



@server

iSeries

Work Management

Version 5 Release 3





@server

iSeries

Work Management

Version 5 Release 3

Note

Before using this information and the product it supports, be sure to read the information in "Notices," on page 77.

Fourth Edition (August 2005)

This edition applies to Version 5, Release 3, Modification 0 of IBM Operating System/400 (product number 5722-SS1) and to all subsequent releases and modifications until otherwise indicated in new editions. This version does not run on all reduced instruction set computer (RISC) models nor does it run on CISC models.

© Copyright International Business Machines Corporation 1998, 2005. All rights reserved.

US Government Users Restricted Rights – Use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM Corp.

Contents

Work management	1
What's new for V5R3	2
Print this topic.	3
Manage daily work	3
Monitor system activity.	5
Work with system status	5
Manage jobs and threads	6
Schedule jobs	7
Compare job schedulers	7
Find a job on the iSeries server	8
Determine the status of a job	10
View performance statistics for a job	11
View affinity information for a job.	14
End a job	14
Job actions.	15
View threads running under a specific job	16
View thread properties	17
Delete or end a thread.	17
Manage job queues	17
View jobs on the job queue	18
Change the priority of a job within a job queue	18
Move jobs to different job queues	19
Manage subsystems	21
Monitor a subsystem	21
View jobs in the subsystem	21
Start a subsystem	22
Stop a subsystem	22
Manage memory pools	22
Monitor the number of jobs in a memory pool	23
Monitor the number of subsystems using a memory pool.	25
Check memory pool use	25
Change the size of a memory pool	26
Manage job logs.	27
Access job logs for active jobs, including server jobs.	28
Access printer output	28
Manage output queues	29
View output queues on the system	30
Move output between and within output queues	30
Clear output queues	30
The structure of your system	31
Jobs	31
Job description	32
Active and inactive jobs	32
Active jobs	32
Inactive jobs	32
Job types	32
Autostart jobs	33
Batch jobs	33
Communications jobs	34
Interactive jobs	34
Prestart jobs	34
Reader and writer jobs	35

Subsystem jobs	35
System jobs	35
Server jobs	39
Messages	40
Job properties	40
Proper authority.	42
Job control special authority (*JOBCTL)	42
Detach printer output	42
Elapsed performance statistics	43
Detailed status	43
End jobs	44
Details: Active job actions	44
Locked objects	45
Job logs.	46
Threads	47
Thread actions	47
Thread properties	47
Thread proper authority	48
Thread Control	48
Thread types	48
Thread status.	49
Job queues.	49
Ordered list	50
How a job queue works	50
Subsystems	51
Subsystem description.	52
Subsystems shipped with the system	61
User-defined subsystems	62
Subsystem properties	62
Subsystem life cycle	63
What happens when the subsystem starts	64
Memory pools	64
Memory pool activity level	65
Types of memory pools	66
Base memory pool	66
Machine memory pool.	66
General shared pools	67
Output queues	67
Attributes of an output queue	68
Order of files	69
Status of printer output	69
How work gets done	70
What work is.	70
What happens before work enters the system	71
How work enters the system	71
How work gets processed	71
How work leaves the system	72
Troubleshoot Work Management	73
My job is hung	73
My job is experiencing poor performance	74
Related information for work management	76

Appendix. Notices	77
Trademarks	79

Terms and conditions for downloading and printing
publications 79

Work management

Work management is an important building block within the iSeries^(TM) server operating system. Its functions are the foundation through which all work enters the system, is processed, run, and completed on iSeries servers. Whether you run a simple batch job once a week or you call an application daily (like Lotus Notes^(R)), work management helps manage the jobs and objects that run on your system. It also supports the commands and internal functions necessary to control system operations and allocate resources to applications when needed.

The iSeries server is set up and ready to use. Most users will not need to change the default settings. However, if you need to tailor the work management piece to fit your company, you will need to understand the terms and concepts associated with it and how they integrate with each other to provide you with the best performance from your iSeries server.

» In addition, you can work with parts of the work management component using iSeries Navigator tasks on the Web. This allows you to work with work management functions using a Web browser. For more information, see iSeries Navigator tasks on the Web. «

Whether you are an experienced iSeries user or just learning, this topic gives you an easy-to-understand view of work management. This topic contains different entry points, so you choose where you want to start learning about work management.

A job's life

Follow a job through its life cycle in the work management infrastructure—use our interactive graphic to click your way to more detailed information about work management.

“Manage daily work” on page 3

Find out the daily tasks you can perform to efficiently manage work from iSeries Navigator and when to perform these tasks. From checking job logs to monitoring system activity, you will learn important daily tasks involved with work management.

“The structure of your system” on page 31

Learn the terms and concepts associated with work management (including job, job queues, subsystems, and memory pools) that you can use to manage work on an iSeries server.

“How work gets done” on page 70

Find out what you will need to do to get work done on your iSeries server. Set up job queues, allocate memory to your subsystems and understand what happens to the job after it finishes running.

“Troubleshoot Work Management” on page 73

Read about how to resolve the problems with jobs through iSeries Navigator.

See the “What's new for V5R3” on page 2 topic for the new and changed information and see the “Print this topic” on page 3 topic if you want to print the PDF for this entire topic.

“Related information for work management” on page 76

IBM^(R) manuals contain technical information, know-how, and “how-to” information.

What's new for V5R3

In V5R3, new features have been added to the work management component in iSeries^(TM) Navigator. These new features and functions are integrated into the work management structure, so you can still choose where you want to start learning about the work management component: A job's life (interactive graphic), manage daily work, iSeries server structure, and how work gets done. Each of these areas represent a different level of understanding of work management. Whether you are an experienced iSeries user or just learning, these articles give you an easy-to-understand view of work management.

Work management functions and tasks have new enhancements. Below is a list of the work management functions and the enhancements for V5R3.

Web accessibility

You can work with parts of the work management component using iSeries Navigator tasks on the Web. This allows you to work with the following items using a Web browser:

- "Manage jobs and threads" on page 6
- "Manage subsystems" on page 21
- "Manage output queues" on page 29

"Work with system status" on page 5

- Removal of the ability to access the **Configure Logical Partitions** dialog directly from System Status due to potential hardware dependencies. You can still configure logical partitioning in one of two ways depending on your hardware configuration. If your system uses model 8xx hardware or earlier, you can configure logical partitions through iSeries Navigator by selecting your system —> **Configuration and Service** —> **Logical Partitions**. Otherwise, you can configure logical partitions using the Hardware Management Console for eServer.
- Specifies additional information regarding processor type when applicable. Depending on your hardware configuration, your processor type may be dedicated, shared-capped, or shared-uncapped.
- Specifies the elapsed percentage of the system's shared processor pool usage.
- Specifies the elapsed percentage of uncapped CPU capacity usage, if hardware supports shared-uncapped processors.

Jobs

- Additional "Details: Active job actions" on page 44:

Open file support has been expanded to include the ability to work with a job's library objects or file system objects. Prior to V5R3, you could only work with a job's library objects.

- Additional job properties:

View a job's local date and time on the **Date/Time** page.

View a job's time zone information on the **Date/Time** page.

View a job's **Offset from coordinated universal time (UTC)** on the **Date/Time** page.

"View affinity information for a job" on page 14 on the **Resources** page.

Job log message

- Usability enhancements have been made to the job log message support, including a new field, **From user**, that represents the profile of the sender of the message.

"Subsystem description" on page 52



- Updated the QSYSWRK and QUSRWRK subsystems to support the move of the Electronic Service Agent product to the base operating system. In addition, the subsystems were updated to reflect the enhancements made to the cluster function of the iSeries server.



Experience reports

- Experience reports, written by IBM^(R) developers, document their hands-on experiences implementing real-world scenarios and solutions. Use these reports to follow the experiences of IBM^(R) developers with a specific implementation of an iSeries^(TM) solution, complete with step-by-step instructions and tips. To view the experience reports related to work management, see “Related information for work management” on page 76.

How to see what’s new or changed

To help you see where technical changes have been made, this information uses:

- The  image to mark where new or changed information begins.
- The  image to mark where new or changed information ends.

 To find other information about what’s new or changed this release, see the Memo to Users. 

Print this topic

To view or download the PDF version of this document, select Work Management (about 660 KB).

You can view or download these related topics:

-  Advanced Job Scheduler 
- System Values



Other information

You can also view or print the V4R5 Work Management manual PDF:




- V4R5 Work Management  (about 2720 KB or 573 pages)

Saving PDF files

To save a PDF on your workstation for viewing or printing:

1. Right-click the PDF in your browser (right-click the link above).
2.  Click **Save Target As...** if you are using Internet Explorer. Click **Save Link As...** if you are using Netscape Communicator. 
3. Navigate to the directory in which you would like to save the PDF.
4. Click **Save**.

Downloading Adobe Acrobat Reader

 You need Adobe Acrobat Reader to view or print these PDFs. You can download a copy from the Adobe Web site (www.adobe.com/products/acrobat/readstep.html)  .

Manage daily work

As a system operator or administrator, one of your tasks is to keep your server running smoothly. This means you monitor, manage, and ensure that your jobs, job queues, subsystems, memory pools, job logs, and output queues function properly.

The topics in this section give you information on the different types of daily work management tasks as well as other tasks you might need to perform on your iSeries server. Each subtopic explains why it is important to do these tasks, as well as how to complete them.



“Monitor system activity” on page 5

Monitoring your system is an important daily activity. You can accomplish this in a variety of ways, such as using iSeries Navigator and iSeries Navigator Management Central. The tasks in these subtopics follow:

- Work with system status
- Monitor system performance
- Work with monitors

“Manage jobs and threads” on page 6

Whether you are asked to report the status of a particular job or thread or to monitor a job or thread’s performance, you can easily find most of the answers you need in iSeries Navigator. The tasks in these subtopics follow:

- Schedule jobs
- Find a job on the iSeries server
- Determine the status of a job
- View performance statistics for a job
-  View affinity information 
- End a job
- Actions done to a job
- View threads running under a specific job
- View thread properties
- End a thread

“Manage job queues” on page 17

Job queues are an important element in the life cycle of a batch job. Job queues help control the rate at which batch jobs enter a subsystem. The tasks in these subtopics follow:

- View jobs on the job queue
- Change the priority of a job within a job queue
- Move jobs to different job queues

“Manage subsystems” on page 21

Because jobs run in subsystems, you may need to monitor subsystem activity for potential problems that could affect a job’s ability to run. The tasks in these subtopics follow:

- Monitor a subsystem
- View jobs in a subsystem
- Start a subsystem
- End a subsystem

“Manage memory pools” on page 22

Memory pools allocate memory to subsystems so that jobs can run. It is important that when jobs run they get enough memory to complete efficiently. The tasks in these subtopics follow:

- Monitor the number of jobs in a memory pool
- Monitor the number of subsystems in a memory pool
- Check memory use
- Change the size of a memory pool

“Manage job logs” on page 27

Job logs contain information related to requests entered for a job, such as commands in the job, commands in the program, and messages. The tasks in these subtopics follow:

- Access job logs for active jobs, including server jobs

- Access printer output

“Manage output queues” on page 29

Output queues help you manage printer output created when a job ends. It is important to understand how to effectively maintain your output queues so that your printed output processes smoothly. The tasks in these subtopics follow:

- View output queues on the system
- Clear output queues
- Move output between and within output queues

Monitor system activity

Monitoring system activity is one of the many important tasks in the day of an administrator. Monitoring the flow of work through the system is only a piece of the information that should be monitored on a daily basis. IBM offers a variety of tools to help you monitor your system performance from basic system checking using system status to advanced system monitoring with Management Central.

“Work with system status”

In iSeries Navigator, the system status window gives you the ability to view and access various system functions on a system in one convenient location.

Manage iSeries performance

The Management Central function in iSeries Navigator has system monitors that collect and display real-time performance data from which you can track and troubleshoot system performance problems.

Work with monitors

Monitor your jobs and servers, your message queues, changes to selected files, and business-to-business transaction activity.

Work with system status

Modeled after the top half of the Work with System Status (WRKSYSSTS) display in the character-based interface, the System Status dialog offers a quick and easy way to check the status of a system. Management Central allows you to monitor more in depth functions through the use of system monitors.

The different functions that you can do from the system status window are:

- View CPU usage
- View the total number of jobs, active jobs, and the maximum number of jobs allowed on the system
- View the number of active “Threads” on page 47 on the system
- View the percentage of addresses (permanent and temporary) used on the system
- View the total disk space
- View the system disk pool capacity and usage
- View the number of processors on your system
- » View the type of processors and whether or not they are dedicated, shared-capped, or shared-uncapped (if hardware supports)«
- » View the elapsed percentage of shared processor pool usage on the system«
- » View the elapsed percentage of shared-uncapped CPU capacity on the system (if hardware supports)«

Note: Three different **Processors** pages exist depending on the type of iSeries system you have. You may see additional processor related information depending on the configuration of your system:

System with no partitions
System with partition, dedicated processors
System with partition, shared processors

For more information on logical partitioning on the iSeries system, see Logical partitions.

- View the total memory on the system
- View the temporary storage used
- View the current amount of temporary storage used and the maximum amount used since the last system restart
- Access active jobs
- Access jobs and storage system values
- Access disk pools
- Access active memory pools

You can access the System Status dialog from the **System** folder or the **Work Management** folder within iSeries Navigator.

To get to system status from the **System** folder:

1. In iSeries Navigator, expand **My Connections**.
2. Right-click the connection on which you want to work and select **System Status**.

To get to the system status from the **Work Management** folder:

1. In iSeries Navigator, expand **Work Management**.
2. Right-click **Work Management** and select **System Status**.

For more information on the different tasks that you can complete using system status, see the iSeries Navigator help.

Manage jobs and threads

Since work done on your system is in the form of jobs and threads, it is important that you can find, track, and manage them within your system.

View the following subtopics to manage your jobs and threads:

- [» "Schedule jobs" on page 7](#) [«](#)
- ["Find a job on the iSeries server" on page 8](#)
- ["Determine the status of a job" on page 10](#)
- ["View performance statistics for a job" on page 11](#)
- [» "View affinity information for a job" on page 14](#) [«](#)
- ["End a job" on page 14](#)
- ["Job actions" on page 15](#)
- ["View threads running under a specific job" on page 16](#)
- ["View thread properties" on page 17](#)
- ["Delete or end a thread" on page 17](#)


For more information on the different tasks you can perform on jobs and threads, see the iSeries Navigator help.

For more detailed information on jobs and the types of jobs on an iSeries server, see “Jobs” on page 31. For more detailed information on threads, see “Threads” on page 47.

Schedule jobs

➤ When scheduling jobs on the iSeries system, you can use the Management Central Scheduler, the OS/400 scheduler, or the Advanced Job Scheduler.

For specific information on each scheduler, see the following topics:

- Management Central Scheduler
Use this scheduler to schedule jobs within Management Central.
- Advanced Job Scheduler
Use this scheduler to schedule jobs on the iSeries server. This scheduler is a plug-in to the iSeries Navigator interface and is more robust than the OS/400 scheduler.
- **OS/400 scheduler**
Use this scheduler for basic scheduling tasks. You can access it only through a 5250 emulator session. It is not accessible from iSeries Navigator. For more information, see Job Scheduler for OS/400 .

For more information, see the following:

“Compare job schedulers”

View this topic to determine what type of job scheduler features are important to you. Then, you can determine which scheduler is right for you.

Scheduling tasks or jobs with Management Central Scheduler

Describes when you should use the OS/400 Management Central scheduler versus the Advanced Job Scheduler.



Compare job schedulers: When choosing a job scheduler product, you need to consider a variety of different features. The following is a list of features to consider when determining which job scheduler to use:

Automated job scheduling

- Flexibility in scheduling jobs
- Unattended (or attended) job processing 24 hours a day, 7 days a week, with total compliance to the schedules you set
- Natural extension of the iSeries operating system
- Complete control of how, when, and where a job is submitted
- Extensive job dependencies such as objects (existence of a file or records within a physical file), the activity or inactivity of other jobs, or the status of a line, controller, or subsystem
- Complete calendaring functions, including fiscal and holiday calendars
- Multiple runs per day

System and user-defined parameters

- Current date, submission date, previous date, and current time can be passed into application programs
- User-defined parameter values can be created, changed, and passed into application programs

Workload/history forecasting

- Forecasts all scheduled jobs to be run next week, next month, or next day
- Optimize production requirements

- Historical tracking and logging of all Advanced Job Scheduler activity

Network management

- Jobs can be set up on any iSeries server in the network to run on any other iSeries server on the network
- Provides complete job history of the job on the submitting system
- Group and dependent jobs can be submitted through the network

Report distribution and management

- Routing, monitoring, and controlling of all output reports generated by Advanced Job Scheduler or OS/400 operating system
- Spooled file distribution to multiple output queues or to remote systems with optional banner pages
- Spooled output can be duplicated or sent to any user on the iSeries network

Security

- Existing iSeries security may be utilized within Advanced Job Scheduler
- Specify who in your organization has authority to set up or change information about scheduled jobs
- Authority can be specified for either the individual functions of Advanced Job Scheduler or for specific jobs

Graphical user interface

- Point and click capabilities when scheduling a job
- Manage jobs
- Maintain dependencies
- Track scheduler activity and log information

Other key features

- Multiple commands per job
- Definition for job LDA (Local Data Area)
- Console monitor to run jobs in restricted state
- Check maximum run time for each job
- Interface directly to a message-based third-party paging system
- Submission and monitoring of System/36 procedures
- Provisions for full online documentation of each job
- Extensive cursor-sensitive help text on all displays

See Advanced Job Scheduler versus standard OS/400 scheduler  for comparison information.

Find a job on the iSeries server

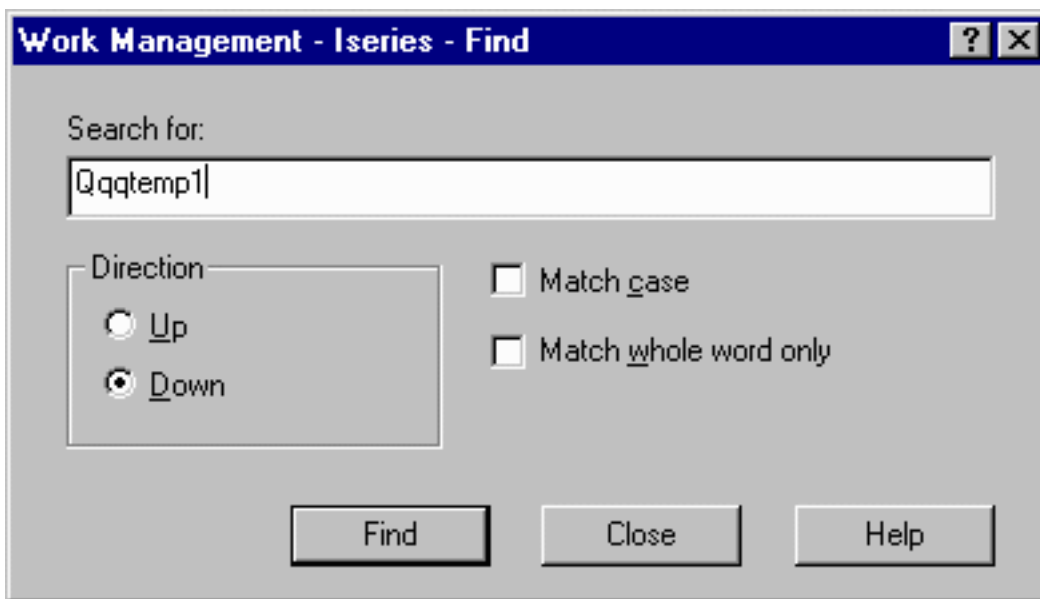
It is important to understand how to find jobs on your iSeries server. Whatever the reason, at some point in time you may need certain information from a particular job. In iSeries Navigator, you can do a **Find** on all your jobs or you can narrow your search using the **Include...** function followed by Find. The Include... function allows you to put limitations on what is displayed in iSeries Navigator. For example, instead of doing a Find on hundreds of jobs, you can run an Include... to display only certain job types. Or, you can display only those jobs with specific job user IDs.

From a performance standpoint, if you have lots of jobs on the system, it is recommended that you use the Include... function to narrow the number of jobs searched. If you have a lot of jobs on the system, searching through all of them can hinder system performance.

Note: You can use the menu bar **Find** and **Include...** throughout work management where you find jobs. You can also use these tools to find job queues, subsystems, and memory pools in the same manner. Remember that you need to click on the area you want to search before you can use these tools.

To find a job using the **Find (Ctrl+F)** option, do the following:

1. In iSeries Navigator, expand **My Connections** → *server-name* → **Work Management** → **Active Jobs**.
2. Select **Edit** → **Find (Ctrl+F)**.
3. In the **Search for** field, type the job ID you want to find (for example, Qqqtemp1). All the job columns are searched for your job.

