Universal Messaging Clustering Guide

Version 10.1

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This document applies to Universal Messaging Version 10.1 and to all subsequent releases.

Specifications contained herein are subject to change and these changes will be reported in subsequent release notes or new editions.

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About this Guide

This guide helps you configure Universal Messaging in a high-availability clustered environment. This guide addresses Universal Messaging administrators.

Document Conventions

Convention	Description
Bold	Identifies elements on a screen.
Narrowfont	Identifies storage locations for services on webMethods Integration Server, using the convention *folder.subfolder:service* .
UPPERCASE	Identifies keyboard keys. Keys you must press simultaneously are joined with a plus sign (+).
Italic	Identifies variables for which you must supply values specific to your own situation or environment. Identifies new terms the first time they occur in the text.
`Monospace font`	Identifies text you must type or messages displayed by the system.
{ }	Indicates a set of choices from which you must choose one. Type only the information inside the curly braces. Do not type the { } symbols.
|	Separates two mutually exclusive choices in a syntax line. Type one of these choices. Do not type the | symbol.
[ ]	Indicates one or more options. Type only the information inside the square brackets. Do not type the [ ] symbols.
...	Indicates that you can type multiple options of the same type. Type only the information. Do not type the ellipsis (...).

Online Information

Software AG Documentation Website

You can find documentation on the Software AG Documentation website at "http://documentation.softwareag.com". The site requires Empower credentials. If you do not have Empower credentials, you must use the TECHcommunity website.

Software AG Empower Product Support Website

You can find product information on the Software AG Empower Product Support website at "https://empower.softwareag.com".

To submit feature/enhancement requests, get information about product availability, and download products, go to "Products".

To get information about fixes and to read early warnings, technical papers, and knowledge base articles, go to the "Knowledge Center".

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- Access product documentation, if you have TECHcommunity credentials. If you do not, you will need to register and specify "Documentation" as an area of interest.
- Access articles, code samples, demos, and tutorials.
- Use the online discussion forums, moderated by Software AG professionals, to ask questions, discuss best practices, and learn how other customers are using Software AG technology.
- Link to external websites that discuss open standards and web technology.

1 Overview

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What is Universal Messaging Clustering?

Universal Messaging provides guaranteed message delivery across public, private, and wireless infrastructures.

A Universal Messaging cluster consists of Universal Messaging servers working together to provide increased scalability, availability, and reliability. An individual Universal Messaging server in the cluster is referred to as a *cluster node*. If one cluster node becomes unavailable, another cluster node takes over the messaging operations. For the clients, a cluster appears to be a single Universal Messaging server.

A Universal Messaging cluster protects your messaging system from the following failures, and provides support for business contingency and disaster recovery.

- Application and service failures
- System and hardware failures
- Site failures

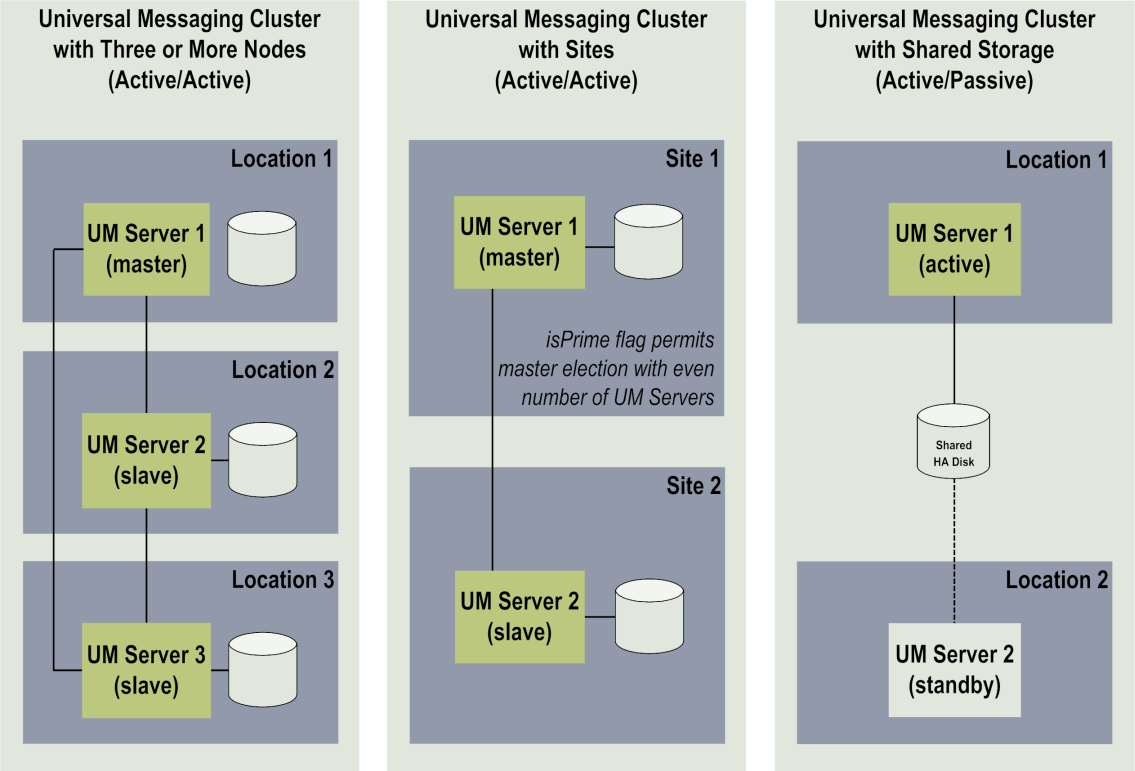
You can use Universal Messaging Enterprise Manager, Software AG Command Central, or the Universal Messaging administration APIs to configure and administer Universal Messaging clusters. For more information about using Software AG Command Central and the administration APIs, see the Universal Messaging webhelp on the Software AG documentation website at "http://documentation.softwareag.com".

