

Section 1: Introduction

This section provides a brief perspective of CICS performance evaluation, provides an overview of the CICS Component of CPEXpert, describes the sources of data used by the CICS Component to analyze system performance, and describes the analysis the CICS Component performs.

Chapter 1: Background

From a global view, CICS performance analysis can be viewed from three perspectives: (1) the interaction between a CICS region and the MVS environment, (2) the performance constraints of an individual CICS region, and (3) the performance of tasks executing in the CICS region. CICS performance constraints may arise in each of these areas. However, the CICS Component primarily addresses the second area (the performance constraints of an individual CICS region).

- **The interaction between a CICS region and the MVS environment.** Performance constraints caused by the interaction between a CICS region and the overall MVS environment relate to such areas as:
 - The processor speed, whether the CPU dispatching priority assigned to the CICS region is sufficient high that CICS has adequate processor resources, or whether a sufficiently high performance goal and goal importance has been assigned for the service class to which the CICS region (or CICS transactions) have been classified.
 - The I/O facilities available, and how those facilities are allocated between CICS and other work executing in the system.
 - The swapping and paging controlled by the MVS Auxiliary Storage Manager, and whether the CICS region is affected by the swapping and paging.
 - The communications network, how CICS users access the CICS region through the network, and the communications software parameters controlling the access.

At this level, it is necessary to determine management objectives for overall performance and resource use of the CICS region relative to that of other workloads (e.g., other CICS regions, TSO transactions, other on-line applications, etc.) executing on the system.

Management must decide how much of the overall system's resources the CICS region should be allowed, versus the resources required to support other workloads. If the CICS region is given inappropriate resource priorities (processor, DASD, etc.), then CICS performance might not meet expectations, regardless of the amount of tuning.

The WLM Component and the DASD Component of CPExpert, as well as other commercially-available tools, can be used to investigate potential problems in the overall MVS environment.

- **The performance of an individual CICS region.** Constraints to improved performance of an individual CICS region are related to the general controls available for effecting how CICS uses resources, and how CICS distributes access to the resources among tasks attached to the CICS region.
 - DASD and file control facilities, and how CICS parameters are established to minimize the amount of physical I/O operations and optimize I/O access times.
 - Data communications facilities, and how CICS parameters are established to control the use of these facilities.
 - Virtual and real storage, and how the CICS region options have been specified to minimize storage constraints.
 - Overall CICS facilities, and how these facilities are employed by the CICS region.

These controls are in the System Initialization Table (SIT) and other tables used by CICS. The effect of selecting particular values for the controls generally can be observed from information available in standard CICS interval statistics and information available from monitoring tools (e.g., IBM's CICS Monitoring Facility).

The CICS Component of CPExpert evaluates constraints to improved performance of an individual CICS region and suggests changes to the controls affecting performance.

With MVS (Goal Mode) and if CICS Version 4.1 or a higher release of CICS is installed, the WLM Component of CPExpert can be used to investigate constraints to a CICS region from an overall system view.

- **The performance of individual CICS tasks or application systems.** The performance of individual CICS tasks or application systems generally relate to application system design, individual coding strategies, and specific file structures or data base design. Other commercially-available tools can be used to analyze application performance. Consequently, the CICS Component of CPExpert performs minimal analysis in this area.

Chapter 2: The CICS Component of CPExpert

The main purpose of the CICS Component of CPExpert is to evaluate the performance of an individual CICS region, identify potential constraints to improved performance, and suggest ways to eliminate the constraints.

CICS Component was implemented with the basic philosophy that (1) CICS performance analysis should be an ongoing process, (2) changes in response to constraints normally will be made only if the problems are persistent, (3) data required for the performance analysis is available from a variety of sources and exists in a variety of forms, and (4) a tool generally useful for analyzing CICS performance should tailor its analysis based upon available information.

- CICS performance evaluation should be done on a regular basis, with problems or potential problems brought to the attention of CICS systems personnel. If a consistent analysis methodology were automatically applied to the basic CICS performance metrics, performance problems can be identified as they arise without requiring a significant amount of time from CICS systems personnel.

The CICS Component is designed to be used on a daily basis, analyzing interval statistics normally recorded by CICS.

