Program Product

H20-0524-1

Information Management System/360 for the IBM System/360 (System Description) Application Description Manual

Program Number: 5736-CX3

The Information Management System/360 is an Operating System/360 processing program designed to facilitate the implementation of medium to large common data bases in a multiapplication environment. This environment is created to accommodate both online message processing and conventional batch processing, either separately or concurrently. The system permits the evolutionary expansion of data processing applications from a batch-only to a teleprocessing environment.

This manual includes a general description of the system and its various facilities and programs, listings of typical and minimum configurations, and a sample application.

This manual has been prepared for data processing management and personnel. Knowledge of the information in the following will be helpful:

- IBM System/360 System Summary, (A22-6810)
- IBM Operating System/360 Concepts and Facilities, (C28-6535)

Acknowledgment

IBM acknowledges the contributions made in the development of Information Management System/360 by the members of Computing and Data System Services, Space Division, North American Rockwell Corporation, Downey, California. Caterpillar Tractor Co., Peoria, Illinois, also contributed to the project.

Second Edition

This edition is a minor revision and does not obsolete H20-0524-0.

This edition applies to Version 1, Modification Level 0, of the Program Product Information Management System/360 for the IBM System/360, 5736-CX3, and to all subsequent versions and modifications until otherwise indicated in new editions or technical newsletters.

Changes are continually made to the specifications herein; before using this publication in connection with the operation of IBM systems, consult the latest System/360 SRL Newsletter, Form N20-0360, for the editions that are applicable and current.

Requests for copies of IBM publications should be made to your local IBM representative or to the IBM branch office serving your locality. A form for readers' comments is provided at the back of this publication. If the form has been removed, comments may be addressed to IBM Corporation, Technical Publications, 112 East Post Road, White Plains, New York 10601.

Form H20-0524-0 and -1
Page Revised 8/1/69
By TNL N20-2012

CONTENTS

Chapter 1. Introduction 1

Chapter 2. Environment 2
Data Base 2
Teleprocessing and Batch Processing 3

Chapter 3. General Description of IMS/360 4
Data Base Facility 4
Data Communication Facility 4
Highlights of IMS/360 5
System Description 5
Data Base Facility 6
Data Communication Facility 6
Utility_Programs 7

Chapter 4. IMS/360 System Concepts 8
Control Facility 8
Telecommunications Facility 8
Message Scheduling Facility 10
Data Language/I Facility 11
Data_Language/I_Capabilities 11
Data Language/I Data Base Organization 12
Checkpoint Facility 20
Restart Facility 20

Chapter 5. System Flow 22
Teleprocessing System 22
Batch Processing of Teleprocessing Data Bases 22
Data Language/I Data Base Batch Processing 23

Chapter 6. User Responsibilities 26
Application Development and Structuring of IMS/360 26

Chapter 7. Performance 27
Large System Performance Example 27
Response Time 28

Chapter 8. Machine Configurations 29
Minimum IMS/360 Configurations 29
Typical IMS/360 Configuration 31
Typical IMS/360 Storage Requirements 32

Chapter 9. Type I Programming System Usage 35

Chapter 10. IMS/360 Sample Application 36
Application Data Base Structure 36
Message Types 39
Message Processing Programs 39
Batch Programs 40

IMS/360 is a concept that has been developed to improve the computer user's ability to implement teleprocessing and/or batch-type data processing application systems. Its development is within the framework of Operating System/360.

Today, companies are evaluating computer systems not only with regard to programming systems and hardware, but also in relation to the needs of the corporate environment. In this respect there are increasing demands to interface with large centralized information files, including the interrogation and maintenance of these files. IMS/360 provides a number of features which facilitate implementation, change, and expansion of such application systems and information files.

The use of IMS/360 can be considered pertinent to the needs of most corporations or institutions. Application systems that might be considered include payroll and personnel, manufacturing bill of material, inventory control, accounts receivable, hospital records, student records, and petroleum well records systems. Using IMS/360, a company can design its applications to interface with the information files from remote typewriter terminals, in the more conventional batch mode, or in combination.

These features, coupled with the ability to respond to the frequent and anticipated high-volume information requests, make IMS/360 a powerful new tool for the data processing user.

ENVIRONMENT

Prior to discussing IMS/360, it is appropriate to describe the environment within which IMS/360 operates and to define pertinent terms and concepts which are used later in this manual.

DATA BASE

Traditionally, data files were designed to serve individual applications, such as inventory control, payroll, engineering drawing release, manufacturing planning, etc. Each data file was specifically designed with its own storage space within the computer or on tape or disk. These data files included, in many instances, duplicate or redundant information. This information overlap would often result in one file being kept current while the other would remain static and fall out of date.

When the same data resided in different application files, it normally existed in different formats. This variance in the format of common data meant that application programs were tailored to specific data organizations and physical devices. When new data management techniques and devices were introduced, the application programs normally had to be changed. Therefore, application programs could be in an almost perpetual state of change, adding appreciably to the overall cost of data processing.

This has been changed by the advent of the "data base". A data base is regarded as a nonredundant collection of interrelated data items processable by one or more applications.

The data base provides for the integration or sharing of common data. As an example, a manufacturing company having an application for release of engineering part data may first integrate its data with an application dealing with a manufacturing part release (Figure 1). Subsequently, application data applicable to assembly installation accounting may be integrated. The point is that the data and the programs of the first two applications above need not change when the data of the third application is integrated.

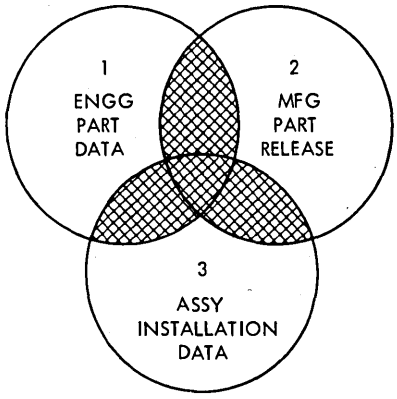


Figure 1. Application data integration - data base concepts

The data base also provides flexibility of data organization. It facilitates the addition of data to a new or an existing application

without modification to existing application programs. In Figure 1, the assembly installation accounting data may be added, when it is ready to be integrated, to the engineering and manufacturing data base. This is accomplished by removing the direct association between the application program and the physical storage of data.

The advantages of the data base are:

- Elimination of redundant data and its maintenance
- Consistency through the use of the same data by all parts of the company
- Application program independence from physical storage of data
- Reduction in application costs, storage costs, and processing costs

TELEPROCESSING AND BATCH PROCESSING

In batch processing, single transactions are accumulated and processed periodically against the data base. The significant characteristic of batch processing is that of elapsed time. The use of batch processing should depend on how current the user's information needs to be and on the costs of alternate forms of processing.

Because the computer data base is not continually available to the batch processing user, the information in the data base may not be up to date. The user of the information in a data base maintained by batch processing may not have current information at his disposal.

The currency of data within a data base may be improved with teleprocessing. Remote terminals provide the user with the ability to enter transactions as "messages", allowing both inquiry and update capability to the data base. Data bases used for teleprocessing can also be used by batch processing programs for functions like the production of reports or for the answering of complex inquiries.

CHAPTER 3. GENERAL DESCRIPTION OF IMS/360

IMS/360 has been designed to extend the capabilities of Operating System/360 in the data base and data communications environment. It has been implemented as an Operating System/360 program. It has four major objectives:

1. To provide data organization methods that are conducive to the creation and maintenance of large common data bases and the multiapplication use of these data bases
2. To provide the means to permit the user to facilitate development and maintenance of a data base system in the batch processing environment
3. To provide the user with the ability to extend his data base processing to the teleprocessing or data communication environment
4. To provide the user with an efficient telecommunication ability for developing a high volume/rapid response online system

IMS/360 is comprised of two major components: (1) the data base facility and (2) the data communication facility.

DATA BASE FACILITY

The data base processing capabilities of IMS/360 are provided through a facility called Data Language/I. The functions of data base definition, creation, access, and maintenance are assisted by these capabilities. The full data base facilities of Data Language/I can be used in the IMS/360 batch processing or teleprocessing environment.

DATA COMMUNICATION FACILITY

Data communication capabilities are characterized by the use of remotely located input/output terminals, connected to the computer, which provide the user with access to the data base. The communication network, consisting of IBM 2260 Display Stations and 1050 and 2740 communications terminals, enables the system to receive and transmit a variety of message types for multiple applications. Terminals need not be dedicated to specific applications. 2260 support is limited to single-screen transmission only (maximum single message length of 960 characters) between the terminal and the message processing programs or other terminals. In addition, a 2260 cannot be designated as a master terminal.

Control information describing each message type allows the system to initiate message processing or message switching. Message entry may result in both data base inquiry and update processing. A user-provided library of application programs for message and batch processing and a description of their data base requirements must be provided. These application programs may be written in any of the following Operating System/360 programming languages: Assembler Language, COBOL, or PL/I.

HIGHLIGHTS OF IMS/360

In order to provide insight into IMS/360 and its capabilities, the following list of highlights is provided:

1. IMS/360 is a general purpose system applicable to the requirements of widely varied companies. It has been designed asan open-ended system, thus providing the ability to extend functions.

2. A data base capability is provided to permit improved access and maintenance to data and provide an effective method for handling the variable-length nature of application data.

3. Application programs are given independence from the physical organization of data.

4. A means is provided to restructure and expand the data base without requiring modifications to existing application programs.

5. Batch programs and teleprocessing or message processing programs may operate separately or concurrently in the system.

6. Security capabilities are provided in the message processing environment to assist the user in ensuring that information is only available to those entitled to it and that only eligible persons may update the data base.

7. Checkpoint and restart facilities are provided.

8. Statistical information is provided by the system to assist the user in evaluation of performance and changing communication requirements.

9. The user of IMS/360 has the capability of structuring data bases, defining various applications, and tailoring the input/output terminal and data storage environment.

10. IMS/360 permits the evolutionary expansion of data processing applications from the batch environment to the teleprocessing environment. An application can initially utilize Data Language/I for data base batch-only processing. Once experience is gained in data base batch-only processing and as the needs of the application dictate, the same data base and application program design may be used in a teleprocessing environment.

SYSTEM DESCRIPTION

IMS/360 includes the following functional facilities:

- Data Base Facility
  - Data Language/I
- Data Communication Facility
  - Telecommunications
  - Message Scheduling
  - Checkpoint
  - Restart

- Utility Programs

Data Base Facility

DATA LANGUAGE/I: Data Language/I is designed to allow users to adapt IMS/360 to the data requirements of their own applications. An application program has two distinct interfaces with Data Language/I: (1) a data base description, the logical data structure of the data base given as a definition external to the application program; and (2) a common source program linkage which contains data allowing Data Language/I to process input/output requests during execution of the application program.

Data Language/I can be used to:

- Assist in the creation and maintenance of data bases
- Promote integration of applications
- Reduce application program maintenance caused by changes in the data requirements of the application user

Data Communication Facility

In the teleprocessing environment of IMS/360, Data Language/I provides the interface for input and output terminal messages. This terminal message interface is the same as that used for all data base requests.

TELECOMMUNICATIONS: IMS/360 supports the IBM 2260 Display Station and 1050 and 2740 communications terminals to be used for message input and output. Depending upon the application requirements specified by the IMS/360 user, input messages may be immediately processed or switched to another terminal. One of the 1050 or 2740 terminals operates as the master terminal of the system and provides the user with a control center for all message processing. The 2260 Display Station cannot be used as a master terminal. The master terminal controls checkpoint/restart initiation, user terminal operation, and input message processing.

MESSAGE SCHEDULING: IMS/360 initiates execution of message processing programs based upon messages received. All message types acceptable to the system are predefined and verified through a one- to eight-character code in the first line of the message. When a valid message is completely received and queued, its presence is made known to message scheduling. When the required resources are available, processing is initiated on a message priority basis.

Data base integrity is a capability of the message scheduling facility. No program which updates a data base is scheduled if that same data base is being processed by any other update program in a message or batch region.

CHECKPOINT: Periodic checkpoints of IMS/360 are required in order to provide the ability to restart after loss of core memory, disk message queue, or data base information. There are many conditions under which IMS/360 may require a checkpoint capability. These conditions, in general, can be grouped into four classifications:

- System-scheduled checkpoints based upon message volume
- Master terminal request to checkpoint the system

- Master terminal request to orderly terminate the system
- Master terminal request to produce a current copy of the data from a data base

RESTART: IMS/360 can be stopped and restarted daily or at explicit intervals. The facilities of restart provide for system reconstruction after a controlled stop, an emergency stop, or a data base destruction.

The checkpoint and restart functions are dependent upon message queuing on direct access storage and the logging to tape of all messages and data base modifications.

Utility Programs

The following utility programs are provided:

- System Definition - Structures control blocks used by IMS/360 to define the particular user's data processing environment
- Data Base Description Generation - Creates the control block required for each data base description
- System Log - Produces statistical reports concerning message type and terminal operation from the IMS/360 log
- Program Specification Block Generation - Creates control blocks that identify the characteristics of the terminals and data bases to be used by a particular application program
- Security Maintenance Program - Creates or alters password or terminal security for the Data Communication facility of IMS/360

CHAPTER 4. IMS/360 SYSTEM CONCEPTS

While a general description of IMS/360 has been given, there are numerous technical considerations which require additional discussion. This chapter discusses those considerations which are of particular interest to personnel responsible for planning the use of IMS/360.

IMS/360 operates as a processing program under Operating System/360. The teleprocessing capabilities require Operating System/360 MFT-II or MVT. The data base processing capabilities of IMS/360, which are provided by Data Language/I, can operate independently for batch processing under Operating System/360-PCP, MFT-II, or MVT, or as part of the IMS/360 teleprocessing environment.

CONTROL FACILITY

The initiation and control of the various IMS/360 facilities are provided by the IMS/360 control facility. The control facility is executed as a job under Operating System/360 with a high scheduling priority. Once loaded it performs the following functions:

1. Initiation and control of all facilities within the IMS/360 control program:

   a. Telecommunications

   b. Message Scheduling

   c. Checkpoint

   d. Restart

   e. Data Language/I

2. Initiation and control of each Operating System/360 region utilized by application programs for message processing. Initiation is performed through the services of the Operating System/360 job management routines. Subsequent scheduling, loading, and execution of message processing programs are performed within an existing message processing region.

