SYSTEM/370 OS/VS

FACILITIES FOR MANAGERS AND SYSTEMS ANALYSTS

STUDENT MATERIALS

STUDENT HANDOUT

OS/VS INTRODUCTION	GR20-4260
VS/1 PLANNING GUIDE	GC24-5090
VS/2 PLANNING GUIDE	GC28-0600
INTRODUCTION TO OS	GC28-6534
VS PROGRAM PRODUCTS	GC28-8200
OS/VS VSAM PLANNING GUIDE	GC26-3799
OS/VS/1 FEATURES SUPPLEMENT	GC20-1752
OS/VS/2 FEATURES SUPPLEMENT	GC20-1753
S/370 PRINCIPLES OF OPERATION	GA22-7000

VS2/2 GC28-0661

OBJECTIVES –

UPON COMPLETION OF THE COURSE, STUDENTS SHOULD BE ABLE TO:

- CITE THE REASONS FOR AN OPERATING SYSTEM
- TRACE FLOW OF A JOB THRU THE SYSTEM IN VS1 AND IDENTIFY SOME DIFFERENCES OF MFT, MVT, VS2 JOB FLOW
- DESCRIBE THE CONCEPT OF VIRTUAL STORAGE AND PAGING
- LIST THE DATA MANAGEMENT FACILITIES OF OS/VS
- DESCRIBE PROGRAM DEVELOPMENT AND FUNCTIONS OF COMPILER/ASSEMBLER AND LINKAGE EDITOR/ LOADER
- CITE THE REASON FOR JCL AND DESCRIBE ITS RELATIONSHIP TO JOB AND DATA MANAGEMENT
- IDENTIFY FUNCTIONS PERFORMED BY UTILITY PROGRAMS
- DESCRIBE THE OPERATOR'S CONTROL OF SYSTEM WITH OPERATOR COMMANDS.
- DRAW STORAGE LAYOUT (USAGE) IN VS1, VS2, MFT, MVT
- DESCRIBE THE PRIORITY SCHEDULING SYSTEM IN OS/VS
- CITE FEATURES OF REMOTE JOB ENTRY SYSTEMS

OVERVIEW

RESOURCES OF A COMPUTING SYSTEM

PURPOSE AND ORGANIZATION OF OS/VS

DEFINITION OF TERMS

MAJOR MANAGEMENT COMPONENTS

JOB FLOW IN THE ADDRESS SPACE

VIRTUAL STORAGE CONCEPTS

DATA MANAGEMENT

PROGRAM DEVELOPMENT

JOB CONTROL LANGUAGE

UTILITIES

PRIORITY SCHEDULING

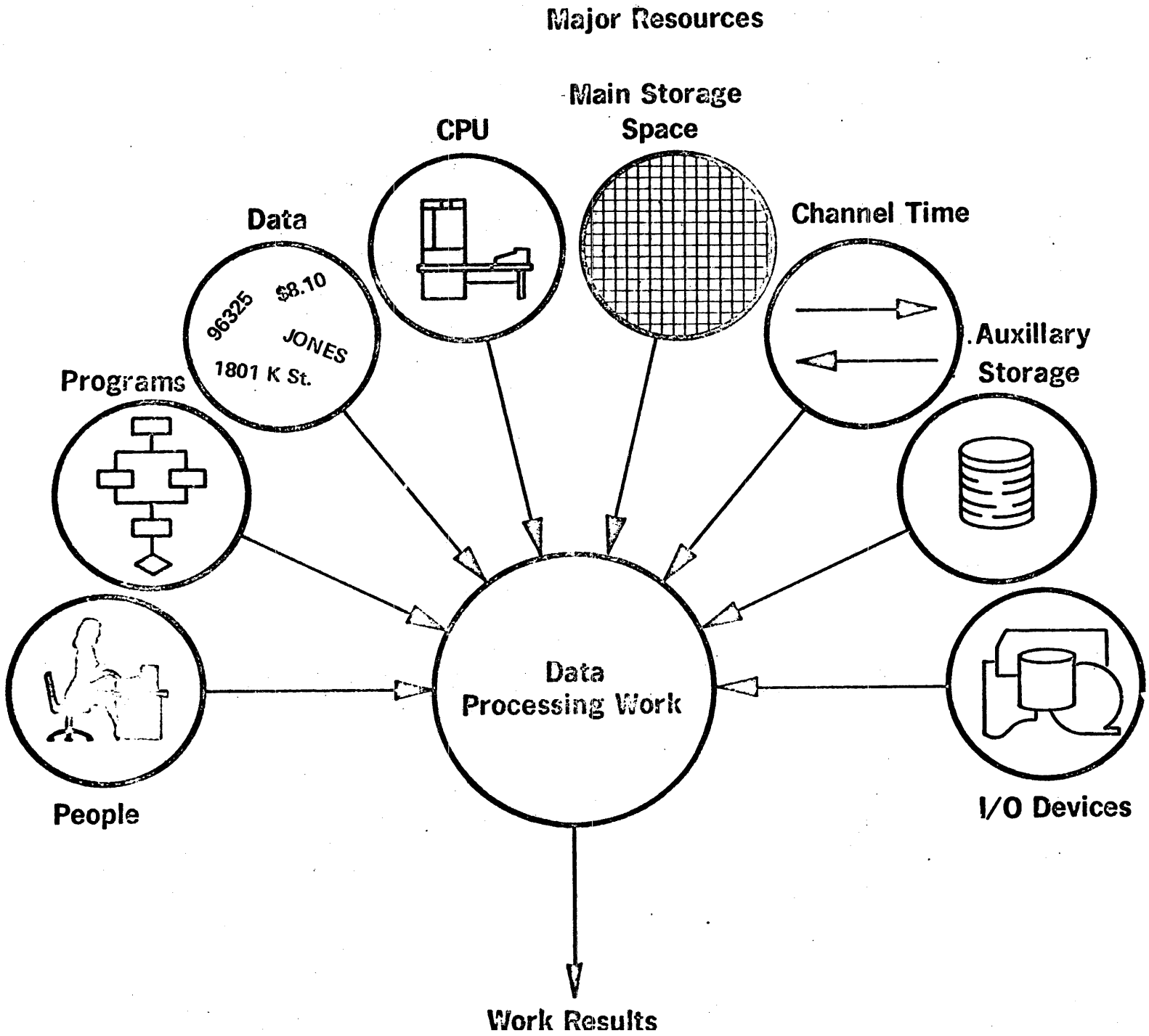
MFT

MVT

VS2

ADDITIONAL FEATURES

REVIEW


Major Resources
Main Storage Space
CPU
Data
96325 $8.10
JONES
1801 K St.
Channel Time
Auxillary Storage
Programs
Data Processing Work
People
I/O Devices
Work Results

WHAT IS AN OPERATING SYSTEM ? ? ?

AN INTERGRATED SET OF PROGRAMS DESIGNED TO IMPROVE THE

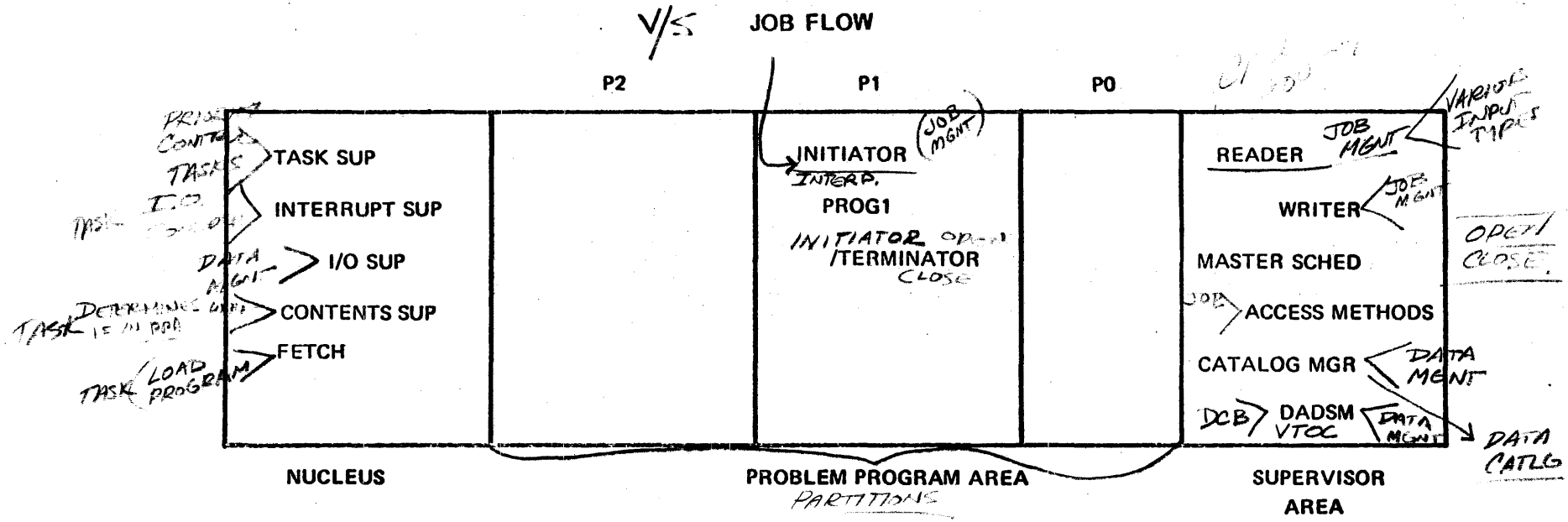
TOTAL OPERATING EFFECTIVENESS OF A DATA PROCESSING INSTALLATION

OS TERMS

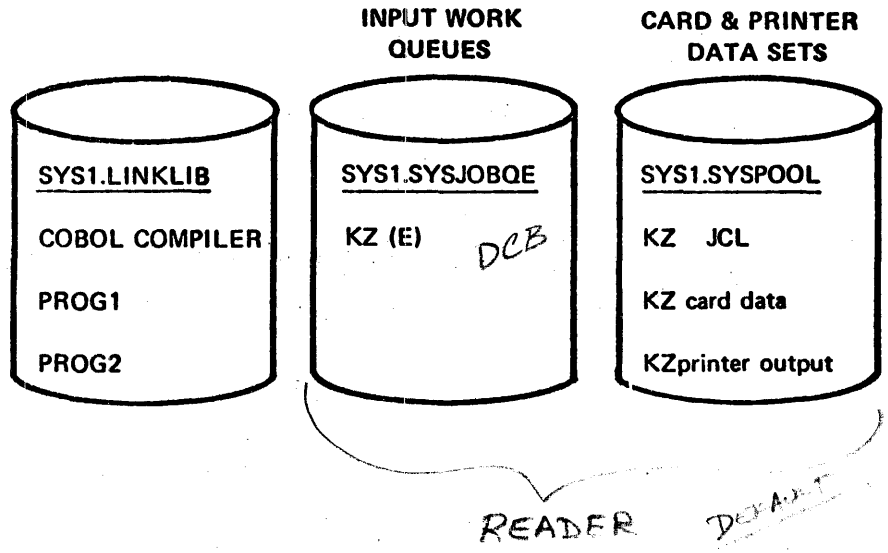
JOB	A TOTAL PROCESSING APPLICATION COMPRISED OF ONE OR MORE RELATED PROGRAMS, EACH CALLED A JOB STEP
TASK	A UNIT OF WORK FOR THE CPU. A JOB STEP BECOMES A TASK INTERNALLY.
JCL	EXTERNAL DIRECTIONS DEFINING TO THE OPERATING SYSTEM A JOBS CHARACTERISTICS AND REQUIREMENTS.
CONTROL BLOCKS	INTERNAL TABLES AND LISTS FOR SYSTEM USE.
PROCESSING PROGRAMS	SET OF INSTRUCTIONS REQUIRED TO PRODUCE SOME RESULT.
CONTROL PROGRAMS	MANAGES OR MANIPULATES THE TOTAL ENVIRONMENT SO AS TO FACILITATE THE OPERATION OF THE PROCESSING PROGRAM.

MAJOR MANAGEMENT MODULES

JOB	external interface
TASK	internal operations
DATA	I/O operations

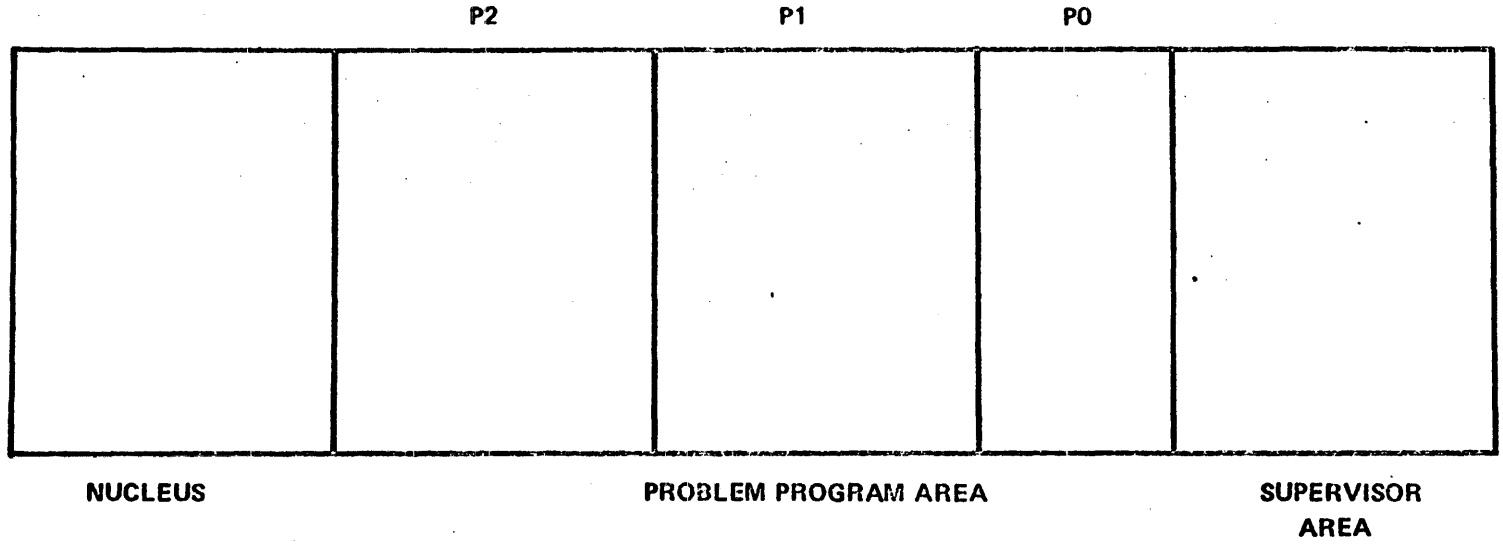



```
          //B2    DD  PRINTER-OUTPUT
         //B1    DD  OLD-DISK-INPUT
        //B   EXEC    PROG2
                      data
      //A5   DD  *
     //A4   DD   PRINTER-OUTPUT
    //A3    DD    NEW-DISK-OUTPUT
   //A2    DD    OLD-TAPE-INPUT
  //A1    DD    OLD-DISK-INPUT
 //A   EXEC    PROG1
//KZ    JOB       CLASS=E
```

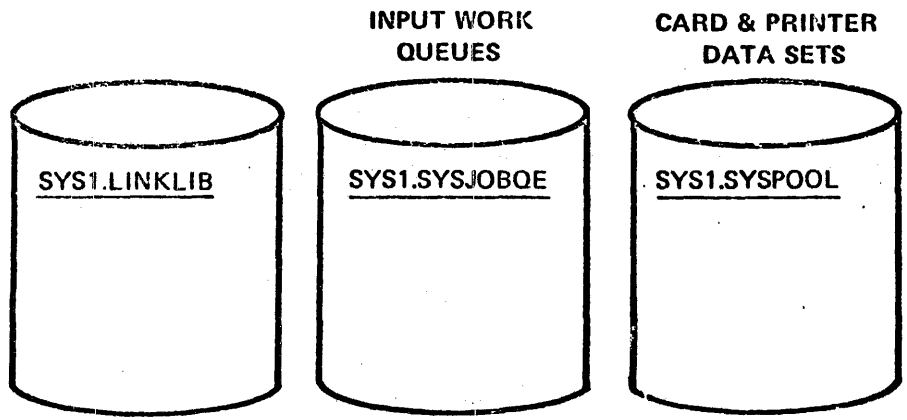


15 JOB CLASSES

JOB FLOW




```
//KZ    JOB       CLASS=E
//A     EXEC    PROG1
//A1    DD    OLD-DISK-INPUT
//A2    DD    OLD-TAPE-INPUT
//A3    DD    NEW-DISK-OUTPUT
//A4    DD    PRINTER-OUTPUT
//A5    DD    *
                data
//B     EXEC    PROG2
//B1    DD    OLD-DISK-INPUT
//B2    DD    PRINTER-OUTPUT
```



JOB

READER
- *reads in JOB*
- *creates control block on SYS1.SYSJOBQE*
- *places card data sets on SYS1.SYSPOOL*

INITIATOR/TERMINATOR
- *selects JOB from Q*
- *interprets JCL*
- *allocates I/O devices*
- *has program loaded into storage*
- *deallocates I/O devices*
- *disposes of data sets*

WRITER
- *writes unit record output from SYS1.SYSPOOL to device*

MASTER SCHEDULER
- *communicates with operator*

TASK

TASK SUPERVISOR
- *switches control of CPU between tasks*

CONTENTS SUPERVISOR
- *maintains directory of programs in main storage*

INTERRUPT SUPERVISOR
- *handles interrupts*

FETCH
- *loads program into storage*

DATA

DIRECT ACCESS SPACE MGT
- *provides disk space for data sets*
- *maintains inventory of free disk space*

CATALOG MGR
- *maintains and searches catalog for location of data set*

OPEN/CLOSE
- *prepares data set for I/O*

ACCESS METHOD
- *method of transmitting data*
- *interfaces between user and I/O supervisor*

I/O SUPERVISOR
- *handles I/O requests at the physical level*

VIRTUAL STORAGE

ADDRESS SPACE:

SPACE IN WHICH DATA, INSTRUCTIONS, AND CONSTANTS ARE DEFINED BY THE PROGRAMMER.

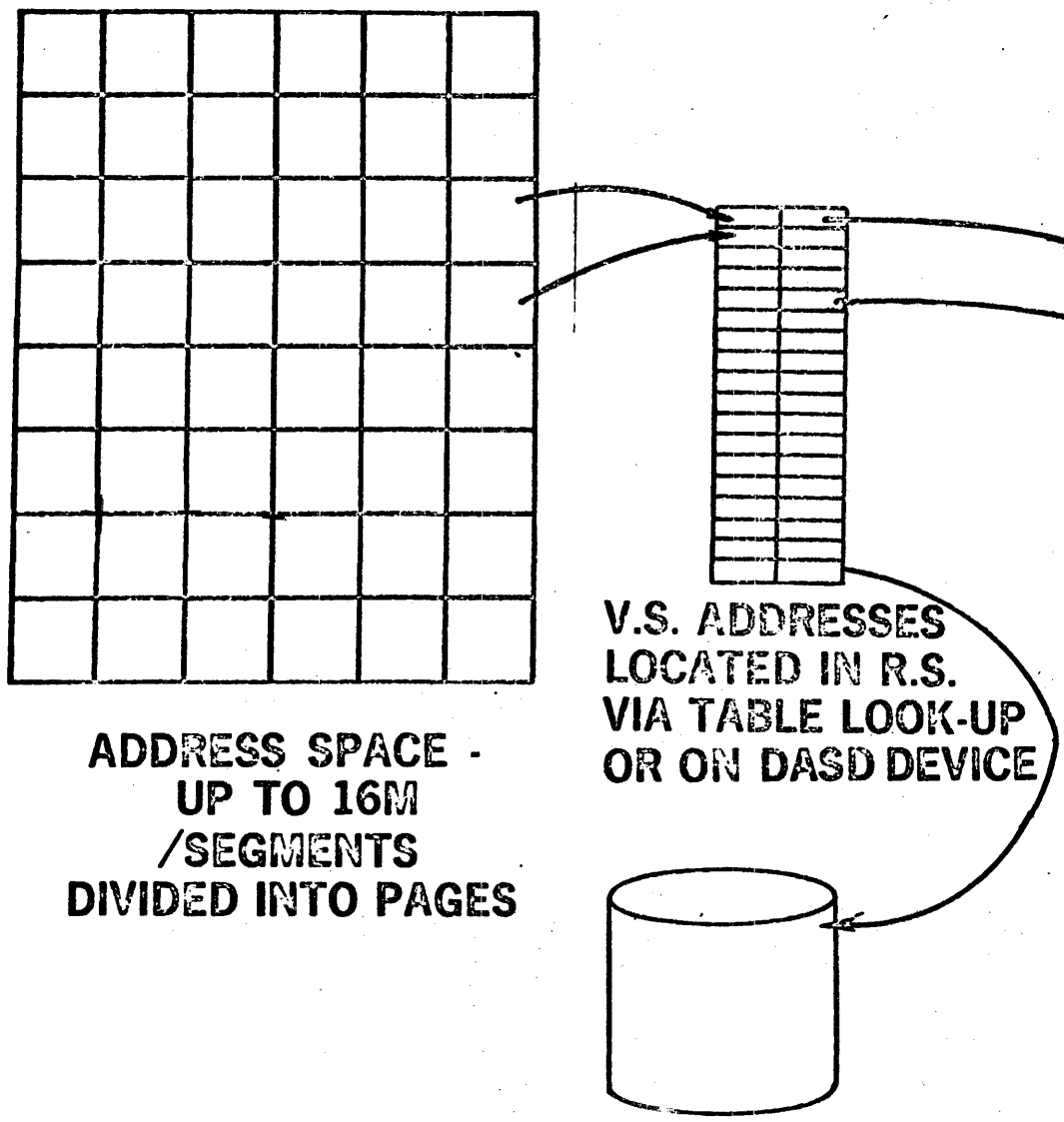
STORAGE SPACE:

PHYSICAL LOCATION OF DATA, INSTRUCTIONS, AND CONSTANTS, DEFINED BY THE SYSTEM.

VIRTUAL STORAGE SYSTEM

A STORAGE MANAGEMENT SYSTEM THAT GIVES THE USER AN ADDRESS SPACE THAT MAY BE GREATER THAN REAL STORAGE SPACE.

THE VIRTUAL ENVIRONMENT



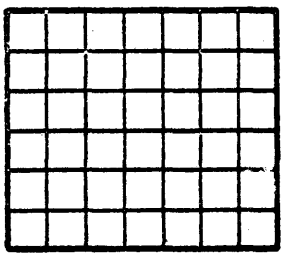
VS-1 2K
VS-2 4K
PAGES
PAGE SUPC 10K
(NUCLEUS)

16
SEGMENTS
64 K
PARTITIONS B/
SEGMENT

STORAGE SPACE
– EXISTS PHYSICALLY

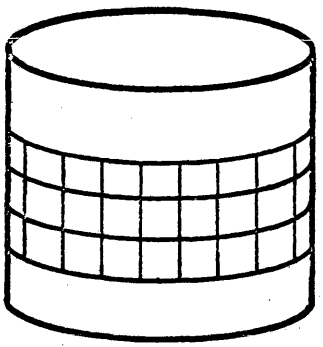
1. PAGE FRAME - A 2K–BYTE UNIT OF MAIN STORAGE
— ACTIVE PROGRAM PARTS.

MAIN STORAGE



2. PAGE SLOT - A 2K–BYTE UNIT OF EXTERNAL PAGE STORAGE
— NOT SO ACTIVE PROGRAM PARTS.

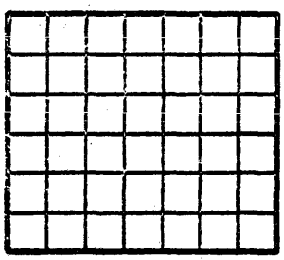
EPS



ADDRESS SPACE
– EXISTS LOGICALLY

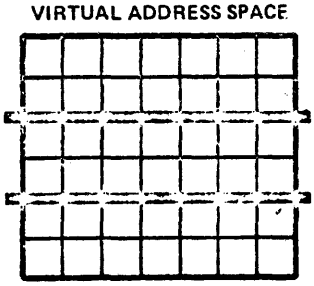
3. PAGE - 2K–BYTES OF INSTRUCTIONS OR DATA OF AN INITIATED PROGRAM IN THE ADDRESS SPACE.

