

Limiting WebSphere MQ Licensing and Processing Capacity with Workload Groups

Recently IBM updated the virtualization technologies that a product can be licensed under. This update now include IBM i workload groups as a valid virtualization technology. This article will outline how to set up WebSphere MQ to leverage workload groups to limit the licensing and processing on an IBM i partition. This new support is only available on Power 7 hardware running IBM i 7.1 or higher with WMQ 7.1 or higher. These basic steps also apply to any other IBM software product that is licensed per processor that recognizes various sub capacity options through virtualization.

Workload groups is a technology that gives you the ability to assign jobs, subsystems, and applications to a number of whole processors that are less then what has been configured to your partition. Example, if you have a partition with 5 processors, today, every job on the partition has access to all 5 processors. With workload groups, you can put a specific job into a group that is limited to 1 processor. This will ensure that job, no matter how busy it gets, will never have access to more then a single processor core worth of capacity.

Overview:

- Adding the workload group to your partition
- Associating the MQ workloads with the workload group
- Update the licensing for the WebSphere MQ product to the workload group
- Verifying the MQ workloads are limited by the workload group

Adding the workload group to your partition

The first step in limiting WebSphere MQ to a processing capacity less than the configured processing capacity of a partition is adding a workload group to the applicable partition(s). The workload group is added with the processor limit (the desired maximum number of processor cores, a.k.a. the cap) with the Add Workload Capping Group (ADDWLCGRP) command.

The following screenshot shows an example of adding workload group MQTEST with a processor limit of 1 processor core:

```
Add Workload Capping Group (ADDWLCGRP)

Type choices, press Enter.

Workload capping group . . . . . > MQTEST      Name
Processor limit . . . . . > 1                1-256
```

Figure 1 - Creating a workload group

Creating the workload group is an easy operation, requiring simply a name for identification later and the number of processor cores that are to be in this group. The processor limit is specified in whole number of cores. You are not limited to a single workload group, the operating system allows you to create 256 different groups on a single LPAR if you need.

Associating the WebSphere MQ workloads with the workload group

Once the workload group has been added to your partition(s) you will have to associate the appropriate WebSphere MQ workloads with the workload group. Associating the MQ workloads with the workload group will result in the relevant jobs and threads being limited by the processor limit established by the workload group.

The applicable workloads for WebSphere MQ can be limited by associating the QMQM subsystem to the previously established workload group. The subsystem must be associated with a workload group prior to the subsystem being started. The QMQM subsystem is tied to the workload group by creating data area QSYS/QWTWLCGRP with the subsystem name and workload group name. When a subsystem is started, this data area is read to determine if a subsystem is associated with a workload group. This association can only be done during subsystem startup. This ensures that all job/process/threads running under that subsystem are limited by the number of processors specified in the workload group. If that data area already exists, then you need to update it to include the QMQM subsystem with the desired workload group.

The following screenshot shows the creation of the QSYS/QWTWLCGRP data area with the QMQM workload tied to the MQTEST workload group:

```

Create Data Area (CRTDTAARA)

Type choices, press Enter.

Data area . . . . . > QWTWLCGRP      Name
Library . . . . . > QSYS          Name, *CURLIB
Type . . . . . > *CHAR          *DEC, *CHAR, *LGL, *DDM
Length:
Length . . . . . > 2000          1-2000
Decimal positions . . . . . >          0-9
Initial value . . . . . > 'QMOM_    MQTEST  '
-----
Text 'description' . . . . . > 'Subsystems to use workload capping'
-----

Additional Parameters

Authority . . . . . > *USE          Name, *LIBCRTAUT, *CHANGE...

Bottom

```

Figure 2 - Create workload group association with subsystem

It is also possible to create a WMQ Queue Manager to use a subsystem other than QMQM. In this scenario, those subsystems would also need to be added to the data area so that its resources can also be limited by the workload group. Adding QMQM and any other Queue Manager subsystems will essentially limit the resources associated with the WMQ product. If there are application jobs using WMQ that also need to be limited by the workload group, then those jobs and/or subsystems may also need to be added to the workload group. There is no way to predetermine (outside of assigning a job to a capped subsystem) which jobs will be associated with a given workload group. The workload group is an attribute of the job so in order to associate an individual job, it's attributes will need to be changed. This can be accomplished with the Change Job (CHGJOB) command or the Change Job (QWTCHGJB) API. The change of the job attributes will result in an audit record which will include the workload group name. For example to add job MQAPP to workload group MQTEST, the CHGJOB command would look something like this:

CHGJOB JOB(123456/MQUSER/MQAPP) WLCGRP(MQTEST)

Associating an individual job with a workload group is something that can be done on the fly. The next time this job is scheduled to run, the operating system verifies the workload group and ensures this job (and all its associated threads) only have access to the processing capacity specified in the workload group.

Update the licensing for the WebSphere MQ product to the workload group

The WebSphere MQ licensed program can be associated with the workload group to provide an easy way to illustrate that the product's workloads have been limited to a particular processing capacity. The Add WLC Product Entry (ADDWLCPRDE) command can be used to link the product with the workload group.

