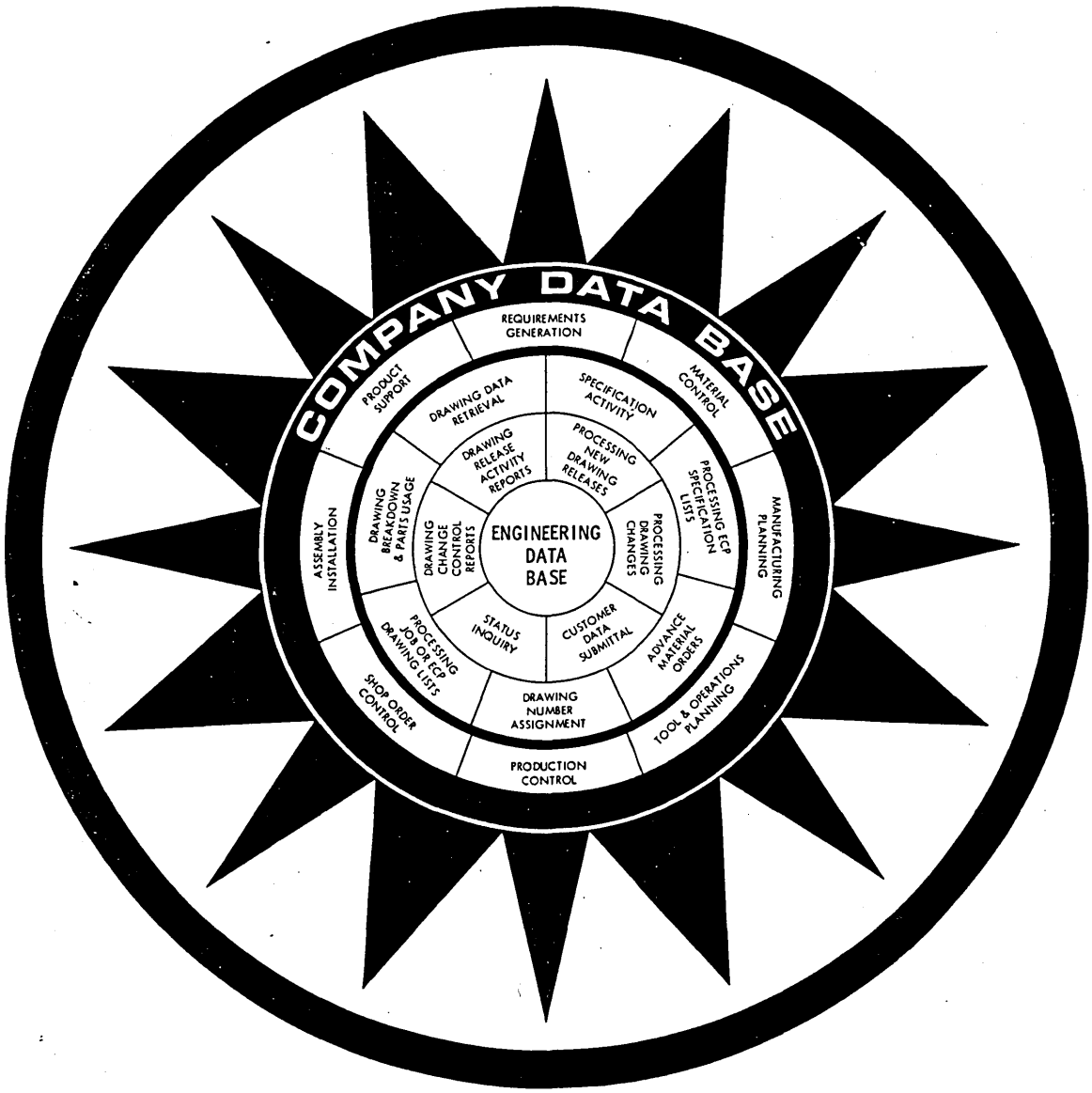
ICS

INFORMATION CONTROL SYSTEM

Functional Specification



ICS

INFORMATION CONTROL SYSTEM

FUNCTIONAL SPECIFICATION

The reader should be familiar with OS/360 MFT and MVT concepts as provided in the IBM SRL Manual OS/360 CONCEPTS AND FACILITIES, Form C28-6535. PARTITION and REGION are equivalent terms and are related to MFT and MVT, respectively. For continuity, REGION will be used throughout this manual.

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I.F. FUNCTIONAL SPECIFICATION

INFORMATION CONTROL SYSTEM (ICS)

1.0 INTRODUCTION

The Information Control System is designed to permit the implementation of a medium to large scale multi-data base, multi-application data processing environment. This environment is created to accommodate concurrently both teleprocessing and conventional batch processing modes. In addition, the Information Control System facilitates the evolutionary expansion of data processing applications from batch to teleprocessing implementation.

The Information Control System operates within the definition and capability of Operating System/360. A communications network consisting of 1030, 1050 and 2740 terminals enables ICS to receive and transmit a variety of message types for multiple applications. Control information describing each message type allows ICS to initiate on-line message processing or message collection for subsequent batch processing. On-line message processing includes both data base inquiry and update processing.

A library of application programs and a description of their data base requirements must be provided for ICS to enable the scheduling of message processing programs. These application programs are normally written in any OS/360 high level programming language. The execution of message processing programs are scheduled by ICS based upon message priority and availability of resources (message processing program; associated data bases, regions, etc.).

