

AIX Version 6.1



IBM Workload Partitions for AIX

AIX Version 6.1



IBM Workload Partitions for AIX

Note

Before using this information and the product it supports, read the information in “Notices,” on page 29.

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This edition applies to AIX Version 6.1 and to all subsequent releases of this product until otherwise indicated in new editions.

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About this document

Workload partitions (WPARs) are a virtualized operating system environment within a single instance of the AIX operating system. WPARs secure and isolate the environment for the processes and signals that are used by enterprise applications. This topic explains how to create and manage WPARs on AIX.

Highlighting

The following highlighting conventions are used in this book:

Bold	Identifies commands, subroutines, keywords, files, structures, directories, and other items whose names are predefined by the system. Also identifies graphical objects such as buttons, labels, and icons that the user selects.
<i>Italics</i>	Identifies parameters whose actual names or values are to be supplied by the user.
Monospace	Identifies examples of specific data values, examples of text similar to what you might see displayed, examples of portions of program code similar to what you might write as a programmer, messages from the system, or information you should actually type.

Case-sensitivity in AIX

Everything in the AIX operating system is case-sensitive, which means that it distinguishes between uppercase and lowercase letters. For example, you can use the **ls** command to list files. If you type `LS`, the system responds that the command is not found. Likewise, **FILEA**, **FiLea**, and **filea** are three distinct file names, even if they reside in the same directory. To avoid causing undesirable actions to be performed, always ensure that you use the correct case.

ISO 9000

ISO 9000 registered quality systems were used in the development and manufacturing of this product.

IBM Workload Partitions for AIX

Workload partitions (WPARs) are virtualized operating system environments within a single instance of the AIX® operating system. WPARs secure and isolate the environment for the processes and signals that are used by enterprise applications.

AIX WPAR overview

The WPAR environment is somewhat different from the standard AIX operating system environment. Various aspects of the system, such as networking and resource controls, function differently in the WPAR environment.

Differences in the WPAR environment

While the WPAR environment is similar to the environment for an application on a stand-alone system, there are differences that some applications will recognize.

Applications might recognize differences in the following areas:

Device access

Some devices are accessible within a WPAR by default, but storage devices must be mounted as file systems from the global environment into the WPAR. Physical devices are not supported within a WPAR.

Default privilege

The WPAR root user does not have the same level of access as the root user in the global environment by default.

Shared kernel

For applications that provide kernel extensions, the user-level application execution environment is compartmentalized between WPAR instances. However, the shared kernel recognizes all WPAR instances and must maintain the compartmentalization.

Statistic and tuning virtualization

While several AIX system utilities have been enabled to work either fully or partially in a WPAR, there are some utilities that work only in the global environment (for example, the **mpstat** utility and the **sar** utility). Because all WPAR instances share the same kernel and certain kernel subsystems are optimized for system-wide usage, it is not possible to tune all kernel subsystem parameters from a WPAR.

Network configuration

You cannot modify the network configuration (for example, addresses and routes) inside a WPAR. Configuration of IPv6 addresses is not supported in a WPAR environment. The default configuration of a WPAR prevents applications from using any kind of raw sockets, but system administrators can enable them.

Devices

In order to function properly, some applications require the use of system devices. For WPARs, you can manage and administer all devices in the global environment.

You can export a limited set of devices to one or more partitions. Applications that require access to non-exportable devices are restricted to running in the global environment.

The current WPARs release supports pseudo-devices in WPARs. The following pseudo-devices are exported to WPARs by default:

- **/dev/clone**
- **/dev/console**

- `/dev/error`
- `/dev/errorctl`
- `/dev/nvram`
- `/dev/random`
- `/dev/sad`
- `/dev/tty`
- `/dev/urandom`
- `/dev/zero`
- `/dev/xti/tcp`
- `/dev/xti/tcp6`
- `/dev/xti/udp`
- `/dev/xti/udp6`
- `/dev/xti/unixdg`
- `/dev/xti/unixst`

Devices that are exported to workload portions must operate safely and securely in the WPAR environment.

Networking

A WPAR can have one or more network addresses assigned to support network login and network services.

You must have the following information to configure networking:

- The name of the global network interface (for example, `en0`, `en1`, `et0`, or `et1`) to associate with the address. In the global environment, the IP addresses assigned to a WPAR appears as an alias address associated with this interface.
- The IPv4 address to assign to the partition.
- The network mask to apply to define the local subnet.
- A dotted-decimal broadcast address, if applicable. If a specified address is already in use or if the specified network parameters cannot be configured for the WPAR, it will not start.

If the name of the WPAR resolves to a network address, that address is used as the default network address for the WPAR. You can create a WPAR with no network addresses assigned. In this case, the only external mechanism to access the partition is the **cllogin** command from the global environment.

Related tasks

“Configuring networks for system WPARs” on page 10

You can configure the network for a system WPAR using the **-h** flag or the **-N** flag for the **mkwpar** command or the **chwpar** command.

“Configuring networks for application WPARs” on page 14

You can configure the network for an application WPAR using the **-h** flag and the **-N** flag for the **wparexec** command or the **chwpar** command.

Security

WPARs provide an isolated application environment that minimizes potential interactions with system objects or processes outside the WPAR. Even though a WPAR is using the same operating system instance as other WPARs or the global environment, the ability to view or interact with processes or devices outside the partition is limited.

In system workload partitions, the ability to interact with the global environment's file systems is limited. For non-persistent system objects, such as IPC and processes, constraints are implemented in the following ways:

- Marking system objects as being owned by an individual WPAR
- Denying users or applications in one WPAR the ability to view or interact with system objects owned by other WPARs

Interaction with persistent objects, such as files and devices, is also limited by maintaining separate file systems local to an individual partition. For persistent objects, constraints are implemented in the following ways:

- Creating and mounting unique file systems separate from file systems available in other WPARs
- Mounting shared, read-only file systems using the **namefs** mount type from the global environment
- Maintaining an environment within the local file system mounts for all processes using the **chroot** command

WPAR isolation

System WPARs and application WPARs are isolated from other partitions. Users cannot subvert the isolation constraints.

WPAR isolation limits the operating environment in the following ways:

- Default configuration of only certain pseudo devices in the **/dev** directory
- Removal of devices, such as **/dev/mem** and **/dev/kmem**, that give a more global view of the system
- Modified behavior of both the reboot command and the halt command to reboot or halt the only the specified systemWPAR, not the entire system

WPAR isolation also prevents users from performing the following administrative tasks:

- Adjusting the system clock
- Manipulating process accounting
- Binding processes to a specific processor
- Exceeding certain system limits, even by privileged users
- Using fine grain timers less than 10 milliseconds
- Manipulating certain machine-level serviceability tools
- Loading or unloading system-level device drivers or kernel extensions
- Manipulating system paging space and certain system-level tuning parameters
- Using certain file system-level operations, such as extension, contraction, or defragmentation

System workload partitions are integrated with the AIX RBAC system, so each system workload partition can have security privileges assigned. The settings are not applicable for application workload partitions.

Note: Workload partition isolation can also constrain the use of computational resources, such as system memory and processor processing time.

