <
 =TABS>
 =COLS> ----+----1----+----2----+----3----+----4----+----5----+----6----+----7--
 000100 //DA0034TA JOB LA2719,'PARAG',NOTIFY=DA0034T,
 000200 //       CLASS=A,MSGCLASS=X
 000300 //*
 000400 //COBRUN EXEC PGM=PROG11
 000500 //STEPLIB DD DSN=DA0034T.TRG.LNK,DISP=SHR
 000510 //*STEPLIB DD DSN=DA0034T.TRG.COBOL2,DISP=SHR
 000600 //INVMAS DD DSN=DA0034T.TRG.INVMAS,DISP=SHR
 000700 //OP1 DD SYSOUT=*
 000710 //*OP1 DD DSN=DA0034T.TRG.EXE7,DISP=(NEW,CATLG,CATLG),
```

Profile Settings

- To switch to a different profile, key in “profile <“profile-name”>
- To lock a profile, at the command line key in “PROFILE LOCK”
- Any changes made to the locked profile are not saved permanently.
- Caps, number Pack, and STATS modes are set each time you begin an edit session.
- To define tab stops, key in TABS on the command line and place ‘@’ on the tabs line one character before where you would like a tab stop. On the command line, key in TABS ON/OFF <tab-character>.
- If you omit the tabbing character, hardware tabbing is assumed.
- Line control Commands:
  - Nonumber/NUM OFF turns off line numbering
  - NUM ON turns on line numbering
  - AUTONUM resequence line numbers on save

- RENUM resequence line numbers
- NUM ON COBOL checks for valid COBOL numbering
- NUM ON STD checks for standard line numbering
- UNNUM removes line numbering.

Edit Modes

- STATS ON/OFF : Controls dataset statistics
- AUTOLIST ON/OFF : Controls Automatic listing
- NULLS ON/OFF : Controls if nulls or spaces are padded
- RECOVERY ON/OFF : Recovers a dataset being edited in case of a system crash.
- UNDO command : This works up to the last save only
- HEX ON/OFF : Displays data in HEX/ASCII mode
- CAPS ON/OFF : Converts Lower case letters to uppercase if set to on Line. Commands for this function are LC or UC. LCLC and UCUC are blocked line commands.
- PACK ON/OFF : Specifies that the data is stored in compressed mode.
- AUTOSAVE ON/ OFF PROMPT/ NOPROMPT : Auto save data when PF3 key is pressed
- IMACRO : Specify initial macro to be run at startup.

Advanced Edit Options

To locate a String within another use the following command:

FIND string range NEXT/PREV/FIRST/LAST/ALL CHARS/PREFIX/SUFFIX/WORD X/NX col-1 col-2

where:

Range : is denoted by 2 labels
String : is the string to be found
NEXT : indicates start search at current line and locate the next occurrence of the string (default).
PREV : indicates start search at current line and locate the previous occurrence of the string.
FIRST : indicates locate the first occurrence of the string
LAST : indicates locate the last occurrence of the string
ALL : indicates same as first but count the occurrences in the file.
CHARS : indicates any occurrence of the string
PREFIX : indicates string must be at the beginning of the word
SUFFIX : indicates string must be at the end of a word
X/NX : indicates search only excluded/Non excluded lines
col-1 col-2 : indicates starting and ending column numbers defining the search boundaries.

To Modify/Change a string with another String;

CHANGE string1 string2 range NEXT/PREV/FIRST/LAST/ALL
CHARS/PREFIX/SUFFIX/WORD X/NX col-1 col-2

String2 replaces string1

Shifting text source

<----------Data shift----------> <---------- Column shift ---------->

<	**<n**	**<<**	**(**	**(n**	**((n**	**left shifts**
>	**>n**	**>>**	**)**	**)n**	**))n**	**right shifts**

Data shifts

- Does not drop blank characters
- Does not combine words by drooping spaces
- Does not delete spaces within apostrophes
- COPY [member] [AFTER/BEFORE label]
- MOVE [member] [AFTER/BEFORE label]
- CREATE [member] [range]
- REPLACE [member] [range]
- Edit member-name to edit recursively

Library Utility

Option 3.1