- Many installations carefully restrict the data elements contained in the performance data base. This management action is done because of the potentially massive amount of data generated by the tools.

The CICS Component primarily analyzes CICS information contained in CICS/ESA, CICS Transaction Server for OS/390, or CICS Transaction Server for z/OS standard interval statistics recorded in SMF¹ and processed by MXG. CICS information must be available in a performance data base created by MXG for CPExpert's analysis.

- A useful CICS analysis tool should not require an inordinate amount of tailoring by users. Rather, the tool should determine the data elements available and generate analysis appropriate to the available information.

The CICS Component automatically generates code appropriate to the source of data and performs analysis in each area only if the required performance-related information is available. At the beginning of execution, the CICS Component lists the rules (if any) which will be suppressed based upon data availability.

These features and the analysis are provided by SAS macros and by extensive use of the SAS macro language. These SAS macros (1) determine the data elements present if a performance data base is used, (2) generate coding to shape the available CICS data, (3)

¹The CICS Component optionally processes system logger information contained in SMF Type 88 records.

generate coding to analyze the CICS statistics depending upon the availability of information and the type of analysis, (4) evaluate the data to assess potential constraints to improved CICS performance, and (5) report the results from the evaluation.

- **Determine data elements in performance data base.** The CICS Component **may** determine the data elements in a MXG performance data base (this action is done only if the STANDARD guidance variable is set to NO in the CICGUIDE module of USOURCE).

The CICS Component determines which data elements are present so that CPEXpert generates only those rules which have data to analyze. The CICS Component lists any rules which are suppressed because of missing data elements or rules which are suppressed because they do not apply to the version of CICS being analyzed.

- **Shape Data.** Based on the data sources and on the data elements available, the CICS Component generates appropriate code to shape the data for analysis. A variety of options are available which can be used to exclude historical data from analysis. For example, a user can exclude weekends or holidays if these periods are not desired in the data analysis and reporting.
- **Evaluate Data.** The evaluation of the CICS performance-related information is accomplished by rules whose purpose is to identify potential constraints to improved CICS performance. The CICS Component invokes rules to analyze the data only if the data required a particular rule is available. The SAS macro language is used to test for the required data elements. Each rule will be invoked only if the necessary data elements are present or if the rule applies to the version of CICS being analyzed.
- **Report Results.** The CICS Component reports the results from the evaluation, producing a detailed narrative associated with each finding. Optionally, the CICS Component can produce output with Hypertext Markup Language (HTML) if the SAS Output Distribution System (ODS) is available².

In normal operation, the CICS Component is used on a daily basis to analyze the standard interval statistics recorded by CICS. The CICS Component conducts its analysis guided by the guidance variables contained in CPEXPRT.USOURCE(CICGUIDE). After the analysis is complete, the CICS Component lists the narrative findings resulting from the analysis.

Some findings may apply only to the performance of CICS for the particular day being analyzed, and some recommendations might involve changes potentially having a significant effect on operation of the CICS region. For many potential problems identified by CPEXpert and for many alternatives suggested, you should **not** make a change

²The SAS ODS is available with SAS Release 8.0.

immediately. Rather, you should wait to see if the analysis results in the same finding and alternatives, or until CPExpert performs an analysis of historical information.

There are some exceptions to this "wait before making changes" advice:

- You feel that the analysis is generally applicable - that is, it is clear that CPExpert has identified a significant problem which will recur and should be immediately addressed.
- The workload processed on the day being analyzed is particularly critical, and the suggested changes are appropriate because the workload has a high management priority.

Each significant finding as a result of the analysis is described in Appendix A of this document. The description summarizes the finding, lists predecessor findings, discusses the rationale for the finding, and suggests alternatives.