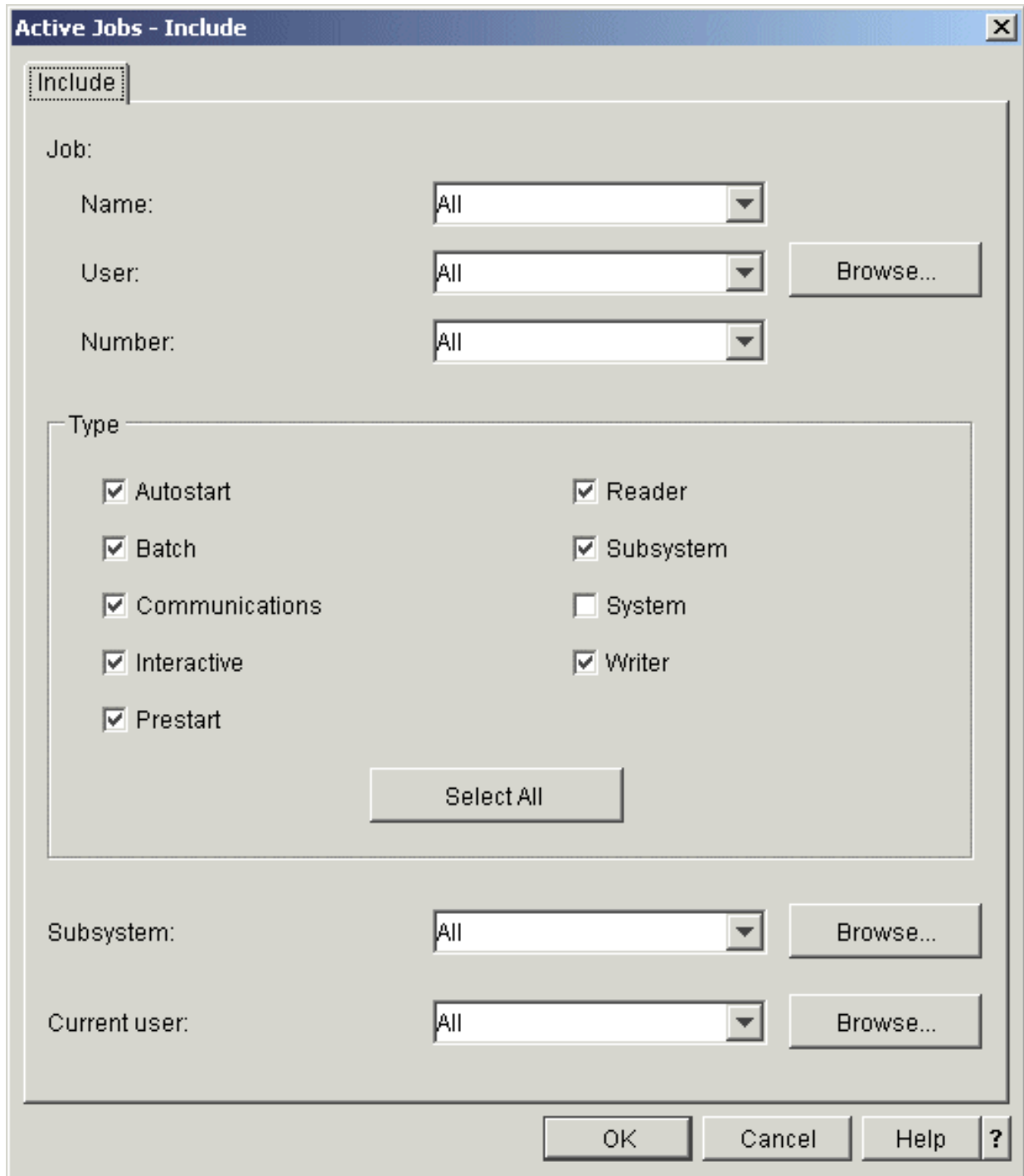


4. Click **Find**. iSeries Navigator will highlight your job once it is found.
Note: Remember that job names are only case sensitive when enclosed in quotations (for example, "MyJob"). If the job name is not enclosed in quotations, then it is not case sensitive.

To limit the information that is displayed using **Include...** function; do the following:

1. In iSeries Navigator, expand **My Connections** → *server-name* → **Work Management** → **Active Jobs** or **Server Jobs**.

2. From the **View** menu, select **Customize this View**, then **Include**. The **Include** dialog appears.



3. In the **Include** dialog, select the options with which you want to search for your job.

4. Click **OK**. From this point, use **Find** to display a particular job.

For more information on jobs, see “Jobs” on page 31.

Determine the status of a job

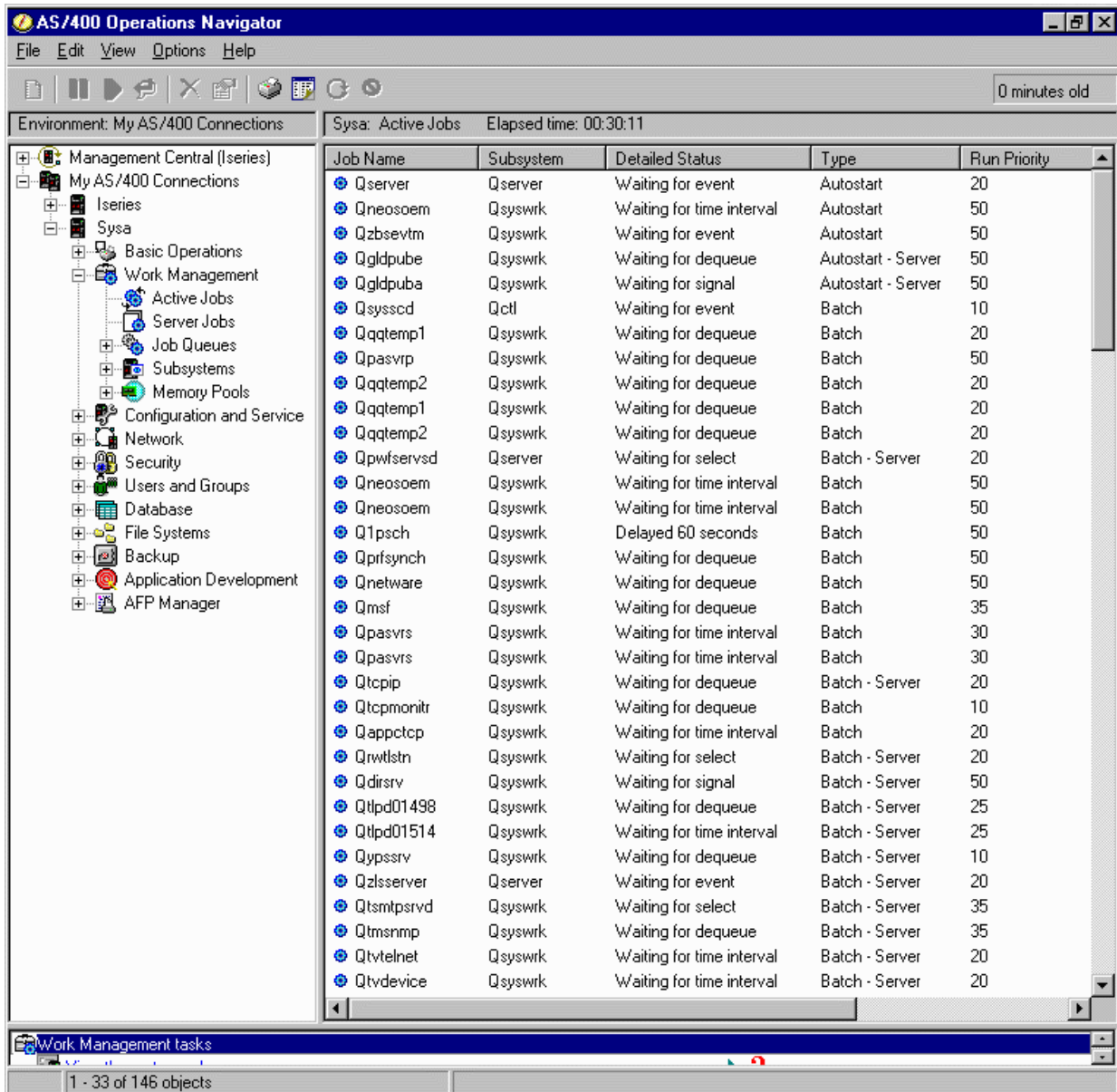
Monitoring your jobs will help you understand what your jobs are doing. The job status is an important piece of information that you can use to find out what a job is doing. In iSeries Navigator job status is easy to find.

To check the status of an active job or server job, do the following:

1. In iSeries Navigator, expand **My Connections** —> *server-name* —> **Work Management** —> **Active Jobs** or **Server Jobs**.

Note: You can see a job status from anyplace within the Work Management folder that you access jobs.

2. Look at the “**Detailed status**” on page 43 column to determine the status of a job (for example, Waiting for event, Waiting for time interval, or Waiting for dequeue).



For more detailed information, see “Detailed status” on page 43.

View performance statistics for a job

A job’s performance is important to anyone that uses an iSeries server because one job running poorly can affect other jobs on the system. To view potentially problematic jobs gives you the ability to prevent performance problems before they occur.

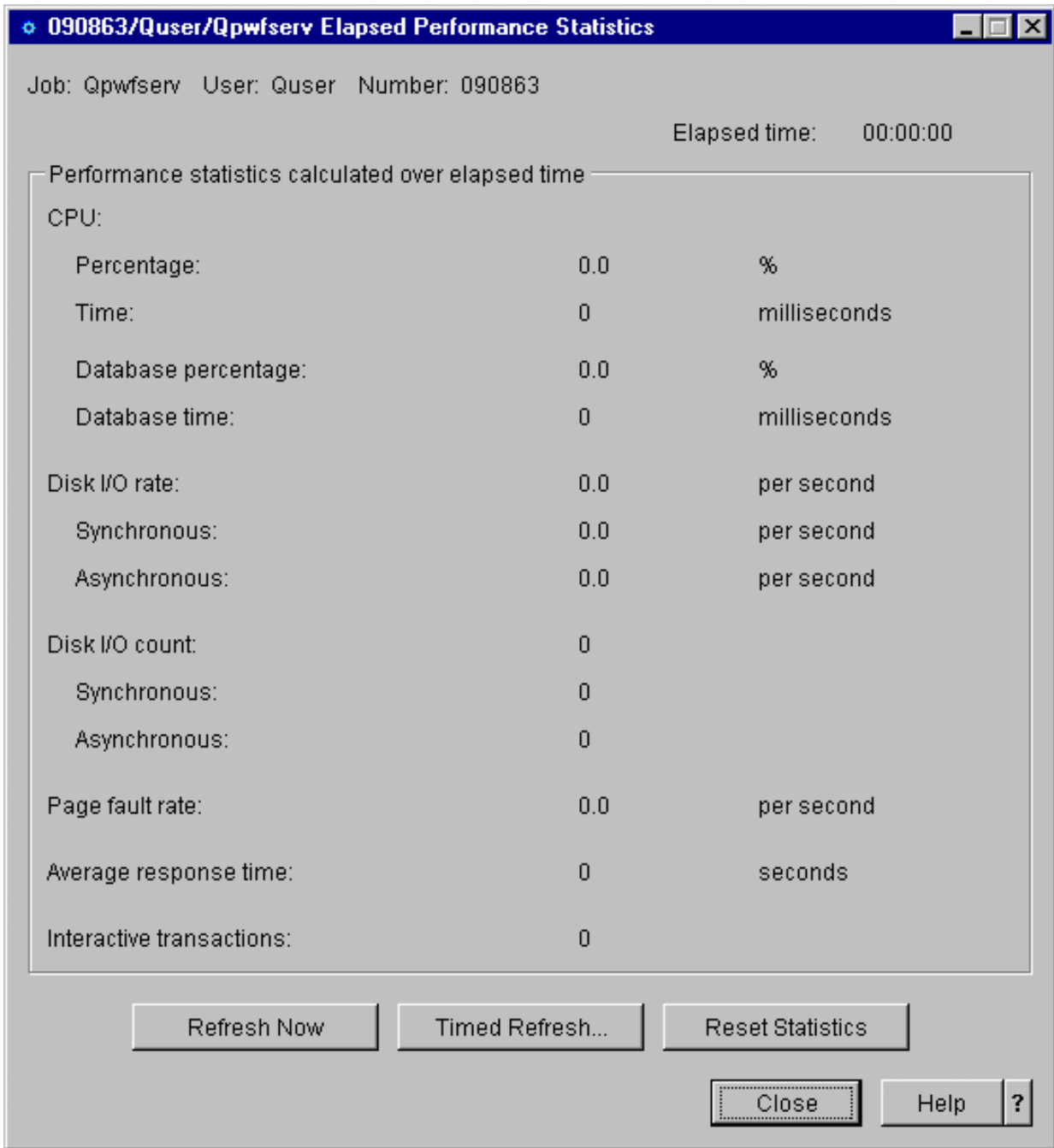
The “Elapsed performance statistics” on page 43 window allows you to monitor a job’s CPU use, disk I/O (hard drive input/output), page fault rates, average response times, and the number of interactive transactions. You can select an option in this window to refresh these statistics manually or on a schedule.

To display the elapsed performance statistics, do the following:

1. In iSeries Navigator, expand **My Connections** —> *server-name* —> **Work Management** —> **Active Jobs**.

Note: You can view the performance of a job from any location within work management where you can see jobs. The **Elapsed Performance Statistics** dialog can be displayed from the Performance tab of a **Job** property sheet.

2. Right-click the job for which you want to display the performance statistics, and select **Details** —> **Elapsed Performance Statistics**.



You can refresh, reset, and schedule the performance statistics to automatically refresh.

Note: You can look at the elapsed performance statistics for more than one job at a time by opening multiple windows. This allows you to view multiple problematic jobs at one time. Each window holds the information for only one job.

The elapsed performance statistics is one way to view the performance of a job as it moves through the system. Another way to view jobs on the system is through the Management Central folder. You can monitor jobs in Management Central as well as monitor system performance and messages. For additional information on job monitors, see Management Central monitors.

View affinity information for a job

» Each job on the iSeries contains memory and processor affinity information. The affinity information describes whether or not threads will have affinity to the same group of processors and memory as the initial thread when they are started. It also specifies the degree to which the system tries to maintain the affinity between threads and the subset of system resources they are assigned to. In addition, the affinity information specifies whether or not a job is grouped with other jobs so they have affinity to the same subset of system resources.

By grouping threads together that share a common set of data in main storage, your system's caching and memory access rates can improve.

To view affinity information, complete the following:

1. In iSeries Navigator, expand **My Connections** —> *server-name* —> **Work Management** —> **Active Jobs**.

Note: You can view the affinity information of a job from any location within work management where you can view jobs.

2. Right-click the job that you want to view, and select **Properties**.
3. On the **Resources** page, you can view the **Memory and processor affinity** information.

For more information on each field, see the online help.

For more information on the affinity system value, see Thread affinity (QTHDRSCAFN). In addition, you can specify to automatically adjust thread resources using the Automatically adjust thread resources (QTHDRSCADJ) system value. «

End a job

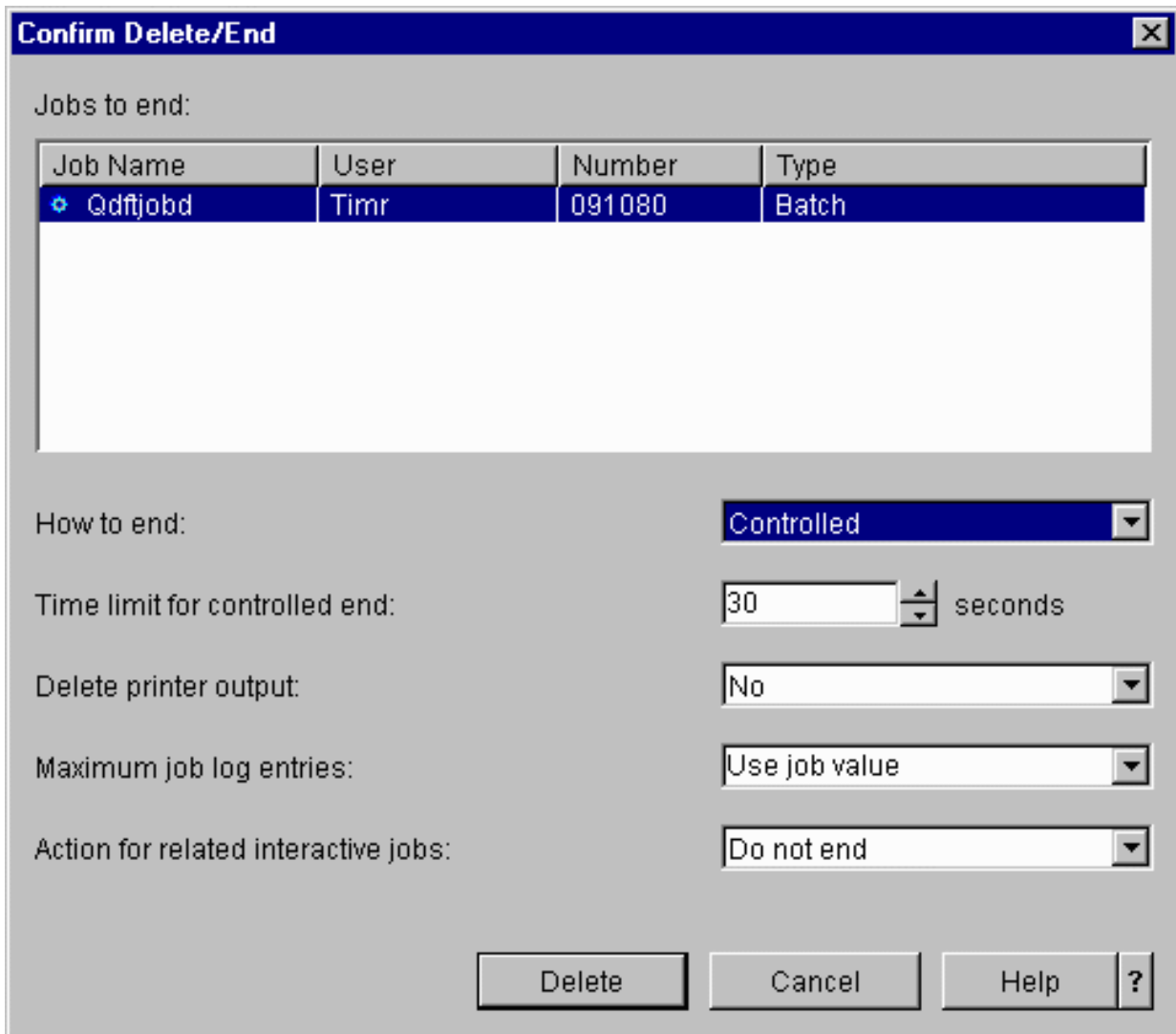
Sometimes you need to end jobs because they take too long to run or they use too much memory, which can affect the performance of other jobs on the system.

To end a job, do the following:

1. In iSeries Navigator, expand **My Connections** —> *server-name* —> **Work Management** —> **Active Jobs**.

Note: You can **Delete/End** a job from any location within work management where you can see jobs.

2. Right-click the job that you want to end (for example, Qdftjobd) and click **Delete/End**.



The image shows a dialog box titled "Confirm Delete/End". It contains a table with the following data:

Job Name	User	Number	Type
Qdftjobd	Timr	091080	Batch

Below the table, there are several fields for configuration:

- How to end:** A dropdown menu set to "Controlled".
- Time limit for controlled end:** A text box containing "30" followed by "seconds".
- Delete printer output:** A dropdown menu set to "No".
- Maximum job log entries:** A dropdown menu set to "Use job value".
- Action for related interactive jobs:** A dropdown menu set to "Do not end".

At the bottom of the dialog box, there are four buttons: "Delete", "Cancel", "Help", and a question mark icon.

3. In the **How to end** field, select "End jobs" on page 44.
4. In the **Time limit for controlled end** field, enter the number of seconds before the job switches from a controlled end to an immediate end. (This parameter only applies to a controlled Delete/End.)
5. In the **Delete printer output** field, select **Yes** or **No**.
6. In the **Maximum job log entries** field, select **Use job value** or **No maximum**.
7. In the **Action for related interactive jobs** field, choose **Do not end**, **End for group jobs**, or **End all**.
8. Click **Delete** to delete the job.

For more information on the actions you can perform on jobs, see "Job actions."

Job actions

Managing jobs and threads is made more efficient with the actions available in Work Management. Once you "Find a job on the iSeries server" on page 8 you want to manage, the following actions are available by right-clicking the job:

Reset Statistics

Allows you to reset the list information you are viewing, and it sets the elapsed time to 00:00:00.

“Output queues” on page 67





Displays printer output, if available, in a separate window.

“Job logs” on page 46

Displays the job log for the selected job, in a separate window.

“Details: Active job actions” on page 44

Contains detailed information about the following actions for active jobs:

- Call Stack
- Library List
- “Locked objects” on page 45
- Open files
 -  Library Objects
 -  File System Objects
- “Threads” on page 47
- Transactions
- “Elapsed performance statistics” on page 43
- Last SQL statement

Reply

Allows you to reply to the message, if you have a job that is waiting for a message.

Hold

Allows you to hold the job. Holding a job holds all threads in the job. This is available for released jobs that are not system jobs. When you hold a job, the job is not available for processing. An active job can be held to temporarily stop its processing.

Release

Releases the job that was held. Releasing the job releases all threads in the job that were held with the **Hold** job action. The job is made available for processing.

“Move jobs to different job queues” on page 19

Allows you to move the selected job to another job queue. You can only move jobs that are on a job queue.

“End jobs” on page 44

Allows you to end the selected job. The two ways to end a job, either controlled or immediately.

Monitor

Allows you to create a job monitor for one or more jobs.

“Job properties” on page 40

The job properties for the selected job can be viewed and changed.

View threads running under a specific job

Every active job running on an iSeries system has at least one thread running under it. A thread is an independent unit of work running within a job that uses the same resources as the job. Because a job depends on the work done by a thread, it is important to know how to find the threads running within a specific job.

To view threads running under a specific job, do the following:

1. In iSeries Navigator, expand **My Connections** —> *server-name* —> **Work Management** —> **Active Jobs**.

2. Right-click the job with which you want to work, and select **Details > Threads**.

For more detailed information, see “Threads” on page 47 or see the iSeries Navigator help.

View thread properties

Threads allow jobs to do more than one thing at a time. If a thread stops processing, it can stop the job from running. The Thread Properties pages allow you to view various thread and thread performance properties that can aid in understanding why a thread is not running.

To view the properties of a thread, do the following:

1. In iSeries Navigator, expand **My Connections** —> *server-name* —> **Work Management** —> **Active Jobs** or **Server Jobs**.
2. Right click the job with which you want to work, and select **Details > Threads**.
3. Right-click the thread with which you want to work, and select **Properties**.

For more detailed information, see “Threads” on page 47 or see the iSeries Navigator help.

Delete or end a thread

An initial thread, which is created when the job starts, can never be deleted or ended. However, sometimes it is necessary to end a secondary thread so that a job can continue to run. Be aware of the thread you intend to end because the job it runs within may not be able to complete without that thread’s work.

Important: Ending threads should not be a part of your daily work management routine. Ending a thread is more serious than ending a job because the work in other threads may or may not stop. When you end a job, all the work stops. However, when you end a thread, only a portion of the work stops. Other threads may or may not continue to run. If they continue running without the thread that you end, they may produce undesirable results.

To delete or end a secondary thread, you must have service (*SERVICE) special authority or “Thread Control” on page 48.

To delete or end a thread, do the following:

1. In iSeries Navigator, expand **My Connections** —> *server-name* —> **Work Management** —> **Active Jobs** or **Server Jobs**.
2. Right-click the job with which you want to work, and select **Details**, and then **Threads**.
3. Right-click the thread with which you want to end, and select **Delete/End**.

For more detailed information, see “Threads” on page 47 or see the iSeries Navigator help.

Manage job queues

In the life cycle of a batch job, job queues are the entry point into the subsystem. Job queues manage the number of jobs allowed into the subsystem at any given time and the order they are allowed into the subsystem.

These subtopics provide instructions for the following tasks:

- “View jobs on the job queue” on page 18
- “Change the priority of a job within a job queue” on page 18
- “Move jobs to different job queues” on page 19

For more information, see “Job queues” on page 49.

View jobs on the job queue

Job queues filter some of the work that is processed in work management (for example, some batch jobs). Being able to view jobs in the job queue allows you to see what jobs are waiting to be sent to a subsystem.

