MODELING A RESPONSIVE MESSAGE EXPLOITATION SYSTEM

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Abstract

The Current Intelligence Traffic Exploitation System (CITES) model was developed at Headquarters, U.S. Strike Command using GPSS/360. The model simulates the flow of messages through a computer system requiring: message receipt; logging and statistical accounting; message header analysis and editing; automated distribution through visual display interaction; and review, storage and retrieval through remote terminals.

The model is being used to validate system design and aid in modifications to the system.

Console display stations can be closed for varying times to study the effects on the queues. Abnormally high message volume can be generated to evaluate the capability of the proposed equipment, personnel and system interaction to function under stress conditions.

Purpose

This model was designed to test the proposed Current Intelligence Traffic Exploitation System (CITES). The CITES is designed to function under abnormal conditions such as a critical period when message volume could increase considerably. The model is also being used to determine if the proposed design would aid in handling daily traffic more efficiently than under the current system

Specifically the model was designed to answer the following questions:

1. Would CITES be able to process the anticipated traffic volumes associated with high volume situations?

2. How long will a functional area user have to spend on the CRT each day to read all of his traffic accumulated since his last CRT session?

3. Will the local printers provide sufficient response time for obtaining hard copy messages?

Introduction

The CITE System consists of the personnel, equipment, and manual and automated procedures by which messages (in electronic form) are received, routed, stored, and disposed of within offices of the U.S. Strike Command (reference Figure 1).

The CITES design calls for four major programs:

1. Message Receipt: Provides computer interface for communications circuits from both teletypes and high-speed digital computers (Reference Figure 2).

2. Header Edit: Creates a Standard Message Header for displaying specified message data elements and, later, for recording indexes, codes, and routing information (Reference Figure 3).

3. Message Distribution Officer: Provides the interface for displaying messages in first-in-first-out (FIFO) within message precedence sequence to Strike Message Distribution Office personnel. Based on the message content, the message is routed to appropriate functional user's queue, or if not of value, the message is deleted. The routing process also changes the message's review sequence for each user to one involving local handling priority (i.e., the message's precedence does not necessarily reflect its importance to this Command (Reference Figure 4).

4. Functional Area Retrieval: The message traffic analysts, often referred to as user/"desk" analysts, can either

review messages routed by the Message Distribution Office (MDO) to him or retrieve messages from the CITES Data Base in researching requests for information. (Reference Figure 5). The messages routed by the MDO can be deleted or coded/indexed on the following:

a. Country code.

b. Subject or topic codes (as determined by a Standard List produced by the user/desk analyst).

c. Reroute to another desk.

d. Add remarks.

e. Print hardcopy on local printer (IBM 2740s or equivalent) or remote printer (IBM 1403 or equivalent).

Elements of the Model

The element of time, which interrelates all the movements, is specified in hundredths of a second (centiseconds) and was selected to provide time-resolution at near-CPU speeds. The other elements of the model fall into the following categories:

1. Unit of Movement: A message arriving at U.S. Strike Command is a GPSS transaction. Each transaction contains the following attributes or parameters in GPSS notation:

a. Message precedence.

b. User-Desk assignment.

c. Message length.

The message precedence assignment is done by a discrete function. This function is based on an analysis performed on actual message traffic received at U.S. Strike Command over a three-month period. The functions for user/desk assignment and message length are also based on studies of actual message traffic received at USSTRICOM. Two FORTRAN programs were written which analyzed the input data to arrive at the functions.

2. Resources: The following facilities and storages are used in the CITES model:

a. Central Processor: Each message must compete for CPU time in the Message Receipt and Header Edit programs. Both of these actions are free from human intervention and are handled completely by an IBM 360/40 computer.

The model allows queues to form at each of the above mentioned stations, but GPSS results to date indicate they have infrequent use as the equipment and programs are able to handle the normal volume of traffic with little delay.

b. Auxiliary Storage: The model utilizes two storage areas. One is a temporary storage where a copy of every message is kept for 24 hours. This is done in case a message is accidentally destroyed during handling by the Message Distribution Office or a "desk" analyst.
The second storage is a "permanent" on-line storage. This storage is used after messages, which are to be retained, are coded by the "desk" analyst for later retrieval. This area will be selectively purged approximately every ninety days. The purged messages will be kept on magnetic tape for off-line retrieval.

c. Message Distribution Office (MDO): This is the first point of human intervention with the system. This office mans two cathode ray tubes (IBM 2250s or equivalent). The model is designed to allow one CRT to act as a backup to the other during unscheduled CRT downtime in addition to its normal role of message distribution. All messages are queued and a savevalue is used to determine the available MDO console. If a CRT is free then gate-blocks route the message to the free CRT. Only when the primary CRT is busy is a message routed to the secondary CRT. It is noted that workload sharing was omitted but the analysts considered it not a critical factor.