Approaches for Clustering

Universal Messaging supports these clustering approaches:

- **Active/Active cluster**
  - Universal Messaging cluster with three or more servers
  - Universal Messaging cluster with sites
- **Active/Passive cluster**
  - Universal Messaging cluster with shared storage

The following figure provides an overview of the different approaches.



The following sections provide an overview of the Universal Messaging clustering approaches. For more information, see "Active/Active Clustering" on page 11 and "Active/Passive Clustering with Shared Storage" on page 23.

Planning for Cluster Implementation and Deployment

A Universal Messaging cluster with three or more servers (active/active cluster) is the recommended approach for clustering. This approach supports scalability, resilience, reduces outage during failover, and uses standard (local) disks.

The table below will help you decide on the clustering approach for your Universal Messaging clustering solution.

Clustering Approach	Automatic client and server failover?	Vendor-specific cluster software required?	Shared storage required?	Minimum number of servers required?
Active/Active cluster with three or more servers	Yes	No	No Uses standard	3

Clustering Approach	Automatic client and server failover?	Vendor-specific cluster software required?	Shared storage required?	Minimum number of servers required?
			(local) disk	
Active/Active cluster with sites **Note:** Administrator must manually set the IsPrime flag to the other site if the site with the IsPrime flag fails.	Automatic client failover. Semi-automatic server failover.	No	No Uses standard (local) disk	2
Active/Passive cluster with shared storage	Yes	Yes	Yes	2

2 Active/Active Clustering

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About Active/Active Clustering

In an active/active cluster, multiple servers are active and working together to publish and subscribe messages. Universal Messaging clients automatically move from one server to another server in a cluster as required or when specific servers within the cluster become unavailable to the client for any reason. The state of all the client operations is maintained in the cluster to enable automatic failover.

To form an active/active cluster, more than 50% of the servers (a quorum) in the cluster must be active and intercommunicating. *Quorum* is the term used to describe the state of a fully formed cluster with an elected master.

Applications connected to a Universal Messaging cluster can:

- Publish and subscribe to channels
- Push and pop events from queues
- Connect to any Universal Messaging server instance and view the server state

If a cluster node is unavailable, client applications automatically reconnect to any of the other cluster nodes and continue to operate. Active/active clustering provides the ability to load balance clients across cluster nodes.

How Does the Active/Active Cluster Work?

In an active/active cluster, one of the cluster nodes must be designated as the master node. The master node is selected by the cluster nodes. Each cluster node submits a vote to choose the master node. If the master node exits or goes offline due to power or network failure, the remaining active cluster nodes elect a new master, provided more than 50% of the cluster nodes are available to form the cluster.

Cluster nodes replicate resources amongst themselves, and maintain the state of the resources across all cluster nodes. Operations such as configuration changes, transactions, and client connections go through the master node. The master node broadcasts the requests to the other cluster nodes to ensure that all the servers are in sync. If a cluster node disconnects and reconnects, all the states and data are recovered from the master node.

You can connect one cluster to another cluster through remote cluster connections. Remote cluster connections enable bi-directional joins between clusters, therefore joining the resources of both the clusters for publish and subscribe.