```
---------------------------- LIBRARY UTILITY  -------------------------------
 OPTION  ===>

   blank - Display member list    B - Browse member
   C - Compress data set            P - Print member
   X - Print index listing         R - Rename member
   L - Print entire data set        D - Delete member
   I - Data set information        E - Edit member
                                    S - Data set information (short)
 ISPF LIBRARY:
   PROJECT ===> DA0034T
   GROUP   ===> TRG      ===>         ===>         ===>
   TYPE    ===> JCL
   MEMBER  ===>              (If   "P", "R", "D", "B", "E" or blank selected)
   NEWNAME ===>             (If  "R" selected)

 OTHER PARTITIONED OR SEQUENTIAL DATA SET:
   DATA SET NAME  ===>
   VOLUME SERIAL  ===>        (If not cataloged)

 DATA SET PASSWORD ===>        (If password protected)
```

DSLIST Commands

M	-	Member list
C	-	Catalog a dataset
D	-	Delete a dataset
E	-	Edit a dataset
F	-	Free unused dataspace in a dataset
I	-	Display information for a dataset
M	-	Display a memberlist
P	-	Print a dataset
R	-	Rename a dataset
S	-	Display a shortened version of dataset information
U	-	Uncatalog a dataset
X	-	Print a dataset indexed listing
Z	-	*Compress a dataset*
=	-	Repeat the last command

Primary Commands

LOCATE	- To locate a dataset
TSO SUBMIT	- To execute Clists from the command line
SHOWCMD ON/OFF	- To show the expanded form of the command
CONFIRM ON/OFF	- Same as Confirm delete request Yes/NO on the delete panel
SORT	- Sorts the dataset list based on the fields shown on the next transparency
FIND	- Finds occurrence of a string with the list of datasets
SAVE dataset-name	- Saves the current dataset list into the dataset name specified
SELECT pattern [line command]	- To make a selection of datasets to be acted upon determined by the line command

Reset

Option 3.5

```
------------------------- RESET ISPF STATISTICS  ----------------------------
 OPTION  ===>

   R - Reset (create/update) ISPF statistics
   D - Delete ISPF statistics

 NEW USERID                  ===>       (If userid is to be changed)
 NEW VERSION NUMBER          ===>       (If version number is to be changed)
   RESET MOD LEVEL                  ===> YES    (YES or NO)
   RESET SEQ NUMBERS           ===> YES    (YES or NO)

 ISPF LIBRARY:
   PROJECT ===> DA0034T
   GROUP   ===> TRG
   TYPE    ===> JCL
   MEMBER  ===>              (Blank or pattern for member selection
                          list, '*' for all members)

 OTHER PARTITIONED DATA SET:
   DATA SET NAME  ===>
   VOLUME SERIAL  ===>          (If not cataloged)
```


Appendix - D: File Aid

File-AID is a data manipulation program developed by COMPUWARE that consolidates the functions of most standard IBM Utilities.

File-AID Utility has two possible modes of Operation:

- Online Mode (Using =F option within ISPF Menu)
- Batch Mode (JCL)

(**Note:** This presentation aims at unfolding the frequently used online capabilities of File-AID utility)

F.1 Browse

File-AID enables you to browse a file created through any standard MVS access method (including IAM files). You can display the entire dataset or a selected subset of records.

You can supply record layouts and view your data in three display modes:

i) Character

ii) Vertical formatted

iii) Formatted

Character Mode:

Step 1: Key in dataset name and record layout of the dataset that you want to browse.

