Workload Scheduler
Version 8.6

Scheduling Workload Dynamically

SC23-9856-02

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Note

Before using this information and the product it integrations, read the information in Notices.

This edition applies to version 8 release 6 of IBM Tivoli Workload Scheduler (program number 5698-WSH) and to all subsequent releases and modifications until otherwise indicated in new editions.

This edition replaces SC23-9856-01.

Contents

Figures

Tables

About this guide

Provides an overview of the guide, with information about changes made to it since the last release, and who should read it. It also supplies information about obtaining resources and support from IBM.

This guide explains how to dynamically allocate resources to run your workload using the services of the dynamic workload broker component of Tivoli Workload Scheduler.

Dynamic workload broker is an on-demand scheduling infrastructure which provides dynamic management of your environment.

What is new in this release

Provides information about things that have changed in the product since the last release.

For information about the new or changed functions in this release, see *Tivoli Workload Automation: Overview, SC32-1256*.

For information about the APARs that this release addresses, see the Tivoli Workload Scheduler Download Document at http://www.ibm.com/support/docview.wss?rs=672&uid=swg24027501, and Dynamic Workload Console Download Document at http://www.ibm.com/support/docview.wss?rs=672&uid=swg24029125.

What is new in this publication

The following section has been added or modified since version 8.5.1:

"Adding dynamic scheduling capabilities to your environment" on page 7 explains how you can add dynamic scheduling capabilities to your environment to schedule both existing Tivoli Workload Scheduler jobs and job types with advanced options.

Who should read this publication

Describes the type of user who should read the documentation.

This guide is intended for administrators responsible for defining user roles and performing high-level tasks and for operators responsible for creating and submitting jobs.

Readers should be familiar with the following topics:
- Working knowledge of IBM Tivoli Workload Scheduler
- PC and UNIX operating systems
- Graphical and command line interfaces

Publications

Full details of Tivoli Workload Automation publications can be found in *Tivoli Workload Automation: Publications*. This document also contains information about the conventions used in the publications.

A glossary of terms used in the product can be found in *Tivoli Workload Automation: Glossary*.

Both of these are in the Information Center as separate publications.

Accessibility

Accessibility features help users with a physical disability, such as restricted mobility or limited vision, to use software products successfully. With this product, you can use assistive technologies to hear and navigate the interface. You can also use the keyboard instead of the mouse to operate all features of the graphical user interface.

For full information with respect to the Dynamic Workload Console, see the Accessibility Appendix in the *Tivoli Workload Scheduler: User's Guide and Reference, SC32-1274*.

Tivoli technical training

For Tivoli® technical training information, refer to the following IBM® Tivoli Education Web site:

http://www.ibm.com/software/tivoli/education

Support information

If you have a problem with your IBM software, you want to resolve it quickly. IBM provides the following ways for you to obtain the support you need:

Online
Go to the IBM Software Support site at http://www.ibm.com/software/support/probsub.html and follow the instructions.

IBM Support Assistant
The IBM Support Assistant (ISA) is a free local software serviceability workbench that helps you resolve questions and problems with IBM software products. The ISA provides quick access to support-related information and serviceability tools for problem determination. To install the ISA software, go to http://www.ibm.com/software/support/isa.

Troubleshooting Guide
For more information about resolving problems, see the problem determination information for this product.

For more information about these three ways of resolving problems, see the appendix on support information in *Tivoli Workload Scheduler: Troubleshooting Guide, SC32-1275*.

Chapter 1. Understanding dynamic workload scheduling

Provides an overview of how dynamic workload scheduling works, and the benefits of using it.

The dynamic workload broker component of Tivoli Workload Scheduler is an on-demand scheduling infrastructure which provides dynamic management of your environment. It improves workload coordination, job throughput, and operations control, and helps to better align IT with business objectives to improve performance and reduce costs. It optimizes the use of the IT infrastructure by constantly analyzing your environment to maintain an up-to-date view of the resources available and matching them to the requirements defined for each job.

The dynamic workload broker **Resource Repository** in the Tivoli Workload Scheduler database stores extensive information about the resources available for running jobs in your environment, as follows:

Physical resources
: Hardware and operating system information is collected by a hardware scan that is regularly run by the Tivoli Workload Scheduler agents. New resources are automatically discovered and integrated in the scheduling environment so that jobs can run automatically on these resources.

Logical resources
: Logical resources represent resources in your environment that cannot be discovered by the scan and that might be required when running a job. For example, logical resources can be set up to represent software licenses. You can use a task on the Dynamic Workload Console to define the logical resources that you need to accurately describe the requirements of jobs in your environment.

To use the dynamic workload broker capability, you must match the Tivoli Workload Scheduler job definitions with dynamic workload broker job definitions. A dynamic workload broker job definition contains all the information required to determine the computer system or systems on which a job could run, any scheduling and job balancing rules that are to be applied when allocating resources, timeout limits, and any recovery actions to be taken in case of failure, as well as the information required to identify and run the application. You write dynamic workload broker job definitions in Job Submission Description Language (JSDL) using the Job Brokering Definition Console, an easy-to-use user interface packaged with the product.

When a job is submitted, dynamic workload broker analyzes job requirements and evaluates resources based on the job definition. If a job must run on the same resource as a previously submitted job, you can provide this information during submission by creating an affinity relationship. After the job is launched, you can monitor its progress.

Thus, if you do install the dynamic scheduling capability of Tivoli Workload Scheduler, you successfully enhance the scheduling and choreography capabilities of Tivoli Workload Scheduler with the dynamic allocation of the best available resources. The Dynamic Workload Console provides a convenient single-access point to all Tivoli Workload Scheduler features, including dynamic workload broker, and allows you to have a complete view of the whole lifecycle of your jobs.

If a job fails or the required resource does not become available before the timeout period specified in the job definition expires, the client that submitted it is notified.

Benefits

Dynamic workload broker implements a job scheduling and brokering infrastructure that provides the following major functions to help you dynamically manage your business:

- Manages the automatic discovery of computers available in the scheduling domain with their attributes.
- Manages the matching of jobs to appropriate resources based on job requirements and resource attributes.
- Manages the job dispatching to target resources, both physical and virtual, that are capable of running the job.
- Optimizes the use of IT resources.
- Manages resource consumption of a job based on the quantities that it is planned to use while running.
- Optionally allocates the required quantity exclusively to the job while it is running.

Interfaces

Dynamic workload broker is a key component of Tivoli Workload Scheduler in the strategy of providing a scheduling solution that integrates business scheduling and dynamic on-demand scheduling.

To schedule your workload dynamically, you use the following interfaces:

Master domain manager command line
It is installed automatically when you install the master domain manager. This command line interface is run only from the workstation serving as the master domain manager. Using the command line, you can define and run your workload dynamically. A backup master domain manager command line also exists on the backup master domain manager.

Dynamic Workload Console
It is a Web-based user interface for managing the Tivoli Workload Scheduler environment, including the dynamic scheduling objects. You can use it to:

- Define and manage logical resources
- Write job definitions in native Job Submission Description Language
- Track job instances and computers

You also use the Dynamic Workload Console to manage the lifecycle of workload.

Job Brokering Definition Console
Is a structured editing tool you use to create and modify Job Submission Description Language (JSDL) files. These files are saved in the **Job Repository** as job definitions and become available for submission. The JSDL files adhere to the XML syntax and semantics as defined in the JSDL schema.

You can submit the following types of jobs:

- Tivoli Workload Scheduler jobs, in the form of scripts or executables

- Extended agent jobs, including jobs based on the access methods supported by Tivoli Workload Scheduler for Applications
- Job types with advanced options, both those supplied with the product and the additional types implemented through the custom plug-ins. For example, those supplied with the product are DB2, file transfer, and web services. Those implemented through the custom plug-ins are the ones you developed using the Integration Workbench of the Software Development Kit (SDK). To run these job types you must also install the Java runtime.

When you submit a job, dynamic workload broker checks the job requirements, the available resources and their related characteristics, and submits the job to the resource that best meets the requirements. Load balancing across resource pools is guaranteed over time. New resources just provisioned are automatically discovered and integrated in the scheduling environment so that jobs can run automatically on these resources.

You can also establish an affinity relationship between two or more jobs when you want them to run on the same resource, for example when the second job must use the results generated by the previous job. If the resource is not available, the affine job is held until the resource is available again. You can define affinity between two or more jobs using the Dynamic Workload Console or the dynamic workload broker command line interface.

Authorization and roles

This section explains the level of authorization required to perform tasks using dynamic workload broker. A role represents a certain level of authorization and includes the tasks appropriate for that level of authorization.

The Dynamic Workload Console is installed on the Tivoli Integrated Portal, an infrastructure which provides a common administration console for multiple products.

To access the Dynamic Workload Console Welcome page, do the following:

1. Enter the following address in a supported browser:
   ```
   http://<server_name>:<port_name>/ibm/console/login
   ```
   where,

   server_name
   : The fully qualified host name of the master domain manager or backup master (where the dynamic scheduling capability was enabled).

   port_name
   : The port number you configured for the master domain manager or backup master running the active dynamic workload broker instance.
2. Enter a supported user name and password.

The Dynamic Workload Console **Welcome** page displays.

The Dynamic Workload Console is a role-based interface, in which tasks are enabled or disabled based on the user role and authorization. Depending on the authorization level of the user logging on to the Tivoli Integrated Portal, some tasks might not be displayed.

When the Dynamic Workload Console is installed, the following user groups are created in the Tivoli Integrated Portal:

TDWBAdministrator
The users in this group can perform the following operations from the Dynamic Workload Console:
- Create logical resources and resource groups, delete, query, suspend, and resume logical resources, computers, and resource groups.
- Define server connections.
- Define, edit, and delete jobs.
- Query and cancel job instances.
- Define user preferences for the Console.

TDWBConfigurator
The users in this group can perform the following operations in the Dynamic Workload Console:
- Create logical resources and resource groups, delete, query, suspend, and resume logical resources, computers, and resource groups.
- Define server connections.
- Define user preferences for the Console.

TDWBDeveloper
The users in this group can perform the following operations in the Dynamic Workload Console:
- Define server connections.
- Define, edit, and delete jobs.
- Define user preferences for the Console.

TDWBOperator
The users in this group can perform the following operations in the Dynamic Workload Console:
- Create logical resources and resource groups, delete, query, suspend, and resume logical resources, computers, and resource groups.
- Define server connections.
- Submit, query and cancel job instances.
- Define user preferences for the Console.

WSClient
This is a WebSphere Application Server role that is automatically defined with the `All authenticated?` property set to Yes. It is required to enable Web services for dynamic workload broker and you must leave it as it is.

Table 1 lists which operations can be performed by each group for each task group available in the Dynamic Workload Console:

Table 1. Authorized operations by user groups

Supported Operations	TDWB Administrator	TDWB Configurator	TDWB Developer	TDWB Operator
Scheduling Environment				
Define New Logical Resources	X	X		X
Define New Resource Group	X	X		X
Logical Resources	X	X		X
Resource Groups	X	X		X

Table 1. Authorized operations by user groups (continued)

Supported Operations	TDWB Administrator	TDWB Configurator	TDWB Developer	TDWB Operator
Configuration				
Server Connections	X	X	X	X
Definitions				
Define a New Job	X		X	
Jobs	X		X	X
Tracking				
Jobs	X			X
Computers	X	X		X
Preferences				
User Preferences	X	X	X	X

For information on adding users, refer to the Tivoli Integrated Portal help.

Managing users and roles

During the Web console installation, new predefined roles and groups are created in the Tivoli Integrated Portal. These roles determine which console panels are available to a user, and therefore which activities the user can perform from the console.

These roles authorize users to access the console panels. The user specified in the engine connection determines which operations can be run locally on a connected engine. For example, if the user specified in a Tivoli Workload Scheduler engine connection is not authorized to run reporting in the Tivoli Workload Scheduler security file, then, even though the user logged in to the console can access the reporting panels, they cannot perform reporting operations on that Tivoli Workload Scheduler engine. For more information about how to configure the security file, refer to the *Tivoli Workload Scheduler: Administration Guide*, *SC23-9113*.

There is a one-to-one relationship between each new role, and the group with the same name. This means, for example, that all users belonging to the TWSWEBUIAdministrator group have the TWSWEBUIAdministrator role.

You cannot modify the roles, but you can create new groups where you combine different roles. For example, you can create a group named my_operators and assign to it the TWSWEBUIOperator and the TDWBOperators roles so that all users added to this group can perform operator actions on both Tivoli Workload Scheduler and dynamic workload broker from the Dynamic Workload Console.

If you do not assign a role to a Tivoli Integrated Portal user, that user, after having logged in, will not see any entry for Tivoli Workload Scheduler or dynamic workload broker in the navigation tree.

The following table lists the roles created in the Tivoli Integrated Portal user registry for accessing the Tivoli Workload Scheduler environments using the Dynamic Workload Console, and the panels they can access:

Table 2. Tivoli Workload Scheduler roles.

Roles	Tivoli Workload Scheduler panels accessible from the Navigation Tree
TWSWEBUIAdministrator	All panels

TWSWEBUIOperator	`Dashboard`
	`My Tasks`
	`Workload Tracking`
	`Workload Submission on Request`
	`Workload Forecasting`
	`Preferences`
	
	Note: The TWSWEBUIConfigurator role is also needed in order to work with Workload Forecasting tasks.

TWSWEBUIDeveloper	`Workload Definition`
	`Preferences`

TWSWEBUIAnalyst	`Reporting` `Preferences`

TWSWEBUIConfigurator	`Scheduling Environment`
	`Preferences`

The following table lists the roles created in the Tivoli Integrated Portal user registry for accessing the dynamic workload broker environments using the Dynamic Workload Console, and the panels they can access:

Table 3. Dynamic workload broker roles.

Roles	Tivoli Dynamic Workload Broker panels accessible from the Navigation Tree
TDWBAdministrator	All panels

TDWBOperator	`Scheduling Environment`
	`Configuration`
	`Definitions, except Define a New Job`
	`Tracking`
	`Preferences`

TDWBDeveloper	`Configuration`
	`Definitions`
	`Preferences`

TDWBConfigurator	`Scheduling Environment`
	`Configuration`
	`Tracking, except Job Instances`
	`Preferences`

Authorization with WebSphere® global security

When dynamic workload broker is installed, corresponding roles are set up on the WebSphere Application Server. By default, these roles are not used. However, if you enable global security for the WebSphere Application Server cell where also dynamic workload broker is installed, the authorization required to perform tasks from the Dynamic Workload Console is also validated by the WebSphere Application Server.

When global security is enabled, Dynamic Workload Console users must provide credentials for accessing the server. These credentials correspond to existing users defined in the operating system where the WebSphere Application Server resides or in an LDAP server. A task on the WebSphere Application Server console maps these users to the dynamic workload broker roles. Using these mappings, WebSphere Application Server is able to determine the level of authorization of the user submitting a request to the server.

For example, the Administrator needs to define John Jones as a TDWBConfigurator in an environment that uses global security. On the WebSphere Application Server console, the user `conf`, has been mapped to the Configurator role. The Administrator does the following:

1. Creates a new user account for John Jones on the Tivoli Integrated Portal.
2. Assigns the new user to the TDWBConfigurator user group.
3. Provides John Jones with his user name and password to access the Dynamic Workload Console and the user name `conf` and its associated password for connecting to dynamic workload broker.

For more information about assigning user roles on the Tivoli Integrated Portal and defining user roles from the WebSphere Application Server console, refer to the *Tivoli Workload Scheduler: Administration Guide*, SC23-9113.

Adding dynamic scheduling capabilities to your environment

This section explains how you can add dynamic scheduling capabilities to your environment to schedule both existing Tivoli Workload Scheduler jobs and job types with advanced options, both those supplied with the product and the additional types implemented through the custom plug-ins.

Dynamic capabilities help you maintain business policies and ensure service level agreements by:

- Automatically discovering scheduling environment resources
- Matching job requirements to available resources
- Controlling and optimizing use of resources
- Automatically following resource changes
- Requesting additional resources when needed

You can add dynamic capabilities to your environment by defining a set of workstation types:

Dynamic agent
A workstation that manages a wide variety of job types, for example, specific database or FTP jobs, in addition to existing job types. This workstation is automatically defined and registered in the Tivoli Workload Scheduler database when you install the dynamic agent. You can group dynamic agents in pools and dynamic pools.

Pool
A workstation that groups a set of dynamic agents with similar hardware or software characteristics to submit jobs to. Tivoli Workload Scheduler balances the jobs among the dynamic agents within the pool and automatically reassigns jobs to available dynamic agents if a dynamic agent is no longer available. To create a pool of dynamic agents in your Tivoli Workload Scheduler environment, define a workstation of type **pool** hosted by the dynamic workload broker workstation, then select the dynamic agents you want to add to the pool. You can define the pool using the Dynamic Workload Console or the **composer** command.

Dynamic pool
A workstation that groups a set of dynamic agents, which is dynamically

defined based on the resource requirements you specify and hosted by the dynamic workload broker workstation. For example, if you require a workstation with low CPU usage and Windows installed to run your job, you specify these requirements using the Dynamic Workload Console or the **composer** command. When you save the set of requirements, a new workstation is automatically created in the Tivoli Workload Scheduler database. This workstation is hosted by the dynamic workload broker workstation. This workstation maps all the dynamic agents in your environment that meet the requirements you specified. The resulting pool is dynamically updated whenever a new suitable dynamic agent becomes available. Jobs run on the first workstation in the dynamic pool which marches all the requirements. Jobs scheduled on this workstation automatically inherit the requirements defined for the workstation.

For information on how to create pools and dynamic pools using the Dynamic Workload Console, see the section on creating a pool of agents in the *Tivoli Dynamic Workload Console User's Guide*. For more information on how to create pools and dynamic pools using the **composer** command, see the *User's Guide and Reference*, *SC32-1274*.

The dynamic agents, pools, and dynamic pools leverage the dynamic functionality built into Tivoli Workload Scheduler and provide the possibility at run time to dynamically associate your submitted workload (or part of it) to the best available resources. You can add dynamic scheduling capabilities to workstations at installation time. For more information on installing the dynamic agents, see the section on installing a new agent in the *Planning and Installation Guide*, *SC32-1273*.

You can use dynamic agents, pools and dynamic pools to schedule job types with advanced options. The job types with advanced options include both those supplied with the product and the additional types implemented through the custom plug-ins. Both job types run only on dynamic agents, pools, and dynamic pools. For more information on how to schedule job types with advanced options, see "Creating job types with advanced options" on page 10. For more information on how to create custom plug-ins, see *Extending Tivoli Workload Automation*, *SC14-7623*.

You can also use dynamic agents, pools, and dynamic pools to run the jobs you created for the existing Tivoli Workload Scheduler workstation types. To run these jobs on the dynamic workstation types, you only have to change the specification of the workstation where you want the job to run. For more information on how to schedule existing Tivoli Workload Scheduler jobs, see "Adding dynamic capabilities to existing Tivoli Workload Scheduler jobs" on page 11.

If you want to leverage the dynamic capability when scheduling job types with advanced options, you schedule them on pools and dynamic pools, which assign dynamically the job to the best available resource. If you are interested only in defining job types with advanced options, without using the dynamic scheduling capability, you schedule these jobs on a specific dynamic agent, on which the job runs statically.

Advantages of job types with advanced options

This section describes the advantages you can obtain implementing job types with advanced options, both those supplied with the product and the additional types implemented through the custom plug-ins, and schedule them on dynamic agents, pools and dynamic pools.

While the standard Tivoli Workload Scheduler job is a generic script or command, you can define jobs to perform specific tasks, such as database, file transfer, Java, and web service operations, using the job types with advanced options available from the Dynamic Workload Console or the composer command. You can easily define these job types without having specific skills on the applications where the job runs.

The job types with advanced options include both those supplied with the product and the additional types implemented through the custom plug-ins

The following job types with advanced options are available

File transfer jobs
: Transfer files to and from a server reachable using FTP, SSH, or other protocols.

JCL
: Run a JCL job, either by reference or by definition. If you define a job by reference, you provide a reference the job you want to submit, without having to write or import the whole job into the JCL. If you define a job by definition, you provide a JCL definition to be submitted. This job type runs only on Tivoli Workload Scheduler distributed - Agent for z/OS.

Web services jobs
: Call a web service.

Database jobs
: Perform queries, SQL statements, and jobs on a number of databases, including custom databases. You can also create and run stored procedures on DB2, Oracle, and MSSQL databases.

Executable jobs
: Run a script or command with advanced options, such as redirecting standard input and standard output to a file.

Java jobs
: Run a Java class

MSSQL jobs
: Run a Microsoft SQL job.

XA jobs
: Extend job scheduling functions of Tivoli Workload Scheduler to other systems and applications using access methods. The access methods communicate with the external system to launch the job and return the status of the job. The following access methods are available:
  - Oracle E-Business Suite
  - PeopleSoft
  - SAP
  - MVS
  - Custom methods

J2EE jobs
: Allow Java applications in the same network to send and receive messages from and to a JMS destination.

IBM i jobs
: Run a command on IBM i systems.

In addition to configuring job types with advanced options using the Dynamic Workload Console or the **composer** command, you can use the related configuration files. For more information, see the section about configuring to schedule job types with advanced options in the *Administration Guide*, *SC23-9113*.

For more information about the procedure for defining job types with advanced options, see the section about creating job types with advanced options in *Tivoli Dynamic Workload Console User's Guide*. For more information about each job type, see the Dynamic Workload Console online help. For information on how to create jobs using the **composer** command, see the section about job definition in the *User's Guide and Reference*, *SC32-1274*.

In addition, you can create custom plug-ins to implement your own job types with advanced options for applications not supported by Tivoli Workload Scheduler. For more information on how to create custom plug-ins, see *Extending Tivoli Workload Automation*, *SC14-7623*.

You run the job types with advanced options, both those supplied with the product and the additional types implemented through the custom plug-ins only on dynamic agents, pools, and dynamic pools.

Creating job types with advanced options

This section explains how to create a specific job type using the job types with advanced options provided with the Dynamic Workload Console.

You can easily define job types with advanced options, without having specific skills on the applications where the job runs. You can then schedule these job types only on dynamic agents, pools, and dynamic pools. The following procedure describes how to create a file transfer job using the Dynamic Workload Console. The procedure for creating the other job types is similar, but each job type contains job-specific options. For more information about each job type, see the Dynamic Workload Console online help.

To create a file transfer job using the Dynamic Workload Console, do the following:

1. Log on to the Dynamic Workload Console.
2. Expand Tivoli Workload Scheduler.
3. In the console navigation tree, expand **Workload > Design** and click **Create Workload Definitions**.
4. Specify an engine name. The **Workload Designer** is displayed.
5. In the Working List panel, select **New > Job Definition > FileTransfer**. The properties of the job are displayed in the right-hand panel for editing.
6. In the properties panel, specify the attributes for the job definition you are creating.
7. Click **Save** to save the job definition in the database.