- The summary presents a short description of the finding.
- The discussion describes as much as necessary of the operation of CICS as it relates to the particular finding. The purpose of the discussion is to explain the reasoning behind the finding. If appropriate, the discussion might refer you to related discussions in the CICS Component User Manual, or in a User Manual of another CPExpert component (e.g., the User Manual for the WLM Component might be used as a reference to avoid repeating a detailed discussion).
- The suggestions list possible actions that should be considered based on the findings. In many cases, multiple alternatives are listed. You must determine which actions should be taken (this determination is based upon the suitability of the actions to your own environment, the financial implications of the action, and the "political" acceptability of the action.)
- Much of the discussion and suggestions have been acquired from IBM's *CICS Performance Guide*. Specific references are given to the appropriate pages in each of the relevant *Guides*, or in other documents (if appropriate). Additionally, some findings or discussions are based on information contained in documents available on IBMLINK³. Reference is made to the specific IBMLINK document number and document title for rules where the findings or discussions use information contained in IBMLINK.

³IBMLINK is a system that provides electronic access to a number of existing IBM software, application, and product support data bases. These data bases normally contain questions to and answers from IBM product developers or support personnel. Access to IBMLINK is acquired through the IBM Information Network.

Chapter 3: Data Sources

CPEXpert analyzes the performance of an individual CICS region based upon data from two sources:

- **Guidance information.** Guidance information is contained in CPEXPERT.USOURCE(CICGUIDE). This PDS member contains information that allows you to select specific data to be analyzed, to specify how you wish reporting to be done, and to provide guidance to CPEXpert with regard to analysis thresholds that may be unique to your environment.
- **Performance data base information.** The CICS Component can analyze measurement information contained in a performance data base. This performance data base must be created from CICS interval statistics, using MXG. The CICS statistics recorded by CICS/ESA, CICS Transaction Server for OS/390, or CICS Transaction Server for z/OS are written to SMF. If these statistics are to be utilized in the analysis, they must be available in a performance data base. CPEXpert does not directly process these statistics.

Please do not confuse the CICS interval statistics with the CICS monitoring data produced by the CICS Monitoring Facility.

- The *CICS interval statistics* are written at user-defined intervals, with a default of once per 3 hours. These statistics are written as SMF Type 110 records, and do **not** consume much space in the SMF file. The records are relatively small and normally are written infrequently. They have virtually no impact on the size of the SMF file.

While you can effectively "turn off" the interval statistics by making the interval extremely large, CICS will still write the statistics at the end of day (at midnight) or when the CICS region is shutdown. Thus, you will receive the statistics at least once per 24 hours.

CPEXpert recommends that you record the interval statistics at least once per 3 hours (the default) or more often if you wish to gain additional insight into CICS performance problems.

- The *CICS Monitoring Facility* data are written based on the setting of the MN, MNPER, MNEXE, and MNEVE keywords in the CICS System Initialization Table. There are three types of CICS Monitoring Facility data: *performance* class data, *exception* class data, and *SYSEVENT* data.
 - The performance class data consist of detailed information at the transaction level. At least one performance class record is written for each CICS transaction.

- The exception class data consist of information on exceptional conditions experienced by a CICS transaction. These exceptional conditions primarily include waits for storage or files.
- The SYSEVENT class data consist of information which is used primarily to record transaction timing data. The SYSEVENT class includes the terminal ID and elapsed time of each CICS transaction.

The SYSEVENT class data are not applicable with CICS/ESA Version 4.1 if executing under the Workload Manager (MVS Goal Mode), as CICS provides the Workload Manager with detailed information about each transaction.

The CICS Monitoring Facility records can be extremely voluminous and can consume a significant part of the SMF file.

Additionally, collecting and recording the performance and accounting data can require a significant amount of processor resources. The IBM *CICS Performance Guides* estimate that the overhead is likely to be about 5% to 10%, depending upon the workload.

CPEXpert does not require and does not use CICS Monitoring Facility data. Many organizations do not collect CICS Monitoring Facility data because of the amount of transaction-level data recorded. Most of the important performance-related data elements previously recorded in the CICS Monitoring Facility file were incorporated in the CICS/ESA, CICS Transaction Server for OS/390, or CICS Transaction Server for z/OS interval statistics file. In fact, the CICS Monitoring Facility records do not contain much of the information which CPEXpert uses to analyze performance. Consequently, CPEXpert processes only the CICS interval statistics.

Note that MXG is required for CPEXpert to comprehensively process the CICS interval statistics. Consequently, MXG should be acquired if you wish to use CPEXpert to analyze CICS interval statistics.