To view jobs on the job queue, do the following:

1. In iSeries Navigator, expand **My Connections** → *server-name* → **Work Management** → **Job Queues** → **Active Job Queues** or **All Job Queues**.
2. Select the job queue with which you want to display the jobs (for example, Jobqueue1). The jobs within the job queue appear.

For more information, see “Job queues” on page 49.

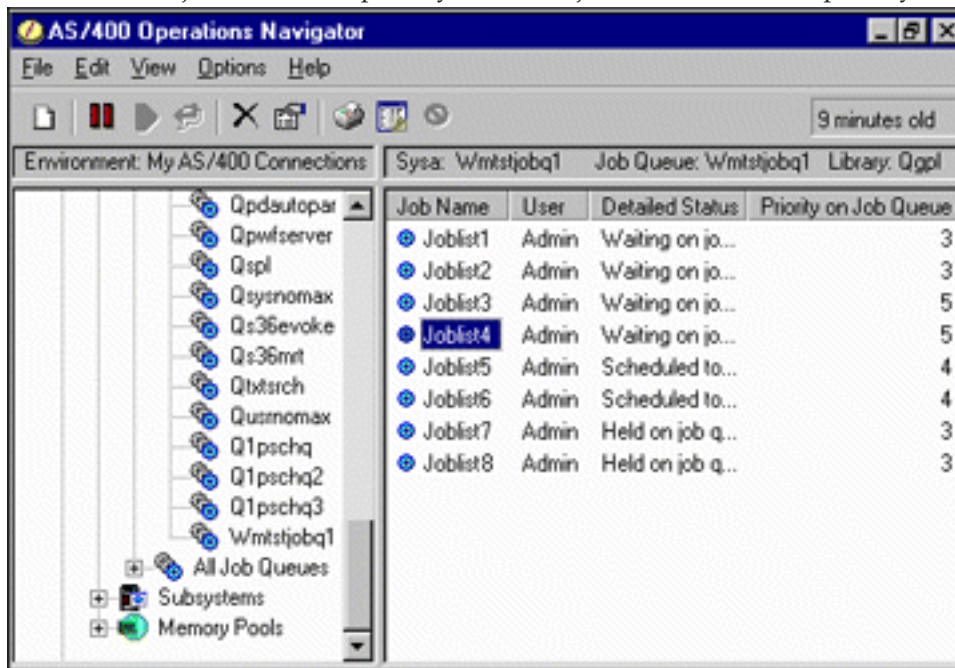
Change the priority of a job within a job queue

Sometimes the importance of a job changes as it goes through its life cycle. It can increase or decrease in priority in relation to other jobs. Because these changes occur, you need to know how to change the priority of a job within the job queue. The priority of a job on a job queue helps determine when the job goes to the subsystem to run. A range from zero to nine (zero being the most important) determines the priority of a job on a job queue.

Within iSeries Navigator, you can either drag and drop jobs or use the property page to increase or decrease the priority of a job.

To change the job queue priority of a job on a job queue using drag and drop, do the following:

1. In iSeries Navigator, expand **My Connections** → *server-name* → **Work Management** → **Active Job Queues** or **All Job Queues**. A list of job queues appears in the right pane.
2. Select the job queue you want to work in (for example, Qbatch). A list of the jobs on the job queue appears.
3. Click the job for which you want to move, and drag it to the new priority position (for example, you want to move joblist4 with a priority of 5 after joblist1 which has a priority of 3).



Use the property page to change the job queue priority of a job on a job queue:

1. In iSeries Navigator, expand **My Connections** —> *server-name* —> **Work Management** —> **Active Job Queues** or **All Job Queues**. A list of job queues appears in the right pane.
2. Select the job queue you want to work in (for example, Qbatch). A list of the jobs on the job queue appears.
3. Right-click the job for which you want to change the priority and select **Properties**. The **Properties** dialog appears.
4. Click the **Job Queue** tab.
5. From the **Priority on job queue** list, select a higher (or lower) priority number. The job queue priority ranges from 0-9, with 0 being the highest priority.
6. Click **OK**. The job queue priority has been changed for your job. For example, changing a priority 4 job to a priority 3 moves the job to the bottom of the list of jobs that have a priority 3.
7. Press **F5** to refresh the Job Queue window.

For more information, see “Job queues” on page 49.

Move jobs to different job queues

Sometimes you need to move jobs from one job queue to another job queue, whether it is because a job queue is too congested and the jobs are not moving quickly to the subsystem or because you create a special job queue for important jobs. iSeries Navigator makes moving jobs between job queues quick and easy.

A job can be moved from one job queue to another job queue in one of two ways, use either drag and drop or the **Move Job** dialog.

To drag and drop a job from one job queue to another job queue, do the following:

1. In iSeries Navigator, expand **My Connections** —> *server-name* —> **Work Management** —> **Job Queues** —> **Active Job Queues** or **All Job Queues**.
2. Double-click the job queue with which you want to work.
3. Select the job you want to move.

Note: You can select multiple jobs to move to another job queue by pressing Ctrl+Shift and selecting each job you want to move.

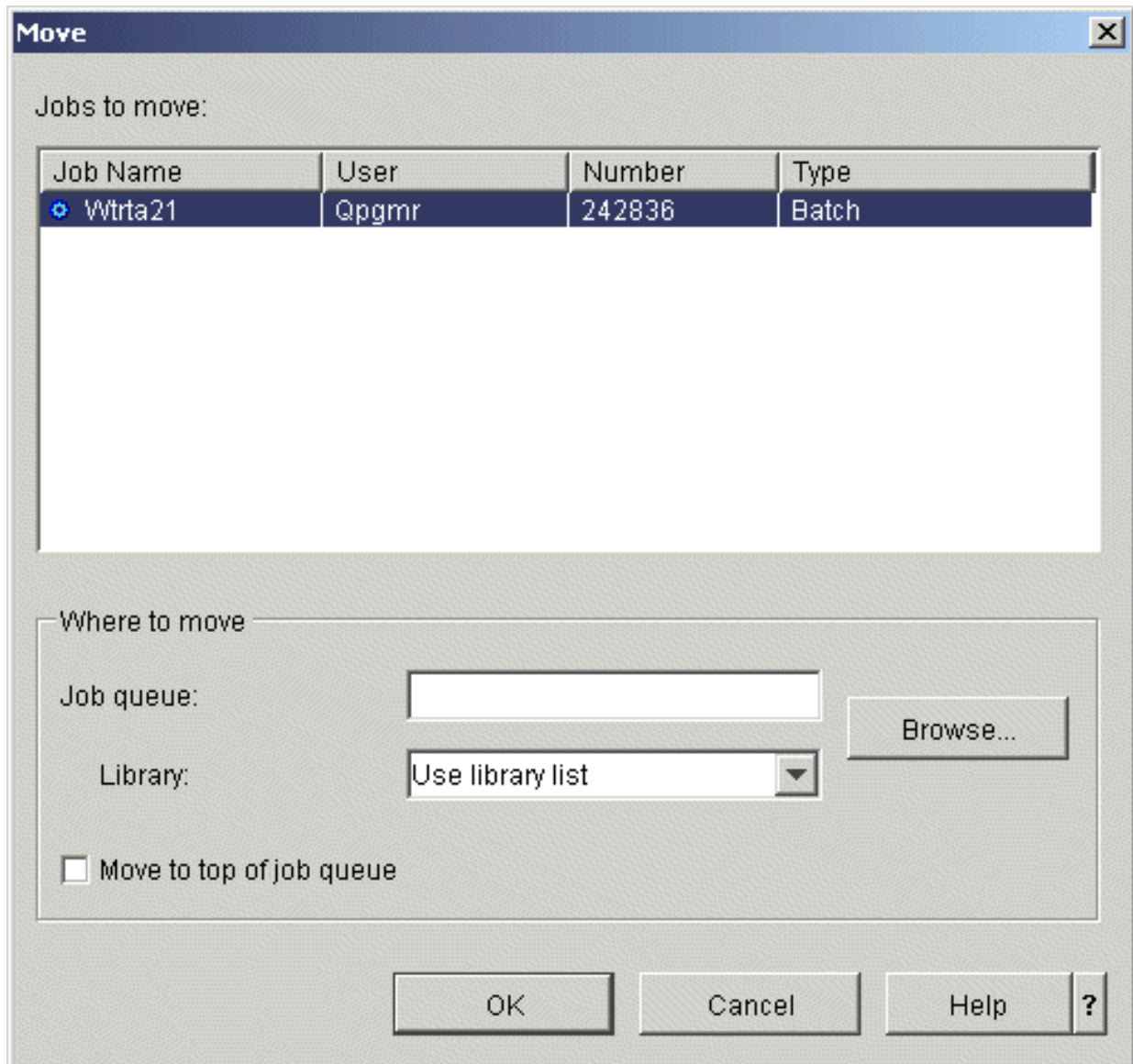
4. Drag the job to the desired job queue. When the job or jobs are dropped on a new job queue, the job or jobs are put into the same relative position they were in on their previous job queue. For example, a priority 3 job that is moved to a new job queue is placed at the end of the priority 3 jobs in the new job queue.

Note: If you drag using the right mouse button, a menu appears with the commands **Move**, **Move to Top**, and **Cancel**. Click the command you want.

To use the **Move...** dialog to move a job from one job queue to another job queue, do the following:

1. In iSeries Navigator, expand **My Connections** —> *server-name* —> **Work Management** —> **Job Queues** —> **Active Job Queues** or **All Job Queues**.
2. Click the job queue with which you want to work in.
3. Right-click the job you want to move to another job queue (for example, Qdftjobd) and select **Move...**

Note: You can select multiple jobs to move from one job queue to another job queue.



4. In the **Jobs to move** field, verify that your job is highlighted. If you want to remove selected jobs, you can press Ctrl and click the jobs you want to remove.
5. In the **Where to move Job Queue** field, type or browse to the job queue where you want to move your job (for example, Qusrnomax).
6. In the **Library** field, type the name of the job queue library or select from the available list.
7. Click **OK**.

When the job or jobs are moved to a new job queue, the job or jobs are put into the same relative position they were in on their previous job queue. For example, a priority 3 job that is moved to a new job queue is placed at the end of the priority 3 jobs in the new job queue. If a job that is held is moved, the job remains held and is placed in the same relative position in the new job queue.

By checking the **Move to Top** box, the job is moved to the top of the target queue, without regard to its current status and priority. (However, if the job at the top of the target queue has a priority greater than the user is allowed, an error message is displayed and the job is not moved.) Jobs that are waiting to run can be moved to the top of another queue. For example, if the selected job has a job queue priority of 5 and the first job on the target queue has a priority of 3, the priority of the selected job is changed to 3 and is placed ahead of the other jobs on the target queue.

Jobs that are held are released and then moved to the top of the target queue. Jobs that are scheduled to run cannot be moved to the top of another queue. An error message is displayed stating that the selected job is not available to be moved.

For more information, see “Job queues” on page 49.

Manage subsystems

The subsystem is the work place for jobs on the iSeries server. All user work is done by jobs running in the subsystem and it is important to monitor this area for slow work performance. In iSeries Navigator, you can view jobs and job queues associated with the subsystems. Also, you have the same functionality with jobs and job queues from any other area that displays jobs and job queues.

To learn more about subsystems, see these topics:

- “Monitor a subsystem”
- “View jobs in the subsystem”
- “Start a subsystem” on page 22
- “Stop a subsystem” on page 22


Monitor a subsystem

Because subsystems are important to the daily activity done on your system, it is important that you monitor the activity in your subsystems. Within a subsystem description you can determine the number of jobs that can run at one time in the subsystem by setting the “Subsystem properties” on page 62 value. As the amount of work on your system increases you may want to change the maximum active jobs value in your subsystem. The number you input here should be set so that the available resources are properly utilized. By increasing the number of active jobs without increasing the resources available can hurt performance on your system.

To check the maximum active jobs value of your subsystem, do the following:

1. In iSeries Navigator, expand **My Connections** —> *server-name* —> **Work Management** —> **Subsystems** —> **Active Subsystems**.
2. Right-click the subsystem which you want to monitor.
3. Select **Properties**.

Note: Make sure you set this option very carefully. If you set maximum active jobs value too high, you may make your system perform slowly. However, if you set your maximum active jobs too low, your work may start to bottleneck and slow performance. For more information about performance

tuning your system, see **Performance Tuning** (chapter 14) in the V4R5 Work Management  (about 2720 KB or 573 pages) manual or see Performance tuning.

View jobs in the subsystem

Subsystems coordinate work flow and the resources that a job uses to run. iSeries Navigator allows you to see what jobs are currently active (but not necessarily running) in the subsystem.

To view jobs in the subsystem, follow these steps:

1. In iSeries Navigator, expand **My Connections** —> *server-name* —> **Work Management** —> **Subsystems** —> **Active Subsystems**.
2. Select the subsystem for which you want to display its jobs.

For more information, see “Subsystems” on page 51.

Start a subsystem

When a subsystem is started, the system allocates the available resources that are defined to it in the “Subsystem description” on page 52 such as memory pools, workstations, and job queues. These resources prepare the subsystem for use.

For details on the chain of events that are triggered when a subsystem starts, see “What happens when the subsystem starts” on page 64.

To start a subsystem, follow these steps:

1. In iSeries Navigator, expand **My Connections** —> *server-name* —> **Work Management** —> **Subsystems**.
2. Right-click **Subsystems**, and then select **Start Subsystem**.
3. Specify the name and the library for the subsystem to be started, or click **Browse...** to select from a list of subsystems.
4. Click **OK**.

Stop a subsystem

You can use iSeries Navigator to stop one or more active subsystems and specify what happens to active work being processed. No new jobs or routing steps are started in the subsystem after the subsystem is stopped.

When a subsystem is stopped, you can specify what happens to active work that is being processed by the system. For example, you can specify for all jobs in the subsystem to be ended immediately (**Immediate**), or you can specify that jobs are allowed to finish processing before the subsystem ends (**Controlled**).

Important: It is recommended that subsystems be stopped using the **Controlled** option whenever possible. This allows active jobs to end themselves. Use this option to ensure that jobs finish before the subsystems end. This allows the programs that are running to perform cleanup (end-of-job processing). Specifying the **Immediate** value can cause undesirable results, for example, from data that has been partially updated.

There are additional options available when stopping subsystems. These options are described in detail in the help associated with the **Stop Subsystem** dialog in iSeries Navigator.

To stop a subsystem, follow these steps:

1. In iSeries Navigator, expand **My Connections** —> *server-name* —> **Work Management** —> **Subsystems** —> **Active Subsystems**.
2. Right-click the subsystem or subsystems you would like to stop, and then select **Stop...**
3. Specify the options to be used when the subsystem is stopped.
4. Click **Stop**.

Manage memory pools

Memory pools allocate memory that subsystems use to run jobs. If too much memory is given to one subsystem and not enough to another subsystem, jobs in the subsystem begin to run poorly. The iSeries server provides a default tuner that will meet the needs of many users. However, if your requirements exceed the capabilities of the system tuner, you will want to know how to manage your memory pools. You can access the performance tuning values in iSeries Navigator by going through the Properties for a shared memory pool to the **Tuning** page. For more information, see Performance. If you want more information on how to tune performance on your system, see Tune performance.

To manage memory pools, see these topics:

- “Monitor the number of jobs in a memory pool” on page 23

- “Monitor the number of subsystems using a memory pool” on page 25
- “Check memory pool use” on page 25
- “Change the size of a memory pool” on page 26

Monitor the number of jobs in a memory pool

Since memory pools give subsystems memory to run jobs, it is important to check on the number of jobs running in a memory pool. Too many jobs in one memory pool can negatively impact system performance.

To monitor the number of jobs in a memory pool, do the following:

1. In iSeries Navigator, expand **My Connections** → *server-name* → **Work Management** → **Memory Pools** → **Active Pools** or **Shared Pools**.
2. Right-click the memory pool you want to use (for example, Base) and select **Jobs**. A dialog appears showing a list of jobs within the memory pool.

You can also view the number of threads in a memory pool by viewing the Thread Count column. The thread count provides additional information about the amount of activity in a memory pool.

Job Name	Detailed Status	Type	Run Priority	Thread Count
Qbatch	Waiting for dequeue	Subsystem	0	1
Qcmn	Waiting for dequeue	Subsystem	0	1
Qacsopt	Waiting for request	Prestart communications	20	1
Qlzpser	Waiting for request	Prestart communications	20	1
Qnmapingd	Waiting for request	Prestart communications	25	1
Qnmarexecd	Waiting for request	Prestart communications	25	1
Qnpser	Waiting for request	Prestart communications	20	1
Qzrcsr	Waiting for request	Prestart communications	20	1
Qzscsr	Waiting for request	Prestart communications	20	1
Qctl	Waiting for dequeue	Subsystem	0	1
Qsysacd	Waiting for event	Batch	10	1
Qinter	Waiting for dequeue	Subsystem	0	1
Qserver	Waiting for dequeue	Subsystem	0	1
Qpwfserv	Waiting for request	Prestart batch	20	1
Qpwfserv	Waiting for request	Prestart batch	20	1
Qpwfserv	Waiting for request	Prestart batch	20	1
Qpwfservsd	Waiting for select	Batch - Server	20	1
Qpwfservso	Waiting for request	Prestart batch - Server	20	1
Qpwfservss	Waiting for request	Prestart batch - Server	20	1
Qpwfservs2	Waiting for request	Prestart batch - Server	20	1
Qserver	Waiting for event	Autostart	20	1
Qtfpjtcp	Waiting for request	Prestart batch - Server	20	1
Qzdainit	Waiting for request	Prestart communications	20	1
Qzdasrvsd	Waiting for select	Batch - Server	20	1
Qzlsfile	Waiting for request	Prestart batch - Server	20	1
Qzlsserver	Waiting for event	Batch - Server	20	1
Qspl	Waiting for dequeue	Subsystem	0	1
Qsyswrk	Waiting for dequeue	Subsystem	0	1
Qappctcp	Waiting for time interval	Batch	20	1
Qdirsv	Waiting for signal	Batch - Server	50	32
Qgldpuba	Waiting for signal	Autostart - Server	50	1
Qgldpube	Waiting for dequeue	Autostart - Server	50	1
Qiwvppjt	Waiting for request	Prestart batch - Server	20	1
Qmsf	Waiting for dequeue	Batch	35	1
Qneosoem	Waiting for time interval	Autostart	50	1
Qneosoem	Waiting for time interval	Batch	50	1

1 - 35 of 136 objects

From this point, you can perform the same functions on jobs as if you were in the Active jobs or Server jobs area.

For more information, see “Memory pools” on page 64.

Monitor the number of subsystems using a memory pool

Subsystems are allocated a certain percentage of memory to run jobs. It is important, as far as performance, to know how many different subsystems are pulling from the same memory pool. Once you know how many subsystems are submitting jobs to a pool and how many jobs are running in a pool, you may want to adjust the size and activity level of the pool to reduce resource contention.

To monitor the number of subsystems using a memory pool, do the following:

1. In iSeries Navigator, expand **My Connections** → *server-name* → **Work Management** → **Memory Pools** → **Active Pools** or **Shared Pools**.
2. Right-click the memory pool you want to work with and select **Subsystems** (for example, Base).

Subsystem	Status	Active Jobs	Description
Qbatch	Active	0	Batch Subsystem
Qcmn	Active	7	Communications Subsystem
Qctl	Active	1	Controlling Subsystem
Qinter	Active	0	Interactive Subsystem
Qserver	Active	13	File Server Subsystem
Qspl	Active	0	Spooling Subsystem
Qsyswrk	Active	68	System subsystem
Qusrwrk	Active	11	User subsystem

From this window, you can determine the number of subsystems that are using an individual memory to run their jobs.

For more information, see “Memory pool activity level” on page 65.

Check memory pool use

Periodically checking the amount of memory your memory pools use is important. By monitoring these levels, you can tune your pools to run at maximum efficiency, which in turn, keeps the work cycle running smoothly. In iSeries Navigator, you can easily monitor the amount of memory your pools are using.

To check the memory use, do the following:

1. In iSeries Navigator, expand **My Connections** → *server-name* → **Work Management** → **Memory Pools** → **Active Pools** or **Shared Pools**.
2. Right-click the memory pool you want to work with (for example, Interactive) and select **Properties**.
3. Click the **Configuration** tab. The **Current** field, under Size, shows the amount of memory the pool currently has.

Note: You can also view the current size of a memory pool when you click **Active Pools** or **Shared Pools**. Current Size (in megabytes) is a default column you see when a list of memory pools appears in the right pane of iSeries Navigator.

For more information, see “Memory pools” on page 64.

Change the size of a memory pool

The size of a memory pool directly affects the amount of work a subsystem can process. The more memory it has, the more work a subsystem can potentially complete. In iSeries Navigator, you can change the amount of defined (or available) memory a pool has. However, it is important that you monitor your system carefully before you start changing the parameters of your memory pools. You will also want to periodically recheck these levels, as some readjustment may need to be done.

Note: Make sure you turn off the system tuner before you start manually changing memory pool sizes. The system tuner automatically adjusts the sizes of your shared memory pools to the amount of work the system is doing. If the system tuner is not turned off, the changes you make manually may be changed automatically by the tuner.

To change the size of a memory pool, do the following:

1. In iSeries Navigator, expand **My Connections** —> *server-name* —> **Work Management** —> **Memory Pools** —> **Active Pools** or **Shared Pools**.
2. Right-click the memory pool you want to work in (for example, Interactive) and select **Properties**. The Memory Pool Properties window appears.

3. Click the **Configuration** tab.



From the Configuration tab of the Properties window, you can change the defined amount of memory. Defined memory is the maximum amount of memory that that pool can use. The number you put here should reflect the amount of memory you think that pool will need to support the subsystems it services.

Special considerations for Base pool: The Base pool is the only memory pool that does not have a defined amount of memory. It has a minimum amount of memory that it needs to run. The Base pool contains everything that is not allocated elsewhere. For example, you may have 1000 MB of memory on your system of which 250 MB is allocated to the Machine pool and 250 MB is allocated to the Interactive pool. 500 MB not allocated to anything. This nonallocated memory is stored in the Base pool until it is needed. Use caution when moving memory. Moving memory from one pool to another can fix one subsystem, but can cause problems for other subsystems, which in turn, can worsen system performance.


For more information, see “Memory pools” on page 64.

Manage job logs

Most jobs on your iSeries have a job log associated with it. Job logs tell the user many different things such as when the job starts, when the job ends, what commands are running, failure notices and error messages. This information gives the user a good idea of how the job cycle is running.

Find out how to access the job log of an active job and access the job log printer output.

