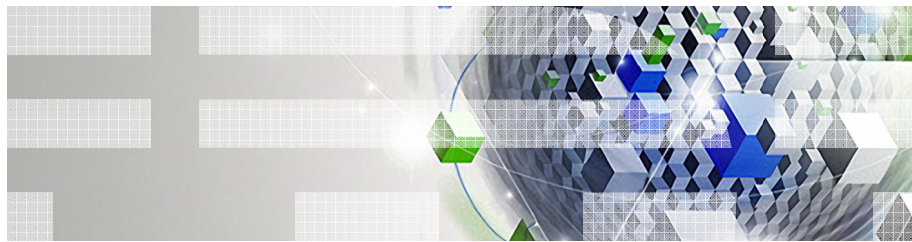


## Get Your System Under Control; Leverage Workload Groups

[timmr@us.ibm.com](mailto:timmr@us.ibm.com) – Business Architect for Application Development



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### The problem

- Power systems are ALL about virtualization
- IBM i has been able to control work on a system for years
  - Subsystem
  - Memory Pools
  - Batch queues
- On IBM i today, how do you control a job from over running the capacity on a system?
  - Run priority
  - Separate Memory Pools
  - Maximum number of threads in a memory pool
  - Separate Partitions

▪

## Why is this a problem

- Virtualization is a key play driving Power Systems and SWG
  - PowerVM and AIX WPARs enable flexible software cap/licensing by processor
  - IBM i integrated stack promotes consolidation into large partitions
    - No means to cap/license a defined IBM i workload within a partition
  - IBM i issue is magnified by P7 multi-core transition
  - Our customers are asking for it
- IBM i clients requirements
  - Large Users Group (LUG MK0839 – Oct 2008)
  - COMMON Americas Advisory Council (CAAC - 2009)
  - COMMON Europe Advisory Council (CEAC MK0067 – Jun 2009)
  - ISV Advisory Council (ISV OS0134 – May 2009)

## IBM i Consolidation and Virtualization

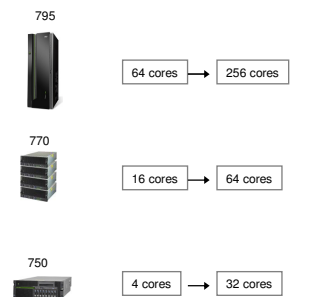


- Supporting multiple workloads within single operating system image has always been a hallmark of IBM i

- IBM i clients often run very large, single partitions

- Consolidation strategies have resulted in larger single partitions, with increasing number of cores

- Power Systems continues to deliver larger SMPs
- System consolidation remains key strategy for Power Systems



## The problems

- Licensing - ie pay for what you use
  - As customers scale vertically, they must pay for additional IBM & Vendor software licenses even if the additional scale demands are not caused by this software. Adding cores to an existing LPAR is cost prohibitive, you pay for the core plus the software cost even if you don't need the extra capacity for the Software.
  - Today, only solution is to remove that workload and put it into a separate partition
  - OR PAY

## Solution - What is Workload Groups

- Provide a method for users to set the amount of processing capacity for a Workload.
  - A workload is defined as a job, subsystem, or product
  - Conceptually if a workload is capped at 1 processor core on a multi core system, the capped workload should respond as if its running on a single core system

## Purpose of Workload Groups

### ■ Workload control

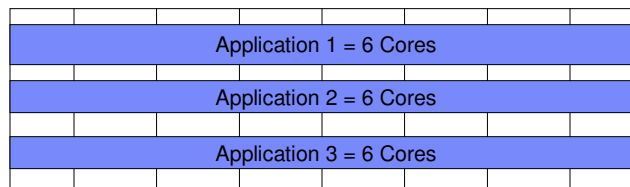
- Fence a workload to a specified number of processors
- Ensure unstable jobs do not have the ability to adversely effect the system performance

### ■ Control Licensing cost

- License a product to less cores then in that partition and ensure that product is fenced

## IBM i Today

- IBM i Workload Management
  - Subsystems provide workload isolation
  - Priorities are used to schedule work
  - No way to cap a given app to a subset of the processor resources in a partition
- All workloads can access the full number of Cores in the Partition

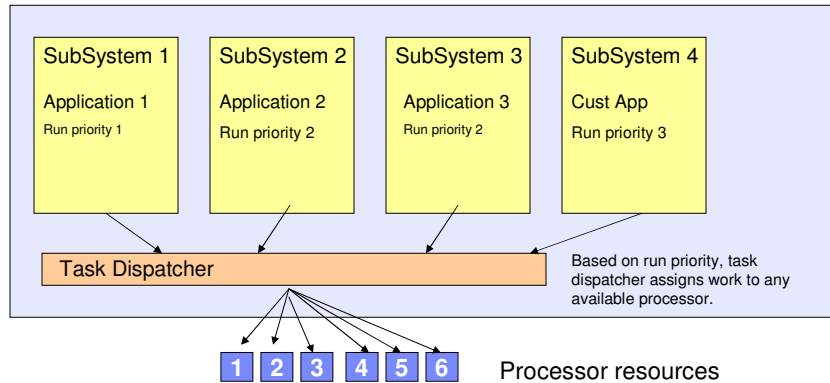


IBM i System / Partition

- Virtually all customers run multiple applications on a single IBM i
- Consistent with integrated value proposition

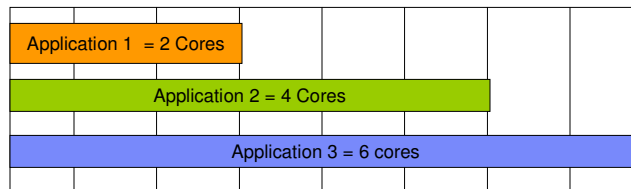
## IBM i Today

Every product today has complete access to every processor assigned to a partition. Scheduling is done based on the potential for every processor to be running that product.



