

**Business Grid Components
for
WebSphere Extended Deployment**

Administration Guide

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Chapter 1 Introduction

The Business Grid components for WebSphere Extended Deployment enables the creation of computing environments that support both interactive workloads and grid applications running in the same cluster of nodes, namely a WebSphere Extended Deployment cell. The general concept of Business Grid is presented in the white paper entitled *WebSphere Extended Deployment Business Grid*, available at <http://www.ibm.com/software/webservers/appserv/extend/library/>.

The Business Grid computing environments are comprised of many interactions among the new Business Grid components (including the Gateway, the workload Balancer, and GUI tools), and other existing products (the backend Scheduler LoadLeveler, the WebSphere Extended Deployment system, WebSphere MQ JMS support, and high availability (HA) tools¹). This document contains configuration information and helpful hints for the administration of the new Business Grid components in these computing environments. It is assumed that the readers are familiar with the configuration of existing products and able to find the necessary details in the product manuals. A list of references is also included at the end of this document.

In Section I of this document, we describe three different administrative tools that are provided in the current technical preview of Business Grid: namely the Business Grid Node Group Enhancement to WebSphere Extended Deployment Administrative Console, the Business Grid Application Runtime Visualization, and the Business Grid Job and Node Management tool. Section II of this document contains helpful hints to some common problems encountered during the configuration and operation of the Business Grid environments.

Section I:

Chapter 2 describes the Business Grid Node Group Enhancement to Extended Deployment administrative console.

Chapter 3 describes the Business Grid Application Runtime Visualization.

Chapter 4 describes the Business Grid Job and Node Management tool.

Section II:

Chapter 5 describes some common problems and helpful hints on using the Gateway component.

¹ Additional information is available on the HA tools in the *Business Grid Install and Configuration* document in Chapter 8, available at: <http://www.ibm.com/software/webservers/appserv/extend/library/>.

Chapter 6 describes some common problems and helpful hints for using LoadLeveler as the backend scheduler.

Chapter 7 includes a list of documents related to WebSphere Business Grid.

Section I

Chapter 2 Business Grid Node Group Enhancement to Extended Deployment Administrative Console

For WebSphere Extended Deployment environments, there are three entities: node groups, nodes, and dynamic clusters. Node groups contain members called nodes, which share a common property. A node group is a resource pool of similarly functionally nodes. Node groups are affiliated closely with dynamic clusters. A dynamic cluster is an application deployment target similar to a cluster, except that it is deployed within a node groups and can reside on multiple nodes within the node group. Grid applications are deployable to Extended Deployment dynamic cluster. The administration details of application deployment can be found in Extended Deployment manuals and would not be addressed here. However, we will describe how the run time tool to visualize performance data for grid applications is used in later sections of this document.

For the Business Grid environments, we extend the concept and usage of a node group, namely a business grid node group. Business grid node groups are capable of running both Extended Deployment interactive workload and grid applications. The current release will allocate a subset of nodes in a business grid node group at a given period of time to run either Extended Deployment workload or grid applications, but not both simultaneously.

In the Business Grid environments, individual nodes in the node group can have an addition property, named the **BgCandidacy**. The **BgCandidacy** of a node is used to designate if it is capable of running grid applications in addition to Extended Deployment interactive workloads. Not all nodes with **BgCandidacy** will run grid applications. A component named Business Grid Balancer makes decisions on node allocation to run grid applications in response to workload demand.

The Business Grid Node Group Enhancement is an administrative tool that supports the setup and editions of additional properties for node groups and nodes such that they can be used in the Business Grid environments. Some properties will be used by the Balancer to decide on when, what and how many of nodes to allocate under various workload conditions.

In the following, we describe:

- How to set up the properties of a node group such that it can be activated and controlled as a business node group
- How to designate nodes within business node group to be candidates for running business grid applications

- How to set properties (Balancer Matrix) that are used by the Business Grid Balancer for making decision on allocating or re-allocating nodes

Business Grid Node Group Properties

Using the WebSphere administrative console, you can select and modify the “Business Grid Node Groups” by clicking **System Administration** (as shown in Figure 1).

System Administration
[Cell](#)
[Deployment Manager](#)
[Nodes](#)
[Node Agents](#)
[Console Users](#)
[Console Groups](#)
[Node Groups](#)
[Health Controller](#)
[Business Grid Node Groups](#)

Figure 1 – Accessing the *Business Grid Node Groups* in the WebSphere administrative console

When the “Business Grid Node Groups” item is clicked, all the node groups defined in Extended Deployment are listed. Under the column name “BGUsage mode”, if the value is “true”, then the node group is business grid capable (as shown in Figure 2).