Return codes

The following is a list of the return codes for database jobs, Java jobs, web services jobs and IBM i jobs.

```
Database Jobs:
RC =  0 -> Job completed successfully
RC = -1 -> SQL statement was run with an exit code different from 1
RC = -2 -> MSSQL Job error
RC = -3 -> SQL statement did not run because of an error in the statement
```

```
Java Jobs:
RC =  0 -> Job completed successfully
RC = -1 -> The Java application launched by the job failed due to an exception
```

```
Web services Jobs:
RC =  0 -> Job completed successfully
RC = -1 -> The server hostname contained in the Web Service URL is unknown
RC = -2 -> Web Service invocation error
```

```
IBM i Jobs:
Return code = user return code when retrieved
Return code = 0 -> job completed successfully
Return code > 0 -> job completed unsuccessfully
```

When the user return code is retrieved, the IBM i Agent Monitor assigns a priority to it.

Promoting jobs scheduled on dynamic pools

This section explains how to promote a critical job scheduled on a dynamic pool. A promoted job can run on a larger number of dynamic agents in the dynamic pool than a non-promoted job. This ensures that an important job runs before other jobs that are less important.

To ensure that a critical job obtains the necessary resources and is processed in a timely manner, you can promote it using promotion variables:

tws.job.promoted
: This environment variable indicates if the job is promoted. Supported values are **YES** and **NO**. The value of this variable applies to all jobs submitted in the specified environment.

tws.job.resourcesForPromoted
: This variable is defined in the dynamic pool definition and indicates the quantity of the required logical resources assigned on a dynamic pool to a promoted job. Values can be **1** if the job is promoted or **10** if the job is not promoted. The quantity is indicated with this notation: **${tws.job.resourcesForPromoted}**.

When a job is scheduled on the dynamic pool, the value of the **tws.job.promoted** variable in the job determines the behavior of the dynamic pool:

- If the value of the **tws.job.promoted** variable is **NO**, the value of the **tws.job.resourcesForPromoted** variable on the dynamic pool is 10, which means that few resources match the requirement.
- If the value of the **tws.job.promoted** variable is **YES**, the value of the **tws.job.resourcesForPromoted** variable on the dynamic pool is 1, which means that more resources match the requirement because the dynamic pool includes workstations with resource quantity equal to or greater than 1 and not only workstations with value equal or greater than 10.

For example, you can write a script that checks the value assigned to the **tws.job.promoted** variable in the job and performs different actions based on whether or not the job is promoted.

Adding dynamic capabilities to existing Tivoli Workload Scheduler jobs

This section explains how to modify an existing job to use the dynamic capabilities provided with dynamic agents, pools, and dynamic pools.

You can modify your existing Tivoli Workload Scheduler jobs to use the dynamic capabilities provided with dynamic agents, pools, and dynamic pools. To modify an existing job, do the following:

1. Install the required number of dynamic agents.
2. Optionally, assign the dynamic agents to pools or create dynamic pools based on your requirements.
3. Analyze your existing Tivoli Workload Scheduler jobs and decide which ones would obtain the best results when using the dynamic capability.
4. Log in to the Dynamic Workload Console.
5. Expand Tivoli Workload Scheduler.
6. In the console navigation tree, expand **Workload > Design** and click **Create Workload Definitions**.
7. Specify an engine name. The **Workload Designer** is displayed.
8. In the Working List panel, select **Search > Job Definition**. The search panel is displayed.
9. Enter your search criteria and click **Search**.
10. Select one or more jobs among the search results and click **Edit**. The selected jobs are displayed in the right-hand panel for editing.
11. In the **General** tab, click on the browse button of the **Workstation** field. The search panel is displayed.
12. Enter your search criteria and click **Search**.
13. Select the appropriate dynamic agent, pool, or dynamic pool and click **OK**. The job is now assigned to the specified workstation and will run on it when scheduled.

A business scenario on dynamic capability

This section demonstrates a sample business scenario which outlines the advantages of job types with advanced options and dynamic capability.

An insurance company runs a number of jobs at night to save the data processed during the day in the backup database. They also need to gather all data about the transactions completed during the day from all the workstations in the company branches. They use DB2 databases. Using the job types with advanced options provided in the Workload Designer, they create a job to perform a DB backup and another job to extract the data for the daily transactions. To perform these operations, they use the new database job type with advanced options.

After gathering data from all the company workstations, they copy the resulting data on a single workstation and process it to generate a report. They choose dynamically the best available workstation by defining the requirements necessary to run the job: a workstation with large disk space, powerful CPU and the program required to generate the report.

If the administrator does not want to modify the job stream he used before Tivoli Workload Scheduler. version 8.6 to run a Java job, for example, he can modify the name of the workstation where he wants the job to run, inserting the name of a pool or dynamic pool of dynamic agents where the Java executable is installed. Tivoli Workload Scheduler translates the syntax of the job so that it can be run by the Java program and assigns the job to the best available resource in the pool.

The report highlights how many new contracts were signed and how many customers are late with their payments. A mail is sent to the chief accountant, listing the number of new contracts and late customers.

The company can reach this objective by:

- Using the new workstations with dynamic capabilities to run the jobs the administrator created for the existing Tivoli Workload Scheduler workstations. To run these jobs on the new workstations, the administrator changes only the workstation where he wants the job to run. The major advantage is that he can use the workflows he previously created without additional effort.
- Defining several job types with advanced options without having specific skills on the applications where the job runs.

These job types with advanced options run on the following workstations:

dynamic agents
: Workstations capable of running both existing jobs and job types with advanced options.

Pools
: Groups to which you can add dynamic agents depending on your needs. Jobs are assigned dynamically to the best available agent.

Dynamic pools
: Groups of dynamic agents for which you specify your requirements and let Tivoli Workload Scheduler select the dynamic agents which meet your needs. Jobs are assigned dynamically to the best available dynamic agent.

A business scenario

The purpose of the following scenario is to show how a system of dynamic allocation of workload to computer resources can make an important contribution to the smooth and profitable running of a business by optimizing use of available resources.

The business

Fine Cola is a medium-sized enterprise that produces and distributes soft drinks to retailers across the country. It owns a production plant and several strategically located distribution centers. Fine Cola has a range of customer types from nationwide foodstore chains to small local outlets. The foodstore chains normally maintain fixed orders though changes can be made at delivery time. Small local outlets often restock directly from the delivery truck with no previous order made. Order quantities can vary, peaking in the warmer season and during holidays.

The process from ordering of the raw materials to the delivery of the finished product and the return of empties consists of a number of subprocesses: inventory, purchase ordering or raw materials, production, supply to distribution centers, and delivery. All of these subprocesses are interdependent and activities in one subprocess are often triggered by an event in another. For example, ordering of a raw material is automatically triggered when inventory discovers that the amount of the raw material currently held in the warehouse has hit the reorder level.

The challenge

Fine Cola uses Tivoli Workload Scheduler to manage the timing and interdependencies of its production and supply process. However, in some areas problems are occurring with computer resource allocation:

- Some scheduled jobs are experiencing long wait times before resources become available.
- Performance problems are occurring as some resources become overloaded.
- When a resource that normally runs workload is removed temporarily or permanently, the job definitions must be manually changed to target a new resource.

Tivoli Workload Scheduler uses fixed resource allocation and this is presenting Fine Cola with the choice of either acquiring more resources or constantly running the risk that jobs will not be completed in a timely manner.

The problems are particularly evident during the end-of-day reconciliation process. This process starts when the last delivery truck returns and must be completed before the next day's delivery route planning can be started. The main focus of the end of day processing is the daily transaction database. This database includes a wide variety of transactions including consignment transactions for each item in a customer order, consignment transactions for each delivery load, receipt transactions for returned items, receipt transactions for empties, adjustments transactions to customer billing when the order amount has been changed on delivery. These transactions are used to update the following databases: customer orders and billing, inventory, and general ledger.

Within a small time window, the following tasks must be completed:
- Update the inventory database with returned items.
- Update the inventory database with returned empties.
- Update customer orders and billing database to take account of changes to orders and to create orders and billing for customers who have restocked from the truck.
- Update the general ledger database.
- Conduct data-mining extractions on the transaction database and save the extracted information in the management reports database for later analysis of buying trends to be used in future promotion campaigns.
- Produce several reports of varying levels of detail of transactions by item, by customer, and by delivery route to enable analysis of the profitability of product lines and routes. Save these reports in the management reports database.

The solution

Fine Cola decides that an important element is missing from their IT solution: the ability to maintain a pool of computer resources, to identify those that match the requirements of a job, and to dynamically assign the job to a matching resource that is available at submission time.

A decision is made to take advantage of the dynamic workload broker feature of Tivoli Workload Scheduler, since this seems to cover their requirements for job scheduling, dependency resolution, and efficient allocation of resources. The IT infrastructure administrator starts by migrating to this version of Tivoli Workload Scheduler and by deploying Tivoli Workload Scheduler agents on the computers normally used to perform the tasks associated with the transaction database in the end-of-day reconciliation process. In this way, it will be possible to see whether dynamic allocation results in a more efficient use of resources.

The hardware scan performed by the agent provides a pool of detailed information about the computer systems, their operating systems, file systems, and network connections. To complete the picture of available resources and make it possible to accurately match resources to job requirements, the administrator must now identify the computer systems that have access to the different databases. She does this by using the Dynamic Workload Console to create a logical resource for each database and linking it to the computer systems from which the database can be accessed.

Now that all the pieces are in place, the administrator can create the job definitions, providing an accurate picture of the physical and logical resources required for the job. She installs the Job Brokering Definition Console on her local workstation. This tool provides an easy-to-use graphical interface for creating JSDL job definitions.

She identifies the jobs and job requirements listed in Table 4.

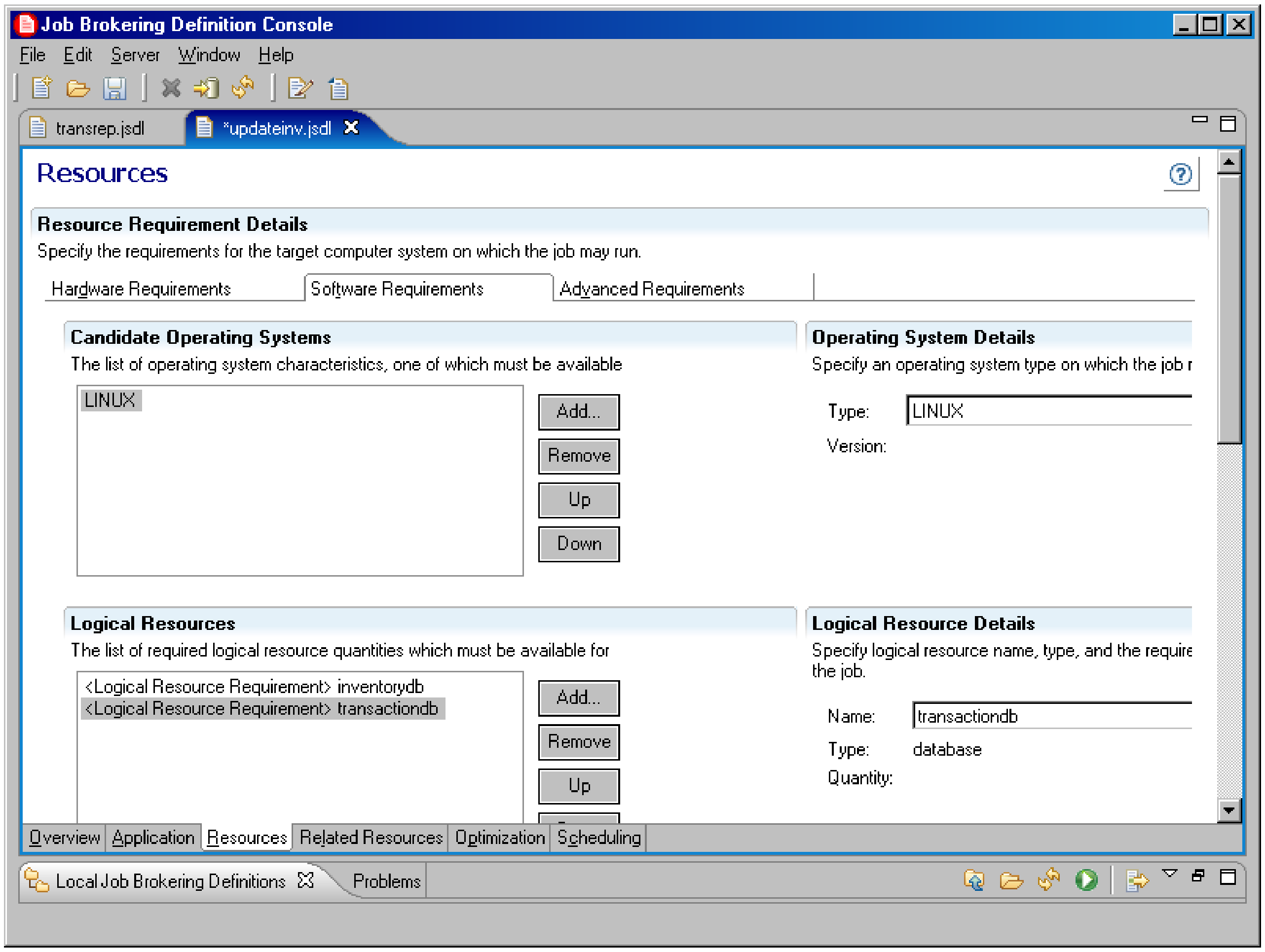
Table 4. Day-end jobs and requirements

Job	**Access to shared remote drives**	**Operating system**	**Database access**
Inventory item update	None	Linux	Inventory, Transaction
Inventory empties update	None	Linux	Inventory, Transaction
Customer orders create/ update	None	AIX® with at least 1024 MB of free physical memory	Customer, Transaction
Customer orders billing	None	AIX	Customer, Transaction
Transaction consolidation and General ledger update	None	AIX	General ledger, Transaction
Item information data mining	None	Linux, AIX, or HP-UX	Transaction, Management reports
route information data mining	None	Linux, AIX, or HP-UX	Transaction, Management reports
Sales summary by item	//shared/reports/ sales	Linux, AIX, or HP-UX	Transaction, Management reports
Sales summary by route	//shared/reports/ sales	Linux, AIX, or HP-UX	Transaction, Management reports
Sales summary by customer	//shared/reports/ sales	Linux, AIX, or HP-UX	Transaction, Management reports

These jobs already exist in Tivoli Workload Scheduler but they use static allocation of resources. She uses the Job Brokering Definition Console to import these jobs and to create a JSDL job definition for each job, including the requirements identified for each job:

- Add the candidate operating systems identified for each job.
- Add a file system requirement for remote access to the directory `//shared/reports/sales` for the reporting jobs.
- Add the appropriate logical resources for the required database access.

.



Resource Requirement Details

Specify the requirements for the target computer system on which the job may run.

Candidate Operating Systems

The list of operating system characteristics, one of which must be available

LINUX

Operating System Details

Specify an operating system type on which the job r

Type: LINUX

Version:

Logical Resources

The list of required logical resource quantities which must be available for

<Logical Resource Requirement> inventorydb
<Logical Resource Requirement> transactiondb

Logical Resource Details

Specify logical resource name, type, and the require the job.

Name: transactiondb

Type: database

Quantity:

Figure 1. Resource requirements for the Inventory item update job

When all the jobs have been created, she checks the matching resources that are found for the jobs she has defined. She finds that eight systems match the job requirements for the reporting and data-mining jobs, which require access to the transaction and management reports databases. The other jobs that require access to the inventory, customer, and general ledger databases respectively, each have two matching systems. However, all these systems are also included in the eight systems found for the reporting and data-mining tasks.

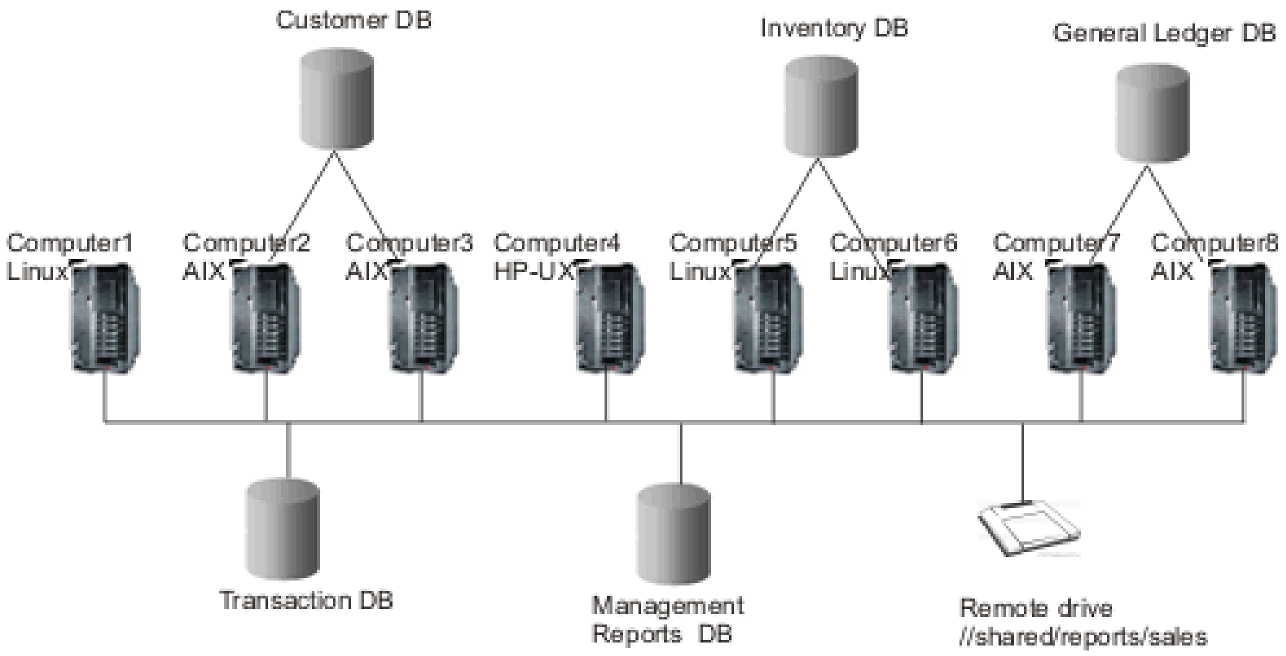
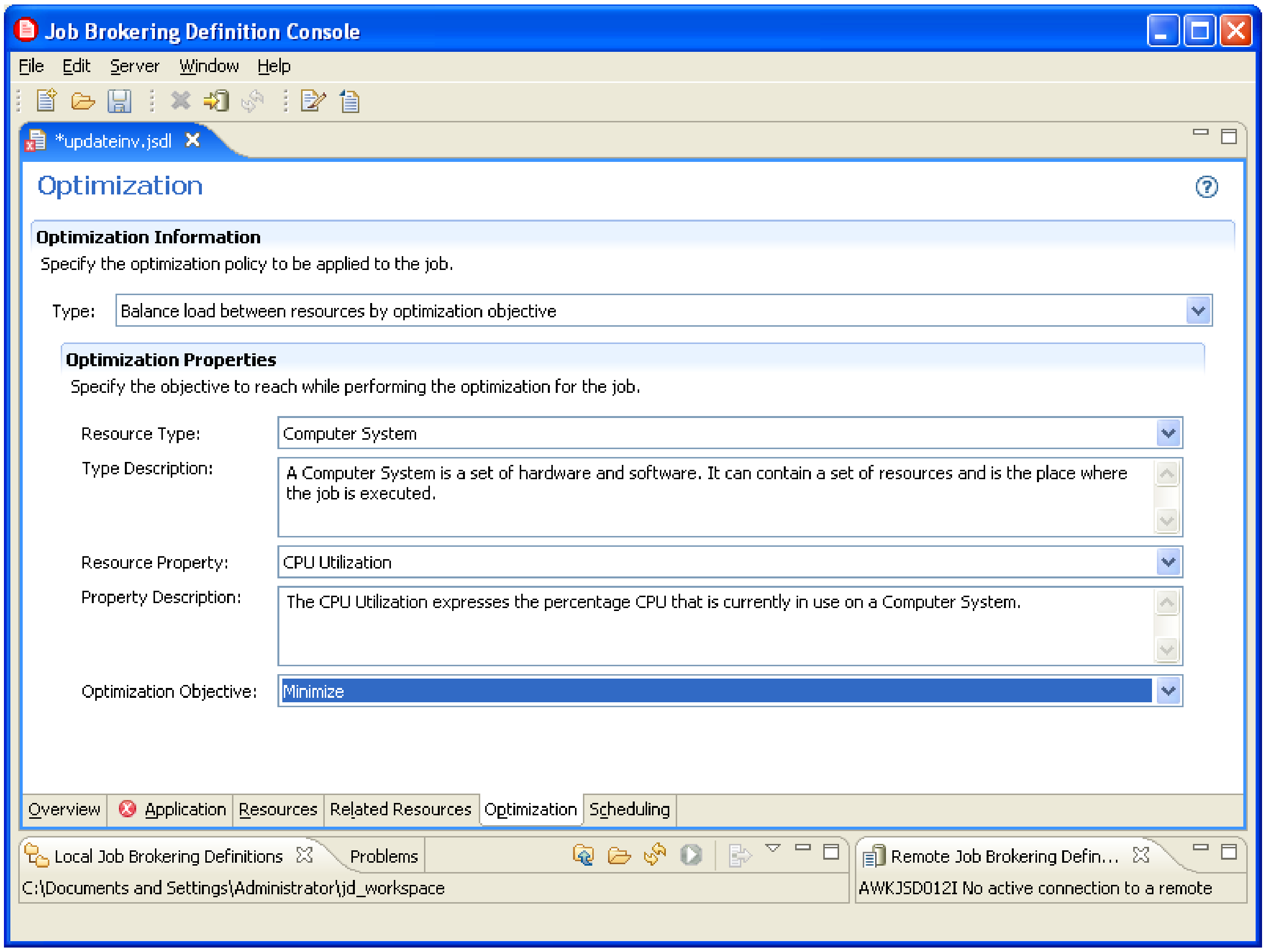


Figure 2. Matching resources for the day-end jobs

She wonders whether there will be problems of load balancing between the eight systems and decides to include some optimization instructions in all of the job definitions.


Job Brokering Definition Console
File Edit Server Window Help
*updateinv.jsdl

Optimization

Optimization Information

Specify the optimization policy to be applied to the job.

Type: Balance load between resources by optimization objective

Optimization Properties

Specify the objective to reach while performing the optimization for the job.

Resource Type: Computer System

Type Description: A Computer System is a set of hardware and software. It can contain a set of resources and is the place where the job is executed.

Resource Property: CPU Utilization

Property Description: The CPU Utilization expresses the percentage CPU that is currently in use on a Computer System.

Optimization Objective: Minimize

C:\Documents and Settings\Administrator\jd_workspace

AWKJSD012I No active connection to a remote

Figure 3. Optimization instructions for a job

The objective she decides on is to distribute jobs between available resources with the aim of keeping CPU usage to a minimum. She thinks that this will provide a more efficient distribution of resources than simply aiming for an equal number of jobs on each available computer system.

She also considers that the update jobs are targeting a subset of the computers available to the data-mining and reporting jobs and decides that the update jobs should be assigned a higher priority, so that their resources are assigned before the jobs that have wider range of options. She goes back to the job definitions of the update jobs, and sets the scheduling priority to 100 (the highest possible).

The job definitions are now complete, and she uploads them to the Job Repository in the Tivoli Workload Scheduler database. She is confident that she will see an improvement in the performance during end-of-day processing, since all jobs have more than one possible target and since she has tailored her definitions to promote a balanced use of available resources.

