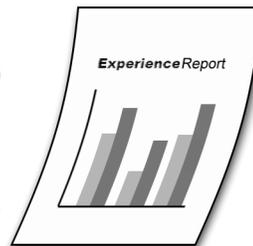


iSeries



Reclaim spooled file storage

Experience Report



iSeries



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Introduction

As hardware capacity and workloads on the system increase, customers are creating ever increasing numbers of spooled files. In order to handle the demand for database members in which to store spooled files, the operating system spool support maintains a list of available members in the QSPL library. If one of these members is available when a new spooled file is created, the system reuses it. If not, a new member has to be created. The available members are cleared in the background by the QSPLMAINT system job. If they are needed before the system job gets to them, they are cleared during spooled file open. The QRCLSPLSTG system value and the RCLSPLSTG command are the means for deciding how long these available members are allowed to stay on the system after a spooled file which uses them is deleted. Customers who try to keep their storage to a minimum can cause themselves performance problems in high volume spooling environments. This experience report is meant to provide information that will help customers decide on the best use of the reclaim spool storage features to avoid causing these performance problems.

This experience report will:

- Provide general information about how the operating system uses the QRCLSPLSTG system value to control the reuse of database members in QSPL.
- Provide information about messages that can be expected if performance problems are encountered due to improper use of the reclaim spooled file storage features.
- Give general recommendations for setting of the system value QRCLSPLSTG.
- Give general recommendations for the use of the RCLSPLSTG CL command.
- Describe several scenarios which illustrate how the spooling function of the operating system utilizes a database member depending on the use of these reclaim features.

General information about the QRCLSPLSTG system value

QRCLSPLSTG with days set to *NONE

When the QRCLSPLSTG days value is set to *NONE, the system immediately deletes the database member used for a spooled file when the spooled file is deleted. Thus, there are no members available when a user program opens a new spooled file. Instead, a new database member must be created in one of the database files in QSPL. An exclusive lock on the database file must be held while the member is added and all other users of that file are locked out during that period of time. When a spooled file is deleted, the database member must be deleted. While the member is deleted, an exclusive lock on the database file must also be obtained and held during the removal of the member from the file. Once again, no other jobs can create or remove members using that database file during this period of time.

QRCLSPLSTG with days set to 1-8 or *NOMAX. Member available and already cleared

When the QRCLSPLSTG days value is set between 1 and 8, database members used for spooled files are not deleted until they haven't been used for the number of days specified. If the value is *NOMAX, they are never deleted. Thus, when a user program opens a spooled file, there are probably members available for spool to use. If a member has been available long enough for the QSPLMAINT system job to have cleared the member, the member can be immediately used for the spooled file with no locks obtained on the database file. When the spooled file is deleted, the member is not deleted but is instead marked as partially available. The system job looks for partially available members and clears the database member, truncates it to a minimum size, and marks the database member as fully available. Once again, no locks need be obtained on the database file in QSPL. Other jobs can also be using members in that database file.

QRCLSPLSTG with days set to 1-8 or *NOMAX. Member available but not cleared

Again, when a user program opens a spooled file, there are probably members available for spool to use. If no member has been available long enough for the QSPLMAINT system job to have cleared the member but there is a member that is partially available, the member is immediately cleared and can be used for the spooled file with no locks obtained on the database file. When the spooled file is deleted, the member is not deleted but is instead marked as partially available. The system job looks for partially available members and clears the database member, truncates it to a minimum size, and marks the database member as fully available. Once again, no locks need be obtained on the database file in QSPL. Other jobs can be using members in that database file.