3. The ability to communicate between Operating System/360 regions which have been initiated for message processing and the Operating System/360 region containing the IMS/360 control program. The purpose of this interregion communication is for scheduling of message processing program execution and for handling data base requests from message processing programs. This ability to communicate is provided through two Type I supervisor call routines (SVC's).

TELECOMMUNICATIONS FACILITY

The telecommunications facility of IMS/360 is primarily directed at providing a teleprocessing data base inquiry and update system. These capabilities include:

1. Initiation and control of input/output operations on all communication lines using Operating System/360-Basic Telecommunications Access Method (BTAM)

2. Translation of messages from communication line code to extended binary coded decimal (EBCDIC)

3. Time stamping, date stamping, and logging of all input and output messages

4. An operator's terminal command language to communicate control information to IMS/360 and permit input message correction

Data messages are the means of application data input from any terminal, and are entered in the following format:

where:

tr - is a one- to eight-character transaction code that identifies for IMS/360 the application that is to process this message, or the output terminal to which the message is to be switched.

password - is an optional field that is necessary only if a password has been assigned to the transaction code to restrict its entry. If present, it is assumed to be the next field following the transaction code.

text - is the actual message with one or more lines.

The telecommunications facility of IMS/360 provides a means by which terminal operators may communicate control information as well as data messages through a terminal command language. The control functions provided by the terminal language allow:

1. Input message character correction

2. Input message cancellation

3. Terminal operation in a test mode

4. Terminal response mode, locking the terminal and its associated line from time of input request to subsequent response

5. The system user the ability to secure (restrict access to) terminals and data bases

6. Information transmission to other terminals

The operational hub of IMS/360 is the master terminal. This IBM 1050 or 2740 terminal has complete control of IMS/360 with respect to communications, message scheduling, and data base operation. It is used for checkpointing and restarting the system, for continuous monitoring of the system, and for altering the operation of the system. Capability is provided for the user to define an alternate master terminal.

In addition to the user terminal functions described above, a Master Terminal Language provides the operator at the master terminal with the ability to:

1. Start the system functions of message receiving, queuing, scheduling, and sending

2. Allow the IMS/360 to purge its message queues prior to shutdown

3. Allow the temporary halt of message processing program scheduling and execution

4. Stop the system functions of message receiving, queuing, scheduling, and sending

5. Modify passwords

6. Initiate and control system checkpoint

7. Initiate and control system restart

8. Display the status of various control blocks related to transaction types, programs, data bases, message queues, and communication facilities

The use of all security capabilities of IMS/360 is at the discretion of the system user. These security capabilities will assist in maintaining proper information access and integrity.

MESSAGE SCHEDULING FACILITY

Separate Operating System/360 regions with unique storage protection keys are used for message processing. These regions are initiated through the normal Operating System/360 job management routines during IMS/360 initialization. Subsequently, message processing programs are loaded into and executed within these regions based upon input messsages received. The message scheduling facilities of IMS/360 initiate message processing program load and execution through resident supervisor call routines added to the Operating System/360 nucleus.

The IMS/360 input message scheduling algorithm is controlled by the system user. The user must provide three parameters at the time he describes each message type:

1. Normal Priority - The normal priority at which messages of this type are processed. This may be priority level 0 through 14.

2. Limit Count - A two-digit number. When the count of messages of this type in the input queue (queue count) is equal to or greater than the limit count, the normal priority is raised to the limit priority (below).

3. Limit Priority - When the limit count is equal to the queue count, the normal priority is raised to the limit priority until the queue count returns to zero. At that point, the normal priority is restored.

An example of the scheduling process is as follows:

- Transaction Code = MTI
- Normal Priority = 4 (level 4)
- Limit Priority = 11 (level 11)
- Limit Count = 20

Assume this application requires a maximum of one hour turnaround on all messages. The minimum message rate is 25 per hour. During normal working hours, message type - MTI may be scheduled every 15 minutes or more often, and most of the messages are processed each time. During peak period when there is high activity on messages at levels 9 through 14, for example, messages at the lower levels may only receive service every 2 or

3 hours or perhaps not until the peak is over. During these peak periods, message MTI will stay at level 4 without service until the twentieth message is enqueued. When the twentieth message arrives, the priority of MTI is automatically boosted to level 11 by making the current priority equal to the limit priority (that is, 11). MTI will now contend for service at a priority of 11. MTI will remain at priority 11 until the enqueued message count returns to zero. MTI is then automatically restored to priority 4.

It is possible for the user to specify a normal priority of zero (null), and no processing occurs until the limit count is reached.

DATA LANGUAGE/I FACILITY

Data Language/I Capabilities

Data Language/I provides application program independence from access methods, from physical storage organization, and from the characteristics of the devices on which the application's data is stored. This independence is provided by a common source program linkage and by a data base description external to the application program. This linkage handles the following languages: COBOL, PL/I, and Assembler Language. The external data base description(s) describes the logical data organization of data base(s) to Data Language/I. Using these techniques, it is possible to physically reorganize established data bases in a timely manner without modification to application programs. A reduction in application program maintenance should be realized.

The common source program linkage and data base description allow the application program the ability to request Data Language/I to:

- Reference a unique segment (Note 1) (GET UNIQUE)
- Retrieve the next sequential segment (GET NEXT)
- Replace the data in an existing segment (REPLACE)
- Delete the data in an existing segment (DELETE)
- Insert a new segment (INSERT)

Note 1: "Segment" refers to a fixed-length data element containing one or more logically related data fields.

In the COBOL language, this common source program linkage uses the ENTER LINKAGE and the CALL verb to perform the input/output functions listed above. Application programs written in PL/I or Assembler Language use similar statements to reference Data Language/I. Because of this approach to data reference, input/output operations and associated control blocks are not compiled into the application program. This removes dependency upon the currently available access methods and physical storage organizations.

Each data base description is created from user-provided statements of the logical and physical structure of each data base. These statements are input to an offline utility program of IMS/360. The result of the utility program is the creation and storage of a data base description in the user-defined data base description library. This data base description provides Data Language/I with a "mapping" from the logical structure of the data base used in the application program, to the physical organization of the data used by Operating System/360 data management. The logical data structure can be "remapped" into a

different physical organization and this can be achieved without program modification. Integration of other application data can also be added to this data base and still not cause a change to the original application programs. The concept of a data base description reduces application program maintenance caused by changes in the data requirements of the application.

Data Language/I provides for elimination of redundant data while providing integration or sharing of common data. The majority of the data utilized by any company has many interrelationships and hence many redundancies. For example, Manufacturing and Engineering have many pieces of data which would be useful to Quality Control; similarly, Purchasing and Accounting. If analysis of the number and types of segments shows that all the data cannot be placed in a single common data base, Data Language/I allows the user the additional capability of physically structuring the data over more than one data base. Before Data Language/I, personnel responsible for application programs frequently were not able, nor did they have the time, to integrate other data with their own to eliminate redundancies without the necessity of a major rewrite of the application programs involved.

Another capability of Data Language/I protects each application of a multiapplication data base through the concept of "sensitive" segments. When operating against a Data Language/I data base, only the data segments that are predefined as sensitive are available for use in this application. Each application using the data base can be sensitive to its unique subset of "sensitive" segments. Where an application program has defined "sensitivity" to a subset of segments within a data base record, modification and addition of nonsensitive segments do not affect the program's processing capability. In addition, any application program can be restricted to "read only" operations against its sensitive segments.

Data Language/I Data Base Organization

The data base structure is best described by providing an example. Figure 2 depicts the hierarchical relationship for a company data base made up of engineering data, inventory data, and purchasing data, which could be typical of any company. All this is based on part master (part number) data.

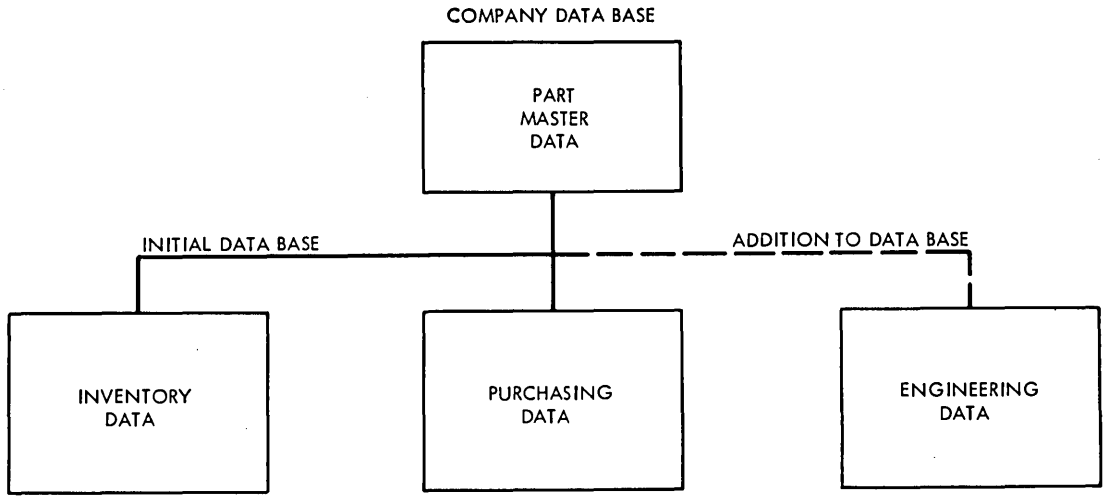


Figure 2. Company data base hierarchical data relationship

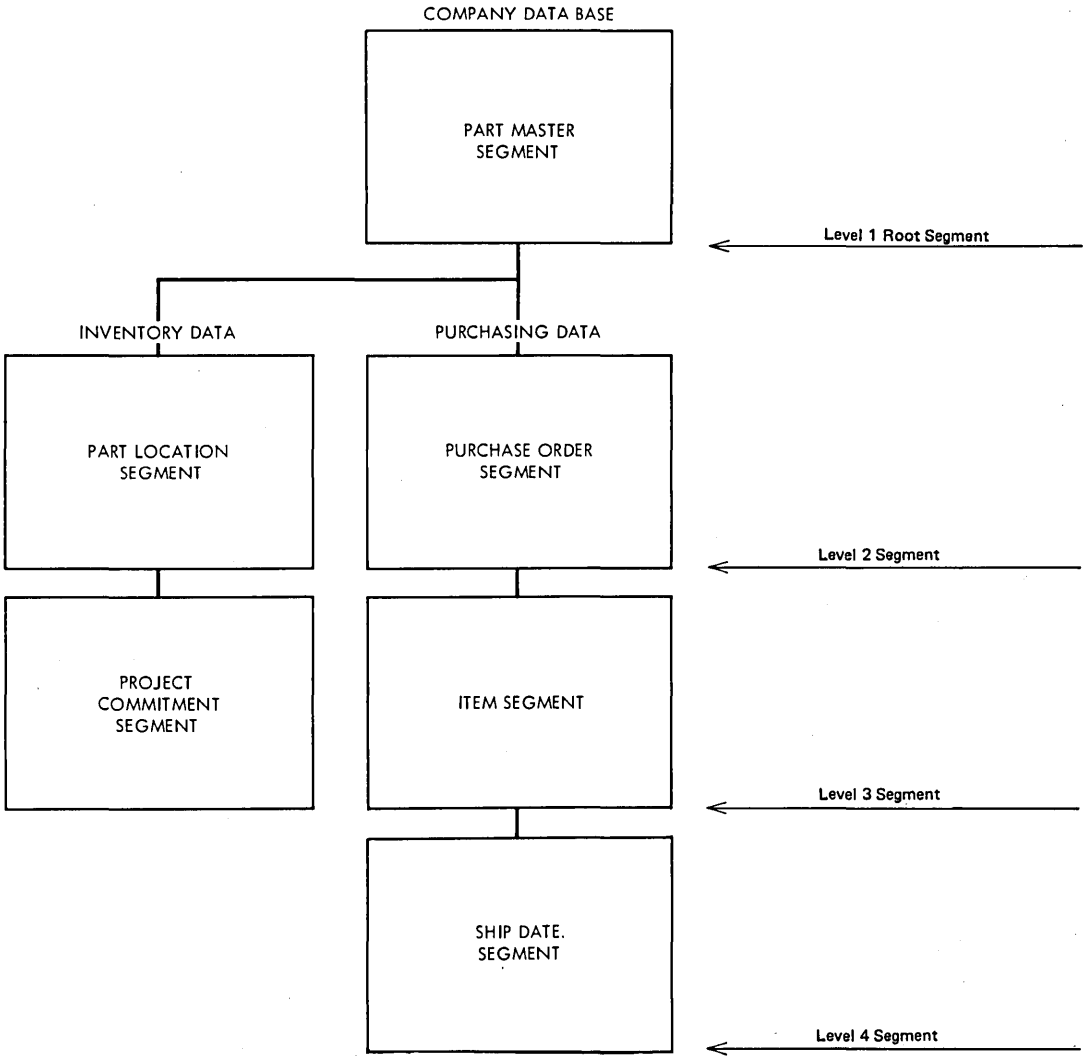
A data base is composed of data base records. A data base record is a collection (a variable number) of hierarchically related, fixed-length data elements, called "segments". A root segment is the highest hierarchical segment in the data base record. A dependent segment is a segment that relies on at least the root segment for its full hierarchical meaning. It is therefore always at a lower hierarchical level than the root segment. There can be 255 segment types within a data base and 15 levels of segment hierarchy within a data base record.

Details of the segments of this data base example will be shown for the inventory and purchasing data contained in the initial company data base segment structure (see Figures 3 and 4). This logical structure may be physically stored in either of Data Language/I's organizations:

- Hierarchical Sequential: The Operating System/360 Basic Sequential Access Method (BSAM) is used to implement the Hierarchical Sequential organization. Storage medium may be tape or direct access storage (see Figure 5).