The model has several timing routines which control through logic switches the amount of time a CRT is on-line. In the case of the Message Distribution Office, the CRTs are closed down for one hour out of every eight to simulate the absence of Message Distribution Office personnel who are performing other non-CITES activities. The Message Distribution Office operates 24 hours a day seven days a week.

When a message is reviewed by the Message Distribution Office, the following actions are taken:

(1) Delete it from the system if of no interest to USSTRICOM.

(2) Determine the correct routing of the message to one or more desk analyst.

(3) Change the precedence of the message to meet local priorities. Items 2c(2) and 2c(3) (Routing and Priority) are done in the GPSS model through the use of assign statements using functions. As mentioned earlier tnese runctions are based on a three-month study of actual message traffic.

After the Message Distribution Office has completed handling the message, it is placed in the proper desk analyst queue to await review by him.

d. User/Desk Analyst: There will be eight desk analysts, each having one CRT (IBM 2260 or equivalent) and one slow-speed printer (IBM 2740 or equivalent) in his working area. Additionally, a high-speed printer is available for large volume and/or fast printing. The analyst will normally review his traffic each day in a first-in-first-out order within local priority.

In the GPSS model a timing routine has been established which allows the desk analyst three hours each weekday and two hours on Saturday and Sunday to review his traffic and to perform any message researching necessary to his normal job function. These allowed times are sufficient for normal message volumes and are discussed in paragraph 2 of the "Summary and Conclusion" Section.

As a desk analyst reviews a message he may take several actions on the message.

(1) Reroute the message to another desk analyst.

(2) Code and place the message in the permanent storage area for later retrieval.

(3) Delete the message.

(4) Obtain a hardcopy of the message using his local printer or having it printed remotely on the highspeed printer.

e. Printers: When an analyst requests a hardcopy of a message, he has the choice of using his slow-speed printer or printing it remotely on a high-speed printer centrally positioned near all analysts' work areas. If the analyst also decides to retain this message after printing it is routed to the "permanent" storage. In the model this process is handled by a split block. The copy is sent to the printer and is terminated after being printed. The original is placed in the "permanent" storage for future reference, if the message is to be retained.

The local printers are designed to share one queue on a first-in-first-out basis. Initially only one local printer can operate at once since a multidropped line without terminal buffers will be used. A logic switch is set in the model which locks out the other seven printers while one is operating. This does not interfere with the use of the eight CRTs. When the CRTs are taken off-line after the normal three-hour period, local printer queue is checked to see if any messages remain to be printed. If so, they are transferred to the queue of the remote 1403 printer, printed, and taken off-line also.

The analyst may also elect to print a message on the high-speed printer instead of having it print locally. Although all eight desks share one queue for the printer, model results indicate exceptional throughput.

Program Description

1. Model Input: In order to make this model as accurate as possible a three-month study was made of actual message traffic. As a result of this study, a function was written to generate traffic volume based on the day of the week. The mean time for message generation is a "dummy" value of one (1) with the modifier based on a function describing the generation rate of seven days. Each day has equal probability of occurrence and the value obtained from the function is a composite rate determined from the ninety-day study.

A significant aspect of the system, that of critical period evaluation, is under continuing study. The effects of high volume message input will be simulated by altering the mean time generation rate in the generate block. The mean time field will be a variable and its modifier a function. The variable is a mathematical calculation using savevalues and a function to generate the mean time based on the day of simulation.

The modifier is a function whose purpose is to modify the mean generation rate according to the hour of the day.

Also as a direct result of this study functions to assign precedence, word length, and the proper user/desk code were also developed. As noted, several timing routines are in the model which control through logic switches the various CRTs being on-line and off-line during the day.

2. Program Coding: The model is coded in GPSS/360 using version one. Each of the three sections as described earlier is easily identified within the model.

When a program logic change (i.e., varying times for CRTs being on-line) is required, only the affected section need be modified. Changes which may be made to the model to test various conditions have been anticipated and can be made with little effort.

The CITES model has been developed in an evolutionary manner over a six-month period. The first model was naturally basic and served as the framework for the present model which consists of 300 statement cards, plus 225 output editor/functions/variables/comment cards.

3. Program Implementation and Output: The model is run on an IBM 360 Model 40 with 256core. It currently requires 200K of reallocated core and two hour forty minutes to simulate thirty days.