Messages that can indicate the need to adjust the use of the QRCLSPLSTG system value or the use of the RCLSPLSTG command

MCH5802 - *Lock operation for object &1 not satisfied.*

If this message is issued to the program QDBCRTME and the object identified is a file name like Q04079Nxxx or Q00512Nxxx where xxx is a number between 001 and 999, it indicates that there is a great deal of contention when trying to create a new member in which to store a new spooled file. This message will normally be followed by a CPF3222 diagnostic message and a CPF3207 escape message from QDBCRTME to QSPFILES. QSPFILES is the spool program which allocates database members for new spooled files. If there are no members available in the pool of members that spool keeps for reuse, it must create a new database member. This message indicates that other jobs are also creating new members in the same database file in order to create spooled files.

This message also indicates the amount of time the job waited to lock the object before giving up. This value is generally the default wait time specified in the subsystem class description where the job was initiated. The shipped default is 30 seconds. Increasing this value may reduce the frequency of this message. However, this may cause other performance problems for the job as it will wait longer for locks on other objects.

CPF3207 - *Member not added. Errors occurred.*

This message is the follow-up message sent from QDBCRTME to QSPFILES when it is unable to create a member in the database file specified by QSPFILES. QSPFILES will then retry the create of the member up to 10 times. If the database member can not be created in 10 tries, QSPFILES will return to QSPOPEN with an error indicating that a database member couldn't be created.

CPF4182 - *File &2 in library &3 member or device &4 not opened.*

This message is issued from QDMCOPEN to a program that is trying to create a spooled file when, for some reason, the spooled file cannot be created. The substitution text for &2 is the printer file name being opened. One reason for this error is that there are no available database members for spool to use in its pool of members for reuse and it cannot create a new member due to time outs during the create. It is up to the user program which is trying to create a spooled file to monitor for this message and retry the open of the printer file.

MCH3402 - *Tried to refer to all of part of an object that no longer exists.*

This message can be issued to several spool programs if a RCLSPLSTG DAYS(*NONE) is run followed by a RCLSTG which produces spooled files. Normally spooled files are not produced by RCLSTG but if for some reason they are (such as an FFDC dump) and there are no available members for spool to use for the spooled file, a condition can occur whereby this damage message is issued when trying to work with certain spooled files.

General recommendations for setting of system value QRCLSPLSTG and use of RCLSPLSTG CL command

The following recommendations can be used as guidelines to set the QRCLSPLSTG system value:

- Set the value for the number of days to be the number of days between creation of the largest volume of spooled files for the system plus 1. For example if 250,000 spooled files are created once a week (end of week processing), set system value QRCLSPLSTG to DAYS(8). If approximately the same number of spooled files are created each day, let the QRCLSPLSTG value for days default to 8.
- Never set the system value QRCLSPLSTG to DAYS(*NONE) unless directed to by IBM i5/OS^(R) development.

If the customer wishes to control removal of members themselves rather than having the system job QSPLMAINT perform this task, the following recommendations can be used as guidelines for the use of the RCLSPLSTG command:

- Set the system value QRCLSPLSTG to DAYS(*NOMAX) so that the system job will not remove any database members.
- Use the RCLSPLSTG CL command on some regular basis with the value of the DAYS parameter equal to the number of days between creation of the largest volume of spooled files for the system plus 1. For example if 250,000 spooled files are created once a week (end of week processing), use RCLSPLSTG DAYS(8). If approximately the same number of spooled files are created each day, use RCLSPLSTG DAYS(8).
- Never use RCLSPLSTG DAYS(*NONE) unless directed to by IBM i5/OS^(R) development.

If the customer has a runaway job that creates hundreds of thousands of spooled files:

- Wait until the normal number of days passes between recurring large create cycles as determined above.
- If the system value for QRCLSPLSTG is not *NONE and not *NOMAX, let the operating system clean up the extra unused database members.
- Wait one day and then use RCLSPLSTG DAYS(1) to clean up the extra unused database members. This will allow a pool of available members to be utilized by spool which will lessen system performance impacts.