VIRTUAL ADDRESS SPACE

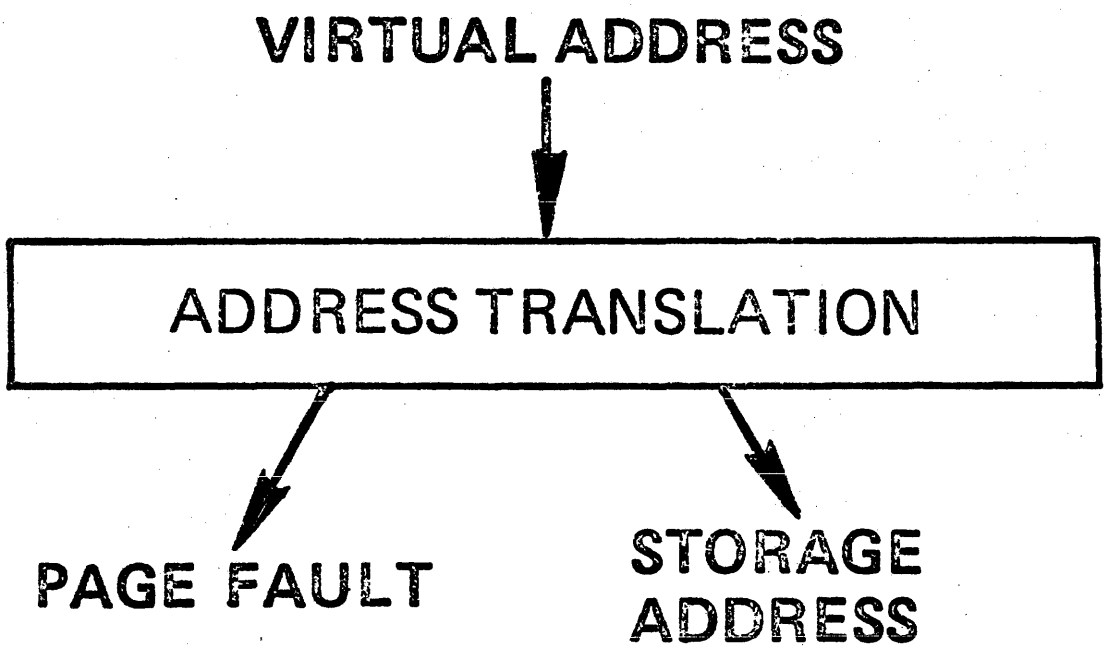


4. SEGMENT - 32 PAGES OF VIRTUAL STORAGE OR 64K. SMALLEST UNIT OF VIRTUAL STORAGE THAT A USER CAN ALLOCATE FOR HIS USE.

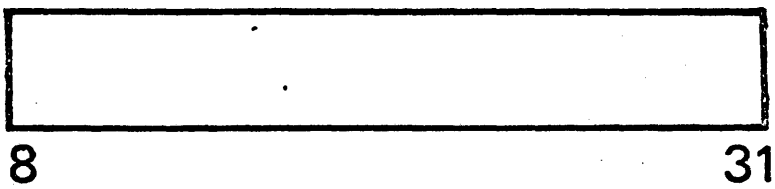
VIRTUAL ADDRESS SPACE



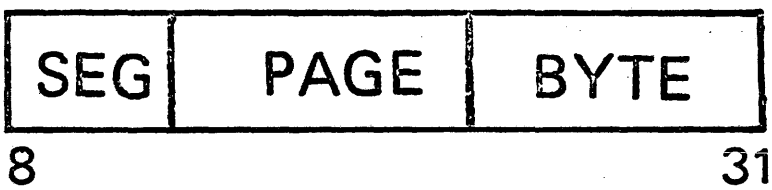
TRANSLATION CONCEPT



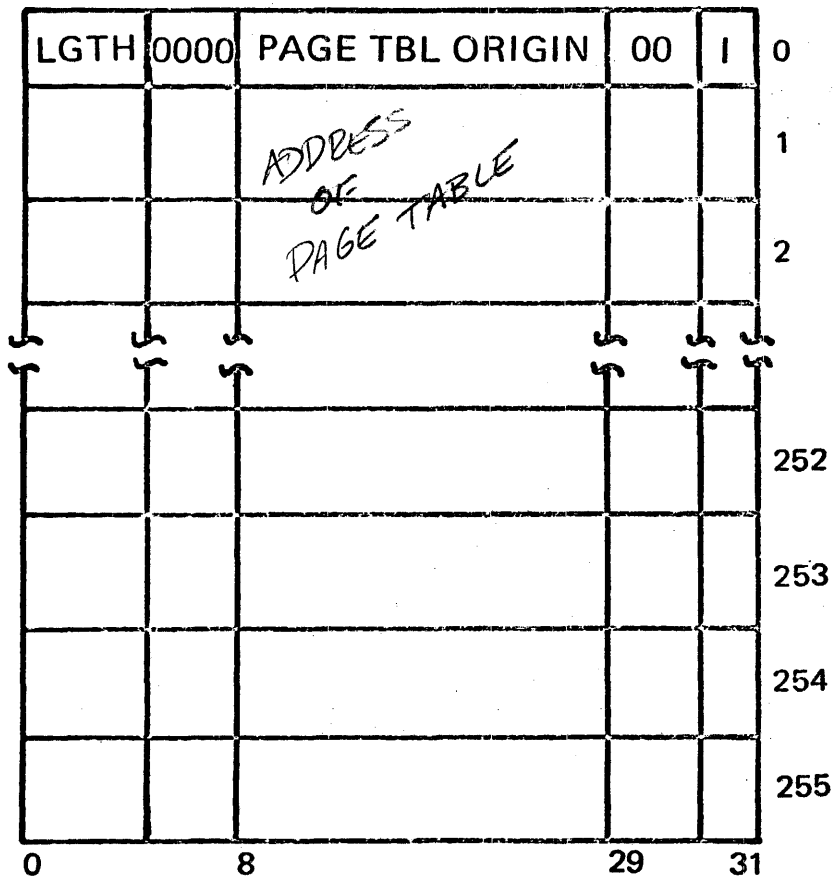
EFFECTIVE STORAGE ADDRESS



VIRTUAL ADDRESS

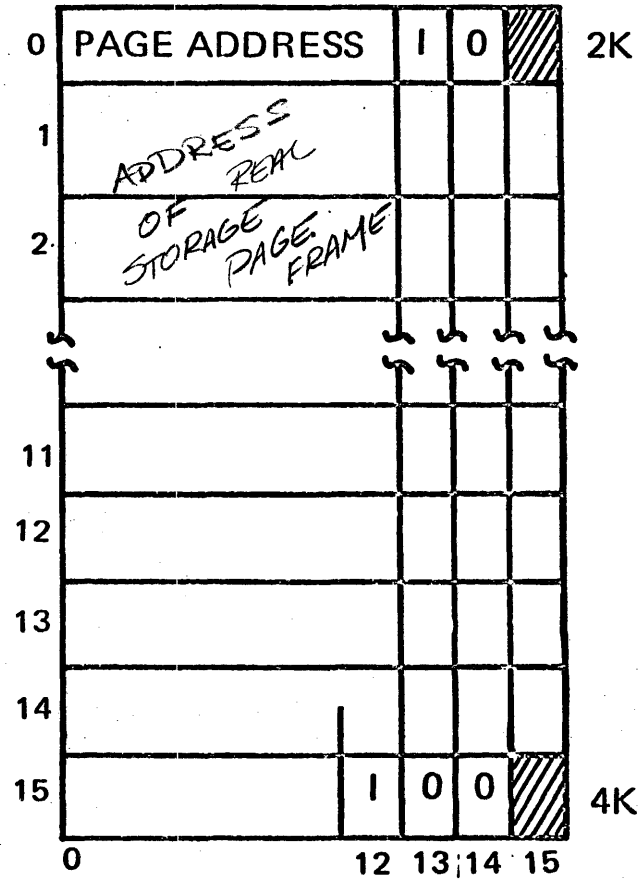


SEGMENT TABLE



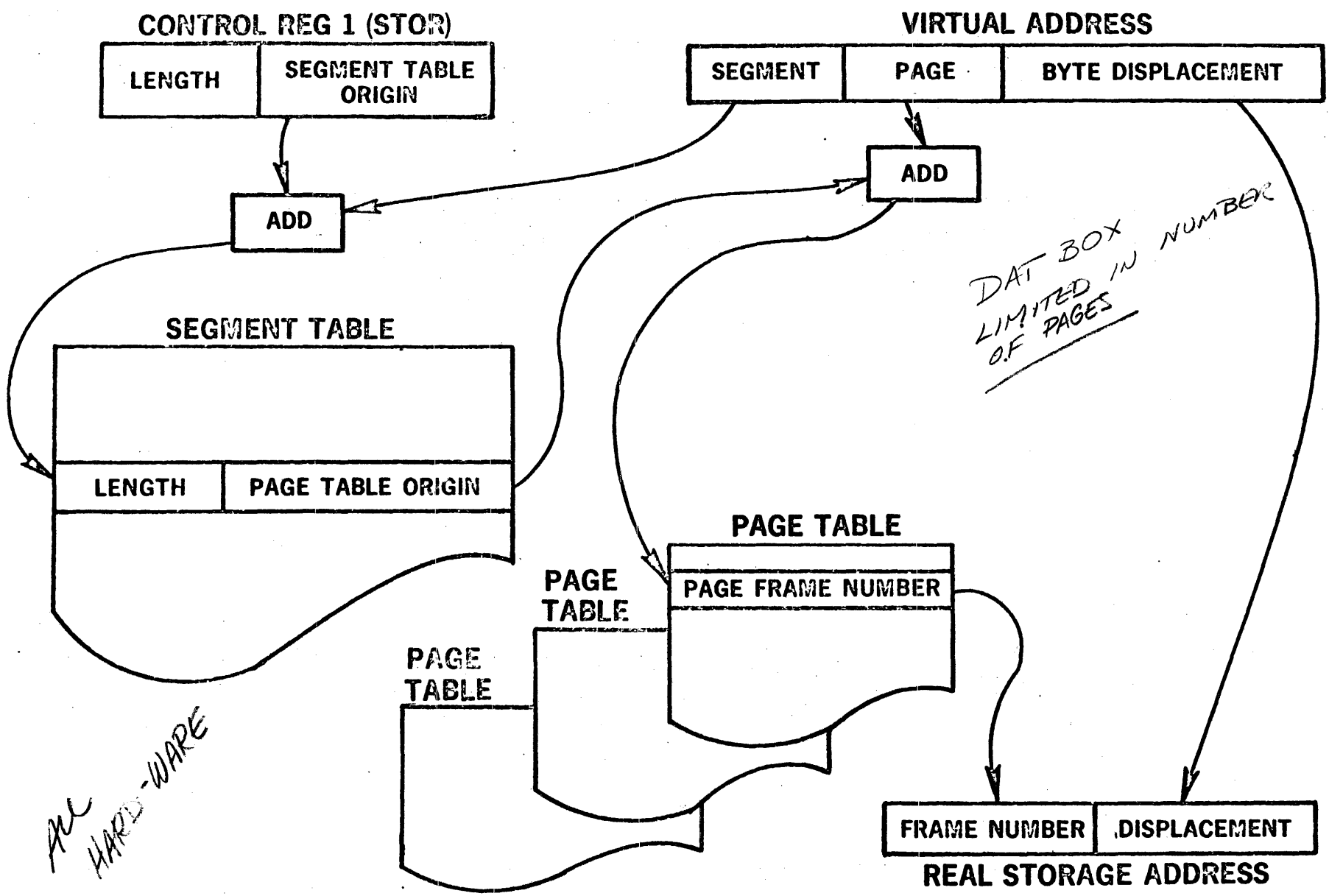
I = INVALID BIT

PAGE TABLE



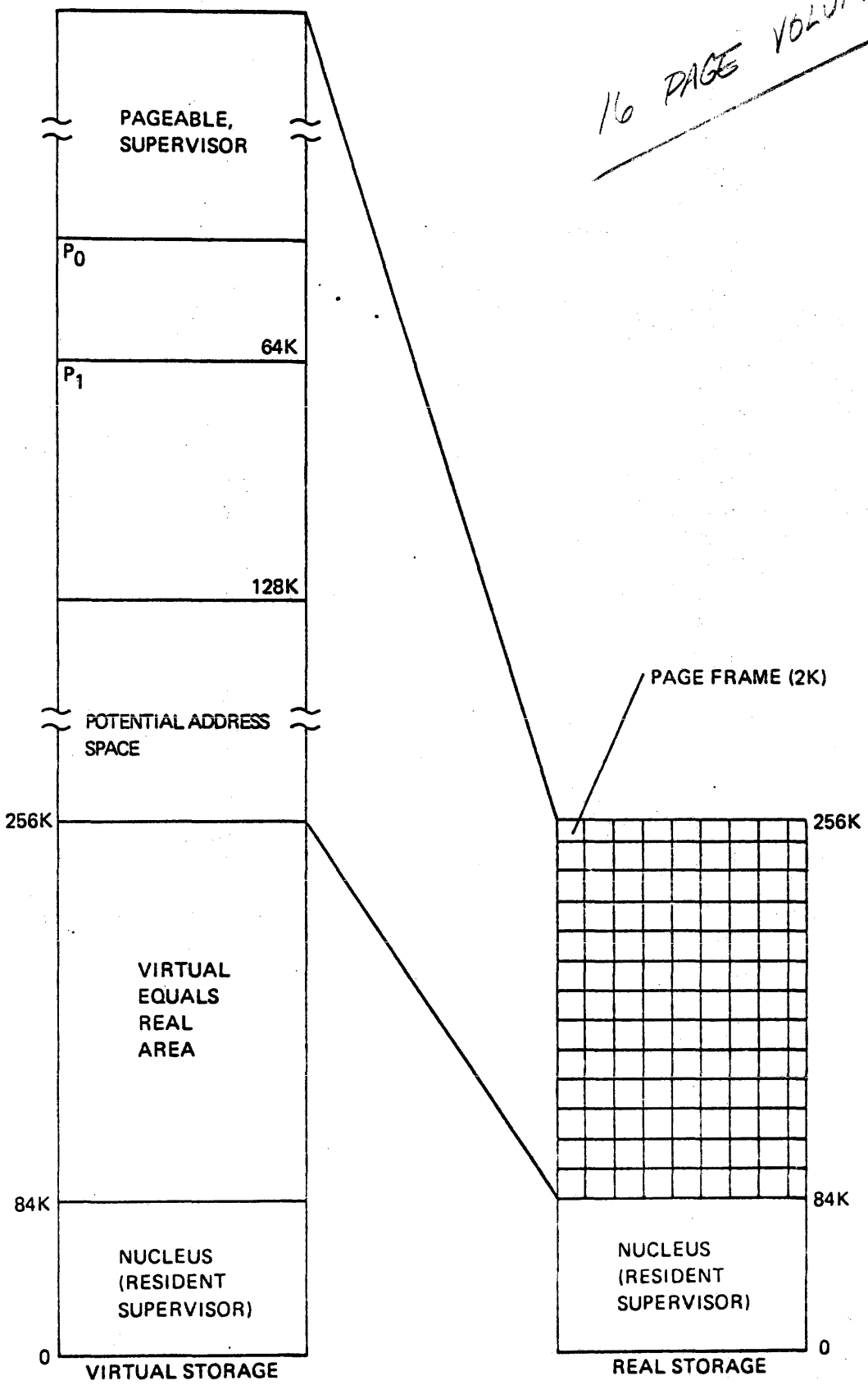
I = INVALID BIT

RELOCATION ACTION TABLE LOOKUP

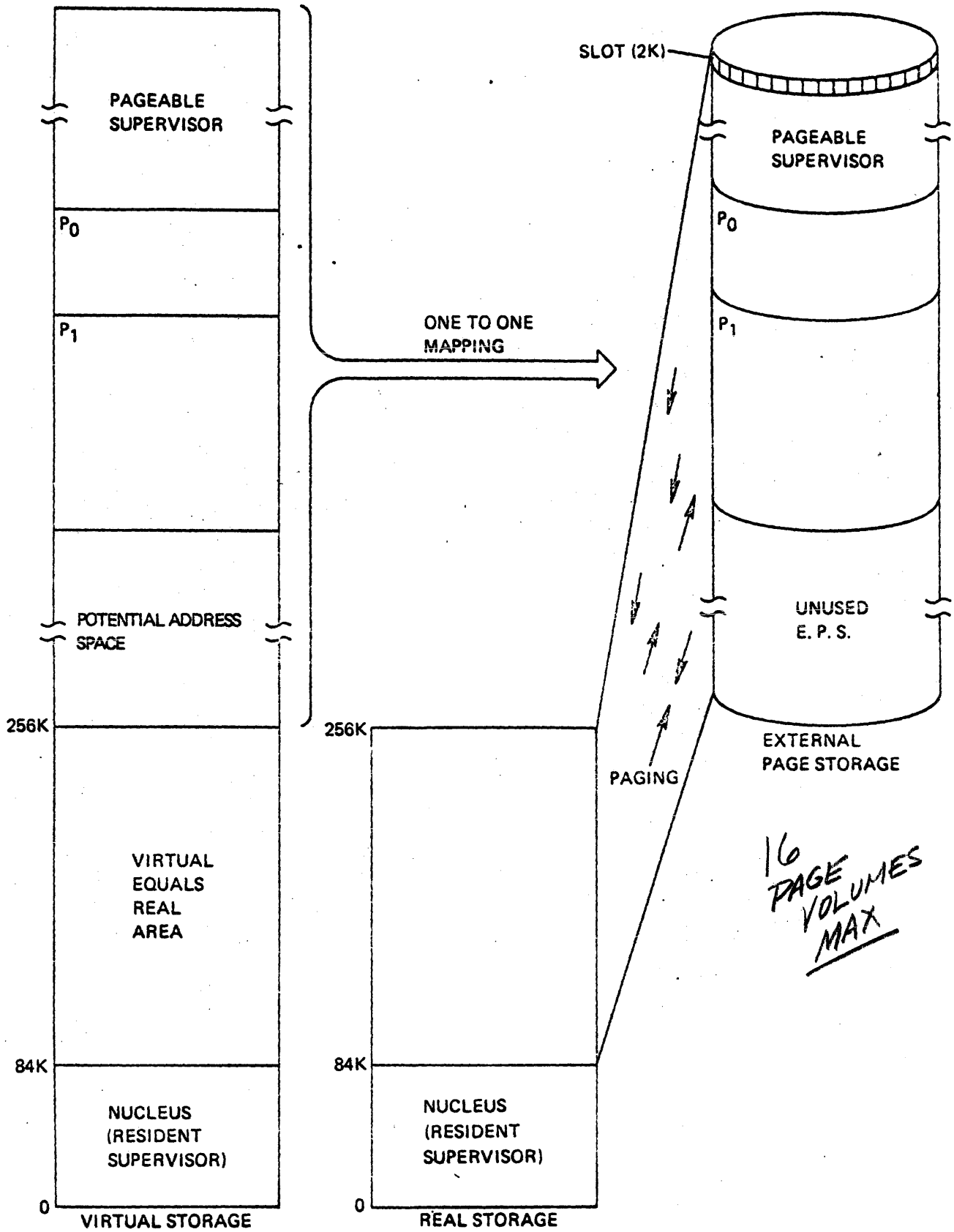


OS/VS1: VIRTUAL STORAGE, REAL STORAGE RELATIONSHIP

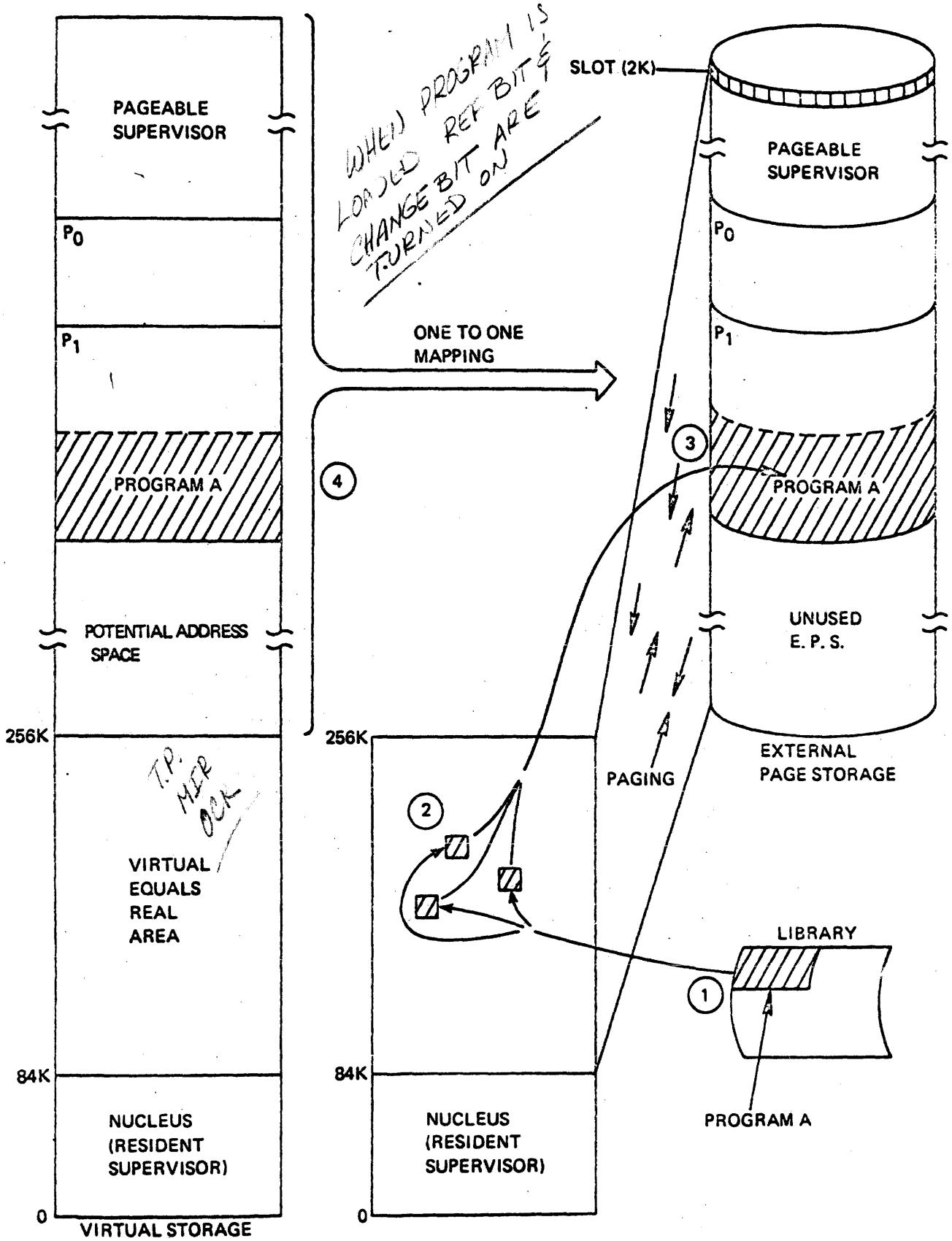
16 PAGE VOLUMES



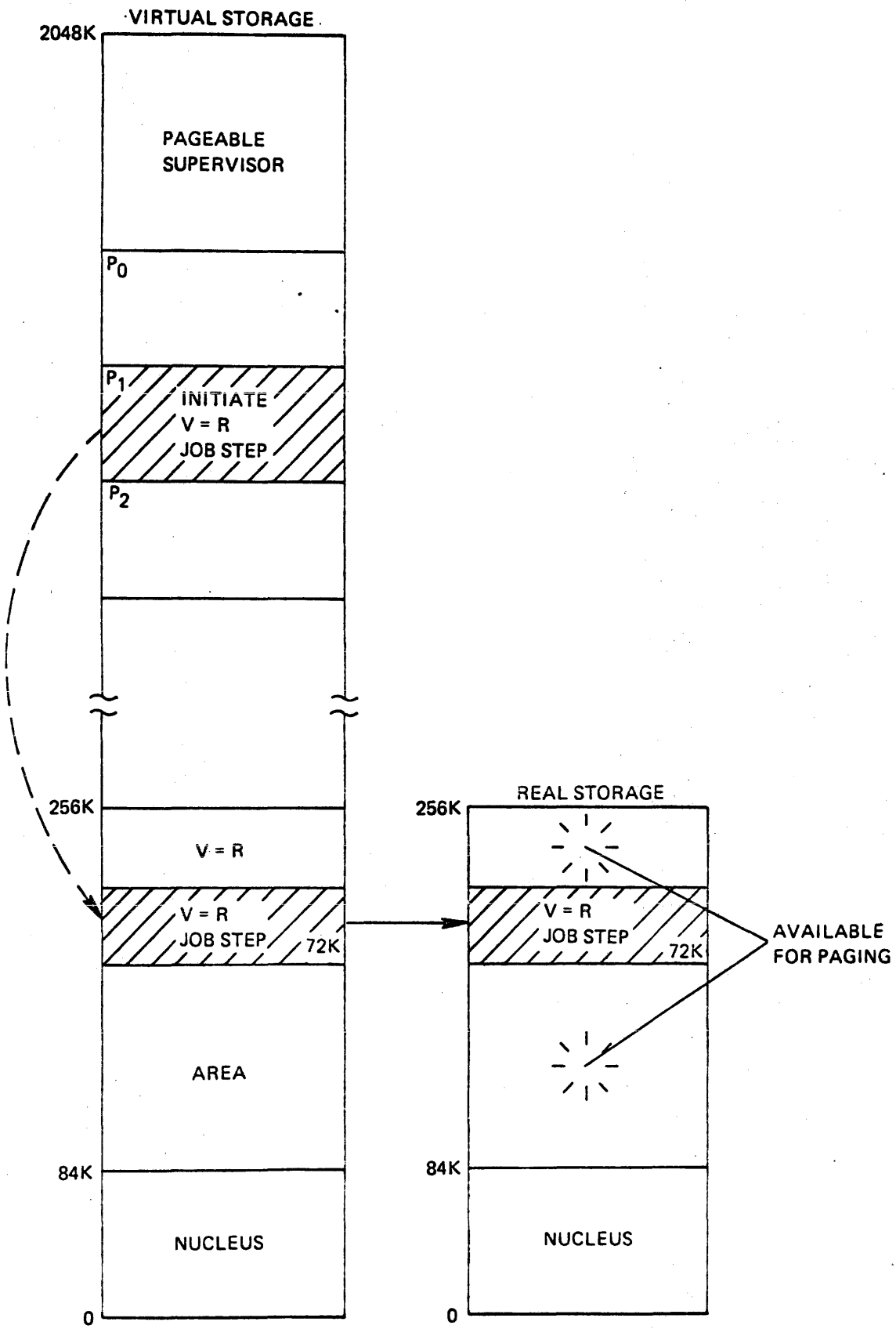
OS/VS1: VIRTUAL STORAGE, REAL STORAGE, EXTERNAL PAGE STORAGE



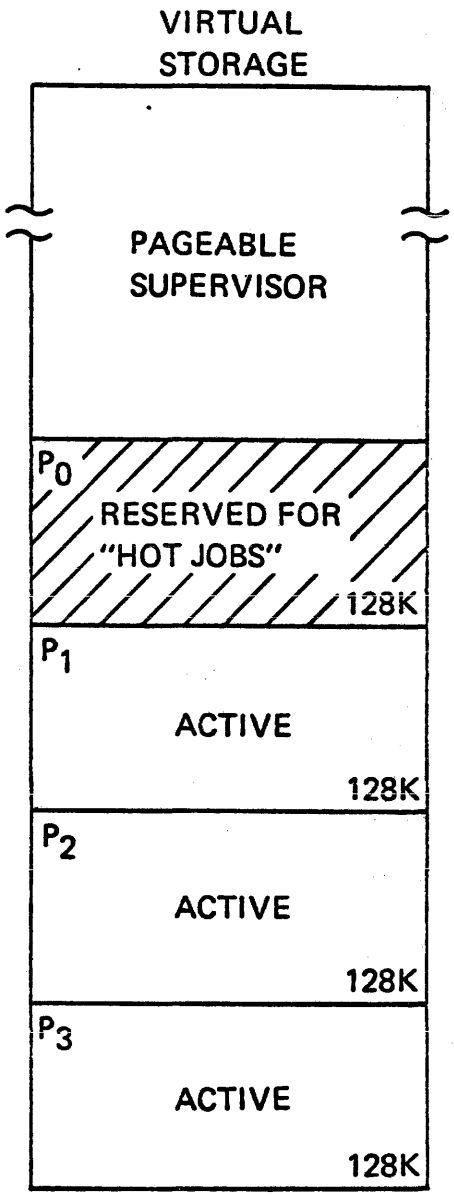
OS/VS1: PROGRAM LOADING IN VIRTUAL STORAGE



