Rule CIC269:   Excessive GETMAIN/FREEMAIN activity for MRO sessions

Finding: CPExpert believes that the IOAREALEN parameters cause excessive GETMAIN/FREEMAIN activity to the SMTP storage subpool for MRO sessions.

Impact: This finding should normally have a LOW IMPACT, MEDIUM IMPACT, or HIGH IMPACT on the performance of the CICS region and the amount of unnecessary CPU overhead used by the CICS region. The level of impact will depend on the amount of unnecessary GETMAIN/FREEMAIN activity to the SMTP storage subpool.

Discussion: The Multiregion Operation (MRO) feature allows communication between CICS systems in the same processor without the use of SNA network facilities. By using MRO, several CICS regions can share resources, such as files, terminals, and temporary storage.

A *SESSIONS definition for MRO* is used to tell CICS about a set of parallel sessions between two CICS regions. The SESSIONS definition has several parameters to describe the link between the two regions.

The IOAREALEN parameter for the SESSIONS definition specifies the length of the terminal input/output area (TIOA)[1] that is to be used for processing messages transmitted between the two regions. The IOAREALEN value controls the length of the TIOA which is used to build a message transmitted to the other CICS system (that is, an outgoing message).

The IOAREALEN parameter has two values that can be specified.   The first value specifies the initial size of the TIOA to be used for the MRO connection. If the size of the message exceeds the first value, CICS acquires a larger TIOA to accommodate the message.

If the optional second value is specified, CICS will use the second value whenever the message does not fit into the TIOA specified by the first value.

A value of zero for the IOAREALEN causes CICS to get a storage area exactly the size of the outgoing message, plus 24 bytes for CICS requirements. If the IOAREALEN value is not specified, it defaults to 4KB.

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[1]The terminal input/output areas are used to "transmit" messages between the regions. The TIOAs are located above the 16MB line.

On the surface, this appears to be a straightforward process that results in best use of storage. Unfortunately, inappropriate selection of the values can cause either (1) a waste of both real and virtual storage or (2) unnecessary CPU overhead.

• Real and virtual storage can be wasted by specifying an IOAREALEN value that is too large for most messages transmitted on MRO link. This is because the storage will be allocated, but the allocation amount is larger than necessary to accommodate the size of the messages. Wasting real or virtual storage can cause performance problems in CICS regions that are "tight" on storage.

• Unnecessary CPU overhead will be required if the IOAREALEN value is too small or zero. This is because a GETMAIN must be executed to acquire the required storage, and a FREEMAN will be executed to release the required storage. Unfortunately, this GETMAIN/FREEMAIN combination will be executed for each message transmitted between the CICS regions. Some studies have shown that millions of unnecessary GETMAIN/FREEMAIN operations can be required with inappropriate settings of the IOAREALEN parameters.

There is no information that directly associates GETMAIN/FREEMAIN activity with Connection IDs. However, The TIOA for MRO message communication is obtained from the SMTP storage subpool, located in each region's ECDSA. CPExpert uses the GETMAIN/FREEMAIN activity against the SMTP subpool to gain insight into potential problems with the IOAREALEN specification.

CPExpert extracts information from the CICS Storage Domain Statistics (MXG CICSMD file) to identify all GETMAIN/FREEMAIN activity to the SMTP subpool for each CICS region. A screening criteria is applied before selecting information from the CICSMD file. This screening criteria excludes information unless the GETMAIN/FREEMAIN rate is greater than the value of the **SMTPGMRT** guidance variable in USOURCE(CICGUIDE). The default value of the SMTPGMRT is 25 GETMAIN+FREEMAIN per second.

After selecting SMTP subpool information for each region, CPExpert uses this information to select data from the CICS Terminal Control Statistics (MXG CICTCR file). This is because the MRO links "appear" to be terminal activity from a CICS view.

Information from CICTCR is selected for all regions that have GETMAIN/FREEMAIN activity sufficiently high that they were selected from the CICSMD file. CPExpert selects only information from CICTCR when the information applies to MRO. The amount of storage acquired for each TIOA (variable A06STG) is retained with the CICTCR information.

