

# Bull

HACMP 4.4

Glossary and Master Index

AIX





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Software

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### **Year 2000**

The product documented in this manual is Year 2000 Ready.

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# Master Glossary

This Glossary contains definitions of terms used throughout the HACMP for AIX, Version 4.4 documentation set. General familiarity with AIX and networking terms and commands is assumed. HACMP usage of some specific AIX terms and commands is explained here.

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## A

### ACD

See *active configuration directory*.

### active configuration directory (ACD)

The directory in which a copy of the HACMP for AIX-specific ODM object classes are stored. All the HACMP for AIX daemons, scripts, and utilities reference the ODM data stored in the ACD at runtime. See also *default configuration directory* and *staging configuration directory*.

### adapter

See *network adapter*.

### adapter label

For TCP/IP networks, the name specified in the */etc/hosts* file or by the Domain Name Service for a specific IP address. That is, the label associated with the IP address of the *cluster node*.

### AIX Connections

An application that allows you to share services with PCs and other platforms. AIX Connections is integrated with HACMP so that it can be configured as a highly available resource, without an application server or additional scripts.

### AIX Fast Connect

An application that allows you to share services between AIX station and PC-based clients. This application is integrated with HACMP so that it can be configured as a highly available resource, without an application server or additional scripts.

### aliasing

The *ifconfig alias* command used for IP address aliasing on the SP\_Switch network on a Scalable POWERparallel SP machine. This permits IP address takeover.

See also *IP address takeover*.

### APAR

IBM Authorized Program Analysis Report. A report of a problem caused by a suspected defect in a current unaltered release of an IBM program.

### application

Software that runs on top of HACMP and uses the services HACMP provides. An application can incorporate calls from the HACMP application programming interfaces (APIs). Applications can use the *Cluster Lock Manager* API to perform resource locking. Likewise, applications can use the *Clinfo* API to obtain cluster status, or *Simple Network Management Protocol* (SNMP) operations to access the *HACMP Management Information Base* (MIB).

### application monitoring

Functionality available in HACMP/ES that allows you to specify applications to be monitored by HACMP/ES and restarted when a problem is detected. Two types of application monitors can be configured:

- *Process application monitors* use RSCT event management to detect the death of one or more processes of an application.
- *User-defined application monitors* use custom scripts and polling intervals to check the health of an application at a user-defined polling interval.

### application server

An application that runs on a *cluster node*. When queried by client applications, the application server may access a database on the shared external disk and then respond to client

# C

requests. Application servers are configured as cluster *resources* that are made highly available with start and stop scripts supplied by the user or application.

## Address Resolution Protocol (ARP)

The Internet communication protocol used to dynamically map Internet addresses to physical (hardware) addresses on local area networks. Limited to networks that support hardware broadcast.

The `/usr/sbin/cluster/etc/clinfo.rc` script, which is invoked by the `clinfo` daemon whenever a network or node event occurs, updates the system's ARP cache. This ensures that the IP addresses of all cluster nodes are updated after an IP address takeover. The script can be further customized to handle site-specific needs.

## Asynchronous System Trap (AST)

In general, a software-initiated interrupt to a service routine. In HACMP, AST is a Lock Manager API asynchronous callback function that indicates the completion of processing of a lock request. The Lock Manager does not actually interrupt a lock client's process to run the AST, but requires that clients call the `ASTpoll` function to collect any ASTs that are ready to run. The Lock Manager can be made to send the lock client a software signal when it has pending ASTs.

## Automatic Error Notification

HACMP for AIX utility that configures AIX Error Notification methods automatically for certain device errors. Users can enable automatic error notification through SMIT.

## boot address

Address for a node to use before HACMP assigns a service address. If you want to use IP address takeover (with or without hardware address swapping) in an HACMP cluster, you must define a boot address (associated with a *service adapter*) so when a failed node comes back up, it can use the boot address until the process of node *reintegration* reassigns IP addresses.

## broadcast

A packet delivery system where a copy of a given packet can be sent to all hosts attached to the network. Ethernet supports broadcast messages.

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## cascading resource group

A resource group in which takeover priority is assigned to each configured node in the cluster such that ownership preference is given to the highest priority node. If that node fails, the resource group falls over to the next-highest priority active node. The movement of one cascading group is independent of another cascading group's movement. Cascading resource groups exist only on one node at a time.

## Cascading without Fallback (CWOFF)

An attribute of a cascading resource group which defines its fallback behavior. When this flag is set to **true**, a cascading resource group will not fallback to a higher priority node as it joins or reintegrates into the cluster. A cascading resource group with CWOFF set to **false** will exhibit fallback behavior.

## clconvert

A utility that converts the configuration of an earlier version of HACMP (4.1 and up) to the current version. The utility creates new data structures and objects, redefines field names and values within data structures, and ensures data integrity between versions of the HACMP software. The `cl_convert` utility is called automatically when HACMP is installed on a system that has a previous version of HACMP installed. Additionally, a `clconvert` utility, `clconvert_snapshot`, is available to convert snapshot files to the current version of HACMP.

## clconvert\_snapshot

A utility that converts cluster snapshot files from an earlier version to the current version of HACMP when upgrading.

See also *clconvert*, *cluster snapshot*.

## cldare utility

The utility used for *DARE* (dynamic reconfiguration) tasks: topology changes, configuration changes, and resource migration.

## client

Machine connected to the cluster network so it can access data or services maintained on the cluster.

## CLMarket

See *Market*.

**cluster**

Loosely-coupled collection of independent systems (nodes) organized into a network for the purpose of sharing resources and communicating with each other. HACMP defines relationships among cooperating systems where peer *cluster nodes* provide the services offered by a cluster node should that node be unable to do so.