Universal Messaging Cluster with Sites

In this approach, you can configure just two servers to form a cluster. The quorum rule of availability of more than 50% servers in the cluster is achieved by defining the servers

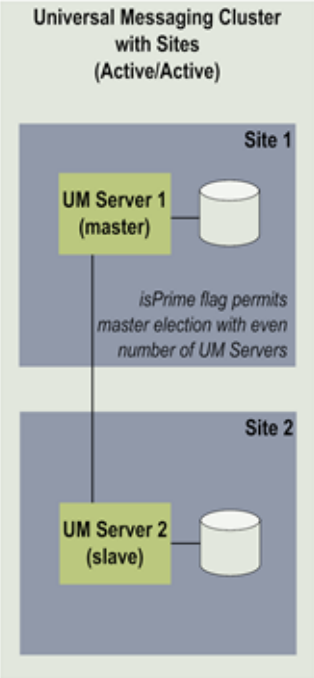
in two sites (primary and backup), and by allocating an additional vote (IsPrime flag) to one of these sites.

The value of the IsPrime flag in a site indicates whether the primary site or the backup site as a whole can cast an additional vote. The failover is automatic if the site where the IsPrime flag is set to false fails. If the site where the IsPrime flag is set to true fails, you need to manually set the IsPrime flag to true on the active site and perform manual failover.

This approach provides:

- Transparent client failover
- Semi-transparent server failover
- Load balancing and scalability

In the diagram, two servers are configured in just two sites: primary (master) and backup (slave). The IsPrimeFlag is set to true in the primary site. If the server in the backup site becomes unavailable, the cluster continues to work with the sever in the primary site because the primary site has an additional vote to achieve the quorum rule of more than 50% available servers.



However, if the connection to the server in the primary site is lost when the server on the backup site is active, you must manually set the IsPrime flag to true in the backup site so that the server in the backup site can achieve quorum.

Even if you configure only two sites, you can define odd or even number of servers split across these sites.

Configuring and Administering an Active/Active Cluster

You can create, modify, and monitor clusters, channels, queues, connections, and sites using Universal Messaging Enterprise Manager or Software AG Command Central. The instructions in this guide are for setting up Universal Messaging clusters using Universal Messaging Enterprise Manager. For information about using Software AG Command Central to create a cluster, see the Using Command Central to Manage Universal Messaging section of the Universal Messaging Administration Guide.

To configure and administer an active/active cluster

1. Install Universal Messaging in the cluster nodes, and verify if Enterprise Manager can connect to the servers. For instructions, see "Before You Create a Cluster" on page 14.
2. Create a cluster and add the Universal Messaging servers to the cluster. For instructions, see "Create a Cluster" on page 15 and "Modify a Cluster" on page 16.
3. Create cluster channels and queues as required. For instructions, see "Create Cluster Channels" on page 16 and "Create Cluster Queues" on page 17.
4. View and monitor cluster information. For instructions, see "View and Monitor Cluster Information" on page 17.
5. Create and manage remote cluster connections if you want to connect one cluster to another cluster. For more information, see "Manage Remote Cluster Connections" on page 18.

Before You Create a Cluster

Before you create a Universal Messaging active/active cluster, make sure you complete these tasks:

1. Install Universal Messaging in the cluster nodes using Software AG Installer.
2. Start the Universal Messaging servers in the nodes and make sure the servers are running.
3. Verify that the permissions on the server machines allow connections to the other servers in the cluster.
4. Connect Universal Messaging Enterprise Manager to all servers that will form the cluster. Click **Connections > Connect to Realm Cluster**, and then enter the realm's URL for all the servers.
5. Ensure that the server instance names are different for each node in a cluster.
6. Ensure that each server instance has Access, Admin API, and Realm ACL permissions for the user who runs the Enterprise Manager or for the group of which the user is a member. The Enterprise Manager requires these ACL permissions to

display cluster members correctly. To define ACL permissions for a server instance, select the server and go to the **Security > ACL** tab.

7. Examine all nodes that will form the cluster, and make sure that the /naming/defaultContext channel exists only on one or none of the nodes. If the /naming/defaultContext channel exists in multiple nodes, delete the /naming/defaultContext channel on all but one of the nodes, preferably from empty nodes where no JNDI objects have been created.

   The Universal Messaging JNDI provider uses the /naming/defaultContext channel to store JMS references and JNDI objects. If channels exist on multiple nodes, Enterprise Manager throws an error and will not allow you to create the cluster.