The data base processing capabilities of ICS are provided via Data Language/I (DL/I). The functions of data base definition, creation, maintenance, and reorganization represent the capabilities of Data Language/I. DL/I data base definition provides for the description of a hierarchical data segment structure. Although data base maintenance is always initiated by message and batch processing programs, the description of a program's data base requirements, data base definition, and mechanics for data base maintenance are provided externally. ICS - DL/I utility programs are provided for data base creation and reorganization.

The full data base properties of DL/I, which are incorporated into ICS, can be used independently of the other ICS functions for batch (non-teleprocessing) data base processing.

ICS provides checkpoint/restart capabilities as an integral part of its design. The normal mode of initiating the ICS system is through the restart procedures. It is assumed that manual intervention is always required to initiate restart: however, message or batch processing program ABEND or data base reconstruct do not require an ICS restart.

2.0 ICS SYSTEM CAPABILITY

2.1 OS/360 ENVIRONMENT

MVT ?

The implementation of the Information Control System operates under OS/360 MFT (multiprogamming with a fixed number of tasks). Each OS/360 job operates in a fixed size region of core storage with a unique memory protection key. Each job not waiting upon the completion of an external event (i.e. completion of I/O request) vies for computer execution time based upon the OS/360 dispatching algorithm. Provision for interregion communication is provided as part of ICS. The batch data base processing capabilities of DL/I can operate under OS/360 PCP (Primary Control Program), MFT or MVT.

Note: Partition and Region are equivalent terms and are related to MFT and MVT, respectively. For continuity, REGION will be used throughout this manual.

2.2 SYSTEM CONFIGURATION

When ICS is operated with OS/360 MFT as the base system, estimated minimum system size is 256,000 bytes — 142,000 bytes for OS and ICS, 30,000 bytes for message processing region and 90,000 bytes for batch processing region. The minimum system handles 25 remote terminals, 10 schedulable programs with 50 different transaction types using 3 different data bases. The batch data base processing capabilities of DL/I can operate with PCP or MFT within 128,000 bytes of storage.

For Complete estimates of storage with examples for both MFT and MVT see the ICS STORAGE ESTIMATES MANUAL.

2.3 ICS STRUCTURE

2.3.1 FUNCTIONAL AREAS

The method used for ICS implementation consists of three functional areas (Figure 1), each of which are contained in a separate OS/360 region:

I ICS Control program, Communications control, application scheduler, Data Language/I, checkpoint-restart

II Message processing *

III Batch processing *

* Application Program for ICS Utility Programs

Communication control includes the ability to handle communication lines and terminals and to receive, assemble, queue, and transmit messages. The application scheduler initiates message processing based upon message priority, processing program availability, and data base and available region availability. Data Language/I's data base definition tables and maintenance routines execute requests from message and batch processing programs for data base and message queue interaction.

The message processing function performs the on-line processing of messages received from terminals. This processing consists of message retrieval, message analysis, data base interaction and message response to one or more terminals. Message processing is initiated by the application scheduler.

Four - OS/360 - Regions

Functional Area #1	Functional Area #2 **	Functional Area #2 **	Functional Area #3
ICS Control Program Communication Control Application Scheduler Data Language/I	Message Processing	Message Processing	Batch Processing

** ICS permits concurrent execution of multiple message processing programs.

Figure 1

The batch processing function may be entirely unrelated to the ICS message processing (i.e. compilation), may employ ICS to access data bases which are also utilized by message processing programs, or may employ DL/I stand-alone to access non-teleprocessing data bases. Batch processing executes concurrent with message processing programs. All batch processing jobs are initiated via the OS/360 input job stream.

2.3.2 BASIC REQUIREMENTS

There are three basic requirements necessary to provide the proper environment for the foregoing ICS structure:

1. Multi-jobbing
2. Job Protection
3. Data Protection

2.3.2.1 Multi-jobbing

A capability is needed to allow concurrent execution of both message and batch processing programs due to large message volume and signifcant I/O data interaction during message processing. OS/360 provides

multi-jobbing as a solution to this requirement.

2.3.2.2 Job Protection

When multiple programs are executed in a single system, a program bug in one program could easily destroy other programs operating concurrently. When teleprocessing and common data bases are involved, this leads to an intolerable situation. Storage protection is designed to prevent this by protecting each job with a unique protection key. OS/360 assigns a unique protection key to each job. ICS utilizes this capability to process each message and batch program under a unique protection key.

2.3.2.3 Data Protection

The ICS System provides two types of data protection. The first insures that no record update is lost in a situation where two programs update the same data base. The initial ICS implementation prohibits concurrent execution of programs which mutually update the same data base. The second type of protection prevents unauthorized access to data by password security on a data base.

2.4 DATA LANGUAGE/I

2.4.1 DL/I CAPABILITIES

The following functions illustrate the significant capabilities of Data Language/I:

1. The introduction of the concept data base which implies a logical structure of records separate from the physical storage of data in OS/360 data sets, physical records, and logical records. The logical structure of a data base is represented by data base records. Each data base record is composed of one or more segments. Each segment is composed of one or more data fields. The physical structure of a data base is represented by one or more data sets. A data base record and the segments which represent the data base are stored in one or more logical and physical records within the

OS/360 data sets.

2. The introduction of the concept data base description which contains the logical structure of the data base as represented by a prototype of its data base records and the physical structure of the data base as represented by data sets, physical records, and logical records. This data base description is maintained as a member of an OS/360 partitioned data set called the Data Base Description Library. Since the data base description is maintained external to the application programs and provides the mapping between the logical data and its storage structure, the data base may be reorganized or restructured in the physical sense without rewriting the application programs.