In addition to the standard GPSS output statistics, which show the utilization and queueing conditions for all system elements, other statistics were gathered and printed using the Output Editor. The standard output on utilization of the CRTs was not desirable since it is computed on the total time of simulation rather than on the time the CRTs were actually on-line. Several macro statements, savevalues, and variables were used to calculate a utilization based on on-line time (approx 3 hours daily).

The Output Editor was also used to graphically portray statistics on facilities and queues. Tables were utilized to measure the transit time for both types of printers. Message distribution and desk analyst consoles assume a reading speed of four hundred fifty and three hundred words per minute respectively. Additionally, processing time (i.e., time necessary for routing and coding messages) at each console is a variable based on message length allowing from three seconds to one minute at the watch desk and five seconds to two minutes at the area desks.

4. Validation of the Model: Since the CITES model is of a proposed system, it is difficult to validate the model by exact analysis. The in-depth three-month study was made to gather statistics about the makeup, arrival rate, and distribution of messages. With the help of several FORTRAN programs, statistical data reduction was achieved to provide three needed GPSS functions. Another three-month study is currently being analyzed to verify the present statistics.

The manufacturer's specifications were used when applicable to simulate equipment characteristics. The existing system was studied to determine the percentage of messages deleted from the system and to obtain a reasonable estimate of the printing requirements.

Summary and Conclusion

Specific areas for evaluation, described in the Purpose Section, have been analyzed with the following results:

1. Critical High Volume Traffic: The Study of the System's ability to handle high volume situations is continuing. Although indications are that the system can handle these situations well within acceptable limits, in-depth analysis of simulation reports will have to be completed before this question is finally resolved.

One noted assumption made in testing high volume periods is that the personnel will respond according to such a situation (i.e., users will have their CRT's on-line for longer periods and traffic can be diverted to multiple consoles for specific "desks".)

2. CRT Availability Requirements: The time a functional area user spends using his CRT is based on discussions with the users and observations of the current system. Currently the users have three hours each weekday and two hours on Saturday and Sunday. GOSS results on normal traffic flow show the users have ample time to review the traffic they have received since their last session and to research any information they may need.

3. Printer Responsiveness: To determine the response time of getting a printed copy of a message at the users local printer, a transit-time table was used. Statistics indicate over ninety per cent of all requests are completed in less than six minutes. If a user has requested a printed copy and has not received it when his CRT is taken off-line, the system will automatically transfer the request to the centrally located high speed printer. Maximum response time on messages routed to the high spped printer is less than eight seconds. This type of system will give sufficient response to the user without unacceptable delays.

The CITES Model has not only answered the questions discussed above but has pointed out areas which had not been thought of earlier. One area which was significant was the amount of time the CRT's need to be on-line to process their traffic. This time is much lower than originally thought, and is an improvement over the current system.

After using the CITES Model to test various conditions of the CITE System, it is felt many mistakes and wrong assumptions will be avoided in programming and implementing the system.

