
Rule CIC443: LOC=BELOW request initially failed and was retried

Finding: The CICS Coupling Facility Data Table (CFDT) AXM storage statistics showed that a high percent of LOC=BELOW storage requests initially failed to obtain the requested storage, and were retried after merging adjacent small free areas to form larger areas.

Impact: This finding has a LOW IMPACT or MEDIUM IMPACT on the performance of the CICS region. However, it could be a warning of a pending HIGH IMPACT on the performance of the CICS region.

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 CICS/Transaction Server for z/OS.

Discussion: A Coupling Facility Data Table provides a means of sharing files between CICS regions. Applications access a CFDT using normal file control commands, just as the application would reference records in a shared data table on a single MVS image, but without the need to use a file-owning region (FOR). Consequently, a CFDT eliminates some of the potential capacity problems associated with using an FOR. From an application view, a CFDT appears much like a sysplex-wide user-maintained data table.

CICS automatically creates a CFDT when a first file control command reference requires the CFDT to be opened. This CFDT is then used by the same region, or other CICS regions, that issue subsequent open requests of other files that name the same coupling facility data table.

CICS can either (1) load the coupling facility data table automatically from a source VSAM data set when it is first opened, or (2) the CFDT can be defined with LOAD(NO) specified (which allows creation of an empty CFDT to which records are added).

A Coupling Facility Data Table is assigned to a *coupling facility data table pool* in a coupling facility. A CFDT pool consists of an XES list structure on the coupling facility.

Access to a CFDT by CICS transactions running in an AOR is through a *CFDT pool server* that supports a specific named CFDT pool. In this context, the CFDT pool server is similar to a File Owning Region (FOR) that would be used for a normal shared data table.

The CFDT pool server is started in its own region, by executing DFHCFMN. Various parameters are provided to DFHCFMN (POOLNAME, list structure parameters, lock wait parameters, tuning parameters, etc.) to allow tailoring of the data sharing server.

A CFDT pool server must be started on each MVS image for each CFDT pool defined in a coupling facility which can be accessed from that MVS image. The Coupling Facility Data Table pool can contain one or more CFDTs, and there can be more than one CFDT pool defined for the coupling facility.

CICS automatically connects to the server for a given CFDT pool the first time that any CFDT within that CFDT pool is referenced. All CFDT pool access is performed by cross-memory calls to the CFDT server for the named pool. The authorized cross-memory (AXM) page allocation services are used to manage server region storage after the server has been initialized.

During server initialization, the CFDT server acquires all of the available storage above the 16M line, as determined by the REGION size, then releases 5% of it for use by operating system services. This storage is referred to as *AXMPGANY* pool. The server also acquires 5% of the free storage below the line for use in routines which require 24-bit addressable storage. This storage is referred to as *AXMPGLOW* pool. Server statistics indicate how much storage is actually allocated and used within the storage areas above the 16M line (*AXMPGANY* pool) and below the 16M line (*AXMPGLOW* pool).

Storage is initially allocated from the pool using a bit map. For faster allocation, free areas are not normally returned to the pool but are added to a *vector of free chains* depending on the size of the free area (1 to 32 pages). When storage is being acquired, this vector is checked before going to the pool bit map.

If there are no free areas of the right size and there is not enough storage left in the pool, free areas in the vector are put back into the pool, starting from the smallest end, until a large enough area has been created. This action appears as a compress attempt in the statistics. If there is still insufficient storage to satisfy the request, the request fails.

If a task in the server region or a cross-memory request runs out of storage, this is likely to result in AXM terminating that task or request using a simulated ABEND with system completion code 80A to indicate a GETMAIN failure. Although the server can usually continue processing other requests, running out of storage in a critical routine can cause the server to terminate.