3. Provision for a common source program interface between application programs and data bases.

4. Ability for a program to define "sensitivity" to a subset of an entire data base segment structure within a data base record. This permits modification and addition of non-sensitive data without effect upon existing programs.

5. Full capabilities of OS/360 fixed length ISAM with significantly improved data insert or add capability via an access method unique to DL/I called OSAM. Full capabilities of OS/360 fixed length ESAM for sequentially referenced data bases on tape or direct access devices.

6. Data Base security is provided by a password technique.

7. Data Base segment and record integrity is provided by exclusive usage of a data base.

8. As IBM offers new storage devices or improved data access methods, new features can be added to DL/I without reprogramming application programs.

9. Utility programs to:

   a. create data base descriptions

   b. Load/Dump/and reorganize data bases

   c. create programdata base requirement definitions

10. DL/I also provides the functions for queuing of input and output messages.

2.4.2 DL/I DATA BASE ORGANIZATIONS

The DL/I Data Base Organizational structures are best described by providing an example of a prototype data base record and illustrating the various OS/360 data management storage structures which may be employed. Assume a data base record which is composed of segments A, B, C, D, E, F, G, H, I, J, K. The logical relationship of segments is provided in figure 2A.

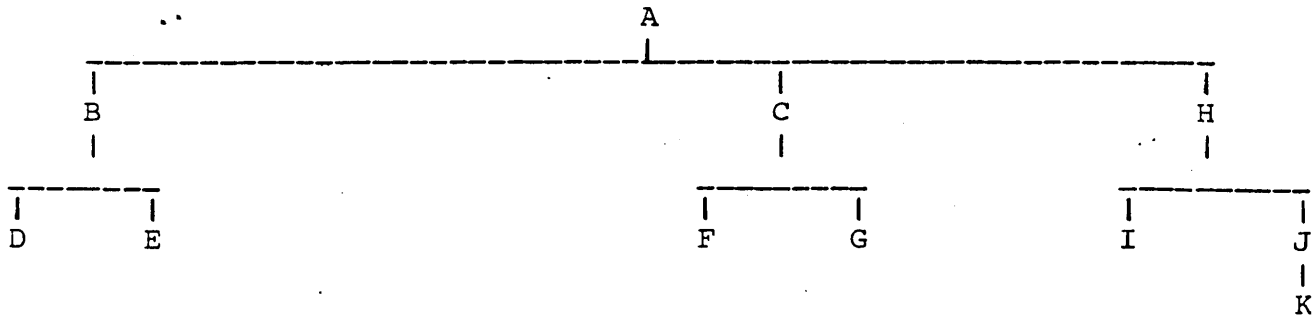


Figure 2A

The highest level segment in the logical hierarchy of segments is called the root segment (A). All segments immediately subordinate to the root segment are called first level dependent segments (B, C, H). Second level (D,E,F,G,I,J) and subsequent dependent level segments are likewise related. This logical structure represents the organization of segments which the application program should use in processing the segments.

This logical structure may be physically organized into either one of DL/I's organization - access methods.

(1) Hierarchical Index Sequential (HISAM)

(2) Hierarchical Sequential (HSAM)

If the HSAM organization-access method is chosen, all segments within a data base record are stored in sequence according to the hierarchical relationship. (Figure 2B)

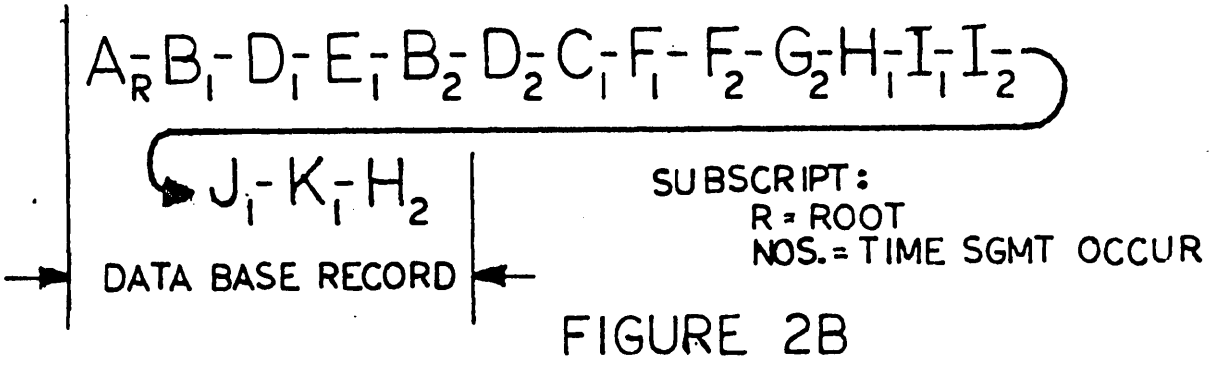


FIGURE 2B

All data base records are stored sequentially in proper sort sequence. The only direct reference provided is to the first root segment in the first data base record. All subsequent segment reference is sequential.

If the HISAM organization access method is chosen direct reference is provided to each root segment (therefore to each data base record) within the data base. The key of the root segment becomes an ISAM logical record key. As many segments (the root and its dependents) as will fit within the ISAM logical record are stored. If storage for additional segments within the data base record is required, a relative block pointer is placed in the ISAM logical record relating it to one or more OSAM records which contain the remaining segments within the data base record (Figure 2C).