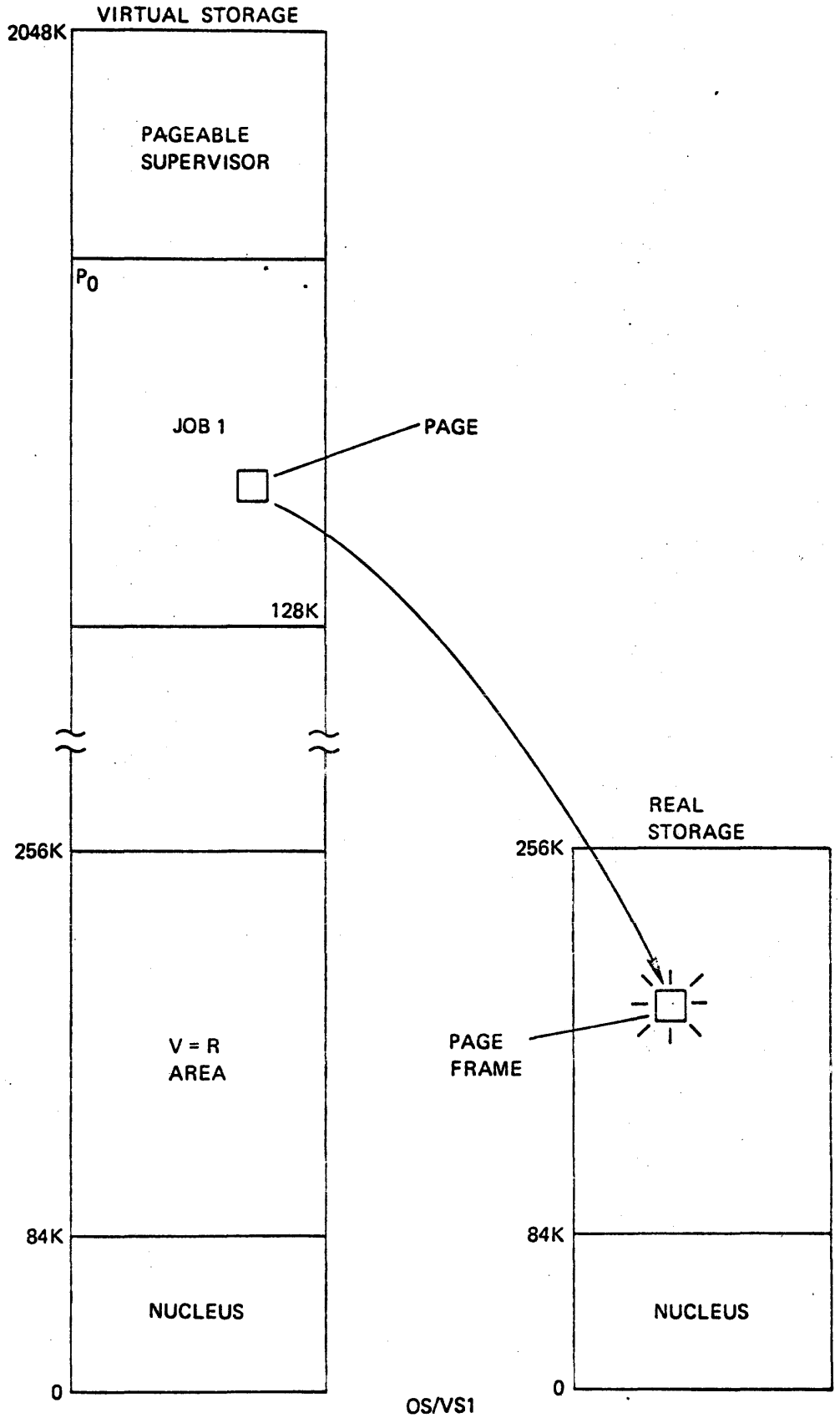
OS/VS1: A VIRTUAL EQUALS REAL JOB STEP

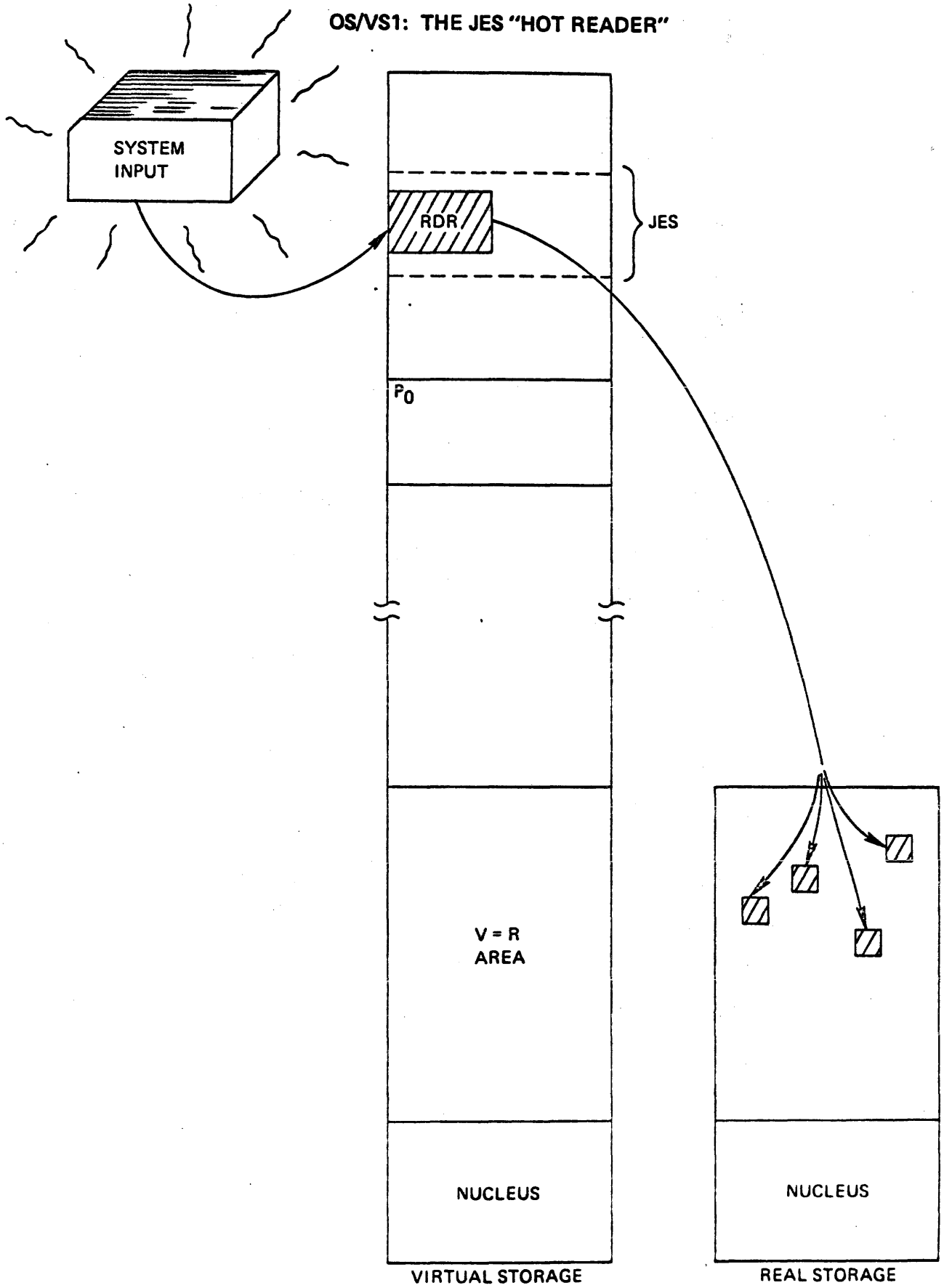


OS/VS1 "HOT JOB" SCHEDULING, A SUGGESTED APPROACH

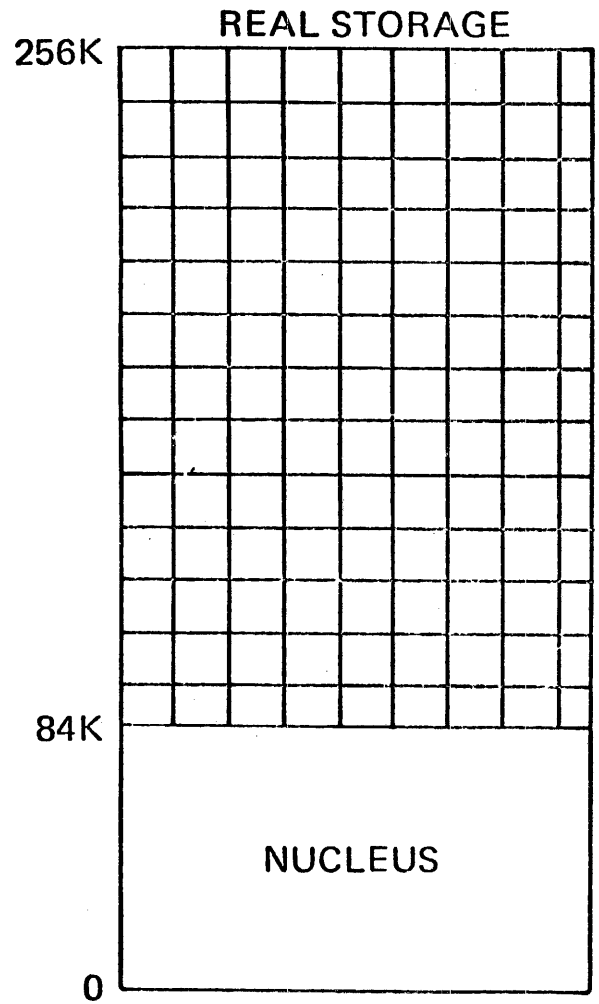


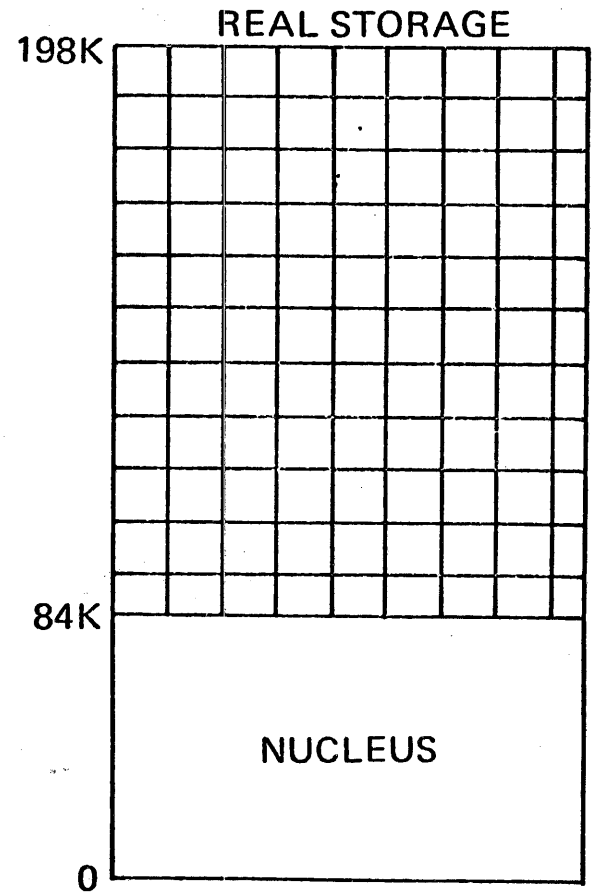
OS/VS1: RELIABILITY



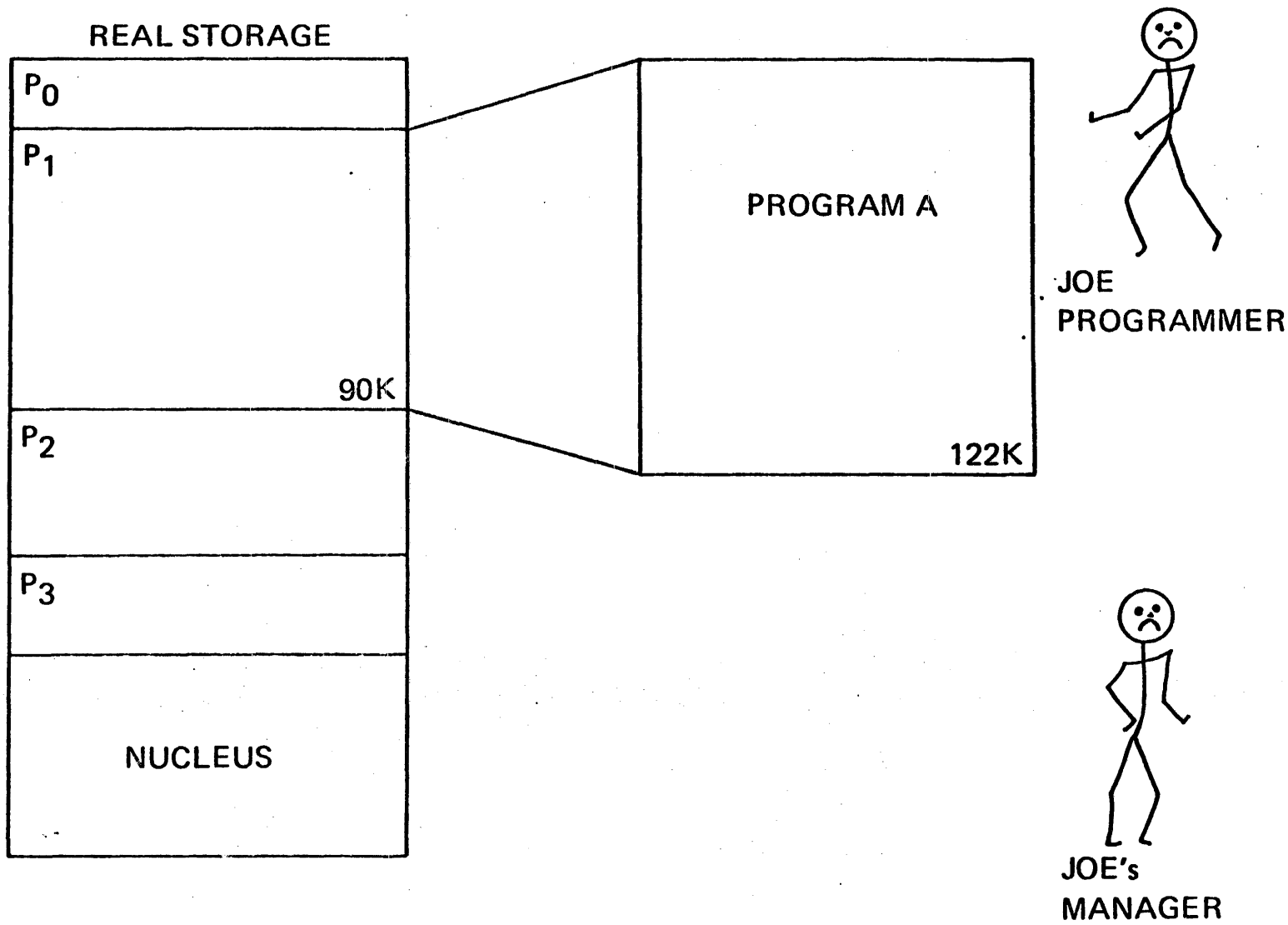

OS/VS1: THE JES "HOT READER"
SYSTEM INPUT
RDR
JES
P_0
V = R AREA
NUCLEUS
VIRTUAL STORAGE
NUCLEUS
REAL STORAGE

OS/VS1: SMALLER SYSTEM BACKUP, EASY GROWTH INTO MORE REAL STORAGE

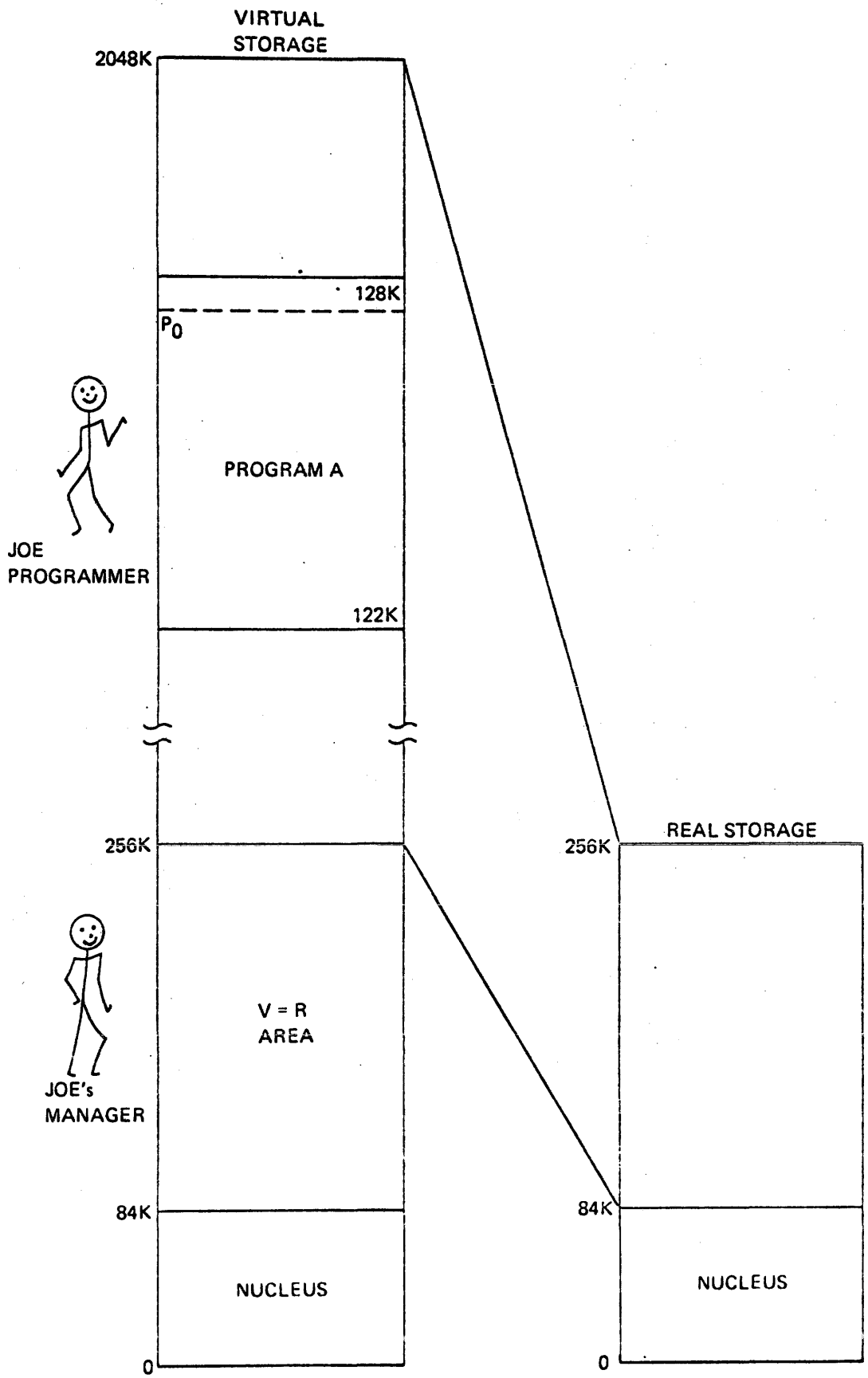




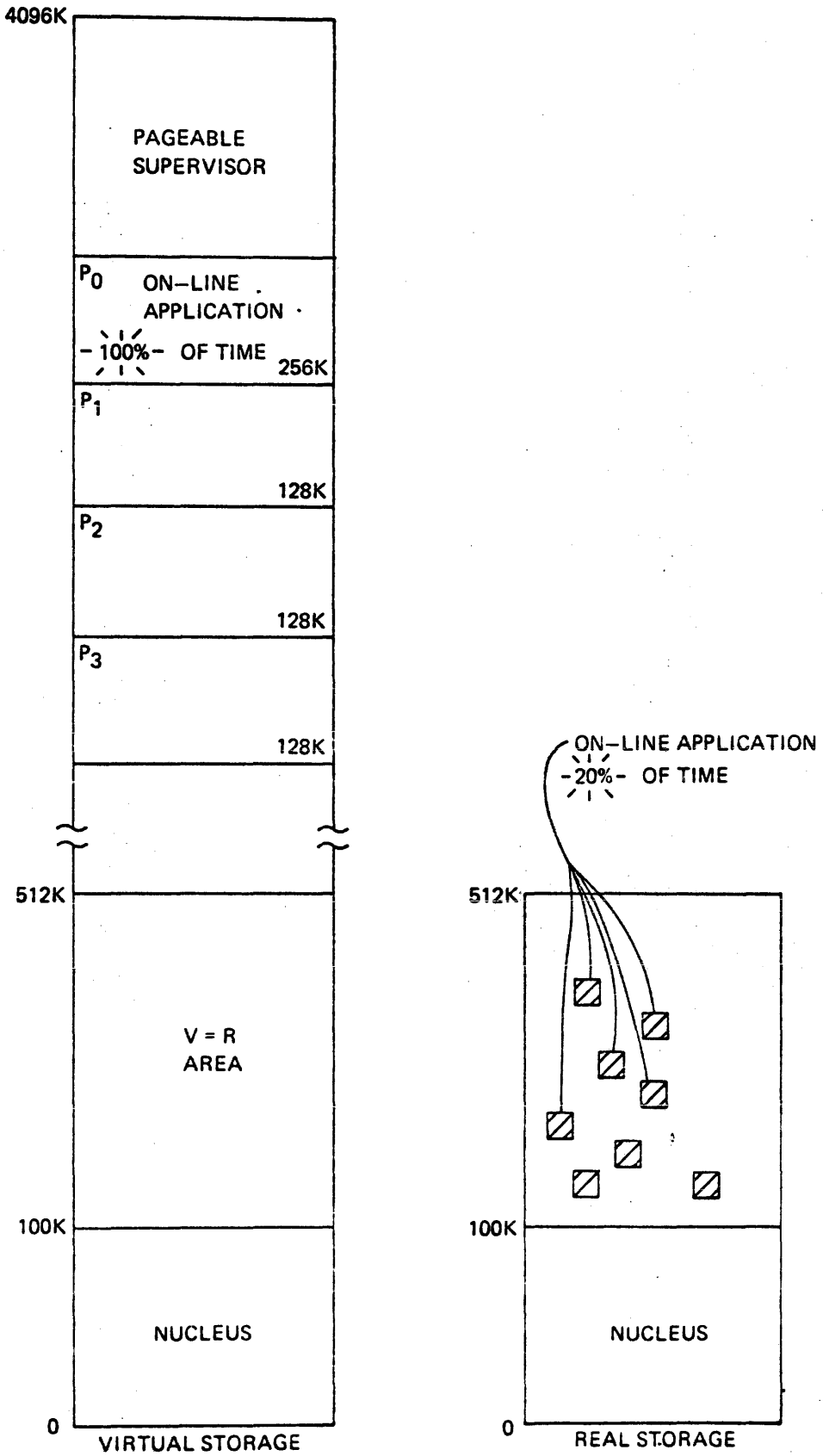
WITHOUT VIRTUAL STORAGE — REAL STORAGE RESTRICTIONS



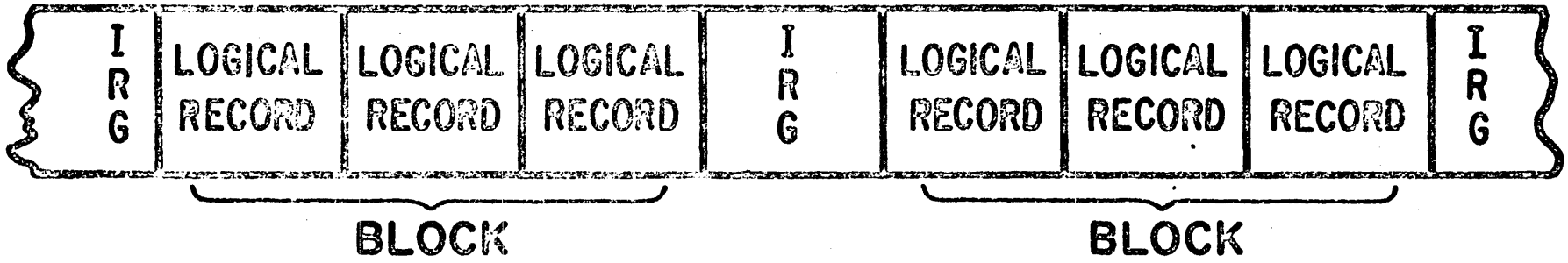
OS/VS1: PROGRAMMER PRODUCTIVITY



OS/VS1: ON–LINE APPLICATION – OPERATION



BLOCKED LOGICAL RECORDS



UNBLOCKED LOGICAL RECORDS

FIXED LENGTH RECORDS

FORMAT F

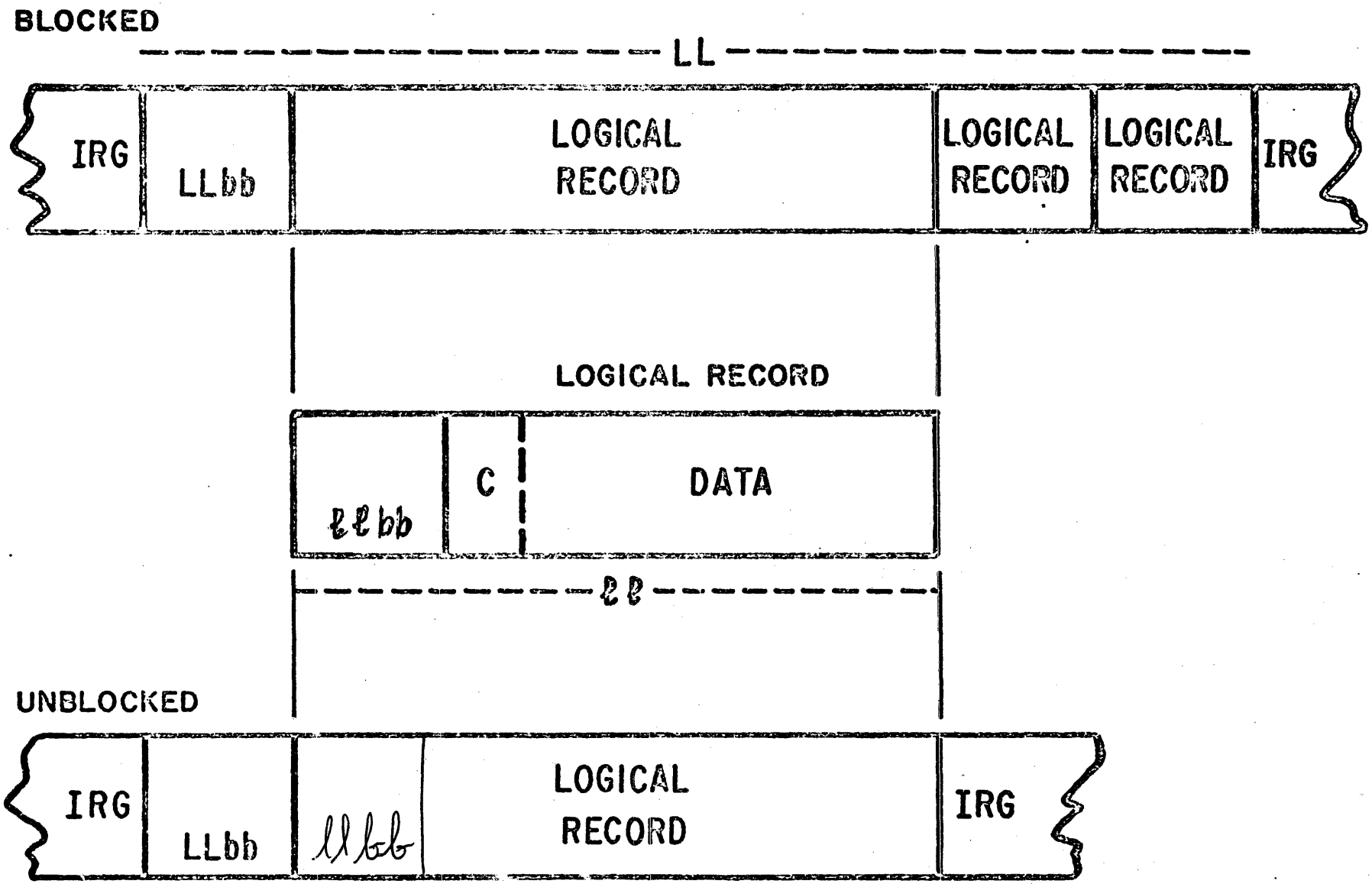
BLOCKED

UNBLOCKED

LOGICAL RECORD

VARIABLE LENGTH RECORDS

FORMAT V



UNDEFINED RECORDS

FORMAT U

UNBLOCKED

LOGICAL RECORDS

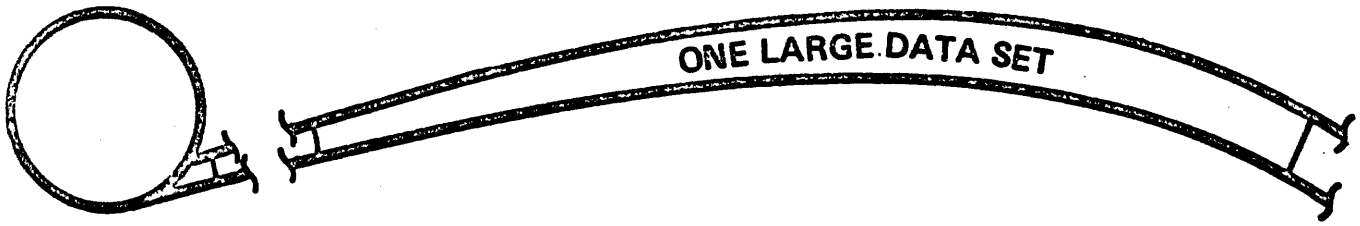
DATA SET NAMES

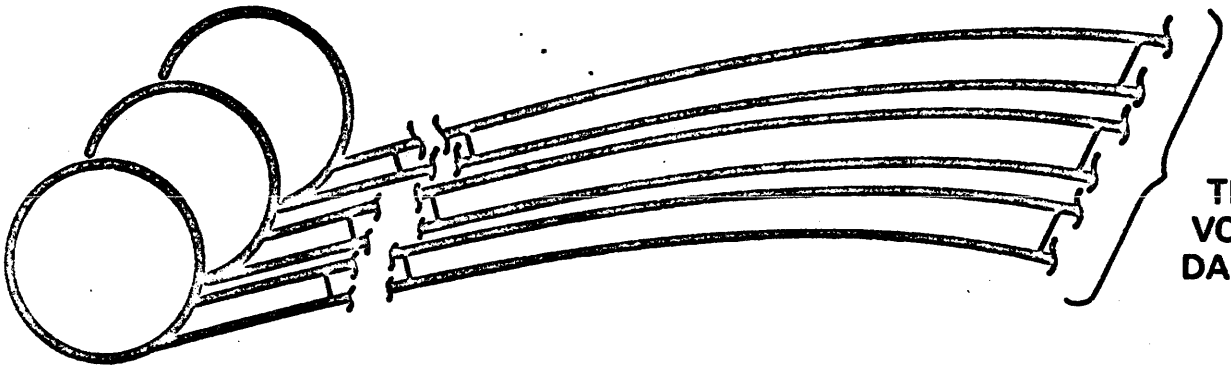
SIMPLE

A
A2
A1234567
INVENTRY

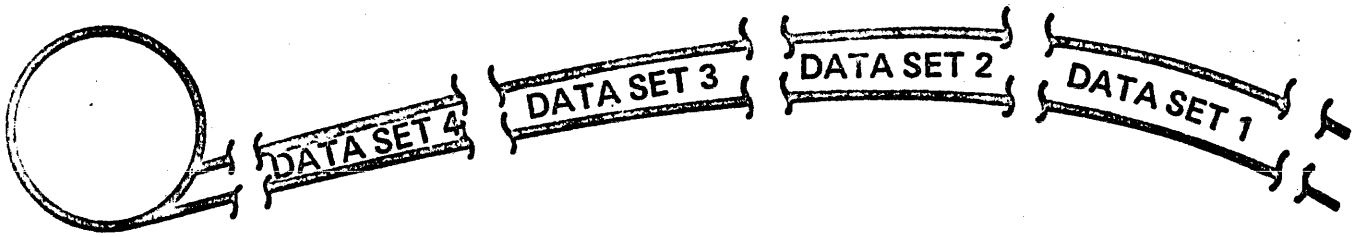
QUALIFIED

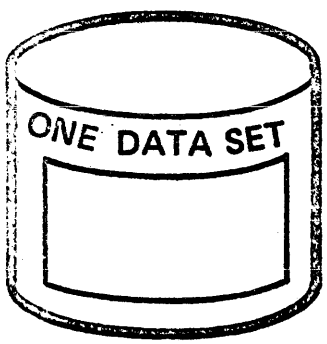
E.A.P
INVENTRY.LOC695.PARTNO25
A.B.C.D.E.F.G.H.I.J.K.L.M.N.O.P.Q.R.S.T.U.V
TREE.FRUIT.APPLE