For a node group to be business grid capable, all or some of the nodes within the group should be defined as schedulable computing resources with the installed scheduling software.

Business Grid Node Groups

Total: 2			
<input type="checkbox"/> Filter			
Name	Number of Members	BGUsage Mode	Description
Unassigned	0		
bgridNG	2	true	this is a test business node group

Figure 2 – Example of content contained within the *Business Grid Node Groups* in the WebSphere administrative console.

By selecting a particular node group, one can configure its general properties with desired values. The properties are used by the Business Grid Balancer to (re)allocate node resources based on utilization. As shown in Figure 3, the general properties that can be edited include:

- *Description*:
 - an optional description of the node group

- a text field of any length
- *BGUsage Mode*:
 - only “true” or “false” are valid for this property
 - set it to “true” if the node group is capable of running grid applications in addition to Extended Deployment interactive workload
- *XDMinNodes*:
 - minimum number of nodes in the node group to be used for Extended Deployment interactive workload regardless of utilization of these nodes
 - this value must always be at least 1 greater than the number of gateway nodes
- *BGMinNode*:
 - minimum number of nodes in the node group to be used for business grid workload regardless of utilization of these nodes
 - the value of *BGMinNodes* plus *XDMinNodes* should be less or equal the number of nodes in the node group
- *BGOvercommittedMaxNodes*:
 - this value should be greater than *BGMinNodes*
 - this value should be less than or equal to the number of nodes in a node group minus *XDMinNodes*
 - this value is used by the balancer in situations where all nodes are overcommitted (highly utilized). The balancer will move toward this number of Business Grid nodes in the node group to achieve a prescribed balance between nodes allocated to Extended Deployment interactive work and Business Grid work
- *BalancerInterval*:
 - Number of minutes between balancer executions.
 - assign an initial value between 2 and 10, and adjust the value later as necessary

Selecting **Business Grid Node Groups** > *bgridNG* in the console, displays the following *bgridNG* content under the configuration tab.

General Properties		
Name	bgridNG	Fully qualified name of this node group
Member count	2	Number of members in this node group
Description	this is a test business node group	Optional description of this node group
BGUsage Mode	true	BgUsage capability of this node group. set value to "true" to activate balancing
XDMinNodes	1	Minimum number of XDnodes in this node group
BGMinNodes	1	Minimum number of business grid nodes in this node group (e.g. 1<=num<=group member count)
BGOvercommittedMaxNodes	1	Maximum number of over-committed nodes in this node group
BalancerInterval	20	Balancer interval (in minutes) for this node group (e.g. 2 - 10 min)
Current Members	df237 df216	A list of the nodes that are currently members of this node group
<input type="button" value="Apply"/> <input type="button" value="OK"/> <input type="button" value="Reset"/> <input type="button" value="Cancel"/>		
Additional Properties		
Node Group Member Information	Properties that pertain to a relationship between a Node and a Node Group. You must have mapped one or more nodes to this node group for anything to exist in the list below.	
Business Grid Balancer Matrix Properties	Configure Business Grid Balancer Matrix	

Figure 3 - *bgridNG*, a configured Business Grid Node Group, configuration settings in the WebSphere administrative console.

Business Grid Node Property

In Figure 3, the count of nodes and node names in the node group are listed. For additional information about these nodes, click “Node Group Member Information”, which is accessible

by selecting **System Administration > Business Grid Node Groups > select an existing node group > Node Group Member Information (Additional Properties)** in the WebSphere administrative console. The resulting list provides the details of nodes in a business grid node group, as shown by an example in Figure 4. The node list can be sorted by node names or utilization by clicking the symbol (↕), and be refreshed by clicking the symbol (🔄).

Using the GUI as shown in Figure 4, node members can have their **BgUsage Candidacy** properties set to either “true” or “false”. The **BgUsage Candidacy** is set to “true” only if the backend scheduler software stack (e.g. LoadLeveler) is already installed and running.

BgUsage Mode of a node is displayed with a value “*bgrid*” when the backend scheduler Loadleveler’s “*startD*” daemon is “*activated*” and not in the “*drain*” state. The **BgUsage Mode** is displayed with a value “*Extended Deployment*” when it is used to serve Extended Deployment interactive workload. The property of **BgUsage Mode** is controlled autonomically by the Business Grid Balancer and can not be set by administrators.