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CPExpert then combines the GETMAIN/FREEMAIN activity selected from the CICSMD file with the MRO link information selected from the CICTCR file. The information is weighted by overall activity, and the information is reported for the most significant connection IDs. Rule CIC269 reports the information about excessive GETMAIN/FREEMAIN activity for the MRO sessions, and provides information necessary to determine a correct specification for the IOAREALEN parameter. Rule CIC269 shows, for each connection id, the size of the TIOA and the percent that the specific size occurred.

The following example illustrates the output from Rule CIC269:

```
RULE CIC269:  EXCESSIVE GETMAIN/FREEMAIN ACTIVITY FOR MRO SESSIONS

   The IOAREALEN parameter specifications for the below connections might
   cause excessive GETMAIN/FREEMAIN activity.  The GETMAIN/FREEMAIN rate
   was greater than 25 per second to the Storage Domain SMTP Subpool.
   This high GETMAIN/FREEMAIN activity normally means that the IOAREALEN
   parameter was set to the default (zero), or was set to a smaller value
   than the TIOA (Terminal I/O Area) required to support the MRO traffic.
   The information shown below describes the total GETMAIN and FREEMAIN
   activity, the Connection ID, the percent of message activity to each
   Connection ID, and TIOA size (and the percent of message activity at
   that TIOA size for the Connection ID) for connections with the highest
   total function shipping activity.

             GETMAIN+  CONN    PERCENT
   APPLID    FREEMAIN   ID    ACTIVITY    TIOA--PCT    TIOA--PCT    TIOA--PCT
   CICS1TAA  191,502   1AAA     34.2      624 96.2%    120  3.7%
   CICS1TAA  191,502   1AAB     33.0      600 97.0%    264  2.9%
   CICS1TAA  191,502   1AAC     32.7      600 97.1%    344  2.8%
```

Suggestion: CPExpert suggests that you consider increasing the value(s) for the IOAREALEN parameter in the SESSION definition for the MRO sessions.

In the *CICS Performance Guide*, IBM recommends that for optimum storage and processor utilization, the IOAREALEN should be made slightly larger than the length of the most commonly encountered formatted application data transmitted across the MRO link for which the sessions are defined. CICS will add 24 bytes to this value for CICS requirements and the total should be a multiple of 64 bytes for most efficient use of system memory.

In the example Rule CIC269 shown above:

• A TIOA size of 624 (600 bytes for the message and 24 bytes for CICS purposes) was used on Connection ID 1AAA for 96.2% of the time.

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- A TIOA size of 600 (576 bytes for the message and 24 bytes for CICS purposes) was used about 97% of the time for Connection ID 1AAB and 1AAC.

If an IOAREALEN of 616 were specified, that size would accommodate all of the message traffic to the MRO link shown for the CICS1TAA region, with a substantial reduction in the number of GETMAIN/FREEMAIN operations. This suggested IOAREALEN value is based on IBM's recommendation that the memory acquired for a TIOT should be a multiple of 64. Thus, if 640 bytes of memory were to be acquired minus 24 bytes for CICS purposes, would be 616 to be specified for the IOAREALEN (640 - 24 = 616).

Note that the default value for the IOAREALEN parameter is 4096. According to IBM, this default would actually result in 4120 bytes of memory being acquired. Not only is 4120 not a multiple of 64 bytes, but it is unlikely that the 4120 bytes acquired would actually meet the needs of message traffic. It is more likely that a smaller amount of memory would meet the needs of the message traffic, and the 4120 bytes simply wasted memory. One approach in determining the optimal IOAREALEN value is to specify zero as the IOAREALEN parameter. In this case, CICS will acquire the actual amount needed for the message (plus 24 bytes). Running the CPExpert CICS Component would then cause Rule CIC269 to produce the actual TIOT area required to meet message traffic.

```
RULE CIC269:  EXCESSIVE GETMAIN/FREEMAIN ACTIVITY FOR MRO SESSIONS

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  was greater than 25 per second to the Storage Domain SMTP Subpool.
  This high GETMAIN/FREEMAIN activity normally means that the IOAREALEN
  parameter was set to the default (zero), or was set to a smaller value
  than the TIOA (Terminal I/O Area) required to support the MRO traffic.
  The information shown below describes the total GETMAIN and FREEMAIN
  activity, the Connection ID, the percent of message activity to each
  Connection ID, and TIOA size (and percent of activity that the TIOA
  size occurred) for connections with the highest total function shipping
  activity.

              GETMAIN+  CONN    PERCENT
  APPLID      FREEMAIN   ID     ACTIVITY    TIOA--PCT   TIOA--PCT   TIOA--PCT
  CICS2TBA      2.4M    2ABC      34.2      1560 65.7%  9344 27.2%  1592  6.5%
  CICS2TBA      2.4M    2ABB      33.4      1560 66.8%  1112 26.7%  7944  6.0%
  CICS2TBA      2.4M    2ABA      31.9      2368 68.2%  1560 26.0%  1928  5.4%
```