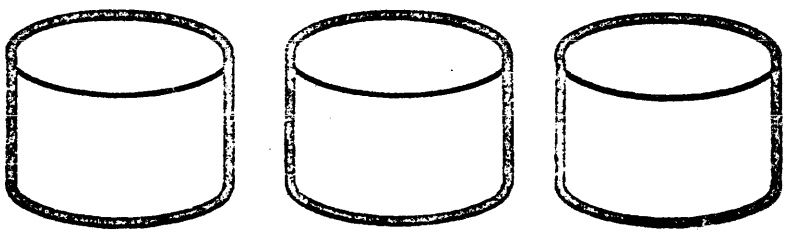




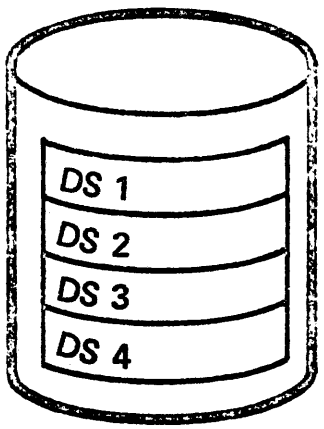
A THREE VOLUME DATA SET



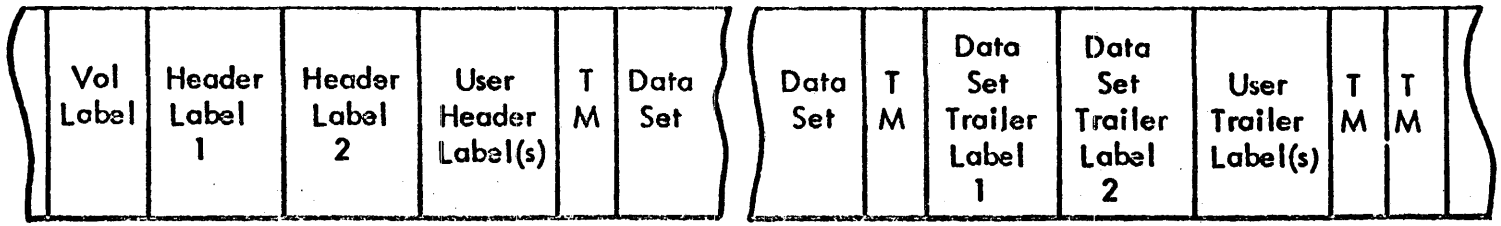




A THREE VOLUME DATA SET

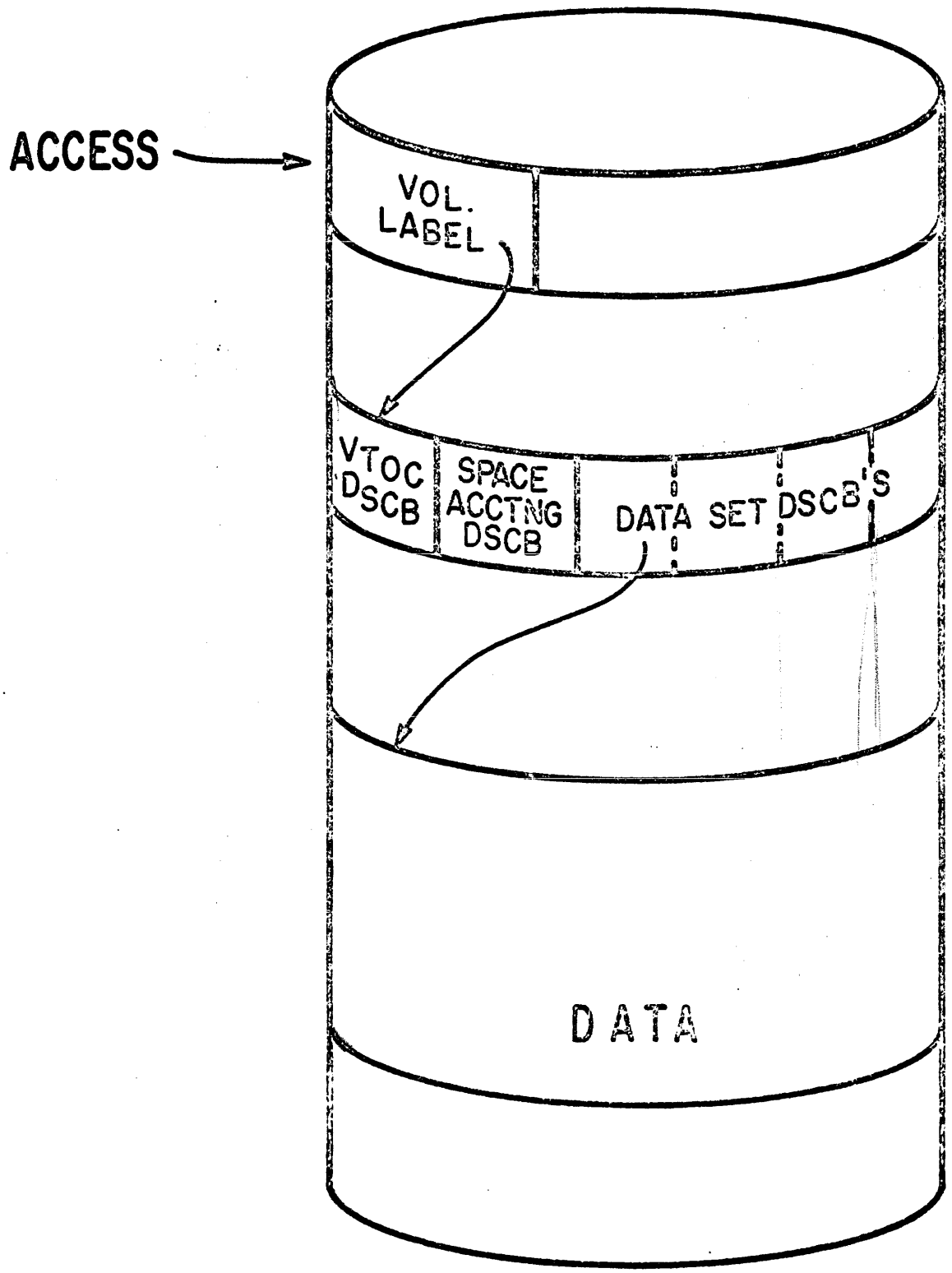


TAPE VOLUME CONTAINING 1 DATA SET (OS)



DASD LABELS

ONLY STANDARD LABELS ARE USED



D.A.D.S.M.

INITIALIZES EACH DASD

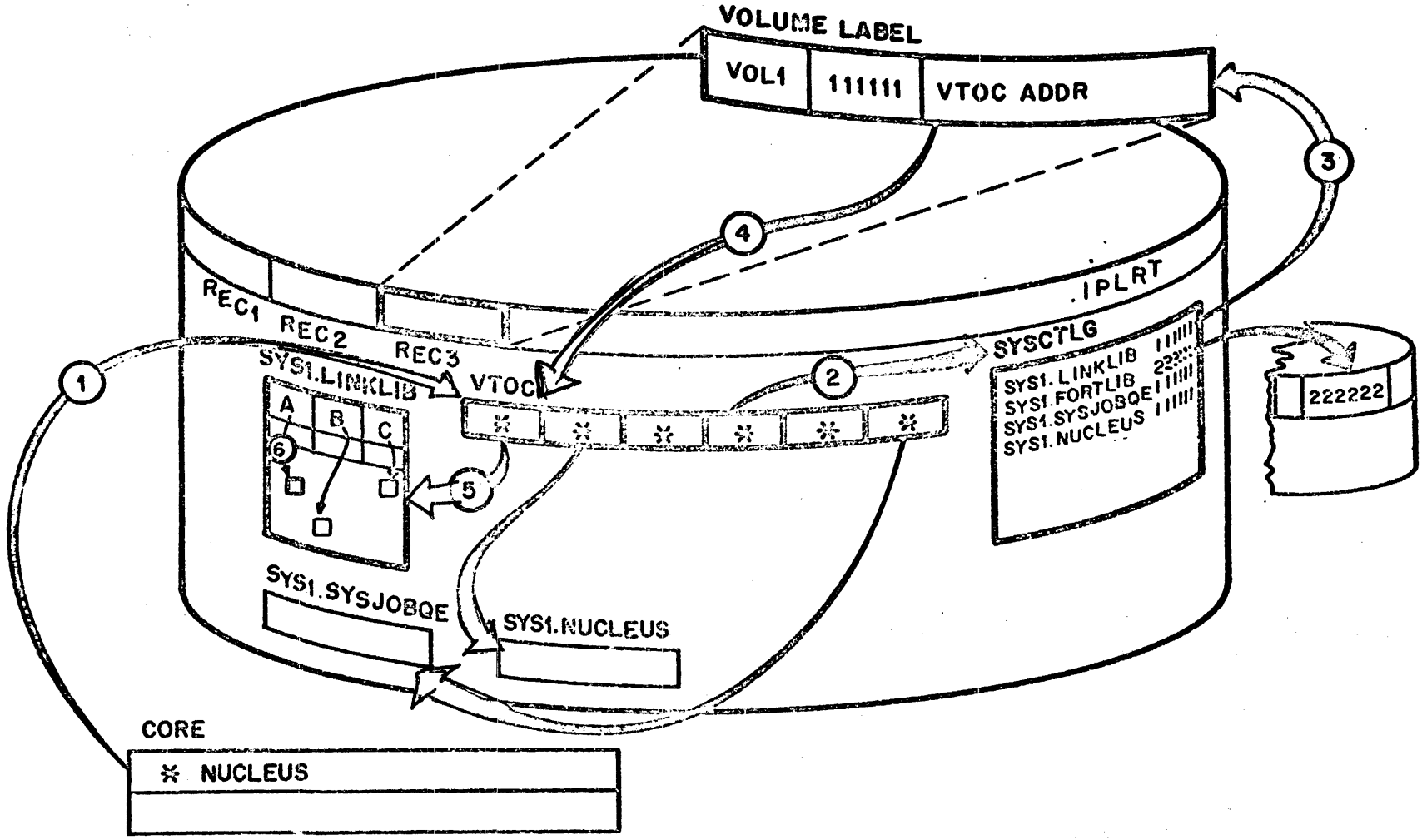
KEEPS TRACK OF ALL SPACE ON EACH DASD

CHECKS FOR DUPLICATE DATA SET NAMES

ALLOCATES SPACE AS REQUESTED BY PROGRAMMER

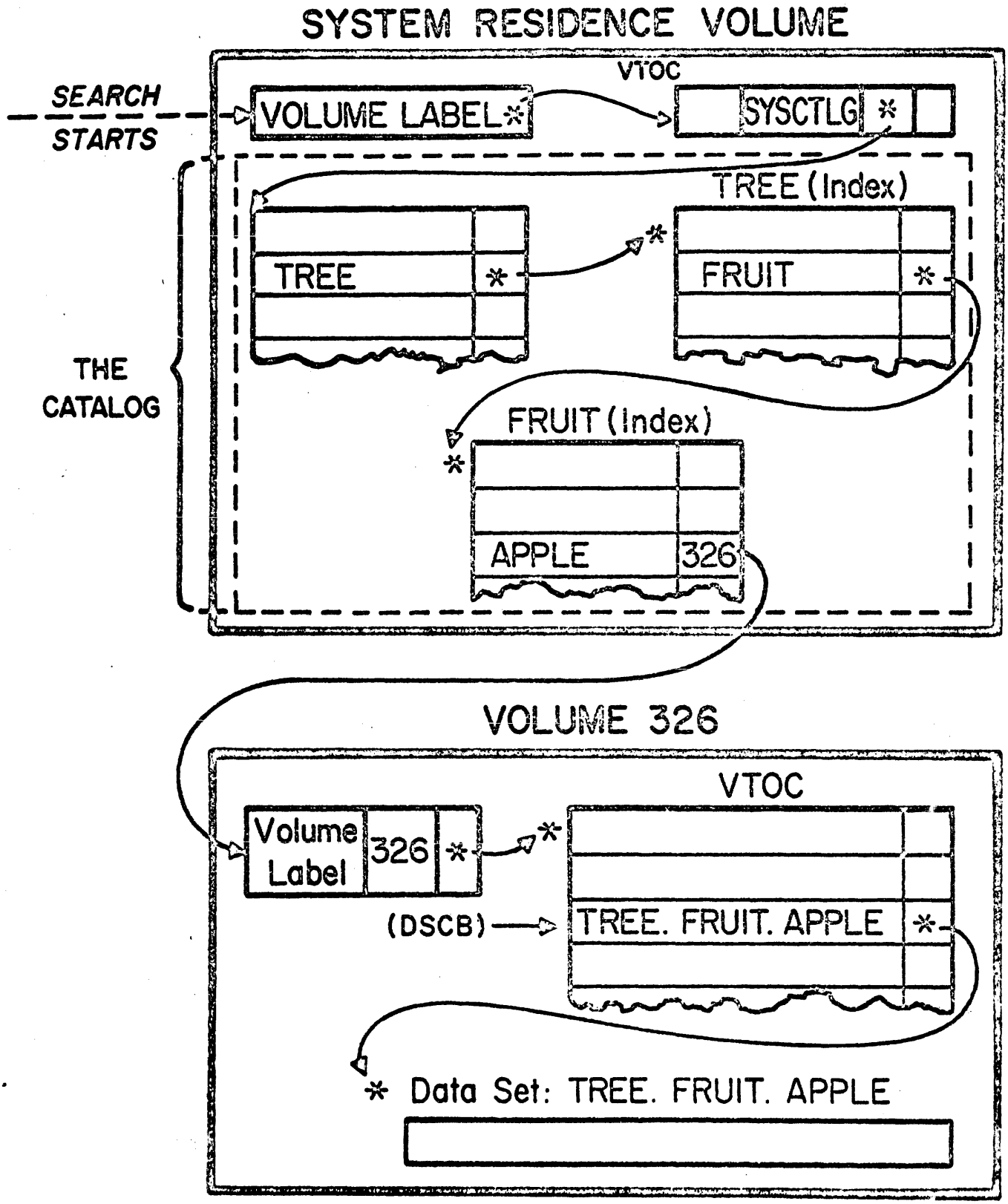
AUTOMATIC EXTENSION OF SPACE WHEN
ORIGINAL AMOUNT PROVIDED IS NOT ADEQUATE

FIND A CATALOGUED DATA SET



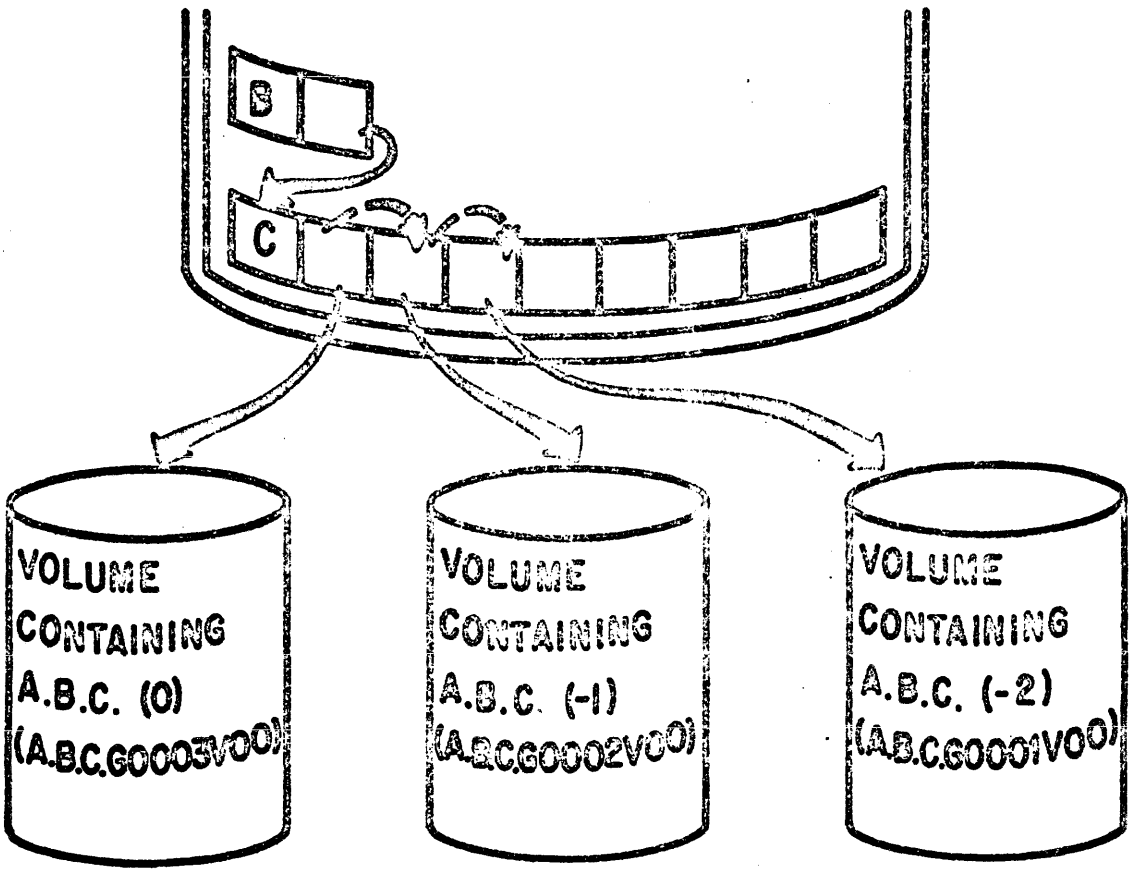
CATALOG SEARCH

FIND: DATA SET TREE.FRUIT.APPLE



RELATIVE POSITIONING—

THREE ENTRIES IN THE CATALOG



LAST CATALOGED —	SECOND CATALOGED —	FIRST CATALOGED —
NEWEST GENERATION	NEXT—TO—LATEST GENERATION	OLDEST GENERATION

GENERATION DATA GROUPS

(ASSUME 3 DATA SETS TO BE MAINTAINED)

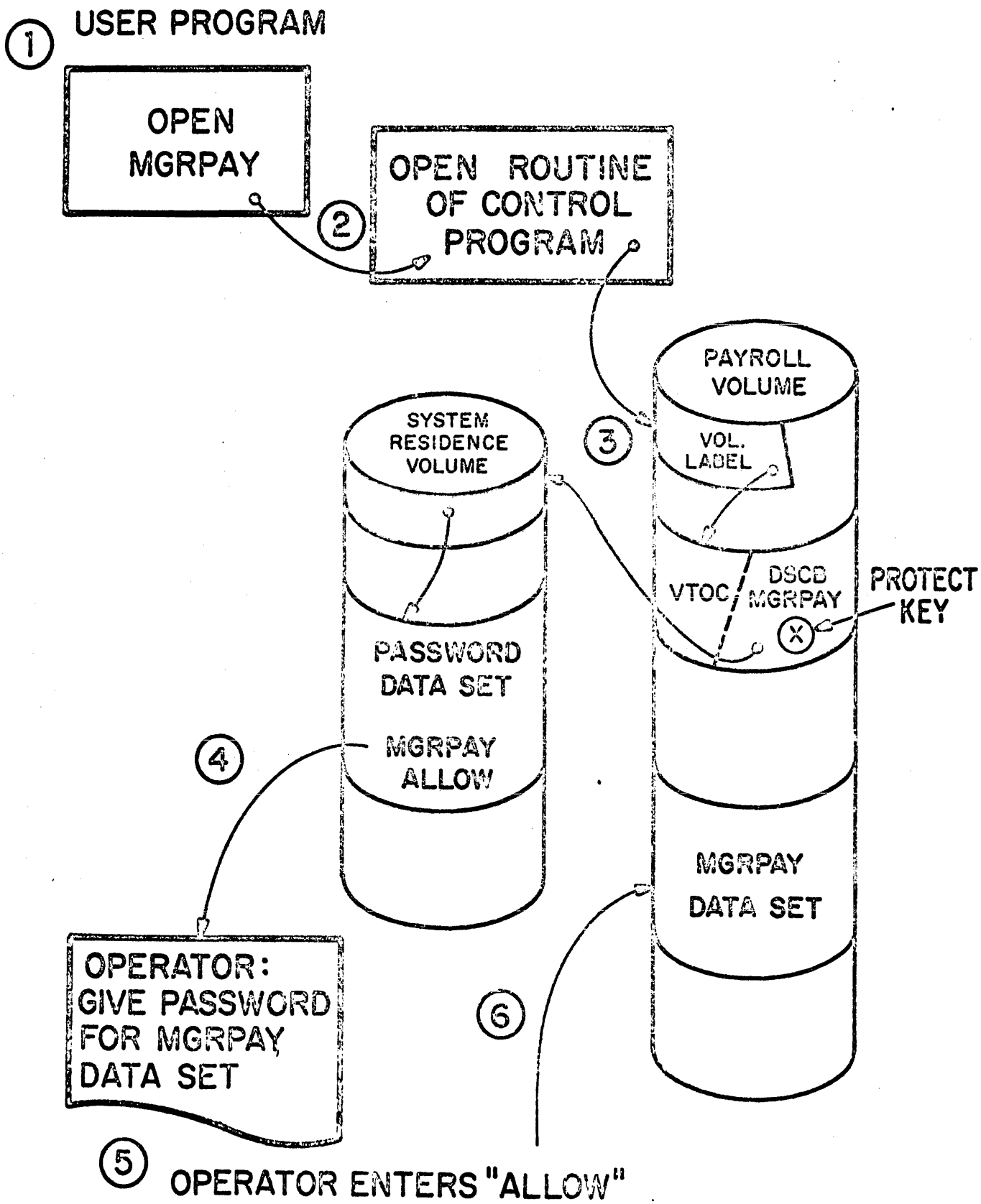
ABSOLUTE GENERATION NAMES

YTD.PAYROLL.G0001V00	Oldest
YTD.PAYROLL.G0002V00	Only one retained
YTD.PAYROLL.G0002V01	
YTD.PAYROLL.G0003V00	Most recent
YTD.PAYROLL.G0004V00	Next to be created

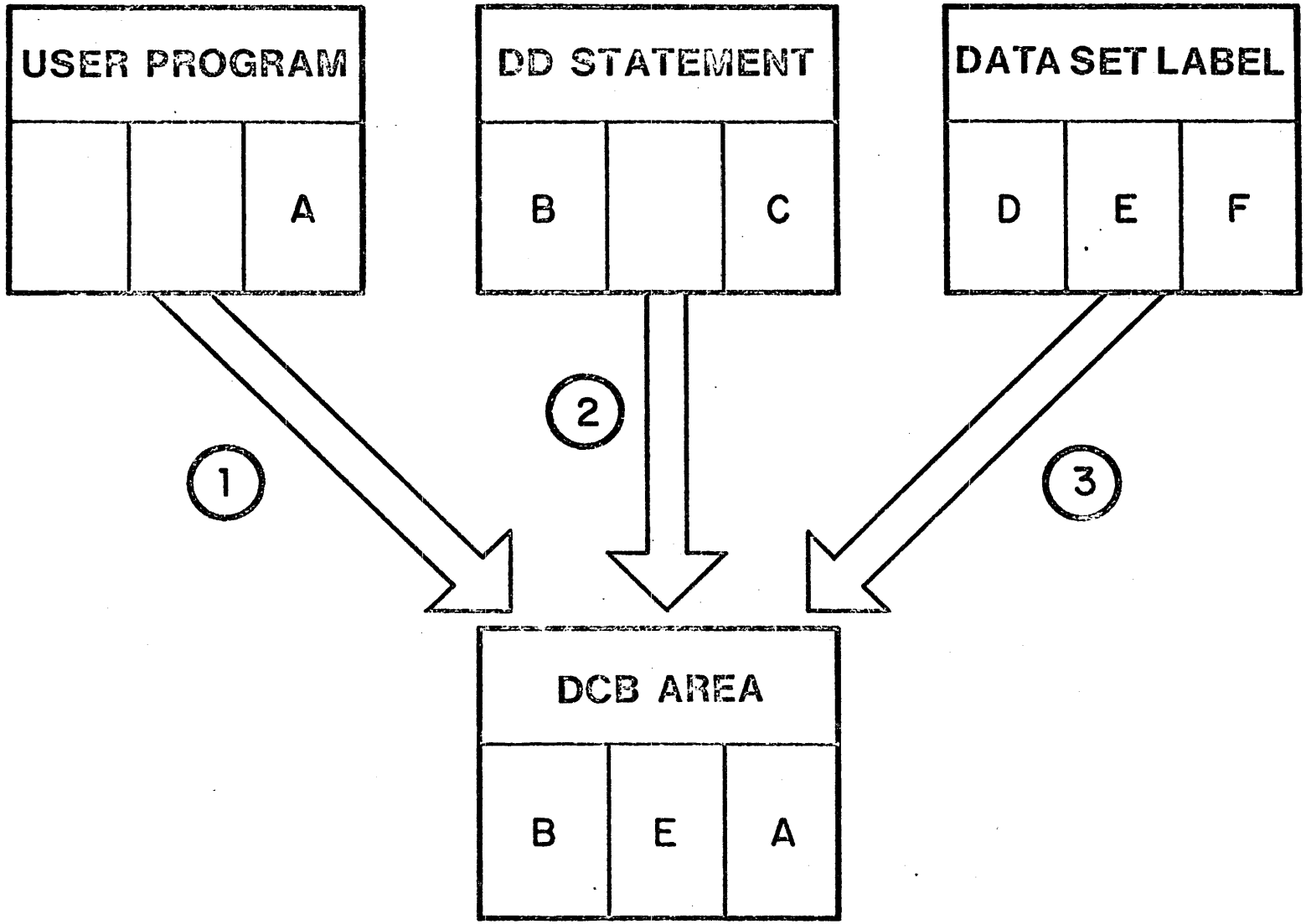
RELATIVE GENERATION NUMBERS

YTD.PAYROLL(-2)	Oldest
YTD.PAYROLL(-1)	
YTD.PAYROLL(0)	Most recent
YTD.PAYROLL(+1)	Next to be created