**cluster configuration**

User definition of all cluster components. Component information is stored in the ODM. Components include cluster name and ID and information about member nodes, adapters, and *network modules*. See also *dynamic reconfiguration*.

**cluster controller**

The “brain” of the *Cluster Manager*. Keeps track of cluster membership and synchronizes information among cluster members about the current membership and distribution of cluster resources. Communicates with, and coordinates actions of the other two Cluster Manager modules (Network Modules and Event Manager).

**cluster diagnostic utility (cldiag)**

HACMP utility that provides a common interface to several HACMP and AIX diagnostic tools for troubleshooting an HACMP cluster.

**cluster environment**

See *cluster configuration*.

**cluster event**

Represents a change in a cluster’s composition that the Cluster Manager recognizes and can respond to. Major cluster events include:

- **node\_down**—a node detaches from the cluster
- **node\_up**—a node joins or rejoins the cluster
- **network\_down**—a network failure
- **network\_up**—a network is added or restored
- **swap\_adapter**—a service adapter fails

**cluster hardware**

Hardware included in the cluster: disks and disk devices, processors, adapters, networks. The Cluster Manager monitors all but disks and disk devices.

**cluster ID**

Each cluster in an HACMP system is uniquely identified by a positive integer less than 99999.

**Cluster Information Program (Clinfo)**

SNMP monitor program. Clinfo, running on a client machine or on a cluster node, queries the clsmuxpd daemon for updated cluster information. It then makes information about the state of an HACMP cluster, nodes, and networks available to clients and applications running in a clustered environment. Clinfo and its associated APIs enable developers to write applications that recognize and respond to changes within a cluster.

**cluster lock daemon (cllockd)**

See *Cluster Lock Manager*.

**Cluster Lock Manager (CLM)**

Application responsible for coordinating requests for shared data across the cluster. It institutes a locking protocol that server processes use to coordinate data access and to ensure data consistency during normal operation as well as in the event of failure. See also *locking model* and *lock resource*.

**Cluster Manager (clstrmgr)**

HACMP daemon responsible for monitoring local hardware and software subsystems, tracking the state of the cluster peers, and triggering cluster events when there is a change in the status of the cluster.

**Cluster Monitoring with Tivoli**

Functionality that allows monitoring of HACMP and HACMP/ES clusters through the Tivoli management interface.

**cluster name**

A user-defined ASCII text string that uniquely identifies a cluster in an HACMP system.

**cluster node**

RS/6000 or SP system unit that participates in an HACMP cluster as a server.

**Cluster Resource Manager**

The Cluster Resource Manager is a new facility added in HACMP/ES version 4.3.1 that centralizes the storage of and publishes updated information about HACMP-defined resource groups. The Resource Manager on each node coordinates information gathered from the HACMP global ODM, the Cluster Manager, and other Resource Managers in the cluster to maintain updated information about the content, location, and status of all HACMP resource groups.

**cluster services**

*Resources* and data maintained on the cluster for access by clients and their applications.

**Cluster-Single Point of Control (C-SPOC)**

HACMP for AIX administrative utility that allows you to perform command maintenance tasks on all nodes in a cluster by executing a C-SPOC command on any node. The C-SPOC utility provides commands to manage cluster services, shared LVM components, and user and group accounts.

**Cluster SMUX Peer (clsmuxpd)**

HACMP daemon that provides Simple Network Management Protocol (SNMP) support to client applications. It maintains cluster status information in a special HACMP MIB. Developers can use one of the Clinfo APIs or standard SNMP routines to access the cluster information in this MIB.

**cluster snapshot**

ASCII file containing a record of all the data that defines a particular cluster configuration. The cluster snapshot utility gives the cluster administrator the ability to save and restore a particular cluster configuration. Recreating a configuration is called applying a cluster snapshot. The cluster must have the requisite hardware and software installed to support the desired configuration. The *clconvert\_snapshot* utility is available to convert snapshot files to the current version of HACMP when upgrading. The cluster snapshot utility is a shell script that can be executed via SMIT or via *VSM*.

**cluster status utility (clstat)**

HACMP utility that reports on cluster, node, and network adapter status. Runs on both ASCII and X terminals.

**cluster topology**

See *topology*.

**cluster verification utility (clverify)**

HACMP utility that verifies the HACMP-specific modifications to AIX software and checks for correct cluster topology and resource configuration.

**clverify**

See *cluster verification utility*.

**Command Execution Language (CEL)**

The language used to create commands that work across cluster nodes. HACMP for AIX supports 8-node clusters, HACMP/ES supports 32-node clusters. C-SPOC commands were created using CEL.

**Communications Server for AIX (CS/AIX)**

A set of communications protocols that enable an AIX computer to participate in an SNA network that includes mainframes, PCs, and other workstations. HACMP for AIX and HACMP/ES enable you to designate CS/AIX Data Link Control (DLC) profile(s) as highly available resources in a resource group.

**concurrent access**

Simultaneous access to a shared volume group or a raw disk by two or more nodes. In this configuration, all the nodes defined for concurrent access to a shared volume group are owners of the shared resources associated with the volume group or raw disk.

If one of the nodes in a concurrent access environment fails, it releases the shared volume group or disk, along with all its resources. Access to the shared volume group or disk is, however, continuously available, as long as another node is up. Applications can switch to another server immediately.

**concurrent capable volume group**

A volume group that can be varied on in either non-concurrent or concurrent access mode in an HACMP cluster environment.

**control packet**

Message used for communication between Cluster Managers. Communication for coordinating the process of nodes joining or leaving the cluster, for coordinating event handling in general.

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## D

### DARE

Dynamic Automatic Reconfiguration. The process by which changes in cluster topology and resource configuration can be made dynamically (without bringing the cluster down) upon synchronization after changes are made to the cluster.

### DARE Resource Migration

The process by which you can move resource groups from one node to another while the cluster is running, using the *cl dare* utility from the command line or the SMIT interface.