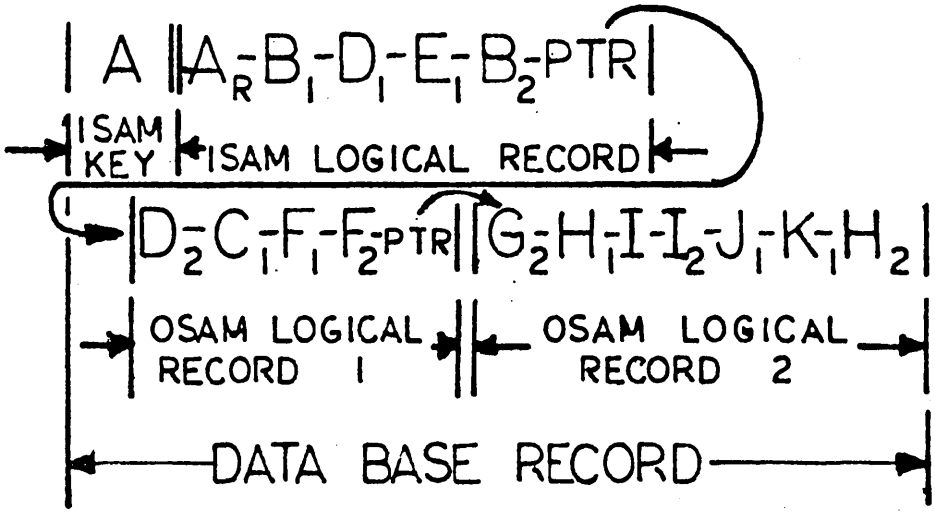

A
A_R-B_1-D_1-E_1-B_2-PTR
ISAM KEY
ISAM LOGICAL RECORD
D_2-C_1-F_1-F_2-PTR
G_2-H_1-I-I_2-J_1-K-H_2
OSAM LOGICAL RECORD 1
OSAM LOGICAL RECORD 2
DATA BASE RECORD

FIGURE 2C

Each data base record starts as an ISAM logical record and may overflow into once or more OSAM logical records. Notice the data base organization incorporates two OS/360 data sets (ISAM and OSAM). Reference to segments within the data base record is sequential.

An additional capability of the HISAM organization-access method is to provide direct access to all root segments and to all or some second level dependent segment types. This capability is provided through the use of multiple ISAM and OSAM data sets. (Figure 2D)

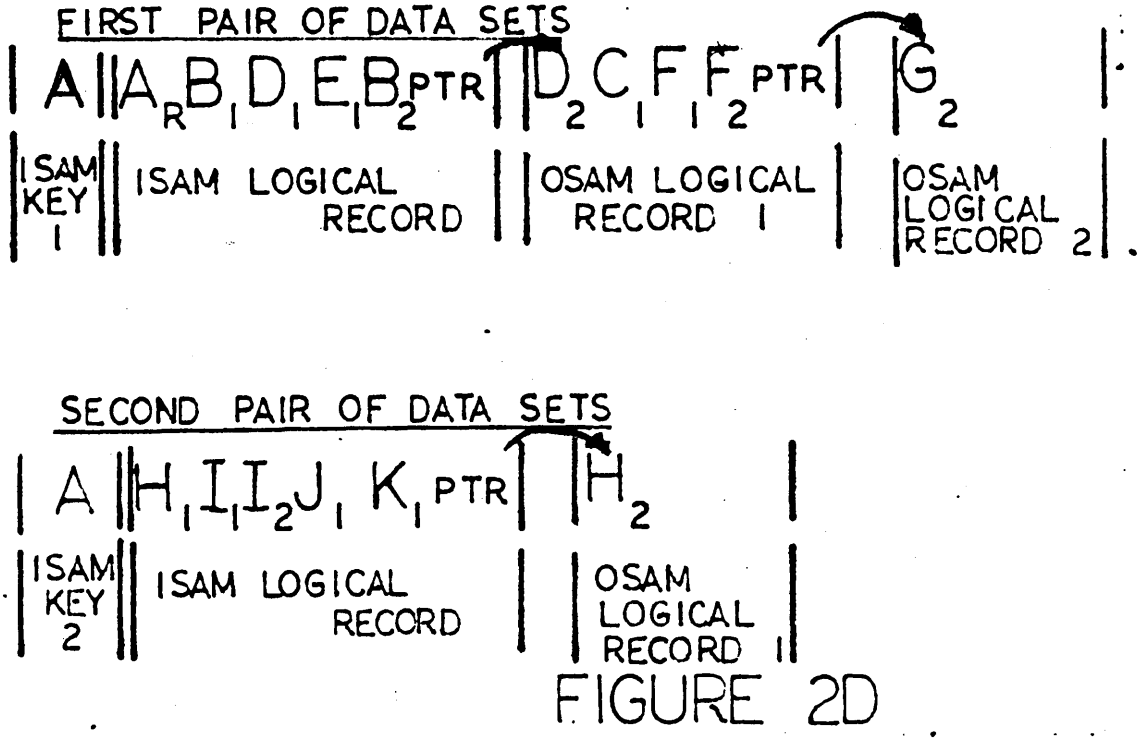


FIGURE 2D

The root segment (A) and dependent segments (B, D, E, C, F, G) are contained within one pair of ISAM - OSAM data sets. Direct reference is provided to each root segment. The first level dependent segment type (H) and its lower level dependent segment types are contained within another pair of ISAM - OSAM data sets. This allows direct reference to the first H segment type within each data base root as well as the root. Other first level dependent segments could be placed in separate pairs of ISAM - OSAM data sets.