Node Group Members

Total: 2

Filter

Unset Node BgUsage Candidacy Set Node BgUsage Candidacy

<input type="checkbox"/>	Name ↕	CPU Utilization % 🔄	BgUsage Mode	BgUsage Candidate
<input type="checkbox"/>	df216	0.49640366	bgrid	true
<input type="checkbox"/>	df237	4.0345235	Extended Deployment	false

Figure 4 – Result of selecting Node Group Member Information from the Additional Properties section of the selected Business Grid Node Group.

Business Grid Balancer Matrix

Balancer Matrix is a collection of node group properties used by the Business Grid Balancer to determine if a node reallocation action is necessary given the current utilization of the Extended Deployment nodes and the BG nodes.

The dimension of the balancer matrix is set by the following two properties in name-value pair format. For example:

```
com.ibm.websphere.xd.bgrid.matrixColHdrs = "25.0-50.0-75.0-100.0"
com.ibm.websphere.xd.bgrid.matrixRowHdrs = "25.0-50.0-75.0-100.0"
```


Parsing the header value entries will determine the number of columns and rows in the matrix. The value entries are separated by dashes “-“. In the above example, the balancer matrix will be a 4 row by 4 column matrix.

The value entries of the property “matrixColHdrs” represent the utilization of Extended Deployment nodes, and the entries of “matrixRowHdrs” represent the utilization of the BG nodes.

The entries of the Balancer Matrix row are set by the properties, also in name-value pair format. The following is a 5 by 5 matrix example:

```
com.ibm.websphere.xd.bgrid.matrixRow1 = "Z-X-X-X"      // 4 columns
com.ibm.websphere.xd.bgrid.matrixRow2 = "B-X-X-X"
com.ibm.websphere.xd.bgrid.matrixRow3 = "B-B-O-O"
com.ibm.websphere.xd.bgrid.matrixRow4 = "B-O-O-O"
```

The values of the name-value pairs are action codes used by the Balancer. The possible action codes are:

- Z = do nothing
- X = give a node to EXTENDED DEPLOYMENT
- B = give a node to BG
- O = move nodes to BG until “BGOvercommittedMax” value is reached

In the above 4 by 4 matrix example, “matrixRow1” instructs the balancer not to take any action if the average BG utilization is less than 25.0% and the average Extended Deployment node utilization is in the range of less than 25.0%. If the average BG utilization of less than 25.0% and the average utilization of Extended Deployment is between 25% and 50%, the balancer should move a node from BG to Extended Deployment if the number of BG nodes is above the value of “xdMinNodes”. Based on the values of “matrixRow4”, the Balancer should move an Extended Deployment node to BG if the average utilization of BG is between 75.0% and 100% and the average utilization of Extended Deployment is the range less than 25.0%. If the average utilization of Extended Deployment is between 25.0% and 100%, the Balancer would move nodes from Extended Deployment to BG only if the number of BG nodes is below the value of “BGOverCommittedMax” and the number of Extended Deployment nodes is above the “xdminNodes”.

Adding, editing and deleting of properties for the Balancer Matrix can be invoked by clicking “Business Grid Balancer Matrix Properties” option as shown in Figure 3. Figure 5 and 6 are examples of the panel used for this function. Figure 5 displays an example of customer properties as seen in the WebSphere administrative console by selecting **System Administration > Business Grid Node Groups > select an existing node group > Custom Properties**, while Figure 6 displays an example of selecting an existing custom property.

The current implementation would validate the syntactical correctness of individual matrix entities. However, there is no semantic checking or cross validation of entries.

Total: 4

Filter

<input type="checkbox"/>	Name	Value	Description
<input type="checkbox"/>	com.ibm.websphere.xd.bgrid.matrixcolhdrs	25.0-50-70-100	
<input type="checkbox"/>	com.ibm.websphere.xd.bgrid.matrixrow1	b-o-x-z	
<input type="checkbox"/>	com.ibm.websphere.xd.bgrid.matrixrow2	b-b-o-o	
<input type="checkbox"/>	com.ibm.websphere.xd.bgrid.matrixrowhdrs	50-100	

Figure 5 – Example of configured custom properties for *bgridND*

General Properties		
Name	<input type="text" value="com.ibm.websphere.xd.bgrid.matrixrow2"/>	<input type="text" value="Name of this property"/>
Value	<input type="text" value="b-b-o-o"/>	<input type="text" value="Value of this property"/>
Description	<input type="text"/>	<input type="text" value="Description of this property"/>
<input type="button" value="Apply"/> <input type="button" value="OK"/> <input type="button" value="Reset"/> <input type="button" value="Cancel"/>		

Figure 6 – Example of the content for the *com.ibm.websphere.xd.bgrid.matrixrow2* custom property

Chapter 3 Business Grid Runtime Visualization

Business Grid collects runtime statistics of grid applications and presents them via Extended Deployment Runtime Operations.