## IBM i Workload Groups

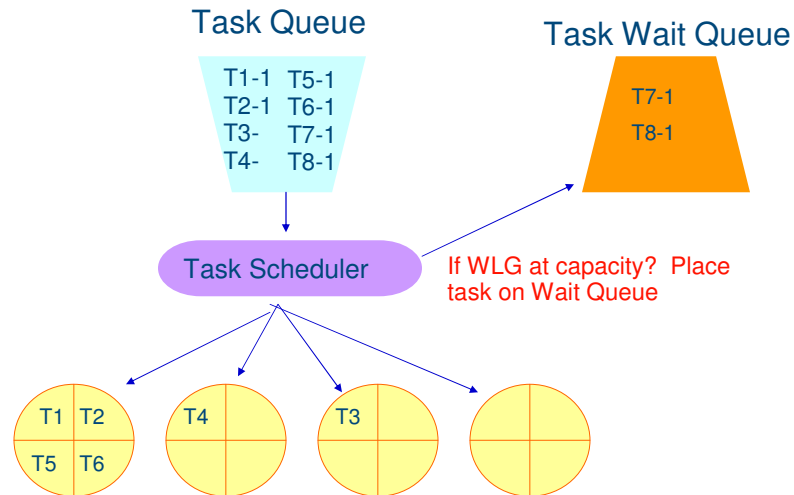
- Customer specifies a workload to be limited to lower than available capacity, OS enforces that limit.



IBM i System / Partition

- Works within a Single IBM i system / partition
- Supported across IBM i subsystems
- Limits placed at the whole processor-core level

## How this works



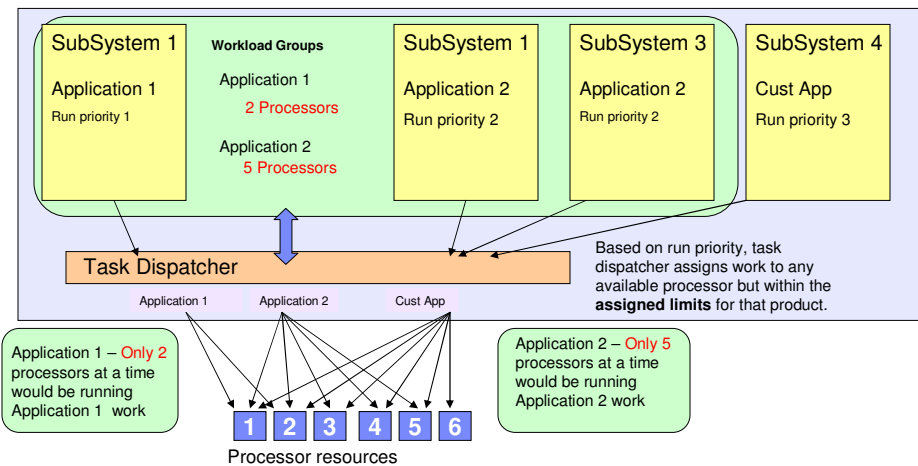
11

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## IBM i with Workload Groups

Products/Applications only have access to the number of processors assigned regardless of the number in the partition. Control is enforced at the task dispatcher.



12

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## Simple Story View

1. Create Workload Group <group name> <# Cores> <product>
2. Set Group on workload <group name>
  - Specify for the Sub System
  - Set on an Active Job
3. The identified work (every job or thread) is limited to running concurrently on the # Cores specified in the Workload Group

# Big News - IBM Software Products Now Support Workload Groups

## Summary of Virtualization Capacity Licensing Requirements

### ▪ Customers must:

- ▶ Adhere the to Sub-capacity licensing terms of the Passport Advantage agreement, including:
  - Use Eligible Sub-capacity Products
  - Use Eligible Virtualization Technologies
  - Use Eligible Processor Technologies
  - Use the IBM License Metric Tool (ILMT) and maintain report documentation
    - Tivoli Asset Discovery for Distributed (TADd) may be used in lieu of IBM License Metric Tool
    - Certain ILMT / TADd use exceptions may apply
- ▶ Follow Virtualization Capacity License Counting rules for their Eligible Virtualization Environment's

#### PLEASE NOTE:

- The above is only a summary. For details about sub-capacity licensing requirements, see the [IBM Passport Advantage Agreement](#) and other information referred to above, at [Passport Advantage Virtualization Capacity website](#)
- Customers are responsible for the installation of the IBM License Metric Tool and for the server it runs on.

