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**Rule CIC403:** Records not found in user-maintained shared data table

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**Finding:** The CICS interval statistics showed that a high percent of records were not found in a shared data table.

**Impact:** This finding has a MEDIUM IMPACT or HIGH IMPACT on the performance of the CICS region.

**Logic flow:** This is a basic finding, based on an analysis of the CICS interval statistics.

**Discussion:** An application can specify that a CICS VSAM key-sequenced data set (KSDS) file is to use shared data table services. When the file is opened, this specification causes CICS to copy the contents of the file into an *MVS data space*. The records can be accessed in an MVS data space significantly quicker than records read from the VSAM data set or via reads serviced by a Local Shared Resources (LSR) pool.

With shared data table support, the KSDS file is called the *source data set*. The copy of the file in memory is called the *data table*. The process of copying the records from the file to the data table is called *loading the data table*. Whenever a CICS application wishes to reference the VSAM file using normal file control commands, CICS attempts to use the representation of the file in the data table, rather than accessing the source data.

CICS supports two types of data table :

- **CICS-maintained data tables.** A CICS-maintained data table is one that CICS keeps in synchronization with their source data sets. That is, any update or delete action on a record in the data table is *automatically applied* to the source data set *before* being applied to the data table.
- **User-maintained data tables.** A user-maintained data table (UMT) is one that is not maintained by CICS, but is completely maintained by user code. A UMT is detached from its source data set after the table is loaded from the source data set, and changes made to the UMT are *not* reflected in the VSAM source data set.

Records are placed into a data table in one of three ways: (1) records placed in the data table by the initial loading of the data table from the source data set, (2) records subsequently added to the data table from the source data set, and (3) new records written to the data table after the data table has been loaded..

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- **Initial loading of the data table.** During initial loading of the data table, CICS reads the entire VSAM KSDS file and attempts to place all records in the data table. The XDTRD user exit can be used to limit the records that are placed in the data table (using screening criteria appropriate to the applications sharing the data). If all records that pass the screening criteria (if any) will not fit into the data table<sup>1</sup>, a “table full” condition applies during the initial loading of the data table.
  - **Records subsequently added from the source data set.** Records from a VSAM KSDS file can be added to a data table after the initial loading<sup>2</sup> if either (1) records would not fit into the data table because the table became full during initial loading or (2) the user exit had excluded records during initial loading but an excluded record was subsequently required by an application. If the data table had become full during initial loading, some record must be deleted from the data table for another record to be subsequently added from the source data set.
  - **New records written to the data table.** New records can be added to a data table via the WRITE file control command. The XDTAD global user exit program can be used to limit the records that are added to the data table as a result of a WRITE request issued to a data table. If all records that pass the screening criteria (if any) will not fit into the data table<sup>3</sup>, a “table full” condition is generated and the write is rejected.

Applications can reference the data table during initial loading. These references will produce a “record not found” condition if the references are to records outside the range of those already loaded into the data table. For both CICS-maintained data tables and user-maintained data tables, the “record not found” condition can occur during initial loading. These conditions should be small and can normally be ignored.

For CICS-maintained data tables, small numbers of the “record not found” condition after initial loading should not normally be a cause for alarm. However, a large number of “records not found” will cause unnecessary overhead and delay to applications<sup>4</sup>.

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<sup>1</sup>The MAXNUMRECS parameter of the DEFINE FILE command can be used to limit the number of records that can be placed in the data table. The MAXNUMRECS parameter has a default maximum of NOLIMIT, which means that the entire VSAM KSDS file can be placed in the data table ( subject, of course, to screening criteria applied by the XDTRD user exit).

<sup>2</sup>Records from the source data set cannot be added to a user-maintained data table after the initial loading of the data table. User-maintained data tables are separated from the source data set after loading.

<sup>3</sup>The MAXNUMRECS parameter of the DEFINE FILE command can be used to limit the number of records that can be added to the data table. The MAXNUMRECS parameter has a default maximum of NOLIMIT, which means that there is no limit to the number of records that can be added to the data table ( subject, of course, to screening criteria applied by the XDTAD user exit).

<sup>4</sup>If the “record not found” condition does occur after initial loading of a user-maintained data table, either the data table is too small or the screening criteria in the XDTRD user exit does not match the record reference patterns of the application. These situations are analyzed in Rule CIC402.