The important concept is that segments within the

data base can be organized and reorganized into varing numbers of ISAM - OSAM data set pairs without altering the data base processing programs which reference the data base. This ability is provided via the data base description which contains the mapping between the logical hierarchical data segment structure and the physical storage of segments into OS/360 data sets.

2.4.3 RELATED ICS FUNCTIONS

Security and exclusive control are functions that affect the capabilities of DL/I but are provided by other ICS areas. Communication control handles security by analyzing UNLOCK and LOCK messages, against a data base, checking the security combinations and notifying the master terminal of any discrepancies. The application schedule area handles the exclusive control by not scheduling a program which intends to update a data base that is currently being updated by another program. The Application Scheduler also will not schedule a program which intends to absolutely lock out a data base currently being used by other programs.

2.4.4 ICS - DL/I SYSTEM GENERATION CONSIDERATIONS

At system generation time a Data Base Directory (resident information about each Data Base Description in the Data Base Description Library) must be created from control cards. The data base names and security combination is part of this resident information.

Either before or after system generation, a Data Base Description (DBD) must be built for each Data Base, placing the entries in the DBD Library and the Data Base records must be loaded using the Data Base Description and Load Utility Program.

2.5 COMMUNICATION CONTROL

The telecommunication capabilities of ICS are primarily directed at providing an on-line data base inquiry and update system.

2.5.1 CAPABILITIES

The capabilities provided are: (1) Language for user description of lines, terminals, and usage, (2) Scheduling of communication tasks, (3) Opening and closing lines, (4) Translation, (5) Time and date stamping, (6) Logging (IRecorder), (7) Facilities for transmission error handling, (8) Input and output queueing(IRead and IWriteQ), (9) Polling terminals, (10) Receiving message, (11) Addressing terminals, (12) Sending messages, and (13) Buffer allocation.

1030, 1050 and 2740 terminal operation is supported. Message switching and message batching capabilties are available. Messages received by the ICS system from remote terminals are maintained in memory and direct access queues. Each message type is recognized by an identifier in the first line of the message.

2.5.2 MESSAGE CONTROL

The Communication Control portion of ICS handles three general categories of messages:

1. Communication Control receives the message, analyzes it and passes control to the scheduler to allow the message to be processed by the proper message program. When processing is finished, it allows transmission of reply to terminal, if any.

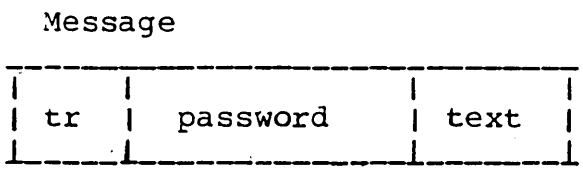
2. Communication Control receives, analyzes it and passes the message to disk or tape with the purpose of processing in a batch mode at a later time (operator intervention required to initiate processing), i.e., 1030 attendance recording.

3. Communication Control receives the message, analyzes it and passes the message to an output queue for another terminal, thereby passing the scheduler, i.e., message switching.

   ICS also allows messages to be generated by a message program to initiate scheduling of another message program.

2.5.3 MESSAGE FORMAT

Data Messages are the normal means of input from any terminal. The message must be entered in the following format:



where:

- tr - is a two to eight character transaction code that identifies for ICS the application that is to process this message, the data set upon which the message is to be batched, 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 8 characters following the transaction code.

- text - is the actual message. It may consist of one or more lines with each line terminating in an EOB. The last line must terminate in an EOB and an EOT when the message type is defined as being a multiple line message.

2.5.4 TERMINAL LANGUAGE

The telecommunications capabilities of ICS provide a means for terminal operators to communicate data handling information as well as data messages via a terminal command language. These data handling functions include:

1. Input message correction during message entry prior to EOT with the execution of commands to:

   . replace (/REPLACE), delete (/DELETE), insert (/INSERT) a message

line

. display a message line (/PRINT)

. cancel a message (/CANCEL)

2. Input message character correction with a backspace.

3. /RESEND allows the ability to request message retransmission on output.

4. /TEST gives the ability to operate terminals in a test mode. No message will be sent and any messages received will be returned until an /END is received.

5. /EXCLUSIVE gives the ability to cause terminals to be used exclusively for input messages and response to the input messages. /END returns the terminal to normal mode. This mode prevents message switching to this terminal from other terminals.

6. /LOCK and /UNLOCK provides the ability to lock and unlock terminals, data bases, transaction codes and programs from a terminal via their name and password.

2.5.5 SYSTEM MESSAGES

ICS provides the ability to notify the terminal operator of system messages, i.e. errors, system status, shutdown.

2.5.6 MASTER TERMINAL

The operational hub of the ICS system is the master terminal. This (1050, 2740) terminal has complete control of the ICS system with respect to communications, message scheduling, and data base operation. The master terminal is used to initialize the ICS system at start time (see 2.8), to continually monitor (via displays) and to alter the system's operation.

The Master Terminal Language provides the operator at the master terminal with the following abilities:

1. / STOP* - halts the sending, receiving and queuing of messages and halts the scheduling of messages, programs, and data bases.

2. / PSTOP* - provides a halt to scheduling of messages, programs and data bases, but allows the queues to continue to build up. (Both input and output)

3. / PURGE* - allows scheduling, processing and sending, but allows no new message input.

