
Rule CIC424: Maximum number of records was reached for CFDT

Finding: The CICS Coupling Facility Data Table (CFDT) list structure statistics showed that the maximum number of records had been reached for the CFDT.

Impact: This finding has a LOW IMPACT, MEDIUM IMPACT, or HIGH IMPACT on the performance of the CICS region. The level of impact depends on whether the situation was expected (and MAXNUMRECS value had been specified to restrict the number of records) or the situation was unexpected (and expected records were not in the CFDT).

Logic flow: This is a basic finding, based on an analysis of the data. The finding applies only with CICS/Transaction Server for OS/390 Release 1.3, or for z/OS.

Discussion: Coupling Facility Data Tables are kept in a *named pool* in an MVS coupling facility. There can be multiple CFDT pools, each containing one or more CFDTs. Each CFDT pool is defined, using MVS cross-system extended services (XES), as a *list structure* in a coupling facility.

A list structure consists of a set of lists and an optional lock table of exclusive locks (which can be used to serialize the use of lists, list entries, or other resources in the list structure). Each list is pointed to by a *list header* and can contain a number of *list entries*. With CFDT pools, the list structure is the CFDT pool, while the lists themselves are CFDTs within the CFDT pool. The CFDT pool server allocates the list structure based on parameters that are provided to the CFDT pool server at startup. These parameters allow a user to specify controls in such areas as allocation, security, tuning, reserved space, etc. Two parameters control the size of the CFDT pool:

- The MAXTABLES parameter provided to the CFDT pool server specifies how many tables can be in the CFDT pool list structure. The default value for the MAXTABLES parameter is 1000, indicating that 1000 tables can be opened in the CFDT pool.
- The POOLSIZE parameter specifies the initial amount of coupling facility storage to be allocated for the pool list structure. IBM recommends that a value not be specified for the POOLSIZE parameter, which allows the server to obtain an initial allocation using the parameters specified in the Coupling Facility Resource Management (CFRM) policy.

CICS automatically creates a CFDT within a CFDT pool when the first reference to the associated VSAM (KSDS) data set requires the CFDT to be opened. Once the CFDT is created, CICS can optionally load the coupling facility data table automatically from a source VSAM data set when it is opened, or the file definition can specify that there is no associated source data set, allowing an empty CFDT to be created.

The XDTRD global user exit can be used to limit the records that are placed in the CFDT during *initial loading* of the CFDT. The XDTAD global user exit program can be used to limit the records that are *added* to the CFDT as a result of a *WRITE request* issued to a data table. Both these user exits can use screening criteria appropriate to the applications sharing the data.

The MAXNUMRECS parameter provided with the VSAM file definition specifies the maximum number of records that can be in the CFDT itself. The default value for the MAXNUMRECS parameter is NOLIMIT, indicating that there is no limit on the maximum number of records.

If a value is specified for the MAXNUMRECS parameter, the CFDT can reach “full” status. When the number of records in the CFDT reaches the MAXNUMRECS value, the CFDT is marked “full” and no further records can be added to the CFDT until records are deleted to make space. The WRITE request is rejected, and the transaction must handle the NOSPACE return with an exception handling routine.

IBM suggests that for a *recoverable* coupling facility data table, the MAXNUMRECS value should be between 5% and 10% more than the maximum number of records that the table is expected to contain. This increased MAXNUMRECS value¹ allows for additional records that might be created internally for processing recoverable requests.

If this margin is not specified, the NOSPACE condition can be raised on a WRITE or REWRITE request to a recoverable coupling facility data table that apparently has fewer records than the MAXNUMRECS limit specifies.