Reclaim spool storage scenarios

Scenario: Numerous errors received creating a spooled file with QRCLSPLSTG system value set to *NONE

When the QRCLSPLSTG system value is set to *NONE on a machine with a heavy spooling environment, bottleneaking on database files in QSPL can result. All spooled files being created from jobs with the same last digit in their job number attempt to use the same database file in which to create their members. This can result in applications taking significantly longer to create a spooled file or even failing. Because of this, jobs attempting to create spooled files or job logs can go into LCKW or hang in END status until the job log for the job can be cut. Messages MCH5802, CPF3222, CPF3207, and CPF4182 can result. Applications which don't handle the CPF4182 can end abnormally.

Recommendations:

- Change the QRCLSPLSTG value to a value from 1-8 depending on the length of time between the largest number of spooled files being created.

Scenario: Numerous errors received creating a spooled file after running the command RCLSPLSTG DAYS(*NONE)

After running the RCLSPLSTG DAYS(*NONE) command on a machine with a heavy spooling environment, bottleneaking on database files in QSPL can result. All spooled files being created from jobs with the same last digit in their job number attempt to use the same database file in which to create their members. This can result in applications taking significantly longer to create a spooled file or even failing. Because of this, jobs attempting to create spooled files or job logs can go into LCKW or hang in END status until the job log for the job can be cut. Messages MCH5802, CPF3222, CPF3207, and CPF4182 can result. Applications which don't handle the CPF4182 can end abnormally.

Recommendations:

- When running the RCLSPLSTG command, use a DAYS value of 1-8 depending on the length of time between the largest number of spooled files being created.
- Do not use the RCLSPLSTG command but instead set the QRCLSPLSTG system value to a value from 1-8 depending on the length of time between large numbers of spooled files being created and let the system delete excess spool database members when appropriate.

Scenario: Numerous errors received creating or using spooled files after running RCLSTG

A customer has his QRCLSPLSTG system value set to *NONE or he has recently run RCLSPLSTG DAYS(*NONE). He then runs RCLSTG and due to an error, an FFDC dump is produced. The customer may encounter damage on spool database members in QSPL when trying to create a spooled file and may not be able to create any spooled files (including a job log) for that job. Because of this, jobs attempting to create spooled files or job logs may get message CPF4182 indicating a spooled file could not be created, followed by CPF2528 if that spooled file was a job log. The job may end abnormally with no spooled files created. Users may notice MCH3402 errors when using spooled files. One or more database files in QSPL indicate damage when a DSPLIB QSPL is issued.

Recommendations:

- Do not set the QRCLSPLSTG system value to a days value of *NONE.
- Do not use the RCLSPLSTG DAYS(*NONE) unless there are no plans to run RCLSTG for period of time long enough such that spooled files will be created and deleted before the RCLSTG.
- Eliminate the cause of the spooled file being created during the RCLSTG.

Scenario: Numerous errors received creating a spooled file when QRCLSPLSTG system value is set to a value that is too low

On a normal day, the customer creates and deletes around 10,000 spooled files. Once a week, the customer creates and deletes 100,000 spooled files. If the days value for QRCLSPLSTG is set to 5, 5 days after the customer creates his 100,000 spooled files, 90,000 database members which haven't been used since the spooled files were deleted will be deleted. Then, 2 days later, the customer again creates 100,000 spooled files but only 10,000 database members will be available. This may cause bottleneaking on database files in QSPL as 90,000 new members must be created. Because of this jobs attempting to create spooled files or job logs can go into LCKW or hang in END status until the job log for the job can be cut. Messages MCH5802, CPF3222, CPF3207, and CPF4182 can result. Applications which don't handle the CPF4182 can end abnormally.

Recommendations:

- Change the QRCLSPLSTG value to a value like 8 that is at least one day longer than the length of time between the largest number of spooled files being created.

How IBM is dealing with this problem

IBM is investigating the possibility of a more sophisticated algorithm for retaining a pool of available members based on the customer's usage of spool. A solution may or may not be delivered in some future release.

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