4. / START* - provides for the starting of the system functions of receiving, queuing, sending, and scheduling.

   * All of these above commands can be used to regulate the operation of these items:
     a. line and terminal
     b. line
     c. terminal
     d. transaction code
     e. program
     f. data base

5. / DISPLAY - proves the ability to display the length of queues and the contents of any of the systems block, tables, or matrix.

6. / CHANGE - is used to permanently change one password to another.

7. / ASSIGN - provides the ability to a permanently relate a logical terminal to a physical terminal.

   a. permanently relate a logical terminal to a physical terminal.

   b. temporarily modify the current priority level of a message type.

   c. assign a new permanent priority level to a message type.

8. / DELETE - used to permanently elimate the password security from a message

type, logical terminal, physical terminal, database or a program.

9. / BROADCAST - is used to send information or warning to one or more terminals.

For the ease of recovery from system failures, input and output messages are recorded, on a line-by-line basis, on a sequential data set (ICS System Log) in addition to being placed into the appropriate message or terminal queue. If errors occur during output transmission of either a single or multi-segment message, transmission will normally be reinitiated with the segment in error.

2.5.7 ICS - COMMUNICATIONS SYSGEN CONSIDERATIONS

At ICS - SYSGEN time, the user's responsibilities include providing ICS with a complete definition of the communication configuration (lines, terminal type, etc.) and a description of each message type, security, relationships, queuing types, and the message priority level. This information is used to build blocks, tables, and lists which will control the execution of the ICS Communication Control Modules.

2.6 APPLICATION SCHEDULER

The Information Control System initiates execution of message processing programs based upon messages received. All message types acceptable (to the ICS Application Scheduler) are predefined and verified via a two to eight character code in the first line of the message. The message (transaction) type definition includes a scheduling priority (one of 15 priority levels), queuing type, and a message processing program name (required to process message).

When a valid message is completely received and queued, its presence is made known to the Application Scheduler. If the message processing program, its associated data bases, a message processing region, and data base buffers are available, processing is initiated on a

message priority basis.

2.6.1 CAPABILITIES

The Application Scheduler provides the ability to 1) maintain priority rights of messages for which resources are not available, 2) to release resources associated with application program previously occupying a region, and 3) to assure orderly release of resources after message program has abnormally terminated. The initial implementation of ICS does not allow concurrent execution of a message processing program or two message processing programs which modify a mutually used data base.

2.6.2 SCHEDULING ALGORITHM

The ICS scheduling algorithm is described as follows by users providing three items of information at the time he describes his message type:

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

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

3. Limit Priority - When the limit count equals the queue count the normal priority will be raised to the limit priority until the queue count returns to zero. At that point the SMB will be returned to the normal priority again.

It will be possible for the user to specify a normal priority or zero (null), which means no processing will occur until the limit count has reached. If normal priority is one, then processing may occur prior to reaching the limit count if there are no higher priority messages in the queue.

2.6.3 ICS SCHEDULER SYSTEM-BLOCK GENERATION CONSIDERATION

1. Create a block for each transaction type priority, queuing type, etc.

2. PSB (Program Specification Block) Directory (resident information about each Program Data Base Requirement) is created at system generation time

3. PSB library on OS/360 partitioned data set is created for storage of PSB's as members.

4. PSB Generation is to create PSB's before and after system generation. PSB's (one per program) contain all the information to describe the programs data base requirements.

2.7 CHECKPOINT

2.7.1 CONDITIONS

There are numerous conditicns under which ICS may require a checkpoint or require portions of the checkpoint system. These conditions generally can be grouped into four classifications:

1. System Scheduled Checkpoints
2. Master Terminal Request to Checkpoint
3. Master Terminal Request to Condense Message Queues
4. Master Terminal Request to Checkpoint (copy) a Selected Data Base

The conditions specified under numbers 1 and 2 become the same once the system recognizes that type of request has been received. Request type 1 will be scheduled by the system on a predetermined algorithm. The algorithm is the reception of a selected number of messages or message lines. Request type 2 may be made by the master terminal any time the system is to be shut down. This can be for an emergency or at normal system shutdown time.

The condition specified as type 3 may occur at any time during processing. This request will be entered any time the system message queue area becomes full. It is anticipated that this condition will occur very seldom The normal use of this request will be in conjunction with the shutting down of the system. This routine will allow user to start out with a new file for message queues each time the ICS control program

is loaded. Type 4 is defined as a Data Base Dump Procedure and invoke the routines necessary to stop further input against a data base, force processing of all messages queued for that data base, and force a system checkpoint with an end of volume forced on the log. When this is complete, the system will request scheduling of a batch region program to copy the data base.

2.7.2 CHECKPOINT COMMANDS

The following are the checkpoint commands received by communications control from the master terminal. These messages will be passed to the checkpoint routine.

1. /CHECKPOINT, (DUMPQ)

   The DUMPQ is an optional parameter which requests a dump of the Scheduler Message Block (SMB) and Communications Name Table (CNT) queues during the checkpoint cycle.

2. /DUMPQ, RESTORE

   This message will cause the message queues (SMB and CNT queues) to be dumped to tape, the message queue data sets closed, the data sets reopened, and the message queue portion of restart called to rebuild the queues eliminating space used by messages already processed.

3. /DBDUMP, DBNAME

   The message identifies a data base which is to be copied for backup purposes.