Runtime Topology can be invoked via the Runtime Operations in the navigation section of the “Administration Console”, as shown in Figure 7.

- Extended Deployment**bgrid**
 - Servers
 - Applications
 - Resources
 - Runtime Operations
 - [Runtime Topology](#)

Figure 7 – Accessing runtime operations in the administrative console

Different perspectives can be selected. Figure 8 shows two of the possible perspectives, namely Node Group and Application perspectives. A perspective is used by the visualization function to create a scope for viewing the runtime based on the user needs.

Select a perspective: Select a node group:

Select a perspective: Select an application:

Figure 8 – Selecting a perspective for your runtime visualization.

For business grid applications, the following statistics are collected and the performance charts are available under the Run Topology, same set as the Extended Deployment interactive workload. However, some of the data are collected using some data from the backend scheduler.

```
average response time (ms)
average throughput
percentile response time
average wait time in queue
average service time
average queue length
average drop rate (always 0 as business does not drop request)
```

Chapter 4 Business Grid Job and Node Management Tool

The Business Grid environment consists of a gateway component which maps between Web service requests from client applications, and the job scheduling functionality provided by a backend scheduler. The Business Grid Gateway has the responsibility of tracking application requests from the time they enter the Business Grid environment until their termination.

In this chapter, we describe a management GUI that is used to perform administrative tasks supported by the Business Grid Gateway. The GUI can be invoked via the URL:

`//http:gatewayNode:port/ BGridAdmin/gui`, where `gatewayNode:port` are installation specific data.² The GUI supports two set of administrative tasks, the job management tasks, and the node management tasks for the backend scheduler, LoadLeveler.

² For information on how to install the GUI tool, please refer to the *Installation and configuration Guide*, available at: <http://www.ibm.com/software/webservers/appserv/extend/library/>.

Job Management

As shown in Figure 9, the GUI tool supports 3 specific job related functions:

- QueryGW:
 - Send a query request to Gateway to obtain information of the current jobs in the Gateway
 - Resulting in a list of job related information including unique application request identification, where there is results from the job waiting to be polled, a unique job identification for the request that is provided by the backend scheduler, and the backend identification.
- Query Job on BE
 - Send a query request to Gateway to obtain the request status on the backend scheduler
 - The Gateway will request the job status from the backend scheduler
 - Result of the query will be shown in the Message box; possible results including job waiting on the backend; job executing on the backend; job not known on backend (this is a normal condition if the job execution is done on the backend and there is job has result waiting to be polled)
- Cancel Job
 - Send a request to Gateway to cancel a job request
 - The Gateway will interact with the backend scheduler on canceling the job, and also remove all related information and results for this job request from the Gateway

WebSphere Business Grid

Job Management

Action: QueryGW Query Job on BE Cancel Job

Message:

Select	Request ID	Status	Job ID	Backend ID
<input type="checkbox"/>	echo:1100347008410	no result	Df237.watson.ibm.com.1003	ll

Figure 9 – Example of the job actions for the Business Grid job and node management GUI tool

The GUI tool also supports a set of node management functions in relation to the backend scheduler. In the release of the Business Grid technical preview, only LoadLevel management functions are supported.

Node Management

As shown in Figure 10, the GUI tool supports 2 specific node management function sets:

- Query Nodes:
 - Click “*submit*” with the “*Query Nodes*” box checked to send a query request to Gateway
 - Gateway will obtain information from the backend scheduler (LoadLeveler) on the current nodes in its domain
 - Result of the query is a list of node related information including a unique node identification, status of the job execution daemon (*startD*) on the node (e.g. drained, idle, or executing), the maximum number of concurrent tasks on the node, the configured job classes, the available job classes, the drained job classes (such that jobs of such classes can not be run on the node), and the draining job classes (such that no new jobs of such classes will be run on the node).
- llctl Option
 - llctl is a control command for the Loadleveler scheduler
 - A request will be sent to the Gateway when clicking “*submit*” along with one “*llctl*” option selected for either “#all” or one node checked
 - The Gateway will interact with the backend scheduler Loadleveler to execute the control command
 - The “*llctl*” options include “*start*”, “*stop*”, “*reconfig*”, “*startD drain*” and “*startD resume*”; please refer to LoadLeveler manual for details on these options
 - The result of the request will be displayed in the message box or/and status changed in *startD* column

Important note on the use of “llctl startd resume” and “llctl startd drain”:

Please refrain from using these two options when the Business Grid Balancer is in use! The Balancer autonomically sets the status of the *startD* on nodes in the business grid node group. Manual setting of the *startD* will create inconsistency with Balancer’s control and lead to unpredictable load balancing results.