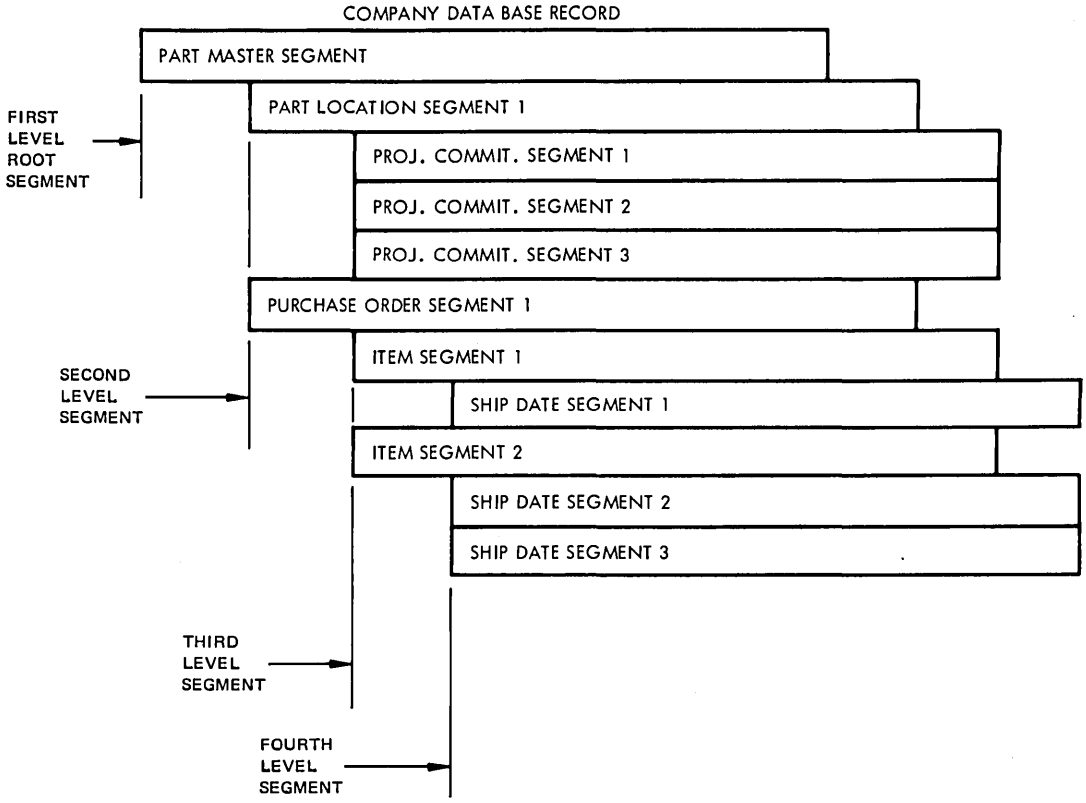
- Hierarchical Indexed Sequential: The Operating System/360 Indexed Sequential Access Method (ISAM) and a unique access method of IMS/360, called Overflow Sequential Access Method (OSAM), are used to enhance the capabilities of ISAM and to implement the Hierarchical Indexed Sequential organization. Storage medium must be direct access storage (see Figure 6).

After the initial data base details shown in Figures 3 through 6, the addition of engineering data in Figures 7 through 10 may be accomplished. As illustrated, the data base segments may be organized or reorganized into the Hierarchical Indexed Sequential organization or the Hierarchical Sequential organization. Note that, even with the addition of engineering data, the expansion of the data base may be accomplished without altering the existing processing programs which reference the data base.



• Figure 3. Company data base segment logical hierarchical relationship - inventory and purchasing data

Figure 3 depicts the Data Language/I segment logical hierarchical relationship for a company data base containing inventory and purchasing information. A programmer might construct a picture (as shown in Figure 4) of the different levels of segments within a data base record from the initial company data base.



• Figure 4. Company data base record segment level structure

The highest level (level one) segment or root segment is the Part Master Segment. All segments immediately subordinate to the root segment are called second level segments: Part Location Segment and Purchase Order Segment. Third level segments are related to the second level segments. In this example, Project Commitment Segment 1 is related to Part Location Segment 1, and Item Segment 1 is related to Purchase Order Segment 1. Fourth level segments are related to the third level. All the segments in Figure 4 constitute a data base record.

If the Hierarchical Sequential organization is chosen for the data base, Figure 5, each segment type is fixed-length within a data base record and is stored in physical sequence according to its hierarchical relationship.

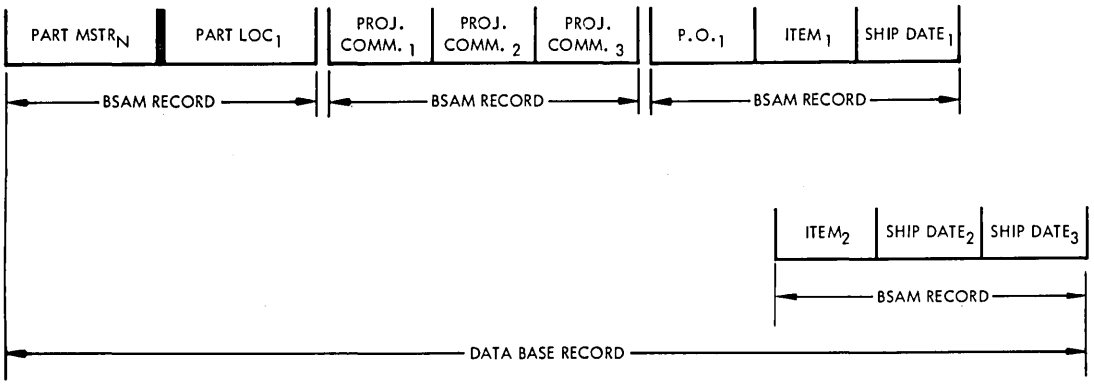


Figure 5. The Nth data base record stored in the hierarchical sequential organization

Figure 5 represents the Nth data base record depicted by the data base in Figure 3. The part master root segment has one occurrence of the second level part location segment type. For inventory purposes, this part has only one storage location. The second level part location segment type has three occurrences of the third level project commitment segment type. There are three projects in this company that have commitments against the inventory of this part.

There is one second level purchase order segment type, the root segment of which is the part master. This second level segment type has two occurrences of the third level segment type: Item Segment 1 and Item Segment 2. They in turn have subordinate or fourth level segment types: Ship Date Segment. The item segments are the purchased components for this particular part (or assembly). Each has a particular shipping date.

All data base records are stored sequentially in sort sequence of the root segments. The only direct data reference provided with the Hierarchical Sequential organization is to the first root segment in the first data base record of the data base. All subsequent reference is sequential.

If the Hierarchical Indexed Sequential organization is chosen, direct reference is provided to each root segment (and therefore to each data base record) within a data base. When the data base is created or reorganized, the key of each root segment is an ISAM logical record key. As many segments (the root and its dependents) are stored as will fit within the ISAM logical record. If storage for additional segments within the data base record is required, a relative block pointer is placed in the ISAM logical record. This pointer relates the ISAM record to one or more OSAM records which contain the remaining segments of the data base record (see Figure 6).

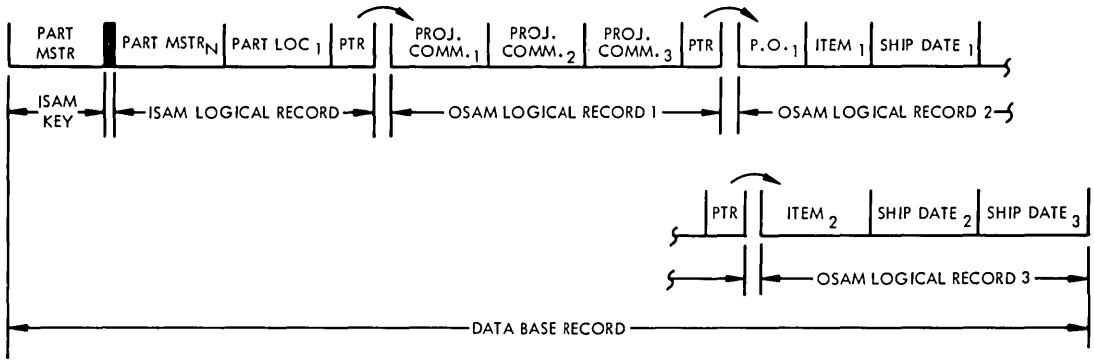


Figure 6. The Nth data base record in hierarchical indexed sequential organization

When the data base is created or reorganized, each data base record starts as an ISAM logical record and may overflow into one or more OSAM logical records. Reference to segments within the data base record is sequential.

As shown in Figure 6, the ISAM logical record consists of two segments: the part master root segment and the second level part location segment. At the end of the ISAM logical record is a pointer to the first OSAM record. The first OSAM logical record consists of three third level project commitment segments (1, 2, and 3). The second and third OSAM logical records contain the remainder of the data base record.

An example is now depicted which illustrates an addition to the company data base of the engineering data. It is assumed that the inventory and purchasing applications are not changing. The addition to the company data base is the integration of the engineering application as shown in Figure 7.

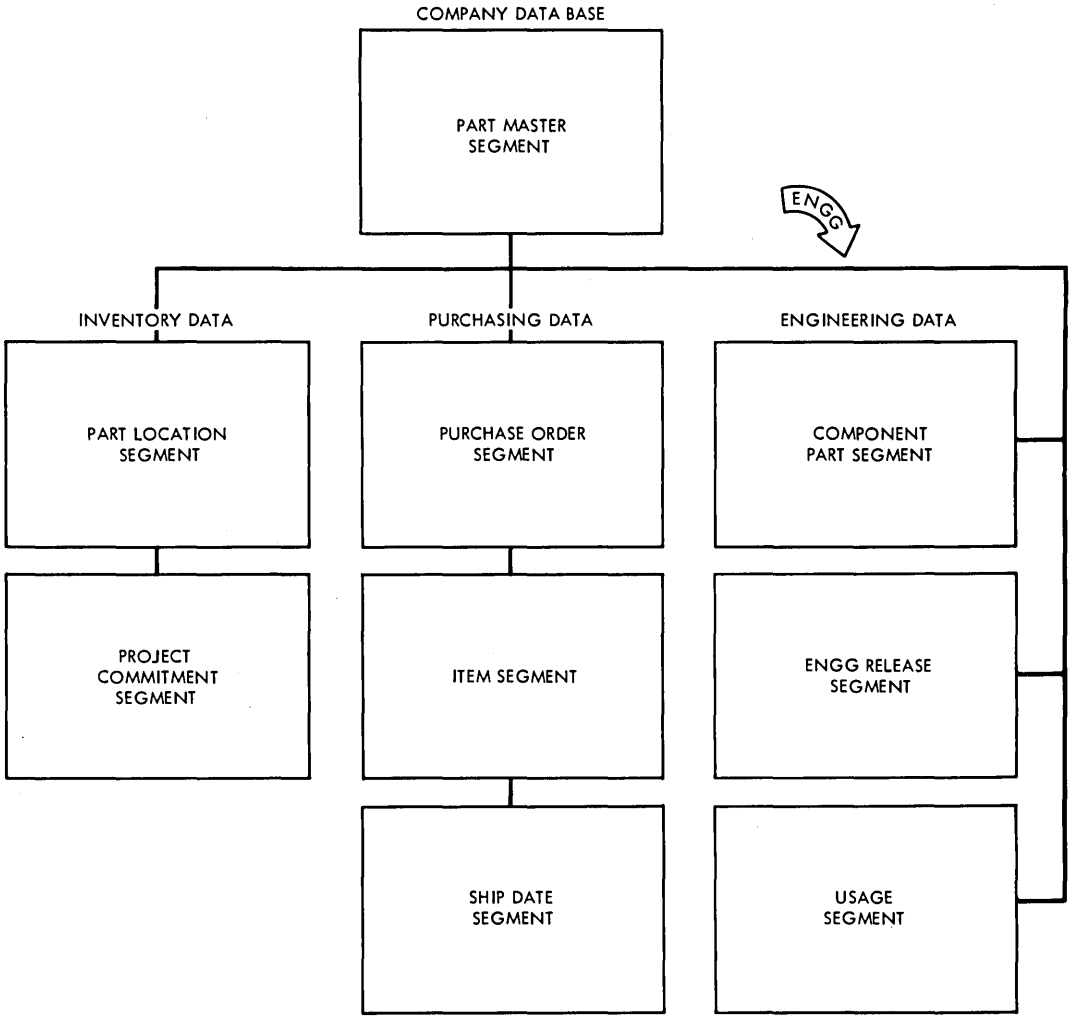
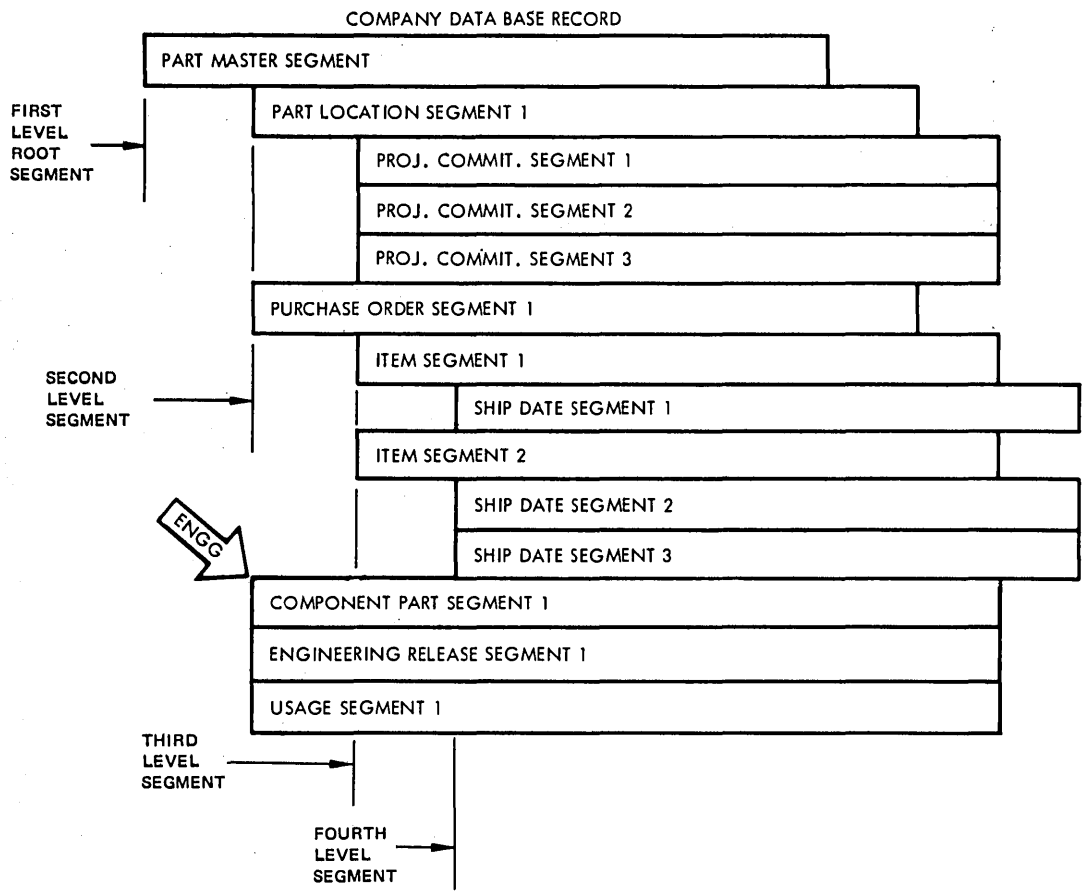


Figure 7. Company data base segment logical hierarchical relationship - inventory and purchasing data - engineering data added

The responsible user personnel may extend the company data base description and insert the engineering data segment structure. Then the existing company data base and the engineering data segments are merged to create the new company data base. Figure 8 depicts a segment level picture of the data base record.