Using Tivoli Workload Scheduler, she creates a job stream for the day-end jobs and schedules it to be submitted on each business day. Most of the jobs do not have dependencies and can run at the same time. However, the route information data mining job requires data produced by the item information data mining job as input. It must wait until the item information data mining job has successfully completed and then it must run on the same computer system.

To achieve this objective without losing the benefits of dynamic allocation of resources, she decides to define an affinity relationship between the two jobs. Using Tivoli Workload Scheduler, she adds information to the route information data mining job to identify its relationship to the item information data mining task. When the job is submitted in the integrated environment, dynamic workload broker recognizes the relationship and allocates the job to the resource where the item information data mining task previously ran.

When the jobs in the job stream are submitted and dynamically allocated to resources, she is able to track their progress and view job output from Tivoli Workload Scheduler.

Chapter 2. Using Tivoli Workload Scheduler variables in dynamic workload broker jobs

This section explains how to add Tivoli Workload Scheduler variables to jobs you plan to run with dynamic workload broker.

When importing jobs from Tivoli Workload Scheduler, you can add Tivoli Workload Scheduler variables to obtain higher flexibility for your job.

The variables are assigned a value when you submit the job in Tivoli Workload Scheduler. The supported Tivoli Workload Scheduler variables are as follows:

Table 5. Supported Tivoli Workload Scheduler variables in JSDL definitions.

Variables that can be inserted in the dynamic workload broker job definition	Description
tws.host.workstation	Name of the host workstation
tws.job.date	Date of the submitted job.
tws.job.fqname	Fully qualified name of the job (UNISON_JOB)
tws.job.ia	Input arrival time of the job
tws.job.interactive	Job is interactive. Values can be `true` or `false`. Applies only to backward-compatible jobs.
tws.job.logon	Credentials of the user who runs the job (LOGIN). Applies only to backward-compatible jobs.
tws.job.name	Name of the submitted job
tws.job.num	UNISON_JOBNUM
tws.job.priority	Priority of the submitted job
tws.job.promoted	Job is promoted. Values can be `YES` or `No`. For more information about promotion for dynamic jobs, see the section about promoting jobs scheduled on dynamic pools in *Tivoli Workload Scheduler: Scheduling Workload Dynamically*.
tws.job.recnum	Record number of the job.
tws.job.resourcesForPromoted	Quantity of the required logical resources assigned on a dynamic pool to a promoted job. Values can be `1` if the job is promoted or `10` if the job is not promoted. For more information about promotion for dynamic jobs, see the section about promoting jobs scheduled on dynamic pools in *Tivoli Workload Scheduler: Scheduling Workload Dynamically*.
tws.job.taskstring	Task string of the submitted job. Applies only to backward-compatible jobs.
tws.job.workstation	Name of the workstation on which the job is defined

Table 5. Supported Tivoli Workload Scheduler variables in JSDL definitions. (continued)

Variables that can be inserted in the dynamic workload broker job definition	Description
tws.jobstream.id	ID of the job stream that includes the job (UNISON_SCHED_ID)
tws.jobstream.name	Name of the job stream that includes the job (UNISON_SCHED)
tws.jobstream.workstation	Name of the workstation on which the job stream that includes the job is defined
tws.master.workstation	Name of the master domain manager (UNISON_MASTER)
tws.plan.date	Start date of the production plan (UNISON_SCHED_DATE)
tws.plan.date.epoch	Start date of the production plan, in epoch format (UNISON_SCHED_EPOCH)
tws.plan.runnumber	Run number of the production plan (UNISON_RUN)

If you want to create a dynamic workload broker job to be submitted from Tivoli Workload Scheduler, you can add one or more of the variables listed in Table 5 on page 21 in the **Variables** field of the **Overview** pane as well as in the **Script** field of the **Application** pane in the Job Brokering Definition Console.

If you plan to use the variables in a script, you also define the variables as environment variables in the **Environment Variables** field in the **Application** pane. Specify the Tivoli Workload Scheduler name of the variable as the variable value. You can find the Tivoli Workload Scheduler name of the variable in the **Variables inserted in the dynamic workload broker job definition** column.

You then create a Tivoli Workload Scheduler job which contains the name of the job definition, as explained in Chapter 5, “Creating Tivoli Workload Scheduler jobs managed by dynamic workload broker,” on page 29.

The following example illustrates a JSDL file with several of the supported Tivoli Workload Scheduler variables defined:

```
...<jsdl:jobDefinition xmlns:jsdl="http://www.ibm.com/xmlns/prod
/scheduling/1.0/jsdl" xmlns:jsdle="http://www.ibm.com/xmlns/prod/scheduling/1.0/
jsdle"
description="This jobs prints UNISON Variables received
from TWS in standard OutPut "
name="sampleUNISON_Variables">
  <jsdl:annotation>This jobs prints UNISON Variables
received from TWS in
standard OutPut </jsdl:annotation>
  <jsdl:variables>
    <jsdl:stringVariable name="tws.jobstream.name">none</jsdl:stringVariable>
    <jsdl:stringVariable name="tws.job.fqname">none</jsdl:stringVariable>
    <jsdl:stringVariable name="tws.master.workstation">none</jsdl:stringVariable>
    <jsdl:stringVariable name="tws.plan.runnumber">none</jsdl:stringVariable>
    <jsdl:stringVariable name="tws.plan.date">none</jsdl:stringVariable>
    <jsdl:stringVariable name="tws.plan.date.epoch">none</jsdl:stringVariable>
    <jsdl:stringVariable name="tws.job.logon">none</jsdl:stringVariable>
  </jsdl:variables>
  <jsdl:application name="executable">
    <jsdle:executable output="${tws.plan.runnumber}">
      <jsdle:environment>
```

```
        <jsdle:variable name="UNISON_SCHED">${tws.jobstream.name}
</jsdle:variable>
        <jsdle:variable name="UNISON_JOB">${tws.job.fqname}
</jsdle:variable>
        <jsdle:variable name="UNISON_MASTER">${tws.master.workstation}
</jsdle:variable>
        <jsdle:variable name="UNISON_RUN">${tws.plan.runnumber}
</jsdle:variable>
        <jsdle:variable name="UNISON_SCHED_DATE">${tws.plan.date}
</jsdle:variable>
        <jsdle:variable name="UNISON_SCHED_EPOCH">${tws.plan.date.epoch}
</jsdle:variable>
        <jsdle:variable name="LOGIN">${tws.job.logon}
</jsdle:variable>
      </jsdle:environment>
...
```

Chapter 3. Using variables in jobs

This section explains how to define and use variables in jobs for additional flexibility.

Dynamic workload broker supports the use of variables in jobs for additional flexibility. You can assign values to the variables or leave them blank, so that you can define the value when the job is submitted.

When you define jobs that will be processed through dynamic scheduling, you can include variables that can be used at run time to valorize or override the variables defined in the JSDL job definition.

You define the variables in the Task String section of the Tivoli Workload Scheduler job, as described in the following example:

```
jobName -var var1Name=var1Value,...,varNName=varNValue
```

To define variables in the Tivoli Workload Scheduler job, perform the following steps:

1. Create a JSDL job definition using the Job Brokering Definition Console.
2. Define the variables for the job. For example, you can define the **memory** variable to specify the amount of memory required for the job to run.
3. Move to the **Resources** tab, **Hardware Requirements** section and type the name of the variable in the **Exact** value field in the **Physical Memory** section. When the job is submitted, the value assigned to the **memory** variable defines the amount of physical memory.
4. Save the job definition in the **Job Repository** database.
5. Define a job in Tivoli Workload Scheduler. This job contains the standard Tivoli Workload Scheduler syntax and instructions; in the **Task String** section of the job, specify the name of the JSDL job definition. The name of the job definition is specified in the **jobDefinition** element in the JSDL file.

   In the **Task String** section of the job, you can also specify the parameters you want to provide to the job while it runs using static text or variables. For example, you can use the **memory** variable you previously defined.

   Note: If you are using variables that you have not previously defined, you must provide them with a value now.
6. Add the job to a job stream.
7. Submit or schedule the job using either the Dynamic Workload Console or **conman**.
8. After any existing dependencies are resolved, the master domain manager submits the job to dynamic workload broker via the dynamic workload broker workstation.
9. The dynamic workload broker workstation identifies the job definition to be submitted based on the information on the **Task String** section of the job. It also creates an alias which contains the association with the job.
10. The job definition is submitted to dynamic workload broker with the value specified for the **memory** variable.
11. Dynamic workload broker manages and monitors the whole job lifecycle.

12. Dynamic workload broker returns status information on the job to the dynamic workload broker workstation, which communicates it to the Master Domain Manager. The job status is mapped to the Tivoli Workload Scheduler status as described in Table 6 on page 31.

Chapter 4. Defining affinity relationships

Affinity relationships cause jobs to run on the same resource. The resource on which the first job runs is chosen dynamically by dynamic workload broker, and the affine job or jobs run on the same resource.

In dynamic workload broker, you can define affinity relationships between two or more jobs when you want them to run on the same resource. When submitting the job from the Tivoli Workload Scheduler environment, you can define affinity that will be resolved by dynamic workload broker by adding an affinity definition to the **Task String** section of the Tivoli Workload Scheduler job in one of the following ways:

- Identifying affine job with the dynamic workload broker job ID
- Identifying affine job with the dynamic workload broker job alias
- Identifying affine job with the Tivoli Workload Scheduler job name

Identifying affine job with the dynamic workload broker job ID

```
jobName [-var varName=varValue,...,]-affinity jobid=jobid
```

Identifying affine job with the dynamic workload broker job alias

```
jobName [-var varName=varValue,...,]-affinity alias=alias
```

where

jobid Is the ID dynamic workload broker assigns when the job is submitted.

alias Is one of the following:
- The alias defined by the user at submission time for dynamic workload broker jobs.
- The alias automatically generated by the dynamic workload broker workstation when the job is submitted from Tivoli Workload Scheduler.

Identifying affine job with the Tivoli Workload Scheduler job name

The jobs must belong to the same job stream

```
jobName [-var varName=varValue,...,]-twsaffinity jobname=twsJobName
```

where

twsJobName
Is the name of the instance of the Tivoli Workload Scheduler job with which you want to establish an affinity relationship.

Chapter 5. Creating Tivoli Workload Scheduler jobs managed by dynamic workload broker

This section explains how to create Tivoli Workload Scheduler jobs to be managed by dynamic workload broker.

To create a Tivoli Workload Scheduler job and have resources allocated dynamically, perform the following steps:

1. Create a JSDL job definition in dynamic workload broker using the Job Brokering Definition Console.
2. Create a job to be submitted in Tivoli Workload Scheduler. Define the job using the standard Tivoli Workload Scheduler syntax and instructions, with the following imperatives:
   a. Define as target CPU the workstation where the dynamic workload broker workstation is installed.
   b. In the **Task String** section of the job, specify the name of the JSDL job definition you created in the dynamic workload broker environment.
   c. Set the task type as BROKER.
3. The Tivoli Workload Scheduler job can now be scheduled and when it is submitted to the dynamic workload broker workstation, the dynamic workload broker job is automatically launched and the resources are dynamically allocated.

Chapter 6. Monitoring and canceling jobs

This section explains how you can monitor and cancel jobs using the Dynamic Workload Console or the **conman** command.

You can use the Dynamic Workload Console or the **conman** command line to monitor the status of submitted jobs, retrieve the job output, and cancel jobs if necessary, as you normally do in Tivoli Workload Scheduler. You can also use the Dynamic Workload Console to view their status since it provides more detail on jobs processed through dynamic workload broker.

Job statuses in dynamic workload broker correspond to the following statuses in Tivoli Workload Scheduler:

Table 6. Status mapping between dynamic workload broker and Tivoli Workload Scheduler

Dynamic workload broker job status	Tivoli Workload Scheduler job status
1. Run failed 2. Unable to start 3. Resource allocation failed 4. Unknown	1. ABEND 2. FAILED 3. FAILED 4. ABEND
1. Submitted 2. Submitted to Agent 3. Resource Allocation Received 4. Waiting for Reallocation 5. Waiting for Resources	1. INTRO 2. WAIT 3. WAIT 4. WAIT 5. WAIT
1. Running	1. EXEC
1. Completed Successfully	1. SUCC
1. Canceled 2. Cancel Pending 3. Cancel Allocation	1. ABEND 2. The status is updated when the job reaches the Canceled state in dynamic workload broker 3. The status is updated when the job reaches the Canceled state in dynamic workload broker

Note: The + flag written beside the INTRO and EXEC statuses means that the job is managed by the local **batchman** process.

You can view the job output by using both the Dynamic Workload Console or the **conman** command-line.

The following example displays the output of the TWS_COLLECT_DATA job, submitted from Tivoli Workload Scheduler to the dynamic workload broker workstation.

```
%sj ITDWB_SA#JOBS.TWS_COLLECT_DATA;stdlist

===========================================================
= JOB       : lab134114#TWS_COLLECT_DATA
= USER      : mdm_821
= JCLFILE   : COLLECT_DATA -var data_collect_interval=12
              -twsaffinity jobname=branch_collect
```

```
= Job Number: 226589429
= Wed Oct 25 00:31:03 GMT+08:00 2006
===========================================================
THIS IS THE OUTPUT OF THE JOB
===========================================================
= Exit Status           : 0
= System Time (Seconds) : 30    Elapsed Time (Minutes) : 0
= User Time (Seconds)   : 30
= Wed Oct 25 00:31:33 GMT+08:00 2006
===========================================================
```

The keywords in the file output are as follows:

JOB Is the host name of the Tivoli Workload Scheduler agent to which the job has been submitted and the job name.

USER Is the Tivoli Workload Scheduler user who submitted the job to the dynamic workload broker workstation. When a scheduled job is submitted, the user name is retrieved from the **STREAMLOGON** keyword specified in the job definition. When an ad-hoc job is submitted from conman and the logon is not specified, the user name corresponds to the user who submitted the job.

JCLFILE
Is the job name.

Job Number
Is the job number.

Exit Status
Is the status of the job when completed.

System Time
Is the time the kernel system spent for the job.

User Time
Is the time the system user spent for the job.

You can also kill the job after submitting it. Killing a job in Tivoli Workload Scheduler performs the same operations as issuing the **cancel** command in dynamic workload broker.

Chapter 7. Identifying the resources for jobs

To schedule jobs, dynamic workload broker first scans the computers in the environment to retrieve hardware and operating system information from the agent computers. You can also optionally create logical resources that represent characteristics of the computers that are not gathered by the scan, such as software licenses or installed applications, to further identify resources available in the environment.

After the Tivoli Workload Scheduler agent is installed, an automatic scan is performed on the discovered computers where the agent is installed. The scan returns hardware and operating system information which is stored in the **Resource Repository**.

The hardware and operating system information returned by the scan is considered a physical resource. Physical resources collected from the agent computers include the following:

Types of physical resources	Examples
Computer system	Computer system name, model, number of processors, CPU speed
Operating system	Operating system type and version, virtual memory, physical memory, swap space
Network system	IP address, network card, host name
File system	File system storage capacity

The automatic discovery process of gathering physical resource information is capable of identifying available computers with the resources required for jobs to run on. The scan is scheduled and configurable. You can configure the scan from the `ResourceAdvisorAgentConfig.properties` file on the master domain manager and from the `JobManager.ini` file on the agents. Ensure the scan runs at regular times to update any changes to resources. Refer to the *Tivoli Workload Scheduler: Administration Guide, SC23-9113* for more information about this configuration file.

When the physical resources gathered by the scan do not supply enough information to accurately address specific job requirements, you can define logical resources or resource groups using the Dynamic Workload Console. The Dynamic Workload Console gives you the capability to set up additional logical resources and link them to computers where the resources are available. Logical resources help identify resources required by jobs to make allocation more accurate. Logical resources can also be used when expressing a consumable quantity of a resource. For example, you might use a logical resource to identify specific applications, and you might also use them to define a limited number of software licenses available. When a job is submitted, the job definition includes the physical and logical resource requirements, and with this information dynamic workload broker finds the most suitable computer.

You can also use the Dynamic Workload Console to define a resource group. A resource group is a combination of physical and logical resources defined to accurately match and allocate resources to job requirements when the job is submitted. After creating logical resources and resource groups, you can subsequently edit them using the Dynamic Workload Console. If a computer, logical resource, or resource group becomes unavailable or you need to make it unavailable to perform maintenance tasks, for example, you can set the status to offline. You can subsequently set the status online using the Dynamic Workload Console.

The following are tasks for configuring resources:
- "Creating logical resources" on page 36
- "Creating resource groups" on page 38

Checking physical resources on computers

You can browse and display the physical resources discovered by the agent scan on the computers in your environment.

The automatically scheduled scan that runs on computers when the Tivoli Workload Scheduler agent is installed returns hardware and operating system information from the agent computers to the Resource Repository. You can use the Dynamic Workload Console to view the information collected by the agent, in addition to the other information about the computers. The following information can be accessed:
- Operating system information
- Computer availability
- Processor information
- Machine information
- Free memory, free virtual memory, and free swap space
- System resources allocated to jobs
- A history of job instances that ran on the computers and are currently running

To view information about the physical resources available on the computers in your environment, do the following:
1. In the Tivoli Dynamic Workload Broker navigation tree, expand **Configuration** and click **Server Connections**
2. Define viable connections, test, and save them .
3. Expand **Tracking** and click **Computers**.
4. Specify the search criteria for the computers you want to find.
5. Click **Search**. The computers that meet the search criteria are displayed in the **Computer Search Results** page.
6. To view the physical resources for a computer, select the display name link for the computer. The **Computer details** page displays the physical resources on the computer.

Figure 4 on page 36 shows the **Computer Search Results** page. From this view you can perform the following tasks:
- Set computers offline so that they cannot be allocated to run jobs.
- Set offline computers back online so that they can be allocated to run jobs.
- Delete computers so that they are no longer visible when you search for computers. When you delete a computer, it is temporarily removed from the database for a period of time defined in the ResourceAdvisorAgentConfig.properties file. After the deletion, the Tivoli Workload Scheduler agent remains installed and running. Any jobs currently

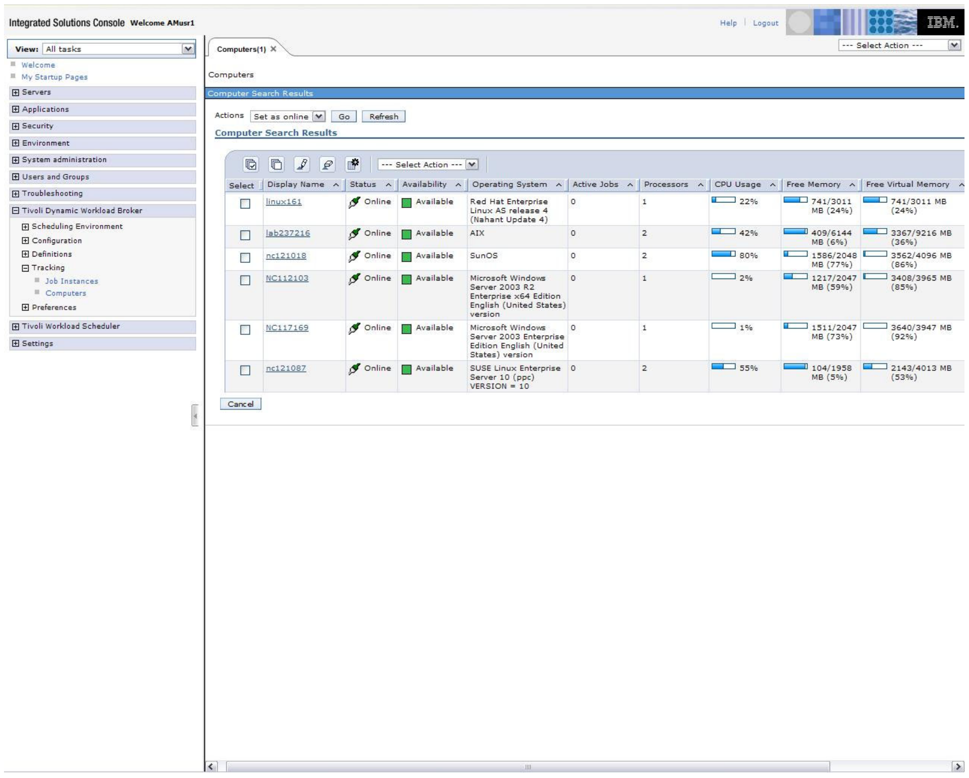
allocated and running on the computer complete. To permanently delete a computer, you must uninstall the Tivoli Workload Scheduler agent.

- Refresh the view of the computer search results to see updated information about computers.
- View the number of jobs currently allocated on a given computer in the **Active Jobs** column. For each computer this column shows the number of jobs that have selected the computer as a target system, as well as the number of jobs that are currently allocating the computer as a related resource. In the specific case you defined a computer system as a type for a related resource required to run a job (in the JSDL definition of the job), when the job is allocated it is displayed twice in **Active Jobs** as follows:
  - If the same computer is selected both as a target system and as a related resource, the column shows 2 jobs for that computer, even though there is only one job running.
  - If different computers are selected for the target system and the related resource, the column shows the same job twice (once for each computer).
- View additional information about a computer.

To perform these tasks, do the following:

1. Select a computer in the **Computer Search Results** table.
2. Select one of the following operations from the **Actions** menu:
   - **Set as online**
   - **Set as offline**
   - **Delete**
   - **Refresh**
3. Click **Go** to perform the operation.

You can display details on computers by clicking the computer name link in the **Computer Search Results** table.



Select	Display Name	Status	Availability	Operating System	Active Jobs	Processors	CPU Usage	Free Memory	Free Virtual Memory
☐	linux161	Online	🟩 Available	Red Hat Enterprise Linux AS release 4 (Nahant Update 4)	0	1	22%	741/3011 MB (24%)	741/3011 MB (24%)
☐	lab237216	Online	🟩 Available	AIX	0	2	42%	409/6144 MB (6%)	3367/9216 MB (36%)
☐	nc121018	Online	🟩 Available	SunOS	0	2	80%	1586/2048 MB (77%)	3562/4096 MB (86%)
☐	NC112103	Online	🟩 Available	Microsoft Windows Server 2003 R2 Enterprise x64 Edition English (United States) version	0	1	2%	1217/2047 MB (59%)	3408/3965 MB (85%)
☐	NC117169	Online	🟩 Available	Microsoft Windows Server 2003 Enterprise Edition English (United States) version	0	1	1%	1511/2047 MB (73%)	3640/3947 MB (92%)
☐	nc121087	Online	🟩 Available	SUSE Linux Enterprise Server 10 (ppc) VERSION = 10	0	2	55%	104/1958 MB (5%)	2143/4013 MB (53%)

Figure 4. Computer Search Results page

In general, you can click links for job names, job instance names, and computers from the Dynamic Workload Console to display more details about them.

Creating logical resources

Using the Dynamic Workload Console, you can define logical resources and resource groups for workstations with properties that are not discovered with a system scan. You create a logical resource specifying the characteristics of the resource that are required to run jobs.