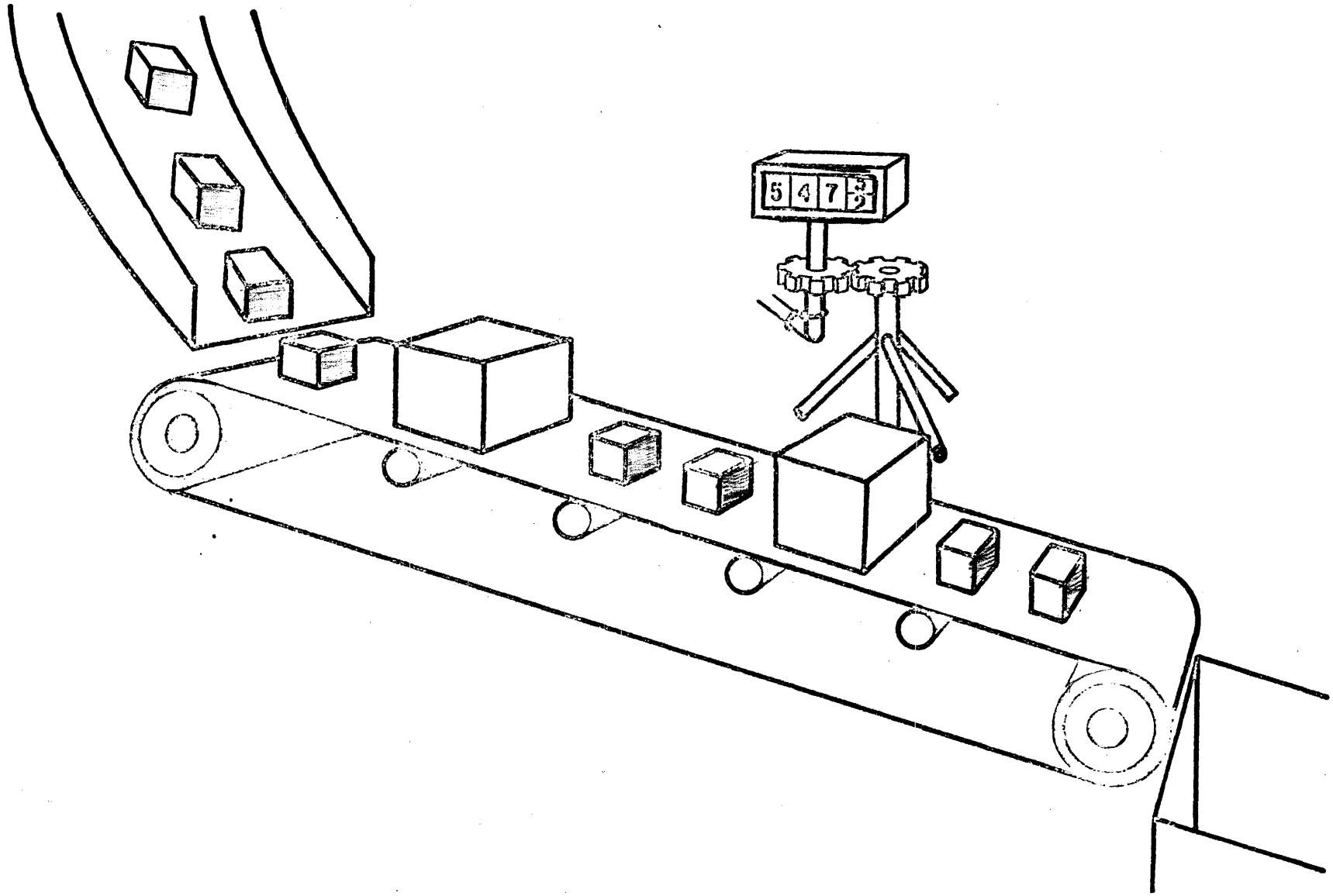
PASSWORD PROTECTION



DATA CONTROL BLOCK CONSTRUCTION



SEQUENTIAL PROCESSING



SEQUENTIAL ORGANIZATION

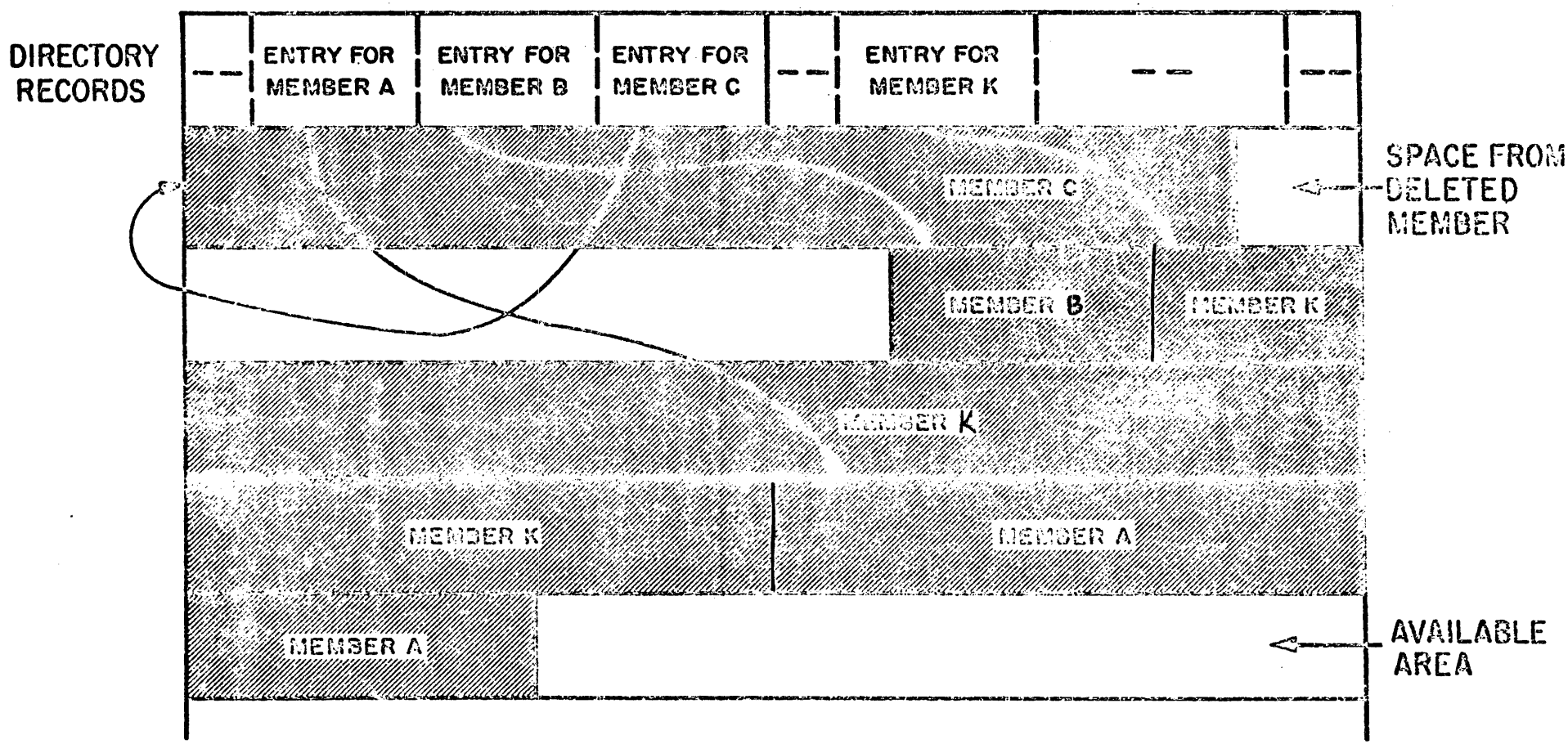
APPLIES TO TAPE, DASD, UNIT RECORD

OBTAIN RECORDS IN SERIAL FASHION

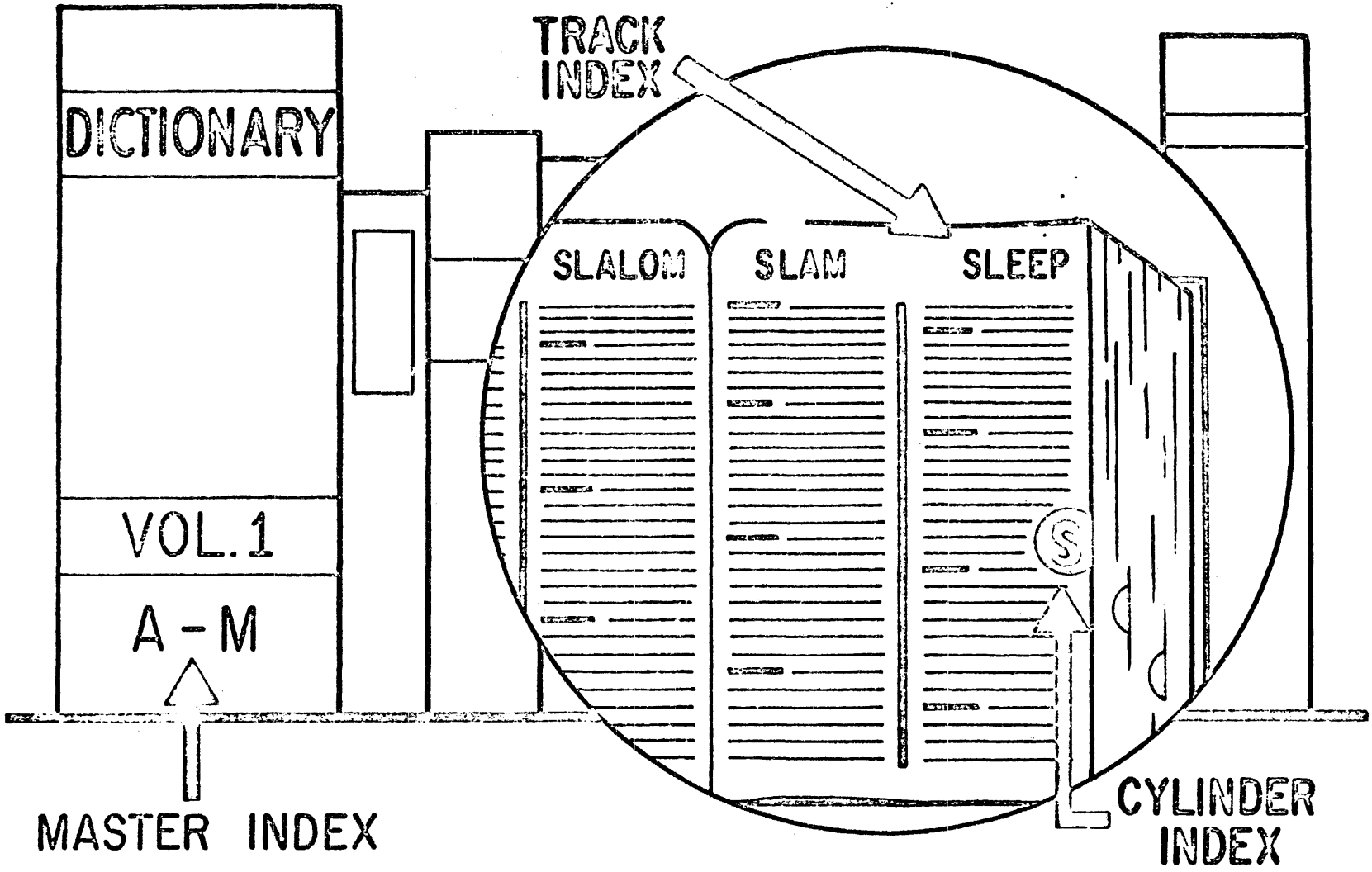
REWRITE ENTIRE FILE IF UPDATE ON TAPE

CAN UPDATE IN PLACE ON DASD BUT MUST REWRITE IF INSERT OR DELETE

PARTITIONED DATA SET

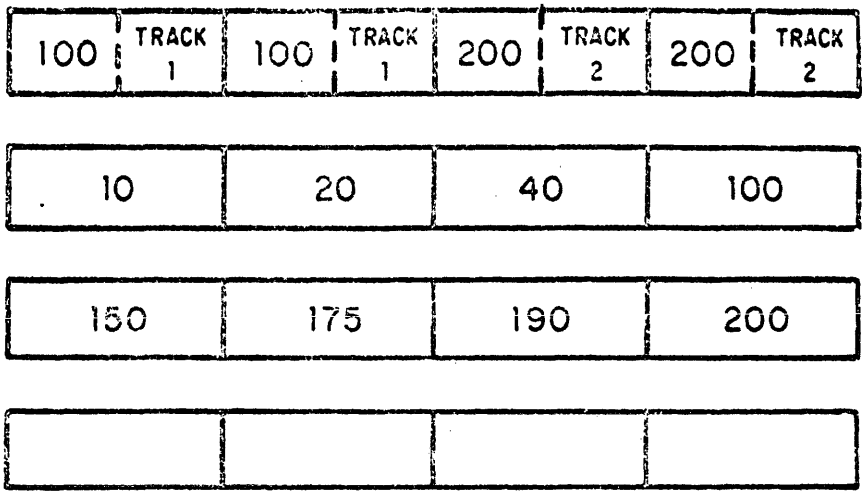


INDEXED SEQUENTIAL ORGANIZATION CONCEPT

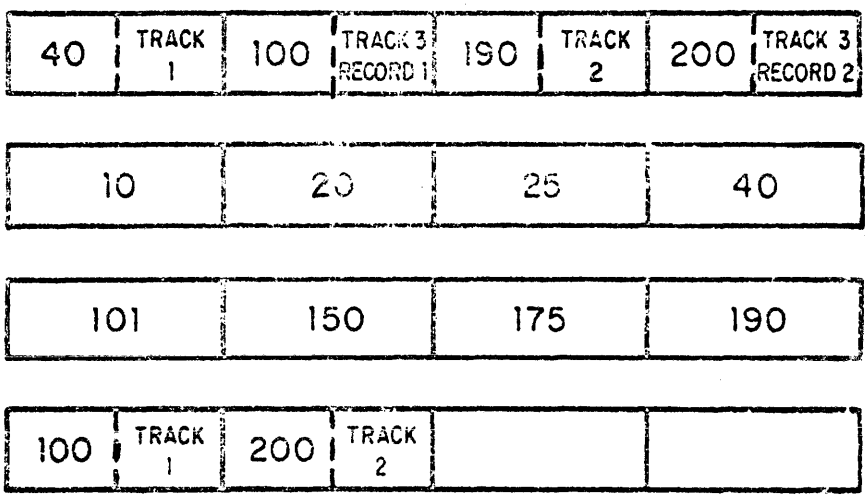


ADDITION OF RECORDS

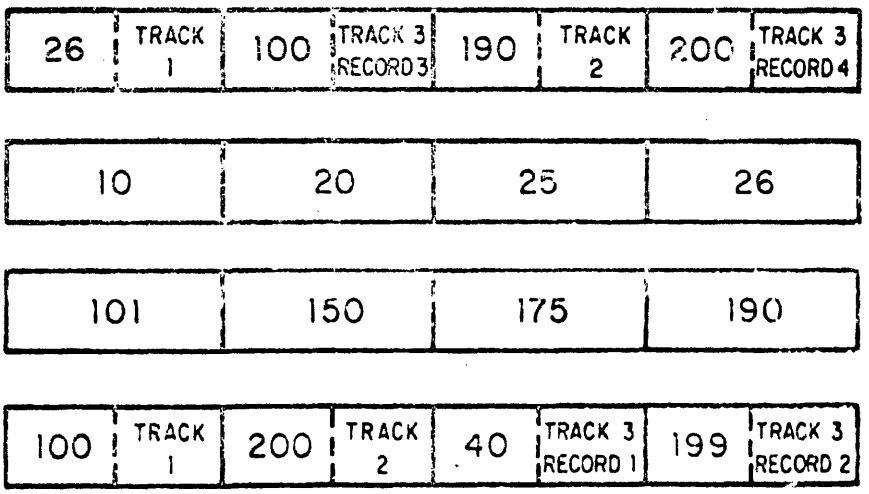
INITIAL FORMAT



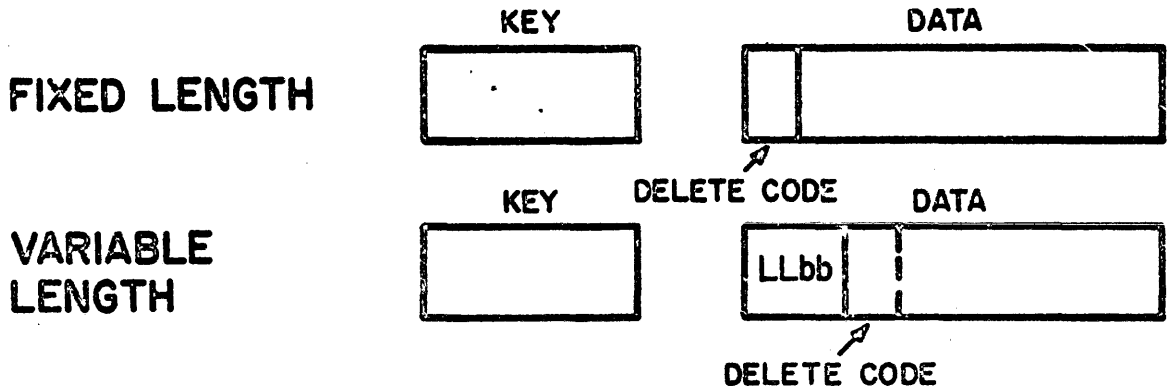
ADD RECORDS 25 AND 101

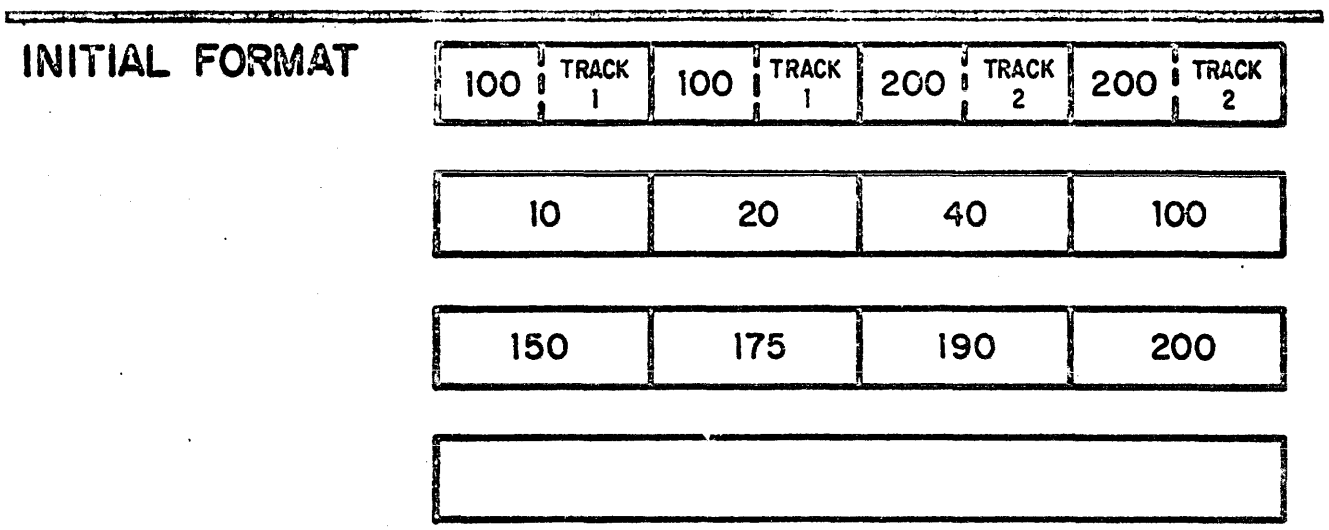


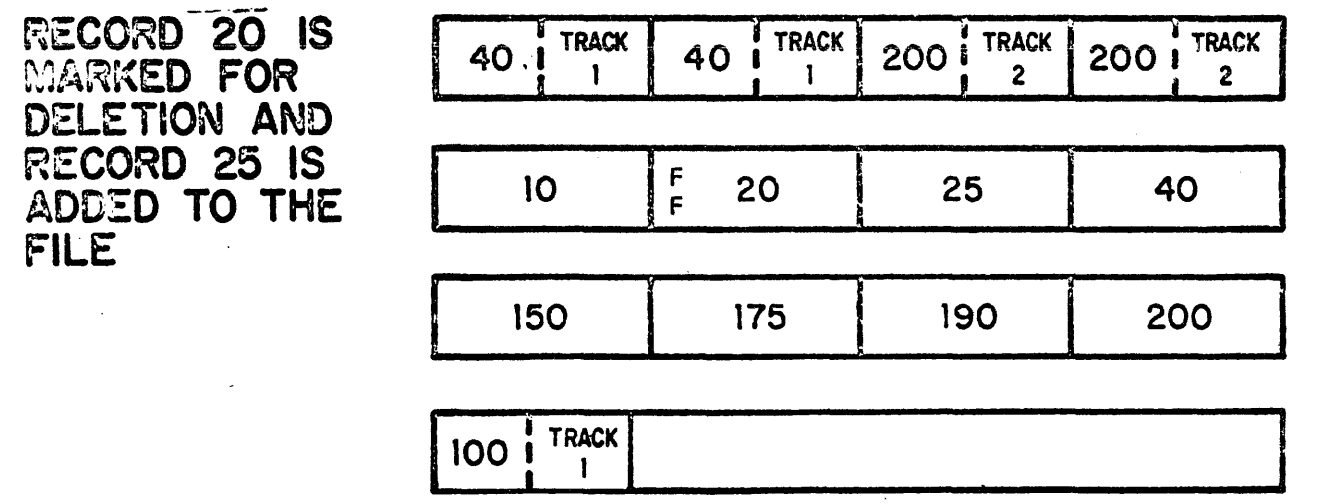
ADD RECORDS 26 AND 199



DELETIONS


KEY
DATA
FIXED LENGTH
DELETE CODE
KEY
DATA
VARIABLE LENGTH
LLbb
DELETE CODE


INITIAL FORMAT
100
TRACK 1
100
TRACK 1
200
TRACK 2
200
TRACK 2
10
20
40
100
150
175
190
200


RECORD 20 IS MARKED FOR DELETION AND RECORD 25 IS ADDED TO THE FILE
40
TRACK 1
40
TRACK 1
200
TRACK 2
200
TRACK 2
10
FF
20
25
40
150
175
190
200
100
TRACK 1

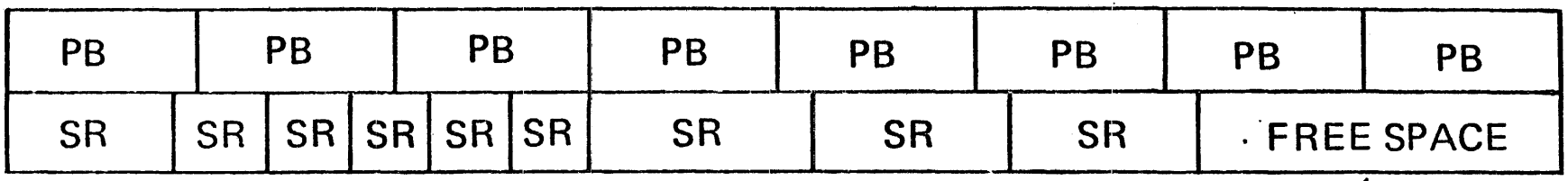
DIRECT ACCESS

ACCESS METHODS

DATA SET ORGANIZATION	LANGUAGE CATEGORY	
	QUEUED	BASIC
SEQUENTIAL	QSAM	BSAM
INDEXED SEQUENTIAL	QISAM	BISAM
DIRECT		BDAM
PARTITIONED		BPAM

WHAT IS IT ?