- Figure 8. Company data base record segment level structure - engineering data added

Figures 9 and 10 illustrate how the new data base may be physically stored.

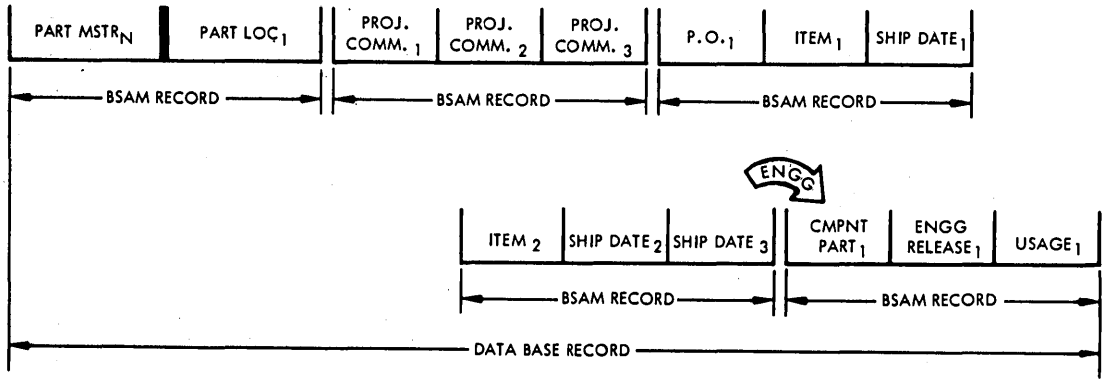


Figure 9. The Nth data base record in the hierarchical sequential organization - engineering data added

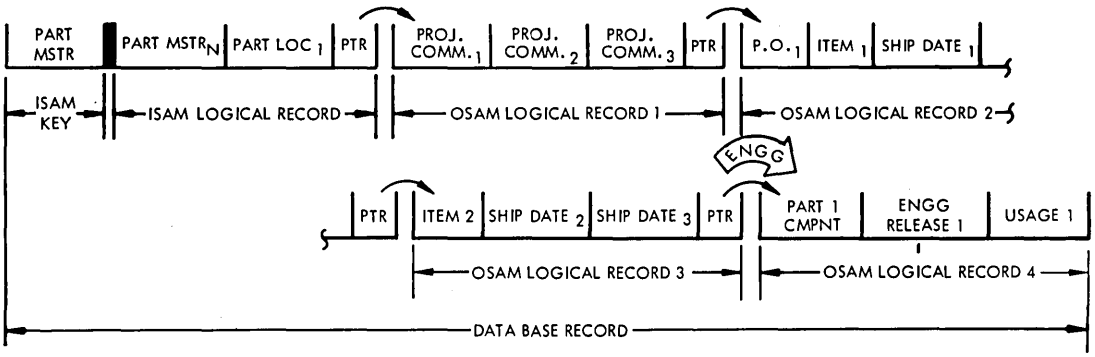


Figure 10. The Nth data base record in hierarchical indexed sequential organization - engineering data added

CHECKPOINT FACILITY

The master terminal of IMS/360 provides the operator a means of entering commands for checkpoint execution. These commands provide the ability to:

- Cause the message queue control blocks and associated pieces of information to be recorded on the IMS/360 system log.
- Cause orderly termination of the IMS/360 system. Unprocessed input messages may be retained on direct access storage queues or recorded on the system log for subsequent processing.

RESTART FACILITY

IMS/360 is capable of being stopped and restarted daily or at other explicit intervals. To start the IMS/360 system, the operator performs the procedure for initial program load (IPL) of the Operating System/360 and then instructs the operating system to read a SYSIN job stream. The SYSIN job stream starts with one job specifying the IMS/360 control program and follows with jobs 2 through n, specifying message regions. Remaining regions are used for batch processing. The job specifying the IMS/360 control program causes this program to be loaded and given control. A message is then transmitted to the master terminal, requesting an indication of the type of restart for IMS/360. The operator's response causes control to pass to the restart facility, which reads a tape of the system log. (This tape was written by CHECKPOINT at the previous system stop.) On this tape are input messages received but not processed or any output messages generated but not transmitted on the previous execution.

Any other information required to restart the system is also carried over on the tape. Messages on this tape are put back into the same queues in which they were left at the previous system stop. When the end-of-file indicator is reached, the master terminal is informed that restart is complete. The master terminal operator may now enter control messages to initiate communication line operation, message processing, and data base reference.

Restart can be performed without a previous system log, which amounts to an initial start for all message transmission and processing.

In addition to normal restart, three emergency restart procedures are provided by IMS/360:

1. A procedure that handles the condition that is caused by an ABEND of IMS/360 or a machine error causing an ABEND where the data bases, system log, and the message queues are not destroyed

2. A procedure that handles the ABEND condition described above when IMS/360 message queues are destroyed

3. A procedure that handles the condition where a data base is destroyed. The procedure is to reload the checkpointed data base copy and reprocess all update or add transactions. This procedure requires that the facilities for logging all input messages and checkpointing a data base are used.

When IMS/360 is restarted after an ABEND condition occurs, the restart capabilities of IMS/360 provide the following information to the master terminal:

1. The message processing program which was executing in each message processing region at the time of ABEND

2. The input messages which caused the message processing programs in Item 1 to be scheduled

TELEPROCESSING SYSTEM

Once the region containing the IMS/360 control program and one or more regions to be utilized for the message processing have been initialized by the job management facilities of Operating System/360, the following system flow occurs (see Figure 11):

1. The telecommunications facility (Event 1) requests restart instructions from the master terminal. After the completion of restart, the master terminal enables communication from all user terminals (Event 2).

2. When an input message or message line is received (Event 2), the telecommunications facility invokes the common service facility (Event 3), and the input message is logged (Event 4) and queued (Event 5).

3. When there are input messages pending for processing and a message region is available for scheduling, control is passed to the scheduling facility to determine the application message processing program to be scheduled. The application program is loaded into region 2 and given control.

4. The application program subsequently makes requests for the input message and/or data base references (Event 6). Control passes to the Data Language/I facility for either message reference (Event 7) or for data base reference (Event 8). The message reference is accomplished through the common service facility.

BATCH PROCESSING OF TELEPROCESSING DATA BASES

Once the IMS/360 regions associated with teleprocessing have been initiated by Operating System/360, a batch region can be initiated. The application program in the batch region is scheduled by Operating System/360 job management. This batch region may contain an application program for processing against teleprocessing data bases. The Data Language/I facility of IMS/360 is used for data base reference and update (Figure 11). Any data reference is initiated by the batch application program (Event 9).

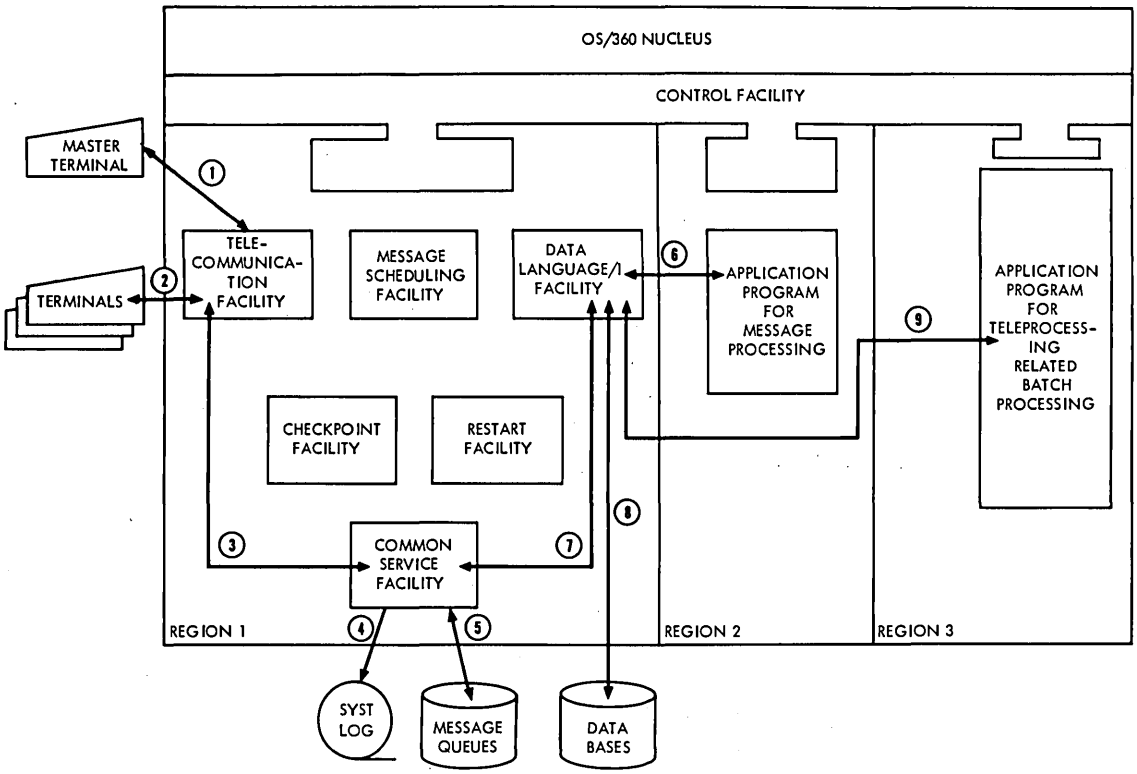


Figure 11. Teleprocessing and related batch IMS/360 system flow

DATA LANGUAGE/I DATA BASE BATCH PROCESSING

Whether the teleprocessing capabilities of IMS/360 exist within the jobs operating under Operating System/360 or not, the Data Language/I facility of IMS/360 can be used in a batch-only data base environment (see Figure 12).

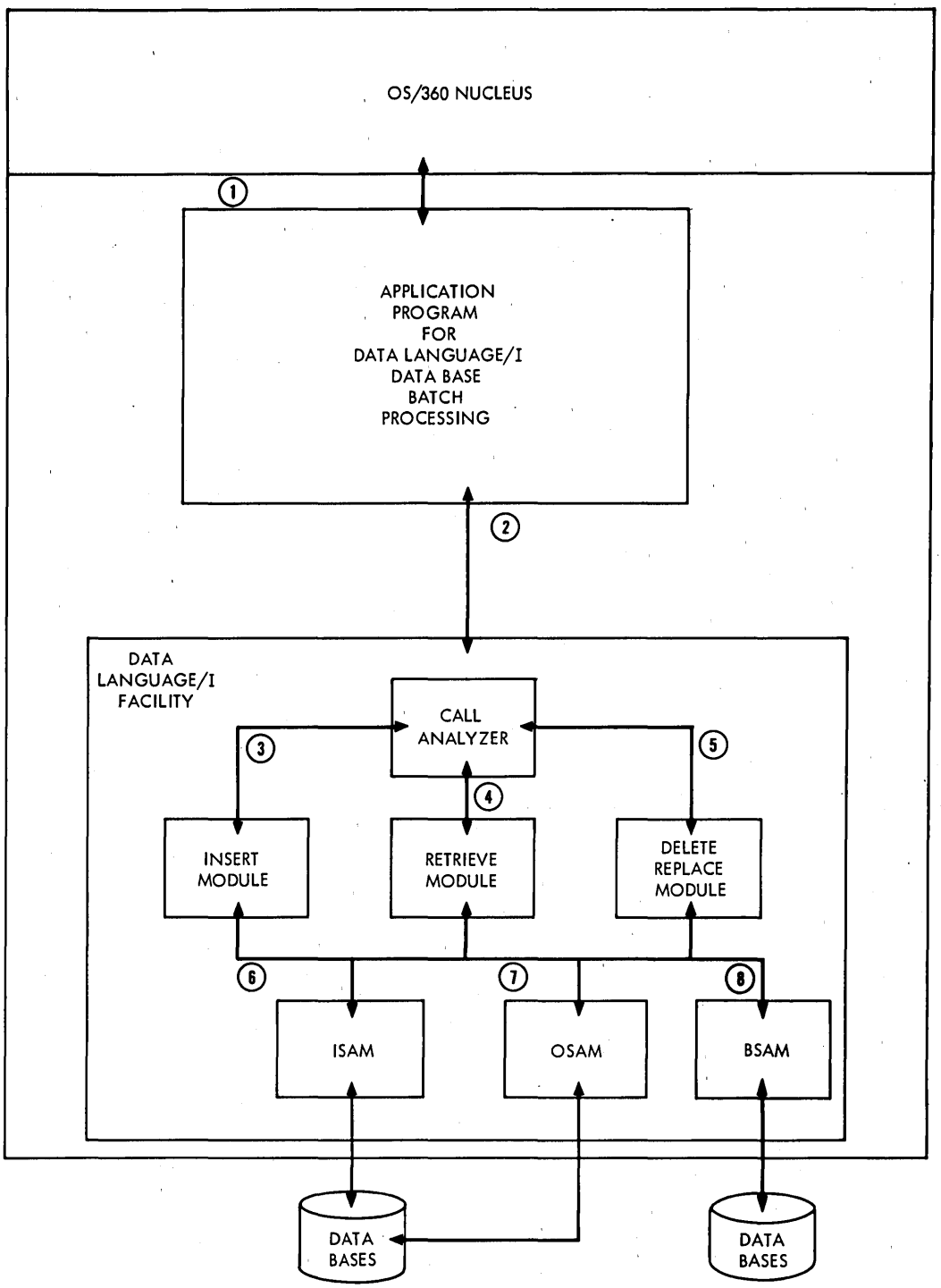


Figure 12. Data Language/I data base batch system flow

1. The application program for batch-only data base processing is initiated through the job management routine of Operating System/360 (Event 1).