Resource controls

WPARs support up to 8192 resource-controlled workload partitions. The number of non-resource-controlled WPARs that can be created is constrained only by the availability of global environment memory and disk space resources. However, a maximum of 8192 can be active at any time.

You can change the resource controls for a WPAR dynamically using the **chwpar** command. If the process or thread limit is reduced on an active WPAR, processes or threads are not terminated, but new process or thread creation is not allowed until the total count falls below the specified limit. For example, if a WPAR has 200 active processes and you change the total process limit on the WPAR to 170, then the system will

not terminate the extra 30 processes. New process creation within the WPAR is not allowed until the process count falls below 170. You can enable resource controls for a WPAR when it is created. You can also change the controls on an existing WPAR using SMIT or using the **chwpar** command with the **-R active = yes** option.

Related tasks

“Configuring resource controls for system WPARs” on page 12

You can configure the resource controls to limit the physical resources a system WPAR has access to using the **-R** flag for the **mkwpar** command and **chwpar** command.

Processor use and memory use controls

Processor use controls and memory use controls allow you to allocate processor and memory resources for the global environment.

You can use share-based allocation or percentage-based allocation for processor and memory resources.

Note: Both share-based controls and percentage-based controls can be specified. In the event of conflict, the percentage-based controls take precedence.

Share-based allocation

The percentage of CPU or memory to allocate to the WPAR is determined by dividing the number of shares by the total number of shares allocated to all active WPARs. The number of shares represents how much of a particular resource a WPAR receives relative to the other WPARs.

For example, if there are three active WPARs (A, B, and C) with shares for a particular resource of 15, 10, and 5, allocation targets would be the following:

WPAR A, 15/30 or 50%

WPAR B, 10/30 or 33%

WPAR C, 5/30 or 17%

Allocation targets adjust with the number of active workload partitions. If partition A is inactive, then the allocation targets would be the following:

WPAR B, 10/15 or 66%

WPAR C, 5/15 or 33%

Share-based allocation is specified by using the **shares_CPU** option with the **mkwpar** command or the **chwpar** command.

Percentage-based allocation

The percentage of CPU or memory to allocate to the WPAR is determined by the following user-specified values:

min%

The minimum amount of a resource that should be made available to the WPAR. If the actual consumption is below this value, the WPAR will be given highest priority access to the resource. The possible values are 0 to 100, with a default value of 0.

soft%

The maximum amount of a resource that a WPAR can use when there is contention for that resource. If the WPAR's consumption exceeds this value, the WPAR will be given the lowest priority access to the resource. If there is no contention for the resource, the WPAR is allowed to consume as many resources as it requires. The possible values are .01 to 100, with a default value of 100.

hard%

The maximum amount of a resource that a WPAR can consume, even when there is no

contention. If the class reaches this limit, it will not be allowed to consume any more of the resource until its consumption percentage falls below the limit. The possible values are .01 to 100, with a default value of 100.

System WPARs

System WPARs are autonomous virtual system environments with their own private file systems, users and groups, login, network space and administrative domain.

Most traditional system services are virtualized at the WPAR level, and they can be independently used and managed within each WPAR. While the system WPAR environment is largely partitioned and isolated, read-only file systems might be shared between WPARs to facilitate the sharing of application data and text.

Shared and non-shared system WPARs

By default, a system WPAR shares the **/usr** file system and the **/opt** file systems from the global environment using read-only **namefs** mounts. You can configure WPARs to have non-shared, writable **/usr** file system and **/opt** file system.

To configure a non-shared system WPAR, run the **mkwpar** command with the **-I** flag.

You can also configure a non-shared system WPAR by specifying writable file systems of one of the following types for the **/usr** file system and the **/opt** file system:

- jfs2
- jfs
- directory
- nfs

If you create a non-shared system WPAR, all files from the **/usr** file system and the **/opt** file system in the global environment are copied to the WPAR. The administrator must allocate enough space in the WPAR file systems for the files.

System software in non-shared system WPARs must be kept at the same system level as the global environment in order to avoid unexpected results.

File systems for system WPARs

System WPARs have their own file systems similar to stand-alone AIX.

For system WPARs, local file system spaces, such as **/home** and **/usr**, are constructed from isolated sections of the file system space for the global environment. By default, these spaces are located in the **/wpars** directory of the global environment. The initial process for each WPAR is moved to the correct path in the global file system using the **chroot** command. All processes run within the WPAR appear in the base directory for the WPAR. For example, users in a WPAR would see the **/wpars/part1/usr** directory as the **/usr** directory.

The file system configuration for a WPAR is specified when the WPAR is created. You can either use the system defaults or customize each file system. Some of the file systems in a system WPAR are local to the partition while others can be shared with the global environment.

The following JFS2 file systems are created with inline logs and populated similar to a stand-alone AIX system with the following sizes:

- **/** (64 MB)
- **/tmp** (96 MB)

- **/var** (128 MB)
- **/home** (32 MB)

Note: The initial sizes of these file systems could change depending upon the system requirements and storage characteristics.

The following JFS2 file systems are shared from the global environment using **namefs** mounts with the followed permissions:

- **/usr** (read-only permissions)
- **/opt** (read-only permissions)
- **/proc** (read-write permissions)

You can specify the use of a flat file system structure for part or all of a WPAR namespace by specifying that one or more directories should be local to a parent directory. This structure means that no distinct file system is created for the parent directory. The sizes of the file systems or directories to be populated in the WPAR must be large enough to hold the files for that partition. This structure simplifies the number of file systems to manage for a partition, but it loses the granularity of control over user files populating the file system. The flat file system structure might be a viable option for servers running in the WPAR that do not offer system login privileges to users.

Related tasks

“Creating a writable directory under a shared directory” on page 10

You can create a writable directory beneath a shared directory using a symbolic link from the global environment.

Application workload partitions

Application workload partitions (WPARs) provide an environment for isolation of applications and their resources to enable checkpoint, restart, and relocation at the application level.

Application WPARs have less overhead on system resources than system WPARs. Application WPARs do not require their own instance of system services.

File systems for application WPARs

Application WPARs share the global environment’s file system namespace. When an application WPAR is created, it has access to all mounts available to the global environment’s file system.

If additional dependencies are required, you can customize the WPAR during creation using the **wparexec** command with the **-M** option. The supported file system types for application WPARs include the same types as for system WPARs, with the exception that no file systems can be created by the **wparexec** command. If a separate local file system is required, you must create it prior to creating the application WPAR.

Related tasks

“Configuring directories and file systems for application WPARs” on page 14

Application WPARs share file systems with the global environment. You can use the **-M** flag for the **wparexec** command to configure directories and file systems.

Global environment

The global environment has an all-encompassing view of processes, IPC, file systems, devices, and other user-level objects and system-level objects within an AIX system.

This environment allows you to view and interact with processes, file systems and other system components that are assigned to an active WPAR on the system. The global environment is the same as the traditional AIX login environment.

You can create new WPARs only in the global environment. You cannot create new WPARs in other WPARs. Many administrative tasks can be performed only from the global environment. Many commands also behave differently when they are run in the global environment than they do in the WPAR environment.