The example Rule CIC269 shown above illustrates a more complex distribution of message traffic against connections and TIOA sizes. A TIOA

size of 1560 was used on for about 66% of the messages on the first two connections (and was used 26.0% of the messages on the remaining connection).

However, the TIOA of 1560 was inadequate for 33.7% (27.2% + 6.5%) of the traffic on Connection ID 2ABC (a TIOA of either 9344 or 1592 was required), the 1560 TIOA was inadequate for 6.0% of the messages on Connection ID 2ABB (a TIOA of 7944 was required), and the 1560 TIOA was inadequate 73.6% (68.2% + 5.4%) of the messages on Connection ID 2ABA (a TIOA of either 2368 or 1928 was required). Further, 1560 is not a multiple of 64, nor is 7944 a multiple of 64.

Since more than 2 million GETMAIN/FREEMAIN operations were required, systems personnel should consider specifying 9320 as the IOAREALEN attribute for Connection ID 2ABC. Note that the resulting TIOT memory acquired would be 9344 (9320 + 24 = 9344), and 9344 is a multiple of 64. This specification should result in a substantial reduction of the more than 2 million GETMAIN/FREEMAIN operations.

Similarly, 7976 should be specified as the IOAREALEN attribute for Connection ID 2ABB. This value would result in 8000 bytes of memory being acquired (7976 + 24 = 8000, and 8000 is a multiple of 64).

Finally, 2344 should be specified as the IOAREALEN attribute for Connection ID 2ABA. This value would result in 2368 bytes of memory being acquired (2344 + 24 = 2368, and 2368 is a multiple of 64).

It should be noted that with IOAREALEN greater than 4096, SMF data shows that 16 bytes are added rather than 24 bytes as described above, as described in IBM documentation, and as described by IBM technical staff. This discrepancy has not yet been explained.

As mentioned in the discussion section, CPExpert applies a screening criteria to exclude information unless the GETMAIN/FREEMAIN rate is greater than the value of the **SMTPGMRT** guidance variable in USOURCE(CICGUIDE). The default value of the SMTPGMRT is 25 GETMAIN+FREEMAIN per second. You can control this analysis by adjusting the SMTPGMRT guidance variable.

Reference: CICS/TS for z/OS Release 2.3 *Performance Guide*: Section 4.11.4 Controlling the length of the terminal input/output area (SESSIONS IOAREALEN) for MRO sessions and Appendix 1.1.33.

CICS/TS for z/OS Release 3.1 *Performance Guide*: Section 4.11.4 Controlling the length of the terminal input/output area (SESSIONS IOAREALEN) for MRO sessions and Appendix 1.1.34.

CICS/TS for z/OS Release 3.2 *Performance Guide*:
　Chapter 20. MRO and ISC: performance considerations
　　Controlling the length of the terminal input/output area (SESSIONS
　　IOAREALEN) for MRO sessions

CICS/TS for z/OS Release 4.1 *Performance Guide*:
　Chapter 20. MRO and ISC: performance considerations
　　Controlling the length of the terminal input/output area (SESSIONS
　　IOAREALEN) for MRO sessions

CICS/TS for z/OS Release 4.2 *Performance Guide*:
　Chapter 12. CICS MRO, ISC and IPIC: performance and tuning
　　Controlling the length of the terminal input/output area (SESSIONS
　　IOAREALEN) for MRO sessions

CICS/TS for z/OS Release 5.1 *Performance Guide*:
　Chapter 14. CICS MRO, ISC and IPIC: performance and tuning
　　Controlling the length of the terminal input/output area (SESSIONS
　　IOAREALEN) for MRO sessions

"Tuning AOR/FOR Traffic in CICS/TS 1.2," **Paul Gordon** (Bank of America, USA), *Mainframe Week,* Issue 32, August 2002.

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　　　　Rule CIC269.6