```
File-AID ----------  Browse - Dataset Specification  ------------------------
COMMAND ===>

 Browse Mode              ===> C        (F=Formatted; C=Char; V=Vertical)

 Specify Browse Information:
   Browse dataset name        ===> “USERID9.FASAMP.EMPMAST”
   Member name                ===>          (Blank or pattern for member list)
   Volume serial          ===>          (If dataset is not cataloged)


 Specify Record Layout and XREF Information:
   Record layout usage        ===> S        (S = Single; X = XREF; N = None)
   Record layout dataset      ===> FASAMP.LAYOUTS
   Member name                ===> EMPLOYEE   (Blank or pattern for member list)
   XREF dataset name          ===>
   Member name                ===>          (Blank or pattern for member list)

 Specify Selection Criteria Information:    (E = Existing; T = Temporary;
   Selection criteria usage   ===> N          M = Modify; Q = Quick; N = None)
   Selection dataset name     ===>
   Member name                ===>          (Blank or pattern for member list)
```


F.1 Browse screen

```
File-AID - Browse - USERID9.FASAMP.EMPMAST ---------- LINE 0000 COL 1  8
 COMMAND ===>                                                SCROLL ===> PAGE|
******************************** TOP OF DATA **********************CAPS OFF-*|
00090MARTIN       EDWARD    M  AIRPLANE MANUFACTURER    427890125 101954
- - - - - - - - - - - - - - - - - - - - - - - - - - - - 1 RECORD(S) NOT SELECTED|
00200JACKSON      JOSEPH    C   ORATOR                   275587177 020462
10000ANDREWS      GEORGE        ACTOR                    576312032 042248
15000MURPHY       RONALD    L   PAINTER                  987654321 120255
18034SCHNEIDER    ELLEN     C   NURSE                    341559549 032960
21035JONES         GEORGE   B   COUNTRY SINGER           463813456 090944
25100ROBERTS      WILLIAM   R   POLITICIAN               879563325 050865
27007ALLEN        JOYCE      M  AUTHOR                   783458334 012132
30001RICHARDS     REX        W  RODEO CLOWN              632764534 040140
31000SAVAGE       JONATHON  C  ELECTRICIAN              348567992 062250
34010SMITH        JANET           AIRLINE ATTENDANT     557782984 112359
34011JACOBS       DIANA           DOCTOR                 225368395 021757
******************************** BOTTOM OF DATA ********************-CAPS OFF-*
                                                        |
 Enter FMT for formatted mode, VFMT for vertical format, HEX ON  for He
```


Vertical Formatted Mode (VFMT) :

Step 2: Type **VFMT** at command prompt from Character Mode or Select Browse Mode as “V” at F.1 screen.

```
File-AID - Browse - USERID9.FASAMP.EMPMAST  ----------
  COMMAND ===> VFMT
 ----+----1----+----2----+----3----+----4----+----5----+-
 ******************************** TOP OF DATA **********
 00090MARTIN        EDWARD    M  AIRPLANE MANUFACTURER
```

Step 3: This expands record as per the file layout columns

```
File-AID - Browse - USERID9.FASAMP.EMPMAST ---------- LINE 0000 COL 1  4|
  COMMAND ===>                                        SCROLL ===> PAGE|
EMP-NUMBER EMP-LAST-NAME   EMP-FIRST-NAME EMP-MID-INIT FILLER   EMP-
TITLE      |
 5/AN       15/AN          10/AN         1/AN        2/AN     30/AN
 (1-5)     (6-20)         (21-30)       (31-31)     (32-33)  (34-49)
 1--------- 2---------- 3------------ 4----------- 5------- 6----------
 ******************************** TOP OF DATA **********************-CAPS OFF-*
 00090      MARTIN         EDWARD        M                AIRPLANE MANUFA
 - - - - - - - - - - - - - - - - - - - - - - - - - - - 1 RECORD(S) NOT SELECTED
 00200      JACKSON        JOSEPH        C                ORATOR
 10000      ANDREWS         GEORGE                         ACTOR
 15000      MURPHY         RONALD        L                PAINTER
 18034      SCHNEIDER       ELLEN        C                NURSE
 21035      JONES          GEORGE        B                COUNTRY SINGER
```


Format Mode (FMT):

Step 4: Type **FMT** at command prompt from Character Mode or select Browse Mode as "F" at F.1 Screen.