### DCD

See *default configuration directory*.

### data link control

A set of rules used by nodes in an SNA network on a data link (such as token ring or ethernet) to accomplish an orderly exchange of information.

### deadman switch

Software designed to solve the occasional problem caused by a system that pauses and then continues normal processing. This pause can be long enough to trigger a fallover to another node. Then when the first node continues processing, it contends for the resources now assigned to the other node in the resource chain.

The deadman switch is a kernel routine that runs on a timer attuned to *failure detection speed*. Default failure detection speed is 6 seconds; the default deadman timer is 5 seconds. If the timer runs out, the node shuts down (it shuts off all interrupts and loops). The Cluster Manager resets the timer every 1/2 second. By default, the deadman switch is enabled when you start the Cluster Manager.

The deadman switch assures that, if the system pauses long enough to trigger a fallover, it will shut itself down and not interfere with the proper handling of the cluster resources.

### default configuration directory (DCD)

The directory in which the system default ODM object classes are stored, including HACMP for AIX specific object classes.

### default migration

A resource group migration that removes any previous stickiness properties of the resource group and attempts to migrate the resource group to the highest-priority node in its node list. Default migrations are one-time migrations, and they are a special type of transient migration. (See *Sticky Migration* for more information).

### Diagnostic Group Shutdown Partition (DGSP)

A DGSP is issued when a node has been out of communication with the cluster and then attempts to reestablish communication.

### direct serial connection

A point-to-point serial connection between cluster nodes. Prevents node isolation and the spurious disk takeovers that can result from node isolation. The direct serial line can be the SCSI-2 Differential bus using Target Mode SCSI, Target Mode SSA, or an RS232 serial line.

### disk events

Disk and disk adapter failures. HACMP does not itself directly handle disk events. Rather, these failures are handled by AIX through LVM mirroring on SCSI disk devices, SSA disks, and 9333 serial disk subsystems, and by internal data redundancy on RAID device disk arrays.

The *error notification* facility can be used if additional action is desired in the case of a disk event.

### disk management

The AIX LVM manages disks at the logical level. HACMP uses AIX LVM facilities to provide high availability—in particular, volume groups and disk mirroring.

### disk mirroring

Method of minimizing the effect of a disk failure by duplicating the contents of the disk. If a disk fails, the node can access the mirrored disk and continue to work.

### disk takeover

Occurs when the node that currently owns the disk fails and a surviving node assumes control of the shared disk so that the disk remains available (for non-concurrent access configurations).

# E

## **distributed CLM**

Version of the CLM that allows for distribution of lock resource masters on various cluster nodes, instead of a centralized primary lock manager. See also *locking model*, *lock resource*, *lock resource master*, *lock resource migration*.

## **DGSP**

See *Diagnostic Group Shutdown Partition*.

## **dynamic reconfiguration**

The process where changes made to the cluster configuration on one node are synchronized across all cluster nodes and the changed configuration becomes the currently active configuration. Dynamic reconfiguration is triggered by synchronization when cluster services are running on the local node, and occurs while the cluster is running.

## **DMS**

See *deadman switch*.

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# E

## **Eprimary**

Node designated for SP switch initialization and recovery.

## **Error Emulation**

The functionality that allows you to test notify methods defined in the AIX Error Notification facility by simulating an error. Once an error has been emulated, your customized response method is run, thereby allowing you to check that notify method will work as planned in the event of an actual error.

## **Error Notification**

AIX facility that allows you to detect an event not specifically monitored by the HACMP software—such as a disk adapter failure—and to program a response to the event.

## **Ethernet**

A 10 million bits per second (Mbps) network. Nodes and clients that communicate over an Ethernet network require the Ethernet High-Performance LAN Adapter.

## **Event Emulator utility**

A utility that emulates cluster events and dynamic reconfiguration synchronization events. The Event Emulator runs event scripts that produce output but that do not affect the cluster configuration or status.

## **Event Management Services**

(HACMP/ES) An RSCT distributed subsystem providing a set of high availability services. It creates events by matching information about the state of system resources with information about resource conditions of interest to client programs. Client programs in turn can use event notifications to trigger recovery from system failures.

## **Event Manager**

HACMP for AIX Cluster Manager module. Queues events based on changes in the cluster state and runs scripts to handle events. Scripts provide both system-level and user-level responses to the event. Also handles communication about events with other nodes and notification of script completion or failure.

Events among nodes in a resource chain are serialized so that any resources are released by one node before being acquired by another node.

## **event notification**

A command that sends mail indicating that an event is about to happen or that an event has just occurred, along with the success or failure of the event.

## **event recovery**

A command that attempts to recover from an event failure.

## **event retry**

The number of times an event command may be rerun if it fails. You can also specify the number of times to attempt to execute the recovery command.

## **events**

See *cluster event*.

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**F**
**failure detection speed**

The amount of time the cluster takes to detect a failure. You can affect this time by setting a shorter or longer *keepalive* cycle for a Network Module. The default is 6 seconds.

**fallback**

Process of a *joining or reintegrating* node acquiring resources previously owned by another node.

**fallover**

Process of an *active* node acquiring resources previously owned by another node, in order to maintain availability of those resources.

**fast recovery**

A feature speeding up fallover in large clusters. Configure your system for fast recovery through the SMIT Configure a Resource Group screen.

**fault tolerance**

A model for maintaining computer data availability. It relies on specialized hardware to detect a hardware fault and instantaneously switch to a redundant hardware component—whether the failed component is a processor, memory board, power supply, I/O subsystem, or storage subsystem.

**FDDI**

An industry-standard fiber optic technology that provides high-speed (100 Megabits per second) communication among cluster members. Nodes and clients that communicate over a FDDI network require either the FDDI Dual Ring Adapter, or the FDDI Single Ring Adapter and (in most cases) the FDDI Concentrator.