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## Definitions

### ▪ VM – Virtual Machine

- ▶ A VM represents a complete system with processors, memory, disk and network resources
- ▶ Multiple VMs can share physical resources and run side by side on the same server

### ▪ Virtual Core (also vCPU)

- ▶ Each VM is assigned a virtual core quantity
- ▶ Each virtual core is equal to one core for PVU licensing
- ▶ The processing capacity of a virtual core cannot be more than one physical processor core

### ▪ Server

- ▶ A machine that provides resources (i.e. processor core capacity) to the VMs
- ▶ Includes single standalone servers or servers within clusters or resource pools

### ▪ Workload Group

- ▶ A workload group defines the number of processor cores that can be used concurrently by jobs and threads that are associated with the group.

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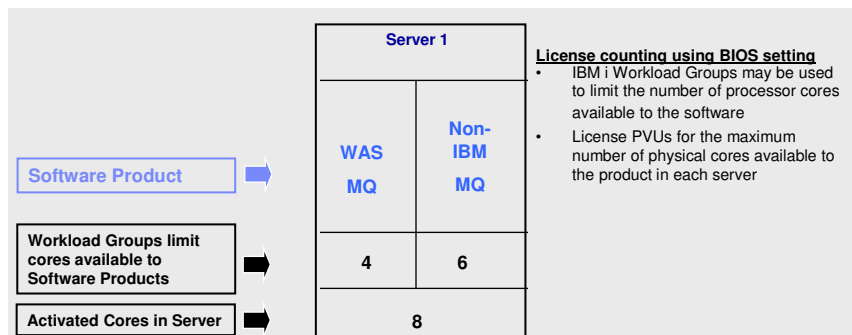
## Licensing Rules

- Sub-capacity eligibility for IBM i Workload Groups is limited to the latest version of the Eligible Sub-capacity Product as of February 7, 2012 running on Power 7 processors.
- License PVUs for the maximum number of virtual cores in the VM(s) available to the Eligible Product at any point in time
- License PVUs for the lower of the sum of virtual cores for each VM for a product or the processor capacity of the workload group
- If ILMT does not yet support a Eligible Virtualization Environment, or you qualify for an exception to use ILMT, you will need to follow the Manual Calculation of Virtualization Capacity.

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### Example : License counting using Workload Groups to limit processor core capacity available



► For above example, the PVU Virtualization Capacity licensing requirement is based on the maximum number of physical cores available to a product in each server

Cores to License	Workload Group 1	Workload Group 2	Virtualization Capacity	Full Capacity
WAS	4	-	4	8
MQ	4	6	10	8

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## Manual Calculation of Virtualization Capacity

- **Eligibility Criteria:** Customers must use the IBM License Metric Tool, with the following exceptions
  - ▶ ILMT does not support the Eligible Virtualization Environment
  - ▶ Customer has fewer than 1000 employees and contractors - [Tool recommended](#)
  - ▶ Customer server Full Capacity licensing for a PVU product is less than 1000 PVUs (on servers with an Eligible Virtualization Environment) - [Tool recommended](#)
- **Requirements:** For the above exceptions, customers must manually manage, track and prepare Audit Reports
  - ▶ An Audit Report must be prepared at least once per quarter and identify the following detail: Each Eligible Sub-Capacity Product deployed in each Eligible Virtualization Environment
  - ▶ An Eligible Virtualization Environment can be a Single Server or a Group of Servers (Server Cluster)
  - ▶ In addition to the above detail, the report should provide a summary total of the required number of PVUs by and for each Eligible Sub-Capacity Product

The above is only a summary. For detailed terms please see the [Passport Advantage Sub-capacity licensing audit Report](#)

Audit Reports must be prepared as frequently as is required to maintain a history of increases to Virtualization Capacity and Full Capacity

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## Manual Calculation of Virtualization Capacity – Rules

The PVU Virtualization Capacity licensing requirement is based on the maximum number of physical cores available to a product in each server

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IBM Power Systems

Manual Calculation of Virtualization Capacity - Worksheet Example

Worksheet has 3 tabs;

use the following tabs

- Instructions & Information
- Single Server
- Group of Servers "Cluster"

Web Link: Worksheet for Manual Calculation of Virtualization Capacity

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VIRTUALIZATION ENVIRONMENT - SINGLE SERVER

This worksheet is for one standalone server for one Software Product

Per the instructions on the first tab, you may choose to leverage this approach or develop / leverage your own processes and reporting format so long as you capture all of the information below

Enter data in input fields below (shaded area)

\* Mandatory

Date of this Audit Report *	March 31, 2009
Product Name *	IBM WEBSHERE APPLICATION SERVER NETWORK DEPLOYMENT
Program Identification Number (S7xxx-xxxx)	S724-H88
P/N Description	IBM WEBSHERE APPLICATION SERVER NETWORK DEPLOYMENT PROCESSOR VALUE UNIT (PVU)
Part Number	D55WUUL
Server ID / Location	Server ID # F6015, Bldg 1, Room 1, Somers, NY
Server Vendor / Brand	IBM System x
Server Model	xxxxxx
Virtualization Technology used *	VMware ESX 3.5
Processor Technology (Vendor, Brand, Type, Model) # (A)	Intel Xeon Quad Core Model 35XX
PVUs per core # (A)	70
Total Activated Cores on Server # (C)	8
Full Capacity PVUs for Server # (C)	560

VM, Partition ID *	DO NOT DELETED ROW	Cores (B)	User Comments
(whatever identifier used for any subdivision of a server such as LPAR #, IP address, hostname, etc.)	per Partition or VM *		
A	4		
B	4		
C	2		
D	2		

Sum of Virtual Cores *	12
PVUs per core *	70
Virtualization Capacity PVUs by Product for Server *	840
PVU Licenses required by Product for Server # (C)	560

\* Mandatory Field

(A) PVUs required for each physical processor core are listed on the PVU table (see link below, including vendor/brand designations)

[http://www.ibm.com/software/development/advantage/vpu\\_licensing\\_for\\_customers.html](http://www.ibm.com/software/development/advantage/vpu_licensing_for_customers.html)

(B) For purposes of "Manual Calculation" of Virtual Capacity, 1 virtual core (or CPU) is equivalent to 1 physical core. Enter values in whole cores.