Configuring system WPARs

You can create and configure system WPARs using the **mkwpar** command and the **chwpar** command.

When you create a system WPAR, a configuration profile is stored in the WPAR database. You can export this profile to create a specification file that contains the exact same configuration information for that WPAR. All WPARs must be created by an authorized administrator in the global environment.

Note: These topics provide specific examples of how to run WPAR-related commands. For complete documentation of all options for a specific command, see the related information for that task.

Naming the system WPAR

You must provide a name for the system WPAR. You can provide a name using the **mkwpar** command with the **-n** flag.

You can specify the name for the system WPAR using the following command:

```
mkwpar -n wpar_name
```

You can also change the name of a system WPAR using the **chwpar** command. You can only change the name of a system WPAR when it is stopped and in the defined state. To change the name of a system WPAR, run the following command:

```
chwpar -n new_name old_name
```

Creating a system WPAR

You can create a new system WPAR with the **mkwpar** command.

Each WPAR has an isolated network environment with unique IP addresses and a unique hostname. You can access WPARs through standard networking programs, such as telnet, ftp, and rlogin (depending on the services running in the WPAR). Before you create a WPAR, you should log in as the root user and complete one of the following prerequisites:

- Choose a name for the WPAR that maps to an IP address for your network.
- Add an entry for the new system WPAR to the **/etc/hosts** file on the server. The entry should include the host name for the WPAR and the name of the WPAR as follows:

```
9.3.18.10 WPARname.austin.ibm.com WPARname
```

To create a new system WPAR, complete the following steps.

1. Verify that the network recognizes your workload partition address by entering the following command:

```
#host WPARname
```

The return should look similar to the following:

```
WPARname.austin.ibm.com is 9.3.18.10, Aliases: WPARname
```

2. Configure the WPAR by running the following command:

```
mkwpar -n WPARname
```

The initial output of the **mkwpar** command should look similar to the following:

```
mkwpar -n WPARname mkwpar:
Creating filesystems...
/
/home
/opt
/proc
/tmp
/usr
/var
populate: Mounting all workload partition file systems
x ./usr
x ./lib
x ./audit
x ./dev
x ./etc
x ./etc/check_config.files
x ./etc/conddef
x ./etc/cronlog.conf
x ./etc/csh.cshrc
x ./etc/csh.login
x ./etc/dlpi.conf
x ./etc/dumpdates
x ./etc/environment
x ./etc/ewlm
x ./etc/ewlm/limits
x ./etc/filesystems
x ./etc/group
x ./etc/inittab
x ./etc/magic
x ./etc/motd
...
```

Each system WPAR has an isolated section of the system's file space configured for the root directory, the **/home** directory, the **/usr** directory and other file systems. Creation and configuration of this space is reflected in the above output from the **mkwpar** command. The return from the **mkpar** command continues with output similar to the following:

```
x ./home
x ./home/guest
x ./home/lost+found
+-----+
Pre-installation Verification...
+-----+
Verifying selections...done
Verifying requisites...done
Results...

SUCSESSES
-----
Filesets listed in this section passed pre-installation verification
and will be installed.
...
```

Each system workload partition has its own **/dev** directory. Creation and configuration of this space is reflected in the populate: Exporting workload partition devices output from the **mkwpar** command. Not all of the devices on the system can be shared among the WPARs so the WPAR's **/dev** directory is a sparse version of the **/dev** directory on the global environment. The **mkwpar** command then continues with the installation of several AIX base system file sets into the WPAR. At the end of the installation phase, you should see output similar to the following:

```
Finished processing all filesets. (Total time: 1 mins 4 secs).

Please wait...
```

```

/usr/sbin/rsct/install/bin/ctposti
0513-071 The ctcas Subsystem has been added.
0513-071 The ctrmc Subsystem has been added.
done

```

```

+-----+
Summaries:
+-----+

```

Installation Summary

Name	Level	Part	Event	Result
Tivoli_Management_Agent.cli	3.7.1.0	ROOT	APPLY	SUCCESS
bos.acct	5.3.0.9500	ROOT	APPLY	SUCCESS
bos.diag.util	5.3.0.40	ROOT	APPLY	SUCCESS
bos.mh	5.3.0.40	ROOT	APPLY	SUCCESS
bos.net.ncs	5.3.0.0	ROOT	APPLY	SUCCESS
bos.net.nfs.client	5.3.0.9500	ROOT	APPLY	SUCCESS
bos.net.nis.client	5.3.0.40	ROOT	APPLY	SUCCESS
bos.net.snapp	5.3.0.0	ROOT	APPLY	SUCCESS
bos.net.tcp.client	5.3.0.9500	ROOT	APPLY	SUCCESS
bos.net.tcp.server	5.3.0.9500	ROOT	APPLY	SUCCESS
bos.net.uucp	5.3.0.40	ROOT	APPLY	SUCCESS
...				
bos.net.ipsec.rte	5.3.0.9500	ROOT	APPLY	SUCCESS
bos.perf.tune	5.3.0.9500	ROOT	APPLY	SUCCESS
devices.chrp.base.diag	5.3.0.40	ROOT	APPLY	SUCCESS
bos.net.ipsec.keymgt	5.3.0.9500	ROOT	APPLY	SUCCESS
ifor_ls.base.cli	5.3.0.30	ROOT	APPLY	SUCCESS
lum.base.cli	5.1.0.0	ROOT	APPLY	SUCCESS
bos.suma	5.3.0.40	ROOT	APPLY	SUCCESS

```

mkwpar: Workload partition WPARname created successfully.
To start the workload partition, execute the following as root: startwpar [-v] 'WPARname'

```

The configuration of the system WPAR is now complete.

Configuring directories and file systems for system WPARs

You can override the default location of the file systems for a system WPAR using the **mkwpar** command with the **-d** option.

By default, the file systems for a new system WPAR are located in the */wpars/wpar_name* directory.

You can override the default location using the following command:

```
mkwpar -n wpar_name -d /newfs/wpar_name
```

For safety and security, the specified base directory must meet the following criteria:

- The directory must be empty.
- The directory must not be a registered file system in the */etc/filesystems* directory.
- The directory must have permissions of 755 (rwxr-xr-x).
- The parent directory of the base directory (*/newfs*, in the example) must have permissions of 700 (rwx-----).

You can also change the base directory of an existing system WPAR, using the following command:

```
chwpar -d /newfs/newbase wpar_name
```

The same criteria apply for changing the base directory with the **chwpar** command. The base directory can only be changed on a stopped system WPAR.

File system customization for system WPARs

You can customize the file systems for a system WPAR using the **mkwpar** command with the **-M** option.

The following file system types are supported using the **vfs** attribute of the **-M** option:

- JFS
- JFS2
- NFS
- Namefs

You can also specify that a directory should be created instead of a file system by specifying **vfs=directory**. Specify this attribute in situations where you do not want to maintain a large number of separate file systems.

Creating a writable directory under a shared directory

You can create a writable directory beneath a shared directory using a symbolic link from the global environment.