**FDDI hardware address takeover**

HACMP functionality that allows takeover of FDDI hardware addresses, preserving ARP caches in the event of a fallover.

**forced shutdown**

One method of shutting down HACMP on a cluster node. Immediate shutdown. The node retains control of its *resources*; other nodes view it as a *graceful shutdown*.

**forced stop**

See *forced shutdown*.

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**G**
**global network**

A logical collection of multiple HACMP/ES networks. This reduces the probability of network partitions that can cause the cluster nodes on one side of a partition to go down. All networks grouped in a global network must be of the same type (all Ethernet, for example).

**global ODM**

Software that extends the ODM. It enables one system to update the ODM entries of other systems. The global ODM allows an entire HACMP cluster to be configured from a single node.

**graceful shutdown**

When a node leaves the cluster intentionally, the Cluster Manager on that node runs the `node_down_local` script to release its resources. Other nodes do not take over the resources, however.

**graceful stop**

See *graceful shutdown*.

**graceful with takeover shutdown**

Same as *graceful shutdown*, except the surviving nodes *do* take over the released resources.

**group ID**

See *lock groups*.

**Group Services**

(HACMP/ES) The Group Services RSCT subsystem provides client subsystems with a distributed coordination and synchronization service. Each client subsystem forms one or more **groups** by having its processes connect to the Group Services subsystem and uses the various Group Services interfaces. A process of a client subsystem is called a **GS client**. For example, *Event Management* is a Group Services client subsystem. The Event Manager daemon on each node is a GS client.

# H

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## H

### **HACMP (High Availability Cluster Multi-Processing) for AIX**

Licensed Program Product (LPP) that provides custom software that recognizes changes within a cluster and coordinates the use of AIX features to create a highly available environment for critical data and applications.

### **HACMP/ES**

Licensed Program Product (LPP) that provides Enhanced Scalability to the *HACMP for AIX* LPP. An HACMP/ES cluster can include up to 32 nodes.

### **hardware address swapping**

Works in conjunction with *IP address takeover*. When an IP address is taken over by a surviving node's standby adapter, its hardware address is also taken over by that adapter. It can then continue to provide service to those clients that depend on the hardware address, rather than only the IP address.

### **HAView utility**

Cluster monitoring utility that lets system administrators view HACMP clusters through the TME 10 NetView for AIX graphical network management interface. HAView extends NetView services to let users monitor HACMP clusters and cluster components across a network from a single node. HAView creates symbols that reflect the state of all nodes, networks, and network interface objects associated in a cluster. In HACMP/ES, the HAView utility also monitors resource groups.

### **heartbeat**

See *keepalive*.

### **high availability**

A model for maintaining computer service availability. It views service availability not as a series of replicated physical components, but rather as a set of system-wide, shared resources that cooperate to guarantee essential services.

### **hostname**

A system in a non-HACMP environment is typically identified by a hostname, which is itself tied to a network interface. Since a system usually has only one network interface, the hostname can uniquely identify a system.

A cluster node has more than one network interface and therefore more than one hostname. To avoid ambiguity, nodes in an HACMP cluster are identified by a user-defined *node name* which is unique to that cluster.

### **Image Cataloger**

A demonstration client/server application that has two cooperating programs, *imcat* and *imserv*. The *imcat* program, which runs on HACMP clients, requests a digital image from a library of images stored on the cluster's shared disk storage. The *imserv* program, which runs on cluster nodes, responds to requests for images from *imcat* and, in turn, requests locks on those images from the *clockd* daemon. When the lock is granted, *imserv* sends the image to *imcat* which then displays the images on an X-Window display.

### **imcat**

See *Image Cataloger*.

### **imserv**

See *Image Cataloger*.

### **inactive takeover**

Resource group/node attribute set by the user. If TRUE, a joining node acquires any resources not currently held by another node, then releases them to higher-priority nodes as they join the cluster. If FALSE, the node does not acquire a resource unless it is designated the highest-priority node for that resource.

### **intentional fallover**

Same as *graceful with takeover stop*. Usual administrative procedure for allowing the cluster services to continue while servicing a member node.

### **interface address**

See *network mask*.

### **interface ID**

See *adapter label*.

### **interface name**

See *adapter label*.

**IP address takeover (IPAT)**

A networking capability that allows one node to assume the network address of a node that has left the cluster. This assures the cluster will continue providing network service to clients. See also *boot address*, *network mask*, *Address Resolution Protocol (ARP)*.

**J****Journalized Filesystem (JFS)**

AIX facility that uses database journaling techniques to protect the integrity of filesystem meta-data. This facility cannot be used in HACMP concurrent access environments.

**K****keepalive**

Heartbeat or state-of-health message exchanged between network modules. The Cluster Manager uses these to track the membership and status of the cluster nodes. Means of detecting failure in the cluster.

**Kerberos**

An authentication mechanism used on the SP that centralizes command authority via one authentication server.

**L****label**

See *adapter label*.

**lazy update**

Process where the ODM definition of LVM components stored on cluster nodes that do not currently have an LVM component activated is not updated until failover occurs. Alternatively, a user can de-activate the volume group on the local node and export and import the volume group on all the other cluster nodes. Lazy update is only an option for LVM components under the control of HACMP for AIX.

**local lock**

Provides improved performance for resources rarely locked by remote clients by allowing the *Cluster Lock Manager* to complete all processing for a lock request on the local node. Remote accesses, however, must search each node in the cluster since the lock manager does not create any directory information.

Local locks do not migrate. Since local locks should only be used for resources typically referenced from a single client or node, the master copy does not migrate.

**local node**

Node where you are logged in. See also *cluster node*.