2. The Data Language/I facility is invoked by the application program (Event 2). The highest level Data Language/I module analyzes the data base call request. Depending upon the I/O function requested in the call request, the insert (Event 3), the retrieve (Event 4), or the delete/replace module (Event 5) is

invoked. These modules subsequently invoke either the ISAM modules (Event 6) or the OSAM modules (Event 7) to reference a data base of Hierarchical Indexed Sequential organization or the BSAM modules (Event 8) to reference a data base of Hierarchical Sequential organization.

USER RESPONSIBILITIES

The user of IMS/360 has two primary responsibilities:

1. The development of data processing applications which use the facilities of IMS/360. This development includes all application programs for message and batch processing and for the creation of data bases through the facilities of Data Language/I.

2. The definition of his data processing environment:

   - Data bases
   - Processing programs
   - Transaction types and processing priority
   - Communications lines and terminals

APPLICATION DEVELOPMENT AND STRUCTURING OF IMS/360

Those parameters which define a particular application must be provided by the user. These include:

1. The definition of each Data Language/I data base in terms of its hierarchical structure and storage, and the creation of each data base in the batch processing environment

2. The definition and construction of all message and batch processing programs. For message processing programs, Data Language/I must be used exclusively for all I/O requests. For both message and batch processing programs, the following restrictions apply:

   a. If multitasking is used within a region, all Data Language/I requests must be made from a single task.

   b. If COBOL is used, no asynchronous processing is allowed against a Data Language/I data base.

3. The definition of various transaction types and their associated processing programs, scheduling priorities, and security aspects

4. The definition of the number and types of communication lines and terminals utilized by the application

The user must also structure IMS/360 by the creation of a control block for each communication line, terminal, message type, message processing program, and data base. The construction and integration of these control blocks into the resident IMS/360 control program are facilitated by the use of the utility programs previously described. Restructuring of the control blocks will be necessary periodically when the operating environment changes.

Where the performance of IMS/360 is measured in message throughput per unit of time, the following factors are primary in determining performance:

- Message processing program load time
- Data base retrieval, update, and insert time
- Message queue retrieval and insert time
- Number of message processing partitions or regions available
- Control block load and data base open time

LARGE SYSTEM PERFORMANCE EXAMPLE

Figure 13 depicts the estimated performance of a large system. Assume the following System/360, Model 65 I, Operating System/360 MVT, and IMS/360 configuration:

1. The IMS/360 message queues are stored on 2311 or 2314 disk storage.
2. The ISAM master and cylinder indices for Data Language/I data bases are stored on 2301 or 2303 drums.
3. The Operating System/360 transient modules of OPEN and CLOSE and data base control blocks are contained on 2311 or 2314 disk storage.
4. The IMS/360 libraries for program and data base control blocks are contained on 2311 or 2314 disk storage.
5. There are three message processing regions or partitions available. Because of system channel interference, message performance can not be expected to increase on a one-to-one ratio with the number of message regions available.
6. There are 30 message processing programs, and the control blocks for the 15 most frequently used can be contained in main storage.
7. There are six data bases, and the control blocks for the four most frequently used can be contained in main storage with the data bases open.
8. The message processing programs are contained on 2301 or 2303 drum storage. A build list entry exists for all programs, and PCI Fetch is employed.
9. Assume a single-line input message which generates a single output message of one to ten lines.

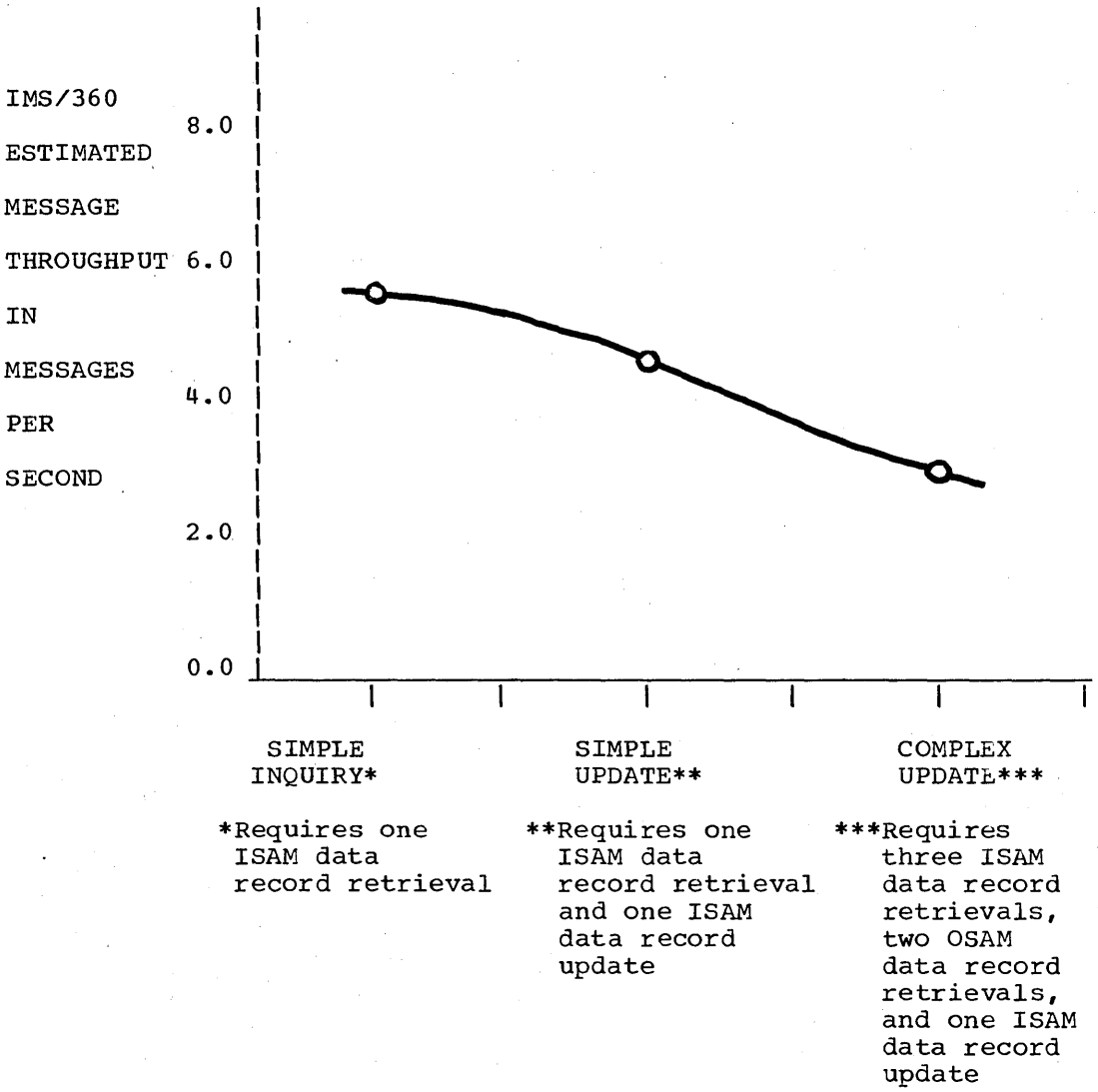


Figure 13. Large Information Management System/360 example - message throughput graph

Response Time

The response time measurement of IMS/360 performance is considered the time from completion of input message entry until initiation of output message generation at the remote terminal. The response time is significantly dependent upon message volume and message processing priority.

Estimated response time is in the range of 5 through 60 seconds.

MINIMUM IMS/360 CONFIGURATIONS

Input/output facilities used by batch-only IMS/360 (in addition to those required by OS/360, other non-IMS/360 application programs, and the data base itself), include: one 7-track or one 9-track magnetic tape unit (required for system distribution and maintenance)...300 cylinders of 2311 Disk Storage for program storage and work space (or equivalent 2314 space). Additional input/output used by the teleprocessing IMS/360 program include at least one 1050 Data Communication System or 2740 Communication Terminal with appropriate control units...a total of two 9-track magnetic tape units. The 2260 Display Station can be added but cannot be used as an IMS/360 master terminal.

The supported terminals and required features are:

- Terminals

2740 Model 1 - Nonswitched Network*

Record Checking	#6114
Station Control	#7479
Terminal to Multiplexer	#9700
Automatic EOB	#1313
Dual Case Printing Element	#9571 or #9591

2740 Model 1 - Switched Network*

Record Checking	#6114
Transmit Control	#8028
Terminal to Multiplexer	#9700
Automatic EOB	#1313
Dial Up	#3255
Dual Case Printing Element	#9571 or #9591

1050 System - Nonswitched and Switched Network*

1051 Model 1 or 2

First Printer Attachment	#4408
Keyboard Request	#4770
Automatic EOB	#1313

1052 Model 1 or 2

Automatic EOB	
Dual Case Printing Element	#9571 or #9591

2260 Model 1 - Nonswitched Network*

2848 Display Control Model 3

Display Adapter	#3357
Line Addressing	#4787
Non-destructive Cursor	#5340
Non-destructive Cursor Adapter	#5341
Data Set Adapter	#9013

2260 Display Station Model 1

Alphameric Keyboard	#4766

- 2701 Data Adapter Unit(*)(**)

IBM Terminal Adapter Type I (for 1050, 2740)	#4645
IBM Terminal Adapter Type III (for 2260)	#4657

- 2702 Transmission Control(*)(**)

IBM Terminal Control Type I with appropriate selective speed feature	#4615
Terminal Control Base	#9696

- 2703 Transmission Control(*)(**)

Start-Stop Base Type I	#7505
IBM Terminal Control Base	#4619
IBM Terminal Control Type I	#4696
Line Speed Option 134.5 Bytes	#4878

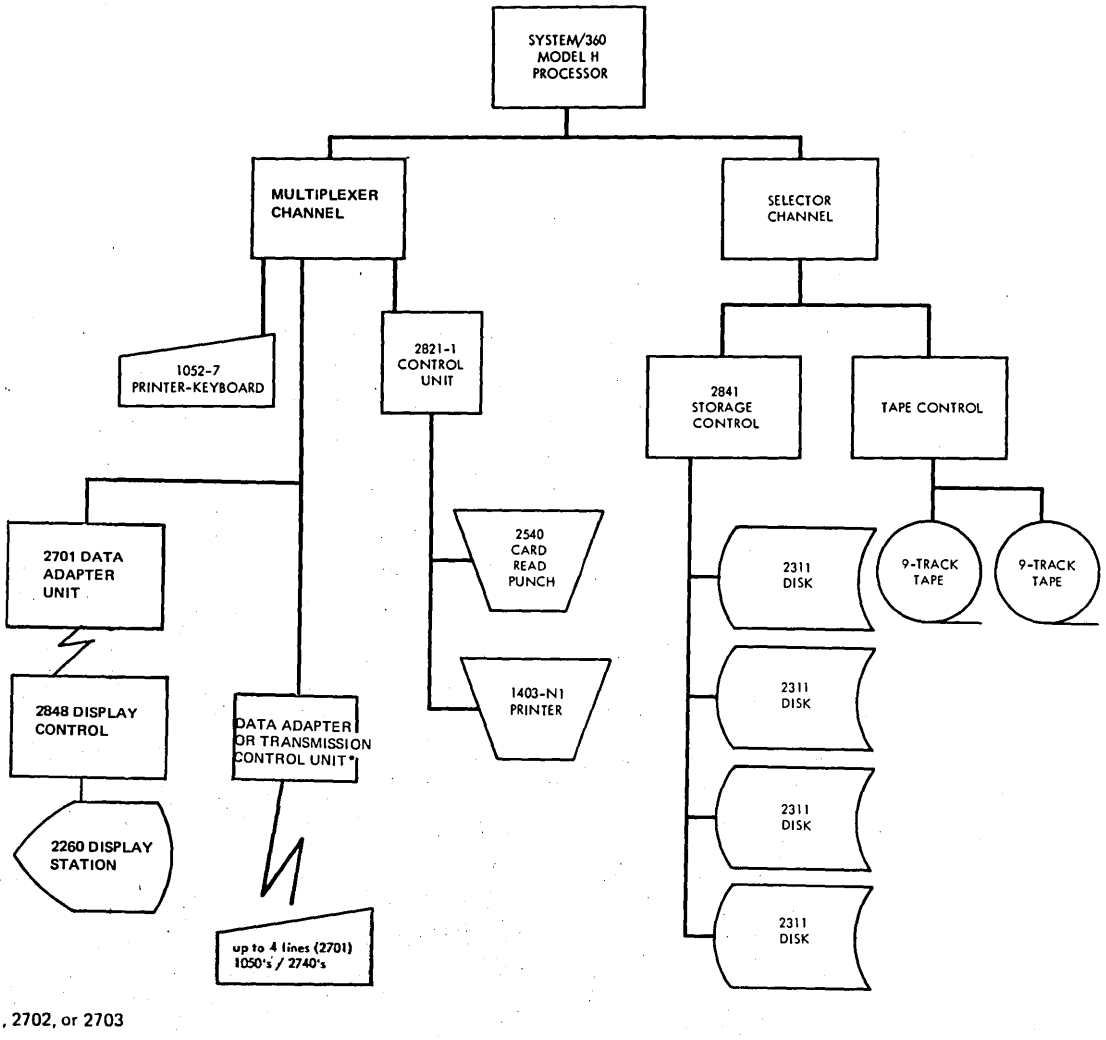
- 2040 Processing Unit

Selector Channel-First	#6980
Storage Protection	#7520
Decimal Arithmetic	#3237

*Line adapter and/or data sets must be added as required to satisfy the user's communications control unit and communications line facilities.