To create a logical resource, perform the following steps:

1. In the Tivoli Dynamic Workload Broker navigation tree, expand **Scheduling Environment** and click **Define a New Logical Resource**. The Define a New Logical Resource wizard starts. The wizard helps you create a new resource and add it to computers in your environment.
2. In the **General Properties** page, define the general properties for the logical resource:
   a. In the **Name** field, type the name to be assigned to the logical resource. This field is required. The name must start with an alphabetical character, and can contain underscore symbols (_), minus symbols (-), and periods (.). Spaces, special characters, accented characters are not supported.
   b. In the **Type** field, type a meaningful name for the logical resource type. For example, if the logical resource describes DB2® applications, you might call the resource DB2. The name must start with an alphabetical character, and can contain underscore symbols (_), minus symbols (-), and periods (.). Spaces, special characters, accented characters are not supported.

c. In the **Quantity** field, specify a value that represents the availability of the logical resource. For example, if the resource consists in a license server, you can specify the number of licenses available on the server for a product. This field is optional.

d. Select the **Set as Offline** check box to mark the resource as not available. You can subsequently change the resource status by expanding **Scheduling Environment** in the left pane and selecting **Logical Resources**. You can then search for a resource and modify the status.

e. Click the **Next** button to proceed.

3. In the **Computer Search Criteria** page, specify the criteria for searching the computers to be added to the logical resource. In this page, you can either perform a search on all computers available in the dynamic workload broker environment or you can search for specific computers. To search on all available computers, leave all fields blank. As an alternative, you can specify one or more of the search criteria listed below. The search criteria are cumulative; each additional information you specify further refines the search:

   - In the **Host Name** field, specify the host name of a computer. Wildcards are supported. The search is performed on computers with the specified host name or section of the host name. For example, if you enter test* in the **Host name** field, the test1 and testing host names are returned.
   - In the **Logical resources already on the computer** area, specify the name and type of logical resources already present on the computer, if any. In the **Name** field, specify the logical resource name and in the **Type** field specify the logical resource type. Wildcards are supported.
   - In the **Availability** area, specify whether the computer is:

     Available
     The computer is available and can be assigned jobs.

     Unavailable
     The computer is not available. The network might be down or the computer might be switched off.
   - In the **Status** area, define the status of the specified computer.

     Online
     The computer is online.

     Offline
     The computer is offline. The administrator might have set the computer offline for maintenance purposes.
   - In the **Hardware Characteristics** area, specify the number of processors available on the computer:

     Single processor
     The computer contains one processor.

     Double processor
     The computer contains two processors.

     Multi processor
     The computer contains three or more processors.
   - In the **Operating System** area, specify the operating system installed on the computers for which you want to search. The search is performed only for computers with the selected operating systems. Available operating systems are:
     - **Windows**
     - **Linux**

   - **AIX**
   - **Oracle Solaris**
   - **HP-UX**

   The results of the search are displayed in the **Computer Search Results** pages.
4. In the **Computer Search Results** page, you specify to which computers you want to add the logical resource you are creating. Your selections are displayed in the **Summary** page.
5. In the **Summary** page, you can optionally remove the selected computer from the logical resource you are defining. Click **Finish** to save the logical resource.

The logical resource has been created and can be accessed using the **Scheduling Environment** > **Logical Resources** task. You can perform the following operations using this task:
- Set the online or offline status of the logical resource.
- Delete the logical resource.
- Edit the logical resource specifications, including the computers where the logical resource is located, the online or offline status of the computers, and the logical resource name, unless the logical resource was imported from the Configuration Management Database. A Configuration Management Database logical resource can be identified in the table of logical resources by the value `CCMDB` in the **Owner** column.

Creating resource groups

Using the Dynamic Workload Console, you can create resource groups to group computers, logical resources, or both. A resource group represents a logical association between computers, logical resources, or both with similar hardware or software characteristics. It is a combination of physical and logical resources to accurately match and allocate resources to job requirements when the job is submitted.

To create a resource group, perform the following steps:
1. In the console navigation tree, expand **Scheduling Environment** and click **Define New Resource Group**. The Resource Group wizard starts. The wizard helps you create a new resource group.
2. In the **Group Type Selection** page, specify a name, the status, and a type for the resource group:
   a. In the **Name** field, type the name to be assigned to the resource group. The name must start with an alphabetical character, and can contain underscore symbols (_), minus symbols (-), and periods (.). Spaces, special characters, and accented characters are not supported. This field is required.
   b. Select the **Set as Offline** check box to mark the resource group as not available. You can subsequently change the resource group status by expanding **Scheduling Environment** in the left pane and selecting **Resource Groups**. You can then search for a resource group and modify the status.
   c. In the **Select items to be grouped** area, select the elements the group consists of. Supported values are computers, logical resources or both. This field is required.
   d. Click the **Next** button to proceed.
3. In the **Computer Search Criteria** page, specify the criteria for searching available computers to be added to the resource group. In this page, you can either perform a search on all computers available in the dynamic workload

broker environment or you can search for specific computers. To search on all available computers, leave all fields blank. As an alternative, you can specify one or more of the search criteria listed below. The search criteria are cumulative; each additional information you specify further refines the search:

- In the **Host Name** field, specify the host name of a computer. Wildcards are supported. The search is performed on computers with the specified host name or section of the host name. For example, if you enter test* in the **Host name** field, the test1 and testing host names are returned.
- In the **Logical resources already on the computer** area, specify the name and type of logical resources already present on the computer, if any. In the **Name** field, specify the logical resource name and in the **Type** field specify the logical resource type. The name and type must start with an alphabetical character, and can contain underscore symbols (_), minus symbols (-), or periods (.). Spaces, special characters, and accented characters are not supported.
- In the **Availability** area, specify whether the computer is:

  Available
  The computer is available to be allocated.

  Unavailable
  The computer is not available. The network might be down or the computer might be switched off.
- In the **Status** area, define the status of the specified computer.

  Online
  The computer is online.

  Offline
  The computer is offline. The administrator might have set the computer offline for maintenance purposes.
- In the **Hardware Characteristics** area, specify the number of processors available on the computer:

  Single processor
  The computer contains one processor.

  Double processor
  The computer contains two processors.

  Multi processor
  The computer contains three or more processors.
- In the **Operating System** area, specify the operating system installed on the computers for which you want to search. The search is performed only for computers with the selected operating systems. Available operating systems are:
  - **Windows**
  - **Linux**
  - **AIX**
  - **Oracle Solaris**
  - **HP-UX**

Click **Next** to perform the search based on the criteria specified. The results of the search are displayed in the **Computer Search Result** page.

4. In the **Computer Search Result** page, you specify to which computers you want to add the group you are creating. Click **Next**.

5. If the resource group you are defining includes a logical resource, then the Logical Resource Search Criteria page prompts you to specify the following search criteria:
   a. The name of the logical resource.
   b. The type of logical resource.

   Click **Next** to display the **Logical Resources Search Results** page.
6. Select the logical resource to add to the resource group you are defining and click **Next** to display the **Summary** page.
7. In the **Summary** page, you can optionally remove any computer or logical resource that you included in the resource group. Click **Finish** to save the resource group.

The resource group has been created and can be accessed using the **Scheduling Environment** > **Resource Groups** task. You can perform the following operations using this task:
- Set the online or offline status of the resource group.
- Delete the resource group.
- Edit the resource group specifications, including adding and removing computers and logical resources from the group, changing their online or offline status, and changing the resource group name.

Chapter 8. Writing JSDL definitions with the Job Brokering Definition Console

The Job Brokering Definition Console provides an easy-to-use graphical interface that helps you create and edit JSDL job definitions for use with dynamic workload broker.

The Job Brokering Definition Console graphical interface helps you create and edit job definitions based on the Job Submission Definition Language (JSDL) schema. Each text field in the Job Brokering Definition Console corresponds to an element or attribute in the JSDL file and vice versa. You can use the Job Brokering Definition Console to create existing job types. If you need to create job types with advanced options, use the Dynamic Workload Console or **composer** command.

The Job Brokering Definition Console simplifies the task of creating a JSDL file by hiding the complexity of the file itself and validating the file structure against the JSDL schema. Information defined in the Job Brokering Definition Console is automatically converted to the corresponding element or attribute in the JSDL file.

You can save a JSDL file locally or upload it as a job definition in the **Job Repository** where it becomes available for submission. When you save the file in the Job Brokering Definition Console, the JSDL file is checked against an .xsd file provided with the product installation which contains the syntax rules. A message is displayed if a syntax error is encountered in the JSDL file, allowing you to correct the error.

The Job Submission Description Language (JSDL) is an XML-based language used for specifying the characteristics and requirements of a job, as well as instructions on how to manage and run it. These include the following:
- Job identification information
- Program running information
- Resource requirements
- Scheduling and running requirements
- Resource quantity to be allocated or required
- Logical allocation of the resource quantity

Selecting target types

When creating a JSDL file, you can choose between the following resource types as targets for your job:

Resources
A resource is a computer system. You can use this resource type to define a basic requirement for your job.

Related resources
A related resource is a set of resource types. You can use this resource type to define a basic requirement for your job. A related resource includes the following resource types:
- A set of hardware and software properties of a computer such as operating system, file system and network system.

- Logical resources and logical entities that can be associated to one or more computers to represent applications, groups, licenses, servers and so on.

Related resources have two main functions:

- You can specify related resources as an additional requirement adding to the resource requirement. In this case, you must create a relationship between the resource and the related resource.
- You can use the related resource to indicate that the presence of a certain resource in your environment is a co-requisite for running the job. In this case, you must not create a relationship between the resource and the related resource. A related resource having no relation to a resource is a global resource. For example, if you want to move a file from resource A to resource B, resource B is a co-requisite for running the job which moves the file. Computers can only be defined as global resources.

Selecting resource types

Dynamic workload broker manages the resource types listed in Table 7. For each resource type, you can specify requirements on the properties listed in the **Available properties** column. Table 7 also lists consumable properties and properties that can be optimized. Consumable properties can be allocated exclusively to the job while it runs using the allocation mechanism. Properties that can be optimized can be used to provide a more effective load balancing on the resource property.

Table 7. Resource types and properties

Resource Type	Available properties	Is consumable	Can be optimized	Supports wildcards
ComputerSystem	CPUUtilization	No	Yes	No
	HostName	No	No	Yes
	Manufacturer	No	No	Yes
	Model	No	No	Yes
	NumOfProcessors	Yes	Yes	No
	ProcessingSpeed	No	Yes	No
	ProcessorType	No	No	No
LogicalResource	DisplayName	No	No	Yes
	SubType	No	No	Yes
	Quantity	Yes	Yes	No
OperatingSystem	DisplayName	No	No	Yes
	FreePhysicalMemory	No	Yes	No
	FreeSwapSpace	No	Yes	No
	FreeVirtualMemory	No	Yes	No
	OperatingSystemType	No	No	No
	OperatingSystem Version	No	No	No
	TotalPhysicalMemory	Yes	Yes	No
	TotalSwapSpace	Yes	Yes	No
	TotalVirtualMemory	Yes	Yes	No

Table 7. Resource types and properties (continued)

Resource Type	Available properties	Is consumable	Can be optimized	Supports wildcards
FileSystem	DisplayName	No	No	Yes
	FileSystemRoot	No	No	Yes
	FileSystemType	No	No	No
	FreeStorageCapacity	No	Yes	No
	TotalStorageCapacity	Yes	Yes	No
NetworkSystem	NetworkAddress	No	No	No
	NetworkSystem HostName	No	No	Yes

When you define the requirements for a job definition, you can define the amount of a consumable property which will be allocated to the job. When a resource property is allocated to a job, the amount you specify is logically reserved for the job. If another job is submitted which allocates a value greater than the remaining capacity of the same consumable property, this job cannot run on the same resource as the previous job because the required property is already reserved. If no property allocation is specified in the job definition, the job can run on the same resource as the previous job because the allocation mechanism applies only if both jobs allocate the same property.

You can use the allocation mechanism to limit concurrent use of the same quantity by several jobs and improve system performance.

To allocate a property for a job, use the **allocation** element in the JSDL file or the Software Requirements and Hardware Requirements tabs in the Job Brokering Definition Console.

This allocation type applies to computer systems. To allocate a property for a resource other than a computer system, you define the resource whose property you want to allocate in the Related resource pane and define the allocation setting for one or more of its properties. You then define a relationship between the resource and the related resource you created. In this way you define the related resource and the allocated property as a requirement for the job to run.

Job definitions

This topic provides an overview of the possible content of job definitions and describes how the different types of job definition content are added using the Job Brokering Definition Console.

A job definition contains all the information required to determine the computer system or systems on which a job could run, any scheduling and job balancing rules that are to be applied when allocating resources, as well as the information required to identify and run the application. It is defined using the Job Submission Description Language (JSDL).

JSDL is an XML-based language used for specifying the characteristics and requirements of a job, as well as instructions on how to manage and run the jobs. A JSDL file can include the following types of information

Basic job information
Includes the job name, any job categories to which you want to assign it, and any variables that are used in the job.

Variables can be used in several ways in a job definition. For example:

- A set of variables can describe a command and its arguments. These can be added to program running information and within the script of the job.
- Variables can also be used to identify resources, for example, a target host.

The default value assigned to the variable in the job definition is used when the job is run, unless it is overridden at submission time. See Chapter 2, "Using Tivoli Workload Scheduler variables in dynamic workload broker jobs," on page 21 and "Using variables in job definitions" on page 51.

Program running information
Identifies the script or executable to be run and, if necessary, standard input, output, and error files and the working directory. If the job needs to provide credentials these can also be specified.

You can define the required credentials to run a job if the credentials are different from those under which the Tivoli Workload Scheduler agent runs.

On Windows targets, jobs with no specified credentials, run under the user account specified during the Tivoli Workload Scheduler agent installation, unless the agent runs under the Local System account. In this case, any job submitted to the agent runs under the default administrator's account.

On UNIX targets, jobs with no specified credentials, run under `root`.

Required resource specifications
Enables dynamic workload broker to identify the computer systems on which the job can run based on hardware and software requirements.

Related requirements
Allow you to specify required relationships between resources and co-requisite resources for a job.

Allocation
Resource quantity to be allocated or required.

Optimization and load-balancing policies.

The following load balancing policies are available:

Balance load between resources by number of jobs running
Jobs are assigned to targets based on the number of jobs currently running on each target. The objective is to ensure that each resource runs the same number of jobs during the same time interval. This policy is the default. It is suitable for situations where many similar jobs, which consume similar quantities of system resources, are to be run on a set of resources

Balance load between resources by optimization objective
You define an objective by selecting a resource type and related resource property and specifying the objective to maximize or minimize the property. For example, you could balance load with the aim of keeping the amount of free physical memory available on operating system resources as high as possible. The objective

would be set to maximize free physical memory and when jobs with this objective are submitted, they are allocated to available resources so that more jobs go to the resources that currently have the greatest amount of free physical memory.

Select best resource by optimization objective
You define the optimization objective in exactly the same way as described for the **Balance load between resources by optimization objective**. However, when a job with this policy is submitted, it would always be assigned to the resource that best matched the objective. For example, if the objective is to maximize free physical memory, the job would run on the resource that had the highest amount of free physical memory at submission time.

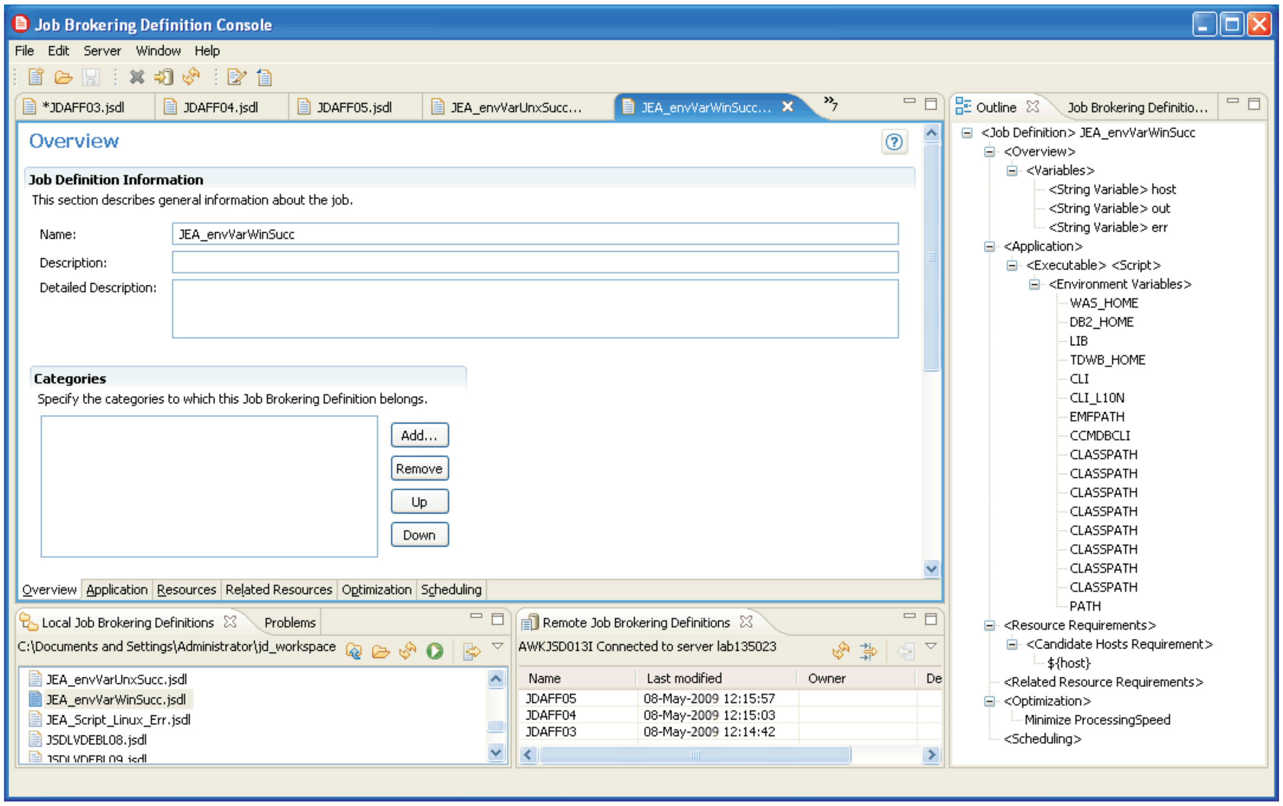
Enterprise Workload Manager
If you have Enterprise Workload Manager installed, you can define jobs with an optimization policy to use the load-balancing capabilities of this product.

In the JSDL schema, the **Optimization** page corresponds to the **optimization** element.

Scheduling and running requirements.
Allows you to define a priority, the time a job can wait for resources before failing, and recovery actions in the event of a failure.

The maximum priority is 100 and priority settings between 90 and 100 should only be used for critical jobs. Jobs with these priorities are always allocated resources ahead of other waiting jobs regardless of how long the other jobs have been waiting. At lower priorities than 90, jobs are allocated resources based on the priority setting and the age of the job. As time passes, jobs with a low priority setting increase their priority so that they eventually are allocated resources even if jobs with higher initial priorities are waiting.

The Job Brokering Definition Console graphical interface allows you to create and edit job definitions based on the JSDL schema. Fields in the Job Brokering Definition Console correspond to elements in the JSDL schema. When creating a job definition using the Job Brokering Definition Console, you can view the job definition structure in the **Outline** pane.


Job Brokering Definition Console
File Edit Server Window Help
*JDAFF03.jsdl
JDAFF04.jsdl
JDAFF05.jsdl
JEA_envVarUnxSucc...
JEA_envVarWinSucc...
Outline
Job Brokering Definitio...
Add...
Remove
Up
Down
Overview Application Resources Related Resources Optimization Scheduling
Local Job Brokering Definitions
Problems
Remote Job Brokering Definitions

Overview

Job Definition Information

This section describes general information about the job.

Name:	JEA_envVarWinSucc
Description:	
Detailed Description:	

Categories

Specify the categories to which this Job Brokering Definition belongs.

C:\Documents and Settings\Administrator\jd_workspace

JEA_envVarUnxSucc.jsdl
JEA_envVarWinSucc.jsdl
JEA_Script_Linux_Err.jsdl
JSDLVDEBL08.jsdl
JSDLVDEBL09.jsdl

AWKJSD013I Connected to server lab135023

Name	Last modified	Owner	De
JDAFF05	08-May-2009 12:15:57		
JDAFF04	08-May-2009 12:15:03		
JDAFF03	08-May-2009 12:14:42		

```
<Job Definition> JEA_envVarWinSucc
  <Overview>
    <Variables>
      <String Variable> host
      <String Variable> out
      <String Variable> err
  <Application>
    <Executable> <Script>
      <Environment Variables>
        WAS_HOME
        DB2_HOME
        LIB
        TDWB_HOME
        CLI
        CLI_L10N
        EMFPATH
        CCMDBCLI
        CLASSPATH
        CLASSPATH
        CLASSPATH
        CLASSPATH
        CLASSPATH
        CLASSPATH
        CLASSPATH
        CLASSPATH
        PATH
  <Resource Requirements>
    <Candidate Hosts Requirement>
      ${host}
  <Related Resource Requirements>
  <Optimization>
    Minimize ProcessingSpeed
  <Scheduling>
```

Figure 5. Job Brokering Definition Console main page

The JSDL schema offers great flexibility in defining jobs and their requirements. A job can have a very open definition, with few defined requirements, allowing it to run on a wide range of resources and to follow default rules for load balancing. Other jobs could have a much more detailed set of hardware and software requirements, as well as specific resource allocations and a load balancing policy. Using the graphical interface simplifies the task of creating JSDL files and eliminates many of the risks of error that occur when the files are edited manually. The different elements that make up a job definition are available, in many cases with a set of fixed values from which you can choose. Information defined in the Job Brokering Definition Console is validated, ensuring that any values you have entered are correct and consistent with each other.

In addition, the Job Brokering Definition Console also includes content assistance that provides server-side values for several fields on the interface, for example, candidate host names and logical resources, to name a few. Fields with content assistance are identified by a light-bulb icon next to the field. Position your mouse over the light-bulb and press **Ctrl + Space** to display a list of possible values. Server-side values are populated using the server cache for the currently active server connection. Server data is cached automatically when the initial connection to a server is made or each time the server connection is changed. You can refresh the cache at any time, for example, if you have defined a new resource requirement on the server, by selecting **Server** > **Refresh Server Data Cache**.

When you save the file in the Job Brokering Definition Console, the JSDL file is checked against an .xsd file provided with the product installation which contains the syntax rules. A message is displayed if a syntax error is encountered in the

JSDL file, allowing you to correct the error. You can save the JSDL files locally or upload them as job definitions in the **Job Repository** where they become available for submission.

Resources in the job definition

This topic provides an overview of how resources and their properties are used in the job definition to identify possible targets, to reserve allocations of consumable resources, and to optimize load balancing between available resources.

An understanding of physical and logical resources and their properties is the key to creating a job definition that accurately targets suitable resources for running the job, determines the resource allocation requirement, and contributes to balancing the load between available resources. Each resource has one or more properties associated with it. Properties can have the following characteristics:

Is consumable
Properties of resources that are consumable have finite amount associated with them which can be consumed by the jobs that are allocated to the resource. For example, a computer system has a finite number of processors.

Can be optimized
Some properties can be used to define optimization objectives, which determine how load is to be balanced when jobs are allocated to a group of resources. For example, you could choose to allocate a job to the matching resource that has the lowest CPU usage.

Supports wildcards
Some properties can be specified in the job definition using wildcards. For example, a requirement for a particular series of computer models could be defined by specifying the model using wildcards.

Table 8 shows the different resource types that can be included in a job definition and their available properties.