**lock groups**

Related lock client processes joined into a single entity. A lock client may create a new lock group or join an existing group. A lock client may belong to at most one lock group. Once a client belongs to a group, the group owns all locks created by that process, including locks created by the process before it joined the group. Therefore, any process in the group may manipulate group-owned locks.

A lock group may not span cluster nodes. The lock manager only acknowledges a group ID on the node on which it was created. Therefore, a lock client on one node cannot join a group created on a different node.

**lock resource**

A lockable entity defined by the lock manager. A lock resource can correspond to an actual object—a file, a database, an executable routine—but it need not. An application requests a lock on a lock resource from the *Cluster Lock Manager*.

A CLM lock resource is composed of a name, a *lock value block*, and a set of lock queues, one for each possible lock state (grant, convert, wait).

**lock resource master**

The record of database information about a given *lock resource* and the locks held on it. The CLM distributes all the lock resource masters among the nodes in a cluster. Each lock resource master is located on the node where it is most efficiently accessed.

# L

## lock resource migration

Movement of a lock resource master among cluster nodes in response to lock resource access patterns. The CLM takes this action to optimize lock throughput. You can tune the migration behavior of lock resources to suit the needs of your application.

## lock statistics

Provide information on lock resource usage. How the lock resource statistics are used is up to the client application. The lock statistics provide information about such items as the number and origin of lock requests and the migration of lock resources.

## lock value block (LVB)

A 16-byte character array associated with a *lock resource* that can be used by applications to store data. The data is application-specific. The LVB provides a client application a small amount of state information that is guaranteed to be consistent throughout the cluster.

## locking model

The Cluster Lock Manager provides two distinct locking models: the CLM locking model, and the UNIX System V locking model. The UNIX locking model supports standard UNIX System V region locking.

The CLM locking model provides a rich set of locking modes and asynchronous execution. The CLM locking model supports:

- Six locking modes that increasingly restrict access to a resource
- The promotion and demotion of locks through conversion
- Asynchronous completion through AST emulation
- Global data through *lock value blocks*

The Cluster Lock Manager provides APIs that applications can use to create a single, unified lock image that is shared among all nodes in the cluster. Cooperating applications running on different nodes in an HACMP cluster can then share common resources without corrupting those resources due to uncoordinated concurrent access.

## log files

Files that contain messages put out by the HACMP for AIX subsystems (e.g., event notification messages, verbose script output messages, and cluster state messages). Log files can provide valuable information for troubleshooting cluster problems.

The **/usr/adm/cluster.log** file contains time-stamped, formatted messages generated by HACMP scripts and daemons.

The **/tmp/cm.log** file contains time-stamped, formatted messages generated by HACMP **clstrmgr** activity.

The **/tmp/hacmp.out** file contains messages generated by HACMP scripts; it does not contain state messages.

In verbose mode, this log file contains a line-by-line record of every command executed by these scripts, including the values of all arguments to these commands.

The **system error log** contains time stamped, formatted messages from all AIX subsystems, including HACMP scripts and daemons.

The **/usr/sbin/cluster/history/cluster.mmdd** file contains time stamped, formatted messages generated by HACMP scripts. The system creates a cluster history file every day, identifying each file by the file name extension, where *mm* indicates the month and *dd* indicates the day.

A log file may be redirected, through SMIT, to a specified directory other than the default directories.

## Logical Volume Manager (LVM)

AIX facility that manages disks at the logical level. HACMP uses AIX LVM facilities to provide high availability—in particular, volume groups and disk mirroring.

## logical link

Cluster network. Connection between nodes that allows messages and other information to pass between cluster nodes.

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## M

**map**

A set of related submaps that provides a graphical and hierarchical presentation of a network and its systems.

**Market application**

Demo that demonstrates client/server computing in an HACMP concurrent access environment. The Market application has two programs, market server and checkout client. The checkout client program queries a product inventory database stored on the cluster shared disk storage. The market server program manages the product inventory database and responds to requests for product information. Because instances of the market server program can run on multiple nodes, the cclockd daemon arbitrates requests for product information.

**Management Information Base (MIB)**

See *SNMP*.

**membership protocol**

Mechanism whereby all cluster managers running in a cluster determine which nodes are members of the cluster and handle membership transitions.

**mirroring**

AIX facility for maintaining more than one copy of stored data, to prevent loss of data.

**multicast**

Logically sending a single message to one or more peer nodes. Not necessarily implemented as a multicast at the network level. The Cluster Manager multicasts control messages at times to speed the distribution of information needed to coordinate action when a node failure occurs.

**multithreaded application**

Application written using threads. See also *thread-safe*.

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## N

**network**

In HACMP environment, connects multiple nodes and allows clients to access these nodes. HACMP defines various types of networks. See also *public network*, *private network*, *serial network*.

**network adapter**

Connects a node to a network. Synonym: interface. A node typically is configured with at least two network interfaces for each network to which it connects: a service interface that handles cluster traffic, and one or more standby interfaces.

**network adapter attribute**

The attributes that define a network adapter include an *adapter label* and a function (boot, service, or standby).

**network adapter event**

Network adapter failure and recovery. HACMP processes these events.

**network attribute**

In HACMP, a network is defined by its name and its attribute: public, private, or serial.

**network failure**

Event that occurs when a network fails for all the nodes in a cluster. That is, no node is able to communicate across that network.

**network interface**

See *network adapter*.

**network mask**

The HACMP software uses the subnet feature of TCP/IP to divide a single physical network into separate logical subnets. In order to use subnets, you must define a network mask for your system.

An IP address consists of 32 bits divided into four octets. Some of the bits form the network address, the remainder form the host address. The *network mask* determines which bits in the IP address refer to the network and which refer to the host.

See also Chapter 3 of *AIX Version 4.3 System Management Guide: Communications and Networks* for more information about classes of

# N

addresses. Also, ask your network administrator about the class and subnets used at your site.