**The user may choose the 2701, the 2702, or the 2703 to meet his minimum configuration requirement.

Minimum system requirements are 128K bytes for batch-only PCP operation and 256K bytes for teleprocessing with MFT-II. In the latter case the system, for all practical purposes, would be dedicated to online IMS/360 applications.



*2701, 2702, or 2703

- Figure 14. Minimum configuration - Teleprocessing IMS/360

This page intentionally left blank.

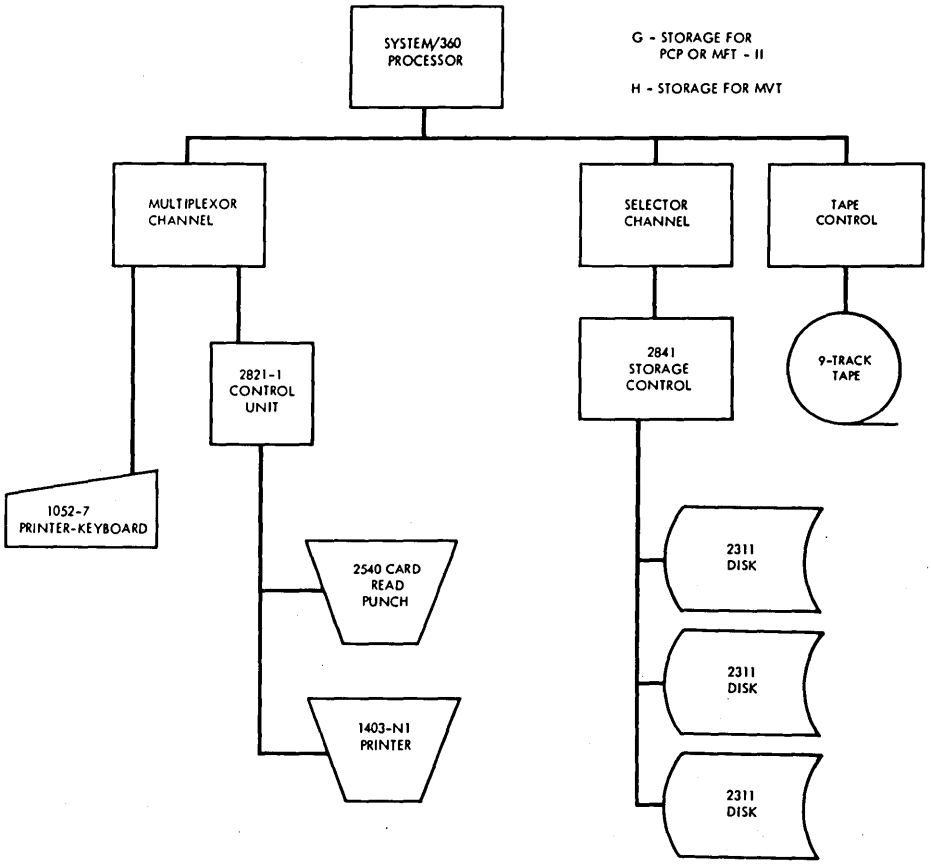
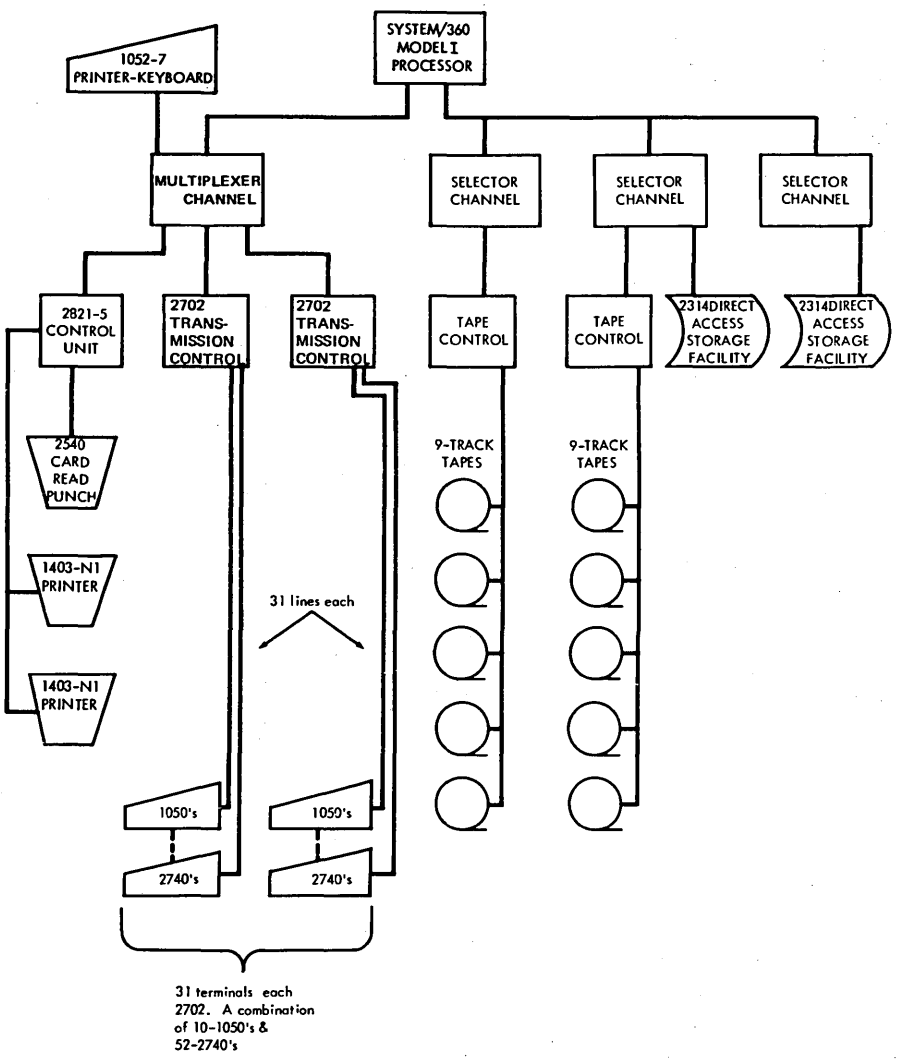


Figure 15. Minimum configuration - IMS/360 batch-only

TYPICAL IMS/360 CONFIGURATION

A System/360 Processing Unit Model I (512K) with Multiplexor Channel...three Selector Channels...two tape controls...ten 9-track magnetic tape units...two 2314 Direct Access Storage Facilities...1052 Printer-Keyboard Model 7...two 2702 Transmission Controls with 31 Line Expansion (#7955) and the features listed under "Minimum IMS/360 Configurations"...ten 1050 Data Communication Systems with the features listed under "Minimum IMS/360 Configurations"...fifty-two 2740 Communication Terminals with the features listed under "Minimum IMS/360 Configurations"...2821 Control Unit Model 5...2540 Card Read Punch...two 1403 Printers Model N1. (See Figure 16.)

Note: The maximum number of input/output devices, including communication lines, that may be attached to the system is in accord with the capabilities of OS/360.



•Figure 16. Typical configuration - IMS/360 System

TYPICAL IMS/360 STORAGE REQUIREMENTS

The typical storage requirements of Operating System/360 MVT and MFT-II as of OS/360 Release 17 are:

	MVT	MFT-II
Nucleus	81K bytes	42K bytes
Master scheduler	13K	---
System queue space	40K	10K *
Writer	16K	12K
Reader (transient)	48K	44K
Basic link pack or RAM**	26K	26K

Resident BTAM	5K	5K
Resident QSAM	0.3K	0.3K
Totals	229.3K bytes	139.3K bytes

*Equivalent Operating System/360 control blocks placed in each MFT-II partition.

**The modules of OSAM and most modules of Data Language/I may be placed in link pack or RAM. Then, additional storage in link pack or RAM is approximately 26K bytes. (See last paragraph in this chapter.)

These figures are provided as guidelines in estimating Operating System/360 resident requirements and should be verified with the current Operating System/360 Storage Estimates manual, (C28-6551).

The following are the estimated resident storage requirements of IMS/360. These figures represent the storage requirements of the IMS/360 control program region. Additional space is required for message processing (typically 30K) and batch processing regions.

IMS Nucleus	60,000 bytes
Each communication line and buffer	500
Each communication terminal	75
Each transaction type	60
Each message program (Note 1)	550
Each open data base (Note 2)	1,000
Each message region (Note 3)	12,000

NOTES

1. This represents space for a control block associated with each message program. Space may be allocated for a subset of all message program blocks. Enough space should be allocated for control blocks associated with message processing programs used to process high priority messages. This storage requirement can vary from about 400 to 2000 bytes, depending on the program's usage of data bases.
2. This represents space for a control block associated with each data base. Space may be allocated for a subset of all data bases. Enough space should be allocated for control blocks associated with frequently used teleprocessing data bases.
3. This includes five required buffers for each data base. One buffer is required for the ISAM block size for each data base and four logical record length buffers are required for each data base. The size of the five buffers required may be specified by the system user.

   The 12,000 bytes for each message region (assumes two data bases being used at 6,000 bytes each) include:

1 - ISAM Block Size (ISAM is blocked 2-1000 Logical Record Lengths per block)	2000 bytes
4 - OSAM Logical Record Lengths of 1000 bytes each (OSAM is unblocked)	4000
	6000 bytes

Based on the above storage estimates, with 17 message programs, 40 transaction types, and five of seven defined data bases open, the typical IMS/360 configuration shown in Figure 16 can provide three 30,000-byte message partitions and one batch partition of approximately 55,000 bytes (MVT base) or 145,000 bytes (MFT-II base).

If Data Language/I data base batch stand-alone is considered, the storage estimates may be figured in two ways:

1. Place in basic link pack or RAM the modules of BISAM, QISAM, and OSAM and most of the IMS/360 Data Language/I modules. The storage estimate for this is approximately 26K. If this has been done, any region or partition can concurrently use the Data Language/I facilities of IMS/360. 8K for non-reentrant code must be added to each region or partition using Data Language/I. Additionally, data base buffers must also be added to each region or partition. The approximate size of the buffers can be calculated as follows:

   1 times the ISAM physical block length/data base plus 4 times the OSAM logical record length/data base

   Example:

   Processing unit capacity
   less selected programming system storage requirements
   less RAM or link pack 26K
   less 8K for non-reentrant code in <u>each</u> region or partition
   less data base buffers
   less core requirements of application program(s)
   equals approximately zero.

2. BISAM, QISAM, and OSAM, and most of the IMS/360 Data Language/I modules, are not placed in the link pack or RAM area. Therefore, each region or partition waiting to use IMS/360 Data Language/I must add 26K plus 8K plus the core requirements for the application program to determine the size of each region or partition.

Additional detail, which enables a more accurate storage estimation for both IMS/360 Type 0 and Type 3 regions, is available in the IMS/360 Operations Manual - Volume 1 - Systems Operation (H20-0635).

CHAPTER 9. TYPE I PROGRAMMING SYSTEM USAGE

IMS/360 operates under Operating System/360 and is written in Assembler Language. The teleprocessing and batch processing application programs may be written in either Assembler Language, COBOL, or PL/I.

The batch-only system operates under PCP, MFT-II or MVT and uses Sequential Access Methods and Indexed Sequential Access Methods.

The teleprocessing and related batch system operates under MFT-II or MVT and, in addition to the items above, uses:

BTAM (with Communication Serviceability Facilities), SER1 or Recovery Management Support, Sort/Merge service program (used by the IMS/360 System Log Utility Program), user-added SVC routines (three SVC numbers must be reserved for IMS/360)

If MFT-II: Storage Protection and Interval Timing are required; in addition, PCI Fetch, Resident Access Methods, and Resident IDENTIFY and ATTACH macro instructions are highly recommended.

CHAPTER 10. IMS/360 SAMPLE APPLICATION

The sample application considered for the IMS/360 environment is a production order location and status reporting system. This example is based on a system designed for installation at North American Rockwell Corporation, Space Division. This application system provides manufacturing personnel with a means of locating, providing status, and monitoring manufacturing orders in the shop from the date of issuance until the manufacturing order is closed out. This application system provides manufacturing management and shop supervision with accurate, comprehensive reports and information concerning location, schedule visibility, and status condition. This is done by providing for a wide range of work orders, expanding and modifying currently available reports, and providing for teleprocessing data collection and reporting (see Figure 17).

This application sample outlines the input/output methodology and the application design. The structure of the data bases and the message formats are application oriented within the constraints of IMS/360.

APPLICATION DATA BASE STRUCTURE

During the application design phase, extensive tradeoff studies should be conducted on alternative data base structures to determine the optimum type of structure. Prime consideration may be given to access time of the data for teleprocessing. Secondary considerations may be the data base structuring for the needs of the batch programs, access time in the batch environment, file size, and ease in programming.