- NEW ACCESS METHOD
  - SUPPORTS INDEXED AND NON–INDEX DIRECT ACCESS DATA SETS *ONLY*
  - OS/VS AND DOS/VS
  - ISAM EQUIVALENT FUNCTION PLUS
  - INCREASED PERFORMANCE
  - NEW STANDARD DATA FORMAT
  - NEW USER INTERFACE
  - NEW HIGH PERFORMANCE CATALOG < ALL ISAM IS CATLG
  - ISAM COMPATIBILITY INTERFACE < CONVERSION POSSIBLE



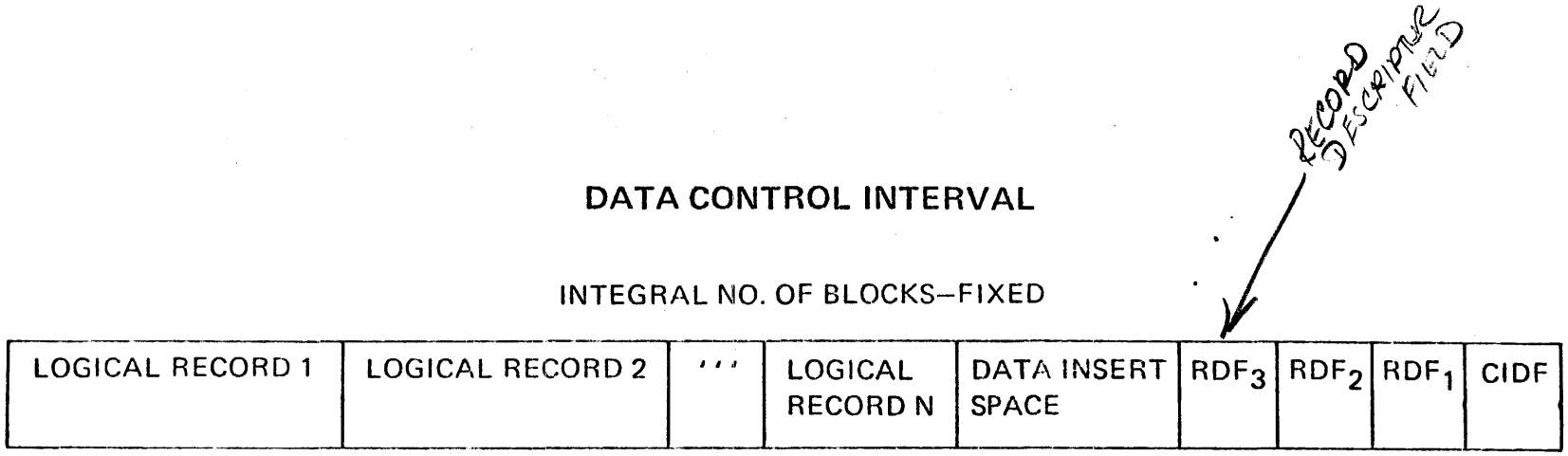
PB
512
1024
2018
4096

SR=STORED RECORD
PB=PHYSICAL BLOCK

% SET BY USER AT "DEFINE" TIME

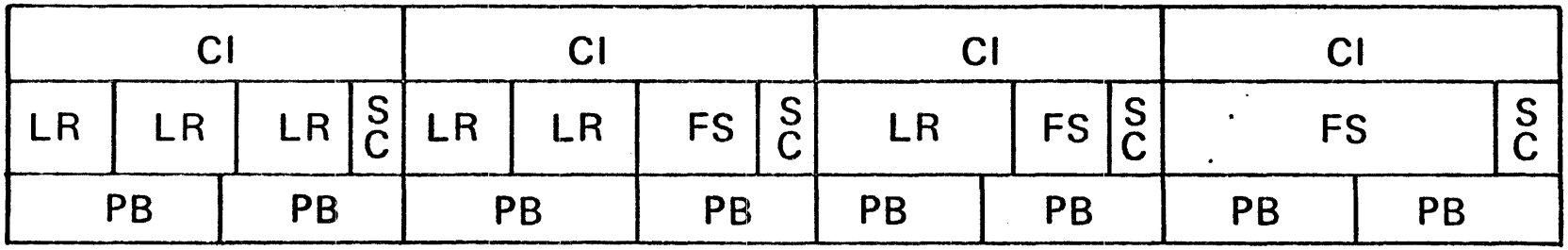
DATA CONTROL INTERVAL

INTEGRAL NO. OF BLOCKS–FIXED



- UNIT OF TRANSMISSION
- KEY SEQUENCE MAINTAINED IN SEQUENCED DATA SET
- CONTROL INFORMATION MAINTAINED AT END OF CI
- TAKES ADVANTAGE OF BOTH FIXED AND VARIABLE RECORD FORMATS
- SINGLE RDF SET TO DESCRIBE SIMILAR RECORDS.

CONTROL AREA



CI – CONTROL INTERVAL
LR– USER LOGICAL RECORD
FS– FREE SPACE
SC– SYSTEM CONTROL
PB– PHYSICAL BLOCK

SEQUENCED DATA SETS

- KEY – SEQUENCED

  BUILT IN ASCENDING SEQUENCE OF A KEY

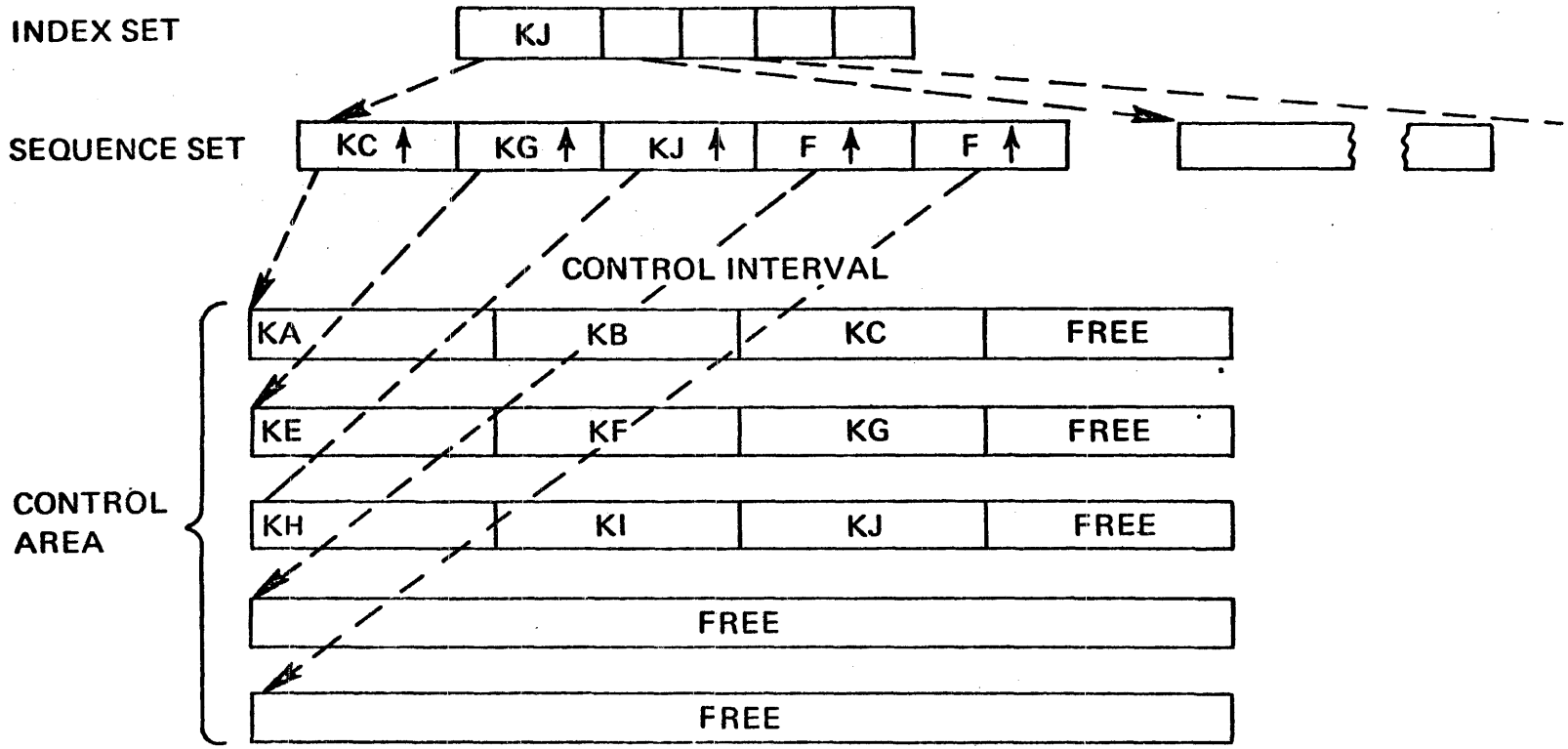
  INSERTS PLACED ACCORDING TO KEY

- ENTRY – SEQUENCED

  BUILT IN ORDER OF ARRIVAL

  ADDITIONS AT END

SEQUENCED DATA SET



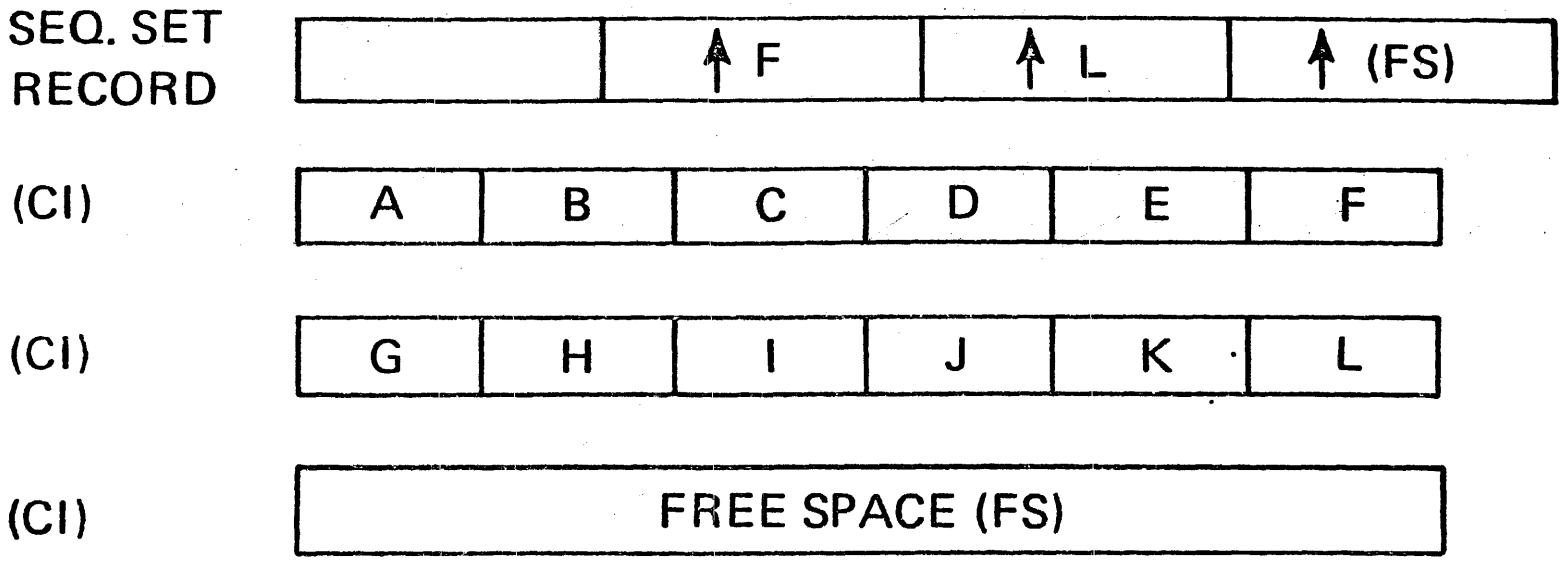
RECORDS ARE LOADED BY PRIME KEY IN ASCENDING SEQUENCE.

% OF CONTROL INTERVAL FREE SPACE AND CONTROL AREA FREE SPACE IS DETERMINED BY THE USER.

LOGICAL RECORDS ARE ALWAYS SEQUENCED BY ASCENDING KEY IN CONTROL INTERVAL.

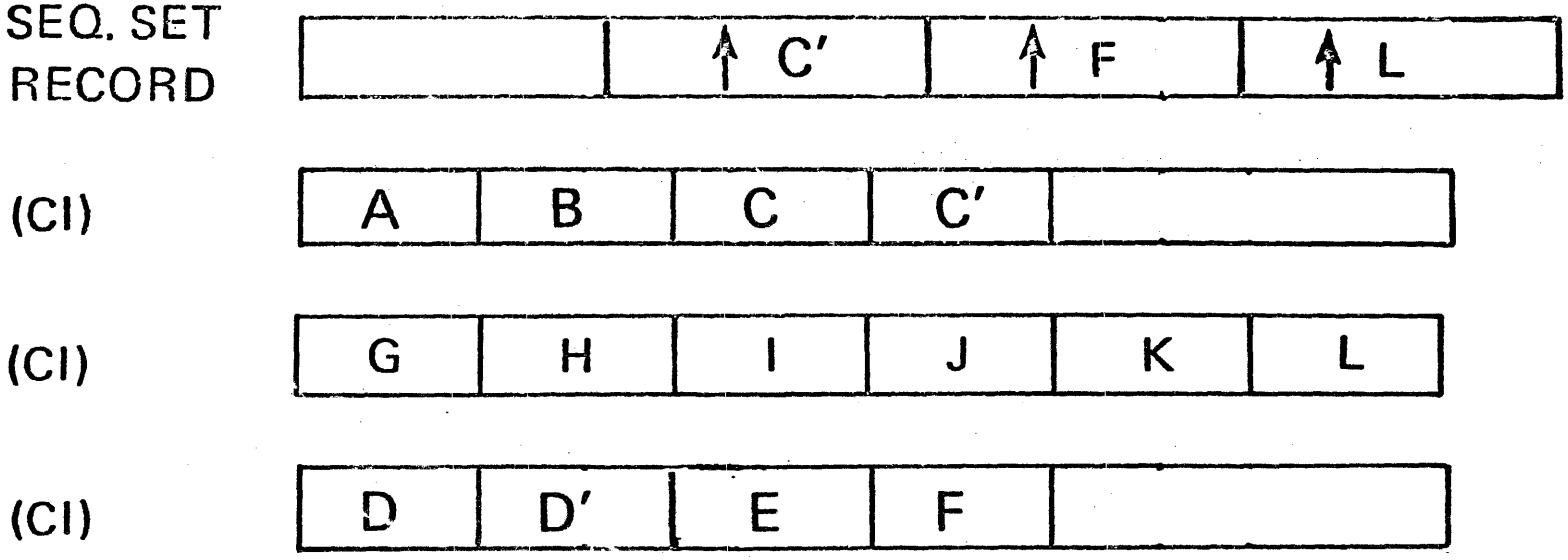
INSERTS NEVER GO TO OVERFLOW–CONTROL INTERVALS AND CONTROL AREAS ARE SPLIT AS REQUIRED.

CONTROL INTERVAL/CONTROL AREA SPLITS



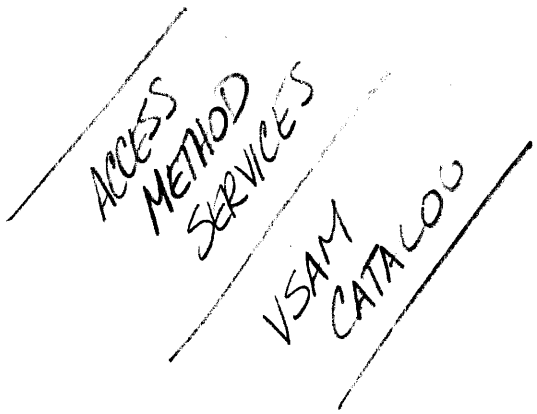
85

ADD C' AND D'



KEYED ACCESSING

- KEYED SEQUENTIAL RETRIEVAL
- SKIP SEQUENTIAL RETRIEVAL
- KEYED SEQUENTIAL INSERT
- KEYED DIRECT RETRIEVAL
- KEYED DIRECT INSERT



VSAM UTILITY COMMANDS

DEFINE

ALTER

DELETE

LIST CATALOG

COPY

PRINT

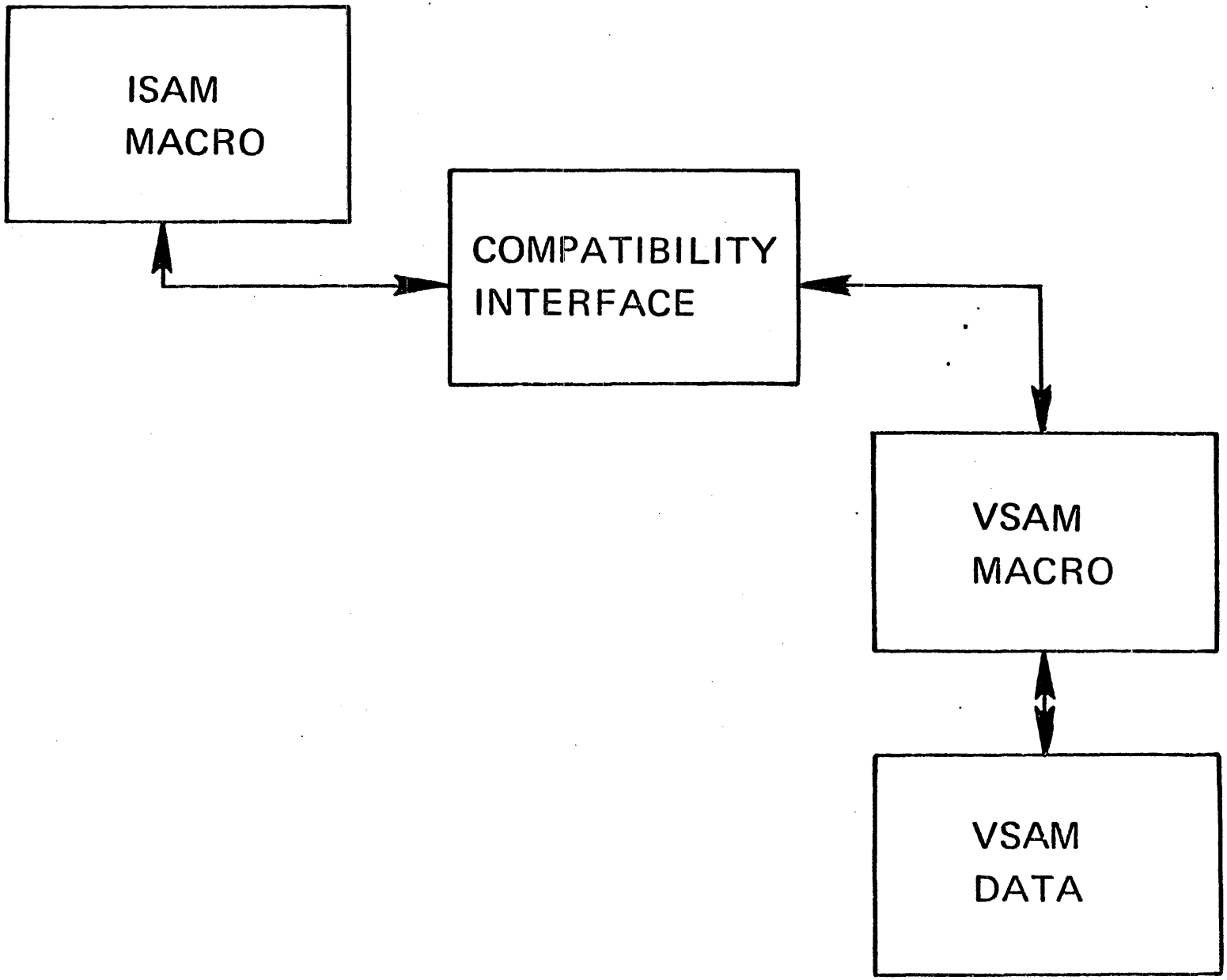
EXPORT

IMPORT

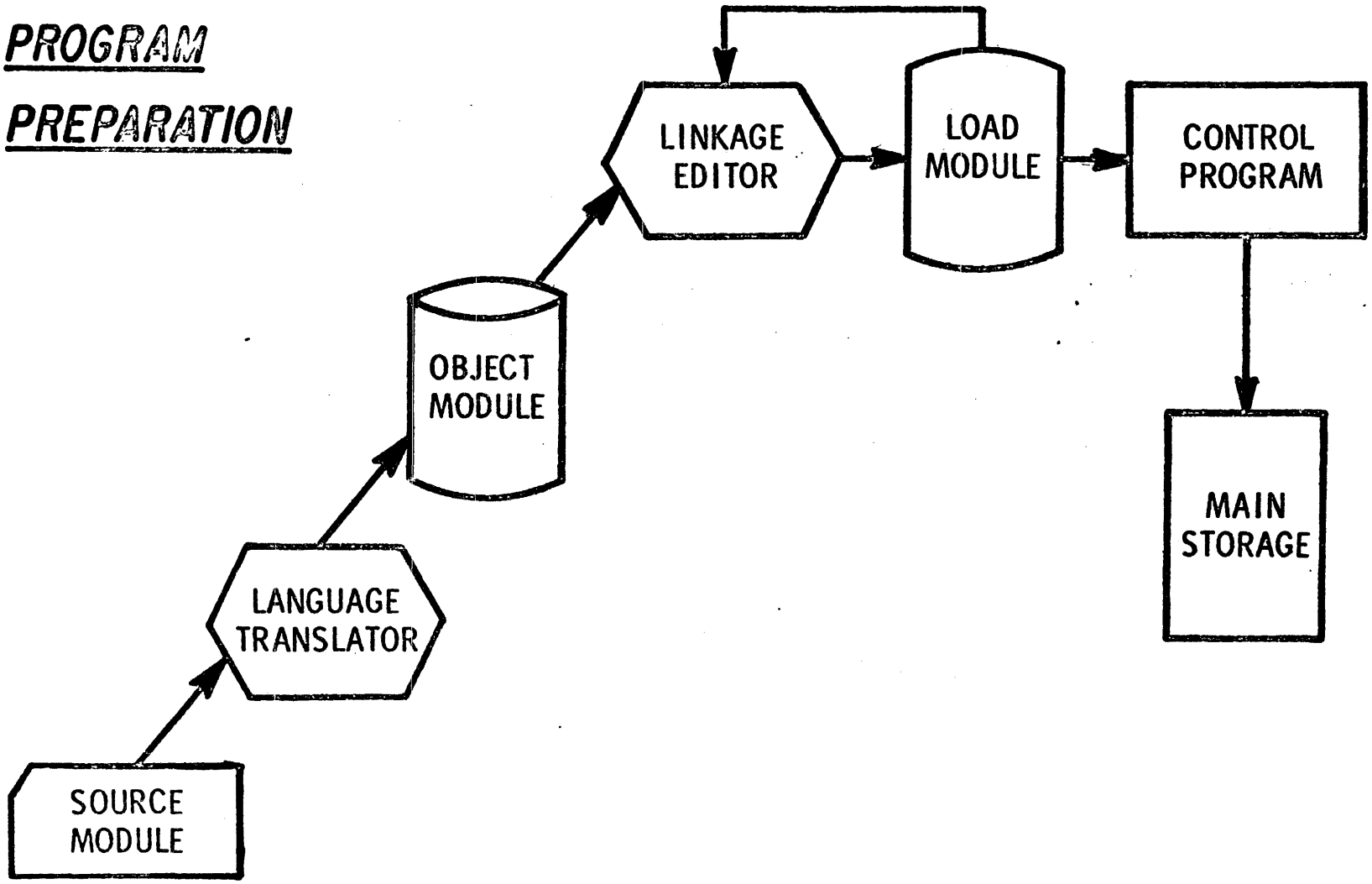
VERIFY

DATA SECURITY

- EXTENSIVE PASSWORD PROTECTION (4 LEVELS)
  - FULL ACCESS
  - CONTROL INTERVAL ACCESS
  - UPDATE ACCESS
  - READ ACCESS
- PASSWORDS CAN BE SUPPLIED IN USER PROGRAM OR FROM CONSOLE/TERMINAL OPERATOR
- USER CAN PROVIDE HIS OWN PASSWORD VERFICATION (OS/VS ONLY)
  - USVR (USER SECURITY VERIFICATION ROUTINE)
  - USAR (USER SECURITY AUTHORIZATION RECORD)
- PASSWORDS MAINTAINED IN CATALOG
- ACCESS METHOD SERVICES UTILITY PROGRAM FOR DEFINING SECURITY OF EACH DATA SET WHEN CREATED