- “Access job logs for active jobs, including server jobs”
- “Access printer output”

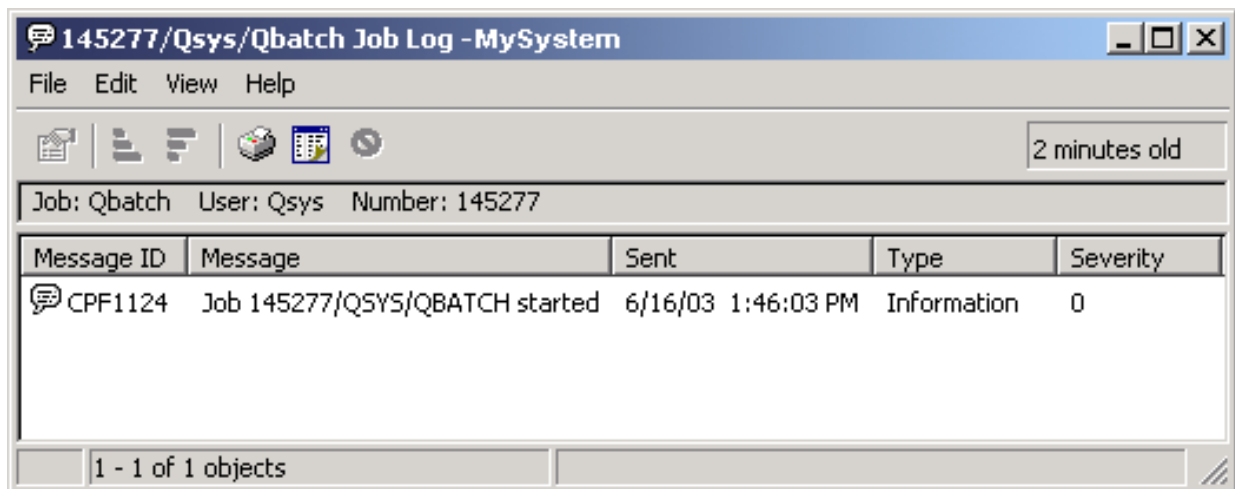
For more information, see Job logs in Chapter 5 of the V4R5 Work Management  (about 2720 KB or 573 pages) manual.



Access job logs for active jobs, including server jobs

Because job logs record information about a job while it is running, it is important to know how to access them.

To access the job log for an “Active and inactive jobs” on page 32 or “Server jobs” on page 39, do the following:

1. In iSeries Navigator, expand **My Connections** —> *server-name* —> **Work Management** —> **Active Jobs** or **Server Jobs**. **Note:** You can see a job log from any place within work management that you access jobs (for example, through the Subsystem area or the Memory Pool area).
2. Right-click a job (for example, Qbatch) and select **Job Log**. Use the image below to see the types of information you can find in a job log. For more information, refer to the help in the **Job Log** dialog.



To view more details of a message,  right-click a message and select **Properties**. The message properties display detailed message information.  This dialog shows the details of the message as well as the message help. The detailed message help gives you information to solve a problem.

For more information, see “Job logs” on page 46 or refer to the help.

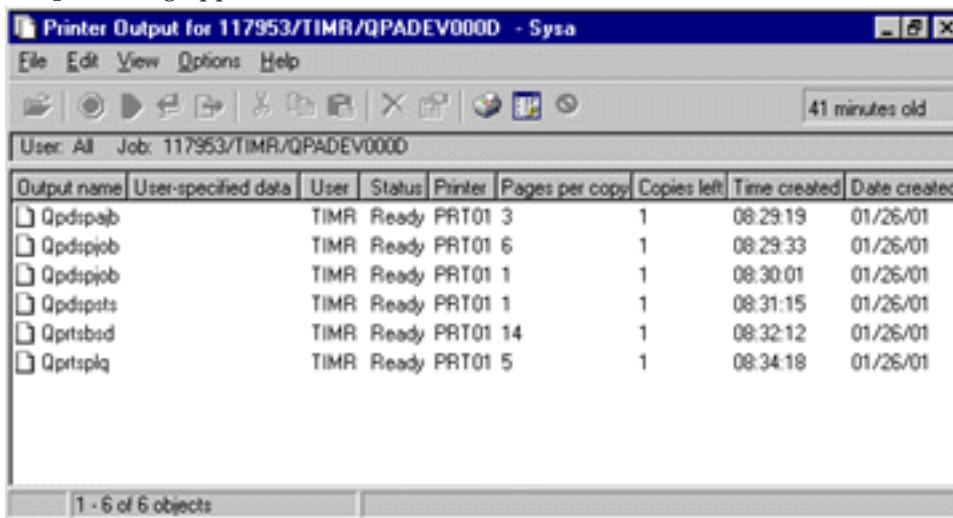
Access printer output

Because you have the choice to “Detach printer output” on page 42 from a job once it finishes running (separating the printer output from the job completely), you can access your printer output in iSeries Navigator through Basic Operations or through Work Management.

To access a job’s printer output through Basic Operations, do the following:

1. In iSeries Navigator, expand **My Connections** —> *server-name* —> **Basic Operations**.
2. Select **Job**. All jobs for the current user appear. See “Find a job on the iSeries server” on page 8 for the different ways to search for jobs.

3. Right-click the job for which you want to display printer output and click **Printer Output**. The **Printer Output** dialog appears.



To access printer output through the **Output Queues** folder, do the following:

1. In iSeries Navigator, expand **My Connections** → *server-name* → **Work Management** → **Output Queues**.
2. Select the output queue with which you want to display printer output (for example, Qprint2). The printer output within the output queue appears.

Manage output queues

Printer output resides on the output queue. The output queue determines the order in which printer output will be processed by the print device. By managing your output queues, you can ensure smooth processing of your printer output.

With the “Attributes of an output queue” on page 68, you can complete the following tasks from the **Output Queues** folder:

- View output queues on the system
- View the properties of an output queue
- Hold an output queue
- Release an output queue
- Clear an output queue
- View output waiting on an output queue
- Move output between and within an output queue
- Change the properties of an output queue

Use these subtopics to view output queues on your system, clear output queues, and move printer output between and within output queues.

- “View output queues on the system” on page 30
- “Move output between and within output queues” on page 30
- “Clear output queues” on page 30

For more information on the different tasks you can complete with output queues, see the iSeries Navigator online help. For more information, see “Output queues” on page 67.

View output queues on the system

Output queues determine the order in which printer output is sent to the printer device.

To view output queues on the system, do the following:

1. In iSeries Navigator, expand **My Connections** → *server-name* → **Work Management**.
2. Select **Output Queues**.

In iSeries Navigator, you can customize the list of output queues you are viewing by using the Include... dialog. The Include... dialog allows you to put limitations on what is displayed in iSeries Navigator. For example, you can run Include... to display only certain output queues. To use the include function, use the **View** menu, and then **Customize this View**.

For more information, see “Output queues” on page 67.

Move output between and within output queues

Sometimes you need to move your output from one queue to another queue or you need to move it to a higher priority level so that it is sent to the printer device more quickly. This can happen if too much output traffic is on an output queue.

You can move output from one output queue to another or you can move output within an output queue.

To move output between output queues, follow these steps:

1. In iSeries Navigator, expand **My Connections** → *server-name* → **Work Management** → **Output Queues**.
2. Double-click the output queue that contains the output you would like to move.
3. Click the output you would like to move, and drag it to the output queue to which you would like to move it in the left pane of iSeries Navigator.

Note: The output is moved to the target queue and placed on the queue according to priority.

To move output within an output queue, follow these steps:

1. In iSeries Navigator, expand **My Connections** → *server-name* → **Work Management** → **Output Queues**.
2. Double-click the output queue that contains the output you would like to move.
3. Click the output you would like to move, and drag it to the output in the queue that you would like to move it after.

Note: The output is moved directly after the target output.

For more information, see “Output queues” on page 67.

Clear output queues

When a job creates printer output it is sent to an output queue to be printed. Most likely you will not print all the printer output created. iSeries Navigator gives you the ability to clean out your output queues using the **Clear** option. Clearing an output queue will delete all output from the queue.

To clear an output queue, follow these steps:

1. In iSeries Navigator, expand **My Connections** → *server-name* → **Work Management** → **Output Queues**.
2. Right-click the output queue you would like to clear, and select **Clear**.

For more information, see “Output queues” on page 67.

The structure of your system

You can separate work management into five different functional areas: jobs, job queues, subsystems, memory pools, and output. Each of these areas has its own terms and concepts associated with it. By themselves they produce different types of data; however, when integrated with each other they become a powerful tool for managing work on your iSeries server.

To learn more about the different functional areas within work management, see these topics:

“Jobs”

Learn about the different types of jobs and their properties. Also, learn about the actions that you can perform on jobs.

“Job queues” on page 49

Learn about the role of the job queue in the work management life cycle.

“Subsystems” on page 51

Learn about the different types of subsystems and their properties.

“Memory pools” on page 64

Learn about the different types of memory pools and their properties.

“Output queues” on page 67

Learn what happens to work when it finishes running.

Note: iSeries Navigator calls application programming interfaces (APIs) that retrieve information from the iSeries system. APIs are iSeries Navigator’s input and output devices for the iSeries server. For more information on APIs, see Application programming interfaces (APIs) or API Concepts.

Jobs

All work done on a system is performed through jobs. Each active job contains at least one thread (the initial thread) and may contain additional secondary threads. Threads are independent units of work. Job properties are shared among the threads of the job, however threads also have some of their own properties, such as a call stack. The job’s properties contain information about how the work is processed. The job serves as the owner for properties that are shared among threads within the same job. Work management provides a way for you to control the work done on your system through a job’s properties.

The general properties of a job determine how the system runs each job. Some of the properties are grouped together in the “Job description” on page 32 for easier multiple job management. The system knows what properties to get and when, based on how the job properties are specified. The iSeries system runs different types of jobs to serve various needs. Most job types use a job description.

For more information about jobs, see the following topics:

“Active and inactive jobs” on page 32

Learn what active and inactive jobs are.

“Job types” on page 32

Learn about the different types of jobs that run on the iSeries.

“Job properties” on page 40

Learn how to work with job properties.

“Job actions” on page 15

Learn how to manage jobs through iSeries Navigator.

“Threads” on page 47

Learn the difference between threads and jobs.

“Job queues” on page 49

Learn how a job goes from waiting on the job queue to performing work.

A job’s life


Learn what happens during a job’s life from the start to the end.

Note:

APIs, such as Open List of Jobs (QGYOLJOB) and Retrieve Job Information (QUSRJOB), can be called to get information on jobs. For more information on APIs, see Application programming interfaces (APIs).

Job description

The job description allows you to create a set of job properties that are saved and available for multiple uses. The job description can be used as the source for some of the “Job properties” on page 40 that tell the system how to run a job. The properties tell the system when to start the job, where to get the job from, and how the job will run. Job descriptions are used by “Autostart jobs” on page 33, “Batch jobs” on page 33, “Interactive jobs” on page 34, and “Prestart jobs” on page 34 job types. You can use the same job description for multiple jobs. The job description is created through a character-based interface.

For more information, see the **Job Description** topic in chapter 5 of the V4R5 Work Management  (about 2720 KB or 573 pages) manual.

Active and inactive jobs

Active jobs:

Active jobs are jobs that have started running but have not completed running. Following are some characteristics of an active job:

- Contains running code
- Has a call stack
- Has objects locked
- Has the status of an active job, for example:
 - Running
 - Waiting for (x)

For information about the properties of active jobs, see “Job properties” on page 40.

To learn how to manage active jobs, see “Manage jobs and threads” on page 6.

Inactive jobs:

Inactive jobs are jobs on a “Job queues” on page 49 waiting to be started, or jobs that have completed processing (ended) but are waiting for a printer output file (also called spooled files) to be printed.

Job types

The iSeries server processes several different job types. You can select one of the following job types to learn more about that job type.

“Server jobs” on page 39 are jobs that have set the server type using the Change Job (QWTCHGJB) API, and they will have an additional classification of Server with one of the following job types:

“Autostart jobs”

An autostart job is started automatically when the subsystem it is associated with starts.

“Batch jobs”

A batch job is a predefined group of processing actions that is submitted to the system.

“Communications jobs” on page 34

A communications job is a batch job that was started by a program start request from a remote system.

“Interactive jobs” on page 34

An interactive job requires input from a signed-on user and an iSeries server.

“Prestart jobs” on page 34

A prestart job is a batch job that starts before a work request is received. The two types of prestart jobs:

- Prestart communications - The job is a communications batch job that starts running before a remote system sends a program start request.
- Prestart batch - The job is a batch job that starts before a work request is received.

“Reader and writer jobs” on page 35

A reader job is a spooled input job, and a writer job is a spooled output job.

“Subsystem jobs” on page 35

The subsystem job provides control over an active subsystem.


“System jobs” on page 35

System jobs are created by the operating system to control system resources and perform system functions.

Autostart jobs: An autostart job starts automatically when the subsystem it is associated with starts. These jobs generally perform initialization work that is associated with a particular subsystem. Autostart jobs can also perform repetitive work or provide centralized service functions for other jobs in the same subsystem.

The subsystem job uses information from the autostart job entry in the subsystem description, when starting a job.

Note: All autostart jobs are started when the subsystem starts. The value specified for the “Subsystem description” on page 52 does not prevent the autostart jobs from starting. If the maximum number of jobs in the subsystem is exceeded, no other jobs can be started. When enough autostart jobs have completed so that the number of jobs running is below the maximum activity level, other jobs in the subsystem can start.

For more information about autostart jobs and how they start, see the Autostart Jobs (Chapter 9) and Autostart Job Entry (Chapter 4) topics in the V4R5 Work Management  (about 2720 KB or 573 pages) manual.

Batch jobs: A batch job is a predefined group of processing actions that is submitted to the system. Batch jobs run in the system background, freeing the user who submitted the job to do other work. The job requires no interaction on the part of the user once it has been set up. Batch jobs are typically low priority jobs. Several batch jobs can be active at the same time.

Following are different kinds of batch jobs:

Simple batch job

Most people are familiar with the simple batch job that is submitted to a job queue. For more information about a simple batch job's life, see *A job's life*.

Batch immediate job


A batch immediate job is a batch job that was started with many of the attributes of its parent job. The job runs in the same subsystem as the parent job. Because the job copies attributes from the parent job and does not go through a job queue, it can start faster than jobs submitted to a job queue.

Batch MRT job


A batch MRT job is a multiple requester terminal (MRT) job. MRT jobs are S/36 Environment jobs that act like servers, allowing other S/36 Environment jobs to attach to them in order to run an MRT procedure.

Batch print job

Batch print jobs track the printer output files (also called spooled files) that were created by a job whose current user profile is different from the user profile that it was started under.

For more information, see *How a Batch Job Starts* in Chapter 8 of the V4R5 Work Management  manual. (about 2720 KB or 573 pages)

Communications jobs: Communication jobs are started when a program start request is received from a remote system. For performance reasons, instead of starting a communications job each time a program start request is received, you can configure a "Prestart jobs" job to handle a program start request from a remote system.

For more information about a program start request, see chapter 3 of the ICF Programming  manual.

For more information, see *Communications Jobs* in Chapter 10 of the V4R5 Work Management  manual. (about 2720 KB or 573 pages)

Interactive jobs: Interactive jobs require continual two-way communications between the user and the iSeries server to perform a task. An interactive job begins when a user signs onto a system. The system requests sign-on information. If the sign-on request is accepted by the system, then the system creates the interactive job. The system then asks the user to supply a request. The user enters a request, and the system responds by processing the request. This pattern is repeated until the user ends the interactive job by signing off the system. If an interactive job is part of a group of jobs or a pair of jobs, then it will have one of the following job types:

Interactive - Group

An Interactive - Group job is part of a group of jobs that is associated with a single display device.

Interactive - System request

An Interactive - System request job is one of a pair of jobs that is associated with each other by the system request function.

Prestart jobs: A prestart job starts before a work request is received, either when the subsystem starts or as a result of the Start Prestart Jobs (STRPJ) command. Prestart jobs start from a prestart job entry (PJE) in the subsystem description. The prestart job entry specifies properties such as what program to run in the prestart job, the user profile under which the prestart job starts running, the "Job description" on page 32, the class used to specify the run-time properties of the job, and the "Memory pools" on page 64 in which the prestart job runs.

Prestart jobs can start and initialize themselves before a work request is received. This reduces the amount of time required to handle the requests. A new job is not required for every work request. In addition, prestart jobs provide the ability to initialize once and handle many requests so that a new job is


not needed for every request. Most client server applications use prestart jobs to handle the requests for the client user. Having a job ready to go makes the performance better in this situation because the prestart job can start processing the request for the user immediately.

Note: The value specified for the “Subsystem description” on page 52 can prevent prestart jobs from starting. If the maximum number of jobs in the subsystem is exceeded, no prestart jobs can be started. When enough jobs have completed so that the number of jobs running is below the maximum number of jobs in the subsystem, prestart jobs in the subsystem can start.

Two types of prestart jobs exist. Each type handles different types of requests. Before a job waits for its first request, it will be shown as Prestart only because the system does not know yet what type of requests the job will handle. Following are the two types of prestart jobs:

Prestart communications job

A prestart communications job is a communications batch job that starts running before a remote system sends a program start request.

For more information about prestart communications jobs, see Prestart Jobs in Chapter 11 of the V4R5 Work Management  (about 2720 KB or 573 pages) manual.

Prestart batch job

A prestart batch job is a batch job that starts before a work request is received.

Reader and writer jobs: Reader



A reader job reads batch job streams from database and diskette files, and places the jobs on a job queue. The reader job is part of input spooling and is an IBM-supplied program.

Writer

A writer job writes records from printer output files (also called spooled files) to a printer. The writer job is an IBM-supplied program, started in the spooling subsystem where it selects files from the output queue to be printed.



Subsystem jobs: A subsystem job (sometimes called subsystem monitor job) is created by the operating system to manage resources and to start, control, and end jobs. The subsystem job provides control over an active subsystem. Many subsystem jobs can run on a system at any time.

For more information, see “Subsystems” on page 51.

System jobs: System jobs are created by the operating system to control system resources and perform system functions. System jobs run when the iSeries server starts  or when an independent disk pool is varied on.  These jobs perform a variety of tasks from starting the operating system, to starting and ending subsystems, to scheduling jobs.

Following are different kinds of system jobs and their functions:

System startup jobs: Scpf (start control program function)

This is the central job when you start the system.  Scpf starts the Qsysarb series, but Qsysarb3 (See 36) starts most of the other system jobs (not Qlus)  and brings the system to a usable state. This job remains active after the system starts, providing an environment for the running of low-priority and possibly long-running system functions. Scpf also runs during the power down (Pwrdownsys) processing, and is the job that ends the machine processing.

Qwcbtclnup (job table cleanup)

This job is used during the start of the system to ensure that the job structures are available for use. It

usually completes processing before the end of the system startup, but it can continue running after the system starts, if there are a lot of job structures to clean up. This system job ends when it completes processing.



Qlpsvr (software agreements acceptance)

This job is automatically started during an IPL if online software agreements need to be accepted. The job ends when all agreements are either accepted or declined.

System arbiters: **Qsysarb (system arbiter)**

The system arbiter provides the environment for the running of high-priority functions. It handles system resources and keeps track of the state of the system. The system arbiter responds to system-wide events that must be handled immediately and those that can be handled more efficiently by a single job.

Qsysarb, Qtaparb (tape arbiter), and Qcmnarbxx (communications arbiters) are responsible for processing communication requests, device locking, line, controller, and device configuration, and handling of other system-wide resources.

Qsysarb2 (system arbiter 2)

This job is responsible for managing tape resources, handling command analyzer spaces for command processing and other system-wide processing for the operating system.

Qsysarb3 (system arbiter 3)

This job is responsible for creating and maintaining the job structures on the system. Whenever temporary or permanent job structures are required for job initiation, the request is processed by Qsysarb3. Qsysarb3 also starts and ends many of the system jobs.

Qsysarb4 (system arbiter 4)

This job is responsible for starting and ending subsystems. This includes the initial power down (Pwrdownsys) processing.

Qsysarb5 (system arbiter 5)

This job is responsible for processing machine events. This includes handling events to support auxiliary power, continuous powered mainstore (CPM), system auxiliary storage pools (ASPs) and storage threshold, and lock table limits. Usually, the machine events are handled and corresponding CPF messages are sent to Qsysopr and Qhst.

Communications jobs: **Qlus (logical unit services)**

Qlus handles the event handling for logical unit devices, known as communications devices. Qlus is also responsible for allocating devices to the correct communications subsystem.

Qcmnarbxx (communications arbiters)

The communications arbiters along with Qsysarb (system arbiter) and Qtaparb (tape arbiter) process work for all types of devices, not just communications devices. This work includes communications connection, disconnection, device locking, and error recovery processing.

The communication arbiter jobs, at restart (QCMNARB) system value determines the number of communications arbiter jobs that are started. A minimum of three communications arbiters are started on single-processor systems.

Qsyscomm1 (system communications)

This job handles some communications and input/output (I/O) activity.

Q400filsvr (remote file system communication)

This job performs the common programming interface communications (APPN or APPC) for the remote file system.

Database jobs: **Qdbfstccol (database file statistic collection)**

This job collects database file statistics. These statistics are crucial to proper database query optimization.

Qdbsrvxr (database cross-reference) » and Qdbx###xr for independent disk pool group ###



This job maintains each of the file level system cross-reference files in Qsys. These files contain cross-reference information about database files and SQL information across the system. The files all begin with the prefix of Qadb in library Qsys. The primary file that must be maintained is Qadbxref, the cross-reference file. This file contains a record of each physical database, logical database, DDM, and Alias file on the system. Qdbsrvxr activates when a file is created, changed, deleted, restored, renamed, or its ownership is changed.

Qdbsrvxr2 (database cross-reference 2) » and Qdbx###xr2 for independent disk pool group ###



This job maintains the two field level cross-reference files. Qadbifld in library Qsys is the field cross-reference file. Qadbkfld in library Qsys is the key field cross-reference file. Qdbsrvxr2 is activated when a file is created, changed or deleted.

Qdbsrv01 (database server) » and Qds###v01 for independent disk pool group ###



This job can be viewed as the database maintenance task dispatcher. The number of database server jobs on the system is one plus twice the number of processors, or one plus twice the number of ASPs, whichever is greater. The minimum started is five. Qdbsrv01 is the main system job assigning work to the others. Typically, Qdbsrv01 will be most active immediately after restoring a library that contains database files. Its function includes:

- Signaling to the system-managed access path protection (SMAPP) Licensed Internal Code (LIC) tasks that new access paths have been restored. SMAPP then determines whether these access paths need to be protected.
- Preparing the list of access paths that are required to be rebuilt because the access paths were not restored.

Of the remaining database server jobs, the first half process high-priority requests, and the second half process low-priority requests. Qdbsrv02 through Qdbsrv05 are high priority, Qdbsrv06 through Qdbsrv09 are low priority.