(C) Lower of Full Capacity or Virtualization Capacity

Instructions + Information

Single Server

Group of Servers "Cluster"

IBM Power Systems

Developer Works

<https://www.ibm.com/developerworks/mydeveloperworks/wikis/home?lang=en#/wiki/IBM%20i%20Technology%20Updates/page/IBM%20i%20workload%20groups>

IBM

English

Sign in (or register)

developerWorks

Technical topics

Evaluation software

Community

Events

Search developerWorks

Public Wikis

My Wikis

Help

This Wiki

Search

IBM i Technology Updates

IBM i Technology Updates

DB2 for i - Technology Updates

General IBM i operating system

IBM Portable Utilities for iSeries

Automate Extra IPL for iSeries

IBM i workload groups

Extend CD (Command) for iSeries

Achieve faster IFS save for iSeries

CL retrieve exit program for iSeries

Look down BNDSPVPG for iSeries

Hardware and Firmware

Integration with BladeCenter

Java on IBM iSeries

IBM iSeries and iSeries

You are in: IBM i Technology Updates > IBM i Technology Updates > General IBM i operating system > IBM i workload groups

IBM i workload groups

Updated Apr 19 by ScottForstie

Tags: None

Page Actions

IBM i 7.1 now provides workload groups. Workload groups provide the ability to restrict a workload to a specified maximum number of processor cores within the partition it is running in.

A workload is defined as a job, subsystem, or product running on the IBM i system. The user or system administrator can define a workload group, assigning a specified number of processing cores to that group. The workload group is then assigned to a job or subsystem. Once the assignment has been done, the workload is limited to the defined number of processing cores. The system enforces this processing core assignment, ensuring that a job or all the jobs running (and threads) under the subsystem are not allowed to run on more processing cores than have been designated. The general concept is if a workload is designated to use a single core, the workload will behave as if it is truly running on a single processor core system.

Example of how workload works


A user has a batch job that is very CPU intensive. The user needs to run this job during the day but can't afford to impact the performance of their production system. By assigning this batch job to a workload group, this job can be put into a "processing

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## Developer Works – Workload Groups MQ setup

sf99357 13 windows 13 esx 12 vmware 12 bladecenter 9 system_x 9 5.4 8 blade 8 sf99309 6 save 5 View as list   <a href="#">cloud</a>   <a href="#">all</a>	<p>To learn more about the workload groups support, visit the IBM i Information Center at <a href="http://publib.boulder.ibm.com/pubs/html/as400/infocenter.html">http://publib.boulder.ibm.com/pubs/html/as400/infocenter.html</a></p> <p><b>Configure WebSphere MQ to use workload groups</b></p> <p>Learn how to configure your systems to leverage workload groups for the WebSphere MQ product. Limit the amount of processing capacity available to this product to better fit your licensing needs based on the capacity being used for this product. To see the details, follow this link: <a href="#">Limiting WebSphere MQ Licensing and Processing Capacity with Workload Groups</a>.</p> <hr/> <p>Updated Apr 19 by ScottForster Show Changes  <a href="#">Comments (0)</a>   <a href="#">History of Changes</a>   <a href="#">Attachments</a>   <a href="#">About</a></p> <p> <a href="#">Subscribe to this page</a></p>
---	--

Instructions for setting up MQ to take advantage of Workload Groups

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## Key Web Links

- IBM i Specific links
  - [IBM i Zone Developer Works](#)
  - [InfoCenter for Workload Groups](#)
- PVU
  - [PVU table and other information](#)
- Sub-capacity
  - [Passport Advantage Sub-capacity licensing information](#)
  - [Virtualization Capacity License Counting Rules](#)
  - [Passport Advantage Sub-capacity licensing terms](#)
  - [Passport Advantage Sub-capacity licensing FAQs](#)
  - [IBM Developer Works - Workload Groups](#)

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## Workload Groups – Performance Monitoring

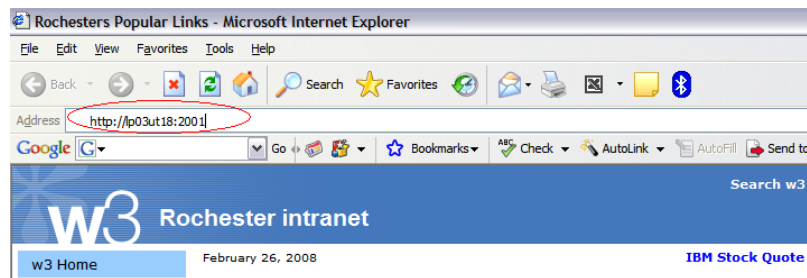
- Once you have an application running in a workload group, how do you know what is happening ?
- Are the jobs being restricted too much ?
- Do you need to add additional CPUs to the workload group ?
- Do you have too many CPUs allocated to the workload group ?