If you are customizing software within a system WPAR, it might be useful or necessary to have a writable directory beneath a directory shared from the global environment. For example, it is common for open source software to install into a **/usr/local** directory hierarchy by default. In order to accommodate an unshared, writable **/usr/local** directory hierarchy, the global environment administrator must create a writable **/usr/local** directory. Create a file system called `/wpar/wparname/usr/local` with the `type=wparname` option.

Related concepts

“File systems for system WPARs” on page 5

System WPARs have their own file systems similar to stand-alone AIX.

Configuring networks for system WPARs

You can configure the network for a system WPAR using the **-h** flag or the **-N** flag for the **mkwpar** command or the **chwpar** command.

If you do not specify any network information when you create a system WPAR, and the name of the WPAR resolves to an IP address on the same network as any active global interface, the **mkwpar** command automatically configures the network for the WPAR. If the WPAR does not resolve, you can specify zero or more network configurations using the **-N** flag for the **mkwpar** command or the **chwpar** command. All network changes can be performed on active or inactive WPARs. The changes take effect immediately.

Each network requires its own instance of the **-N** flag. For example:

```
mkwpar -n wpar_name -N interface=en0 address=224.128.9.3 \  
netmask=255.255.255.0 broadcast=224.128.9.255 -N interface=en1 \  
address=192.168.0.3 netmask=255.255.255.0 broadcast=192.168.0.255
```

To configure a system WPAR with a network address of 224.128.9.3 using the en0 interface for the global environment, run the following command:

```
mkwpar -n wpar_name -N interface=en0 address=224.128.9.3 \  
netmask=255.255.255.0 broadcast=224.128.9.255
```

You can also use the **-N** flag with the **chwpar** command to add additional networks on a previously defined system WPAR. To add a network, run the following command:

```
chwpar -N address=224.128.9.4 wpar_name
```

If you want to change the network settings for a system WPAR, use the **address** attribute to identify the network you want to change. For example, to change the netmask and broadcast address of the network at 224.128.9.3, run the following command:

```
chwpas -N address=224.128.9.3 netmask=255.255.255.128 \  
broadcast=224.128.9.127 wpar_name
```

Related concepts

“Networking” on page 2

A WPAR can have one or more network addresses assigned to support network login and network services.

Changing the host name for a system WPAR

By default, the name for a system WPAR is used as its host name. You can use the **-h** flag with the **mkwpar** command or the **chwpas** command to change the host name for a system WPAR.

To override the default host name when you create a system WPAR, run the following **mkwpar** command:

```
mkwpar -n wpar_name -h wpar_hostname
```

To change the host name for an existing system WPAR, run the following **chwpas** command:

```
chwpas -h new_hostname wpar_name
```

Removing a network from a system WPAR

You can remove a network from a system WPAR using the **chwpas** command with the **-K** flag.

To remove a network from the system WPAR, run the following **chwpas** command, using the address of the network to identify it:

```
chwpas -K -N address=124.128.9.3 wpar_name
```

Note: There is no direct way to change the address of a system WPAR network; you must remove the old network with the **chwpas -K** command and add the network with the new address.

Configuring domain resolution for system WPARs

You can configure the domain resolution for system WPARs using the **-r** flag for the **mkwpar** command.

Files such as the **/etc/resolv.conf** file do not exist in system WPARs by default.

To copy the global environment’s domain resolution configuration into the system WPARs, run the following command:

```
mkwpar -n wpar_name -r
```

Running this command copies the following files into the system WPARs, if they exist in the global environment:

- **/etc/resolv.conf**
- **/etc/hosts**
- **/etc/netsvc.conf**
- **/etc/irs.conf**
- **/etc/networks**

If the NSORDER environmental variable is set in the environment where you run the **mkwpar** command, the variable is added to the **/etc/environment** file for the new system WPAR.

The **-r** flag is not supported by the **chwpas** command. Any changes to the domain resolution configuration of an existing WPAR must be made by manually editing the relevant files.

Configuring resource controls for system WPARs

You can configure the resource controls to limit the physical resources a system WPAR has access to using the **-R** flag for the **mkwpar** command and **chwp** command.

To initialize resource control settings, run the following **mkwpar** command:

```
mkwpar -n wpar_name -R active=yes CPU=10%-20%,50% totalProcesses=1024
```

In this example, the WPAR is entitled to the following system resources:

- A minimum of 10% of the global environment's processors upon request
- A maximum of 20% of the global environment's processors when there is contention
- A maximum of 50% of the global environment's processors when there is no contention
- A maximum of 1024 processes at a time

The **active** attribute can be set to yes or no. When the **active** attribute is set to no, resource controls are disabled, but the settings are maintained in the configuration database.

To change resource control settings dynamically for an existing active or inactive application WPAR run the following **chwp** command:

```
chwp -R totalThreads=2048 shares_memory=100 wpar_name
```

Note: You can also use the **-K** flag for the **chwp** command to remove individual attributes from the profile and restore those controls to their default, as follows:

```
chwp -K -R totalProcesses shares_CPU wpar_name
```

Related concepts

"Resource controls" on page 3

WPARs support up to 8192 resource-controlled workload partitions. The number of non-resource-controlled WPARs that can be created is constrained only by the availability of global environment memory and disk space resources. However, a maximum of 8192 can be active at any time.

Using specification files for system WPARs

You can create a WPAR with all of the options from a specification file using the **-f** flag for the **mkwpar** command.

To use a specification file to create a system WPAR, run the **mkwpar** command as follows:

```
mkwpar -f /tmp/specfile1
```

To create a specification file as part of the WPAR creation process, run the following **mkwpar** command with the **-o** flag:

```
mkwpar -n wpar_name -o /tmp/specfile2
```

Note: If the name of the system WPAR is provided in the specification file, the **-n** flag is not required. The specification file reflects the settings being used to create the WPAR.

To generate a specification file without creating the WPAR, run the following **mkwpar** command with the **-w** flag and the **-o** flag:

```
mkwpar -o /tmp/specfile3 -w
```

For a comprehensive description of the format and permitted contents of a specification file, see the **/usr/samples/wpars/sample.spec** file.

Using an `image.data` file for system WPARs

You can use an `image.data` file to specify additional logical volume options and file system options when you create a system WPAR using the `mkwpar` command with the `-L image_data=` flag.

The following restrictions apply to using `image.data` files with system WPARs:

- WPARs use only the `lv_data` stanza type and the `fs_data` stanza type in an `image.data` file. All other stanza types are ignored.
- If the logical volume device name matches an existing device name on the system, a new name is generated, and a warning is issued.
- The file system paths specified with the `FS_NAME` attribute should correspond to their appearance in the WPAR (for example, the root file system is `/` and the home file system is `/home`).
- The base directory for the global environment should not be included in `image.data` paths.
- All file systems must have associated LVs in the `image.data` file.
- All logical volumes must have associated file systems in the `image.data` file.

To create a system WPAR using the logical volume options and file system options in an `image.data` file, run the following command:

```
mkwpar -L image_data=image.data file -n wpar_name
```

Related information

`image.data` file

Configuring application WPARs

You can create and configure application WPARs using the `wparexec` command and the `chwpar` command.

When you create an application WPAR, a configuration profile is stored in the WPAR database. You can export this profile to create a specification file that contains the exact same configuration information for that WPAR. All WPARs must be created by an authorized administrator in the global environment.