```
File-AID - Browse - USERID9.FASAMP.EMPMAST  ------------------------ COL 1  92
 COMMAND ===>                                          SCROLL ===> PAGE
 RECORD:     1             EMPLOYEE-MASTER-FILE             LENGTH:   198  ---- FIELD LEVEL/NAME --
----- COLUMNS- ----+----1----+----2----+----3----+----4|
 5 EMP-NUMBER                  1    00090
 5 EMP-LAST-NAME                6    MARTIN
 5 EMP-FIRST-NAME              21    EDWARD
 5 EMP-MID-INIT                31    M
 5 FILLER                      32
 5 EMP-TITLE                   34    AIRPLANE MANUFACTURER
 5 EMP-PERSONAL-INFO SYNC      64
  10 EMP-NATL-ID-NUMBER        64    427890125
  10 FILLER                    73
  10 EMP-DATE-OF-BIRTH         74    101954
  10 EMP-DOB-REDEF REDEFINES EMP-DATE-OF-BIRTH
  10 EMP-DOB-REDEF SYNC        74
    15 EMP-DOB-MM              74    10
    15 EMP-DOB-DD              76    19
    15 EMP-DOB-YY              78    54
  10 EMP-HIRE-DATE             80    920101
  10 EMP-MARITAL-STATUS        86    M
 5 EMP-WITHOLD-INFO SYNC       87
  10 EMP-LIFE-INS-WITHOLD-AMT  87    30000}
Enter CHAR for character mode, VFMT for vertical format mode
```

Navigating To Browse Your Formatted Records

Each of the navigation commands has a corresponding **PF** key set as the default in your user profile.
The default settings are:

PF7	UP
PF8	DOWN
PF10	LEFT (BACK)
PF11	RIGHT (FORWARD)

You can specify a number of records to scroll forward. For example, if record number 10 is the currently displayed record.

F.2 Edit

Step 1: Select F.2 and key in the name of the dataset you want to edit. Press **Enter** key to go to next screen. Edit the data and type **SAVE** at command prompt to save the data.

```
File-AID ----------  Edit - Dataset Specification  ------------------------
COMMAND ===>

 Edit Mode              ===> C        (F=Formatted; C=Char; V=Vertical)

 Specify Edit Information:
   Edit dataset name     ===> “USERID9.FASAMP.EMPMAST”
   Member name            ===>          (Blank or pattern for member list)
   Volume serial          ===>          (If dataset is not cataloged)


 Specify Record Layout and XREF Information:
   Record layout usage     ===> N        (S = Single; X = XREF; N = None)
   Record layout dataset   ===>
  Member name             ===>          (Blank or pattern for member list)
   XREF dataset name       ===>
   Member name            ===>          (Blank or pattern for member list)

 Specify Selection Criteria Information:    (E = Existing; T = Temporary;
   Selection criteria usage ===> N         M = Modify; Q = Quick; N = None)
   Selection dataset name   ===>
   Member name            ===>          (Blank or pattern for member list)
```


F.3 Utilities

File Copy Utility:

Step 1: Key in **3** at the Option Prompt.

```
 File-AID 8.8.2 -------------  Primary Option Menu  ----------------------------
OPTION ===> 3

 0  PARAMETERS  - Specify ISPF and File-AID parameters       USERID   - USERID9
 1  BROWSE      - Display file contents                     PF KEYS  - 24
 2  EDIT        - Create or change file contents            TERMINAL - 3278
 3  UTILITIES   - File-AID/SPF extended utilities           TIME     - 01:10
 5  PRINT       - Print file contents                       JULIAN   - 05.194
 6  SELECTION   - Create or change selection criteria       DATE     - 05/07/13
 7  XREF        - Create or change record layout cross reference
 8  VIEW        - View interpreted record layout
 9  REFORMAT    - Convert file from one format to another
10  COMPARE     - Compare file contents
 C  CHANGES     - Display summary of File-AID changes
 T  TUTORIAL    - Display information about File-AID
 X  EXIT        - Terminate File-AID and return to ISPF

   Use END to terminate File-AID
```


Step 2: We will reach the below mentioned screen. Enter **3** for Copy option.