Qdbsrvxx (database server, high priority) » and Qds###vxx for independent disk pool group ###



These jobs perform journal and commitment control maintenance for the system and are considered quick or short-running work.

Qdbsrvxx (database server, low priority) » and Qds###vxx for independent disk pool group ###



These jobs perform access path maintenance on user data files. Typically, these jobs are inactive, but in certain cases, they may activate to perform access path rebuilds. Some reasons why these jobs could be active are:

- Restoring database files that were not saved with access paths.
- Restoring logical files without the physical file they are based on.
- Canceling of an Rgzpfm command while in process.
- Invalidation of an index due to damage found in the index.
- Post-iSeries installation activity to complete cross-reference or other DB upgrade activity.


- Constraint verification

Qqqtemp1 and Qqqtemp2 (database parallelism)

The database parallelism system jobs perform asynchronous database processing for the DB2^(R) Multisystem. If users query distributed files, the jobs are used to speed up the queries by doing certain tasks in parallel.

Other jobs: **Qalert (alert manager)**

This job performs the tasks necessary to process alerts (for information about alerts, see the Alerts

Support  manual). This includes such activities as processing alerts received from other systems, processing locally created alerts, and maintaining the sphere of control.

Qdcpobjx (decompress system object)

These jobs decompress newly installed operating system objects as needed. There is a storage requirement for these jobs to run. If available storage on your system drops below a certain limit, these jobs will end. The number of decompress system object jobs is the number of processors plus one.

Qfilesys1 (file system)

This job supports the background processing of the integrated file system. It ensures that changes to files are written to storage and also performs several general file system cleanup activities.

Qjobscd (job schedule)

This job controls the system's job scheduling functions. Qjobscd monitors the timers for job schedule entries and scheduled jobs.



Qli###cl for independent disk pool group ### (library cleanup)

This job cleans up libraries on independent disk pools. «



Qli###rp for independent disk pool group ###: (object cleanup)

This job cleans up replaced objects on independent disk pool libraries. «

Qlur (LU 6.2 resynchronization)

Qlur handles the two-phase commit resynchronization processing.

Qpfradj (performance adjustment)

This job manages changes to the storage pool sizes and activity levels. All requests to change storage pools are processed by this job. In addition, if system value Qpfradj is set to a value of 2 or 3, this job dynamically changes the sizes and activity levels of storage pools to improve the system performance.

Qsplmaint (system spool maintenance) » and Qspmn##### for independent disk pool group #####



This job performs system spooling functions that include:

- » Spooled file cleanup after an IPL or a system is varied on.
- Moves stranded spooled files of damaged user output queues in the system auxiliary storage pool or in a basic user auxiliary storage pool into the output queue QSPRCLOUTQ in library QRCL.
- Clears the spool database member which contained a deleted spooled file's data and attributes.
- Deletes the spool database members that have not been reused within the time specified in system value QRCLSPLSTG. «



Qsppl##### for independent disk pool group ##### (system spool PRTQ updater)
This job performs spooled file operations for the specific independent disk pool group. <<



Qtaparb (tape devices)
This job processes work related to tape devices including device locking and error recovery processing <<

Server jobs: Server jobs are jobs that run continuously in the background on the iSeries system waiting for work. Work can come from network functions, operating system functions, on behalf of a user, another system within the network, or from general system services, such as the clustering server jobs. Server jobs typically run in one of three basic “Subsystems shipped with the system” on page 61 - QSYSWRK, QSERVER, or QUSRWRK. Server jobs are most commonly associated with such functions as HTTP, Lotus Notes^(R), and TCP/IP. The iSeries system has three basic models for server jobs:

Threaded Job Model - In the threaded job model the server job is a job with multiple “Threads” on page 47. One thread acts as the distributor of work to the other threads. For example, when the server receives a client request, the initial thread reads the request and passes it to another thread to fulfill the request. With this model, the amount of jobs on the system is greatly reduced because work is handled in different threads rather than requiring multiple jobs. A few examples of server jobs that use the the threaded job model are Domino^(TM), HTTP server, and Websphere.

Prestart Job Model - In the prestart job model there is usually a primary job that acts as a listener for requests that come into the system. This job is usually called the daemon job. The daemon job handles the initial request and then passes the request to the appropriate “Prestart jobs” on page 34 server job. With this job model, using prestart jobs can reduce the number of jobs that are required because once a request has been fulfilled the prestart server job waits for the next request. The server job is reused. Also, from a performance perspective, the prestart job is already running and waiting to process the request. Some examples of server jobs that use the prestart job model are SQL server, host servers, and simple mail transfer protocol (SMTP).

Note: For jobs that run user code, typically the job is not reused (like most server jobs). This is because the user code may have changed anything in the job.

Multiple Listening Job Model - In the multiple listening job model, several server jobs are started. When a request comes in, the job that receives the request handles the job, while the next available server job waits for the next request to come in. Once the server job completes the request, it closes the connection and ends. A new server job starts and the cycle continues. With this model, you do not have to be concerned with prestart job entries. However, sometimes configuring subsystems unique to your environment is not possible because this model runs in the default subsystem. One exception is file transfer protocol (FTP). With file transfer protocol you can configure the subsystem in which the file transfer protocol server runs. There is no ability to have some file transfer protocol work to run in one subsystem and the rest of the work to run in a different subsystem. Also, from a performance perspective, the cost of job initiation and job termination cannot be avoided because once a job is run it is ended and another job starts. However, because jobs end when the connection is complete and the next job is started, the new job will generally be up and running when the next request is received, so the job initiation and termination cost should not affect the time it takes to connect to the server. Some examples of server jobs that use the multiple listening job model are file transfer protocol (FTP) and line printer daemon (LPD).


“Messages” on page 40 allow the user to understand the status of the server and troubleshoot any problems that it may be having. They play an important role in managing server jobs.

For more detailed information on the job names of the server jobs that run on the system, see the server job table. This table shows you the subsystem and the job name so that you can “Access job logs for active jobs, including server jobs” on page 28. The table also shows the job description each server job uses. By default most server jobs do not generate a job log when the job ends (the LOG parameter is set to 4 0 *NOLIST), which means that the job log is not created. If you want a job log to be generated with all the messages sent to the job log, the LOG parameter needs to specify 4 0 *SECLVL.

If you want to generate a job log, do the following:

- If you need to change the the job log parameter for one specific job when it is active use **Change Job (CHGJOB)** (from the character based interface) and change the LOG parameter or go to the Job log dialog in Job Properties in iSeries Navigator.
- If you need to change the job log parameter for an extended amount of time or for many jobs use **CHGJOB** (from the character based interface) and change the LOG parameter on the job description. Once the change is made you need to stop and restart your server job for the change to take effect. This will create job logs for all the jobs using the job description. To change the job log setting back you need to repeat these steps and set the job log parameter back to 4 0 *NOLIST.



Messages: Because server jobs run for an undetermined amount of time it is essential that you understand the messages that are sent to QSYSOPR message queue and to the job log so that you can troubleshoot any problems that may occur on your servers. Messages contain the job name, the message type, the date and time it was sent, the action that occurred, and the necessary actions needed to fix a problem. You can “Access job logs for active jobs, including server jobs” on page 28 for server jobs through iSeries Navigator.

Alertable messages - These messages are sent to QSYSOPR because they need immediate action. The message contains the problem, the cause, and the recovery action necessary. For example, the server fails to start or the server ends unexpectedly. Some servers send alertable messages to QSYSOPR. These messages have the Alert Option (ALROPT) defined in the message description. You can use alerts to provide centralized handling of alertable messages. For more information, see the Alerts Support .

Messages logged in a job log - These messages are diagnostic in nature, meaning that they are not critical but are alerting the user of some action that was taken. These messages can be system generated as well as user created.

For more information on the messages, see the iSeries Navigator online help or see Messages.

Job properties

Job properties contain information about how jobs are processed. They are originally specified when the job is created. Some of the properties come from the “Job description” on page 32. After the job is created, the job properties can be viewed and managed through Work Management in iSeries Navigator. The job properties pages in iSeries Navigator make a system operator’s job easier by providing efficient and easy-to-use functions for managing jobs. Job properties can be viewed by any user, but can only be changed by a user with the “Proper authority” on page 42. Similarly, an authorized user can manage jobs through “Job actions” on page 15. Properties for “System jobs” on page 35 cannot be changed in iSeries Navigator. However, the run priority of  some  system jobs can be changed in the character based interface using the change system job (CHGSYSJOB) command.

Work with job properties

To view or change a job’s properties, follow these steps:

1. In iSeries Navigator, expand **My Connections** —> *server-name* —> **Work Management** —> **Active Jobs** or **Server Jobs**, depending on the type of job you want to work with.
2. “Find a job on the iSeries server” on page 8 whose properties you want to view or change.
3. Right-click the **Job Name**.
4. Select **Properties**.

Job property sheets

General job properties allow you to view general information about jobs. This information includes the job's name and its "Job types" on page 32, when it entered the system, when the job started, the job's "Detailed status" on page 43, and other information.

Performance properties allow you to view basic performance information and make changes that will affect a job's performance. You can view the performance statistics that have been calculated over the life of the job, such as CPU and disk I/O. You can change the following values that affect how the job will run:

- Run priority
- Time slice
- Default wait time

You can also view, refresh, set up an automatic refresh, or reset the Elapsed performance statistics that have been calculated for an "Active and inactive jobs" on page 32. For more information, see "Elapsed performance statistics" on page 43.

"Job queues" on page 49 properties are available for jobs that are on a job queue or started from a job queue. You can change information for jobs currently on a job queue. You can work with the priority of the job on the job queue, view the date and time the job was placed on the job queue, and change when to make the job available to run.

Printer Output properties allow you to view and change properties that affect the printing of output for the job. You can also display the printer output for a job by using the printer output button. You can choose to "Detach printer output" on page 42 from a job, select a printer, choose the output queue and its library, specify the order that you want the information printed (priority), specify a page footer, and specify whether border and header information should be printed.

Messages properties allow you to specify how inquiry and break messages will be handled. If the job is a "Batch jobs" on page 33, the message severity level that causes the job to end is also shown.

Job Log properties allow you to view and change information related to the job log as well as display the job log. The job log contains information that is related to requests entered for a job, such as commands in the job, commands from CL programs, and messages. This page allows you to specify whether or not to keep messages in the job log, what action the job needs to take when the job log is full, what kind of messages to keep, whether a printed job log (printer output) is generated for jobs that end normally, and the amount of detail to include for each message. For more information, see "Job logs" on page 46.

Security properties allow you to view security properties for jobs that are currently active. This includes the job user identity, the method used to set the job user identity (Set by), the current, user and the names of the group profiles that are associated with the initial thread of a job (Groups).

» **Date/Time** properties allow you to view date and time information about jobs. You can view the date and time separator values. In addition, you can view time zone information and the local date and time of the job. «

International properties allow you to view or change properties related to the » language and country/region associated with the job. This includes the format to use when decimals are represented. In addition, these properties specify what language, country/region, character identifier control, and sort sequence of the job. « There is also an indication of whether the job is capable of handling double-byte character sets (DBCS).

Threads properties allow you to view information related to threads for a job that is currently active or on a job queue. You can also display the threads for a job by using the Threads button. This page

includes information about whether the job can run with multiple user threads, the number of active threads in the job, and the maximum number of user and system threads that the job can run with at any time.

Server properties allow you to view information about server jobs. For each server job, you can see the type of server, job user identity, and if available, the client IP address. The client IP address is the address of the user that this server is currently servicing.

» **Resources** properties allow you to view the job's memory pool, disk pool group, and memory and processor affinity information. You can view whether or not the job is grouped with the initial thread and the level of affinity. In addition, you can view whether or not the job is grouped with other jobs. «

Other properties allow you to view and change properties related the accounting code, switch settings, and whether or not to keep DDM connections active. You can also view whether the job is running in a System/36 special environment.

For more information, refer to the iSeries Navigator help.

Proper authority: To make most changes to a job's properties you need to have either "**Job control special authority (*JOBCTL)**" (*JOBCTL) or your user profile needs to match the job user identity of the job being changed.

There are a few properties where having *JOBCTL special authority is necessary to make any changes. These properties are:

- Default wait time
- Run priority
- Time slice

Note: If you plan to make changes to the job's accounting code, you need *USE authority to the Change Accounting Code (CHGACGCDE) command in addition to *JOBCTL special authority or a user profile matching the job's job user identity.

For any job properties that refer to an OS/400 object, such as job queues, output queues, and sort sequence tables, the user needs to have the proper authority to the object. For more details on iSeries authorities, see Appendix D Authorities Required for Objects Used by Commands in the iSeries Security

Reference .

Job control special authority (*JOBCTL): **Job control special authority (*JOBCTL)** allows you to hold, release, change, and cancel other users' jobs, change the running attributes of a job, such as the printer device for a job, stop subsystems and perform an initial program load (IPL). You must have *JOBCTL special authority to change the run priority (RUNPTY) of your own job. Changes to the output priority and job priority of a job are limited by the priority limit (PTYLMT) in the profile of the user making the change.

A user with *JOBCTL special authority can change the priority of jobs and of printing, end a job before it has finished, or delete output before it has printed. *JOBCTL special authority can also give a user access to confidential printer output, if output queues are specified OPRCTL(*YES). A user who abuses *JOBCTL special authority can cause negative impacts on individual jobs and on overall system performance.

Detach printer output: In releases prior to V5R2, printer output was attached to a job until it was deleted either as a result of being sent to the printer or explicitly by the user.

You have the option to detach printer output from the job when the job ends. Printer output that is detached from the job is not deleted from the system, but resides on the output queue. This allows the job to leave the system, which frees up the job structures to be used by another job.

Note: If you choose to detach printer output from the job, you will no longer be able to look at printer output by going through the job. You will need to look at the actual output queue where the output resides to see it.

Elapsed performance statistics: The Elapsed performance statistics page allows you to view performance statistics, for an active job or thread, that are calculated over the elapsed time. This is important when you are monitoring a job or thread and in detecting potential problems. These statistics include CPU, disk I/O, page fault rate, average response time, and interactive transactions.

Note: The elapsed performance statistics for a thread do not include average response time and interactive transactions.

You can change the viewing options for these statistics by selecting one of the following buttons from the **Elapsed performance statistics** page:

- **Refresh Now**
Refreshes the elapsed performance statistics and extends the time period that the statistics are calculated.
- **Timed Refresh**
Allows you to set up automatic refreshes of the elapsed performance statistics. This can be used to monitor the performance information for a job.
- **Reset Statistics**
Clears the elapsed performance statistics and resets the time period that the statistics are calculated.

Detailed status: The current status of a job is viewed from the **General** page in “Job properties” on page 40, under **Detailed status**. Examples of detailed status follow:

Scheduled to run at

The job remains waiting on the job queue until the scheduled date and time. At the scheduled time on the scheduled date, the job is available to be selected from the job queue.

The detailed status can display an associated status value (status - x), which provides additional details about the current status of the job. An example of a detailed status plus the associated status value is: **Ended - CPU limit exceeded**

Ended refers to the status of the job (the job has ended), and *CPU limit exceeded* represents why the job has that status (Ended).

The detailed status can also have another associated status value displayed [status - x (x)] to reflect the current status of the job. For example a job that is ending could have the following status:

Ending - CPU limit exceeded (Waiting for lock)

The job is in the process of ending (Ending) because the CPU limit was exceeded (CPU limit exceeded), and the job is currently waiting for a lock (Waiting for lock) in the ending process.

If the job does not end in a timely manner, this information can assist with problem analysis.

Status values can have additional information in the properties pages. For example, the status waiting for a lock, on the properties page, will show you what object is associated with the lock request.

End jobs: There are two ways to end a job either controlled or immediate. Selecting **controlled** is usually the better choice because it allows programs running in the job to perform their end-of-job cleanup and to end properly. » Selecting **immediate** ends the job immediately after the maximum time for immediate end is reached. It is recommended that immediately ending a job be done only after the controlled option has failed. «


A job can check the end status for a job through the Job APIs such as the Retrieve Job Information (QUSRJOBI) API. When a controlled end is selected, an application that needs to perform end-of-job cleanup should detect the controlled end. One way an application can do this is by the asynchronous signal SIGTERM.

» When a job being ended has a signal handling procedure for the asynchronous signal SIGTERM, the SIGTERM signal is generated for that job. When the signal handling procedure for the SIGTERM signal is given control, the procedure can take the appropriate actions to avoid undesirable results such as application data that has been partially updated. If the SIGTERM signal handler has not completed in the specified amount of time, the system ends the job.

If a job is ended in an immediate manner, the maximum time for the signal handler is specified by the Maximum time for immediate end (QENDJOBLMT) system value. This system value's time limit is used when ending one job, when ending all the jobs in a subsystem, or when ending all jobs in all subsystems. After two minutes from the initial end request, the system operator can use the End Job (ENDJOB) command with OPTION(*IMMED) to override the QENDJOBLMT value and end individual jobs immediately. Only use this command if a job is unable to perform its cleanup due to lock or wait conditions.

In order to allow enough time for both application cleanup and system end-of-job processing, you may need to adjust the Maximum time for immediate shutdown (QPWRDWNLMT) system value in the Restart category of system values. If you set the Maximum time for immediate end (QENDJOBLMT) system value to a value greater than Maximum time for immediate shutdown system value, a warning message will be displayed. When a power down occurs, all jobs must end within the time frame specified by the Maximum time for immediate shutdown system value in order for the power down to complete in a controlled manner. «

For detailed steps about how to end a job, see "End a job" on page 14.

For more information about ending a job and detecting the controlled end, see **Ending a Job** in chapter 5 of the V4R5 Work Management  (about 2720 KB or 573 pages) manual.

Details: Active job actions: The Details menu in the Work Management folder provides access to the following resources that are being used by the job or initial thread of the job:

Call stack

The call stack for the job is displayed. The call stack is the programs and procedures that are being used. This is helpful for finding out what program a job is running and what the job is doing.

Library list

The library list for the selected job or thread is displayed. A library list is a list of system and user-created libraries to search and the order that they are to be searched. A library is a container for objects, and all objects on the iSeries server require a reference consisting of the object name and a library. It is important to have the library list properly established because objects are found by

searching the libraries. If the library list is not properly established, the job may not find an object or it may find the object in the wrong library. IBM supplies some libraries (library names that begin with Q), but you can also create your own. By selecting a library from this dialog and right-clicking, you can work with the properties of that library.

Locked objects

The list of “Locked objects” and the objects for which the job or thread is waiting for a lock are displayed. This allows you to see what objects a job is using as well as the objects the job is attempting to use.

Open files

» Allows you to view the library objects or file system objects of the job. These are helpful for debugging and for checking the status of a job.

Library Objects

Displays a list of library objects associated with the selected job.

File System Objects

Displays all IFS objects in any file system, including QSYS.LIB, that are associated with the selected job. «

Threads

A list of “Threads” on page 47 running within a job. The initial thread, by default, is listed at the top of the window. Threads are independent pieces of work that help the job process more than one thing at a time.

Transactions

A list of transactions associated with the job. A transaction is a logical unit of work on the iSeries system. It is commonly referred to in relation to database operations. For more information on Transactions, see the iSeries Navigator help or go to Transactions.

Elapsed performance statistics

A list of “Elapsed performance statistics” on page 43 calculated over a period of time is displayed. This information is helpful for monitoring jobs and can assist with problem analysis.

Last SQL statement

The Last SQL statement option displays the last SQL statement run in a job. This SQL statement is displayed in Run SQL Scripts. From Run SQL Scripts, you can re-run the statement, edit and run the statement, or save the statement to a database file or PC file.

Locked objects: Jobs and threads use objects to process work. Because more than one piece of work is processing at a time, a lock is put on an object so that data integrity is retained. **Locked objects** are system objects used by jobs and threads to process work. Once the job or thread is finished running, the object is unlocked and ready to be used to process more work. Depending on the lock request type used, locking an object permits only one user to use an object at a time. For example, if two or more users tried to change an object at the same time, the changes to the object by the second user would be locked out until the first user finished updating the object. With the use of lock holders, a user can see what currently has a lock or is currently waiting on a lock for an object.

Scope specifies whether the lock is associated with a job, a thread, or a lock space. Scope also defines how long the lock will be available and what lock request type and conflict rules the object has on it.

Lock request types are different levels of access that a job, thread or lock space can have to an object that is locked. For example, a lock exclusive, no read lock type would be used if an object is being changed or deleted on the system. This lock request type would not allow anyone to use the object, nor would it allow anyone to read the object.

The different lock request types are:

- **Exclusive - No read**
The object is reserved for exclusive use. However, if the object is locked by any lock request type, you cannot obtain exclusive use of the object. This lock state is appropriate when a user does not want any other user to have access to the object until the function being performed is complete.
- **Exclusive-Read**
The object can only be shared with the shared-read lock request type. This lock is appropriate when a user wants to prevent other users from performing any operation other than a read.
- **Shared-Update**
The object can be shared with either the shared-read or shared-update lock request type. That is, another user can request either a shared-read lock state or a shared-update lock state for the same object. This lock state is appropriate when a user intends to change an object but wants to allow other users to read or change the same object.
- **Shared-No update**
The object can be shared with only share - no update, and shared-read lock request types. This lock state is appropriate when a user does not intend to change an object but wants to ensure that no other user changes the object.
- **Shared-Read**
The object can be shared with all lock requests other than exclusive - no read. That is, another user can request an exclusive-read, shared-update, shared-read, or shared-no update lock state.

For more information on lock conflicts, see the iSeries Navigator online help.

The **lock status** tells the state of the lock request. The different lock statuses are:

- Held** - The lock request has been fulfilled and the job, thread or lock space is holding the lock.
- Waiting** - The job or thread is waiting to obtain the lock.
- Requested** - The job or thread has requested the lock.

Lock holders are the jobs, threads and lock spaces that are currently holding a lock or are waiting for a lock on a specific locked object.

For more information on locked objects, lock requests, lock holders, lock statuses and scope, see the iSeries Navigator online help.

Job logs: The job log displays a list of messages that are associated with a specific job. Additional information about the messages, for example the date and time they were sent, is also displayed. Because the date and times are recorded in the job log, you can determine when an error occurred. ➤ Right-click on a message and select **Properties** for more information about the message. On the **General** page, you can view who sent the message, the cause of the message and an explanation of what action should be taken, if any, to recover from the error. For job log messages, you can view the **Details** page to see information about the program that sent the message and the program to which the message was sent. ⏪ You can make changes to how the job log is handled and what information is logged in the job log on the **Job Log** page in the “Job properties” on page 40 dialog.

For information about how to view the job log for jobs, see “Access job logs for active jobs, including server jobs” on page 28.