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## How does it work ?

- Enter the following URL into a browser
  - <http://system:2001>



Supports the following browsers:

- Microsoft® Internet Explorer, 7.0 or later
- Mozilla Firefox, 3.6 or later



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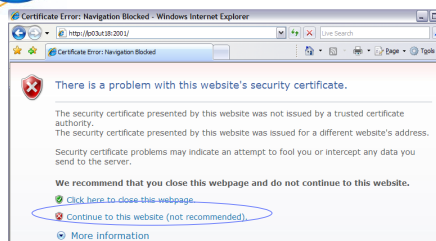
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## How does it work ?

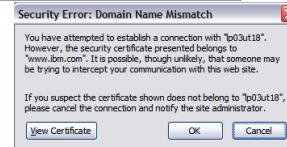
- Accept the certificate warnings
  - Consoles runs on SSL



Internet Explorer 7



Firefox 3

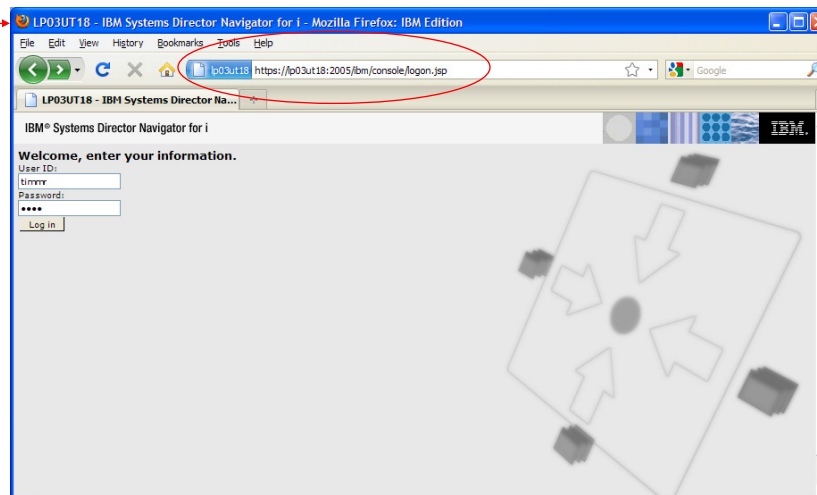


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## How does it work ?

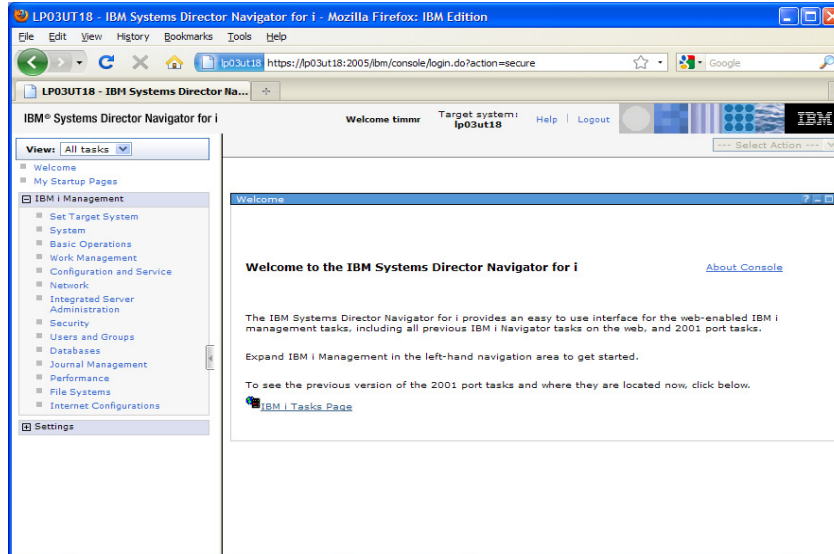
- URL will be re-routed to secure path
- Enter your IBM i user ID and password for this system



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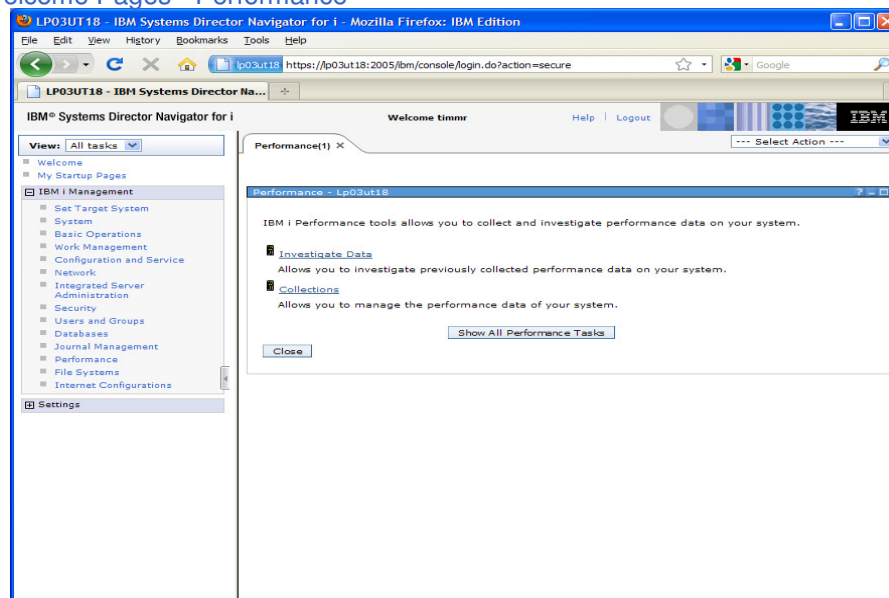
## IBM Systems Director Navigator