2.8 INITIAL PROGRAM LOAD - START

The initial program load (IPL) is considered to be a normal restart. The system will provide for ICS to be stopped and restarted daily or on some explicit interval. To start the system, the operator will perform the procedure for IPL of the Operating System/360. The operator will instruct the Operating System to start reading the SYSIN job stream. The SYSIN job stream will start with one job having an EXEC card specifying ICS and follow with jobs 2 through n specifying message regions. If the generated operating system contains n + 1 region, region n + 1 can be used for batch

processing. OS/360 (MVT) allows for multiple batch processing regions.

The EXEC card specifying ICS causes the ICS system to be loaded and given control. Initialization includes loading and initialization of DL/I, Application Scheduler, and Communication Control and their service routines. Block modification can be accomplished at this time. After loading is complete, the master terminal receives a message to indicate to the ICS system what type of restart. The response to this message will be passed to the restart module. Being a normal start, the restart module will read a tape which was written by checkpoint at the previous system stop. On this tape will be input messages received but not processed or any output messages generated but not sent on the previous day. 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 they were left in at the previous close. This procedure will allow the message queue disk packs to be changed daily or to start at the beginning of the same disk packs. When the end of file on this tape is reached, the master terminal is informed that restart is complete and upon the system receiving the command (/START, terminal, all) polling of the lines will be started.

2.9 RESTART

There are four emergency restart procedures other than normal restart that are provided by ICS.

1. A procedure that will handle a condition that could have been caused by an ABEND of the ICS control program region or a machine error causing an ABEND where the data sets, the log, and the message queues are not disturbed.

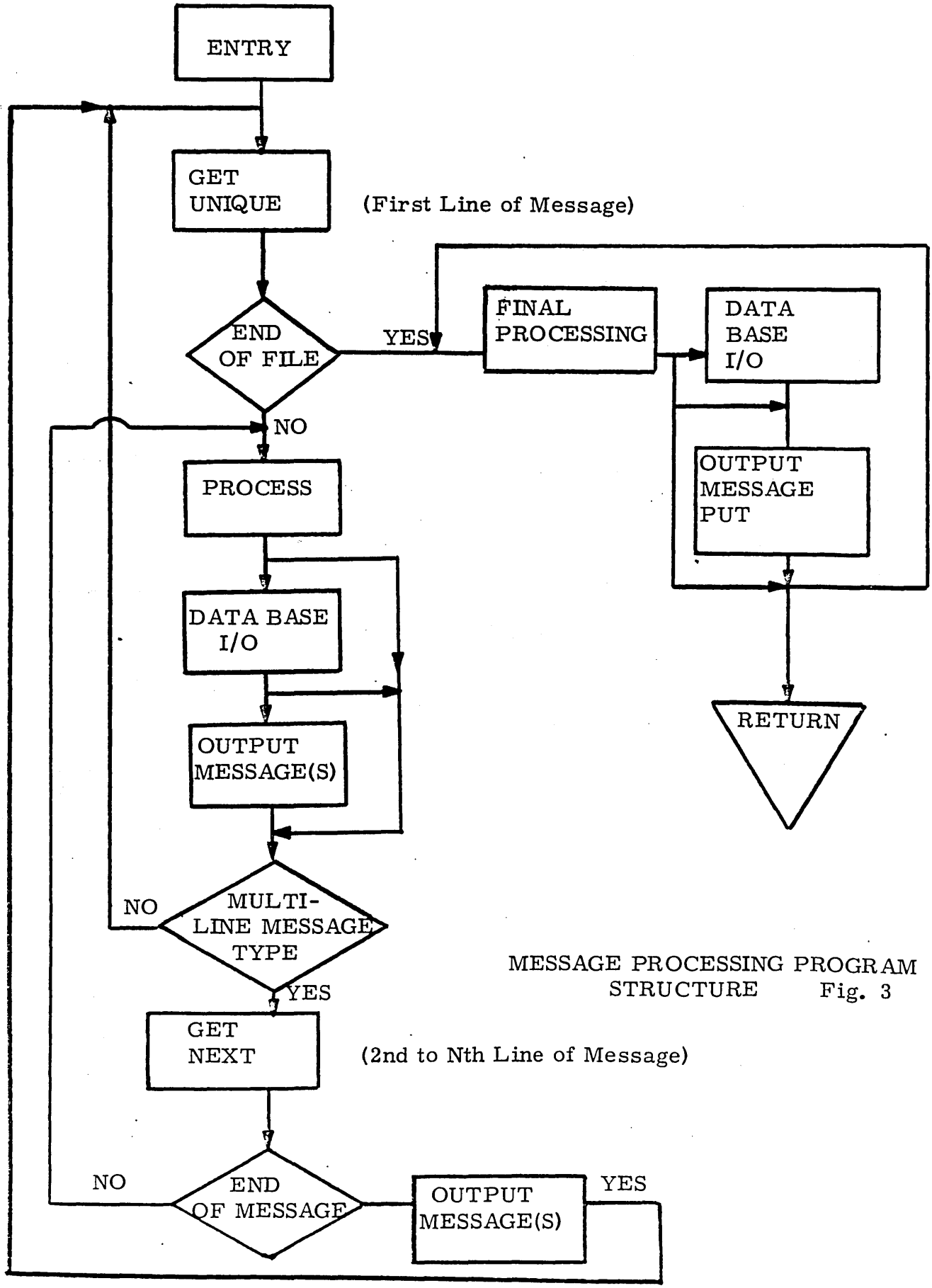
2. A procedure to handle the additional problem if a failure occurs which prevents the normal closing of the data sets by OS/360.