Table 8. Resource types and properties

Resource Type	Available properties	Is consumable	Can be optimized	Supports wildcards
ComputerSystem	CPUUtilization	No	Yes	No
	HostName	No	No	Yes
	Manufacturer	No	No	Yes
	Model	No	No	Yes
	NumOfProcessors	Yes	Yes	No
	ProcessingSpeed	No	Yes	No
	ProcessorType	No	No	No
LogicalResource	DisplayName	No	No	Yes
	SubType	No	No	Yes
	Quantity	Yes	Yes	No

Table 8. Resource types and properties (continued)

Resource Type	Available properties	Is consumable	Can be optimized	Supports wildcards
OperatingSystem	DisplayName	No	No	Yes
	FreePhysicalMemory	No	Yes	No
	FreeSwapSpace	No	Yes	No
	FreeVirtualMemory	No	Yes	No
	OperatingSystemType	No	No	No
	OperatingSystem Version	No	No	No
	TotalPhysicalMemory	Yes	Yes	No
	TotalSwapSpace	Yes	Yes	No
	TotalVirtualMemory	Yes	Yes	No
FileSystem	DisplayName	No	No	Yes
	FileSystemRoot	No	No	Yes
	FileSystemType	No	No	No
	FreeStorageCapacity	No	Yes	No
	TotalStorageCapacity	Yes	Yes	No
NetworkSystem	NetworkAddress	No	No	No
	NetworkSystem HostName	No	No	Yes

Resource properties can be used in the job definition in the following ways:

Identifying targets for the job

On the **Resources** page of the Job Brokering Definition Console, you can supply information about the resources required for the job. Using this information, dynamic workload broker can identify the computer systems on which the job could run. In addition to the basic hardware and software requirements, you can use the **Advanced Requirements** tab to include requirements for specific resource properties. For example, you can add a requirement for a specific processor type or specify a required range of processor speeds. In the JSDL schema, the **Resources** page corresponds to the **resources** element.

When you define a resource requirement, the underlying relationship between the required resource and the computer system which contains the resource is automatically created by the Job Brokering Definition Console to facilitate the usage of the product.

Resource property requirements to be used when identifying targets for job can also be specified on the **Related Resources** page. A related resource includes the following resource types:

- A set of hardware and software properties of a computer such as operating system, file system, and network system.
- Logical resources, which are a flexible means of providing information about your environment in addition to the information collected by the hardware scan. For example, you could create logical resources to represent applications, groups, licenses, or database access. A logical resource can be linked to one or more specified computers or it can be a freestanding global resource, available to all computers.

Related resources have two main functions:

To specify additional requirements, making the matching criteria for possible targets more precise

Targets can only match if they either contain or are associated with the specified resource. In addition to defining the related resource in the job definition, you must also define its relationship to the target resource and specify the relationship type as **contains** or **associates with**. Related resource that define hardware and software properties always have a **contains** relationship while logical resources often have an **associates with** relationship. For example, if a related requirement for a logical resource that represents a node-locked license is included, the target system must be one of those that is associated with this resource, and therefore a target where the license is available.

To specify global resources that must be available for the job to run

These related resources are not related to the target resource and have no role in finding matching resources for the job to run on. The resource must be available to the job at submission time. For example, if a license required to run the software used by the job is of a type that is not assigned to any computer, a logical resource could be created to identify it and to track the number of licenses that exist and that are in use. No computers are associated with this logical resource and so it is referred to as a global resource, available to all computers. The job definition includes a related resource identifying the floating license logical resource and the number of licenses required. Before the job can run, it must be possible to meet this requirement.

In the JSDL schema, the **Related Resources** page corresponds to the **relatedResources** element.

When the resource requirements for the job are defined, logical rules are applied to determine whether the requirements are alternatives to each other (OR) or whether they are inclusive (AND). In general, the different types of requirements have an AND relationship, for example, if you specify an operating system type, CPU architecture, and a value for minimum physical memory, the target resource for the job must meet all of these requirements.

Within the following requirement types, you can specify alternatives that have an OR relationship:

- Candidate hosts
- Candidate CPU architectures
- Candidate operating systems

If several entries are added for any of these requirement types, they are considered as alternatives. For example, if Linux, AIX, and HP-UX are specified as candidate operating systems, the target resource for the job must have one of these operating system types.

Within the following requirement types, all requirements specified must be met by the target resource for the job.

- Logical resources
- File systems

For example, if you add Local Disk and CD ROM to the File system requirements, the target resource for the job must have both a local disk and a CD ROM.

Reserving resources

When defining the requirements for a job definition, you can define the amount of a consumable property which will be allocated to the job. When a resource property is allocated to a job, the amount you specify is logically reserved for the job. If another job is submitted which allocates a value greater than the remaining capacity of the same consumable property, this job cannot run on the same resource as the previous job because the required property is already reserved. If no property allocation is specified in the job definition, the job can run on the same resource as the previous job because the allocation mechanism applies only if both jobs allocate the same property.

You can use the allocation mechanism to limit concurrent use of the same quantity by several jobs and improve system performance.

On the Job Brokering Definition Console, you can allocate a specified quantity of a consumable property. You can use the allocation pane from the **Advanced Requirements** tab of the **Resources** page or you can define a required resource and property in the **Related resource** page and specify the amount of the property to be allocated. From the **Advanced Requirements** tab on the **Resources** page, you can only allocate consumable properties of computer system resources.

Defining load-balancing policies

You can use the **Optimization** page in the Job Brokering Definition Console to define custom rules for load-balancing to be applied when the job is submitted. The default method of load-balancing is to aim to equalize the number of jobs running on each resource.

Dynamic workload broker provides two types of optimization policy types that use rules based on resource properties:

- Balance load between resources by optimization objective
- Select best resource by optimization objective

For both policies, you define an objective to distribute jobs minimizing or maximizing the property of a computer system, a file system, a logical resource, or an operating system. For example, you could balance loads with the aim of keeping the free physical memory available on operating system resources as high as possible.

When the **Balance load between resources by optimization objective policy** is used, jobs are distributed between matching resources based on a statistical probability that the resource currently has highest amount of free physical memory of all matching resources. When the **Select best resource by optimization objective policy** is used, the job is allocated to the resource that has the highest amount of free physical memory.

When defining an objective, you must select a resource that is included in the job definition as part of the identification of targets for the job. For example, if you want to define the objective to minimize free physical memory, at least one operating system requirement must be included in the job definition. This could be candidate operating systems, a physical or virtual memory requirement, or a related requirement involving operating system properties. Computer system properties are the exception to this rule. Optimization objectives using computer system properties can be always defined even if the job definition includes no explicit computer system requirements.

For information about all available load balancing policies, see "Job definitions" on page 43.

Using variables in job definitions

This section explains how to use variables to add flexibility to the job definitions.

There are two types of variables in a job definition:

Job variables

There are three types of job variables: String, Double, Integer. You can define job variables in your job definition that are resolved or overwritten at job submission time. This enables the job definition to be used for different situations by specifying different values for the variable at submission time. You define variables in the variable element, but you can refer to the variable from several other elements.

You define variables and assign them values from the **Overview** page on the Job Brokering Definition Console. Job variables are referenced in the job definition in the format ${*variable_name*}. For example, to use a variable to set the minimum amount of physical memory required for a job to 512 MB, do the following:

1. In the **Variables** pane of the **Overview** page, add the string variable `memory` and assign it a value of `512`.
2. On the **Hardware Requirements** tab of the **Resources** page, select **Range value** for Physical memory and set the Minimum value to `${memory}`.

When jobs are submitted, using Dynamic Workload Console, Tivoli Workload Scheduler Task field, or the dynamic workload broker CLI, default values for variables defined in the job definition can be overridden and new variables can be added.

Environment variables

Environment variables are set in the run time environment for the dynamic workload broker job definition. Environment variables can be used to change the run time environment for the job on the assigned resource. This enables you to change only the values of the environment variables when you change the resources for the job definition. Environment variables are referenced in the job definition in the format $*variable_name* where *variable_name* is the name of the environment variable.

Environment variable values cannot be set or overwritten when the job is submitted.

Using JSDL job definition templates

Use job definition templates to be able to run multiple jobs based on a single JSDL document, or to turn a traditional job into a *dynamic* job without the need to create a specific JSDL definition for it.

You have two options for writing the JSDL job definitions for the workload you want to submit with dynamic workload broker:

- Writing a separate definition for each job

- Writing a generalized definition that you can use as a template to run more jobs

Writing and using templates is an option that lets you reuse the same JSDL document on multiple jobs when they use the same resources and candidate hosts and share similar scheduling and optimization preferences. This requires that you also define an extended agent workstation for each template you implement, so that at runtime the JSDL template can be properly identified by selecting the extended agent on which the job you want to run is defined. In this way, you can make up *classes* of jobs where all the jobs that belong to the same class are defined to run on the same extended agent and therefore select, by means of the dynamic workload broker workstation, the same JSDL document to submit to the broker.

Traditional Tivoli Workload Scheduler jobs can be routed to dynamic workload broker by simply changing their CPU to an appropriate extended agent, without changing the job definition and without requiring a different JSDL definition for each job. This is the recommended way for changing static workload into dynamic workload in Tivoli Workload Scheduler.

Writing a JSDL job definition template

Specific, prepackaged JSDL templates that you can fill in do not exist. Rather, you work a number of steps so that you can write in the Job Brokering Definition Console a JSDL file that can be referenced by more Tivoli Workload Scheduler job definitions.

To write a template you use the following:
- The `composer` command line or the Dynamic Workload Console to define extended agents (with their access method) and to create or modify job definitions in Tivoli Workload Scheduler.
- The Job Brokering Definition Console to write the JSDL file that you then use as a template.

The steps are:
1. In the Job Brokering Definition Console, you create a JSDL document, give it a name, and save it in the Job Repository of dynamic workload broker. Like for regular job definitions, fill in the data throughout the pages of the Job Brokering Definition Console, specifying the required resources, and optimization and scheduling details. Unlike you do in regular job definitions, in the Application page, after setting the `Type` to `Executable` (or to `Extended Job`), specify the following variable name in the `Script` (or `Task string`) field:
   ```
   ${tws.job.taskstring}
   ```
2. With `composer` or the Dynamic Workload Console define a workstation of type `extended agent` hosted by the dynamic workload broker workstation.

   If you need background information about extended agents, see the *Tivoli Workload Scheduler: User's Guide and Reference*, *SC32-1274*. For the purpose of creating the template, however, you only need to know the following facts about an extended agent:
   - It is a logical definition that must be hosted by a physical workstation. In this case the physical workstation must always be the dynamic workload broker workstation. This workstation can host as many extended agents as you need.
   - It requires an access method. An access method can be a complex program, but in this case it is only a statement that references the name of the JSDL

file that will be your template. The access method statement is included in the definition of the extended agent and must have the following syntax:

```
ACCESS "/jsdl/filename_of_the_ JSDL_template -var name=value,name=value,..."
```

where `-var` *name=value* is optional and represents one or more variables passed by the dynamic workload broker workstation to dynamic workload broker at job submission time.

3. Add the extended agent to the plan as you do with any other workstation. The dynamic workload broker workstation has the task of managing the lifecycle of the extended agent, notifying the master domain manager that it is up and running.

When jobs are run on the extended agent, they are routed to the dynamic workload broker workstation, which handles them differently from other jobs. Instead of searching for the name of the JSDL definition in the task string of the job, the dynamic workload broker workstation:

1. Gets the name of the target JSDL from the access method, and passes the task string as a value for variable `${tws.job.taskstring}`.
2. The task string value is replaced in the script element of the target JSDL, and is used as a command string to run on the target agent that is dynamically selected by the dynamic workload broker.

   Thus, the JSDL definition invoked by the dynamic workload broker workstation works as a sort of template that you can use to run different task strings defined in different Tivoli Workload Scheduler jobs: the same JSDL document is reused for multiple jobs.

Example

You want to exploit dynamic workload broker to run a job named `SUBMIT_JOBXA` and you want to use a JSDL template. The following definitions accomplish this:

1. The definition of the dynamic workload broker workstation. It is named `DGCENTER_DWB` and it is of type `BROKER`. There can be only one dynamic workload broker workstation running at a time in a Tivoli Workload Scheduler network (this applies also to the dynamic workload broker server).

```
CPUNAME DGCENTER_DWB
  OS OTHER
  NODE DGCENTER TCPADDR 41111
  ENGINEADDR 31111
  DOMAIN MASTERDM
  FOR MAESTRO
    TYPE BROKER
    AUTOLINK ON
    BEHINDFIREWALL OFF
    FULLSTATUS OFF
END
```

2. The definition of extended agent `DGCENTER_DWBXA`. The extended agent must:
   - Be hosted by the dynamic workload broker workstation (`DGCENTER_DWB` in this example).
   - Include the access method. While normally the `ACCESS` keyword is followed by the name of the program that implements the specific access method, in the case of JSDL templates it needs only to define the name of the JSDL document you use as template - that must be stored in the dynamic workload broker Job Repository in the Tivoli Workload Scheduler database and available in a local folder in the workstation where you run the Job

Brokering Definition Console- and whatever other parameters you want to use. These items must be enclosed between double quotes.

This requires that you created the JSDL document you will be using as a template (named SJT in this example), defining the required resources, candidate hosts, and scheduling and optimization preferences, and specifying ${tws.job.taskstring} in the Script field of the executable.

```
CPUNAME DGCENTER_DWBXA
  OS OTHER
  NODE DGCENTER TCPADDR 41111
  FOR MAESTRO HOST DGCENTER_DWB ACCESS "/jsdl/SJT -var
target=D:\vmware,RES=RES1"
    TYPE X-AGENT
    AUTOLINK OFF
    BEHINDFIREWALL OFF
    FULLSTATUS OFF
END
```

3. The definition of job SUBMIT_JOBXA in Tivoli Workload Scheduler:

```
DGCENTER_DWBXA#SUBMIT_JOBXA
 SCRIPTNAME "C:\TWS\Utils\Jobs\javacount_on.bat"
 STREAMLOGON Administrator
 DESCRIPTION "Added by composer."
 TASKTYPE WINDOWS
 RECOVERY STOP
```

The fact that the job is defined to run on extended agent DGCENTER_DWBXA, hosted by the dynamic workload broker workstation and matched with the SJT JSDL definition, drives the process that:

a. Submits the job via dynamic workload broker
b. Uses the specifications of the SJT JSDL definition
c. Replaces variable ${tws.job.taskstring} in SJT with the task string of SUBMIT_JOBXA, that is:

```
C:\TWS\Utils\Jobs\javacount_on.bat
```

Scenarios for creating job definitions

These scenarios provide examples of creating job definitions with different types of requirements.

JSDL and the Job Brokering Definition Console provide very flexible tools for defining jobs. The following scenarios provide examples of how to set up a job definition to achieve your objectives for identification of targets, resource allocation, and load balancing:

- "Scenario: Creating a job definition using a computer resource group" on page 55.

  This scenario demonstrates the use of a resource group to specify candidate target systems.
- "Scenario: Creating a job definition using a logical resource group" on page 55.

  This scenario demonstrates the use of a resource group to specify logical resources required for the job..
- "Scenario: Creating a job definition for a job to run on x86 processors" on page 56

  This scenario demonstrates the use of advanced requirements for resources and the use of resource properties for defining load-balancing rules.
- "Scenario: Creating a job definition for a script to run on a specific operating system" on page 58

This scenario demonstrates the creation of relationships between an operating system type software resource and an additional resource requirement.

- “Scenario: Alternative operating system requirements” on page 59

  This scenario demonstrates the definition of two resource requirements related to specific operating system types and a minimum free physical memory requirement.

Scenario: Creating a job definition using a computer resource group

In this scenario, a job is created to run the inventory update program, selecting the target system from the **invadmin** resource group set up to include the computers that are suitable for running the script.

To create a job definition that does this, perform the following steps:

1. In the Job Brokering Definition Console select **File** > **New** > **Job brokering definition** and create a new job definition named `compgroupjob`. The job definition opens at the Overview page with the job name assigned.
2. Open the Application page and identify and attach the script, as follows:
   a. In the **Type** menu, select **Executable**.
   b. In the **Executable** pane, select the **Executable File** radio button.
   c. Click **Browse** and locate the executable file.
   d. Click **OK**.
3. Open the Resources page and specify the resource group, as follows:
   a. Select the **Advanced Requirements** tab.
   b. In the Resource Group pane, click **Add**. The Resource Group Details dialog box is displayed.
   c. In the Group Name field, type `invadmin` (the resource group name, as defined in the Dynamic Workload Console).
4. Select **File** > **Save** to save the job definition file.

The JSDL file created for this scenario has the following syntax:

```
<jsdl:jobDefinition xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:jsdl="http://www.ibm.com/xmlns/prod/scheduling/1.0/jsdl"
xmlns:jsdle="http://www.ibm.com/xmlns/prod/scheduling/1.0/jsdle"
xsi:schemaLocation="http://www.ibm.com/xmlns/prod/scheduling/1.0/jsdl JSDL.xsd
http://www.ibm.com/xmlns/prod/scheduling/1.0/jsdle JSDL-Native.xsd"
description="Run inventory update script on a computer from the
invadmin resource group.
" name="compgroupjob">
  <jsdl:application name="executable">
    <jsdle:executable path="/opt/invupdate">
</jsdle:executable>
  </jsdl:application>
  <jsdl:resources>
    <jsdl:group name="invadmin"/>
  </jsdl:resources>
</jsdl:jobDefinition>
```

Scenario: Creating a job definition using a logical resource group

In this scenario, the target for the job is determined by several requirements defined as logical resources. A resource group has been created to include all the logical resources required for the job.

To create a job definition that does this, perform the following steps:

1. In the Job Brokering Definition Console select**File** > **New** > **Job brokering definition** and create a new job definition named `loggroupjob`. The job definition opens at the Overview page with the job name assigned.
2. Open the Application page and define the required information for the application that the job is to run.
3. Open the Related Resources page and create a requirement for a logical resource, as follows:
   a. In the Resource Requirements pane, click **Add**. The Resource Requirement Details dialog box is displayed.
   b. In the **ID** field, specify a meaningful ID, in this example, `loggroup`.
4. Open the Resources page and create a relationship to the resource requirement, as follows:
   a. Select the **Advanced Requirements** tab.
   b. In the Relationships pane, click **Add**. The Relationship Details dialog box is displayed.
   c. In the **Type** menu, select **Associates with**.
   d. In the **Target** menu, select the resource requirement that you created and click **OK**.
5. Switch back to the Related Resources page and add the logical resource group as follows:
   a. In the Resource Group pane, click **Add**. The Resource Group Details dialog box is displayed.
   b. In the Group Name field, type the resource group name, as defined in the Dynamic Workload Console.
6. Select **File** > **Save** to save the job definition file.

The JSDL file created for this scenario has the following syntax:

```
<jsdl:jobDefinition xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:jsdl="http://www.ibm.com/xmlns/prod/scheduling/1.0/jsdl"
xsi:schemaLocation="http://www.ibm.com/xmlns/prod/scheduling/1.0/jsdl JSDL.xsd"
description="A job whose requirements are defined by a number of logical
resources. " name="loggroupjob">
  <jsdl:application name="executable">
    <jsdle:executable path="/opt/myExecutable">
    </jsdle:executable>
  </jsdl:application>
  <jsdl:resources>
    <jsdl:relationship target="loggroup" type="AssociatesWith"/>
  </jsdl:resources>
  <jsdl:relatedResources id="loggroup" type="LogicalResource">
    <jsdl:group name="logresgroup"/>
  </jsdl:relatedResources>
</jsdl:jobDefinition>
```

Scenario: Creating a job definition for a job to run on x86 processors

In this scenario, a job is created to run the application, appx86. The application must run on a workstation with an x86 processor where the CPU usage between 3 and 30%. Load balancing is to be defined by an objective to keep CPU use on matching resources to a minimum.

To create the job definition, perform the following steps:

1. In the Job Brokering Definition Console select **File** > **New** > **Job brokering definition** and create a new job definition named `x86job`. The job definition opens at the Overview page with the job name assigned.
2. Open the Application page and define the required information for the appx86 application that the job is to run.
3. Open the Resources page and specify the processor and CPU usage requirements as follows:
   a. Select the Advanced Requirements tab.
   b. Click **Add Requirement**. The Resource Property Details dialog box is displayed.
   c. In the **Property Name** menu, select **CPU Utilization**.
   d. In the **Property Value** section, select the **Range Value** radio button and assign values of 3 to **Minimum** and 30 to **Maximum**.
   e. Click **Add Requirement**. The Resource Property Details dialog box is displayed.
   f. In the **Property Name** menu, select **Processor type**.
   g. In the **Property Value** section, select the **Exact Value** radio button and assign a values of x86.
4. Open the Optimization page and specify the load balancing requirement as follows:
   a. In the **Type** menu, select **Balance load between resources by optimization objective**.
   b. In the **Resource Type** menu, select **Computer System**.
   c. In the **Resource Property** menu, select **CPU Utilization**.
   d. In the **Optimization Objective** menu, select the **Minimize**.
5. Select **File** > **Save** to save the job definition file.

The JSDL file created for this scenario has the following syntax:

```
<jsdl:jobDefinition xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:jsdl="http://www.ibm.com/xmlns/prod/scheduling/1.0/jsdl"
xsi:schemaLocation="http://www.ibm.com/xmlns/prod/scheduling/1.0/jsdl JSDL.xsd"
description="Job to run on X86 processors" name="x86job">
 <jsdl:application name="executable">
    <jsdle:executable path="/opt/appx86">
    </jsdle:executable>
  </jsdl:application>
  <jsdl:resources>
    <jsdl:properties>
      <jsdl:requirement propertyName="CPUUtilization">
        <jsdl:range>
          <jsdl:minimum>3</jsdl:minimum>
          <jsdl:maximum>30</jsdl:maximum>
        </jsdl:range>
      </jsdl:requirement>
      <jsdl:requirement propertyName="ProcessorType">
        <jsdl:exact>x86</jsdl:exact>
      </jsdl:requirement>
    </jsdl:properties>
  </jsdl:resources>
  <jsdl:optimization name="JPT_JSDLOptimizationPolicyType">
    <jsdl:objective propertyObjective="minimize"
          resourcePropertyName="CPUUtilization"
          resourceType="ComputerSystem"/>
  </jsdl:optimization>
</jsdl:optimization>
</jsdl:jobDefinition>
```

Scenario: Creating a job definition for a script to run on a specific operating system

In this scenario, a job is created to run a script on a Red Hat Enterprise Linux system.