The following screenshot details how WebSphere MQ, release V7R1M0 product is added to the MQTEST workload group:

```
ADD WLC PRODUCT ENTRY (ADDWLCPRDE)

Type choices, press Enter.

WORKLOAD CAPPING GROUP . . . . . > MQTEST           Name
Product identifier . . . . . > 5725A49           Identifier
License term . . . . . > V7R1M0           Vx, VxRy, VxRyMz, *ALLINS
Feature . . . . . > 5050           5001-9999, *ALLINS

Bottom
```

Figure 3 - Associate the WebSphere MQ product with the workload group

This step only identifies for licensing purposes that the product has been limited. To ensure you are compliant; you need to be sure that the necessary jobs/subsystems have been associated with the workload group specified in this step.

Verifying the MQ workloads are limited by the workload group

Now that the workload group is established, the subsystem is tied to the workload group, and the product has been associated with the workload group, the QMQM subsystem (or any other subsystems you may have specified) can be started. After the subsystem is started, any workload that runs in the subsystem from that point on will be limited to the processor (core) limit of the workload group.

When the subsystem starts, message CPI146C indicating that the subsystem is limited by the workload group will be issued to the subsystem joblog. This screenshot shows the content of the message:

```
Additional Message Information
Message ID . . . . . : CPI146C      Severity . . . . . : 00
Message type . . . . . : Completion
Date sent . . . . . : 05/17/11     Time sent . . . . . : 15:26:24

Message . . . . . : Subsystem QMQM is using workload capping group MQTEST.
Cause . . . . . : Subsystem QMQM will use workload capping group (WLCGRP)
MQTEST when starting new jobs or new routing steps.
Technical description . . . . . : Use the Display Workload Capping
Group (DSPWLCGRP) command for more information.
```

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Figure 4 - Subsystem workload group association message

There are various methods to verify that the WebSphere MQ workloads and product are being properly limited.

The simplest way to verify the workload group settings on your partition is the Display Workload Capping Group (DSPWLCGRP) command. The command output will show the workload groups, their processor limit, and any licensed programs that are tied to the workload group. This screenshot shows the output of the DSPWLCGRP command:

```

Display Spooled File
File . . . . . : QSYSPRT
Control . . . . . : _____
Find . . . . . : _____
*...+...1...+...2...+...3...+...4...+...5...+...6...+...7...+...8...
                Display Workload Capping Group                LP000000
                                                                05/17/11 15:44:22
Workload capping group . . . . . : MQTEST
Processor limit . . . . . : 1
Product Entry
  Product identifier . . . . . : 5725A49
  License term . . . . . : V7R1M0
  Feature . . . . . : 5050
          * * * * * E N D O F L I S T I N G * * * * *

```

Figure 5 - Display workload groups output

If your partition has auditing enabled, multiple audit log entries will be created for various workload group functions. The functions audited are:

- A JS (Job Change) journal entry with the workload group is written to the QAUDJRN journal when starting, ending, or changing a job.
- Adding, updating, and removing workload groups.
- Adding and removing licensed programs associated with workload groups.

The following screenshot illustrates an audit entry for a job starting and being limited by the MQTEST workload group:

```

Display Journal Entry
Object . . . . . : Library . . . . . :
Member . . . . . :
Incomplete data . . . : No           Minimized entry data : *NONE
Sequence . . . . . : 264
Code . . . . . : T - Audit trail entry
Type . . . . . : JS - Job data

Entry specific data
Column *...+...1...+...2...+...3...+...4...+...5
02801  '
02851  '
02901  '
02951  '
03001  ' *NONE *SYSBAS 00001QN06'
03051  '00CST2MQTEST
03101  ' *SYSBAS 000000'
Bottom

```

Figure 6 - Details of workload groups audit log

For details on auditing the addition, removal, and changes of workload groups see the following Information Center article:

<http://publib.boulder.ibm.com/infocenter/series/v7r1m0/topic/rzam8/rzam8audwrkcap.htm>

Aside from the audit entries, the jobs' association with the MQTEST workload group can be programmatically verified by retrieving the attributes of their (the jobs') threads. The workload group name can be retrieved using the Retrieve Thread Attribute (QWTRTVTA) API.

After retrieving the job's workload group name, you can use the Retrieve Workload Capping Group Information (QLZRTVWC) API to retrieve additional information about the workload group. This information can be used to programmatically verify that the workload group has the correct processor core capacity. See the IBM i Information Center for documentation on how to use the QLZRTVWC API.

To make use of this support you need to ensure you have a couple of PTFs applied to your system. The primary PTF for this support is:

PTF/FIX #: SI39795 - IBM i
LICENSED PROGRAM: 5770SS1

This primary PTF has a number or requisite PTF associated with it. They are all listed in the cover letter. Ensure all these PTFs are applied including any PTFs that have superseded these specific PTFs. In addition, ensure SI46357 – 5770SS1 is also applied.