CFDT list structure statistics for the coupling facility are available in MXG file CICCFS6D. The S6RSP6CT variable contains a count of the number of times that a list became full. CPExpert calculates the percent of requests that encountered a “list full” condition, using the following algorithm:

$$\text{Percent list full} = \frac{S6RSP6CT}{S6RSP1CT + \text{Abnormal responses}}$$

¹The number of additional records required for this internal processing depends on the level of use of the coupling facility data table, and the nature of that use.

where S6RSP1CT = Number of normal responses
Abnormal = S6RSP2CT + S6RSP3CT + S6RSP4CT +
S6RSP5CT+ S6RSP6CT + S6RSP7CT +
S6RSP8CT

S6RSP2CT = Entry data was larger than the input buffer length
S6RSP3CT = Specified entry (table or item) not found
S6RSP4CT = Version check failed for entry being updated
S6RSP5CT = List authority comparison failed
S6RSP6CT = List Full (a table reached maximum number of items)
S6RSP7CT = List structure became full
S6RSP8CT = Other IXLLIST return code occurred

CPEXpert produces Rule CIC424 when the percent of List Full conditions is greater than the value specified by the **CFPCTFUL** guidance variable in USOURCE(CICGUIDE). The default value for the **CFPCTFUL** is 0, indicating that CPEXpert should produce Rule CIC424 whenever any List Full conditions occurred.

Suggestion: If this finding is produced, you should assess whether reaching the MAXNUMRECS value is expected.

- The CFDT list structure statistics relate to the entire CFDT pool, and do not identify a specific CFDT to which the statistics apply. From this view, the CFDT list structure is a “summary” of conditions for all tables in the coupling facility list structure.

However, Rule CIC401 should have been produced to identify the shared data table to which this rule (Rule CIC424) applies. Consequently, you can use the information provided by Rule CIC401 to identify the specific shared data tables that reached MAXNUMRECS value. Examine the applications using the shared data table to determine why the “List Full” condition was encountered in the CFDT.

- It is quite likely that the MAXNUMRECS value was specified without considering the margin required to allow for additional records that might be created internally for processing recoverable requests. If this is the case, the MAXNUMRECS should be increased to account for these additional records.
- Reaching the List Full condition might be an expected result of the value specified for MAXNUMRECS. In this case, you should either change the CFPCTFUL guidance variable in USOURCE(CICGUIDE) so that Rule CIC424 would be produced only with a large number of List Full situations, or “turn off” Rule CIC424.

-
- Reaching MAXNUMRECS might **not** be an expected result, if there is more than one occurrence of the situation. The MAXNUMRECS value could have been set to curtail the number of records being read from the source data set. In this case, you should consider the following:
 - The user exit XDTRD might be used to screen the records being loaded into the CFDT. Applying a scheme to screen the records loaded into the CFDT might be more suitable than arbitrarily restricting the number of records loaded.
 - The user exit XDTAD might be used to screen the records being written to the CFDT after loading has completed (or after the null CFDT was established, in the case of a CFDT that has not corresponding source data set). Applying a scheme to screen the records written to the CFDT might be more suitable than arbitrarily restricting the number of records loaded.
 - Multiple occurrences of the List Full condition might imply that there is an error in the application logic. A List Full condition can be removed only after records are deleted from the CFDT. If records are deleted, additional records could be written to the CFDT raising the number of records to the limit set by MAXNUMRECS and creating a new List Full condition.

More than one List Full condition implies that this cycle was executed, and the larger the number of List Full conditions implies a corresponding larger number of times the cycle was executed. A looping transaction (or a transaction with incorrect logic) could generate a very large number of List Full conditions, with corresponding overhead and performance degradation.

- You can change the CFPCTFUL guidance variable in USOURCE(CICGUIDE) so Rule CIC424 is produced only when you wish to be aware of a larger number of List Full situations.
- You can “turn off” the rule using the process described in Section 3 of this User Manual. However, this alternative is **not** recommended! You should always be aware of List Full situations.

Reference: CICS/TS for OS/390 Release 1.3
CICS System Definition Guide: Section 2.10.8 (Coupling facility data tables)

CICS Customization Guide: Section 1.1.7 (Data tables management exits XDTRD, XDTAD, and XDTLC)

CICS/TS for z/OS Release 2.1

CICS System Definition Guide: Chapter 27 (Starting a CFDT server)

CICS Customization Guide: Chapter 23 (Data tables management exits XDTRD, XDTAD, and XDTLC)

CICS/TS for z/OS Release 2.2

CICS System Definition Guide: Section 4.3 (Starting a CFDT server)

CICS Customization Guide: Section 1.1.7 (Data tables management exits XDTRD, XDTAD, and XDTLC)