CITE SYSTEM OVERVIEW

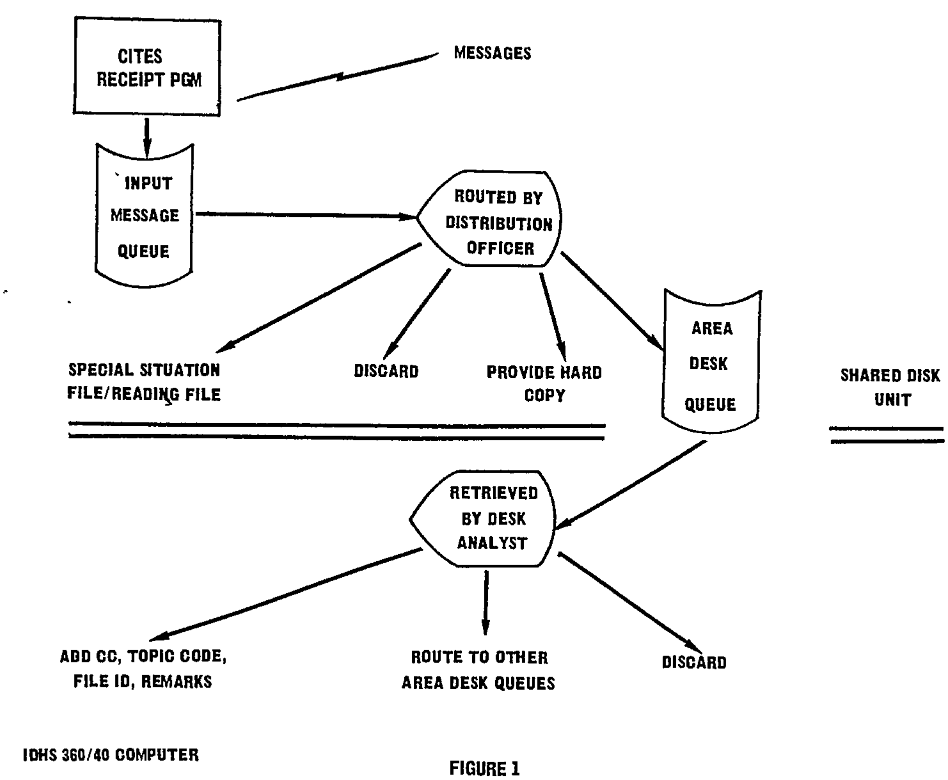

FIGURE 1

MESSAGE RECEIPT

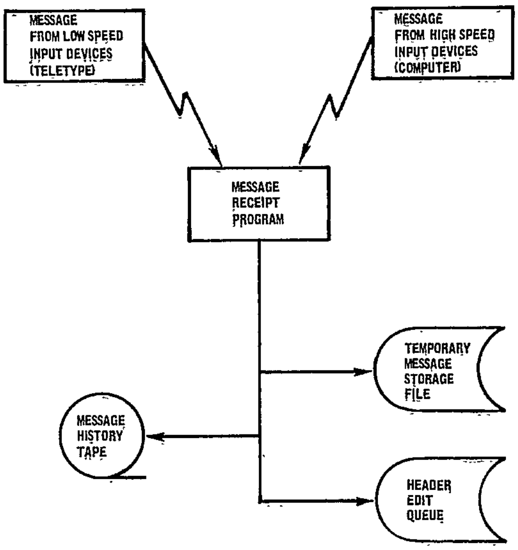

FIGURE 2

MESSAGE DISTRIBUTION OFFICE

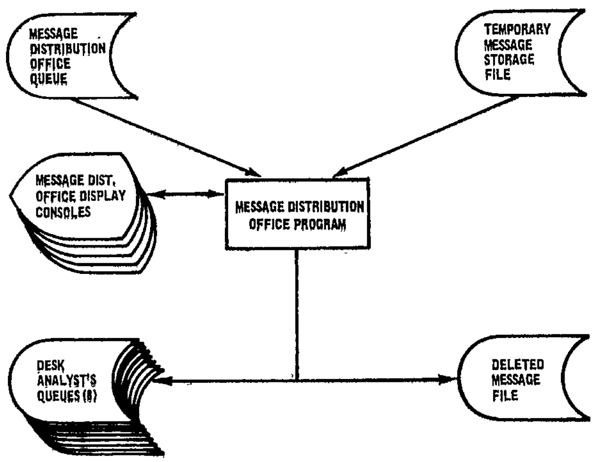

FIGURE 4

HEADER EDIT

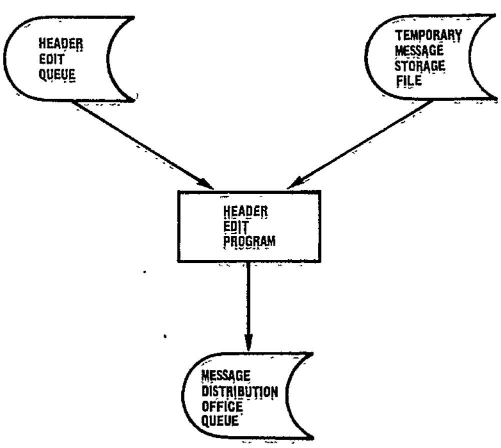

FIGURE 3

DESK ANALYST

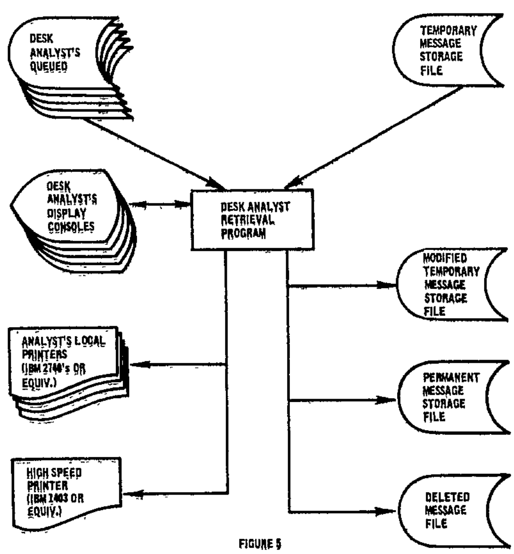

FIGURE 5