## Network Module

Cluster Manager interface module. Monitors a network and its interfaces associated with a cluster. Each network module monitors one kind of hardware interface using one kind of communication protocol (for example, FDDI, Ethernet). Provides data transport for messages between nodes.

Configuring includes defining a network module name, description, address (IP or /dev), pathname, and heartbeat rate.

## network module update speed

Each network module is responsible for reporting when a given link actually fails. It declares a failure when no keepalive messages have been received for a given number of cycles. This combination (messages and cycles) determines the module's update speed. Users can adjust the amount of time between keepalives to allow before the network module should declare a failure.

## network monitoring

See *cluster status utility*.

## network name

A symbolic value that identifies a network participating in an HACMP system. Cluster processes need this information to determine which adapters are connected to the same physical network. The network name is arbitrary, but must be used consistently.

## Network Filesystem (NFS)

Distributed filesystem for computer networks. Independent of operating system, type of system, and network architecture. See InfoExplorer for more information.

## node

See *cluster node*.

## node attachment

Node event that occurs when a node joins or rejoins the cluster. See also *cluster event*.

## node-by-node migration

The process of migrating a cluster from HACMP for AIX to the HACMP/ES subsystem on a node by node basis without stopping the cluster.

## node detachment

Node event that occurs when a node leaves the cluster voluntarily or fails. See also *cluster event*.

## node environment

Includes the definition and distribution of *resources* among participating nodes in a cluster and the setting of *run-time parameters* per node.

## node isolation

Complete loss of communication between two or more parts of the cluster. Occurs when all TCP/IP-based networks connecting cluster nodes fail, if a global network (HACMP/ES only) is not defined. Each group (one or more) of nodes is completely isolated from the other groups. A cluster experiencing node isolation is termed a partitioned cluster.

## node name

A symbolic value (string) that identifies a node participating in an HACMP system. (This is not the *hostname*.)

## node state

Current situation of a cluster node. States include: Stable (a node is known to be up or down), reconfiguring (event scripts are handling an event that calls for reorganization of one or more cluster resources), unstable (a node is joining or leaving the cluster). Monitored by *cluster status utility*.

## non-concurrent access

Term used when referring to shared resources, especially disks. In non-concurrent environments, only one connection is active at any given time, and the node with the active connection owns the disk.

## non-sticky migration

A resource group migration that is not sticky and which cancels any previous stickiness properties of a resource group. Alternatively, a one-time resource migration. Such migrations should only be applied to rotating resources in most circumstances.

---

**O**
**object**

In HAView, a generic term for any entity that HAView discovers and displays on the topology map, or any entity that you add to the topology map. (2) In the AIX object data manager, an instance or member of an object class, conceptually similar to a structure that is a member or array of structures.

In HAView, objects convey to the symbol various semantic attributes that represent an entity.

See also *symbol*.

**Object Data Manager (ODM)**

AIX facility that stores objects describing HACMP entities such as nodes and resources. HACMP includes a global ODM so that changes made to the system on one node can be synched on the whole cluster.

---

**P****partitioned cluster**

See *node isolation*.

**point-to-point**

Direct communications link between two nodes. For example, SOCC and SLIP lines are point-to-point connections.

**post-events**

One or more commands specified by the system administrator that execute after the Cluster Manager runs a particular event script. Usually these are site-specific scripts integrated into the system when it is installed.

**pre-events**

One or more commands specified by the system administrator that execute before the Cluster Manager runs a particular event script. Usually these are site-specific scripts integrated into the system when it is installed.

**primary lock manager**

See *distributed lock manager*.

**primary node**

User-designated node in a cluster.

**priority**

See *takeover priority*.

**private network**

Provides point-to-point communication between two nodes; it does not allow client access (except for the SP\_switch networks on SP nodes, and ATM networks). A SOCC line is considered a private network. Any network (such as Ethernet) can be defined as private in the HACMP environment.

If a private network is available when the cluster lock manager is started, lock traffic is directed over the private network.

**process takeover**

After the *takeover* process, the node configured to take over any application server resources runs the script to restart those applications (for example, a database backend process).

**PTF**

Program Temporary Fix. A correction for a software problem reported in an *APAR*.

**public network**

Connects multiple (two or more) nodes and allows clients to access the cluster nodes. Ethernet, Token-Ring, and FDDI are considered public networks.

---

**Q****quick configuration utility**

An X Window System application that simplifies the task of configuring an HACMP cluster. You can use the utility to configure a predefined two-node cluster configuration.

**quorum**

An LVM facility that must be considered when configuring logical volume components in an HACMP environment. Quorum determines whether a volume group can be placed online, using the *varyonvg* command or whether it can remain online after a failure of one or more of the physical volumes in the volume group. Quorum checking is enabled by default.

If a processor fails before all copies of the Volume Group Descriptor Area and Volume Group Status Area (VGDA and VGSA) have been updated or if a disk drive fails while writing, all copies of the information within the

# R

volume group may not be the same. The Logical Volume Manager uses a voting scheme called quorum where “majority rules” to determine the correct mapping and status information. In reference to a volume group, quorum is achieved when more than half of the VGDA and VGSA are accessible and identical in content. Having exactly half of the VGDA and VGSA accessible and current does not achieve quorum.

AIX provides an option to disable quorum checking. With quorum disabled, a volume group will remain varied on until the last physical volume in the volume group becomes unavailable. Quorum should never be disabled in concurrent access configurations as disk subsystem failures could result in nodes accessing diverged database copies.

---

## R

### RS232 serial line

See *serial network*.

### reconfiguration

Process whereby the cluster adjusts to changes in membership. See also *dynamic reconfiguration*.

### reentrant

See *thread-safe*.