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For user-maintained data tables, the “record not found” condition should not occur after loading of the data table. Since the VSAM source data set is not available after the initial loading of the data table, any “record not found” condition for user-maintained data tables normally indicates a coding or logic error with the application.

Shared data table statistics are available in MXG file CICFCR. CPEXpert uses the A17DTRNF variable to assess the number of records not found situation. The A17DTRNF variable contains a count of the number of times CICS attempted to read a record but was unable to satisfy the read request because the record was not in the data table.

The CICS statistics contain an indicator (the A17DTTYP variable) describing whether a shared data table is CICS-maintained or user-maintained. Unfortunately, this indicator is set only when the VSAM data set is closed. CPEXpert does a “reverse scan” of the shared data table statistics to identify CLOSED status of a shared data table. A17DTTYP is propagated to all observations prior to CLOSE, so CPEXpert can identify whether a shared data table is CICS-maintained or User-maintained. Additionally, CPEXpert examines all variables that represent data set accesses that modify the data set (these are the A17DSGU, A17DSWRU, A17DSWRA, A17DSDEL, A17RMDEL, and A17DSBRU variables). If the source data set is modified, the data table must be a CICS-maintained data table.

This approach works only if the shared data table actually was closed within the CICS statistics data available in the performance data base being analyzed by CPEXpert, or if modifications were made to the data set. If the shared data table CLOSE record is not present in the data or if modifications were made to the data set, CPEXpert will be unable to determine whether the shared data table is CICS-maintained or user-maintained. From a practical matter, this should be of little import as the analysis depending on CICS-maintained versus user-maintained data tables would not be seriously effected for tables that are not closed and which have no source data set access.

CPEXpert produces Rule CIC403 when the A17DTRNF value is greater than the **UMTRNF** guidance variable in USOURCE(CICGUIDE). The default value for the **UMTRNF** guidance variable is 0, indicating that CPEXpert should produce Rule CIC403 when any read request resulted in a “record not found” condition.

Note that during initial loading of the data table, any read requests outside the range of records loaded will produce a count for the “record not found” condition. As mentioned earlier, this is not normally a cause for alarm. In an attempt to eliminate these read requests during initial table loading, CPEXpert suppresses Rule CIC403 for any CICS interval statistics period

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when the table is being loaded (this suppression is based on the A17DTAVR variable being non-zero).

**Suggestion:** If Rule CIC403 is produced, you consider the following alternatives:

- Consult with applications personnel to review the application logic and coding. It is possible that an error exists with the application. Alternatively, the application might “test” for the presence of a record before adding a new record. If this is the case, the UMTRNF guidance should be changed for this specific table (Section 3 describes how to change guidance for individual shared data tables).
- Increase the number of records allowed in the shared data table. The number of records allowed in the shared data table is controlled by MAXNUMRECS parameter of the DEFINE FILE command. The DEFINE FILE command can be applied at the CEDA panel.

Increasing the number of records in the shared data table would result in a larger table, using more virtual storage. Using more virtual storage could increase CICS paging operations, or increase overall system paging. Consequently, paging rates should be monitored if there is a large increase in the number of records allowed in the shared data table.

- If increasing the number of records allowed in the shared data table is not feasible, determine whether the XDTRD user exit has been used for the VSAM KSDS file. If the XDTRD user exit **has** been used, consider revising the screening criteria in the user exit to include a larger number of records during loading. The screening criteria might not match the records required by the application (perhaps because of different transactions or different distribution of transaction types requiring different records). Consequently, the existing screening criteria might exclude more records than are required by the applications or transaction patterns being submitted.
- You can change the UMTRNF guidance variable in USOURCE(CICGUIDE) if you believe that Rule CIC403 is produced too often.

**Reference:** CICS/TS for OS/390 Release 1.3 *CICS Shared Data Tables Guide*:  
Section 6.1 Using the DEFINE FILE command to define data tables  
Section 8.4 Interpreting data table statistics

CICS/TS for z/OS Release 2.1 *CICS Shared Data Tables Guide*:  
Section 6.1 Using the DEFINE FILE command to define data tables  
Section 8.4 Interpreting data table statistics

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CICS/TS for z/OS Release 2.2 *CICS Shared Data Tables Guide*:  
Section 6.1 Using the DEFINE FILE command to define data tables  
Section 8.4 Interpreting data table statistics