Threads

A thread is an independent unit of work within a job that uses many of the jobs resources to complete work. The difference between jobs and threads is that threads run within the job helping it to finish its work. Every active job has at least one thread, which is called an initial thread. The initial thread is created as part of starting the job. The use of threads within a job allows many things to be done at once. For example, while a job is processing, a thread may retrieve and calculate data needed by the job to finish processing.

For more information on threads, see the following topics:

- **“Thread actions”**
Manage threads through iSeries Navigator.
- **“Thread types” on page 48**
This covers the different types of threads running within a job.
- **“Thread status” on page 49**
This includes the different statuses of a thread.

Thread actions: Threads help jobs process more than one operation at a time while running. Monitoring the threads that are running within a job may be necessary as you attempt to keep the job running efficiently. Once you “View threads running under a specific job” on page 16 you want to manage, the following actions are available by right-clicking the thread.

Reset Statistics

Allows you to reset the list information you are viewing, and it sets the elapsed time to 00:00:00.

“Details: Active job actions” on page 44

Because the functions of a thread are similar to that of a job, they share some of the same actions. Details contains detailed information about the following thread actions:

- Call stack
- Library list
- “Locked objects” on page 45
- Transactions
- “Elapsed performance statistics” on page 43

Hold

Allows you to hold the thread. Threads can be held multiple times. The operating system keeps track of the number of times a thread is held.

Release

Releases the thread that was held. The thread must be released each time that it is held in order for it to run.

Delete/End

Allows you to end the selected thread or threads. For more information, see “Delete or end a thread” on page 17.

“Thread properties”

Displays the different properties of a thread.

For more detailed information on the actions you can perform on Threads, see the iSeries Navigator help.

Thread properties: Thread properties show information about how the threads are processed through work management. Threads use many of the job’s properties and resources to process work for the job it

runs within. Once the thread is created you can “View thread properties” on page 17. A user must have the “Thread proper authority” to view a list of threads or to see the properties of a thread.

Work with thread properties: To view or change a thread’s properties, follow these steps:

1. In iSeries Navigator, expand **My Connections**.
2. Expand the connection for your **iSeries server**.
3. Expand **Work Management**.
4. Double-click **Active Jobs** or **Server Jobs**, depending on the type of job you want to work with.
5. Right-click the job with which you want to work, select **Details > Threads**.
6. Right-click the thread with which you want to work, select **Properties**.

General thread properties allow you to view the properties of a thread. These properties include the thread identifier, the detailed “Thread status” on page 49 of the thread, the current user, the “Thread types” of thread running, the job the thread is running under, and the disk pool group the thread is running in.

Performance properties allow you to view basic performance elements and let you change the run priority of the thread. **Run priority** indicates the importance of the thread in relation to other threads running in the system. The possible values range from job priority to 99 (meaning the highest possible priority will vary). The thread run priority may never be higher than the run priority for the job in which the thread is running.

You can view the performance values calculated since the thread started, which include CPU and total disk I/O. You can also view, refresh, set up an automatic refresh, or reset the **Elapsed performance statistics** that have been calculated for a thread. For more information see “Elapsed performance statistics” on page 43.

Thread proper authority: To view and change most properties of a thread you need to have “Job control special authority (*JOBCTL)” on page 42 special authority, or your user profile needs to match the job user identity of the job containing the thread. To change the run priority of a thread, you must have *JOBCTL special authority. “**Thread Control**” will allow you to view some of the properties of a thread.

To hold or release a thread, you need to have *JOBCTL special authority or Thread Control authority, or your user profile needs to match the job user identity of the job containing the thread. To end a thread, you need to have *SERVICE special authority or Thread Control authority.

For any thread properties that refer to an OS/400 object, such as a library in the library list, the user needs to have the proper authority to the object. For more details on iSeries authorities, see Appendix D

Authorities Required for Objects Used by Commands in the iSeries Security Reference manual. 

Thread Control: **Thread Control** authority allows a user to end, hold, and release threads of another job. It allows one to retrieve information about threads of another job. Thread Control can be granted and revoked for individual users by using iSeries Navigator’s Application Administration support, or by using the Change Function Usage Information (QSYCHFUI) API, with a function ID of QIBM_SERVICE_THREAD. For more detailed information on application administration, see Application Administration.

Thread types: The thread type determines how the thread was created on the system.


The types of threads are:

User

The thread is created by the customer application. The initial thread in a job is always a user thread. The Allow multiple threads field must be set to yes for multiple user threads to be used.

System

The thread is created by the system on behalf of the user. Some system functions use system threads to complete processing. If a customer's application uses a system function that uses threads, system threads are used.

Note: In the threads on iSeries Navigator, by default, you will see **Initial** as the type of the first thread in the list. The initial thread is the first thread created within the job when it starts. In iSeries Navigator, the initial thread is represented by this  icon. You can never "Delete or end a thread" on page 17 the initial thread.

Thread status: The current status of a thread is viewed from the **General** page in the Thread properties dialog, under Detailed status. An example of a detailed status is:

Waiting for dequeue

The thread of the job is waiting for completion of a dequeue operation. A dequeue is an operation for removing messages from queues. Messages are communications sent from one person or program to another. In particular, a message is enqueued (placed) on a queue system object by one thread and dequeued (removed) by another thread.

Note: When Waiting for dequeue is shown on a properties page, additional information that identifies the queue being waited on is displayed. When the job or thread is waiting on the dequeue operation to complete for an OS/400^(R) object, you will see a 10-character object name, its library, and the object type. If the job or thread is waiting on the dequeue operation to complete for an internal object, you will see a 30-character object name. For internal objects you need job control special authority (*JOBCTL) to see the 30-character name.

The detailed status can display an associated status value (status - x), which provides additional details about the current status of the thread. An example of a detailed status plus the associated status value is:

Held (n)

An individual thread is held. Unlike a job, a thread can have multiple holds on it at the same time. A number (for example, Held (3)) following the thread status tells the user how many times that thread has been held without being released. For example, if a thread has had three holds put on it and then has been released once, it still has two holds against it. A number is only shown when the status appears on the Properties page and will not appear when displayed in a list. To resume thread processing, select the Release action for the thread.

For more information on the different thread statuses, see the iSeries Navigator help.

Job queues


A job queue contains an "Ordered list" on page 50 of jobs waiting to be processed by a subsystem. The job queue is the first place that a submitted "Batch jobs" on page 33 goes before becoming active in a subsystem. The job is held here until a number of factors are met. In order for jobs on a job queue to be processed, there must be an active subsystem that is accepting work from that job queue. When a subsystem starts, it attempts to allocate the job queues that it is configured to accept work from, and it must successfully allocate a job queue in order to process jobs from that job queue. Therefore, while one subsystem may be processing jobs from multiple job queues, only one subsystem may be processing jobs from a particular job queue at a time.

Subsystems select jobs from job queues in priority order, within limits that may be configured for each priority. Each job has a job queue priority that can be managed when the job is on the job queue through “Job properties” on page 40. A base set of job queues is provided with your system. In addition, you may create additional job queues that you need.

Note: APIs, such as Open List of Job Queues (QSPOLJBQ) and Retrieve Job Queue Information (QSPRJOBQ), can be called to get information on job queues. For more information on APIs, see Application programming interfaces (APIs).

For more information about jobs on job queues, see the following topics:

- “How work enters the system” on page 71.
Understand how work gets onto a job queue.
- “How a job queue works”
Understand how a job gets from a job queue to a subsystem.
- **Creating a job queue**

Create a job queue with information in Chapter 8 of the V4R5 Work Management  (about 2720 KB or 573 pages) manual.

Ordered list

The ordered list refers to the order in which jobs appear on the job queue. The values that help determine the order of jobs on the job queue are as follows:

Availability

Refers to the status of the job on the job queue. The possible values in order are waiting, scheduled, and held.

Priority

Refers to the priority the job has on the job queue. The possible priority values are 0-9, with 0 being the highest priority.

Date and time

Refers to the date and time of the job:

- If the job is scheduled, the date and time refers to when the job is scheduled to run.
- If the job is not scheduled, the date and time refers to when the job entered the system.

Note: There are cases where the date and time end up being a date and time manually set to properly position a moved job to a particular job queue.

How a job queue works

Jobs are taken from a job queue to do work in a subsystem after the job queue is allocated by an active subsystem. The different factors that determine how the jobs are selected from a job queue. Jobs that are not coming off of a job queue can be moved from one job queue to another, in order for better efficiency.

The following determine how jobs are taken from a job queue:

Maximum active jobs for subsystems

This represents the maximum number of jobs that can be running in a subsystem. Once this limit is reached, no more jobs can start in the subsystem.

Maximum active jobs for job queues

This represents the maximum number of jobs from the job queue that can be running in a subsystem at the same time. Once this limit is reached, no more jobs can start from that job queue.

Priority on job queue

Jobs that are waiting to run are selected based on the job queue priority. The subsystem attempts to run higher priority jobs first (job queue priority ranges from 0 through 9 where 0 is the higher priority), but if the number of jobs running from a priority level reaches the Maximum Active Jobs value per priority level, the next priority level is processed. (If jobs with the same priority enter the job queue, the first job submitted will run first, then the second, and so on.)

For detailed information, see “Change the priority of a job within a job queue” on page 18.

Sequence

You specify the sequence in the job queue entry of the subsystem description. The sequence number defines the order in which the subsystem will process the job queues. The subsystem takes jobs from the job queue with the lowest sequence number first. If there are no more jobs on the job queue, or if one of the maximum values associated with the job queue is reached, the subsystem will process the job queue with the next highest sequence number.

For detailed information about moving jobs, see “Move jobs to different job queues” on page 19.

Subsystems

The **subsystem** is where work is processed on the iSeries^(TM) server. All jobs, with the exception of “System jobs” on page 35, run within subsystems.

More technically, a subsystem is a single, predefined operating environment through which the system coordinates work flow and resource use. The system can contain several subsystems, all operating independently of each other. Subsystems manage resources. Each subsystem can run unique operations. For instance, one subsystem may be set up to handle only interactive jobs, while another subsystem handles only batch jobs. Subsystems can also be designed to handle many types of work. The system allows you to decide the number of subsystems and what types of work each subsystem will handle.

A subsystem can be either active or inactive. An active subsystem is one that has been started (see “Start a subsystem” on page 22 for details). An inactive subsystem is one that either has not yet been started, or has been stopped (see “Stop a subsystem” on page 22 for details).

The **controlling subsystem** is the interactive subsystem that starts automatically when the system starts, and it is the subsystem through which the system operator controls the system during system startup.

A **subsystem job** is a job created by the operating system to manage resources and to start, control, and end jobs.

Note: APIs, such as Retrieve Subsystem Information (QWDRSBSD) and Retrieve System Status (QWCRSSTS), can be called to get information on subsystems. For more information on APIs, see Application programming interfaces (APIs).

See the following for more information on subsystems:

“Subsystem description” on page 52

The run-time characteristics of a subsystem are defined in the subsystem description.

“**Subsystems shipped with the system**” on page 61

Two complete subsystem configurations are supplied by IBM^(R).

“**User-defined subsystems**” on page 62

You can create your own subsystem description.

“Subsystem properties” on page 62

The attributes of a subsystem are provided.







“Subsystem life cycle” on page 63



This explains how work is processed on the iSeries server.

Subsystem description

The run-time characteristics of a subsystem are defined in an object called a **subsystem description**. A subsystem description acts as a set of instructions, telling the subsystem how, where, and how much work enters a subsystem, and which resources the subsystem uses to perform the work. A subsystem is created when a subsystem description is defined or created. An active subsystem takes on the simple name of the subsystem description.

For details on what information is contained in the subsystem description, see the following table:

Information in subsystem description		Description	Additional information (Work Management manual)
Subsystem attributes		<p>Specifies overall system characteristics:</p> <ul style="list-style-type: none"> Operational attributes such as the number of jobs that can be active in the subsystem at the same time, and the sign-on display. Memory pools used by the subsystem. Authority to the subsystem description. Text description of the subsystem description. 	<p>Changing the sign-on display file, Chapter 4 of the Work Management manual. </p>
Work entries		<p>The work entry in a subsystem description specifies the source from which jobs can be accepted for processing in the subsystem. In other words, the location where work can enter the subsystem.</p>	<p>Work entries, Chapter 4 of the Work Management manual. </p>
	Autostart job entry	<p>Identifies the autostart jobs to start as soon as the subsystem starts.</p>	<p>Autostart jobs, Chapter 9 of the Work Management manual. </p>
	Communications entry	<p>Identifies the communications device that another system uses to submit work.</p>	<p>Communications jobs, Chapter 10 of the Work Management manual. </p>
	Job queue entry	<p>Identifies the job queue from which to take work and determine how much work to accept.</p>	<p>Batch jobs, Chapter 8 of the Work Management manual. </p>
	Prestart job entry	<p>Identifies the information used when prestart jobs are started.</p>	<p>Prestart jobs, Chapter 11 of the Work Management manual. </p>

Information in subsystem description		Description	Additional information (Work Management manual)
	Workstation entry	Identifies the workstation from which to take work.	Interactive jobs , Chapter 6 of the Work Management manual. 
Routing entries		Identifies the subsystem memory pool to use, the controlling program to run, and run-time information.	Routing entries , Chapter 4 of the Work Management manual. 

Subsystem Description objects are shipped with every system. Below are the updates to the shipped subsystem descriptions on the iSeries server. For each object, this table provides:

- Object Name
- Command used to update the object
- Command parameters other than the default

This table and Appendix C in the Work Management manual  will allow you to see most of the shipped subsystem descriptions on the iSeries.

Object	Addition, Deletion, or Update	Parameters other than default
QBASE	Added a communication entry (ADDCMNE)	SBSD (QSYS/QBASE) DEV (Q1PLOC) DFTUSR (*NONE) MODE (Q1PMOD) MAXACT (0)
QBASE	Added a communication entry (ADDCMNE)	SBSD (QSYS/QBASE) REMLOCNAME (Q1PLOC) DFTUSR (*NONE) MODE (Q1PMOD) MAXACT (0)
QBASE	Added prestart job entry (ADDPJE)	SBSD (QSYS/QBASE) PGM (QSYS/QZSCSRVR) USER (QUSER) STRJOBS (*YES) INLJOBS(1) THRESHOLD (1) ADLJOBS(3) JOB (*PGM) JOB (*USRPRF) MAXUSE (1) WAIT (*YES) POOLID (2) CLS (QGPL/QCASERVR *CALC *NONE *CALC)

Object	Addition, Deletion, or Update	Parameters other than default
QBASE	Added prestart job entry (ADDPJE)	SBSD (QSYS/QBASE) PGM (QSYS/QNPSEVR) USER (QUSER) STRJOBS (*YES) INLJOBS(1) THRESHOLD (1) ADLJOBS(3) JOB (*PGM) JOB (*USRPRF) MAXUSE (200) WAIT (*YES) POOLID (1) CLS (QGPL/QCASERVR *CALC *NONE *CALC)
QBASE	Added prestart job entry (ADDPJE)	SBSD (QSYS/QBASE) PGM (QSYS/QZRCSEVR) USER (QUSER) STRJOBS (*YES) INLJOBS(1) THRESHOLD (1) ADLJOBS(3) JOB (*PGM) JOB (*USRPRF) MAXUSE (1) WAIT (*YES) POOLID (2) CLS (QGPL/QCASERVR *CALC *NONE *CALC)
QCMN	Added a communication entry (ADDCMNE)	SBSD (QSYS/QCMN) REMLOCNAME (Q1PLOC) DFTUSR (*NONE) MODE (Q1PMOD) MAXACT (0)
QCMN	Added a communication entry (ADDCMNE)	SBSD (QSYS/QCMN) DEV (Q1PLOC) DFTUSR (*NONE) MODE (Q1PMOD) MAXACT (0)
QCMN	Added prestart job entry (ADDPJE)	SBSD (QSYS/QCMN) PGM (QSYS/QZRCSEVR) USER (QUSER) STRJOBS (*YES) INLJOBS(1) THRESHOLD (1) ADLJOBS(3) JOB (*PGM) JOB (*USRPRF) MAXUSE (1) WAIT (*YES) POOLID (1) CLS (QGPL/QCASERVR *CALC *NONE *CALC)



Object	Addition, Deletion, or Update	Parameters other than default
QCMN	Added prestart job entry (ADDPJE)	SBSD (QSYS/QCMN) PGM (QSYS/QZSCSRVR) USER (QUSER) STRJOBS (*YES) INLJOBS(1) THRESHOLD (1) ADLJOBS(3) JOB (*PGM) JOB (*USRPRF) MAXUSE (1) WAIT (*YES) POOLID (1) CLS (QGPL/QCASERVER *CALC *NONE *CALC)
QCMN	Added prestart job entry (ADDPJE)	SBSD (QSYS/QCMN) PGM (QSYS/QNPSEVR) USER (QUSER) STRJOBS (*YES) INLJOBS(1) THRESHOLD (1) ADLJOBS(3) JOB (*PGM) JOB (*USRPRF) MAXUSE (200) WAIT (*YES) POOLID (1) CLS (QGPL/QCASERVER *CALC *NONE *CALC)
QSERVER	Added prestart job entry (ADDPJE)	SBSD (QSYS/QSERVER) PGM (QSYS/QZDAINIT) USER (QUSER) STRJOBS (*YES) INLJOBS(1) THRESHOLD (1) ADLJOBS(3) JOB (*PGM) JOB (*USRPRF) MAXUSE (1) WAIT (*YES) POOLID (1) CLS (QGPL/QPWSERVER *CALC *NONE *CALC)
QSERVER	Added prestart job entry (ADDPJE)	SBSD (QSYS/QSERVER) PGM (QSYS/QPWFSERVSO) USER (QUSER) STRJOBS (*NO) INLJOBS(1) THRESHOLD (1) ADLJOBS(2) MAXJOBS (*NOMAX) JOB (*USRPRF) JOB (*PGM) MAXUSE (200) WAIT (*YES) POOLID (1) CLS (QGPL/QPWFSERVER *CALC *NONE *CALC)

Object	Addition, Deletion, or Update	Parameters other than default
QSYSWRK	Added job queue entry (ADDJOBQE)	SBSD (QSYS/QSYSWRK) JOBQ (QSYS/Q1PSCHQ) MAXACT (1) SEQNBR (70)
QSYSWRK	Added job queue entry (ADDJOBQE)	SBSD (QSYS/QSYSWRK) JOBQ (QSYS/Q1PSCHQ2) MAXACT (1) SEQNBR (80)
QSYSWRK	Added job queue entry (ADDJOBQE)	SBSD (QSYS/QSYSWRK) JOBQ (QSYS/Q1PSCHQ3) MAXACT (1) SEQNBR (90)
QSYSWRK	Added an autostart job entry (ADDAJE)	SBSD (QSYS/QSYSWRK) JOB (QGLDPUBA) JOBQ(QSYS/QGLDPUBA)
QSYSWRK	Added an autostart job entry (ADDAJE)	SBSD (QSYS/QSYSWRK) JOB (QGLDPUBE) JOBQ(QSYS/QGLDPUBE)
QSYSWRK	Added autostart job entry (ADDAJE)	SBSD (QSYS/QSYSWRK) JOB (QPM400) JOBQ (QSYS/Q1PJOBQ)
QSYSWRK	Added a communication entry (ADDCMNE)	SBSD (QSYS/QSYSWRK) DEV (Q1PDEV) JOBQ (*USRPRF) DFTUSR (QUSER) MODE (Q1PMOD) MAXACT (*NOMAX)
QSYSWRK	Added a communication entry (ADDCMNE)	SBSD (QSYS/QSYSWRK) DEV (Q1PLOC) JOBQ (*USRPRF) DFTUSR (QPM400) MODE (Q1PMOD) MAXACT (*NOMAX)
QSYSWRK	Added a communication entry (ADDCMNE)	SBSD (QSYS/QSYSWRK) RMTLOCNAME (Q1PLOC) JOBQ (*USRPRF) DFTUSR (QPM400) MODE (Q1PMOD) MAXACT (*NOMAX)
QSYSWRK	Added routing entries (ADDRTE)	SBSD (QSYS/QSYSWRK) SEQNBR (2150) CMPVAL (TOTNTP) PGM (QSYS/QTOTSNTP) CLS (QSYS/QSYSCLS10)
QSYSWRK	Added routing entry (ADDRTE)	SBSD (QSYSWRK) SEQNBR (300) CMPVAL (PGMEVOKE 29) PGM (*RTGDTA) CLS (QSYS/QSYSCLS50) MAXACT (*NOMAX) POOLID (1)

Object	Addition, Deletion, or Update	Parameters other than default
QSYSWRK	Added routing entry (ADDRTGE)	SBSD (QSYS/QSYSWRK) SEQNBR (2536) CMPVAL ('QZSCSRVSD') PGM (QSYS/QZSCSRVSD) CLS (QGPL/QCASERVR)
QSYSWRK	Added routing entry (ADDRTGE)	SBSD (QSYS/QSYSWRK) SEQNBR (2537) CMPVAL ('QZHQSRVD') PGM (QSYS/QZHQSRVSD) CLS (QGPL/QCASERVR)
QSYSWRK	Added routing entry (ADDRTGE)	SBSD (QSYS/QSYSWRK) SEQNBR (2538) CMPVAL ('QNPSEVRD') PGM (QSYS/QNPSEVRD) CLS (QGPL/QCASERVR)
QSYSWRK	Added routing entry (ADDRTGE)	SBSD (QSYS/QSYSWRK) SEQNBR (2539) CMPVAL ('QZRCSRVD') PGM (QSYS/QZRCSRVD) CLS (QGPL/QCASERVR)
QSYSWRK	Added routing entry (ADDRTGE)	SBSD (QSYS/QSYSWRK) SEQNBR (2540) CMPVAL ('QZSOSGND') PGM (QSYS/QZSOSGND) CLS (QGPL/QCASERVR)
QSYSWRK	Added routing entry (ADDRTGE)	SBSD (QSYS/QSYSWRK) SEQNBR (2541) CMPVAL ('QZSOSMAPD') PGM (QSYS/QZSOSMAPD) CLS (QGPL/QCASERVR)
QSYSWRK	Added routing entry (ADDRTGE)	SBSD (QSYS/QSYSWRK) SEQNBR (2170) CMPVAL ('QSYEIMMON') PGM (QSYS/QSYEIMMON) CLS (QSYS/QSYSCLS20) MAXACT (*NOMAX) POOLID (1)
QSYSWRK	Added routing entry (ADDRTGE)	SBSD (QSYS/QSYSWRK) SEQNBR (2200) CMPVAL ('QYASPPGM') PGM (QSYS/QYASPPGM) CLS (QSYS/QSYSCLS20) MAXACT (*NOMAX) POOLID (1)
» QSYSWRK	Added an autostart job entry (ADDAJE)	SBSD (QSYS/QSYSWRK) JOB (QS9AJE) JOB(QSYS/QS9AJE) «
» QSYSWRK	Added an autostart job entry (ADDAJE)	SBSD (QSYS/QSYSWRK) JOB (QCSTSRCD) JOB(QSYS/QCSTSRCD) «