### reintegration

Refers to the actions that occur within the cluster when a component that had previously detached from the cluster returns to the cluster. These actions are controlled by the event scripts and, when necessary, by manual intervention.

### remote node

Node in the cluster other than the *local node*. See also *cluster node*.

### resource

Cluster entity, such as a disk, filesystem, network adapter, or application server, that is made highly available in the cluster.

### resource chain

Nodes assigned to participate in the takeover of a given *resource group*. See also *cascading resources* and *Event Manager*.

### resource group

Set of resources handled as one unit. Configured by the user. See also *cascading resources* and *Event Manager*.

### resource group migration

Movement of a resource group from one node to another without an actual fallover.

### Resource Manager

See *Cluster Resource Manager*.

### rotating resource group

*Resource group* that may be associated with one of several nodes. Each resource group rotates among all the nodes defined in the resource chain, one resource per network per node. There must be at least one *standby* node. The node with the highest priority in the *resource chain* for the resource group takes over for a failed node. When a failed node joins a cluster, it does not reacquire its resources; it comes up as a *standby*.

### RSCT (RS/6000 Cluster Technology)

RSCT services provide scalability, notify distributed subsystems of software failure, and coordinate recovery and synchronization among all subsystems in the software stack. This package of services is a prerequisite for HACMP/ES. The package includes *Topology Services*, *Group Services*, and *Event Management*.

### run time parameters

Environmental conditions set per node. For example, activating an NIS server, setting Cluster Manager debug level.

---

## S

### SCD

See *staging configuration directory*.

### serial connections

See *serial network*.

### serial network

A SCSI bus using Target Mode SCSI, Target Mode SSA, or an RS232 serial line that may be used to connect pairs of nodes in a cluster. The purpose of the serial network is to prevent node isolation.

**service adapter**

The primary connection between the node and the network. A node has one service adapter for each physical network to which it connects. The service adapter is used for AIX network connections and is the address published by the Cluster Information Program (Cinfo) to application programs that want to use cluster services.

**service address**

See *service adapter*.

**shared adapter**

An adapter resource that can be the *service adapter* for any one of the cluster nodes in a *rotating resources* configuration. It maintains the same address no matter which one of the nodes is active at a given time. You must also have a *boot address* defined for the network.

**shared disks**

Disks configured to serve more than one node. In the HACMP system, shared disks are physically connected to multiple nodes.

**shared filesystems**

Filesystems configured to serve more than one node. See *shared disks*.

**shared IP address**

IP address configured so that it may rotate among cluster nodes. See also *rotating resources*.

**shared logical volume**

Logical volume configured to allow access by more than one node.

**shared volume group**

Volume group configured to allow access by more than one node. Resides entirely on the external disks shared by cluster nodes.

**single point-of-failure**

A single point-of-failure exists when a critical cluster function is provided by a single component. If that component fails, the cluster has no alternative way to provide that function and essential services become unavailable.

**Serial Line Internet Protocol (SLIP)**

Connects two nodes over a serial line using the IP subsystem.

**Serial Optical Channel Converter (SOCC)**

A proprietary IBM serial optical link that provides high-speed communication between two nodes.

**Simple Network Management Protocol (SNMP)**

Industry-standard specification for monitoring and managing TCP/IP-based networks. SNMP includes a protocol, a database specification, and a set of data objects. A set of data objects forms a Management Information Base (MIB). HACMP supplies its own MIB, encoded into the *clsmuxpd* agent, and accessed by the Cinfo program.

**SMIT**

System Management Interface Tool. IBM utility. HACMP menus are accessible through SMIT.

**snapshot**

See *cluster snapshot*.

**SNMP**

See *Simple Network Management Protocol*.

**SP Switch (SP\_switch)**

Network used on the POWERparallel SP machine. In an HACMP environment, the *SP\_switch* is defined as a private network. See also *aliasing* and *private network*.

**SRC**

See *System Resource Controller*.

**Staging configuration directory (SCD)**

The directory in which the HACMP for AIX-specific ODM object classes are stored temporarily during a dynamic reconfiguration operation. See also *active configuration directory* and *default configuration directory*.

**standby**

Idle resource available to replace another equal resource currently in use. For example, a processor or an adapter.

**standby adapter**

Backs up the service adapter. If the service adapter fails, the Cluster Manager directs the traffic for that node to the standby adapter. Using a standby adapter eliminates a network adapter as a single point-of-failure.

# T

## **sticky location**

A special resource marker (named “STICKY\_LOCATION”) that resides in the HACMP ODM (*/etc/objrepos*) and which indicates that (1) its associated resource group is sticky and (2) that the node specified by its value field is the associated home node. Sticky locations are discarded when a cluster is rebooted (all nodes go down at least once).

## **sticky migration**

A type of migration that produces a sticky resource group, in which the resource group is permanently attached to the target node. (See also *Sticky Resource Group*).

## **sticky resource group**

A resource group (usually cascading) that has a “sticky home node” (location) to which it continually attempts to return. This stickiness is a property of a particular instance of the Cluster Manager and is lost on reboot of the Cluster Manager. Stickiness supersedes the normal resource policy. If a resource group cannot stay on its sticky location for some reason, then it uses the node-ordering policy in the HACMPresource ODM class for fallover.

## **submap**

A particular view of some aspect of a network that displays symbols that represent objects. Some symbols may explode into other submaps, usually having a more detailed view than their parent submap. The application that creates a submap determines what part of the network the submap displays.

## **swapping hardware address**

See *hardware address swapping*.

## **symbol**

In HAView, a picture or icon that represents an object. Each symbol has an outside and inside component.

The outside component differentiates the object classes; the inside component differentiates the objects within the class.

## **synchronize cluster topology**

Command that propagates the local node’s definition of the cluster topology to the rest of the cluster.