WebSphere Business Grid

The screenshot shows a GUI window titled "Node Management". It contains three main sections:

- A header bar with a camera icon and the text "Node Management".
- A middle section labeled "Action:" with two radio buttons. The first is "Query Nodes" (checked) and the second is "llctl Option". To the right of "llctl Option" is a dropdown menu currently showing "LL start".
- A bottom section with a "Submit" button.

Message:

```
drain df216.watson.ibm.com REQUEST_PROCESSED
```

Select	Node Name	Startd Status	Max tasks	Config Classes	Avail Classes
<input type="checkbox"/>	df237	idle	4	small, large	small, large
<input type="checkbox"/>	df216	drain	4	small, large	small, large

Figure 10 – Example of the node actions for the Business Grid job and node management GUI tool

Section II

Chapter 5 Troubleshooting for Business Gateway Related Issues

Some of the Business Grid components have been enabled with integrated JRAs for logging and tracing. The following are logging and tracing tips:

- To turn tracing on/off for the Gateway under the application server “*bgridgateway*”:
WebSphereBGrid=all=enabled
WebSphereBGrid=all=disable
- To turn tracing on/off for Business Grid Node Group Management GUI under the application server “*dmgr*”:
webui.bgnodegroups=all=enabled
webui.bgnodegroups=all=disabled

The Business Grid Gateway is configured using a properties file. Some of the properties can be used for troubleshooting purposes

- To update the contents of the properties file
While logged on as root on the node running bgridGateway
stop the bgridGateway server
cd <was_base_dir>
cd
<was_app_dir>/8installedApps/<cell_name>/BGrid.ear
unzip BGridEJB.jar bgrid.properties
<edit bgrid.properties as needed>
zip BGridEJB.jar bgrid.properties
- The following properties in the bgrid.properties are useful for troubleshooting
keepJobfile=never|on_error|always
When a job request is submitted to the backend scheduler, one or more java temporary files are generated. This setting specifies when the job request files(s) should be kept after a job completes; default value is “never”
jobCleanupTime=-1|0|nn

There are some reasons that jobs can be known to Gateway but not known to the backend scheduler (e.g. during the testing cycle of backend scheduler, job reply failed to reach Gateway due to abnormally termination); this setting specifies when the orphaned job request should be removed from the Gateway

"-1"

Never clean the job from the Gateway

"0"

Job should be removed from the Gateway the next time the cleanup task executes

"nn"

Number of minutes in time after which orphaned job should be removed from the Gateway; default value is 10 minutes

pollingCleanupTime=-1|0|nn

Results of job requests can be queued at the Gateway for retrieval by other polling requests; this setting specifies when the results should be removed from the Gateway if not polled

"-1"

Never clean the results from the Gateway

"0"

Results should be removed from the Gateway the next time the cleanup task executes

nn

Number of minutes in time after which results should be removed from the Gateway; default value is 10 minutes

JMS errors encountered after rebooting the node running MQ

- It is possible that an installation does not automatically start the MQ at boot time
- Try to re-start WebSphere MQ services on the node

While logged on as root, issue the following commands:

```
su - mqm
export LD_ASSUME_KERNEL=2.4.19
strmqm bgrid.queue.manager
runmqsc bgrid.queue.manager
```