Note: These topics provide specific examples of how to run WPAR-related commands. For complete documentation of all options for a specific command, see the related information for that task.

Creating an application WPAR

You can create an application WPAR using the `wparexec` command.

You must supply the path to the application or command that you want to create an application WPAR for, and you must supply any command line arguments when you run the `wparexec` command. The application can either come from a specification file, or be specified on the command line. Unlike system WPARs, it is not necessary to assign an explicit name to an application WPAR. Although both WPAR types require a name, the names for application WPARs are generated based on the name of the application running in the WPAR.

Complete the following steps to create an application WPAR:

1. Log in as the root user to the system where you want to create and configure the workload partition. This login places you into the global environment.
2. To create and configure the workload partition, run the following command:

```
wparexec -n wparname -- /usr/bin/ps -ef > /ps.out
```

The output should look similar to the following:

```

wparexec: Verifying filesystems...
wparexec: Workload partition wparname created successfully.
startwpar: COMMAND START, ARGS: wparname
startwpar: Starting workload partition 'wparname'
startwpar: Mounting all workload partition file systems
startwpar: Loading workload partition
startwpar: Shutting down all workload partition processes
rmwpar: Removing workload partition firstapp
rmwpar: Return Status = SUCCESS
startwpar: Return Status = SUCCESS

```

You have now successfully created an application WPAR.

Application WPARs start as soon as the **wparexec** command is issued, and stop as soon as the application completes its operation. When the operation is complete, the configuration for the application WPAR is destroyed.

Configuring directories and file systems for application WPARs

Application WPARs share file systems with the global environment. You can use the **-M** flag for the **wparexec** command to configure directories and file systems.

Unlike system WPARs, application WPARs do not have a base directory. You cannot override the default settings for the local file system dependencies, but you can use the **-M** flag for the **wparexec** command to specify additional file system dependencies, such as a remote NFS mount. The **directory** attribute represents the mount point and this attribute is required for all instances created with the **-M** flag. The directory mount point will appear both in the WPAR and in the global environment.

Application WPARs do not create new file systems. Therefore, the local JFS and JFS2 file system types cannot be specified. A local file system dependency can be specified, but it must already exist in the **/etc/filesystems** directory.

To mount the remote **/export/shared** directory over the **/shared** directory in the global environment, run the following **wparexec** command with the **-M** flag, using the appropriate values for your environment:

```

wparexec -M directory=/shared vfs=nfs host=homeserver.customer.com dev=/export/shared \
-- /path/to/application arg1 arg2 ... argN

```

To specify a local file system dependency, specify only the directory attribute for that mount stanza, as follows, using the appropriate values for your environment:

```

wparexec -M directory=/mylocalshare -- /path/to/application arg1 arg2 ... argN

```

Related concepts

“File systems for application WPARs” on page 6

Application WPARs share the global environment’s file system namespace. When an application WPAR is created, it has access to all mounts available to the global environment’s file system.

Configuring networks for application WPARs

You can configure the network for an application WPAR using the **-h** flag and the **-N** flag for the **wparexec** command or the **chwpar** command.

By default, the name of an application WPAR is used as its host name.

To override the default hostname for an application WPAR when you are creating it, run the following **wparexec** command with the **-h** flag:

```

wparexec -h wpar_hostname -- /path/to/application arg1 arg2 ... argN

```

You can also change the host name for an application WPAR at any time using the **-h** flag with the following **chwpar** command:

```
chwpar -h new_hostname wpar_name
```

If you do not specify any network information when you create an application WPAR, and the name of the WPAR resolves to an IP address on the same network as any active global interface, the **wparexec** command automatically configures the network for the WPAR. If the WPAR name does not resolve, you can specify zero or more network configurations using the **-N** flag for the **wparexec** command or the **chwpar** command. All network changes can be performed on active or inactive WPARs. The changes take effect immediately.

Each network requires its own instance of the **-N** flag. For example:

```
wparexec -N interface=en0 address=224.128.9.3 netmask=255.255.255.0 broadcast=224.128.9.255 \  
-N interface=en1 address=192.168.0.3 netmask=255.255.255.0 broadcast=192.168.0.255 \  
-- /path/to/application arg1 arg2 ... argN
```

You can also use the **-N** flag with the **chwpar** command to add additional networks on a previously defined application WPAR. For example, to add a network, run the following command:

```
chwpar -N address=224.128.9.4 wpar_name
```

If you want to change the network settings for an application WPAR, use the **address** attribute to identify the network you want to change. For example, to change the netmask and broadcast address of the network at 224.128.9.3, run the following command:

```
chwpar -N address=224.128.9.3 netmask=255.255.255.128 broadcast=224.128.9.127 wpar_name
```

Related concepts

“Networking” on page 2

A WPAR can have one or more network addresses assigned to support network login and network services.

Configuring resource controls for application WPARs

You can configure the resource controls to limit the physical resources an application WPAR has access to using the **-R** flag for the **wparexec** command and **chwpar** command.

To initialize resource control settings, run the following **wparexec** command:

```
wparexec -R active=yes CPU=10%-20%,50% totalProcesses=1024 -- /path/to/application arg1 arg2 ... argN
```

In this example, the application WPAR is entitled to the following system resources:

- A minimum of 10% of the global environment’s processors upon request
- A maximum of 20% of the global environment’s processors when there is contention
- A maximum of 50% of the global environment’s processors when there is no contention
- A maximum of 1024 processes at a time

The **active** attribute can be set to yes or no. When the **active** attribute is set to no, resource controls are disabled, but the settings are maintained in the configuration database.

For example, to change control settings dynamically for an application WPAR, run the following **chwpar** command:

```
chwpar -R totalThreads=2048 shares_memory=100 wpar_name
```

Note: You can also use the **-K** flag for the **chwpar** command to remove individual attributes from the profile and restore those controls to their default, as follows:

```
chwpar -K -R totalProcesses shares_CPU wpar_name
```

Working with specification files for application WPARs

You can create a specification file with all of the options for an application WPAR using the **-f** flag for the **wparexec** command.

If you specify the application for an application WPAR to run, including the command and all arguments, the command is not required when you create the specification file. To create a specification file for an application WPAR, run the following command:

```
wparexec -f /tmp/specfile1
```

To create a specification file as part of the WPAR creation process, run the **wparexec** command with the **-o** flag as follows:

```
wparexec -n wpar_name -o /tmp/specfile2 -- /path/to/application arg1 arg2 ... argN
```

The specification file reflects the settings being used to create the WPAR.

To generate a specification file without creating the WPAR, run the **wparexec** command with the **-w** flag and the **-o** flag:

```
wparexec -o /tmp/specfile3 -- /path/to/application arg1 arg2 ... argN
```

For a comprehensive description of the format and permitted contents of a specification file, see the **/usr/samples/wpars/sample.spec** file.

Listing WPARs

You can list summary data for system WPARs and application WPARs using the **lswpar** command.

You can list information about one or more WPARs using the **lswpar** command by specifying zero or more workload partition names. The **lswpar** command supports shell-style wildcards.