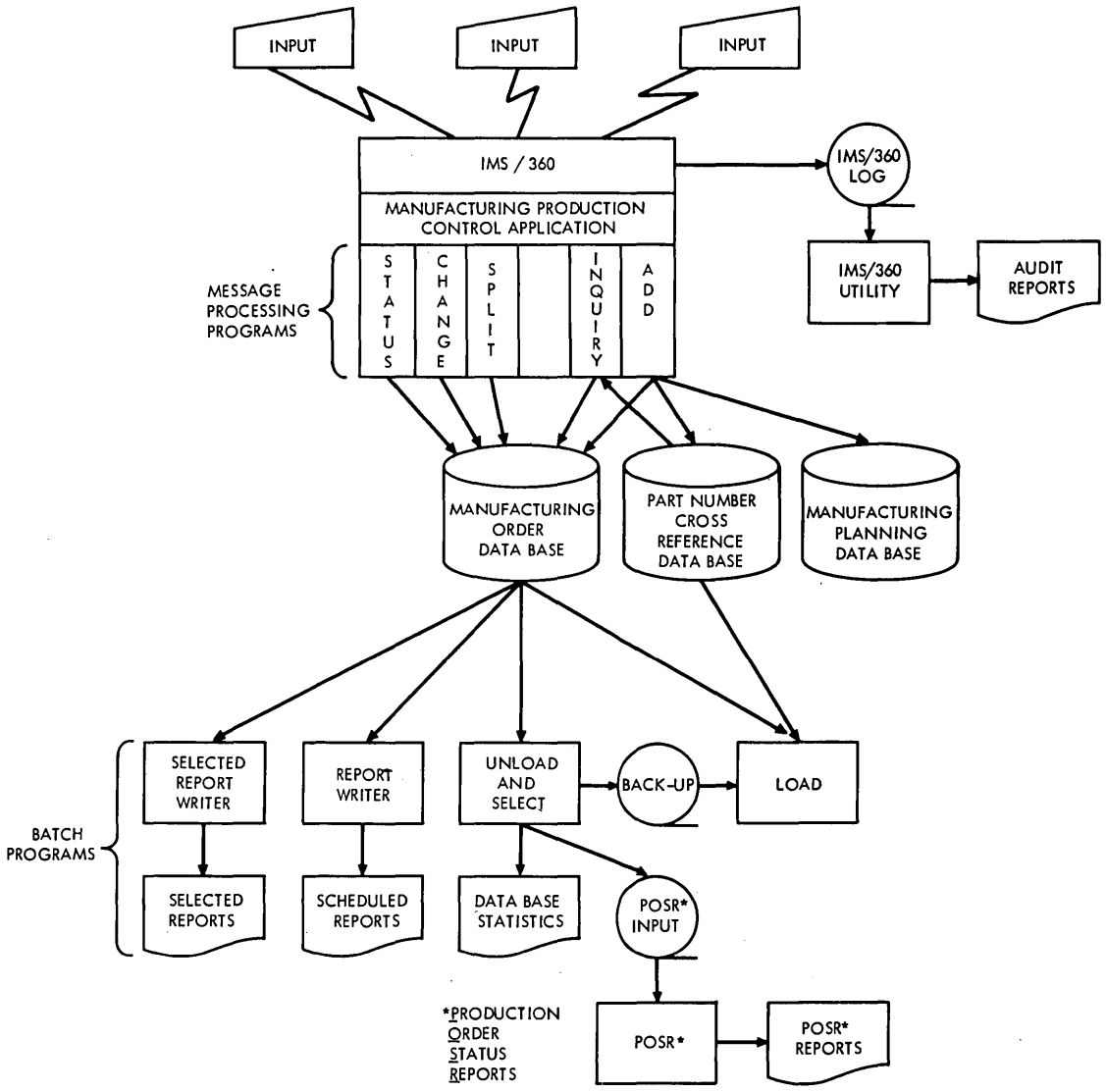


Figure 17. IMS/360 sample application

Three data bases are required. First is the manufacturing order data base, which contains a record for each manufacturing order. This data base is a Hierarchical Indexed Sequential organization (see Figure 18). The structure of the manufacturing order data base provides superior access times for the message-processing programs and reasonably good access times in the batch environment; it is also by far the logically simplest data base structure for this data. The manufacturing order data base is the heart of the application system.

The manufacturing order data base is a two-level hierarchical structure containing the variable or top portion of a manufacturing order and the last reported status of the order in the root segment level. The first level dependent segments contain records of all status transactions other than the last reported for that order. The last reported status is being kept in the root segment because it is the only status required for batch processing. Placing it here eliminates the need for accessing the first level dependent segments during the batch reporting.

The second data base relates a part number to all open manufacturing orders for that particular part (part number cross-reference data base). The structure of this data base is a Hierarchical Indexed Sequential organization in which the data base root segment contains the part number, and first level dependent segments contain the related manufacturing order (see Figure 19).

The third is the manufacturing planning data base, which contains a record for each manufacturing order that has been planned and that will be released to the shop floor for work. This data base is a Hierarchical Sequential organization. This data base is required for audit trail and control function (see Figure 20).

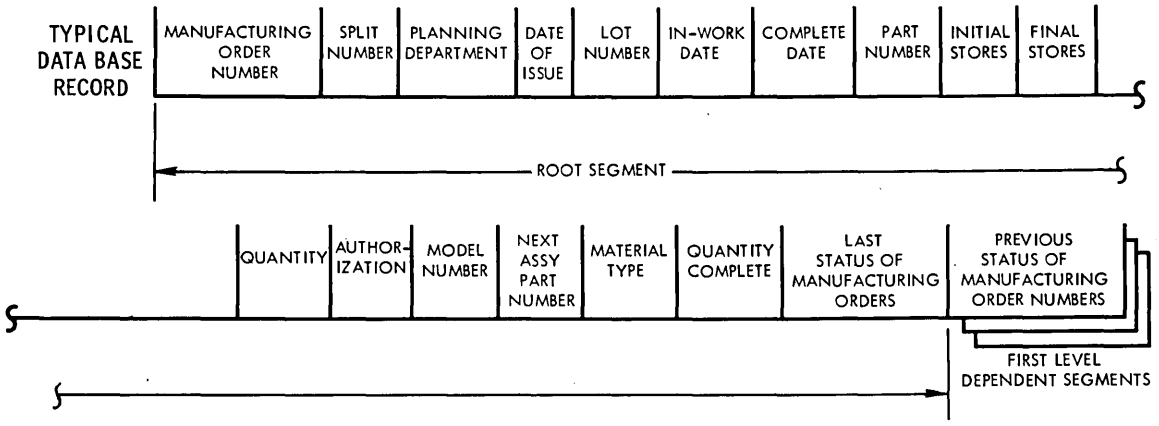


Figure 18. Manufacturing order data base

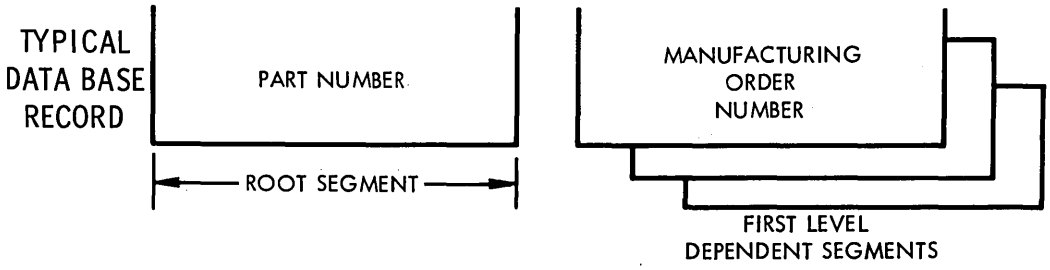


Figure 19. Part number cross-reference data base

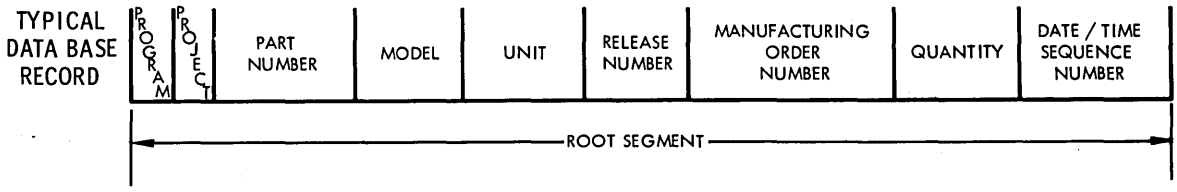


Figure 20. Manufacturing planning data base

Data base and program control blocks are created using the appropriate IMS/360 utility for each data base and each data base load program, respectively. These control blocks are placed in their respective IMS/360 partitioned data set libraries. After batch processing programs have been written for the data base creation, these control blocks are utilized to perform the actual data base load through the Data Language/I facility in the batch program environment.

Before these data bases can be referenced in the teleprocessing environment, control block information must be incorporated into IMS/360 through the IMS/360 system generation utility.

MESSAGE TYPES

This application system has data input and inquiry message types. The need for data input message types is dictated by the rapid movement of parts in the shop. The reflection of these movements is contained in the appropriate data base. The reporting of this movement is submitted through the IMS/360 terminal network located at key points throughout the shop complex. The terminals are the IBM 2740 communication terminals.

The various data input message types are Add, Change, Status, and Split transactions. Their descriptions are explained under "Message Processing Programs".

The inquiry message types are keyed upon either of two data groups: (1) the manufacturing order or (2) the part number. An inquiry can retrieve all or part of the data about a particular part number or manufacturing order. The response to the inquiry can be provided on an immediate or an overnight basis.

The IMS/360 system generation utility is utilized to incorporate each transaction type (message type), with its terminal security, its processing priority, its processing program, and its data base interaction. This information is incorporated in the form of resident control blocks. This control block definition subsequently allows the IMS/360 modules to process the messages, programs, and data bases described by the user in the system generation utility.

MESSAGE PROCESSING PROGRAMS

There are five message processing programs which process all transaction (message) input for this application system.

Add Program - Adds New Manufacturing Orders

The Add program generates a new Data Language/I data base root segment in the manufacturing order data base which contains information located on the top of the work order. In addition, the program places the manufacturing order number on the part number cross-reference data base.

Change Program - Changes Existing Manufacturing Work Order

The Change program allows the root segment of the manufacturing order data base to be corrected or modified as required.

Status Program

The Status program allows the shop to report the progress of parts as they flow to various operations within manufacturing. The status code is interrogated and the appropriate action is taken. A status segment

(data base segment), which is utilized in batch programs to produce reports, is generated.

Split Program - Splits an Existing Manufacturing Order

It is often necessary to split a manufacturing order because of part quantity change requirements with respect to schedule. The split number uniquely identifies each split of the order. The Split program splits the manufacturing order; that is, it generates a new data base root segment with a unique split number. It then adjusts the quantity in the two data base records in accordance with the total required quantity.

Inquiry Program

The Inquiry program handles the processing of inquiries in both the teleprocessing and the batch environment. The requests for batch reporting are stored in an interim or temporary data base to be used in processing the regularly scheduled reports.

BATCH PROGRAMS

Six programs select and format reports in the batch environment:

Report Writer Program

The Report Writer program selects and formats the regularly produced reports on a periodic basis. This program sequentially passes the manufacturing order data base, selecting the desired data base records for inclusion in the reports. Inclusion is determined either on the basis of a request submitted by manufacturing or on an exception reporting basis.

Unload and Select Program

The Unload and Select program unloads the manufacturing order data base on a periodic basis and selects the applicable records for subsequent reports. Production order status reports provide information about all unfilled manufacturing orders in an effort to give manufacturing up-to-date information regarding workloads, and/or behind schedule position, and provide an input to the Production Order Status Report program. As part of this program, a data base statistical report for data base reorganization is produced.

Load Program

The Load program unloads/reloads the manufacturing order data base, eliminating the ISAM overflow and any deleted data base records.

Production Order Status Report Program

Using data base information provided through the Unload and Select program, this program produces the Production Order Status Reports.

Selected Report Writer Program

The Selected Report Writer program allows manufacturing personnel to vary the range and sorting sequence of 18 types of reports. For example, manufacturing may request a part number report for a specific department and for a specific model and unit and receive only the manufacturing order numbers which apply to those criteria. This program allows manufacturing to produce a wide range of unique reports, a possible combination of nearly 1000.

Information Management System/360 Log Report Writer

There are various utility programs provided in the IMS/360 software which support teleprocessing.

This program produces various counts of the messages and message types, allowing manufacturing to audit terminal usage, department participation, and file maintenance. The output enables manufacturing to provide better terminal utilization within the system.

International Business Machines Corporation
Data Processing Division
112 East Post Road, White Plains, N.Y. 10601
(USA Only)

IBM World Trade Corporation
821 United Nations Plaza, New York, New York 10017
(International)

IBM **Technical Newsletter**

Re: Form No. H20-0524-0 and -1

This Newsletter No. N20-1945

Date February 28, 1969

Previous Newsletter Nos. None

INFORMATION MANAGEMENT SYSTEM/360 FOR THE
IBM SYSTEM/360 (SYSTEM DESCRIPTION)

APPLICATION DESCRIPTION MANUAL

This Technical Newsletter provides replacement pages for the subject manual. Pages to be inserted and/or removed are listed below.

Front Cover
9, 10
13 - 20
29 - 34

A change to the text or a small change to an illustration is indicated by a vertical line to the left of the change. A changed or added illustration is denoted by the symbol • to the left of the caption.

Please file this cover letter at the back of the manual to provide a record of changes.

IBM Corporation, Technical Publications Dept., 112 E. Post Road, White Plains, N.Y. 10601

Printed in U.S.A.

IBM Technical Newsletter

Re: Form No. H20-0524-0 and -1

This Newsletter No. N20-2012

Date August 1, 1969

Previous Newsletter Nos. N20-1945

INFORMATION MANAGEMENT SYSTEM/360
FOR THE IBM SYSTEM/360 (SYSTEM DESCRIPTION)
PROGRAM NUMBER: 5736-CX3
APPLICATION DESCRIPTION MANUAL

This Technical Newsletter, a part of Version 1, Modification Level 0, of Information Management System/360 for the IBM System/360, provides replacement pages for the subject manual. These replacement pages remain in effect for subsequent versions and modifications unless specifically altered. Pages to be inserted and/or removed are listed below.

Pages
Front Cover
Contents
3-8
29-30
30.1-30.2 (added)
31-36
Readers' Comments

A change to the text or a small change to an illustration is indicated by a vertical rule to the left of the change. A changed or added illustration is denoted by the symbol • to the left of the caption.

Please file this cover letter at the back of the manual to provide a record of changes.

IBM Corporation, Technical Publications Dept., 112 E. Post Road, White Plains, N.Y. 10601

Printed in U.S.A.

Notice

The Array Processor Access Method (APAM) referenced in this manual is a part of IBM Program Product Number 5736-P71, the Array Processing Subroutine Package. The APAM program is based on a Type III IBM-contributed program, the Array Processor Access Method for the IBM System/360 Model 44 (program number 360D.03.4.019).

First Edition (July 1969)

Significant changes or additions to the specifications contained in this publication will be reported in subsequent revisions or Technical Newsletters.

This edition applies to Version 1, Modification Level 0 of System/360 Array Processing Subroutine Package–PS (5736-P71) and to all subsequent versions and modifications until otherwise indicated in new editions or Technical Newsletters.