Note: You can migrate resources such as channels and named objects from a stand-alone server to a cluster, Software AG recommends that you delete any existing resources present on the stand-alone servers, and recreate the resources in the newly created cluster.

Create a Cluster

When you create a cluster, one of the servers in the cluster will become the master. The master server monitors the other servers and synchronizes the state of all the servers in the cluster.

To create a cluster using Enterprise Manager

1. In Enterprise Manager, right-click **Clusters** in the Universal Messaging Enterprise pane, and then click **Create Cluster**.
2. In the Create New Cluster dialog box, do the following:
   a. Provide a **Cluster Name**.
   b. From the **Available Realms:** list, select the servers that you want to add to the **Cluster Members:** list by either double-clicking on the server names, or by selecting the servers and clicking **Add**.

      Important: When you add a new Universal Messaging server to a cluster, the shared named objects present in the newly added server will not be automatically converted to become cluster-wide objects. Recreate the affected shared named objects in the cluster.

      To remove servers from the **Cluster Members** list, either double-click on the server names, or select the servers and click **Remove**.

   c. Click **OK**.
3. In the **Cluster Summary** tab, view the state of the cluster nodes to check which server is the current master for the cluster and if all the cluster nodes are online. You cannot create cluster channels and cluster queues if any of the cluster servers are offline.

Important: After creating a Universal Messaging cluster, delete the default connection factories that were created when you first installed Universal Messaging, and re-create these default connection factories to include the IP and port details of all the clustered nodes (for example, nodeone:9000,nodetwo:9001). The default connection factories of Universal Messaging are not updated when you add nodes to the Universal Messaging cluster. If the default connection factories are not updated with details of the cluster nodes, Integration Server fails to connect to the Universal Messaging cluster when the cluster node that is defined in the default connection factory fails.

Modify a Cluster

You can add more servers to a cluster or remove servers from a cluster. The necessary cluster resources are added or deleted as per your changes.

To modify a cluster using Enterprise Manager

1. In Enterprise Manager, right-click on the name of the cluster listed under the **Clusters** node, and click **Modify Cluster Members**.
2. To add servers to the **Cluster Members** list, select the servers from the **Available Realms** list by either double-clicking on the server names, or by selecting the servers and clicking **Add**.

   Important: When you add a new Universal Messaging server to an existing cluster, the shared named objects present in the newly added server will not be automatically converted to become cluster-wide objects. Recreate the affected shared named objects in the cluster.
3. To remove any server from the **Cluster Members** list, either double-click on the server name, or select the server and click **Remove**.
4. Click **OK**. When you remove a cluster member, you can choose to either:
   - Delete the cluster-wide resources from the removed servers. This option deletes only the resources created for the cluster. The locally created resources are not deleted.
   - Convert all the cluster-wide resources within the removed servers to local. This option retains the data contained within the cluster resources.

Create Cluster Channels

When you create a cluster channel, an instance of the channel will be created across all the servers within the cluster. The cluster servers maintain the same state for all the instances of a cluster channel. Hence, if an event is published to a cluster channel, that event will be available on all the cluster nodes simultaneously.

To create cluster channels using Enterprise Manager

1. In Enterprise Manager, right-click on the name of the cluster listed under the **Clusters** node, and then click **Create Cluster Channel**.
2. Provide the attributes for the new cluster channel.
3. Click **OK**.

   An instance of the newly created channel will be added to all the cluster nodes.

Create Cluster Queues

When you create a cluster queue, an instance of the queue will be created across all the servers within the cluster. The cluster servers maintain the same state for all the instances of a queue.

To create a cluster queue using Enterprise Manager

1. In Enterprise Manager, right-click on the name of the cluster listed under the **Clusters** node, and select the **Create Cluster Queue** menu option.
2. Provide the attributes for the new cluster queue.
3. Click **OK**.

   An instance of the newly created queue is added to all the servers of the cluster.

View and Monitor Cluster Information

Enterprise Manager provides real-time information about the cluster members, connections, and events.

To view and monitor a cluster using Enterprise Manager

1. In Enterprise Manager, right-click on the name of the cluster listed under the **Clusters** node.
2. Cluster information is organized in the following tabs. Click the appropriate tab for viewing the cluster details.

Tab	Summary
Cluster Summary	Displays the following cluster details: ■ Cluster member names ■ Whether a cluster member is master or slave ■ Whether a cluster member is online or offline

Tab	Summary
	■ Total number of servers, channels, queues, and services ■ Total number of events consumed and published ■ Number of events consumed per second and published per second ■ Status of connections
Connections	Displays the details of cluster connections.
Remote Cluster Connections	Displays the details of remote cluster connections, if any. For information about creating and deleting remote cluster connections, see "Manage Remote Cluster Connections" on page 18.
Logfile	Displays a real-time log for the cluster activities. Provides the **Start Stream** option to stream the log output to a file.
Sites	Displays the site configuration details, if the sites have been configured in the cluster.