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## Welcome Pages - Performance



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- Collections



IBM i Management

- Set Target System
- System
- Basic Operations
- Work Management
- Configuration and Service
- Network
- Integrated Server Administration
- Security
- Users and Groups
- Databases
- Journal Management**
- Performance**
- File Systems
- Internet Configurations
- Backup, Recovery and Media Services
- High Availability Solutions Manager
- Cluster Resource Services

- 
- Performance(1) x
- IBM | Navigator Tasks
- Performance
    - Collections
      - Collection Services
        - Collection Services
- Close
- Active Collection Services Collections
- Collection Services Collections
  - Collection Services Status
  - Configure Collection Services
  - Cycle Collection Services
  - Start Collection Services
  - Stop Collection Services

## Performance Data Investigator

### Performance link, Collection Services, Workload Groups

### Perspectives

- Collection Services
  - CPU Utilization and Waits Overview
  - CPU Utilization by Thread or Task
  - Resource Utilization Overview
- Workload Group
  - Dispatch Latency Totals by Workload Group
- Job Statistics Overviews
- Waits
- CPU
- Disk
  - Physical Disk I/O
  - Synchronous Disk I/O
- Page Faults
- Logical Database I/O
- Virtual I/O
- Communications
- S2S0 Display Transactions
- Physical System
- Java

### Selection

Name

Dispatch Latency Totals by Workload Group

---

Description

This chart shows an overview of workload group dispatch latency. It shows the total delay time for each workload group. This is the amount of time ready to run threads could not be dispatched due to the group's maximum concurrent processor limit.

☒ Locked

New Folder...
New Perspective...

Edit
Advanced Edit
Delete

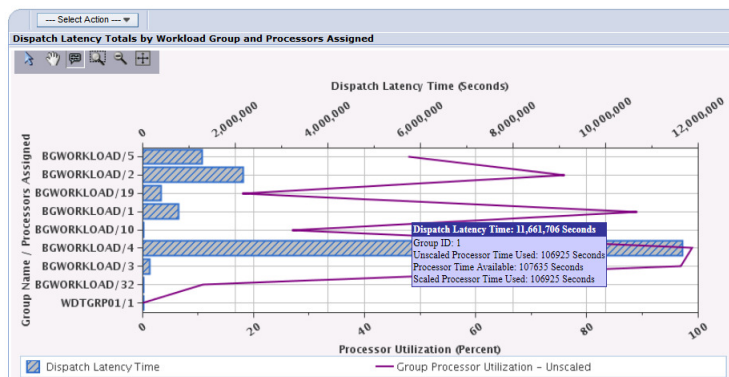
Move Up
Move Down



## PDI – Workload Groups

- See all the workload groups defined
- CPU associated with each group
- Cumulative latency time per group

Dispatch Latency Totals by Workload Group and Processors Assigned



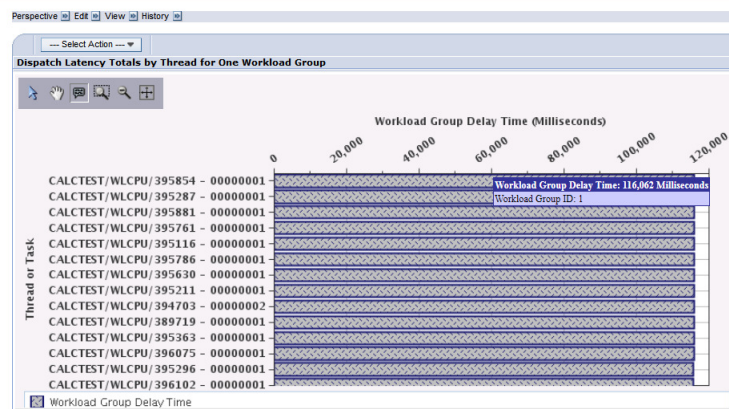
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## PDI – Workload Groups

- Drill down to see all the jobs running in the workload group
- View delay latency time per job