```
 OPTION ===>  3

 1  LIBRARY       - Display and modify directory entries; display load
                    module CSECT maps; browse, delete, rename PDS members
 2  DATASET       - Display dataset information; allocate non-VSAM datasets
                    and GDGs; catalog, uncatalog, delete, or rename datasets
 3  COPY          - Copy entire datasets; copy selected records; copy PDS
                    members based on name, statistics and/or content
 4  CATALOG       - Display generic catalog entries or VSAM datasets on a
                    volume in list form and do dataset list processing
 5  VSAM          - Allocate, display, delete, modify, or rename VSAM clusters,
                    alternate indexes, or paths; manage IAM files
 6  SEARCH/UPDATE - FIND and CHANGE across PDS members.  Search for and/or
                    update data globally in any type of dataset.
 7  VTOC          - Display and process datasets on a volume(s)

 8  INTERACTIVE   - Execute File-AID/Batch

 9  BATCH SUBMIT  - Build batch jobstreams

 G  XMLGEN        - Generate an XML tagged document from data file
```


Step 3: Key in the dataset name to be copied, and the new dataset name. In case you wish to copy into an existing dataset, give the DISP as old.

```
 File-AID ----------------------  Copy Utility  ---------------------------------
COMMAND ===>

Specify "FROM" Dataset or HFS Path Information:
 Dataset or path ===> 'USERID9.FASAMP.EMPMAST'
 Volume serial   ===>                 (If not cataloged)

Specify "TO" Dataset or HFS Path Information:
 Dataset or path ===> 'USERID9.FASAMP.EMPMAST.NEW'
 Volume serial   ===>                 (If not cataloged)
 Disposition     ===> NEW             (OLD, MOD, NEW)


Specify Execution Information:
 Process online or batch   ===> O       (O = Online; B = Batch)

Specify Selection Criteria Information:   (E = Existing; T = Temporary;
 Selection criteria usage  ===> T        M = Modify; Q = Quick; N = None)
 Selection dataset name    ===>
 Member name               ===>        (Blank or pattern for member list)
```


Step 4: The new dataset will have the same parameters as the original one. We can change the same over here. Press **Enter** key to move to next screen.

```
 File-AID ---------------  Allocate New SMS Dataset  ---------------------------
COMMAND ===>


Dataset name: USERID9.FASAMP.EMPMAST.NEW

 Management Class    ===> CS843I     (Blank for default)
 Storage Class       ===> CSNORM     (Blank for default)
  Volume serial      ===> CST006     (Blank for authorized default volume)
 Data Class          ===>            (Blank for default)
  Space units        ===> BLKS       (BLKS; TRKS; CYLS; KB; or MB)
  Primary quantity   ===> 120        (In above units)
  Secondary quantity ===> 24         (In above units)
  Directory quantity ===> 0          (Partitioned only)
  Record format      ===> VB
  Record length      ===> 255
  Block size         ===> 6233
  Expiration date    ===>            (YYYY/MM/DD or blank)
  Dataset Name Type  ===>            (Library (PDS/E); PDS; or blank)
  Number of Volumes  ===>            (No. of VOLS or blank for SMS default)
```


Step 5: Key in **1** at the **Option** prompt for selective Copying of records.