Object	Addition, Deletion, or Update	Parameters other than default
» QSYSWRK	Added routing entry (ADDRTGE)	SBSD (QSYS/QSYSWRK) SEQNBR (2220) CMPVAL ('Q59PAL') PGM (QSYS/QCMD) CLS (QSYS/QSYSCLS50) MAXACT (1) <<
» QSYSWRK	Added routing entry (ADDRTGE)	SBSD (QSYS/QSYSWRK) SEQNBR (2221) CMPVAL ('Q59PRB') PGM (QSYS/QCMD) CLS (QSYS/QSYSCLS50) MAXACT (1) <<
» QSYSWRK	Added job queue entry (ADDJOBQE)	SBSD (QSYS/QSYSWRK) JOBQ (QSYS/QSJINV) MAXACT (1) SEQNBR (100) <<
» QSYSWRK	Added routing entry (ADDRTGE)	SBSD(QSYS/QSYSWRK) SEQNBR(2230) CMPVAL('SERVICERMDRVR') PGM(QSYS/QSVRMEVJ) CLS(QSYS/QSYSCLS25) MAXACT(*NOMAX) <<
QUSRWRK	Added prestart job entry (ADDPJE)	SBSD (QSYS/QSYSWRK) PGM (QSYS/QZSOSIGN) USER (QUSER) STRJOBS (*YES) INLJOBS(1) THRESHOLD (1) ADLJOBS(2) MAXJOBS (*NOMAX) JOB (*PGM) JOB (QSYS/QZBSJOB) MAXUSE (200) WAIT (*YES) POOLID (1) CLS (QGPL/QCASERVR *CALC *NONE *CALC)
QUSRWRK	Added prestart job entry (ADDPJE)	SBSD (QSYS/QUSRWRK) PGM (QSYS/QZSCSRVS) USER (QUSER) STRJOBS (*YES) INLJOBS(1) THRESHOLD (1) ADLJOBS(2) MAXJOBS (*NOMAX) JOB (*PGM) JOB (QSYS/QZBSJOB) MAXUSE (200) WAIT (*YES) POOLID (1) CLS (QGPL/QCASERVR *CALC *NONE *CALC)

Object	Addition, Deletion, or Update	Parameters other than default
QUSRWRK	Added prestart job entry (ADDPJE)	SBSDB (QSYS/QUSRWRK) PGM (QSYS/QNPSESRV) USER (QUSER) STRJOBS (*YES) INLJOBS(1) THRESHOLD (1) ADLJOBS(2) MAXJOBS (*NOMAX) JOB (*PGM) JOBD (QSYS/QZBSJOBDB) MAXUSE (200) WAIT (*YES) POOLID (1) CLS (QGPL/QCASERVR *CALC *NONE *CALC)
QUSRWRK	Added prestart job entry (ADDPJE)	SBSDB (QSYS/QUSRWRK) PGM (QSYS/QZRCSESRV) USER (QUSER) STRJOBS (*YES) INLJOBS(1) THRESHOLD (1) ADLJOBS(2) MAXJOBS (*NOMAX) JOB (*PGM) JOBD (QSYS/QZBSJOBDB) MAXUSE (1) WAIT (*YES) POOLID (1) CLS (QGPL/QCASERVR *CALC *NONE *CALC)
QUSRWRK	Added prestart job entry (ADDPJE)	SBSDB (QSYS/QUSRWRK) PGM (QSYS/QZDASOINIT) USER (QUSER) STRJOBS (*YES) INLJOBS(1) THRESHOLD (1) ADLJOBS(2) MAXJOBS (*NOMAX) JOB (*PGM) JOBD (*USRPRF) MAXUSE (200) WAIT (*YES) POOLID (1) CLS (QGPL/QPWFSESRVR *CALC *NONE *CALC)

Object	Addition, Deletion, or Update	Parameters other than default
QUSRWRK	Added prestart job entry (ADDPJE)	SBSDB (QSYS/QUSRWRK) PGM (QSYS/QZHQSSRV) USER (QUSER) STRJOBS (*YES) INLJOBS(1) THRESHOLD (1) ADLJOBS(2) MAXJOBS (*NOMAX) JOB (*PGM) JOBD (QSYS/QZBSJOBDB) MAXUSE (200) WAIT (*YES) POOLID (1) CLS (QGPL/QCASERVR *CALC *NONE *CALC)
QUSRWRK	Added prestart job entry (ADDPJE)	SBSDB (QSYS/QUSRWRK) PGM (QSYS/QZDASSINIT) USER (QUSER) STRJOBS (*YES) INLJOBS(1) THRESHOLD (1) ADLJOBS(2) MAXJOBS (*NOMAX) JOB (*PGM) JOBD (QSYS/*USRPRF) MAXUSE (200) WAIT (*YES) POOLID (1) CLS (QSYS/QPWFSEVER *CALC *NONE *CALC)
QUSRWRK	Added prestart job entry (ADDPJE)	SBSDB (QSYS/QUSRWRK) PGM(QSYS/QRWTSSRV) USER (QUSER) STRJOBS (*YES) INLJOBS (1) THRESHOLD (1) ADLJOBS (2) MAXJOBS (*NOMAX) JOB (*PGM) JOBD (*USRPRF) MAXUSE (200) WAIT (*YES) POOLID (1) CLS (QSYS/QSYSCLS20 *CALC *NONE *CALC)
 QUSRWRK	Added routing entry (ADDRTE)	SBSDB (QSYS/QUSRWRK) SEQNBR (2210) CMPVAL (WATCHEVENT) PGM (QSYS/QSCWCMON) CLS (QSYS/QSYSCLS25) MAXACT (*NOMAX) POOLID (1) 

Object	Addition, Deletion, or Update	Parameters other than default
➤ QUSRWRK	Added routing entry (ADDRTGE)	SBSD (QSYS/QUSRWRK) SEQNBR (2211) CMPVAL (WATCHLICEVENT) PGM (QSYS/QSCLICEV) CLS (QSYS/QSYSCLS25) MAXACT (*NOMAX) POOLID (1) ⚡

Subsystems shipped with the system

Two complete subsystem configurations are supplied by IBM and can be used without being changed.

The configuration the system uses when the system is started is controlled by the controlling subsystem description system value (QCTLSBSD). The default configuration consists of the following “Subsystem description” on page 52:

Qbase (controlling subsystem)

	Qbase supports interactive, batch, and communications jobs. It has an autostart job, which automatically starts the Qusrwrk, Qserver, and Qspl subsystems.
Qcmn	This is the subsystem that supports communications jobs, excluding TCP/IP communications jobs. These communications jobs are necessary for various communications protocols that the OS/400 system supports.
Qserver	This is the file server subsystem.
Qspl	This is the spool subsystem that supports reader and writer jobs.
Qsyswrk	This is the system work subsystem. It contains jobs that support system functions that are started automatically at system startup and when the system comes out of restricted state.
Qusrwrk	This is the user work subsystem. It contains jobs that are started by servers to do work on behalf of a user.

The other configuration, which is supplied by IBM, consists of the following subsystem descriptions:

Qctl (controlling subsystem)

	Qctl has an autostart job, which automatically starts the Qinter, Qbatch, Qcmn, Qusrwrk, Qserver and Qspl subsystems.
Qinter	This is the subsystem that supports interactive jobs, except those at the console.
Qbatch	This is the subsystem that supports batch jobs.

Qcmn	This is the subsystem that supports communications jobs, excluding TCP/IP communications jobs. These communications jobs are necessary for various communications protocols that the OS/400 system supports.
Qserver	This is the file server subsystem.
Qspl	This is the spool subsystem that supports reader and writer jobs.
Qsyswrk	This is the system work subsystem. It contains jobs that support system functions that are started automatically at system startup and when the system comes out of restricted state.
Qusrwrk	This is the user work subsystem. It contains jobs that are started by servers to do work on behalf of a user.


The Qbase configuration gives the ability to run all the same functions that you can run with the Qctl configuration and is easier to manage because it consists of fewer subsystems.

The Qctl default configuration allows for more individualized control over your system operations by dividing the system activity into different subsystems based on the type of activity. For example, if you want to run batch jobs over the weekend or overnight but do not want anyone to be able to sign on (except at the console), you can easily do that with the Qctl configuration by simply ending the Qinter subsystem.

If you are considering creating your own subsystem configuration, you may also find that it is easier to use the Qctl configuration as a starting point than the Qbase configuration.

User-defined subsystems

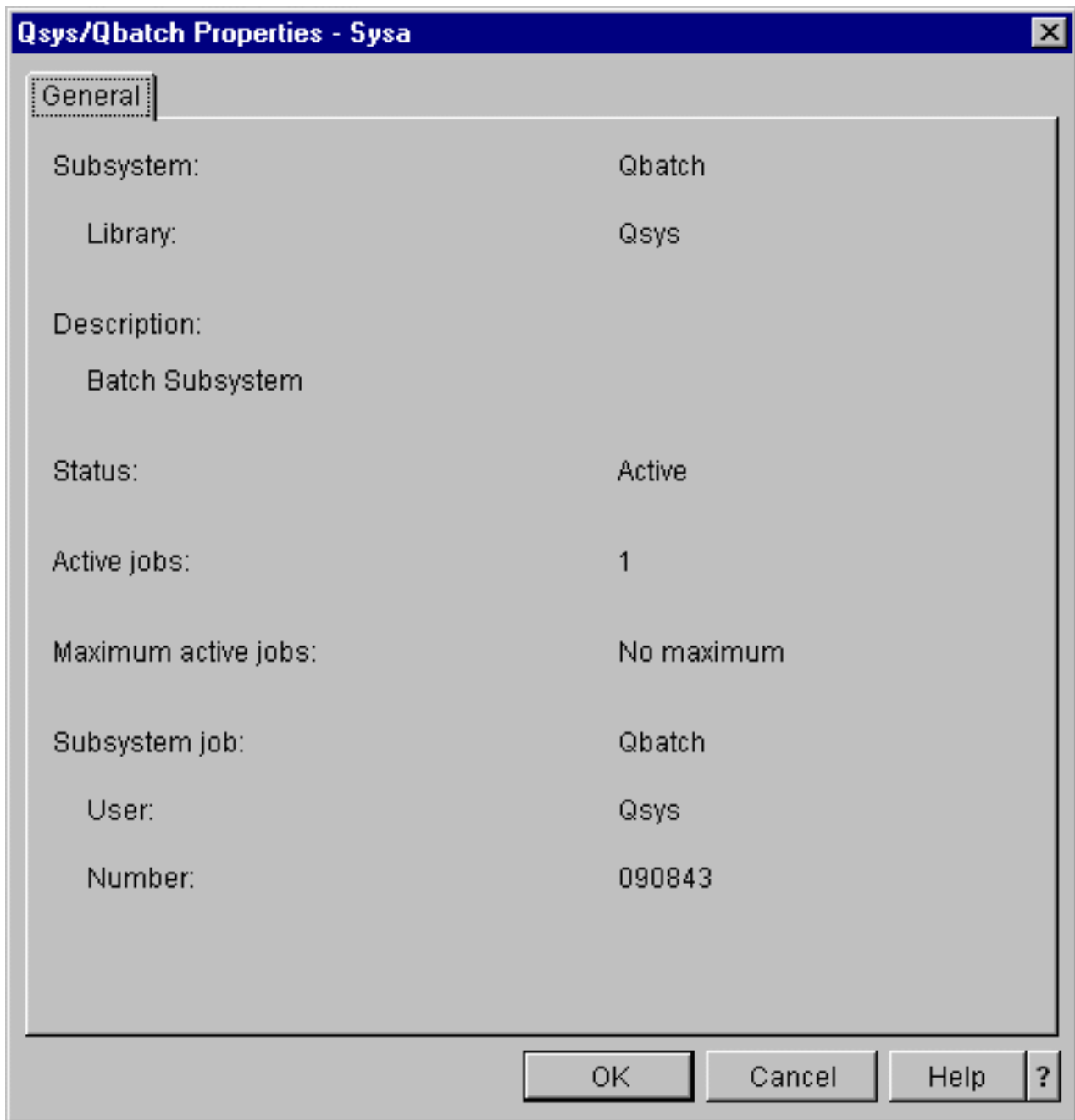
IBM provides "Subsystems shipped with the system" on page 61. You can also create your own subsystem description. You can copy an existing subsystem description and change it, or you can create an entirely new description.

See Creating a subsystem description in Chapter 4 of the V4R5 Work Management  (about 2720 KB or 573 pages) manual for details.

Subsystem properties

Subsystems have attributes, or properties. These properties give information about the current status of the subsystem, or about values identified in the "Subsystem description" on page 52. Using iSeries Navigator, the following properties can be viewed for an active subsystem:

Subsystem	The name of the subsystem, as well as the library that contains the subsystem description.
Description	The description of the subsystem.
Status	The current status of the subsystem. The help contains details on the possible statuses.
Active jobs	The number of jobs currently active, either running or waiting to run, in the subsystem. This number does not include the subsystem job.
Maximum active jobs	The maximum number of jobs that can be active, either running or waiting to run, in the subsystem.
Subsystem job	The name of the subsystem job, including user and number.



To view the properties of a subsystem, follow these steps:

1. In iSeries Navigator, expand **My Connections** → *server-name* → **Work Management** → **Subsystems** → **Active Subsystems**.
2. Right-click the subsystem you would like to view, then select **Properties**.

Subsystem life cycle

The life of a subsystem begins when it is started, and ends when the subsystem stops. In between, work is processed in the subsystem. See the following for details:

- “Start a subsystem” on page 22
- “What happens when the subsystem starts” on page 64
- “Stop a subsystem” on page 22

What happens when the subsystem starts: When a subsystem starts, the system allocates several items and starts autostart and prestart jobs before the subsystem is ready for work. The “Subsystem description” on page 52 is used to determine how items are allocated.

The following list represents the sequence of events that occur when the subsystem starts:

1. **Request to start subsystem is issued.**

2. **Memory pools are allocated.**

Memory is allocated to the pools defined in the subsystem description. The memory that is allocated to each defined pool is taken from the Base memory pool. The system does not allocate memory to a pool if the amount of memory available to the Base memory pool would be less than the minimum size specified by the base memory pool minimum size (Qbaspool) system value. If the system cannot allocate all of the requested memory, it allocates as much memory as is available and allocates all the other as memory becomes available.

See **Pool Allocation** in Chapter 4 of the V4R5 Work Management



(about 2720 KB or 573 pages) manual.

3. **Display stations are allocated.**

- If there are workstation entries and the device is varied on and has not been allocated by any other subsystem, the subsystem can allocate it and display the Sign-On display.

- If the device is varied on and has been allocated by another subsystem and is at the Sign-On display (the Sign-On display was displayed before the second subsystem was started), a second subsystem can allocate the device from the first subsystem and display the Sign-On display.

- If the device is not varied on, the subsystem cannot allocate it. The system arbiter (Qsysarb) and the Qcmnarbxx jobs hold locks on all varied-off devices.

See **Workstation Device Allocation** in Chapter 4 of the V4R5 Work Management



(about 2720 KB or 573 pages) manual.

4. **Communications devices are allocated.**

Requests are sent to the Qlus (LU services) system job, which handles device allocation for all communications devices.

See **Communications Devices and Mode Allocation** in the V4R5 Work Management



(about 2720 KB or 573 pages) manual.

5. **Job queues are allocated.**

The subsystem will not be able to allocate a job queue if it is already allocated to another active subsystem.

6. **“Prestart jobs” on page 34 are started.**

7. **“Autostart jobs” on page 33 are started.**

8. **Environment is ready for work.**

Memory pools

A **memory pool** is a logical division of main memory or storage that is reserved for processing a job or group of jobs. On the iSeries^(TM) server, all main storage can be divided into logical allocations called memory pools. By default, the system manages memory pools. The system manages the transfer of data and programs into memory pools if necessary.

You can control how much work can be done in a subsystem by controlling the number and size of the memory pools. The greater the size of the memory pools in a subsystem, the more work that can be done in the subsystem.

Note: Although tuning and managing your system can help the efficiency of the flow of work through your iSeries server, it cannot account for inadequate hardware resources. Consider a hardware upgrade if the demands of your workload are significant..

The memory pool from which user jobs get their memory is always the same pool that limits their activity level. System jobs (such as Scpf, Qsysarb, and Qlus) get their memory from the base pool but use the machine pool activity level. Subsystem monitors get their memory from the first subsystem description pool but not the activity level. This allows a subsystem monitor to always be able to run regardless of the activity level setting.

Note: APIs, such as Retrieve System Status (QWCRSSTS), can be called to get information on memory pools. For more information, see Application programming interfaces (APIs)

See the following for more information on memory pools:

- “Memory pool activity level”
- “Types of memory pools” on page 66

Memory pool activity level

Memory pool activity levels allow for efficient use of system resource by limiting the number of threads that can be active at the same time in a memory pool.

The activity level of a memory pool is the number of threads that can actively use the CPU at the same time in a memory pool. The system manages the control of this level. Often during processing in a thread, a program waits for a system resource or a response from a workstation user. During such waits, a thread gives up its use of the memory pool activity level so that another thread that is ready to be processed can take its place.

When more threads are started than can run at the same time because of the activity level controls, the excess threads have to wait to use the processing unit (normally this wait is short). The memory pool activity level lets you limit the amount of main memory contention in the various memory pools in your subsystems.

The number of threads running (or active threads) refers to the number of threads that are eligible to compete for the processor and that count against the activity level for a memory pool. In this sense, active threads do not include threads that are waiting for input, for a message, for a device to be allocated, or for a file to be opened. Active threads do not include threads that are ineligible (threads that are ready to run but the memory pool activity level is at its maximum).

How activity levels work


More than one thread can be active at the same time in a memory pool because the processing for a thread can be briefly interrupted while needed data is retrieved from auxiliary storage. During this delay, which is usually short, another thread can run. Using the activity level, the machine can process a large number of threads in a memory pool and, at the same time, hold the level of contention to the limit you specify.


Maximum activity level

Once the maximum activity level for a memory pool has been reached, additional threads needing the memory pool are placed in the ineligible state to wait for the number of active threads in the memory pool to fall below the maximum activity level or for a thread to reach the end of its time slice. As soon as a thread gives up its use of the memory pool, the other

threads that are not active become eligible to run by their priority. For example, if a running thread is waiting for a response from a workstation, it gives up its activity level and the activity level is no longer at its maximum.

Defining memory pool activity levels

Defining memory pools and activity levels correctly is generally dependent on size of the memory pool, the number of CPUs, the number of disk unit arms, and the characteristics of the application. See Performance tuning in Chapter 14 of the V4R5 Work Management  (about 2720 KB or 573 pages) manual for a more detailed description of how to set appropriate activity levels.

See Controlling levels of system activity in Chapter 4 of the V4R5 Work Management  manual for more information.

Types of memory pools

A memory pool is a division of main storage or auxiliary storage. On the iSeries server, all main storage can be divided into logical allocations called memory pools. The two types of memory pools in a system are either private or shared. As many as 64 memory pools, in any combination of private and shared pools, can be active at the same time.

Private memory pool

Identified by subsystem name in iSeries Navigator, it is a pool in which a single subsystem can run jobs. Private pools are pools of main storage that cannot be shared by multiple subsystems. A private pool contains a specified amount of storage to be used by only one subsystem. You can have as many as 62 private pools allocated for use in active subsystems. A private pool does not have to be large enough to contain your programs.

Shared memory pool

A shared memory is a pool in which multiple subsystems can run jobs. Using shared memory pools allows the system to distribute similar jobs across multiple subsystems, still allowing these jobs to run in the same memory pool. You can specify 63 of the 64 shared memory pools that are defined on the system for use when creating subsystem descriptions. The machine pool is reserved for system use. Shared pools are either special or general; the “Machine memory pool” and “Base memory pool” are considered special shared pools, and all other shared pools are considered “General shared pools” on page 67.

Base memory pool: The **base memory pool**, identified as **Base** in iSeries Navigator, contains all unassigned main storage on the system that is, all main storage that is not required by another memory pool. The base pool contains storage that can be shared by many subsystems. The base memory pool is used for batch work and miscellaneous system functions.

The minimum size and activity level for the base memory pool are controlled by system values. See the following system values for details:

- QBASACTLVL (base memory pool activity level)
- QBASPOOL (minimum size of the base memory pool)

Machine memory pool: The **machine memory pool**, identified as **Machine** in iSeries Navigator, is used for highly-shared machine and operating system programs. The machine memory pool provides storage for jobs the system must run that do not require your attention. The size for this memory pool is specified in the machine memory pool size system value (QMCHPOOL). No user jobs run in this memory pool.

General shared pools: General shared pools, identified as **Interactive**, **Spool**, and **Shared 1 - Shared 60** in iSeries Navigator, are pools of main storage that multiple subsystems can use at the same time.

shared pool	description
Interactive	the storage pool used for interactive work
Spool	the storage pool used for printing
Shared 1 - Shared 60	storage pools available for your own use

Output queues

Output queues are areas where printer output files (also called spooled files) wait to be processed and sent to the printer. Printer output is created either by the system or by the user using a print file. A **print file** is similar to a template or a guideline where the default values for the attributes of printer output are set. It is the beginning of the printer output life cycle.

The print file contains the output queue (OUTQ) and print device (DEV) attributes, which dictate how the printer output is to be directed. The default settings are usually *JOB, meaning that the job attributes of the output queue and printer device determine how the printer output is directed. The job attributes of the output queue and printer device settings are based on information obtained when the job is created. This is based on information from the user profile the job is running under, the job description, the workstation device description, and the default printer system value (QPRTDEV).

When the printer output is ready to be created, the system checks the print file and the job attributes (in this order) to see what output queue will process the printer output and which printer device the system will use. You can change the parameters of the output queue (OUTQ) and printer device (DEV) at the time the job is submitted or at job run-time to bypass extended processing. For example, the user can set the print file output queue to a specific queue and set the printer device to their specific printer in the print file at job initiation for the changes to take effect immediately. In doing this, the printer output does not have to go through the job attributes to find the output queue and printer device it will use. If a specified output queue cannot be found, the printer output will be directed to QGPL/QPRINT. For more information on how printer output is created, see Chapter 1 of the Printer Device Programming manual.



Printer output files are files that hold information waiting to be printed or processed. The printer output file holds important attributes that define the position of the printer output on the queue with relation to other printer output. The position is defined by the priority, status, and schedule attributes.

Output queue

An **output queue** is an object that contains a list of printer output files to be written to an output device. The output queue carries important “Attributes of an output queue” on page 68 that determine the order in which printer output is processed and the authority needed to make changes to the printer output file.