Dispatch Latency Totals by Thread for One Workload Group

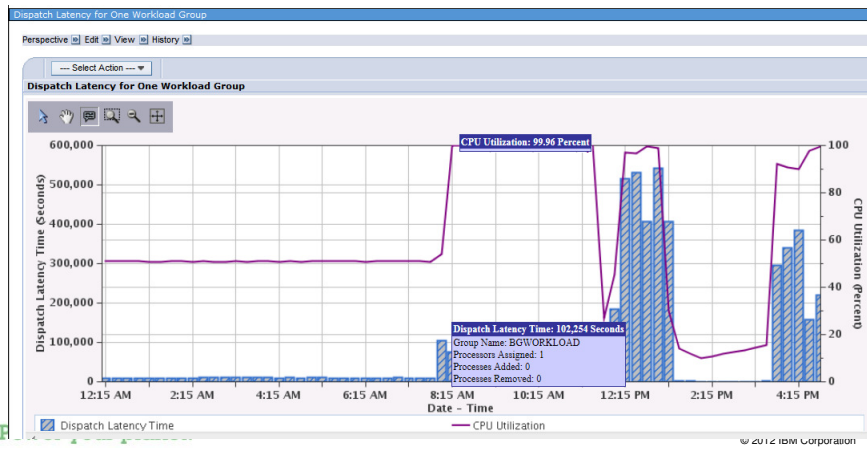


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## PDI – Workload Groups

- Drill down on a single job
- View when the latency for a job occurred



# Details

## MQ Example

### Create the Workload Group

- New command – Add Workload Group
  - `ADDWLCGRP WLCGRP(MYGROUP) PRCLMT(2)`
  - Create up to 256 separate groups
  - Max 256 cores
- A workload can be associated with only 1 workload group
- A workload group can be associated with multiple workloads

## MQ Example

### Create the Workload Group

- Create the workload group
  - Name and number of cores

```
Add Workload Capping Group (ADDWLCGRP)

Type choices, press Enter.

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

## MQ Example

- Associate the MQ workload with the workload group
- Subsystem - QMQM
  - Custom subsystems can be specified, that SBS needs to be associated with the workload group
- When Subsystems starts the data area below is read
  - [QSYS/QWTWLCGRP](#)
  - Name value pairs are read, if this starting SBS is in the data area, then the workload group is applied
  - Every Job, thread, process running under that SBS will be tied to the specified workload group

## MQ Example

- Create the data area
  - Type \*CHAR
  - Length 2000 (can be shorter)
  - Subsystem name, Workload Group name Pairs

### 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 . . . . . > 'QMQM'      MQTEST

```

```

Text 'description' . . . . . > 'Subsystems to use workload capping'

```

### Additional Parameters

```

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

```

## MQ Example

- Stop and Restart the Subsystem

```

Command Entry
Previous commands and messages:
> ENDSBS SBS(QMQM) OPTION(*IMMED)
> STRSBS SBS(QMQM)

Type command, press Enter.
==>

```

## MQ Example

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

#### Register product

- Add Workload Group Product Entry
- Specify the Workload Group name
- Product ID for target product
- Release
- Feature

```

ADD WLC PRODUCT ENTRY (ADDWLCPRDE)

Type choices, press Enter.

WORKLOAD CAPPING GROUP . . . . . > M0TEST      Name
Product identifier . . . . . > 5725049      Identifier
License term . . . . . > V7R1M0          Vx, VxRy, VxRyMz, *ALLINS
Feature . . . . . > 5050          5001-9999, *ALLINS

```

## MQ Example

Verify workloads are limited by the workload group

- Job log for Subsystem
  - Message CPI146C will be displayed
  - Specifies SBS name and Workload Group its associated with

### 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.
  
```

## MQ Example

Display the Workload Group

- Display Workload Capping Group (DSPWLCGRP)
  - Workload Group
  - Processor limit
  - Licensed program

```

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
***** END OF LISTING *****
  
```

## MQ Example

### Auditing capability

- If enabled, Multiple audit log entries are created
  - 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.

```

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  :
03051  : '00CST2M0TEST      *NONE      *SYSBAS      00001QN06'
03101  : ' *SYSBAS      00000'