For example, to list the WPARs on a system with names that start with "mypar_", run the following command:

```
lswpar 'mypar_*'
```

Related information

lswpar command

Listing WPAR identifiers

You can list the identifiers for a WPAR using the **lparstat** command or the **uname** command.

WPARs have the following identifiers:

WPAR name

The name you assign to the WPAR.

WPAR configured ID

A dynamic identifier that is assigned each time the WPAR is started. For the global environment, the value of this identifier is 0.

WPAR key

A static identifier that is the same each time you start the WPAR. For the global environment, the value of this identifier is 0.

You can display the WPAR configured ID and the WPAR key by running the **lparstat** command with the **-W** flag. This command also displays processor information that might be helpful for licensing.

To view WPAR identification and processor information, run **lparstat** command with the **-W** flag as follows:

```
lparstat -W
```

To display the WPAR key, run the **uname** command with the **-W** flag as follows:

```
uname -W
```

Related information

lparstat command

uname command

Logging in to a WPAR

After you configure and activate a system WPAR, you can log in to it locally using the **clogin** command.

You can log in to a WPAR as the root user or as a different user. You might be prompted for a password when you log in. Output for the **clogin** command is displayed on the console where the command was issued. When you exit the command, the command returns to the global environment.

To log in to a system WPAR and create a shell as the root user, run the following command:

```
clogin wpar_name
```

To log in to a system WPAR and create a shell as a different user, run the following command:

```
clogin -l username wpar_name
```

Note: You can also log into a system WPAR remotely using the a network-based login command, such as the **rlogin** command, the **telnet** command, or the **rsh** command.

Related information

clogin command

Backing up WPARs

You can back up a WPAR using the **savewpar** command, the **mkcd** command, or the **mkdvd** command.

The **savewpar** command uses the data created by the **mkwpardata** command to back up your WPAR. If these files are not already on your system, the **savewpar** command will call the **mkwpardata** command to create these files. The image files contain the following information:

- A list of logical volumes and their sizes
- A list of file systems and their sizes
- A list of volume groups
- The WPAR name

To back up a WPAR to the default tape device, run the following command:

```
savewpar wparname
```

To back up a WPAR to a file, run the following command:

```
savewpar -f file wparname
```

You can also back up a WPAR to a CD device using the **mkcd -W** command or to a DVD device using the **mkdvd -W** command.

Related information

mkcd command

mkdvd command

mkwpardata command

savewpar command

Restoring WPARs

You can restore a WPAR using the **restwpar** command.

You can restore a WPAR from a backup image created by the **savewpar** command, the **mkcd** command, or the **mkdvd** command.

To restore the backup image from the **/dev/rmt1** device, run the following command:

```
restwpar -f/dev/rmt1
```

Related information

restwpar command

Removing WPARs

You can remove a WPAR using the **rmwpar** command.

To remove a WPAR, it must be in the defined state, and you must provide the name of the WPAR.

To remove a WPAR, run the following command:

```
rmwpar wpar_name
```

To stop a WPAR before removing it, run the following **rmwpar** command with the **-s** flag:

```
rmwpar -s wpar_name
```

Related information

rmwpar command

Starting system WPARs

You can start a system WPAR from the global environment using the **startwpar** command.

To start a system WPAR, run the following command in the global environment:

```
startwpar wpar_name
```

You can also start a system WPAR in maintenance mode. Starting in maintenance mode performs all of the actions of starting the WPAR with the exception of network configuration. You can use this flag to prevent external access to the WPAR while you perform maintenance.

To start a system WPAR in maintenance mode, run the following command in the global environment:

```
startwpar -m wpar_name
```

Note: You cannot start WPARs that rely on NFS-mounted file systems in maintenance mode.

Related information

startwpar command

Stopping WPARs

You can stop a WPAR from the global environment using the **stopwpar** command.

Stopping a system WPAR follows a similar paradigm to the **shutdown** command and the **halt** command for AIX. For application WPARs, running the **stopwpar** command is equivalent to removing the WPAR with the **rmwpar** command.

To stop a system WPAR in the same way that the **shutdown** command stops a system, run the following command:

```
stopwpar wpar_name
```

To stop a system WPAR quickly in the same way that the **halt** command stops a system, run the following command:

```
stopwpar -F wpar_name
```

Related information

stopwpar command

Using the Advanced Accounting subsystem with WPARs

You can use the Advanced Accounting subsystem to produce WPAR accounting reports.

Advanced Accounting produces the following records for WPARs:

- Process records
- Aggregated process records
- Aggregated application records
- File system activity records
- Network interface I/O records
- Disk I/O records
- Third-party kernel extension common aggregation records

Related information

Accounting records

Using the trace facility with WPARs

You can use the trace facility to isolate system problems by monitoring selected system events in a WPAR.

The following tracing capabilities are available for WPARs:

- Launching a trace from within a WPAR
- Correlating a trace entry to a WPAR
- Filtering which WPAR trace entries to log from the global environment
- Filtering which WPAR entries to report from the global environment
- Running more than one kernel trace at the same time
- Additional trace utility hooks

Note: A maximum of 7 WPARs can run the trace facility at the same time.

By default you cannot run trace facility in a WPAR. To enable the trace facility from a WPAR, you must grant PV_KER_RAS privilege to the WPAR. You can grant this privilege when you run the **mkwpar** command or by running the **chwpar** command with the **-S privs+=PV_KER_RAS** flag.

Related information

trace daemon

trcrpt command

Making software available to other WPARs

When you install software in the global environment, it is not always automatically available for use within your system WPAR. You can use the **syncwpar** command or the **syncroot** command to make software available.

Application workload partitions share their file systems with the global environment and do not create new file systems. Therefore, the **syncwpar** command and the **syncroot** command are applicable only to system WPARs.

To make software available in one or more WPARs, run the following command in the global environment:

```
syncwpar wpar_name1 wpar_name2
```

The **syncroot** command performs the same function as the **syncwpar** command, but the **syncroot** command operates only within the WPAR where it is issued.

Related information

syncroot command

syncwpar command

Example: Installing Apache in a WPAR

Installing Apache allows you to take advantage of the portability and scalability of WPARs.

Before you install Apache, you must download the Apache RPM and the following dependencies:

- **expat**
- **lynx**

You can download all of these RPM files from the following Web site:

<http://www.ibm.com/servers/aix/products/aixos/linux/download.html>

To install Apache, complete the following steps.

1. Install the Apache RPM file and its dependencies in the global environment using the **rpm** command. Many of the installation images are installed in the **/opt** directory and the **/usr** directory. Because these directories are shared by the global environment and all shared WPARs, it is not necessary to install Apache separately on all WPARs.
2. Make Apache available to other WPARs.
 - If the WPAR where you want to run Apache does not exist, create it using the **mkwpar** command or SMIT.
 - If the WPAR where you want to run Apache does exist, make the installation of Apache available to the WPAR using the **syncwpar** command or SMIT.
3. Configure Apache in the WPARs where you want Apache to run. At a minimum, you should modify the *DocumentRoot* variable in the **/etc/opt/freeware/Apache/httpd.conf** file to a directory that contains the files you want to serve.
4. Start Apache in every WPAR where you want it to run.