Manage Remote Cluster Connections

Clusters remotely connected together provide the ability to create joins between the channels of different clusters.

Add a Remote Cluster Connection

To add a new remote cluster connection

1. In Enterprise Manager, right-click on the name of the cluster listed under the **Clusters** node, and select **Add Remote Cluster Connection** .

   The **Create Cluster to Cluster Connection** dialog box appears.

2. From the **To Cluster** list, select the cluster to which you want to establish a remote connection from this cluster.

3. Click **OK**.

   You can now go to the **Remote Cluster Connection** tab to see all the remote cluster connections.

Delete a Remote Cluster Connection

To delete a remote cluster connection using Enterprise Manager

1. In Enterprise Manager, connect to the servers of the clusters that you want to view and manage. Make sure the clusters are visible.
2. Click on the name of the cluster.
3. Click the **Remote Cluster Connections** tab.
4. Select the remote cluster connection you want to delete.
5. Click **Delete**.

Delete a Cluster

When you delete a cluster, you can choose to either delete all the resources created by the clusters or convert the resources of the deleted cluster to local. When you delete a cluster, the servers that were part of the deleted cluster are not deleted.

To delete a cluster using Enterprise Manager

1. In Enterprise Manager, connect to the clusters you want to view and manage.
2. Right-click on the **Clusters** node, and select the **Delete Cluster** menu option.
3. Select the cluster you want to delete.
4. Click **OK**. When you delete a cluster, you can choose to either:
   - Delete all the resources of the cluster members. This option deletes only the resources created for the cluster. The locally created resources are not deleted.
   - Convert all the resources of the cluster members to local. This option retains the data contained within the cluster resources.

Configuring a Cluster with Sites

Configure sites in an active/active cluster to allow the cluster to operate with as little as 50% of the cluster members.

Note: The value of the `nirvana.conxExceptionOnRetryFailure` property of a JMS connection factory determines whether the Universal Messaging cluster fails over transparently when the prime site fails or throws an exception to the JMS client. For transparent cluster failover, set this property to `true`. By default, the value of the `nirvana.conxExceptionOnRetryFailure` property is `false`.

To configure an active/active cluster with sites

1. Configure an active/active cluster. For information about creating and managing active/active clusters, see "Configuring and Administering an Active/Active Cluster" on page 14.
2. Create the primary site and the backup site. For instructions, see "Create a Site" on page 20.
3. Set the IsPrime flag to a site. For instructions, see "Set the IsPrime Flag" on page 20.

Create a Site

Create a site and add servers to the site to logically group the nodes in the site.

To create a site using Enterprise Manager

1. In Enterprise Manager, connect to the cluster where you want to create the sites.
2. Click on the name of the cluster.
3. Click the **Sites** tab.
4. Click **New** and select the members for the site.

   Note that the **Sites** tab lists all servers in the cluster. To add or remove a server from a site, select or clear the check box corresponding to the server.

Set the IsPrime Flag

Use the IsPrime flag to determine which site in the cluster will contain the master server. The site with the IsPrime flag can vote for a new master when the other site fails. If the site with the IsPrime flag fails, the administrator must set the IsPrime flag on the other site to permit that site to elect the new master.

To set the IsPrime Flag to a site in Enterprise Manager

1. In Enterprise Manager, connect to the cluster with sites.
2. Click on the name of the cluster with sites.
3. Click the **Sites** tab.
4. Select the **IsPrime** flag for the site you want to set and confirm the flag setting.

Delete a Site

When you delete a site, the logical grouping of the nodes in the site is removed. The servers grouped in the site are not deleted when you delete a site.

To delete a site using Enterprise Manager

1. In Enterprise Manager, connect to the cluster with sites.
2. Click on the name of the cluster.
3. Click the **Sites** tab.
4. Select the site you want to delete.
5. Click **Delete** and select the sites you want to delete.

3 Active/Passive Clustering with Shared Storage

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About Active/Passive Clustering

Active/passive clustering is a solution that uses clustering software and special purpose hardware to minimize system downtime. Active/passive clusters are groups of computing resources that are implemented to provide high availability of software and hardware computing services. Active/passive clusters operate by having redundant groups of resources (such as CPU, disk storage, network connections, and software applications) that provide service when the primary system resources fail.