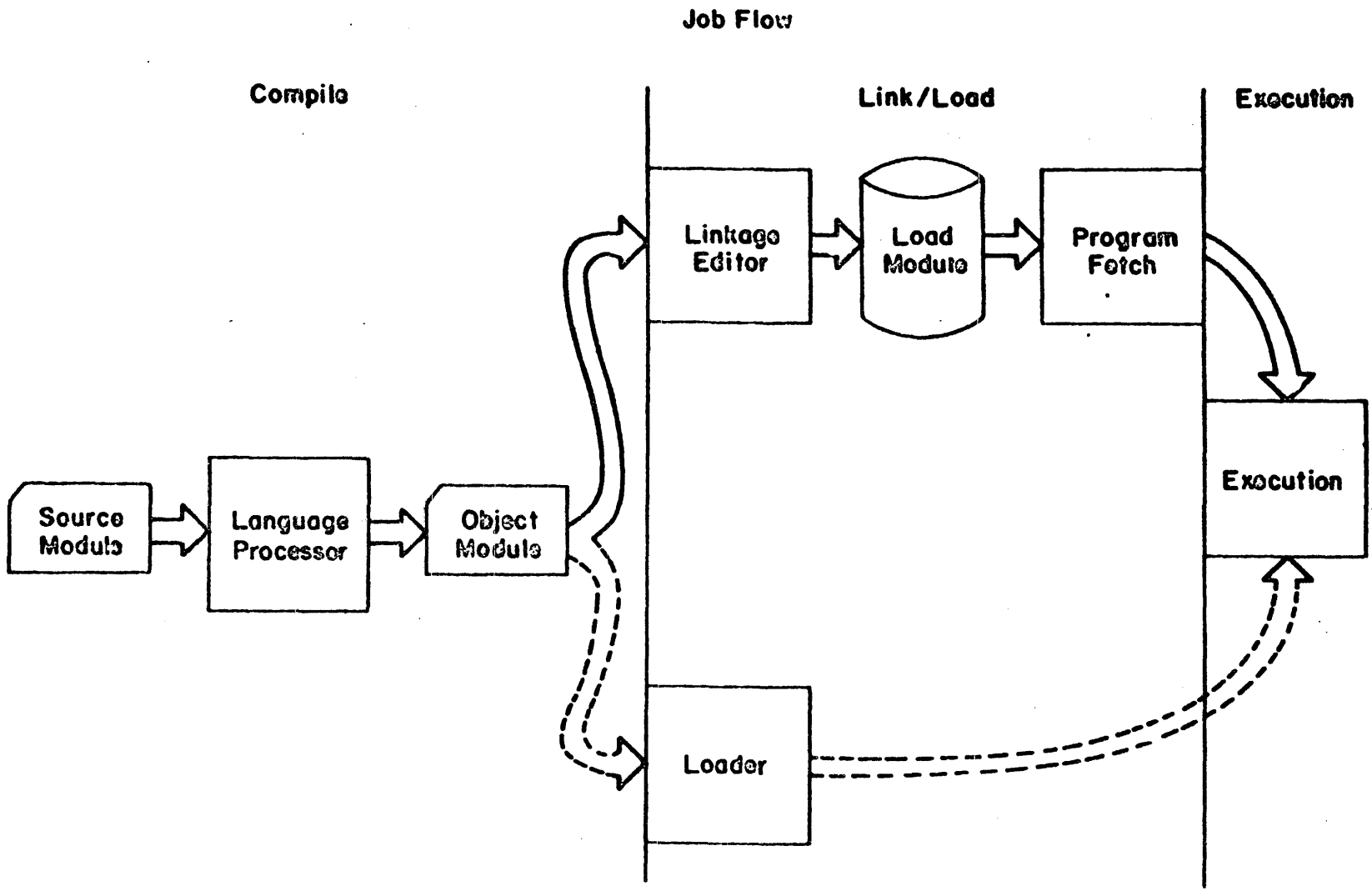

ISAM
MACRO
COMPATIBILITY
INTERFACE
VSAM
MACRO
VSAM
DATA

PROGRAM PREPARATION

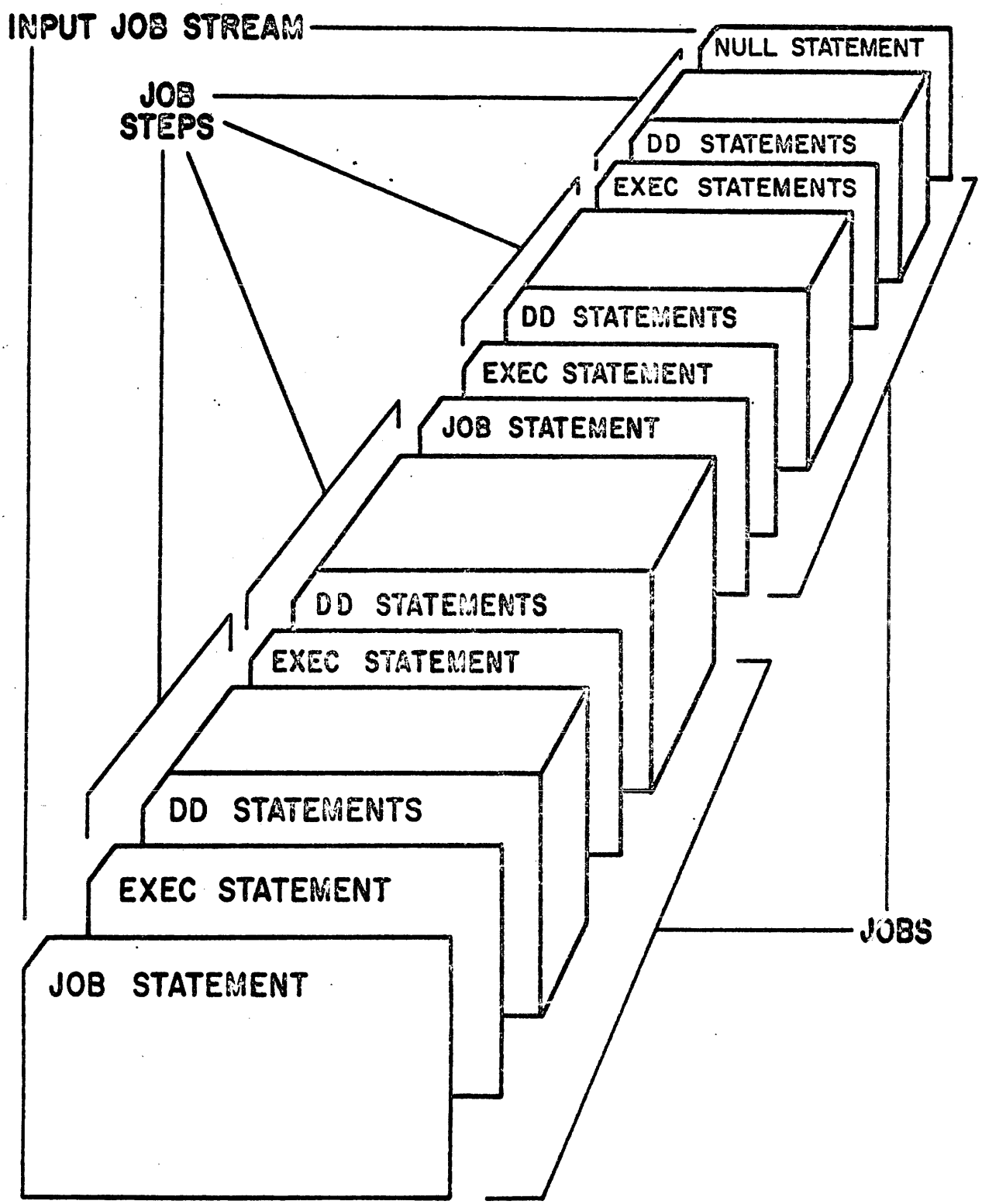


LINKAGE EDITOR

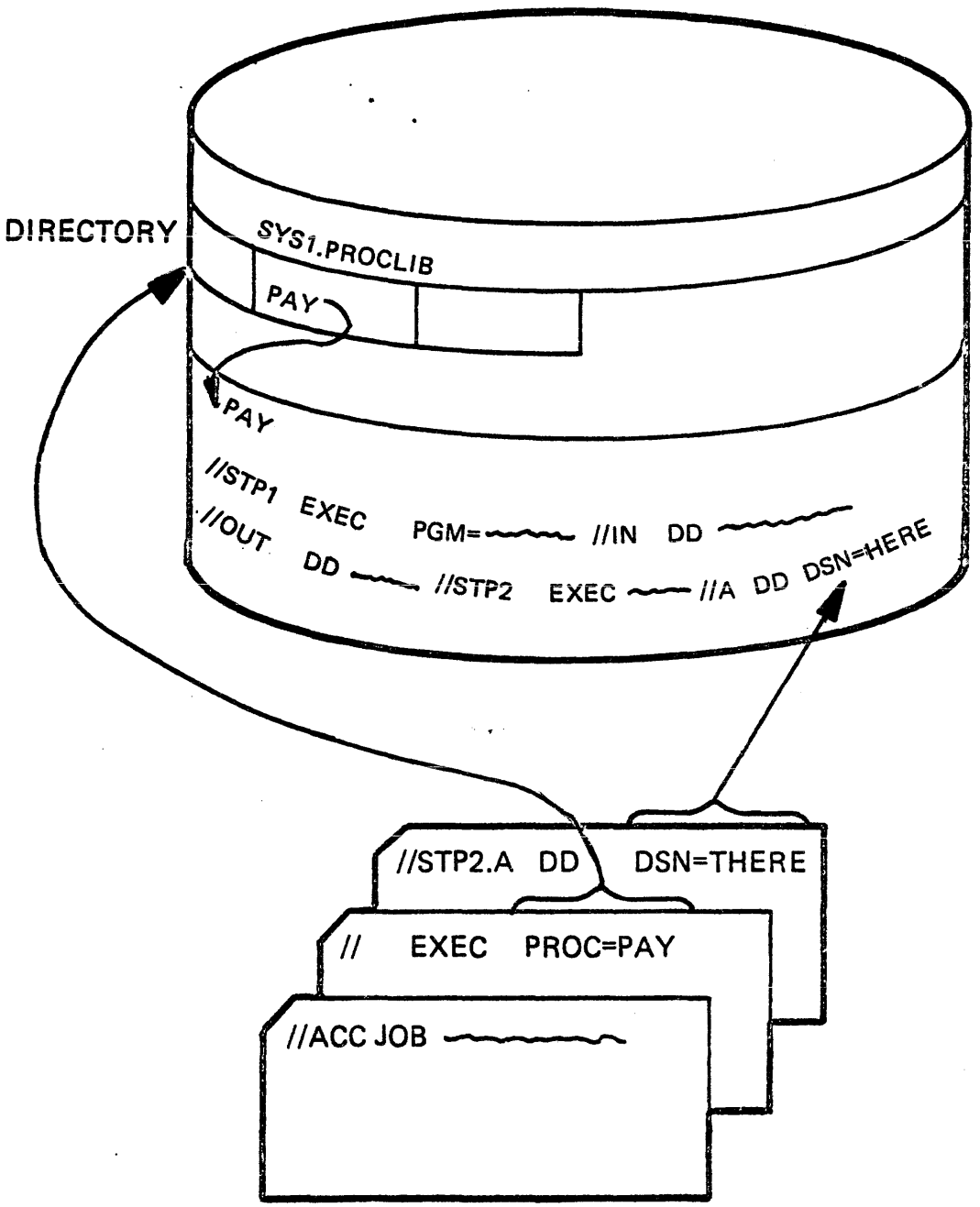
- PRODUCES A LOAD MODULE
- COMBINES ONE OR MORE OBJECT AND LOAD MODULES INTO A SINGLE LOAD MODULE
- RESOLVES SYMBOLIC CROSS REFERENCES AMONG THE COMBINED MODULES
- CONSTRUCTS AN OVERLAY PROGRAM
- REPLACES, DELETES, REARRANGES CONTROL SECTIONS


Job Flow
Compile
Link/Load
Execution
Source Module
Language Processor
Object Module
Linkage Editor
Load Module
Program Fetch
Execution
Loader

DEFINING JOB AND JOB-STEP BOUNDARIES



CATALOGED PROCEDURES



SYSTEM UTILITY PROGRAMS

SYSTEM UTILITY PROGRAMS MANIPULATE COLLECTIONS OF DATA AND SYSTEM CONTROL INFORMATION.

IEHATLAS	ASSIGNS ALTERNATE TRACKS WHEN DEFECTIVE TRACKS ARE INDICATED.
IEHDASDR	INITIALIZES DIRECT ACCESS VOLUMES OR DUMPS OR RESTORES DATA.
IEHINITT	WRITES STANDARD LABELS ON TAPE VOLUMES.
IEHIOSUP	UPDATES ENTRIES IN THE SUPERVISOR CALL LIBRARY.
IEHLIST	SYSTEM CONTROL DATA.
IEHMOVE	MOVES OR COPIES COLLECTIONS OF DATA.
IEHPROGM	BUILDS AND MAINTAINS SYSTEM CONTROL DATA.
IFHSTATR	SELECTS, FORMATS, AND WRITES INFORMATION ABOUT TAPE ERRORS FROM THE IFASMFDP TAPE OR THE SYS1.MAN DATA SET.

DATA SET UTILITY PROGRAMS

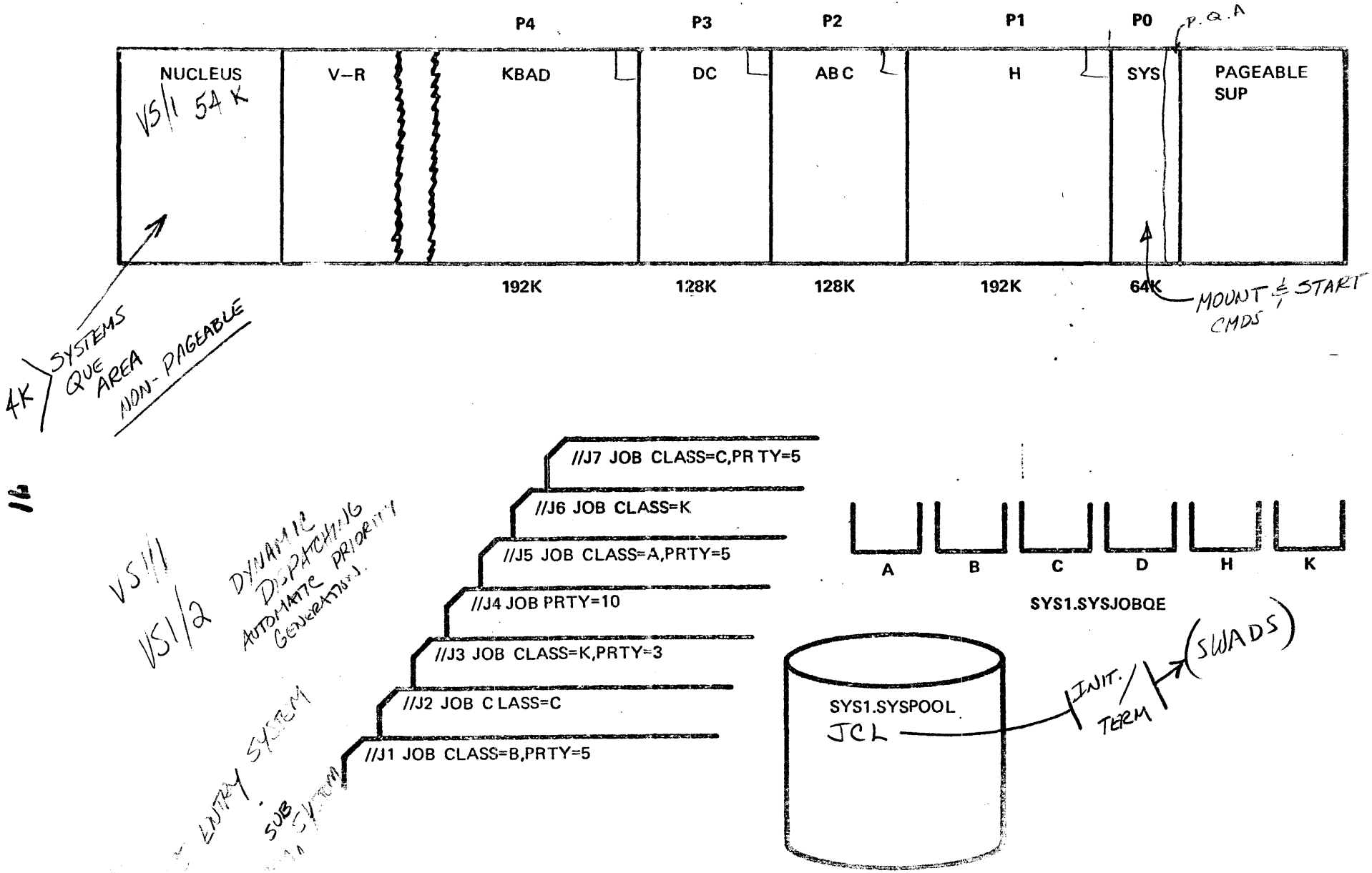
DATA SET UTILITY PROGRAMS MANIPULATE PARTITIONED, SEQUENTIAL, OR INDEXED-SEQUENTIAL DATA SETS PROVIDED AS INPUT TO THE PROGRAMS. DATA RANGING FROM FIELDS WITH A LOGICAL RECORD TO ENTIRE DATA SETS CAN BE MANIPULATED.

IEBCOMPR	COMPARES RECORDS IN SEQUENTIAL OR PARTITIONED DATA SETS.
IEBCOPY	COPIES, COMPRESSES, OR MERGES PARTITIONED DATA SETS, SELECTS OR EXCLUDES SPECIFIED MEMBERS IN A COPY OPERATION, AND RENAMES AND/OR REPLACES SELECTED MEMBERS OF PARTITIONED DATA SETS.
IEBDG	CREATES A TEST DATA SET CONSISTING OF PATTERNED DATA.
IEBEDIT	SELECTIVELY COPIES JOB STEPS AND THEIR ASSOCIATED JOB STATEMENTS.
IEBGENER	COPIES RECORDS FROM A SEQUENTIAL DATA SET OR CONVERTS DATA SET FROM SEQUENTIAL ORGANIZATION TO PARTITIONED ORGANIZATION.
IEBISAM	PLACES SOURCE DATA FROM AN INDEXED-SEQUENTIAL DATA SET INTO A SEQUENTIAL DATA SET IN A FORMAT SUITABLE FOR SUBSEQUENT RECONSTRUCTION.
IEBPTPCH	PRINTS OR PUNCHES RECORDS THAT RESIDE IN A SEQUENTIAL OR PARTITIONED DATA SET.
IEBTCRIN	CONSTRUCTS RECORDS FROM THE INPUT DATA STREAM THAT HAVE BEEN READ FROM THE IBM 2495 TAPE CARTRIDGE READER.
IEBUPDTE	INCORPORATES CHANGES TO SEQUENTIAL OR PARTITIONED DATA SETS.

INDEPENDENT UTILITY PROGRAMS

INDEPENDENT UTILITY PROGRAMS OPERATE OUTSIDE, AND IN SUPPORT OF THE OPERATING SYSTEM.

IBCDASDI	INITIALIZES A DIRECT ACCESS VOLUME AND ASSIGNS ALTERNATE TRACKS.
IBCDMPRS	DUMPS AND RESTORES THE DATA CONTENTS OF A DIRECT ACCESS VOLUME.
ICAPRTBL	LOADS THE FORMS CONTROL AND UNIVERSAL CHARACTER SET BUFFERS OF A 3211 AFTER AN UNSUCCESSFUL ATTEMPT TO IPL WITH THE 3211 PRINTER ASSIGNED AS THE OUTPUT PORTION OF A COMPOSITE CONSOLE.

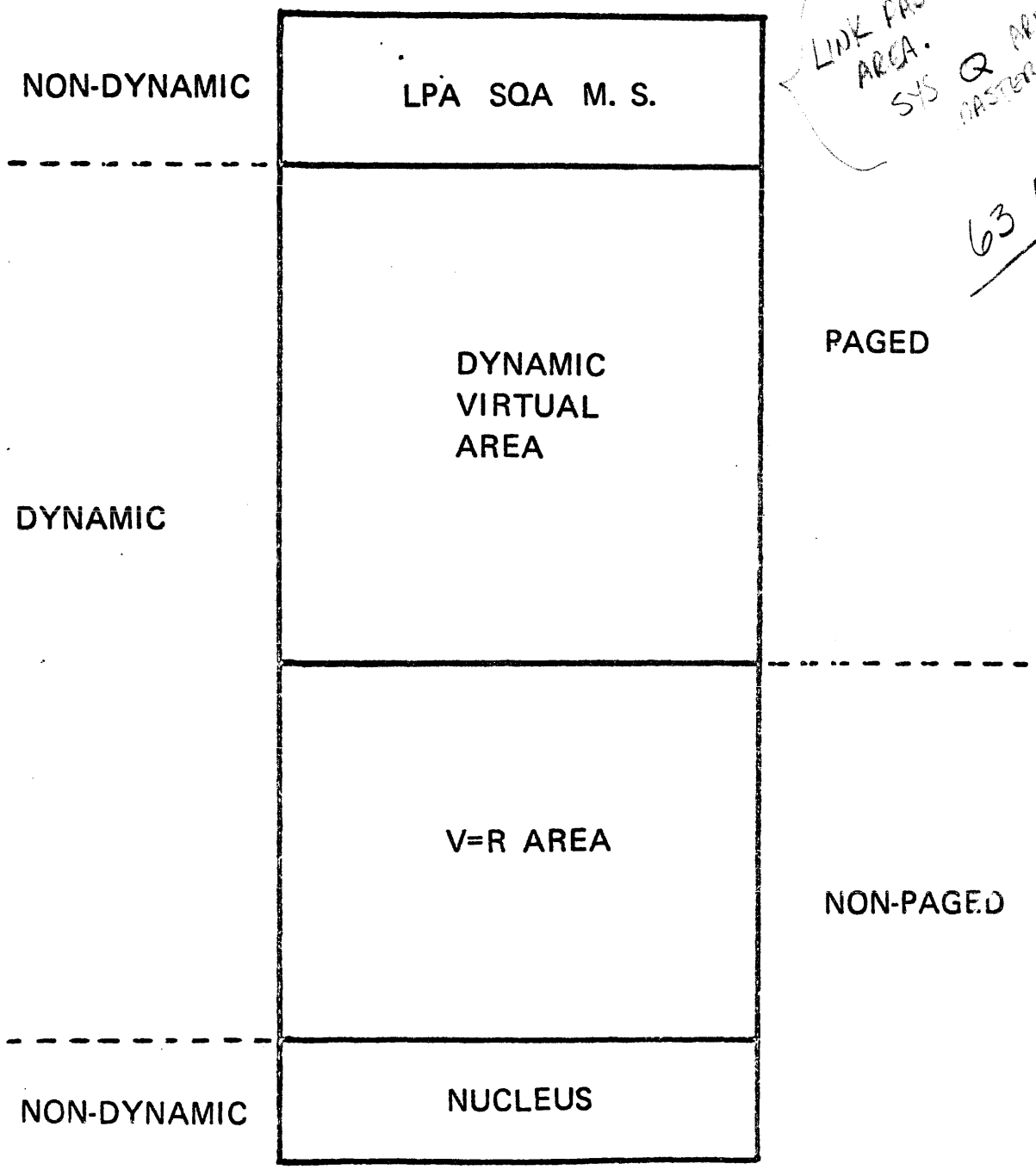

P4
P3
P2
P1
P0
P.Q.A
NUCLEUS
V=R
KBAD
DC
ABC
H
SYS
PAGEABLE SUP
192K
128K
128K
192K
64K
MOUNT & START CMDS
4K SYSTEMS QUE AREA NON-PAGEABLE
//J7 JOB CLASS=C,PRTY=5
//J6 JOB CLASS=K
//J5 JOB CLASS=A,PRTY=5
//J4 JOB PRTY=10
//J3 JOB CLASS=K,PRTY=3
//J2 JOB CLASS=C
//J1 JOB CLASS=B,PRTY=5
A
B
C
D
H
K
SYS1.SYSJOBQE
SYS1.SYSPOOL
JCL
INIT.
TERM
(SWADS)

VS2 – VS1 COMPARISONS
MVT – MFT

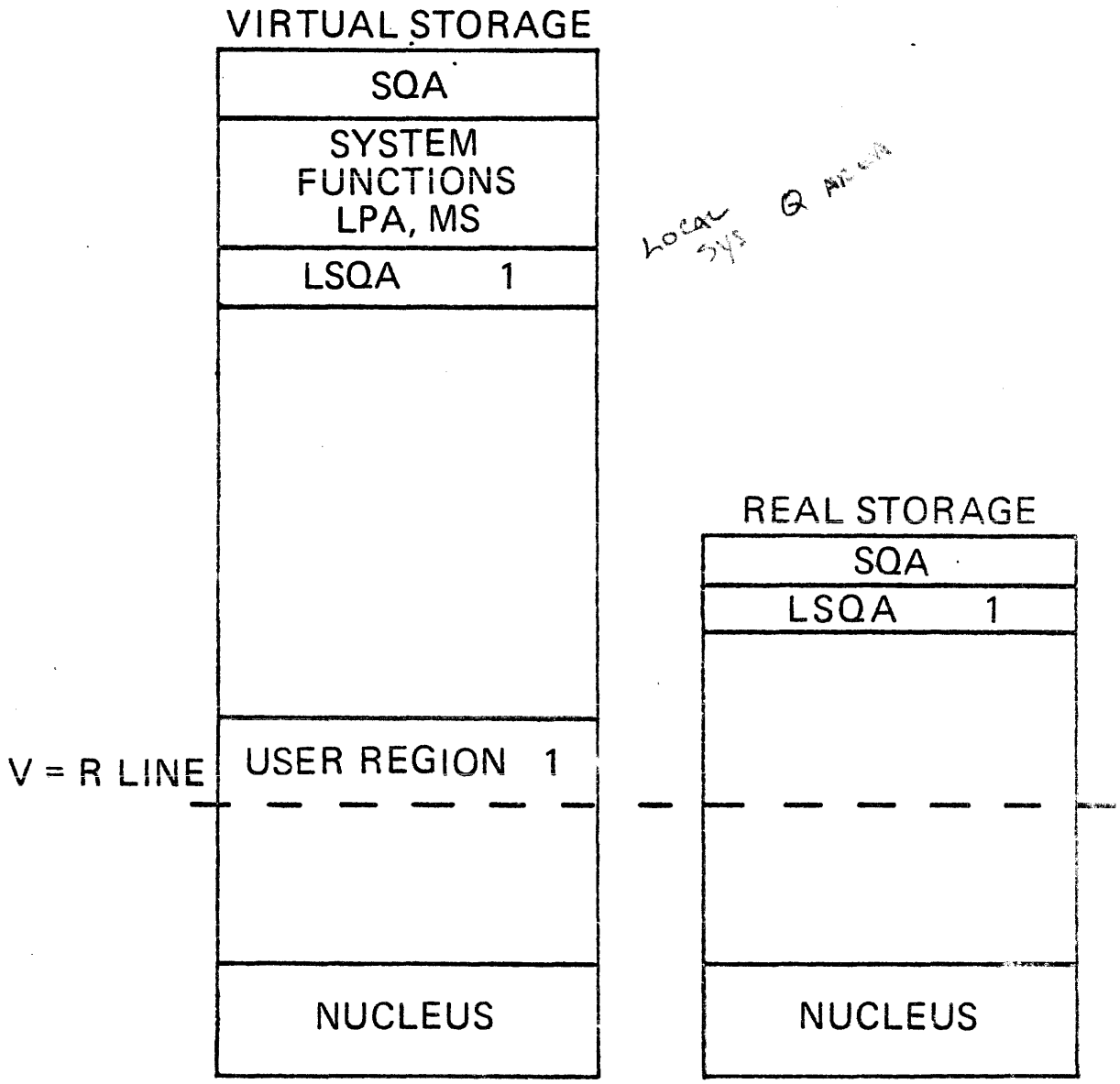
DESIGN SPECIFICATIONS	VS2	VS2 Rel 2	MVT	VS1	MFT
Priority job class	Yes	Yes	Yes	Yes	Yes
Maximum number of jobs (Init.)	63	No Limit	15	15	15
Maximum number of Readers	No Limit	No Limit	No Limit	No Limit	3
Maximum number of Output writers	No Limit (HASP)	No Limit (JES)	No Limit	No Limit (JES)	36
Main Storage allocation	Dynamic Page	Dynamic Page	Dynamic Region	Dynamic Page	Fixed Partition
Virtual Storage allocation	Region	Address Space	N/A	Partition	N/A
Minimum job scheduling requirements					
Step initiation	N/A	N/A	52K	N/A	30K - 44K
Step termination	N/A	N/A	12K (term in LPA)	N/A	30K - 44K
Minimum region/partition for job step	64K	N/A	12K (term in LPA)	64K	8K (must have large part)
Options					
Fetch protect	Yes	Yes	No	Yes	No
Store protect	Yes	Yes	Yes	Yes	Yes
Resident rent. modules	Yes	Yes	Yes	Yes	Yes
Resident access methods	Yes	Yes	Yes	Yes	Yes
Time slicing	Yes	Yes	Yes	Yes	Yes
SMF	Yes	Yes	Yes	Yes	Yes
Checkpoint/restart	Yes	Yes	Yes	Yes	Yes
Rollout/Rollin	N/A	N/A	Yes	N/A	No
TSO	Yes (paged)	Yes (paged)	Yes (swapped)	No	No
Dynamic Dispatching	Yes (APG)	Yes	With HASP only	Yes (APG)	With HASP only
I/O Load Balancing	Yes	Yes	No	Yes	No
Virtual I/O	No	Yes	No	No	No
Spin off Data Sets	No	Yes	No	No	No
Multiprocessing	No	Yes (JES2)	Yes	No	No
Attached Support Processing	No	Yes (JES3)	Yes	No	No
Minimum system	384K	768K	256K	160K	128K
Practical system	768K (TSO & HASP)	1024K	512K	256K	256K