Changes are continually made to the specifications herein. Therefore, before using this publication, consult the latest IBM System/360 SRL Newsletter (N20-0360) for the editions that are applicable and current.

Copies of this and other IBM publications can be obtained through IBM branch offices. Address comments concerning the contents of this publication to: IBM, Technical Publications Department, 112 East Post Road, White Plains, N. Y. 10601.

IMS/360 TECHNICAL NEWSLETTER

IMS/360 Manual ADM

This Newsletter No. 1001

Date 10-15-68

Previous Newsletter Nos.
1000
(To be replaced)

IMS/360 APPLICATION DESCRIPTION MANUAL H20-0524

This technical newsletter replaces TNL #1000, dated 8-14-68, and contains amendments to the IMS/360 ADM. Replacement and/or supplemental pages to be inserted in the publication are listed below. Corrections and additions to text and illustrations are indicated by a vertical bar to the right of the text or illustration.

Pages to be Inserted	Pages to be Removed
9	9
14-16	14-17
16A	19
17	29-34
19	
29	
29A	
30-32	
32A	
33	
33A	
34	

P.R. Hill
IMS/360 Project Manager

IBM System/360

Information Management System/360 (IMS/360)

Project Code 6185
Program Code 360A-CX-31X

Application Directory

This application directory contains information on all available material associated with Information Management System/360. It is designed to enable the recipient to understand the material he has received, to delineate where to locate specific items, and to aid in the understanding of what to do with them.

Distribution of the System Manual is limited; users who require it should order it through their IBM Systems Engineer.

REFERENCE MATERIAL

Knowledge of the information in the following publications is necessary to users of IMS/360.

All Potential Users

IBM System/360 System Summary (Form A22-6810)

IBM Operating System/360 Concepts and Facilities (Form C28-6535)

Application Programmers

OS/360 PL/I Language (Form C28-8201)

or

OS/360 Assembler Language (Form C28-6514)

or

OS/360 COBOL Language - (COBOL E) 360S-CO-503

(COBOL F) 360S-CB-524 (Form C28-6516)

System Programmers

OS/360 Basic Telecommunications Access Method (Form C20-2004)

OS/360 System Programmer's Guide (Form C28-6550)

OS/360 System Generation (Form C28-6554)

OS/360 Operator's Guide (Form C28-6540)

OS/360 Linkage Editor (Form C28-6538)

OS/360 Planning for Multiprogramming with a Fixed Number of Tasks Version II (MFT-II) (Form C27-6939)

OS/360 Job Control Language (Form C28-6539)

OS/360 Supervisor and Data Management Services (Form C28-6646)

OS/360 Sort/Merge (Form C28-6543)

MAGNETIC TAPE KEY

Before attempting to use the tapes described below, the reader should refer to the Operations Manual, Volume 1 - Systems Operations. The pertinent details on the tape are:

- 2400 foot reel length
- Seven or nine track
- 800 bpi density
- Unlabelled tape
- EBCDIC mode
- IMS.GENLIB and IMS.LOAD data sets
- Record length = 80 bytes for IMS.GENLIB; 3265 bytes for IMS.LOAD
- Maximum block length: IMS.GENLIB - 800 bytes on tape, 3360 bytes on disk; IMS.LOAD - 800 bytes on tape, 3265 bytes on disk
- Blocking factor: 10 on tape, 42 on disk
- Number of logical records = (To be added later)
- Number of physical records = (To be added later)
- Number of tapemarks = Three

PROGRAMMING SYSTEMS

Application programs which use IMS/360 may be written in Assembler, PL/I, or COBOL.

IMS/360 operates as a processing program under Operating System/360, Release 15/16 and subsequent. The teleprocessing capabilities require Operating System/360 MFT-II or MVT.

The data base processing capabilities can operate independently for batch processing under Operating System/360-PCP, MFT-II, or MVT.

Data management facilities and access methods used are BISAM, BSAM, QSAM, BTAM, QISAM, and OSAM.

The Sort/Merge (Form C28-6543) service program is used.

MINIMUM IMS/360 CONFIGURATION

Input/output facilities used by batch-only IMS/360 (in addition to those required by OS/360, other non-IMS/360 application programs, and the data base itself) include: one 9-track magnetic tape unit...300 cylinders of 2311 Disk Storage for program storage and work space (or equivalent 2314 space). Additional input/output used by the teleprocessing IMS/360 program includes at least one 1050 Data Communication System or 2740 Communication Terminal with appropriate control units...one additional 9-track magnetic tape unit.

The required terminals are:

2740 MODEL 1 - NONSWITCHED NETWORK

RECORD CHECKING	#6114
STATION CONTROL	#7479
TERMINAL TO MULTIPLEXOR	#9700
AUTOMATIC EOB	#1313

Note: Line adapter and/or data sets must be added as required to satisfy the user's communications control unit and communications line facilities.

2740 MODEL 1 - SWITCHED NETWORK

RECORD CHECKING	#6114
TRANSMIT CONTROL	#8028
TERMINAL TO MULTIPLEXOR	#9700
AUTOMATIC EOB	#1313
DIAL UP	#3255

Note: Line adapter and/or data sets must be added as required to satisfy the user's communications control unit and communications line facilities.

1050 SYSTEM - NONSWITCHED AND SWITCHED NETWORK

1051 MODEL 1 or 2

FIRST PRINT ATTACHMENT	#4408
KEYBOARD REQUEST	#4770
AUTOMATIC EOB	#1313

Note: Line adapter and/or data sets must be added as required to satisfy the user's communications control unit and communications line facilities.

1052 MODEL 1 or 2

AUTOMATIC EOB #1313

- 2701 *

  IBM TERMINAL LINE ADAPTER TYPE I #4645

  Note: Line adapter and/or data sets must be added as required to satisfy the user's communications control unit and communications line facilities.

- 2702 *

IBM TERMINAL CONTROL TYPE I	#4615
SELECTIVE SPEED	#9684
TERMINAL CONTROL BASE	#9696

  Note: Line adapter and/or data sets must be added as required to satisfy the user's communications control unit and communications line facilities.

- 2703 *

START-STOP BASE TYPE I	#7505
IBM TERMINAL CONTROL BASE	#4619
IBM TERMINAL CONTROL TYPE I	#4696
LINE SPEED OPTION 134.5 BYTES	#4878

  Note: Line adapter and/or data sets must be added as required to satisfy the user's communications control unit and communications line facilities.

- 2040 PROCESSING UNIT

1052 ADAPTER	#7920
SELECTOR CHANNEL - FIRST	#6980
STORAGE PROTECTION	#7520
DECIMAL ARITHMETIC	#3237

* By indicating either the 2701, the 2702, or the 2703, the user may choose which one meets his minimum configuration.

Minimum system requirements are 128K bytes for batch-only PCP operation and 256K bytes for teleprocessing with MFT-II. In the latter case, the system, for all practical purposes, would be dedicated to online IMS/360 applications.

SAMPLE PROBLEM

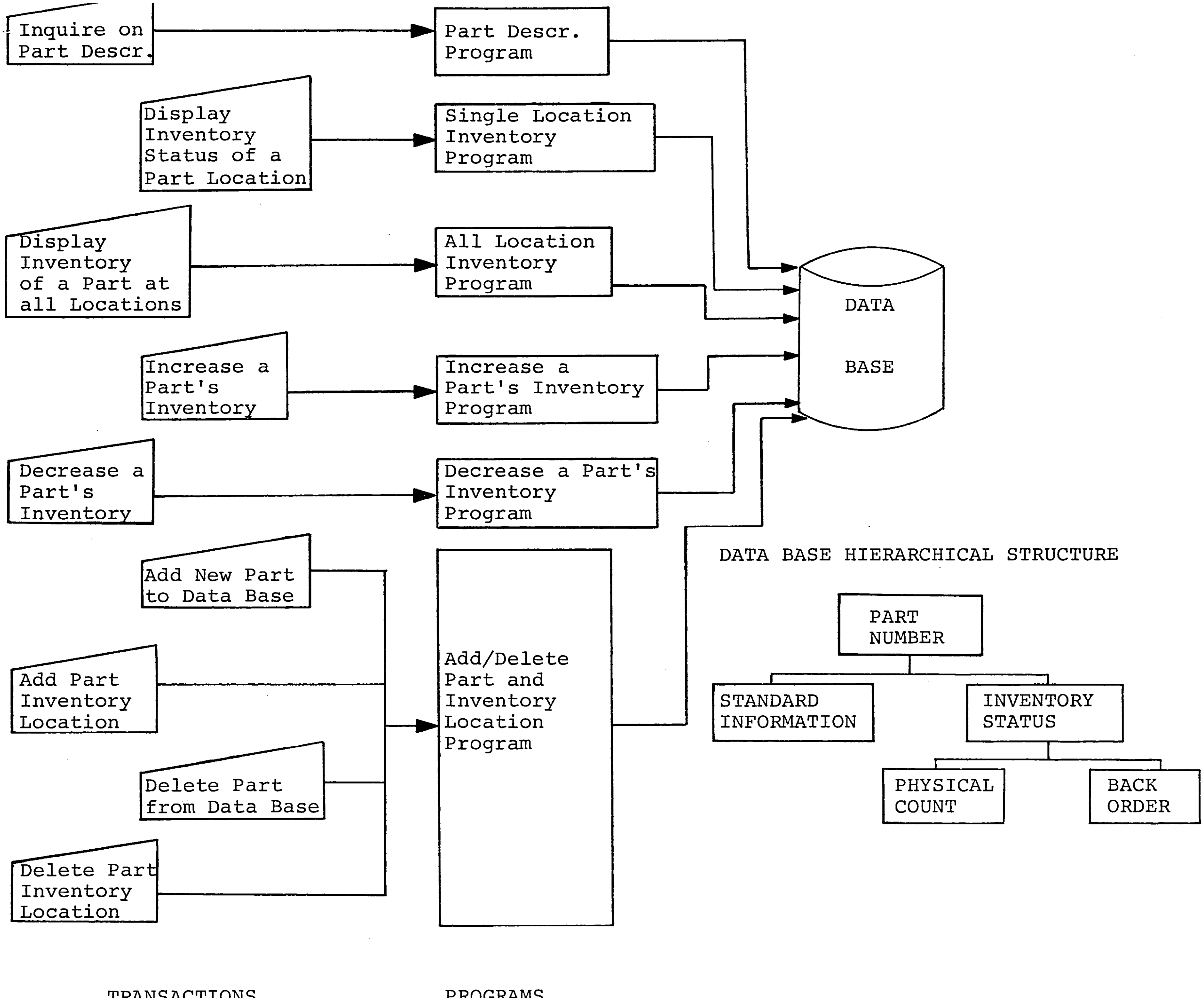
The sample program is basically one of inventory control. The nature of the company is one where a particular part type may be stored in multiple locations. An inventory is maintained by location. A data base record consists of a part number, standard information about the part, inventory by location, audit count by location, and back orders.

Transaction codes are provided to allow the data base to be updated. It is possible to add new inventory items, delete obsolete items, increase the inventory at a specific location, and decrease the inventory at a specific location. The standard information concerning an item can be displayed as can the inventory at a specific location. Other information is also displayed, such as whether a usage was planned or unplanned.

A variance between the recorded inventory and an audit count can be displayed. This allows a spot inventory to be taken on a rotating basis.

Instructions and details of the sample program and machine configuration are provided in the IMS/360 Operations Manual, Volume 1 Systems Operation.

The following illustration shows the logical configuration of sample problem and the hierarchical structure of the data base.



ENGINEERING CHANGE LEVEL REQUIREMENTS

See the section of this manual titled Programming Systems.

MAINTENANCE PROCEDURES

This program will be maintained through the use of serially numbered modification and version change letters. The initial availability of the program is Version 1, Modification Level 0. Each subsequent modification raises the modification level by 1. When the nature or number of changes makes a replacement version of the program necessary, the version number is raised by 1 and the modification level restarts at 0, e.g., Version 2, Modification Level 0.

Modification letters and machine-readable changes are sent to all previous recipients of the program. New recipients receive program material updated through the latest modification level. A notice of the availability of a new version is sent to all prior recipients of the program. The new version must then be ordered if continued maintenance is desired.

An Authorized Programming Analysis Report (APAR) should be submitted through the local IBM systems engineer to report any difficulties encountered in the use of this program. The APAR should be addressed to APAR Processing, IBM Application Programming Standards, 112 East Post Road, White Plains, New York 10601.

CONTENTS

	Page
DOCUMENTATION DIRECTORY	2
REFERENCE MATERIAL	4
MAGNETIC TAPE KEY	5
PROGRAMMING SYSTEMS	6
MINIMUM IMS/360 CONFIGURATION	7
SAMPLE PROBLEM	9
ENGINEERING CHANGE LEVEL REQUIREMENTS	12
MAINTENANCE PROCEDURES	13

READER'S COMMENT FORM

IMS/360 Application

Description Manual

H20-0524-1

Please comment on the usefulness and readability of this publication, suggest additions and deletions, and list specific errors and omissions (give page numbers). All comments and suggestions become the property of IBM. If you wish a reply, be sure to include your name and address.

COMMENTS

fold fold

fold fold

- Thank you for your cooperation. No postage necessary if mailed in the U.S.A. FOLD ON TWO LINES, STAPLE AND MAIL.

YOUR COMMENTS PLEASE...

Your comments on the other side of this form will help us improve future editions of this publication. Each reply will be carefully reviewed by the persons responsible for writing and publishing this material.

Please note that requests for copies of publications and for assistance in utilizing your IBM system should be directed to your IBM representative or the IBM branch office serving your locality.

fold fold

FIRST CLASS
PERMIT NO. 1359
WHITE PLAINS, N. Y.

BUSINESS REPLY MAIL
NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

POSTAGE WILL BE PAID BY...

IBM Corporation
112 East Post Road
White Plains, N. Y. 10601

Attention: Technical Publications

fold fold

IBM

International Business Machines Corporation
Data Processing Division
112 East Post Road, White Plains, N.Y. 10601
[USA Only]

IBM World Trade Corporation
821 United Nations Plaza, New York, New York 10017
[International]

IMS/360 Application Description Manual Printed in U.S.A. H20-0524-1