JMS errors when deploying a new grid application using JMS

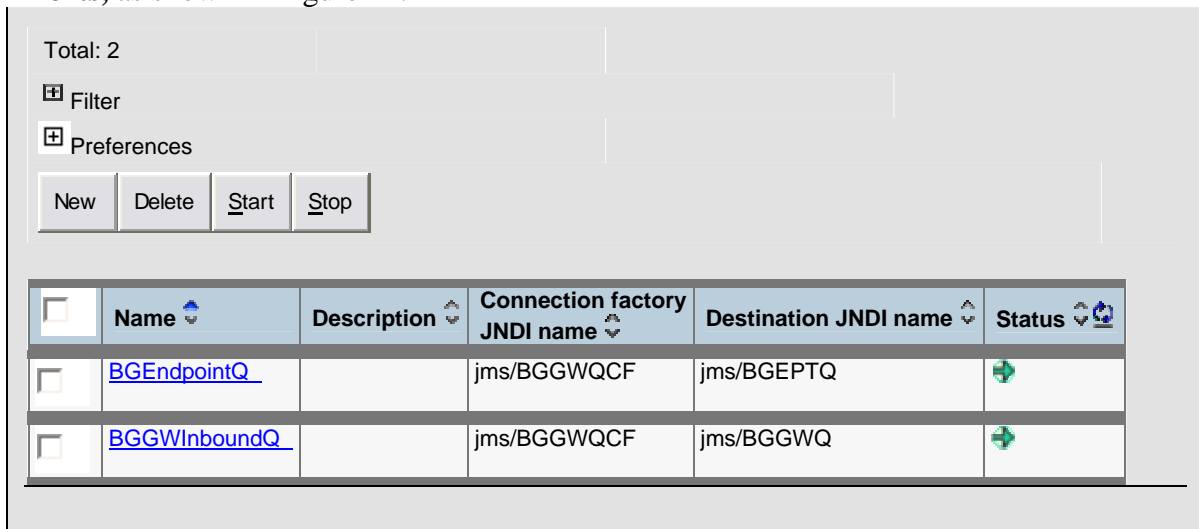
- If a new response queue is defined by a new application to receive response messages from the Gateway, be sure the new queue is defined using the following instructions

While logged on as root, issue the following commands:

```
su - mqm
export LD_ASSUME_KERNEL=2.4.19
runmqsc bgrid.queue.manager
define qlocal (new queue name for the application)
end
```

Failure in Gateway JMS listener

Check the status of the listener port using the WebSphere administrative console, by selecting **Application Servers > bgridGateway > MessageListenerService > Listener Ports**, as shown in Figure 11.



Name	Description	Connection factory JNDI name	Destination JNDI name	Status
BGEPTQ		jms/BGGWQCF	jms/BGEPTQ	+
BGGWInboundQ		jms/BGGWQCF	jms/BGGWQ	+

Figure 11 – Listener Ports status in the WebSphere administrative console

Chapter 6 Troubleshooting for LoadLeveler Scheduler Related Issues

At the initial bring-up of the Business Grid environment, job requests are in hold status at Loadleveler scheduler

- Ensure the group id number of user “loadl” to be identical on all nodes

Requests not being executed

- Using the Job Management Tool to ensure requests have assigned valid job and backend scheduler identifications; if identifications are not assigned
 - Check for Gateway problems in the `SystemOut.log` or `trace.log` of the Gateway application server
- Using the Node Management Tool to ensure the correct running status of the backend scheduler
 - If “*Query Nodes*” results an empty list, the backend scheduler may not be running
 - Check if there is at least one `startD` in non-drain state for the nodes in the dynamic cluster assigned to run the requests

Requests waiting on the backend for an extended period of time and at least one `startD` is in non-drain status

- Check if job classes are available and matched the job classes of requests

Chapter 7 Resources

WebSphere Extended Deployment Product Documentation Library

<http://www.ibm.com/software/webservers/appserv/extend/library/>

WebSphere MQ family books

<http://publibfp.boulder.ibm.com/epubs/html/amq1ac03/amq1ac0314.htm#TBLAMQ803O>.

Backend Scheduler documentation

IBM Loadleveler documentation:

- LoadLeveler for AIX 5L and Linux **Install Memo:**
 1. Access the IBM Publications Web site
<http://www.elink.ibm.com/public/applications/publications/cgibin/pbi.cgi?CTY=US>
 2. Select the search for publications option
 3. Key in the form number **GI11-2819-02** and click **Go**
- LoadLeveler for AIX 5L and Linux **Diagnosis and Messages Guide:**
 1. Access the IBM Publications Web site
<http://www.elink.ibm.com/public/applications/publications/cgibin/pbi.cgi?CTY=US>
 2. Select the search for publications option
 3. Key in the form number **GA22-7882-02** and click **Go**
- LoadLeveler for AIX 5L and Linux **Using and Administering:**
 1. Access the IBM Publications Web site
<http://www.elink.ibm.com/public/applications/publications/cgibin/pbi.cgi?CTY=US>
 2. Select the search for publications option
 3. Key in the form number **SA22-7881-02** and click **Go**

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