In a high availability active/passive clustered environment, one of the nodes in the cluster will be active and the other nodes will be inactive. When the active node fails, the cluster fails over to one of the inactive nodes automatically. As a part of this failover process, clustering software will start the resources on the redundant node in a predefined order (or resource dependency) to ensure that the entire node comes back up correctly.

Universal Messaging can run in an active/passive cluster environment, under Windows or UNIX. This approach does not provide load balancing or scalability.

Active/Passive Clustering Requirements

You need the following to configure a Software AG Universal Messaging active/passive cluster:

- Cluster control software to manage the clusters on Windows or UNIX.
- Shared Storage for sharing data files.
- IP address for running the Universal Messaging cluster service.
- Universal Messaging installed on the cluster nodes in the same directory path (for example, C:\SoftwareAG_UM). In the installations, the data directory path for the shared storage must be the same.

Important: Universal Messaging installation must be identical on all cluster nodes. All instances of Universal Messaging must point to the same Universal Messaging storage files on the shared storage.

Universal Messaging Capabilities for Active/Passive Clustering

The following capabilities of Universal Messaging enable the vendor-specific cluster control software to monitor and manage Universal Messaging in an active/passive cluster.

- Functionality to start, stop, and monitor the servers.
- Ability to store the server's state information and data on a shared disk.

- Ability to survive a crash and restart itself in a known state.
- Ability to meet license requirements and host name dependencies.

Virtual IP Address of an Active/Passive Cluster

A virtual IP address is like any other IP address except it does not have a specific host or node to resolve to. It resolves at run time to a server wherever the IP is physically bound and reachable on the network.

For client applications to access the services in an active/passive cluster in a transparent way, the virtual IP address of the cluster must be supplied to the client applications. This virtual IP address is usually referred to as the "logical host." This logical host identity is a network address (or host name) and is not tied to a single cluster server.

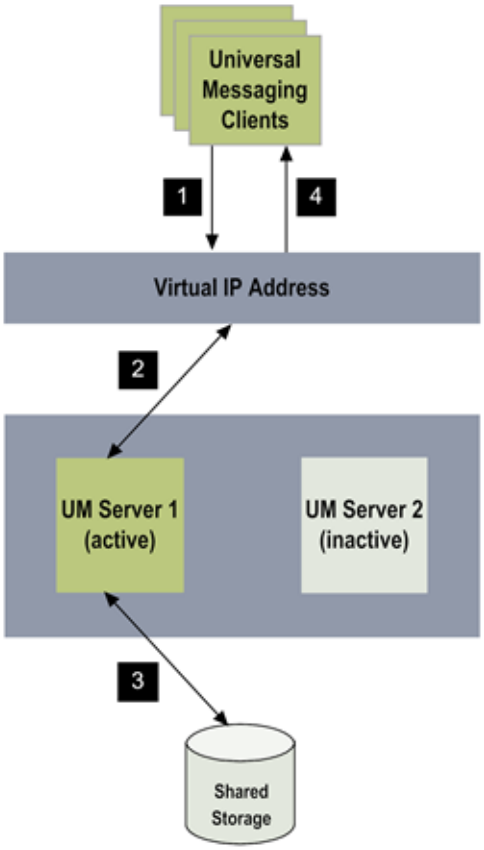
When there is a failover, the cluster control software will resolve the virtual IP address to the physical IP address of the current active server in the cluster. The client application is not affected in any way other than experiencing a brief outage of the services.

Failover Mechanism in an Active/Passive Cluster

Universal Messaging runs as a service in a cluster. Within an active/passive cluster, there only be a single instance of Universal Messaging server running at any given time. The other Universal Messaging servers are inactive.

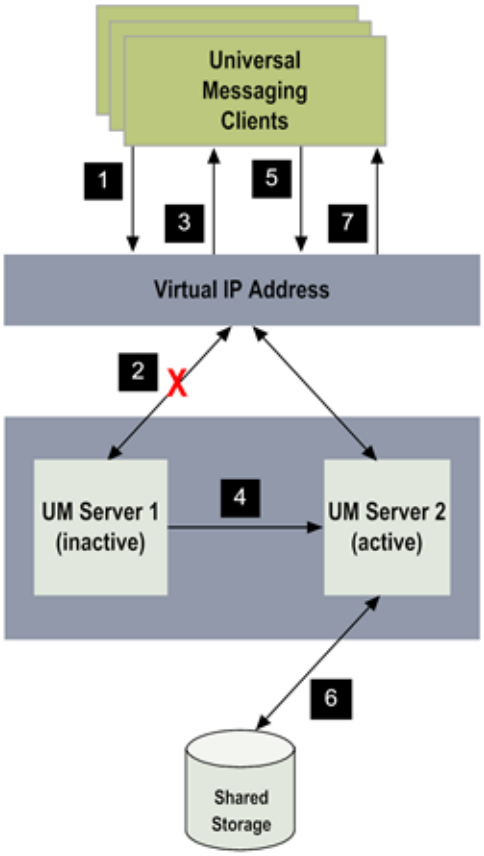
In a clustered environment, when a client makes a request to a server, the server handles the request much the same as in an unclustered environment, except that the server writes the client information to a shared disk instead of a private data store.