MAR. 74

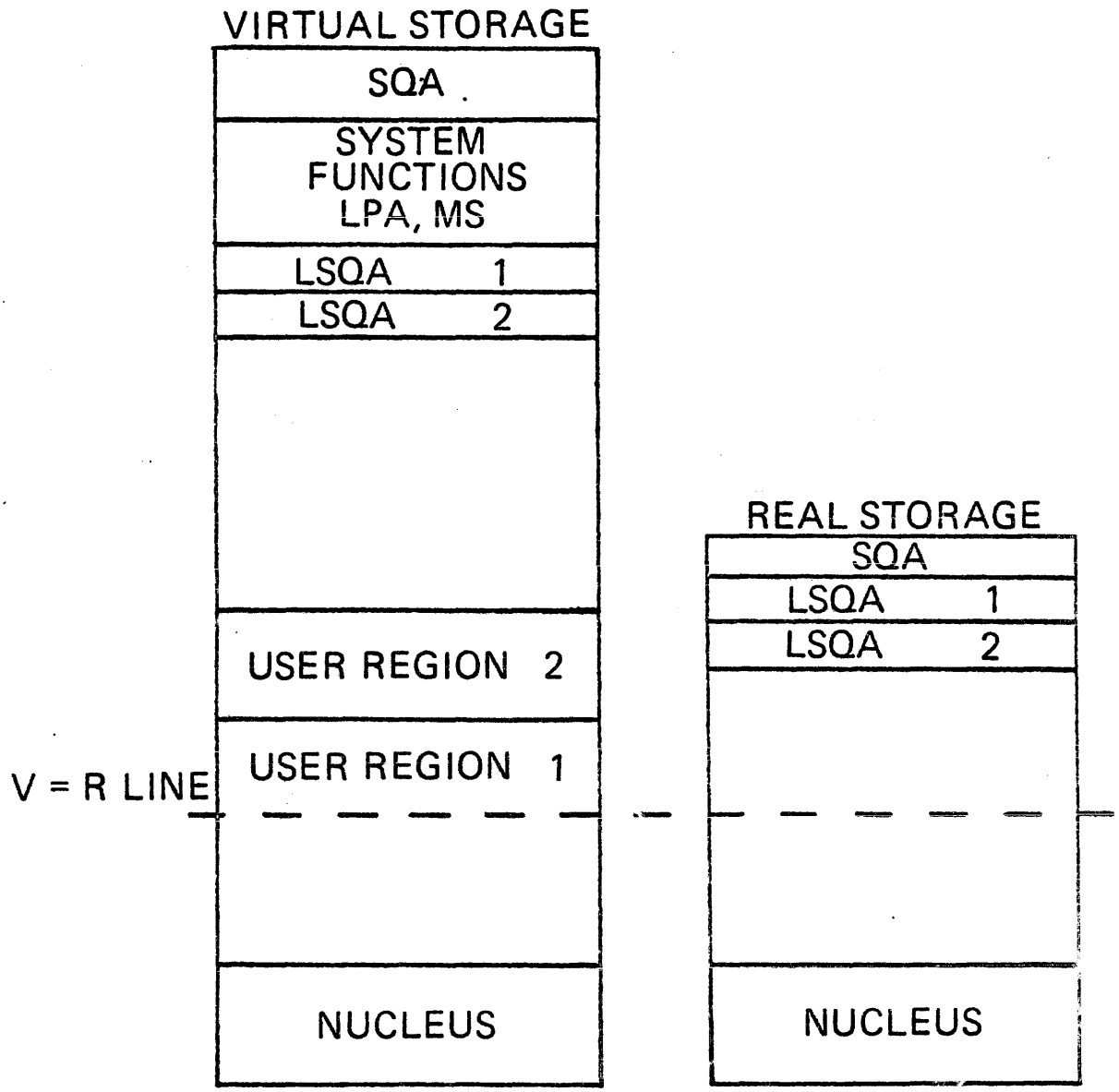
VIRTUAL STORAGE ORGANIZATION VS2/1



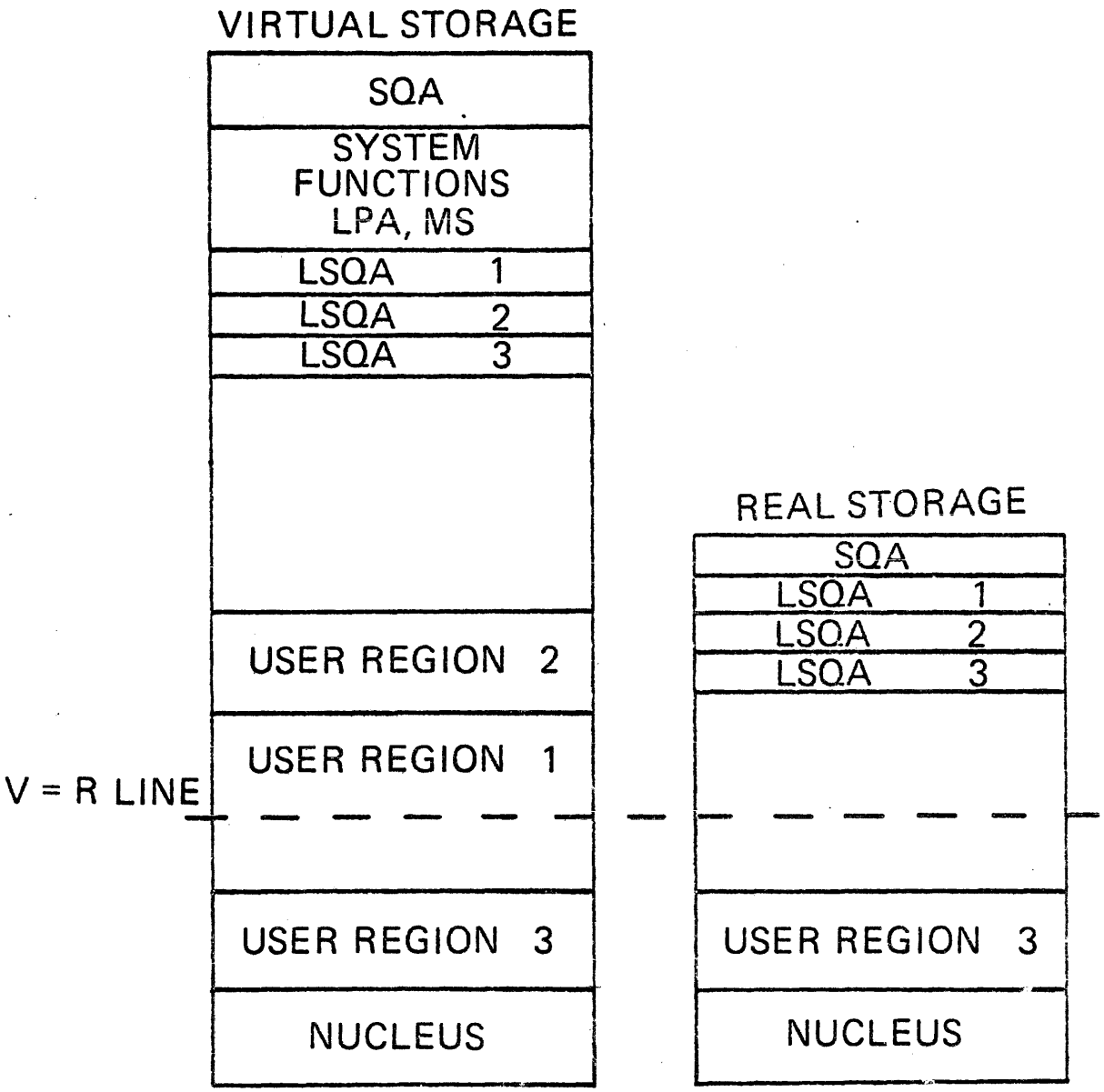
STORAGE LAYOUT



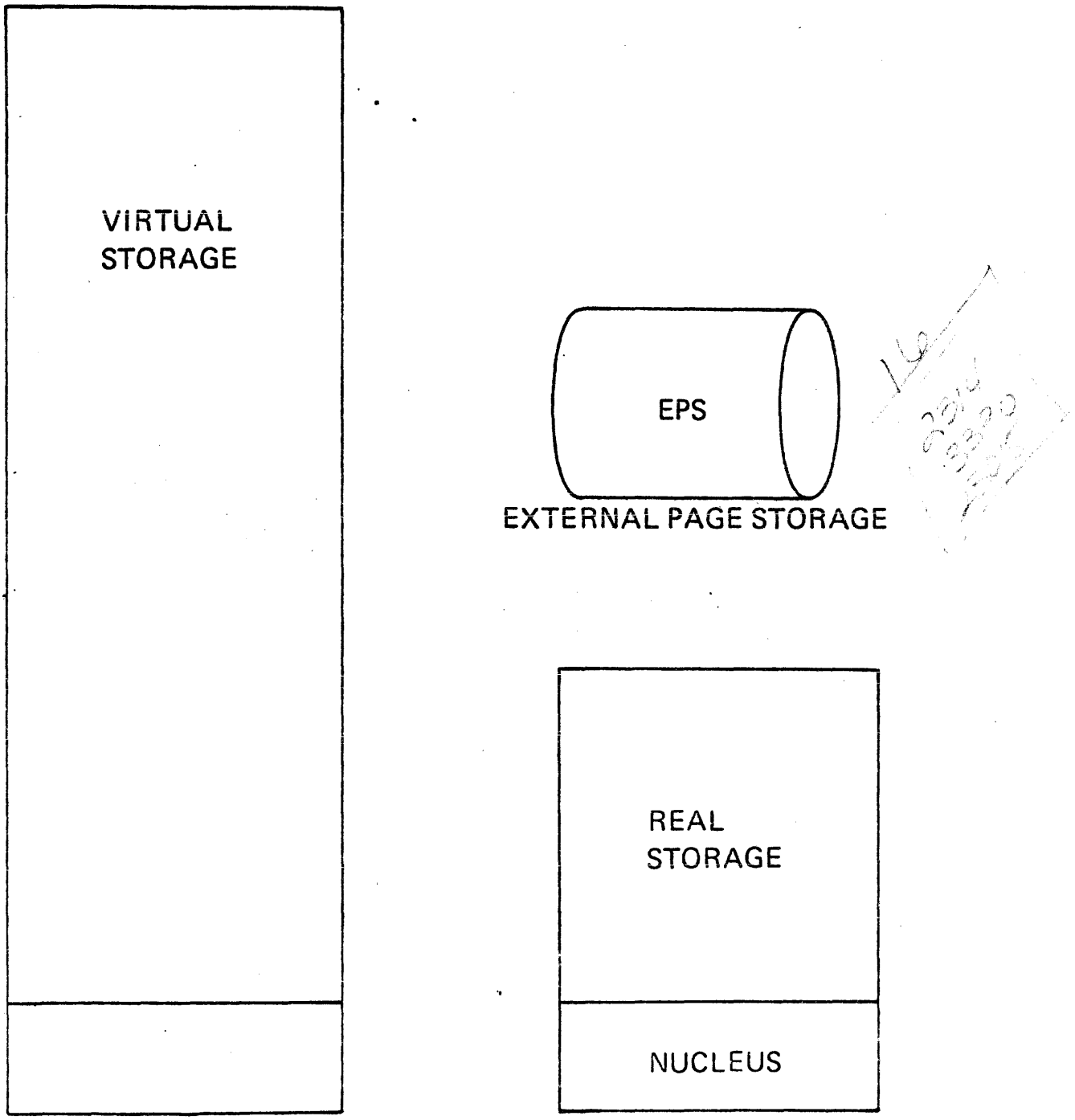
STORAGE LAYOUT



STORAGE LAYOUT



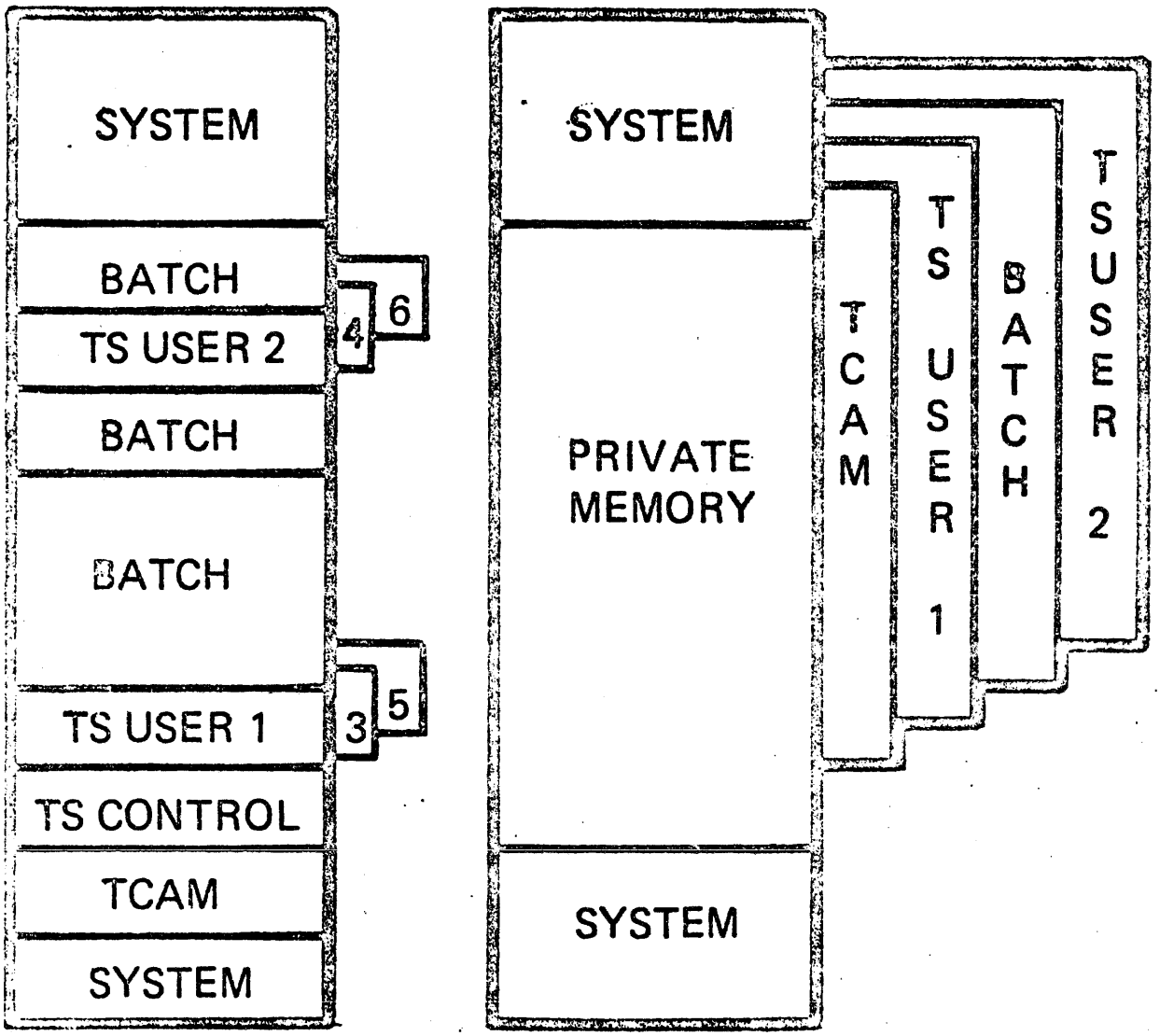
EXTERNAL STORAGE ADMINISTRATION



EXTERNAL STORAGE ADMINISTRATION

- MANAGES EXTERNAL PAGE STORAGE
- ASSIGN SLOTS FOR PAGE-OUT
- BALANCES DEVICE USAGE
- CONTROLS MIGRATION

MULTIPLE ADDRESS SPACES



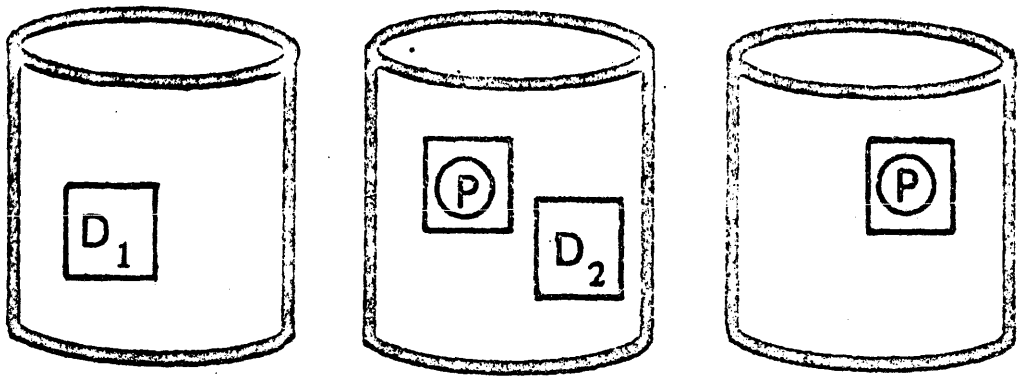
VS2-R1

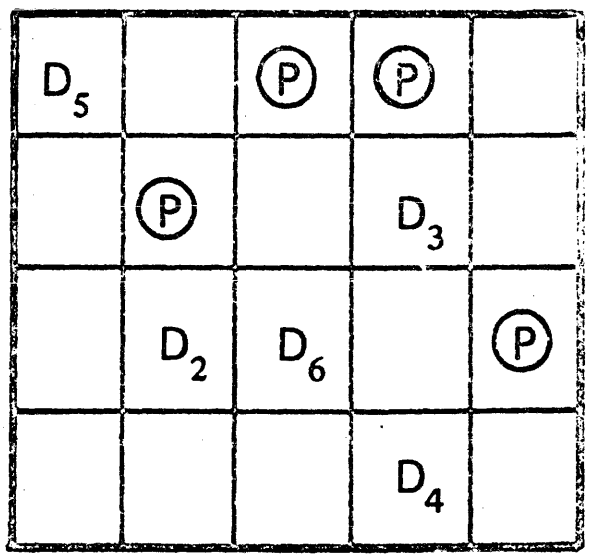
SINGLE ADDRESS SPACE

VS2-R2

MULTIPLE 16MB ADDRESS SPACES

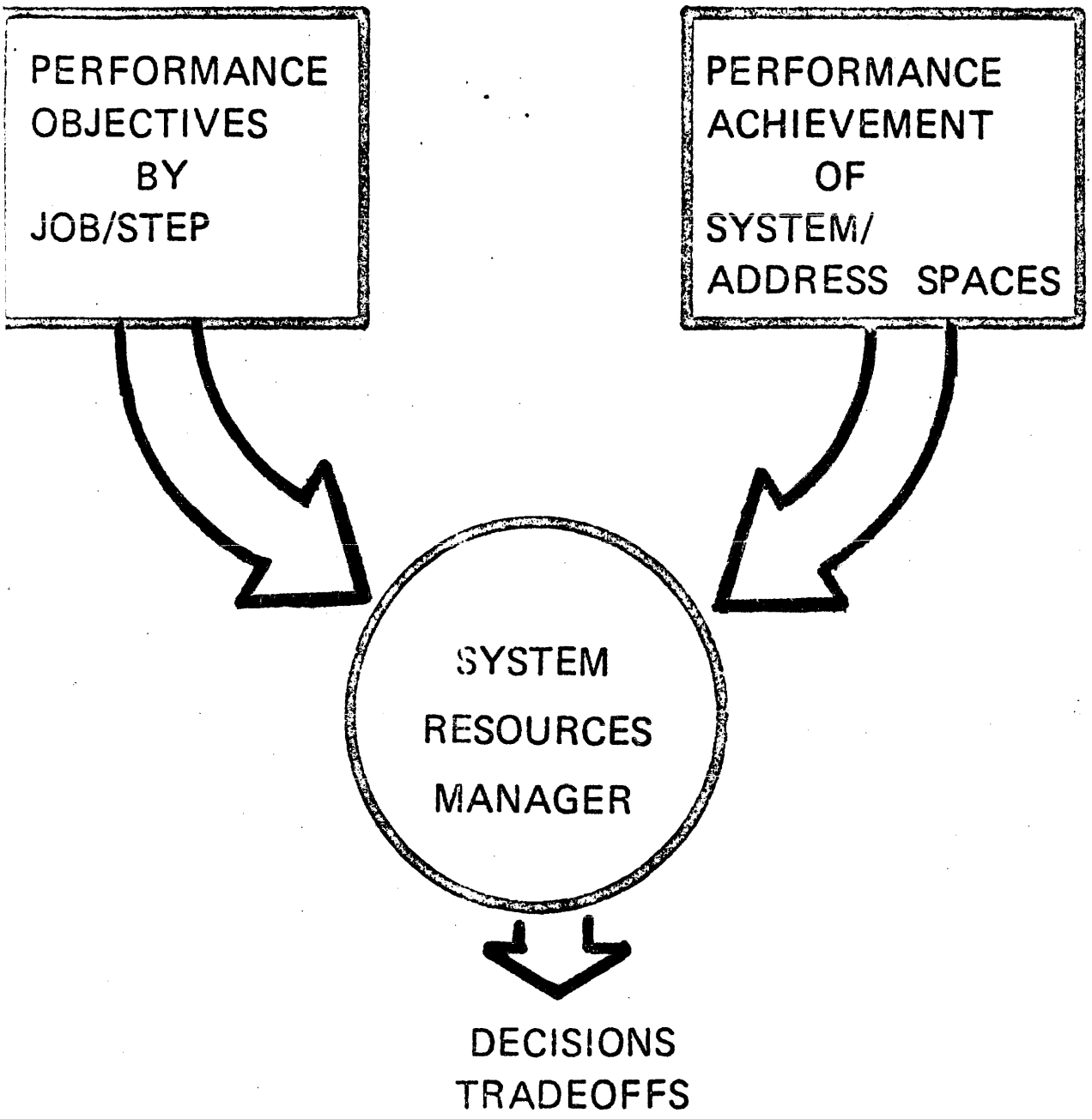
VIRTUAL I/O
" DATA SETS IN PAGING SPACE"





TEMPORARY DATASETS INCLUDED
IN STORAGE HIERARCHY

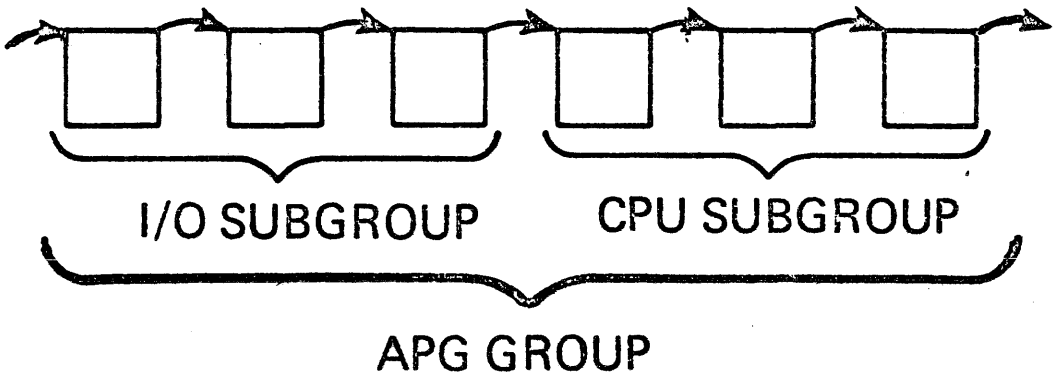
CENTRAL RESOURCE MANAGEMENT



PAGING, SWAPPING, DISPATCHING, ALLOCATION

DYNAMIC OR "HEURISTIC" DISPATCHING

SPECIFY PRIORITY LEVEL AS
AUTOMATIC PRIORITY GROUP



TASKS START AS I/O

IN APG – SWITCH ONLY FROM CPU TO I/O

TASKS DISPATCHED WITH TIME INTERVAL

DOES TASK VOLUNTARILY SURRENDER
OR TIME INTERVAL END?

TIME INTERVAL SELF ADJUSTING

MULTIPLE PROGRAMS

COMPILERS

LINKAGE EDITOR

RELOCATABILITY

FLEXIBLE JCL

CATALOGED PROCEDURES

DEVICE INDEPENDENCE

PRIVATE LIBRARIES

PRIORITY SCHEDULING

SYSTEM CATALOG

RESIDENT REENTRANT ROUTINES

OPERATOR CONTROL

RESOURCE ALLOCATION

SPOOLING

ACCOUNTING FACILITY

DIRECT ACCESS SPACE MANAGEMENT

ACCESS METHODS

VSAM

DYNAMIC PRIORITY ADJUSTMENT

TIME SLICING

VIRTUAL STORAGE

SELF EVALUATION QUIZ 1

1. Name 5 resources of a computing system:

   PEOPLE

   MAIN STORAGE

   PROGRAMS

   CPU

   I.O.

2. An OPERATING SYSTEM is an integrated set of programs designed to improve operating effectiveness of a data processing installation.

3. Match the following:

Job	F	A. Set of instructions required to produce some result
Task	C	B. External directions defining to the operating system a job's characteristics and requirements
JCL	B	C. A unit of work for the CPU.
Control Block	D	D. Internal tables and lists for system use
Processing Program	A	E. Manages or manipulates the total environment so as to facilitate the operation of the processing program
Control Program	E	F. A total processing application comprised of one or more related programs, each called a _____

SELF EVALUATION QUIZ 2

Which control module performs the following functions:

1.	TASK SUP.	Switch between tasks
2.	WRITER	Writes unit record output from SYS1.SYSPOOL
3.	MASTER SCHED.	Communication with operator
4.	DADSM	Space management on direct access device.
5.	INITIATOR/T	Selects JOB from SYS1.SYSJOBQE
6.	CATALOG MGR	Maintains catalog of Data sets
7.	READER	Reads job stream
8.	CONTENT SUP	Maintains directory of load modules in storage.
9.	INITIATOR/T	Interprets JCL
10.	ACCESS METHOD	Method of transmitting data – Interface to IOS.
11.	I/O SUPER.	Handles I/O at the physical level.
12.	INITIATOR/T	Allocates I/O devices to a job step.
13.	OPEN/CLOSE	Prepare data set for I/O
14.	FETCH	Loads program into storage

SELF EVALUATION QUIZ 3

1. During the execution of a program, (~~all of it,~~ part of it) is being used at any point in time?

2. ADDRESS — space in which data, instructions, and constants are defined by the programmer.

3. STORAGE — physical location of data instructions and constants as defined by the system.

4. The maximum size of virtual storage is 16 M .

5. Virtual storage is divided into PAGES , and real storage into FRAMES .

6. T or F — A software feature maps virtual to real addresses. F

7. Where is a page if it is not in a page frame? EXTERNAL PAGE STORAGE

8. A SEGMENT is a group of pages.

9. In VS1, the page size is 2 K, and the segment size is 64 K.

10. On an address translation, if the page is in real storage, we get the R.S.A.
If the page is not in real storage, a PAGE FAULT occurs.

ELF EVALUATION QUIZ 4

1. The nucleus (is - (is not)) pageable. VS1

2. E.P.S. has a slot for every page of pageable virtual storage.

3. PAGE SUPR allocates and releases page frames.

4. The two indicators for page frame replacement are REF BIT and CHANGE BIT.

5. If a page was referenced but not changed it (is - (is not)) necessary to page out.

6. Jobs that cannot tolerate paging, run as V=R.

SELF EVALUATION QUIZ 6

Match the access methods with the descriptions:

You may use multiple choices.

1. B A set of sequential data sets with a directory.
2. A Can be on card, tape, or disk.
3. C D, E Can be processed sequentially or directly.
4. D, C, E Must be on direct access.
5. E Has Distributed free space.
6. C Uses randomizing technique to establish address of record
7. E Reclaims space from deleted records.
8. D Additions may cause records to go into overflow.
9. E Provides multiple levels of data security.
10. E Keeps its keys in compressed format.

A. Sequential

B. Partitioned

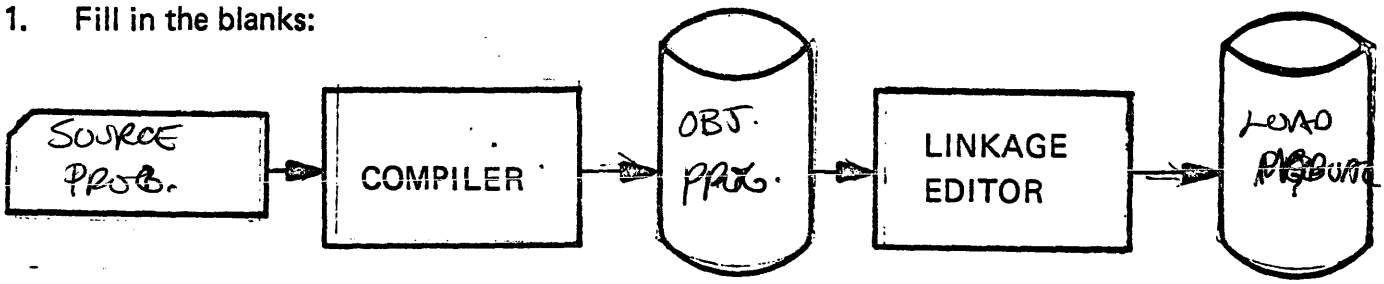
C. Direct

D. Index Sequential

E. Virtual

SELF EVALUATION QUIZ 7

1. Fill in the blanks:



2. Which of the above module types is executable? LOAD.

3. A ~~REENTRANT~~ program can be used by many tasks at the save time.

4. The LINKAGE EDITOR produces load modules that must be loaded into storage; the LOADER produces executable code in storage.

5. The JOB card identifies the job, the EXEC identifies the program to be executed, and the DD card describes the data set.

6. A PROC is a precoded set of JCL that can be reset and modified for program execution.

7. SYS. UTL. manipulates collections of data and system control information.

8. DATA SET UTL. manipulates partitioned, sequential, or indexed-sequential data sets.

9. IND. UTL. operates outside and in support of the operating system.

0. ~~CATALOG~~ ACCESS METH SERV. maintains catalog for VSAM.

SELF EVALUATION QUIZ 8

1. An installation would perform a SYS. GEN. to tailor an OS/VS system to meet their requirements.

2. VS1 can have 15 problem program partitions.

3. Job CLASSES are used to separate jobs by their characteristics.

4. Minimum partition size in VS1 is 64K .

5. Card input and printer output is placed on SYS1.SYSPOOL .

6. The output writer can start to print the output at (End of Job Step - End of Job).

7. At I.P.L. time, the operator can modify system parameters for the day.