By specifying candidate operating systems, you can define the type of operating system on which a job is to run, in this case Linux. To direct the job to a specific flavor of Linux, you must define a related resource and link it to the job resources by creating a relationship. To create a job definition that does this, perform the following steps:

1. In the Job Brokering Definition Console select **File** > **New** > **Job brokering definition** and create a new job definition named `rhjob`. The job definition opens at the Overview page with the job name assigned.
2. Open the Application page and define the required information for the application that the job is to run.
3. Open the Resources page and specify the operating system type requirement, as follows:
   a. Select the **Software Requirements** tab.
   b. In the **Candidate Operating Systems** pane, click **Add**. The Operating System Details dialog box is displayed.
   c. In the **Type** menu, select **LINUX** and click **OK**.
4. Open the Related Resources page and create a resource requirement for the Red Hat flavor of Linux, as follows:
   a. In the Resource Requirements pane, click **Add**. The Resource Requirement Details dialog box is displayed.
   b. In the **ID** field, specify a meaningful ID, in this example, `redhat`.
   c. In the **Type** menu, select **Operating System**.
   d. In the Resource Properties pane, click **Add Requirement.** The Resource Property details dialog box is displayed.
   e. In the **Property Name** menu, select **Display Name**.
   f. In the **Property Value** , type `Red*`.
5.
6. Switch back to the Resources page to link the resource requirement to the operating system resource.
   a. Select the Advanced Requirements tab.
   b. In the Relationships pane, click **Add**. The Relationship Details dialog box is displayed.
   c. In the **Type** menu, select **Contains**.
   d. In the **Target** menu, select the Red Hat resource requirement that you created and click **OK**.
7. Select **File** > **Save** to save the job definition file.

The JSDL file created for this scenario has the following syntax:

```
<jsdl:jobDefinition xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:jsdl="http://www.ibm.com/xmlns/prod/scheduling/1.0/jsdl"
xsi:schemaLocation="http://www.ibm.com/xmlns/prod/scheduling/1.0/jsdl
JSDL.xsd" description="Job to run on Red Hat Linux" name="rhjob">
  <jsdl:application name="executable">
    <jsdle:executable path="/opt/myExecutable">
    </jsdle:executable>
  </jsdl:application>
  <jsdl:resources>  <jsdl:resources>
    <jsdl:candidateOperatingSystems>
      <jsdl:operatingSystem type="LINUX"/>
    </jsdl:candidateOperatingSystems>
    <jsdl:relationship target="redhat" type="Contains"/>
  </jsdl:resources>
  <jsdl:relatedResources id="redhat" type="OperatingSystem">
    <jsdl:properties>
      <jsdl:requirement propertyName="DisplayName">
        <jsdl:exact>red*</jsdl:exact>
      </jsdl:requirement>
    </jsdl:properties>
  </jsdl:relatedResources>
</jsdl:jobDefinition>
```

Scenario: Alternative operating system requirements

In this scenario, a definition is created for a job that can run on either a Linux or an AIX computer.

The job can run on Linux operating systems with a minimum of 512 MB of RAM or on AIX operating systems with a minimum of 1024 MB of RAM. The job definition must include a resource requirement that specifies the two alternative requirements.

To create job definition for this job, perform the following steps:

1. In the Job Brokering Definition Console select **File** > **New** > **Job brokering definition** and create a new job definition named `jobWithRequirementsByOS`. The job definition opens at the Overview page with the job name assigned.
2. Open the Application page and define the required information for the application that the job is to run.
3. Open the Related Resources page.
4. In the Resource Requirements pane, click **Add** then specify a meaningful value for the **ID** field. In this example it is `OperatingSystemType`.
5. In the Resource Properties pane, define the logic that describes the two alternative operating system requirements, as follows:
   a. Click **Add OR Operand** to indicate that you are defining alternatives.
   b. Highlight the OR operand and click **Add AND Operand** to indicate that the alternative includes more than requirement.
   c. Highlight the AND operand and click **Add Requirement**.
   d. In the Resource Property Details dialog, select **Operating System Type** from the **Property Name** menu and type `LINUX` in the **Property value** field.
   e. Highlight the AND operand again and click **Add Requirement**.
   f. In the Resource Property Details dialog, select **Total Physical Memory** from the **Property Name** menu and type `512` in the **Property value** field.
   g. Highlight the OR operand again and click **Add AND Operand** to add the requirements for the second alternative.
   h. Highlight the new AND operand and click **Add Requirement**.
   i. In the Resource Property Details dialog, select **Operating System Type** from the **Property Name** menu and type `AIX` in the **Property value** field.
   j. Highlight the AND operand again and click **Add Requirement**.
   k. In the Resource Property Details dialog, select **Total Physical Memory** from the **Property Name** menu and type `1024` in the **Property value** field.

6. Open the Resources page and create a relationship to the resource requirement, as follows:
   a. Select the **Advanced Requirements** tab.
   b. In the Relationships pane, click **Add**. The Relationship Details dialog box is displayed.
   c. In the **Type** menu, select **Contains**.
   d. In the **Target** menu, select the resource requirement `OperatingSystemType` and click **OK**.
7. Select **File** > **Save** to save the job definition file.

The JSDL file created for this scenario has the following syntax:

```
<jsdl:jobDefinition xmlns:jsdl="http://www.ibm.com/xmlns/prod/scheduling/
    1.0/jsdl" xmlns:jsdle="http://www.ibm.com/xmlns/prod/scheduling/1.0/jsdle"
    xmlns:xmi="http://www.omg.org/XMI" xmi:version="2.0" description="This job
    has different requirements for memory based on the operating system it will
    run on  " name="jobWithRequirementsByOS">
  <jsdl:application name="executable">
    <jsdle:executable path="/opt/myExecutable">
    </jsdle:executable>
  </jsdl:application>
  <jsdl:resources>
    <jsdl:relationship target="OperatingSystemType" type="Contains"/>
  </jsdl:resources>
  <jsdl:relatedResources id="OperatingSystemType" type="OperatingSystem">
    <jsdl:properties>
      <jsdl:or>
        <jsdl:and>
          <jsdl:requirement propertyName="OperatingSystemType">
            <jsdl:exact>LINUX</jsdl:exact>
          </jsdl:requirement>
          <jsdl:requirement propertyName="TotalPhysicalMemory">
            <jsdl:range>
              <jsdl:minimum>512</jsdl:minimum>
            </jsdl:range>
          </jsdl:requirement>
        </jsdl:and>
        <jsdl:and>
          <jsdl:requirement propertyName="OperatingSystemType">
            <jsdl:exact>AIX</jsdl:exact>
          </jsdl:requirement>
          <jsdl:requirement propertyName="TotalPhysicalMemory">
            <jsdl:range>
              <jsdl:minimum>1024</jsdl:minimum>
            </jsdl:range>
          </jsdl:requirement>
        </jsdl:and>
      </jsdl:or>
    </jsdl:properties>
  </jsdl:relatedResources>
</jsdl:jobDefinition>
```

Chapter 9. Submitting and tracking jobs

Although you should normally use the standard Tivoli Workload Scheduler means to schedule and submit workload, there is also an additional way to submit jobs directly to dynamic scheduling using either the Dynamic Workload Console or the dynamic workload broker command line, described in the next chapter. This implies that you only need to write a JSDL job definition. You do not need to write a job definition in Tivoli Workload Scheduler and the dynamic workload broker workstation does not come into play. Choosing to do so, however, results in not exploiting the scheduling and choreography services of Tivoli Workload Scheduler. This chapter explains how to submit and track jobs using the Dynamic Workload Console.

Job definitions are stored in the **Job Repository** and you search for them and select them when the job needs to be submitted. At submission time, you can also specify that a job run on the same resource as a job that has previously run. The job definition provides all necessary parameters for a job to run, however, you can add to and change the parameters defined in the job definition for the job instance you are submitting. This does not change the job definition stored in the Job Repository.

The lifecycle of a job involves the following sequence of phases:

1. Submission of the job to the Job Dispatcher.
2. Job scheduling.
3. Allocation of resources by the Resource Advisor.
4. Job execution.
5. Job status monitoring.

Using the Dynamic Workload Console, you can manage the whole lifecycle of a job by performing the following task:

- "Monitoring submitted jobs" on page 63

Submitting jobs with affinity relationships

An affinity relationship is established between two or more jobs when you want them to run on the same resource.

An affinity relationship is useful when the results of one job are required for the next job to run. You can define an affinity relationship between two or more jobs in the following ways:

- "Submitting a job with affinity from the command line"
- Chapter 4, "Defining affinity relationships," on page 27 in Tivoli Workload Scheduler.

Submitting a job with affinity from the command line

The **`jobsubmit`** command requires a job ID or an alias name for the affine job.

Submit the following command to make the job defined in job definition WinJob2.jsdl, with the alias WJ220070606, run on the same resource as the previously run job, WinJob1, which was submitted with the alias, WJ120070606:

```
jobsubmit -jsdl WinJob2.jsdl -alias WJ220070606 -affinity alias=WJ120070606
```

Submitting jobs with variables

When you submit a job, you can define or change a variable to be used by the job.

During job submission, you can define variables that are to be used by the job itself or to assign the job to a resource. You can add new variables or override the default values for variables that are included in the job definition. For more information about including variables in the job definitions see “Using variables in job definitions” on page 51. At submission time, you can add or change variables in the following ways:

- “Submitting a job with variables from the command line”
- Chapter 2, “Using Tivoli Workload Scheduler variables in dynamic workload broker jobs,” on page 21 in Tivoli Workload Scheduler.

Submitting a job with variables from the command line

The **jobsubmit** command submits jobs from the command line interface. You can include arguments to change the value of predefined variables and add new ones. For example, the job definition for Job1 includes the variable `memory` with the value `512` which is used to set the free physical memory requirement. To increase the requirement to `1024` when submitting the job, issue the following command:

```
jobsubmit -jdname Job1 -var memory=1024
```

Job statuses

This section describes all supported statuses for a job as returned both by the command line interface and by the Dynamic Workload Console. It also lists the operations a user can perform depending on the status the job is in.

Table 9. Job statuses and supported operations

Dynamic Workload Console status	Icon	Command line status	You can cancel the job	You can browse the job output	You can define affinity
Run failed	RED	FAILED_ EXECUTION		√	√
Resource allocation failed	RED	RESOURCE_ ALLOCATION_ FAILED			
Unable to start	RED	NOT_EXECUTED			√
Unknown	YELLOW	UNKNOWN		√	√
Submitted	WAITING	SUBMITTED	√		
Waiting for resources	WAITING	WAITING_FOR_ RESOURCES	√		
Resource allocation received	WAITING	RESOURCE_ ALLOCATION_ RECEIVED	√		
Submitted to agent	WAITING	SUBMITTED_ TO_ENDPOINT	√		√
Waiting for reallocation	WAITING	RESOURCE_ REALLOCATE	√		

Table 9. Job statuses and supported operations (continued)

Dynamic Workload Console status	Icon	Command line status	You can cancel the job	You can browse the job output	You can define affinity
Cancel pending	ABORT	PENDING_ CANCEL		√	√
Cancel allocation	ABORT	CANCEL_ ALLOCATION		√	√
Canceled	ABORT	CANCELLED		√	√
Running	RUNNING	EXECUTING	√	√	√
Completed successfully	GREEN	SUCCEEDED_ EXECUTION		√	√

Note: You can define an affinity relationship with a job in Canceled state only if the job was canceled while running.

Monitoring submitted jobs

A job instance is a job that is submitted to run at a specific time. You can track the outcome of a submitted job from the Dynamic Workload Console.

Prerequisite:A job must be submitted to dynamic workload broker before you can view its instances. Submitted jobs are stored in the Job Repository for a default time interval. See the *Tivoli Workload Scheduler: Administration Guide*, *SC23-9113* for information about configuring this interval in the JobDispatcherConfig.properties file. You can access the following information about job instances:

- Status of the job instance.
- The host name of the computer where the job instance ran.
- The return code of the job instance.
- The date and time the job was submitted.
- The date and time the job started and finished running.

For example, to view all jobs that have resulted in error within the last 24 hours, follow these steps:

1. In the console navigation tree, expand **Tracking** and click **Job Instances**. The **Track Job Instance Search Criteria** page is displayed
2. Specify the search criteria for the job instances as follows:
   a. In the Submission Time section, select the **Last 24 Hours** radio button.
   b. In the Job Status section, select **Error Conditions**.
   c. Click **Search**.

   The results are displayed in the **Job Tracking** page.

As an alternative, you can take the following steps:

1. In the console navigation tree, expand **Definitions** and click **Jobs**. The **Job Definition Search Criteria** page is displayed.
2. Specify the search criteria for the job definition associated with the job instance that you want to view.
3. Select the job for which you want to show instances.

4. Click **Show Instances**. The results are displayed in the **Job Definitions Search Result** page.

Once a job is submitted to the Job Dispatcher, it goes through the phases of job scheduling, allocation of resources, and finally, job execution. Problems might occur along the way, and there are specific job statuses that identify at which point things went wrong. The following is a list of job statuses that a job can assume after it is submitted to be run:

Job completing successfully
The job goes through the following statuses: **Submitted** > **Waiting for resources** > **Resource allocation received** > **Submitted to agent** > **Running** > **Completed successfully**.

Job being canceled
The job goes through the following statuses: **Submitted** > **Waiting for resources** > **Resource allocation received** > **Submitted to agent** > **Running** > **Cancel pending** > **Canceled**.

Job being reallocated
The job is allocated to a computer which is temporarily unreachable, for example because of a network problem. The job goes through the following statuses: **Submitted** > **Waiting for resources** > **Resource allocation received** > **Waiting for reallocation** > **Waiting for resources** .

Job encountering an error
There can be several reasons for the error. Here are some examples:

- The job encounters an error because the selected working directory does not exist on the target system. The job goes through the following statuses: **Submitted** > **Waiting for resources** > **Resource allocation received** > **Submitted to agent** > **Unable to start**. As the job cannot start, no output is available.
- The job requires an operating system which is not available in the environment. The job goes through the following statuses: **Submitted** > **Waiting for resources** > **Resource allocation failed**.
- The job encounters an error because one of the parameters specified in the job is not supported on the target system. The job goes through the following statuses: **Submitted** > **Waiting for resources** > **Resource allocation received** > **Submitted to agent** > **Running** > **Run failed**.

When viewing the job instance details for this job **Job Tracking** page, the reason for the error is displayed. You can also use the ID indicated in the **Identifier** field to retrieve more information on the job results, which is stored in a series of log files on the computer where the job ran. The name of the computer where the job ran is also indicated in the **Job Tracking** page. Locate the computer and analyze the log files available in the folder named with the job ID in the following path:

```
TWA_home/TWS/stdlist/JM/yyyy.mm.dd/archive
```

Every job has a compressed file whose name is the job ID, for example:

```
ed1d4933-964b-3f5e-8c73-f720919491d6.zip
```

The compressed file contains the following:

diagnostics.log
May or may not include diagnostic information.

jm_exit.properties
: Includes the return code as well as other job statistics, like CPU and memory usage.

out.log
: Includes the full job output.

trace.log
: Includes the output trace of the task launcher process spawned by the Tivoli Workload Scheduler agent to run the job.

trace.log_cmd
: Includes the command used to run the task launcher.

Chapter 10. Using the command line interface

Dynamic workload broker provides a command line for running a set of commands. You can use the command line interface to save, submit, query, monitor, cancel jobs, and view the job output. You can also archive database tables.

Commands are stored in the following location on the master domain manager:
TWA_home/TDWB/bin

The following commands are available:

Table 10. Dynamic workload broker commands

Command	Purpose	See
exportserverdata	Downloads the list of dynamic workload broker instances from the Tivoli Workload Scheduler database to a temporary file. Use to record a port number or host name change.	"exportserverdata command - downloading the list of workload broker instances from the database" on page 71
importserverdata	Uploads the list of dynamic workload broker instances from the temporary file to the Tivoli Workload Scheduler database after you are done recording a port number or host name change.	"importserverdata command - uploading the list of workload broker instances to the database" on page 73
jobsubmit	Submits a job to the Job Dispatcher.	"jobsubmit command - Submitting jobs" on page 74
jobdetails	Returns property information for the specified job.	"jobdetails command - Viewing details on jobs" on page 80
jobquery	Returns a list of submitted jobs matching the selection criteria.	"jobquery command - Performing queries on jobs" on page 76
jobcancel	Cancels a submitted job.	"jobcancel command - Canceling jobs" on page 82
jobstore	Manages job definitions.	"jobstore command - Managing job definitions" on page 83
jobgetexecutionlog	Displays the results of submitted jobs.	"jobgetexecutionlog command - Viewing job output" on page 85
movehistorydata	Moves data present in the **Job Repository** database to the archive tables.	"movehistorydata command - Maintaining the database tables" on page 86

Table 10. Dynamic workload broker commands (continued)

Command	Purpose	See
resource	Creates and manages resources and groups. Manages associated computers. By properly configuring the **CLIConfig.properties** file on the agent, you can run this command also from any connected Tivoli Workload Scheduler agent. See "Using the resource command from an agent" on page 96 for details.	"resource command - Working with resources" on page 88

Command-line syntax

This chapter uses the following special characters to define the syntax of commands:

[] Identifies optional attributes. Attributes not enclosed in brackets are required.

... Indicates that you can specify multiple values for the previous attribute.

| Indicates mutually exclusive information. You can use the attribute to the left of the separator or the attribute to its right. You cannot use both attributes in a single use of the command.

{} Delimits a set of mutually exclusive attributes when one of the attributes is required. If the attributes are optional, they are enclosed in square brackets ([]).

\ Indicates that the syntax in an example wraps to the next line.

Command-line configuration file

The `CLIConfig.properties` file contains configuration information which is used when typing commands. By default, arguments required when typing commands are retrieved from this file, unless explicitly specified in the command syntax.

The `CLIConfig.properties` file is created at installation time and is located on the master domain manager in the following path:

```
TWA_home/TDWB/config
```

Starting from this version of Tivoli Workload Scheduler, an additional instance of this file is installed on every agent for users who want to be able to run the **resource** command not only from the master but also from specific agents. See "Using the resource command from an agent" on page 96 for details.

The `CLIConfig.properties` file contains the following set of parameters:

Dynamic workload broker default properties

ITDWBServerHost
Specifies the IP address of dynamic workload broker.

ITDWBServerPort
Specifies the number of the dynamic workload broker port. The default value is **9550**.

ITDWBServerSecurePort
Specifies the number of the dynamic workload broker port when security is enabled. The default value is **9551**.

use_secure_connection
Specifies whether secure connection must be used. The default value is **false**.

KeyStore and trustStore file name and path

keyStore
Specifies the name and path of the keyStore file containing private keys. A keyStore file contains both public keys and private keys. Public keys are stored as signer certificates while private keys are stored in the personal certificates. The default value is /Certs/TDWBClientKeyFile.jks.

trustStore
Specifies the name and path of the trustStore file containing public keys. A trustStore file is a key database file that contains public keys. The public key is stored as a signer certificate. The keys are used for a variety of purposes, including authentication and data integrity. The default value is /Certs/TDWBClientTrustFile.jks.

Passwords for keyStore and trustStore files

keyStorepwd
Specifies the password for the keyStore file.

trustStorepwd
Specifies the password for the trustStore file.

File types for keyStore and trustStore files

keyStoreType
Specifies the file type for the keyStore file. The default value is JKS.

trustStoreType
Specifies the file type for the trustStore file. The default value is JKS.

Default user ID and password for dynamic workload broker

tdwb_user
Specifies the user name for a user authorized to perform operations on dynamic workload broker when security is enabled. The default value is **ibmschedcli**. This password must be previously defined on IBM WebSphere. For more information on security considerations, see the *Tivoli Workload Scheduler: Administration Guide*, *SC23-9113*.

tdwb_pwd
Specifies the password for a user authorized to perform operations on dynamic workload broker when security is enabled. This password must be previously defined on IBM WebSphere . For more information on security considerations, refer to *Tivoli Workload Scheduler: Administration Guide*.

Detail level for command-line log and trace information

logger.Level
: Specifies the detail level for the command-line trace and log files. The command-line trace and log files are created in the following location:

  log file
  : *TWA_home*/TDWB/logs/Msg_cli.log.log

  trace file
  : *TWA_home*/TDWB/logs/Trace_cli.log

  The default value is INFO.

logger.consoleLevel
: Specifies the detail level for the log and trace information to be returned to standard output. The default value is FINE. Supported values for both the **consoleLevel** and **loggerLevel** parameters are as follows:

  ALL Indicates that all messages are logged.

  SEVERE
  : Indicates that serious error messages are logged.

  WARNING
  : Indicates that warning messages are logged.

  INFO Indicates that informational messages are logged.

  CONFIG
  : Indicates that static configuration messages are logged.

  FINE Indicates that tracing information is logged.

  FINER
  : Indicates that detailed tracing information is logged.

  FINEST
  : Indicates that highly detailed tracing information is logged.

  OFF Indicates that logging is turned off.

logger.limit
: Specifies the maximum size of a log file in bytes. The default value is 400000. When the maximum size is reached, a new file is created, until the maximum number of files is reached. When all files reach the maximum size and the maximum number of files is exceeded, the oldest file is re-written.

logger.count
: Specifies the maximum number of log files. The default value is 6. When the maximum size is reached, a new file is created, until the maximum number of files is reached. When all files reach the maximum size and the maximum number of files is exceeded, the oldest file is re-written. When a new file is created the 0 suffix is appended after the file extension. The file with the 0 suffix is always the current file. Any older files are renumbered accordingly.

java.util.logging.FileHandler.pattern
: Specifies that the trace information for the Java Virtual Machine is logged in the Trace_cli.log file. The default value is INFO.

java.util.logging.FileHandler.limit
: Specifies the maximum size of a trace file in bytes. The default

value is 400000. When the maximum size is reached, a new file is created, until the maximum number of files is reached. When all files reach the maximum size and the maximum number of files is exceeded, the oldest file is re-written.

java.util.logging.FileHandler.count
Specifies the maximum number of trace files. The default value is 6. When the maximum size is reached, a new file is created, until the maximum number of files is reached. When all files reach the maximum size and the maximum number of files is exceeded, the oldest file is re-written. When a new file is created the 0 suffix is appended after the file extension. The file with the 0 suffix is always the current file. Any older files are renumbered accordingly.

java.util.logging.FileHandler.formatter
Specifies the formatter to be used for the Trace_cli.log file. The default value is `com.ibm.logging.icl.jsr47.CBEFormatter`.

DAO common configuration
This section defines the RDBMS settings for the **exportserverdata**, **importserverdata**, and **movehistorydata** commands. These commands use the RDBMS installed on dynamic workload broker These parameters are valorized at installation time and should not be modified, except for `com.ibm.tdwb.dao.rdbms.useSSLConnections` as noted below.

com.ibm.tdwb.dao.rdbms.rdbmsName
Specifies the RDBMS name.

com.ibm.tdwb.dao.rdbms.useDataSource
Specifies the data source to be used.

com.ibm.tdwb.dao.rdbms.jdbcPath
Specifies the path to the JDBC driver.

com.ibm.tdwb.dao.rdbms.jdbcDriver
Specifies the JDBC driver.

com.ibm.tdwb.dao.rdbms.userName
Specifies the name of the RDBMS user.

com.ibm.tdwb.dao.rdbms.password
Specifies the password of the RDBMS user.

com.ibm.tdwb.dao.rdbms.useSSLConnections
Specifies that access to the Tivoli Workload Scheduler DB2 database by some of the CLI commands is over SSL. Is set to `FALSE` by default. You must set to `TRUE`, if the database is DB2 and you use FIPS security, for the following commands to work:

- **`exportserverdata`**
- **`importserverdata`**
- **`movehistorydata`**

exportserverdata command - downloading the list of workload broker instances from the database

Use the **exportserverdata** command to download the list of dynamic workload broker instances from the Tivoli Workload Scheduler database and change a port number or a host name.