When requests in the AXMPGLOW pool are retried, this means that all free storage in the AXMPGLOW pool had been exhausted. This is not a problem, as such (the algorithm is designed to place storage buffers that are freed onto a vector of free chains). However, as the percent of requests that require a retry increases, overhead caused by the “compress attempt” to reduce fragmentation in the AXMPGLOW storage pool will correspondingly increase.

Coupling Facility Data Table pool server storage statistics are available in MXG file CICCFS9D. CPEXpert uses data in CICCFS9D to calculate the percent of storage requests in the AXMPGLOW pool initially failed and were retried, using the following algorithm:

$$\text{Percent AXMPGLOW storage requests retried} = \frac{S9LOWRQC}{S9LOWRQG}$$

where S9LOWRQC= Times a storage request initially failed and was retried
S9LOWRQG = Number of storage GET requests

CPEXpert produces Rule CIC443 when the percent of storage requests in the AXMPGLOW pool that initially failed and were retried is greater than the value specified by the **CFPCTLRC** guidance variable in USOURCE(CICGUIDE). The default value for the **CFPCTLRC** is .1, indicating that CPEXpert should produce Rule CIC443 whenever more than one tenth percent of the storage requests in the AXMPGLOW pool initially failed and were retried.

Suggestion: If this finding is produced, you should consider the following alternatives:

- If this finding occurs often (or if a large percent of requests initially failed and were retried), this could be an indication that storage in the AXMPGLOW pool is becoming exhausted and requests might begin failing. Requests are retried only (1) if there are no free areas of the right size and (2) there is not enough storage left in the pool to satisfy the request. Either of these situations occurring frequently could indicate that storage in the pool is in danger of becoming exhausted. If storage is in danger of becoming exhausted, Rule CIC445 (LOC=BELOW had low percent minimum free storage) might be produced, but you might have altered the guidance for Rule CIC445 and Rule CIC445 might have been suppressed.
- If storage in the AXMPGLOW pool is in danger of becoming exhausted, you should consider increasing the amount of storage that is available for the CFDT pool server identified by this finding. Increasing the amount

of storage can be accomplished by increasing the REGION parameter on the EXEC Job Control Language that starts the server.

In order to prevent overloading the CFDT pool server, the number of CFDT requests that each connected CICS region can have active at a time is limited. The *CICS System Definition Guide* states that this limit is about 10 concurrent requests. Since each request requires about 40KB, the REGION size should specify at least 400KB for each connected CICS region, plus a margin of about 10% for other storage areas. Thus, for a server supporting up to 5 CICS regions, IBM suggests that you should specify REGION=2200K.

It is possible that the REGION size was specified correctly initially, but additional CICS regions began using CFDTs (via the CFDT pool server, of course). In this case, it is possible that the REGION size for the CFDT pool server was not updated to account for the additional CICS regions requiring service. Rule CIC446 will be produced if CPEXpert's analysis indicates that more CICS regions are using the CFDT pool server than would be expected based on the amount of storage allocated.

- Change the **CFPCTLRC** guidance variable in USOURCE(CICGUIDE) so Rule CIC443 is produced only when you wish to be aware of a different percent of storage requests in the AXMPGLOW pool that initially failed and were retried. Since Rule CIC443 provides an "early warning" of potential impending request failures, you should **not** normally change the CFPCTLRC guidance variable.

Reference: *CICS/TS for OS/390 Release 1.3*
CICS System Definition Guide: Section 4.3.2 (Defining and starting a coupling facility data table server region)

CICS Performance Guide: Section 4.6.13 (Coupling facility data tables)

CICS/TS for z/OS Release 2.1
CICS System Definition Guide: Section 4.3.2 (Defining and starting a coupling facility data table server region)

CICS Performance Guide: Section 4.5.13 (Using coupling facility data tables to gain performance benefits)

CICS/TS for z/OS Release 2.2
CICS System Definition Guide: Section 4.3.2 (Defining and starting a coupling facility data table server region)

CICS Performance Guide: Section 4.5.13 (Using coupling facility data tables to gain performance benefits)