The following diagram illustrates the flow of documents through a typical clustered environment.



Steps	Description
1	Universal Messaging clients use the virtual IP address of the cluster to connect to the active/passive Universal Messaging cluster.
2	Cluster control software forwards the client request to the active server in the cluster.
3	The active server reads data from or writes data to the shared storage.
4	Universal Messaging returns the results to the client application.

The following diagram illustrates the failover in a clustered environment. If a server fails, subsequent requests for the session are redirected to a spare server in the cluster that is currently active and running.



Steps	Description
1	Universal Messaging clients use the virtual IP address of the cluster to connect to the active/passive Universal Messaging cluster.
2	The active server experiences failure and shuts down.
3	The cluster software returns the error code to the client.
4	Cluster control software marks the spare server as active.
5	Cluster control software forwards the client request to the active server in the cluster.
6	The active server reads data from or writes data to the shared storage.
7	Universal Messaging returns the results to the client application.

Cluster Verification

A cluster installation consultant will typically perform the cluster installation for you; however, verify the following to make sure that the cluster is installed properly:

- The shared drive can be accessed from the cluster nodes.
- The virtual IP address of the cluster is accessible on the public network.
- Only one Universal Messaging server instance in the cluster can access the shared drive at any given time.

Roles and Responsibilities for Configuring an Active/Passive Cluster

Configuring Universal Messaging in a high-availability cluster requires the efforts of the following people:

- System administrator
- Cluster vendor's installation consultant
- Universal Messaging administrator

Role	Responsibilities
System administrator	Perform system and network administration tasks.
Cluster vendor's installation consultant	Install cluster hardware and software (for example, Windows Server, Veritas, HP ServiceGuard, IBM HACMP, or Oracle Solaris Cluster) installation.
Universal Messaging administrator	Install Universal Messaging and high availability (HA) scripts.

Overview of Active/Passive Clustering on Windows

This section describes how to configure Universal Messaging with shared storage on Windows Server 2008 R2, Windows Server 2012 R2, and Windows Server 2016.

How Does Universal Messaging Run in a Windows Cluster?

In a Windows cluster environment, Universal Messaging runs as a service or as an application defined within a Windows cluster group. You use the Failover Cluster Manager to configure and monitor the Universal Messaging servers and all the

associated resources. For more information about the settings in Failover Cluster Manager, see the Microsoft Windows Failover Cluster Manager manuals.

Active/Passive Cluster Configuration on Windows Server

Perform the following steps to configure Universal Messagingfor high availability.

1. Mount and configure the shared drive, and add the shared drive to the cluster. For more information about adding and configuring a shared drive, see the Microsoft Server documentation for your Microsoft Server version.
2. Install Universal Messagingon the cluster nodes.

   Use the same directory name on all cluster nodes. Ensure that the data directory path for the shared storage is the same in all the installations (for example, C:\SoftwareAG_UM). The data directory path in the nserver.conf configurations files must correctly refer to the same shared storage path. For example, the data directory path in all the nodes is specified as `wrapper.java.additional.4="-DDATADIR=H:\UMSharedStorage\Data"`.
3. Create the Universal Messaging cluster in Windows Server. See the Microsoft Server documentation for instructions to create a failover cluster.
4. Create the Universal Messaging cluster group. Define all the resources and dependencies required to run Universal Messaging.
5. Configure Universal Messaging as a clustered service.

   You can run Universal Messaging as a service or an application.
6. Customize the Universal Messaging startup behavior. For instructions to configure the startup behavior, see the relevant Microsoft Server documentation.

   You can configure the number of possible attempts for starting the Universal Messaging server before failover.
7. Verify failover in the cluster using Windows Server tools.

   You or a system administrator can verify failover when there is a hardware failure.
8. Ensure that the installation and configuration enables the Universal Messaging server to failover correctly from one cluster node to the other.