Priority

Printer output that is waiting to process is moved to the output queue based on its priority (ranges from 1-9 where 1 is the highest priority).

Status

The current “Status of printer output” on page 69. You can view this status from the General page in Output properties.

Schedule

The schedule attribute tells when the file should start physical printing of the output data.

Immediate

Print immediately, even if the printer output file is not closed.

File end (default)

Printing begins as soon as the printer output file is closed.

Job end

Printing begins when the job ends.

Once the printer output file is ready to be printed, a writer job, a job that processes the printer output from the output queue to the printer device, takes data from the printer output file and sends it to the designated printer.

Attributes of an output queue

The output queue controls how printer output files (also called spooled files) are processed and who has the authority to perform actions on the output queue and associated printer output.

The “Order of files” on page 69 attribute determines how the printer output will leave the output queue to be processed. The two ways to configure the output queue, either by the job number or by the first in, first out (FIFO) rule.

Because most of the information that you print on the iSeries system is created as printer output, security is necessary to prevent unauthorized users access to confidential or sensitive material. Authority to check, data authorization, operator control, spool control, or being the owner allows you to access and makes changes to an output queue or printer output file . You need one of the following authorities to perform any action on an output queue or printer output:

Authority to check. You must be the owner of the queue or have data authorization.

Display data. When this authority is set to *YES, it allows you to perform such actions as viewing, moving, sending output to another system, and copying printer output.


Operator control. If this attribute is set to *YES, users with *JOBCTL special authority are authorized to perform actions like hold, release, and delete printer output from the output queue. Other actions on printer output, output queues, and writers are allowed as well and are

documented in the iSeries Security Reference. 

Spool control. Allows the user to perform all operations on printer output. The user must have *EXECUTE authority to the library the output queue is located in to perform any actions on the output queue.

Owner. This allows the user who owns the output queue to change or delete printer output.

Note: The default authority to the output queue is *USE public authority. Display Data authority is set to *NO (meaning not just anyone can view printer output). Authority to check is *OWNER (so the output queue owner can manipulate the printer output). Operator Control is set to *YES (meaning a user with *JOBCTL can hold, release, and delete printer output).

For more information on authorities needed to work with output queues, see Appendix D in the Security Reference Manual .

Order of files: The **order of files** attribute determines the sequence in which the printer output files (also called spooled files) are placed and processed on the output queue. Two ways to configure the output queue are by **job number** and **first in, first out (FIFO)**.

Job number

The queue entries for the printer output file are sorted in priority sequence using the job number of the job that created the printer output file.

First in, first out

New printer output files (also called spooled files) that enter the queue are placed after all other printer output files that have the same priority.

Note: You can only change the output queue order of files attribute when no printer output files are on the queue.

Status of printer output

The status of a printer output file (also called spooled files) determines where you will see it in the output queue. The following statuses are listed from the bottom of the output queue to the top.

Still being created

The printer output file is being created.

Printed and kept

The data in the printer output file has been printed, but has been saved to be used later.

Held

The printer output file is held, preventing it from being processed by a writer job.

Not scheduled to print yet

The creation of the printer output file is complete, but it is not eligible to be printed. This is only seen when the schedule attribute of the printer output file is set to *JOBEND. This means the job that owns the printer output file must end before the printer output file is allowed to be processed by a writer job.

Page limit exceeded

The file exceeds the maximum number of pages allowed to be printed by a writer job. This status is only seen if the output queue is active to a writer job.

Ready

The printer output file is waiting to be processed by the writer job.

The following statuses are seen when the output queue is active to a writer job (being processed by a writer job) and will be seen at the top of the output queue.

Converting for printer

The printer output file is in the process of being transformed (made ready) for the printer device.

Printing

The contents of the printer output file are being sent to the printer device.

Sent to printer

The contents of the printer output file are being printed. The operating system is waiting for confirmation that the printer output file is done printing.

Being sent

The printer output file is being transferred from one system to another system.

Message waiting

The writer job has encountered a problem, such as out of paper or a paper jam, where it may not be able to proceed printing. When this condition occurs, sometimes operator intervention will be required.

Finished printing

The printer output file has been deleted. Note, the printer output file may or may not have been printed.

How work gets done

Use this information to learn about what work is, what needs to be set up before work can begin, how work travels through the system, and what happens to work once it is done running.

- “What work is”
- “What happens before work enters the system” on page 71
- “How work enters the system” on page 71
- “How work gets processed” on page 71
- “How work leaves the system” on page 72

For more detailed information on the concepts of Work Management, see “The structure of your system” on page 31.

What work is

On the iSeries server, work is always being done, whether you initiate it or the system initiates it. Work is done when you power on your system, when you open a file, or when you query a database. Any action done on the iSeries server has some type of work being performed to complete it.

Each piece of work on the system is performed by a job. A job can be as simple as an application that waits for a user to call it or it can be as complex as a system query to monitor the number of users on the system every hour that runs constantly. Some jobs, specifically batch and interactive jobs, have “Job description” on page 32 associated with them that tell when and where the job will run.

Jobs are made up of programs that perform certain functions. There is no limit to the amount of functions a job performs. A job contains the step-by-step instructions that must be completed for work to be done. The programs that make up the job run in a specific order. For example, program A needs to run before program B can begin. “Threads” on page 47 help a job complete its work. An active job contains at least

one thread. When a job contains multiple threads, it has the ability to do more than one thing at once. For example, one thread can go out and do calculations while another thread waits for more data to process.

For more detailed information on jobs and job types on the iSeries server, see “Jobs” on page 31.

What happens before work enters the system

All jobs, with the exception of system jobs, run within subsystems. For work to start in an active subsystem, memory pools and at least one “How work enters the system” need to be established. Job queues are an example of a source of work. The iSeries server ships with a default set of job queues, subsystems, and memory pools, which can allow work to begin as soon as the system is powered on.

You can tailor the subsystem and memory pool configurations to optimize your iSeries servers capabilities and performance. For example, if batch jobs are critical to the success of your business, you may want to allocate more memory for them to run. Or, you may determine that the number of jobs running at one time in your Qbatch subsystem should be lower so that those jobs can use the maximum amount of resources to run. Also, you can create job queues, subsystems, and memory pools specifically designed to complete specific types of work. For example, you can create a job queue called Nightreps, where nightly batch reports are sent to a subsystem called Nightrep that allocates memory exclusively for running these batch jobs.

To learn more about job queues, subsystems, and memory pools, see the “The structure of your system” on page 31. For more information on what IBM supports for work management, see **Appendix C**.


IBM-Supplied Object Contents in the V4R5 Work Management  (about 2720 KB or 573 pages) manual.

How work enters the system

Work entries identify the sources where jobs enter a subsystem to become available to run. Each type of job on iSeries has different types of work entries it uses.

Most batch jobs use job queues to enter the subsystem. Job queue entries are the mechanism through which a job queue is defined as a source of work to a subsystem.

Work entries are kept in the “Subsystem description” on page 52. If a subsystem description does not have a work entry for the type of work being done, the job cannot run in that subsystem. The IBM-shipped subsystems have default work entries in the subsystem descriptions. Keep in mind, some of the default work entries that ship with the subsystems are already allocated to run specific jobs. For example, in the QCMN subsystem one of the communications work entries is set up to run the iSeries Access server.

For more information on how work enters the system, see work entries in Chapter 4 of the V4R5 Work Management  (about 2720 KB or 573 pages) manual.


How work gets processed

When the iSeries server is started, a subsystem monitor job begins running. The subsystem monitor job controls the jobs within “Subsystems” on page 51. It also starts and ends work, as well as manages the resources for work in the subsystem. Work (or jobs) enters a subsystem through “How work enters the system” where it becomes active and eligible to run. Work can only be completed when the subsystem is allocated memory to run. Memory is allocated to the subsystem by a “Memory pools” on page 64.

How the subsystem description helps process work

Like a job, a subsystem has a description, called a “Subsystem description” on page 52. The subsystem description contains important information that tells how, where, how much work can be active in a subsystem at one time, and which resources it can use to perform the work.

Routing entry

A **routing entry** exists within the subsystem description that tells the subsystem what memory pool to run the job in, what program to run for the job, and which class object to use to run the job. For more information about routing entries, see chapter 4 in the V4R5 Work Management  manual.


Class Object

The **Class** object defines the run priority, default wait time, timeslice, and other attributes. The **run priority** is important because it determines when a job will get processor time in order to run. The run priority scale goes from 0 to 99, with 0 being the highest priority. (Only system jobs are given priority of 0 because they are the jobs that run the iSeries server.)

When a job enters the subsystem, the subsystem tries to match the **routing data** with the compare value in the routing entry. If the routing data and the compare value in a routing entry match, the routing entry is assigned to the job. If a match is not made, the job ends.

Another factor that affects when a job runs in the subsystem is the number of jobs allowed to be active in the subsystem at one time (also known as “Subsystem properties” on page 62 in the subsystem). When the maximum number of active jobs in a subsystem has been met, no more jobs can enter the subsystem until existing active jobs complete running. “Memory pools” on page 64 has to be allocated to the subsystem for a job to run. “**Memory pool activity level**” on page 65 tell the iSeries server how many threads can be active within a memory pool. Remember, an active job contains at least one thread. When the memory pool activity level has been reached, the job has to wait for another thread to give up its use of the activity level. A job can be active in a subsystem and not be running.

Note: Do not confuse the subsystem “Subsystem properties” on page 62 with the “Memory pool activity level” on page 65.

For more information on jobs, subsystems, and memory pools, see the V4R5 Work Management  (about 2720 KB or 573 pages) manual.

How work leaves the system

The output queue works similarly to a job queue in that it schedules output to be printed. Both the printer output and the output queue carry attributes that are used to print the information.

Printer output holds output data waiting to be processed, such as information waiting to be printed. Printer output also holds important information used to schedule when it will be printed. Printer output attributes include the “Output queues” on page 67 in which the printer output will reside, the priority, the “Status of printer output” on page 69 and the schedule of the printer output.

The output queue contains attributes of its own that determine the “Order of files” on page 69 in which the printer output files are processed. It also contains the “Attributes of an output queue” on page 68 needed to make changes to the printer output and the output queue.

When the printer output is ready to be sent to the printer it is picked up by a writer job. The writer job takes the data from printer output and prepares it to be printed.

For details about how the output queue gets selected see Controlling print activity in Chapter 1 of the Printer Device Programming  manual.

You can create specific output queues or use the output queues shipped with the system. For more detailed information, see [Creating an output queue](#).

Troubleshoot Work Management

When a job does not appear to be processing efficiently on your iSeries server, it could be that the job is hung, or that it is just performing poorly. In each case, there are some diagnosis and recovery actions that can assist you in troubleshooting the problem. See the following topics for details.

- [“My job is hung”](#)
- [“My job is experiencing poor performance”](#) on page 74
- [» System time is incorrect and jobs are not running with the proper time «](#)

My job is hung

The following are possible reasons why a job might be hung:

Job is waiting to get a lock on an object

How to diagnose:	View the status of the job in iSeries Navigator; see “Determine the status of a job” on page 10. A job that is waiting to get a lock will have a status of <i>Waiting for lock</i> .
Recovery:	View the list of locked objects for the job to determine which object the job is waiting to get a lock on; see “Details: Active job actions” on page 44. Then use the Lock Holders action against the object to determine which job already holds the lock. You then need to determine why this job is holding the lock, and what can be done to release the lock. In V5R2, status values can have additional information on the properties pages. For example, the status waiting for a lock on the Properties page shows you what object is associated with the lock request.

Job is held

How to diagnose:	View the status of the job in iSeries Navigator; see “Determine the status of a job” on page 10
Recovery:	Right click on the job and select <i>Release</i> .

The following are possible reasons why a job on a job queue might be hung:

Job queue is held

How to diagnose:	View the status of the job queue in iSeries Navigator;
Recovery:	<ol style="list-style-type: none">1. Move the job to a job queue that is not held, see “Move jobs to different job queues” on page 19.2. Release the job queue. To do so, right-click the job and select <i>Release</i>.

Job queue has not been allocated by an active subsystem

How to diagnose:	View the status of the job queue in iSeries Navigator.
Recovery:	<ol style="list-style-type: none">1. Move the job to a job queue that is allocated by an active subsystem, see “Move jobs to different job queues” on page 19.2. Start a subsystem which contains a job queue entry for this job queue, see “Start a subsystem” on page 22.3. Add a job queue entry for this job queue to an active subsystem using the Add Job Queue Entry (ADDJOBQE) command.

Subsystem maximum has been reached

How to diagnose: View the maximum active jobs value for the subsystem in iSeries Navigator. To do so, right-click on the subsystem and select *Properties*

Recovery:

1. Move the job to a different job queue, see “Move jobs to different job queues” on page 19.
2. Increase the maximum value. To do so, use the Change Subsystem Description (CHGSBSD) command.

Job queue maximum has been reached

How to diagnose: View the maximum active jobs value for the job queue in iSeries Navigator. To do so, right-click on the job queue and select *Properties*. Then select the **Activity** tab.

Recovery:

1. Move the job to a different job queue; see “Move jobs to different job queues” on page 19.
2. Increase the maximum value. To do so, use the Change Job Queue Entry (CHGJOBQE) command.

Maximum value for the priority level has been reached

How to diagnose: Determine the job queue priority of the job by viewing its properties. Then view the maximum active jobs by job priority values for the job queue in iSeries Navigator. To do so, right-click the job queue and select *Properties*. Then select the Activity tab and click the Advanced button.

Recovery:

1. Move the job to a different job queue; see “Move jobs to different job queues” on page 19.
2. Change the job queue priority of the job; see “Change the priority of a job within a job queue” on page 18.
3. Increase the maximum value. To do so, use the Change Job Queue Entry (CHGJOBQE) command.

My job is experiencing poor performance

The following are possible reasons why a job might experience poor performance:

Insufficient memory

How to diagnose: View the properties of the job to determine which memory pool the job is running in. Then view the properties of the memory pool in iSeries Navigator, see “Check memory pool use” on page 25. A high rate of faulting in a pool indicates that there is not enough memory in the pool, or that too many jobs are in the pool competing for the memory.

Recovery:

1. Turn on the system tuner if you are not already using it. The system value QPFRADJ automatically adjusts memory pools and activity levels.
2. If possible, manually tune the pool you are working with by increasing the amount of memory in the pool or reducing the activity level for the memory pool. You may also want to check the machine pool to verify that the amount of memory being used is not affecting all jobs on the system.

Activity level too low

How to diagnose: View the properties of the job to determine its status and which memory pool the job is running in. If the job shows a status of *Waiting for activity level*, then view the properties of the memory pool in iSeries Navigator, see “Check memory pool use” on page 25. A high rate of transitions to the ineligible state in a pool indicates that too many jobs in the pool are competing for the memory.

Recovery:

1. Turn on the system tuner if you are not already using it. The system value QPFRADJ automatically adjusts memory pools and activity levels.
2. Manually tune the pool by increasing the activity level for the memory pool.

Insufficient CPU resource

How to diagnose: View the CPU % column for the job and other jobs in the Active Jobs list of iSeries Navigator. If the system is very busy, your job may not be getting enough CPU resource to complete its work.

Recovery:

1. If possible, end or hold unnecessary work on the system.
2. If a few jobs are CPU intensive, change the run priority of these jobs (a higher run priority value equals a lower run priority for the job).

Memory pool paging option

How to diagnose: If an application is disk intensive, if the CPU is under utilized and if there is sufficient memory, the use of expert cache may be beneficial.

Recovery: The expert cache can be turned on in iSeries Navigator by changing the Paging option for a shared memory pool to Calculated. The Paging option is located on the **Configuration** tab of the memory pool's **Properties** page and is only available on shared pools(not private pools).

Low job run priority

How to diagnose: View the job's “Job properties” on page 40 to determine the run priority of a job relative to other jobs on the system.

Recovery: If the job has a low run priority (higher number) relative to other jobs and is not using much CPU because the higher priority (lower number) jobs are using most of the CPU resource, you might need to increase the job's run priority, see “Job properties” on page 40. Also, on a system with high CPU utilization and a job with a low run priority, setting the Dynamically adjust job priorities within priority bands (QDYNPTYSCD) and the Dynamically adjust job priorities of interactive jobs (QDYNPTYADJ) system values may be useful.

For more information on performance, see Performance. If you want more information on how to tune performance on your system, see Tune performance.

Related information for work management

➤ Listed below are the iSeries^(TM) manuals (in PDF format) and experience reports that relate to the work management topic. You can view or print any of the PDFs.

Manuals

- **V4R5 Work Management**



This manual provides information about how to effectively manage the system workload by changing work management objects to meet your needs. This publication also provides guidelines for performance tuning, description of system values, information on collecting performance data, gathering system use data, using work entries, and scheduling batch jobs.

- **Job Scheduler for OS/400**



This manual provides information about the job scheduler that is supplied with the OS/400 system.

Experience reports

- **Subsystem configuration**

The default subsystem configuration shipped with OS/400 is a basic subsystem configuration that works well for small systems. However, as the number of users increases on the system, it is desirable to split the work into multiple subsystems to better manage the work on the system. View this experience report to learn more about subsystem configuration.

- **Tuning prestart job entries**

This experience report describes how to manage prestart jobs to improve overall system performance. Prestart jobs are jobs that start running before the work arrives. A prestart job entry in a subsystem description tells the system how many jobs to create and how to manage the prestart jobs.

- **The Performance Adjuster (QPFRADJ)**


The iSeries^(TM) server has the ability to automatically manage the shared memory pools without any user interaction. This function is controlled by the performance adjustment system value, QPFRADJ. When this system value is set to '2' or '3,' the system periodically checks the performance of all the active shared pools and adjusts or rearranges the storage and activity levels as needed. This function is active by default (the shipped value of QPFRADJ is '2' which means 'Adjustment at IPL and automatic adjustment'). This experience report explains how the user-defined settings on the Work with Shared Pools (WRKSHRPOOL) display affect the performance adjuster algorithm, and gives examples of how to tailor them for your environment.

Saving PDF files

To save a PDF on your workstation for viewing or printing:

1. Right-click the PDF in your browser (right-click the link above).
2. Click **Save Target As...** if you are using Internet Explorer. Click **Save Link As...** if you are using Netscape Communicator.
3. Navigate to the directory in which you would like to save the PDF.
4. Click **Save**.

Downloading Adobe Acrobat Reader

You need Adobe Acrobat Reader to view or print these PDFs. You can download a copy from the Adobe Web site (www.adobe.com/products/acrobat/readstep.html)  .

Appendix. Notices

This information was developed for products and services offered in the U.S.A.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:

IBM Director of Licensing
IBM Corporation
North Castle Drive
Armonk, NY 10504-17855
U.S.A.

For license inquiries regarding double-byte (DBCS) information, contact the IBM Intellectual Property Department in your country or send inquiries, in writing, to:

IBM World Trade Asia Corporation
Licensing
2-31 Roppongi 3-chome, Minato-ku
Tokyo 106-0032, Japan

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law: INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product and use of those Web sites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Licensees of this program who wish to have information about it for the purpose of enabling: (i) the exchange of information between independently created programs and other programs (including this one) and (ii) the mutual use of the information which has been exchanged, should contact:

IBM Corporation
Software Interoperability Coordinator, Department 49XA
3605 Highway 52 N
Rochester, MN 55901
U.S.A.

Such information may be available, subject to appropriate terms and conditions, including in some cases, payment of a fee.

The licensed program described in this information and all licensed material available for it are provided by IBM under terms of the IBM Customer Agreement, IBM International Program License Agreement, or any equivalent agreement between us.

Any performance data contained herein was determined in a controlled environment. Therefore, the results obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurements may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

All statements regarding IBM's future direction or intent are subject to change or withdrawal without notice, and represent goals and objectives only.

All IBM prices shown are IBM's suggested retail prices, are current and are subject to change without notice. Dealer prices may vary.

This information is for planning purposes only. The information herein is subject to change before the products described become available.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs. You may copy, modify, and distribute these sample programs in any form without payment to IBM for the purposes of developing, using, marketing, or distributing application programs conforming to IBM's application programming interfaces.

Each copy or any portion of these sample programs or any derivative work, must include a copyright notice as follows:

(C) (your company name) (year). Portions of this code are derived from IBM Corp. Sample Programs. (C) Copyright IBM Corp. _enter the year or years_. All rights reserved.

If you are viewing this information softcopy, the photographs and color illustrations may not appear.

Trademarks

The following terms are trademarks of International Business Machines Corporation in the United States, other countries, or both:

Application System/400

AS/400

IBM

iSeries

Operating System/400

OS/400

400

System/36

Lotus Notes

Domino

DB2

WebSphere

Lotus, Freelance, and WordPro are trademarks of International Business Machines Corporation and Lotus Development Corporation in the United States, other countries, or both.

C-bus is a trademark of Corollary, Inc. in the United States, other countries, or both.

ActionMedia, LANDesk, MMX, Pentium, and ProShare are trademarks or registered trademarks of Intel Corporation in the United States, other countries, or both.

Microsoft, Windows, Windows NT, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.

SET and the SET Logo are trademarks owned by SET Secure Electronic Transaction LLC.

Java and all Java-based trademarks are trademarks of Sun Microsystems, Inc. in the United States, other countries, or both.

UNIX is a registered trademark of The Open Group in the United States and other countries.

Other company, product, and service names may be trademarks or service marks of others.

Terms and conditions for downloading and printing publications

Permissions for the use of the information you have selected for download are granted subject to the following terms and conditions and your indication of acceptance thereof.

Personal Use: You may reproduce this information for your personal, noncommercial use provided that all proprietary notices are preserved. You may not distribute, display or make derivative works of this information, or any portion thereof, without the express consent of IBM.

Commercial Use: You may reproduce, distribute and display this information solely within your enterprise provided that all proprietary notices are preserved. You may not make derivative works of this information, or reproduce, distribute or display this information or any portion thereof outside your enterprise, without the express consent of IBM.

Except as expressly granted in this permission, no other permissions, licenses or rights are granted, either express or implied, to the information or any data, software or other intellectual property contained therein.

IBM reserves the right to withdraw the permissions granted herein whenever, in its discretion, the use of the information is detrimental to its interest or, as determined by IBM, the above instructions are not being properly followed.

You may not download, export or re-export this information except in full compliance with all applicable laws and regulations, including all United States export laws and regulations. IBM MAKES NO GUARANTEE ABOUT THE CONTENT OF THIS INFORMATION. THE INFORMATION IS PROVIDED "AS-IS" AND WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT, AND FITNESS FOR A PARTICULAR PURPOSE.

All material copyrighted by IBM Corporation.

By downloading or printing information from this site, you have indicated your agreement with these terms and conditions.



Printed in USA