3. A procedure to handle a condition where the ICS queues are destroyed.

4. A procedure to handle a condition where a data base is destroyed.

2.10 MESSAGE PROCESSING PROGRAM STRUCTURE

Once a message processing program is loaded into a message processing region, it is allowed to execute in a multi-programming manner concurrent with the ICS control programs, other message processing regions, and the batch processing region. A time interval is allowed the program for execution. If the program is written to process multiple messages and there are multiple messages available, a single program copy may be permitted to process several messages. In order to take advantage of this increased processing efficiency, the structure of message processing programs should follow that outlined in Figure 3.



MESSAGE PROCESSING PROGRAM STRUCTURE Fig. 3

A Message processing programmer must describe his program's data base requirements to ICS. This description , called the program specification block (PSB), must include the data base names, sensitive segments and processing modes used by the program. The PSB is composed of one or more sub divisicn for each data base referenced by the program. The sub division's are called program communication blocks (PCB). ICS enables the programmer to create this description external to the message processing program. When the message processing program is loaded for execution, an address list of critical blocks containing the data requirements is passed to the program.

2.11 ICS UTILITY PROGRAMS

ICS will provide the following Utility Programs as a part of the total support:

1. ICS System Generation
2. ICS - DL/I Data Base Load/Dump *
3. DL/I - DBD Generation
4. ICS - PSB Generation
5. ICS - System Measurement

* Deferred Capability

2.11.1 ICS SYSTEM GENERATION

An ICS system programmer's manual will be provided so the user can create an ICS system generation control card deck. This control card deck contains all the necessary parameterized information to structure the resident blocks of the ICS system to a particular user's needs. This deck will become the input to the OS/360 job stream and invokes the ICS system generation utility program. The result of ICS system generation is the creation of ICS system. ICS System modules are placed in SYS1.LINKLIB for further use.

2.11.2 ICS - DL/I DATA BASE LOAD/DUMP **

The ICS - DL/I Data Base Load/Dump is a utility program that provides the capability of dumping an already created data base (if considerable overflow is apparent), rearrange that data according to the Data Base Description (DBD) and load the rearranged data back on disk. The program can also create a

DL/I data base from a OS/360 BSAM or QSAM data set. The program also has statistical data for management analysis.

** Deferred Capability

2.11.3 DL/I - DBD GENERATION

The DL/I - DBD (Data Base Description) generation utility program provides a means for the user of the Data Language/I data base organization to structure a description of a data base according to his needs.

The result of the DL/I - DBD generation places the Data Base Description generated as a member in the DBD Library. Any DBD's are described as input to an ICS System Generation but must be placed in the DBD Libary prior to use of the data base by a message processing program.

2.11.4 ICS - PSB GENERATION

The ICS - PSB (Program Specification Block) generation utility program provides the skeleton whereby the user places all PCB (Program Control Block) information for that application program in the PSB. The result of PSB generation places the PSB as a member in the PSB Libary. The PSBs are called into the ICS control program region when the associated program is used to process the message in a message region. The PCB's provide information ICS needs to process the application programmer's data base requests. PSB's which are described as input to an ICS System Generation must be placed in the PSB prior to use by a message processing program.

2.11.5 SYSTEM MEASUREMENT

Significant numbers of people will be in direct contact with ICS and are dependent upon the system for information necessary to the accurate and timely performance of their jobs. Performance will be measured in terms of system availability, mean time to interruption, mean time to repair, system throughput, response time to the user, simplicity of use, volume of work, and etc. System measurement information is placed in two broad categories: 1) on-line, and 2) batched statistical reports.

2.12 ICS - OS/360 SYSTEM CREATION

ICS will provide as a part of the total effort a complete description of system creation. Systems Creation will follow this outline:

1. Obtain a copy of the ICS Distribution .
2. Obtain OS/360 Starter System .
3. Perform an OS/360 System Generation including the incorporation of resident Type I ICS supervisor call routines .
4. Update OS/360 Generated System with ICS modules into SYS1.LINKLIB, SYS1.MACLIB, and SYS1.SVCLIB.
5. Perform an ICS System Generation as a job under the generated OS/360 system.
6. Create OS/360 partitioned data sets for a DBD library and a PSB library.
7. Create data base description, data bases, program specification blocks, and message processing programs.
8. Perform an ICS Initial Program Load.

2.13 EXTENSIONS CONSIDERED

The following are extensions of ICS that are being considered: 1) support for the CRT (Cathode Ray Tube) terminal device 2260, 2) support for Audio Response Device 7770, 3) support for the Binary Synchcons support of the 2780 4) remote job entry, 5) support for BDAM Data Bases, 6) support for retrieval of data on multi-attributes, 7) report generator capability and 8) Data Base record exclusive use at a lower level.

3.0 ICS INTERNAL OPERATION

3.1 OS/360 ENVIRONMENT

Operating System/360 provides the capability to define up to seven regions. Each partition has associated with it a task control block, a priority, a unique memory protection key, and a fixed area of core storage. The task control block is the mechanism which the operating system uses to allow each task to contend for computer execution in a multi-programming manner. If a task control block is "ready", which indicates the program in the

associated region is ready to execute, it vies for computer usage based upon priority.

The highest priority region always contain the ICS region (communication control, application scheduling and data language/I). The lower priority regions are used for message processing programs. The lowest priority region can be used for message or batch processing (Figure 4).