Overview of Active/Passive Clustering on UNIX

This section describes how to configure Universal Messaging with shared storage on UNIX.

Cluster Monitoring Scripts

The cluster control software determines the health of the servers by periodically probing the servers using the monitor scripts. When the cluster control software determines that

one of the servers in the cluster has failed, it will shut down that server and start the server on the spare node.

You must incorporate the UNIX shell scripts for starting, stopping, and monitoring the servers in the cluster control software's infrastructure. You might have to customize code to enable the cluster control software to invoke these UNIX shell scripts.

Summary of Active/Passive Cluster Configuration on UNIX

This section is written primarily to a Universal Messaging administrator to gain a better understanding of the configuration process.

To configure Universal Messaging in an active/passive cluster

1. Ask the cluster vendor's installation consultant to perform these tasks:
   a. Install the HA cluster environment.
   b. Configure the HA cluster environment including the shared disk storage.
2. Ask the system administrator to perform these tasks:
   a. Administer the HA cluster environment so it is ready for software installation.
   b. Configure the external network connection to the HA cluster and create the virtual host (virtual IP address) for the HA cluster.
3. Ask the cluster vendor's installation consultant and the system administrator to test the basic HA installation to ensure it functions properly.
4. Install and configure Universal Messaging on the cluster nodes with the help of the cluster vendor's installation consultant.

   For information about how to install the cluster nodes and configure the cluster, see "Configuring a Universal Messaging Active/Passive Cluster on UNIX" on page 31.
5. Verify that Universal Messaging runs on the cluster node. For instructions, see "Verify the Universal Messaging Server Installation" on page 31.
6. Make sure the cluster is installed properly and configured. For information, see "Verify Failover in the Cluster" on page 32.
7. Configure and test the scripts according to the cluster vendor's specification for starting, stopping, and monitoring the Universal Messaging servers. For instructions, see "Configure the Start, Stop, and Status Scripts" on page 31.
8. Verify failover in the cluster. For instructions, see "Verify Failover in the Cluster" on page 32.

Configuring a Universal Messaging Active/Passive Cluster on UNIX

Install Universal Messaging on Cluster Nodes

When you install Universal Messaging on cluster nodes, you must:

- Follow the instructions in the *Using the Software AG Installer* guide.
- Work with the cluster vendor's installation consultant to prepare the cluster node to respond to the virtual IP address and have access to the storage files on the shared storage.

To install Universal Messaging on cluster nodes

1. Install Universal Messaging on the first cluster node and configure to use the shared storage.
2. Unmount the shared storage from cluster node 1 and mount it on cluster node 2.
3. Make the first cluster node inactive.
4. Install Universal Messaging on the second cluster node and configure it to use the shared storage.
5. Make the second cluster node active so that it will respond to the virtual IP address and have access to the storage files on the shared storage.

Verify the Universal Messaging Server Installation

Use the Universal Messaging Enterprise Manager to verify that the Universal Messaging server is properly installed and working.

To verify that the servers are installed properly

1. Start the Enterprise Manager.
2. Connect to the servers that are part of the cluster.
3. Verify the status of the servers in the cluster.

Configure the Start, Stop, and Status Scripts

Incorporate the scripts of each cluster node into the cluster control software with the help of the cluster vendor’s installation consultant.

To configure the start, stop, and status scripts of a server

1. Provide the location of the start and stop scripts to the cluster vendor consultant.

The scripts to start and stop a Universal Messaging server are located here:

- *Universal Messaging_directory*/server/*server_name*/bin/nserver to start the server.
- *Universal Messaging_directory*/server/*server_name*/bin/nstopserver to stop the server.

2. Implement a status script using the Universal Messaging API and provide the script to the cluster vendor consultant. For example, to return the server time stamp, you can use: *Universal Messaging_directory*/java/*server_name*/bin/ngetservertime.
   a. Modify env.sh and change last command from "$SHELL" to "$SHELL $*".
   b. Run this command to monitor the server status:

```
./env.sh -c "ngetservertime" | grep "Server Time"
```

Verify Failover in the Cluster

Test the entire cluster with an application to make sure that the cluster functions properly. With the help of the system administrator and the cluster vendor's installation consultant, you can verify the cluster configuration and installation by causing a failover.

To verify failover in a cluster

1. In the Enterprise Manager, provide the virtual IP address of the cluster to connect to the server and view the status.
2. Shut down the server on cluster node 1.
3. Start the server on cluster node 2 or let the cluster software start the server on cluster node 2.
4. Verify the status of the servers.