Example: Using DB2 Version 8 for Linux, UNIX, and Windows in a WPAR

You can install and use DB2[®] Version 8 for Linux[®], UNIX[®], and Windows[®] (DB2 8) in a WPAR environment.

Installing DB2 8 in the global environment

You can install DB2 8 in the global environment with the installation media.

Restriction: DB2 8 can be installed only in the global environment. You cannot install or update DB2 8 in a WPAR.

For complete documentation on installing DB2 8, see the DB2 Information Center at the following Web site:

<http://publib.boulder.ibm.com/infocenter/db21uw/v8>

A typical installation installs all of the necessary utilities for configuring DB2 8 in a WPAR.

After you install DB2 8, you can make it available to other WPARs with the **syncwpar** command.

Creating a database administration server

Creating a database administration server is a one-time process that must be performed on each WPAR.

To create a database administration server, complete the following steps.

1. Log in to the WPAR as the root user using telnet or the **cllogin** command.
2. Verify that the host name for the WPAR where you are configuring DB2 resolves using the host command. Run the command as follows:

```
host wpar_host_name
```
3. Modify the root user environment to set the DB_HOME environment variable to point to the **/usr/opt/db2_08_01** directory.
4. Create a new, non-administrative group called dasadm.
5. Create a new user called dasusr with the primary group of staff.
6. Add the root user and the dasusr user to the dasadm group.
7. Create the DB2 administration server by running the following command:

```
$DB_HOME/instance/dascrt -u dasusr
```
8. Verify that the DB2 administration server is successfully created by running the following command:

```
$DB_HOME/instance/daslist
```
9. Run the following command to verify the creation process was successful:

```
$DB_HOME/instance/db2ilist
```

The WPAR should run successfully and show zero instances.

Creating a DB2 instance

After you create a database administration server, you can create DB2 instances on your WPARs.

Restriction: You cannot create DB2 instances in a WPAR with the **db2setup** tool from the installation media.

If you are configuring existing users as DB2 instances, run the following command:

```
$DB_HOME/instance/db2icrt
```

Running this command allows you to manually provide parameters for configuring the instance.

You can also use the **db2isetup** script to create users and groups when you create the instance.

When you create the instance, you might receive the following error:

```
Enabling Asynchronous I/O:.....Failure
```

This is a not a fatal error, and it can be ignored.

Removing DB2 8

You must remove all of your DB2 instances to remove DB2.

Restriction: DB2 8 can be removed only in the global environment.

To remove DB2 8, complete the following steps.

1. Remove the DB2 instances from each of your WPARs by running the following command:
`$DB_HOME/instance/db2idrop`
2. Remove the DB2 administration server from each of your WPARs by running the following command:
`$DB_HOME/instance/dasdrop`

You can now remove DB2 8 from the global environment. For complete documentation on removing DB2 8, see the DB2 Information Center at the following Web site:

<http://publib.boulder.ibm.com/infocenter/db21uw/v8>

Example: Using WebSphere Application Server, Version 6.0 in a WPAR

You can install and use WebSphere® Application Server, Version 6.0, in the global environment or in each individual WPAR.

Installing WebSphere Application Server, Version 6.0, in the global environment

You can install WebSphere Application Server, Version 6.0, in the global environment, and it will also be installed in any WPARs in the environment.

If you install WebSphere Application Server, Version 6.0, in the global environment, the product files are shared product binaries. These binary files are shared by all WebSphere profiles inside individual WPARs.

1. Install WebSphere Application Server, Version 6.0, in the global environment. For complete documentation of how to install WebSphere Application Server, see the WebSphere Application Server, Version 6.0 Information Center at the following Web site:

<http://publib.boulder.ibm.com/infocenter/wasinfo/v6r0>

Note: If you install WebSphere Application Server in any directory other than the default (**/usr/IBM/WebSphere/AppServer**), you must complete the following steps:

- Export the file system to all WPARs with read-only access.
 - Mount the directory where you installed WebSphere Application Server into each WPAR where you want to run DB2.
2. In the global environment, modify the WAS_HOME environment variable for the root user to point to the **/usr/IBM/WebSphere/AppServer** directory, or the directory where you installed WebSphere Application Server.
 3. In the WPAR, modify the WAS_HOME environment variable for the root user to point to **/usr/IBM/WebSphere/AppServer**, or the appropriate mounted directory.
 4. Create the **/home/WASProfileRoot** directory in both the global environment and in each WPAR where you will be creating WebSphere Application Server profiles. For each profile, you must have at least 200 MB of available disk space in the directory. This procedure refers to the profile directory as the **/home/WASProfileRoot**, but it is not a fixed path. You can create a directory with a different path and then use that particular path for all steps in these instructions.
 5. Create the **/home/WASProfileRoot/properties** directory in both the global environment and in each WPAR where you will be creating WebSphere Application Server profiles.

6. In the global environment, back up the **WAS_HOME/properties/wasprofile.properties** file.
7. Modify the **wasprofile.properties** file by updating the following values:

```
WS_CMT_LOG_HOME=/home/WASProfileRoot/logs/wasprofile
WS_PROFILE_REGISTRY=/home/WASProfileRoot/properties/profileRegistry.xml
```

Your environment is now ready for the creation of WebSphere Application Server profiles. If you run the **WAS_HOME/bin/wasprofile.sh -list Profiles** command both in the global environment and in your other WPARs, you can list the profiles. The command should run successfully and show zero profiles.

Installing WebSphere Application Server, Version 6.0, in a WPAR

You can install WebSphere Application Server, Version 6.0, directly in a WPAR if that WPAR does not share the **/usr** directory with the global environment, or if the WPAR was created after WebSphere Application Server, Version 6.0, was installed in the global environment.

Installing WebSphere Application Server, Version 6.0, in a WPAR allows you to run WebSphere Application Server, Version 6.0, from the WPAR without referring back to the global environment. This type of installation keeps all WebSphere Application Server, Version 6.0, processes and data independent from other WPARs and the global environment.

1. Install WebSphere Application Server, Version 6.0, from the global environment using an installation directory that specifies a non-shared directory in the targeted WPAR (for example, the **/wpars/wpar_name/home/WebSphere/AppServer** directory). For complete documentation of how to install WebSphere Application Server, Version 6.0, see the WebSphere Application Server, Version 6.0 Information Center at the following Web site:

<http://publib.boulder.ibm.com/infocenter/wasinfo/v6r0>

Note: If you install WebSphere Application Server, Version 6.0, in any directory other than the default (**/usr/IBM/WebSphere/AppServer**), you must complete the following steps:

- Export the file system to all WPARs with read-only access.
 - Mount the directory where you installed WebSphere Application Server, Version 6.0, into each WPAR where you want to run DB2.
2. Log in to the WPAR.
 3. Modify the **WAS_HOME** environment variable for the root user to point to the **/usr/IBM/WebSphere/AppServer** directory or the appropriate mounted directory.
 4. Create the **/home/WASProfileRoot** directory. For each profile, you must have at least 200 MB of available disk space in the directory. This procedure refers to the profile directory as the **/home/WASProfileRoot**, but it is not a fixed path. You can create a directory with a different path and then use that particular path for all steps in these instructions.
 5. Create the **/home/WASProfileRoot/properties** directory.
 6. Back up the **WAS_HOME/properties/wasprofile.properties** file.
 7. Modify the **wasprofile.properties** file by updating the following values:

```
WS_CMT_LOG_HOME=/home/WASProfileRoot/logs/wasprofile
WS_PROFILE_REGISTRY=/home/WASProfileRoot/properties/profileRegistry.xml
```

You can repeat this procedure on as many WPARs as you desire.