Bottom
  
```

45

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## Details of ALL the commands and APIs

46

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## CHGJOB Command changes

- Change Job command (CHGJOB)
  - The Change Job command will add a new parameter for workload group
    - Possible values \*SAME, \*NONE or a 10 character name
    - To assign to a single job, it must be running
    - Using licensing ? License manager must be called before CHGJOB

## Defining a Workload Group for an entire Subsystem

- Subsystem support
  - Only one workload group may be defined per subsystem
  - Set via the use of a data area
    - Create a new data area named QWTWLCGRP in library QSYS
    - Data area must be TYPE(\*CHAR)
    - Contain pairs of ten-character names: subsystem name and workload group name
    - Up to 100 subsystem/workload group pairs may be defined
    - The data area can easily be created, changed, retrieved and displayed using existing command interfaces.



## New Workload Group Commands

- **Add Workload Capping Group (ADDWLCGRP)**
    - The Add Workload Capping Group (ADDWLCGRP) command adds a workload capping group for the current system or logical partition. The workload capping group can be used to limit the processing capacity of a job by setting a limit on the number of processors the job can run on concurrently.
  - **Remove Workload Capping Group (RMVWLCGRP)**
    - The Remove Workload Capping Group (RMVWLCGRP) command removes a workload capping group for the current system or logical partition.
    - You can remove a workload capping group while active jobs and threads are referencing the group. Any jobs or threads that are associated with the group will not be limited to a subset of activated processors for the system or logical partition once the workload capping group is removed.
  - **Display Workload Capping Group (DSPWLCGRP)**
    - The Display Workload Capping Group (DSPWLCGRP) command shows the information for all workload capping groups or a single workload capping group on the current system or logical partition. The information shown includes the processor limit and all product entries for the specified workload capping group.
  - **Change Workload Capping Group (CHGWLCGRP)**
    - The Change Workload Capping Group (CHGWLCGRP) command changes the operational attributes of the specified workload capping group.
    - You can change the workload capping group while active jobs and threads are referencing the group. Changes made to the workload capping group will take effect immediately for jobs and threads which are associated with the group.
- *Full Details will be made available on the 7.1 info center*

## New License Commands for Workload Groups

- **ADDWLCPRDE – Add WLC Product Entry**
    - The Add Workload Capping Product Entry (ADDWLCPRDE) command adds an entry to an existing workload capping group. The product entry identifies the license term and feature of the product that will be limited by the number of processors defined for the workload capping group
    - To remove a product entry from a workload capping group, use the Remove Workload Capping Product Entry (RMVWLCPRDE) command. To make a change to the feature or license term for a product entry, remove the existing entry and add a new product entry.
    - Product entries that cover the same license term or feature cannot be added to multiple workload capping groups.
    - You can add product entries for products which have not yet been installed on the system or logical partition. When the product is installed, the placeholder entry will be replaced with one or more specific product entries.
    - You can add products to a workload group even if the product does not use the IBM i License Management interfaces for its licensing. This may prove useful for auditing a customer's compliance with a product's customized implementation of workload group for software sub-capacity pricing.
  - **RMVWLCPRDE – Remove WLC Product Entry**
    - The Remove Workload Capping Product Entry (RMVWLCPRDE) command removes an entry from a workload capping group. The product entry identifies the license term and feature of the product that will be limited by the number of processors defined for the workload capping group
- *Full Details will be made available on the 7.1 info center*

## APIs

- Change to Work Management APIs

- Change Job API (QWTCHGJB)

- A new key will be added to the QWTCHGJB API to allow a user to change the workload group for your own job or for another job. The workload group name must be defined using the license manager interface (ADDWLCGRP) prior to calling the QWTCHGJB API

- Retrieve Thread Attributes API (QWTRTVTA)

- A new key will be added to the QWTRTVTA API to retrieve the workload group associated with a job. If no workload group has been set in the job, the API will return a special value of \*NONE.

- New License Management API

- Retrieve Workload Groups Information (QLZRTVWC) API

- The QLZRTVWC API retrieves information for the specified workload group. This information includes the configured processor core limit for the workload group and the licensed programs (software products) associated with the workload group.

- The API can also be used to retrieve a list of all the workload groups defined on the partition.

- *Full Details will be made available on the 7.1 info center*

## Workload Groups Message / Audit changes

- New Message CPI146C

- Subsystem &1 is using workload group &2
  - This message is sent during subsystem startup if the subsystem uses a workload group.

- Workload Group added to the JS audit record (cut for job start, job end, and change job)

- Auditing of licensed products in workload groups

- Auditing is done for adding licensed products to and removing licensed products from workload groups. For more information on how to retrieve the audit information, see Information Center topic "Auditing workload groups licensed program information" at the following link:

- <http://publib.boulder.ibm.com/infocenter/series/v7r1m0/topic/rzam8/rzam8keywrkcap.htm>

## Changes to Performance Metrics

### Collection Services

- Collection Services modified to support reporting system wide usage data for workload groups as well as TDE level data to assist in understanding performance issues related to group actions.
- The \*JOBMI data category and QAPMJOBMI file modified to support additional TDE metrics that identify the group a TDE (thread) was associated with at sample time along with how much time that thread was not able to run due to workload group constraints
- The \*SYSLVL collection category will be modified to collect WLC group data for groups that are in use
- A new file QAPMSYSWLC will be created in the target performance database library to contain this data. The QAPMSYSWLC file and/or member will be created only if the source \*MGTCOL collection contains data for workload groups.

### PEX

- Added a new metric to the existing PDC TaskingSwitchIn event records. The metric provides the workload group dispatch latency. For tasks that belong to a workload group, this time will equal the time a task waits because the workload group is over-committed.
- Added a new PDC trace event which identifies when a task is added to or removed from a workload group.
- Added task start and end workload group identifier to the PDC task information data.
- Added workload group identifier to the PmProcessCreate and PmProcessTerm PDC events.

## Developer Works

<https://www.ibm.com/developerworks/mydeveloperworks/wikis/home?lang=en#/wiki/IBM%20i%20Technology%20Updates/page/IBM%20i%20workload%20groups>

The screenshot shows the IBM DeveloperWorks website interface. At the top, there's a navigation bar with 'developerWorks' and links for 'Technical topics', 'Evaluation software', 'Community', and 'Events'. A search bar is on the right. Below this, a breadcrumb trail reads: 'You are in: IBM i Technology Updates > IBM i Technology Updates > General IBM i operating system > IBM i workload groups'. The main content area is titled 'IBM i workload groups' and includes a 'Page Actions' dropdown. The text explains that IBM i 7.1 provides workload groups to restrict a workload to a specified maximum number of processor cores. It defines a workload as a job, subsystem, or product running on the IBM i system. An example is provided: a user has a batch job that is very CPU intensive and needs to run during the day but can't afford to impact the performance of their production system. By assigning this batch job to a workload group, the job can be put into a "nonprocessing" state.

## Questions?



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