Syntax

exportserverdata ?

exportserverdata -dbUsr *db_user_name* **-dbPwd** *db_user_password* **-exportFile** *filename*

Description

This command extracts a list of URIs (Uniform Resource Identifier) of all the dynamic workload broker instances from the Tivoli Workload Scheduler database and copies them to a temporary file so that, if either the hostname or the port number of any of the instances listed are changed, the administrator can record this information in the file and place it back in the database with the `importserverdata` command. By default, the list of URIs is saved to the server.properties file, located in the current directory.

This action is necessary because the list of dynamic workload broker instances must be kept up-to-date at all times, since the Resource Advisor agents periodically connect to the active instance to send their data about the resources discovered in each computer. They are able to automatically switch between the instances of this list and find the active one to copy these data in its Resource Repository. Since the master domain manager and every backup master are installed with a dynamic workload broker instance, the active dynamic workload broker instance runs in the master domain manager, while an idle instance resides in each backup master.

The URI pointing to each dynamic workload broker instance is the following:

```
https://hostname:port_number/JobManagerRESTWeb/JobScheduler
```

You can change only the hostname and the port number.

Important: The list is ordered. You can change the order of the instances as they appear in this list, and the agents will follow this order. If you have several backup masters and decide to follow a specific switching order when a master fails, you can instruct the agents to switch to the right instance using this ordered list, speeding up the transition time.

If your Tivoli Workload Scheduler database is DB2 and you use FIPS security, to run this command successfully you need to have the **com.ibm.tdwb.dao.rdbms.useSSLConnections** option set to `TRUE` in the `CLIConfig.properties` file.

Options

? Displays help information.

-dbUsr *db_user_name*
The user name required to access the Tivoli Workload Scheduler database server.

-dbPwd *db_user_password*
The user password required to access the Tivoli Workload Scheduler database server.

-exportFile *filename*
The name of the temporary file where the URIs extracted from the database are copied for editing. This text file is created when you run the command and

you can open it with any editor to change the hostname or the port number. If you do not specify a path, the file is created in the same directory where the command is located, that is:

```
<TWA_home>/TDWB/bin
```

If you do specify a different path, make sure the path exists before you run this command.

Example

To download the current list of all (active and backup) dynamic workload broker instances and copy them in a file named `c:\myservers\uris160709`, run:

```
exportserverdata -dbUsr twsadm -dbPwd fprefect -exportFile c:\myservers\uris160709
```

The command returns file `uris160709`, that looks like this:

```
https://accrec015:42127/JobManagerRESTWeb/JobScheduler
https://prodop099:52529/JobManagerRESTWeb/JobScheduler
https://prodop111:31116/JobManagerRESTWeb/JobScheduler
```

`prodop099` is the active dynamic workload broker instance because is hosted by the currently active master domain manager, whereas `accrec015` and `prodop111` are idle because they are hosted by backup masters.

You can edit this file to apply your changes before using the `importserverdata` command to upload the URIs back to the database.

See Also

"importserverdata command - uploading the list of workload broker instances to the database"

importserverdata command - uploading the list of workload broker instances to the database

Use the **importserverdata** command to upload the list of dynamic workload broker instances to the Tivoli Workload Scheduler database after editing the temporary file to change a port number or a host name.

Syntax

importserverdata ?

importserverdata -dbUsr *db_user_name* **-dbPwd** *db_user_password* **-importFile** *filename*

Description

This command puts back the list of dynamic workload broker instances in the Tivoli Workload Scheduler database from the temporary file where they were previously downloaded with the `exportserverdata` command.

Use the `exportserverdata` and `importserverdata` commands if you have to record any hostname or port number changes in the URIs of the instances. This is necessary to keep the list of dynamic workload broker instances up-to-date at all times, since the Resource Advisor agents periodically connect to the active instance to send their data about the resources discovered in each computer. They are able to automatically switch between the instances of this list and find the active one to copy these data in its Resource Repository. Since the master domain manager and every backup master are installed with a dynamic workload broker instance, the active dynamic workload broker instance runs in the master domain manager, while an idle instance resides in each backup master.

Important: The list is ordered. You can change the order of the instances as they appear in this list, and the agents will follow this order. If you have several backup masters and decide to follow a specific switching order when a master fails, you can instruct the agents to switch to the right instance using this ordered list, speeding up the transition time.

If your Tivoli Workload Scheduler database is DB2 and you use FIPS security, to run this command successfully you need to have the **com.ibm.tdwb.dao.rdbms.useSSLConnections** option set to `TRUE` in the `CLIConfig.properties` file.

Options

? Displays help information.

`-dbUsr` *`db_user_name`*
: The user name required to access the Tivoli Workload Scheduler database server.

`-dbPwd` *`db_user_password`*
: The user password required to access the Tivoli Workload Scheduler database server.

`-importFile f`*`filename`*
: The name of the temporary file you specified with the `-exportFile` keyword in the `exportserverdata` command.

Example

To upload the edited list of dynamic workload broker instance URIs from file `c:\myservers\uris160709` to the Tivoli Workload Scheduler database, run:

```
importserverdata -dbUsr twsadm -dbPwd fprefect -importFile c:\myservers\uris160709
```

See Also

"exportserverdata command - downloading the list of workload broker instances from the database" on page 71

jobsubmit command - Submitting jobs

Use the **jobsubmit** command to submit jobs to the Job Dispatcher.

Syntax

jobsubmit ?

jobsubmit [**-usr** *user_name* **-pwd** *password*] {**-jsdl** *jsdl_file* | **-jdname** *job_definition_name*} [**-alias** *job_alias*] [**-var** *variable*=*value*...] [**-affinity** {**jobid**=*job_id* | **alias**=*alias*}] [**-configFile** *configuration_file*]

Description

This command submits a job to the Job Dispatcher. When the job is submitted, it is assigned a unique ID, which can be used for retrieving information on and canceling jobs.

You can use this command to submit jobs saved locally on the dynamic workload broker server or saved in the Job Repository. To submit a local job, use the **-jsdl** option and specify the path to the JSDL file. To submit a job saved in the Job Repository, use the **-jdname** option and specify the job definition name.

When submitting jobs, you can also define an alias to be used as an alternative to the job ID when performing queries on the job, or for defining subsequent jobs as affine. To define affinity between two or more jobs, use the **-affinity** option when submitting the subsequent jobs. You define jobs as affine when you want them to run on the same resource, for example when the second job must use the results generated by the previous job.

Options

? Displays help information.

-usr *user_name*
Specifies the username for a user authorized to perform operations on the command line. This parameter is required when security is enabled and the username is not defined in the CLIConfig.properties configuration file (with the `tdwb_user` keyword).

-pwd *password*
Specifies the password for a user authorized to perform operations on the command line. This parameter is required when security is enabled and the password is not defined in the CLIConfig.properties configuration file (with the `tdwb_pwd` keyword).

-jsdl *jsdl_file*
Specifies the name and path to a local JSDL file which provides the parameters for a job when it is submitted. This parameter is required when the **jdname** parameter is not specified.

-jdname *job_definition_name*
Specifies the name of a job definition stored in the **Job Repository** database. The job definition name is defined within the JSDL file and can be modified only by editing the JSDL file. This parameter is required when the **jsdl** parameter is not specified. To obtain this name, you can use the **Definitions** > **Jobs** task from the Dynamic Workload Console console navigation tree, or the **jobstore** command specifying one or more of the query options. For more information on the **jobstore** command, see "jobstore command - Managing job definitions" on page 83.

-alias *job_alias*
Indicates that an alias must be generated for the job being submitted. You can use the alias as a user-friendly alternative to the job ID when performing queries on the job. You can also use the alias when submitting new jobs so that the new job is affine to the job having this alias. To define affinity between two or more jobs, use the **-affinity** option when submitting the new jobs. You define jobs as affine when you want them to run on the same resource. On Windows systems, the maximum length for the alias is 200 characters, if you used the default installation paths for WebSphere Application Server and dynamic workload broker.

-var *variable=value*
Specifies a variable and the associated value. You can also specify a list of variables by separating them with a comma. This value overrides the value specified when creating the JSDL file. You can also specify new variables without previously defining them in the JSDL file.

-affinity jobid=*job_id*
Specifies that the current job is affine to a previously submitted job. To establish the affinity relationship, specify the job ID for the previous job. The job ID is automatically generated at submission time.

-affinity alias=*alias*
Specifies that the current job is affine to a previously submitted job. To establish the affinity relationship, specify the job alias for the previous job. The job alias is generated at submission time when you specify the **-alias** option.

-configFile *configuration_file*
Specifies the name and path of a custom configuration file. This parameter is optional. If this parameter is not specified, the default configuration file is assumed. For more information on the configuration file, see "Command-line configuration file" on page 68.

Authorization

The user name and password for the command are defined in the CLIConfig.properties file. To override the settings defined in this file, you can enter the user name and password when typing the command. For more information on the CLIConfig.properties file, see "Command-line configuration file" on page 68.

Return Values

The **jobsubmit** command returns one of the following values:

0	Indicates that **jobsubmit** completed successfully.
< > 0	Indicates that **jobsubmit** failed.

Examples

1. To submit the local job `test_job` located in the `/staging_area/accounts/` path using the configuration parameters specified in the `custom_config.properties` configuration file, type the following command:
```
jobsubmit -jsdl /staging_area/accounts/test_job -configFile
 /opt/test/custom_config.properties
```
2. To submit the job definition `domestic_accounts` saved in the Job Repository, type the following command:
```
jobsubmit -jdname domestic_accounts
```

See Also

"jobdetails command - Viewing details on jobs" on page 80

jobquery command - Performing queries on jobs

Use the **jobquery** command to perform advanced queries on submitted jobs.

Syntax

jobquery ?

jobquery [**-usr** *user_name* **-pwd** *password*] {[**-status** *status*...] [**-submitter** *submitter*] [**-name** *job_definition_name*] [**-alias** *job_alias*] [**-sdf** *submit_date_from*] [**-sdt** *submit_date_to*] [**-jsdf** *job_start_date_from*] [**-jsdt** *job_start_date_to*] [**-jedf** *job_end_date_from*] [**-jedt** *job_end_date_to*]} [**-configFile** *configuration_file*]

Description

This command performs advanced queries on submitted jobs based on the following attributes:

- job status
- name of the user who submitted the job
- job name
- job alias
- job submission date
- job start date
- job completion date

You can also use this command to retrieve the job ID generated at submission time, which is required when running the **jobstatus**, **jobdetails** and **jobcancel** commands. To retrieve the job ID, specify the **-name** option.

Options

? Displays help information.

-usr *user name*
: Specifies the user name for a user authorized to perform operations on the command line. This option is required when security is enabled and the user name is not defined in the CLIConfig.properties configuration file (with the `tdwb_user` keyword).

-pwd *password*
: Specifies the password for a user authorized to perform operations on the command line. This option is required when security is enabled and the password is not defined in the CLIConfig.properties configuration file (with the `tdwb_pwd` keyword).

-status *status*
: Specifies the status of the jobs to be searched. Separate statuses using commas; spaces are not supported. Supported statuses are as follows:

0	all supported statuses
1	submitted
2	waiting for resources
3	resource allocation received
4	submitted to agent
5	running
6	cancel pending
7	canceling allocation
8	waiting for reallocation
10	bound
41	resource allocation failed

42	run failed
43	completed successfully
44	canceled
45	unknown job
46	job not started
48	error

-submitter *submitter*
Specifies the name of the user who submitted the job.

-name *job_definition_name*
Specifies the job name. This option returns the unique job ID, which can be used for retrieving information on and canceling jobs. This option supports the asterisk (*) wildcard character as described below:

as a single parameter
it must be enclosed in inverted commas, for example

```
C:\Program Files\TDWB\bin>jobquery -name "*"
```

This command returns a list of all submitted jobs.

to complete a job name
it does not require inverted commas, for example

```
C:\Program Files\TDWB\bin>jobquery -name batchsub*
```

This command returns a list of all submitted jobs starting with the **batchsub** suffix.

-alias *job_alias*
Specifies the job alias. The job alias is generated at submission time using the **-alias** option. For more information see "jobsubmit command - Submitting jobs" on page 74.

-sdf *submit_date_from*
Specifies a time range starting from the date when the job was submitted. The query is performed starting from the date you specified to the present date, unless the **-sdt** option is specified. Use both the **-sdf** and **-sdt** options to define a specific time range. Specify the date in the dd/MM/yyyy-hh:mm:ss format.

-sdt *submit_date_to*
Specifies a time range starting from the date when the job was submitted. The query is performed starting from the date when the dynamic workload broker database was populated to the date you specified, unless the **-sdf** option is specified. Use both the **-sdf** and **-sdt** options to define a specific time range. Specify the date in the dd/MM/yyyy-hh:mm:ss format.

-jsdf *job_start_date_from*
Specifies a time range starting from the date when the job started. The query is performed starting from the date you specified to the present date, unless the **-jsdt** option is specified. Use both the **-jsdf** and **-jsdt** options to define a specific time range. Specify the date in the dd/MM/yyyy-hh:mm:ss format.

-jsdt *job_start_date_to*
Specifies a time range starting from the date when the job started. The query is performed starting from the date when the dynamic workload broker database was populated to the date you specified, unless the **-jsdf** option is specified. Use both the **-jsdf** and **-jsdt** options to define a specific time range. Specify the date in the dd/MM/yyyy-hh:mm:ss format.

-jedf *job_end_date_from*
: Specifies a time range starting from the date when the job completed. The query is performed starting from the date you specified to the present date, unless the **-jedt** option is specified. Use both the **-jedf** and **-jedt** options to define a specific time range. Specify the date in the dd/MM/yyyy-hh:mm:ss format.

-jedt *job_end_date_to*
: Specifies a time range starting from the date when the job completed. The query is performed starting from the date when the dynamic workload broker database was populated to the date you specified, unless the **-jedf** option is specified. Use both the **-jedf** and **-jedt** options to define a specific time range. Specify the date in the dd/MM/yyyy-hh:mm:ss format.

-configFile *configuration_file*
: Specifies the name and path of a custom configuration file. This option is optional. If this option is not specified, the default configuration file is assumed. For more information on the configuration file, see "Command-line configuration file" on page 68.

Authorization

The user name and password for the command are defined in the CLIConfig.properties file. To override the setting defined in this file, you can enter the user name and password when typing the command. For more information on the CLIConfig.properties file, see "Command-line configuration file" on page 68.

Return Values

The **jobquery** command returns one of the following values:

0	Indicates that **jobquery** completed successfully.
< > 0	Indicates that **jobquery** failed.

Examples

1. To retrieve the job ID for a job named CLIJSB11, type the following command:
   ```
   jobquery -usr john -pwd BCA12EDF -name CLIJSB11
   ```
   The following output is displayed. The job ID is associated to the Job Identifier key:
   ```
   Call Job Dispatcher to query jobs. There are 10 Jobs found for your request
   Details are as follows:

   Job Name: CLIJSB11
   Job Alias: alias
   Job Identifier: 617c9bf7095787c83e1c36744e569ceb
   Status: FAILED_running
   Job EPR: http://lab135200.romelab.it.ibm.com:955
   /JDServiceWS/services/Job
   Job Submitter Name:
   Submit Time: Tue May 23 15:41:54 CEST 2006
   Start Time: Tue May 23 14:48:09 CEST 2006
   End Time: Tue May 23 14:48:09 CEST 2006
   Job Last Status Message:
   Job Duration: PT0S
   Returncode: 0
   Job Resource Name: LAB237010
   Job Resource Type: ComputerSystem
   ```
2. To retrieve all jobs submitted by test_user in submitted, resource allocation failed, and canceled state, type the following command:

```
jobquery -status 1,3,44 -submitter test_user
```

See Also

"jobsubmit command - Submitting jobs" on page 74

jobdetails command - Viewing details on jobs

Use the **jobdetails** command to view details on submitted jobs.

Syntax

jobdetails ?

jobdetails [**-usr** *user_name* **-pwd** *password*] **-id** *job_ID* [**-v**][**-configFile** *configuration_file*]

Description

This command displays details on submitted jobs using the unique ID created at job submission. To retrieve the job ID after submitting the job, use the `jobquery` command specifying the **-name** parameter.

Options

? Displays help information.

-usr *username*
: Specifies the username for a user authorized to perform operations on the command line. This parameter is required when security is enabled and the username is not defined in the CLIConfig.properties configuration file (with the `tdwb_user` keyword).

-pwd *password*
: Specifies the password for a user authorized to perform operations on the command line. This parameter is required when security is enabled and the password is not defined in the CLIConfig.properties configuration file (with the `tdwb_pwd` keyword).

-id *job_ID*
: Specifies the unique job ID created at submission time. This parameter is required.

-v
: Displays job details.

-configFile *configuration_file*
: Specifies the name and path of a custom configuration file. This parameter is optional. If this parameter is not specified, the default configuration file is assumed. For more information on the configuration file, see "Command-line configuration file" on page 68.

Authorization

The user name and password for the command are defined in the CLIConfig.properties file. To override the setting defined in this file, you can enter the user name and password when typing the command. For more information on the CLIConfig.properties file, see "Command-line configuration file" on page 68.

Return Values

The **jobdetails** command returns one of the following values:

0	Indicates that **jobdetails** completed successfully.
< > 0	Indicates that **jobdetails** failed.

Examples

1. To view run information on a job with ID 617c9bf7095787c83e1c36744e569ceb, type the following command:
   ```
   jobdetails -id 617c9bf7095787c83e1c36744e569ceb
   ```
   An output similar to the following is displayed:
   ```
   Call Job Dispatcher to get the job properties.
   Success return from Job Dispatcher.
   Job Identifier: 617c9bf7095787c83e1c36744e569ceb
   Job Name: CLIJSB11
   Job Alias: alias
   Job State: SUBMITTED
   Job Submitter: null
   Client Notification: http://lab135200.romelab.it.ibm.com:9550
   /RAServiceWS/services/Allocation
   Job Last Status Message:
   Job Submit Time: Tue May 23 15:43:44 CET 2009
   Job Start Time: Tue May 23 14:49:51 CET 2009
   Job End Time: Tue May 23 14:49:51 CET 2009
   Job Duration: PT0S
   Job Return Code: 0
   Job Resource Name: LAB237010
   Job Resource Type: ComputerSystem
   Job Usage Metric Name: StartTime
   Job Usage Metric Type: null
   Job Usage Metric Value: 1148388591000
   Job Usage Metric Name: EndTime
   Job Usage Metric Type: null
   Job Usage Metric Value: 1148388591000
   ```
2. To submit the job with ID 617l9jw7095787g83f1c36744e569glf using the configuration parameters specified in the custom_config.properties configuration file, type the following command:
   ```
   jobdetails -id 617l9jw7095787g83f1c36744e569glf -configFile
   /opt/test/custom_config.properties
   ```
3. To view the status of a job with ID 617c9bf7095787c83e1c36744e569ceb, type the following command:
   ```
   jobdetails -id 617c9bf7095787c83e1c36744e569ceb
   ```
   An output similar to the following is displayed:
   ```
   Call Job Dispatcher to get the job properties.
   Success return from Job Dispatcher.
   Job ID: 617c9bf7095787c83e1c36744e569ceb
   Status: SUBMITTED
   ```
4. To view details on the job with ID 617c9bf7095787c83e1c36744e569ceb using the configuration parameters specified in the custom_config.properties configuration file, type the following command:
   ```
   jobdetails -jsdl 617c9bf7095787c83e1c36744e569ceb -configFile
   /opt/test/custom_config.properties
   ```

See Also

- "jobsubmit command - Submitting jobs" on page 74
- "jobquery command - Performing queries on jobs" on page 76

jobcancel command - Canceling jobs

Use the **jobcancel** command to cancel a submitted job.

Syntax

jobcancel ?

jobcancel [**-usr** *user_name* **-pwd** *password*] **-id** *job_ID* [**-configFile** *configuration_file*]

Description

This command cancels the running of submitted jobs using the unique ID created at job submission. To retrieve the job ID after submitting the job, you can use the **jobquery** command specifying the job name.

Options

? Displays help information.

-usr *user_name*
Specifies the username for a user authorized to perform operations on the command line. This parameter is required when security is enabled and the username is not defined in the CLIConfig.properties configuration file (with the `tdwb_user` keyword).

-pwd *password*
Specifies the password for a user authorized to perform operations on the command line. This parameter is required when security is enabled and the password is not defined in the CLIConfig.properties configuration file (with the `tdwb_pwd` keyword).

-id *job_ID*
Specifies the unique job ID created at submission time. This parameter is required.

-configFile *configuration_file*
Specifies the name and path of a custom configuration file. This parameter is optional. If this parameter is not specified, the default configuration file is assumed. For more information on the configuration file, see “Command-line configuration file” on page 68.

Authorization

The user name and password for the command are defined in the CLIConfig.properties file. To override the settings defined in this file, you can enter the user name and password when typing the command. For more information on the CLIConfig.properties file, see “Command-line configuration file” on page 68.

Return Values

The **jobcancel** command returns one of the following values:

0	Indicates that **jobcancel** completed successfully.
< > 0	Indicates that **jobcancel** failed.

Examples

1. To cancel the running of a job with ID `617l9jq7037529f83x1w36185e569fwl`, type the following command:

```
jobcancel -id 617l9jq7037529f83x1w36185e569fwl
```

See Also

"jobsubmit command - Submitting jobs" on page 74

jobstore command - Managing job definitions

Use the **jobstore** command to manage job definitions.

Syntax

jobstore ?

jobstore [**-usr** *user_name* **-pwd** *password*]{[**-create** *jsdl_file*] | [**-update** *jsdl_file*] | [**-del** *job_definition_name*] | [**-get** *job_definition_name*] | [**-queryall**] | [[**-queryname** *job_definition_name*...] [**-querydesc** *job_definition_desc*...] [**-queryowner** *job_definition_owner*...]]} [**-configFile** *configuration_file* }

Description

This command saves and updates JSDL files in the **Job Repository**. JSDL files are saved in the database as job definitions with unique names. After saving JSDL files in the database, you can perform the following operations on job definitions:
- Delete job definitions
- Print job definitions to standard output or save them to a file
- Perform queries on job definitions based on several attributes

You can submit job definitions using the **jobsubmit** command. For more information about the **jobsubmit** command, see "jobsubmit command - Submitting jobs" on page 74.

Options

? Displays help information.

-usr *username*
: Specifies the user name for a user authorized to perform operations on the command line. This parameter is required when security is enabled and the user name is not defined in the CLIConfig.properties configuration file (with the `tdwb_user` keyword).

-pwd *password*
: Specifies the password for a user authorized to perform operations on the command line. This parameter is required when security is enabled and the password is not defined in the CLIConfig.properties configuration file (with the `tdwb_pwd` keyword).

-create *jsdl_file*
: Specifies the name and path to a JSDL file to be saved in the **Job Repository** database. The JSDL file is saved as a job definition. The name for the job definition is saved within the JSDL file and can be only modified by editing the JSDL file. Delete and retrieve (get) operations are performed on the job definition.

-update *jsdl_file*
: Specifies the name and path to a JSDL file to be updated in the **Job Repository** database. The JSDL file must be existing in the database.

-del *job_definition_name*
Deletes a job definition from the **Job Repository** database.

-get *job_definition_name*
Prints the JSDL file contained in the job definition to standard output or to a file you specify. You can use this command for performing minor editing on job definitions.

-queryall
Performs a query without any filters. This query returns all job definitions stored in the dynamic workload broker database.