## **synchronous lock requests**

A synchronous lock request performs the same function as an asynchronous lock request, but does not return control to the calling process until the request is resolved. The calling process does not have to poll for an AST; it simply waits until the request returns. See also *Asynchronous System Trap*, and *locking model*.

## **synchronize node environment**

Command that sends the information contained on the current node to all defined cluster nodes. If a node attempts to join a cluster with a node environment which is out-of-sync with the active cluster nodes, it will be denied. The user must manually sync the node environment to the joining member.

## **system commit number (SCN)**

Cluster-global counter available for use by locking applications. For example, a database application can use it to track database transactions. The SCN is stored in the *lock value block* (LVB) associated with a *lock resource*.

## **System Resource Controller (SRC)**

Standard AIX facility. Used to start and stop the HACMP daemons.

---

# T

## **takeover**

See *fallover*.

## **takeover priority**

Value assigned to each configured cluster resource on a per-node basis. In the event of a takeover, the active node with the highest priority will acquire the resource. Resources may also be grouped, and a priority assigned to the group. See also *resource group*.

## **target mode SCSI**

A *serial* network that may be used to connect pairs of nodes in a cluster over a SCSI bus.

## **target mode SSA**

A *serial* network that may be used to connect nodes in an HACMP cluster using an SSA loop.

**TaskGuide**

A graphical interface that presents a series of panels to aid the user in the steps of performing a task. The TaskGuide for Creating Shared Volume Groups is incorporated into the HACMP and HACMP/ES products.

**TCP/IP**

Transmission Control Protocol/Internet Protocol. A communications subsystem that allows you to set up local area and wide area networks. HACMP for AIX uses TCP/IP facilities to maintain communication among cluster members.

**thread-safe**

AIX includes support for threads in user programs. A thread is a path of execution: a program counter, registers, and a stack. You can have one or more threads per process, and they all share the same address space. On a multiprocessor machine these threads can be running simultaneously. HACMP for AIX supplies versions of the HACMP libraries for multithreaded applications to use.

A program is thread-safe when multiple threads in a process can be running that program successfully without data corruption. A library is thread-safe or *reentrant* when multiple threads can be running a routine in that library without data corruption.

**tm SCSI**

See *target mode SCSI*.

**tm SSA**

See *target mode SSA*.

**Token-Ring**

A type of network. Can be configured to run at either 4 megabits per second (Mbps) or 16 Mbps. Nodes and clients that communicate over a Token-Ring network require the Token-Ring High-Performance Network Adapter.

**topology**

Cluster layout and connections. Cluster, node, network, and adapter information. Use the *clverify* program to check cluster topology.

**topology services**

(HACMP/ES) An RSCT subsystem that generates heartbeats over multiple networks and provides information about adapter

membership, node membership, and routing. Adapter and node membership provide indication of adapter and node failures respectively. Reliable Messaging uses the routing information to route messages between nodes around adapter failures.

**tracing**

Diagnostic aid. HACMP tracing applies to the following daemons: *clstrmgr*, *clinfo*, *cllockd*, and *clsmuxpd*. Their execution is logged and reported by the system trace utility, *trcrpt*.

**transaction ID (XID)**

Provides an alternate method for lock clients to specify the ownership of a lock. Normally, the lock manager assumes the process that created the lock owns the lock when determining whether to grant a lock request or when determining whether a deadlock cycle exists. By allowing clients to specify a transaction ID, lock ownership can be attributed to a transaction and not to a process. For deadlock detention, therefore, a transaction replaces a process or group as the owner of a lock.

A transaction ID does not span nodes. Therefore, the lock manager considers equivalent transaction IDs on different nodes to be different transaction IDs.

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**V****verifying**

Checking software modifications and cluster configuration, using the *clverify* (*cluster verification*) utility.

Verifying software assures you that the HACMP-specific modifications to AIX system files exist and are correct.

Verifying the cluster topology and resource configuration assures you that all resources used by HACMP are validly configured and that ownership and takeover of those resources are defined and agreed upon by all nodes.

See also *cluster verification utility (clverify)*.

**version compatibility**

Online update of software. HACMP Version 4.1 and up provides the capability for the user to install future versions of hardware or software without total loss of cluster

# V

availability during the replacement period. Upgrades from pre-3.1 versions to 4.1 require taking the system down during the upgrade.

## **Visual System Manager (VSM)**

An X Window System graphical user interface for system management tasks. The VSM-based application for HACMP for AIX provides cluster administrators with a means to load, manipulate, verify, and apply cluster configurations to their cluster.

## **volume group**

An AIX LVM facility logical storage entity. Allows filesystems to be spread across multiple disks and dynamically expanded during run time. A volume group can represent one or more physical disks. Each group contains a table of information about the disks it contains (for example, the filesystem, physical location, contents of the disk). If a node detaches from the cluster, the surviving nodes can provide exactly the same view of disk services.

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# Master Index

This Master Index contains entries for topics covered in all the manuals in the HACMP for AIX 4.4 documentation set. Each index entry identifies the manual in which the topic is covered using one of the following abbreviations:

<i>Concepts</i>	<i>HACMP for AIX, Version 4.4: Concepts and Facilities</i>
<i>Planning</i>	<i>HACMP for AIX, Version 4.4: Planning Guide</i>
<i>Install</i>	<i>HACMP for AIX, Version 4.4: Installation Guide</i>
<i>Admin</i>	<i>HACMP for AIX, Version 4.4: Administration Guide</i>
<i>Trouble</i>	<i>HACMP for AIX, Version 4.4: Troubleshooting Guide</i>
<i>Locking</i>	<i>HACMP for AIX, Version 4.4: Programming Locking Applications</i>
<i>Clients</i>	<i>HACMP for AIX, Version 4.4: Programming Client Applications</i>

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