```
 File-AID - Selection Criteria Menu - TEMPORARY -------------------------------
OPTION ===> 1
                                                - Status -
    1  OPTIONS      - Enter selection criteria options          default
    2  FORMATTED    - Edit formatted selection criteria         0   sets
    3  UNFORMATTED  - Edit unformatted selection criteria       0   sets


Member list description ===> ____________________________________

   Long    ===>
_____________________________________________________________________________
Description ===>
_____________________________________________________________________________

Use VIEW command to display selection criteria summary
Use SAVE command to write selection criteria request
Use END to continue processing
Use CANCEL to return to main panel
```


Step 6: We can provide the number of records to skip, select, and start record as options while copying as shown below:

```
File-AID ----------  Selection Criteria Options  -------------------------
COMMAND ===>

Specify Selection Criteria Options:
                                Start at the following record key
                                (both blank for start of dataset)
 Starting record key         ===>
   - OR -                         OR at the following RBA or RRN
 Starting RBA or RRN          ===>

 Initial records to skip     ===> 50       then skip this many records

 Subsequent Selection Interval:          then repeat the following
   Records to select         ===> 10      - select this many records
   Records to skip           ===> 5       - then skip this many records
                                until
 Number of records to search ===> ALL     you have read this many records
 Number of records to select ===> ALL     or selected this many records

SEQ/VSAM processing direction ===> F      (F = Forward; B = Backward)


 Use ENTER to return to selection criteria menu
```


Step 7: Once we key in the required criteria and press **Enter** key, we get to the screen shown below. Here we can press **PF3** key or type 'enter' at command prompt to complete the copying process.

```
File-AID - Selection Criteria Menu - TEMPORARY -------------------------------
 OPTION ===>
                                              - Status -
     1  OPTIONS      - Enter selection criteria options         default
     2  FORMATTED    - Edit formatted selection criteria        0   sets
     3  UNFORMATTED  - Edit unformatted selection criteria      0   sets


 Member list description ===> ____________________________________

    Long    ===>
 ____________________________________________________________________________
 Description ===>
 ____________________________________________________________________________




 Use VIEW command to display selection criteria summary
 Use SAVE command to write selection criteria request
 Use END to continue processing
 Use CANCEL to return to main panel
```


Step 8: The screen given below shows that 71 records have been copied from the original file.

```
File-AID ----------------------  Copy Utility  ---------- 71 RECORDS COPIED
COMMAND ===>

Specify "FROM" Dataset or HFS Path Information:
  Dataset or path ===> 'USERID9.FASAMP.EMPMAST'
  Volume serial   ===>                 (If not cataloged)

Specify "TO" Dataset or HFS Path Information:
  Dataset or path ===> 'USERID9.FASAMP.EMPMAST.NEW'
  Volume serial   ===>                 (If not cataloged)
  Disposition     ===> OLD              (OLD, MOD, NEW)


Specify Execution Information:
  Process online or batch   ===> O       (O = Online; B = Batch)

Specify Selection Criteria Information:   (E = Existing; T = Temporary;
  Selection criteria usage  ===> T        M = Modify; Q = Quick; N = None)
  Selection dataset name    ===>
  Member name               ===>        (Blank or pattern for member list)
```


Step 9: The below screen is for direct copying without any selection criteria. Please note that we need to set the selection criteria as **N**.

```
File-AID ----------------------  Copy Utility  --------------
COMMAND ===>

Specify "FROM" Dataset or HFS Path Information:
  Dataset or path ===> 'USERID9.FASAMP.EMPMAST'
  Volume serial   ===>                 (If not cataloged)

Specify "TO" Dataset or HFS Path Information:
  Dataset or path ===> 'USERID9.FASAMP.EMPMAST.NEW1'
  Volume serial   ===>                 (If not cataloged)
  Disposition     ===> NEW               (OLD, MOD, NEW)


Specify Execution Information:
  Process online or batch   ===> O       (O = Online; B = Batch)

Specify Selection Criteria Information:   (E = Existing; T = Temporary;
  Selection criteria usage  ===> N        M = Modify; Q = Quick; N = None)
  Selection dataset name    ===>
  Member name               ===>        (Blank or pattern for member list)
```