-queryname *job_definition_name*
Performs a search on job definitions based on the job definition name. The job definition name is unique. This parameter is case-sensitive. Wildcards (*, ?) are supported.

-querydesc *job_definition_desc*
Performs a search on job definitions based on the job definition description. Wildcards are supported.

-queryowner *job_definition_owner*
Performs a search on job definitions based on the user who created the job definition.

-configFile *configuration_file*
Specifies the name and path of a custom configuration file. This parameter is optional. If this parameter is not specified, the default configuration file is assumed. For more information about the configuration file, see "Command-line configuration file" on page 68.

Authorization

The user name and password for the command are defined in the CLIConfig.properties file. To override the setting defined in this file, you can enter the user name and password when typing the command. For more information about the CLIConfig.properties file, see "Command-line configuration file" on page 68.

Return Values

The **jobstore** command returns one of the following values:

0	Indicates that **jobstore** completed successfully.
< > 0	Indicates that **jobstore** failed.

Examples

1. To retrieve all jobs created by user `Administrator`, type the following command:
```
jobstore -queryuser Administrator
```
2. To update the job branch_update already stored in the Job repository database, type the following command:
```
jobstore -update ../jsdl/branch_update.xml
```

See Also

- "jobsubmit command - Submitting jobs" on page 74
- "jobquery command - Performing queries on jobs" on page 76

jobgetexecutionlog command - Viewing job output

Use the **jobgetexecutionlog** command to view the output of a submitted job.

Syntax

jobgetexecutionlog ?

jobgetexecutionlog [**-usr** *user_name* **-pwd** *password*] **-id** *job_ID* **-sizePage** *size Page* **-offset** *offset* [**-configFile** *configuration_file*]

Description

This command displays the job output for submitted jobs using the unique ID created at job submission. To retrieve the job ID after submitting the job, you can use the **jobquery** command specifying the job name. You can also specify the length of the output page to be displayed and the number of the byte in the job output from where you want to start displaying the output.

Options

? Displays help information.

-usr *user_name*
: Specifies the username for a user authorized to perform operations on the command line. This parameter is required when security is enabled and the username is not defined in the CLIConfig.properties configuration file (with the `tdwb_user` keyword).

-pwd *password*
: Specifies the password for a user authorized to perform operations on the command line. This parameter is required when security is enabled and the password is not defined in the CLIConfig.properties configuration file (with the `tdwb_pwd` keyword).

-id *job_ID*
: Specifies the unique job ID created at submission time. This parameter is required.

-sizePage *size Page*
: Specifies the number of bytes to be displayed in the job output page.

-offset *offset*
: Specifies the number of the first byte to be displayed in the job output page. This option can be used to view large job outputs.

-configFile *configuration_file*
: Specifies the name and path of a custom configuration file. This parameter is optional. If this parameter is not specified, the default configuration file is assumed. For more information on the configuration file, see “Command-line configuration file” on page 68.

Authorization

The user name and password for the command are defined in the CLIConfig.properties file. To override the settings defined in this file, you can enter the user name and password when typing the command. For more information on the CLIConfig.properties file, see “Command-line configuration file” on page 68.

Return Values

The **jobgetexecutionlog** command returns one of the following values:

0 Indicates that **jobgetexecutionlog** completed successfully.
< > 0 Indicates that **jobgetexecutionlog** failed.

Examples

1. To view the output of a job with ID `6171 9jq7037529f83x1w36185e569fwl` displaying the output in pages containing 400® bytes starting from the first byte in the page, type the following command:

   ```
   jobgetexecutionlog -id 6171 9jq7037529f83x1w36185e569fwl -sizePage 400 -offset 1
   ```

   The following output is displayed:

   ```
   Call Job Dispatcher to get the output of the job
   Success returned from Job Dispatcher
   Get Execution Log request submitted
   The Execution Log Page requested is:
    al 5
   drwxrwxrwx  7 root root 200 Aug 24 16:39 .
   drwxrwxrwx  8 root root 208 Aug 22 15:11 ..
   drwxrwxrwx  6 root root 248 Aug 22 15:11 eclipse
   -rw-rw-rw-  1 root root 139 Aug 24 16:39 jsdef
   drwxr-xr-x  2 root root 552 Aug 24 16:54 logs
   drwxrwxrwx  5 root root 240 Aug 22 15:11 rcp
   drwxrwxrwx  3 root root  72 Aug 22 15:11 shared
   drwxrwxrwx  3 root root  80 Aug 22 15:11 workspace

   The  file size is:
   381
   ```

See Also

- "jobsubmit command - Submitting jobs" on page 74
- "jobquery command - Performing queries on jobs" on page 76

movehistorydata command - Maintaining the database tables

You can use the **movehistorydata** command when access to the database becomes too slow.

This problem might be due to a huge number of records being present in the database, for example when bulk job submissions are performed.

You can use the **movehistorydata** command to move the data present in the Job Repository to the archive tables. When you run this command, the jobs are moved to the following tables in the database:

JOA_JOB_ARCHIVES
Contains archived job instances

JRA_JOB_RESOURCE_ARCHIVES
Contains resource information related to the jobs

MEA_METRIC_ARCHIVES
Contains metrics collected for the jobs

For more information on historical tables, refer to the *Tivoli Workload Scheduler: Administration Guide*, *SC23-9113*.

Note: Depending on the number of jobs and accesses to the database, a cleanup operation might cause some peaks in memory or CPU usage.

If your Tivoli Workload Scheduler database is DB2 and you use FIPS security, to run this command successfully you need to have the **com.ibm.tdwb.dao.rdbms.useSSLConnections** option set to `TRUE` in the `CLIConfig.properties` file.

Syntax

movehistorydata ?

movehistorydata -dbUsr *db_user_name***-dbPwd** *db_user_password* [**-successfulJobsMaxAge** *successfulJobsMaxAge* [**-notSuccessfulJobsMaxAge** *notSuccessfulJobsMaxAge*][**-archivedJobsMaxAge** *archivedJobsMaxAge*]]

Description

This command performs a cleanup operation on the Job Repository database. Based on the values you specify, information on submitted jobs is moved to the archive database and the information in the archive database is deleted.

Use this command to temporarily override the settings defined in the **JobDispatcherConfig.properties** file, when unexpected events require an immediate database cleanup. The settings in the **JobDispatcherConfig.properties** file remain unchanged. For more information on the **JobDispatcherConfig.properties** file, refer to the *Tivoli Workload Scheduler: Administration Guide*.

Options

? Displays help information.

`-dbUsr` *`db_user_name`*
Specifies the username for a user authorized to perform operations on the database server.

`-dbPwd` *`db_user_password`*
Specifies the password for a user authorized to perform operations on the database server.

| **`-successfulJobsMaxAge`** *`successfulJobsMaxAge`*
| Specifies how many hours jobs completed successfully or canceled must be
| kept in the Job Repository database before being archived. The default value is
| 240 hours, that is ten days.

| **`-notSuccessfulJobsMaxAge`** *`notSuccessfulJobsMaxAge`*
| Specifies how many hours jobs completed unsuccessfully or in unknown status
| must be kept in the Job Repository database before being archived. The default
| value is 720 hours, that is 30 days.

| **`-archivedJobsMaxAge`** *`archivedJobsMaxAge`*
| Specifies how many hours jobs must be kept in the archive database before
| being archived. The default value is 720 hours, that is 30 days.

Return Values

The **`movehistorydata`** command returns one of the following values:

0 Indicates that **`movehistorydata`** completed successfully.

< > 0 Indicates that **`movehistorydata`** failed.

Examples

1. To move to the archive database all successful jobs completed in the last 40 hours, type the following command:
   ```
   movehistorydata -dbUsr halmst -dbPwd dgordon -successfulJobsMaxAge 40
   ```
2. To move to the archive database all jobs in all supported statuses and remove from the archive database all jobs older than 700 hours, type the following command:
   ```
   movehistorydata -dbUsr halmst -dbPwd dgordon -successfulJobsMaxAge 0
                   -notSuccessfulJobsMaxAge 0 -archivedJobsMaxAge 700
   ```

resource command - Working with resources

You can use the **resource** command to create, modify, associate, query, or set resources online or offline.

Syntax

resource ?

resource [**-usr** *user_name* **-pwd** *password*]
{
[**-create**{ **-logical** *name* **-type** *type*[**-quantity** *quantity*][**-offline**] |
-group *name*[**-offline**]}]
|
| [**-delete**{**-logical** *name* |
-group *name* }]
|
[**-update**{**-computer** *name*{[**-setOnline** | **-setOffline**]} |
-logical *name*
[**-setName** *name*]
[**-setType** *type*]
[**-setQuantity** *quantity*]
[**-setOnline** | **-setOffline**]
[**-addComputer** *name* |
-addComputerByID *ID* |
-removeComputer *name* |
-removeComputerByID *ID*]
|
-group *name*
[**-setName** *name*]
[**-setOnline** | **-setOffline**]
[**-addComputer** *name* |
-addComputerByID *ID* |
-removeComputer *name* |
-removeComputerByID *ID* |
-addLogical *name* |
-removeLogical *name*]}]
|
[**-query**{**-computer** *name* [*-v*] |
-logical *name* [*-v*] |
-group *name* [*-v*]}
[**-configFile** *configuration_file*]
}

Description

Use this command to work with computers, logical resources, and resource groups. In particular it is possible to:

- Create, update, list, and delete logical resources or groups
- Create logical resources, associate them to computers, define groups of logical resources or computers, and set them online or offline
- Retrieve and update resource properties using the query and the update options
- Discover the list of computers associated to a logical resource performing a detailed query on the logical resource
- Change the association between computers and logical resources
- Set resources online or offline and query computer properties

Options

? Displays help information.

-usr *user_name*
Specifies the user name for a user authorized to perform operations on the command line. This option is required when security is enabled and the user name is not defined in the `CLIConfig.properties` configuration file (with the `tdwb_user` keyword).

-pwd *password*
Specifies the password for a user authorized to perform operations on the command line. This option is required when security is enabled and the password is not defined in the `CLIConfig.properties` configuration file (with the `tdwb_pwd` keyword).

-create -logical *name* **-type** *type*
Creates the logical resource with the specified name and type. It is also possible to set a specific quantity or set the resource offline by using optional parameters in the following way:

-create -logical *name* **-type** *type***-quantity** *quantity* **-offline**

-create -group *name*
Creates the resource group with the specified name. It is also possible to set it offline by using the `-offline` optional parameter in the following way:

-create -group *name* **-offline**

-delete -logical *name*
Deletes the logical resource with the specified name.

-delete -group *name*
Deletes the resource group with the specified name.

-update -computer *name*
Updates the computer system with the specified name. You can set the computer online or offline as follows:

-update -computer *name* **-setOnline**
Sets the specified computer online.

-update -computer *name* **-setOffline**
Sets the specified computer offline.

-update -logical *name*
Updates the specified logical resource. You can update the properties and status of a resource in the following ways:

-update -logical *name* **-setName** *name*
Updates the name of the specified logical resource.

-update -logical *name* **-setType** *type*
Updates the type of the specified logical resource.

-update -logical *name* **-setQuantity** *quantity*
Updates the quantity of the specified logical resource.

-update -logical *name* **-setOnline**
Sets online the specified logical resource.

-update -logical *name* **-setOffline**
Sets offline the specified logical resource.

You can change the association between a logical resource and a computer in the following ways:

-update -logical *name* **-addComputer** *name*
Associates the specified logical resource to the computer with the specified name.

-update -logical *name* **-addComputerByID** *ID*
Associates the specified logical resource to the computer with the specified ID.

-update -logical *name* **-removeComputer** *name*
Removes the association between the specified logical resource and the computer with the specified name.

-update -logical *name* **-removeComputerByID** *ID*
Removes the association between the specified logical resource and the computer with the specified ID.

-update -group *name*
Updates the specified resource group. You can update the properties and status of a resource group in the following ways:

-update -group *name* **-setName** *name*
Updates the name of the specified resource group.

-update -group *name* **-setOnline**
Sets online the specified resource group.

-update -group *name* **-setOffline**
Sets offline the specified resource group.

You can add and remove logical resources or computers to and from a resource group in the following ways:

-update -group *name* **-addLogical** *name*
Adds the logical resource with the specified name to the resource group.

-update -group *name* **-removeLogical** *name*
Removes the logical resource with the specified name from the resource group.

-update -group *name* **-addComputer** *name*
Adds the computer with the specified name to the resource group.

-update -group *name* **-addComputerByID** *ID*
Adds the computer with the specified ID to the resource group.

-update -group *name* **-removeComputer** *name*
Removes the computer with the specified name from the resource group.

-update -group *name* **-removeComputerByID** *ID*
Removes the computer with the specified ID from the resource group.

-query -computer *name*
Retrieves the following properties of the specified computer:

- Name
- Computer ID
- Operating system name
- Operating system type
- Operating system version
- Status
- Availability status

Retrieves the following additional properties if you add the `-v` option:

- Physical memory
- Virtual memory
- CPU utilization
- Free physical memory
- Free virtual memory
- Free swap space
- Allocated physical memory
- Allocated virtual memory
- Allocated swap space
- Processors number
- Allocated processors number
- Processor type
- Processor speed
- Manufacturer
- Model
- Serial number

You can use the asterisk (*) as a wildcard character in the following ways:

As a single parameter
You must enclose it between double quotes, for example:

```
C:\IBM\TWA\TDWB\bin>resource –query –computer "*"
```

This command returns a list of all existing computers.

To complete a computer name
You must enclose the entire name between double quotes, for example:

```
C:\IBM\TWA\TDWB\bin> resource –query –computer "lab123*"
```

This command returns a list of all existing computers with a name starting with `lab123`.

-query -logical *name*
Retrieves the name and the type of the specified logical resource. Retrieves the following additional properties if you add the `-v` option:

- Status

- Quantity
- Current allocation
- Computers list

You can use the asterisk (*) as a wildcard character in the following ways:

As a single parameter
You must enclose it between double quotes, for example:

```
C:\IBM\TWA\TDWB\bin>resource –query –logical "*"
```

This command returns a list of all existing logical resources.

To complete a resource name
You must enclose the entire name between double quotes, for example:

```
C:\IBM\TWA\TDWB\bin> resource –query –logical "myRes*"
```

This command returns a list of all existing logical resources with a name starting with `myRes`.

-query -group *name*
Retrieves the name and the status of the specified resource group. Retrieves the list of computers and of logical resources contained in the resource group if you use the `–v` option.

You can use the asterisk (*) as a wildcard character in the following ways:

As a single parameter
You must enclose it between double quotes, for example:

```
C:\IBM\TWA\TDWB\bin>resource –query –group "*"
```

This command returns a list of all existing resource groups.

To complete a resource group name
You must enclose the entire name between double quotes, for example:

```
C:\IBM\TWA\TDWB\bin> resource –query –group "myResGrou*"
```

This command returns a list of all existing resource groups with a name starting with `myResGrou`.

-configFile *configuration_file*
Specifies the name and the path of a custom configuration file. This keyword is optional. If you do not specify it, the default configuration file is assumed. For more information on the configuration file, see “Command-line configuration file” on page 68.

Authorization

The user name and password for the command are defined in the `CLIConfig.properties` file. To override the settings defined in this file, you can enter the user name and the password when you type the command. For more information on the `CLIConfig.properties` file, see “Command-line configuration file” on page 68.

Return Values

The **resource** command returns one of the following values:

0	Indicates that the command completed successfully.
< > 0	Indicates that the command failed.

Examples

- To create a logical resource named `myApplication`, of type Applications, type the following command:

  ```
  resource.bat -usr john -pwd BXVFDCGS -create -logical myApplication
  -type Applications
  ```

  The following output is displayed:

  ```
  AWKCLI153I Logical resource "myApplication" created.
  ```

- To update the quantity of the logical resource named `myApplication`, type the following command:

  ```
  resource.bat -update -logical myApplication -setQuantity 5
  -usr john -pwd BXVFDCGS
  ```

  The following output is displayed:

  ```
  AWKCLI165I Logical resource "myApplication" updated.
  ```

- To add the relationship between a logical resource and a computer, type the following command:

  ```
  resource.bat -update -logical myApplication -addComputer myComputer
  -usr john -pwd BXVFDCGS
  ```

  The following output is displayed:

  ```
  AWKCLI165I Logical resource "myApplication" updated.
  ```

- To retrieve details of a logical resource named `myApplication`, type the following command:

  ```
  resource.bat -usr john -pwd BXVFDCGS -query -logical myApplication –v
  ```

  The following output is displayed:

  ```
  AWKCLI171I Calling the resource repository to perform a query on resources.

  AWKCLI172I "1" logical resources were found for your query.
  Details are as follows:

  Resource Name:myApplication
  Resource Type:Applications
  Resource Status:Online
  Resource Quantity:5
  Resource Current Allocation:0
  Computers List:
          Computer Name:myComputer
          Computer ID:D656470E8D76409F9F4FDEB9D764FF59
          Computer Status:Online
          Computer Availability Status:Unavailable
  ```

- To set the logical resource named `myApplication` offline, type the following command:

  ```
  resource.bat -usr john -pwd BXVFDCGS -update -logical myApplication
  -setOffline
  ```

  The following output is displayed:

  ```
  AWKCLI165I Logical resource "myApplication" updated.
  ```

- To set the computer named `myComputer` offline, type the following command:

  ```
  resource.bat -usr john -pwd BXVFDCGS -update -computer myComputer
  -setOffline
  ```

  The following output is displayed:

  ```
  AWKCLI165I Computer "myComputer" updated.
  ```

- To retrieve basic properties of the computer named `myComputer`, type the following command:

  ```
  resource.bat -usr john -pwd BXVFDCGS -query -computer myComputer
  ```

  The following output is displayed:

```
AWKCLI171I Calling the resource repository to perform a query on resources.
AWKCLI174I "1" computers were found for your query.
Details are as follows:


Computer Name: myComputer
Computer ID:D656470E8D76409F9F4FDEB9D764FF59
Computer OS Name: Microsoft Windows XP Professional English (United States) version
Computer OS Type:Windows XP
Computer OS Version:5
Computer Status:Offline
Computer Availability Status:Unavailable
```

- To retrieve detailed properties of the computer named `myComputer`, type the following command:

  ```
  resource.bat -usr john -pwd BXVFDCGS -query -computer myComputer -v
  ```

  The following output is displayed:

```
AWKCLI171I Calling the resource repository to perform a query on resources.
AWKCLI174I "1" computers were found for your query.
Details are as follows:


Computer Name: myComputer
Computer ID:D656470E8D76409F9F4FDEB9D764FF59
Computer OS Name:Microsoft Windows XP Professional English (United States) version
Computer OS Type:Windows XP
Computer OS Version:5
Computer Status:Offline
Computer Availability Status:Unavailable
Computer details:
        Physic memory = 2095536.0
        Virtual memory = 3513788.0
        Cpu utilization = 16.0
        Free physic memory = 947972.0
        Free virtual memory = 2333484.0
        Free swap space = 52.0
        Allocated physic memory = 0.0
        Allocated virtual memory = 0.0
        Allocated swap space = 0.0
        Processors number = 1.0
        Allocated processors number = 0.0
        Processor type = x86
        Processor speed = 1995.00
        Manufacturer = IBM
        Model = 2668F8G
        Serial number = L3WZYNC
```

| - To retrieve detailed properties of the logical resource named `geneva`, including
| the list of associated computers, type the following command:

```
resource.bat -usr john -pwd BXVFDCGS -query -logical geneva -v
```

| The following output is displayed:

```
| Setting CLI environment variables....
| AWKCLI171I Calling the resource repository to perform a query on resources.
| AWKCLI172I "1" logical resources were found for your query.
| Details are as follows:
|
|
```

```
| Resource Name:geneva
| Resource Type:prod_wks
| Resource Status:Online
| Resource Quantity:1
| Resource Current Allocation:0
| Computers List:
|     Computer Name:bd_ff139_1
|     Computer ID:666AADE61CBA11E0ACBECD0E6F3527DE
|     Computer Status:Online
|     Computer Availability Status:Available
|     AWKCLI171I Calling the resource repository to perform a query on resources.
```

- To create a resource group named myGroup, type the following command:

  ```
  resource.bat -usr john -pwd BXVFDCGS -create -group myGroup
  ```

  The following output is displayed:

  ```
  AWKCLI153I Resource group  "myGroup" created.
  ```

- To retrieve basic properties of a resource group named myGroup, type the following command:

  ```
  resource.bat -query -group myGroup
  ```

  The following output is displayed:

  ```
  Setting CLI environment variables....
    AWKCLI171I Calling the resource repository to perform a query on resources.
    AWKCLI173I "1" groups were found for your query.
    Details are as follows:


    Group Name:myGroup
    Group Status:Online
  ```

- To add the computer named myComputer to a resource group named myGroup, type the following command:

  ```
  resource.bat -update -group myGroup  -addComputer myComputer
  ```

  The following output is displayed:

  ```
  Setting CLI environment variables....
    AWKCLI165I Resource Group  "myGroup" updated.
  ```

- To retrieve details of a resource group named myGroup, type the following command:

  ```
  resource.bat -query -group myGroup -v
  ```

  The following output is displayed:

  ```
  Setting CLI environment variables....
    AWKCLI171I Calling the resource repository to perform a query on resources.
    AWKCLI173I "1" groups were found for your query.
    Details are as follows:


    Group Name:myGroup
    Group Status:Online
    Computers List:
     Computer Name:myComputer
             Computer ID:D656470E8D76409F9F4FDEB9D764FF59
             Computer Status:Online
     Computer Availability Status:Unavailable

    Resources List:
  ```

Using the resource command from an agent

You can create and manage resources and groups of resources and computers from Tivoli Workload Scheduler agents other then on the master domain manager.

Enabling the resource command

To enable this feature you must:

1. Add the runtime for Java jobs when installing the agent. See information on how to install the agent in the *Planning and Installation* manual.
2. Configure the **`CLIConfig.properties`** file. See "Configuring the local CLIConfig.properties file."
3. Run the **resource** command. See "Running the resource command."

For this purpose an additional instance of the **`CLIConfig.properties`** file is installed on every agent. If you intend to run the **`resource`** command from an agent, you must configure the **`CLIConfig.properties`** locally.

Configuring the local CLIConfig.properties file

When you install the agent, a local copy of **`CLIConfig.properties`** is automatically installed and partially configured on your agent in the following path:

```
TWA_home/TWS/TDWB_CLI/config
```

To run the **`resource.bat`** or **`resource.sh`** command from the agent, customize the following keywords of the local **`CLIConfig.properties`** file:

ITDWBServerHost
: Specify the IP address or the hostname of the master domain manager.

ITDWBServerPort
: Specify the number of the WebSphere Application Server HTTP port.

ITDWBServerSecurePort
: Specify the number of the WebSphere Application Server HTTPS port.

tdwb_user
: Specify the user name for a user authorized to perform operations on dynamic workload broker when security is enabled. This user must be previously defined on IBM WebSphere. For more information on security considerations, refer to *Tivoli Workload Scheduler: Administration Guide, SC23-9113*.

tdwb_pwd
: Specify the password for a user authorized to perform operations on dynamic workload broker when security is enabled. This password must be previously defined on IBM WebSphere. For more information on security considerations, refer to *Tivoli Workload Scheduler: Administration Guide*.

Running the resource command

To run the command, enter:

On Windows:

```
resource.bat
```

On UNIX:

```
resource.sh
```

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Index

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