Creating WebSphere Application Server profiles

You can create WebSphere Application Server profiles in both the global environment and in individual WPARs.

1. Log in to the global environment or the WPAR where you want to create the profile.
2. Run the **wasprofile** command.

Note: Do not use the default profile location *was_install_path/profiles* as the profile location. The following example shows the recommended usage for the **profilePath** parameter:

```
$WAS_HOME/bin/wasprofile.sh \
-create \
-profileName AppServer01 \
-profilePath /home/WASProfileRoot/profiles/AppServer01 \
-templatePath $WAS_HOME/profileTemplates/default \
-nodeName.....[name of Node ] \
-hostName.....[name of Host / "hostname" ] \
-cellName.....[name of Cell ]
```

Removing WebSphere Application Server

To remove WebSphere Application Server from the global environment and all WPARs delete all profiles and remove the application.

1. Delete all of the WebSphere Application Server profiles from the WPARs that have them using the following command:

```
$WAS_HOME/bin/wasprofile.sh -delete -profileName name_of_profile
```

Note: You must run this command on every WPAR that has a WebSphere Application Server profile.

2. In the global environment, delete all existing WebSphere Application Server profiles.
3. Remove WebSphere Application Server by running the following command:

```
$WAS_HOME/_uninst/uninstall
```

Modified and enhanced AIX commands for WPARs

Some commands have different or enhanced behavior in a WPAR environment.

The following table shows how the behavior of some commands differs when they are run in a WPAR or run in the global environment. Some commands have different behavior only when certain flags are specified.

Table 1. Modified and enhanced AIX commands

Command	Flags and arguments	Behavior in a WPAR	Behavior in the global environment
acctcom	- @ <i>WPAR name</i>	Fails with workload partition not found message unless WPAR name is "global"	Executes normally displaying accounting records for WPAR named <i>WPAR name</i>
	-@ <i>no argument</i>	Fails with cannot open /var/adm/pacct message	Executes normally displaying accounting records for all WPARs; a WPAR name is displayed for each record
acctctl		Fails with cannot open /var/adm/pacct message	Executes normally if user has correct privilege
clogin	-C <i>wpar name command</i>	Not allowed in a WPAR	Prompts for password and runs command in the WPAR or login if no command is specified
df		Displays information on WPAR mounted file systems only; paths are displayed relative to the WPAR root	Displays information on all file systems; paths are absolute

Table 1. Modified and enhanced AIX commands (continued)

Command	Flags and arguments	Behavior in a WPAR	Behavior in the global environment
domainname	No flags	Displays domain name of WPAR	Displays domain name of system
	<i>new domain name</i>	Sets domain name of WPAR if run by WPAR root	Sets the domain name of system if run by global root
hostid	No flags	Displays host ID of WPAR	Displays host ID of system
	IP address <i>hex number</i>	Sets host ID of WPAR if run by WPAR root	Sets host ID of system if run by global root
hostname	No flags	Displays host name of WPAR	Displays host name of system
	<i>new host name</i>	Sets host name of WPAR if run by WPAR root	Sets host name of system if run by global root
ifconfig	All display flags (-a and -l)	Displays information about the WPAR	Displays information about the global environment
ioo		Does not function in a WPAR	No change in behavior
ipcrm	Without -@ <i>argument</i>	Removes IPC objects associated with the WPAR	Removes IPC objects associated with the global environment
	-@ <i>WPAR name</i>	Does not function unless WPAR name is "global"	Removes IPC objects associated with WPAR named <i>WPAR name</i>
ipcs	Without -@ <i>argument</i>	Displays information on IPC objects created by processes within the WPAR	Displays information on IPC objects created by processes in the global environment; no WPAR-associated objects are displayed
	-@	Displays IPC information for the WPAR where the command is run	Displays information on all IPC objects in the system; the name of the WPAR associated with the object is listed.
	-@ <i>WPAR name</i>	Displays no IPC information unless WPAR name is "global;" global case displays information on IPC objects associated with processes within the WPAR	Displays information on IPC objects associated with processes in the WPAR named <i>WPAR name</i>
mkclass		Only updates the /etc/wlm directory; fails updating kernel data	No change in behavior
mount	No flags	Displays only WPAR-mounted file systems relative to the WPAR root	Displays all mounted file systems with absolute paths
	With flags	Only NFS mounts without cacheofs allowed	No change in behavior

Table 1. Modified and enhanced AIX commands (continued)

Command	Flags and arguments	Behavior in a WPAR	Behavior in the global environment
netstat	-c -C -g -m -M -P -v -Z	These flags are not supported.	Display network information and statistics for the entire system
	All other flags	Display network information and statistics for the WPAR	Display network information and statistics for the entire system
	-@ <i>WPAR name</i>	Does not function in a WPAR	Display network information and statistics for the WPAR specified, or all WPARs if <i>WPAR name</i> is not specified
nfso		Has read-only functionality in a WPAR	No change in behavior
no	All flags except -a	Fails with an error message	No change in behavior if user has the correct privilege
	-a	No change in behavior	No change in behavior if user has the correct privilege
projctl	All flags except -qproj	Fails with a not owner message	No change in behavior if user has the correct privilege
	qproj	No change in behavior	No change in behavior if user has the correct privilege

Table 1. Modified and enhanced AIX commands (continued)

Command	Flags and arguments	Behavior in a WPAR	Behavior in the global environment
ps	-e	Displays all processes in the WPAR	Displays everything within the system; processes are not screened from view unless a specific WPAR name is specified using the <i>-@ WPAR name</i> flag
	-@	Displays process information for processes in the WPAR; WPAR name is included in output	Displays process information for all processes in the system; WPAR name is included in output
	-@ WPAR name	Displays no process information unless WPAR name is "global;" global case displays information on processes within the WPAR; WPAR name is included in output	Displays information on processes associated with the WPAR named <i>WPAR name</i> ; WPAR name is included in output
	-o wpar	Produces a WPAR name header and the name of the WPAR associated with the process; name is always "global"	Produces a WPAR header and the name of the WPAR in which the process is executing
schedo		Does not function in a WPAR	No change in behavior
uname	-n	Displays name of the WPAR	Displays node name of the system
vmo		Does not function in a WPAR	No change in behavior
wlmstat	No flags	Displays information about the WPAR class	No change in behavior
	-@	Displays information about the WPAR class	Displays data for WPAR class
wlmtune		Does not function in a WPAR	No change in behavior
wlmcntrl		Does not function in a WPAR	No change in behavior

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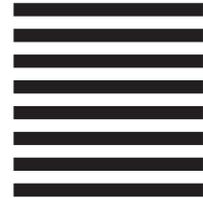
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